talis
delivering solutions

Asset Management | Environmental Services | Spatial Intelligence | Waste Management

Environmental Assessment and Management Plan

Onslow Waste Transfer Station

Prepared for the Shire of Ashburton
November 2014
Project Number TW14026

Talis Consultants Pty Ltd
Level 1 8/663 Newcastle Street
Leederville WA 6007
Ph: 1300 251 070
www.talisconsultants.com.au

ABN: 85 967 691 321

DOCUMENT CONTROL

Version	Description	File Ref	Author	Reviewer
0a	Internal Draft	TW14026 – EAMP.0a	Alex Upitis Joanna Skiba	Ronan Cullen
1a	Released for Client Review	TW14026 – EAMP.1a	Alex Upitis Joanna Skiba	Ronan Cullen
1b	Final issued	TW14026 – EAMP.1b	Alex Upitis Joanna Skiba	Ronan Cullen

Table of Contents

Tables

Figures

Drawings

Appendices

1 Introduction

The town of Onslow is located within the Shire of Ashburton (the Shire) approximately 100 km north-east of the North West Cape peninsula on the coast of Western Australia. Throughout the 1900s, Onslow operated as a small port town servicing the Pilbara wool and local fishing industries. In 2011, Onslow had a population of less than 700 which is considered to be a reflection of the limited industry in the area.

Since the early 2000s, the Pilbara region has experienced significant growth due to the rapid expansion of the resources industry, particularly in the mining and oil and gas sectors. In Onslow, this growth is currently peaking as a result of the development of on and off-shore liquid natural gas (LNG) processing infrastructure. With deep water access and proximity to off-shore gas reserves the town of Onslow has been selected to support the construction and operation of the Ashburton North Strategic Industrial Area (ANSIA). The Chevron lead Wheatstone project is currently being constructed in the ANSIA. Supporting this significant development, Onslow is currently undergoing rapid development and population growth.

The current Onslow landfill was established as a self-sufficient, fit for purpose facility located on the edge of town which catered for the existing small population. The Onslow landfill is reaching the end of its operation life which is compounded by development in some of the surrounding land. As a result, the current Onslow Landfill is scheduled to cease operations in March 2015.

However, following the completion of a Site Selection Study, a preferred new location for a new modern Waste Management Facility has been determined and the Shire is actively pursuing the advancement of that project. Delivery of the new Waste Management Facility will take a substantial amount of time, approximately 3-4 years, well after the current landfill has ceased operations. Therefore, the Shire has proposed to develop of a Waste Transfer Station (WTS) at Lot 500 Onslow Road (the Site) to continue to provide waste disposal services to the community. In the short term, the WTS will accept and consolidate the majority of waste materials generated within Onslow town site. Putrescible waste (food etc) will be consolidated ready for transportation off-site to licensed facilities within the region. In addition, a stockpile area will be established for clean streams of inert materials (concrete, sand, etc), scrap metal and greenwaste for future recycling. In the longer term, following the development of a new waste management facility, the WTS will be utilised solely as a community drop-off centre whereby the Shire's residents and small commercial operators will take their recyclables and waste materials. These materials will then be consolidated and brought to the new Waste Management Facility.

The WTS will provide appropriate modern waste management practices to the local residential and business community during and following the period of construction of the new Onslow Waste Management Facility. The importance of the development of the WTS is considered by the Shire as a high priority as it will provide the only waste disposal option in close proximity to the town of Onslow and an interim solution during the period of 3-4 years of the development of the new Onslow Waste Management Facility.

1.1 Approval Process

To ensure that the proposed WTS complies with all legislative requirements, the Shire is seeking to obtain the following environmental and planning approvals:

- Works Approval and Licence pursuant to Part V of the *Environmental Protection Act 1986* administered by the Department of Environment Regulation (DER);
- Environmental Referral to the Environmental Protection Authority (EPA) to determine the appropriate level of assessment pursuant to Part IV of the *Environmental Protection Act 1986*; and
- Town Planning Approval.

The Shire has engaged Talis Consultants Pty Ltd (Talis) to assist with the process of obtaining the relevant approvals for the Site. To maximise the efficiency of the approvals process, the environmental and planning approvals processes will be run concurrently. This EAMP has been prepared to support all relevant Environment and Planning approval applications. The Environment and Planning approvals are discussed in greater detail within the following sections.

1.1.1 Environmental Approvals

The WTS will be classified as a Prescribed Premises pursuant to Part V of the *Environmental Protection Act* 1986. The various Prescribed Premises categories and the maximum throughputs are shown in **Table 1**.

Table 1: Maximum throughput of Prescribed Premise

Category No.	Name	Description	Maximum Throughput	Expected Throughput
57	Used Tyre Storage (general)	Premises on which used tyres are stored.	> 100 tyres per annum	50 tonnes per annum
62	Solid waste depot	Premises on which waste is stored, or sorted, pending final disposal or re-use.	> 500 tonnes per annum	20,000 tonnes per annum

The WTS will require a Works Approval from the DER for its construction. In addition, the Shire will require a Licence from the DER for the operation of the WTS. The Shire will also refer the proposal to the EPA to determine level of assessment pursuant to Part IV of the *Environmental Protection Act* 1986.

1.1.2 Planning Approvals

In accordance with the *Town Planning and Development* Act 1928 the Shire is proposing to complete this as a public works proposal. This will be submitted to the Shire and assessed in relation to planning and environmental matters. At this stage it is anticipated that the proposal will be advertised in accordance with the town planning scheme.

1.2 Purpose of the Report

This Environmental Assessment and Management Plan (EAMP) has been prepared to support all the relevant environmental and planning approvals required for the establishment of a WTS at the Site. The objectives of this EAMP are to:

- Describe the current conditions on and surrounding the Site;
- Describe the proposed design operations of the WTS;
- Identify any potential environmental impacts associated with the proposal; and
- Develop environmental engineering and management measures to ensure that all potential impacts are managed to appropriate standards.

1.3 Scope of the Report

This EAMP details the existing environmental conditions of the Site, the Shire's proposal and the environmental management measures to be implemented on the Site to ensure that any potential impacts are appropriately managed. To achieve the objectives of the report, this EAMP consists of:

- Section 2: Site Selection Study;
- Section 3: Site information;
- Section 4: Existing Environmental and Social Attributes;
- Section 5: Conceptual Description of Proposed Site Activities;
- Section 6: Environmental Aspects;
- Section 8: Environmental Management Measures; and
- Section 9: Conclusion.

Talis is at the belief that the information provided within this report will satisfy the environmental data requirements of DER, EPA, Planning Officers and the Shire of Ashburton Planning Officers.

2 Site Selection Study

A Site Selection Study was completed by Talis in early 2014 for a new WTS to cater for the future needs of the Onslow catchment. The Site Selection Study process was undertaken utilising best practice siting and design principles to identify a Preferred Site for the new WTS. The following section describes the process of the Site Selection Study and provides background information regarding the Site.

The initial phase of the Site Selection process involved defining Site Selection Criteria based on environmental, social and planning factors that governed the overall siting works. These include aspects such as distance from Onslow and separation distances from social and environmentally sensitive areas.

Following the adoption of Site Selection Criteria, constraints mapping was carried out utilising Geographical Information Systems (GIS) spatial modelling. As shown in **Table 2**, a suite of GIS layers covering social, environmental and planning factors were utilised to identify Sites of Interest that warranted further consideration by the Shire.

Table 2: Constraints Mapping Datasets

Key Factor	Spatial Layer	Layer Author
ENVIRONMENTAL	**Wetlands**	• Department of Parks and Wildlife (DPaW) formerly known as the Department of Conservation (DEC) • Department of Environment Regulation (DER) formerly known as the Department of Conservation (DEC) • Landgate
	Environmentally Sensitive Areas	• DPaW • DER
	Contaminated Sites	• DPaW • DER
	Acid Sulphate Soils	• DPaW • DER
	Threatened and Priority Fauna	• DPaW
	Declared Rare and Priority Flora	• DPaW
	Threatened and Priority Ecological Communities (TECs/PECs)	• DPaW
	Conservation Areas	• DPaW • DER
	Ramsar Sites	• DPaW • DER
	Geology	• Department of Mines and Petroleum (DMP) • Geoscience Australia
	Groundwater	• Department of Water (DoW)
	Floodplains	• Landgate • DoW • Bureau of Meteorology (BoM)
	Surface Water Hydrology	• Landgate • DoW • BoM
	Topography – Contours/Morphology	• Landgate

Key Factor	Spatial Layer	Layer Author
	Topography – Digital Elevation Model (DEM)	• Chevron
SOCIAL	**Surface Water Proclaimed Areas**	• DoW
	Public Drinking Water Source Areas	• DoW
	Aboriginal Heritage	• Department of Aboriginal Affairs
	European Heritage	• Heritage Council - State Heritage Office
	Aerial Imagery	• Landgate
PLANNING	**Mine Sites and Tenements**	• DMP • Landgate
	Cadastral Boundaries	• Landgate
	Land Tenure	• Landgate
	Town Planning Scheme Zones	• Western Australia Planning Commission
	Land use/landmarks	• Landgate
	Airports	• Landgate
	Road and Rail Network	• Landgate • Main Roads Western Australia
	Underground Utilities and Industrial Features	• Landgate • DoW • Geoscience Australia • DMP

Based on the Site Selection Criteria adopted, Talis generated a Constraints Mapping Model for the study area which contained a range of environmental, planning and social data layers. A total of 12 Sites of Interest were identified through the mapping works and then further evaluated through Site visits. All Sites of Interest were then assessed through a Multi Criteria Analysis on a range of aspects including:

- Distance;
- Road Access;
- Separation Distances;
- Land Availability;
- Area;
- Environmental;
- Flooding;
- Vegetation Cover;
- Hydrogeology;
- Topography;
- Infrastructure;
- Soil Characteristics;
- Screening; and
- Onsite Capital Costs

The Multi Criteria Analysis was utilised as a decision making tool to assist stakeholders better understand the strengths, weaknesses and points of difference between the various sites being evaluated.

Based on the analysis undertaken, Talis identified the Site (the subject of this EAMP) as the preferred location for the development of a WTS.

3 Site Information

3.1 Site Location

The Site is located at Lot 500 Onslow Road, Onslow within the Shire of Ashburton, approximately 5.5 km from the Onslow town site. A locality plan of the Site is shown in **Figure 1**.

3.2 Site Identification

Table 3 below provides information on the identification of the Site.

Table 3: Site Identification

Address	Ownership	Tenure	Centre point Coordinates	
			Easting	Northing
Lot 500 Onslow Rd, Onslow	State of WA (LR0315200106)	Crown/Reserve	302879.77	7601193.96

It can be seen from **Table 3** that the Site is located on Crown/Reserve land. It needs to be noted that Lot 500, Onslow Rd, Onslow comprises an area of 44,930,080 m^2 (~4,493 hectare (ha), of which 22,000 m^2 (2.2 ha) would be required for the WTS Site. A cadastral plan of the Site is shown in **Figure 2** and the Certificate of Title is provided in **Appendix A**.

3.3 Site Description

The Site covers an area of approximately 22,000 m^2 and has previously not been developed. The Site has recreational four wheeled drive tracks on it, however there is no regular use of the Site. The Site is covered in low lying brush, scrub and grasses with several termite mounds spread across the Site. An aerial photograph of the Site is shown in **Figure 3**.

3.4 Site Access

The access to the Site is through an intersection between Onslow Road and an unnamed gravel road to the west of Onslow Road, approximately 5.5 km from Onslow town site. The Site utilises the gravel access road from Onslow Road which services the former Main Roads Western Australia (MRWA) borrow pit and lay down area located approximately 150 m south-west of the Site. The access gravel road from Onslow Road to the Site is approximately 600 m in length. The Shire has commenced the process of gazetting the gravel road to become a public road and further information on this can be provided if required.

3.5 Surrounding Land Uses

As evident in **Drawing 1**, the immediate surrounds of the Site is comprised of undisturbed land containing a similar sparse vegetation profile. Further afield, the following land uses have been identified:

- MRWA Site;
- NTC Contracting; and
- Onslow Airport.

The former MRWA Site is a borrow pit and lay down area located to the south west of the Site. There are no built structures on the MRWA site nor any utilities provided. The MRWA site is approximately 34,200 m^2 in area. It appeared that the main extraction at the MRWA site occurred in early 2012.

NTC Contracting currently operates a site approximately 300 m to the south west of the proposed WTS Site for quarrying activities to support their civil construction works. Activities onsite include extraction, crushing and screening of sand, gravel and rock material. There are some mobile office buildings located in the western portion of the site approximately 1,100 m from the proposed WTS Site.

The Onslow Airport is located on the opposite side of Onslow Road across the estuary system in a north east direction from the Site. The western side runway is approximately 1,350m from the Site at its closest point. However, it should be noted that the WTS is not located along the airports flight paths.

3.6 Separation Distances

The EPA's *Guidance Statement No. 3 – Separation Distances between Industrial and Sensitive Land Uses 2005* contains the recommended minimum separation distances between industrial activities, including waste management facilities, and sensitive land uses. Sensitive land uses are defined as those that are sensitive to industrial emissions and include residential developments, schools, hospitals, shopping centres and other public areas and buildings. The recommended minimum separation distances between sensitive land uses and the Prescribed Premises categories required for the Site are shown in **Table 4**.

Table 4: Recommended Separation Distances between Industrial and Sensitive Land Uses

Category No.	Industry	Impacts			Recommended Separation Distance (m)
		Noise	Dust	Odour	
57	Used tyre storage		✓		100-200
62	Solid waste depot	✓	✓	✓	200

The land uses surrounding the WTS are not classified as sensitive land uses. The nearest sensitive receptor to the Site is located approximately 3.6 km to the north-east as shown in **Figure 4**. This distance is significantly greater than the recommended separation distances of the EPA.

3.7 Zoning

Under the Shire of Ashburton's *Town Planning Scheme No. 7 2014* (TPS 7), the Site is located within a Rural zone. Under the TPS 7, the objective of this zone is to allow *"a variety of Rural activities, providing for agriculture, horticulture, viniculture, grazing, dairying or farming generally and may include market gardens, stables, horse training, nurseries and the like. It also provides for extractive industry"*.

Under TPS 7, our proposal falls into the category 'industry – noxious' which is defined as "an industry which is subject to licensing as "Prescribed Premises" under the environmental Protection Regulations 1987 (as amended)".

The Shire will assess the proposal in relation to its planning and environmental matters through the public works approval process.

3.8 Mining Tenements

Talis undertook an investigation to determine if any mining tenements exist over the Site, including:

- Exploration and prospecting;
- Quarrying (Extractive Industries Licence); and
- Mining.

According to the Shared Land Information Platform (SLIP) Western Australian Atlas, there are currently no such tenements existing over the Site. The nearest active mining tenement (Onslow Salt) is approximately 500 m directly south of the proposed Site.

4 Existing Environmental and Social Attributes

This section provides a description of the existing environmental and social attributes of the Site. This information has been obtained from field studies and a desktop review of relevant online databases.

4.1 Topography

A topographic survey was undertaken in October 2014 as shown in **Drawing 2**. The survey indicates that the south eastern and north western boundaries of the Site gently slope towards the centre of the Site. The ground surface elevation ranges from 5.7m Australian Height Datum (AHD) along the south eastern boundary of the Site to 3.8m AHD towards the front of the Site near the existing unsealed access road. The topography of the Site presents a natural bowl shape around the Site which will minimise the movement of emissions off-site.

4.2 Geology

A Geotechnical Investigation was undertaken by Talis in October 2014 to understand the ground conditions to support the construction of the WTS. The Geotechnical Investigation was undertaken within and surrounding the immediate area in which the Putrescible Waste Bunker and associated access routes will be constructed. The works carried out comprised of:

- The excavation and logging of seven test pits;
- Soil penetrometer testing;
- Moisture content testing;
- Particle size distribution analysis; and
- Water table measurements where possible.

The Geotechnical Investigation discovered that the Site comprises of Loose to Medium Dense brown silty fine sand to a depth of 1m and Medium Dense Dark Brown Silty Fine to Medium Sand with some Clay and some fine to coarse gravel from 1-2 m. Groundwater was encountered at approximately 2 m below ground level in the centre of the Site. Refer to **Appendix B** for the Geotechnical Report which details the results from the geotechnical investigation including trial pit locations, logs for each test pit along with the laboratory and field testing results.

4.3 Acid Sulphate Soils

Acid sulphate soils (ASS) are naturally occurring soils that contain iron sulphide (iron pyrite) minerals. If disturbed by dewatering, drainage or soil excavation, the pyrites can oxidise thereby releasing acidity, potentially causing environmental impacts.

According to the SLIP Western Australian Atlas, the soils underlying the Site are rated as low risk of ASS generation. **Figure 6** shows the areas that are at a higher risk of ASS surrounding the Site which are based along the estuarine area and island.

4.4 Flora and Fauna

The Site is currently undeveloped and it is anticipated that any previous use would have been through a pastoral lease. The Site is scarcely vegetated and is anticipated to contain little ecological value.

4.4.1 Threatened Species

A threatened flora and flora search was conducted using the DER's NatureMap tool. The results of a 1 km search surrounding the Site returned a total of 17 species potentially listed within the area. However, none of the species identified were listed as conservation risk or a priority as shown within the NatureMap Species Report attached as **Appendix C**. **Figure 7** shows the threatened species mapped in the local area. According to a search of the SLIP Western Australian Atlas the nearest Environmentally Sensitive Area (ESA) is associated with Direction Island in the Indian Ocean, located approximately 16.5 km to the north of the Site. The nearest onshore ESA is located approximately 34.5 km to the southwest of the Site.

It is anticipated that due to the industries already established in the surrounding area, the development of a WTS at the Site will not impact significantly on any identified species.

A search of the Federal *Environmental Protection and Biodiversity Conservation Act* (EPBC Act) Protected Matters Search Tool (PMST) generated a list of protected matters within 1 km of the Site and is attached as **Appendix D**. The results of the search concluded that two listed threatened species and nine migratory species potentially frequent the Site. However, none of the following matters of national environmental significance were identified:

- World Heritage Properties;
- National Heritage Places;
- Wetlands of International Importance;
- Commonwealth Marine Areas; and
- Listed Threatened Ecological Communities.

As previously stated, it is anticipated that the Site has little environmental value due to farming and current industries in the area. The government searches are indicative and represent the potential for a species to exist in the area. It does not necessarily mean that the species is actually located within the search area or the Site.

4.4.2 Site Surveys

A Level 1 Fauna and a Level 2 Flora and Vegetation Surveys were conducted by an ecological consultant (Terratree). The full report is attached as **Appendix E** and key findings are summarised below.

4.4.2.1 Database search

Based on the database search conducted, a total of 17 flora and 49 fauna of conservation significance were identified within the vicinity of the Site, however no Threatened (Declared Rare) Flora were recorded on the database search. Additionally, no Threatened or Priority Ecological Communities within 5 km radius of the Site were identified.

One place was listed on the Register of National Estate (RNE) which is located within 10 km of the Site. This place is known as the Coastal Margin Exmouth Gulf to Cape Preston and is 120,000 ha, comprising three sections extending 260 km north-east and south-west of Onslow.

4.4.2.2 *Field work*

The Site contains native vegetation, which is considered to be in a 'very good' –"Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeating fires, the presence of more aggressive weeds, dieback, logging and grazing" (Keighery, 1994). It was noted during field work that the primary disturbance to the vegetation were vehicle tracks.

It was identified that no Threatened (Declared Rare) or Priority Flora were recorded during the Site visit.

A total of eight vertebrate fauna species were recorded during the Site visit, however none of which were of conservation significance.

The habitat of the Site was assessed to determine the suitability of the Site to support the 49 fauna species of conservation significance to occur in the region. Of those species, 44 are considered to unlikely occur at the Site due to unsuitable habitat. One species (Short-tailed Mouse) was considered to likely habitat the Site and six species (Western Pebble-mound Mouse, Flock Bronzewing, Star Finch, Australian Bastard, Keeled Slider and Australian Peregrine Falcon and the Rainbow bee-eater) were considered to possibly occur/occasionally use the Site. However, none of these were recorded during the Site Survey.

4.5 Hydrogeology and Hydrology

4.5.1 Groundwater

As part of the Geotechnical Investigation, groundwater measurements were taken at each of the test pits during the investigation. It was concluded that the standing water table of the groundwater is approximately 2m below ground level. Based on research undertaken, Talis is of the understanding that the groundwater flows is in a north easterly direction. In addition the groundwater is understood to be brackish to saline and therefore not suitable for drinking purposes.

4.5.2 Surface Water

Following a review of aerial photography and a site visit, no surface water bodies were identified within the Site. The nearest natural surface water body is a salt lake located approximately 500 m to the north-west of the Site as shown in **Figure 8**. However, for the majority of the year the salt lake remains dry.

In the event that surface water is generated, it is anticipated that it would flow in a south-westerly direction towards the front of the Site as the topography facilitates the flow in this direction. However, the climate conditions in the Onslow area result in high evaporation rates and low rainfall rates. Therefore, it is anticipated that surface water flow would not be a common occurrence.

4.5.3 Wetlands

Geomorphic wetlands are only mapped in certain parts of the state, however they're not mapped in Onslow therefore no relevant wetland dataset exists. It is anticipated that if wetlands were mapped in the Onslow area, the wetlands surrounding the Onslow Airport would be considered to have environmental value. These wetlands are located, at their closest point, approximately 850 m to the east of the Site boundary.

4.5.4 Floodplains

The Department of Water (DoW) prepares floodplain mapping (FPM) to indicate the extent of flooding associated with Average Recurrence Interval (ARI) 100 year flood events. The ARI 100 year flood event is a statistical estimate of the average period in years between the occurrences of a flood of a given size and is roughly equal to a 1% probability of occurring in any given year.

The nearest FPM 100 year ARI mapped area is in Exmouth over 100 km to the south west of the Site.

In addition, the Site has an elevation range from 3.8 m AHD to 5.7 m AHD and would be considered at low risk of flooding.

4.6 Cultural Heritage

4.6.1 Aboriginal Heritage and Native Title

A search of the Department of Indigenous Affairs' (DIA's) online Aboriginal Heritage Inquiry System (October, 2014) identified that the Site is situated within a Native Title Determination named Thalanyji. The Shire is currently investigating the implications of this Native Title Determination on the Site. However, utilising the DIA's online Aboriginal Heritage Inquiry System, there were no sites of Aboriginal heritage significance identified within the Site. The closest Aboriginal Heritage site is located approximately 850 m north of the Site.

4.6.2 European Heritage

The Australian Heritage Database contains a listing of significant natural, historic and Indigenous places including those in the:

- World Heritage List;
- National Heritage List;
- Commonwealth Heritage List;
- Register of the National Estate;
- List of Overseas Places of Historic Significance to Australia; and
- Places under consideration, or that may have been considered for, any one of these lists.

A search of the online Australian Heritage Database identified no sites of significant Australian heritage value within the Site or the surrounding area.

4.6.3 Local Government Heritage

A search of the State Heritage Register identified no places of heritage significance within the Site. The closest state heritage site is located approximately 5 km north of the Site within the township of Onslow.

4.7 Contaminated Site Information

4.7.1 Field work

Talis has undertaken a series of site walkovers and a detailed intrusive Geotechnical Investigation, via seven trial pits. No evidence of contamination was identified as part of these works.

4.7.2 Contaminated Sites Database Search

The DER's Contaminated Sites Database contains a register of sites classified as:

- Contaminated – remediation required;
- Contaminated – restricted use; and
- Remediated for restricted use.

A search of the Contaminated Sites Database identified that the Site is not listed as a contaminated site.

Freedom of Information (FOI) request was submitted to the DER, Department of Mines and Petroleum (DMP) and Department of Parks and Wildlife (DPAW) on 8 October 2014 to request documentation relating to the following:

- DER – Soil/groundwater contamination (confirmed, under investigation or previously investigated), pollution complaints, notices or any other documents relating to contamination or pollution of the environment;
- DMP – Licenses to store flammable liquids/dangerous goods, underground tanks, fuel pumps and the storage of liquefied petroleum gas within the Site; and
- DPAW – Conservational or Heritage information pertaining to the Site.

The DMP confirmed that it failed to locate any documentation associated with the request. At the time of writing, no response had been received from the DER and DPAW, however it is anticipated that these searches will fail to identify any documentation due to the undeveloped status of the Site. Talis will provide additional information to the various approval authorities once we have obtained a response on the various FOI searches.

4.8 Summary of Environmental and Social Attributes

A summary of the existing environmental and social attributes of the Site are shown in **Table 5.**

Table 5: Summary of Environmental and Social Site Attributes

Attribute	Comment
Topography	The elevation of the Site ranges from 5.7 m AHD along the south-eastern boundary to 3.8 m AHD. The south-eastern and north-western boundaries of the Site gently slope down towards the centre of the Site.

Geology	Loose to medium dense brown silty fine sand to a depth of 1 m and medium dense dark brown silty fine to medium sand with some clay and some fine to coarse gravel from 1-2 m.
Acid Sulphate Soils	Soils at the Site are low risk of ASS generation.
Flora and Fauna	The native vegetation at the Site is considered to be in a 'very good' condition. No native flora or fauna of conservation significance are located at or within the vicinity of the Site. Six fauna species of conservation significance are considered to potentially use the Site, and one species likely to use the Site as its habitat. The Site is not located within an ESA. The closest ESA is located approximately 17 km north of the Site. The Site is not a listed on the RNE. The nearest RNE listed site was located within 10 km of the Site.
Hydrogeology & Hydrology	Depth to groundwater is approximately 2 m across the Site. No surface water bodies are located within the Site. The Site is not located in close proximity to wetlands or floodplains.
Cultural Heritage	The Site has a Native Title Determination claim over it. No listed Aboriginal heritage sites within the Site. No listed Australian heritage sites within the Site. No listed Local Government heritage sites within the Site.
Contaminated Site Information	No known former contaminating activities were identified for the Site, nor was it classified as a contaminated site on the DER's Contaminated Sites Database.

5 Conceptual Description of Proposed Site Activities

The following section provides a conceptual description of the Shire's proposal to develop a WTS at the Site under the following headings:

- Waste Transfer Station Concept Design;
- Site Equipment and Machinery;
- Types and Sources of Waste Materials;
- Vehicle Movements;
- Waste Transfer Station Operations;
- Staffing; and
- Operational Hours.

An advanced conceptual drawing set (Drawing 1 to Drawing 9) illustrating the WTS is provided including layout plans, cross sections and typical features.

5.1 Waste Transfer Station Concept Design

The proposed concept design comprises of the following elements which will provide for an efficient and effective WTS:

- Site Layout;
- Site Roads and Surfaces;
- Putrescible Waste Bunker:
  - Push Walls and Floor;
  - Shelter System;
  - Drainage System;
- Stockpile Areas; and
- Supporting Infrastructure.

The following sections provide a detailed description of each element of the WTS concept design.

5.1.1 Site layout

The Site is rectangular in shape and is orientated where the rear of the Site is in a north-easterly direction from the Site access road as shown in **Drawing 4**. Access to the Site is gained by turning off Onslow Road and travelling approximately 600 m along an unsealed road to the entrance of the Site. The entrance gate is located in the southern corner of the Site. The internal roads of the Site are one directional and therefore vehicles are required to enter and exit at alternate gates and therefore perform an anticlockwise loop when visiting the Site. The exit gate is located at the western corner of the Site approximately 120 m from the entrance gate. The Office is located adjacent to the WTS within the middle of the Site. The Putrescible Waste Bunker is located within the north-eastern (rear) end of the WTS and is confined by the three-sided configuration of pushwalls. A surface water evaporation pond is located outside the Putrescible Waste Bunker adjacent to its most eastern corner. The stockpile area is located in the north eastern half of the Site towards the rear. Six separate stockpiles areas have been accommodated for and include scrap metal and mixed building rubble in the eastern corner of the Site, mixed building rubble and tyres towards the middle of the stockpile area and concrete and greenwaste along the northern boundary. The

majority of the Site will be developed as hardstand and graded to fall towards the Site boundary as shown in **Drawing 5** and **Drawing 6**. A security fence will be constructed around the majority of the hardstand area.

5.1.2 Site Roads and Surfaces

The Site access and internal roads will be constructed of locally sourced material to form a suitable hardstand that can withstand constant use from heavy vehicles. The trafficked hardstand area is shown within **Drawing 4**. It extends from the entrance and exit gates at the front of the Site, through to the rear of the Site where the stockpile areas are proposed.

The whole area will be graded to drain to the sides of the Site as shown in **Drawing 6**.

5.1.3 Putrescible Waste Bunker

The Putrescible Waste Bunker consists of a concrete floor with push walls which will be all cast in situ. This will be covered with a tension fabric. The Putrescible Waste Bunker is the covered area where waste materials are unloaded, stored and consolidation prior to placement into the waste transfer vehicle via a front end loader. The Putrescible Waste Bunker as a capacity to store waste materials generated in Onslow for up to three days to cover any unforeseen events or disruptions to the services. However normal practice will involve daily removal of waste from the Putrescible Waste Bunker.

5.1.3.1 Push Walls and Floor

The pushwalls are vertical standing reinforced concrete formed insitu to provide greater strength. The pushwalls will stand approximately 3.6 m tall in order to retain waste material that has been deposited within the Putrescible Waste Bunker. The height of the walls directly affects the capacity of waste that can be stored. The pushwalls will be protected by a sheet of metal attached to the bottom half of the wall. This prevents the front end loader bucket from damaging the concrete during operations and extends the life of the pushwalls.

In addition, the floor at the Putrescible Waste Bunker will be constructed of reinforced concrete cast in situ. Below the reinforced concrete floor, sub base materials will be laid to support the concrete structure. The thickness of the concrete and sub base will be determined during the detailed design stage of the WTS development. The floor of the WTS will extend 1 metre past the northern, eastern and southern edges of the pushwalls and 8m towards the western edge to cover an area of approximately 745 m^2. Refer to **Drawing 8** for detail of the pushwalls and Putrescible Waste Bunker floor.

It is important to note that as the floor and pushwalls will both be cast in situ, this will mean that the bunker will be fully contained and not facilitate the seepage of water from the bunker.

5.1.3.2 Shelter System

It is proposed that the Shire will utilise an engineered shelter system comprised of a steel framework and fabric roof cover mounted on stacked sea containers similar to the 'Container Mounted DomeShelter' system provided by DomeShelter Australia.

The structure will have the following characteristics:

- Rated to cyclonic conditions;

- Bolted, welded or similar to the top of the sea containers;
- Canopy fabric with characteristics for:
  - Thickness;
  - UV resistance;
  - Tear resistance;
  - Tensile strength;
  - Burst strength;
  - Hydrostatic pressure;
  - Flex cracking resistance;
- Lightweight non-corrosive steel frame structure; and
- Netting installed at the back of the shelter for litter control.

The WTS structure concept design is shown in **Drawing 7** and **Drawing 8**.

5.1.3.3 Drainage System

The drainage system utilised within the Putrescible Waste Bunker will facilitate the flow of surface water in two directions. In the front 8 m portion at the front of the WTS, the surface water will fall to the front of the Putrescible Waste Bunker. As no putrescible waste will be sorted in this area, any surface water will not come in contact with any waste materials and can therefore be classified as clean surface water. **Drawing 9** shows the direction of surface water flow within the WTS.

Water that falls in this area would be caused by rainfall events where wind causes the rain to enter under the roof of the Putrescible Waste Bunker or through the netting system. The floor at the rear portion of the Putrescible Waste Bunker will drain towards a shallow sump located in the north eastern corner of the WTS floor. Surface water in this area may come into contact with waste materials and therefore require appropriate management. The water will be captured and retained in an evaporation pond located outside the Putrescible Waste Bunker. Refer to Drawing 9 for detail of the drainage system.

5.1.4 Stockpile Areas

The rear of the Site will be utilised for stockpiling of clean streams that are recyclable or reusable. These materials will include the following:

- Green waste;
- Clean concrete;
- Mixed soils and sand;
- Mixed building rubble;
- Scrap metal; and
- Tyres.

The size of the stockpile areas have been calculated based on anticipated quantities of those materials to be produced per annum and the expected storage time required in order to generate a viable quantity for recycling or reuse. An approximate layout of the stockpiles areas is shown within **Drawing 4.** In addition, Drawing 4 details the material storage requirements for each of the stockpiled materials.

5.1.5 Supporting Infrastructure

Apart from the components of the Site already outlined, the following pieces of supporting infrastructure are required to be constructed or installed:

- Gate house;
- Generator;
- Fences and gates; and
- Signage.

The gate house will be utilised for administration and amenities purposes. It is anticipated that the gate house will be a basic portable building approximately 3 m x 10 m in size. A generator will be utilised to satisfy the periodical electrical needs within the gate house.

A 1.8 m tall steel mesh fence will be constructed around the Site for security purposes and to prevent animals accessing the Site. Gates will be installed at the entrance and exit to the Site which will be locked when the Site is not operational.

Appropriate signage will be installed across the Site to advise on types of materials accepted at the Site. In addition, a sign at the front gates will detail a contact name and number for emergencies.

5.2 Site Equipment and Machinery

The equipment and machinery that are proposed for the operations of the WTS include a front end loader and B-Double vehicles.

The front end loader will be utilised to undertake all materials handling operations at the WTS. In addition, the front end loader will be used to maintain the stockpile areas at the rear of the Site. It is anticipated that, the front end loader will load the B-Double vehicles with the waste material from the Putrescible Waste Bunker. Once the materials are loaded, it will be transported to an appropriate landfill facility for disposal. The B-Double vehicles will provide efficient transportation.

5.3 Types and Sources of Waste Materials

5.3.1 Current Landfill Volumes

The Shire currently maintains a detailed register of the waste that it currently accepts at Onslow Landfill. Across all waste streams (MSW, C&I and C&D), approximately 5,000 tonnes per annum of waste is landfilled at the facility.

5.3.2 Pilbara Data Study

As outlined previously, Onslow is currently undergoing significant unprecedented growth. Therefore, it is important to understand the potential volumes that may be required to be catered for at the WTS, which will be the only public waste facility in the area.

Data that qualifies the types and quantities of waste materials produced in the Onslow area was sourced from the *Waste Data Study for the Pilbara Region and Shire of Broome* (the Waste Data Study) which was prepared by Talis in 2012 on behalf of the Waste Authority of Western Australia.

Following on from the Waste Data Study, Talis was commissioned by the Waste Authority and the Pilbara Development Commission to prepare waste stream projections across the Pilbara. These were undertaken using three growth rates, namely high, medium and low, which were based on population growth and development predictions from a number of sources. For the purposes of this EAMP, Talis has utilised the high growth rate which caters for a level of conservatism appropriate for the WTS design.

The Waste Data Study and projection models are the only publically available data on waste generation and treatment covering all waste streams. Therefore, Talis has utilised the Waste Data Study and the Projection Model as the basis for this EAMP as these are the most robust data available covering total waste generation within the Onslow area.

To assist in the gathering and reporting of the waste data for the Waste Data Study, Talis developed a Waste Classification System (WCS). The WCS consisted of a three-level coding system to classify each waste material in terms of Waste Stream, Sector and Material Type.

The WCS was firstly utilised to identify the source of the waste by grouping the material into one of three waste stream categories namely MSW, C&I and C&D. The second level of the WCS further identifies the source of the waste by the sector of the economy within which the waste was generated. The key sectors in the Onslow area include Domestic, Mining, Petroleum and Natural Gas Processing, Employee Camps and Other/Mixed Sectors.

The final classification within the WCS is Material Type, which reflects the composition of the waste. Each Material Type was given a Material Type code within the range of 100 – 899.

It is anticipated that the following waste streams, sectors and material types shown in **Table 6** will be accepted at the WTS.

Table 6: Waste to be accepted at the WTS

Waste Stream	Sector	Material Types
MSW	1 - Domestic	Kerbside refuse, Vergeside Hard waste, Public place refuse, Greenwaste, Comingled Recyclables
C&I Waste	2 - Mining, exploration, quarrying, physical and chemical treatment of minerals	Mixed Refuse, scrap metal and other clean streams
	5 - Petroleum refining, natural gas purification and pyrolytic treatment of coal	
	9 - Other/Mixed Sectors	
	10 - Employee camps	
C&D Waste	1 – Domestic	Mixed building rubble, greenwaste and inert streams
	5 - Petroleum refining, natural gas purification and pyrolytic treatment of coal	
	9 - Other/Mixed Sectors	

Talis analysed the waste streams, sectors and material types produced within the Onslow area and determined that it is likely that not all waste generated within the area will be accepted at the WTS. This is due to a number of factors including existing contractual arrangements for the LNG producers. Therefore, a percentage of the total waste generated within each Sector was applied to a waste projection model to determine the expected waste quantities to be received at the WTS. **Table 7** shows the projected tonnages of waste materials to be accepted at the WTS by waste stream and sector to 2020.

Table 7: Maximum Projected Volumes to be received at the WTS (2014-2020)

Sector	Waste Stream	Percent of Total Waste to WTS	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Sector 1 Domestic	MSW	100%	475	495	516	538	560	584
	C&I							
	C&D	100%	2,720	2,835	2,955	3,080	3,211	3,346
	Sub-Total		**3,195**	**3,330**	**3,471**	**3,618**	**3,771**	**3,931**
Sector 2 Mining, exploration, quarrying, physical and chemical treatment of minerals	MSW							
	C&I	100%	2,006	2,091	2,180	2,272	2,368	2,468
	C&D							
	Sub-Total		**2,006**	**2,091**	**2,180**	**2,272**	**2,368**	**2,468**
Sector 5 Petroleum refining, natural gas purification and pyrolytic treatment of coal	MSW							
	C&I	25%	2,813	2,813	2,972	2,972	3,131	3,131
	C&D	25%	349	349	511	511	672	672
	Sub-Total		**3,163**	**3,163**	**3,483**	**3,483**	**3,803**	**3,803**
Sector 9 Other/Mixed Sectors	MSW							
	C&I	100%	1,598	1,666	1,736	1,810	1,886	1,966
	C&D	100%	5,096	5,312	5,536	5,771	6,015	6,269
	Sub-Total		**6,695**	**6,978**	**7,273**	**7,581**	**7,901**	**8,235**
Sector 10 Employee camps	MSW							
	C&I	25%	66	69	72	75	78	82
	C&D							
	Sub-Total		**66**	**69**	**72**	**75**	**78**	**82**
Total			**15,125**	**15,631**	**16,479**	**17,029**	**17,922**	**18,519**

It can be seen from **Table 7** that waste is predicted to be accepted at the WTS into the future utilising the high growth rate of 4.32% as specified in the Projections Model. In 2020 a total of approximately 18,500 tonnes per annum will be accepted at the WTS. Talis anticipates that only 25% of the waste from Sector 5 and Sector 10 will be received at the WTS as the Shire will not be required to manage these wastes. Therefore, to include an appropriate level of conservatism the WTS will be designed to cater for 20,000 tonnes per annum.

Capacity modelling was undertaken to determine an appropriate size for the WTS, in particular the Putrescible Waste Bunker, to cater for the largest volume of waste. Following the development of the new Onslow Waste Management Facility, it is anticipated that waste quantities accepted at the WTS will reduce significantly, as the Shire will direct heavy vehicles containing waste materials to the new landfill facility.

5.3.3 Capacity Modelling

The capacity and hence size of the WTS was determined utilising the anticipated waste volume of 20,000 tonnes per annum to be accepted at the Site. It is essential that the WTS be able to house incoming waste volumes for a period of 72 hours in the event of an emergency and transport off-site is delayed. However, as part of normal operations, the Shire will load and remove all putrescible wastes from the WTS within 24 hours, ready for haulage.

Utilising waste data from the Projections Model, Talis determined the quantity of waste to be accepted at the WTS into the future. In order to cater for the anticipated quantities, the Putrescible Waste Bunker was designed to have a nominal capacity of approximately three days which represents the equivalent of 190 tonnes or 20,000 tonnes per annum. A freeboard of 0.6 m was added to the 3 m tall pushwalls as a factor of safety. In the event that the freeboard is fully utilised, it would represent the equivalent of 25,000 tonnes per annum or 210 tonnes per three days.

5.4 Vehicle Movements

Talis investigated the current vehicle movements at the existing Onslow Landfill in order to understand the potential movements at the WTS. The existing Onslow Landfill currently accepts approximately 5,000 tonnes per annum of waste materials for disposal. This equates to approximately 16 tonnes per day over a six day working week. Whereas, the maximum anticipated tonnes per annum (20,000) to be accepted at the WTS is the equivalent of 64 tonnes per day. Talis has compared the current waste acceptance rates at the existing Onslow Landfill to the maximum future waste acceptance volumes to the WTS and determined the associated vehicle movements and presented them in **Table 8**.

Table 8: Comparison of vehicle movement calculations per day at the WTS

Waste Per Annum (tonnes)	Waste per day (tonnes)	Vehicle Type	Avg Vehicle Capacity (tonnes)	Vehicle Movements (per day)	Movement Frequency (%)	Tonnes (per day)
Inbound to WTS						
5,000	16	Public Vehicles	0.5	4	67%	2
		Waste Collection Vehicles	6	1	17%	6
		Medium to light trucks	8	1	17%	8
Sub-total				**6**	**100%**	**16**
20,000	64	Public Vehicles	0.5	24	77%	12
		Waste Collection Vehicles	6	2	6%	12
		Medium to light trucks	8	5	16%	40
Sub-total				**31**	**100%**	**64**
Outbound from WTS						
5,000	16	B-Double Road Trains	45	0.5	100%	22.5
Sub-total				**0.5**	**100%**	**22.5**
20,000	64	B-Double Road Trains	45	1.5	100%	67.5
Sub-total				**1.5**	**100%**	**67.5**

It can be seen from **Table 8** that the 5,000 tonnes per annum associated with the existing Onslow Landfill represents six inbound and 0.5 outbound vehicle movements per day. The 20,000 tonnes per annum equates to 31 inbound vehicle movements and 1.5 outbound. However, as these scenarios are considered to be low (5,000 tonnes per annum) and high (20,000 tonnes per annum), Talis anticipates that the waste acceptance at the WTS will be within this range.

As previously mentioned, the Shire will remove putrescible wastes from the Putrescible Waste Bunker within 24 hours (except in the event of an emergency). Waste that remains at the end of the days will be stored within a sealed haulage container or similar prior to transporting to landfill the following day when sufficient volume is generated to fill the B-Double road train.

5.5 Waste Transfer Station Operations

5.5.1 Material Handling

All vehicles that enter the Site will be inspected by the gatehouse attendant to ensure they are carrying conforming waste material. If non-conforming waste is discovered within the vehicles these will be denied access. Patrons carrying conforming loads will be guided to the designated drop-off location either within the Putrescible Waste Bunker or the stockpile area. This will also allow the relevant data to be recorded for both internal and external invoicing and reporting requirements.

All vehicles carrying conforming loads of waste material will be directed towards the designated area for that material. Vehicles directed to the Putrescible Waste Bunker will be required to reverse into the WTS. Prior to reversing, vehicles will be directed as to the exact location for unloading of their waste material. Once vehicles have entered the Putrescible Waste Bunker in a reverse motion, unloading can begin in the designated area. It is anticipated that light and heavy vehicles will have separate unloading areas within the Putrescible Waste Bunker clearly identified via line markings on the concrete floor. Staff will be present to ensure that all drivers depositing of materials comply with these arrangements.

Vehicles that contain material which can be stockpiled such as inert C&D waste, tyres and greenwaste will be directed to areas designated for those materials at the rear of the Site.

The putrescible waste within the WTS will be loaded into B-Double vehicles utilising a front end loader. The front end loader operator will utilise the concrete pushwalls within the Putrescible Waste Bunker to gather up the waste materials from the floor. Any materials that are spilt during this process will be picked up either manually or by the front end loader and placed within the high sided trailer.

Materials that have been stockpiled will be periodically consolidated utilising the front end loader to maintain the amenity and thoroughfares towards the north eastern end of the Site.

5.5.2 Material Transport

The waste materials accepted at the Site will be taken off-site at regular intervals utilising B-Double vehicles. Based on the modelling undertaken, it is anticipated that the Shire would be taking approximately one load off-site per day. However, current volumes would require a vehicle movement every second day.

All putrescible waste that is taken off-site will be transported to an appropriately licenced (Class II or III) landfill facility. At this stage it is anticipated that this will be to the Shire's Tom Price Landfill.

Scrap metals will be collected by a third party metal recycler on a periodic basis when a sufficient quantity is stockpiled. Inert materials such as clean concrete, mixed soils and sands and mixed building rubble will be transported to the new Onslow Waste Management Facility. Once commissioned, the new Onslow Waste Management Facility will be licenced for crushing of inert material.

In addition, tyres will be relocated to the new Onslow Waste Management Facility on a periodic basis to be stored in a designated tyre mono-cell for safe temporary storage until recycling can occur in the future. Greenwaste will be mulched onsite if sufficient volumes are generated for beneficial reuse. Otherwise this material will be sent to landfill.

5.6 Staffing

It is anticipated that one to two staff will be required onsite in order to operate and supervise the day to day operations at the WTS.

It is anticipated that the staff who currently undertake the operative roles at the Shire's existing Onslow Landfill will have their roles transferred to the WTS. This can be easily facilitated as the closing of the Onslow Landfill will coincide with the commencement of operations at the WTS.

The staff will undertake the administrative, material acceptance, handling and loading activities. The team of staff have the experience, capabilities and capacity based on their previous roles at the Onslow Landfill to ensure that the WTS is run in an effective, safe and efficient manner.

All staff will be qualified and/or trained appropriately to undertake their relevant roles. The onsite training that they will undertake will include health and safety and environment management.

5.7 Operational Hours

The Shire proposes to operate the WTS on the following days within the following specified times:

- Monday to Saturday – 7:00 am to 5.00 pm; and
- Closed on Sundays and public holidays.

However, it is anticipated that the Shire will open the WTS to the public between the hours of 8:00am and 4:00pm Monday to Saturday. The site may also be closed from 11:00am to 1:00 pm. This allows additional time at the beginning, during and end of each day to undertake start-up and shut-down procedures and maintenance at the Site.

6 Environmental Aspects

This section details all the potential environmental impacts associated with the Shire's proposed WTS development. Based on our similar experiences with waste facilities, Talis anticipates that key environmental aspects to include:

- Odour;
- Dust;
- Stormwater;
- Surface Water;
- Asbestos;
- Litter;
- Traffic;
- Noise;
- Flora and Fauna; and
- Vermin.

The source and potential impacts associated with these aspects are described in the following sections.

6.1 Odour

Odour may be generated from the storage of putrescible waste or other potentially odorous materials at the Site. Significant odour emissions may reduce amenity values for site workers and surrounding land users as well as attracting vermin. However, it should be noted that the Site is currently isolated, with no plans for development within the surrounding areas. Furthermore, it is important to remember that once the proposed Onslow Waste Management Facility, including landfill, is constructed in the next 3-4 years, the vast majority of putrescible waste will not be accepted at the WTS but carted directly to the new facility.

The proposed operations are not anticipated to generate significant odour emissions as putrescible wastes will only be stored onsite in small quantities and for short periods of time.

The management measures that will be implemented to ensure that potential odour impacts are appropriately managed on Site are outlined in **Section 7.2**.

6.2 Dust

The proposed development has the potential to generate dust during several stages of the operations, including:

- Construction of the facility;
- Vehicle movements;
- Material handling (loading and unloading etc); and
- Stockpiling of materials.

The generation of dust may impact workers at the Site and potentially the surrounding land users if transported off-site. The dust management measures that will be adopted at the Site are described within **Section 7.3**.

6.3 Surface Water

Surface water or stormwater will be generated as the result of precipitation falling onto the Site. The Site will be graded so that surface water will flow to the edges and discharged appropriately through soak wells and swales (**Drawing 6**). Rainwater which falls onto the Putrescible Waste Bunker canopy will be shed to the ground and then to the soak wells.

The canopy will prevent the majority of precipitation coming in contact with the Putrescible Waste Bunker. Furthermore, the front 8 metres of the floor where waste will never be held, will drain surface water to the front hardstand area. The rear of the bunker, where waste will be held, drains to the eastern corner, where it will be fed to the evaporation pond (**Drawing 8**). However, surface water will only be produced in particular events including angled rain. As a result, the evaporation pond will be dry the majority of the time. However, the evaporation pond has been designed to ensure it can cater for cyclonic events.

The management measures to be adopted for the management of stormwater are outlined in **Section 7.4**.

6.4 Asbestos

Asbestos is a hazardous fibrous substance which can occur within waste materials particularly C&D wastes such as building rubble. If prolonged exposure to asbestos occurs, serious illnesses including lung cancer, mesothelioma and asbestosis may occur.

As the Site will accept inert waste materials, there is the potential for asbestos or asbestos containing material to be brought onsite within contaminated loads. Asbestos represents a hazard to personnel at the Site, surrounding land users and the wider community.

Operational measures and training programs to prevent any impacts that asbestos or asbestos containing material may have to any personnel at or surrounding the Site are outlined in **Section 7.5** and further detailed within the Asbestos Management Plan contained within **Appendix F**.

6.5 Litter

Litter may be generated at the Site as a result of the handling of waste, particularly during windy conditions. As well as reducing visual amenity, litter can attract vermin to the Site and may affect surrounding land uses if allowed to migrate off-site.

The management measures that will be utilised to control the generation of litter at the Site are described in **Section 7.6**.

6.6 Traffic

Traffic movements onsite will include:

- Entry and exit of the Shire's MSW kerbside collection vehicles;
- Residents of the Shire dropping off small quantities of waste materials;
- Small commercial vehicles;
- The Shire's front end loader moving waste materials within the Putrescible Waste Bunker to the B-Doubles and occasional maintenance of stockpiles towards the rear of the Site;

- B-Doubles transporting consolidated waste material off-site; and
- Staff movements.

On site traffic movement has the potential to generate noise, dust and create an occupational health and safety risk to workers at the Site. As the Site will only accept relatively small volumes of waste, the traffic movement will be low. These movements will reduce further as the proposed Onslow Waste Management facility becomes operational and vast majority of waste direct hauled to that facility.

The management measures that will be adopted to ensure that any impacts resulting from traffic movements at the Site are appropriately managed are described in **Section 7.7**.

6.7 Noise

Noise emissions have the potential to affect amenity at the Site and surrounding areas. Noise will be generated on Site as a result of:

- The operation of equipment such as the front end loader and generator;
- Vehicle movements on the Site; and
- On site material handling such as loading and unloading.

The management measures that will be implemented to manage noise emissions at the Site are described in **Section 7.8**.

6.8 Flora and Fauna

The acceptance of waste materials at the Site may potentially impact sensitive fauna and flora receptors in surrounding areas. As there will be clearing required as part of this proposal, there may potentially be a loss of current fauna and flora values. The clearing of vegetation may indirectly impact on the flora and fauna in the area.

As outlined previously, the Site does not contain any significant flora or fauna species with would prohibit its clearance. This has been confirmed through desktop analysis and a site visit by ecological consultants Terratree. However, the mitigation measures to be implemented at the Site to minimise impact on flora and fauna values at or surrounding the Site are outlined in **Section 7.9**.

We have reviewed '*A guide to the exemptions and regulations for clearing native vegetation*' (DER, 2014) document, we believe that our proposal which includes clearing of vegetation for the proposed WTS falls within the exemption specified within this document. Regulation 5, Item 1 (the regulation) of DER (2014) states that:

"*Clearing of a site for the lawful construction of a building or other structure on a property, being clearing which does not, together with all limited clearing on the property in the financial year in which the clearing takes place, exceed five hectares, if –*

(a) the clearing is to the extent necessary; and
(b) the vegetation is not riparian vegetation"

In relation to the regulation DER (2014), clearing for the WTS will not exceed 5 ha within a financial year. Clearing of 1.8 ha is required for the WTS. It is noted that the WTS is part of a larger block of land comprising 4,493 ha as previously mentioned, however no clearing is scheduled or forecasted for the remainder of this block within the same financial year. This

has been confirmed by the Shire, which own the Lot. Other than the development of the WTS, there is no other development or clearing proposed for the remainder of the Lot.

Talis has submitted a letter to the Native Vegetation Conservation Branch outlining the process to verify our interpretation of the exemption.

6.9 Vermin

Vermin such as rats, mice, birds and insects may be attracted to waste management facilities particularly those with poor housekeeping practices. If uncontrolled, vermin can present a health risk to site workers and surrounding land users. In addition, these vermin may have a detrimental effect on the surrounding ecosystems via the spread of diseases and predatory instincts.

The management measures that will be implemented to control vermin are outlined in **Section 7.10**.

7 Environmental Management Measures

To ensure the potential environmental impacts identified will be appropriately minimised and managed, the Shire will implement a range of engineering and management measures which are described in the following sections.

7.1 Legislative Context

The environmental management measures that are summarised within this section have been prepared in accordance with all relevant legislative and guidance documents, including:

Legislative:

- *Environmental Protection Regulations 1987;*
- *Environmental Protection (Controlled Waste) Regulations 2004;*
- *Environmental Protection (Noise) Regulations 1997*; and
- *Waste avoidance and Resource Recovery Act 2007*.

Guidance Documents:

- Ecorecycle Victoria (2004) *Guide to Best Practice Resource Recovery and Waste transfer Facilities*; Melbourne, Victoria;
- Ecorecycle Victoria (1996) *Guide to Best Practice at Waste Transfer Stations*; Melbourne, Victoria;
- New South Wales Department of Environment and Conservation (2006) *Handbook for Design and Operation of Rural and Regional Transfer Stations*; Sydney, New South Wales; and
- Waste Management Association Australia (2009) *Guidelines for Management Workplace Health and Safety within the Waste Management and Recycling Industries in Western Australia.*

It should be noted that some of the above mentioned legislative and guidance documents relate to putrescible waste landfilling and specify measures to be adopted. Some of these measures have been proposed within this environmental management plan, which will result in the Site being operated in excess of the relevant statutory requirements or guidance for the operation of a WTS.

7.2 Odour Management

As outlined within **Section 6.1**, the Shire recognises that there is the potential for odour emissions to be generated at the Site as part of the proposed WTS activities. To ensure that the generation of odour at the Site is appropriately minimised and managed, the following management measures will be implemented:

- All vehicles carrying putrescible waste on Site will be required to be enclosed or covered;
- All putrescible waste handling operations will be confined to the Putrescible Waste Bunker ;

- Once placed within the Putrescible Waste Bunker, there will be minimal movement of the waste mass prior to loading the B-Double vehicles;
- The Shire will inspect all loads dropped within the Putrescible Waste Bunker for highly odorous materials. These materials will be removed from the Site at the earliest possible occasion;
- All potentially odorous putrescible wastes will be removed from the Site and loaded into the haulage containers by the end of each day which will be covered;
- Once a week, the Shire will sweep down the Putrescible Waste Bunker with the aim of eradicating any potential odour emitting sources;
- The Site operating hours will be limited to those specified within this EAMP;
- The Shire will maintain a complaints register to ensure that the community has the opportunity to express their comments or concerns regarding the operations at the Site; and
- Odour levels at the Site will be continuously monitored by staff and action taken if required.

It is anticipated that these management measures will enable the Shire to appropriately manage potential odour impacts at the Site. In addition, the remote nature of the Site and distance to the surrounding premises will ensure that odour does not adversely impact the surrounding amenity.

7.3 Dust Management

As indicated within **Section 6.2**, the proposal to operate a WTS at the Site may generate dust. To manage the generation of dust onsite, the Shire will implement the following management measures:

- Appropriate dust management measures will be implemented during the construction works including the use of a water cart;
- The WTS floor will be built of reinforced concrete;
- Vehicles will be restricted to a maximum speed of 5 km/h at the Site which will be sign posted at appropriate locations including the entrance;
- Slow unloading of materials from the lowest height possible;
- Site operations will be ceased during periods of high winds and cyclone events;
- A water cart will be utilised on a daily basis for dust suppression along the main access, internal and exit roads of the Site;
- Waste will be removed from Site on a daily basis; and
- The WTS floor will be cleaned of dust, dirt and sand on a weekly basis.

During the dry summer months, the frequency of dust suppression activities can be increased.

It is anticipated that the implementation of the engineering and management measures listed above will be sufficient to manage dust at the Site.

7.4 Surface Water Management

As stated previously in **Section 6.3**, the Shire will ensure that surface water and stormwater will be managed through a variety of ways to ensure appropriate treatment and discharge. To ensure that surface water on Site is appropriately managed, the following management measures will be adopted:

- Rainfall onto the Putrescible Waste Bunker canopy will be directed off the sea containers into underground soak wells to prevent erosion and scouring of the hardstand;
- Rainfall that falls on the front 8 m of Putrescible Waste Bunker Floor will be directed away from the waste towards the front of the Site;
- Rainfall that manages to enter the Putrescible Waste Bunker will be captured and directed towards a sump which flows to the lined leachate evaporation pond;
- During large rainfall events, stormwater will be collected in a site perimeter swale to control the discharge of surface water off-site;
- The stormwater drainage system will be inspected on a weekly basis to ensure that it is operating appropriately and to ensure that there is no litter locking any of the drains; and
- All stormwater engineering features at the Site will be inspected monthly and maintenance works scheduled appropriately.

The proposed surface water management measures are anticipated to be sufficient to ensure that no surface water or stormwater leaves the Site.

7.5 Asbestos Management

As indicated within **Section 6.4**, the Shire has developed an Asbestos Management Plan for the Site. The Asbestos Management Plan outlines the management measures to provide a systematic approach to be adopted to minimise the unlikely risk of asbestos being brought to the Site and to provide management in the event that asbestos is identified onsite.

The Asbestos Management Plan outlines the following key management measures which will minimise the potential for asbestos to be received and asbestos emissions to be generated at the Site:

- Pre-Acceptance;
- Materials Acceptance;
- Materials Handling; and
- Dust management.

The Asbestos Management Plan which outlines the management measures to be adopted onsite as well as training of staff members is attached as **Appendix F**.

7.6 Litter Management

As outlined within **Section 6.5**, the operations of a WTS may create litter. To ensure that the generation of litter is minimised and appropriately managed at the Site, the following management measures will be implemented:

- All waste materials will be confined to the Putrescible Waste Bunker;
- All vehicles entering the Site will be covered to prevent uncontrolled release of litter on the Site;
- The rear netting of the Putrescible Waste Bunker will be maintained to minimise wind-blown litter escaping from the Site;
- The Putrescible Waste Bunker will be surrounded by concrete pushwalls which further limit the movement of litter;
- The boundary fence will prevent any litter escaping from the Site;

- The netting and boundary fence will be inspected weekly and any nuisance works scheduled accordingly;
- Any litter generated around the Site and along fence lines will be collected on a daily basis as part of routine procedures; and
- Any litter carried off-site will be collected immediately and taken back onsite.

These management measures will enable the Shire to appropriately manage litter at the Site.

7.7 Traffic Management

To minimise any potential impacts of traffic movements at the Site such as those identified in **Section 6.6**, the following management measures will be implemented:

- All vehicles restricted to hardstand areas;
- Vehicles will be restricted to a maximum speed of 5 km/h at the Site which will be sign posted at appropriate locations including the entrance;
- All vehicles will be maintained in good working condition and drivers instructed to use conservative driving techniques; and
- Water card used to suppress dust onsite and along the access road.

As previously mentioned, the number of anticipated vehicle movements at the WTS will be 31 vehicles per day. This number is expected to decrease once the new Onslow Waste Management Facility is constructed in approximately 3-4 years. It is anticipated that these measures will be sufficient to manage traffic at the Site during its busiest period following commissioning.

In addition, the Shire is currently in consultation with Main Roads regarding any potential approval requirements associated with the development, including the intersection with Onslow Road.

The Shire will monitor the number of traffic movements at the Site to ensure that the potential impacts of traffic movements are appropriately managed using the proposed measures.

7.8 Noise Emission Management

As indicated within **Section 6.7**, noise emissions may be produced from the operations of the WTS. As mentioned previously, there are several sources of noise associated with the proposed development including operation of equipment and machinery, vehicle movements and the loading and unloading of materials. However, as the Site is isolated from any other current or proposed future development, Talis is of the view that compliance with the *Environmental Protection (Noise) Regulation 1997* will be achieved.

To ensure that noise emissions are minimised, the following measures will be implemented onsite:

- Waste acceptance and the operation of equipment and machinery on Site will be restricted to operational hours only;
- Vehicles will be restricted to a maximum speed of 5 km/h at the Site;
- Noise reducing workplace procedures will be adopted such as slow unloading of materials from the lowest height possible;
- All material handling will be confined to the designated areas;

- The Putrescible Waste Bunker will be surrounded by concrete pushwalls which further limit the noise emissions;
- All equipment and machinery will be maintained in good working condition; and
- Workers employed at the Site will continue to be provided with personal protective clothing (PPE) including ear muffs to mitigate any noise impacts associated with the Site activities.

It is anticipated that the management measures listed above, will be sufficient to appropriately manage noise emissions at the Site and compliance with the Noise Regulations.

7.9 Flora and Fauna Values

As specified previously in **Section 6.8**, the development of a WTS at the Site will result in some clearing of the Site, however the flora and fauna values have been identified as insignificant. To minimise any potential impacts associated with the development and operation of the WTS, the following management measures will be adopted onsite:

- All clearing undertaken will be confined to the appropriate area onsite during the construction. This will be supervised by the Shire appointed Construction Superintendent;
- All clearing will be undertaken in a conservative manner;
- Any cleared vegetation and/or topsoil will be either placed within the non-cleared area at the front of the facility or stored on site for future revegetation projects such as the rehabilitation of the current landfill;
- The Shire will implement all dust management measures as outlined within this EAMP;
- All vehicles restricted to hardstand areas; and
- The Shire will implement all vermin management measures as outlined within this EAMP to control any potential vermin issues on Site.

All stormwater management measures as outlined within this EAMP will be implemented by the Shire.

Through the adoption of the management measures detailed within this EAMP, it is anticipated that there will be no significant impact to flora or fauna on or surrounding the Site as part of the Shire's proposed WTS development or operations.

7.10 Vermin Control

As outlined within **Section 6.9**, accepting putrescible wastes at the Site may attract vermin which have the potential to impact local health and ecological communities. To control the potential vermin issues at the Site, the Shire proposes the following proactive management measures to be implemented:

- All putrescible waste handling operations will be confined to the Putrescible Waste Bunker;
- To minimise any feeding opportunities for vermin, the Shire will store all putrescible waste into covered haulage vehicles at the end of each operational day;
- A minimum of once per week the Shire will sweep down the Putrescible Waste Bunker;
- The generation of odour and litter will be minimised through the implementation of appropriate management measures;

- The Shire will undertake regular litter collections onsite;
- All vehicles carrying putrescible waste to be covered;
- A perimeter fence of 1.8m will be installed surrounding the Site;
- The perimeter fence will be monitored and maintained on a regular basis
- The Shire will have any suspected and/or known shelters or breeding grounds for vermin on the Site eliminated; and
- Should any significant vermin issues be experienced, the Shire will utilise professional services to eradicate vermin at the Site.

Though the adoption of the vermin management measures any potential impacts associated with the proposed WTS operation will be adequately managed.

7.11 Security

As mentioned previously, the Site will be surrounded by a 1.8m tall steel mesh fence. The entrance and exit gates to the Site will be closed and locked outside operational hours to ensure access for unauthorised vehicles and persons is prevented. To ensure the security of the Site is not compromised, the following practices will be adhered to:

- A perimeter fence of 1.8m will be installed surrounding the Site;
- The perimeter fence will be monitored and maintained on a regular basis; and
- The entrance and exit gates will be locked securely outside of operational hours.

The utilisation of these management measures will ensure that security issues are not associated with the Site.

7.12 Community Liaison

The perception of the local community towards activities at the WTS site is important to the Shire. The Shire will maintain an open channel of communication with the local community. As part of this open line of communications, the Shire will adopt a system of recording all community concerns within the Site register as they arise. All comments or complaints received will be immediately forwarded to the Site operations manager. The Site operational manager will report back to the person that lodged the comments or complaints regarding its resolution.

The community liaison management measure that the Shire will adopt as part of their proposed expansion to their waste acceptance criteria includes:

- The Shire will maintain a community comments and complaints register onsite. Any entries within this register will be forwarded to the Site operational manager immediately or suitably followed up; and
- The Shire will expand their current community feedback register to ensure that the community has the opportunity to express their comments or concerns on a 24 hour basis via an answering machine. Any messages left on this answering machine will be forwarded, via text message, to the Site operational manager.

These management measures will ensure that open lines of communication are established and maintained between the Shire and the local community.

7.13 Summary of Proposed Management Measures

A summary of the proposed management measures to be implemented at the Site is shown in **Table 9**.

Table 9: Summary of Proposed Management Measures

Aspect	Management Measures
Odour	• All vehicles carrying putrescible waste on Site will be required to be enclosed or covered;
	• All putrescible waste handling operations will be confined to the Putrescible Waste Bunker ;
	• Once placed within the Putrescible Waste Bunker, there will be minimal movement of the waste mass prior to loading the B-Double vehicles;
	• The Shire will inspect all loads dropped within the Putrescible Waste Bunker for highly odorous materials. These materials will be removed from the Site at the earliest possible occasion;
	• All potentially odorous putrescible wastes will be removed from the Site and loaded into the haulage containers by the end of each day which will be covered;
	• Once a week, the Shire will sweep down the Putrescible Waste Bunker with the aim of eradicating any potential odour emitting sources;
	• The Site operating hours will be limited to those specified within this EAMP;
	• The Shire will maintain a complaints register to ensure that the community has the opportunity to express their comments or concerns regarding the operations at the Site; and
	• Odour levels at the Site will be continuously monitored by staff and action taken if required.
Dust	• Appropriate dust management measures will be implemented during the construction works including the use of a water cart;
	• The WTS floor will be built of reinforced concrete;
	• Vehicles will be restricted to a maximum speed of 5 km/h at the Site which will be sign posted at appropriate locations including the entrance;
	• Slow unloading of materials from the lowest height possible;
	• Site operations will be ceased during periods of high winds and cyclone events;
	• A water cart will be utilised on a daily basis for dust suppression along the main access, internal and exit roads of the Site;
	• Waste will be removed from Site on a daily basis; and
	• The WTS floor will be cleaned of dust, dirt and sand on a weekly basis.
Stormwater	• Rainfall onto the Putrescible Waste Bunker canopy will be directed off the sea containers into underground soak wells to prevent erosion and scouring of the hardstand;

Aspect	Management Measures
	• Rainfall that falls on the front 8 m of Putrescible Waste Bunker Floor will be directed away from the waste towards the front of the Site;
	• Rainfall that manages to enter the Putrescible Waste Bunker will be captured and directed towards a sump which flows to the lined leachate evaporation pond;
	• During large rainfall events, stormwater will be collected in a site perimeter swale to control the discharge of surface water off-site;
	• The stormwater drainage system will be inspected on a weekly basis to ensure that it is operating appropriately and to ensure that there is no litter locking any of the drains; and
	• All stormwater engineering features at the Site will be inspected monthly and maintenance works scheduled appropriately.
Asbestos	The Asbestos Management Plan which outlines the management measures to be adopted onsite as well as training of staff members is attached as **Appendix F**.
Litter	• All waste materials will be confined to the Putrescible Waste Bunker;
	• All vehicles entering the Site will be covered to prevent uncontrolled release of litter on the Site;
	• The rear netting of the Putrescible Waste Bunker will be maintained to minimise wind-blown litter escaping from the Site;
	• The Putrescible Waste Bunker will be surrounded by concrete pushwalls which further limit the movement of litter;
	• The boundary fence will prevent any litter escaping from the Site;
	• The netting and boundary fence will be inspected weekly and any nuisance works scheduled accordingly;
	• Any litter generated around the Site and along fence lines will be collected on a daily basis as part of routine procedures; and
	• Any litter carried off-site will be collected immediately and taken back onsite.
Traffic	• All vehicles restricted to hardstand areas;
	• Vehicles will be restricted to a maximum speed of 5 km/h at the Site which will be sign posted at appropriate locations including the entrance;
	• All vehicles will be maintained in good working condition and drivers instructed to use conservative driving techniques; and
	• Water card used to suppress dust onsite and along the access road.
Noise	• Waste acceptance and the operation of equipment and machinery on Site will be restricted to operational hours only;
	• Vehicles will be restricted to a maximum speed of 5 km/h at the Site;

Aspect	Management Measures
	• Noise reducing workplace procedures will be adopted such as slow unloading of materials from the lowest height possible;
	• All material handling will be confined to the designated areas;
	• The Putrescible Waste Bunker will be surrounded by concrete pushwalls which further limit the noise emissions;
	• All equipment and machinery will be maintained in good working condition; and
	• Workers employed at the Site will continue to be provided with personal protective clothing (PPE) including ear muffs to mitigate any noise impacts associated with the Site activities.
Flora & Fauna	• All clearing undertaken will be confined to the appropriate area onsite during the construction. This will be supervised by the Shire appointed Construction Superintendent;
	• All clearing will be undertaken in a conservative manner;
	• Any cleared vegetation and/or topsoil will be either placed within the non-cleared area at the front of the facility or stored on site for future revegetation projects such as the rehabilitation of the current landfill;
	• The Shire will implement all dust management measures as outlined within this EAMP;
	• All vehicles restricted to hardstand areas; and
	• The Shire will implement all vermin management measures as outlined within this EAMP to control any potential vermin issues on Site.
Vermin	• All putrescible waste handling operations will be confined to the Putrescible Waste Bunker;
	• To minimise any feeding opportunities for vermin, the Shire will store all putrescible waste into covered haulage vehicles at the end of each operational day;
	• A minimum of once per week the Shire will sweep down the Putrescible Waste Bunker;
	• The generation of odour and litter will be minimised through the implementation of appropriate management measures;
	• The Shire will undertake regular litter collections onsite;
	• All vehicles carrying putrescible waste to be covered;
	• A perimeter fence of 1.8m will be installed surrounding the Site;
	• The perimeter fence will be monitored and maintained on a regular basis
	• The Shire will have any suspected and/or known shelters or breeding grounds for vermin on the Site eliminated; and
	• Should any significant vermin issues be experienced, the Shire will utilise professional services to eradicate vermin at the Site.

Aspect	Management Measures
Security	• A perimeter fence of 1.8m will be installed surrounding the Site;
	• The perimeter fence will be monitored and maintained on a regular basis; and
	• The entrance and exit gates will be locked securely outside of operational hours.
Community Liaison	• The Shire will maintain a community comments and complaints register onsite. Any entries within this register will be forwarded to the Site operational manager immediately or suitably followed up; and
	• The Shire will expand their current community feedback register to ensure that the community has the opportunity to express their comments or concerns on a 24 hour basis via an answering machine. Any messages left on this answering machine will be forwarded, via text message, to the Site operational manager.

8 Conclusion

With deep water access and proximity to off-shore gas reserves the town of Onslow has been selected to support the construction and operation of the Ashburton North Strategic Industrial Area (ANSIA). The Chevron lead Wheatstone project is currently being constructed in the ANSIA. Supporting this significant development, Onslow is currently undergoing rapid development and population growth.

The Onslow landfill is reaching the end of its operational life which is compounded by development in some of the land surrounding the landfill site. As a result, the current Onslow Landfill is scheduled to cease operations in March 2015. As the delivery of the new landfill will take a substantial amount of time, approximately 3-4 years, well after the current landfill has ceased operations, the Shire has proposed the development of a WTS to continue to provide waste disposal services to the Onslow community.

In the short term, the WTS will accept and consolidate the majority of waste materials generated within the Onslow town site. In the longer term, following the development of a new waste management facility, the WTS will be utilised solely as a community drop-off centre whereby the Shire's residents and small commercial operators will take their recyclables and waste materials.

To ensure that the proposed WTS complies with all legislative requirements, the Shire is seeking to obtain the following environmental and planning approvals:

- Works Approval from the DER;
- Licence from the DER;
- Environmental Referral from the EPA to determine the appropriate level of assessment; and
- Planning Approval.

The Site will be classified as a Prescribed Premise pursuant to the *Environmental Protection Act 1987* and licenced as a Category 57 - Used Tyre Storage (general) and Category 62 - Solid waste depot.

A Site Selection Study was undertaken utilising best practice siting and design principles to identify a Preferred Site for the new WTS. The Site Selection Study identified a parcel of land within Lot 500 Onlsow Road, Onlsow that was isolated, contained no evidence of significant environmental or social values, is undeveloped and was not included or situated within close proximity to any proposed future development or growth. Therefore, the identified site was considered appropriate for its proposed purpose as a WTS.

The WTS concept design comprises of seven key components which include the internal Site Roads and hardstand Surfaces located across the Site. The Putrescible Waste Bunker located towards the middle of the Site and is covered by the Shelter System. The Push Walls and Floor are the concrete containment system of the Putrescible Waste Bunker, which has a Drainage System that shed surface water away from the putrescible waste. The Stockpile Areas are located towards the rear of the Site.

It is anticipated that the WTS will accept waste volumes in the range between 5,000 tonnes per annum and 20,000 tonnes per annum, however, the WTS has been designed to cater for

the maximum volume. In addition, the WTS will be capable of storing 72 hours' worth of waste during emergency periods such as cyclonic events. However, as part of normal operations the Shire will remove waste from the Site within 24 hours.

The key environmental impacts associated with the development and operations of the WTS at the Site include:

- Odour;
- Dust;
- Stormwater;
- Surface Water;
- Asbestos;
- Litter;
- Traffic;
- Noise;
- Flora and Fauna; and
- Vermin.

Following an evaluation of the potential environmental impacts, a suite of engineering and management measures will be adopted as part of the construction and operations of the proposed WTS.

Given the above, Talis is of the view that the Shire's proposed development and operation of the WTS at the Site can be achieved in a manner that ensures that any potential environmental impacts associated can be managed appropriately.

Figures

297,000 298,000 299,000 300,000 301,000 302,000 303,000 304,000 305,000 306,000 307,000 308,000 309,000

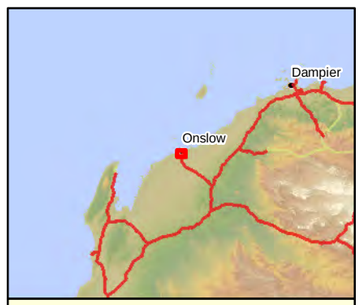
7,606,000 7,605,000 7,604,000 7,603,000 7,602,000 7,601,000 7,600,000 7,599,000 7,598,000 7,597,000 7,596,000

LEGEND

- Site Boundary

Road Network (MRWA)

- Access Road
- Local Distributor
- Primary Distributor



0 500
Kilometres

SITE LOCALITY

Onslow Waste Transfer Station Environmental Assessment and Management Plan

N

0 200 400 800 1,200 1,600
Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3:	1:40,000	Prepared:	R Cullen
Date:	28/10/2014	Checked:	A Upitis
Revision:	Rev A	Reviewed:	N King
Project No:	TW14026		

Figure 01

talis delivering solutions

Document Path: \\server\Talis\SECTIONS\Waste\PROJECTS\TW2014\TW14026 - Onslow WTS Approval\GIS\Maps\TW14026_001_Locality.mxd

297,000 298,000 299,000 300,000 301,000 302,000 303,000 304,000 305,000 306,000 307,000 308,000 309,000

7,606,000 7,605,000 7,604,000 7,603,000 7,602,000 7,601,000 7,600,000 7,599,000 7,598,000 7,597,000 7,596,000

Lot 500 (P401881 500)

LEGEND

- Site Boundary
- Cadastral Boundaries
- Lot 500 (Parcel - P401881-500)

SITE CADASTRE

Onslow Waste Transfer Station Environmental Assessment and Management Plan

N

0 200 400 800 1,200 1,600

Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3:	1:40,000	Prepared:	R Cullen
Date:	28/10/2014	Checked:	A Upitis
Revision:	Rev A	Reviewed:	N King
Project No:	TW14026		

Figure 02

talis delivering solutions

Document Path: \\server\Talis\SECTIONS\Waste\PROJECTS\TW2014\TW14026 - Onslow WTS Approval\GIS\Maps\TW14026_002_Cadastre.mxd

303,000

303,000

LEGEND

Site Boundary

SITE AERIAL

Onslow Waste Transfer Station
Environmental Assessment and
Management Plan

N

0 5 10 20 30 40

Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3:	1:1,000	Prepared:	R Cullen
Date:	28/10/2014	Checked:	A Upitis
Revision:	Rev A	Reviewed:	N King
Project No:	TW14026		

Figure 03

talis
delivering solutions

Document Path: Z:\SECTIONS\Waste\PROJECTS\TW2014\TW14026 - Onslow WTS Approval\GIS\Maps\TW14026_003_Aerial.mxd

297,000 298,000 299,000 300,000 301,000 302,000 303,000 304,000 305,000 306,000 307,000 308,000 309,000

7,606,000 7,605,000 7,604,000 7,603,000 7,602,000 7,601,000 7,600,000 7,599,000 7,598,000 7,597,000 7,596,000

LEGEND

- Site Boundary
- Nearest Sensitive Receptor

Road Network (MRWA)

- Access Road
- Local Distributor
- Primary Distributor

NEAREST SENSITIVE RECEPTOR

Onslow Waste Transfer Station Environmental Assessment and Management Plan

N

0 200 400 800 1,200 1,600

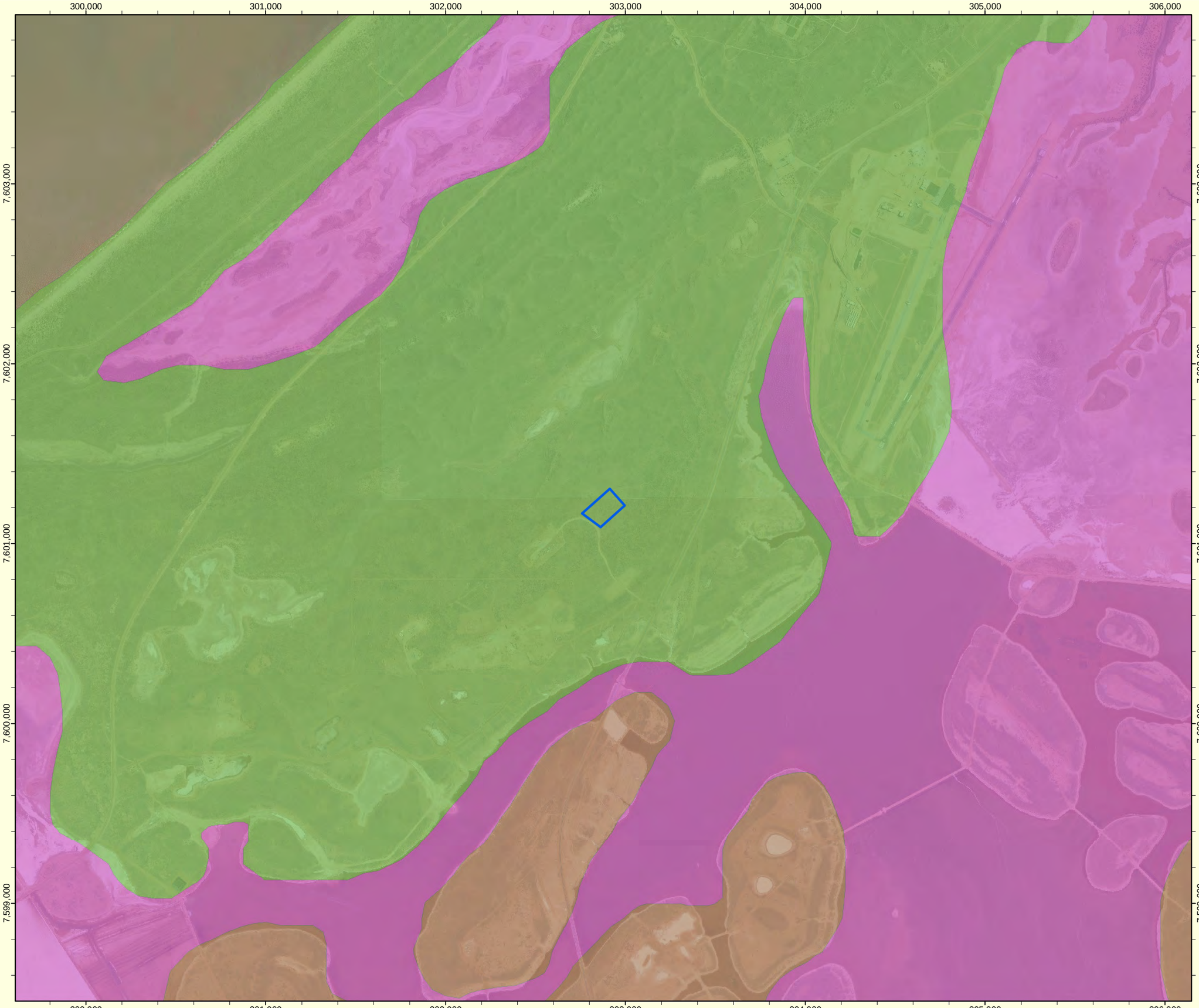
Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3:	1:40,000	Prepared:	R Cullen
Date:	28/10/2014	Checked:	A Upitis
Revision:	Rev A	Reviewed:	N King
Project No:	TW14026		

Figure 04

talis delivering solutions



LEGEND

Site Boundary

Soil Landscape Systems

201Du - Dune fields supporting soft spinifex and minor hard spinifex grasslands.

201Li - Bare coastal mudflats (unvegetated), samphire flats, sandy islands, coastal dunes and beaches, supporting samphire low shrublands, sparse acacia shrublands and mangrove forests.

201On - Undulating sandplains, dunes and level clay plains supporting soft spinifex grasslands and minor tussock grasslands.

SOIL LANDSCAPE SYSTEM

Onslow Waste Transfer Station
Environmental Assessment and Management Plan

N

0 100 200 400 600 800
Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3:	1:20,000	Prepared:	R Cullen
Date:	28/10/2014	Checked:	A Upitis
Revision:	Rev A	Reviewed:	N King
Project No:	TW14026		

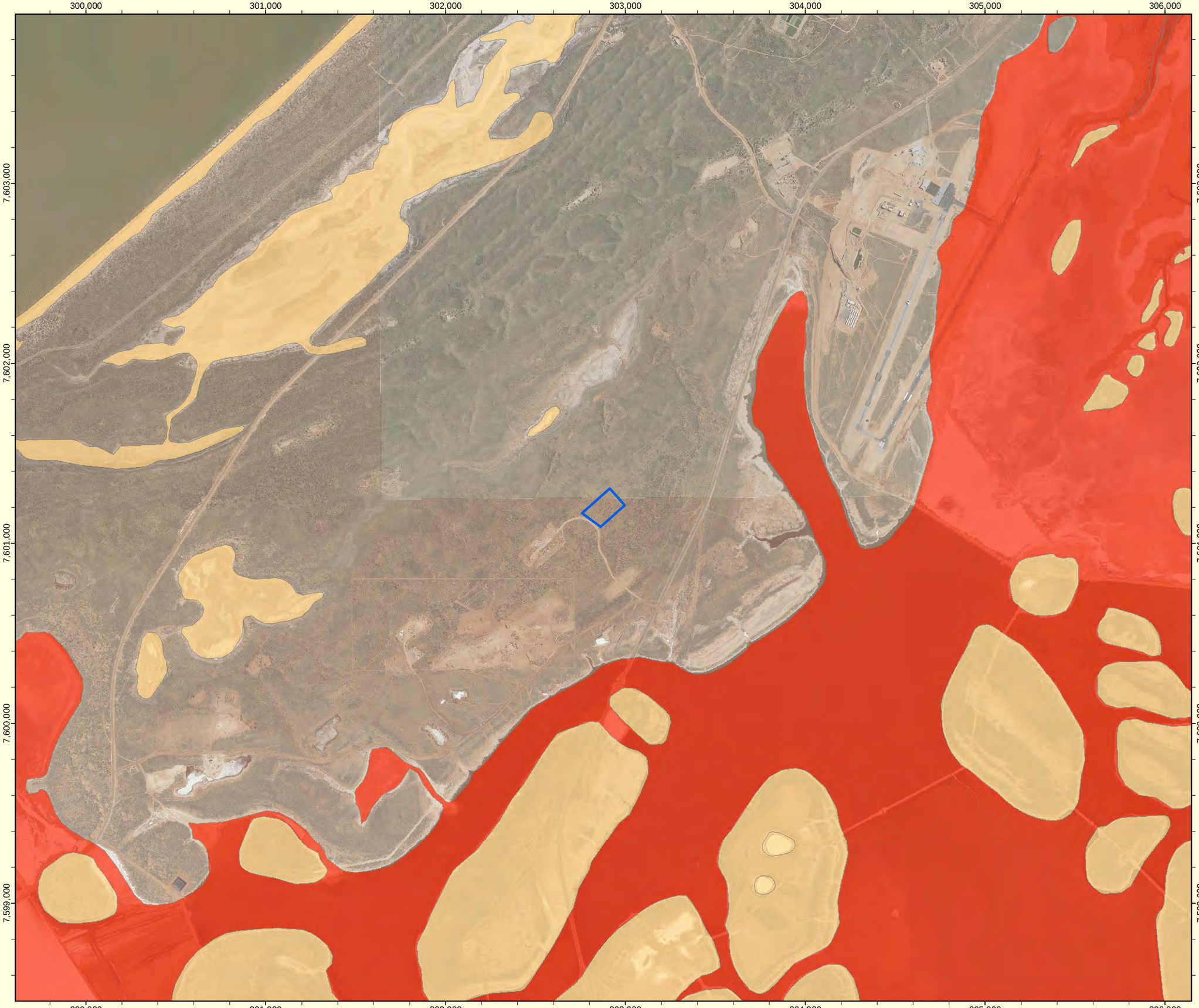
Figure 05

talis delivering solutions

Document Path: Z:\SECTIONS\Waste\PROJECTS\TW2014\TW14026 - Onslow WTS Approval\GIS\Maps\TW14026_005_Soil.mxd

300,000 301,000 302,000 303,000 304,000 305,000 306,000

7,603,000
7,602,000
7,601,000
7,600,000
7,599,000



LEGEND

- Site Boundary

Acid Sulfate Soils Risk Category

- High to moderate risk
- Moderate to low risk

ACID SULFATE SOILS

Onslow Waste Transfer Station
Environmental Assessment and Management Plan

N

0 100 200 400 600 800
Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3:	1:20,000	Prepared:	R Cullen
Date:	28/10/2014	Checked:	A Upitis
Revision:	Rev A	Reviewed:	N King
Project No:	TW14026		

Figure 06

talis delivering solutions

297,000 298,000 299,000 300,000 301,000 302,000 303,000 304,000 305,000 306,000 307,000 308,000 309,000

7,606,000 7,605,000 7,604,000 7,603,000 7,602,000 7,601,000 7,600,000 7,599,000 7,598,000 7,597,000 7,596,000

LEGEND

- Site Boundary

Fauna Search Results

Conservation Code

- T - Threatened
- IA - Migratory birds protected under an international agreement
- S - Other specially protected fauna
- 1 - Priority 1
- 4 - Priority 4

Flora Search Results

Conservation Code

- 1 - Priority 1

THREATENED SPECIES

Onslow Waste Transfer Station Environmental Assessment and Management Plan

N

0 200 400 800 1,200 1,600

Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3:	1:40,000	Prepared:	R Cullen
Date:	28/10/2014	Checked:	A Upitis
Revision:	Rev A	Reviewed:	N King
Project No:	TW14026		

Figure 07

talis delivering solutions

Document Path: Z:\SECTIONS\Waste\PROJECTS\TW2014\TW14026 - Onslow WTS Approval\GIS\Maps\TW14026_007_Threatened_Species.mxd

LEGEND

- Site Boundary
- Water Course
- Surface Water Body
- Inland Intertidal Water Systems

SURFACE WATER

Onslow Waste Transfer Station Environmental Assessment and Management Plan

N

0 100 200 400 600 800

Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3:	1:20,000	Prepared:	R Cullen
Date:	28/10/2014	Checked:	A Upitis
Revision:	Rev A	Reviewed:	N King
Project No:	TW14026		

Figure 08

talis delivering solutions

Document Path: Z:\SECTIONS\Waste\PROJECTS\TW2014\TW14026 - Onslow WTS Approval\GIS\Maps\TW14026_008_SurfaceWater.mxd

Drawings

Drawing 1: Surrounding Land Uses

Drawing 2: Site Survey

Drawing 3: Geotechnical Investigation Layout

Drawing 4: General Site Arrangement

Drawing 5: Formation Levels

Drawing 6: Final Levels

Drawing 7: Site Elevations

Drawing 8: WTS Elevation Details

Drawing 9: Building Drainage Details

talis
delivering solutions
www.talisconsultants.com.au

ASSET MANAGEMENT
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

8/663 Newcastle Street, Leederville WA 6007
PO Box 454, Leederville WA 6903
T: 1300 251 070
E: admin@talisconsultants.com.au

Client: Shire of Ashburton

NOTES

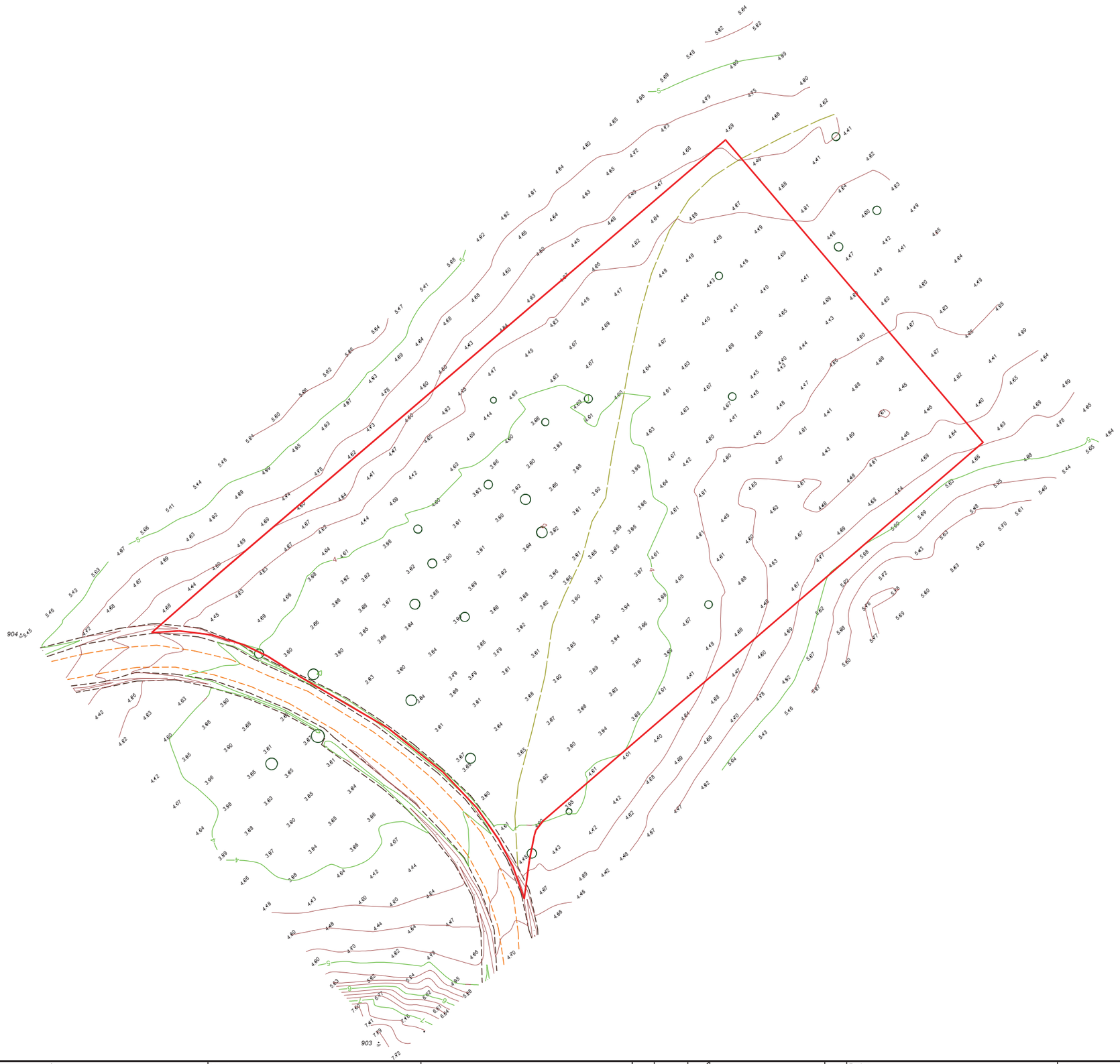
1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

No.	Date	Drawn / Chk	Amendment / Issue	App.
A	2/10/14	AU / KG	EOI	KR

Project: Onslow Waste Transfer Station

Title: Surrounding Land Use

Drawn by:	AU	Job No:	TW14030
Checked by:	KG	File No:	TW14030DG002
Approved by:	KR	Drg. No: 001	Rev: A
Scale:	1:7500		
Date:	2/10/14		



LEGEND

- Spike (Survey Control)
- Spot Height
- Termite Mound
- Toe of Bank
- 1m Contours
- 0.25m Contours
- Track
- Unsealed Road
- Site Boundary

Survey Control Coordinates

Point	Easting	Northing	Elevation
901	44234.891	200870.278	3.248
902	43987.373	201064.377	12.522
903	43864.548	201265.747	7.747
904	43758.337	201386.944	5.110

talis
delivering solutions
www.talisconsultants.com.au

ASSET MANAGEMENT
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

8/663 Newcastle Street, Leederville WA 6007
PO Box 454, Leederville WA 6903
T: 1300 251 070
E: admin@talisconsultants.com.au

Client: Shire of Ashburton

NOTES

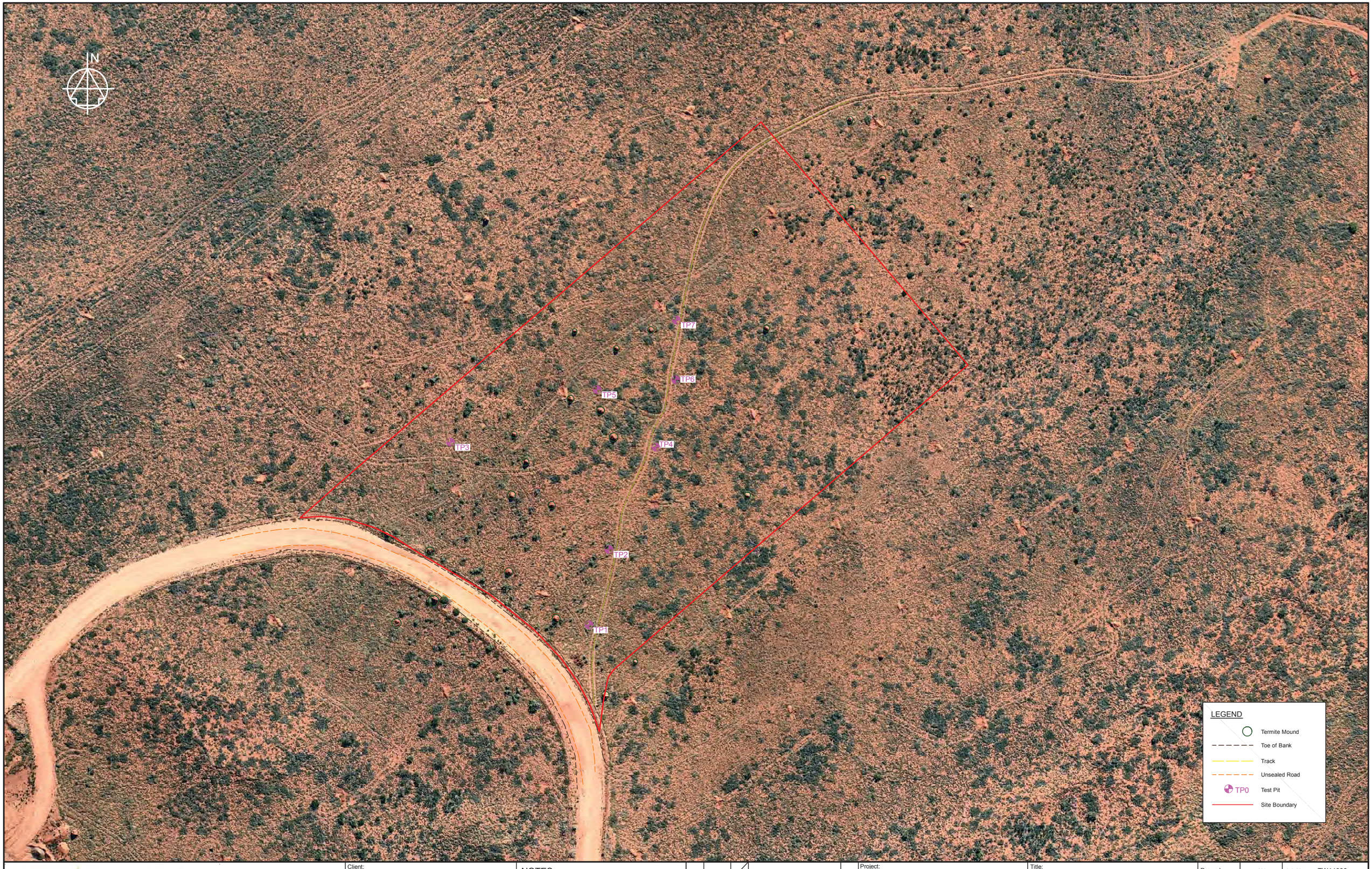
1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

No.	Date	Drawn / Chkd	Amendment / Issue	App.
A	28/10/14	AU / KG	EOI	KR

Project: Onslow Waste Transfer Station

Title: Existing Site Survey

Drawn by:	AU	Job No:	TW14030
Checked by:	KG	File No:	TW14030DG003
Approved by:	KR	Drg. No: 002	Rev: A
Scale:	1:1250		
Date:	28/10/14		



talis
delivering solutions
www.talisconsultants.com.au

ASSET MANAGEMENT
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

8/663 Newcastle Street, Leederville WA 6007
PO Box 454, Leederville WA 6903
T: 1300 251 070
E: admin@talisconsultants.com.au

Client: Shire of Ashburton

NOTES

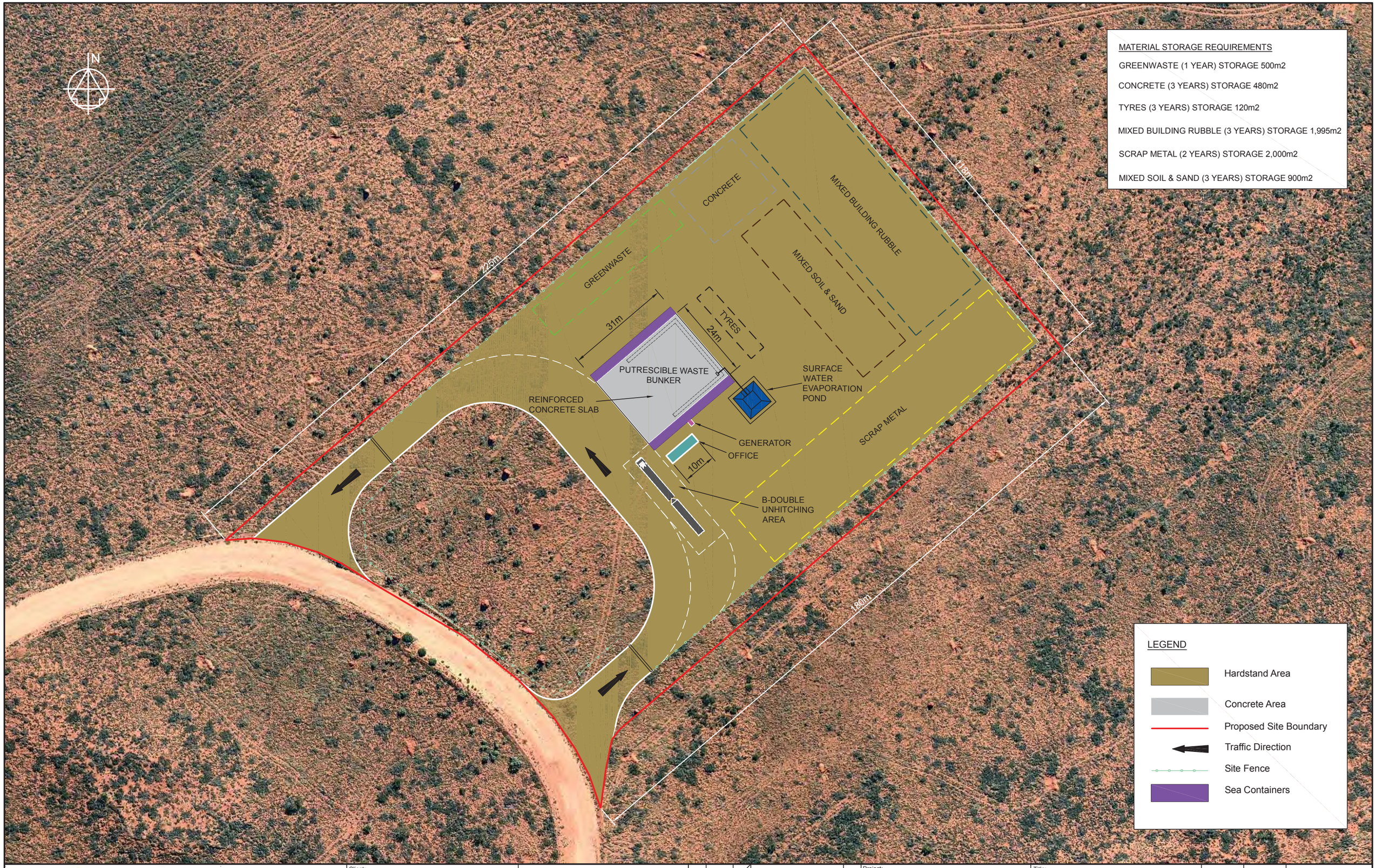
1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

No.	Date	Drwn / Chkd	Amendment / Issue	App.
A	28/10/14	AU / KG	EOI	KR

Project: Onslow Waste Transfer Station

Title: Geotechnical Investigation Layout

Drawn by:	AU	Job No:	TW14030
Checked by:	KG	File No:	TW14030DG004
Approved by:	KR	Drg. No: 003	Rev: A
Scale:	1:1250		
Date:	28/10/14		



talis
delivering solutions
www.talisconsultants.com.au

ASSET MANAGEMENT
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

8/663 Newcastle Street, Leederville WA 6007
PO Box 454, Leederville WA 6903
T: 1300 251 070
E: admin@talisconsultants.com.au

Client: Shire of Ashburton

NOTES

1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

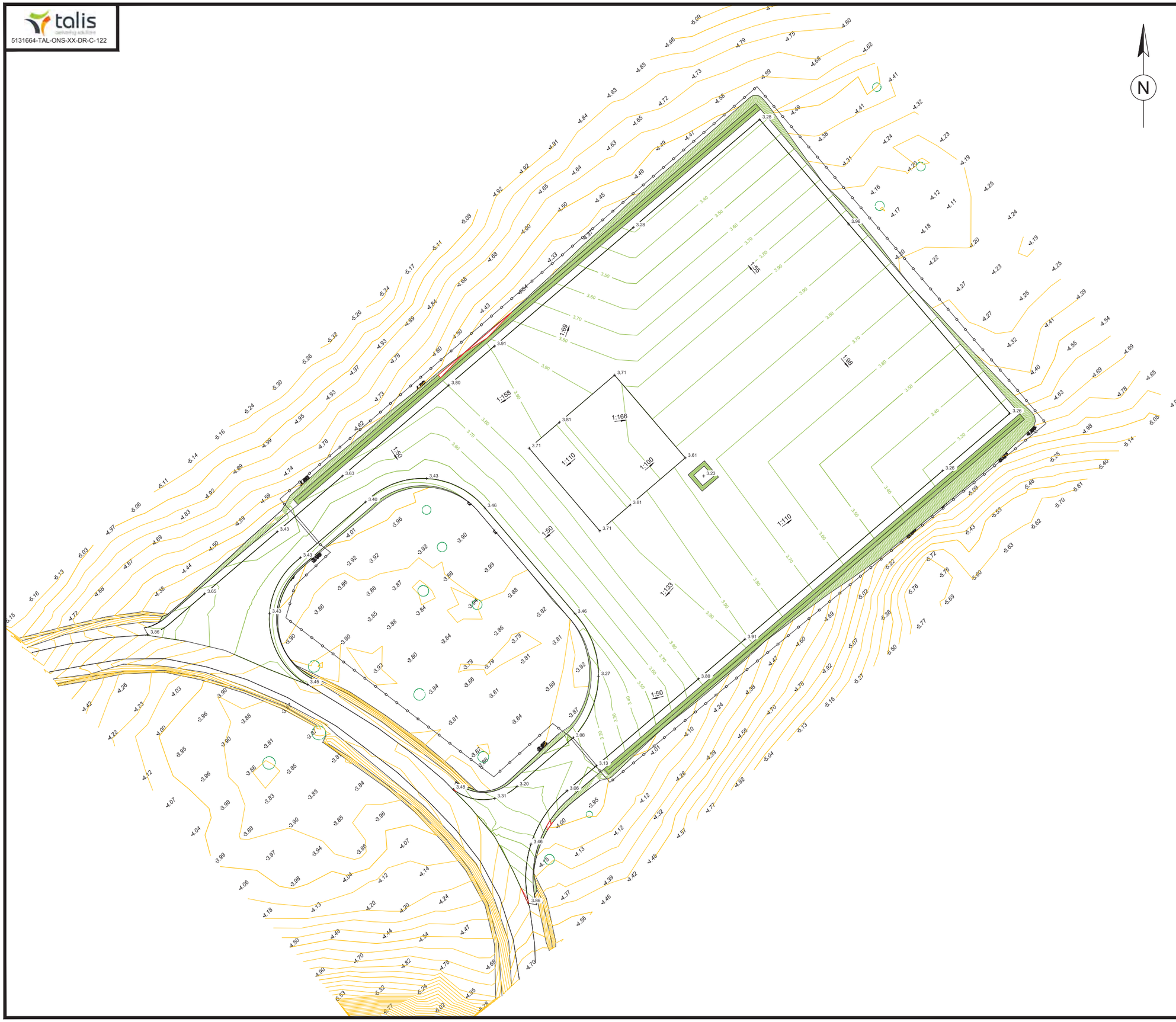
No.	Date	Drwn / Chk	Amendment / Issue	App.
A	28/10/14	AU / KG	EOI	KR

Project: Onslow Waste Transfer Station

Title: General Arrangement

Drawn by:	AU	Job No:	TW14030
Checked by:	KG	File No:	TW14030DG005
Approved by:	KR	Drg. No: 004	Rev: A
Scale:	1:1000		
Date:	28/10/14		

talis
5131664-TAL-ONS-XX-DR-C-122



ATKINS

The modelling and subsequent drawing presented herein has been undertaken by Atkins Plc, The Axis, 10 Holiday Street, Birmingham, B1 1TF, United Kingdom

REVISIONS	Drawn By	Checked By	Date
DRAFT FOR COMMENT	P01	KR	21/10/14

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date

talis
LEVEL 1 UNIT 8 663
NEWCASTLE ST, LEEDERVILLE
WA 6007
TEL 1300 251 070
MOB 0488 33 2424

CLIENT
SHIRE OF ASHBURTON

PROJECT
ONSLOW
WASTE TRANSFER STATION

DRAWING TITLE
FORMATION LEVELS

Scales	DRAWN	CHECKED	CO-ORD CHECK
1 : 500	JH	KR	
	DATE 21/10/14	DATE 21/10/14	DATE 21/10/14

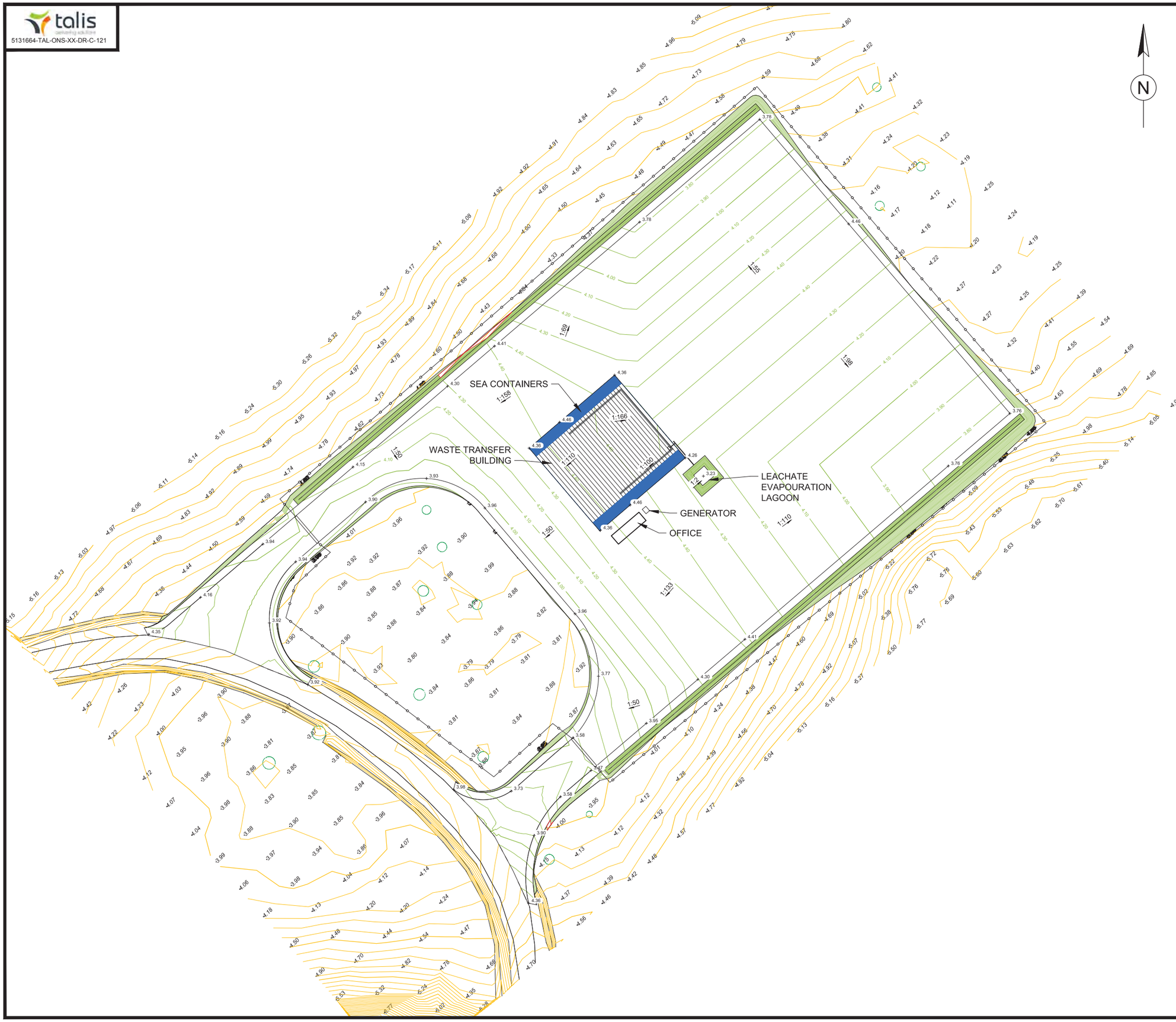
0

SHEET	PLOT DATE
A1	24/10/14

DRAWING NO	REV
005	P01

P:\GBBMA1\DEZ\Dw77\5131664 Stretton Consulting Projects (RA)\File Structure\50 Drawings\Onslow\51-WIP\C\DR\5131664-TAL-ONS-XX-DR-C-122 WTS.dwg, 122, 24/10/2014 10:28:44, fraud0503

5131664-TAL-ONS-XX-DR-C-121



ATKINS

The modelling and subsequent drawing presented herein has been undertaken by Atkins Plc, The Axis, 10 Holiday Street, Birmingham, B1 1TF, United Kingdom

REVISIONS	Drawn By	Checked By	Date
DRAFT FOR COMMENT	P01	KR	21/10/14

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date

talis

LEVEL 1 UNIT 8 663
NEWCASTLE ST, LEEDERVILLE
WA 6007

TEL 1300 251 070
MOB 0488 33 2424

CLIENT
SHIRE OF ASHBURTON

PROJECT
ONSLOW
WASTE TRANSFER STATION

DRAWING TITLE
FINAL LEVELS

Scales	DRAWN	CHECKED	CO-ORD CHECK
1 : 500	JH	KR	
	DATE 21/10/14	DATE 21/10/14	DATE 21/10/14

0

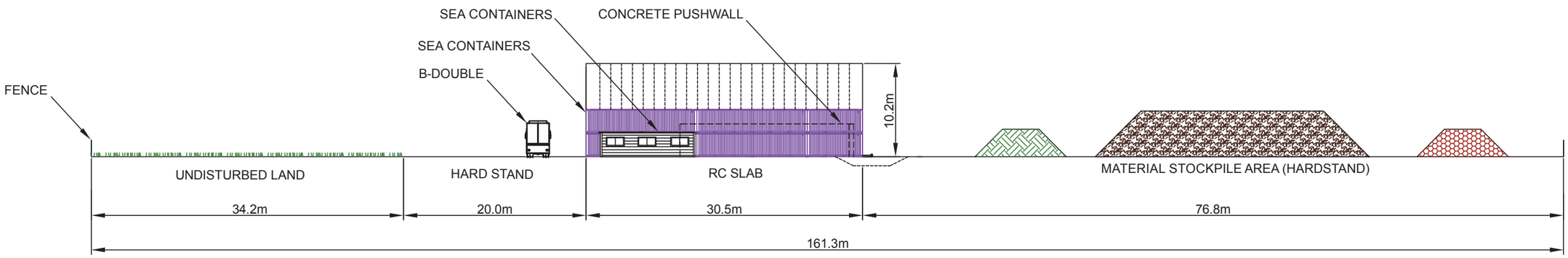
SHEET A1

PLOT DATE 24/10/14

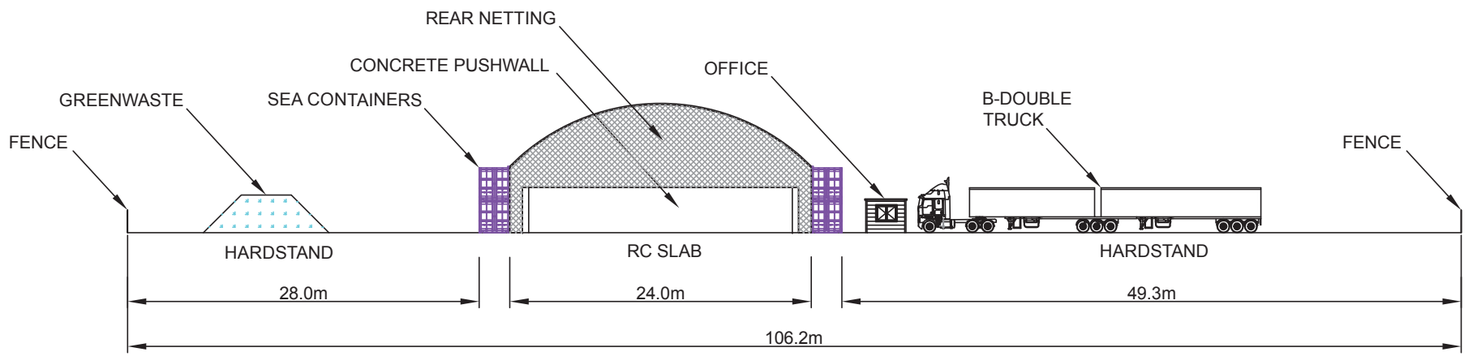
DRAWING NO 006

REV P01

P:\GBBMA1\DE2\Dw77\5131664 Stretton Consulting Projects (RA)\File Structure\50 Drawings\Onslow\51-WIP\C\DR\5131664-TAL-ONS-XX-DR-C-121 WTS.dwg, 121, 24/10/2014 10:28:20, ruaa8053



SIDE ELEVATION



FRONT ELEVATION

talis
delivering solutions
www.talisconsultants.com.au

ASSET MANAGEMENT
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

8/663 Newcastle Street, Leederville WA 6007
PO Box 454, Leederville WA 6903
T: 1300 251 070
E: admin@talisconsultants.com.au

Client: Shire of Ashburton

NOTES

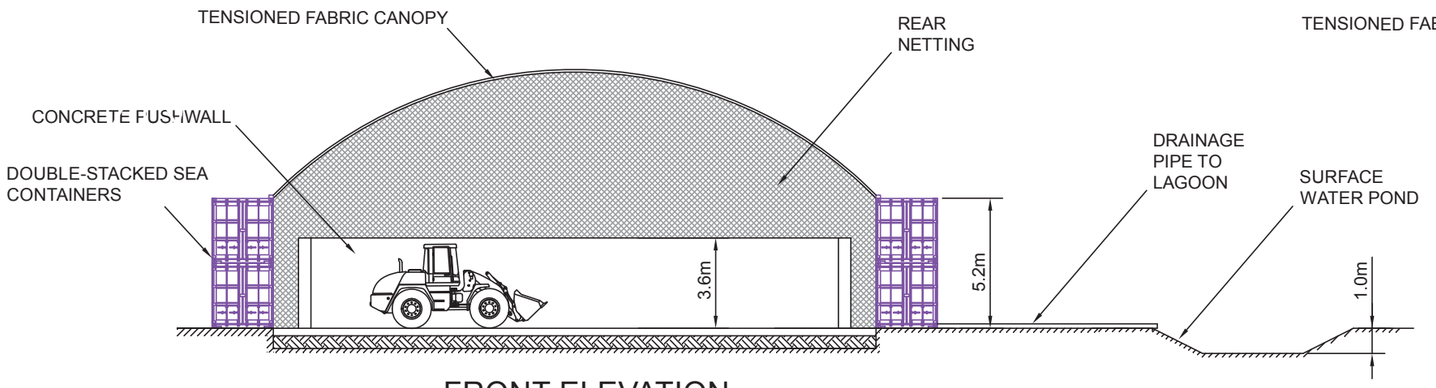
1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

No.	Date	Drwn Chk	Amendment / Issue	App.
A	28/10/14	AU KG	EOI	KR

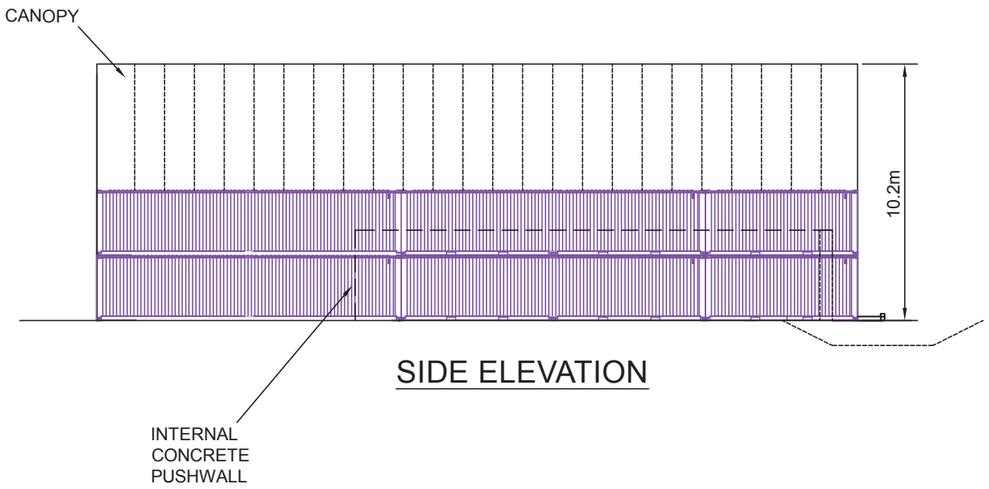
Project: Onslow Waste Transfer Station

Title: Site Elevations

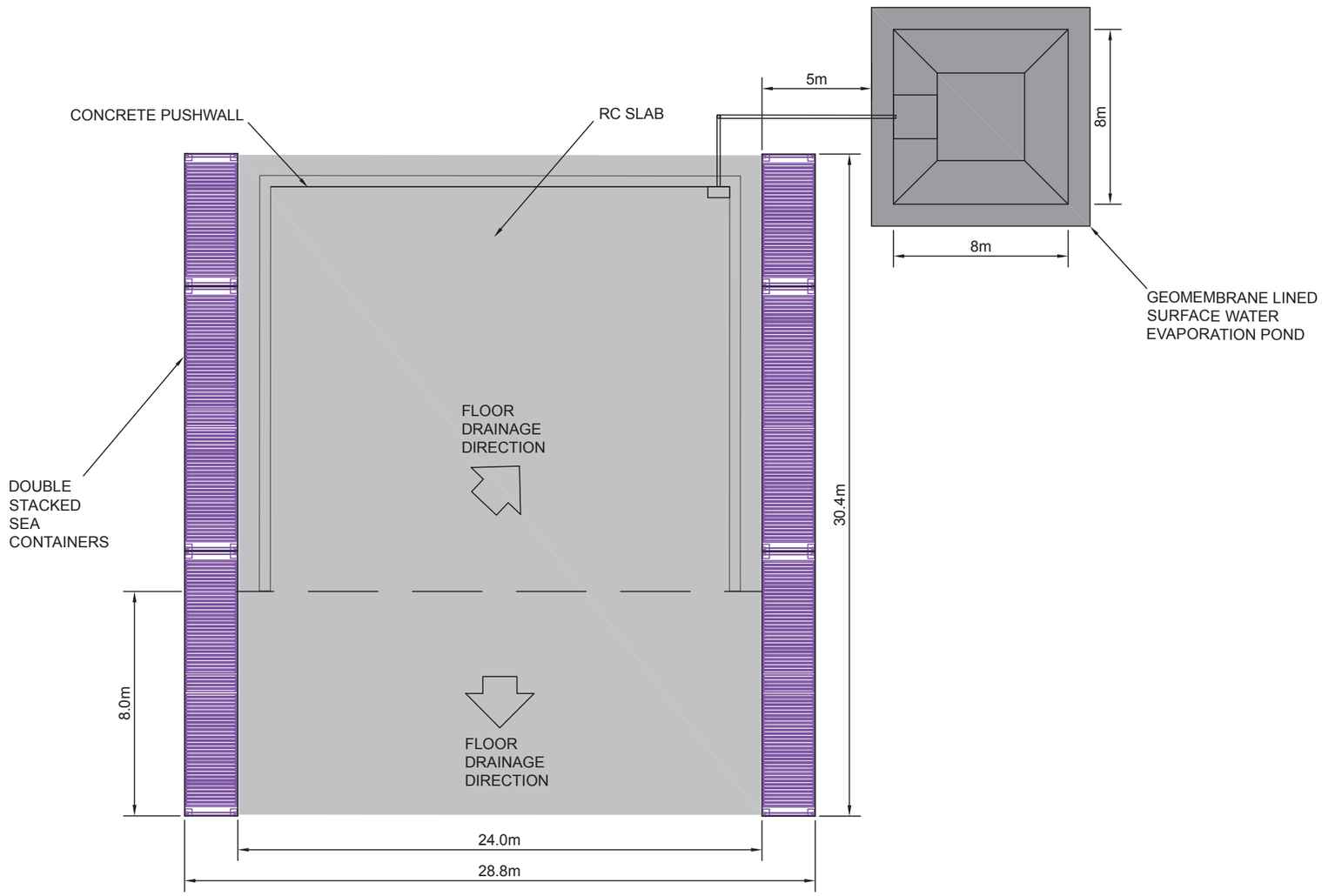
Drawn by:	AU	Job No:	TW14030
Checked by:	KG	File No:	TW14030DG008
Approved by:	KR	Drg. No: 007	Rev: A
Scale:	1:500		
Date:	28/10/14		



FRONT ELEVATION



SIDE ELEVATION



PLAN ELEVATION

talis delivering solutions
www.talisconsultants.com.au

ASSET MANAGEMENT
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

8/663 Newcastle Street, Leederville WA 6007
PO Box 454, Leederville WA 6903
T: 1300 251 070
E: admin@talisconsultants.com.au

Client: Shire of Ashburton

NOTES

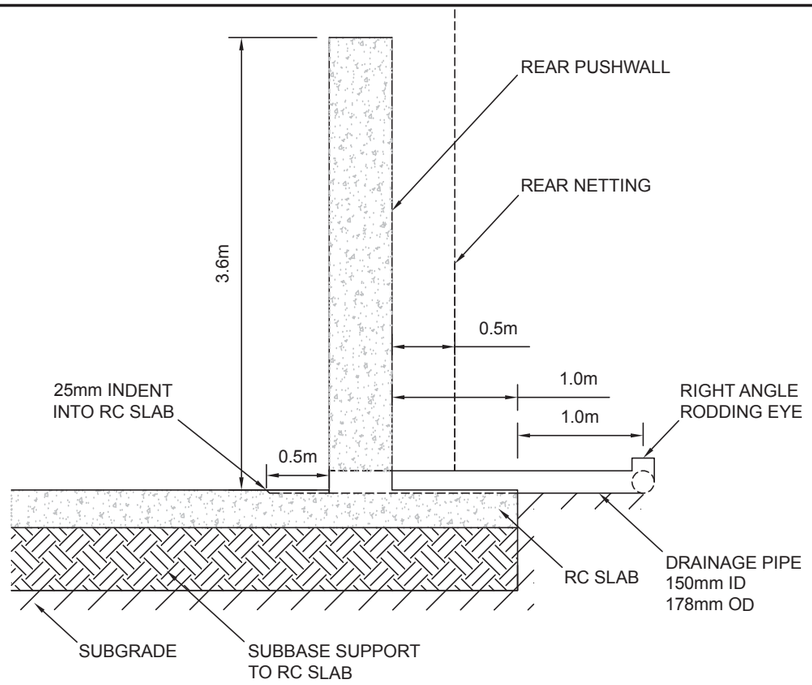
1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

No.	Date	Drawn / Chk	Amendment / Issue	App.
A	28/10/14	AU / KG	EOI	KR

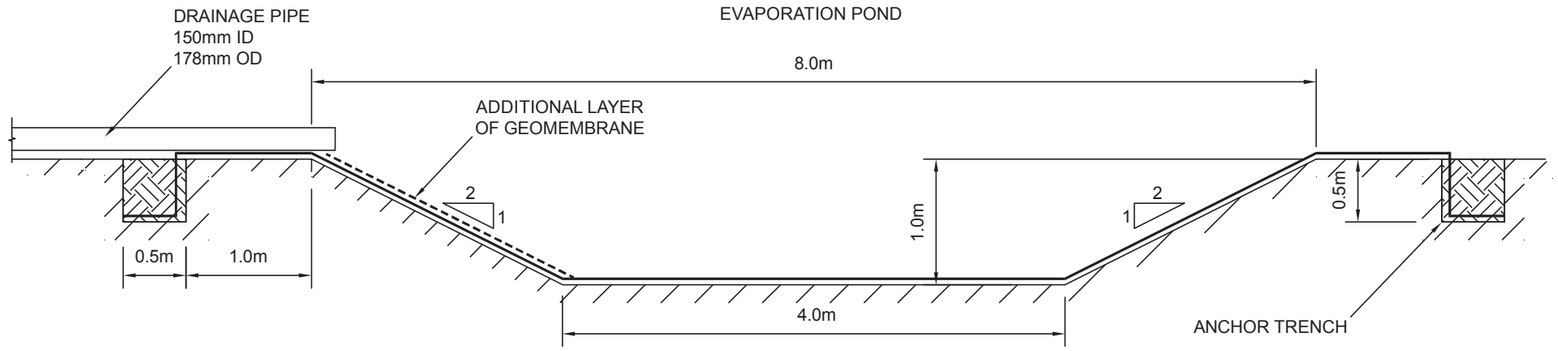
Project: Onslow Waste Transfer Station

Title: WTS Elevation Details

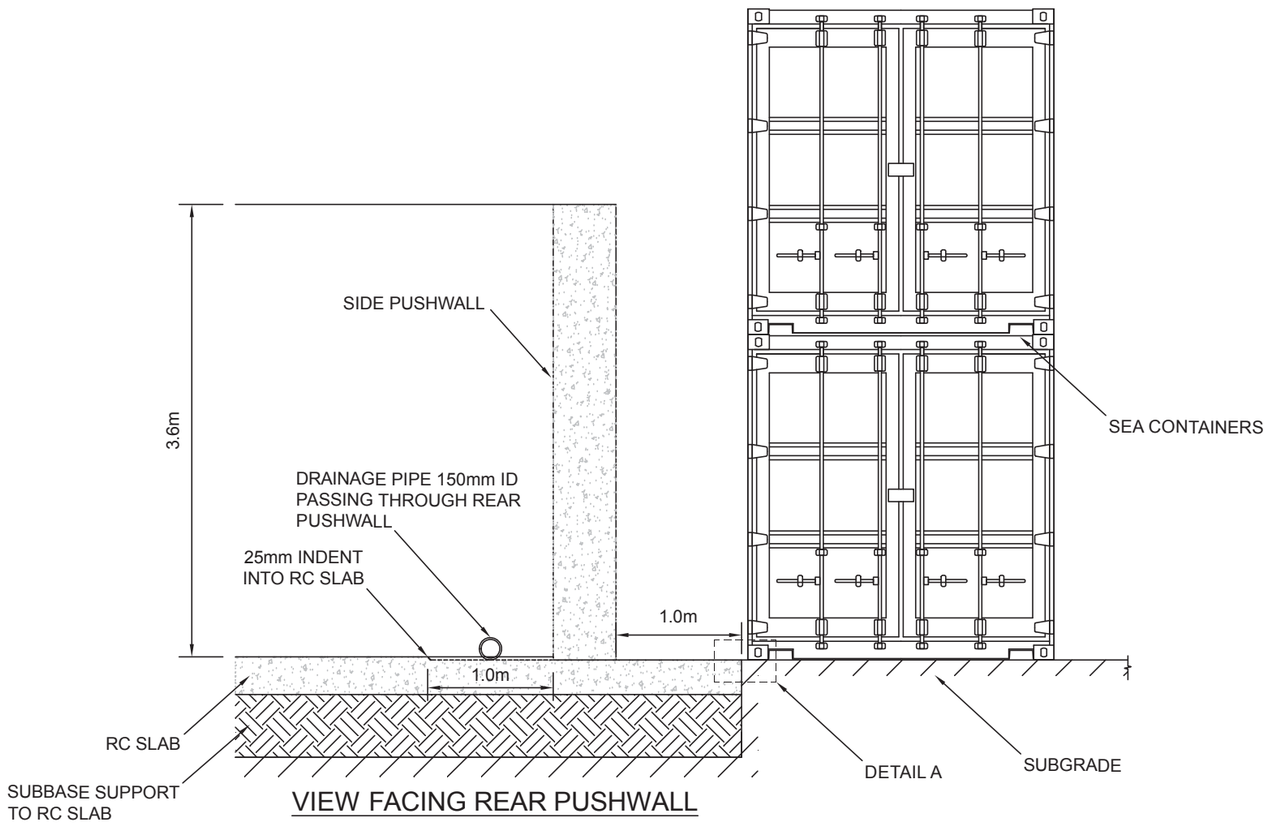
Drawn by:	AU	Job No:	TW14030
Checked by:	KG	File No:	TW14030DG009
Approved by:	KR	Drg. No: 008	Rev: A
Scale:	1:250		
Date:	28/10/14		



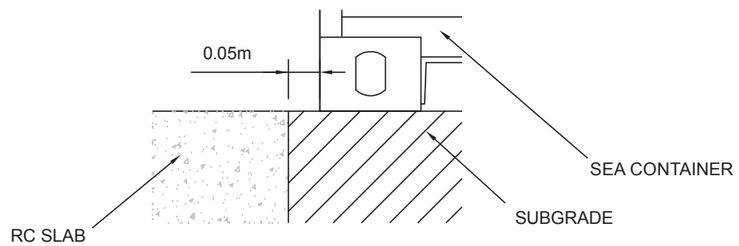
SECTION THROUGH DRAINAGE PIPE



SECTION ALONG DRAINAGE PIPE INSERTION TO EVAPORATION POND



VIEW FACING REAR PUSHWALL



DETAIL A (SCALE 1:10)

talis
delivering solutions
www.talisconsultants.com.au

ASSET MANAGEMENT
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

8/663 Newcastle Street, Leederville WA 6007
PO Box 454, Leederville WA 6903
T: 1300 251 070
E: admin@talisconsultants.com.au

Client: Shire of Ashburton

NOTES

1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

No.	Date	Drawn / Chk	Amendment / Issue	App.
A	28/10/14	AU / KG	EOI	KR

Project: Onslow Waste Transfer Station

Title: Building Drainage Details

Drawn by:	AU	Job No:	TW14030
Checked by:	KG	File No:	TW14030DG010
Approved by:	KR	Drg. No:	009
Scale:	1:50	Rev:	A
Date:	28/10/14		

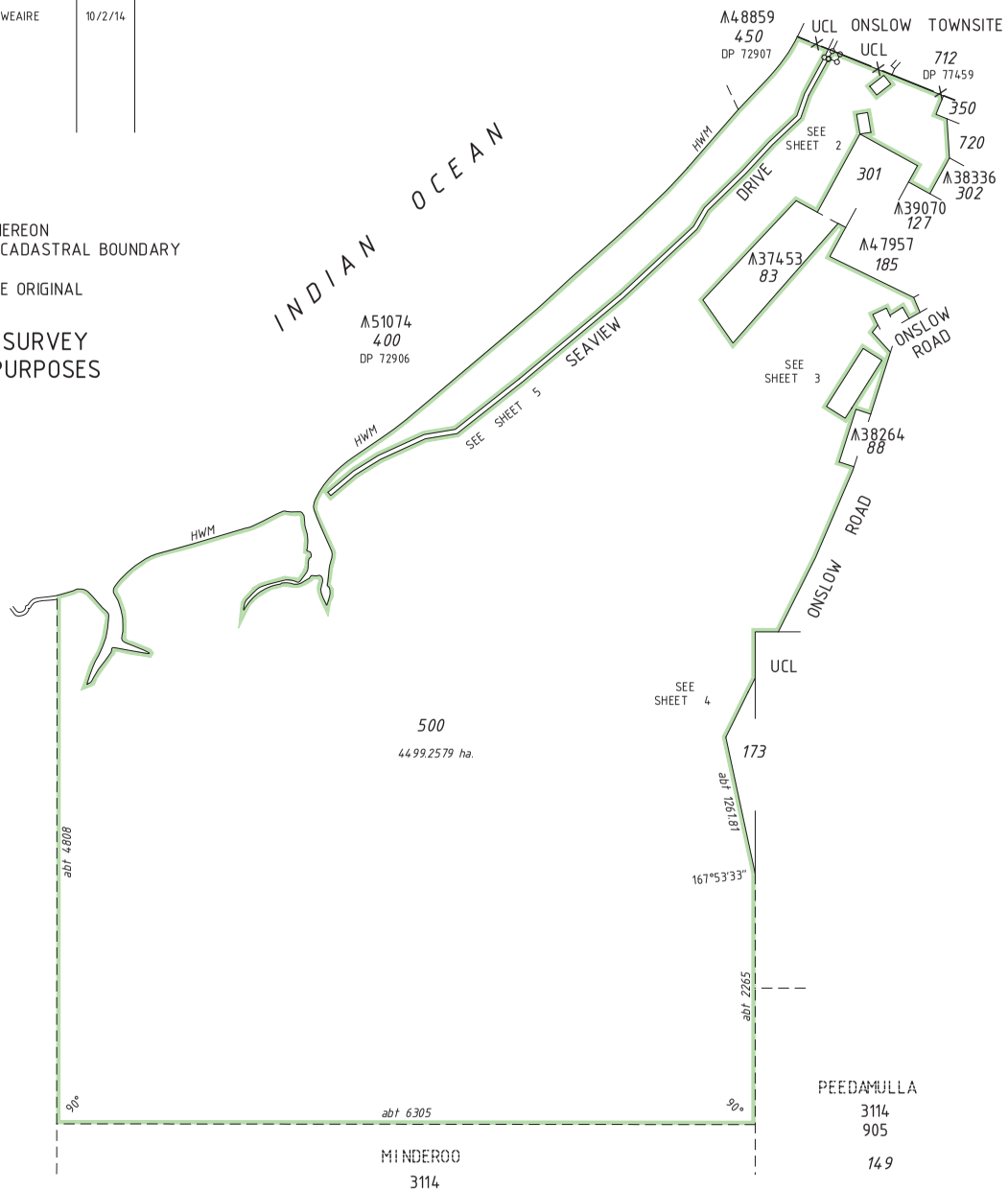
Appendix A: Certificates of Title

VER	AMENDMENT	AUTHORISED BY	DATE
2	AUDIT REQUIREMENTS	J. WEAIRE	10/2/14

WATER LINES SHOWN HEREON
DO NOT NECESSARILY DEPICT AN EXACT CADASTRAL BOUNDARY

ALL DIMENSIONS HEREON ARE ORIGINAL

LOT 500 SUBJECT TO SURVEY
NOT FOR ALIENATION PURPOSES



HELD BY LANDGATE
IN DIGITAL FORM ONLY.

ORACLE SURVEYS
LICENSED & ENGINEERING SURVEYORS

500 0 SCALE 1:30000 @ A2 2500
ALL DISTANCES ARE IN METRES

TYPE CROWN

PURPOSE SUBDIVISION

PLAN OF

LOTS 500 & 501

DISTRICT ASHBURTON
TOWNSITE

SSA NO

FILE 02434 - 1884 - 05
LOCALITY ONSLOW
LOCAL AUTHORITY SHIRE OF ASHBURTON

FORMER TENURE
LOT 718
DP 400252
CLR 3162 / 951

INDEX ON SEE SMARTPLAN

FIELD BOOK 125508

SCALE 1 : 30000 @ A2
ALL DISTANCES ARE IN METRES

SURVEYOR'S CERTIFICATE - Reg 54
I Jason F. WEAIRE
hereby certify that this plan is accurate and is a correct representation of the
(a) * survey; and/or
(b) * calculations from measurements recorded in the field records
(* delete if inapplicable)
undertaken for the purposes of this plan and that it complies with the relevant
written law(s) in relation to
Licensed Surveyor Jason F. Weaire Date 28-Jan-14

SURVEY FIRM ORACLE SURVEYS
Phone (08) 9470 1888
Email: e@oraclesurveys.com.au

LODGED
DATE 7-Feb-14
FEE PAID $0.00
ASSESS No. 14425568

TYPE OF VALIDATION
FULL AUDIT
LEGAL COMPONENT DJH
DOCKET PLAN/DIAGRAM TRIM
CERTIFIED CORRECT
I.S.C.
F.S.C.

APPROVED BY WESTERN AUSTRALIAN PLANNING COMMISSION
FILE
EXEMPT FROM WAPC APPROVAL
DELEGATED UNDER S.16P. & D. ACT 1995
DATE

IN ORDER FOR DEALINGS
SUBJECT TO
RESERVE ACTION
18/2/14
For INSPECTOR OF PLANS & SURVEYS / AUTHORIZED LAND OFFICER DATE

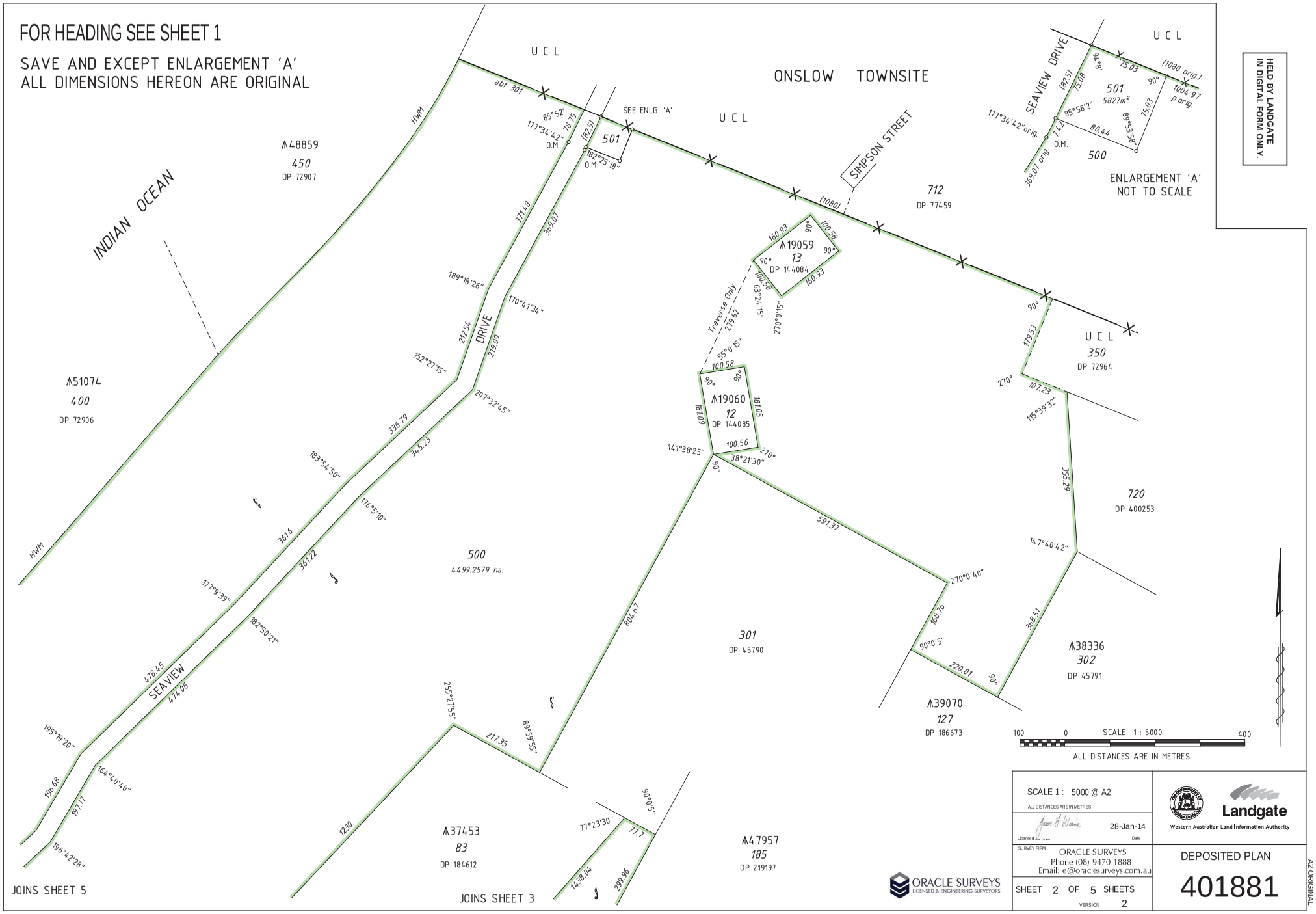
APPROVED
14/3/14
INSPECTOR OF PLANS & SURVEYS / AUTHORIZED LAND OFFICER DATE

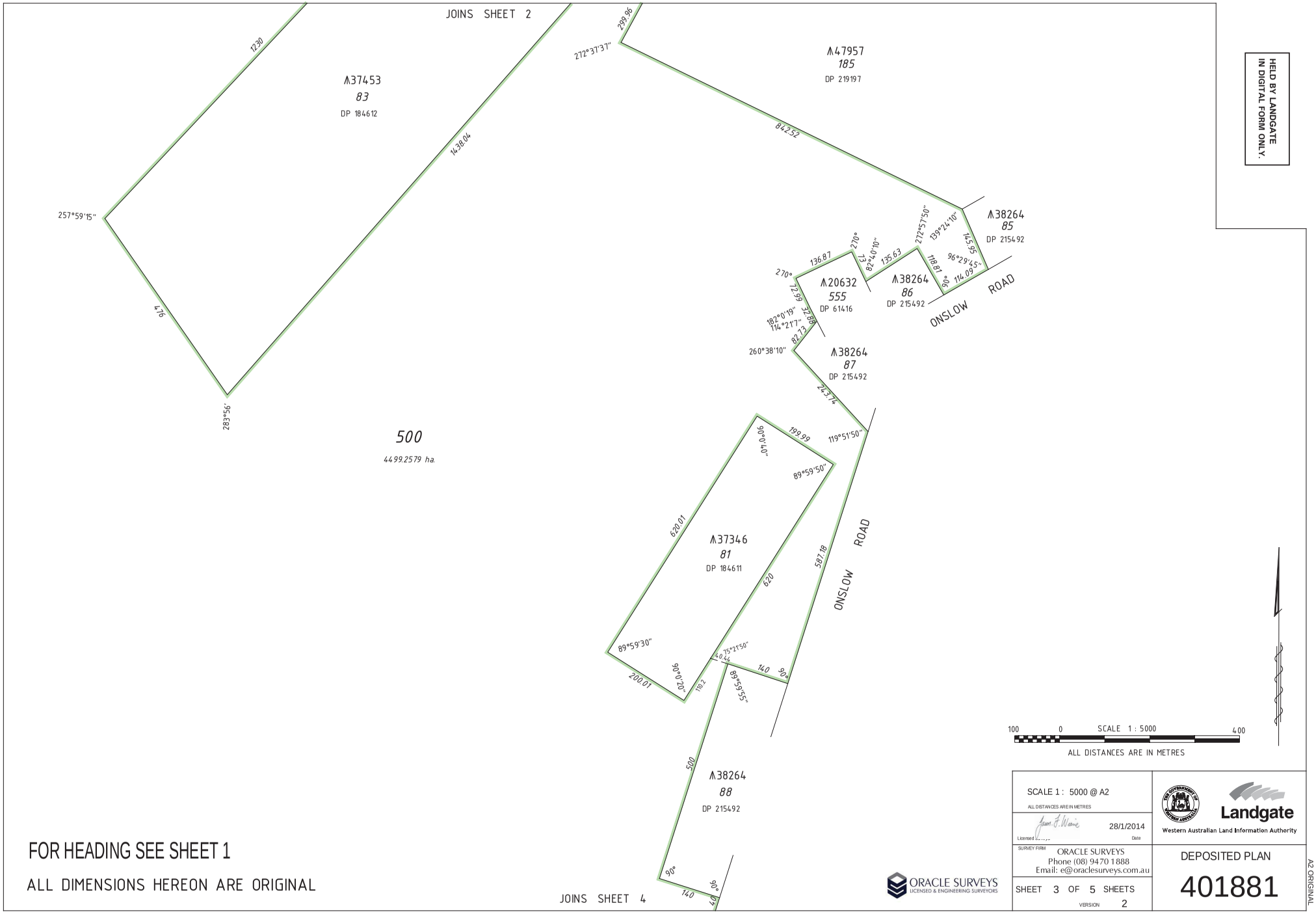
Landgate
Western Australian Land Information Authority

DEPOSITED PLAN
401881

SHEET 1 OF 5 SHEETS
VERSION 2

A2 ORIGINAL





FOR HEADING SEE SHEET 1

ALL DIMENSIONS HEREON ARE ORIGINAL

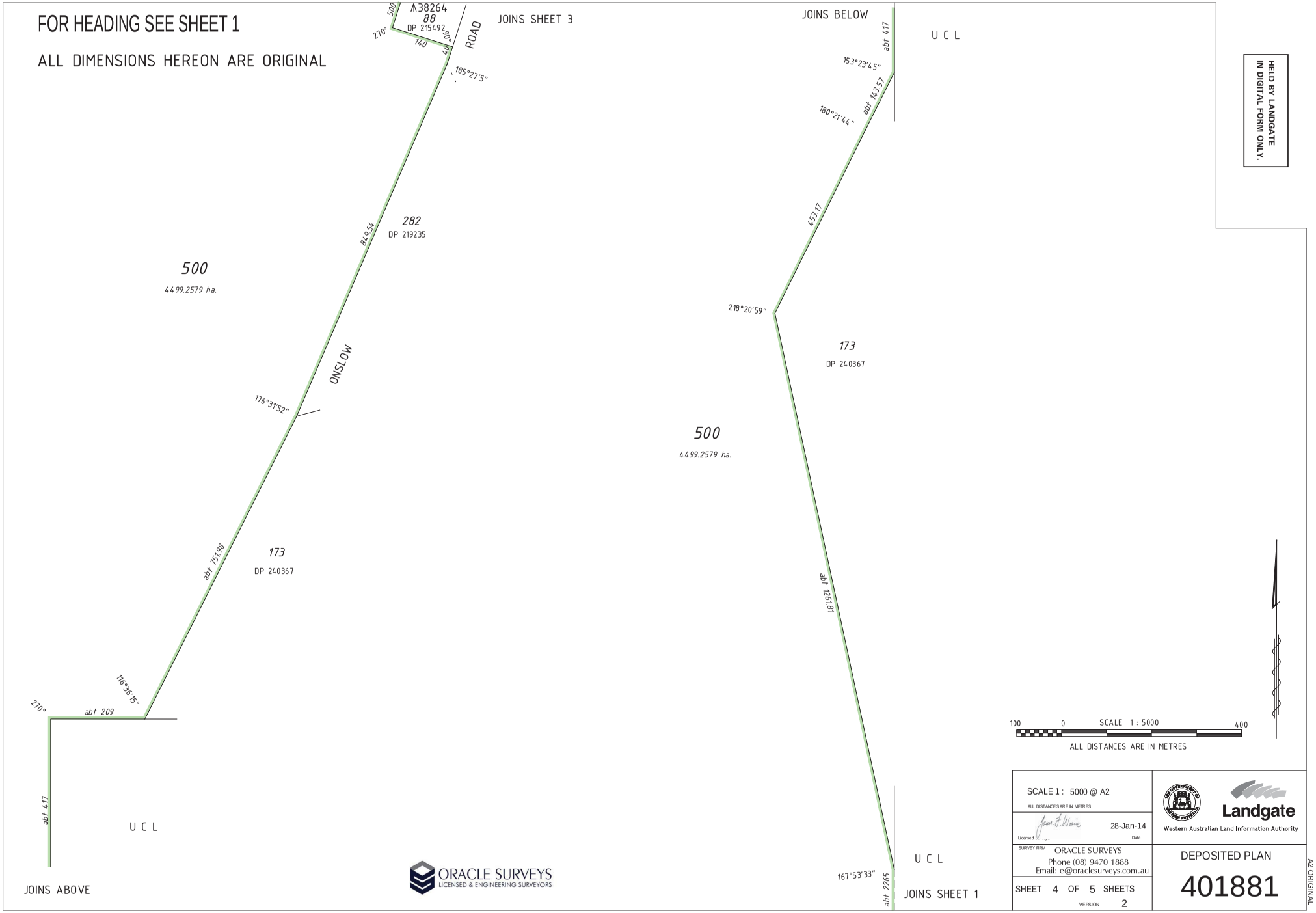
ORACLE SURVEYS
LICENSED & ENGINEERING SURVEYORS

SCALE 1 : 5000 @ A2 ALL DISTANCES ARE IN METRES	Landgate Western Australian Land Information Authority
Licensed [illegible] 28/1/2014 Date	
SURVEY FIRM ORACLE SURVEYS Phone (08) 9470 1888 Email: e@oraclesurveys.com.au	DEPOSITED PLAN
SHEET 3 OF 5 SHEETS VERSION 2	401881

A2 ORIGINAL

FOR HEADING SEE SHEET 1

ALL DIMENSIONS HEREON ARE ORIGINAL



ORACLE SURVEYS
LICENSED & ENGINEERING SURVEYORS

100 0 SCALE 1 : 5000 400

ALL DISTANCES ARE IN METRES

HELD BY LANDGATE IN DIGITAL FORM ONLY.

SCALE 1 : 5000 @ A2 ALL DISTANCES ARE IN METRES	Landgate Western Australian Land Information Authority
Licensed [illegible] 28-Jan-14 Date	
SURVEY FIRM ORACLE SURVEYS Phone (08) 9470 1888 Email: e@oraclesurveys.com.au	DEPOSITED PLAN
SHEET 4 OF 5 SHEETS VERSION 2	401881

A2 ORIGINAL

FOR HEADING SEE SHEET 1

ALL DIMENSIONS HEREON ARE ORIGINAL

HELD BY LANDGATE IN DIGITAL FORM ONLY.

JOINS SHEET 2

JOINS BELOW

JOINS ABOVE

JOINS SHEET 1

INDIAN OCEAN

INDIAN OCEAN

H.W.M.

H.W.M.

H.W.M.

H.W.M.

A51074
400
DP 72906

A51074
400
DP 72906

500
4499.2579 ha.

500
4499.2579 ha.

SEAVIEW DRIVE

SEAVIEW DRIVE

894.86
901.8
1189.93
1191.54
738.61
749.53
455.05
447.15
263.75
258.39
299.56
296.69
285.68
290.65
189.93
1191.54
738.61
749.53

163°17'32"
196.68
197.17
196°4'28"
116°58'31"
183°1'29"
178°25'31"
181°34'29"
195°24'21"
164°35'36"
150°55'27"
209°4'33"
187°8'6"
189°11'20"
172°51'54"
171°48'40"
178°25'31"
181°34'29"
270°
40
270°

SCALE 1 : 5000

100 0 400

ALL DISTANCES ARE IN METRES

SCALE 1 : 5000 @ A2 ALL DISTANCES ARE IN METRES	Landgate Western Australian Land Information Authority
Licensed [illegible] 28/1/2014 Date	DEPOSITED PLAN
SURVEY FIRM ORACLE SURVEYS Phone (08) 9470 1888 Email: e@oraclesurveys.com.au	401881
SHEET 5 OF 5 SHEETS VERSION 2	

ORACLE SURVEYS
LICENSED & ENGINEERING SURVEYORS

A2 ORIGINAL

WESTERN AUSTRALIA

REGISTER NUMBER	
500/DP401881	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
N/A	**N/A**

VOLUME **LR3164** FOLIO **235**

RECORD OF CERTIFICATE OF CROWN LAND TITLE

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.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 500 ON DEPOSITED PLAN 401881

STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)

STATUS ORDER/INTEREST: RESERVE UNDER MANAGEMENT ORDER

PRIMARY INTEREST HOLDER: SHIRE OF ASHBURTON OF PO BOX 567, TOM PRICE
(XE M491784) REGISTERED 12 DECEMBER 2013

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

1. M577596 PART RESERVE 19291 FOR THE PURPOSE OF COMMON REGISTERED 14.3.2014.
M491784 MANAGEMENT ORDER. CONTAINS CONDITIONS TO BE OBSERVED.
REGISTERED 12.12.2013.

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:	DP401881.
PREVIOUS TITLE:	LR3162-951.
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AREA:	SHIRE OF ASHBURTON.
RESPONSIBLE AGENCY:	DEPARTMENT OF LANDS (SLSD).

NOTE 1: M577595 CORRESPONDENCE FILE 02434-1884-05RO
NOTE 2: SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES

Appendix B: Geotechnical Report

talis
delivering solutions

Asset Management | Spatial Intelligence | Waste Management

Geotechnical Investigation

Onslow Waste Transfer Station

Prepared for the Shire of Ashburton
October 2014
Project Number TW14025

Talis Consultants Pty Ltd
8/663 Newcastle St
Leederville WA 6007
Ph: 1300 251 070
www.talisconsultants.com.au

ABN: 85 967 691 321

DOCUMENT CONTROL

Version	File Ref	Author	Reviewer
1a	TW14025 – Geotechnical Investigation	Keith Rogers	Ronan Cullen

Table of contents

Tables

Figures

Appendices

1 Introduction

Talis Consultants Pty Ltd. (Talis) was appointed by the Shire of Ashburton (Shire) to assess the ground conditions at the site of a proposed Waste Transfer Station (the Site) located approximately 5 km south-west of Onslow. This will be used to bulk up the waste generated by the residents, commerce, industry and construction as delivered by official collection vehicles as well as the public. Thereafter, it will be taken in bulk haulage vehicles to an alternative landfill or other suitable venue.

The purpose of the investigation is to establish the near surface geological strata and any geotechnical properties that are relevant to the design of the Waste Transfer Station and the surrounding hardstanding.

The Waste Transfer Station is to comprise a flexible tensioned fabric canopy supported on an arched light weight metal frame spanning between two parallel rows of a double-stacked assembly of sea containers. In between under the cover of the canopy is a reinforced concrete slab on which the waste materials will be stored prior to be bulk hauled to a landfill or other suitable destination.

The hardstanding access roadway and stockpiling areas will be unsealed and formed from a number of granular layers.

2 Site location

The Site is located approximately 5 km south south-west of the town of Onslow and approximately 1.5km west south-west of the southern extremity of the Onslow Airport's runway. The Waste Transfer Station is proposed to be constructed within a shallow topographic bowl approximately 600 m west of the main road into Onslow. A small hill lies between the site and the road which offers a natural screen from the surrounding area. In addition, natural grasses cover the area along with a number of 1-2 metres (m) high termite mounds. The location of the site in relation to the geography of the area is shown in **Figure 1**.

3 Geology

The 1:250,000 Onslow geological map sheet (Geological Survey of Western Australia (GSoWA 1981)) indicates that Onslow Landfill is located in an area comprised of Quaternary sands and sediments. The Onslow region is dominated by Quaternary aged beach and coastal dune deposits consisting of light grey, unconsolidated and poorly consolidated quartzose calcarenite (Parsons Brinkerhoff, 2013)[1].

4 Ground Investigation

A ground investigation, comprising fieldwork and laboratory testing, was carried out at the site and consisted of:

- Seven back-hoe excavated trial pits;
- A series of Dynamic Cone Penetrometer Tests (DCPs); and
- A number of laboratory tests.

4.1 Fieldwork

The fieldwork comprising trial pits and the DCPs was carried out on 1 October 2014. The trial pits were employed to visually examine the near surface materials and retrieve a number of samples for the laboratory testing. The DCPs were used to measure the likely geotechnical properties of the underlying near surface soils.

4.2 Trial Pits

Seven trial pits were excavated to a depth of between 1 m and 2.6 m below ground level (bgl). Trial Pits TP01 to TP03 were taken to a depth of approximately 1 m, with TP04 to TP07 extended as far as could be practically achieved. Once positioned on site using a GPS, a backhoe excavator was used to excavate the trial pits. The depths were not dictated by the reach of the excavator but were due to the collapse of the pit walls as a result of infiltrating groundwater or in in the case of TP05, a layer of limestone which prevented any further progress. The location of the trial pits are shown on **Figure 2** and their logs presented in **Appendix A**.

The trial pits revealed the surface to 200 mm below ground level (bgl) to comprise loose brown silty fine sand with numerous roots emanating from the surface vegetation.

Underlying the surface skim of soil lay a variable thickness of loose to medium dense silty fine to medium sand, with occasional traces of clay and the presence of rootlets which decreased in frequency with depth.

Beyond a depth of 1.0 to 1.6 m bgl the soil contained varying amounts of fine to coarse gravel which continued until the trial pit was terminated, with the exception of TP05 where, at 2.15 m bgl, a layer of limestone was encountered which prevented any further excavation.

Groundwater was not encountered at TP01-TP03 as these test pits did not extend deep enough into the ground. Groundwater was encountered in TP04-TP07 at a consistent depth of 2 m bgl. Where the limestone was not encountered the groundwater promoted the collapse of the sides of the trial pits at a depth of 2.6 m bgl. A summary of the near surface soils is provided in **Table 1** below.

Table 1: Summary of near surface ground conditions

Depth	Soils	Comments
0 to 0.2 m bgl	Loose Silty Fine SAND with roots	-
0.2 to 1.6 m bgl	Loose to Medium dense Silty Fine to Medium SAND with a trace of clay and some roots	Roots decreased with depth
1.0 to 2.6 m bgl	Loose to Dense Silty Fine to Medium Sandy Fine to Coarse GRAVEL	Except for TP05 where limestone was encountered at 2.15mbgl. Groundwater was encountered at a depth of 2m

4.2.1 Dynamic Cone Penetrometer Tests

Dynamic Cone Penetrometer Testing was carried in each of the seven trial pits to measure the soil's strength to support the Waste Transfer Station and the surrounding areas of hardstanding.

The Penetrometer is a portable piece of equipment used to measure the relative density of the underlying soils and through empirical correlations ascertains properties such as California Bearing Ratio (CBR) and occasionally shear strength. The equipment is an extendable rod with a sliding 9 kg hammer located on top which drops through a height of 600 mm to strike a head which transmits a driving energy down to the bottom of the rod. At the bottom of the rod is a 60 degree cone which, under each hammer strike, causes the apparatus to penetrate the soils. The number of strikes are recorded for each 100 mm of penetration into the soil. Depending on the relative density, more drops will be needed to achieve the same penetration. This type of investigative tool is widely employed for such investigations where the structures to be built are lightly loaded and have a reasonable tolerance to differential settlement.

In TP01 to TP03, the depths of the DCP tests were between 0.4 and 1.2 m bgl which included the foundation soils for the access roadways into the site. For TP04 to TP07, two tests were carried out which secured results for depths varying between 0.6 and 3m bgl level. On two occasions the progress of the Penetrometer was halted. These were both in TP05 at depths of 1.3 and 2.15 m. The backhoe did not find anything of significance when excavating through 1.3 m and therefore it is presumed that a larger piece of gravel obstructed any further penetration. The test pit was terminated at 2.15 m depth as no further progress was possible due to the present limestone layer. The results of the Dynamic Cone Penetrometer tests are presented in **Appendix B**.

4.3 Laboratory Testing

The moisture content was obtained from laboratory tests conducted by SGS Australia Pty Ltd. (SGS) in Karratha on a number of soil samples retrieved from the trial pits. These are provided in **Table 2** below and the SGS certificate is provided in **Appendix C**.

Table 2: Moisture Content Results

Trial Pit	Depth (m)	Moisture Content (%)
TP01	0.7	6.6
TP02	0.7	7.7
TP03	0.8	4.2
TP04	0.9	9.0
TP04	1.5	10.9
TP04	2.0	16.4
TP05	0.9	6.6
TP05	1.7	12.4
TP06	1.0	10.6
TP06	1.6	10.6
TP07	1.0	6.3

Overall, the moisture content ranged from 4.2-12.4% with an average of 9.2%. The soils within 1 m of the surface had moisture contents in the range of 4.2-10.6% with an average of 7.3%. The soils below 1 m had moisture content between 10.6% and 16.4% with an average of 12.6%. The higher moisture contents were usually recorded in the gravelly soils and may be subject to capillary action from the groundwater table at a depth of 2 m.

5 Foundation Assessment

There are two aspects of the soils that require assessment to provide design parameters for the Waste Transfer Station, these include:

- The foundations to the Waste Transfer Station Building; and
- The hardstanding for the approach roadways and storage areas.

Both aspects can be assessed using the Dynamic Cone Penetrometer results. The raw data is provided in **Appendix B**. However, this data needs to be rationalised and correlated with design parameters in order to design the reinforced concrete (RC) slab and hardstand area.

The DCP test results are converted into what is termed Dynamic Index (DI) which is effectively the number of millimetres for one penetrative blow. The raw results are converted into the DI and presented in depth profiles as shown on **Figure 3** and **Figure 4**.

5.1 Transfer Station Building

The design of the RC slab which lies beneath the canopy relies not only on the imposed loading, but also on the CBR of the soil formation.

There are a number of the empirical relationships between CBR and DI. Paige-Green and Du Plessis[2] summarised a number of relationships. From this, two have been employed which more accurately reflect the ground conditions. They have been proposed by the UK Transport and Road Research Laboratory (TRL)[3] and Harrison[4] and are replicated in the following equations:

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057\ \text{Log}_{10}(\text{DN}) \quad \text{.....1} \qquad \text{TRL}$$

$$\text{Log}_{10}(\text{CBR}) = 3.03 - 1.51\ \text{Log}_{10}(\text{DN}) \quad \text{.....2} \qquad \text{Harrison}$$

Other relations yield higher values of CBR, however it needs to be noted that the Dynamic Cone Penetrometers were tested at natural moisture and not at the more usual soaked conditions. Therefore, it is prudent to adopt some conservatism in the correlation.

A design value has been proposed for the Reinforced Concrete slab (red dotted line in **Figure 3**) which reflects a lower bound state, ignoring the extremely weak layer indicated at a depth of approximately 0.8 m bgl. Incidentally, nothing unusual was observed in the trial pit excavation. At a depth of 0.4 m bgl the DI is 50 mm per strike.

Using the relationships in equations 1 and 2, the equivalent CBR's are 4.8 and 2.9 respectively. It is reasonable to therefore adopt a design CBR of 3. It is recommended that the RC slab uses a value of 3 for its design.

5.2 Hardstanding

The same empirical correlations as used above can be used in the design of the hardstanding for the access roadways and stockpiles. The design DI as indicated by the red dotted line in **Figure 4** is 80. This has been adopted to reflect the condition approximately midway between the results in the upper 1 m, where the ground conditions will dictate the behaviour and hence the design the hardstanding.

Using the same relationships the CBR is 2.9 and 1.4. A reasonable design value to adopt would therefore be 2.2.

6 Conclusion

The geotechnical investigation has shown the ground conditions to be predominantly silty fine to medium grained sand overlying a fine to medium sandy gravel where groundwater is observed at a depth of 2 m bgl.

Based on conventional empirical relationships between the DCP and the CBR, the design CBR for the RC slab in the Waste Transfer Station building is 3 and with a design CBR of 2.2 for the hardstanding areas.

References

1 Parsons Brinkerhoff, 2009
"Detailed Site Investigation, Onslow, WA"

2 Paige-Green, P and Du Plessis, L, 2009
"*The Use and Interpretation of the Dynamic Cone Penetrometer (DCP) Test*
CSIR Built Environment, Pretoria

3 TRANSPORT RESEARCH LABORATORY, 1993.
"*A guide to the structural design of bitumen-surfaced roads in tropical and sub-tropical countries*". Crowthorne: TRL.(Overseas Road Note 31).

4 Harrison, JA. 1986.
"*Correlation of CBR and Dynamic Cone Penetrometer strength measurement of soils*". Australian Road Research, 16(2), June 1986, pp 130-136.

Figures

297,000 298,000 299,000 300,000 301,000 302,000 303,000 304,000 305,000 306,000 307,000 308,000 309,000

7,606,000 7,605,000 7,604,000 7,603,000 7,602,000 7,601,000 7,600,000 7,599,000 7,598,000 7,597,000 7,596,000

LEGEND

- Site Boundary

Road Network (MRWA)

- Access Road
- Local Distributor
- Primary Distributor

SITE LOCALITY

Onslow Waste Transfer Station

N

0 200 400 800 1,200 1,600

Meters

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

Scale @ A3:	1:40,000	Prepared:	J Botterill
Date:	30/10/2014	Checked:	K Garvey
Revision:	Rev A	Reviewed:	N King
Project No:	TW14025		

Figure 001

talis delivering solutions

Document Path: \\server\Talis\SECTIONS\Waste\PROJECTS\TW2014\TW14025 - Onslow Geotech Investigation\GIS\Maps\TW14025_001_Locality.mxd

Figure 3 - Dynamic Index for Waste Transfer Building Slab

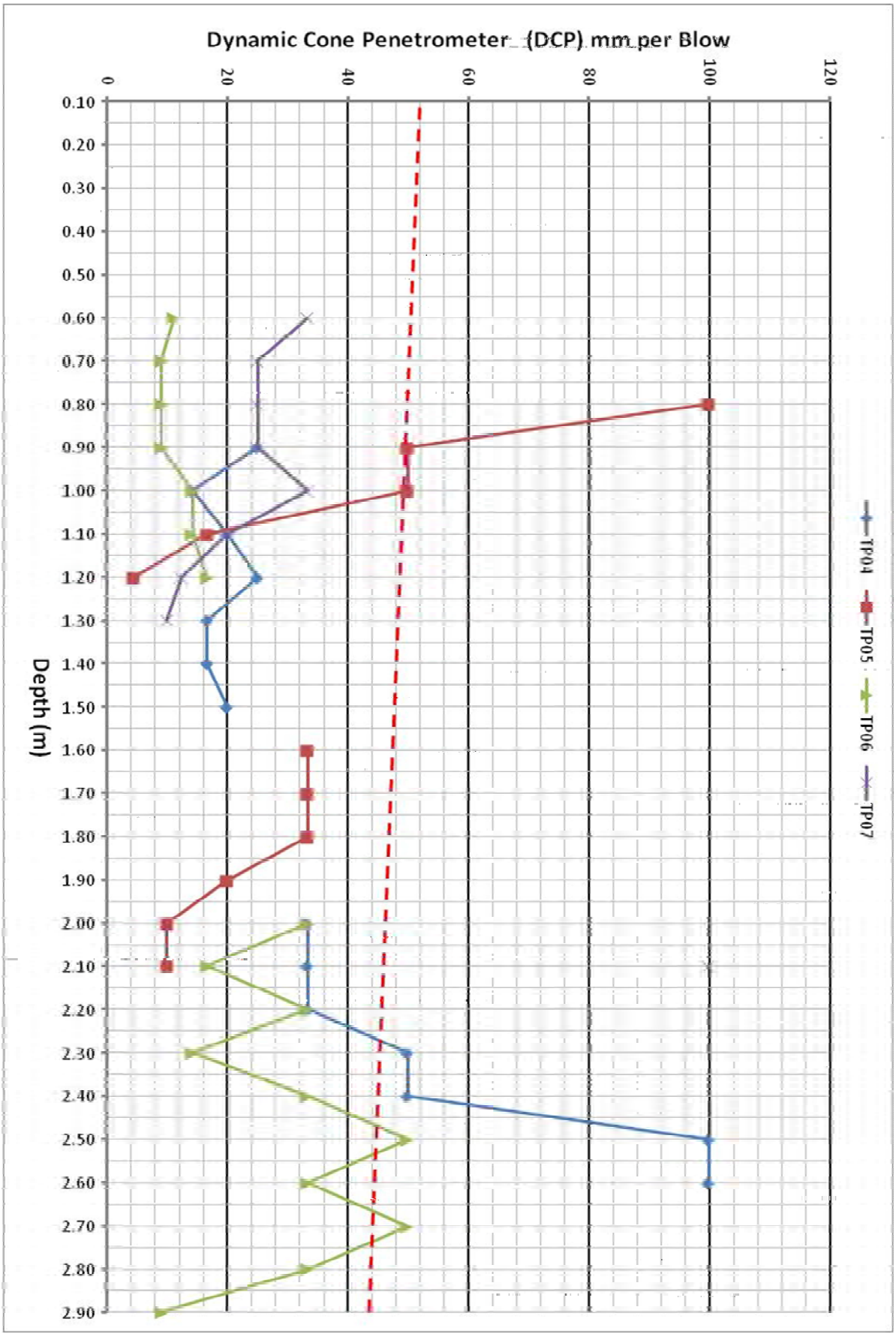
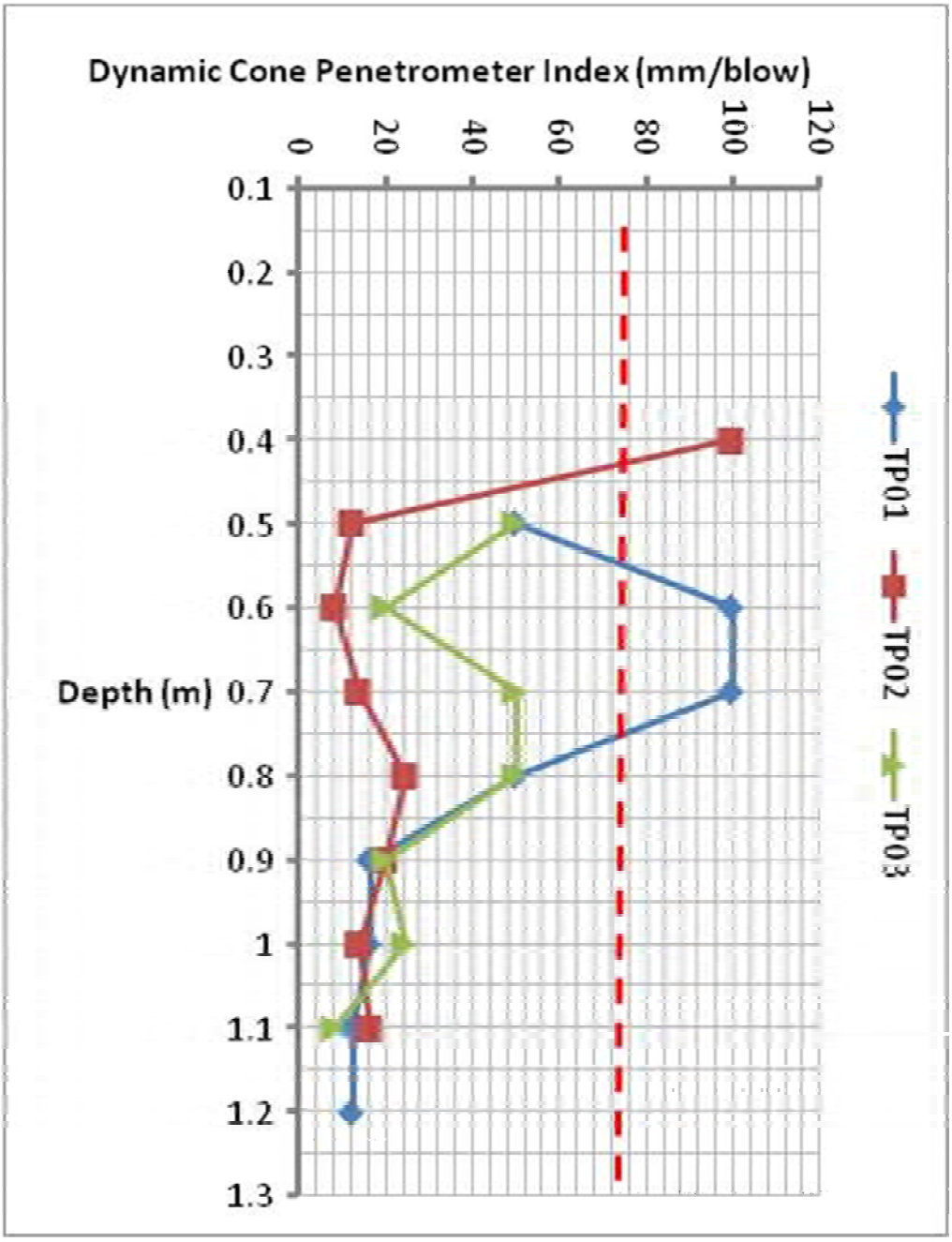


Figure 4 - Dynamic Index for Hardstanding Areas



talis
delivering solutions
www.talisconsultants.com.au

ASSET MANAGEMENT
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

8/663 Newcastle Street, Leederville WA 6007
PO Box 454, Leederville WA 6903
T: 1300 251 070
E: admin@talisconsultants.com.au

Client: Shire of Ashburton

NOTES

1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

No.	Date	Drawn / Chkd	Amendment / Issue	App.
A	28/10/14	AU / KG	Final Report	KR

Project: Onslow Waste Transfer Station Geotechnical Investigation

Title: Geotechnical Investigation Layout

Drawn by:	AU	Job No:	TW14025
Checked by:	KG		
Approved by:	KR		
Scale:	1:1250		
Date:	28/10/14		

FIGURE 2

Appendix A: Trial Pit Logs

Test Pit Log No. TP01

Project
Proposed Waste Transfer Station at Onslow, Shire of Ashburton

Location
Onslow, Shire of Ashburton

Job No.
TW14025

Date Excavated
1/10/14

GPS Position (GDA50)
302848 *7601109*

Surface Level
3.86 m AHD

Equipment
Backhoe

Logged by *KSR*

Checked by *KG*

	Depth (m bgl)	Description of Strata	Samples	Remarks
0.2	0.2	Loose Brown silty fine SAND with numerous roots from the surface vegetation		
0.4		Medium Dense brown silty fine SAND with occasional roots from the surface vegetation		
0.6	0.6			
0.8		Medium dense dark brown silty fine to medium SAND	Small Bag @0.7m	
1	1.0			
	1.1	Medium Dense dark brown fine to coarse sandy fine GRAVEL		
1.2				
		No groundwater encountered		
1.4		Trial pit terminated at a depth of 1.1mbgl.		
		Dynamic Cone Penetrometer Tests performed at a depth of 0.5m bgl		
1.6		(see separate results sheet)		
1.8				
2				
2.2				
2.4				
2.6				
2.8				
3				
3.2				
3.4				
3.6				
3.8				
4				
4.2				
4.4				

Test Pit Log No. TP02

Project
Proposed Waste Transfer Station at Onslow, Shire of Ashburton

Location
Onslow, Shire of Ashburton

Job No.
TW14025

Date Excavated
1/10/14

GPS Position (GDA50)
302855 *7601137*

Surface Level
3.85 m AHD

Equipment
Backhoe

Logged by *KSR*

Checked by *KG*

Depth (m bgl)	Description of Strata	Samples	Remarks
0.15	Loose Brown silty fine SAND with numerous roots from the surface vegetation		
	Loose brown silty fine SAND with some fine gravel and occasional roots from the surface vegetation		
0.55			
	Dense brown silty fine to medium SAND with a trace of clay	Small Bag @0.7m	
0.8			
1.0	Medium Dense brown silty fine to medium SAND with some fine gravel and a trace of clay		
	No groundwater encountered		
	Trial pit terminated at a depth of 1.0mbgl.		
	Dynamic Cone Penetrometer Tests performed at a depth of 0.4m bgl		
	(see separate results sheet)		

Test Pit Log No. TP03

Project
Proposed Waste Transfer Station at Onslow, Shire of Ashburton

Location
Onslow, Shire of Ashburton

Job No.
TW14025

Date Excavated
1/10/14

GPS Position (GDA50)
302796 *7601176*

Surface Level
4.15 m AHD

Equipment
Backhoe

Logged by *KSR*

Checked by *KG*

	Depth (m bgl)	Description of Strata	Samples	Remarks
0.2	0.25	Medium Dense Brown silty fine SAND with numerous roots from the surface vegetation		
0.4		Medium Dense brown silty fine to medium SAND with some fine gravel and occasional roots from the surface vegetation		
0.6	0.7			
0.8		Medium dense brown silty fine to medium sandy fine to coarse GRAVEL		
1	1.0		Small Bag @0.8m	
1.2		No groundwater encountered		
		Trial pit terminated at a depth of 1.0mbgl.		
1.4		Dynamic Cone Penetrometer Tests performed at a depth of 0.55m bgl		
		(see separate results sheet)		
1.6				
1.8				
2				
2.2				
2.4				
2.6				
2.8				
3				
3.2				
3.4				
3.6				
3.8				
4				
4.2				
4.4				

Test Pit Log No. TP04

Project
Proposed Waste Transfer Station at Onslow, Shire of Ashburton

Location
Onslow, Shire of Ashburton

Job No.
TW14025

Date Excavated
1/10/14

GPS Position (GDA50)
302872 *7601175*

Surface Level
3.86 m AHD

Equipment
Backhoe

Logged by *KSR*

Checked by *KG*

	Depth (m bgl)	Description of Strata	Samples	Remarks
0.2	0.20	Loose brown silty fine SAND with numerous roots from surface vegetation		
0.4		Loose to Medium Dense brown Silty Fine SAND. Some vegetative roots continue down to 0.7m		
0.6				
0.8				
1	1.00		Small @0.9m	
1.2		Medium Dense Dark Brown Silty Fine to Medium SAND with a trace of clay		
1.4	1.40			
1.6		Medium Dense Dark Brown Silty Fine to Medium SAND with some Clay and some fine to coarse GRAVEL. Stratum is wet.	Small @1.5m	
1.8				
2	2.00			
2.2		Very loose to loose silty fine brown SAND and fine to coarse GRAVEL with a trace of clay.	Small @2.0m	
2.4				
2.6	2.60			
2.8		**Notes:**		
		Groundwater encountered at 2mbgl		
3		Trial pit terminated at a depth of 2.6mbgl due to groundwater rushing.		
		Dynamic Cone Penetrometer Tests performed at a depth of 0.9m and 2.0m bgl		
3.2		(see separate results sheet)		
3.4				
3.6				
3.8				
4				
4.2				
4.4				

Test Pit Log No. TP05

Project
Proposed Waste Transfer Station at Onslow, Shire of Ashburton

Location
Onslow, Shire of Ashburton

Job No.
TW14025

Date Excavated
1/10/14

GPS Position (GDA50)
302850 *7601196*

Surface Level
3.91 m AHD

Equipment
Backhoe

Logged by *KSR*

Checked by *KG*

	Depth (m bgl)	Description of Strata	Samples	Remarks
0.2	0.2	Loose brown silty fine SAND with numerous roots from surface vegetation.		
0.4	0.4	Loose brown silty fine SAND with numerous roots from surface vegetation		
0.6		Loose brown silty fine to medium SAND		
0.8	0.8			
1		Loose dark brown silty fine to medium SAND with a trace of clay.	Small Bag @0.9m	
1.2	1.2			
1.4		Medium dense to dense dark brown silty fine to medium SAND with a trace of clay and some fine gravel.		
1.6				
1.8	2.15		Small Bag @1.7m	
2				
2.2				
		LIMESTONE layer		
2.4	2.25			
		Notes:		
2.6		Groundwater encountered at 2.15mbgl		
		Trial pit terminated at a depth of 2.25mbgl due to naturally hard layer.		
2.8		Dynamic Cone Penetrometer Tests performed at a depth of 0.8m and 1.6m bgl		
		(see separate results sheet)		
3				
3.2				
3.4				
3.6				
3.8				
4				
4.2				
4.4				

Test Pit Log No. TP06

Project
Proposed Waste Transfer Station at Onslow, Shire of Ashburton

Location
Onslow, Shire of Ashburton

Job No.
TW14025

Date Excavated
1/10/2014

GPS Position (GDA50)
302879 *7601200*

Surface Level
3.97 m AHD

Equipment
Backhoe

Logged by *KSR*

Checked by *KG*

	Depth (m bgl)	Description of Strata	Samples	Remarks
0.2	0.2	Loose brown silty fine SAND with numerous roots from surface vegetation		
0.4		Dense brown silty fine SAND with some roots from the surface vegetation. Becoming medium dense to dense from 0.6mbgl.		
0.6				
0.8				
1	1.0			
1.2		Medium dense dark brown silty fine to medium SAND with a trace of fine to coarse gravel.		
1.4	1.35			
1.6		Medium dense dark brown silty fine to medium SAND with a trace of fine to coarse gravel and a trace of clay.		
1.8				
2	1.95		Small Bag @ 2m	
2.2		Medium Dense dark brown fine to medium sandy fine to coarse GRAVEL with some cobbles with depth. Moisture of the surface of the soil until groundwater encountered at 2.00m bgl.		
2.4				
2.6	2.6			
2.8		**Notes:**		
3		Groundwater encountered at 2mbgl		
3.2		Trial pit terminated at a depth of 2.6mbgl due to groundwater rushing.		
3.4		Dynamic Cone Penetrometer Tests performed at a depth of 0.6m and 2.0m bgl		
3.6		(see separate results sheet)		
3.8				
4				
4.2				
4.4				

Test Pit Log No. TP07

Project
Proposed Waste Transfer Station at Onslow, Shire of Ashburton

Location
Onslow, Shire of Ashburton

Job No.
TW14025

Date Excavated
1/10/14

GPS Position (GDA50)
302879 *7601222*

Surface Level
4.00 m AHD

Equipment
Backhoe

Logged by *KSR*

Checked by *KG*

Depth (m bgl)	Description of Strata	Samples	Remarks
0.15	Loose to medium dense brown silty fine SAND with numerous roots from the surface vegetation.		
0.7	Medium Dense brown silty fine to medium SAND with occasional roots from the surface vegetation		
1.2	Medium Dense dark brown silty fine to medium SAND with occasional fine gravel.	Small Bag @1m	
1.6	Dense dark brown silty fine to medium SAND with some fine gravel and a trace of clay.		
2.0	Dense dark brown silty fine to medium sandy fine to coarse GRAVEL		
2.6	Very loose fine to medium sandy fine to coarse GRAVEL		

Notes:

Groundwater encountered at 2mbgl

Trial pit terminated at a depth of 2.6mbgl due to groundwater rushing.

Dynamic Cone Penetrometer Tests performed at a depth of 0.9m and 2.1m bgl

(see separate results sheet)

Possible contamination observed as an oily sheen could be seen on the surface of the groundwater when it had entered the trial pit.

Appendix B: Dynamic Cone Penetrometer Results

Shire of Ashburton
Proposed Onslow Waste Transfer Station
Dynamic Cone Penetrometer Results

Trial Pit 04 @ 0.9m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0.0 - 0.1	0.9 -1.0	4
0.1 - 0.2	1.0 - 1.1	7
0.2 - 0.3	1.1 - 1.2	5
0.3 - 0.4	1.3 - 1.4	4
0.4 - 0.5	1.4 - 1.5	6
0.5 - 0.6	1.5 - 1.6	6
0.6 - 0.7	1.6 - 1.7	5

Trial Pit 04 @ 2.0m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0.0 - 0.1	2.0 - 2.1	3
0.1 - 0.2	2.1 - 2.2	3
0.2 - 0.3	2.2 - 2.3	3
0.3 - 0.4	2.3 - 2.4	2
0.4 - 0.5	2.4 - 2.5	2
0.5 - 0.7	2.5 - 2.7	2*

*DCP jumped approximately 150mm in 1 blow

Trial Pit 06 @ 0.6m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0 - 0.1	0.6 - 0.7	9
0.1 - 0.2	0.7 - 0.8	11
0.2 - 0.3	0.8 - 0.9	11
0.3 - 0.4	0.9 - 1.0	11
0.4 - 0.5	1.0 - 1.1	7
0.5 - 0.6	1.1 - 1.2	7
0.6 - 0.7	1.2 - 1.3	6

Trial Pit 06 @ 2.0m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0.0 - 0.1	2.0 - 2.1	3
0.1 - 0.2	2.1 - 2.2	6
0.2 - 0.3	2.2 - 2.3	3
0.3 - 0.4	2.3 - 2.4	7
0.4 - 0.5	2.4 - 2.5	3
0.5 - 0.6	2.5 - 2.6	2
0.6 - 0.7	2.6 - 2.7	3
0.7 - 0.8	2.7 - 2.8	2
0.8 - 0.9	2.8 - 2.9	3
0.9 - 1.0	2.9 - 3.0	11

Trial Pit 07 @ 0.6m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0 - 0.1	0.6 - 0.7	3
0.1 - 0.2	0.7 - 0.8	4
0.2 - 0.3	0.8 - 0.9	4
0.3 - 0.4	0.9 - 1.0	4
0.4 - 0.5	1.0 - 1.1	3
0.5 - 0.6	1.1 - 1.2	5
0.6 - 0.7	1.2 - 1.3	8
0.7 - 0.8	1.3 - 1.4	10

Trial Pit 07 @ 0.6m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0.0 - 0.1	2.1 - 2.2	1
0.1 - 0.5	2.2 - 2.6	1*

*DCP jumped approximately 400mm in 1 blow. The DCP could be easily pushed further into the soil by hand.

Trial Pit 05 @ 0.8m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0 - 0.1	0.8 - 0.9	1
0.1 - 0.2	0.9 - 1.0	2
0.2 - 0.3	1.0 - 1.1	2
0.3 - 0.4	1.1 - 1.2	6
0.4 - 0.5	1.2 - 1.3	22

DCP stopped because of obstacle. Note not encountered in trial pit – presumed piece of gravel

Trial Pit 05 @ 1.6m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0.0 - 0.1	1.6 - 1.7	3
0.1 - 0.2	1.7 - 1.8	6
0.2 - 0.3	1.8 - 1.9	6
0.3 - 0.4	1.9 - 2.0	5
0.4 - 0.5	2.0 - 2.1	10
0.5 - 0.6	2.1 - 2.14	10*

* No further penetration

Trial Pit 03 @0.55m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0 - 0.1	0.55 - 0.65	2
0.1 - 0.2	0.65 - 0.75	5
0.2 - 0.3	0.75 - 0.85	2
0.3 - 0.4	0.85 - 0.95	2
0.4 - 0.5	0.95 - 1.05	5
0.5 - 0.6	1.05 - 1.15	4
0.6 - 0.7	1.15 - 1.25	12

Trial Pit 02 @0.4m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0 - 0.1	0.4 - 0.5	1
0.1 - 0.2	0. 5 - 0.6	8
0.2 - 0.3	0.6 - 0.7	12
0.3 - 0.4	0.7 - 0.8	7
0.4 - 0.5	0.8 - 0.9	4
0.5 - 0.6	0.9 - 1.0	5
0.6 - 0.7	1.0 - 1.1	7
0.7 - 0.8	1.1 - 1.2	6

Trial Pit 01 @0.5m		
Penetration (m)	Depth BGL (m)	Blows/100mm
0 - 0.1	0.5 - 0.6	2
0.1 - 0.2	0.6 - 0.7	1
0.2 - 0.3	0.7 - 0.8	1
0.3 - 0.4	0.8 - 0.9	2
0.4 - 0.5	0.9 - 1.0	6
0.5 - 0.6	1.0 - 1.1	6
0.6 - 0.7	1.1 - 1.2	8
0.7 - 0.8	1.2 - 1.3	8

Appendix C: Laboratory Results

TEST CERTIFICATE

steven.hoffman@sgs.com
ABN: 44000964278
ph: (08) 9144 0624
fx: (08) 9144 2904

SGS Australia
PO Box 947 Karratha WA 6714
Unit 2 / 991 Croyden Rd
Karratha WA 6714

Client:	Talis Consultants Pty Ltd	Client Job No:	
Order No:		Project:	Onslow
Tested Date:	3/10/2014	Location:	Onslow
SGS Job Number:	14-04-869	Sample No:	14-KT-4444
Lab:	Karratha	Sample ID:	Test Pit Natural Moisture Content

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

	1	2	3	4	5	6	7	8	9
Sample ID	**TP01-0.7m**	**TP02-0.7m**	**TP03-0.8m**	**TP04-0.9m**	**TP04-1.5M**	**TP04-2.0M**	**TP05-0.9M**	**TP05-1.7M**	**TP06-1.0M**
Moisture Content (%)	**6.6**	**7.7**	**4.2**	**9.0**	**10.9**	**16.4**	**6.6**	**12.4**	**10.6**

Note: Sample supplied by client.

Approved Signatory: (Mitchell.Stevenson, Karratha Senior Technician) Date: 22/10/2014

TEST CERTIFICATE

steven.hoffman@sgs.com
ABN: 44000964278
ph: (08) 9144 0624
fx: (08) 9144 2904

SGS Australia
PO Box 947 Karratha WA 6714
Unit 2 / 991 Croyden Rd
Karratha WA 6714

Client:	Talis Consultants Pty Ltd	Client Job No:	
Order No:		Project:	Onslow
Tested Date:	3/10/2014	Location:	Onslow
SGS Job Number:	14-04-869	Sample No:	14-KT-4445
Lab:	Karratha	Sample ID:	Test Pit Natural Moisture Content

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

	1	2	3	4	5	6	7	8	9
Sample ID	**TP06-1.6M**	**TP07-1.0M**	**TP08-1.0M**	**TP08-2.0M**	**TP09-1.3M**	**TP10-1.0M**	**TP11-1.3M**	**TP12**	**TP13**
Moisture Content (%)	**10.6**	**6.3**	**3.4**	**22.5**	**4.4**	**0.9**	**1.3**	**5.4**	**6.7**

Note: Sample supplied by client.

Approved Signatory: (Mitchell.Stevenson, Karratha Senior Technician) Date: 22/10/2014

Accredited for compliance with ISO/IEC 17025

Accreditation No.: 2418
Client Address: Unit 8 663 Newcastle Street Leederville WA 6007

Site No.: 4007
Cert No.: 14-KT-4445-S200
Form No.PF-(AU)-[IND(MTE)]-TE-S200.LCER/A/01.01.2009

Appendix C: NatureMap Species Report

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 23/10/2014

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115°05' 49" E,21°40' 44" S
Buffer 1km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	19456	*Acacia stellaticeps*			
2.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
3.	25448	*Antaresia stimsoni (Stimson's Python)*			
4.	25046	*Ctenotus iapetus*			
5.	25053	*Ctenotus maryani*			
6.	43381	*Eremiascincus pallidus (Western Narrow-banded Skink, Narrow-banded Sand Swimmer)*			
7.	17309	*Heliotropium pachyphyllum*			
8.	30928	*Lerista clara*			
9.	25489	*Macropus robustus (Euro)*			
10.	24136	*Macropus rufus (Red Kangaroo, Marlu)*			
11.	24736	*Melopsittacus undulatus (Budgerigar)*			
12.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
13.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
14.	25277	*Ramphotyphlops grypus*			
15.	12584	*Scaevola pulchella*			
16.	27348	*Udotea argentea*			
17.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix D: EPBC Act Protected Matters Report

Australian Government

Department of the Environment

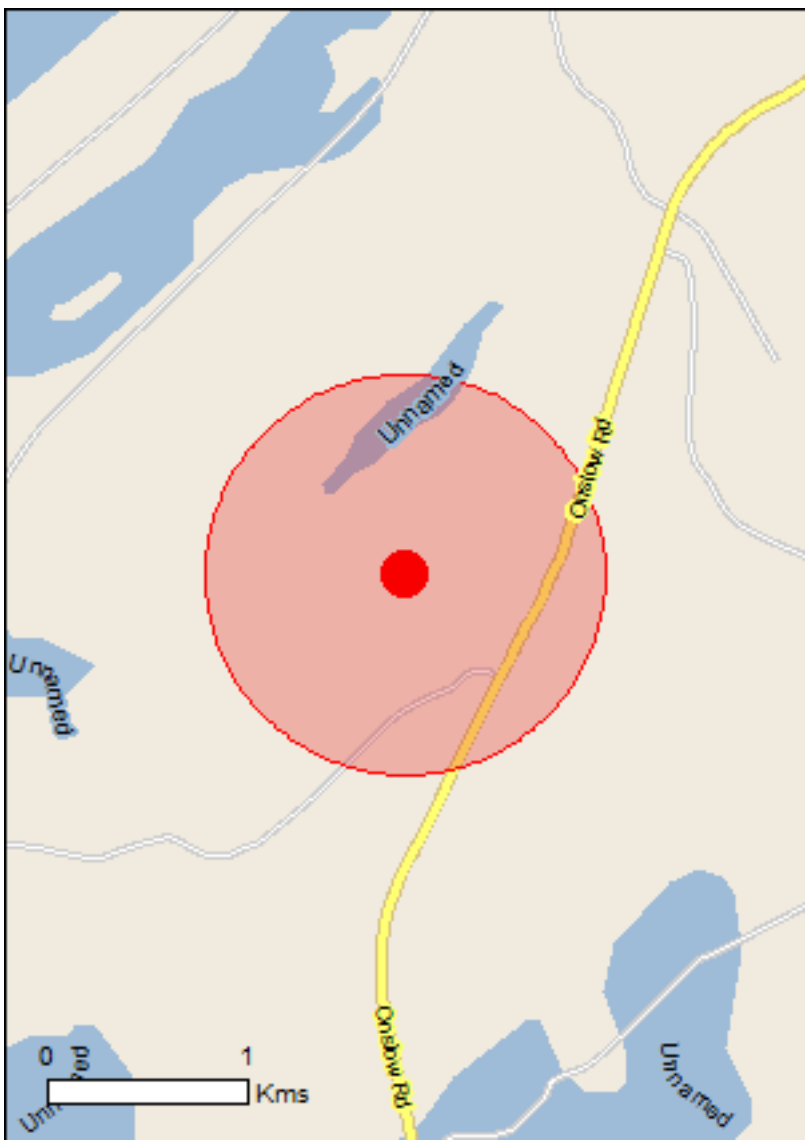
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

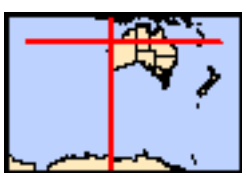
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 23/10/14 15:09:32



Coordinates

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	2
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	1
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	8
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Mammals		
Dasyurus hallucatus		
Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Ctenotus angusticeps		
Airlie Island Ctenotus [25937]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Sterna bengalensis		
Lesser Crested Tern [815]		Breeding known to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Breeding known to occur

Name	Threatened	Type of Presence within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Coastal Margin Exmouth Gulf to Cape Preston	WA	Indicative Place

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area

Coordinates

-21.68235 115.09329

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix E: Fauna and Flora Surveys Report (Terratree)

Terratree

October 2014 Level 1 Fauna and Level 2 Flora and Vegetation Survey of Waste Transfer Site, Onslow WA

Prepared for the Shire of Ashburton

Ref: T14011a

ecological assessment & management

Terratree Pty Ltd

ABN 48 159 6065 005

Unit 10, 17 High Street

Fremantle

WA 6160

Telephone (08)9335 4228

Mobile 0400 003 688

Email: joeg@terratree.com.au

www.terratree.com.au

Document Control

Version	Date	Author	Reviewer
Draft	23/10/2014	J. Fielder C. McGary	J. Grehan
Final	3/11/2014	J. Fielder C. McGary	J. Skiba

Author: Joseph Grehan

Principal Ecologist

DISCLAIMER

This document is prepared in accordance with and subject to an agreement between Terratree Pty Ltd ("Terratree") and the client for whom it has been prepared ("Shire of Ashburton") and is restricted to those issues that have been raised by the Client in its engagement of Terratree and prepared using the standard of skill and care ordinarily exercised by Environmental Scientists in the preparation of such Documents.

Any organisation or person that relies on or uses this document for purposes or reasons other than those agreed by Terratree and the client without first obtaining the prior written consent of Terratree, does so entirely at their own risk and Terratree denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed with the client.

Terratree Pty Ltd

Contents

List of Tables

List of Figures

Appendices

1 Introduction

The Shire of Ashburton proposes an expansion to its existing waste management facilities near the town of Onslow, in the Pilbara Region of Western Australia (WA). As part to of the environmental impact assessment process for these sites, the Shire of Ashburton (the Shire) commissioned Terratree Pty Ltd (Terratree) to complete a single visit Level 2 (EPA, 2004) vegetation survey, targeted Threatened (Declared Rare) and Priority flora survey and Level 1 fauna survey (habitat assessment) at the proposed Waste Transfer Station (Site L; **Figure 1**) and along the existing access track. This is an area of approximately 2.5 hectares (ha), and will be referred to as the "survey area".

1.1 Regulatory Context

As part of the regulatory requirements regarding native vegetation clearing within the survey area, the Shire is required to conduct various levels of biological surveys, depending of the scale and intensity of the clearing and the likely impact to flora and fauna.

The surveys were completed in accordance with the surveys descriptions in EPA Guidance Statements 51 (EPA 2004a) and 56 (EPA 2004b), and meet the requirements under Western Australian environmental legislation and regulations. The flora, vegetation and fauna surveys were integrated and occurred during one site visit. The flora and fauna surveys included the following:

- Vegetation mapping
- Targeted searches for Threatened (Declared Rare) and Priority flora
- Assessment of habitat suitability to support Threatened (Rare or Likely to Become Extinct), Priority, Migratory, Short-Range Endemic and other Specially Protected fauna
- Targeted searches for sign (tracks, scat, burrows and mounds, etc.) of conservation significant fauna

1.2 Legislation

Current State and Federal Government legislation relevant to environmental impact assessment and the conservation of biodiversity and in WA includes:

State:

- *Environmental Protection Act* (1986)
- *Wildlife Conservation Act* (1950)

Federal:

- *Environmental Protection and Biodiversity Conservation Act* (1999) (EPBC Act)

1.2.1 Government Policy and Guidelines

A number of State policies, EPA position statements, EPA guidance statements and relevant environmental guidelines and codes of practice are relevant to environmental impact assessment of the proposed exploration programs.

These include:

- *EPA Position Statement No. 2 Environmental Protection of Native Vegetation* (EPA 1999)
- *EPA Position Statement No. 3 Terrestrial Biological Surveys* (EPA 2002a)
- *EPA Position Statement No. 7 Principles of Environmental Protection* (EPA 2002b)
- *EPA Guidance Statement No. 33 Environmental guidance for Planning and Development* (EPA 2008)
- *EPA Guidance Statement No. 20 Sampling of Short Range Endemic Invertebrate Faun*a (EPA 2009)

297,000 298,000 299,000 300,000 301,000 302,000 303,000 304,000 305,000 306,000 307,000 308,000 309,000

7,606,000 7,605,000 7,604,000 7,603,000 7,602,000 7,601,000 7,600,000 7,599,000 7,598,000 7,597,000 7,596,000

LEGEND

- Site Boundary
- **Road Network (MRWA)**
- Access Road
- Local Distributor
- Primary Distributor

Site Locality

Level 1 Fauna and Level 2 Flora and Vegetation: Onslow Waste Transfer Station

N
W E
S

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

0 250 500 1,000 1,500 2,000
Meters

Scale @ A3:	1:40,000
Date:	31/10/2014
Revision:	Rev A
Project No:	TW14026
Prepared:	R Cullen
Checked:	C McGary
Reviewed:	N King

Figure 01

Terratree

talis consulting

Document Path: \\server\Talis\SECTIONS\Waste\PROJECTS\TW2014\TW14026 - Onslow WTS Approval\GIS\Maps\Terratree\TW14026_001_Locality.mxd

- *EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys* (EPA 2004a)
- *EPA Guidance Statement No. 56 Terrestrial Fauna Surveys* (EPA 2004b)

1.2.2 Wildlife Conservation Act 1950

All Australian native flora and fauna are protected under the Western Australian *Wildlife Conservation Act* 1950 where flora is defined as any plant (including wildflower, palm, shrub, tree, fern, creeper or vine) which is either native to WA or declared to be flora under the Act, and includes any part of flora and all seed and spores thereof. Any activity in WA that involves taking part of or the whole of a WA native plant may require a licence or permit to do so.

Species and subspecies of flora and fauna may be listed as 'Threatened' pursuant to Schedule 1 of the *Wildlife Conservation Act*. Flora and fauna may be listed as Threatened under federal legislation as well, see section 1.2.4 below.

A flora species may be designated 'Declared Rare' species under subsection 2 of section 23F of the *Wildlife Conservation Act* and it is an offence to 'take' or damage rare flora without Ministerial approval. Section 23F of the Act defines 'to take' as " to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora to cause or permit the same to be done by any means". The WA State Minister for the Environment can declare taxa (species, subspecies or variety) as 'Declared Rare Flora' (DRF) if they are considered to be in danger of extinction, rare or otherwise in need of special protection. At the State level, the term Threatened Flora is now commonly used to refer to DRF regardless of their Commonwealth status.

Flora and fauna taxa acquire a 'Declared Rare' or 'Priority' conservation status when populations are restricted geographically or threatened by local processes (**Table 1**). The Department of Parks and Wildlife (DPaW) recognises these threats and applies regulations towards population protection and species conservation. DPaW enforces regulations under the *Wildlife Conservation Act* to conserve DRF and Priority Flora and protect significant populations.

The list of Threatened flora and fauna is reviewed annually by a scientific panel that assess a taxon's conservation status and ranks them into categories. The Priority Flora and Fauna list is dynamic, as new information becomes available conservation status is reviewed and changes to the listing may result. The categories for Priority Flora and Fauna give an indication of the priority for undertaking further surveys based on the number of known sites, and degree of threat to those populations.

1.2.3 Scheduled and Priority Fauna Species

There are four levels of conservation significance provided for fauna under the *Wildlife Conservation Act*. Scheduled species are prioritised and listed as:

- Schedule 1: Fauna that is rare or likely to become extinct (also known as "Threatened Species")
- Schedule 2: Fauna presumed to be extinct
- Schedule 3: Migratory birds protected under an international agreement
- Schedule 4: Other specially protected fauna

DPaW has also produced a supplementary list of 'Priority' fauna, including species that are not scheduled under the *Wildlife Conservation Act*, but for which the DPaW considers require attention (**Table 1**).

DPaW also classifies species into one of five categories developed by the International Union for Conservation of Nature (IUCN): extinct (EX), extinct in the wild (EW), critically endangered (CR), endangered (EN) or vulnerable (VU).

These categories are determined by the total distribution of the species within Australia (and internationally where migratory species are concerned), not just within WA.

Table 1: Definition of Threatened and Priority Species under the *Wildlife Conservation Act* (DPaW 2013)

Conservation Code	Category
T	**Threatened Flora and Fauna (Extant)** Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such. Threatened Flora are further ranked by the Department according to their level of threat using IUCN Red List criteria: • CR: Critically endangered – considered to be facing an extremely high risk of extinction in the wild; • EN: Endangered – considered to be facing a very high risk of extinction in the wild; • VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X	**Threatened – Presumed Extinct Taxa** Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such. Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List under Priorities 1, 2 or 3.
P1	**Priority One – Poorly Known Taxa** Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	**Priority Two – Poorly Known Taxa** Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3	**Priority Three – Poorly Known Taxa** Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but need further surveying.
P4	**Priority Four – Rare, Near Threatened and other taxa in need of monitoring** • Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. • Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. • Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	**Priority Five – Conservation Dependent Species** Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

1.2.4 Environmental Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) is the Australian Government's key piece of environmental legislation. The EPBC Act protects matters of National Environmental Significance (NES) including, Threatened flora and fauna species, Threatened Ecological Communities and Migratory species protected under international agreements such as the Japan–Australia Migratory Bird Agreement (JAMBA), the China–Australia Migratory Bird Agreement (CAMBA), the Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA) and the Bonn Convention (the Convention on the Conservation of Migratory Species of Wild Animals). The EPBC Act also protects other NES, such as world heritage properties, national heritage places, wetlands of international importance (designated under the Ramsar Convention) and Commonwealth marine areas, including the Great Barrier Reef Marine Park. Any action likely to have a significant impact on a matters of NES listed under the EPBC Act requires referral to the Commonwealth Department of the Environment (DotE) and potentially the approval of the Commonwealth Minister for the Environment. The EPBC Act states that the proponent must not take an action that is likely to have a significant impact on any matters of NES without approval.

1.2.5 Local and Regionally Significant Flora

In addition to flora and fauna taxa being recognised as significant through their Threatened or Priority status, they can also be significant for a number of other reasons. The Environmental Protection Authority (EPA) in Guidance Statement No. 51 – Terrestrial flora and vegetation surveys for environmental impact assessment in WA (EPA 2004a) states that "significant flora" may include taxa that have:

- "a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species;
- relic status;
- anomalous features that indicate a potential new discovery;
- being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- the presence of restricted subspecies, varieties or naturally occurring hybrids;
- local endemism/a restricted distribution; or
- being poorly reserved. "

Similarly, plant communities or vegetation may be considered "significant vegetation" for reasons other than a listing as a Threatened Ecological Community. The EPA (EPA 2004a) states that these reasons include:

- "scarcity;
- unusual species;
- novel combinations of species;
- a role as a refuge;
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species;
- being representative of the range of a unit (particularly, a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range); or
- a restricted distribution. "

1.2.6 Threatened and Priority Ecological Communities

In WA, "Threatened Ecological Communities" (TECs) are defined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (within DPaW) and are assigned to one of the categories outlined below (**Table 2**). While they are not afforded direct statutory protection at a State level (unlike Threatened flora and fauna under the *Wildlife Conservation Act*) their significance is acknowledged

through other State environmental approval processes (i.e. Environmental Impact Assessment process pursuant to Part IV of the *Environmental Protection Act 1986*).

Table 2: Categories of DPaW Threatened Ecological Communities (DEC 2010)

Category	Description
PD	**Presumed Totally Destroyed** An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	**Critically Endangered** An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future
EN	**Endangered** An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
VU	**Vulnerable** An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

Selected TECs are also afforded statutory protection at a Federal level as matters of NES pursuant to the EPBC Act. Not all State listed TECs are given Federal protection, only a select few. The EPBC Act provides for the strong protection of TECs, which are listed under Section 181 of the EPBC Act, and are defined as "Critically Endangered", "Endangered" or "Vulnerable" under Section 182 of the EPBC Act.

The EPBC Act provides protection for TECs under Federal legislation, which is defined as communities that are:

- **Critically Endangered** (if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future);
- **Endangered** (if, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future); or
- **Vulnerable** (if, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium term future).

A community that is not listed as a TEC may be listed as a Priority Ecological Community (PEC). DPaW (DEC 2010) describes a PEC as an ecological community that is under consideration for listing as a TEC, but does not yet meet the criteria or has not been adequately defined. It is placed in either Category 1, 2, or 3 of the PEC list. Ecological communities that are adequately known, and are rare but not threatened, or meet criteria for Near Threatened, or those who have recently been removed from the threatened list, are placed in Priority 4. These ecological communities require monitoring. Conservation dependent ecological communities are placed in Priority 5. Categories and definitions of PEC are listed in **Table 3**.

Table 3: Categories of Priority Ecological Communities (DEC 2010)

Priority Rating	Description
Priority 1	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do

	not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3	1. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: 2. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; 3. Communities made up of large, and/or widespread occurrences, which may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	Ecological communities that are adequately known, rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
Priority 5	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

1.2.7 Environmentally Sensitive Areas

Under section 51B of the *Environmental Protection Act* the Minister can, by notice, declare an area of the State specified in the notice or an area of the State to be an Environmentally Sensitive Area (ESA). ESAs are protected under the *Environmental Protection (Clearing of Native Vegetation) Regulation 2004* and are selected for their environmental values at state or national levels. Some of the reasons for assigning this status include:

- Protection of rare or threatened species of native plants
- Protection of wetlands and water courses
- Protection of sites that have other high conservation, scientific or aesthetic values
- Protection of Aboriginal or European cultural sites

2 Existing Environment

2.1 Biogeography

The survey area is in the Carnarvon IBRA bioregion. The Carnarvon bioregion is characterised quaternary alluvial, aeolian and marine sediments overlying Cretaceous strata. The vegetation is a mosaic of saline alluvial plains with samphire flats and saltbush low shrublands. Bowgada low woodland occurs on the sandy ridges and plains, with Snakewood (*Acacia xiphophylla*) scrub on clay flats and tree to shrub steppe over hummock grasslands on and between red sand dune fields. The northern portion of the bioregion supports Acacia stuartii or A. bivenosa shrubland on limestone outcrops. Extensive tidal flats in sheltered bays support mangroves (Kendrick & Mau 2002).

The climate is described as arid, semi-desert to sub-tropical, with highly variable rainfall in both winter and summer. Cyclonic activity has a significant influence and can affect the coast and hinterland on an annual basis (Kendrick & Mau 2002).

The dominant land uses within the subregions include grazing of native pastures, conservation, mining and urban centres (Kendrick & Mau 2002).

2.2 Soils and Landforms

The survey area lies within the Exmouth Province (20) of the Western Region (2) of the Soil Landscapes of WA (Tille 2006). The Exmouth Province is described as 'Alluvial plains and sandplains with coastal flats and dunes (and some ranges and stony plains) on sedimentary rocks of the Carnarvon Basin' (Tille 2006).

The geology of the Exmouth Province is described by (Tille 2006) as follows:

Exmouth Province mostly sits over the sedimentary rocks of the Northern Carnarvon Basin. To the east of the Exmouth Gulf are the Cretaceous Windalia Radiolarite and Birdrong Sandstone of the Peedamullah Shelf. These are overlain by Quaternary alluvium, colluvium and aeolian sand. Along the eastern margin of the province are scattered outliers of the Gascoyne Complex comprising Palaeoproterozoic granitoid rocks, paragneiss and metasedimentary schist. Also present are some Palaeoproterozoic conglomerates, sandstones, siltstones and mudstones of the Mount Minnie Group. To the west of Exmouth Gulf, the Tertiary limestone of the Cape Range Group is found on top of the Triassic-Jurassic sediments of the Exmouth Sub-basin. South of Exmouth Gulf, this province extends onto the northern end of the Southern Carnarvon Basin. This is dominated by Merlingleigh Sub-basin which has Windalia Radiolarite and Birdrong Sandstone like the Peedamullah Basin. To the east, these are mostly overlain by Quaternary deposits. Closer to the coast Tertiary deposits and the Cretaceous chalky deposits, clayey siltstone and greensand of the Toolonga Calcilutite/Alinga Formation are found. The Gascoyne Platform, mostly overlain by these calcareous marine deposits, is found in the south-west corner of this province.

Landforms of the Exmouth Province are described by (Tille 2006) as follows*:*

Most of the province consists of sandplains or alluvial plains. Broad sandplains (with large linear dunes) and broad sandy-surfaced plains are dominant in the south-east. Mixed in with these are some active floodplains and alluvial plains covered with sand in parts. In the north there is a complex of sandy-surfaced plains, alluvial plains, gilgaied clay plains and flood plains (with some gravelly plains and deltaic deposits). Along the coast from Exmouth Gulf northwards tidal mudflats are backed by undulating sandplains and dunefields between clay plains. South of North West Cape, the deeply dissected limestone plateau of the Cape Range dominates the coastline. This contains hills and ridges with gorges and steep stony footslopes. From Ningaloo southwards, the range gives way to undulating sandy plains with linear dunes, minor limestone ridges and outcrop plains. Inland from these there are limestone hills, gently sloping outwash plains and undulating stony plains.

Soils of the Exmouth Province are described by (Tille 2006) as follows*:*

The sandplains and dunes are dominated by Red deep sands. On the broad, sandy-surfaced plains are Red deep sandy duplexes with some Red sandy earths. Red/brown non-cracking clays, Hard cracking clays and Red deep sandy duplexes are found on the alluvial plains and floodplains, along with some Red loamy earths. Tidal soils are found on the coastal flats while the coastal dunes have Calcareous deep sands and Red deep sands. Calcareous shallow loams, Red loamy earths and Stony soils are found on the Cape Range and other limestone hills with Red deep sands on the undulating sandy plains to the south.

The survey area is within the Onslow Plain Zone (201), which is described by Tille (2006) as:

Coastal mudflats (with some sandplains and coastal dunes) on coastal deposits over Cretaceous sedimentary rocks of the Carnarvon Basin. Tidal soils with Calcareous deeps sands and some Red deeps sands, Red/brown non-cracking clays and Salt lake soils. Bare mudflats with samphire and spinifex/tussock grasslands (and some mangroves). Located in the north-west coast between Cape Preston and the Exmouth Gulf.

2.3 Land Systems

The project areas were overlaid onto the Land System Mapping dataset for the Ashburton River Catchment (Payne *et al.* 1988) to determine their characteristics in terms of soils, topography and vegetation. As a result, one land system, the Dune Land System, was mapped within the survey areas by Payne *et al.* (1988) (**Table 4**).

Table 4: Dune Land System (Payne *et al.* 1988)

Landform	Soils	Vegetation
Linear and reticulate dunes: up to 15 m high and 2.5 km long	Dark red sands and loamy sands to over a metre deep.	Hummock grasslands of feathertop spinifex (*Triodia schinzii*) with numerous low shrubs, herbs and forbs.
Swales: sandy surfaces 50 to 300 m wide between dunes.	Dark red sands and loamy sands to over a metre deep.	Hummock grasslands mostly of soft spinifex (*Triodia pungens*) but with some hard spinifex (*Triodia lanigera*). Sparse low shrubs such as *Acacia translucens* and herbs and forbs.
Swamps and depressions: low lying areas between dunes, circular or oval up to 500 m in diameter or extent.	Surface cracking reddish brown to brown clay soils over a metre deep.	Low open woodland of *Eucalyptus coolabah* with *Muehlenbeckia cunninghamii* and perennial grasses such as *Sporobolus mitchellii* and *Eriachne benthamii*.
Claypans: bare, circular, oval or elongated surfaces mostly less than 150 m in diameter or length but up to 500 m, up to 1.5 m below adjacent sand[plains or swale with abrupt marginal slopes.	Dark red clay soils often with lime or gypsum in profile, sealed, glazed surfaces or crusted surfaces with desiccation cracks.	No vegetation.

2.4 Regional Vegetation

The survey area lies in the northern portion of the Carnarvon Region of the Eremaean Province (Beard 1990). This region is described as *Acacia* scrub and low woodland becoming tree and shrub steppe in the north, and with halophytes along the lower river courses. The survey area is mapped as unit 676, Cape Yannare Coastal Plain, which is described as succulent steppe with samphires (Beard 1975; Shepherd, Hopkins & Beeston 2002).

2.5 Climate

The climate in Onslow has been described as tropical desert that receives summer rainfall. In the summer season long periods of very hot, dry conditions prevail, due to the progression of anti-cyclones south of the town and the high levels of solar radiation received year round. These hot and dry conditions are occasionally broken by thunderstorms and tropical cyclones. As a result the area can receive large amounts of rainfall in short time periods. During the winter months the conditions are fine and warm during the day and cool at night. Cool, dry conditions can occasionally be broken by rain-bearing depressions from the south (Payne *et al.* 1988). The climate data for Onslow is outlined in Figure .

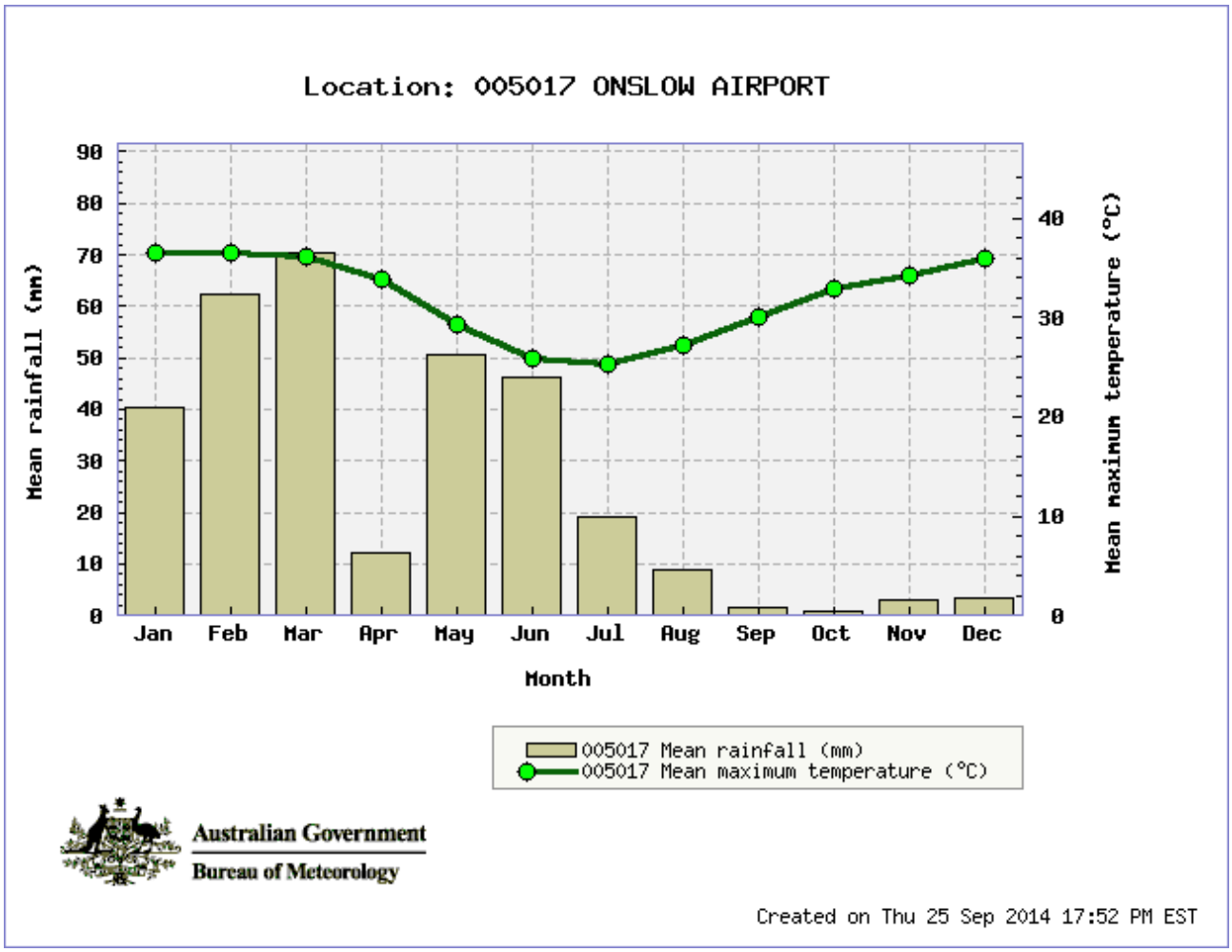


Figure 2: Average monthly rainfall and maximum temperature at Onslow Airport (Bureau of Meteorology 2014).

3 Methods

The field surveys were conducted on October 6-7, 2014 by Senior Botanist, Julie Fielder, and Senior Ecologist, Cara McGary. Both staff are qualified and experienced in conducting flora, vegetation and fauna surveys. The field surveys consisted of three components: 1) Quadrat-based Level 2 Flora and Vegetation survey; 2) Targeted Threatened and Priority Flora searches; and 3) A habitat assessment and Level 1 fauna survey.

3.1 Database Searches

Before field work commenced, searches were requested of DPaW's Threatened and Priority Flora, Threatened Fauna, and Ecological Communities databases. The Flora and Ecological Communities databases were searched using a 5 km buffer around a central point (302879.77 mE, 7601193.96 mN; MGA94 Zone 50) for the project areas (reference numbers 17-1014FL and 31-01014EC, respectively), while the Threatened Fauna database was searched using a 20 km buffer around the same point (reference number 2013/000283 #4919). The Protected Matters Search Tool (DotE 2014a) database was also searched with a 10km buffer around the same central coordinates.

3.2 Level 2 Flora and Vegetation Survey

A Level 2 flora and vegetation survey was carried out in the survey area, totalling 2.5 ha. Two quadrats were surveyed to represent the vegetation and landforms present. The following landscape description information was recorded in each quadrat location:

- coordinates and photographs
- slope and aspect
- landform
- rock type, fragment size and percent cover
- soil type and colour
- vegetation description (NVIS level 5)
- vegetation health and disturbance factors

All vascular plant species observed within each quadrat were recorded. All species were collected on initial observation for specimen verification, following which observations were recorded as references to the original specimen for each species. Species were recollected if botanists had any doubt they were identical to previous collections or if better flowering or fruiting material could be obtained. Additional opportunistic collections were made throughout the survey area wherever different species were observed, particularly if they were not recorded inside of quadrats.

Vegetation condition was assessed according to the following scale adapted from Keighery (1994):

Pristine (1): Pristine or nearly so, no obvious signs of disturbance.

Excellent (2): Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3): Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (4): Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5): Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to

vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Completely Degraded (6): The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora compromising weed or crop species with isolated trees or shrubs.

3.2.1 Mapping

Vegetation community areas were determined based on quadrat data and aerial photography. Vegetation communities were digitised using QGIS 2.4 software (QGIS Application Team 2014), by drawing vector polygons over a high-resolution aerial photograph layer.

3.2.2 Specimen identification and locations

Following the survey, plant specimens collected were identified in the WA Herbarium by Chris Hancock. Specimens of interest will be lodged in the WA Herbarium.

3.3 Targeted Threatened and Priority Flora Search

Descriptions and photographs of Threatened and Priority taxa identified in database searches were compiled from FloraBase (WA Herbarium, 2013) and other resources at the WA Herbarium to produce a 'field guide'. This field guide was used to assist with identifying species in the field for the targeted searches. The Threatened and Priority Flora searches were conducted by botanists walking along lines spaced 50 m apart through native vegetation within the survey area.

3.4 Level 1 Fauna Survey

Fauna database search results from DPaW and the Atlas of Living Australia (Atlas of Living Australia 2014) databases were used to develop a guide to fauna that may occur in the survey areas. During the field survey, the survey areas were assessed to determine their suitability to support Threatened (Rare or Likely to Become Extinct), Priority, Migratory, Short-Range Endemic and other Specially Protected fauna. During targeted searches, all vertebrate fauna and sign (tracks, scat, burrows and mounds, etc.) encountered were recorded. Bird surveys were conducted 15 minutes prior to and 30 minutes after sunrise on one morning.

3.5 Survey Limitations

The potential limitations of the survey, as outline in the EPA Guidance Statement No. 51 (2004a) and No. 56 (2004b) are outlined in **Table 5**.

Table 5: Potential limitations and discussion of their relevance to the survey

Potential Limitation	Discussion
Competency/experience of the consultants doing the survey	Both consultants have extensive experience conducting flora and fauna surveys in the Pilbara and throughout WA.
Site access	Site access was adequate and uninhibited.
Sources of information and availability of contextual information (i.e. pre-existing background vs. new material) and biogeographic information for the region	Existing information was adequate. Several fauna, flora and vegetation surveys had been done in and around Onslow within the last 10 years.
Scope (e.g. what taxa forms, etc., were sampled)	There were no inappropriate limitations on the scope. The survey assessed fauna habitats, vegetation types, targeted priority vascular plant species.
Proportion of flora collected and identified (based on sampling, timing and intensity)	The survey occurred in early October, with 2.4 mm of rainfall in Onslow in the two months preceding the field survey. Ephemeral

Potential Limitation	Discussion
	species were not present, and the majority of plants were not in flower.
Proportion of fauna identified, recorded and/or collected	The survey intensity was high. The area of native vegetation surveyed was small and traversed at a maximum interval of 50m. All vertebrate fauna (including sign) were recorded, all flora observed in quadrats were recorded and collected. Opportunistic collections were made for any flora not represented in the quadrats that could not be readily identified in the field.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	The relevant portions of the survey areas were completely assessed to scope.
Taxonomic certainty	There were no significant limitations on taxonomic certainty. Species profiles, descriptions and photographs were compiled from specimens and information available on FloraBase, SPRAT profiles, Atlas of Living Australia and resources in the WA Herbarium. These were used for field identification of any species with potential to be a threatened or priority species.
Mapping reliability	The vegetation mapping has been based on a Level 2 survey, using quadrat data. Current and detailed aerial photography was available for the purposes of mapping.
Timing, weather, season, cycle	Timing of the survey, in October, was preceded by low rainfall, except in May. Timing was not suitable for detecting ephemeral species and most plant species were not flower.
Disturbances (fire, flood, accidental human intervention etc.)	The site had minimal signs of disturbance. Aside from the main existing tracks, there were a few old vehicle tracks. There was no sign of recent fire.
Intensity (in retrospect, was the intensity adequate)	The intensity of the survey was adequate for the purpose of the survey.
Resources	The field survey, plant identification and reporting were all adequately resourced.
Experience levels (e.g. degree of expertise in plant and animal identification to taxon level).	The field survey was carried out by suitably qualified and experienced personnel. Plant identification was done by Chris Hancock and Julie Fielder, who have over ten years of experience in taxonomic identification and have extensive experience identifying flora from the Pilbara region, including specimens from several surveys in Onslow. Animal identification in the field was done by Cara McGary who has over four years of experience identifying fauna and fauna habitats in the Pilbara.

4 Results

4.1 Desktop Review

4.1.1 Previous Studies

No previous flora, vegetation or fauna surveys are known to have occurred in the survey area. However, several flora and fauna surveys have occurred in the vicinity of Onslow within the last ten years, associated with various infrastructure projects. Flora and fauna survey reports associated with the Wheatstone LNG project are particularly pertinent for regional context. These reports were reviewed to determine what species of conservation significance were recorded and in what habitats. These reports include:

- A Level 2 flora and vegetation survey of the Wheatstone LNG and Domgas plant, accommodation camp and gas pipeline, approximately 9,794 ha (Biota 2010a).
- A Level 2 fauna survey at 16 trapping sites in the Wheatstone LNG and Domgas project area (Biota 2010b).

4.1.2 Database Searches

The combined review of databases, survey reports and published literature yielded a total of 69 taxa of conservation significance (17 plants and 49 animals) previously recorded in database searches near the survey area. No Threatened (Declared Rare) Flora were recorded in database searches. Eighteen species of Priority Flora were returned from the DPaW flora database searches (**Table 6**). The Protected Matters Search Tool (DotE 2014a) database search returned no Endangered flora species (**Table 6**), and two invasive plant species (**Appendix 2**).

Table 6: Conservation significant flora taxa recorded in desktop surveys and previous survey reports

Taxon name and conservation status	Databases [1)]				Survey reports [2)]
	TPFL	WA Herb	TP List	PMR	Biota 2010a
Priority 1					
Abutilon sp. Pritzelianum (S. van Leeuwin 5095)		•			
Abutilon sp. Onslow (F. Smith s.n. 10/9/61) PN (formerly '*Abutilon uncinatum*')	•	•	•		•
Goodenia pallida			•		
Tecticornia globulifera			•		
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)			•		
Tephrosia rosea var. Port Hedland (A.S. George 1114) PN			•		
Abutilon sp. Onslow (F. Smith s.n. 10/9/61) PN			•		
Priority 2					
Carpobrotus sp. Thevenard Island (M. White 050)	•	•			
Euphorbia inappendiculata var. *inappendiculata*			•		
Vigna sp. central (M.E. Trudgen 1626)		•			
Priority 3					
Acacia glaucocaesia			•		
Eleocharis papillosa		•			•
Eremophila forrestii subsp. *viridis*		•	•		•
Owenia acidula			•		
Tecticornia medusa			•		

Taxon name and conservation status	Databases [1]				Survey reports [2]
	TPFL	WA Herb	TP List	PMR	Biota 2010a
Triumfetta echinata		•	•		
Priority 4					
Eremophila youngii subsp. *lepidota*			•		

TPFL: DPaW Threatened (Declared Rare) and Priority Flora database and Threatened and Priority Flora List
WAHerb: Western Australian Herbarium Database
TPList: DPaW Threatened and Priority List
PMR: EPBC Act Protected Matters Report

There were no occurrences of Threatened or Priority Ecological Communities within 5 km of the project area (31-01014EC). One place on the Register of the National Estate (RNE) is located within 10 km of the survey areas (**Appendix 2**). This area, called the Coastal Margin Exmouth Gulf to Cape Preston, is 'about 120,000ha, in three sections extending 260 km north-east and south-west of Onslow, comprising saline coastal flats between Giralia Bay, Exmouth Gulf, and Cape Preston, inshore from the Mary Anne Group of Islands' (DotE 2014b). The area has 'numerous ramifying tidal channels extend landward from the sublittoral zone and carry tidal waters to the interior. The channels and inter-channel areas of the seaward margin of the flats are bordered by extensive mangrove thickets and terrains of algal mat' (DotE 2014b). It is an 'important representation of intact tidal flats and mangrove thicket of the north-west coast of WA; important habitat for juveniles of many marine species; important bird habitat; dugong colony present' (DotE 2014b). The survey area is not within this RNE and is not near any similar habitats.

DPaW's Threatened Fauna database returned 12 Threatened fauna species, including one that is presumed extinct; 26 migratory birds and one other Specially Protected fauna species (**Table 7**). The DPaW database search also returned one Priority 1 species and six Priority 4 species (**Table 7**). The Protected Matters Search Tool (DotE 2014a) database search returned two Endangered and Vulnerable fauna species, ten Migratory species (**Table 7**), and six invasive fauna species (**Appendix 2**).

Table 7: Conservation significant fauna taxa recorded in desktop surveys

Taxon name and conservation status		Conservation Status		Databases [1]		Survey Reports
		State	Federal	DPaW	PMR	Biota 2010b
Threatened						
Calidris canutus subsp. *rogersi*	Red Knot (north-eastern Siberia)			•		
Calidris ferruginea	Curlew Sandpiper			•		
Calidris tenuirostris	Great Knot			•		
Charadrius leschenaultii subsp. *leschenaultii*	Greater Sand Plover (Mongolian)			•		
Charadrius mongolus	Lesser Sand Plover			•		
Ctenotus angusticeps	Airlie Island Ctenotus		VU		•	
Dasyurus hallucatus	Northern Quoll		EN	•	•	
Liasis olivaceus subsp. *barroni*	Pilbara Olive Python			•		
Limosa lapponica subsp. *menzbieri*	Bar-tailed Godwit (Northern Siberian)			•		
Numenius madagascariensis	Eastern Curlew			•		
Pezoporus occidentalis	Night Parrot			•		
Sterna nereis subsp. *nereis*	Fairy Tern			•		
Presumed Extinct						

Taxon name and conservation status		Conservation Status		Databases [1)]		Survey Reports
		State	Federal	DPaW	PMR	Biota 2010b
Perameles bougainville	Western Barred Bandicoot, Marl			•		
Migratory Birds						
Actitis hypoleucos	Common Sandpiper	IA		•		
Apus pacificus	Fork-tailed Swift	IA	M		•	•
Ardea alba (modesta)	Great Egret, White Egret	IA	M	•	•	
Ardea ibis	Cattle Egret		M		•	
Ardea sacra	Eastern Reef Egret, Eastern Reef Heron	IA		•		
Arenaria interpres	Ruddy Turnstone	IA		•		
Calidris acuminata	Sharp-tailed Sandpiper	IA		•		
Calidris alba	Sanderling	IA		•		
Calidris ruficollis	Red-necked Stint	IA		•		
Charadrius leschenaultii	Greater Sand Plover	IA		•		
Charadrius veredus	Oriental Plover	IA	M	•	•	
Chlidonias leucopterus	White-winged Black Tern	IA		•		
Glareola maldivarum	Oriental Pratincole	IA	M	•	•	
Haliaeetus leucogaster	White-bellied Sea Eagle	IA	M	•	•	•
Hirundo rustica	Barn Swallow		M		•	
Limosa lapponica	Bar-tailed Godwit	IA		•		
Merops ornatus	Rainbow Bee-eater	IA	M	•	•	•
Numenius minutus	Little Curlew	IA		•		
Numenius phaeopus	Whimbrel	IA		•		
Oceanites oceanicus	Wilson's Storm Petrel	IA		•		
Pandion haliaetus	Osprey		M		•	
Pluvialis squatarola	Grey Plover	IA		•		
Sterna bengalensis	Lesser Crested Tern	IA	M	•	•	
Sterna caspia	Caspian Tern	IA		•		
Sterna dougallii	Roseate Tern	IA		•		
Sterna hirundo	Common Tern	IA		•		
Sterna leucoptera	White-winged Black Tern	IA		•		
Tringa brevipes	Grey-tailed Tattler	IA		•		
Tringa glareola	Wood Sandpiper	IA		•		
Tringa nebularia	Common Greenshank	IA		•		
Schedule 4 Specially Protected Fauna						
Falco peregrinus	(Australian) Peregrine Falcon	S4		•		
Priority 1						
Lerista planiventralis subsp. *maryani*	Keeled Slider (NW coast Onslow to Barradale), skink	P1		•		
Mormopterus loriae cobourgensis	Northern Freetail-bat	P1				•
Priority 4						
Ardeotis australis	Australian Bustard	P4		•		•

Taxon name and conservation status		Conservation Status		Databases [1)]		Survey Reports
		State	Federal	DPaW	PMR	Biota 2010b
Burhinus grallarius	Bush Stone-curlew	P4		•		
Leggadina lakedownensis	Short-tailed Mouse, Karekanga	P4		•		
Neochmia ruficauda subsp. *subcanescens*	Star Finch (western)	P4		•		
Phaps histrionica	Flock Bronzewing, Flock Pigeon	P4		•		
Pseudomys chapmani	Western Pebble-mound Mouse, Ngadji	P4		•		•

DPaW: DPaW Threatened Fauna Database
PMR: EPBC Act Protected Matters Report

4.2 Vegetation Survey

The Waste Transfer Station survey area contains native vegetation in 'Very Good' condition (Keighery 1994). Vehicle tracks were the primary types of disturbance in the survey area. Vegetation in the survey area is comprised of the following two assemblages:

- *Acacia stellaticeps* low shrubland over *Triodia epactia* hummock grassland.
- *Santalum lanceolatum* tall sparse shrubland over *Hakea stenophylla ssp. ?stenophylla*, *Acacia stellaticeps* low shurbland over *Triodia epactia* hummock grassland.

Vegetation mapping is provided in **Figure 3**. Quadrat data and photos are provided in **Appendix 1**.

4.3 Flora

No Threatened (Declared Rare) or Priority Flora was recorded during the survey. A full list of flora recorded in the survey is provided in **Appendix 1**

One weed species, **Cenchrus ciliaris* was recorded in low densities in the survey area. Buffel Grass (**Cenchrus ciliaris*) is a perennial grass that has been introduced to the Pilbara for grazing. While not a listed weed, this species is an aggressive and effective competitor with native flora species and also demonstrates allelopathic properties by releasing growth inhibiting chemicals that affect surrounding plants.

4.4 Fauna

A total of 513 vertebrate fauna are known to occur with a 10 km radius of the survey area (DPaW 2014). The vertebrate species listed in **Table 8** were recorded during the surveys by direct observation, call or sign (tracks, scat or remains).

Table 8: Vertebrate fauna reported in the survey areas

Species	Common Name
Cacatua roseicapilla	Galah
Elanus axillaris	Black-shouldered Kite
Falco cenchroides	Australian Kestrel
Gavicalis virescens	Singing Honeyeater
Grallina cyanoleuca	Magpie-lark
Malurus leucopterus	White-winged Fairy-wren
Oreoica gutturalis	Crested Bellbird
Taeniopygia guttata	Zebra Finch

302,600 302,700 302,800 302,900 303,000 303,100 303,200

7,601,400
7,601,300
7,601,200
7,601,100
7,601,000

LEGEND

Site Boundary

Vegetation Mapping Description

1 - *Santalum lanceolatum* tall sparse shrubland over *Hakea stenophylla* ssp. *stenophylla, Acacia stellaticeps* low shrubland over *Triodia epactia* hummock grassland

2 - *Acacia stellaticeps* low shrubland over *Triodia epactia* hummock

Vegetation Mapping

Level 1 Fauna and Level 2 Flora and Vegetation: Onslow Waste Transfer Station

N
W E
S

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994, Units: Meter

0 10 20 40 60 80 100
Meters

Scale @ A3:	1:2,000
Date:	31/10/2014
Revision:	Rev A
Project No:	TW14026
Prepared:	R Cullen
Checked:	C McGary
Reviewed:	N King

Figure 03

Terratree

talis consulting

Document Path: \\server\Talis\SECTIONS\Waste\PROJECTS\TW2014\TW14026 - Onslow WTS Approval\GIS\Maps\Terratree\TW14026_003_VegMapping.mxd

Fauna habitats within the survey areas were assessed to determine their suitability to support the 49 fauna species of conservation significance known to occur in the region. These assessments are presented below in **Table 9**. The assessments are based on habitat associations published by in the Department of Environment's Species Profile and Threats Database (Department of Environment 2014) and the Atlas of Living Australia (2014).

Table 9: Suitability of habitats in the survey areas to support conservation significant fauna

Taxon name and conservation status	Habitat suitability	Likelihood to occur
Threatened		
Calidris canutus subsp. rogersi - Red Knot (north-eastern Siberia)	In WA there are scattered records in the south, and is widespread on the coast from Ningaloo and Barrow Island to the south-west Kimberley Division. In Australasia the Red Knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks. This species does not breed in Australia. There is no suitable habitat for this species in the survey area.	**Unlikely**
Calidris ferruginea - Curlew Sandpiper	In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. In WA, they are widespread around coastal and subcoastal plains from Cape Arid to south-west Kimberley Division, but are more sparsely distributed between Carnarvon and Dampier Archipelago. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast. This species does not breed in Australia. There is no suitable habitat for this species in the survey area.	**Unlikely**
Calidris tenuirostris - Great Knot	The Great Knot has been recorded around the entirety of the Australian coast, with a few scattered records inland. The species is common on the coasts of the Pilbara and Kimberley, where it typically inhabits sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. This species does not breed in Australia. There is no suitable habitat for this species in the survey area.	**Unlikely**
Charadrius mongolus - Lesser Sand Plover	The Lesser Sand-Plover is widespread in coastal regions, mainly occurring in northern and eastern Australia. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. It also sometime occurs in short saltmarsh or among mangroves. This species does not breed in Australia. There is no suitable habitat for this species in the survey area.	**Unlikely**
Ctenotus angusticeps - Airlie Island Ctenotus	The Airlie Island Ctenotus is known from approximately 12 locations in north-west WA. The Airlie Island Ctenotus generally inhabits the landward fringe of salt marsh communities in samphire shrubland or marine couch grassland in the intertidal zone along mangrove margins. The Airlie Island Ctenotus is strongly associated with samphire species *Tectornia halocnemoides* subsp. *tenuis* and *Suaeda arbusculoides*, which occur on clayey soils, and mixed herb and grass cover of *Muellerolimon salicorniaceum* and *Sporobolus virginicus*, which occur on sandy soils. There is no suitable habitat for this species in the survey area.	**Unlikely**

Taxon name and conservation status	Habitat suitability	Likelihood to occur
Dasyurus hallucatus - Northern Quoll	In the Pilbara, the distributional boundaries of Northern Quoll are defined in the north, east and south by the Great Sandy Desert, Gibson Desert and Little Sandy Deserts. The Northern Quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. Northern Quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal. Rocky habitats are usually of high relief, often rugged and dissected but can also include tor fields or caves in low lying areas such as in WA. Eucalypt forest or woodland habitats usually have a high structural diversity containing large diameter trees, termite mounds or hollow logs for denning purposes. Dens are made in rock crevices, tree holes or occasionally termite mounds. In the Pilbara region, the species tends to prefer the Rocklea, Macroy and Robe land systems. These land systems comprise of basalt hills, mesas (and buttes of limonites), high and low plateaux, lower slopes, occasional tor fields and stony plains supporting either hard or soft spinifex grasslands. The Northern Quoll has also been recorded in other land systems which comprise sandstone and dolomite hills and ridges, shrublands, sandy plains, clay plans and tussock grasslands and coastal fringes including dunes islands and beaches. The habitat in the survey area has no suitable denning habitat in or near it. It is generally unsuitable for this species.	**Unlikely**
Liasis olivaceus subsp. barroni - Pilbara Olive Python	The Olive Python (Pilbara subspecies) is restricted to ranges within the Pilbara region, north-western WA, and islands of the Dampier Archipelago. It is known to occur at 17 locations within the Pilbara. The Olive Python (Pilbara subspecies) prefers escarpments, gorges and water holes in the ranges of the Pilbara region, where it shelters under rock piles, on top of rocks or under spinifex. The habitat in the survey area is generally unsuitable for this species.	**Unlikely**
Numenius madagascariensis - Eastern Curlew	Within Australia, the Eastern Curlew has continuous distribution from Barrow Island and Dampier Archipelago, WA, through the Kimberley Division and along Northern Territory, Queensland, and New South Wales (NSW) coasts and the islands of Torres Strait. They are patchily distributed elsewhere. They are primarily a coastal species. The species is a scarce visitor to Houtman Abrolhos and adjacent mainland, and is also recorded around Shark Bay. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. This species does not breed in Australia. There is no suitable habitat for this species in the survey area.	**Unlikely**
Pezoporus occidentalis - Night Parrot	The distribution of the Night Parrot is very poorly understood. There are a small number of confirmed and well-regarded records from arid and semi-arid regions of Queensland, South Australia (SA), WA and the NT. Currently, locations of extant populations are unknown, there is no reliable method by which to detect the species and there is no direct evidence to link any threatening process to the apparent decline of the species. The Night Parrot inhabits arid and semi-arid areas that are characterised by having dense, low vegetation. Based on accepted records, the habitat of the Night	**Unlikely**

Taxon name and conservation status	Habitat suitability	Likelihood to occur
	Parrot consists of *Triodia* grasslands in stony or sandy environments, and of samphire and chenopod shrublands, including genera such as *Atriplex*, *Bassia* and *Maireana*, on floodplains and claypans, and on the margins of saltlakes, creeks or other sources of water. The habitat in the survey area is *Triodia* grassland on sand and some chenopod species are present. However, this species has not been recorded in the area, and is unlikely to occur there due to the amount of pre-existing noise disturbance in the area.	
Sterna nereis subsp. nereis - Fairy Tern	The Fairy Tern occurs along the coasts of Victoria, Tasmania, SA and WA; occurring as far north as the Dampier Archipelago near Karratha. It roosts and nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation, colonies of various sizes (generally between 2–400 pairs) on coral shingle on continental islands or coral cays, on sandy islands and beaches inside estuaries, and on open sandy beaches. They nest in clear view of the water and on sites where the substrate is sandy and the vegetation sparse. Nests typically consist of a shallow scrape in the sand which is often lined with small shells and vegetation. There is no suitable habitat for this species in the survey area.	**Unlikely**
Presumed Extinct		
Perameles bougainville - Western Barred Bandicoot, Marl	This species has been extinct on the mainland of Australia since the 1930's.	**Unlikely**
Migratory Birds		
Actitis hypoleucos - Common Sandpiper	This species has been recorded in estuaries and deltas of streams, on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. No suitable habitat is present in the survey area.	**Unlikely**
Apus pacificus - Fork-tailed Swift	The Fork-tailed Swift is found mostly over inland plains but sometimes above foothills and in coastal and marine areas. They are almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. Because of its wide distribution, this species may use habitats in the survey areas, but the survey area has no features that are particularly suited for use by this species.	**Unlikely**
Ardea alba (modesta) - Great Egret, White Egret	Habitats include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. No suitable habitat is present in the survey area.	**Unlikely**
Ardea ibis - Cattle Egret	Occurs in grasslands, wooded lands and terrestrial wetlands; rarely seen in arid and semi-arid regions. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. High numbers have been observed in moist, low-lying poorly drained pastures with abundant tall grass. It has been recorded on earthen dam walls and ploughed fields and is commonly associated with the habitats of farm animals. No suitable habitat is present in the survey area.	**Unlikely**
Ardea sacra - Eastern Reef Egret, Eastern Reef Heron	The Eastern Reef Egret is found on the coast and islands of most of Australia, where it inhabits beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs. They breed throughout the year,	**Unlikely**

Taxon name and conservation status	Habitat suitability	Likelihood to occur
	nesting in trees in island woodlands, or on the ground under shrubs or rock ledges. The stick nest platform is lined with seaweed. No suitable habitat is present in the survey area.	
Arenaria interpresa - Ruddy Turnstone	The Ruddy Turnstone is found along coasts, particularly on rocky or stony shores. It is often found on man-made structures such as breakwaters and jetties. It may venture onto open grassy areas near the coast and small numbers sometimes turn up on inland wetlands, especially during the spring and autumn migrations. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Calidris acuminata - Sharp-tailed Sandpiper	Uses muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. No suitable habitat is present in the survey area.	**Unlikely**
Calidris alba - Sanderling	The Sanderling occurs in coastal areas around Australia, with inland occurrences likely attributable to migrating individuals and groups. They occur on most of the coast from Eyre to Derby, and also around Wyndham. They are more often recorded on the south and southwest coasts and north to around southern Shark Bay, with more sparsely scattered records further north in Gascoyne and Pilbara Regions and the Kimberley Division. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Calidris ruficollis - Red-necked Stint	Mostly found in coastal habitats, but occasionally recorded in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland (including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats) and sometimes use flooded paddocks or damp grasslands. No suitable habitat is present in the survey area.	**Unlikely**
Charadrius leschenaultii - Greater Sand Plover	In Australia, the Greater Sand Plover occurs in coastal areas in all states, though the greatest numbers occur in northern Australia, especially the north-west. They mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons and inshore reefs, rock platforms, small rocky islands or sand cays on coral reefs. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Charadrius veredus - Oriental Plover	Within Australia, the species occurs in both coastal and inland areas, mostly in northern Australia. Most records are along the north-western coast, between Exmouth Gulf and Derby in WA, with scattered records along the northern coast, such as in the Top End, the Gulf of Carpentaria and on Cape York Peninsula. The species also often occurs further inland on the 'blacksoil' plains of northern WA, the NT and north-western Queensland. Upon arrival in Australia, Oriental Plovers spend a few weeks in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland into flat, open, semi-arid or arid grasslands. At the onset of the Wet Season, some may move into lightly wooded grasslands. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**

Taxon name and conservation status	Habitat suitability	Likelihood to occur
Chlidonias leucopterus - White-winged Black Tern	This species is widespread and common along south-western, northern and central-eastern coasts, with scattered records along the coasts elsewhere in southern Australia. In WA, the species is widespread on the southern west coast, and also on coasts of the Pilbara region and Kimberley Division, with occasional records farther inland. The species only rarely occurs in the Gascoyne Region of the central-western coast. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Glareola maldivarum - Oriental Pratincole	This migratory visitor is widespread in northern areas of Australia, especially along the coasts of the Pilbara region and the Kimberley Division in WA, the Top End of the NT, and parts of the Gulf of Carpentaria. It is also widespread but scattered inland, mostly north of 20° S. It usually inhabits open plains, floodplains or short grassland, often with extensive bare areas. They often occur near terrestrial wetlands, such as billabongs, lakes or creeks, and artificial wetlands such as reservoirs, saltworks and sewage farms. The species also occurs along the coast, inhabiting beaches, mudflats and islands, or around coastal lagoons. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Haliaeetus leucogaster - White-bellied Sea Eagle	Primarily found in coastal habitats and other large areas of open water. The survey areas did not have suitable habitat for this species.	**Unlikely**
Hirundo rustica - Barn Swallow	This species usually occurs patchily along the north coast of the mainland from the Pilbara region, WA, to Fraser Island in Queensland. The species has also been recorded irregularly as far south as Carnarvon in WA. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Limosa lapponica - Bar-tailed Godwit	The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. In WA it is widespread around the coast, from Eyre to Derby, with a few scattered records elsewhere in the Kimberley Division. The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Merops ornatus - Rainbow Bee-eater	Mainly found in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation; usually in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. There are numerous records of this species from Onslow. This species may use the survey area.	**Possible**
Numenius minutus - Little Curlew	Little Curlews generally spend the non-breeding season (September-April) in northern Australia from Port Hedland in WA to the Queensland coast. In WA, the species is recorded from Peron Peninsula, Carnarvon, McNeill Claypan and Port Cloates-Ningaloo in low numbers; and in the northern Pilbara region around Port Hedland, and in south-west, north and east Kimberley it is widespread. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Numenius phaeopus - Whimbrel	The Whimbrel has a primarily coastal distribution, and is common and widespread from Carnarvon to the north-east Kimberley Division in WA. It is occasionally seen on the south coast of WA and has occasionally been recorded in south-west WA and further north to Shark Bay. The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with	**Unlikely**

Taxon name and conservation status	Habitat suitability	Likelihood to occur
	mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. This species does not breed in Australia. No suitable habitat is present in the survey area.	
Pandion haliaetus - Osprey	The breeding range of the Eastern Osprey extends around the northern coast of Australia (including many offshore islands) from Albany in WAto Lake Macquarie in NSW; with a second isolated breeding population on the coast of SA. Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers. They require extensive areas of open fresh, brackish or saline water for foraging, and frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. No suitable habitat is present in the survey area.	**Unlikely**
Pluvialis squatarola - Grey Plover	In Australia, Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Sterna bengalensis - Lesser Crested Tern	This coastal species occurs in sandy and coral coasts and estuaries, breeding on low-lying offshore islands, coral flats, sandbanks and flat sandy beaches. It breeds in a shallow scrape on ridges or bare areas surrounded by vegetation on flat sandy beaches, low-lying sandy islands, coral flats, small coral islets and sandbanks. No suitable habitat is present in the survey area.	**Unlikely**
Sterna caspia - Caspian Tern	Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat. In WA, it is widespread in coastal regions, from the Great Australian Bight to the Dampier Peninsula. Breeding occurs from the Recherche Archipelago to Dirk Hartog Island and Faure Island in Shark Bay, and also in the Pilbara region from around Point Cloates to North Turtle Island. No suitable habitat is present in the survey area.	**Unlikely**
Sterna dougallii - Roseate Tern	In WA, the subspecies is regularly recorded north from Mandurah to around Eighty Mile Beach, in the Pilbara region. The Roseate Tern occurs in coastal and marine areas in subtropical and tropical seas. The species inhabits rocky and sandy beaches, coral reefs, sand cays and offshore islands, usually in association with coral reefs, where foraging may occurs along the seaward margin, within reef lagoons, or over the reef itself. Breeding in WA occurs from Second Rock, near Penguin Island, to Lacepede Island. No suitable habitat is present in the survey area.	**Unlikely**
Sterna hirundo - Common Tern	In WA, the species is rarely recorded south of approximately 30° S, with only scattered records north of there to the Kimberley Division. Common Terns are marine, pelagic and coastal, commonly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**

Taxon name and conservation status	Habitat suitability	Likelihood to occur
Sterna leucoptera - White-winged Black Tern	The White-winged Black Tern is found in the coastal and sub-coastal north, east, and south-east of the Australian, where it mostly inhabits coastal or sub-coastal wetlands including tidal estuaries, lagoons, grassy swamps, and sewage ponds. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Tringa brevipes - Grey-tailed Tattler	Grey-tailed Tattler has a primarily northern coastal distribution and is found in most coastal regions of Australia. In WA, there are a few scattered records for the species along the south coast near the Eyre Bird Observatory, Point Malcolm, Rossiter Bay, Shark Lake Nature Reserve and surrounding swampland. It is found in the south-west between Augusta and Cervantes. The Grey-tailed Tattler is widespread from Houtman Abrolhos and the mainland adjacent to the Kimberley Division. It is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide. It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Tringa glareola - Wood Sandpiper	In WA the species is widespread but scattered in most regions. The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially *Melaleuca* and River Red Gums *Eucalyptus camaldulensis*, and often with fallen timber. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. This species does not breed in Australia. No suitable habitat is present in the survey area.	**Unlikely**
Tringa nebularia - Common Greenshank	Found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats and artificial wetlands (sewage farms and saltworks dams, inundated rice crops and bores), but are generally not found in dry grassland. No suitable habitat is present in the survey area.	**Unlikely**
Schedule 4 Specially Protected Fauna		
Falco peregrinus (Australian) Peregrine Falcon (S4)	Found everywhere from woodlands to open grasslands and coastal cliffs – though less frequently in desert regions. It feeds almost entirely on other birds. It also eats rabbits and other moderate sized mammals, bats and reptiles. This species may occasionally use the habitats in the survey area, but there is no suitable nesting habitat there.	**Possible**
Priority 1		
Lerista planiventralis subsp. *maryani* - Keeled Slider (NW coast Onslow to Barradale), skink	This subspecies is known from a few records and is restricted to Onslow to Barridale. It may be associated with near-coastal sand dunes and may forage in litter and detritus in hummock grassland, open heath, open scrub and tall shrubland. Little is known about the habitat associations of this species. Although the survey area is some distance from the coast, it has a sandy substrate with low relief. This species may occur there.	**Possible**

Taxon name and conservation status	Habitat suitability	Likelihood to occur
Mormopterus loriae cobourgensis - Northern Freetail-bat	Occurs in mangroves in WA. Preys upon flying insects in the open air above and beside the forest canopy. Roosts in small spouts. Suitable habitat does not occur within the survey area.	**Unlikely**
Priority 4		
Ardeotis australis Australian Bustard (P4)	Found on dry plains, grasslands and in open woodland. It could occur in the survey areas.	**Possible**
Burhinus grallarius Bush Stone-curlew (P4)	This species occurs in a huge variety of habitats across Australia, mostly in lightly wooded country with thickets, and often along creek lines. Sometimes including partly cleared forests. The survey area's habitats are unlikely to be suitable for this species.	**Unlikely**
Leggadina lakedownensis - Short-tailed Mouse, Karekanga	This is a nocturnal species found in areas of open tussock and hummock grassland, acacia shrubland, and savanna woodland, on alluvial clay or sandy soils. Suitable habitat for this species occurs in the survey area, it may occur there.	**Likely**
Neochmia ruficauda subsp. *subclarescens* - Star Finch (western)	Inhabits short, dense, moist grasslands or reeds that border freshwater bodies, but it can also be found living in savannah-type sclerophyll woodland. This species has sometimes been recorded in towns and along roadsides. Habitats in the survey area are not particularly suitable, but this species may occasionally use the site, particularly after rainfall.	**Possible**
Phaps histrionica - Flock Bronzewing, Flock Pigeon	This species is highly nomadic and ranges throughout open woodland and grassland across northern Australia. They frequent saltbush, Triodia hummock grasslands, grassy woodlands and roadsides. Habitat in the survey area is not particularly suitable for this species but it may occasionally use the area.	**Possible**
Pseudomys chapmani - Western Pebble-mound Mouse, Ngadji	This species is found in areas of rocky, hummock grassland with little or no soil and an overstorey of *Acacia*. Animals live in small family groups in burrows below mounds of pebbles. A disused mound attributed to this species was recorded by Biota (2010b) near the survey area. Substrates in the survey area are not suitable for this species, but vegetation assemblages are similar to described habitat. This species could forage in the survey area, but the substrate is not suitable for building mounds.	**Possible**

5 Discussion

5.1 Flora of Conservation Significance

No flora of conservation significance were recorded during the survey. No species of Threatened (Declared Rare) Flora pursuant to the Western Australian *Wildlife Conservation Act* 1950, or listed as Threatened pursuant to the Commonwealth *EPBC Act* 1999 were reported from database searches or recorded during the targeted search or the Level 2 vegetation surveys. No Priority Flora taxa were recorded in the survey area.

5.2 Fauna of Conservation Significance

Of the 49 fauna species of conservation significance reported in database searches, 44 are unlikely to occur in the survey area because the habitat is not suitable. Four species may use the survey area, including the Rainbow Bee-eater, Peregrine Falcon, Keeled Slider and Australian Bustard. One species, the Short-tailed Mouse, is likely to occur in the survey area.

5.2.1 Merops ornatus - Rainbow Bee-eater (M)

The Rainbow Bee-eater is listed as Migratory under the Commonwealth *EPBC Act* 1999. It occurs in open woodlands and shrublands, including mallee, and in open forests that are usually dominated by eucalypts, grasslands and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. It also occurs in inland and coastal sand dune systems, in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches. It has also been recorded in towns and suburbs, orchards and vineyards, roadside vegetation, quarries and mines or gravel pits (Department of Environment 2014).

The breeding season extends from August to January. Nesting occurs in an enlarged chamber at the end of long burrow or tunnel that is usually in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces (Department of Environment 2014).

The widespread distribution of the Rainbow Bee-eater, and the variety of habitats that it has been recorded in, indicate that it could potentially occur in the survey area. Furthermore, there are numerous observation records of this species from Onslow. To avoid impacts, disturbance activities should be scheduled to occur outside of the nesting season. If disturbance activities occur within the breeding season, impacts to active nests should be avoided. Where active nests are present and would be impacted, consultation with the relevant state agencies would be required.

5.2.2 Falco peregrinus - (Australian) Peregrine Falcon (S4)

The Peregrine Falcon, or Australian Peregrine Falcon, is a listed as a Specially Protected species under Schedule 4 of the *Wildlife Conservation Act* 1950. This species is found everywhere from woodlands to open grasslands and coastal cliffs, although less frequently in desert regions. It feeds almost entirely on other birds (Birdlife Australia 2014). It also eats rabbits and other moderate sized mammals, bats and reptiles. Peregrine Falcons typically breed on cliffs and rocky ledges, sometimes on buildings, between August and November (Birdlife Australia 2014). This species may occasionally use the habitats in the survey area, but there is no suitable nesting habitat there. However, clearing of the 2.4 ha of native vegetation in the survey area would not significantly affect this species.

5.2.3 Lerista planiventralis subsp. *maryani* - Keeled Slider (P1)

The Keeled Slider is listed as Priority 1 by DPaW. There have been relatively few records of this species. It has been observed between Onslow and Barridale, in association with coastal and inland sand dunes. Little

is known about the habitat associations of this species, but it may forage in litter and detritus in hummock grassland, hopen heath, open scrub and tall shrubland. The survey area is not coastal and does not contain sand dunes, but it does have sandy substrate and some low relief. Because little is known about habitat use in this species, a conclusive determination of the survey area's habitat suitability for this species cannot be made. As such, this species may use the survey area. However, the survey area is small and contiguous with an extensive area of similar habitat. Therefore, impacts from vegetation clearing in the survey area would be unlikely to impact the conservation status of this species.

5.2.4 Ardeotis australis - Australian Bustard (P4)

The Australian Bustard is listed as Priority 4 by DPaW. They are found on dry plains, grasslands and in open woodland. This species may occur in the spinifex grasslands of the survey area. However, clearing of the 2.4 ha of native vegetation in the survey area would not significantly affect this species.

5.2.5 Leggadina lakedownensis - Short-tailed Mouse, Karekanga (P4)

The Short-tailed Mouse is listed as Priority 4 by DPaW. This is a nocturnal species whose population is known to fluctuate, possibly in response to environmental conditions and/or food supply. In the Pilbara, it is generally found on cracking clay or gilgai soils and in grasslands with heavy soils, and may occur on the margins of claypans. Biota (2009) has recorded this species from sandy coastal areas in the vicinity of Onslow. As such, this species may use the survey area. However, the survey area is small and contiguous with an extensive area of similar habitat. Therefore, impacts from vegetation clearing in the survey area would be unlikely to impact the conservation status of this species.

5.2.6 Phaps histrionica – Flock Bronzewing Pigeon (P4)

The Flock Bronzewing Pigeon is listed as a Priority 4 species by DPaW. It was historically wide-ranging across plains of northern half of Australia, and occurring in arid plains of north-eastern WA and much of the Kimberley as well as riverine/coastal plains of Pilbara south to Carnarvon. It is a gregarious nomadic bird, varying in abundance seasonally and locally from scarce to moderately common, but overall an irregular non-breeding visitor to WA. Management issues mostly pertain to degradation of habitat by livestock, fire management and hunting, but the species often occurs in remote areas and is usually influenced by natural climatic influences rather than anthropogenic factors. It occurs in a variety of habitats across Australia, mostly in more arid and northern parts, particularly open treeless or lightly wooded grassland plains on black/cracking soils.

This species was not recorded in the survey area but it was recorded nearby. The survey area is within the range of this species, but does not contain optimal habitats such as cracking soils and riverine or floodplains. The species is considered to have a low likelihood to occur in the survey area.

5.2.7 Pseudomys chapmani - Pilbara Pebble-mound Mouse (P4).

The Pilbara Pebble-mound Mouse is listed as a Priority 4 species by DPaW. It was originally described from a population from West Angelas Mine site, Western Australia. Its distribution has substantially declined since description, and is only known from the Pilbara and Gascoyne regions of Western Australia.

The mouse is sparse and infrequently encountered across its entire range. Management issues include anthropogenic factors such as introduced predators (especially the fox) and introduced herbivores (cattle and sheep), even though the species occurs in remote areas. It is always found on stony plains and slopes in rock desert areas, mainly in *Triodia* dominated grasslands. Current threatening processes include habitat clearing, low natural population densities, feral predators, and introduced herbivores. The survey area does not contain any stony sites which would be likely to support breeding mounds of this species.

6 References

Atlas of Living Australia. (2014) Atlas of Living Australia. URL http://www.ala.org.au/ [accessed 18 August 2014]

Beard, J.S. (1975) *Pilbara, 1:1 000 000 Vegetation Series : Explanatory Notes to Sheet 5 : The Vegetation of the Pilbara Area.* University of Western Australia Press, Nedlands, W.A.

Beard, J.S. (1990) *Plant Life of Western Australia.* Kangaroo Press, Kenthurst, N.S.W.

Biota. (2009) *West Turner Syncline Section 10 Development Two-Phase Fauna Survey*. Prepared for Pilbara Iron Ore Company.

Biota. (2010a) *A Vegetation and Flora Survey of the Wheatstone Study Area, near Onslow*. Prepared for URS Australia Pty Ltd on behalf of Chevron Australia Pty Ltd.

Biota. (2010b) *Wheatstone Project Terrestrial Fauna Survey*. Prepared for URS Australia Pty Ltd on behalf of Chevron Australia Pty Ltd.

Birdlife Australia. (2014) *Peregrine Falcon Factsheet*.

Bureau of Meteorology. (2014) Bureau of Meteorology. URL http://www.bom.gov.au/ [accessed 25 September 2014]

Department of Environment. (2014) *Species Profile and Threats Database*.

Department of Environment and Conservation. (2010) Definitions, categories and criteria for threatened and prioirty ecological communities.

Department of Parks and Wildlife. (2013) Conservation Codes for Western Australian Flora and Fauna.

Department of Parks and Wildlife. (2014) *NatureMap*. online.

Department of the Environment. (2014a) Protected Matters Search Tool: Report by Coordinates. URL http://www.environment.gov.au/webgis-framework/apps/pmst/pmst-coordinate.jsf [accessed 10 October 2014]

Department of the Environment. (2014b) *Coastal Margin Exmouth Gulf to Cape Preston, Onslow, WA, Australia*. Register of the National Estate (Non-statutory archive).

Environmental Protection Authority. (1999) *Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation, with Particular Reference to the Agricultural Area, Position Statement No. 2*. Environmental Protection Authority, Perth, W.A.

Environmental Protection Authority. (2002a) Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3.

Environmental Protection Authority. (2002b) *Principles of Environmental Protection*. Environmental Protection Authority, Perth, W.A.

Environmental Protection Authority. (2004a) Guidance Statement for the Assessment of Environmental Factors - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia. No. 51.

Environmental Protection Authority. (2004b) Guidance for the Assessment of Environmental Factors - Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. No. 56.

Environmental Protection Authority. (2008) Environmental Guidance for Planning and Development. Guidance Statement 33.

Environmental Protection Authority. (2009) Guidance for the Assessment of Environmental Factors. Sampling of Short Range Endemic Fauna for Environmental Impact Assessment in Western Australia. No. 20.

Keighery, B. J. (1994) *Bushland Plant Survey. A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc.), Western Australia.

Kendrick, P. & Mau, R. (2002) Carnarvon 1 (CAR1 - Cape Range subregion). *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002* (eds N. McKenzie & J.E. May), Department of Conservation and Land Management.

Payne, A.L., Mitchell, A.A., Holman, W.F., Western Australia, Department of Agriculture, Western Australia & Pastoral Appraisement Board. (1988) *An Inventory and Condition Survey of Rangelands in the Ashburton River Catchment, Western Australia*. Dept. of Agriculture, South Perth, W.A.

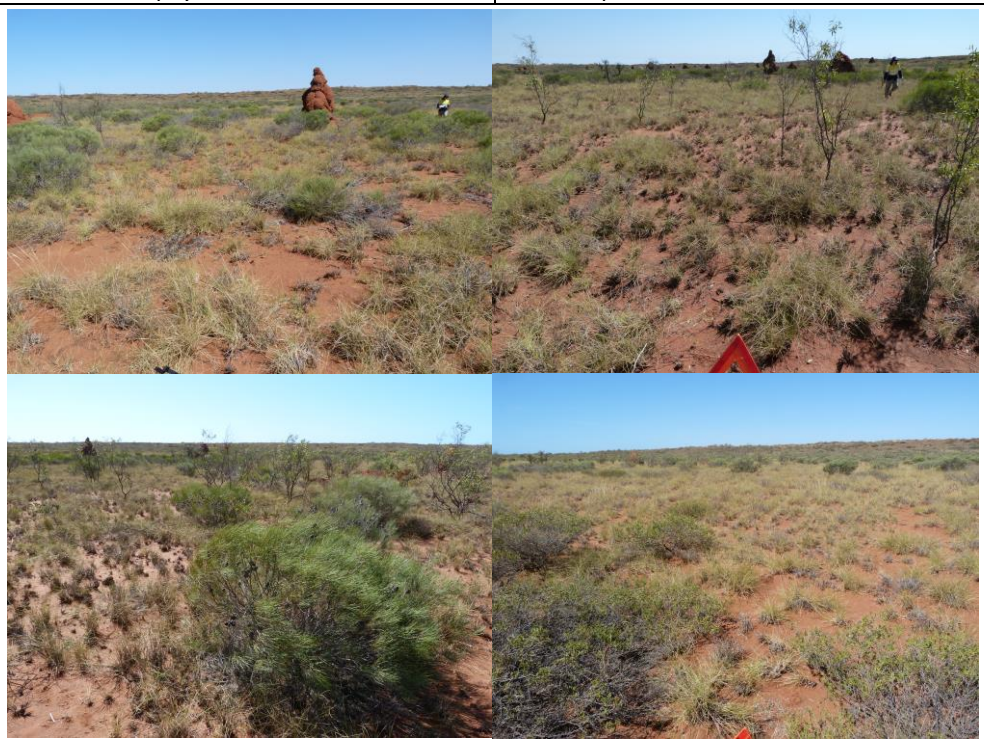
QGIS Application Team. (2014) *QGIS Geographic Information System.* Open Source Geospatial Foundation Project.

Shepherd, D.P. (Damian P., Hopkins, A.J.M. & Beeston, G. (2002) *Native Vegetation in Western Australia : Extent, Type and Status.* Department of Agriculture, South Perth, W.A.

Tille, P.J. (2006) *Soil-Landscapes of Western Australia's Rangelands and Arid Interior*. Resource Science and Land Management Branches of the Department of Agriculture.

Appendices

Appendix 1: Vegetation quadrat data

Quadrat Number 1	Date: 6/10/14	Waypoint: (GDA94 Zone 50): 3029370mE/ 7601280mN
Landform Description	Flat swale between red dunes	
Soil	Red sand	
Vegetation Description	*Santalum lanceolatum* tall sparse shrubland over *Hakea stenophylla* ssp. *?stenophylla, Acacia stellaticeps* low shurbland over *Triodia epactia* hummock grassland	
Vegetation Condition	Very Good – vehicle tracks	
Associated species	*Acacia stellaticeps* *Acacia bivenosa* *Cassytha capillaris* *Hakea chordophylla*	*Hakea stenophylla ssp. ?stenophylla* *Santalum lanceolatum* *Scaevola spinescens* *Triodia epactia*
Photos		

Quadrat Number 2	Date: 6/10/14	Waypoint: (GDA94 Zone 50): 302848 mE/ 7601188 mN
Landform Description	Flat swale between red dunes	
Soil	Red sand	
Vegetation Description	*Acacia stellaticeps* low shurbland over *Triodia epactia* hummock grassland	
Vegetation Condition	Very Good – vehicle tracks	
Associated species	*Acacia bivenosa* *Acacia gregorii* *Acacia stellaticeps* **Cenchrus ciliaris* *Eriachne pulchella*	*Grevillea stenobotrya* *Solanum lasiophyllum* *Stemodia sp. Onslow (A. A. Mitchell 76/148)* *Triodia epactia*
Photos		

All flora species collected

Species	Stratum	Height
Acacia stellaticeps	LS	0.6
**Cenchrus ciliaris*	Grass	0.6
Acacia bivenosa	LS	0.4
Acacia coriacea ssp. *pendens*	TS	2.5
Acacia gregorii	LS	0.6
Acacia stellaticeps	LS	0.8
Adriana tomentosa var. *tomentosa*	SH	1.2
Bulbostylis barbata	Sedge	0.1
Calandrinia polyandra	H	0.2
Cassytha capillaris	Climber	
Corchorus sidoides ssp. *vermicularis*	LS	0.2
Crotalaria cunninghamii	TS	1.4
Cullen martinii	TS	2.5
Enchylaena tomentosa var. *tomentosa*	LS	0.5
Eriachne pulchella	Grass	0.6
Euphorbia trigonosperma	H	0.2
Goodenia armitiana	H	0.1
Grevillea stenobotrya	TS	2
Gyrostemon ramulosus	MS	1.1
Hakea chordophylla	TS	2.2
Hakea stenophylla ssp. *?stenophylla*	LS	0.6
Hibiscus brachychlaenus	MS	1.6
Indigofera boviperda	LS	0.2
Indigofera monophylla	LS	0.2
Myoporum montana	MS	1
Nicotiana occidentalis ssp. *?occidentalis*	H	0.2
Paraneurachne muelleri	Grass	0.4
Pimelea ammocharis	LS	0.5
Pterocaulon sphaeranthoides	H	0.2
Ptilotus axillaris	H	0.1
Ptilotus polystachyus	H	0.6
Quoya loxocarpa	LS	0.4
Rhagodia eremaea	LS	0.5
Salsola australis	LS	0.4
Santalum lanceolatum	Tree	2
Scaevola pulchella	LS	0.4
Scaevola sericophylla	LS	0.3
Scaevola spinescens	LS	0.3
Sida rohlenae ssp. *rohlenae*	Sedge	0.4
Solanum lasiophyllum	LS	0.6
Sorghum plumosum	Grass	0.5
Stemodia sp. Onslow (A. A. Mitchell 76/148)	H	0.2
Threlkeldia diffusa	LS	0.4

Trianthema turgidifolia	LS	0.1
Trichodesma zeylanicum var. *grandiflorum*	H	1
Triodia epactia	Grass	0.4
Whiteochloa airoides	Sedge	0.3

Appendix F: Asbestos Management Plan

talis
delivering solutions

Asset Management | Environmental Services | Spatial Intelligence | Waste Management

Asbestos Management Plan

Onslow Waste Transfer Station

Prepared for Shire of Ashburton
November 2014
Project Number TW14026

Talis Consultants Pty Ltd
8/663 Newcastle St
Leederville WA 6007
Ph: 1300 251 070
www.talisconsultants.com.au

ABN: 85 967 691 321

DOCUMENT CONTROL

Version	File Ref	Author	Reviewer
0a	TW14026 – Onslow WTS – Asbestos Management Plan	Kieran Garvey	Ronan Cullen

Table of contents

Tables

1 Introduction

1.1 Onslow Waste Transfer Station

The Shire of Ashburton (the Shire) currently operates Onslow Landfill. Onslow Landfill is scheduled to cease operations in March 2015. Delivery of the new landfill will take approximately 3-4 years, well after the current landfill has ceased operations. Therefore, the Shire has proposed the development of a Waste Transfer Station (WTS) at Lot 500 Onslow Road (the Site) to continue to provide waste disposal service to the Shire.

In the short term, the WTS will accept and consolidate the majority of waste materials generated within Onslow townsite. Putrescible waste (food etc.) will be consolidated ready for transportation off-site to licensed facilities within the region. In addition, a stockpile area will be established for clean streams of inert materials (concrete, sand, etc.) scrap metal and greenwaste for future recycling.

Under the *Environmental Protection Regulations 1987*, the proposed activities at the Site are classified as Prescribed Premises Category 62 – Solid Waste Depot. An Environmental Assessment and Management Plan (EAMP) has been prepared to support all the relevant environmental and planning approvals required for the establishment of a WTS at the Site.

As part of the process of approval, the Department of Environment Regulation (DER) has requested an Asbestos Management Plan (AMP) be prepared for the operations at the Site.

1.2 Inert Materials Storage

As mentioned above the WTS will store or stockpile a range of products onsite, including those derived from construction and demolition (C&D) waste which predominantly consists of inert materials such as bricks, concrete, paving slabs, tiles, sand and gravel. These materials will be stored onsite for future processing offsite at licenced facilities to generate a range of recycled building products including sand, road bases and aggregates. Asbestos is a hazardous material which was utilised extensively in the construction of buildings and structures until 1990. There is therefore a risk that asbestos, asbestos containing material (ACM), fibrous asbestos (FA) or asbestos fines/fibres (AF) may be received at the WTS presenting health risks to staff and the wider community.

1.3 Scope of Asbestos Management Plan

Aligning with the EAMP, this AMP will provide a systematic approach to be adopted by the Shire to further minimise the unlikely risk of asbestos being brought to site and to provide management in the event that asbestos is identified onsite.

The AMP has been developed to minimise the potential for:

- Asbestos or ACM to be received and processed at the Site; and
- Asbestos emissions to be generated within and from the Site.

In addition, this AMP will assist the Shire in achieving the objectives contained within their EAMP.

2 Site Description and Proposed Operations

2.1 Site Description

The EAMP provides an outline of the key characteristics on and surrounding the Site that are relevant to the proposed WTS operations. It also provides a detailed description of the proposed activities and environmental management measures.

2.2 Proposed Inert Materials Storage Operations

As outlined previously, this AMP covers the proposed storage of inert materials at the Subject Site. All vehicles that enter the Site will be inspected by the gatehouse attendant to ensure they are carrying conforming waste material.

All vehicles carrying conforming loads of waste material will be directed towards the designated area for that material. Vehicles that contain material which can be stockpiled such as inert C&D waste, tyres and greenwaste will be directed to areas designated for those materials at the rear of the Site. Customers will unload their vehicles at the designated areas. Site staff will use the front end loader to regularise the material stockpiles periodically as required. Indicative material stockpile locations and capacities are shown in **Drawing 4** of the Environmental Assessment and Management Plan (EAMP). Stockpile areas have been sized to cater for storage of inert material until the new Onslow Waste Management Facility (WMF) is operational, after which inert materials will be transported to the new WMF. Once commissioned, the WMF will be licenced for crushing and processing and all such activities will be undertaken at that site in accordance with its licence conditions.

3 Site Procedures

This section describes the procedures that will be undertaken at the Site in relation to the management of asbestos and ACM. A full description of the Subject Site's operational procedures is contained within the EAMP.

3.1 Pre-Acceptance

To minimise the potential for asbestos or ACM to be brought to the Site, the Shire will ensure that the requirement for no asbestos to be contained in incoming loads is clearly communicated to customers through:

- Information provided on the Shire's website and gate fees;
- Responses to telephone and email enquiries; and
- Signage at the entrance to the Subject Site.

As well as accepting material from local domestic and commercial premises, the Shire may form agreements with regular commercial contractors for the receipt of source separated inert materials at the Site. If these agreements are established, the Shire will generate a written agreement with these contractors specifying:

- Criteria for loads such as acceptable and unacceptable materials;
- Rates;
- Payment and administration procedures; and
- Compliance with the WTS site rules.

The Shire anticipates that these agreements will ensure that the quality of the materials received at the Site will be high, as well as improving understanding and compliance with its EAMP.

3.2 Materials Acceptance

All loads brought to the Site will be subject to inspection. Contractors will be required to sign a customer warranty form for each vehicle to confirm that the load does not contain asbestos. If any loads are identified to contain asbestos or ACM, or if the contractor declines to sign the warranty form, entry to the Site will be refused. In circumstances where asbestos or ACM is identified within the loads, contractors will be charged a monetary penalty and directed to an appropriate disposal facility.

The Shire will maintain records of all refused loads, as well as those found to contain asbestos or ACM at any stage during inspection or processing. These records will include:

- Source of materials;
- Materials carrier;
- Vehicle registration number; and
- Date of rejection.

3.3 Materials Handling

All loads will be visually inspected for asbestos and ACM while being unloaded prior to stockpiling. If suspect ACM is identified, the load will be reclassified as high risk and treated according to the procedure described below. If suspect FA or AF is identified, the load will be isolated, kept wet using the Shire's water bowser, and contained and transported according to the *Environmental Protection (Controlled Waste) Regulations 2004* to an appropriate disposal facility.

For loads in which no suspect material is identified, the material will be stockpiled in accordance with normal operating procedures.

3.3.1 High Risk Loads

Loads classified as high risk will be unloaded and spread to allow a visual inspection to be conducted.

For loads in which suspect ACM is identified, and the suspect material is able to be removed by hand it will be assumed to be ACM, isolated, triple-bagged and sealed and then transported to an appropriate disposal facility by the customer. The remainder of the load will be stockpiled onsite as normal.

If suspect ACM is identified but is not able to be easily removed by hand, the entire load will be assumed to be contaminated, isolated and taken to an appropriate disposal facility.

As for the low risk loads, if suspect FA or AF is identified, the load will be isolated, kept wet using the Shire's water bowser, and contained and transported according to the *Environmental Protection (Controlled Waste) Regulations 2004* to an appropriate disposal facility. If no suspect material is identified, the material will be transferred to a stockpile for normal storage.

In all instances, the Shire will investigate the likely cause of the contamination and implement measures to prevent reoccurrence. Details of this process will be retained as part of the Shire's commitment to record keeping.

3.4 Dust Management

The Shire recognises that managing dust emissions at the Site will assist in reducing the potential for asbestos fibres to be released. As part of the implementation of the EAMP, and to satisfy the requirements of the Asbestos Guidelines, the Shire has prepared Dust Management procedures for the Site, which are outlined in the EAMP. The Dust Management procedures include identification of potential sources of dust emissions as well as the engineering and management measures that will be implemented at the Site to ensure that dust emissions are managed appropriately.

4 Responsibilities and Training

It is the responsibility of all Shire personnel to ensure that this AMP is implemented and asbestos is managed appropriately at the Site. This section outlines the specific responsibilities of Shire personnel and the training that will be provided to ensure that these responsibilities are carried out.

4.1 Responsibilities

The responsibilities of each Shire staff member in relation to asbestos management are shown in **Table 1**.

Table 1: Personnel Roles and Responsibilities

Position	Responsibilities
Site Manager	• Ensuring implementation of the EAMP and associated management plans; • Inspection of incoming loads; • Refusing loads and imposing penalties as required; • Record keeping; • Undertaking waste inspection; • Managing stockpiles; • Isolating and storing asbestos; • Ensuring safe transportation of asbestos offsite;
Shire Waste Co-ordinator	• Managing record keeping; • Ensuring compliance with legislative requirements; • Ensuring implementation of the EAMP and associated management plans; • Occupational Health and Safety.

In addition to the Shire staff, external personnel have responsibilities as part of the implementation of the AMP including:

Contractors:

- Ensure no asbestos or ACM is delivered to the Site;
- Sign the customer warranty form; and
- Comply with the WTS site rules.

The Shire will communicate these responsibilities to the relevant personnel and, where possible, incorporate these into agreements with these parties. In the event that external personnel are not able to fulfil these responsibilities, the Shire may terminate their involvement in operations at the Site.

4.2 Training

To ensure that all personnel have the required knowledge and understanding to fulfil their responsibilities in relation to asbestos management, the Shire will conduct staff training.

As part of the initial implementation of this AMP, and as part of the staff induction process in the future, the Shire will provide training to all personnel on the following aspects of asbestos management at the Subject Site:

- Risk associated with asbestos including;
  - Health hazards;
  - Environmental risks;
  - Risks to the business in relation to compliance;
- Use of personal protective equipment;
- Identification of asbestos;
- Overview of site operating procedures; and
- Relevant legislation, guidelines and site specific documentation including this AMP, EAMP and Licence.

In addition, staff will receive detailed training on the site operating procedures relevant to their particular roles and responsibilities such as:

- Material Acceptance:
  - Visual inspection;
  - Rejection of loads;
- Material Inspection:
  - Unloading low and high risk loads;
  - Inspection of low and high risk loads;
  - Separating potential asbestos or ACM;
  - Storage of potential asbestos or ACM;
  - Transportation and disposal of potential asbestos or ACM;
- Waste Handling:
  - Visual inspection;
  - Stockpile management; and
- Record keeping.

To ensure that the required level knowledge and understanding is maintained, Shire personnel will receive refresher training every two years.