PROPOSED STRUCTURE PLAN

VOLUME 1: Report

Lots 110, 115, 500 & 116 White Cliffs Road

HORROCKS BEACH

SHIRE OF NORTHAMPTON

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Town Planners, Advocates
& Subdivision Designers

PREPARED FOR:
Horrocks Syndicate

PREPARED BY:

Allerding & Associates

AUGUST 2010

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1.0 INTRODUCTION

A comprehensive structure plan report was prepared and submitted to the Shire of Northampton in May 2007 primarily comprising land zoned 'Development' under the Shire of Northampton TPS8. Most of this area had been previously zoned by the Shire and endorsed by the Hon Minister for Planning for the specific purpose of the Horrocks Townsite expansion.

The May 2007 plan provided for a mixture of lots from residential (small lot) subdivision, special residential (2000m^2 to 1 hectare) to rural residential (1-4 hectares and rural living size lots (4 - 40 hectares). The May 2007 plan is included as Annexure 2.

The purpose of the Structure Plan was to guide the future expansion (subdivision and development) of land surrounding the Horrocks townsite, taking into account the environmental attributes of the land, the prevailing strategic planning framework and the existing town layout. Such a Structure Plan is a statutory requirement as a precursor to the subdivision of the subject land under the Shire of Northampton's TPS8.

The May 2007 plan was supported by the Shire of Northampton for the purpose of advertising and forwarded to the Western Australian Planning Commission (WAPC) for consent to advertise. Upon consideration by the WAPC, it was subsequently resolved to proceed to advertise only part of the structure plan as it related to the residential component along White Cliffs Road, as well as rural living lots to the north of the structure plan area. The balance of the 'Development' area and those immediately adjoining has been earmarked for further structure planning consideration at a later time.

An amended structure plan (November 2007) was advertised and endorsed by the Shire of Northampton in April 2008 and that plan, together with the Structure Plan report dated June 2008, was forwarded to the WAPC for endorsement in July 2008. A copy of that version of the Structure Plan is included as Annexure 2

The WAPC advised, via a letter dated December 2008 that whilst the WAPC supports *"the concept of developing the structure plan area for the intended uses and its view that it would be premature to endorse the proposed structure plan in the absence of crucial water management information."*

The November 2007 plan & accompanying report dated June 2008 has since been updated to address those concerns raised in the WAPC's correspondence and also address matters raised by the Department of Environment and Conservation.

The updated plan is referred to as the August 2010 plan and this is included as Annexure 1. It is this plan that approval is sought for from the Shire of Northampton and the Western Australian Planning Commission

This report provides an overall context to this structure plan as amended and justification for the endorsement by the Shire of Northampton and the WAPC.

The Structure Plan is compiled into 2 volumes being:

- Volume 1 contains the report and Annexure 1 (being the Structure Plan).
- Volume 2 contains only the Annexures (Annexure 1, being the structure plan, is again reprinted and contained in Volume 2).

2.0 STRUCTURE PLAN AREA

2.1 Location

Horrocks is located in the Shire of Northampton, approximately 25 kilometres west of the Northampton townsite. The City of Geraldton is located approximately 70 kilometres to the south.

The land the subject of this Structure Plan is located to the immediate east of the Horrocks townsite. It is generally bounded to the south by Horrocks Road and the northern boundaries of Lots 112 and 114. The eastern boundary of the Structure Plan area is to Lot 27. Broad acre farming properties abut the subject land to the east.

A plan is included as Figure 1 depicting the location of the subject land.


Nanga Bay
Carbla
Overlander Roadhouse
Hamelin
Tamala
Coburn
Meadow
Wannoo Billa Roadhouse
ZUYTDORP N.R.
TOOLONGA N.R.
Nerren Nerren
175
HIGHWAY
Eurardy
KALBARRI
Kalbarri
Rainbow Jungle
Bluff Pt
N.P.
Mary Springs
Lake Nerramyne
Coolcalalya
201
Woolgorong
Pinegrove
Mt View
Binnu
Hutt River Province
Yuin
WANDANA N.R.
Gregory
SUBJECT LAND
Horrocks
Yuna
Northampton
Gabyon
Tallering
Wallabi Group
100
Nabawa
Mullewa
Pindar
Houtman Abrolhos
Easter Group
Geraldton
99
Pelsaert Group
65
115
Mingenew
Dongara
Leander Point
218
SUBJECT LAND
Allerding Associates
DRAWING NUMBER: SHE HOR SP
DATE: 10.04.2007
310A Newcastle Street, Perth W.A. 6000
PH: (08) 9328 5555 FAX: (08) 9328 5559
www.planningwa.com
NORTH
LOCATION PLAN
HORROCKS
SHIRE OF NORTHAMPTON

Figure 1

3.0 SITE ANALYSIS

3.1 Landform, Topography and Land Capability

Maunsell consultants prepared an Environmental Report over the subject land dated August 2004. The Maunsell report was included in the Structure Plan report dated June 2008. However this report has been superseded by the Flora and Fauna Survey dated March 2010, undertaken by GHD. The Maunsell report has been included in the report as Annexure 13 for reference purposes where applicable, but has been practically superseded by the recommendations under the GHD Flora and Fauna survey report of March 2010 which has been included as Annexure 4 to this report.

The Maunsell report reveals that, from west to east, the Horrocks area is comprised of calcareous sands of marine origin at the coastline, which are characterised by formed dunes and beach deposits, some of which have been stabilised by vegetation and other means.

Further to the east, tamala limestone of Pleistocene origin is exposed as near-shore platforms and forms a plateau inland from the above-mentioned dunes.

Laterite with overlying quartz sands and underlying weathered rock lie further inland. Such soil type is described as the Northampton Block, which contains rounded undulating hills of Precambrian rocks and flat topped mesas of Jurassic and Triassic sediments.

To the south of the Structure Plan area lay recent alluvial and colluvial soils along with Palaeozoic sandstone, each associated with the Bowes River.

With respect to topography, the Structure Plan area is in an elevated position due to the limestone plateau upon which it sits. As noted in the Maunsell report the plateau is characterised by deposited calcareous sands and sandy top soil. These elements combine to form a ridge located to the east of the scarp.

The above-mentioned ridge runs in a north-westerly direction across the Structure Plan area and contains several peaks at a level of RL 105 metres. At the northern extent of the ridge, it rises to a maximum RL of roughly 115 metres.

3.2 Conservation and Environment

Bushland

Typical vegetation types associated with the wider locality include Acacia/Banksia scrub, scrub heath coastal association and Eucalyptus Sclerophyll Woodland.

With specific regard to the Structure Plan area, much of the land is cleared as is visible from the aerial photography included at Figure 2. However, the Sensitive Coastal Area identified by the environmental constraints mapping within the Maunsell Environmental Report is noted. This area contains a range of vegetation that would need to be retained.

Further, the environmental constraints mapping shows the possible location of two instances of declared rare flora, being, Caladenia bryceana. The population of *Caladenia bryceana* has been previously recorded. However discussions with CALM have indicated that surveys in 2002-04 have been unable to identify the population.

The western-most instance of this vegetation is located, generally, within the existing townsite and is not affected by this structure plan. The eastern most case is to be located in Special Residential allotments where there would be capacity to retain the vegetation within designated areas, afforded formal protection by a future development guide plan.

In response to these findings, a Spring Survey was undertaken in 2006, by Dingle & Bird Environmental, however, again no *Caladenia bryceana* populations were found although it was noted in the Survey that with the low rainfall in the area that if *Caladenia bryceana* were present on the subject land they may have remained dormant during the time of the Survey.

The 2006 Spring Survey did not find any of the *Caladenia bryceana* population within the structure plan area. The owners have advised that they acknowledge that there is a potential population of *Caladenia bryceana* on site.

In August 2009 GHD Pty Ltd (GHD) completed a Vegetation, Flora and Fauna Survey and the findings of that survey are incorporated into the Flora and Fauna report dated March 2010. A copy of this report is provided in Annexure 4. This later survey did confirm the presence of the *Caladenia bryceana* on site.

The Vegetation, Flora and Fauna Survey was then reviewed by the Department of Environment and Conservation (DEC) and the DEC identified a number of issues not adequately addressed in the structure plan. The DEC, in correspondence dated 2 February 2010 (copy included in Annexure 6) recommended that the structure plan address certain issues prior to adoption. The structure plan report and the structure plan design has been revised to address the issues identified by DEC.

The Vegetation, Flora and Fauna Survey report was prepared in March 2010 and subsequently, a meeting was held with all stakeholders to discuss the findings of the report. At the meeting it was agreed by all stakeholders that a site inspections would be conducted in order to ascertain the location and the extent of areas that would be required to be set aside for the retention of native vegetation and that this information would be contained within a subsequent report being the Flora Management Plan.

Accordingly, in response to the DEC letter and the findings of the Flora and Fauna Survey a flora management plan has been prepared. A copy of the Flora Management Plan is included as Annexure 6

In compiling the Vegetation and Flora Management Plan and based upon the findings as a result of the stakeholder site inspection, a map was prepared identifying Proposed Areas for Retention of Native Vegetation (Annexure 6, Appendix A). The location and configuration of public open space has been revised in the August 2010 structure plan in order to protect those areas considered worthy of protection by the DEC.

The Vegetation and Flora Management Plan and the revised Structure Plan design has addressed those matters raised in the Flora and Fauna Survey and the DEC letter.

All subdivision and development is to meet the requirements of the Vegetation and Flora Management Plan.

Fauna

Maunsell also undertook a study of CALM's Threatened Fauna database. Such search revealed the presence of a number of fauna species in need of special protection, species that are rare or likely to become extinct, or priority taxa, being:

- Carnaby's Black Cockatoo;
- Peregrine Falcon;
- Tammar Wallaby;
- Bush Stone Curlew; and
- Hooded Plover.

It is considered that the protection of these animals would be maintained through the preservation of priority vegetation areas and wildlife corridors. To this end, the proposed structure plan will retain open space to the north of the townsite and make provision for a significant number of large rural smallholding lots which would accommodate remnant vegetation and facilitate the free movement of animals.

The Flora and Fauna Survey undertaken by GHD also addresses the matter of fauna.

In addition, a Fauna Management Plan has been prepared and is included in Annexure 7. The revised subdivision design provides that the major and minor linkages within the Structure Plan area can be preserved.

All subdivision and development is to be consistent with the Fauna Management Plan.

Wetlands and Damplands

No wetlands or damplands have been identified in the structure plan area.

Streams and Water Courses

Bowes River is located to the south of the Structure Plan area. There is no immediate interface requiring detailed consideration for the purpose of this Structure Plan.

Foreshore Reserves

The designated coastal foreshore is illustrated in the Zoning Plan at Annexure 6. Appropriate interfacing with this area has been incorporated into the Structure Plan in relation to the coastal environment as outlined later in this report.

Heritage

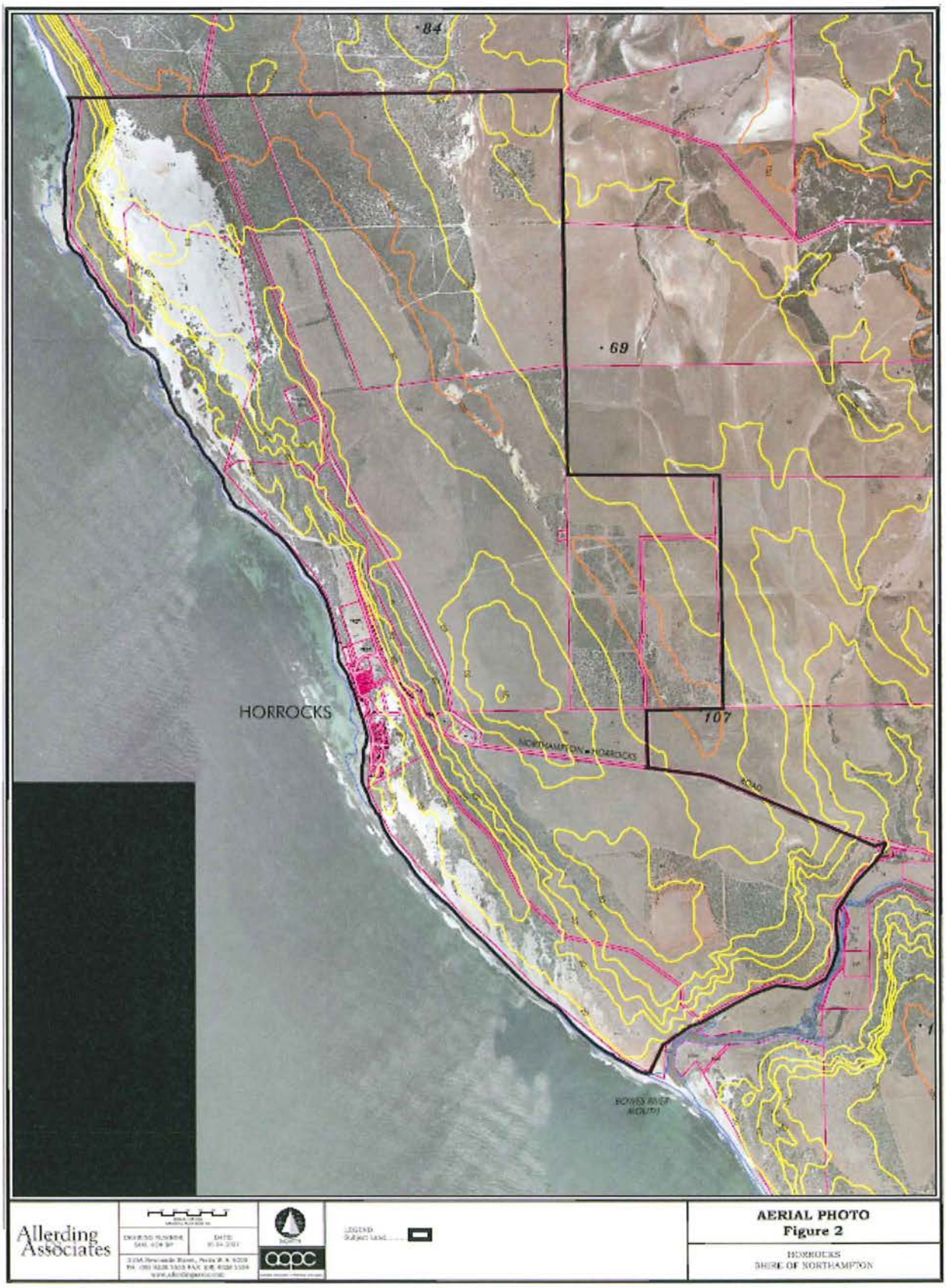
The Environmental Constraints Plan identifies two aboriginal sites in the vicinity of Whaleboat Cove and a further 5 sites located in the general area surrounding Bowes River.

It is noted that the majority of the sites are located in the sensitive costal area and/or an odour buffer associated with the sewer treatment plant. Thus, the land within which these sites are contained would be unavailable for urban development in any case and have been excluded from the Structure Plan.

Bushfire Protection

The Commission's Development Control Policy 3.7 'Fire Planning' and the Fire and Emergency Services Authority of Western Australia (FESA) Planning for Bushfire Protection document outline measures to ensure adequate fire protection for new subdivisions and related developments. Proper strategic land use planning, good subdivisional layout, and development criteria will ensure the least possible exposure to damage by fire and the best possible response should fire occur.

The landowner will prepare a Bushfire Management Strategy prior to any subdivision being undertaken within the Structure Plan area.


84
69
107
HORROCKS
NORTHAMPTON - HORROCKS
ROAD
BOWES RIDGE
MOUNT
Allerding Associates
LEGEND
AERIAL PHOTO
Figure 2
HORROCKS
SHIRE OF NORTHAMPTON

4.0 CONTEXT ANALYSIS

4.1 Statutory Planning Framework

Shire of Northampton Town Planning Scheme No. 8

The subject land is zoned Rural under Council's Town Planning Scheme No. 8 (TPS8) and is within the Special Control Area being "DA1 - *Development Area.*" It abuts a range of other zones and reserves including a Parks and Recreation reserve, Rural zone, Foreshore Conservation and Dune Protection reservation, Residential zone and Town Centre zone. The Structure Plan design (as outlined below) has been careful to interface appropriately with these zones. A zoning plan is provided at Annexure 8.

Under Clause 6.7.4.1 of TPS8, Council is prohibited from approving significant development or recommending approval to a significant subdivision application in the Development zone until such time as a Structure Plan is in place for the subject portion of the zone.

Clause 6.7.3.2 of the Scheme guides future subdivision to the Structure Plan approved for the land.

While the final decision on subdivision ultimately rests with the WAPC it is considered unlikely that the Commission would be prepared to approve a subdivision application over the land prior to (or inconsistent with) an approved Structure Plan contrary to the provisions of the Scheme and the strategic planning for the area as outlined below.

Clause 6.7.6.1 of TPS8 identifies the range of issues that a Structure Plan should address and it is considered that this report and the accompanying Structure Plan, address each of those matters.

Conservation Reserve

Conservation areas have been created to the northwest of the Horrocks townsite and along the coastal foreshore reserve. These areas are proposed to be preserved in the Structure Plan.

4.2 Strategic Planning Framework

Western Australian Planning Commission Statement of Planning Policy No. 1 – State Planning Framework Policy (Variation No. 2)

This Statement of Planning Policy brings together existing State and regional policies and plans which apply to land use and development in Western Australia into a State Planning Framework. It also restates and expands upon the key principles of the State Planning Strategy in planning for sustainable land use and development.

The Policy sets out the key principles relating to environment, community, economy, infrastructure and regional development which should guide the way in which future planning decisions are made. It also provides a range of strategies and actions which support these principles generally and for each of the ten regions of the State. The proposed Structure Plan meets the key principles of the State Planning Framework with respect to the following:

Environment

- The Structure Plan promotes the conservation of ecological systems and the biodiversity they support including ecosystems, habitats, species and genetic diversity by identifying priority vegetation areas and associated fauna.

Community

- Future population growth of the area is accommodated within the design including housing choice and diversity to suit the needs of different households and the services they require.

- A local commercial centre is proposed and has been centrally located such that they would be readily accessible to nearby residential, rural living and tourist locations.

Economy

- The proposal has identified sites for tourism accommodation and facilities taking into account of their special location and servicing needs. The locality is dependant upon tourism and proximity to commercial and non-commercial fisheries, therefore reliance on these industries is likely to continue for the foreseeable future.

Infrastructure

- The structure planning process will ensure providers of infrastructure will have regard to planning policies and strategic land use planning when making their investment decisions. This will ensure that land use and development are closely integrated with the provision of required infrastructure services.

Regional Development

- This policy states that planning should assist communities of the outlying regions in achieving the opportunities comparable with towns of the southwest despite their isolation, size and climatic disadvantages.

- The proposed Structure Plan assists in the better co-ordination of land uses, high standards of development and the availability of land, physical and social services to make regional communities sustainable in the long term.

Western Australian Planning Commission Statement of Planning Policy No. 2 – Environmental and Natural Resources Policy

The key to sustainability in the planning sector is integrating ecological, economic and social considerations into decision-making.

In order to meet the objectives of sustainability, there is a clear need to protect land, air and water, vital resources that support a diverse range of flora, fauna and ecosystems, from unacceptable levels of loss or degradation. The proposed Structure Plan identifies these environmental and natural resources and identifies how the planning of the locality addresses the protection of these resources.

Western Australian Planning Commission Statement of Planning Policy No. 2.6 – State Coastal Planning Policy

SPP No. 2.6 represents the highest order of coastal planning policy in Western Australia (refer to Policy DC 6.1 – Coastal Planning Policy as outlined below).

It is considered that the proposed Structure Plan is broadly consistent with the measures outlined in the Policy with particular regard to:

- The achievement of appropriate setbacks as outlined above;
- The Structure Plan is well-setback from foreshore areas.
- The maintenance of public access to and enjoyment of the coastline;
- The plan reinforces the public ownership of a coastal foreshore reserve;
- The Plan affords the protection of natural, indigenous, visual and cultural features of the coast;
- The discharge of waste into coastal areas is avoided by the plan;
- The continued use of the coast for recreation, conservation, tourism and fishing is maintained; and,
- Urban development shall be concentrated in and around an existing settlement with established infrastructure and services (though it is recognised that such infrastructure and services would need to be upgraded as part of the future subdivision and development of the land).

We note the 2006 amendment made to the Policy, which limits building height within 300 metres of the HSD to (generally) a maximum of 5 storeys and not exceeding 21 metres in height. The structure plan proposes development that is consistent with this height limitation as the structure plan provides for lower-density residential and rural living development.

Western Australian Planning Commission Statement of Planning Policy No. 2.9 – Water Resources

The Commission's SPP No. 2.9 states that planning should contribute to the protection and wise management of water resources by ensuring local and regional planning strategies, structure plans, schemes, subdivisions, strata subdivision and development applications adopt the policy measures outlined in the document. These policy measures are addressed in the Local Water Management Strategy prepared as part of this Structure Plan.

Western Australian Planning Commission Statement of Planning Policy No. 3 – Urban Growth and Settlement

The Structure Plan meets the following objectives of SPP No. 3 in relation to new urban growth and settlement:

- *'To promote a sustainable and well planned pattern of settlement across the State, with sufficient and suitable land to provide for a wide variety of housing, employment, recreation facilities and open space.*

- *To build on existing communities with established local and regional economies, concentrate investment in the improvement of services and infrastructure and enhance the quality of life in those communities.*

- *To coordinate new development with the efficient, economic and timely provision of infrastructure and services.'*

The proposal intends to capitalise on the opportunity for growth around the existing townsite by providing new areas of urban development including residential lots and rural small holdings. Economic growth will be focused on employment opportunities by the identification of appropriate 'day-use,' eco-tourism and overnight accommodation sites.

Policy No. DC 6.1 – Country Coastal Planning Policy

The above policy identifies 3 objectives to guide coastal subdivision and development, being:

- *'To encourage orderly and balanced development on and adjacent to the coast consistent with the protection of coastal resources.*

- *To protect, conserve and enhance, as appropriate, coastal resources.*

- *To permit public access to the coast consistent with the protection of coastal resources.'*

In order to achieve these objectives, the policy identifies a range of development principles and ecological guidelines, which this Structure Plan is considered to satisfy by reason that it:

- Avoids the linear expansion of towns along the coast and, rather, concentrates expansion in an existing centre and designated local centres;

- A foreshore reserve separates development from the coast and public access to the coast is maintained by the plan;

- The visual amenity of the foreshore is maintained – the Structure Plan takes into account view-scapes associated with landmarks, the topography of the land, view points, scenic routes and pathways;

- Resultant development would not cast shadows on the beach and nor would it increase wind velocities. Reference is made to height limitations as outlined above. At the same time, the Structure Plan exceeds the setback requirements of the Commission's Policy;

- Resultant development would be fully serviced in accordance with the normal requirements of the relevant agencies;

- The future development of the land would not result in discharge into the water circulation pattern and nor would natural drainage patterns, near-shore sediment transport patterns or water quality be impacted upon;

- Through the designations and provisions of the Structure Plan, permanent structures would be located on stable landforms and have been subject to appropriate geotechnical investigations where required;

- The Structure Plan is located largely on un-vegetated portions of land thus minimising the degree of clearing required;

- The Structure Plan formalises recreational access points thus limiting the potential for off-road vehicles to degrade dune systems;

- The subject area is generally away from the foreshore area, behind the existing townsite and, thus, a foreshore management plan is not required in this instance; and

- The Structure Plan responds to the landscape, cultural and environmental attributes of the land.

Greater detail is provided in relation to the above-factors through closer discussion of the specific design elements of the plan as outlined later in this report.

Batavia Coast Strategy December 2001

The report does not identify a projected population for individual urban centres. However, it does recognise that Horrocks has potential for expansion into surrounding private and publicly-held holdings adjacent to the existing townsite.

Detailed comment on servicing is provided later in this report, however, generally, it is considered that this Structure Plan would have the impact of satisfying strategic planning requirements in terms of identifying 'preferred expansion areas and development considerations'.

Horrocks is recognised as a potential future local centre, located centrally between an overnight accommodation site at Little Bay to the north and a major day-use recreation site at Bowes River to the south. This entire stretch of coast is termed as *Day Use Precinct 3 – Horrocks*, which is to be managed by the Shire of Northampton according to the Strategy.

The function of a local centre is to *'provide localised services to surrounding areas and low-key tourism and recreation/holiday facilities.'* In addition, Horrocks is recognised as an important maritime centre offering both commercial and recreational shelter, moorings, a jetty and other facilities between more major centres.

The Strategy identifies a range of criteria that both urban expansion proposals (including for Horrocks) and proposals incorporating a rural-living element, should satisfy. It is considered that these criteria are generally reflected in the range of matters to be addressed in structure plans as identified by Clause 6.7.6.1 of Council's Town Planning Scheme No. 8. Thus, it is considered that the range of information contained within this report (prepared on the basis of Clause 6.7.6.1) effectively addresses each of the criteria contained within the Strategy.

In terms of the more site-specific *Local Strategy* within the wider document, Horrocks is contained within *Sector H* of the *Horrocks-Port Gregory Precinct.* The Local Strategy confirms the range of ownership types within the town and its surrounds, from local government and freehold to unallocated crown land. The Local Strategy also identifies a number of recommendations for future management including public agency management in places, site-specific transferral to public agencies and cooperative management arrangements between the public and private sectors.

Geraldton Region Plan

The Geraldton Region Plan predicts an intensification of development pressure for Horrocks, stemming from its reputation as a coastal/tourist destination. Such expansion would be, however, limited until such time as servicing (sewer, roads and other services) and strategic constraints have been dealt with.

Shire of Northampton Draft Local Planning Strategy – September 2007

The document contains a settlement strategy, which confirms that population growth may be satisfied within existing townsites in an expanded form. Existing towns offer a level of community services, infrastructure and employment that would be beneficial to a growing population.

With respect to the timing of townsite expansion, the Strategy recognises that the improvement and upgrading of service/utilities would represent a catalyst to growth (and vice versa).

The proposed Structure Plan includes a *Rural Living* component at the northern outskirts of the (expanded) Horrocks townsite and such outcome is consistent with the Strategy, which explains that such *'alternative form of settlement' ... 'satisfies a legitimate lifestyle demand, and attracts residents and development that contribute to the socio-economic well-being of the general community.'* Finally, the strategy recognises the beneficial impact of this form of subdivision on maintaining and enhancing landscape values. Accordingly, the Strategy seeks to 'positively' encourage rural small holdings around Horrocks.

The land surrounding the Horrock's Townsite is located within the Coastal Precinct. This Precinct is recognised as containing a range of recreational assets but, at the same time, is an area of high environmental quality and landscape amenity with particular regard to Bowes River, its bays and beaches.

The Strategy recognises that the Precinct is experiencing development pressure as a result of its proximity to townsites such as Horrocks and the ongoing progress of the coastal route from Kalbarri to Horrocks.

It is considered that the proposed Structure Plan reflects and respects the various strategies and principles identified for the Precinct with particular regard to the following:

- It realises appropriate development and land use activities while protecting the rural amenity and high landscape values of the area;
- Public enjoyment of the coast is protected while compatible development is facilitated in coastal areas;
- The high visual amenity of the coastal road is maintained; and
- Urban development is concentrated in and around existing developments.

The Horrocks townsite itself is situated within its own Precinct. The townsite is described as 'small' with a population less than 150 persons in 1991. This has however expanded with incremental land releases undertaken by the Shire of Northampton. It is dependent upon tourism and proximity to commercial and non-commercial fisheries. Reliance on these industries is likely to continue for the foreseeable future.

Importantly, the Strategy recognises that there is 'significant' scope to expand the town to the east and acknowledges that a Structure Plan is required to facilitate and guide such expansion. By way of helping to resolve the issue of service provision, the Strategy confirms that a new sewer system has now been constructed in the townsite.

The opportunity for an integrated and innovative subdivision design is confirmed by the local government ownership of much of the land to the east of the townsite as described by the Precinct overview. A preference has been identified for land to be released in the southern extent of the Development zone though both northern and southern areas have been designated (for future expansion).

The Strategy identifies a range of principles and strategies for the ongoing development of the townsite. It is considered that the Structure Plan reflects and responds to these elements with particular regard to the following:

- It realises appropriate development and land use activities while protecting the environmental and high landscape values of the area;
- A range of housing options are facilitated by the Structure Plan;
- Services, infrastructure and accommodation would improve as a result of the Structure Plan;
- The development facilitated by the plan would not prejudice the longer-term sustainable use of the coast for conservation, recreation, fishing and tourism;
- Public use of and access to the coast is maintained and enhanced;
- Sufficient commercial and industrial land is proposed and a diversity of local businesses is facilitated;
- Urban development would be adequately serviced and infrastructure provided.

Shire of Northampton Draft Local Planning Scheme No. 10

The Draft Local Planning Scheme No 10 has been advertised and the Shire of Northampton is presently reviewing submissions. The draft scheme identifies this area as Special Control Area 6 and requires the preparation of a structure plan prior to development proceeding, (Horrocks Development Area)

The structure plan is consistent with the provisions of the draft Scheme.

Draft Horrocks Beach Expansion Strategy

The draft Horrocks Beach Expansion Strategy has been advertised and in June 2009, Council resolved to endorse the Draft Horrocks Beach Expansion Strategy for the purposes of further community consultation only.

Since this time, Shire staff have been working together with the Department for Planning & Infrastructure and the Strategy has not progressed given that the Western Australian Planning Commission are likely to embark on a major review of the Batavia Coast Strategy which is to include a review of the major growth townsites within the region. As part of the Batavia Coast Strategy Review there may be scope to consider an increase in density above that shown on the Draft Horrocks Beach Expansion Strategy.

Notwithstanding, the Structure Plan is consistent with the Draft Horrocks Beach Expansion Strategy.

Horrocks Beach Coastal Plan 1993

The Coastal Plan seeks to designate a management framework to guide future use and development of coastal areas at Horrocks. It proposes a number of strategies for this area as outlined below:

- Little Bay may be able to accommodate more formal use in the long term;
- The limestone ridge behind Little Bay may be able to accommodate a look out as may the top of the escarpment;
- The existing rubbish tip should be relocated (this has now occurred);
- Development on top of the ridge should be setback to avoid negative visual impact on the townsite and foreshore area;
- The Bowes River Mouth should be provided with a greater degree of amenity.

4.3 Existing and Future Land Use

The Horrocks townsite is presently comprised of low density residential with limited instances of commercial development. As indicated previously in this report, such development has occurred in response to a need to service the local tourism and fishing industries.

Land to the west and northwest of the townsite is used for conservation/recreation purposes while to the south and east the subject area is comprised of a combination of vacant land and land used for broadacre farming.

It is considered that the discussion of the strategic planning framework of the area previously in this report provides sufficient comment on the intended future land use of the locality.

In addition, any future urban development will have due regard to the principles outlined in the WAPC's Liveable Neighbourhoods policy. Liveable Neighbourhoods exists as an operational policy for the design and assessment of structure plans (regional, district and local) and subdivision for new urban (predominantly residential) areas in the metropolitan area and country centres, on greenfield and large urban infill sites. Any development must therefore be considered with regard to the provisions of this policy.

4.4 Transport Routes

Recently constructed and future road connections between Kalbarri and Horrocks would reinforce accessibility to the townsite and thus it's designated local centre functions.

The Batavia Coast Strategy confirms that Horrocks is classified as 'Priority 1' for new/upgraded 2-wheel drive access on public roads. In this regard, a new coastal road connection is proposed to better connect Horrocks with Port Gregory to the north while an upgrading of the access road east to Northampton is also anticipated.

4.5 Local and Regional Centres

Horrocks is a local centre, providing a limited range of goods and services to the town's residents and tourist population. Nearby Northampton is the Shire's major settlement and provides district-level services. Higher-order needs are provided at the regional capital, Geraldton, which is located some 70 kilometres to the south. The development at Horrocks is intended to reinforce and consolidate the primacy of Northampton through the provision of local level commercial facilities within Horrocks itself as well as retaining primary services and facilities within the Northampton townsite.

5.0 THE STRUCTURE PLAN

5.1 Structure Plan Themes and Objectives

The modified structure plan has been prepared with a view to maximising the residential and rural living land use and development of Horrocks and its surrounds in a sustainable manner. This is to be achieved by balancing the environmental, topographical, servicing and recreation needs/attributes of the locality while retaining a focus on growth around the existing townsite. A copy of the amended structure plan is included as Annexure 1.

5.2 Design Rationale

By way of elaborating on the above statement, the following factors were important in determining the rationale for design across the structure plan area:

- Capitalising on the opportunity for growth around the existing townsite;
- Identification of appropriate 'day-use,' eco-tourism and overnight accommodation sites;
- Capitalising of viewscapes and natural topography;
- Servicing and access;
- Transition between land uses;
- Open space distribution; and
- Providing an interface and a relationship to the existing Horrocks townsite.

5.3 Interface with Existing Townsite & Surrounding Land

The existing Horrocks Townsite is predominantly located within 150 metres of the coast line. The Horrocks Development Plan, prepared by the Shire of Northampton, identifies future expansion at a density of R20, located to the east of the existing townsite and west of the limestone ridge. The Development Plan identifies future development up to the intersection of Glance Street and Mitchell Street to the north and the Dune Conservation area to the east.

The existing Horrocks townsite is separated from the bulk of the structure plan by a steep ridge located along the eastern edge of the town. A Geotechnical Assessment of the escarpment has been undertaken by the landowner and any development and or subdivision will be consistent with the recommendations of the geotechnical report.

Notwithstanding, it is considered appropriate to locate higher density (in comparison to the remainder of the structure plan) urban allotments adjacent to the townsite are an appropriate interface, to generate a critical mass capable of supporting the servicing required and the proposed commercial areas. The primacy of the Horrocks townsite in line with the strategic planning framework for the area is also reinforced by this arrangement.

The proposed urban residential land is anticipated at a density of R20 with some R30 in close proximity to the commercial area. Opportunities for higher densities can be further examined at the detailed planning stage.

Open space areas are located giving due consideration to the designated conservation area, surrounded by residential allotments overlooking the space to ensure that there is adequate surveillance of conservation areas while maintaining a delineation between public and private space.

5.4 Commercial Centres

A local commercial centre is proposed in the form of mixed use service-commercial-tourist sites. This site has been centrally located such that they would be readily accessible to nearby residential, rural living and tourist locations.

The centre will accommodate minor subordinate convenience shopping and mixed tourist uses that will complement the primacy of the existing commercial uses within the townsite. The centres have been located such that it is evenly spaced and on a high-profile corner site, to provide for long term sustainability.

It is anticipated that other less-intense commercial activities would be located in the various tourist (day use, eco and overnight) areas identified in the structure plan.

Whilst the local commercial centre was located on the western side of White Cliffs Road on the earlier versions of the Structure Plan, it is considered more desirable to have the commercial centre on the eastern side of White Cliffs Road. This would ensure that the site is of a sufficient site to accommodate any future tourist uses, including the possibility of a caravan park or other form of tourist accommodation.

The August 2010 plan also includes a new Public Open Space reserve on the eastern side of White Cliffs Road, adjacent to the proposed local commercial centre. The DEC has requested this Public Open Space area be reserved due to the environmental significance of that area.

The Structure Plan provides for a road linkage from White Cliffs Road that will separate the POS and commercial site and will then form a four way intersection with the Mitchell Street extension.

It is noted that the commercial centre site would have to be rezoned prior to any subdivision or development.

5.5 Natural Features

The plan responds to the natural features of the land in the following manner:

- The road layout facilitates a lot pattern that would take advantage of views to the Indian Ocean; and,
- The plan nominates a number of lookouts and other tourist nodes at key environmental/geographic features such as Stinky Point and Little Bay.

5.6 Street Block Layout & Street Network

The street block and street network layouts have been based on a traditional grid design consistent with contemporary planning principles and in order to facilitate a robust, permeable design allowing ease of implementation.

Streets and block modules have been orientated to take advantage of view-scapes over the Indian Ocean and coastline.

Distributor roads have been identified to accommodate traffic into the townsite and to the north of the townsite.

The extension of Mitchell Street is proposed to facilitate a fully permeable townsite layout with both the existing and future sections to be fully connected. Along the ridge escarpment a direct lot interface is provided on the public open space. This interface is preferred because:

- The area does not provide a logical thoroughfare for vehicle traffic to access destinations.
- The development seeks to enhance the pedestrian environment and amenity along the section of the escarpment and Public Open Space (POS) by removing traffic.
- There is a ready supply of other lookouts providing views over the Horrocks coastline.
- The Structure Plan provides strong and legible pedestrian links to this area forming part of the district level pedestrian network.

Prior to the time of subdivision Detailed Area Plans will be prepared if required and provide detailed consideration of the interface treatments between residential lots and open space.

5.7 Transport Corridors for Pedestrians & Cyclists

This matter would be granted further consideration at detailed design stage following the adoption of the structure plan. However, it is considered that the identification of a series of nodal points (recreation/tourist/commercial etc) that are well-connected through a permeable and logical street layout would be in the best interests of creating effective corridors for pedestrian and cyclist movement (particularly along foreshore areas). The pedestrian treatment of land along the scarp is shown as Annexure 1. The plan included in Annexure 1 also identifies the primary pedestrian pathway continuing through the proposed residential area to the north of the Mitchell Street extension.

5.8 Residential Densities

The structure plan allows for the creation of lots at a predominant density of R20 with some areas around the commercial area of R30. Some flexibility may be required in accommodating a range of densities at the detail planning stage. The current designs prepared to date have provided in the order of 400 residential lots, but these are based on larger lot sizes in the order of 800m^2 – 1,000m^2; consistent with the currently sought lot sizes in the area. However, the density of R20 and grid layout has been maintained to provide opportunity for greater consolidation of lot sizes in accordance with WAPC objectives as the residential market in the area matures.

The Rural Residential element of the structure plan provides for approximately 40 lots.

5.9 Schools & Community Facilities

The Structure Plan doesn't nominate any specific school or community facilities. The existing townsite currently contains areas for community use while a district high school is located at nearby Northampton. Senior High School services would be provided in Geraldton.

With the proximity and primacy of the Northampton town site, it is not intended that these sorts of facilities would be replicated within the Horrocks town site.

5.10 Open Space

The structure plan area is well catered for through regional conservation and foreshore areas depicted on Structure Plan 2 of 2.

The Structure Plan provides for more public open space that the standard requirement of 10% open space as required for residential areas under the policies of the Western Australian Planning Commission.

The Public Open Space reserves have been distributed to provide easy access for all residents and have been located in areas to ensure a mix between providing active and passive open space and other areas that the DEC has requested be retained for either flora and or fauna protection. In some instances they also act as pedestrian corridors and interface with regional conservation zones while a higher degree of residential amenity could be expected for lots surrounding the open space.

5.11 Public Utilities

An Infrastructure Report has been prepared by Maunsell in January 2004 (Annexure 9). That report confirmed that the topography and landforms of the Structure Plan area are suitable for the construction of roads and services. More specific comment on each of the services are provided below.

Sewerage

Reticulated sewer is available to residential lots though it is not required for rural residential lots. Rural residential lots would be serviced through on-site effluent disposal systems.

Water Supply

A necessary prerequisite to subdivision and development will be obtaining the necessary approvals from the Water Corporation to supply water to the proposal. Preliminary discussions with the Water Corporation indicate adequate capacity exists to accommodate the proposal. Refer Annexure 10 which includes correspondence from the Water Corporation in regard to water supply.

Staging will be dependent upon final servicing arrangements but generally be in a south to north direction. Shorter term development is dependent on the availability of water as follows:

- Stage 1, is the area for capacity exists under the current water allocation
- Stage 2 covers areas within the Water Supply Operating Licence Area
- Stage 3 covers those areas outside the Water Supply Operating Licence Areas.

In addition, and in response to the Department of Water, a Local Water Management Strategy has been prepared and is included in Annexure 11. This Local Water Management Strategy has been accepted by the Department of Water and a copy of the response from the Department of Water is also included in Annexure 11. The strategy is consistent with water sensitive urban design principles and will be effected as part of the subdivision works.

Drainage

Residential lots and street networks would drain into the local drainage network, which would gravitate to open space areas where drainage areas would be landscaped appropriately.

Drainage from the Structure Plan area is addressed in the Local Water Management Strategy included in Annexure 11.

Gas

Reticulated gas supply is not proposed.

Electricity

Power supply is 'readily available' through existing HV mains. Appropriate easements and access points would need to identified and created through the subdivisional process. Correspondence from Western Power is included in Annexure 12

Communication Services

The telecommunications capacity of the existing townsite is insufficient to cater for the expansion facilitated by this Structure Plan. However, such services could be adequately upgraded via a fibre-optic link from Northampton or, alternatively, a satellite link/mini-exchange. This is a matter that will be contemplated as part of normal subdivision considerations.

6.0 CONCLUSION

This report has provided justification for the Structure Plan proposed in terms of the strategic and statutory planning framework of the land, its natural attributes and from a design perspective.

The outcome proposed is based on contemporary and sustainable planning principles that reflect both State and local objectives for the growth of Horrocks and the Region as a whole. It also balances the environmental, economic and social issues associated with such expansion.

It is intended that Horrocks will complement and support the primacy of the Northampton town site and the additional population generated will consolidate the existing services and facilities.

The Structure Plan is intended as a long term plan for development within the town site over a twenty year period.

In light of this, we believe that the Structure Plan as proposed would effectively and appropriately guide future subdivision and development of Horrocks over the coming years, providing certainty to government, landowners and the general community alike.

Annexure 1

Structure Plan December 2010

TO PORT GREGORY/KALBARRI

LOOKOUT & CAFE/ RESTAURANT

Little Bay

Whaleboat Cove

INDIAN OCEAN

NB: Dune area and clifftop may be subject to geotechnical report recommendations

Stinky Point

Mitchell Street extension

Horrocks Townsite

Camels Head

Three Mile Beach

WHITE

CLIFFS

ROAD

HORROCKS ROAD

TO NORTHAMPTON

WILLIGULLI ROAD

P.O.S.

Former waste disposal site boundary - Prior to the site being utilised as POS and the surrounding land being developed for residential remediation works may be required

Road to Industrial Estate

Water Corporation Sewage Treatment Plant

500

9000

SHIRE OF NORTHAMPTON COMMON SEAL

Adopted for final approval by resolution of the Shire of Northampton at the Ordinary meeting of the Council held on the 20th day of August 2010 and the Seal of the Municipality was pursuant to that resolution hereunto affixed in the presence of:

GORDON WILSON, PRESIDENT

GARRY KEEFE, CHIEF EXECUTIVE OFFICER

Endorsed by the Western Australian Planning Commission

Date:

Signed for and on behalf of the Western Australian Planning Commission.

an officer of the Commission Duly authorised by the Commission pursuant to Section 24 of the Planning and Development Act 2005.

Witness

- 4 JAN 2011

Date

LEGEND

- URBAN RESIDENTIAL
- RURAL SMALLHOLDINGS (4 - 40 ha) (Provisions of Power) Area Approx.. 775 ha
- RURAL RESIDENTIAL
- RECREATION
- CONSERVATION AREAS (subject to coastal processes)
- RURAL LAND SUBJECT TO FUTURE PLANNING
- MINOR DAY USE SITE
- MIXED SERVICE-COMMERCIAL-TOURIST SITE
- ECO TOURISM SITE
- S SEWER TREATMENT
- DISTRIBUTOR ROAD
- PROPOSED ROAD
- FORMAL LOOKOUT
- BUFFERS
- RIDGE LINE
- SUBJECT TO FURTHER PLANNING

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

SCALE 1:10 000
ORIGINAL PLAN SIZE A1

DRAWING NUMBER: HOR HOR SP

DATE: 02.12.2010

125 Hamersley Road, Subiaco WA 6008
PH: (08) 9382 3000 FAX: (08) 9382 3005
www.allerdingassoc.com

NORTH

LEGEND:
Subject Land.....

NOTE:
1. Detailed Area Plan may be required to be prepared and endorsed prior to subdivision in certain areas where necessary.
2. Building envelopes to be shown on rural residential lots and endorsed prior to subdivision.

STRUCTURE PLAN
Plan 1 of 2

HORROCKS
SHIRE OF NORTHAMPTON

SHIRE OF NORTHAMPTON
WA
COMMON SEAL
VIAS • TUTAS • CUPIAS

Adopted for final approval by resolution of the Shire of Northampton at the Ordinary meeting of the Council held on the 19th day of August 2010 and the Seal of the Municipality was pursuant to that resolution hereunto affixed in the presence of.

GORDON NELSON, PRESIDENT

GARRY KEEFE, CHIEF EXECUTIVE OFFICER

Endorsed by the Western Australian Planning Commission

Date

Signed for and on behalf of the Western Australian Planning Commission.

an Officer of the Commission duly authorised by the Commission pursuant to Section 24 of the Planning and Development Act 2005.

Witness

04 JAN 2011 Date

WHITE ROAD

Road Subject to Closure

P.O.S. 2.51ha

Public Open Space 13.0ha

500m Buffer to Water Treatment Plant

R30

P.O.S. 4.81ha

P.O.S. 1.90ha

CLIFFS ROAD

Mitchell Street extension

500

INDIAN OCEAN

P.O.S. 2.16ha

Reserve 29151 10972

R21450

Reserve 29152 12158

P.O.S. 3.67ha

Horrocks Townsite

0 50 100 150 200 250m

SCALE 1:8000
ORIGINAL PLAN SIZE: A3

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

DRAWING NUMBER: HOR HOR SP

DATE: 02.12.2010

125 Hamersley Road, Subiaco WA 6008
PH: (08) 9382 3000 FAX: (08) 9382 3005
www.allerdingassoc.com

NORTH

LEGEND:
Subject Land.....
Proposed Pathway.....
Public Open Space (22.91ha).
Residential (R20).....

NOTE:
1. Detailed Area Plan may be required to be prepared and endorsed prior to subdivision in certain areas where necessary.
2. Land subject to geotechnical report recommendations

STRUCTURE PLAN
Plan 2 of 2

HORROCKS
SHIRE OF NORTHAMPTON

TO PORT GREGORY/KALBARRI

LOOKOUT & CAFE/ RESTAURANT

Little Bay

Whaleboat Cove

INDIAN OCEAN

NB: Dune area and clifftop may be subject to geotechnical report recommendations

Stinky Point

Mitchell Street extension

Horrocks Townsite

Camels Head

Three Mile Beach

WHITE

CLIFFS ROAD

HORROCKS ROAD

WILLIGULLI ROAD

TO NORTHAMPTON

LEGEND:

- URBAN RESIDENTIAL
- RURAL SMALL HOLDINGS (4 - 40 ha) (Provisions of Power) Area Approx 775 ha
- RURAL RESIDENTIAL
- RECREATION
- CONSERVATION AREAS (subject to detailed processes)
- RURAL LAND SUBJECT TO FUTURE PLANNING
- MINOR DAY USE SITE
- MIXED SERVICE COMMERCIAL-TOURIST SITE
- ECO TOURISM SITE
- S SEWER TREATMENT
- BUFFER
- FORMAL LOOKOUT
- RIDGE LINE
- SUBJECT TO FURTHER PLANNING

SHIRE OF NORTHAMPTON
"SIS TUTAS CUM MORE" COMMON SEAL

Adopted for final approval by resolution of the Shire of Northampton at the Ordinary meeting of the Council held on the 20th day of August 2010 and the Seal of the Municipality was pursuant to that resolution hereinto affixed in the presence of:

GORDON WILSON, PRESIDENT

GARRY KEEFE, CHIEF EXECUTIVE OFFICER

Endorsed by the Western Australian Planning Commission

Date:

Signed for and on behalf of the Western Australian Planning Commission

an officer of the Commission Duly authorised by the Commission pursuant to Section 24 of the Planning and Development Act 2005.

Witness

04 JAN 2011

Date

STAGING PLAN LEGEND:

Subject Land.....

Stage 1: Lots within current Water Supply Scheme Capacity (maximum of 30 lots)....

Stage 2: Lots with Water Corporation supply operating licence area.....

Stage 3: Lots outside Water Corporation water supply operating licence area.....

NOTE:

a) Location of Stage 1 subject to change, based upon detailed infrastructure costing but will be not more than 30 lots.

b) Stage 2 & 3 will be developed in land releases of not more than 50 lots.

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

SCALE 1:10 000
ORIGINAL PLAN SIZE: A1

DRAWING NUMBER: HOR HOR SP

DATE: 02.12.2010

125 Hamersley Road, Subiaco WA 6008
PH: (08) 9382 3000 FAX: (08) 9382 3005
www.allerdingassoc.com

NORTH

STAGING PLAN

HORROCKS
SHIRE OF NORTHAMPTON

WHITE

CLIFFS

ROAD

P.O.S.
3.67ha

SHIRE OF NORTHAMPTON
VISCUTAS OCTAVIUS
COMMON SEAL
WESTERN AUSTRALIA

Adopted for final approval by resolution of the Shire of Northampton at the Ordinary meeting of the Council held on the 20th day of August 2010 and the Seal of the Municipality was pursuant to that resolution hereunto affixed in the presence of:

GORDON WILSON, PRESIDENT

GARRY KEEFE, CHIEF EXECUTIVE OFFICER

Endorsed by the Western Australian Planning Commission

Date:

Signed for and on behalf of the Western Australian Planning Commission.

an officer of the Commission Duly authorised by the Commission pursuant to Section 24 of the Planning and Development Act 2005.

Witness

04 JAN 2011

Date

96
95
94
93
92
91
12786

R37037
11373
R37038
11374

3

4

30

STAGING PLAN LEGEND:

Subject Land.....

Stage 1: Lots within current Water Supply Scheme Capacity (maximum of 30 lots)....

Stage 2: Lots with Water Corporation supply operating licence area.....

Stage 3: Lots outside Water Corporation water supply operating licence area.....

NOTE:
a) Location of Stage 1 subject to change, based upon detailed infrastructure costing but will be not more than 30 lots.
b) Stage 2 & 3 will be developed in land releases of not more than 50 lots.

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

SCALE 1:2000
ORIGINAL PLAN SIZE: A3

DRAWING NUMBER: HOR HOR SP
DATE: 02.12.2010

125 Hamersley Road, Subiaco WA 6008
PH: (08) 9382 3000 FAX: (08) 9382 3005
www.allerdingassoc.com

NORTH

STAGING PLAN - STAGE 1
Plan 4

HORROCKS
SHIRE OF NORTHAMPTON

Annexure 2

Previous Structure Plan Proposals
November 2007

TO PORT GREGORY/KALBARRI

84

LOOKOUT & CAFE/ RESTAURANT

Little Bay

Whaleboat Cove

INDIAN OCEAN

NB: Clifftop subject to Geotechnical Investigation

Stinky Point

Mitchell Street extension

Horrocks Townsite

Camels Head

Three Mile Beach

69

107

WHITE

CLIFFS

ROAD

HORROCKS

WILLIGULL

TO NORTHAMPTON

ROAD

LEGEND

- URBAN RESIDENTIAL
- URBAN RESIDENTIAL RE-DEVELOPMENT SUBJECT TO GEOTECHNICAL REPORTS AFTER TIP CLOSURE
- SPECIAL RESIDENTIAL < 2000 m²
- RURAL RESIDENTIAL (1 - 4 ha) (Provisions of Scheme Water & Power) Area Approx. : 87 ha
- RURAL SMALLHOLDINGS (4 - 40 ha) (Provisions of Power) Area Approx. : 775 ha
- RECREATION
- CONSERVATION AREAS (subject to coastal processes)
- COMPOSITE MIXED RESIDENTIAL
- RURAL LAND SUBJECT TO FUTURE PLANNING
- SUBDIVISION OF THIS LAND DEPENDANT ON SCHEME BOUNDARY CHANGE
- OVERNIGHT ACCOMMODATION SITE
- MAJOR DAY USE SITE
- MINOR DAY USE SITE
- MIXED SERVICE-COMMERCIAL-TOURIST SITE
- ECO TOURISM SITE
- W WATER TANK
- S SEWER TREATMENT
- T TIP CLOSED
- PRIMARY DISTRIBUTOR ROAD
- FORMAL LOOKOUT
- BUFFERS
- RIDGE LINE
- SUBJECT TO FURTHER PLANNING

Allerding & Associates

SCALE 1:10 000
ORIGINAL PLAN SIZE: A1

DRAWING NUMBER: SHE HOR SP

DATE: 09.06.2008

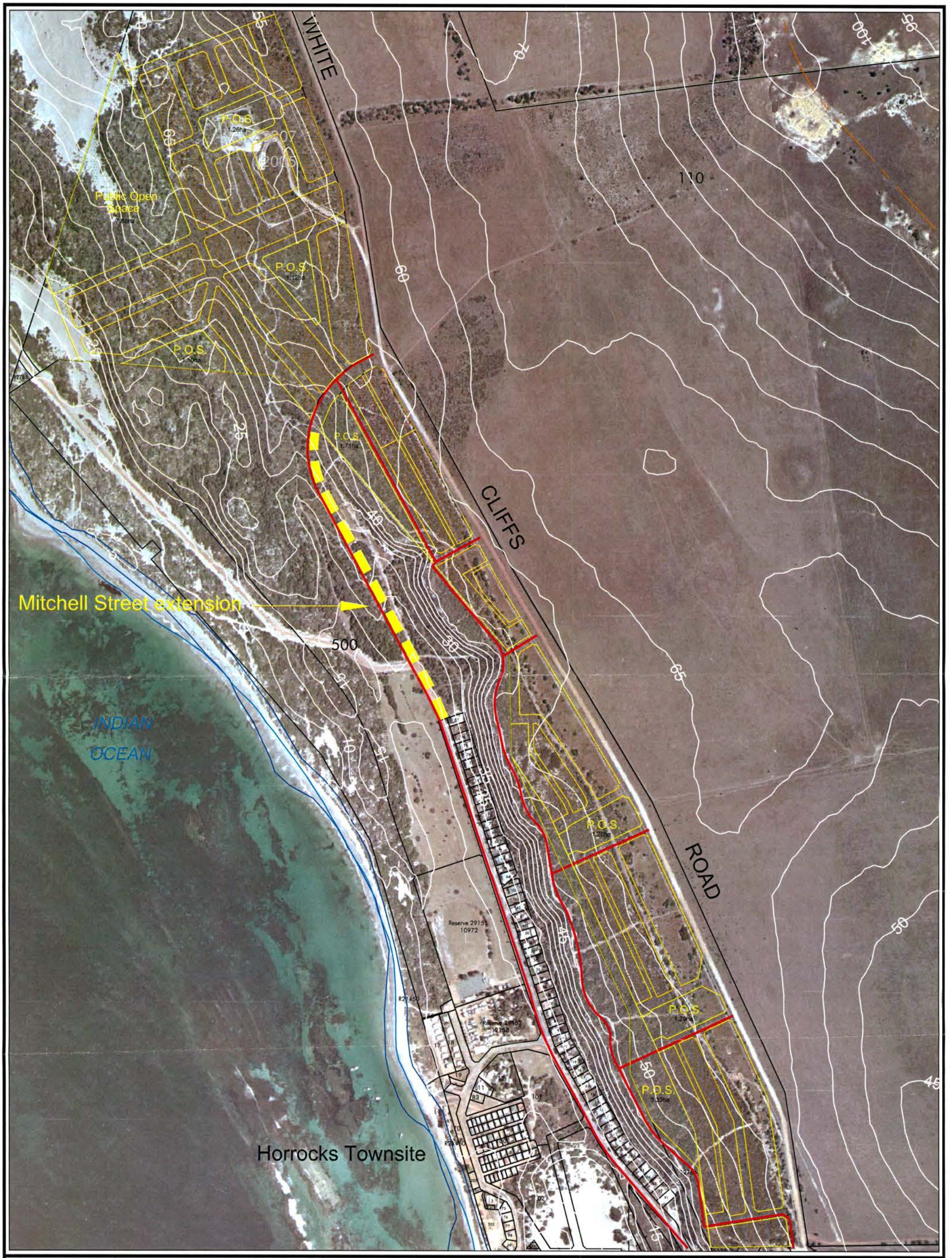
125 Hamersley Road, Subiaco WA 6008
PH: (08) 9382 3000 FAX: (08) 9382 3005
www.allerdingassoc.com

NORTH

LEGEND:
Subject Land.....

STRUCTURE PLAN
Plan 1 of 2

HORROCKS
SHIRE OF NORTHAMPTON



Allerding & Associates

125 Hamersley Road, Subiaco WA 6008
PH: (08) 9382 3000 FAX: (08) 9382 3005
www.allerdingassoc.com

0 50 100 150 200 250m
SCALE 1:7500
ORIGINAL PLAN SIZE: A3

DRAWING NUMBER: SHE HOR SP
DATE: 25.10.2007

NORTH

LEGEND:
Subject Land.....
Proposed Pathway.....
Public Open Space (15.48ha).
Urban.....
Service Commercial...

STRUCTURE PLAN
Plan 2 of 2

HORROCKS
SHIRE OF NORTHAMPTON

Annexure 3

Previous Structure Plan Proposal

May 2007

TO PORT GREGORY/KALBARRI

84

LOOKOUT & CAFE/ RESTAURANT

Little Bay

Whaleboat Cove

INDIAN OCEAN

NB: Clifftop subject to Geotechnical Investigation

Stinky Point

Mitchell Street extension

500

Horrocks Townsite

9000

69

107

WHITE

ROAD

WILLIGULLI

HORROCKS

TO NORTHAMPTON

ROAD

Camels Head

Three Mile Beach

114

112

6

6

20

20

VCL

S

W

LEGEND

- URBAN RESIDENTIAL
- URBAN RESIDENTIAL RE-DEVELOPMENT SUBJECT TO GEOTECHNICAL REPORTS AFTER TIP CLOSURE
- SPECIAL RESIDENTIAL < 2000 m²
- RURAL RESIDENTIAL (1 - 4 ha) (Provisions of Scheme Water & Power) Area Approx. : 87 ha
- RURAL SMALLHOLDINGS (4 - 40 ha) (Provisions of Power) Area Approx. : 775 ha
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- OVERNIGHT ACCOMMODATION SITE
- MAJOR DAY USE SITE
- MINOR DAY USE SITE
- MIXED SERVICE-COMMERCIAL-TOURIST SITE
- ECO TOURISM SITE
- W WATER TANK
- S SEWER TREATMENT
- T TIP CLOSED
- PRIMARY DISTRIBUTOR ROAD
- FORMAL LOOKOUT
- BUFFERS
- RIDGE LINE
- SUBJECT TO FURTHER PLANNING

0 250 500 750

ALL DISTANCES ARE IN METRES

Allerding & Associates

SCALE 1:10 000
ORIGINAL PLAN SIZE: A1

DRAWING NUMBER: SHE HOR SP

DATE: 30.04.2007

310A Newcastle Street, Perth W.A. 6000
PH: (08) 9328 5555 FAX: (08) 9328 5559
www.allerdingassoc.com

NORTH

LEGEND:
Subject Land.....

STRUCTURE PLAN

HORROCKS
SHIRE OF NORTHAMPTON

Annexure 4

GHD Flora and Fauna Survey

CLIENTS | PEOPLE | PERFORMANCE

Seaview Farms

Horrocks Beach Development

Flora and Fauna Survey

March 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Table Index

Figure Index

Appendices

Executive Summary

Seaview Farms commissioned GHD to undertake a Vegetation, Flora and Fauna Survey for the proposed development site - Lots 110, 112, 114 and 115 at Horrocks (the Project Area) in the Shire of Northampton. The purpose of the survey is to undertake an appropriate examination and description of the existing environment and provide adequate information to the Department of Environment and Conservation to assist in the approvals process.

Baseline flora, vegetation and fauna surveys were undertaken for the Project Area. The following conclusions on environmental aspects are made:

- The vegetation of the Project Area is identified by Beard (1976) is considered to be *Depleted* or *Vulnerable*, with 32% and 18.9% of the pre-European extent considered to be remaining in the Geraldton Sandplains Interim Biogeographic Regionalisation for Australia (IBRA) region (Shepherd, 2005);
- A total of 15 vegetation types were recorded from the Project Area, the majority of which fall in to the broad-scale mapping of Beard (1976);
- No Threatened or Priority Ecological Communities were recorded from the Project Area;
- Dieback susceptible vegetation occurs in the Project Area; however, the area is considered unlikely to support an infestation of *Phytophthora cinnamomi*;
- Vegetation condition throughout the Project Area ranged from Condition 1-2 (*Pristine or Nearly So - Excellent*) to Condition 6 (*Completely Degraded*). The main disturbance factor was from historical clearing for the purpose of agricultural activities;
- A total of 221 flora taxa from 72 families were recorded from the Project Area, representing a medium to high level of diversity;
- One Declared Rare Flora species (*Caladenia bryceana* subsp. *cracens*) was recorded during the field survey at a known location. This location is proposed to be protected as part of Public Open Space. No other DRF were recorded from the Project Area;
- One Priority 1 species (*Melaleuca huttensis*) was recorded from the Project Area. This taxon was dominant across the Project Area and was also recorded to the north and south of the Project Area. No other Priority Flora species were recorded from the Project Area;
- No other significant plants species were recorded from the Project Area;
- A total of 40 weed species were recorded from the Project Area, dominated by grasses and associated pasture species. Three Declared Plants and one Weed of National Significance were recorded from the Project Area;
- A total of 33 birds, 6 mammals (1 native) and 3 reptiles were recorded from the Project Area;

- Protected fauna species are known to occur or considered likely to occur in the Project Area. No threatened fauna species were recorded in the Project Area during the reconnaissance fauna survey. Threatened fauna species known to occur in the general area, as identified in the desktop assessment, are generally unlikely to use the Project Area for breeding or refuge purposes;
- No Protected fauna species were recorded during the field survey;
- A number of *Environmental Protection and Biodiversity Conservation Act* Marine and Migratory Listed species were recorded from the Project Area;
- An examination of the DEC's Ten Clearing Principles applied against the finding of this flora and fauna assessment and any clearing of native vegetation within the Project Area has been assessed to be:
  - At variance with clearing principles (c1), (c3), (e1) and (e4); and
  - May be at variance with clearing principles (a1), (b3), (b4) and (h4).
- With regards to significant flora (Clearing Principle c): the "at variance" assessment has not been deemed to be significant, due to the Declared Rare Flora known from the Project Area will be protected as part of any structure plan; and the Priority 1 species is considered to be abundant in the local area.
- With regards to the vegetation extent remaining in the Project Area (Clearing Principle e): consideration may be given by the DEC to the allowance of clearing of this vegetation (with conditions). However, as this vegetation is already considered to be *Vulnerable* in extent, any application for clearing may be declined.
- On the basis of this assessment, the application for a clearing permit from the DEC may not be granted. This Project is considered likely require referral to the Environmental Protection Authority for any approval to clear vegetation.

1. Introduction

1.1 Background

Horrocks is located on the Mid-West coast of Western Australia, approximately 20 km west of Northampton and approximately 50 km north from Geraldton (Figure 1, Appendix B).

The Shire of Northampton identified Horrocks as a location that will undergo significant future population growth. Seaview Farms are progressing plans to subdivide property at Horrocks (Lots 110, 112, 114 and 115) (the Project Area). The Shire of Northampton Horrocks Structure Plan includes urban and lifestyle blocks with a mixed use commercial area and is expected to be finalised by the Western Australian Planning Commission in 2009.

GHD understands that Seaview Farms has previously undertaken flora surveys on the property at Horrocks that have identified a known location of the Declared Rare Flora (DRF) species *Caladenia bryceana* subsp. *cracens*.

As part of the environmental approvals process GHD Pty Ltd (GHD) met with the Department of Environment and Conservation (DEC) in order to delineate a clear process for Seaview Farms to achieve environmental and planning approvals.

To adequately assess the proposed project, the DEC has indicated that further surveys (vegetation, flora and fauna) are required. The DEC indicated that the reasons for the requirement for further surveys are such that previous surveys did not provide adequate information.

1.2 Scope of Work

Seaview Farms commissioned GHD to undertake a Vegetation, Flora and Fauna Survey for the proposed development site (the Project Area) (Figure 2, Appendix B). The purpose of the survey is to undertake an appropriate examination and description of the existing environment and provide adequate information to the DEC to assist in the approvals process.

Baseline flora, vegetation and fauna surveys were undertaken for the Project Area.

All work was undertaken with reference to the following Environmental Protection Authority (EPA) guidance statements:

- EPA (2004a). Guidance Statement No. 51, *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*; and
- EPA (2004b). Guidance Statement No. 56, *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.*

Detailed methodology undertaken to achieve the scope of work is indicated in Section 2 (Methodology).

2. Methodology

The biological survey of the Project Area was broken into two components: a desktop assessment and a field assessment.

2.1 Desktop Assessment

The desktop assessment was carried out prior to the field survey in order to consider biological constraints, which may be in the vicinity of the Project Area. The following factors were reviewed:

- Adjoining land use including conservation reserves or other listed areas such as Bush Forever sites or Red Book sites; (refer to Section 3.4);
- Listed wetlands (refer to Section 3.5);
- Public Drinking Water Catchment Areas; (refer to Section 3.6);
- Environmentally Sensitive Areas (refer to Section 3.7);
- Broad vegetation types shown in existing mapping (e.g. Beard (various), Heddle *et al.*, 1980); (refer to Section 3.9.1);
- Remnant vegetation clearing in relation to statutory requirements; (refer to Section 3.9.2);
- Threatened Ecological Communities (refer to Section 3.9.3);
- Declared Rare and Priority Flora; (refer to Section 3.11.1); and
- Threatened or otherwise protected Fauna; (refer to Section 3.12).

2.2 Vegetation and Flora Survey

Suitably qualified GHD Ecologists undertook a vegetation and survey between the 26th and 28th August, 2009. Work was completed with reference to the EPA Guidance Statement No. 51 (2004a): Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.

The survey was undertaken according to the following process:

- Vegetation types were identified by means of a combination of aerial photography and field observation;
- Quadrat sampling sites were an area of 10 m x 10 m and the position of each site was recorded using a GPS unit. A minimum of two (2) quadrats within each identified vegetation type was undertaken (where possible);
- In addition to quadrat sampling, a *relévé*[1] of the entire Survey Area was undertaken to ensure that all vegetation types were covered during the survey.

[1] For the purposes of this flora and vegetation assessment, a ***relévé*** is defined as an unconfined survey area in which a general statement about the floristic composition of the location can be made.

- The vegetation types and their boundaries were delineated, recording vegetation composition, condition rating, weed species and evidence of disturbance;
- Vegetation was rated according to the Bush Forever vegetation condition scale (Government of Western Australia, 2000);
- The presence of potential Threatened Ecological Communities (TECs) in the area was assessed;
- A search of the Department of Environment and Conservation's (DEC) Declared Rare and Priority Flora database and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool was undertaken to identify expected significant flora for the area;
- Suitable habitat for Declared Rare and Priority Flora species was searched during the survey to determine the presence of recorded and previously unrecorded threatened flora; and
- Where field identification of plant taxa was not possible, specimens were collected in a systematic manner so that they could be later identified at the Western Australian Herbarium by comparison with the reference collection and use of identification keys. Nomenclature of the species follows that of *FloraBase* (2009).

2.3 Fauna Survey

Suitably qualified GHD Ecologists undertook a fauna survey between the 26th and 28th August, 2009. Work was completed with reference to the EPA Guidance Statement No. 56 (2004b): Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.

The fauna survey was undertaken according to the following process:

- The fauna survey was limited to a Level 1 reconnaissance fauna survey;
- An opportunistic recording of species, including pest, declared or feral animals. Habitats were examined using non-systematic techniques, with non-systematic (diurnal) observation undertaken throughout the Project Area:
  - The Project Area was searched for amphibians, reptiles, and mammals. Surveys comprised of searching ground layer (overturning logs, rocks and leaf litter) and low vegetation (under bark and in tree stumps) and recording all individuals observed. Species presence was also determined via secondary evidence, in the form of scats, tracks, burrows and remains.
  - While conducting vegetation and flora surveys in the Project Area, opportunistic observations were made of any other vertebrates (or signs of their presence). Fauna taxa observed or heard will be noted (particularly bird species), and indirect evidence (such as scats, tracks, diggings, nests, feathers, bones, pellets [Triggs, 2004]) indicating the current or recent presence of species also noted;
- Identification of any habitats of significance; and

- An assessment of the value of the Project Area in providing habitat and facilitating movement between conservation areas.

The fauna field survey was conducted in conjunction with the field vegetation and flora survey.

3. Desktop Assessment

3.1 Project Area Location

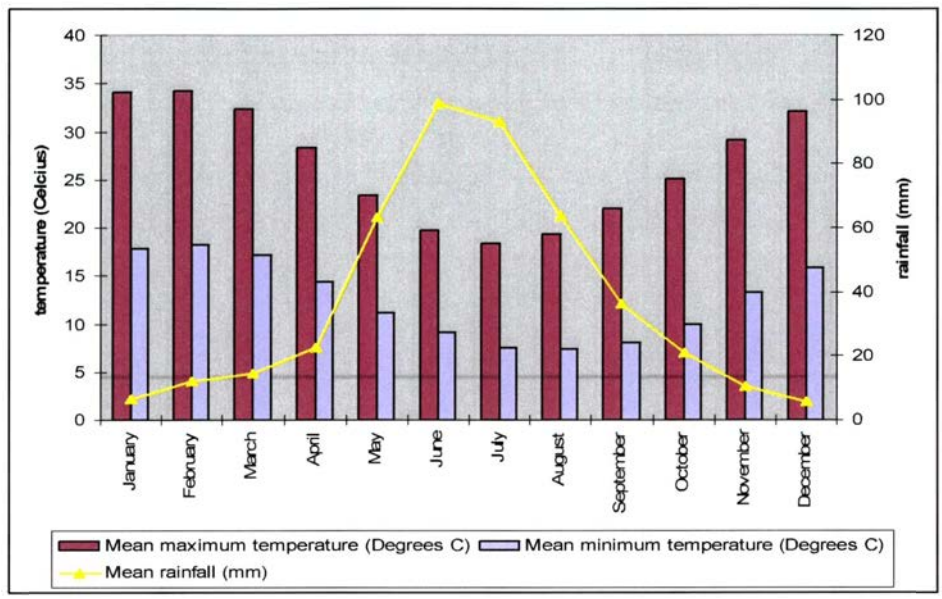
The area surveyed (Project Area) is located to the north and east of the existing Horrocks townsite and comprises an area of approximately 715 ha. Examination of threatened flora species extended beyond the boundary of the Project Area during this survey. The boundary of the Project Area is identified in Figure 2 (Appendix B).

3.2 Climate

The climate of the Project Area is best described as Mediterranean, characterised by hot dry summers and mild wet winters. The closest operating Bureau of Meteorology station located to the Project Area is at Nabawa (c.50 km east of Horrocks). Recorded climatic data for this weather station is presented in Graph 1 and summarised as follows:

- Mean Maximum Temperature: 34.2°C (February) to 18.4°C (July)
- Mean Minimum Temperature: 18.3°C (February) to 7.4°C (August and September)
- Mean Annual Rainfall: 448 mm
- Mean Annual Rain Days: 77.7 days
- Highest Recorded Daily Rainfall 95 mm (10 March 2000)
- Highest Monthly Rainfall 317.6 mm (June 1923)

Source: Bureau of Meteorology (2009)



Graph 1 Nabawa Temperature and Rainfall (data source: Bureau of Meteorology, 2009)

3.2.1 2009 Climate

The region surrounding the Project Area has received an average – to slightly above average Winter rainfall. Geraldton Airport received 274 mm of rain in Winter 2009 (June – August) against a long-term average of 257.6 mm. Kalbarri received 217.5 mm of rain in Winter 2009 (June – August) against a long-term average of 204.9 mm.

3.3 Geology and Soils

The Project Area is located at the northern extent of the Geraldton soil-landscape zone of the Greenough province. Coastal dunes, consisting of deep yellow sands overlying Tamala limestone, and alluvial flats are found in this area (Tille, 2006).

The Geological Survey of Western Australia (1971) describes the soils of the Project Area as comprising:

- **Qs:** Dune and beach sands-white calcareous and quartzose sands;
- **Czl:** Laterite with overlying quartz sand and underlying highly weathered rock; and
- **Qpc:** Coastal Limestone: and overlying podsolised sand – eolianite and leached quartz sands.

3.4 Reserves and Conservation Areas

No reserves or conservation areas occur within the Project Area. Oakabella Nature Reserve, which is approximately 20 km to the south east, is the nearest conservation reserve (data source: DEC Managed Lands and Waters GIS Database).

3.5 Rivers and Wetlands

Bowes River is located approximately 2.7 km south of the Survey Area (Figure 1, Appendix B). The nearest wetland area is the Hutt Lagoon (Port Gregory) approximately 30 km north of the Project Area,

3.6 Public Drinking Water Catchment Areas

The Project Area is not located within any gazetted Public Drinking Water Supply Areas protected under the *Country Areas Water Supply Act 1947*. The nearest Public Drinking Water Supply Area identified is Horrocks Beach Water Reserve, located approximately 2 km north east of the Project Area (Department of Water, 2009). This Reserve does not directly intersect the Project Area.

3.7 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are subject to definition under Section 51B of the *Environmental Protection Act* (1986) and may include areas such those requiring special management attention to protect important scenic values, fish and wildlife resources, historical and cultural values, and other natural systems or processes.

A small ESA is located in the south western corner of the Project Area (Department of Environment and Conservation 2009a). This ESA is associated with the presence of a Declared Rare Flora (DRF) (*Caladenia bryceana* subsp. *cracens*). The location of the ESA, however, does not directly correspond with the location of the DRF due to changes in quality of mapping over time.

No other ESAs are located within close proximity to the Project Area.

3.8 Previous Reports

A number of previous reports have been completed for the Project Area. These include:

- Maunsell (2004). Desktop Environmental Assessment for Horrocks Structure Planning. Unpublished report for Hille, Thompson and Delfos Surveyors and Planners, August 2004.
- Connell Wagner (2006). Horrocks Spring Vegetation Survey, Seaview Farms. Unpublished report by Dingle & Bird Environmental, 26 October 2006.
- ENV (2008 various). Letter reports detailing outcomes of surveys undertaken to locate Caladenia bryceana subsp. cracens. Unpublished letter reports for Seaview Farms.

- Larry Smith Planning (2009). Horrocks Beach Expansion Strategy: Draft for Public Discussion. Unpublished report for Shire of Northampton, May 2009.

An examination of relevant biological aspects of each report will be discussed in each section below.

3.9 Vegetation

3.9.1 Vegetation Types

The vegetation of the Project Area is identified by Beard (1976) as likely to contain the following vegetation associations:

- 129 – Bare areas; drift sand; and
- 359 – Shrublands; acacia & banksia scrub.

3.9.2 Vegetation in a Regional Context

A vegetation type is considered under represented if there is less than 30% of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation in States where clearing is still occurring (Environmental Protection Authority, 2000), namely:

- The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at 30% of the pre-European / pre-1750 extent for the vegetation type;
- A level of 10% of the original extent is regarded as being a level representing *Endangered*; and
- Clearing which would put the threat level into the class below should be avoided.

Such status can be delineated into five classes (Table 1).

Table 1 Vegetation Extent and Status

Class	Classification
Presumed Extinct	Probably no longer present in the bioregion
*Endangered**	< 10% of pre-European extent remains
*Vulnerable**	10-30% of pre-European extent exists
*Depleted**	< 30% and up to 50% of pre-European extent exists
Least Concern	> 50% pre-European extent exists and subject to little or no degradation over a majority of this area.

Note: * or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

The extent of the vegetation in the Project Area is considered to be of *Vulnerable* or *Depleted* with 32% (2055 ha) and 18.9% (8383 ha) of the pre-European extent

remaining of Vegetation Association 129 and 359, respectively, within the Geraldton Sandplains Interim Biogeographic Regionalisation for Australia (IBRA) region (Shepherd, 2005) (Table 2).

The Shire of Northampton is listed as containing 18.6% of its vegetation extent remaining (Shepherd *et al.*, 2002).

Table 2 Regional Assessment of Vegetation Extent (Shepherd, 2005) Geraldton Sandplain IBRA Region

Vegetation Association Number	Association Description	Pre-European Extent (Ha) in Geraldton Sandplain IBRA region	Current Extent (Ha) in Geraldton Sandplain Plain IBRA region	% Remaining	% Current Extent in IUCN Class I-IV Reserves	Occurrence in Project Area
129	Bare areas; drift sand	6419.783	2055.326	32.0	22.1	Northwest portion of the Project Area.
359	Shrublands; acacia & banksia scrub	44412.001	8383.923	18.9	0.0	Majority of the Project Area.

3.9.3 Vegetation Types Previously Recorded

Maunsell (2004) states that regional scale descriptive information about vegetation within the vicinity of the Project Area is limited. Maunsell (2004) indicates that the Horrocks Beach Coastal Plan (Department of Planning and Urban Development, 1993) provides descriptions of dune vegetation (foredune, swales and stabilised dunes). Maunsell further indicates that in 1995, during a survey of proposed road alignment options between Horrocks and Kalbarri, Ecologia provided broad descriptions of the vegetation within the vicinity of the Project Area includes: *Acacia/Banksia* scrub, scrub heath coastal associations and *Eucalyptus* sclerophyll woodland.

Connell Wagner (2006) does not define vegetation types or associations within the Project Area during their search of the Declared Rare Flora taxon *Caladenia bryceana* subsp. *cracens* and associated habitat.

3.9.4 Threatened Ecological Communities

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered, and Vulnerable.

Some TECs are protected under the *EPBC Act.* Although TECs are not formally protected under the State *Wildlife Conservation Act 1950,* the loss of, or disturbance to, some TECs trigger the EPBC Act. The EPA's position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Possible TECs that do not meet survey criteria are added to the DEC's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. These are ecological communities that area adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

A search was undertaken of the DEC's TEC database. No TECs protected under the *Environment Protection and Biodiversity Conservation Act 1999* are known to be present within the Project Area (Department of Environment, Water, Heritage and the Arts, 2009b).

A search of the DEC's Threatened Ecological Communities (TEC) database was undertaken for the Project Area (Appendix C). No TECs are known to be located within the Project Area. No Priority Ecological Communities are known within or in the vicinity of the Project Area. A Priority 1 Ecological Community: Shrublands of the Northampton Area – dominated by Melaleuca species over exposed Kockatea Shale, is identified within 10 km of the Project Area. This ecological community will not be impacted by the Project.

3.10 Diseases and Pathogens

Phytophthora cinnamomi threatens over 2300 (40%) of different plant species in Western Australia. Once the pathogen infects the roots, the plant may begin to show symptoms of 'dying back', hence the common name used for the pathogen: Dieback. However, for many species 'sudden death' is a better description. Introduced following European settlement, *Phytophthora cinnamomi* is a soil-borne pathogen that kills a wide range of native plant species in the south west of Western Australia by attacking their root system. *Phytophthora cinnamomi* can also survive and reproduce on a wide range of native plant species without killing them. It has a widespread but discontinuous range in areas of the south-west with an annual rainfall above 400 mm (Dieback Consultative Council, 2001).

Indigenous species most affected by *Phytophthora cinnamomi* belong to four families: Proteaceae, Epacridaceae, Papilionaceae, and Myrtaceae. Not all genera within a family or all species within a genus are necessarily susceptible.

The Project Area occurs within this area and is considered likely to contain species susceptible to the *Phytophthora cinnamomi* pathogen. The field survey assessed the presence of Dieback in the Project Area (see Section 4.1.4).

3.11 Flora

3.11.1 Significant Flora

Flora species considered to be significant are listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the State *Wildlife Conservation Act 1950*. The DEC also keeps a list of Priority species that are not listed under legislation but for which the DEC feels there is cause for concern, or for which not enough information is known (Table 10 and Table 11, Appendix B).

An *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) Protected Matters Search was undertaken for the Project Area. Seven *EPBC* Act protected flora (5 *Endangered* and 2 *Vulnerable*) were identified as occurring or likely to occur within a 10 km buffer of the Project Area. These species are included in Table 12, Appendix B.

A search of the Department of Environment and Conservation's Threatened Flora Databases for Declared Rare and Priority Flora known to occur or likely to occur within the vicinity of the Project Area (10 km buffer). Descriptions of the flora taxa recorded from the search are presented in Table 12, Appendix B.

Four Declared Rare Flora (DRF) and 11 Priority Flora taxa were identified in the DEC search area.

The locations of these taxa are presented in Figure 3, Appendix A. Two of the identified flora taxa are located within the boundaries of the Project Area: the DRF *Caladenia bryceana* subsp. *cracens*; and the Priority 1 *Melaleuca huttensis*.

Of note: there are two location records of the DRF *Caladenia bryceana* subsp. *cracens*. One of these records is an old (outdated) recorded from the 1980s and the accuracy

and location of the record cannot be verified. This record is indicated to occur immediately south-west of the Project Area with a location of "Horrocks". The other record has been re-checked a number of times, and is confirmed as a known location of this DRF taxon.

3.11.2 Significant Flora Previously Recorded

Maunsell (2004) indicated that a search of the (then) Department of Conservation and Land Management's Threatened (Declared Rare) Flora database, Declared Rare and Priority Flora list and the Western Australian Herbarium database indicated seven DRF, six Priority 1, three Priority 3 and one Priority 4 species within the vicinity of the Project Area. Of these threatened flora, Maunsell (2004) indicates that only the DRF *Caladenia bryceana* subsp. *cracens* occurs within the Project Area.

Connell Wagner (2006) did not record any significant flora taxa from the Project Area. The search for *Caladenia bryceana* subsp. *cracens* was unsuccessful, deemed to be due to the dry 12 months preceding the survey.

ENV (2008) did not positively identify mature flowering specimens of the DRF *Caladenia bryceana* subsp. *cracens* from the Project Area, but did record a total of seven (7) vegetative leaves recorded from one location. This DRF was identified in its mature stage with the location also confirmed by staff from the DEC (C. Page, pers. comm.). ENV (2008) indicated the presence of a Priority 1 *Melaleuca huttensis* from the Project Area but did not report on the numbers or extent of this species.

Larry Smith Planning (2009) utilised Coffey Environments to undertake a search of the DEC's Declared Rare and Priority Flora database as well as review the Western Australian Herbarium specimen database for priority species opportunistically collected in the area of interest. In addition to the species recorded by this report's DEC database searches, Larry Smith Planning (2009) includes:

- *Acacia pelophila* Priority 1;
- *Acacia latipes* subsp. *licina* Priority 3;
- *Anthrotroche myoporoides* Priority 2;
- *Baeckea* sp. Nolba (M.E. Trudgen MET21632) Priority 1;
- *Philotheca wonganensis* Declared Rare Flora; and
- *Verticordia chrysostachys* var. *pallida* Priority 3

Comparing the results of the Larry Smith Planning (2009) DEC database searches, to that undertaken for this report, it appears that the search by Larry Smith Planning has been undertaken over larger search area and encompassed an increased number of significant flora taxa.

3.12 Fauna

3.12.1 Existing Fauna Records

A search of *NatureMap* (2009) records was undertaken for the Project Area, inclusive of a 10 km buffer. The *NatureMap* records show that 4 amphibian, 2 bird species, 2 mammal species and 5 reptile species have been officially recorded as present within the *NatureMap* search area (Table 17, Appendix D).

In the vicinity of the Project Area, Maunsell (2004) indicates that in 1995, during a survey of proposed road alignment options between Horrocks and Kalbarri, Ecologia recorded 56 species of birds, 9 species of mammals (6 introduced and 3 native), 12 reptile species and no amphibians.

3.12.2 Significant Fauna

The conservation of fauna species and their significance status is currently assessed under both State and Commonwealth Acts. The acts include the Western Australian *Wildlife Conservation Act* (1950); and the *Environment Protection and Biodiversity Conservation Act 1999*.

Commonwealth

The significance levels for fauna used in the *EPBC Act* are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). A description of Conservation Categories delineated under the *EPBC Act* and the circumstances under which a project will trigger referral to the DEWHA are described Appendix D.

The *EPBC Act* also protects migratory species that are listed under the following International Agreements:

- Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a range state under the Convention;
- The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA);
- The Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA); and
- Listed migratory species also include species identified in other international agreements approved by the Commonwealth Environment Minister.

The *Act* also protects marine species on Commonwealth lands and waters.

State

The *Wildlife Conservation Act* (1950) uses a set of Schedules but also classifies species using some of the IUCN categories (Table 14, Appendix D).

In Western Australia, the DEC also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the Western Australian *Wildlife Conservation Act* (1950) but for which the Department feels there is a cause for concern. These species have no special legislatory protection, but their presence would normally be considered. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Levels of Priority are described in Table 15, Appendix D.

Assessment

From the DEWHA and DEC databases, a number of protected fauna species were identified as potentially occurring within the Project Area (Table 16, Appendix D).

It should be noted that some species that appear in the *EPBC Act* Protected Matters Search Tool may not occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. The records from the DEC searches of threatened fauna provide more accurate information for the general area; however some records of sightings or trappings can be dated and often misrepresent the current range of threatened species.

4. Field Investigation Results

4.1 Vegetation

4.1.1 Vegetation Description

A total of 15 vegetation types were recorded from the Project Area during this study. The majority is Cleared / Degraded vegetation resulting from agricultural activities. Table 4 summarises the vegetation types recorded in the Project Area.

Vegetation Types have been mapped in Figure 4, Appendix A. Photographs and quadrat descriptions are in Appendix C.

4.1.2 Vegetation Condition

The majority of the native vegetation within the Project Area has been historically impacted from agricultural activities, with a large proportion cleared for sheep/wheat purposes. Sheep have been historically grazed right up to the cliff edge of the limestone areas immediately east of the Horrocks townsite, however this is now limited to east of the White Cliffs Road alignment.

Fire activity is not recent, with the last major fire occurring in the mid-1960's (R. Reynolds, R. Johnson, *pers. comm.*) towards the northern end of Horrocks townsite (centre and north of the Project Area).

Impact on vegetation condition also occurs from grazing from feral pigs, and from the dieback impact of the plant pathogen *Phytophthora cinnamomi*.

The vegetation in the Project Area was given a condition rating based on the Bush Forever (Government of Western Australia, 2000) vegetation condition ratings scale. This scale recognises a level of intactness of vegetation, which is defined by the following:

- Completeness of structural levels;
- Extent of weed invasion;
- Historical disturbance from tracks and other clearing or dumping;
- The potential for natural or assisted regeneration.

The ratings in this scale are described in Table 3. Vegetation condition across the Project Area is mapped in Figure 5, Appendix A.

Table 3 Government of Western Australia (2000) Vegetation Condition Scale

Assigned Number	Classification	Description
1	*Pristine or nearly so*	No obvious signs of disturbance
2	*Excellent*	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species
3	*Very Good*	Vegetation structure altered, obvious signs of disturbance
4	*Good*	Vegetation structure significantly altered by very obvious signs of multiple disturbance, retains basic vegetation structure or ability to regenerate it
5	*Degraded*	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	*Completely Degraded*	The structure of the vegetation is no longer intact and the area is completely or almost without native species

Table 4 Project Area Vegetation Types, Description and Condition Rating

Vegetation Type	Brief Description	Dominant Species	Vegetation Condition	Location
1	Cleared / Degraded	Pasture grasses and weeds:	6	Majority of south-east portion of Project Area. Includes roads and small sections near sand quarry, old rubbish tip and housing.
2	Mobile sand dunes with scattered native plants	*Acacia rostellifera, Spinifex longifolius*	2 to Not Applicable	Northern end of large blowout north of Horrocks townsite
3	Regrowth Acacia shrubland	*Acacia rostellifera,* pasture grasses and weeds	5	Recently cleared agricultural areas along the western side of White Cliffs Road and north east
4	Melaleuca huttensis heath	*Melaleuca huttensis, Stylobasium spathulatum, Acanthocarpus preissii, Dianella revoluta, Austrostipa macalpinei, Thysanotus manglesianus, Trachymene pilosa, Calandrinia* spp.	2 – 3	South-western portion of Project Area, west of White Cliffs Road. On shallow limestone soils
5	Melaleuca cardiophylla scrub	*Melaleuca cardiophylla, Rhagodia preissii, Diplolaena grandiflora, Templetonia retusa, Stylobasium spathulatum, Acanthocarpus preissii, Dianella revoluta Cassytha racemosa*	2 – 4	South-western portion of Project Area, west of White Cliffs Road. On shallow limestone soils, particularly along exposed cliff edge.
6	Eucalyptus grove	*Eucalyptus dolichochera, Melaleuca cardiophylla, M. huttensis, Templetonia retusa, Rhagodia preissii*	2	South-western portion of Project Area, west of White Cliffs Road. On shallow limestone soils

Vegetation Type	Brief Description	Dominant Species	Vegetation Condition	Location
7	Mosaic – mixed low heath	*Acacia rostellifera, Melaleuca huttensis, Templetonia retusa, Phyllanthus calycinus, Diplolaena mollis, Olearia axillaris, Austrostipa* spp.	3 – 5	Vegetation surrounding old rubbish tip site. Grades north into Acacia shrubland, south into Melaleuca heath / scrub, west into coastal scrub.
8	Coastal scrub on mobile dunes	*Acacia rostellifera, Olearia axillaris, Acanthocarpus preissii, Senecio pinnatifolius, Tetragona implexicoma, Threlkeldia diffusa*	2 – 4 (some areas n/a)	Vegetation north of Horrocks, surrounding blowout
9	Low coastal heath on foredunes	*Rhagodia preissii, Stylobasium spathulatum, Olearia axillaris, Acanthocarpus preissii, Senecio pinnatifolius, Tetragona implexicoma, Threlkeldia diffusa, Carpobrotus virescens, Spinifex longifolius*	2 – 4	Coastal strip along Little Bay Road, south of Little Bay
10	Mixed Myrtaceous heath (on limestone)	*Melaleuca cardiophylla, M. huttensis, Thryptomene baeckeacea, Templetonia retusa, Phyllanthus calycinus, Diplolaena mollis, Olearia axillaris, Austrostipa* spp.	2	Coastal limestone strip at Little Bay. Extends north beyond Project Area.
11	"Mix of Vegetation Type 9 and 10"	Mix of Vegetation Type 9 and 10. Major differences is that this veg type occurs on coastal sand, and is flat in topography, and is likely to be underlain by limestone at a relatively shallow depth. Contains *Melaleuca huttensis* within 5 m of beach.	3	Coastal limestone strip at Little Bay. Extends north beyond Project Area.
12	Mixed open Acacia scrub	*Acacia rostellifera, Pittosporum angustifolium, Pimelea microcephala, Diplolaena mollis, Zygophyllum fruticulosum, Trachymene pilosa, Guichenotia ledifolia, Austrostipa* spp.	3 – 4	Along White Cliffs Road, northern end of Project Area, both sides of road.

Vegetation Type	Brief Description	Dominant Species	Vegetation Condition	Location
13	Mosaic of low open Banksia woodland and mixed Myrtaceous scrub	*Banksia prionotes, Melaleuca huttensis, Grevillea leucopteris, Leucopogon* sp. Mid West, *Acacia rostellifera, A. spathulifolia, Thryptomene baeckeacea*	3 (dieback affected)	North-east corner of Project Area, from White Cliffs Road
14	Allocasuarina grove	Small grove of *Allocasuarina campestris*	3	North-east corner of Project Area, from White Cliffs Road
15	Very Open Banksia woodland over Myrtaceous scrub	*Banksia prionotes, Melaleuca huttensis, Leucopogon* sp. Mid West, *Acacia rostellifera, A. spathulifolia, Thryptomene baeckeacea, Jacksonia rigida, Mesomelaena pseudostygia, Dianella revoluta*	4	South east corner of Project Area, north of Horrocks Water Tank

4.1.3 Regional Significance of the Vegetation

Vegetation Types 2, 12, 13 and 15 can be considered to be comparable to the broader Vegetation Association Descriptions of Beard (Table 2). The coastal scrub vegetation (Types 8 and 9) are considered to be fairly representative of coastal vegetation of the southern half of Western Australia with all species common along the coast.

However, the *Melaleuca* dominated scrublands and heaths on the limestone areas do not fit into any of these Associations. The broad-scale nature of Vegetation Association mapping does not allow for small vegetation types to be adequately picked up. Within the Project Area, these the *Melaleuca* dominated scrublands and heaths tend to merge into each other, depending on soil depth and closeness to the coast. These vegetation types are not considered to be regionally significant, with similar *Melaleuca* dominated scrublands and heathlands relatively common in the regional area on limestone. Within the local area, better quality, less disturbed *Melaleuca* vegetation types were observed occurring the north of the Project Area, along the cliff edges north of Little Bay.

4.1.4 Diseases and Pathogens

Dieback caused by the infestation of *Phytophthora cinnamomi* is considered to be rife through the Project Area. Dieback susceptible vegetation occurs throughout the Project Area.

Comments from the DEC (2nd February 2009) indicate that it is unlikely for *Phytophthora cinnamomi* to occur in the area as:

i) there are currently no confirmed infestations of *Phytophthora cinnamomi* north of the Eneabba area; and

ii) *Phytophthora cinnamomi* is known to be uncommon in areas containing coastal limestone.

GHD concurs with the comments made by the DEC, and as such considers that it the presence of the Dieback pathogen in the Project Area is unlikely.

4.1.5 Threatened Ecological Communities

No Threatened Ecological Communities were recorded from the Project Area.

No Priority Ecological Communities were recorded from the Project Area.

4.2 Flora

The field survey recorded a total of 221 flora taxa from 71 families within the Project Area. The Project Area is considered to contain a medium to high level of diversity, based on the fact that a number of different habitats (coast, limestone, deep sands) are present. The diversity of flora taxa recorded is considered to be slightly elevated due to the presence of weed species. Of the 221 flora taxa, 40 are weed / introduced species.

Dominant families recorded from the Project Area were:

- Asteraceae (daisies) 19 taxa;

- Poaceae (grasses) 17 taxa;
- Myrtaceae (melaleuca) 13 taxa;
- Papilionaceae (peas) 12 taxa;
- Proteaceae (banksia, grevillea) 9 taxa; and
- Orchidaceae (orchids) 8 taxa.

Dominant genera recorded from the Project Area were:

- *Caladenia* 5 taxa;
- *Melaleuca* 5 taxa;
- *Acacia* 5 taxa; and
- *Grevillea* 4 taxa.

For a full list of flora taxa recorded from the Project Area, see Table 13, Appendix B.

4.2.1 Significant Flora Species

Declared Rare Flora

One Declared Rare Flora (DRF) taxon was recorded from the Project Area: *Caladenia bryceana* subsp. *cracens* was relocated at the known location. No mature plants were recorded during the field survey. Three basal leaves of this DRF were recorded from this site. Two other common orchid species were also recorded at this location.

Plate 1 Declared Rare Flora *Caladenia bryceana* subsp. *cracens* basal leaf

No other Declared Rare Flora species were recorded from the Project Area.

Of note, a Declared Rare Flora species *Drakaea concolor* was recorded to the north-east of the Project Area during the field survey. A total of 41 basal leaves of this species were recorded in a small area approximately 500 m north-east of the Project Area boundary. Habitat for this species was not recorded within the Project Area.

Plate 2 Declared Rare Flora *Drakaea concolor* basal leaf from north of the Project Area

Priority Flora

The Priority 1 flora species *Melaleuca huttensis* was recorded from the Project Area. This species was considered to form a dominant portion of the flora recorded, and was located in coastal areas to limestone areas and also in deeper sands in the north east.

This taxon was typically growing between 0.5 and 1.5 m tall and was in full flower at the time of survey.

Plate 3 Melaleuca huttensis occurring as dominant species in scrub-heath vegetation (Left) and close to the coast (Right)

Figure 6 (Appendix A) shows the spread of records across the Project Area. This taxon was also considered to be relatively common in similar vegetation to the north and south of the Project Area.

Plate 4 Priority 1 flora taxa *Melaleuca huttensis*

No other Priority Flora taxa were recorded from the Project Area.

Locally Significant Flora Species

No plant species occurring at the limit of or exhibiting an extension to their known range was recorded from the Project Area.

Three taxa were recorded from the Project Area as filling in a gap in their recorded range:

- *Dysphania sphaerosperma*;
- *Triglochin trichophora*; and
- *Poa drummondiana*.

None of these species are considered to be rare or threatened.

4.2.2 Weed Species

A total of 40 weed and introduced species were recorded from the Project Area. These were dominated by the grasses (Poaceae), daisies (Asteraceae) and peas (Papilionaceae), all of which form a dominant component of pasture.

Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WONS) is based on four major criteria: invasiveness; impacts; potential for spread; and socio-economic and environmental values.

One WONS was recorded from the Project Area: *Tamarix aphylla* (Athel Pine) was recorded from Little Bay in the west of the Project Area.

Declared Plants

Weeds that are, or may, become, a problem to agriculture or the environment can be formally classified as Declared Plants under the *Agriculture and Related Resources Protection Act, 1976* (ARRP Act). The Department of Agriculture and Food (DAFWA) and the Agriculture Protection Board maintains a list of Declared Plants for Western Australia. If a plant is declared for the whole of the State or for particular Local Government Areas, all landholders are obliged to comply with the specific category of control. Declarations specify a category, or categories, for each plant according to the control strategies or objectives which the Agriculture Protection Board believes are appropriate in a particular place.

Among the factors considered in categorising declared plants are:

- The impact of the plant on individuals, agricultural production and the
- Community in general;
- Whether it is already established in the area, and
- The feasibility and cost of possible control measures.

These Declared Plants are divided into 5 classes, which are detailed in Table 5.

Table 5 Department of Agriculture and Food Declared Plant Control Classes.

Control Class Code	Description
P1	Prohibits movement of plants or their seeds within the State. This prohibits the movement of contaminated machinery and produce including livestock and fodder.
P2	Eradicate infestation to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.
P3	Control infestation in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants.
P4	Prevent the spread of infestation from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set on all plants.
P5	Infestations on public lands must be controlled.

The classes are specifically applied to municipal areas including shires, councils, and cities, and may not necessarily be broadly applied to the whole state.

Three Declared Plants pursuant to the *Agriculture and Related Resources Protection Act 1976* were recorded from the Project Area:

- *Tamarix aphylla*: Athel Pine (P1);
- Emex australis: Doublegee (P1, P3, P4, P5); and
- *Echium plantagineum*: Paterson's Curse (P1, P3, P4).

Of note, *Emex australis* does not have any control codes applicable to the Shire of Northampton; and *Echium plantagineum* has only the P1 control code applicable to the Shire of Northampton.

Environmental Weeds

The Environmental Weed Strategy for Western Australia (1999) developed a set of criteria for the assessment and rating of weeds in terms of their environmental impact on biodiversity. The criteria were determined through a workshop involving participants from the (then) CALM, CSIRO, the (then) Agriculture Western Australia, the (then) Water and Rivers Commission and relevant community group representatives.

Weeds were rated in broad groups such as high impact, medium impacts and low impacts, rather than rank them from the worst to the least important weed. The final

criteria arrived following workshop activities and review and evaluation by weed experts were:

- **Invasiveness** - ability to invade bushland in good to excellent condition or ability to invade waterways. (Scored as yes or no).
- **Distribution** - wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world. (Scored as yes or no).
- **Environmental Impacts** - ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community. (Scored as yes or no).

The rating of each weed was to be determined by the following scoring system (Table 6).

Table 6 Environmental Weed Rating Definitions

Environmental Weed Rating	Definition
High	A weed species would have to score yes for all three criteria. Rating a weed species as high would indicate prioritising this weed for control and/or research i.e. prioritising funding to it
Moderate	A weed species would have to score yes for two of the above criteria. Rating a weed species as moderate would indicate that control or research effort should be directed to it if funds are available, however it should be monitored (possibly a reasonably high level of monitoring).
Mild	A weed species scoring one of the criteria. A mild rating would indicate monitoring of the week and control where appropriate
Low	A weed species would score none of the criteria. A low ranking would mean that this species would require a low level of monitoring.

Weed species in Western Australia also include taxa that have yet to be advised of a rating level, and those taxa not considered by this process. Within the Project Area, the following environmental weed ratings have been allocated:

- High 5 taxa;
- Moderate 20 taxa;
- Mild 7 taxa; and
- Low 6 taxa

4.3 Fauna

The Level 1 reconnaissance fauna survey was conducted over a period of 3 days, in conjunction with the vegetation and flora survey. The fauna survey examined terrestrial vertebrate fauna species only, and was limited to diurnal searches. The climate during the field survey was variable, with wind, sun and rain all occurring over the duration. The survey was conducted during an optimal time for a field flora survey, which results in a likely paucity of fauna records (particularly reptiles). The lack of a record of amphibians within the Project Area was somewhat surprising, with residual moisture present from Winter rains and human habitation.

4.3.1 Fauna Species

The reconnaissance fauna survey recorded 33 bird species, 6 mammal species (one native), three reptile species and no amphibians.

A full list of observed fauna is provided in Table 17, Appendix D.

4.3.2 Threatened and Priority Fauna

No threatened fauna species were recorded during the field survey.

The desktop assessment indicated that a number of protected fauna may occur within the Survey Area (refer to Section 3.12.2). The habitat requirements of these species and the likelihood of their occurrence in the Project Area (with information from the field survey) are considered as follows:

Tristan Albatross (*Diomedea exulans exulans*) Endangered, Listed Marine, Listed Migratory [EPBC Act 1999]

The Tristan Albatross is a migratory marine species. It forages in open waters within the Atlantic Ocean and generally remains in the marine environment apart from during its breeding season, where nesting occurs on Inaccessible Island and Gough Island (DEWHA, 2009b).

Assessment: The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.

Indian Yellow-nosed Albatross (*Thalassarche carteri*) Vulnerable, Listed Marine, Listed Migratory [*EPBC Act 1999*]

Global populations of the Indian Yellow-nosed Albatross are estimated at between 160,000 and 180,000 birds. The species breeds on islands of the southern Indian Ocean. The species generally occupies inshore and offshore waters while in Australasian waters, concentrating in areas with calm seas and light winds (DEWHA, 2009b).

Assessment: The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.

Shy Albatross, Tasmanian Shy Albatross (*Thalassarche cauta cauta*) Vulnerable, Listed Marine, Listed Migratory [*EPBC Act 1999*]

The Shy Albatross is thought to occur all over Australian coastal waters below 25° S. It is less pelagic than other Albatross species and has been known to enter bays and harbours. Breeding occurs on Islands of the south of Tasmania (DEWHA, 2009b).

Assessment: The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) Endangered [EPBC Act 1999] Schedule 1 [WC Act 1950]

Carnaby's Black-Cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain Salmon Gum and Wandoo, and in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea species (DEWHA, 2009b).

Assessment: There are a number of species suitable as forage in the north and east of the Project Area (banksia and myrtaceous scrub). The Project Area does not contain habitat suitable for refuge or breeding for this species. This area is at the extreme northern end of this species' range, and while it may use the north and east of the Project Area it is likely to be as a vagrant.

Peregrine Falcon (*Falco peregrinus*) Schedule 4 [WC Act 1950]

The Peregrine Falcon has a wide global range, occurring in many countries around the world. It is currently assessed as Least Concern in the ICUN Red List of Threatened Species, as global population trends are thought to be relatively stable (Birdlife International, 2008).

Assessment: This species is considered likely to occur in the Project Area. Habitat suitable for refuge (breeding and foraging) occurs in the Project Area. This species was not recorded in the Project Area, but has been recorded in the vicinity (NatureMap).

Australian Lesser Noddy (*Anous tenuirostris melanops*) Vulnerable, Listed Marine [EPBC Act 1999]

The Australian Lesser Noddy is a gregarious, marine species, with flock sizes increasing during breeding season then breaking down into smaller flocks for the remainder of the year. It is usually only found around its breeding islands in the Houtman Abrolhos. It is considered likely that they may leave the breeding islands for short periods in between breeding seasons and that they may forage widely during this time (DEWHA, 2009c).

Assessment: The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.

White-browed Babbler (western wheatbelt) (*Pomatostomus superciliosus ashbyi*) Priority 4 [DEC]

This species inhabits eucalypt forests and woodlands where they create bulky domed nests for breeding and roosting. They forage near the ground where they forage on insects and seeds. The species is generally restricted to larger fragments of remnant vegetation as they do not seem to cope well with introduced edges (Garnett and Crowley, 2000).

Assessment: This species may occur in the Project Area. It is known to occur in similar habitat to the south and north of the Project Area. This species was not recorded during this survey.

Bush Stonecurlew (*Burhinus grallarius*) Priority 4 [DEC]

This species is a nocturnal feeding insectivore that inhabits open forest and woodlands. It prefers habitats with high levels of fallen vegetable matter on the ground. Feeding usually occurs in open country and birds will often feed on paddocks or stubble when occurring in agricultural areas. Breeding pairs will generally occupy stable territories (Birdlife International 2008b).

Assessment: This species may occur in the Project Area. It has been recorded in the vicinity in the past (NatureMap). Habitat is considered to be suitable within northern and eastern portions of the Project Area.

Southern Giant-Petrel (*Macronectes giganteus*) Endangered, Listed Marine, Listed Migratory [EPBC Act 1999]

The Southern Giant-Petrel is a migratory species which breeds on sub-Antarctic and Antarctic islands. It disperses widely during the Antarctic winter and can be found off South America, South Africa, Australian and New Zealand. They are a marine species. There majority of their feeding is done at the ocean surface however they will occasionally dive for food (DEWHA, 2009c).

Assessment: The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.

Northern Giant-Petrel (*Macronectes halli*) Vulnerable, Listed Marine, Listed Migratory [EPBC Act 1999]

This species breeds in the sub-Antarctic and migrates to areas off the Australian mainland during the winter months. They are commonly seen in inshore waters along the southern coast of Australia between Freemantle and Sydney. Their diet is made up of fish and scavenged meet from dead carcases (i.e. penguins and seals), they are also known to follow fishing boats to scavenge offal (DEWHA, 2009c).

Assessment: The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.

Soft-plumaged Petrel (*Pterodroma mollis*) Vulnerable, Listed Marine [EPBC Act 1999]

Known breeding grounds for this species are restricted to Maatsuyker Island, off southern Tasmania. The species is generally restricted to marine environments and is most numerous between 30S and 50S in the southern Indian Ocean and between 30S and 60S in the South Atlantic. Their diet consists of cephalopods, fish and crustaceans (DEWHA, 2009c).

Assessment: The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.

Tammar Wallaby (*Macropus eugenii derbianus*) Priority 5 [DEC]

Tammar Wallabies generally occur in areas of dense shrub or in more open pasture including coastal scrub, heath, dry sclerophyll woodland and mallee. Males can reach up to 10 kg but the average size is 7.5 kg, females tend to be smaller with an overage of 5.5 kg and the largest only reaching 6 kg. They are grazers and may be found to aggregate on foraging sites.

Assessment: This species has been recorded from the Project Area in the past (NatureMap). Habitat is considered to be suitable within the Project Area, however, this species prefers dense thickets which are more prevalent to the north and east of the Project Area. Much of the Project Area has been subject to historical disturbance, reducing the risk that this species will utilise the Project Area exclusively. This species was not recorded during the field survey.

Shield-backed Trapdoor Spider (*Idiosoma nigrum*) Schedule 1 [WC Act 1950]

The Shield-backed Trapdoor Spiders are found in eucalypt-acacia dry woodlands and schlerophyll open forests in the south-west of Australia. They construct burrows of up to 32 cm with leaf and twig trip-lines radiating out from the mouth. The spiders wait in the burrow entrance and dart out to capture prey that disturbs the trip-lines. The species is under threat due to habitat loss and clearing (DEWHA, 2009x?).

Assessment: This species is known to occur in relatively coastal areas in the region. Although invertebrates were not specifically targeted during this survey, Shield-back Trapdoor Spider burrows are relatively distinctive, and a search for burrows was included during the reconnaissance survey. No burrows were recorded during this survey. This species is considered unlikely to occur in the Project Area due to the relatively open nature of the vegetation.

Migratory and Marine Species

A number of Migratory and/or Marine species, protected under the *EPBC Act,* may occur in the Project Area. Most migratory species, if occurring in the area, will be present as foraging species during the winter. Many of these migratory species are considered common in Western Australia and do not have special protection under the Western Australian *Wildlife Conservation Act 1950.* Table 7 provides comment on the likelihood of these species occurring in the Project Area.

Table 7 Migratory and Marine Species listed for the Project Area on the EPBC Protected Matters Search Tool

Species	Status	Comment
White-bellied Sea Eagle *Haliaeetus leucogaster*	Migratory (CAMBA) Marine	Has been recorded (this survey) to fly over the Project Area. This species was recorded using the updraft of the cliff edges to fly between areas of foraging habitat.
Cattle Egret *Ardea ibis*	Migratory (CAMBA, JAMBA), Marine	May occur in the Project Area as a vagrant.
Rainbow Bee-eater *Merops ornatus*	Migratory (JAMBA) Marine	May occur in the Project Area. Not recorded during the field survey.
Great Egret *Ardea alba*	Migratory (CAMBA, JAMBA) Marine	May occur in the Project Area as a vagrant.
Fork-tailed Swift *Apus pacificus*	Migratory (CAMBA, JAMBA, ROKAMBA) Marine	May occur in the Project Area as a vagrant.
Yellow-nosed Albatross *Thalassarche chlororhynchos*	Migratory (BONN) Marine	May occur in the Project Area as a vagrant.
Great Skua *Catharacta skua*	Marine	May occur in the Project Area as a vagrant.

A number of other Migratory and Marine Listed fauna species were recorded during this survey and are listed in Table 17, Appendix D.

4.3.3 Introduced Fauna Species

A total of six introduced fauna species were recorded from the Project Area (1 bird species, 5 mammal species) and are listed in Table 17, Appendix D. The Laughing Turtle-dove and European Rabbit were the most commonly observed throughout the Project Area.

4.3.4 Habitat Types and Habitat Linkages

Six main habitat types were identified within the Project Area: Cleared/Degraded; Mobile Sand Areas; Open Acacia scrubland; Mixed Low Scrub / Heath on Limestone; Mixed Coastal Scrub on Sand; and Open Banksia Woodlands over Low Scrub / Heath. These habitat types are shown in Table 8, and are mapped in Figure 7 (Appendix A).

Based on the field survey, habitat exists for a diverse range of fauna species in the Project Area. This habitat is somewhat degraded, however, due to the historical clearing undertaken for agricultural purposes. Weed species have invaded a lot of the Project Area, and, combined with Dieback impacts, has opened out the scrub and woodlands. Better quality habitat is restricted to smaller areas, particularly limestone dominated heaths, and areas to the north of the Project Area, which remain contiguous with other, larger habitat.

Remaining habitat, particularly the open woodland areas are small and isolated, restricting movement to larger fauna and bird species.

Leaf litter is present throughout the Project Area due to age since last fire, which is suitable for small mammals and reptile species.

The vegetation and habitat types located in the Project Area are considered to be relatively common in the local area, with similar fauna habitat exists in the areas surrounding the Project Area. Better quality, more extensive habitat occurs to the north of the Project Area.

Table 8 Habitat types recorded in the Survey Area

Habitat Type	Photo
Cleared / Degraded: includes open fields and pasture, roads, and firebreaks	

Habitat Type	Photo
Mobile Sand Areas	
Open Acacia Scrubland	
Mixed Low Scrub / Heath on limestone	

Habitat Type	Photo
Mixed Low Coastal Scrub on Sand	
Open Banksia Woodland over Low Scrub / Heath	

4.3.5 Fauna Impacts

Clearing of vegetation in the Project Area is considered to likely to have an impact on fauna species. If managed carefully, it is not considered that the clearing of vegetation will significantly alter the fauna habitat of the region. Disturbance is most likely to occur on a local scale, impacting individual animals, rather than a species. The Project Area adjoins similar contiguous vegetation and habitat to the north.

Impacts are likely to occur to individual animals and include:

- Loss of habitat and feeding areas. There will be a loss of refuge vegetation and associated foraging resources; and
- Harm/deaths/displacement of individual animals. This may occur during clearing activities.

5. Requirement for Referral

5.1 Vegetation Clearing

Clearing applications are assessed against ten principles outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003*. These principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way. The principles address three main environmental areas:

- Biodiversity significance
- Land degradation
- Ground and surface water quality.

These principles apply to all lands throughout Western Australia. If the project involves significant impacts other than on native vegetation, or the clearing is exempt under Section 51C but is considered likely to have a significant impact, it should be referred to the EPA for consideration.

Any clearing of native vegetation will require a permit under Part V of the *Environmental Protection Act 1986*, except where exemptions apply under Schedule 6 of the Act or are prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, and not in an ESA.

An examination of the Ten Clearing Principles applied against the finding of this flora and fauna assessment is undertaken in Table 9.

Any clearing of native vegetation within the Project Area has been assessed to be:

- At variance with clearing principles (c1), (c3), (e1) and (e4); and
- May be at variance with clearing principles (a1), (b3), (b4) and (h4).

With regards to significant flora (Clearing Principle c): the "at variance" assessment has not been deemed to be significant, due to the fact that: the Declared Rare Flora known from the Project Area will be protected as part of any structure plan; and the Priority 1 species is considered to be abundant in the local area.

With regards to the vegetation extent remaining in the Project Area (Clearing Principle e): consideration may be given by the DEC to the allowance of clearing of this vegetation (with conditions). However, as this vegetation is already considered to be *Vulnerable* in extent, any application for clearing may be declined.

On the basis of this assessment, the application for a clearing permit from the DEC may to be declined.

5.2 Requirement for Referral

The results of this biological survey indicate that the clearing of the vegetation, flora and fauna habitat within the Project Area is considered likely to require referral to the EPA.

Table 9 Assessment of Project Against Ten Clearing Principles

Principle	Criteria	Assessment	Outcome
a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	a1) Native vegetation should not be cleared if it is representative of an area of outstanding biodiversity in the Bioregion.	221 flora taxa and 42 fauna species were recorded within the Project Area. Approximately 20% of the flora taxa were weed species, indicating that the diversity of native vegetation has been reduced by historical clearing and ongoing agricultural practices. The Project Area is considered to contain a medium to high level of diversity. Other equivalent or better areas occur outside the Project Area, due to less historical disturbance.	**May be at variance with clearing principle.**
	a2) Native vegetation should not be cleared if it has higher diversity of indigenous aquatic or terrestrial plant or fauna species than native vegetation of that ecological community in good or better condition in the Bioregion.	The remnant native vegetation within the Project Area is generally considered to be in a Good or better condition. Other areas within the vicinity of the Project Area are considered to contain vegetation and associated fauna habitat in better condition. Other equivalent or better areas occur outside the Project Area, due to less historical disturbance.	Not considered to be at variance with clearing principle.
	a3) Native vegetation should not be cleared if it has higher diversity of indigenous aquatic or terrestrial plant or fauna species than the remaining vegetation of that ecological community in the local area.	Remnant native vegetation was not considered to contain a higher diversity of indigenous aquatic or terrestrial plant or fauna species than the remaining vegetation of that ecological community in the local area. Other equivalent, or better areas occur outside the Project Area (particularly to the north), due to less historical disturbance.	Not considered to be at variance with clearing principle.
	a4) Native vegetation should not be cleared if it has higher ecosystem diversity than other native vegetation of that local area.	Native vegetation within the Project Area is not considered to have a higher ecosystem diversity than other native vegetation of that local area. Other equivalent or better areas occur outside the Project Area, due to less historical disturbance.	Not considered to be at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	a5) Native vegetation should not be cleared if it has higher genetic diversity than the remaining native vegetation of that ecological community.	Native vegetation is not considered to have a higher genetic diversity than the remaining native vegetation of that ecological community. Other equivalent or better areas occur outside the Project Area, due to less historical disturbance.	Not considered to be at variance with clearing principle.
b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	b1) Native vegetation should not be cleared if it is or is likely to be habitat for fauna that is declared Specially Protected under the *Wildlife Conservation Act*.	Where native vegetation remained, it is generally considered to contain habitat for a number of fauna species, including threatened fauna. In the main, the habitat in the Project Area is considered to contain areas likely to be used by protected fauna for foraging purposes rather than breeding or for refuge. As such, protected fauna are not likely to be resident within the Project Area. Habitat within the Project Area is generally considered to have been reduced in quality due to historical clearing activities. Better quality, more continuous habitat occurs to the north of the Project Area. Habitat within the Project Area should be retained, where possible.	Considered unlikely to be variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	b2) Native vegetation should not be cleared if it is or is likely to be habitat for Priority Listed Fauna.	Where native vegetation remained, it is generally considered to contain habitat for a number of fauna species, including threatened fauna. In the main, the habitat in the Project Area is considered to contain areas likely to be used by protected fauna for foraging purposes rather than breeding or for refuge. As such, protected fauna are not likely to be resident within the Project Area. Habitat within the Project Area is generally considered to have been reduced in quality due to historical clearing activities. Better quality, more continuous habitat occurs to the north of the Project Area. Habitat within the Project Area should be retained, where possible.	Considered unlikely to be variance with clearing principle.
	b3) Native vegetation should not be cleared if it is or is likely to be habitat for fauna that is otherwise significant.	Habitat remains within the Project Area that exists in a largely cleared landscape. Where larger areas of remnant vegetation occurs within the Project Area, consideration of management options should be undertaken to retain habitat corridors, and protect areas of continuous habitat.	**May be at variance with clearing principle.**
	b4) Native vegetation should not be cleared if it provides significant habitat for fauna species in the local area.	Remnant native vegetation within the Project Area is considered to provide significant habitat for fauna species in the local area, largely due to the fact that much of the surrounding area has been cleared of native vegetation. Similar or better condition fauna habitat is known to occur in the local area. Larger, continuous habitat occurs north of the Project Area. Where larger areas of remnant vegetation occurs within the Project Area, consideration of management options should be undertaken to retain habitat corridors, and protect areas of continuous habitat.	**May be at variance with clearing principle.**

Principle	Criteria	Assessment	Outcome
	b5) Native vegetation should not be cleared if it maintains ecological functions and processes that protect significant habitat for fauna.	Although much of the Project Area has been impacted by historical clearing for agricultural purposes, the remaining vegetation is fairly extensive and provides fauna habitat. The clearing of native vegetation is considered likely alter ecological functions and processes that protect locally significant habitat. Similar or better condition fauna habitat is known to occur in the local area. Larger, continuous habitat occurs north of the Project Area. Where larger areas of remnant vegetation occurs within the Project Area, consideration of management options should be undertaken to retain habitat corridors, and protect areas of continuous habitat.	**May be at variance with clearing principle.**
	b6) Native vegetation should not be cleared if it forms, or is part of, an ecological linkage that is necessary for the maintenance of fauna.	One major ecological linkages run through the Project Area, particularly related to remnant native vegetation along the limestone cliffs west of White Cliffs Road. Much of the area contains bushland contiguous with the surrounding area. This linkage is unlikely to be severed by the proposed development. The Project Area contains isolated remnants that may be useful for larger mammals and bird species to use as stepping stones. Where larger areas of remnant vegetation occurs within the Project Area, consideration of management options should be undertaken to retain habitat corridors, and protect areas of continuous habitat.	Not considered to be at variance with clearing principle.
	b7) Native vegetation should not be cleared if it provides significant habitat for fauna communities (assemblages) and meta-populations.	The Project Area is not considered to contain significant habitat for faunal assemblages that is not also present adjacent to the Project Area. The Project Area is not considered to contain a set of geographically isolated fauna populations.	Not considered to be at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	c1) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of populations of Declared Rare Flora under the *Wildlife Conservation Act 1950*.	One Declared Rare Flora is known from the area (Caladenia bryceana subsp. cracens), and was recorded during the field survey. Seaview Farms has indicated that the location (and surrounds) of this DRF will be protected as part of Public Open Space. No other DRF were recorded from the Project Area	**At variance with clearing principle.**
	c2) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of other significant flora.	No flora species at the ends of known ranges or in geographical isolation were recorded from the Project Area.	Not at variance with clearing principle.
	c3) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of significant habitat for priority flora species published by the Department of Environment and Conservation.	Priority Flora species were recorded from the Project Area. Melaleuca huttensis (Priority 1) was recorded from the Project Area. This species was extremely common in the Project Area, forming a dominant part of many vegetation types. This species was recorded to the north and south of the Project Area. No significant habitat for the continued existence of Priority Flora species will be impacted by the proposed works.	**At variance with clearing principle.**
d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.	d1) Native vegetation should not be cleared if threatened ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* are present.	No TECs will be impacted by the proposed works. No TECs are known from the vicinity of the Project Area.	Not at variance with clearing principle.
	d2) Native vegetation should not be cleared if it is necessary for the maintenance of Threatened Ecological Communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.	No EPBC Act TECs or associated native vegetation will be will be impacted by the proposed works.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	d3) Native vegetation should not be cleared if other significant ecological communities are present.	No other significant ecological communities area known from the Project Area	Not at variance with clearing principle.
	d4) Native vegetation should not be cleared if it is necessary for the maintenance of other significant ecological communities.	No DEC listed TECs or associated native vegetation will be will be impacted by the proposed works.	Not at variance with clearing principle.
	d5) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of significant examples of priority threatened ecological communities published by the Department of Environment and Conservation.	No Priority Ecological Communities are known to occur within the Project Area.	Not at variance with clearing principle.
e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	e1) Native vegetation should not be cleared if the remaining native vegetation represents less than 30%, or the clearing would reduce the representation of remaining native vegetation to less than 30% in the Bioregion (or subregion where applicable).	Vegetation Associations known from the Project Area are considered to be *Depleted* (32%) or *Vulnerable* (18.9% remaining) within the Geraldton Sandplains IBRA region	**At variance with the clearing principle.**
	e2) Native vegetation should not be cleared if an ecological community represents less than 30% of its original extent or clearing would reduce the representation of any ecological community to less than 30% of its original extent in the Bioregion (or subregion where applicable).	No information is available to delineate extents of ecological communities within the Bioregion Vegetation Associations known from the Project Area are considered to be *Depleted* (32%) or *Vulnerable* (18.9% remaining) within the Geraldton Sandplains IBRA region	Unknown if at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	e3) Native vegetation should not be cleared if clearing would reduce an ecological community to less than 1% of the Bioregion (or subregion where applicable)	No information is available to delineate extents of ecological communities within the Bioregion. No TECs will be impacted by the proposed works. Vegetation complexes within the survey area are considered to be of Least Concern (i.e. greater than 30% remaining).	Not considered to be at variance with clearing principle.
	e4) Native vegetation should not be cleared if the remaining native vegetation represents less than 30% or the clearing would reduce the representation of remaining native vegetation to less than 30% in the Local Area.	There is no information available to delineate extents remaining in the Local Area. The Shire of Northampton is listed as containing 18.6% of its vegetation extent remaining (Shepherd et al., 2002). This is considered to be *Vulnerable.*	**At variance with clearing principle.**
	e5) Native vegetation should not be cleared if an ecological community represents less than 30% of its original extent or clearing reduce the representation of any ecological community to less than 30% of its original extent in the Local Area.	There is no information available to delineate extents of ecological communities remaining in the Local Area. No TECs will be impacted by the proposed works. . The Shire of Northampton is listed as containing 18.6% of its vegetation extent remaining (Shepherd et al., 2002). This is considered to be *Vulnerable*	Not at variance with clearing principle.
	e6) Native vegetation should not be cleared if clearing would reduce any ecological community to less than 1% of the Local Area.	There is no information available to delineate extents of ecological communities remaining in the Local Area. No TECs will be impacted by the proposed works. . The Shire of Northampton is listed as containing 18.6% of its vegetation extent remaining (Shepherd et al., 2002). This is considered to be *Vulnerable*	Not at variance with clearing principle.
f) Native vegetation should not be cleared if it is growing in, or in association with, an	f1) Native vegetation should not be cleared if it is growing in a watercourse or wetland that has been identified as having significant environmental values.	There are no wetlands or watercourses that have been identified as having significant environmental values occurring within or in the vicinity of the Project Area.	Not considered to be at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	f2) Native vegetation should not be cleared if it provides a buffer area for watercourses and wetlands identified in criteria (f1) and (f2).	Riparian vegetation is not present in the Project Area. There are no wetlands or watercourses that have been identified as having significant environmental values occurring within or in the vicinity of the Project Area.	Not considered to be at variance with clearing principle.
	f3) Native vegetation should not be cleared if water tables are likely to change and adversely affect ecological communities that are wetland or groundwater dependent.	The clearing of the Project Area is considered unlikely to alter water tables, or alter ecological communities that are wetland or groundwater dependent.	Not considered to be at variance with clearing principle.
	f4) Native vegetation should not be cleared if it is growing in other watercourses or wetlands.	The EPA Position Statement No 4 *Environmental Protection of Wetlands* has as a goal, no net loss of wetland values and functions. No wetlands or watercourses occur in the Project Area.	Not at variance with clearing principle.
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	g1) Native vegetation should not be cleared if wind or water erosion of soil is likely to be increased (on or off site).	Short-term Soil erosion will occur within this project due to landscape development requirements. Long-term soil erosion can be mitigated by use of appropriate rehabilitation regimes.	Not considered to be at variance with clearing principle.
	g2) Native vegetation on land with soils with high or low pH should not be cleared.	No vegetation on soils with significantly low (or high) pH will be impacted by the proposed works. Acid sulphate soils are not considered to be disturbed by the proposed project as any acid generating material is considered to be associated with coal bearing ores which will not be disturbed by the project.	Not considered to be at variance with clearing principle.
	g3) Native vegetation should not be cleared if water logging is likely to be increased (on or off site).	Soils in the project area have a low risk of waterlogging. It expected that waterlogging would not be increased as much of the native vegetation has already been cleared from the Project Area.	Not considered to be at variance with clearing principle

Principle	Criteria	Assessment	Outcome
	g4) Native vegetation should not be cleared if land salinisation is likely to be increased (on or off site).	Soil salinity may alter in the Project Area (on or off site) by the clearing of native vegetation. The clearing of the Project Area is considered not to significantly alter salinity on or offsite	Not considered to be at variance with clearing principle.
h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	h1) Native vegetation should not be cleared if it contributes significantly to the environmental values of a conservation area.	There are no conservation areas within the vicinity of the Project Area.	Not at variance with clearing principle.
	h2) Native vegetation should not be cleared if that vegetation provides a buffer to a conservation area.	There are no conservation areas within the vicinity of the Project Area.	Not at variance with clearing principle.
	h3) Native vegetation should not be cleared if the land contributes to an ecological linkage to a conservation area.	The clearing of vegetation is likely to impact on an ecological linkage. However, the majority of this linkage will be protected (cliff edge / limestone ridge). In addition, there are no conservation areas within the vicinity of the project area.	Not at variance with clearing principle.
	h4) Native vegetation should not be cleared if it provides habitats not well represented on conservation land.	It is not known whether the habitats in the Project Area occur on conservation land. Fauna habitats are considered to be in better condition to the north of the Project Area.	**May be at variance with clearing principle.**
i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	i1) Native vegetation should not be cleared if clearing the vegetation will reduce the quality of surface or underground water in proclaimed, gazetted or declared areas or catchments.	The Project Area is not located in an area which is also a proclaimed Public Drinking Water Source Area under the *CAWS Act*. The potential clearing of native vegetation is considered unlikely to cause deterioration in the quality of surface or underground waters within the nearest drinking water area to the north-east.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	i2) Native vegetation should not be cleared if sedimentation, erosion, turbidity or eutrophication of water bodies on or off site is likely to be caused or increased.	Sedimentation, erosion and turbidity are considered likely to increase during the clearing of the Project Area. However, this can be mitigated using appropriate management techniques.	Not considered to be at variance with clearing principle.
	i3) Native vegetation should not be cleared if water tables are likely to change significantly altering salinity or pH.	The clearing of native vegetation is not considered to alter the quality of surface or ground waters within the Project Area.	Not considered likely to be at variance with clearing principle.
	i4) Native vegetation should not be cleared if the clearing is likely to alter the water regimes of groundwater-dependent ecosystems (GDEs) on or off site, causing degradation to the biological communities associated with these systems.	The clearing of native vegetation will alter the regimes of surface or ground waters within the Project Area. No known groundwater-dependent ecosystems are known within or within the vicinity of the Project Area.	Not at variance with clearing principle.
j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	j1) Native vegetation should not be cleared if it is likely to lead to an incremental increase in peak flood height.	The clearing of native vegetation is not considered to cause any alteration to flood duration or flood height, particularly if management actions are included to mitigate runoff volume and speed.	Not at variance with clearing principle.
	j2) Native vegetation should not be cleared if it is likely to lead to an incremental increase in duration of flood peak.	The clearing of native vegetation is not considered to cause any alteration to flood duration or flood height.	Not at variance with clearing principle.

6. Conclusions and Recommendations

6.1 Conclusions

The following conclusions on environmental aspects are made:

- The vegetation of the Project Area is identified by Beard (1976) is considered to be *Depleted* or *Vulnerable*, with 32% and 18.9% of the pre-European extent considered to be remaining in the Geraldton Sandplains Interim Biogeographic Regionalisation for Australia (IBRA) region (Shepherd, 2005);
- A total of 15 vegetation types were recorded from the Project Area, the majority of which fall in to the broad-scale mapping of Beard (1976);
- No Threatened Ecological Communities were recorded from the Project Area. No Priority Ecological Communities were recorded from the Project Area;
- Dieback susceptible vegetation occurs in the Project Area; however, the area is considered unlikely to support an infestation of *Phytophthora cinnamomi*;
- Vegetation condition throughout the Project Area ranged from Condition 1-2 (*Pristine or Nearly So - Excellent*) to Condition 6 (*Completely Degraded*). The main disturbance factor was from historical clearing for the purpose of agricultural activities;
- A total of 221 flora taxa from 72 families were recorded from the Project Area, representing a medium to high level of diversity;
- One Declared Rare Flora species (*Caladenia bryceana* subsp. *cracens*) was recorded during the field survey at a known location. This location is proposed to be protected as part of Public Open Space. No other DRF were recorded from the Project Area;
- One Priority 1 species (Melaleuca huttensis) was recorded from the Project Area. This taxon was dominant across the Project Area and was also recorded to the north and south of the Project Area. No other Priority Flora species were recorded from the Project Area;
- No other significant plants species were recorded from the Project Area;
- A total of 40 weed species were recorded from the Project Area, dominated by grasses and associated pasture species. Three Declared Plants and one Weed of National Significance were recorded from the Project Area;
- A total of 33 birds, 6 mammals (1 native) and 3 reptiles were recorded from the Project Area;
- Protected fauna species are known to occur or considered likely to occur in the Project Area. No threatened fauna species were recorded in the Project Area during the reconnaissance fauna survey. Threatened fauna species known to occur in the general area, as identified in the desktop assessment, are generally unlikely to use the Project Area for breeding or refuge purposes;
- No Protected fauna species were recorded during the field survey;

- A number of Marine and Migratory Listed species were recorded from the Project Area; and
- An examination of the Ten Clearing Principles applied against the finding of this flora and fauna assessment and any clearing of native vegetation within the Project Area has been assessed to be:
  - At variance with clearing principles (c1), (c3), (e1) and (e4); and
  - May be at variance with clearing principles (a1), (b3), (b4) and (h4).
- With regards to significant flora (Clearing Principle c): the "at variance" assessment has not been deemed to be significant, due to the fact that: the Declared Rare Flora known from the Project Area will be protected as part of any structure plan; and the Priority 1 species is considered to be abundant in the local area.
- With regards to the vegetation extent remaining in the Project Area (Clearing Principle e): consideration may be given by the DEC to the allowance of clearing of this vegetation (with conditions). However, as this vegetation is already considered to be *Vulnerable* in extent, any application for clearing may be declined.
- On the basis of this assessment, the application for a clearing permit from the DEC may not be granted. This Project is considered likely require referral to the Environmental Protection Authority for any approval to clear vegetation.

6.2 Recommendations

A number of recommendations can be made from the results of the field assessment:

- Continued liaison with the DEC with regards to key environmental issues and concerns present within the Project Area;
- The protection of the known location of the DRF *Caladenia bryceana* subsp. *cracens* (GHD understands that Seaview has already made commitments to ensure that this will be location will be not be disturbed);
- The minimisation of the clearing of native vegetation (where possible) for any proposed subdivision within the Project Area.
- Retention of vegetation and associated habitat (where possible) within the Project Area for the protection of the Priority 1 flora species *Melaleuca huttensis* and fauna habitat;
- Maintenance of native vegetation (where possible) along proposed roads to facilitate the retention of fauna movement and ecological corridors;
- The preferred use of local native flora species for rehabilitation purposes (where required) and for ornamental purposes in any subdivision landscaping (streetscapes and residential gardens).

7. Limitations

7.1 Survey Limitations

The GHD field survey was carried out during only one season, and in one year. Complete surveys require multiple surveys, at different times of year, and over a period of a number of years, to enable full survey of all species present. Some flora species, such as annuals, are only available for collection at certain times of the year, and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to above factors.

7.2 Report Limitations

This report presents the results of a Level 2 flora and reconnaissance fauna survey, and desktop findings, prepared for the purpose of this commission. The fauna survey was limited to a Level 1 reconnaissance fauna survey. GHD is aware that at the Project Area location, the EPA Guidance Statement No. 51 indicates that a Level 2 fauna survey is preferred. The data and advice provided herein relate only to the project described herein and must be reviewed by a competent scientist before being used for any other purpose. GHD accepts no responsibility for other use of the data.

Where reports, searches, any third party information and similar work have been performed and recorded by others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

For these investigations GHD has conducted desktop data searches and a field survey. The conclusions of this report were based on the information gathered during these investigations and thus reflect the environment of the survey area at the time of survey. GHD accepts no responsibility for any variation in the flora present in the survey area due to natural and seasonal variability.

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Appendix A

Figures

1:500,000 (at A4)

0 2.5 5 10 15 20

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

N

CLIENTS|PEOPLE|PERFORMANCE

Seaview Farms
Biological Survey

Job Number | 61-24450
Revision | 0
Date | 20 NOV 2009

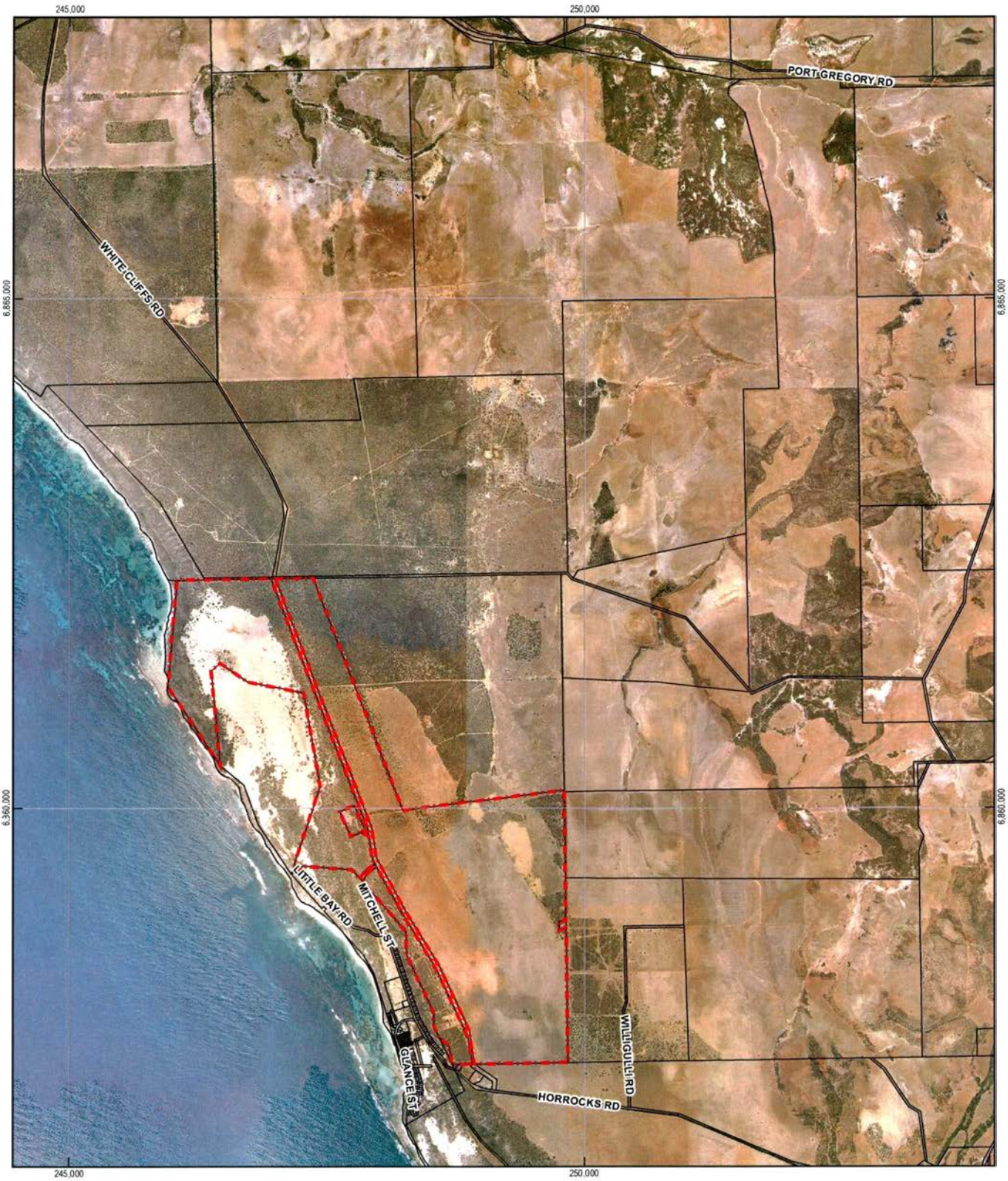
Locality Map

Figure 1

76 Forrest Street Geraldton WA 6530 T 61 8 9964 3677 F 61 8 9921 7997 E getmail@ghd.com.au W www.ghd.com.au

G:\61\24450\GIS\mxds\61-24450-E001.mxd

Data Source: Landgate: Travellers Atlas - 2004 Edition; GHD: Project Area - 200908. Created by: mlogue, xntan



LEGEND

Project Area

Cadastre

1:50,000 (at A4)

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

Metres

Geographic Coordinate System

Horizontal Datum: Geocentric Datum of Australia 1994

N

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Seaview Farms

Biological Survey

Job Number 61-24450

Revision 0

Date 20 NOV 2009

Project Area

Figure 2

76 Forrest Street Geraldton WA 6530 T 61 8 9964 3677 F 61 8 9921 7997 E getmail@ghd.com.au W www.ghd.com.au

G:\61\24450\GIS\mxds\61-24450-E002.mxd

Data Source: GHD: Project Area - 200908; Landgate: Cadastre - 20090819, Hutt 2006 Mosaic - 2006. Created by: mlogue, xntan

LEGEND

- Project Area
- Cadastre

Declared Rare & Priority Species

- (R) Declared Rare Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa
- Environmentally Sensitive Area

1:60,000 (at A4)

0 300 600 1,200 1,800 2,400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

N

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Seaview Farms
Biological Survey

Project Area
Environmental Constraints

Job Number 61-24450
Revision 0
Date 20 NOV 2009

Figure 3

76 Forrest Street Geraldton WA 6530 T 61 8 9964 3677 F 61 8 9921 7997 E getmail@ghd.com.au W www.ghd.com.au

G:\61\24450\GIS\mxds\61-24450-E008.mxd

Data Source: GHD: Project Area - 200908; Landgate: Cadastre - 20090819, Hutt 2006 Mosaic - 2006; DEC: Declared Rare & Priority Species Ref No. 21-0809 - 20090812, Environmentally Sensitive Areas - 20050530. Created by: mlogue, xntan

247,000 248,500 250,000

6,861,000 6,859,500 6,858,000

LEGEND

Survey Area

1 - Cleared / Degraded
2 - Mobile sand & native scattered plants
3 - Regrowth *Acacia* shrubland
4 - *Melaleuca huttensis* heath
5 - *Melaleuca cardiophylla* scrub
6 - Eucalyptus grove
7 - Mosaic - mixed low heath
8 - Coastal scrub on mobile dunes
9 - Low coastal heath on foredunes
10 - Mixed Myrtaceous heath
11 - Mix of 9 and 10
12 - Mixed open Acacia scrub
13 - Mosaic of low open Banksia woodland & mixed myrtaceous scrub
14 - Allocasuarina grove
15 - Very open Banksia woodland over Myrtaceous shrubland

1:15,000 (at A3)

0 75 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

N

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Seaview Farms
Biological Survey

Project Area Vegetation Type

Job Number	61-24450
Revision	0
Date	20 NOV 2009

Figure 4

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76 Forrest Street Geraldton WA 6530 **T** 61 8 9964 3677 **F** 61 8 9921 7997 **E** getmail@ghd.com.au **W** www.ghd.com.au

Data Source: Landgate: Hutt 2006 Mosaic - 2006; GHD: Vegetation Type - 20090914, Survey Area - 200908. Created by: mlogue, xntan

247,000 248,500 250,000

6,861,000 6,860,500 6,860,000 6,859,500 6,859,000 6,858,500 6,858,000

LEGEND

Survey Area

Vegetation Condition

- 1 - Pristine
- 2 - Excellent
- 3 - Very Good
- 4 - Good
- 5 - Degraded
- 6 - Completely Degraded

1:15,000 (at A3)

0 75 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

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Seaview Farms
Biological Survey

Project Area Vegetation Condition

Job Number	61-24450
Revision	0
Date	20 NOV 2009

Figure 5

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76 Forrest Street Geraldton WA 6530 **T** 61 8 9964 3677 **F** 61 8 9921 7997 **E** getmail@ghd.com.au **W** www.ghd.com.au

Data Source: Landgate: Hutt 2006 Mosaic - 2006; GHD: Vegetation Condition - 20090914, Survey Area - 200908. Created by: mlogue, xntan

246,000
248,000
250,000
6,862,000
6,860,000
6,858,000
WHITE CLIFFS RD
LITTLE BAY RD
MITCHELL ST
NORTH CT
DRAGE ST
GLASS ST
STOKES ST
GLANCE ST
WILLIGULLI RD
HORROCKS RD

LEGEND

Survey Area

Significant Flora

- *Caladenia bryceana* subsp. *cracens*
- *Drakaea concolor*
- *Echium plantagineum*
- *Melaleuca huttensis*
- *Tamarix aphylla*

1:20,000 (at A3)
0 100 200 400 600 800
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

N

CLIENTS | PEOPLE | PERFORMANCE

Seaview Farms
Biological Survey

Project Area
Significant Flora Records

Job Number	61-24450
Revision	0
Date	20 NOV 2009

Figure 6

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76 Forrest Street Geraldton WA 6530 **T** 61 8 9964 3677 **F** 61 8 9921 7997 **E** getmail@ghd.com.au **W** www.ghd.com.au

Data Source: Landgate: Hutt 2006 Mosaic - 2006; GHD: Survey Area - 200908, Significant Flora - 20091' . Created by: mlogue, xntan

247,000 248,500 250,000

6,861,000 6,860,000 6,859,500 6,859,000 6,858,000

WHITE CLIFFS RD

LITTLE BAY RD

MITCHELL ST

GLANCE ST

DRAGE ST

GLASS ST

LEGEND

Survey Area

Fauna Habitat Type

1. Cleared/Degraded
2. Mobile Sand Areas
3. Open Acacia Scrubland
4. Mixed Low Scrub/Heath on Limestone
5. Mixed Coastal Scrub on Sand
6. Open Banksia Woodland over Low Scrub/Heath

1:15,000 (at A3)

0 75 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

CLIENTS | PEOPLE | PERFORMANCE

Seaview Farms
Biological Survey

Project Area
Fauna Habitat Types

Job Number 61-24450
Revision 0
Date 24 NOV 2009

Figure 7

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76 Forrest Street Geraldton WA 6530 **T** 61 8 9964 3677 **F** 61 8 9921 7997 **E** getmail@ghd.com.au **W** www.ghd.com.au

Data Source: Landgate: Hutt 2006 Mosaic - 2006; GHD: Survey Area - 200908, Fauna Habitat Types - 20091124. Created by: mlogue, xntan

Appendix B

Flora

Flora Conservation Categories

Significant Flora Species

Environmental Weed Criteria

Flora Species List

Table 10 Conservation Categories and Definitions for *EPBC Act* listed Flora and Fauna Species

Conservation Category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened

Table 11 Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species.

Conservation Code	Description
R: Declared Rare Flora – Extant Taxa	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.
X: Declared Rare Flora – Presumed Extinct Taxa	Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
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 are in urgent need of 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 are in need of further survey.
P4: Priority Four – Rare Taxa	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.

Table 12 Significant Flora Species identified in the Threatened Flora Database and *EPBC Act* Protected Matters Search Results

Species	Conservation Code	Description [1]	Flowering Time [1]	Preferred Habitat [1]	Distribution [1]	Data Source
Blackallia nudiflora	Priority 3*	Shrub, 0.3–1 m high, often with spinescent branchlets. Fl. white, pink	Jul–Sep	Clay or sandy clay with granite. On hills or breakaways, plains	-	WA-Herb
Caladenia bryceana subsp. *cracens*	Declared Rare* Vulnerable**	Tuberous, perennial, herb, 0.03–0.08 m high. Fl. green, yellow	Aug–Sep	Sand over limestone. South of Kalbarri in low heath on limestone hills; north in winter-moist flats	Southwest Botanical Province: Geraldton Sandplains	EPBC, DEFL & WA-Herb
Caladenia elegans	Declared Rare* Endangered**	Tuberous, perennial, herb, 0.2–0.3 m high. Fl. yellow	Jul–Aug	Clayey loam. Winter-wet clay flats	Southwest Botanical Province: Geraldton Sandplains	EPBC, DEFL & WA-Herb
Caladenia hoffmanii	Declared Rare* Endangered**	Tuberous, perennial, herb, 0.13–0.3 m high. Fl. green, yellow, red	Aug–Oct	Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies	Southwest Botanical Province: Geraldton Sandplains	EPBC & DEFL
Diuris recurva	Priority 4*	Tuberous, perennial, herb, 0.2–0.3 m high. Fl. yellow, brown	Jul–Aug	Loam. Winter-wet areas	Southwest Botanical Province: Avon Wheatbelt, Geraldton Sandplains, Jarrah Forrest	DEFL & WA-Herb
Eremophila brevifolia	Priority 2*	Erect, spindly shrub, 0.9–2(–3.6) m high. Fl. white, pink, blue	Jul–Sep	-	Southwest Botanical Province: Avon Wheatbelt, Geraldton Sandplains	DEFL
Eucalyptus blaxellii	Declared Rare* Vulnerable**	Mallee, 1–4 m high, bark smooth. Fl. white, cream	Aug–Nov	Grey sand, clay. Rocky hillsides, creek flats	Southwest Botanical Province: Avon Wheatbelt, Geraldton Sandplains	EPBC
Eucalyptus cuprea	Declared Rare* Endangered**	Mallee, 2.5–5 m high, bark rough to 1.5 m, box-type. Fl. white	Aug–Nov	Shallow soils over granite	Southwest Botanical Province: Geraldton Sandplains	EPBC
Gastrolobium propinquum	Priority 3*	Low, bushy shrub, to 1(–1.8) m high. Fl. orange, yellow, red	Jun–Sep	Clay, clay-loam or sandy clay soils, granite, shale. Hills, flats, drainage lines, winter-wet areas	Southwest Botanical Province: Avon Wheatbelt, Geraldton Sandplains	WA-Herb

Species	Conservation Code	Description [1]	Flowering Time [1]	Preferred Habitat [1]	Distribution [1]	Data Source
Geleznowia verrucosa subsp. Kalbarri (L.M. Broadhurst 123)	Priority 3*	Rounded, erect, branching, woody shrub, to 1.5 m high. Fl. yellow	Aug–Oct	White/orange-brown sand, gravel, laterite, sandstone, limestone. Disturbed edges of quarries, slopes	Southwest Botanical Province: Geraldton Sandplains	WA-Herb
Grevillea leptopoda	Priority 3*	Spreading to erect shrub, 0.6–1.5 m high. Fl. white, cream	Aug–Sep	Loam & lateritic gravel, sand, clay	Southwest Botanical Province: Avon Wheatbelt, Geraldton Sandplains	DPLIST
Hypocalymma longifolium	Declared Rare* Endangered**	Open shrub, to 1 m high. Fl. white, cream	Aug–Sep	Grey sand or clay, sandstone. Rocky breakaways, swampland	Southwest Botanical Province: Geraldton Sandplains	EPBC
Melaleuca huttensis	Priority 1*	Upright shrub, to 3 m high, bark gnarled, white to grey. Fl. cream, yellow	Jun–Sep	Light yellow or beige sand. Lower slopes of undulating plains, sandplains	Southwest Botanical Province: Geraldton Sandplains	DEFL & WA-Herb
Pterostylis sp. Northampton (S.D. Hopper 3349)	Declared Rare* Endangered**	Herb	Aug	Brown-yellow sandy clay, brown clay loam, laterite. Slopes, near crests of hills, winter-wet areas	Southwest Botanical Province: Geraldton Sandplains	EPBC, DEFL & WA-Herb
Scaevola oldfieldii	Priority 3*	Erect shrub, to 2.3 m high. Fl. white	Aug–Dec	Sand, loam, clay. Near rivers	Southwest Botanical Province: Geraldton Sandplains	WA-Herb
Serichonus gracilipes	Priority 3*	Evergreen shrub, 0.2–0.7 m high. Fl. white, pink	Aug–Sep	Red sandy clay over granite, brown sandy clay loam with laterite gravel, yellow-brown sandy loam over sandstone. Rock crevices, rocky gullies, margins of summits and basal slopes of mesas, near rock outcrops	-	DEFL & WA-Herb
Verticordia densiflora var. *roseostella*	Priority 3*	Open shrub, 0.4–1.3 m high. Fl. pink, white	Sep–Dec	Sandy gravelly soils	Southwest Botanical Province: Avon Wheatbelt, Geraldton Sandplains	WA-Herb
Vittadinia cervicularis var. *occidentalis*	Priority 1*	Annual, herb, more than 0.3 m high. Fl. white, purple, blue	Aug–Sep	-	Southwest Botanical Province: Avon Wheatbelt, Geraldton Sandplains	WA-Herb

[1]Data Source FloraBase accessed online at http://florabase.calm.wa.gov.au/ on 03/07/2009

[2]DEC Declared Rare and Priority Flora Database and WA Herbarium Database Search

*State

**Commonwealth

WAHERB: Western Australian Herbarium Specimen Database

DEFL Threatened (Declared Rare) Flora Database

DP List Declared Rare and Priority Flora List

Table 13 Horrocks Project Area Flora List

Family	Genus	Species	Common Name	Status
Aizoaceae	*Carpobrotus*	*virescens*	Coastal Pigface	
Aizoaceae	*Mesembryanthemum*	*crystallinum*	Iceplant	*
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach	
Amaranthaceae	*Ptilotus*	*divaricatus*	Climbing Mulla Mulla	
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip	
Apocynaceae	*Alyxia*	*buxifolia*	Dysentery Bush	
Asparagaceae	*Agave*	*americana*	Century Plant	*
Asparagaceae	*Dichopogon*	*tyleri*		
Asparagaceae	*Lomandra*	*maritima*		
Asparagaceae	*Sowerbaea*	*laxiflora*	Purple Tassels	
Asparagaceae	*Thysanotus*	*mangelsianus*	Fringed Lily	
Asteraceae	*Arctotheca*	*calendula*	Cape Weed	*
Asteraceae	*Centaurea*	*melitensis*	Maltese Cockspur	*
Asteraceae	*Chthonocephalus*	*pseudevax*	Woolly Groundheads	
Asteraceae	*Euchiton*	*sphaericus*	Star Cudweed	
Asteraceae	*Hyalosperma*	*cotula*		
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*
Asteraceae	*Millotia*	*myosotidifolia*		
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush	
Asteraceae	*Podotheca*	*angustifolium*	Sticky Longheads	
Asteraceae	*Reichardia*	*tingitana*	False Sowthistle	*
Asteraceae	*Rhodanthe*	*oppositifolia* subsp. *oppositifolia*		
Asteraceae	*Senecio*	*pinnatifolius*		
Asteraceae	*Senecio*	sp. (insufficient material)		
Asteraceae	*Sonchus*	*asper*	Rough Sowthistle	*
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle	*
Asteraceae	*Urospermum*	*picroides*	False Hawkbit	*
Asteraceae	*Ursinia*	*anthemoides*	Ursinia	*
Asteraceae	*Waitzia*	*acuminata*	Orange Immortelle	
Asteraceae	*Waitzia*	*podolepis*		
Boraginaceae	*Echium*	*plantagineum*	Paterson's Curse	*DP
Boraginaceae	*Halgania*	*bebrana*		

Family	Genus	Species	Common Name	Status
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*
Brassicaceae	*Cakile*	*maritima*	Sea Rocket	*
Brassicaceae	*Raphanus*	*raphanistrum*	Wild Radish	*
Caesalpiniaceae	*Senna*	*glutinosa* subsp. *chatelainiana*		
Caryophyllaceae	*Petrorhagia*	*dubia*		*
Caryophyllaceae	*Polycarpon*	*tetraphyllum*	Fourleaf Allseed	*
Caryophyllaceae	*Silene*	*gallica*	French Catchfly	*
Casuarinaceae	*Allocasuarina*	*campestris*		
Casuarinaceae	*Allocasuarina*	*humilis*	Dwarf Sheoak	
Celastraceae	*Stackhousia*	*monogyna*		
Chenopodiaceae	*Dysphania*	*sphaerosperma*		
Chenopodiaceae	*Enchylaena*	*tomentosa*	Barrier Saltbush	
Chenopodiaceae	*Rhagodia*	*preissii* subsp. *obovata*		
Chenopodiaceae	*Rhagodia*	*preissii* subsp. *preissii*		
Chenopodiaceae	*Salsola*	*tragus*	Roly Poly	
Chenopodiaceae	*Threlkeldia*	*diffusa*	Coast Bonefruit	
Colchicaceae	*Wurmbea*	sp. (insufficient material)		
Convolvulaceae	*Bonamia*	*rosea*	Felty Bellflower	
Crassulaceae	*Crassula*	*colorata*	Dense Stonecrop	
Crassulaceae	*Crassula*	*colorata* var. *acuminata*	Dense Stonecrop	
Cucurbitaceae	*Citrullus*	*lanatus*	Pie Melon	*
Cunoniaceae	*Aphanopetalum*	*clematideum*		
Cyperaceae	*Isolepis*	*cernua* var. *setiformis*		
Cyperaceae	*Lepidosperma*	*?squamatum*		
Cyperaceae	*Lepidosperma*	*scabrum*		
Cyperaceae	*Lepidosperma*	*squamatum*		
Cyperaceae	*Mesomelaena*	*pseudostygia*		
Cyperaceae	*Schoenus*	*grandiflorus*	Large Flowered Bogrush	
Dasypogonaceae	*Acanthocarpus*	*preissii*		
Dilleniaceae	*Hibbertia*	*acerosa*	Needle Leaved Guinea Flower	
Dilleniaceae	*Hibbertia*	*hypericoides*	Yellow Buttercups	
Dilleniaceae	*Hibbertia*	*spicata* subsp. *spicata*		
Dioscoreaceae	*Dioscorea*	*hastifolia*	Warrine	
Droseraceae	*Drosera*	*humilis*		

Family	Genus	Species	Common Name	Status
Ecdeiocoleaceae	*Ecdeiocolea*	*monostachya*		
Epacridaceae	*Leucopogon*	sp. Mid West (J.S. Beard 7388)		
Euphorbiaceae	*Beyeria*	*cinerea*		
Euphorbiaceae	*Euphorbia*	*boophthona*	Gascoyne Spurge	
Euphorbiaceae	*Euphorbia*	*boophthona*	Gascoyne Spurge	
Euphorbiaceae	*Euphorbia*	*terracina*	Geraldton Carnation Weed	*
Euphorbiaceae	*Phyllanthus*	*calycinus*	False Boronia	
Euphorbiaceae	*Phyllanthus*	*scaber*		
Euphorbiaceae	*Poranthera*	*microphylla*	Small Poranthera	
Geraniaceae	*Erodium*	*cicutarium*	Common Storksbill	*
Geraniaceae	*Erodium*	*cygnorum*	Blue Heronsbill	
Goodeniaceae	*Dampiera*	*altissima*	Tall Dampiera	
Goodeniaceae	*Goodenia*	*berardiana*		
Goodeniaceae	*Lechenaultia*	*linarioides*	Yellow Leschenaultia	
Goodeniaceae	*Scaevola*	*crassifolia*	Thick-leaved Fan-flower	
Goodeniaceae	*Scaevola*	*tomentosa*	Ragged Leaf Fanflower	
Gyrostemonaceae	*Gyrostemon*	*racemiger*		
Gyrostemonaceae	*Gyrostemon*	*ramulosus*	Corkybark	
Haemodoraceae	*Anigozanthos*	*humilis*	Catspaw	
Haemodoraceae	*Anigozanthos*	sp. (insufficient material)	Kangaroo Paw	
Haemodoraceae	*Conostylis*	*stylidioides*		
Haemodoraceae	*Dianella*	*revoluta*	Blueberry Lily	
Haloragaceae	*Glischrocaryon*	*aureum*	Common Popflower	
Hemerocallidaceae	*Caesia*	sp. Wongan (K.F. Keneally 8820)		
Hemerocallidaceae	*Corynotheca*	*micrantha*	Sand Lily	
Hemerocallidaceae	*Dianella*	*revoluta*	Blueberry Lily	
Hemerocallidaceae	*Stypandra*	*glauca*	Blind Grass	
Hemerocallidaceae	*Tricoryne*	*elatior*	Yellow Autumn Lily	
Iridaceae	*Orthrosanthus*	*laxus* var. *laxus*	Morning Iris	
Iridaceae	*Patersonia*	*occidentalis*	Purple Flag	
Juncaginaceae	*Triglochin*	*trichophora*		
Lamiaceae	*Lachnostachys*	*eriobotrya*	Lambswool	
Lamiaceae	*Pityrodia*	*loxocarpa*		
Lamiaceae	*Westringia*	*dampieri*		

Family	Genus	Species	Common Name	Status
Lauraceae	*Cassytha*	*racemosa*	Dodder Laurel	
Lauraceae	*Cassytha*	sp. (insufficient material)	Dodder Laurel	
Loranthaceae	*Amyema*	*preissii*	Wireleaf Mistletoe	
Loranthaceae	*Nuytsia*	*floribunda*	Christmas Tree	
Malvaceae	*Alyogyne*	*coronopifolia ms*		
Malvaceae	*Sida*	*calyxhymenia*	Tall Sida	
Mimosaceae	*Acacia*	*idiomorpha*		
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle	
Mimosaceae	*Acacia*	*saligna*	Orange Wattle	
Mimosaceae	*Acacia*	*spathulifolia*		
Mimosaceae	*Acacia*	*xanthina*	White-stemmed Wattle	
Molluginaceae	*Macarthuria*	*australis*		
Myoporaceae	*Eremophila*	*glabra* subsp. *albicans*	Tar Bush	
Myoporaceae	*Myoporum*	*insulare*	Blueberry Tree	
Myrtaceae	*Calothamnus*	*glaber*		
Myrtaceae	*Calothamnus*	*homalophyllus*	Murchison Clawflower	
Myrtaceae	*Calothamnus*	*oldfieldii*		
Myrtaceae	*Darwinia*	*pauciflora*		
Myrtaceae	*Eremaea*	*bracteata*		
Myrtaceae	*Eucalyptus*	*dolichocera*		
Myrtaceae	*Melaleuca*	*campanae*		
Myrtaceae	*Melaleuca*	*cardiophylla*	Tangling Melaleuca	
Myrtaceae	*Melaleuca*	*depressa*		
Myrtaceae	*Melaleuca*	*huttensis*		P1
Myrtaceae	*Melaleuca*	*systena*		
Myrtaceae	*Thryptomene*	*baeckeacea*		
Myrtaceae	*Thryptomene*	*racemulosa*		
Nyctaginaceae	*Commicarpus*	*australis*	Perennial Tar Vine	
Oleaceae	*Jasminum*	*calcarium*		
Orchidaceae	*Caladenia*	*?bryceana* subsp. *cracens*	Dwarf Spider Orchid	DRF
Orchidaceae	*Caladenia*	*bicalliata*		
Orchidaceae	*Caladenia*	*flava*	Cowslip Orchid	
Orchidaceae	*Caladenia*	*longicauda* subsp. *borealis*	Daddy-long-legs Spider Orchid	
Orchidaceae	*Caladenia*	sp. (insufficient material)		

Family	Genus	Species	Common Name	Status
Orchidaceae	*Diuris*	aff. *magnifica*	Common Donkey Orchid	
Orchidaceae	*Drakaea*	*concolor*		DRF
Orchidaceae	*Thelymitra*	sp. (insufficient material)		
Oxalidaceae	*Oxalis*	*perennans*		
Papaveraceae	*Fumaria*	*capreolata*	Whiteflower Fumitory	*
Papilionaceae	*Bossiaea*	*spinescens*		
Papilionaceae	*Chorizema*	*racemosum*		
Papilionaceae	*Daviesia*	*divaricata subsp. lanulosa* ms	Marno	
Papilionaceae	*Glycine*	*canescens*	Silky Glycine	
Papilionaceae	*Gompholobium*	*tomentosum*	Hairy Yellow Pea	
Papilionaceae	*Isotropis*	sp. Shark Bay (M.E. Trudgen 7170)		
Papilionaceae	*Jacksonia*	*rigida*		
Papilionaceae	*Leptosema*	*aphyllum*		
Papilionaceae	*Lupinus*	*cosentinii*	Western Australian Blue Lupin	*
Papilionaceae	*Melilotus*	*indicus*	Common Melilot	*
Papilionaceae	*Templetonia*	*retusa*	Cockies Tongues	
Papilionaceae	*Trifolium*	*hirtum*	Rose Clover	*
Pittosporaceae	*Pittosporum*	*angustifolium*		
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass	
Poaceae	*Austrostipa*	*elegantissima*	Showy Feathergrass	
Poaceae	*Austrostipa*	*macalpinei*		
Poaceae	*Avena*	*barbata*	Bearded Oat	*
Poaceae	*Bromus*	*diandrus*	Great Brome	*
Poaceae	*Ehrharta*	*brevifolia* subsp. *cuspidata*	Annual Veldt Grass	*
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*
Poaceae	*Ehrharta*	sp. (insufficient material)		*
Poaceae	*Lamarckia*	*aurea*	Goldentop	*
Poaceae	*Neurachne*	*alopecuroidea*	Foxtail Mulga Grass	
Poaceae	*Pennisetum*	*setaceum*	Fountain Grass	*
Poaceae	*Poa*	*drummondiana*	Knotted Poa	
Poaceae	*Rostraria*	*cristata*	Annual Catstail	*
Poaceae	*Rostraria*	*pumila*	Roughtail	*
Poaceae	*Setaria*	sp. (insufficient material)	Pigeon Grass	
Poaceae	*Spinifex*	*longifolius*	Beach Spinifex	

Family	Genus	Species	Common Name	Status
Poaceae	*Triodia*	*danthonioides*		
Polygalaceae	*Comesperma*	*integerrimum*		
Polygonaceae	*Comesperma*	*scoparium*	Broom Milkweed	
Polygonaceae	*Emex*	*australis*	Doublegee	*DP
Portulacaceae	*Calandrinia*	*brevipedata*	Short Stalked Purslane	
Portulacaceae	*Calandrinia*	*granulifera*		
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*
Primulaceae	*Anagallis*	*arvensis* var. *caerulea*	Pimpernel	*
Proteaceae	*Banksia*	*attenuata*	Slender Banksia	
Proteaceae	*Banksia*	*fraseri* var. *ashbyi*		
Proteaceae	*Banksia*	*prionotes*	Acorn Banksia	
Proteaceae	*Conospermum*	*stoechadis*	Common Smokebush	
Proteaceae	*Grevillea*	*?eriostachya* (insufficient material)	Flame Grevillea	
Proteaceae	*Grevillea*	*argyrophylla*	Silvery-leaved Grevillea	
Proteaceae	*Grevillea*	*commutata*		
Proteaceae	*Grevillea*	*leucopteris*	White Plume Grevillea	
Proteaceae	*Hakea*	*recurva*	Djarnokmurd	
Ranunculaceae	*Clematis*	*linearifolia*		
Restionaceae	*Desmocladus*	*asper*		
Restionaceae	*Lepidobolus*	*preissianus*		
Rhamnaceae	*Stenanthemum*	*intricatum*		
Rhamnaceae	*Stenanthemum*	*pomaderroides*		
Rubiaceae	*Opercularia*	*?spermacocea* (insufficient material)		
Rubiaceae	*Opercularia*	*spermacocea*		
Rubiaceae	*Opercularia*	*vaginata*	Dog Weed	
Rutaceae	*Boronia*	*coerulescens*		
Rutaceae	*Diplolaena*	*grandiflora*	Wild Rose	
Rutaceae	*Diplolaena*	*mollis*		
Rutaceae	*Geleznowia*	*verrucosa* subsp. *verrucosa*		
Santalaceae	*Anthobolus*	*foveolatus*		
Santalaceae	*Exocarpos*	*sparteus*	Broom Ballart	
Sapindaceae	*Diplopeltis*	*petiolaris*		
Solanaceae	*Anthocercis*	*littorea*	Yellow Tailflower	
Solanaceae	*Lycium*	*ferocissimum*	African Boxthorn	*

Family	Genus	Species	Common Name	Status
Solanaceae	*Nicotiana*	*glauca*	Tree Tobacco	*
Solanaceae	*Nicotiana*	*occidentalis* subsp. *hesperis*		
Solanaceae	*Solanum*	*nigrum*	Black Berry Nightshade	*
Solanaceae	*Solanum*	*oldfieldii*		
Solanaceae	*Solanum*	*symonii*		
Sterculiaceae	*Guichenotia*	*ledifolia*		
Sterculiaceae	*Lasiopetalum*	*angustifolium*	Narrow Leaved Lasiopetalum	
Sterculiaceae	*Rulingia*	*borealis*		
Stylidiaceae	*Stylidium*	*elongatum*	Tall Triggerplant	
Stylidiaceae	*Stylidium*	*kalbarriense*		
Surianaceae	*Stylobasium*	*spathulatum*	Pebble Bush	
Tamaricaceae	*Tamarix*	*aphylla*	Athel Tree	*WONS, DP
Thymelaeaceae	*Pimelea*	*floribunda*		
Thymelaeaceae	*Pimelea*	*gilgiana*		
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower	
Urticaceae	*Parietaria*	*cardiostegia*		
Violaceae	*Hybanthus*	*floribundus* subsp. *floribundus*		
Vitaceae	*Clematicissus*	*angustissima*		
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf	

Where: * = weed species, + = planted species, DP = Declared Plant, WONS = Weed of National Significance, DRF = Declared Rare Flora, P1 = Priority 1

Appendix C

Vegetation

Results of DEC TEC Search

Field Survey Quadrat Data

From: "Hunter, Monica" <Monica.Hunter@dec.wa.gov.au> on 17/08/2009 02:12:28 PM

Repository: 6124450 Seaview Farms Vegetation, Flora and Fauna Survey

To: <Mark.Logue@ghd.com.au>

cc:

Subject: Results of TEC/PEC Search - (Horricks search area - Northampton area) (Ref:Mark Logue - GHD on behalf of Seaview Farms - 61\23879)

Hi Mark,

I refer to your request on the 11th of August 2009 for information on threatened and priority ecological communities occurring within the search area provided.

A search was undertaken on the Department's Threatened Ecological Communities database. Please note that there are no known occurrences of threatened ecological communities recorded within this boundary.

Please note not all priority ecological communities are currently recorded on our database. You may like to view the current list in related documents at http://www.dec.wa.gov.au/management-and-protection/threatened-species/wa-s-threatened-ecological-communities.html.

Attached are the conditions under which this information has been supplied. The information supplied should be regarded as an indication only of the threatened and priority ecological communities that may be present.

It would be appreciated if any occurrences of threatened and priority ecological communities encountered by you in the area could be reported to this Department to ensure their ongoing management.

An invoice for $220 (includingGST) for the supply of this information will be forwarded.

Kind regards,

Monica Hunter

Ecologist - Threatened Ecological Community Database

Department of Environment and Conservation, Kensington

Ph: 9334 0116 Fax: 9334 0300

Quadrat 1

Location: 248715 mE, 6857834 mN (Zone 50)

Topography: Gentle west hilltop above limestone cliff **Rocks**: nil

Logs: 2-10 % **Branches:** 2-10 % **Leaves:** 2-10 %

Bare Ground: 2-10 %

Soil Type: Pale Sand over limestone

Field Vegetation Description: *Melaleuca huttensis* thicket

Vegetation Condition: 2-3

Other: Disturbances; urban clearing, fire breaks, rabbits, drought

Plate 1: Vegetation located in Quadrat 1

Table 1 Species List for Quadrat 1

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.1	2-10
Asparagaceae	*Sowerbaea*	*laxiflora*	Purple Tassels		0.2	<2
Asparagaceae	*Thysanotus*	*manglesianus*	Fringed Lily		C	<2
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*	0.15	2-10
Asteraceae	*Millotia*	*myosotidifolia*			0.05	<2
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle	*	0.1	<2
Boraginaceae	*Halgania*	*bebrana*			1	<2
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*	0.5	<2
Chenopodiaceae	*Rhagodia*	*preissii* subsp. *preissii*			0.75	2-10
Convolvulaceae	*Bonamia*	*rosea*	Felty Bellflower		0.2	<2
Crassulaceae	*Crassula*	*colorata* var. *acuminata*	Dense Stonecrop		0.02	<2
Cyperaceae	*Isolepis*	*cernua* var. *setiformis*			0.05	<2
Dasypogonaceae	*Acanthocarpus*	*preissii*			0.5	<2
Dioscoreaceae	*Dioscorea*	*hastifolia*	Warrine		C	10-30
Euphorbiaceae	*Phyllanthus*	*calycinus*	False Boronia		0.15	<2
Haemodoraceae	*Conostylis*	*stylidioides*			0.3	<2
Hemerocallidaceae	*Dianella*	*revoluta*	Blueberry Lily		0.5	<2
Myrtaceae	*Melaleuca*	*huttensis*		P1	1.1	30-70
Poaceae	*Austrostipa*	*macalpinei*			0.8	<2
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*	0.2	<2
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*	0.2	<2
Portulacaceae	*Calandrinia*	*brevipedata*	Short Stalked Purslane		0.1	<2
Portulacaceae	*Calandrinia*	*granulifera*			0.05	<2
Primulaceae	*Anagallis*	*arvensis* var. *caerulea*	Pimpernel	*	0.15	<2
Restionaceae	*Desmocladus*	*asper*			0.1	2-10
Surianaceae	*Stylobasium*	*spathulatum*	Pebble Bush		1.9	2-10
Vitaceae	*Clematicissus*	*angustissima*			C	<2

Quadrat 2

Location: 248645 mE, 6857782 mN (Zone 50)

Topography: Slope West **Rocks**: 2-10 %

Logs: 2 % **Branches:** 2-10 % **Leaves:** 2-10 %

Bare Ground: 10-30%

Soil Type: Sand over limestone

Field Vegetation Description: *Melaleuca cardiophylla* shrub thicket

Vegetation Condition: 3

Other: Disturbances; rabbit grazing, fire?

Plate 2: Vegetation located in Quadrat 2

Table 2 Species List for Quadrat 2

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach		0.7	<2
Amaranthaceae	*Ptilotus*	*divaricatus*	Climbing Mulla Mulla		1.2	<2
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.02	2-10
Asparagaceae	*Thysanotus*	*mangelsianus*			C	<2
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle	*	0.1	<2
Boraginaceae	*Echium*	*plantagineum*	Paterson's Curse	*DP	0.02	<2
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*	0.02	<2
Chenopodiaceae	*Rhagodia*	*preissii* subsp. *obovata*			1.1	<2
Crassulaceae	*Crassula*	*colorata* var. *acuminata*	Dense Stonecrop		0.05	<2
Cyperaceae	*Lepidosperma*	*squamatum*			0.5	<2
Dasypogonaceae	*Acanthocarpus*	*preissii*			0.5	<2
Dilleniaceae	*Hibbertia*	*spicata* subsp. *spicata*			0.7	<2
Dioscoreaceae	*Dioscorea*	*hastifolia*	Warrine		C	2-10
Dioscoreaceae	*Dioscorea*	*hastifolia*	Warrine		C	<2
Euphorbiaceae	*Phyllanthus*	*scaber*			0.4	<2
Lamiaceae	*Westringia*	*dampieri*			1	<2
Lauraceae	*Cassytha*	*racemosa*	Dodder Laurel		C	<2
Myrtaceae	*Melaleuca*	*campanae*			1.1	10-30
Myrtaceae	*Melaleuca*	*cardiophylla*	Tangling Melaleuca		1.3	>70
Oxalidaceae	*Oxalis*	*perennans*			0.2	<2
Pittosporaceae	*Pittosporum*	*angustifolium*			1.1	<2
Poaceae	*Austrostipa*	*macalpinei*			0.6	<2
Portulacaceae	*Calandrinia*	*brevipedata*	Short Stalked Purslane		0.1	<2
Portulacaceae	*Calandrinia*	*granulifera*			0.05	<2
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*	0.05	<2
Restionaceae	*Desmocladus*	*asper*			0.4	<2
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower		1.2	2-10
Vitaceae	*Clematicissus*	*angustissima*			0.1	<2

Quadrat 3

Location: 248840 mE, 6857595 mN (Zone 50)

Topography: West gentle **Rocks**: nil

Logs: <2 % **Branches:** <2 % **Leaves:** 10-30 %

Bare Ground: 30-70 %

Soil Type: Sand (pale)

Field Vegetation Description: *Melaleuca huttensis* thicket

Vegetation Condition: 2

Other: Disturbances; rabbits

Plate 3: Vegetation located in Quadrat 3

Table 3 Species List for Quadrat 3

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.1	<2
Asparagaceae	*Thysanotus*	*manglesianus*			C	<2
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*	0.05	<2
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush		1.2	<2
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle		0.05	<2
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*	0.1	<2
Chenopodiaceae	*Rhagodia*	*preissii subsp. preissii*			1.2	<2
Crassulaceae	*Crassula*	*colorata var. acuminata*	Dense Stonecrop		0.05	<2
Dasypogonaceae	*Acanthocarpus*	*preissii*			0.9	<2
Dilleniaceae	*Hibbertia*	*spicata subsp. spicata*			0.7	<2
Droseraceae	*Drosera*	*humilis*			0.05	<2
Euphorbiaceae	*Phyllanthus*	*calycinus*	False Boronia		0.15	<2
Haemodoraceae	*Conostylis*	*stylidioides*			0.25	2-10
Hemerocallidaceae	*Dianella*	*revoluta*	Blueberry Lily		0.4	<2
Hemerocallidaceae	*Stypandra*	*glauca*	Blind Grass		0.9	2-10
Hemerocallidaceae	*Tricoryne*	*elatior*	Yellow Autumn Lily		0.2	<2
Iridaceae	*Patersonia*	*occidentalis*	Purple Flag		0.3	<2
Lauraceae	*Cassytha*	*racemosa*			C	<2
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		2	<2
Myrtaceae	*Melaleuca*	*huttensis*		P1	1.3	30-70
Papilionaceae	*Lupinus*	*cosentinii*	Western Australian Blue Lupin	*	0.3	<2
Papilionaceae	*Templetonia*	*retusa*	Cockies Tongues		0.8	<2
Poaceae	*Austrostipa*	*macalpinei*			1.1	<2
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*	0.3	<2
Poaceae	*Triodia*	*danthonioides*			1.3	<2
Polygonaceae	*Comesperma*	*scoparium*	Broom Milkweed		0.8	<2
Portulacaceae	*Calandrinia*	*brevipedata*	Short Stalked Purslane		0.2	<2
Portulacaceae	*Calandrinia*	*granulifera*			0.05	<2
Ranunculaceae	*Clematis*	*linearifolia*			C	<2
Restionaceae	*Desmocladus*	*asper*			0.15	<2
Rubiaceae	*Opercularia*	*spermacocea*			1	<2
Vitaceae	*Clematicissus*	*angustissima*			C	<2

Quadrat 4

Location: 248330 mE 6858554 mN (Zone 50)

Topography: Gentle west hilltop above limestone cliff **Rocks**: 10-30 %

Logs: <2 % **Branches:** 2-10 % **Leaves:** 30-70 %

Bare Ground: 10-30 %

Soil Type: Sand over limestone

Field Vegetation Description: Low *Melaleuca cardiophylla* with *Eucalyptus* sp. grooves.

Vegetation Condition: 2

Other: n/a

Plate 4: Vegetation located in Quadrat 4

Table 4 Species List for Quadrat 4

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach		0.3	<2
Asparagaceae	*Lomandra*	*maritima*			0.2	<2
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle	*	0.1	<2
Chenopodiaceae	*Rhagodia*	*preissii subsp. obovata*			0.6	<2
Cyperaceae	*Lepidosperma*	*squamatum*			0.5	<2
Dilleniaceae	*Hibbertia*	*spicata subsp. spicata*			0.3	<2
Euphorbiaceae	*Beyeria*	*cinerea*			0.2	2-10
Lauraceae	*Cassytha*	*racemosa*	Dodder Laurel		C	<2
Myrtaceae	*Eucalyptus*	*dolichocera*			2	10-30
Myrtaceae	*Melaleuca*	*campanae*			0.5	<2
Myrtaceae	*Melaleuca*	*cardiophylla*	Tangling Melaleuca		1.2	10-30
Myrtaceae	*Melaleuca*	*huttensis*		P1	0.4	<2
Papilionaceae	*Templetonia*	*retusa*	Cockies Tongues		1	<2
Restionaceae	*Desmocladus*	*asper*			0.2	2-10

Quadrat 5

Location: 247742 mE, 6859767 mN (Zone 50)

Topography: East Medium **Rocks**: 0%

Logs: <2 % **Branches:** 2-10 % **Leaves:** 2-10 %

Bare Ground: 10-30 %

Soil Type: Sand over ?limestone

Field Vegetation Description: N/A

Vegetation Condition: 3-4

Other: Disturbances; old rubbish tip, rabbits

Plate 5: Vegetation located in Quadrat 5

Table 5 Species List for Quadrat 5

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.1	2-10
Asparagaceae	*Lomandra*	*maritima*			0.3	<2
Asparagaceae	*Thysanotus*	*manglesianus*			C	<2
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*	0.02	<2
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush		0.5	2-10
Asteraceae	*Reichardia*	*tingitana*	False Sowthistle	*	0.3	<2
Asteraceae	*Senecio*	*pinnatifolius*			0.87	<2
Asteraceae	*Waitzia*	*podolepis*			0.15	<2
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*	0.1	<2
Chenopodiaceae	*Rhagodia*	*preissii subsp. preissii*			1.2	<2
Colchicaceae	*Wurmbea*	*sp. (insufficient material)*			0.1	<2
Dasypogonaceae	*Acanthocarpus*	*preissii*			0.7	2-10
Euphorbiaceae	*Euphorbia*	*boophthona*	Gascoyne Spurge		0.9	2-10
Euphorbiaceae	*Phyllanthus*	*calycinus*	False Boronia		0.5	2-10
Euphorbiaceae	*Phyllanthus*	*scaber*			1	<2
Hemerocallidaceae	*Dianella*	*revoluta*	Blueberry Lily		0.8	<2
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		1.9	<2
Myrtaceae	*Melaleuca*	*huttensis*		P1	0.3	2-10
Papilionaceae	*Templetonia*	*retusa*	Cockies Tongues		1.4	<2
Pittosporaceae	*Pittosporum*	*angustifolium*			1.2	<2
Poaceae	*Austrostipa*	*elegantissima*	Showy Feathergrass		1.0	<2
Poaceae	*Austrostipa*	*macalpinei*			1.0	<2
Rutaceae	*Diplolaena*	*mollis*			0.7	<2
Solanaceae	*Anthocercis*	*littorea*	Yellow Tailflower		2.0	<2
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower		0.6	<2
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf		1.1	2-10

Quadrat 6

Location: 246310 mE, 6862209 mN (Zone 50)

Topography: West gentle cliff top **Rocks**: 2-10%

Logs: <2 % **Branches:** 2-10 % **Leaves:** 10-30 %

Bare Ground: 10-30%

Soil Type: Pale sand over limestone

Field Vegetation Description: Mixed Myrtaceae heath

Vegetation Condition: 2

Other: Disturbances; tracks, some weeds.

Plate 6: Vegetation located in Quadrat 6

Table 6 Species List for Quadrat 6

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Aizoaceae	*Carpobrotus*	*virescens*	Coastal Pigface		0.3	<2
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.1	<2
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*	0.05	<2
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush		0.9	2-10
Asteraceae	*Senecio*	*sp. (insufficient material)*			0.07	<2
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle	*	0.1	<2
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*	0.3	<2
Chenopodiaceae	*Threlkeldia*	*diffusa*	Coast Bonefruit		0.2	<2
Crassulaceae	*Crassula*	*colorata var. acuminata*	Dense Stonecrop		0.02	<2
Euphorbiaceae	*Poranthera*	*microphylla*	Small Poranthera		0.05	<2
Goodeniaceae	*Goodenia*	*berardiana*			1	2-10
Goodeniaceae	*Scaevola*	*crassifolia*	Thick-leaved Fan-flower		0.5	<2
Juncaginaceae	*Triglochin*	*trichophora*		RI	0.05	<2
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		1.1	<2
Myrtaceae	*Melaleuca*	*cardiophylla*	Tangling Melaleuca		1.2	10-30
Myrtaceae	*Thryptomene*	*baeckeacea*			1	10-30
Orchidaceae	*Thelymitra*	*sp. (insufficient material)*			0.05	<2
Poaceae	*Austrostipa*	*macalpinei*			1.1	<2
Poaceae	*Poa*	*drummondiana*	Knotted Poa	RI	0.7	<2
Poaceae	*Rostraria*	*cristata*	Annual Catstail	*	0.05	<2
Poaceae	*Rostraria*	*pumila*	Roughtail	*	0.08	<2
Portulacaceae	*Calandrinia*	*brevipedata*	Short Stalked Purslane		0.05	<2
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*	0.05	<2
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower		0.6	<2
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf		0.4	<2

Quadrat 7

Location: 246730 mE, 6862208 mN (Zone 50)

Topography: Flat **Rocks**: 0%

Logs: <2 % **Branches:** 2-10 % **Leaves:** 2-10%

Bare Ground: >70%

Soil Type: Loamy sand

Field Vegetation Description: Open mixed Acacia scrubland

Vegetation Condition: 3

Other: Disturbances; weeds, grazing by kangaroos and rabbits

Plate 7: Vegetation located in Quadrat 7

Table 7 Species List for Quadrat 7

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.1	<2
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*	0.1	<2
Asteraceae	*Podotheca*	*angustifolium*	Sticky Longheads		0.1	<2
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*	0.05	<2
Chenopodiaceae	*Dysphania*	*sphaerosperma*		RI	0.1	2-10
Crassulaceae	*Crassula*	*colorata*	Dense Stonecrop		0.1	<2
Lauraceae	*Cassytha*	*racemosa*	Dodder Laurel		C	2-10
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		4	2-10
Pittosporaceae	*Pittosporum*	*angustifolium*			3	2-10
Poaceae	*Austrostipa*	*macalpinei*			1	2-10
Poaceae	*Rostraria*	*pumila*	Roughtail	*	0.15	<2
Portulacaceae	*Calandrinia*	*granulifera*			0.05	<2
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*	0.15	<2
Rutaceae	*Diplolaena*	*mollis*			1.3	<2
Sterculiaceae	*Guichenotia*	*ledifolia*			0.3	<2
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower		1.6	2-10
Vitaceae	*Clematicissus*	*angustissima*			C	<2
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf		1	<2

Quadrat 8

Location: 247071 mE, 6861844 mN (Zone 50)

Topography: West gentle **Rocks**: 0%

Logs: <2 % **Branches:** 2-10 % **Leaves:** 10-30%

Bare Ground: 30-70%

Soil Type: Sand over limestone

Field Vegetation Description: Open mixed Acacia scrubland

Vegetation Condition: 3

Other: Disturbances; grazing by roos and rabbits

Plate 8: Vegetation located in Quadrat 8

Table 8 Species List for Quadrat 8

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.05	2-10
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*	0.1	<2
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush		1.4	<2
Asteraceae	*Sonchus*	*oleraceus*	Common Sowthistle	*	0.1	<2
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*	0.1	<2
Chenopodiaceae	*Rhagodia*	*preissii subsp. obovata*			1.1	<2
Dasypogonaceae	*Acanthocarpus*	*preissii*			0.8	<2
Lauraceae	*Cassytha*	*racemosa*	Dodder Laurel		C	<2
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		4.5	2-10
Poaceae	*Austrostipa*	*macalpinei*			1.2	2-10
Poaceae	*Rostraria*	*pumila*	Roughtail	*	0.0.5	<2
Primulaceae	*Anagallis*	*arvensis var. caerulea*	Pimpernel	*	0.1	<2
Solanaceae	*Anthocercis*	*littorea*	Yellow Tailflower		1.4	<2
Sterculiaceae	*Guichenotia*	*ledifolia*			0.7	2-10
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower		1.5	2-10
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf		1.2	<2

Quadrat 9

Location: 247307 mE, 6862222 mN (Zone 50)

Topography: West gentle **Rocks**: 0%

Logs: <2 % **Branches:** 10-30 % **Leaves:** 10-30%

Bare Ground: 10-30%

Soil Type: Pale sand over limestone

Field Vegetation Description: Mixed Acacia and Proteaceae and Myrtaceae scrub heath

Vegetation Condition: 3

Other: Disturbances; ?dieback, rabbit grazing, ?fire.

Plate 9: Vegetation located in Quadrat 9

Table 9 Species List for Quadrat 9

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Apiaceae	*Stenanthemum*	*intricatum*			0.15	2-10
Asteraceae	*Acanthocarpus*	*preissii*			0.1	<2
Asteraceae	*Bonamia*	*rosea*	Felty Bellflower		0.2	<2
Asteraceae	*Gompholobium*	*tomentosum*	Hairy Yellow Pea		0.15	<2
Asteraceae	*Triglochin*	*trichophora*		*	0.05	<2
Brassicaceae	*Acacia*	*spathulifolia*		*	0.1	<2
Chenopodiaceae	*Leucopogon*	*sp. Mid West (J.S. Beard 7388)*			0.3	<2
Convolvulaceae	*Hypochaeris*	*glabra*	Smooth Catsear		0.45	<2
Dasypogonaceae	*Rhagodia*	*preissii subsp. obovata*			0.45	<2
Dioscoreaceae	*Olearia*	*axillaris*	Coastal Daisybush		C	<2
Droseraceae	*Phyllanthus*	*calycinus*	False Boronia		0.1	<2
Epacridaceae	*Clematicissus*	*angustissima*			0.9	<2
Euphorbiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.2	<2
Haemodoraceae	*Senecio*	*sp. (insufficient material)*			0.25	<2
Haloragaceae	*Desmocladus*	*asper*			0.4	<2
Hemerocallidaceae	*Drosera*	*humilis*			0.9	<2
Juncaginaceae	*Pimelea*	*microcephala*	Shrubby Riceflower		0.05	<2
Lauraceae	*Dianella*	*revoluta*	Blueberry Lily		C	<2
Mimosaceae	*Glischrocaryon*	*aureum*	Common Popflower		1.9	<2
Mimosaceae	*Thryptomene*	*baeckeacea*			2.5	<2
Myrtaceae	*Grevillea*	*leucopteris*	White Plume Grevillea		1.4	30-70
Myrtaceae	*Phyllanthus*	*calycinus*	False Boronia	P1	1.9	10-30
Orchidaceae	*Conostylis*	*stylidioides*			0.2	<2
Papilionaceae	*Austrostipa*	*macalpinei*			0.45	<2
Poaceae	*Anagallis*	*arvensis*	Pimpernel		0.5	<2
Primulaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*	0.1	<2
Proteaceae	*Acacia*	*spathulifolia*			3	<2
Proteaceae	*Waitzia*	*acuminata*	Orange Immortelle		0.3	<2
Restionaceae	*Caladenia*	*longicauda subsp. borealis*			0.3	2-10
Rhamnaceae	*Dioscorea*	*hastifolia*	Warrine		0.2	<2
Thymelaeaceae	*Cassytha*	*racemosa*	Dodder Laurel		0.5	<2
Vitaceae	*Thryptomene*	*baeckeacea*			C	<2

Quadrat 10

Location: 247659 mE, 6861440 mN (Zone 50)

Topography: South gentle **Rocks**: 0%

Logs: 2-10 % **Branches:** 10-30 % **Leaves:** 30-70 %

Bare Ground: 10-30 %

Soil Type: Pale sand

Field Vegetation Description: Myrtaceous and Proteaceous scrub with Acacia

Vegetation Condition: 3

Other: Disturbances; grazing by rabbits, dieback

Plate 10: Vegetation located in Quadrat 10

Table 10 Species List for Quadrat 10

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.1	2-10
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*	0.05	<2
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush		1.3	<2
Dilleniaceae	*Hibbertia*	*hypericoides*	Yellow Buttercups		1	<2
Dioscoreaceae	*Dioscorea*	*hastifolia*	Warrine		C	<2
Euphorbiaceae	*Poranthera*	*microphylla*	Small Poranthera		0.05	<2
Haemodoraceae	*Conostylis*	*stylidioides*			0.2	<2
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		2.5	<2
Mimosaceae	*Acacia*	*spathulifolia*			1.9	10-30
Myrtaceae	*Thryptomene*	*baeckeacea*			1.4	30-70
Papilionaceae	*Daviesia*	*divaricata subsp. lanulosa*	Marno		1.4	<2
Poaceae	*Austrostipa*	*macalpinei*			1	<2
Proteaceae	*Hakea*	*recurva*	Djarnokmurd		2.1	<2
Restionaceae	*Desmocladus*	*asper*			0.2	<2

Quadrat 11

Location: 249760 mE, 6859995 mN (Zone 50)

Topography: East Medium **Rocks**: 0%

Logs: <2 % **Branches:** <2 % **Leaves:** 10-30%

Bare Ground: 30-70%

Soil Type: Sand over deep limestone

Field Vegetation Description: Very open Banksia woodland over Myrtaceous shrubland

Vegetation Condition: 4

Other: Disturbances; ?dieback, rabbits, old clearing activities

Plate 11: Vegetation located in Quadrat 11

Table 11 Species List for Quadrat 11

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Myrtaceae	*Thryptomene*	*baeckeacea*			1.4	10-30
Cyperaceae	*Mesomelaena*	*pseudostygia*			0.4	<2
Proteaceae	*Banksia*	*prionotes*	Acorn Banksia		5	2-10
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.4	2-10
Epacridaceae	*Leucopogon*	*sp. Mid West (J.S. Beard 7388)*			0.6	<2
Papilionaceae	*Jacksonia*	*rigida*			0.4	<2
Asteraceae	*Ursinia*	*anthemoides*	Ursinia	*	0.2	<2
Orchidaceae	*Caladenia*	*flava*	Cowslip Orchid		0.2	<2
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*	0.2	<2
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.1	<2
Portulacaceae	*Calandrinia*	*granulifera*			0.05	<2
Droseraceae	*Drosera*	*humilis*			0.05	<2
Hemerocallidaceae	*Corynotheca*	*micrantha*	Sand Lily		0.1	<2
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*	0.3	2-10
Haemodoraceae	*Dianella*	*revoluta*	Blueberry Lily		1	<2
Asparagaceae	*Sowerbaea*	*laxiflora*	Purple Tassels		0.4	<2
Rhamnaceae	*Stenanthemum*	*intricatum*			0.4	<2

Quadrat 12

Location: 246256 mE, 6860931 mN (Zone 50)

Topography: West medium **Rocks**: 0%

Logs: <2 % **Branches:** <2 % **Leaves:** 10-30%

Bare Ground: 10-30%

Soil Type: Sand unconsolidated front dune

Field Vegetation Description: Stabilised foredune

Vegetation Condition: 3

Other: Disturbances; fire past 10 years

Plate 12: Vegetation located in Quadrat 12

Table 12 Species List for Quadrat 12

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Aizoaceae	*Carpobrotus*	*virescens*	Coastal Pigface		0.3	2-10
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach		0.8	2-10
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush		1.1	2-10
Asteraceae	*Reichardia*	*tingitana*	False Sowthistle	*	0.4	2-10
Asteraceae	*Urospermum*	*picroides*	False Hawkbit	*	0.2	<2
Chenopodiaceae	*Rhagodia*	*preissii subsp. obovata*			1	2-10
Chenopodiaceae	*Threlkeldia*	*diffusa*	Coast Bonefruit		0.5	10-30
Crassulaceae	*Crassula*	*colorata var. acuminata*	Dense Stonecrop		0.05	<2
Dasypogonaceae	*Acanthocarpus*	*preissii*			0.6	2-10
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		1.1	<2
Poaceae	*Ehrharta*	*brevifolia subsp. cuspidata*	Annual Veldt Grass	*	0.4	<2
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*	0.6	<2
Poaceae	*Lamarckia*	*aurea*	Goldentop	*	0.1	<2
Poaceae	*Spinifex*	*longifolius*	Beach Spinifex		1.1	2-10
Portulacaceae	*Calandrinia*	*brevipedata*	Short Stalked Purslane		0.25	<2
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*	0.02	<2
Solanaceae	*Anthocercis*	*littorea*	Yellow Tailflower		1	<2
Solanaceae	*Nicotiana*	*glauca*	Tree Tobacco	*	0.5	<2
Urticaceae	*Parietaria*	*cardiostegia*			0.3	<2

Quadrat 13

Location: 246049 mE, 6862008 mN (Zone 50)

Topography: Flat **Rocks**: 0%

Logs: 2-10 % **Branches:** 10-30 % **Leaves:** 30-70 %

Bare Ground: 2-10 %

Soil Type: Sand 50 m from beach

Field Vegetation Description: Coastal scrub heath

Vegetation Condition: 2-3

Other: Disturbances; rabbits, fire

Plate 13: Vegetation located in Quadrat 13

Table 13 Species List for Quadrat 13

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach		0.9	2-10
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.1	<2
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush		1	<2
Dasypogonaceae	*Acanthocarpus*	*preissii*			1.5	2-10
Euphorbiaceae	*Phyllanthus*	*calycinus*	False Boronia		0.9	<2
Euphorbiaceae	*Poranthera*	*microphylla*	Small Poranthera		0.1	<2
Lauraceae	*Cassytha*	*racemosa*	Dodder Laurel		C	<2
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		1.5	2-10
Myrtaceae	*Melaleuca*	*cardiophylla*	Tangling Melaleuca		1.3	2-10
Myrtaceae	*Melaleuca*	*huttensis*		P1	1.3	2-10
Myrtaceae	*Thryptomene*	*racemulosa*			1.4	2-10
Poaceae	*Austrostipa*	*macalpinei*			0.2	<2
Ranunculaceae	*Clematis*	*linearifolia*			C	<2
Solanaceae	*Anthocercis*	*littorea*	Yellow Tailflower		1.6	<2
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf		1.3	30-70

Quadrat 14

Location: 247573 mE, 6860595 mN (Zone 50)

Topography: west very gentle **Rocks**: 0%

Logs: 0 % **Branches:** 2-10 % **Leaves:** 10-30%

Bare Ground: 2-10%

Soil Type: Sand

Field Vegetation Description: Open mixed Acacia shrubland

Vegetation Condition: 4

Other: Disturbances; grazing by kangaroos and rabbits, weeds

Plate 14: Vegetation located in Quadrat 14

Table 14 Species List for Quadrat 14

Family	Genus	Species	Common Name	Status	Height (m)	Coverage %
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach		1	<2
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip		0.05	<2
Asparagaceae	*Thysanotus*	*manglesianus*			C	2-10
Asteraceae	*Euchiton*	*sphaericus*	Star Cudweed		0.02	<2
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*	0.15	2-10
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush		1.6	2-10
Asteraceae	*Sonchus*	*asper*	Rough Sowthistle	*	0.2	<2
Boraginaceae	*Echium*	*plantagineum*	Paterson's Curse	*DP	0.4	<2
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*	0.2	<2
Euphorbiaceae	*Euphorbia*	*boophthona*	Gascoyne Spurge		0.9	2-10
Euphorbiaceae	*Euphorbia*	*terracina*	Geraldton Carnation Weed	*	0.3	<2
Loranthaceae	*Amyema*	*preissii*	Wireleaf Mistletoe		C	<2
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle		3.5	2-10
Poaceae	*Austrostipa*	*macalpinei*			1.5	10-30
Poaceae	*Ehrharta*	*longiflora*	Annual Veldt Grass	*	0.2	<2
Poaceae	*Rostraria*	*pumila*	Roughtail	*	0.15	2-10
Portulacaceae	*Calandrinia*	*granulifera*			0.1	<2
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*	0.05	<2
Solanaceae	*Solanum*	*nigrum*	Black Berry Nightshade	*	1	<2
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower		1.7	2-10
Urticaceae	*Parietaria*	*cardiostegia*			0.4	<2
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf		1.1	2-10

Relévé 1

Location: 248555 mE, 6858243 mN (Zone 50)

Table 15 Species List for Relévé 1

Family	Genus	Species	Common Name	Status
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach	
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush	
Boraginaceae	*Echium*	*plantagineum*	Paterson's Curse	*DP
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*
Chenopodiaceae	*Enchylaena*	*tomentosa*	Barrier Saltbush	
Dasypogonaceae	*Acanthocarpus*	*preissii*		
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle	
Myrtaceae	*Melaleuca*	*huttensis*		P1
Oleaceae	*Jasminum*	*calcarium*		
Portulacaceae	*Calandrinia*	*brevipedata*	Short Stalked Purslane	
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*
Ranunculaceae	*Clematis*	*linearifolia*		
Solanaceae	*Anthocercis*	*littorea*	Yellow Tailflower	
Solanaceae	*Lycium*	*ferocissimum*	African Boxthorn	*
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf	

Relévé 2

Location: 0247724 mE, 6859823 mN (Zone 50)

Table 16 Species List for Relévé 2

Family	Genus	Species	Common Name	Status
Apocynaceae	*Alyxia*	*buxifolia*	Dysentery Bush	
Asteraceae	*Waitzia*	*podolepis*		
Lamiaceae	*Pityrodia*	*loxocarpa*		
Malvaceae	*Alyogyne*	*coronopifolia*		ms
Rutaceae	*Diplolaena*	*mollis*		

Relévé 3

Location: 247471 mE, 6859733 mN (Zone 50)

Field Vegetation Description: Mixed Coastal Scrubland

Plate 15: Releve' 3

Table 17 Species List for Relévé 3

Family	Genus	Species	Common Name	Status
Aizoaceae	*Carpobrotus*	*virescens*	Coastal Pigface	
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach	
Amaranthaceae	*Ptilotus*	*divaricatus*	Climbing Mulla Mulla	
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush	
Asteraceae	*Senecio*	*pinnatifolius*		
Chenopodiaceae	*Threlkeldia*	*diffusa*	Coast Bonefruit	
Dasypogonaceae	*Acanthocarpus*	*preissii*		
Goodeniaceae	*Scaevola*	*crassifolia*	Thick-leaved Fan-flower	
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle	
Myrtaceae	*Melaleuca*	*huttensis*		P1
Myrtaceae	*Thryptomene*	*baeckeacea*		
Nyctaginaceae	*Commicarpus*	*australis*	Perennial Tar Vine	
Poaceae	*Ehrharta*	*brevifolia subsp. cuspidata*	Annual Veldt Grass	*
Portulacaceae	*Calandrinia*	*brevipedata*	Short Stalked Purslane	
Urticaceae	*Parietaria*	*cardiostegia*		
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf	

Relévé 4

Location: 247519 mE, 6861828 mN (Zone 50)

Table 18 Species List for Relévé 4

Family	Genus	Species	Common Name	Status
Apiaceae	*Trachymene*	*pilosa*	Native Parsnip	
Asparagaceae	*Sowerbaea*	*laxiflora*	Purple Tassels	
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*
Celastraceae	*Stackhousia*	*monogyna*		
Cyperaceae	*Lepidosperma*	*scabrum*		
Dilleniaceae	*Hibbertia*	*hypericoides*	Yellow Buttercups	
Dioscoreaceae	*Dioscorea*	*hastifolia*	Warrine	
Haemodoraceae	*Conostylis*	*stylidioides*		
Hemerocallidaceae	*Caesia*	*sp. Wongan (K.F. Keneally 8820)*		
Hemerocallidaceae	*Dianella*	*revoluta*	Blueberry Lily	
Hemerocallidaceae	*Stypandra*	*glauca*	Blind Grass	
Iridaceae	*Orthrosanthus*	*laxus var. laxus*	Morning Iris	
Iridaceae	*Patersonia*	*occidentalis*	Purple Flag	
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle	
Mimosaceae	*Acacia*	*spathulifolia*		
Myrtaceae	*Melaleuca*	*depressa*		
Myrtaceae	*Melaleuca*	*huttensis*		P1
Myrtaceae	*Thryptomene*	*baeckeacea*		
Orchidaceae	*Caladenia*	*flava*	Cowslip Orchid	
Orchidaceae	*Thelymitra*	*sp. (insufficient material)*		
Papilionaceae	*Isotropis*	*sp. Shark Bay (M.E. Trudgen 7170)*		
Papilionaceae	*Jacksonia*	*rigida*		
Poaceae	*Austrostipa*	*macalpinei*		
Proteaceae	*Banksia*	*attenuata*	Slender Banksia	
Proteaceae	*Banksia*	*prionotes*	Acorn Banksia	
Proteaceae	*Conospermum*	*stoechadis*	Common Smokebush	
Proteaceae	*Grevillea*	*leucopteris*	White Plume Grevillea	
Restionaceae	*Lepidobolus*	*preissianus*		
Rubiaceae	*Opercularia*	*vaginata*	Dog Weed	
Stylidiaceae	*Stylidium*	*kalbarriense*		
Thymelaeaceae	*Pimelea*	*floribunda*		

Relévé 5

Location: 248777 mE, 6860035 mN (Zone 50)

Plate 16: Releve' 5

Table 19 Species List for Relévé 5

Family	Genus	Species	Common Name	Status
Asparagaceae	*Lomandra*	*maritima*		
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*
Brassicaceae	*Brassica*	*tournefortii*	Mediterranean Turnip	*
Caryophyllaceae	*Petrorhagia*	*dubia*		*
Caryophyllaceae	*Silene*	*gallica*	French Catchfly	*
Casuarinaceae	*Allocasuarina*	*campestris*		
Dasypogonaceae	*Acanthocarpus*	*preissii*		
Dilleniaceae	*Hibbertia*	*spicata subsp. spicata*		
Dioscoreaceae	*Dioscorea*	*hastifolia*	Warrine	
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle	
Myrtaceae	*Melaleuca*	*campanae*		
Myrtaceae	*Melaleuca*	*cardiophylla*	Tangling Melaleuca	
Myrtaceae	*Melaleuca*	*huttensis*		P1
Papilionaceae	*Lupinus*	*cosentinii*	Western Australian Blue Lupin	*
Poaceae	*Austrostipa*	*macalpinei*		
Proteaceae	*Banksia*	*fraseri var. ashbyi*		
Restionaceae	*Desmocladus*	*asper*		
Rutaceae	*Diplolaena*	*mollis*		
Solanaceae	*Solanum*	*oldfieldii*		
Thymelaeaceae	*Pimelea*	*floribunda*		
Thymelaeaceae	*Pimelea*	*microcephala*	Shrubby Riceflower	

Relévé 6

Location: 247198 mE, 6859428 mN (Zone 50)

Table 20 Species List for Relévé 6

Family	Genus	Species	Common Name	Status
Aizoaceae	*Carpobrotus*	*virescens*	Coastal Pigface	
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush	
Asteraceae	*Urospermum*	*picroides*	False Hawkbit	*
Goodeniaceae	*Scaevola*	*crassifolia*	Thick-leaved Fan-flower	
Lauraceae	*Cassytha*	*racemosa*	Dodder Laurel	
Mimosaceae	*Acacia*	*rostellifera*	Summer-scented Wattle	
Poaceae	*Avena*	*barbata*	Bearded Oat	*
Poaceae	*Rostraria*	*cristata*	Annual Catstail	*
Santalaceae	*Exocarpos*	*sparteus*	Broom Ballart	

Relévé 7

Location: 246319 mE, 6860679 mN (Zone 50)

Plate 17: Releve' 7

Table 21 Species List for Relévé 7

Family	Genus	Species	Common Name	Status
Aizoaceae	*Mesembryanthemum*	*crystallinum*	Iceplant	*
Aizoaceae	*Tetragonia*	*implexicoma*	Bower Spinach	
Asteraceae	*Olearia*	*axillaris*	Coastal Daisybush	
Asteraceae	*Urospermum*	*picroides*	False Hawkbit	*
Chenopodiaceae	*Rhagodia*	*preissii subsp. obovata*		
Goodeniaceae	*Scaevola*	*crassifolia*	Thick-leaved Fan-flower	
Myoporaceae	*Myoporum*	*insulare*	Blueberry Tree	
Poaceae	*Avena*	*barbata*	Bearded Oat	*
Poaceae	*Bromus*	*diandrus*	Great Brome	*
Solanaceae	*Anthocercis*	*littorea*	Yellow Tailflower	
Solanaceae	*Lycium*	*ferocissimum*	African Boxthorn	*
Urticaceae	*Parietaria*	*cardiostegia*		
Zygophyllaceae	*Zygophyllum*	*fruticulosum*	Shrubby Twinleaf	

Appendix D

Fauna

Fauna Conservation Codes

Threatened Fauna Database Search

Expected and Recorded Fauna

EPBC Act Fauna Conservation Categories

Listed threatened species and ecological communities

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- extinct in the wild,
- critically endangered,
- endangered, or
- vulnerable.
- (See Table 10)

Critically endangered and endangered species

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population, or
- reduce the area of occupancy of the species, or
- fragment an existing population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of a population, or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or
- interfere with the recovery of the species.

**Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

Vulnerable species

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- lead to a long-term decrease in the size of an important population of a species, or
- reduce the area of occupancy of an important population, or
- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an important population, or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or

- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
- interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.

Listed migratory species

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The criteria below are relevant to migratory species that are not threatened.

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- result in invasive species that is harmful to the migratory species becoming established* in an area of important habitat of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

1. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
2. habitat utilised by a migratory species which is at the limit of the species range, or
3. habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an ecologically significant proportion of the population varies with the species (each circumstance will need to be evaluated).

*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.

The Commonwealth marine environment

An action will require approval from the Environment Minister if:

- the action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment, or
- the action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment in a Commonwealth marine area.

An action has, will have or is likely to have a significant impact on the environment in a Commonwealth marine area if it does, will, or is likely to:

result in a known or potential pest species becoming established in the Commonwealth marine area*, or

modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results, or

have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (e.g. breeding, feeding, migration behaviour, and life expectancy) and spatial distribution, or

result in a substantial change in air quality** or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or

result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.

*Translocating or introducing a pest species may result in that species becoming established.

**The Commonwealth marine area includes any airspace over Commonwealth waters

Table 14 *Western Australia Wildlife Conservation Act* (1950) Conservation Codes

Conservation Code	Description
Schedule 1	"...fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
Schedule 2	"...fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
Schedule 3	"...birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection."
Schedule 4	"...fauna that is in need of special protection, otherwise than for the reasons mentioned [in Schedule 1 – 3]"

Table 15 DEC Priority Fauna Codes

(Species not listed under the *Wildlife Conservation Act (*1950), but for which there is some concern).

Conservation Code	Description
Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc.
Priority 3	Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Table 16 Threatened fauna occurring, or likely to occur, in the Project Area as indicated by the EPBC Act Protected Matters Search Tool and the DEC's Threatened Fauna Database search

				Conservation Status	
Family	**Genus**	**Species**	**Common Name**	**EPBC Act**	**DEC**
Birds					
Accipitridae	*Haliaeetus*	*ieucogaster*	White-bellied Sea-Eagle	Marine Migratory	
Apodidae	*Apus*	*pacificus*	Fork-tailed Swift	Marine Migratory	
Ardeidae	*Ardea*	*alba*	Great Egret, White Egret	Marine Migratory	
Ardeidae	*Ardea*	*ibis*	Cattle Egret	Marine Migratory	
Burhinidae	*Burhinus*	*grallarius*	Bush Stonecurlew	-	Priority 4
Cacatuidae	*Calyptorhynchus*	*latirostris*	Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo	Endangered	Schedule 1
Diomedeidae	*Diomedea*	*exulans exulans*	Tristan Albatross	Endangered Marine Migratory	
Diomedeidae	*Thalassarche*	*carteri*	Indian Yellow-nosed Albatross	Vulnerable Marine Migratory	
Diomedeidae	*Thalassarche*	*cauta cauta*	Shy Albatross, Tasmanian Shy Albatross	Vulnerable Marine Migratory	

Diomedeidae	*Thalassarche*	*chlororhynchos*	Yellow-nosed Albatross, Atlantic Yellow-nosed Albatross	Marine Migratory	
Falconiformes	*Falco*	*peregrinus*	Peregrine Falcon	-	Schedule 4
Laridae	*Anous*	*tenuirostris melanops*	Australian Lesser Noddy	Vulnerable Marine	
Laridae	*Catharacta*	*skua*	Great Skua	Marine	
Meropidae	*Merops*	*ornatus*	Rainbow Bee-eater	Marine Migratory	
Pomatostomidae	*Pomatostomus*	*superciliosus ashbyi*	White-browed Babbler (western wheatbelt)	-	Priority 4
Procellariidae	*Macronectes*	*giganteus*	Southern Giant-Petrel	Endangered Marine Migratory	
Procellariidae	*Macronectes*	*halli*	Northern Giant-Petrel	Vulnerable Marine Migratory	
Procellariidae	*Pterodroma*	*mollis*	Soft-plumaged Petrel	Vulnerable Marine	
Mammals					
Macropodidae	*Macropus*	*eugenii derbianus*	Tammar Wallaby	-	Priority 5
Insects					
Idiopidae	*Idiosoma*	*nigrum*	Shield-backed Trapdoor Spider	-	Schedule 1

Table 17 Expected and Recorded Fauna List, Horrocks Project Area

				Status	Status	Status	Status		
Family	**Genus**	**Species**	**Common Name**	**EPBC**	**WCAct**	**DEC**	**Exotic/Domestic**	**NatureMap**	**Survey**
Birds									
Accipitridae	*Accipiter*	*cirrhocephalus*	Collared Sparrowhawk	Mi					x
Accipitridae	*Elanus*	*caeruleus*	Black-shouldered Kite	Mi					x
Accipitridae	*Haliaeetus*	*leucogaster*	White-bellied Sea-Eagle	Mi, Ma					x
Accipitridae	*Pandion*	*haliaetus*	Osprey	Mi, Ma					x
Alcedinidae	*Streptopelia*	*senagalensis*	Laughing Turtle-Dove				*		x
Anatidae	*Anas*	*superciliosus*	Pacific Black Duck	Mi					x
Anatidae	*Tadorna*	*tadornoides*	Australian Shelduck	Mi					x
Artamidae	*Artamus*	*cinereus*	Black-faced Woodswallow						x
Burhinidae	*Burhinus*	*grallarius*	Bush Stone-curlew			P4		x	
Campephagidae	*Coracina*	*novaehollandiae*	Black-faced Cuckoo-shrike	Ma					x
Corvidae	*Corvus*	*coronoides*	Australian Raven						x
Cracticidae	*Cracticus*	*tibicen*	Australian Magpie						x
Cuculidae	*Cacomantis*	*flabelliformis*	Fan-tailed Cuckoo	Ma					x
Cuculidae	*Chrysococcyx*	*basalis*	Horsfield's Bronze Cuckoo	Ma					x
Dicruridae	*Grallina*	*cyanoleuca*	Australian Magpie-lark	Ma					x
Dicruridae	*Rhipidura*	*leucophrys*	Willie Wagtail						x
Falconidae	*Falco*	*cenchroides*	Australian Kestrel	Mi, Ma					x
Falconidae	*Falco*	*peregrinus macropus*	Peregrine Falcon	Mi	S4	P1		x	

				Status	Status	Status	Status		
Family	**Genus**	**Species**	**Common Name**	**EPBC**	**WCAct**	**DEC**	**Exotic/Domestic**	**NatureMap**	**Survey**
Hirundinidae	*Hirundo*	*neoxena*	Welcome Swallow	Ma					x
Laridae	*Larus*	*novaehollandiae*	Silver Gull	Ma					x
Laridae	*Larus*	*pacificus*	Pacific Gull	Ma					x
Laridae	*Sterna*	*bergii*	Crested Tern	Ma					x
Maluridae	*Malurus*	*sp.*	Fairy-wren Species						x
Meliphagidae	*Lichenostomus*	*virescens*	Singing Honeyeater						x
Meliphagidae	*Manorina*	*flavigula*	Yellow-throated Miner						x
Motacillidae	*Anthus*	*australis*	Australian Pipit						x
Pachycephalidae	*Oreoica*	*gutturalis*	Crested Bellbird						x
Pachycephalidae	*Pachycephala*	*rufiventris*	Rufous Whistler						x
Pelecanidae	*Pelecanus*	*conspicillatus*	Australian Pelecan	Ma					x
Phalacrocoracidae	*Phalacrocorax*	*melanoleucos*	Little Pied Cormorant						x
Phalacrocoracidae	*Phalacrocorax*	*sulcirostris*	Little Black Cormorant						x
Phalacrocoracidae	*Phalacrocorax*	*varius*	Pied Cormorant						x
Psittacidae	*Cacatua*	*roseicapilla*	Galah						x
Psittacidae	*Platycercus*	*zonarius*	Australian Ringneck						x
Rallidae	*Fulica*	*atra*	Eurasian Coot						x
Mammals									
Bovidae	*Ovis*	*aries*	Domestic Sheep				+		x
Canidae	*Vulpes*	*vulpes*	Red Fox				*		x
Felidae	*Felis*	*catus*	Feral Cat				*		x

Family	Genus	Species	Common Name	Status EPBC	Status WCAct	Status DEC	Status Exotic/Domestic	NatureMap	Survey
Leporidae	*Oryctolagus*	*cuniculus*	European Rabbit				*		x
Macropodidae	*Macropus*	*sp.*	Macropod species						x
Macropodidae	*Macropus*	*eugenii derbianus*	Tammar			P5		x	
Muridae	*Mus*	*musculus*	House Mouse				*	x	
Suidae	*Sus*	*scrofa*	Feral Pig				*		x
Reptiles									
Agamidae	*Ctenophorus*	*sp.*	Dragon species						x
Agamidae	*Ctenophorus*	*reticulatus*	Western Netted Dragon					x	
Agamidae	*Pogona*	*minor minor*	Dwarf Bearded Dragon					x	
Elapidae	*Simoselaps*	*littoralis*	West Coast Banded Snake					x	
Gekkonidae	*Gehyra*	*variegata*						x	
Gekkonidae	*Nephurus*	*milii*	Barking Gecko					x	
Pygopodidae	*Pygopus*	*lepidopodus*	Common Scaly-foot						x
Scincidae	*Cryptoblepharus*	*buchananii*						x	
Amphibians									
Hylidae	*Litoria*	*adelaidensis*	Slender Tree Frog					x	
Hylidae	*Litoria*	*moorei*	Motorbike Frog					x	
Myobatrachidae	*Helioporus*	*albopunctatus*	Western Spotted Frog					x	
Myobatrachidae	*Limnodynastes*	*dorsalis*	Western Banjo Frog					x	

GHD

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	J Foster	A Nagle		A Nagle		01/12/2009
1	J Foster	A Nagle		A Nagle		09/03/2010

ANNEXURE 5

CORRESPONDENCE FROM DEC

Government of **Western Australia**
Department of **Environment and Conservation**

Your ref.
Our ref: 2007/2860
Enquiries: Catherine Page
Phone: 9921 5955
Fax: 9921 5713
Email: Catherine.Page@dec.wa.gov.au

ICR 19925

NORTHAMPTON SHIRE COUNCIL
File: 10.5.12
11 FEB 2010

Admin	Eng	Hlth Bldg	Town Plnr	Rang

Ms Hayley Williams
Principal Planner
Shire of Northampton
PO Box 61
NORTHAMPTON WA 6535

Dear Hayley

Proposed Structure Plan, Lot 110, 112, 114 and 115, Horrocks and White Cliffs Road, Flora and Fauna Survey

I refer to our recent telephone conversation regarding the Seaview Farms Structure Plan in reference to the flora and fauna survey recently completed by GHD. The Department of Environment and Conservation (DEC), Geraldton District received a copy of the report for this survey in December 2009 and has since reviewed the document in relation to the existing structure plan, completed by Allerding and Associates in June 2008.

A number of the issues identified in the report are not addressed adequately in the existing structure plan. I have attached DEC's comments in relation to this. DEC recommends that a new structure plan be developed which addresses these issues before it is adopted by the Northampton Shire and WAPC.

The proponent should also be aware that the survey identifies one flora species and a number of fauna species listed under the Commonwealth Environmental Protection and Biodiversity Conservation (EPBC) Act that may be impacted by this proposal therefore it may require referral. It is the proponent's responsibility to determine if a proposal requires referral. Please contact the Department of the Environment, Water, Heritage and the Arts Community Information Unit on 1800 803 772 for further information. Please also see the attached fact sheets regarding the EPBC act.

Please note that DEC Geraldton District has reviewed the available information in relation to nature conservation issues and potential impacts on DEC managed areas only. For guidance on managing issues on which the DEC Geraldton District does not provide site specific advice, you are referred in the first instance to the environmental planning policies and criteria for Western Australia published by WAPC, EPA, DEC and other agencies with responsibilities in environmental protection.

If you have any queries relating to this advice, please contact Catherine Page, Operations Officer on 9921 5955.

Sincerely,

David Rose
District Manager
Geraldton District
2 February 2009

Cc: Jerom Hurley, Department of Planning

Proposed Structure Plan, Lot 110, 112, 114 and 115, Horrocks and White Cliffs Road, written by Allerding and Associates, June 2008

Comments from the Department of Environment and Conservation in relation to the Flora and Fauna Survey Report, completed by GHD, November 2009

1) General Comments

- The report states that the majority of the project area is infested with dieback (*Phytophthora cinnamomi*) however no evidence is presented to support this claim. Sample information would confirm the presence of this pathogen. If present, a hygiene management plan to minimise the spread of the pathogen would be required.

However, DEC considers it unlikely for *Phytophthora cinnamomi* to occur in the area as:

> i) There are currently no confirmed infestations of *Phytophthora cinnamomi* north of the Eneabba area
> ii) *Phytophthora cinnamomi* is known to be uncommon in areas containing coastal limestone.

- There is an error on page 10. The IBRA region for the project area is listed as the Ord Victoria Plain. It is assumed that this is supposed to be the Geraldton Sandplains IBRA region, as this is the IBRA region referred to in the remainder of the report

2) Regional Significance in relation to Beard's Mapping

The area contains two Beard's vegetation types. Vegetation type 129, described by Beard as bare areas and drift sand and vegetation type 359, described as Acacia and Banksia shrubland.

The EPA position statement number 2, "Protection of Native Vegetation in Western Australia," states that the threshold level below which species loss accelerates exponentially is 30% of the pre-clearing extent for that vegetation type.

On page 10 of the report, vegetation association 359 is listed as having 18.9% remaining of its pre-European extent, which is below the 30% threshold and Vegetation 129 is identified as having 32% of the pre European extent remaining. If further clearing occurs as a result of this proposal, it may fall below the 30% threshold

Position statement 2 also states that when the EPA is assessing a proposal, where the proposal will result in a reduction below 30% of the pre-European extent, alternative mechanisms are to be put forward to address the protection of biodiversity. The current structure plan does not address this issue.

Further to this, the report states that only 18% of the pre-European extent of the vegetation in the shire of Northampton remains.

Recommendation 1 -The structure plan should address the protection of biodiversity, as per the EPA Position Statement 2.

3) Regional Significance of Vegetation Types identified by GHD

GHD identified a total of 15 communities to occur within the project area. The regional significance of these communities is discussed on page 21 of the report and is examined further below.

The report states that communities 2, 12, 13, and 15 are directly comparable with the vegetation association descriptions of Beard. The report does not directly link the vegetation communities with any of the Beards associations, but it is assumed that GHD consider vegetation community 2 to be comparable with Beards Association 129 because of it's location in the landscape. This is conceivable, as the description for this association is more a description of the landscape values than of the vegetation. It is also assumed that GHD consider communities 12, 13, and 15 to be comparable with Beard's vegetation association 359, because they contain Acacia and Banksia species.

Association 359 is described by Beard as "Acacia and Banksia Shrubland". Communities 13 and 15 are described by GHD as Banksia woodlands, containing Acacia species, which fits the Beard's description. Communities 13 and 15 also have a number of other species in common, however, vegetation community 12 does not contain any Banksia species and the species composition is quite different. The species associated with community 12 are more fitting of an *Acacia rostellifera* dominated coastal community, than a Banksia shrubland.

The report also says that the Melaleuca dominated communities over limestone do not fit any of the Beards Associations and it describes them as being relatively common in the area. However, no evidence has been provided to support this. Community 4 dominated by the priority 1 species, *Melaleuca huttensis* has not been recorded anywhere else.

It is however, considered plausible that communities 8 and 9 are representative of other coastal communities found in the south west of Australia, as stated in the report.

Therefore DEC considers the regional significance of vegetation communities 1,3,4,5,6,7,10,11,12 and 14 to be unknown.

Recommendation 2 –Where the significance of the vegetation communities is unknown, communities that are uncommon in the area should be protected.

Recommendation 3- Community 4, Melaleuca huttensis heath should be retained.

4) Vegetation Condition

The vegetation condition survey identified the area adjacent to White Cliffs road to be in the best condition. Much of this area is proposed to be cleared. No reference has been made in the current structure plan to the condition of the vegetation to be retained.

Recommendation 4 - Vegetation retained public open should be in the best possible condition for that vegetation community

5) Significant Flora

Declared Rare Flora (DRF)

The DRF species *Caladenia bryceana* subspecies *cracens* occurs within the proposal area. There is a statutory requirement to protect this species and its critical habitat under the state Wildlife Conservation (WC) Act (1950) and the Commonwealth EPBC Act (1999). Whilst the proponent has completed a number of surveys in the area, it is difficult to accurately predict the full extent of this population, as it is an annual species which is highly sensitive to seasonal changes. Therefore DEC supports the retention of this species known critical habit. The critical habitat for this species in this area is Myrtaceae dominated shrublands over limestone. The effect the removal of critical habitat will have on this species is unknown, however a larger area will offer the known population better protection.

Recommendation 5 – All of the critical habitat for the Caladenia bryceana subspecies cracens should be retained. If this is not feasible, as much as possible of this species critical habitat should be retained surrounding the known population

Recommendation 6 - A management plan is to be created for the area of public open space containing the population of Caladenia bryceana subspecies cracens. The aim of this management plan should be to protect the population and minimise threats.

Priority Flora

The priority 1 flora *Melaleuca huttensis* was recorded from the area.
The report does not state how many plants approximately occur in the area however DEC recently contacted GHD for further information regarding this.

GHD has since provided DEC with the following information:

"Based on the size of plants and area covered by each plant, the estimate ranges from a minimum of 21,000 plants (at <2% coverage) to 735,000 plants (at 70% coverage). Likely estimate will fall somewhere in between the two. I would expect that a figure of 150,000 - 200,000 plants would be more suitable." Joshua Foster, Senior Ecologist, GHD, via email, January 2010.

There is some degree uncertainty regarding the exact numbers of plants that occur within the proposal area. Further to this, little is known about the occurrence of this species outside of the project area. *M.huttensis* is currently only known from 11 collections. Therefore it is difficult to predict the impact this proposal will have on this species.

In order to protect this species, DEC recommends that as much as possible of community 4, *Melaleuca huttensis* heath be retained, as per DEC's recommendation 3.

6) Significant Fauna

The following species are listed as potentially occurring in the area on pages 29-32 of the report:

- Carnaby's Black Cockatoo - listed as endangered under the WC Act and the EPBC Act.
- Peregrine Falcon - Schedule 4 under the WC Act.
- White Brow Babbler - Priority 4 under the WC Act
- Bush Stonecurlew- Priority 4 under the WC Act
- Numerous migratory and marine species, protected under the EPBC Act

As suitable habitat within the project area for each of these species has not been clearly identified, the impact that the proposal may have on these species can not be determined.

Recommendation 7 - The structure plan should address the potential impact of the proposal on the significant fauna species that may occur in the area and describe how these impacts will be managed.

ANNEXURE 6

VEGETATION & FLORA MANAGEMENT PLAN

CLIENTS | PEOPLE | PERFORMANCE

Seaview Farms

Horrocks Beach Development

Vegetation and Flora Management Plan

August 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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B Vegetation and Flora Management Plan

1. Introduction

1.1 Project Background

The Shire of Northampton has identified Horrocks as a location that will undergo significant future population growth. Horrocks is located on the Mid-West coast of Western Australia within the Shire of Northampton, approximately 20 km west of Northampton and approximately 50 km north of Geraldton (GHD, 2010: Figure 1)).

To provide for the anticipated population growth in Horrocks, Allerding & Associates prepared a proposed structure plan for endorsement by the Shire of Northampton and the Western Australian Planning Commission (WAPC) in June 2008. The land subject to this Structure Plan includes Lots 110, 112, 114 and 115 Horrocks and White Cliffs Road.

GHD Pty Ltd (GHD) completed a Vegetation, Flora and Fauna Survey for the proposed development site - Lots 110, 112, 114 and 115 at Horrocks for Seaview Farms in August 2009. The Department of Environment and Conservation (DEC) consequently reviewed the proposed structure plan completed by Allerding & Associates (June, 2008) and identified a number of issues not adequately addressed in the existing structure plan.

It was recommended by the DEC in a letter dated the 2nd February 2010 (DEC, 2010), that a new structure plan be developed which addresses the identified issues before it is adopted by the Shire of Northampton and the WAPC.

A number of recommendations proposed by the DEC for examination in this management plan include:

- Recommendation 1 – The structure plan should address the protection of biodiversity, as per the EPA Position Statement 2.
- Recommendation 2 – Where the significance of the vegetation communities is unknown, communities that are uncommon in the area should be protected.
- Recommendation 3 – Community 4, *Melaleuca huttensis* heath should be retained.
- Recommendation 4 – Vegetation retained public open should be in the best possible condition for that vegetation community.
- Recommendation 5 – All of the critical habitat for the *Caladenia bryceana* subspecies *cracens* should be retained. If this is not feasible, as much as possible of this species critical habitat should be retained surrounding the known population.
- Recommendation 6 – A management plan is to be created for the area of public open space containing the population of *Caladenia bryceana* subspecies *cracens*. The aim of this management plan should be to protect the population and minimise threats.

1.2 Purpose and Scope

This Vegetation and Flora Management Plan addresses these recommendations and is proposed for inclusion in an updated structure plan for the subject land.

The recommendations have been previously addressed in a GHD (2010) response to the comments from the DEC letter (dated 2nd February 2010). These responses will be adapted in this management plan such that this plan can be used as a stand-alone document.

2. Background Information

2.1 Baseline Vegetation, Flora and Fauna Studies

A number of studies have been completed within the Project Area, namely:

- Maunsell (2004). Desktop Environmental Assessment for Horrocks Structure Planning. Unpublished report for Hille, Thompson and Delfos Surveyors and Planners, August 2004.
- Connell Wagner (2006). Horrocks Spring Vegetation Survey, Seaview Farms. Unpublished report by Dingle & Bird Environmental, 26 October 2006.
- ENV (2008 various). Letter reports detailing outcomes of surveys undertaken to locate Caladenia bryceana subsp. cracens. Unpublished letter reports for Seaview Farms.
- Larry Smith Planning (2009). Horrocks Beach Expansion Strategy: Draft for Public Discussion. Unpublished report for Shire of Northampton, May 2009.
- GHD Pty Ltd (2010). Horrocks Beach Development: Flora and Fauna Survey. Unpublished report for Seaview Farms, March 2010.

2.1.1 Vegetation and Flora outcomes

The major vegetation and flora outcomes of these studies were:

- The vegetation of the Project Area is identified by Beard (1976) is considered to be *Depleted* or *Vulnerable*, with 32% and 18.9% of the pre-European extent considered to be remaining in the Geraldton Sandplains Interim Biogeographic Regionalisation for Australia (IBRA) region (Shepherd, 2005);
- A total of 15 vegetation types were recorded from the Project Area, the majority of which fall in to the broad-scale mapping of Beard (1976);
- No Threatened or Priority Ecological Communities were recorded from the Project Area;
- Vegetation condition throughout the Project Area ranged from Condition 1-2 (*Pristine or Nearly So - Excellent*) to Condition 6 (*Completely Degraded*). The main disturbance factor was from historical clearing for the purpose of agricultural activities;
- A total of 221 flora taxa from 72 families were recorded from the Project Area, representing a medium to high level of diversity;
- One Declared Rare Flora species (*Caladenia bryceana* subsp. *cracens*) was recorded during the field survey at a known location. This location is proposed to be protected as part of Public Open Space. No other DRF were recorded from the Project Area;
- One Priority 1 species (*Melaleuca huttensis*) was recorded from the Project Area. This taxon was dominant across the Project Area and was also recorded to the

north and south of the Project Area. No other Priority Flora species were recorded from the Project Area;

- No other significant plants species were recorded from the Project Area;
- A total of 40 weed species were recorded from the Project Area, dominated by grasses and associated pasture species. Three Declared Plants and one Weed of National Significance were recorded from the Project Area.

2.2 GHD Response to DEC Letter

In the response to the DEC's Letter (dated 2nd February 2010), GHD (2010a) addressed the Recommendations proposed by the DEC.

2.3 April Stakeholder Meeting

The majority of the DEC Recommendations were examined during a stakeholder meeting on the 15th of April 2010. Stakeholders attending the meeting were from Seaview Farms; the Shire of Northampton, GHD Pty Ltd, the DEC (Geraldton), and Allerding & Associates.

The outcome of the Stakeholder meeting was the production of a map detailing areas proposed to be set aside for the purposes of retaining vegetation, habitat and locations of significant flora and habitat for significant fauna.

2.4 On-site Confirmation

Following the Stakeholder meeting, an on-site examination of the areas proposed for the retention of vegetation was undertaken. Members attending the on-site confirmation were from GHD Pty Ltd, the DEC (Geraldton) and Seaview Farms.

The boundaries of areas proposed for the retention of vegetation were confirmed and mapped (Figure 1). These areas are examined in more detail in Table 1, and the following comments are considered valid:

- Area 1 covers the largest proportion of vegetation proposed to be retained. This area was mapped with Catherine Page (DEC Geraldton) and Seaview Farms in early May 2010 using a hand-held GPS, and maps used produced for the GHD Flora and Fauna survey. Boundaries used for this area incorporated existing cleared firebreaks. Area 1 contains the best condition vegetation; *Melaleuca huttensis* heath vegetation type; a known location and habitat of the Declared Rare Flora (DRF) *Caladenia bryceana* subsp. *cracens*; known location and habitat for the Priority 1 *Melaleuca huttensis*, and direct linkage to a reserve vested in the Shire of Northampton.
- Area 2 includes a small *Eucalyptus* grove on shallow (exposed limestone) soils. Seaview Farms indicated that they were unlikely to include areas where soils were as shallow as this for housing due to geotechnical issues. Seaview Farms indicated that there were other areas similar to this particularly those closer to the cliff edge (vested in the Shire of Northampton) west of the Project Area. Seaview

Farms indicated that some of these areas would also be likely to be included in public open space.

- Area 3 is a corridor approximately 100 – 150 m wide, providing a stepping stone corridor between existing Shire of Northampton open space and a large area of vegetation (Area 4) to the east of White Cliffs Road. Area 3 has the potential to be shifted (north or south) depending on the final layout of the proposed town centre at the conjunction of the proposed Mitchell Street extension and White Cliffs Road The size of Area 3 will not be reduced as part of any shift. Both the DEC and Seaview Farms have agreed that Area 3 will provide a vegetated corridor between residential areas to the south and the residential area to the north.
- Area 4 is a relatively degraded area of vegetation. It contains known locations and habitat of the Priority 1 species Melaleuca huttensis. Seaview Farms indicated that this area is considered to be a useful buffer for a proposed caravan park that may be situated on the north side of Area 4.
- Area 5 includes *Banksia* woodland and an *Allocasuarina* grove on the eastern side of the area. Seaview Farms has indicated that any potential clearing in this area for residential purposes will be minimal and limited to building envelopes (and required infrastructure).
- Areas 6 and 7 are Banksia woodland and have been included as areas preferred to be retained to the potential to support significant fauna.

The following table indicates the merits of the areas selected (Table 1).

Table 1 Examination of Areas Proposed for Retention of Vegetation

Area	Size	Protection of Biodiversity (Beard Vegetation Associations)	Vegetation Community	Vegetation Condition	Habitat for DRF	Location of DRF	Habitat of Priority Flora	Location of Priority Flora	Habitat for Significant Fauna (from GHD, 2010)	Fauna Corridor
1	3.6	Least Concern	Melaleuca huttensis heath; Melaleuca cardiophylla scrub	Excellent – Very Good	Yes	Yes	Yes	Yes	No	Yes – also linked via Shire of Northampton open space to west
2	0.8	Least Concern	*Eucalyptus* Grove	Excellent	No	No	Yes	Yes	No	Yes – also linked via Shire of Northampton open space to west
3	1.5	Least Concern	*Melaleuca huttensis* heath; *Melaleuca cardiophylla* scrub	Very Good - Excellent	Yes	No	Yes	Yes	No	Yes – also linked via Shire of Northampton open space to west
4	4.7	Least Concern	*Melaleuca cardiophylla* scrub	Degraded	No	No	Yes	Yes	No	No – vegetation remnant (link as stepping stone)
5	38.8	Least Concern; Vulnerable	Mixed Open Acacia scrub, Mosaic of low open Banksia woodland and mixed Myrtaceous scrub Allocasuarina grove	Good – Very Good	?Yes	No	Yes	Yes	Yes	Yes – to adjacent bushland north and east out of Project Area
6	5.8	Vulnerable	Very Open Banksia woodland over Myrtaceous scrub	Good	No	No	Yes	Yes	Yes	No – vegetation remnant (link as stepping stone)
7	10.7	Vulnerable	Very Open Banksia woodland over Myrtaceous scrub	Good	No	No	Yes	Yes	Yes	No – vegetation remnant (link as stepping stone)

3. Vegetation

3.1 General Principles

Approximately half of the Project Area has been historically cleared for agricultural purposes, with the remainder occurring as remnant native vegetation.

The Project will be designed, constructed and operated to minimise the impacts on remnant vegetation by:

- avoiding clearing of native vegetation where possible, particularly of large trees;
- defining the area to be cleared on maps and supervising clearing activities (see Figure 1 – note: areas to be finalised by a redeveloped structure plan;
- confining temporary work areas to previously disturbed areas, where practicable;
- parking vehicles and machinery in designated areas;
- ensuring that effective dust control measures are implemented;
- retaining topsoil, subsoil, root stock and cleared vegetation in designated areas for use in rehabilitation;
- progressively rehabilitating and monitoring disturbed areas with native vegetation where appropriate; and
- raising the awareness of the workforce about conservation issues through environmental awareness training.

3.2 Management of Cleared Vegetation

Green waste includes trees, bushes and undergrowth generated from clearing activities. Green waste will be utilised where possible, to minimise the amount of waste requiring disposal. It is suggested that seed material should be salvaged where possible prior to the clearing of vegetation. Firewood timber will be removed from site for use. A proportion of the vegetation will be mulched or chipped and stockpiled for use in rehabilitation. Green waste that cannot be milled, mulched or chipped due to excessive sand, rock or other impediment, will be stacked and burnt.

3.3 Planting Guide

Local provenance species should be utilised for street-scaping and landscaping purposes where possible, and utilised in areas proposed for rehabilitation.

Where non-local plants are to be used as ornamental plantings, Water Wise species are strongly suggested.

Planting will combine a number of methods, including: hydromulching/seeding, tube-stock planting, jute matting, and/or direct seeding. The use of tube-stock is generally preferred and could be combined with advanced plantings in larger pots to create an instant effect.

During plant establishment the landscape works should be checked regularly for plant health and weed invasion. Regular inspections will reduce the potential for minor infestations becoming major problems. Weed control and ongoing plant maintenance will be carried out by the landscape contractor for a period of 12 months. All rubbish related to landscape works is to be removed by the landscape contractor before it is allowed to accumulate. During the maintenance period the contractor shall undertake the following (as required): regular watering, weeding, mulching and other activities to promote healthy growth and the replacement of any dead or dying plants within this period.

3.4 Weed Control

The management of weeds throughout the Project Area should form part of any vegetation management plan. This is to ensure the greatest protection of remnant vegetation, and minimise the spread of weed species. Suggested objectives for weed control are to:

- identify and control existing weeds with the highest priority for control – e.g. noxious weeds such as Athel Pine (*Tamarix aphylla*), Paterson's Curse (*Echium plantagineum*) and Doublegee (*Emex australis*);
- where possible, prevent introduction of additional weed species;
- where possible, prevent further encroachment of weeds into bushland areas;
- minimise any detrimental effects of a weed control program on native vegetation; and
- integrate the weed control program with a potential bushland restoration program.

3.4.1 Weed Control Techniques

In areas proposed for retention of vegetation, identified weed species should be removed where possible, taking care not to dislodge seeds, off cut limbs, or leave rootstock in the ground. Weed removal should be timed to minimise weed germination and seed dispersal. Care should be taken to minimise disturbance to existing juvenile natives and any disturbance to the soil.

Acceptable methods may include:

- Mechanical Removal including bulldozing, blade ploughing, brushcutters, slashers, mowers etc.
- On larger woody weeds, cutting the trunk and poisoning the remaining stump with concentrated glyphosate herbicide.
- Spraying actively growing leaves with glyphosate herbicide.
- Hand removal of the entire plant taking care not to leave plant material or dislodge seeds.

Displaced weed material is to be disposed of off site in an appropriate, approved location, where there is no potential of seed dispersal. Where areas of ground are

disturbed from the weed removal, the soil is to be tamped into place and covered with site leaf litter or site mulch (free from weed seed) to avoid erosion.

4. Flora

4.1 Significant Flora

Within the Project Area there are two flora taxa of conservation significance: the Declared Rare Flora (DRF) orchid *Caladenia bryceana* subsp. *cracens*, and the Priority 1 *Melaleuca huttensis*.

4.1.1 *Caladenia bryceana* subspecies *cracens* (Declared Rare Flora)

The DRF orchid is only known from one location (Area 1, Figure 1). This taxon was recorded from shallow soils over limestone within the Melaleuca huttensis heath. A maximum of seven plants have been recorded from this location.

Preferred habitat for this taxon within the vicinity of the Project Area is low heath over limestone hills. The vegetation types within the Project Area considered to provide suitable habitat include Vegetation Types 4, 5, 7, 10 and possibly 11 (GHD, 2010a).

Plate 1 Basal leaf of a *Caladenia bryceana* subsp. *cracens*

4.1.2 Melaleuca huttensis (Priority 1)

The Priority 1 *Melaleuca huttensis* is widely distributed within and adjacent to the Project Area (see GHD, 2010). An estimate of population size indicate that there may be 150,000 – 200,000 plants within the Project Area. Habitat for this species was variable, recorded from locations of shallow soil over limestone within low heath and scrub, to deeper sands associated within Banksia woodlands. This taxon was widely observed across the Project Area (and beyond) including from relatively degraded areas; near coastal situations (see Plate 2); and vegetation in excellent condition.

Plate 2 ***Melaleuca huttensis*** **(foreground) shrub**

4.2 Potential Impacts

4.2.1 Land Disturbance

The area of land to be disturbed as part of the proposed development has yet to be finalised. The potential impacts arising from land disturbance include:

- Loss of individual plants;
- Loss of habitat;
- Soil erosion;
- Weed invasion and establishment; and
- Habitat fragmentation.

4.2.2 Weed Invasion

A large proportion of the Project Area has been historically disturbed from agricultural activities, which have deliberately (and accidentally) introduced plant species palatable to livestock (see Section 3.4). The spread of such taxa along firebreaks and roadsides within the Project Area is relatively common.

Weed species may impact on the biodiversity of the Project Area by reducing the viability and robustness of populations of conservation-significant flora species. The composition of the vegetation types may also be impacted by weed species through competition, which often results in a simplified (reduced) vegetation type.

4.2.3 Introduced Fauna

Introduced fauna species in natural ecosystems have the potential to impact on flora species resulting in the decline of the invaded flora community. Within the Project Area the impact from feral pigs and rabbits was relatively common, with disturbance to soil and vegetation evident. Disturbance from introduced fauna can alter the vegetation structure and enhance the likelihood of invasion of weed species.

4.3 Management Strategies

Surveys for the presence of conservation significant flora species have been undertaken. Population size, location and preferred habitat have been mapped.

The planning process for the proposed development of the Project Area have led to the demarcation of areas of vegetation and associated habitat to be retained (Figure 1). It is anticipated that within these areas, disturbance to natural vegetation will be minimised.

During the development of the Project Area the following management strategies are suggested:

- Vegetation retention zones to be clearly marked and sign-posted;
- Minimal disturbance to the areas not required for the Project Area development;
- Appropriate use of fencing of the location (and associated habitat) of the DRF *Caladenia bryceana* subsp. *cracens* to be undertaken;
- No unauthorised entry to be allowed into the vegetation retention zones;
- No unauthorised off-track driving;
- Use of local provenance seed (particularly *Melaleuca huttensis*) and areas set aside for rehabilitation and landscaping;
- Land disturbance requirements will be included in contracts with all earthmoving and land clearing contactors;
- Training on the identification, location and reporting of conservation significant flora taxa will be included in any environmental induction and environmental awareness sessions;

- Training on land clearing procedures will be included in any environmental induction and environmental awareness;
- A conservation significant flora identification guide will be made available to development personnel;
- An appropriate fire management plan should be put in place during the development of the Project Area to minimise the risk to vegetation and conservation significant flora.

5. References

Connell Wagner (2006). Horrocks Spring Vegetation Survey, Seaview Farms. Unpublished report by Dingle & Bird Environmental, 26 October 2006.

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Larry Smith Planning (2009). Horrocks Beach Expansion Strategy: Draft for Public Discussion. Unpublished report for Shire of Northampton, May 2009.

Maunsell (2004). Desktop Environmental Assessment for Horrocks Structure Planning. Unpublished report for Hille, Thompson and Delfos Surveyors and Planners, August 2004.

Appendix A

Figures

DRAFT

247,000 248,500 250,000

6,861,000 6,859,500 6,858,000

WHITE CLIFFS RD

LITTLE BAY RD

MITCHELL ST

NORTH CT

GLANCE ST

DRAGE ST

GLASS ST

HORRACKS RD

HORROCKS

5 7 6 4 3 2 1

Areal extent to remain constant. Final location dependent on structure plan design

Locality Map

KALBARRI
INDIAN OCEAN
NORTHAMPTON
MULLEWA
DRUMMOND COVE
GERALDTON
DONGARA
MINGENEW

LEGEND

Place Name

Declared Rare & Priority Species

(R) Declared Rare Flora - Extant Taxa
Priority 1 - Poorly Known Taxa
Priority 2 - Poorly Known Taxa
Priority 3 - Poorly Known Taxa
Priority 4 - Rare Taxa

Roads
Study Area

Retention Areas

Area For Minimal Clearing- Building Envelopes
Areas Preferred To Be Retained As Well
Minimum Areas Proposed For Retention (i.e. no clearing)

1:15,000 (at A3)
0 75 150 300 450 600 750
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

N

GHD
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Seaview Farm

Seaview Farm
Structure Plan Assistance

Proposed Areas For Retention Of Native Vegetation

Job Number 61-25241
Revision A
Date 28 MAY 2010

G:\61\25241\GIS\Maps\MXD\6125241_001.mxd

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Data Source: GHD: Retention Areas - 20100527, Study Area - 20090820; DEC: Declared Rare and Priority Flora - 20090824; Landgate: Hutt 2006 Mosaic - 20100527, Roads - 20100527. Created by: kdiralu

Appendix B

Vegetation and Flora Management Plan

Table 2 Vegetation and Flora Management Plan for the Project Area

Reference No.	Management Measure	Phase of Project
1.1	Vegetation communities in the best possible condition will be retained in accordance with the Vegetation and Flora Management Plan.	Pre-Construction
1.2	Habitat for conservation significant flora will be retained in accordance with the Vegetation and Flora Management Plan	Pre-Construction
1.3	The retention of fauna corridors within the Project Area will be made through the retainment of the vegetation communities identified in the Vegetation and Flora Management Plan.	Pre-Construction
1.4	Vegetation clearing will be undertaken in accordance with an approved Construction Environmental Management Plan (CEMP).	Construction
1.5	All staff, contractors and field personnel will meet all requirements of the *Wildlife Conservation Act 1950*.	All phases
1.6	Large trees should be retained where possible.	Construction
1.7	Lay-down areas will be constructed on previously disturbed areas.	Construction
1.8	The relevant staff will be inducted into the requirements of the Vegetation and Flora Management Plan and the Construction Environmental Management Plan. The objectives of the awareness training include: ◗ Vegetation and Flora requiring protection; ◗ Risk of encountering significant flora and actions to be taken; ◗ Weed management practices; and ◗ Vegetation and flora hygiene practices.	Pre-construction

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	M Scott	J Foster		J Foster		
A	M Scott	J Foster		J Foster		09082010

Annexure 7

Fauna Management Plan

CLIENTS | PEOPLE | PERFORMANCE

Seaview Farms

Horrocks Beach Development

Fauna Management Plan

August 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Table Index

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Appendices

1. Introduction

1.1 Project Background

The Shire of Northampton has identified Horrocks as a location that will undergo significant future population growth. Horrocks is located on the Mid-West coast of Western Australia within the Shire of Northampton, approximately 20 km west of Northampton and approximately 50 km north of Geraldton (Figure 1).

To provide for the anticipated population growth in Horrocks, Allerding & Associates prepared a proposed structure plan for endorsement by the Shire of Northampton and the Western Australian Planning Commission (WAPC) in June 2008. The land subject to this Structure Plan includes Lots 110, 112, 114 and 115 Horrocks and White Cliffs Road.

GHD Pty Ltd (GHD) completed a Vegetation, Flora and Fauna Survey for the proposed development site - Lots 110, 112, 114 and 115 at Horrocks for Seaview Farms in August 2009. The Department of Environment and Conservation (DEC) consequently reviewed the proposed structure plan completed by Allerding & Associates (June, 2008) and identified a number of issues not adequately addressed in the existing structure plan.

It was recommended by the DEC in a letter dated the 2nd February 2010 (DEC, 2010), that a new structure plan be developed which addresses the identified issues before it is adopted by the Shire of Northampton and the WAPC.

One of the recommendations (Recommendation 7) proposed by the DEC was that "the structure plan address the potential impact of the proposal on the significant fauna species that may occur in the area and describe how these impacts will be managed".

1.2 Purpose and Scope

This Fauna Management Plan addresses this recommendation and is proposed for inclusion in an updated structure plan for the subject land.

1.3 Objective of the Plan

The Horrocks Beach Development Project involves the clearing of remnant native vegetation in a predominantly rural farming and residential landscape. This Fauna Management Plan outlines the procedures for minimising impacts on fauna and the management measures to be implemented for the Project.

2. GHD Reconnaissance Fauna Survey

GHD (2010) completed a reconnaissance fauna survey concurrently with a vegetation and flora survey for the proposed development site - Lots 110, 112, 114 and 115 (the Project Area) at Horrocks for Seaview Farms in August 2009.

The purpose of the survey was to undertake an appropriate examination and description of the existing environment and provide information to the DEC to assist in the approvals process.

A summary of findings from this survey with regards to fauna is provided in Sections 2.1 to 2.3.

2.1 Habitat Types and Habitat Linkages

2.1.1 Habitat Types

Six main fauna habitat types were identified within the Project Area as follows:

1. Cleared/Degraded;
2. Mobile Sand Areas;
3. Open Acacia scrubland;
4. Mixed Low Scrub / Heath on Limestone;
5. Mixed Coastal Scrub on Sand; and
6. Open Banksia Woodlands over Low Scrub / Heath.

These habitat types are shown in Table 1, and are mapped in GHD (2010) Figure 7 (included here).

Based on the field survey, habitat exists for a diverse range of fauna species in the Project Area. However, the majority of habitat is somewhat degraded due to the historical clearing undertaken for agricultural purposes. Weed species have invaded a large proportion of the remaining vegetation within of the Project Area, and has opened out the scrub and woodland areas.

Better quality habitat is restricted to smaller areas, particularly limestone dominated heaths, and areas to the north of the Project Area, which remain contiguous with other, larger habitat outside the Project Area. Remaining habitat, particularly the open woodland areas are small and isolated, restricting movement to larger fauna and bird species. Leaf litter is present throughout the Project Area due to age since last fire, which is suitable for small mammals and reptile species.

The habitat types located in the Project Area are considered to be relatively common in the local area, and similar fauna habitat exists in the areas surrounding the Project Area. Better quality, more extensive habitat occurs to the north of the Project Area.

2.1.2 Habitat Value

Where landscapes have been highly modified through land clearing for agricultural activities and urbanisation, extensive fauna habitat loss has resulted. As a consequence, remaining remnants of native vegetation are of high importance. Trees, especially mature specimens, provide feeding and breeding habitat, and may be important locations for refuge. A healthy and diverse understorey is important habitat for mammals and reptiles. The survey area also has a number of microhabitats that would be utilised by reptile species, such as areas of thick leaf litter, logs and loose sand.

There are large areas in the Project Area that are completely degraded, and offer little habitat value. These disturbed areas are located primarily in the centre of the Project Area associated with agricultural activities. This area has created edge effects, with weed invasion into habitat areas along the White Cliffs Road and *Banksia* woodland areas.

The habitats west of White Cliffs Road along the limestone ridge, and the *Banksia* woodland in the north-east corner are considered to hold the highest habitat values of the site. This is primarily due to vegetation being in good condition, and, in the north-east corner, direct linkage to adjacent bushland.

Some of the taller trees have value as potential nesting habitat; however, no hollows were observed in the trees on this site, and as a result do not provide habitat to significant fauna such as the Black-Cockatoo species. The Banksia woodlands may, however, provide some food resources for these species during foraging.

A total of six (6) habitats were recorded in the Project Area (GHD, 2010). Photographs of habitat types are displayed in Table 1.

Table 1 Habitat Types Recorded in the Project Area

Habitat Type	Photo
1. Cleared / Degraded: includes open fields and pasture, roads, and firebreaks	

Habitat Type	Photo
2. Mobile Sand Areas	
3. Open Acacia Scrubland	
4. Mixed Low Scrub / Heath on limestone	

Habitat Type	Photo
5. Mixed Low Coastal Scrub on Sand	
6. Open Banksia Woodland over Low Scrub / Heath	

2.1.3 Ecological Linkages

Fauna corridors and habitat linkage are important to allow animals to move between areas of resource availability. Such corridors are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction.

One of the greatest concerns for fauna survival is the potential for the lack of fauna corridors between habitat remnants. Habitat corridors are important in areas where extensive clearing has occurred to help overcome the effects of habitat fragmentation. These corridors assist in maintaining genetic diversity through connection of gene pools, enabling the recolonising of disturbed areas and the provision of habitat. Where contiguous bushland areas can not be maintained a connection can still be maintained through "stepping stones", which are isolated patches of vegetation close enough together to allow certain species to move between them. Stepping stones are primarily of importance to very mobile species such as birds. Birds often require 'flyways', vegetated areas along a bush corridor, which they can use to move between habitat areas. These corridors can provide shelter from predators and rest sites.

Project Area Linkages

A number of ecological linkages are present in the Project Area:

- Major Linkage 1: A major linkage along the cliffs west of the Project Area (west of White Cliffs Road) linking intact bushland south of the Project Area to the coastal vegetation and cliffs north of the Project Area;
- Major Linkage 2: A major linkage along the limestone ridge (west of White Cliffs Road) linking currently intact bushland to the south of the Project Area to vegetation east of the mobile sand (blowout) but west of White Cliffs Road and into bushland to the north of the Project Area; and
- Minor Linkage 1: A minor linkage using fragmented patches of vegetation (stepping stones) from the limestone ridge west of White Cliffs Road through vegetation on the eastern side of the road (south of the proposed Mitchell Street extension) to link with intact vegetation to the north east outside the Project Area.

The potential for the clearing of native vegetation is considered unlikely to alter Major Linkage 1, due to vegetation present in an existing Shire of Northampton reserve along the cliffs west of White Cliffs Road and proposed public open space as part of required coastal setbacks along Little Bay Road.

Major Linkage 2 will have a minor disruption to the linkage by the clearing of vegetation for residential areas located either side of the Mitchell Street extension. A continuous link will remain along the cliff edge, and into the bush along the edge of the large mobile sand (blowout). The retention of a large area of Public Open Space south-east of the blowout will assist in the maintenance of the ecological linkage and associated stepping stones.

Minor Linkage 1 is unlikely to be significantly altered. It will remain as a series of stepping stones between vegetation to the north and east of the Project Area and vegetation along the cliff face west of White Cliffs Road.

2.2 Recorded and Expected Fauna Species

GHD (2010) makes the following conclusions with regards to fauna species for the Project Area:

- A search of *NatureMap* (2009) records undertaken for the Project Area, inclusive of a 10 km buffer show that 4 amphibian, 2 bird species, 2 mammal species and 5 reptile species have been officially recorded as present within the *NatureMap* search area;
- A total of 33 birds, 6 mammals and 3 reptiles were recorded from the Project Area during the fauna survey.
- A total of six introduced fauna species were recorded from the Project Area (1 bird species, 5 mammal species). The Laughing Turtle-dove and European Rabbit were the most commonly observed throughout the Project Area.
- The desktop assessment indicated that a number of significant fauna species are known or considered likely to occur in the Project Area;
- Threatened fauna species known to occur in the general area, as identified in the desktop assessment, are in general unlikely to use the Project Area for breeding or refuge purposes; and
- No threatened fauna species were recorded in the Project Area during the reconnaissance fauna survey. However, a number of *Environmental Protection and Biodiversity Conservation Act* Marine and Migratory Listed species were recorded from the Project Area.

Expected and recorded fauna species for the Project Area are provided in Table 3, Appendix A.

2.3 Significant Fauna Risk Assessment

GHD (2010) assessed the habitat requirements and the likelihood of their occurrence in the Project Area (with information from the field survey) for the significant fauna species identified in the desktop assessment. The risk assessment inclusive of an examination of the suitable habitat within the Project Area for each of the threatened fauna species is provided in Sections 2.3.1 and 2.3.2.

2.3.1 Threatened Fauna

The threatened fauna risk assessment is provided as follows:

Species	**Tristan Albatross (*Diomedea exulans exulans*)**
Conservation Status	Endangered, Listed Marine, Listed Migratory [*EPBC Act 1999*].
Preferred Habitat	The Tristan Albatross is a migratory marine species. It forages in open waters within the Atlantic Ocean and generally remains in the marine environment apart from during its breeding season, where nesting occurs on Inaccessible Island and Gough Island (DEWHA, 2009a).
Assessment	The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.
Suitable Habitat within Project Area	This is a marine species. Habitat within the Project Area is not present.

Species	**Indian Yellow-nosed Albatross (*Thalassarche carteri*)**
Conservation Status	Vulnerable, Listed Marine, Listed Migratory [*EPBC Act 1999*]
Preferred Habitat	Global populations of the Indian Yellow-nosed Albatross are estimated at between 160,000 and 180,000 birds. The species breeds on islands of the southern Indian Ocean. The species generally occupies inshore and offshore waters while in Australasian waters, concentrating in areas with calm seas and light winds (DEWHA, 2009a).
Assessment	The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.
Suitable Habitat within Project Area	This is a marine species. Habitat is not considered to be present within the Project Area.

Species	**Shy Albatross, Tasmanian Shy Albatross (*Thalassarche cauta cauta*)**
Conservation Status	Vulnerable, Listed Marine, Listed Migratory [*EPBC Act 1999*]
Preferred Habitat	The Shy Albatross is thought to occur all over Australian coastal waters below 25° S. It is less pelagic than other Albatross species and has been known to enter bays and harbours. Breeding occurs on Islands of the south of Tasmania (DEWHA, 2009a).
Assessment	The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.
Suitable Habitat within Project Area	This is a marine species. Habitat is not considered to be present within the Project Area.

Species	**Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)**
Conservation Status	Endangered [*EPBC Act 1999*] Schedule 1 [*WC Act 1950*]
Preferred Habitat	Carnaby's Black-Cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain Salmon Gum and Wandoo, and in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea species (DEWHA, 2009a).
Assessment	There are a number of flora species suitable as forage in the north and east of the Project Area (banksia and myrtaceous scrub). The Project Area does not contain habitat suitable for refuge or breeding for this species. This area is at the extreme northern end of this species' range, and while it may use the north and east of the Project Area it is likely to be as a vagrant.
Suitable Habitat within Project Area	Habitat within the Project Area is present within habitat type: Open Banksia Woodland over Low Scrub / Heath (refer to Table 2 and Figure).

Species	Peregrine Falcon (*Falco peregrinus*)
Conservation Status	Schedule 4 [*WC Act 1950*]
Preferred Habitat	The Peregrine Falcon has a wide global range, occurring in many countries around the world. It is currently assessed as Least Concern in the ICUN Red List of Threatened Species, as global population trends are thought to be relatively stable (Birdlife International, 2008a).
Assessment	This species is considered likely to occur in the Project Area. Habitat suitable for refuge (breeding and foraging) occurs in the Project Area. This species was not recorded in the Project Area, but has been recorded in the vicinity (DEC and WAM, 2009).
Suitable Habitat within Project Area	Habitat within the Project Area is present in the north-west corner within habitat type: Mixed Low Scrub/Health on Limestone due to the presence of limestone cliffs in this area (refer to Table 2 and Figure). Habitat for this species is also located to the west, outside the Project Area.

Species	Australian Lesser Noddy (*Anous tenuirostris melanops*)
Conservation Status	Vulnerable, Listed Marine [*EPBC Act 1999*]
Preferred Habitat	The Australian Lesser Noddy is a gregarious, marine species, with flock sizes increasing during breeding season then breaking down into smaller flocks for the remainder of the year. It is usually only found around its breeding islands in the Houtman Abrolhos. It is considered likely that they may leave the breeding islands for short periods in between breeding seasons and that they may forage widely during this time (DEWHA, 2009b).
Assessment	The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.
Suitable Habitat within Project Area	This is a marine species. Habitat is not considered to be present within the Project Area.

Species	**White-browed Babbler (western wheatbelt) (*Pomatostomus superciliosus ashbyi*)**
Conservation Status	Priority 4 [DEC]
Preferred Habitat	This species inhabits eucalypt forests and woodlands where they create bulky domed nests for breeding and roosting. They forage near the ground where they forage on insects and seeds. The species is generally restricted to larger fragments of remnant vegetation as they do not seem to cope well with introduced edges (Garnett and Crowley, 2000).
Assessment	This species may occur in the Project Area. It is known to occur in similar habitat to the south and north of the Project Area. This species was not recorded during the fauna survey.
Suitable Habitat within Project Area	Habitat within the Project Area is present within habitat type: Open Banksia Woodland over Low Scrub/Heath. This habitat type is fragmented in the Project Area and this species may avoid the area due to the level of disturbance.

Species	**Bush Stonecurlew (*Burhinus grallarius*)**
Conservation Status	Priority 4 [DEC]
Preferred Habitat	This species is a nocturnal feeding insectivore that inhabits open forest and woodlands. It prefers habitats with high levels of fallen vegetable matter on the ground. Feeding usually occurs in open country and birds will often feed on paddocks or stubble when occurring in agricultural areas. Breeding pairs will generally occupy stable territories (Birdlife International, 2008b).
Assessment	This species may occur in the Project Area. It has been recorded in the vicinity in the past. Habitat is considered to be suitable within northern and eastern portions of the Project Area.
Suitable Habitat within Project Area	Habitat within the Project Area is present within habitat type: Open Banksia Woodland over Low Scrub/Heath (refer to Table 2 and Figure). Habitat for this species is also located to the north and south, outside the Project Area.

Species	Southern Giant-Petrel (*Macronectes giganteus*)
Conservation Status	Endangered, Listed Marine, Listed Migratory [*EPBC Act 1999*]
Preferred Habitat	The Southern Giant-Petrel is a migratory species which breeds on sub-Antarctic and Antarctic islands. It disperses widely during the Antarctic winter and can be found off South America, South Africa, Australian and New Zealand. They are a marine species. The majority of their feeding is done at the ocean surface however they will occasionally dive for food (DEWHA, 2009b).
Assessment	The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.
Suitable Habitat within Project Area	This is a marine species. Habitat is not considered to be present within the Project Area.

Species	Northern Giant-Petrel (*Macronectes halli*)
Conservation Status	Vulnerable, Listed Marine, Listed Migratory [*EPBC Act 1999*]
Preferred Habitat	This species breeds in the sub-Antarctic and migrates to areas off the Australian mainland during the winter months. They are commonly seen in inshore waters along the southern coast of Australia between Freemantle and Sydney. Their diet is made up of fish and scavenged meet from dead carcases (i.e. penguins and seals), they are also known to follow fishing boats to scavenge offal (DEWHA, 2009b).
Assessment	The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.
Suitable Habitat within Project Area	This is a marine species. Habitat is not considered to be present within the Project Area.

Species	Soft-plumaged Petrel (*Pterodroma mollis*)
Conservation Status	Vulnerable, Listed Marine [*EPBC Act 1999*]
Preferred Habitat	Known breeding grounds for this species are restricted to Maatsuyker Island, off southern Tasmania. The species is generally restricted to marine environments and is most numerous between 30°S and 50°S in the southern Indian Ocean and between 30°S and 60°S in the South Atlantic. Their diet consists of cephalopods, fish and crustaceans (DEWHA, 2009b).
Assessment	The Project Area does not contain optimal habitat for this species. The species may fly over the area however; the potential for this species to utilise the Project Area is considered to be low.
Suitable Habitat within Project Area	This is a marine species. Habitat is not considered to be present within the Project Area.

Species	Tammar Wallaby (*Macropus eugenii derbianus*)
Conservation Status	Priority 5 [DEC]
Preferred Habitat	Tammar Wallabies generally occur in areas of dense shrub or in more open pasture including coastal scrub, heath, dry sclerophyll woodland and mallee. Males can reach up to 10 kg but the average size is 7.5 kg, females tend to be smaller with an overage of 5.5 kg and the largest only reaching 6 kg. They are grazers and may be found to aggregate on foraging sites.
Assessment	This species has been recorded from the Project Area in the past (DEC and WAM, 2009). Habitat is considered to be suitable within the Project Area, however, this species prefers dense thickets which are more prevalent to the north and east of the Project Area. Much of the Project Area has been subject to historical disturbance, reducing the risk that this species will utilise the Project Area exclusively. This species was not recorded during the field survey.
Suitable Habitat within Project Area	Habitat within the Project Area is present in most areas except the cleared/degraded and mobile sand areas.

Species	Shield-backed Trapdoor Spider (*Idiosoma nigrum*)
Conservation Status	Schedule 1 [*WC Act 1950*]
Preferred Habitat	The Shield-backed Trapdoor Spiders are found in eucalypt-acacia dry woodlands and schlerophyll open forests in the south-west of Australia. They construct burrows of up to 32 cm with leaf and twig trip-lines radiating out from the mouth. The spiders wait in the burrow entrance and dart out to capture prey that disturbs the trip-lines. The species is under threat due to habitat loss and clearing (DEWHA, 2009c).
Assessment	This species is known to occur in relatively coastal areas in the region. Although invertebrates were not specifically targeted during this survey, Shield-back Trapdoor Spider burrows are relatively distinctive, and a search for burrows was included during the reconnaissance survey. No burrows were recorded during this survey. This species is considered unlikely to occur in the Project Area due to the relatively open nature of the vegetation.
Suitable Habitat within Project Area	Suitable habitat for the Shield-backed Trapdoor spider is not considered to be present in the Project Area.

2.3.2 Migratory and Marine Species

The desktop assessment indicated that a number of Migratory and/or Marine species, protected under the *EPBC Act,* may occur in the Project Area.

Most migratory species, if occurring in the area, will be present as foraging species during the winter. Many of these migratory species are considered common in Western Australia and do not have special protection under the Western Australian *Wildlife Conservation Act 1950.*

The Migratory and Marine Listed fauna species risk assessment is provided in Table 2.

A number of other Migratory and Marine Listed fauna species were recorded during the fauna survey and are listed in Table 3, Appendix A.

Table 2 Migratory and Marine Species listed for the Project Area on the EPBC Protected Matters Search Tool

Species	Status	Comment
White-bellied Sea Eagle *Haliaeetus leucogaster*	Migratory (CAMBA) Marine	This species was recorded during the fauna survey. This species was recorded using the updraft of the cliff edges to fly between areas of foraging habitat.

Species	Status	Comment
Cattle Egret *Ardea ibis*	Migratory (CAMBA, JAMBA), Marine	May occur in the Project Area as a vagrant. Not recorded during the field survey.
Rainbow Bee-eater *Merops ornatus*	Migratory (JAMBA) Marine	May occur in the Project Area. Not recorded during the field survey.
Great Egret *Ardea alba*	Migratory (CAMBA, JAMBA) Marine	May occur in the Project Area as a vagrant. Not recorded during the field survey.
Fork-tailed Swift *Apus pacificus*	Migratory (CAMBA, JAMBA, ROKAMBA) Marine	May occur in the Project Area as a vagrant. Not recorded during the field survey.
Yellow-nosed Albatross *Thalassarche chlororhynchos*	Migratory (BONN) Marine	May occur in the Project Area as a vagrant. Not recorded during the field survey.
Great Skua *Catharacta skua*	Marine	May occur in the Project Area as a vagrant. Not recorded during the field survey.

3. Fauna Impacts and Management Measures

3.1 Potential Fauna Impacts

It is considered likely that clearing of vegetation in the Project Area will have an impact on fauna species. Minimal impact is expected to occur on significant fauna species as a result of the Project.

If managed carefully, it is not considered that the clearing of vegetation will significantly alter the fauna habitat of the region. Disturbance is most likely to occur on a local scale, impacting individual animals, rather than a species. The Project Area adjoins similar contiguous habitat to the north of the Project Area.

Impacts are likely to occur to individual animals and include:

- Loss of habitat and feeding areas. There will be a loss of refuge vegetation and associated foraging resources;
- Harm/deaths/displacement of individual animals. This may occur during clearing activities; and
- Loss of fauna corridors in the area which allow larger mobile species (mammals and birds) to disburse and migrate between remnants of vegetated areas. Removal of vegetation may increase their susceptibility to predation and limit disbursal.
- During the construction phase, waste, including food scraps, may assist undesirable fauna species to increase by providing a food resource.

3.2 Management Measures

The following management measures will be incorporated into the Structure Plan to manage the potential impacts to significant fauna species within the Project Area:

- Vegetation communities in the best possible condition will be retained in accordance with the Vegetation Management Plan;
- The retention of fauna corridors (refer to Section 2.1.3) within the Project Area will be made through the retainment of the vegetation communities identified in the Vegetation Management Plan, where possible;
- Vegetation clearing will be undertaken in accordance with an approved Construction Environmental Management Plan (CEMP) or similar;
- All staff, contractors and field personnel will meet all requirements of the *Wildlife Conservation Act 1950*;
- No domestic dogs to be brought into the construction areas;
- Rubbish will be removed from construction areas;
- Native wildlife are not to be fed;
- No deliberate lighting of fires within construction areas;
- Machinery is to be checked prior to start-up for the presence of native wildlife; and

- The speed of vehicle movement is to be reduced between dusk and dawn within construction areas.
- Noise and vibration impacts will be managed in accordance with the CEMP;
- Works will cease on sighting of a significant fauna species which might be at risk of injury in the Project Area. Works will recommence once the animal has moved on;
- During clearing activities, the work site will be left in a safe condition at the end of each working day to ensure animals are not subject to harm from the clearing works;
- No open pits / trenches will be left open overnight in the Project Area;
- During construction works, the area will be inspected each morning to ensure no fauna have been trapped during the previous evening. A Regional DEC Officer or designated representative will be contacted to facilitate removal if necessary;
- No native fauna (including venomous snakes) will be deliberately impaired or killed during Project works;
- Where possible, clearing will be undertaken at a time of year that is least likely to impact on breeding or nesting species;
- Barriers to native fauna movement will be minimised where possible;
- Large trees which contain numerous nests should be retained where possible;
- Lay-down areas will be constructed on previously disturbed areas;
- The movement of machinery and vehicles will be minimised or restricted at dusk and dawn and during night-time hours;
- The relevant staff will be inducted into the requirements of the Fauna Management Plan and the Construction Environmental Management Plan. The objectives of the awareness training include:
  - Fauna requiring protection;
  - Risk of encountering significant fauna and actions to be taken;
  - Fauna handling and registered personnel; and
  - Fauna and flora hygiene practices.

These management measures are provided in a tabular format in Appendix B.

4. References

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Figures

LEGEND

Project Area

1:500,000 (at A4)

0 2.5 5 10 15 20

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

CLIENTS | PEOPLE | PERFORMANCE

Seaview Farms
Biological Survey

Job Number 61-24450
Revision 0
Date 20 NOV 2009

Locality Map

Figure 1

76 Forrest Street Geraldton WA 6530 T 61 8 9964 3677 F 61 8 9921 7997 E getmail@ghd.com.au W www.ghd.com.au

G:\61\24450\GIS\mxds\61-24450-E001.mxd

Data Source: Landgate: Travellers Atlas - 2004 Edition; GHD: Project Area - 200908. Created by: mlogue, xntan

247,000 248,500 250,000

6,861,000 6,859,500 6,858,000

WHITE CLIFFS RD
LITTLE BAY RD
MITCHELL ST
GLANCE ST
DRAGE ST
GLASS ST

LEGEND

Survey Area

Fauna Habitat Type

1. Cleared/Degraded
2. Mobile Sand Areas
3. Open Acacia Scrubland
4. Mixed Low Scrub/Heath on Limestone
5. Mixed Coastal Scrub on Sand
6. Open Banksia Woodland over Low Scrub/Heath

1:15,000 (at A3)

0 75 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50

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CLIENTS | PEOPLE | PERFORMANCE

Seaview Farms
Biological Survey

Project Area
Fauna Habitat Types

Job Number	61-24450
Revision	0
Date	24 NOV 2009

Figure 7

G:\61\24689\GIS\mxds\61-24450-E009.mxd

76 Forrest Street Geraldton WA 6530 **T** 61 8 9964 3677 **F** 61 8 9921 7997 **E** getmail@ghd.com.au **W** www.ghd.com.au

Data Source: Landgate: Hutt 2006 Mosaic - 2006; GHD: Survey Area - 200908, Fauna Habitat Types - 20091124. Created by: mlogue, xntan

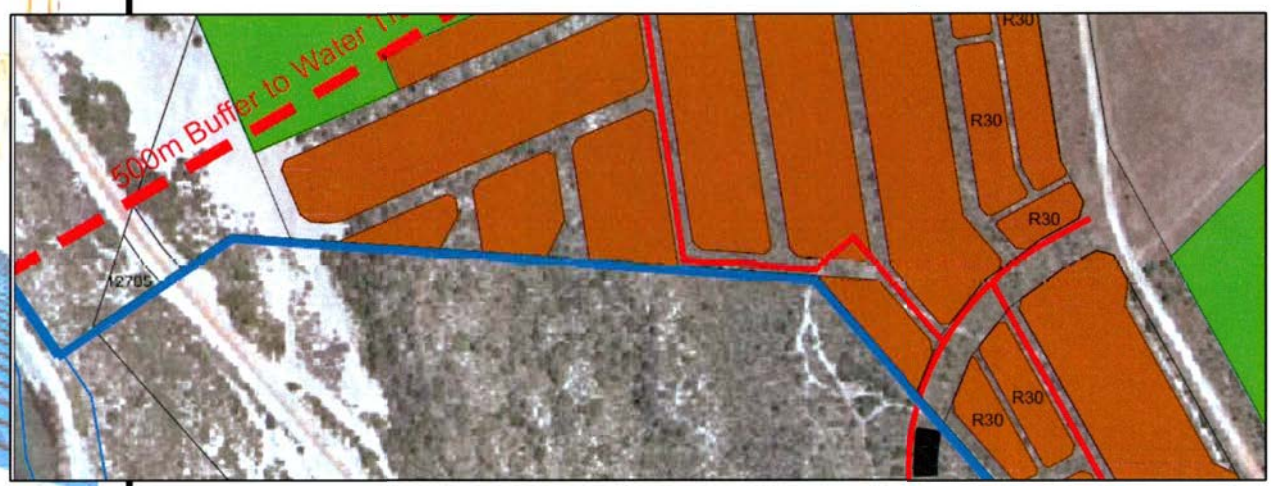
PROPOSED STRUCTURE PLAN

VOLUME 3: Annexures 8-13

Lots 110, 115, 500 & 116 White Cliffs Road

HORROCKS BEACH

SHIRE OF NORTHAMPTON



Allerding Associates
Town Planners, Advocates & Subdivision Designers

PREPARED FOR:
Horrocks Syndicate

PREPARED BY:
Allerding & Associates

DECEMBER2010

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VOLUME 2

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VOLUME 3

ANNEXURE 8

ZONING PLAN

DA1

Refer to Map 2

DA1

Produced by Planning Information - Mapping and Spatial, Department for Planning and Infrastructure.

Whilst all care has been taken to accurately portray the current Scheme provisions, no responsibility shall be taken for any omissions or errors in this documentation.

Consultation with the respective Local Government Authority should be made to view a legal version of the Scheme. Please advise the Department for Planning and Infrastructure of any omissions or errors in the document.

Digital Cadastral Data Supplied by the Department of Land Administration, Perth Western Australia

SHIRE OF NORTHAMPTON

TOWN PLANNING SCHEME NO 8

(DISTRICT SCHEME)

N

GDA

SCALE 1:40000

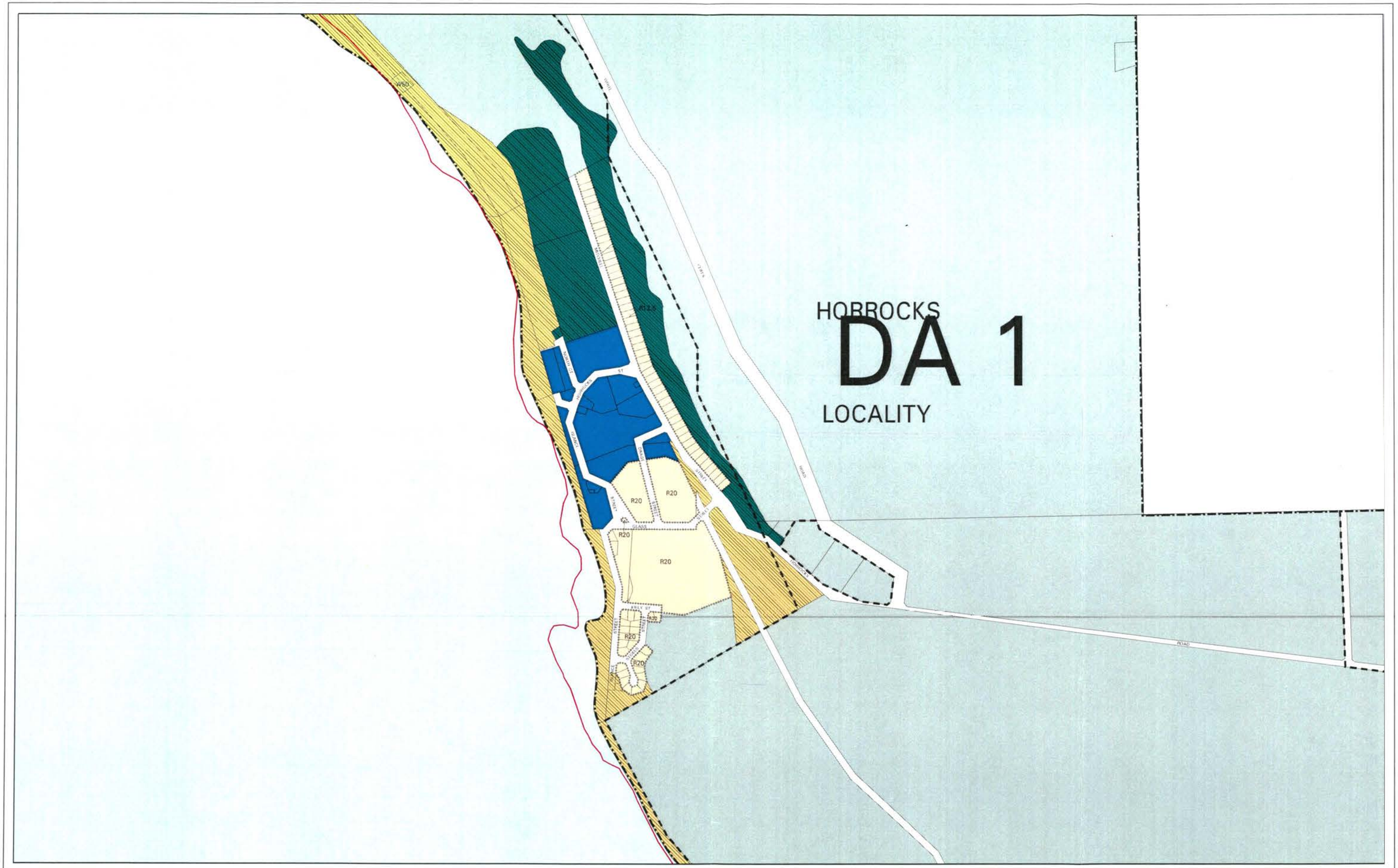
0 500 m

MAP OVERVIEW

2 1

Authorised: Victor Chew
Plot date: 13 Jan 2005
G.Gazette: 16-April-1992

TOWN PLANNING SCHEME MAP No. 1 of 2



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Digital Cadastral Data Supplied by the Department of Land Administration, Perth Western Australia

SHIRE OF NORTHAMPTON

TOWN PLANNING SCHEME NO 8

(DISTRICT SCHEME)

SCALE 1:10000

0 250 m

MAP OVERVIEW

1

Authorised: Victor Chew
Plot date: 13 Jan 2005
G.Gazette: 16-April-1992

TOWN PLANNING SCHEME MAP No. 2 of 2

LEGEND

LOCAL SCHEME RESERVES

FORESHORE CONSERVATION & DUNE PROTEC

PARKS AND RECREATION

PUBLIC PURPOSES

PUBLIC PURPOSES
DENOTED AS FOLLOWS:
WSD WATER SUPPLY, SEWERAGE & DRAINAGE

ZONES

RESIDENTIAL

TOWN CENTRE

RURAL

OTHER

R CODES

SPECIAL CONTROL AREA-DEVELOPMENT AREA (SEE SCHEME TEXT)

NO ZONE

SCHEME BOUNDARY

LOCAL GOVERNMENT BOUNDARY

TOWNSITE – LAND ACT

VERSION No 1

SHIRE OF NORTHAMPTON

TOWN PLANNING SCHEME NO 8

(DISTRICT SCHEME)

Annexure 9

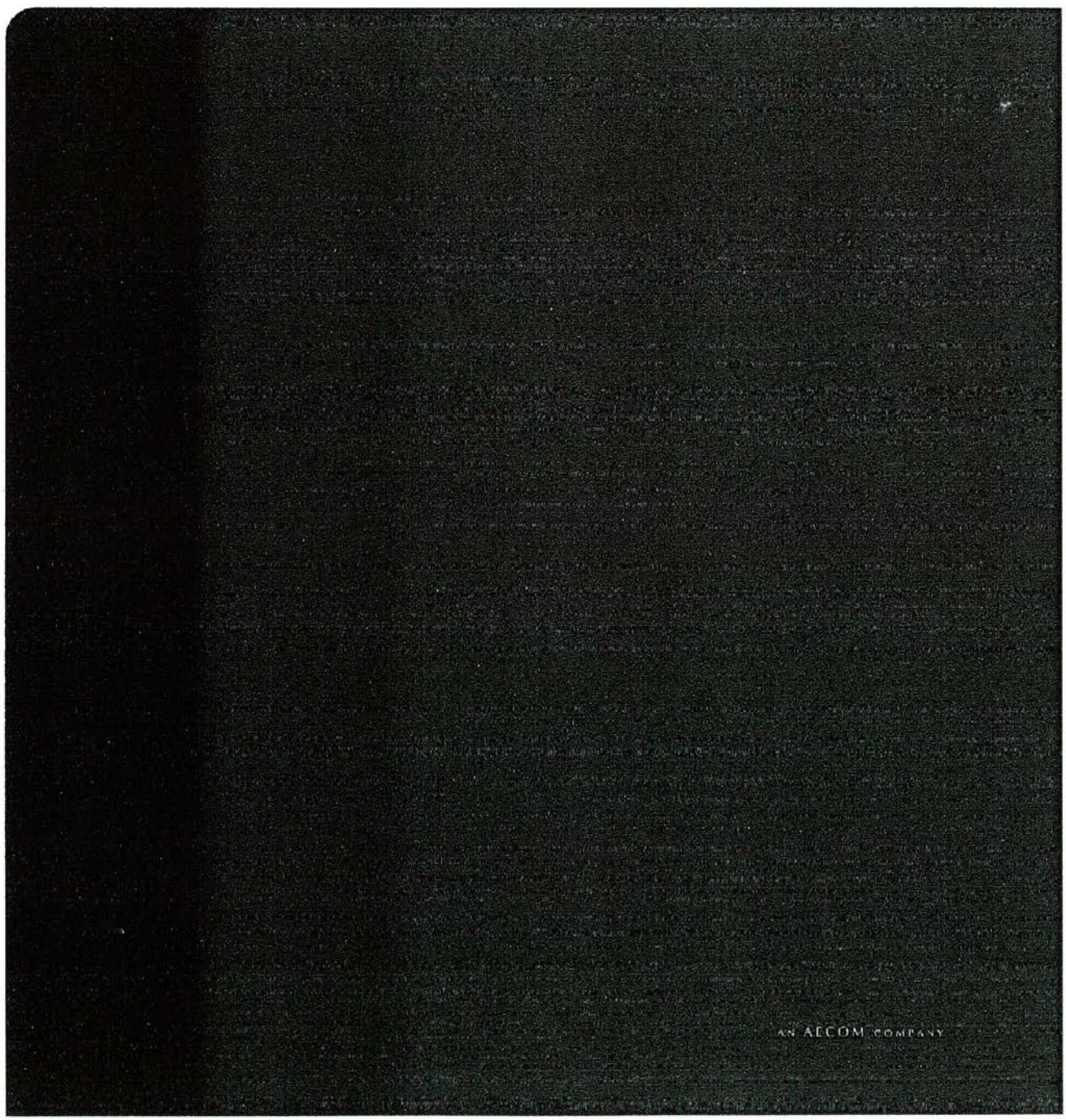
Infrastructure Report

maunsell

Horrocks Infrastructure Study Report

HTD Surveyors & Planners

January 2004



maunsell

Horrocks Infrastructure Study Report

Prepared for

HTD Surveyors & Planners

Prepared by

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PO Box 263

Geraldton 6531

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Tel +61 8 9921 8299

Fax +61 8 9921 7265

geraldton@maunsell.com

January 2004

71100600.00

Quality Information

Document	Horrocks Infrastructure Study Report
Ref	71100600.00 g:\maunsell australia\711 - civil\71100600.00 - horrocks strat planning\doc\horrocks infrastructure study.doc
Date	January 2004
Revision	A

Description *Horrocks Infrastructure Study Report*

Originator
Robert Stawarz .....

Checked
Robert Stawarz .....

Approved
Robert Stawarz
Geraldton Regional Manager  .....

Table of Contents

1.0 Introduction

Maunsell Australia Pty Ltd have been commissioned to provide a Servicing Infrastructure Report for proposed development of land surrounding the existing Horrocks Townsite. This report will contribute to the preparation of a Structure Plan for future subdivisions within the area of the study.

Whilst the whole Structure Plan incorporates land north of the Bowes River and westwards up to the coastline (including Horrocks townsite), the study area for this servicing report only covers land to the north of Horrocks Road, low density residential lots and the tourist site west of White Cliffs Road and all areas to the east of White Cliffs Road.

Reference is made to HTD Surveyors & Planners Drawing No. 03500PS-2-1-0, Horrocks Structure Plan.

Proposed Lots primarily consist of:-

1. Low density Residential (2,000 m^2 – 1 ha)
2. Rural Residential (1 – 4 ha)
3. Rural Smallholdings (4 – 40 ha)
4. Tourism Site

2.0 Infrastructure Services

2.1 Topography and Earthworks

The study area is situated astride an elevated limestone plateau exposed along the western edge between Horrocks Road and White Cliffs Road. The plateau is overlain with calcareous sands and sandy topsoil which rises to a ridge approximately 150m from the edge of the escarpment. This ridge runs in a north-westerly direction across the study area with several peaks at a contour level of 105m rising to the highest point at the north end (115 m).

The land falls at approximately 7% for 50 – 60 m away from this ridge before flattening out to "softer" grades of around 2%.

The majority of the area is anticipated to be readily excavatable to depths required for various infrastructure services and roadworks. Some limestone cap rock may be encountered during the process of service trench excavation but this is not anticipated to present any construction implications with currently available earthmoving and rock breaking equipment.

It is anticipated that the majority of earthworks will be limited to road reserves which can readily follow the contour of the land.

Topographical aspects of the subject land pose no unusual challenges to those experienced in this type of landform.

2.2 Roads

The Shire of Northampton advise that by the end of 2004 White Cliffs Road will be a formed gravel road on a gazetted road reserve through to Port Gregory. This is likely to promote attention to this area through increasing traffic once its existence becomes more publicised.

Various areas of this road may require upgrading with subsequent development applications.

Typical road construction requirements are as follows:-

up to 2,000 m^2 Lots	-	bituminous seal with kerbing and underground stormwater pipework.
> 2,000 m^2 Lots	-	bituminous seal, unsealed shoulders, table drains and culverts with kerbing only at intersections and traffic colouring devices.

2.3 Stormwater

Internal stormwater drainage needs to be dealt with in accordance with the Shire of Northampton's Land Development Guidelines.

Stormwater disposal should be promoted via soakage in table drains wherever possible to eliminate the necessity for stormwater compensating basins. It is anticipated that this may be suitable in the rural smallholdings lots.

However, special attention to stormwater controls and disposal may be expected in the areas adjoining the low density residential lots; in particular the proposed road skirting the western boundaries of these lots.

Dedicated compensation basin(s) may be required due to the proximity of this road to the edge of the escarpment overlooking Horrocks Townsite.

2.4 Water Supply

2.4.1 Existing Infrastructure

Horrocks townsite' potable water supply is provided from a production borefield located approximately 5.0 – 6.0 km north east of the Town. Water is delivered via 100 mm and 150 mm diameter PVC pressure mains from the borefield to an existing 1,000 m^3 capacity tank located within the study area (refer Appendix 1).

This tank site incorporates a water treatment plant and is situated approximately 2 – 3 km from White Cliffs Road along the ridge line at approximately the 95 m contour level. This tank gravity feeds via a 200 mm diameter gravity main into Horrocks townsite.

An overhead power supply running along the pipeline route feeds the tank and borefield sites with transformers located at each site.

Operation of equipment is monitored by a point to point radio control system with units at each bore site and at the treatment plant.

Water Corporation's master meter for Horrocks is located at the point where this main joins into the Horrocks Road reserve.

2.4.2 Borefield Operating Licence Limitations

The existing Operating Licence for the borefield is depicted in Appendix 2. This area incorporates only a small portion of the study area namely the low density residential (< 1 ha) lots west of White Cliffs Road and the four proposed rural smallholdings (4 – 40 ha) abutting Horrocks Road to the south.

This licence has a maximum limit of 100 megalitres (ML) drawn from the borefield.

Existing water supply infrastructure services 100 properties in Horrocks with an average annual consumption of approximately 70 ML. The Shire has recently developed approximately 56 urban lots in town which has stretched the current operating licence almost to its limit.

Proposed low density residential lots west of White Cliffs Road may still be serviced under the current operating licence but a review of projected average annual consumption would be required to validate this.

The additional 120 – 130 lots within the study area will almost double the existing demand and hence major infrastructure and licence upgrades will be required.

2.4.3 Operating Licence Upgrades

Operating Licences are controlled by the Office of Water Regulation and any amendments require Ministerial approval.

To instigate these changes the Developer needs to write to the Water Corporation requesting an extension to the operating licence area with Water Corporation being the preferred service provider. The Water Corporation will refer this on to the Office of Water Regulations. Subject to the capacity of the groundwater acquifer to sustain this extra demand they may decide to approve the extension outright or if there is sufficient justification they may call for expressions of interest for private operators to own and operate an independent water supply system for the development. In this instance an independent borefield supply and delivery system would be most likely required which would also be subject to similar constraints on the capacity of the groundwater acquifer. The Water and Rivers Department would also need to approve this as they have jurisdiction over groundwater bores.

2.4.4 Infrastructure Upgrades

The development will probably require the duplication of the existing 1,000 m^3 tank. This additional tank will need to be an elevated type to serve most of the proposed allotments.

There are several peaks along the ridge line at a contour level of 105 m (10 m above the contour level at the existing tank site i.e. 95 m). At the very north end of the study area the ground rises to a contour level of 115 m. To fully service all of these lots a booster pump station may be required or another tank at this end of the development.

The water treatment plant at the tank site may be expected to require some upgrade.

The borefield pumps and delivery mains may also require upgrading or alternatively a transfer pump station between the borefield and the storage tanks. The existing 200 mm diameter main from the tank site to Horrocks Road may also require upgrade in size to meet the additional draw on the system (approximately 2,400 m).

Water Corporation advise that there is generally only one master meter per town supply or scheme. The existing master meter would need to be relocated to the tank site.

Any new infrastructure such as pumping stations will require a power supply and communications link to enable link up to Water Corporation's remote site monitoring system. It is anticipated that with new Telstra landlines being provided to the development, the tank site would also be served with the borefield radio control system retained.

The tank site (and pump station sites) will require a dedicated right of way or road reserve with a gravelled road access as a minimum. The water supply mains require an easement and access would need to be maintained over the route.

It is anticipated that all of these infrastructure upgrades, depending on detailed investigations, may cost anywhere between $0.6 – 1.0 M (this excludes the internal subdivisional reticulation). It is likely that all of these upgrade costs plus headworks will be assigned to the development.

2.5 Sewerage

Health Department policy allows subdivisions without sewers subject to site suitability for septic tanks and minimum lot sizes of 2,000 m^2.

Irrespective of this, it is anticipated that Water Corporation may impose a sewerage condition on any planning applications. This would necessarily be subject to an appeal process. Considering the proposed lot sizes indicated and the existing geology, groundwater depth (approximately 40 m) and proximity to the ocean, a successful appeal against any such condition is likely.

2.6 Power Supply

Horrocks is presently fed from an overhead power transmission line across open farmland from the east along an alignment approximating the northern boundary of the 4 proposed rural smallholding lots fronting Horrocks Road.

There is an existing overhead power supply following the Water Corporation's pipelines to the borefields. Western Power have yet to confirm if this is single or three-phase.

The water tank site and each of the bore sites are provided with a 10 kVa transformer. It is likely that water tank site transformer will need to be upgraded to meet extra power supply demands associated with any additional water booster pumps or transfer pumps. The borefield transformers may need upgrading depending if any bore pump upgrades are required.

An easement would be required to protect the existing overhead power lines as a preference (cost wise) to relocation of these mains.

Similar access requirements as for the water mains are required for all overhead power lines not within road reserves.

Western Power requirements are for lots < 5 ha to be served by underground power reticulation. Hence, the smaller low density residential and rural residential lots will require underground power reticulation.

At the boundary to the larger lots the power mains can jump up to an overhead power transmission line system with 10 kVa pole top transformers serving each lot.

The smaller lots (< 5 ha) may be served adequately from the existing H.V. transmission lines with drop down three-phase 63 kVa transformers serving approximately 12 lots each.

The tourism site will require independent assessment of power supply demand depending on the nature of the development.

2.7 Telecommunications

Telstra advise that there is limited capacity in the existing infrastructure to cater for any significant developments.

There is some infrastructure in White Hills Road but this is likely also to be insufficient for the proposed developments.

Telstra advise that they generally plan infrastructure upgrades on the basis of forecast growth which is assessed from information provided through zoning amendments and WA Planning Commission applications.

A development of this magnitude may require a new optic fibre link from Northampton if its supply is adequate or alternatively a satellite link and mini exchange may be feasible.

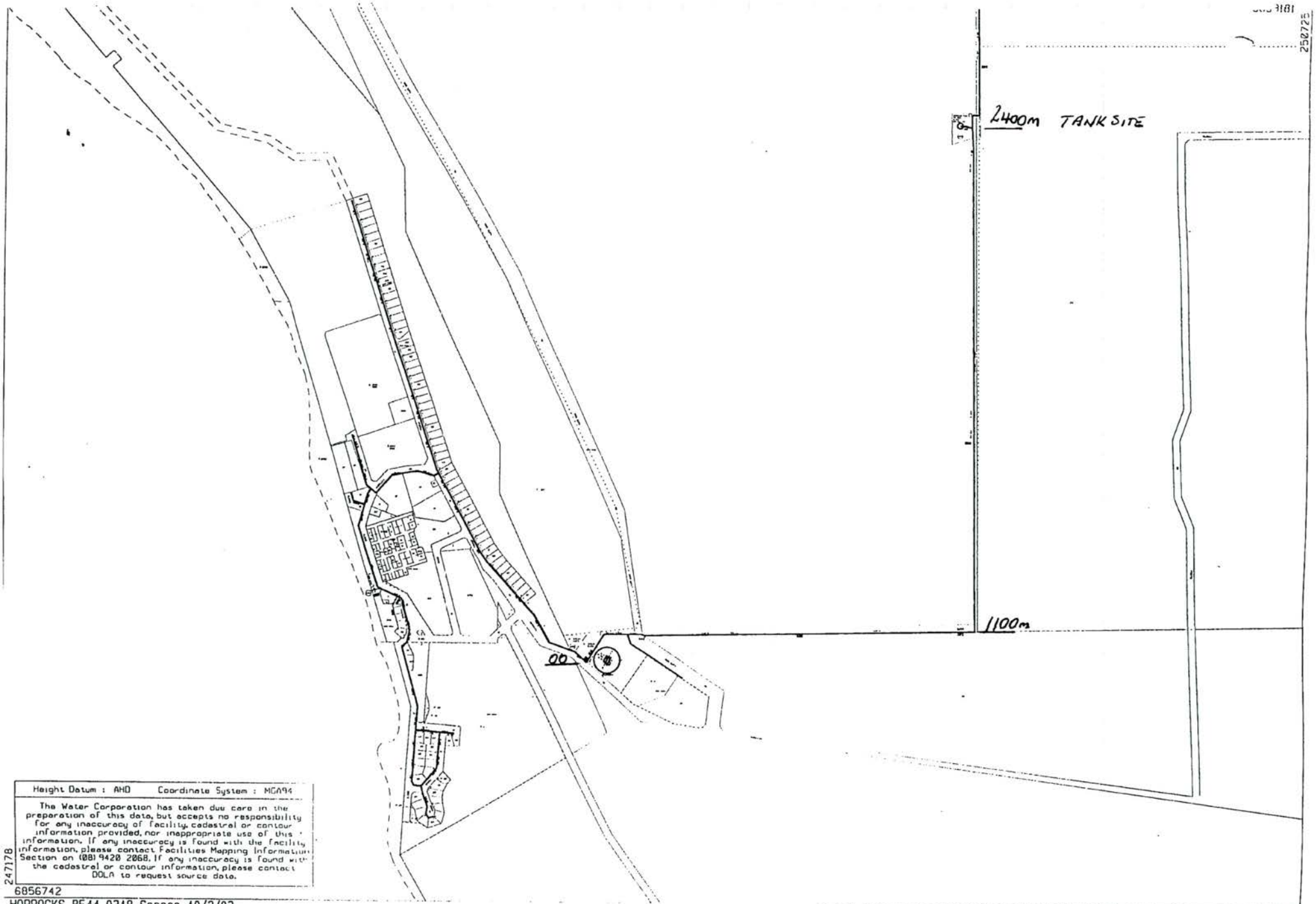
Either way, Telstra would respond to each planning approval application as they arise.

3.0 Summary

The following are the key elements affecting the development of the study area.

- The topography and landforms are generally favourable to the construction of roads and services.
- Extensions to the existing Water Corporation Operating Licence for its water supply borefields will be required. This needs Ministerial approval and will be subject to acquifer capacity.
- Existing water supply infrastructure will require major upgrades including:-
  - probable duplication of water storage tanks
  - probable upgrade of water treatment plant
  - relocation of the master meter
  - possible borefield and delivery main upgrades or transfer pump station
  - possible water reticulation main upgrades
  - probable water booster pump station or additional storage tanks
  - easements over existing water mains and access via dedicated road reserves to the water tank site(s)
  - power supply (transformer) upgrades to new pumping stations and possibly borefields
- It is unlikely to require gravity sewerage although sewer conditions may be imposed on any development application.
- Power supplies are readily available from existing HV mains to Horrocks although easements and access will be required.
- Telecommunications facilities – there is limited capacity within the existing infrastructure servicing Horrocks to cater for this development. Options may be a new optic fibre link from Northampton or a satellite link and mini exchange.

Appendix 1 Existing Water Supply Infrastructure



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The Water Corporation has taken due care in the preparation of this data, but accepts no responsibility for any inaccuracy of facility, cadastral or contour information provided, nor inappropriate use of this information. If any inaccuracy is found with the facility information, please contact Facilities Mapping Information Section on (08) 9420 2068. If any inaccuracy is found with the cadastral or contour information, please contact DOLA to request source data.

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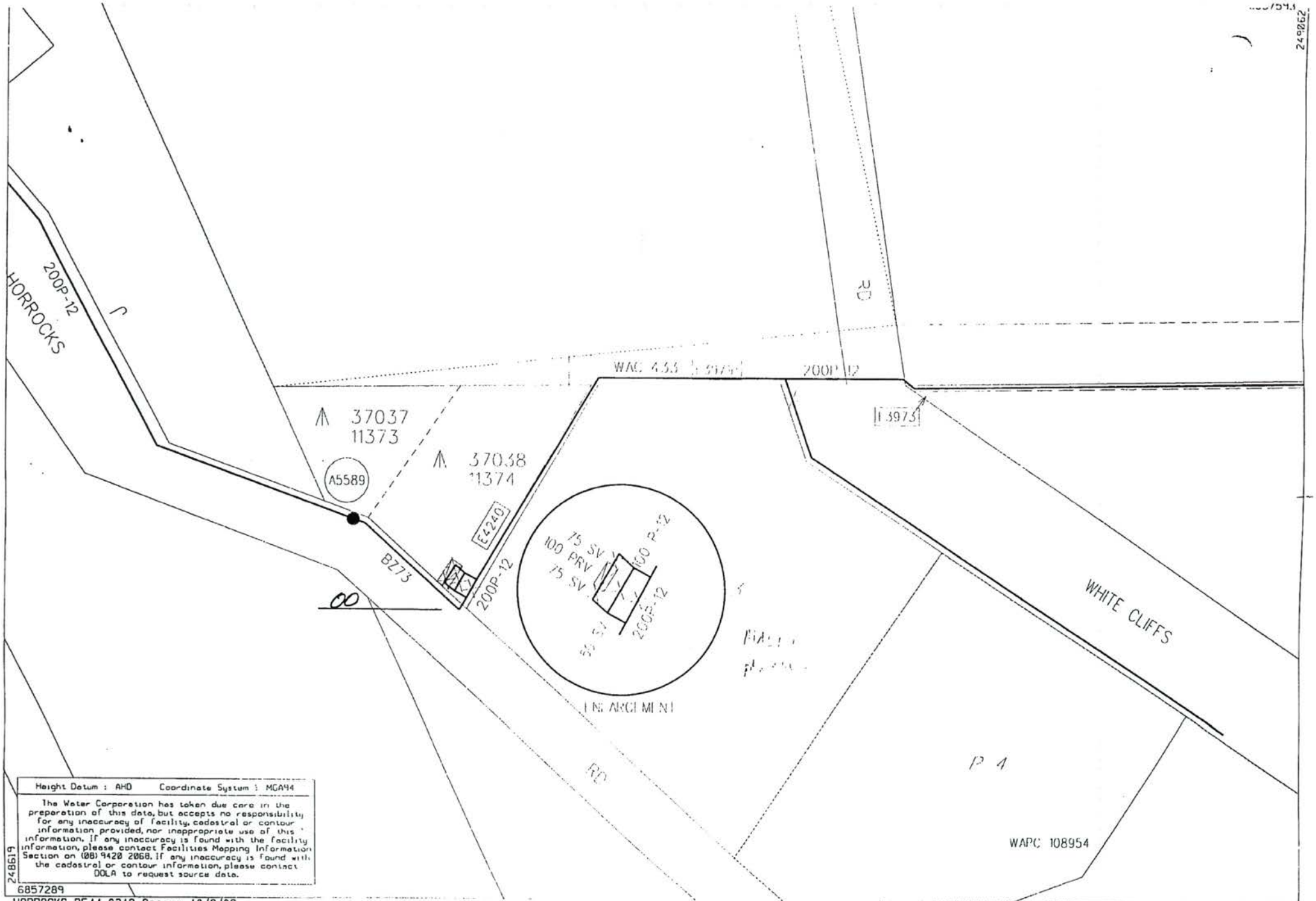
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The Water Corporation has taken due care in the preparation of this data, but accepts no responsibility for any inaccuracy of facility, cadastral or contour information provided, nor inappropriate use of this information. If any inaccuracy is found with the facility information, please contact Facilities Mapping Information Section on (08) 9420 2068. If any inaccuracy is found with the cadastral or contour information, please contact DOLA to request source data.
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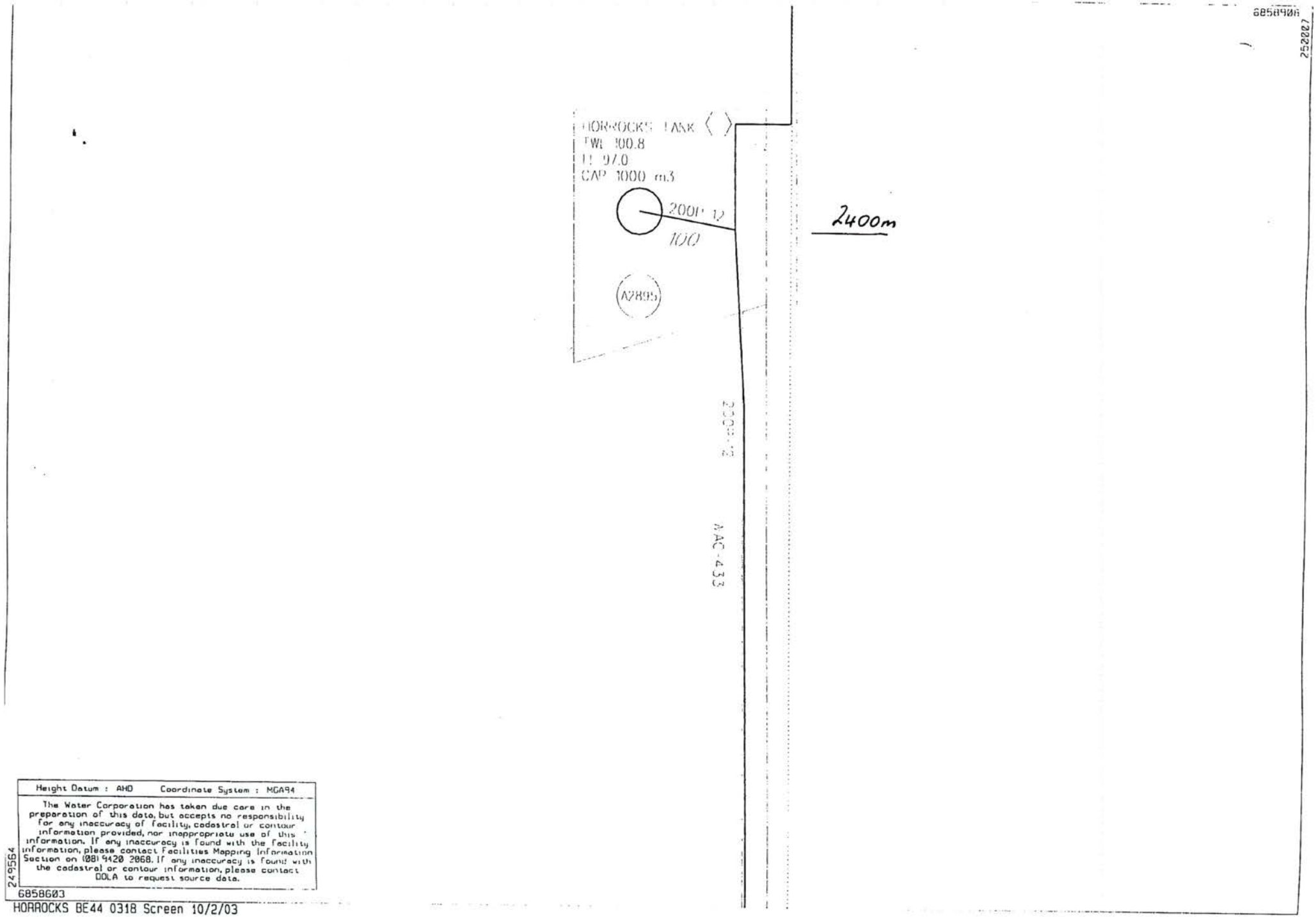

Height Datum : AHD Coordinate System : MGA94

The Water Corporation has taken due care in the preparation of this data, but accepts no responsibility for any inaccuracy of facility, cadastral or contour information provided, nor inappropriate use of this information. If any inaccuracy is found with the facility information, please contact Facilities Mapping Information Section on (08) 9420 2868. If any inaccuracy is found with the cadastral or contour information, please contact DOLA to request source data.

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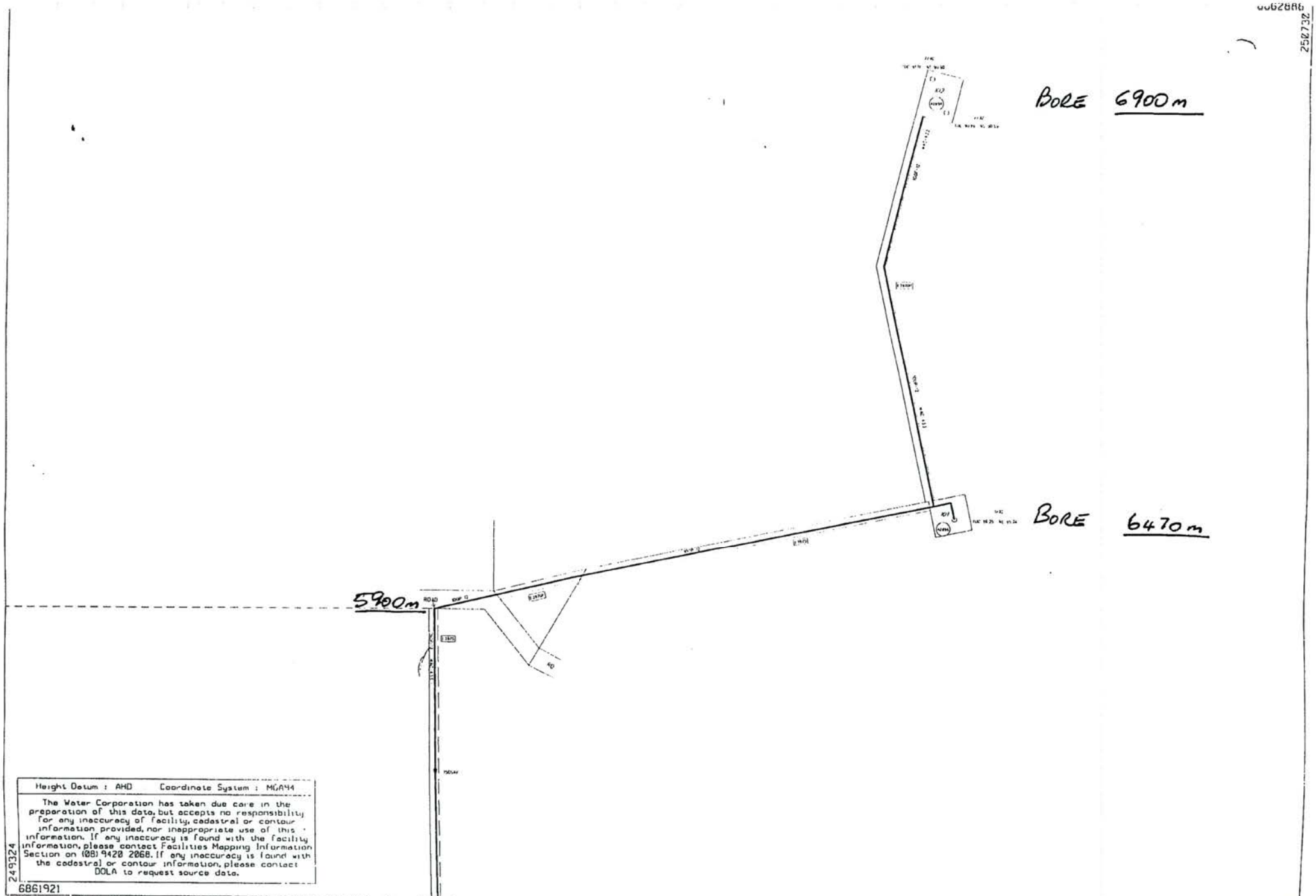

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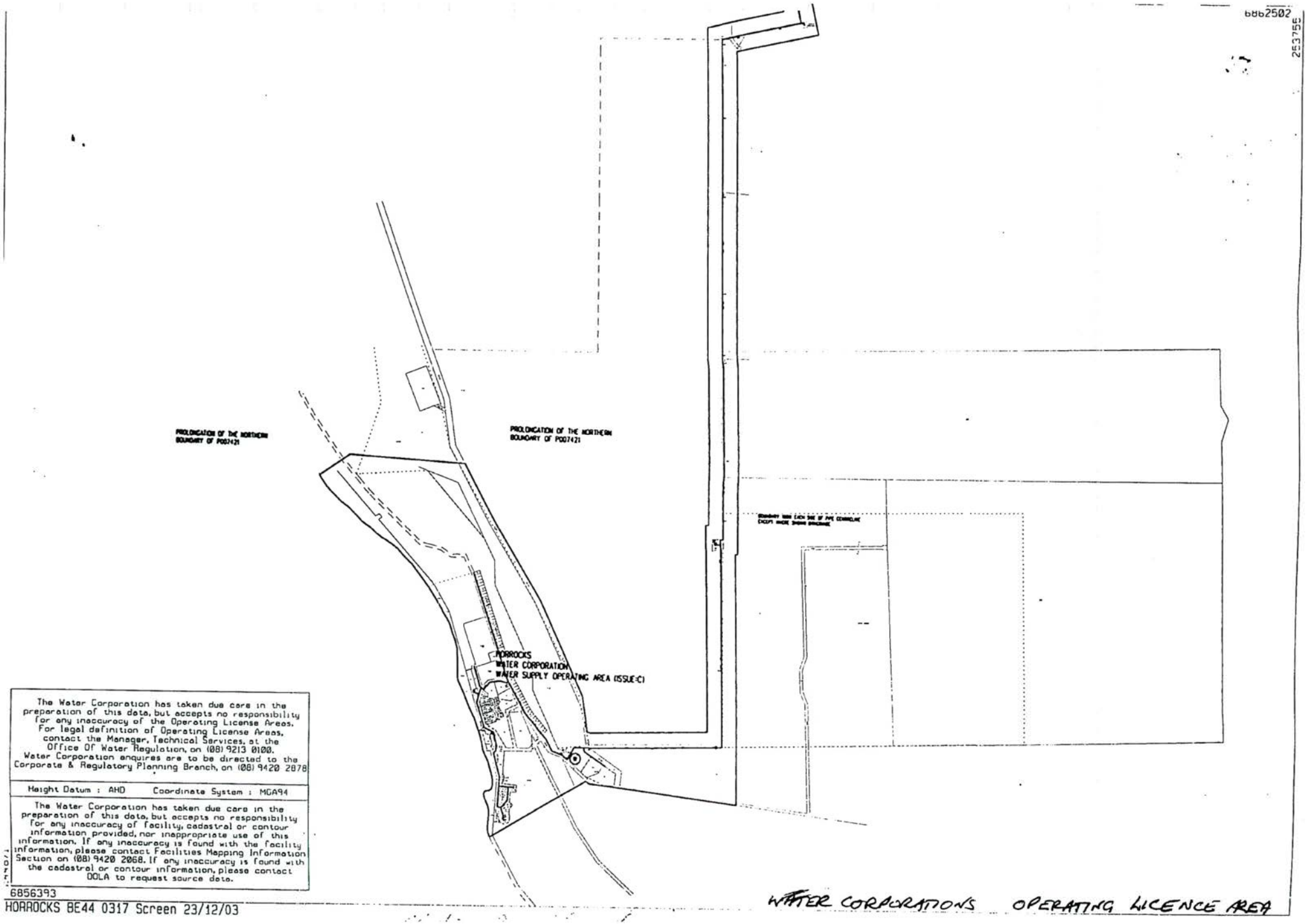
HORROCKS BE44 0318 Screen 10/2/03

Appendix 2 Existing Water Corporation Operating Licence Area



The Water Corporation has taken due care in the preparation of this data, but accepts no responsibility for any inaccuracy of the Operating License Areas. For legal definition of Operating License Areas, contact the Manager, Technical Services, at the Office Of Water Regulation, on (08) 9213 0100. Water Corporation enquires are to be directed to the Corporate & Regulatory Planning Branch, on (08) 9420 2878

Height Datum : AHD Coordinate System : MGA94

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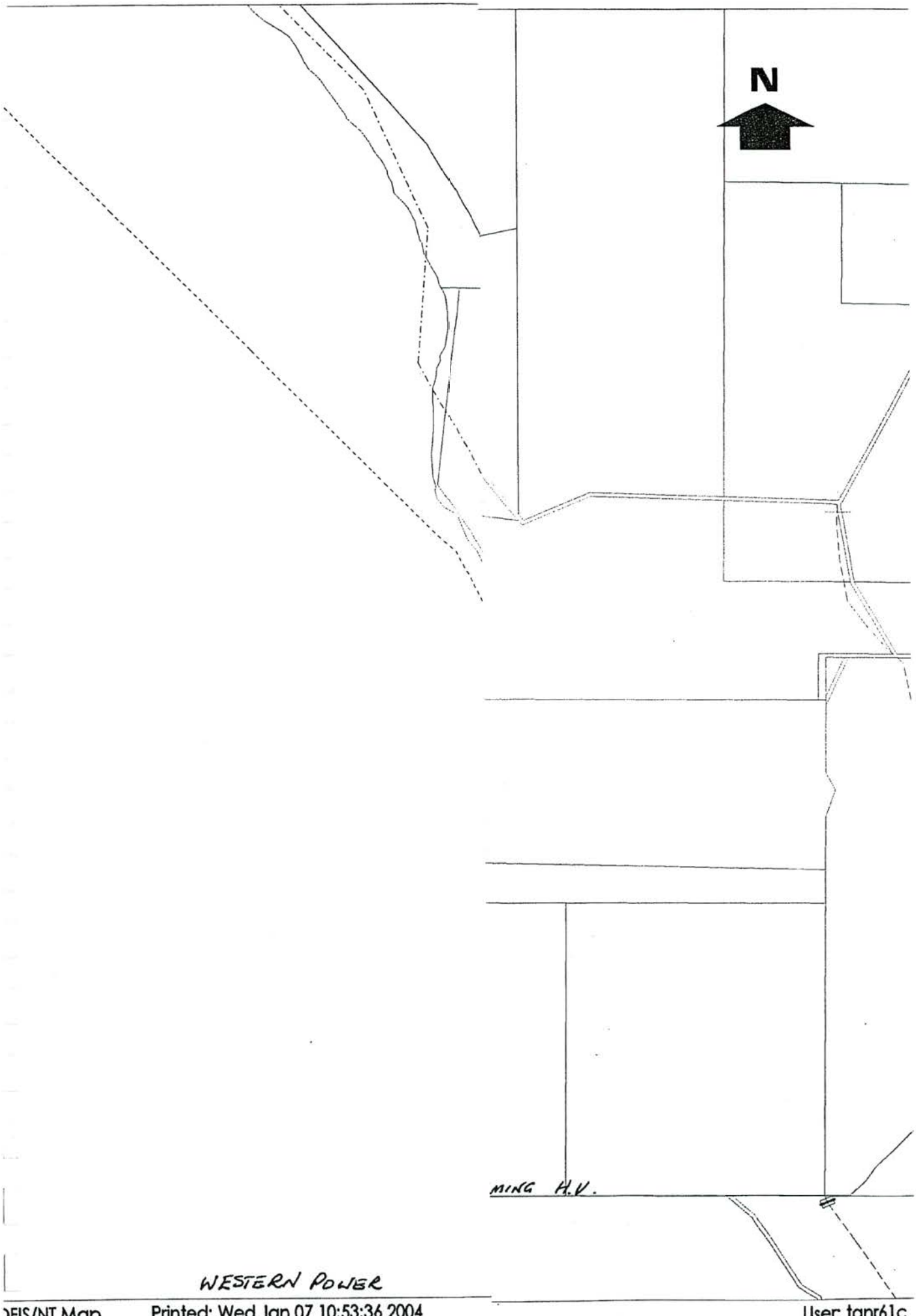
HORROCKS BE44 0317 Screen 23/12/03

WATER CORPORATIONS OPERATING LICENCE AREA



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POSTED

WATER CORPORATION

Your Ref: 10.5.10/OCR17045
Our Ref: GN1 2006 00618 V01 Doc 563398
Enquiries Phil Gale
Direct Tel: 08 9923 4942 Fax: 08 9923 4966

17 December 2009

10.5.10

1

HW

Shire Of Northampton
PO Box 61
NORTHAMPTON WA 6535

Attention: Hayley Williams

Midwest Region
45 Cathedral Avenue
Geraldton WA 6530
PO Box 43
Geraldton WA 6531
Fault Enq 13 13 75
Account Enq 13 13 85
Technical Enq 13 13 95
Fax (08) 9923 4966
www.watercorporation.com.au
ABN 28 003 434 917

SHIRE OF NORTHAMPTON
NORTHAMPTON HORROCKS BEACH STRUCTURE PLAN

The Water Corporation recently met with the Mr. Reg Reynolds to clarify the provision of water and wastewater services for the Horrocks Beach Structure Plan.

The Water Corporation has a water supply and sewerage operating license area for Horrocks Beach as shown on the attached plans and it is noted that a portion of the Urban Residential area is located outside the water supply operating license area.

The operating license areas are issued to service providers like the Water Corporation by the Economic Regulation Authority (ERA) to provide water and wastewater services, and it is the service provider's role to carry out the planning and investigation for developments within the operating license area.

Developments within the Operating License Area

For developments that are located within the operating license area the Corporation is obligated to providing the water and sewerage services and will also receive a Community Service Obligation from Government to cover the shortfall in the cost in running the scheme that is not covered by the revenue obtained from the water and sewerage charges.

The Corporation is granted a water allocation from the Department of Water (DoW) to provide a water supply scheme to service a town.

The Corporation as a service provider will initiated planning and investigation for increases in allocation or alternative supplies if and when it becomes necessary.

Developments outside the Operating License Area

If a developer's land or a portion of their land is outside the license area then it is the responsibility of the developer to carry out the planning and investigation for these services, they then can approach a service provider to make an application to the Economic Regulation Authority (ERA) to grant an operating license or an extension to an existing license.

The ERA when granting an operating license or an extension will be making a Government commitment for the provision of Community Service Obligation to the licensed service provider.

The developer should be working with the DoW and service providers to determine what investigation is required to provide a sustainable water supply for the Horrocks Beach Structure Plan.

Current Water Corporation Water Supply Scheme capacity within the Horrocks Beach Operating License Area

The Corporation's has from DoW a water allocation of 100,000 kl per year for the land within the operating license area with 32,000 kl per year currently being consumed by the town residents.

The estimated number of lots that can be served from the current water supply scheme is dependant upon the assumed total water demands and their demography. The current usage for Horrocks is 170 kl/lot/year for holiday home use when this is compared to Kalbarri of 310 kl/lot/year which is permanent residential use.

Using holiday home use for Horrocks the number of additional lots could be in the order of approximately 240, but if the water demand is assumed to be permanent residential then the number of additional lots would only be in the order of 50.

Future Water Supply Planning for Horrocks within the Operating License Area

The Corporation has not completed any detailed planning for the Horrocks water supply scheme but a number of options could be considered for securing a water supply within the license area but all these options will require Department of Water (DoW) approval.

1. Expand local groundwater scheme.
2. Pipeline from Northampton.
3. Desalination

Or a combination of the above.

1. Expand Local Groundwater Scheme

The current annual water allocation for the Horrocks bore field from DoW is 100,000 kl and the current town site is using on average 32,000 kl per year.

If the allocation was to become fully used then the Corporation will carry out an investigation to increase the allocation for only the lots within the license area and then make an application to DoW for an increase. DoW will only approve the increase if it determined that the aquifer can sustain the additional extraction.

Then if granted, works may include the construction of new bores and mains which the developer may be required to prefund.

2. Pipeline from Northampton

The Corporation's long term water supply planning for the Horrocks is the construction of a pipeline and headworks infrastructure from Northampton and upgrading of the Allanooka – Northampton pipeline. The Corporation will be required carry out an investigation for an increased allocation from the Allanooka borefield for only the lots within the license area and then make an application to DoW for this increase.

DoW will only approve the increase if it determined that the Allanooka aquifer can sustain the additional extraction. The Corporation is yet to determine the budget cost of these works and the developer may be required to prefund.

3. Desalination

The Corporation's alternative long term water supply planning for the Horrocks is the construction of a desalination plant treating groundwater or seawater. This infrastructure will require a number of environmental and DoW approvals for a sustainable water supply for the Horrocks town site.

The developer will be required to provide all reticulation mains and contribute to water supply headworks and may also be required to prefund headworks infrastructure as needed.

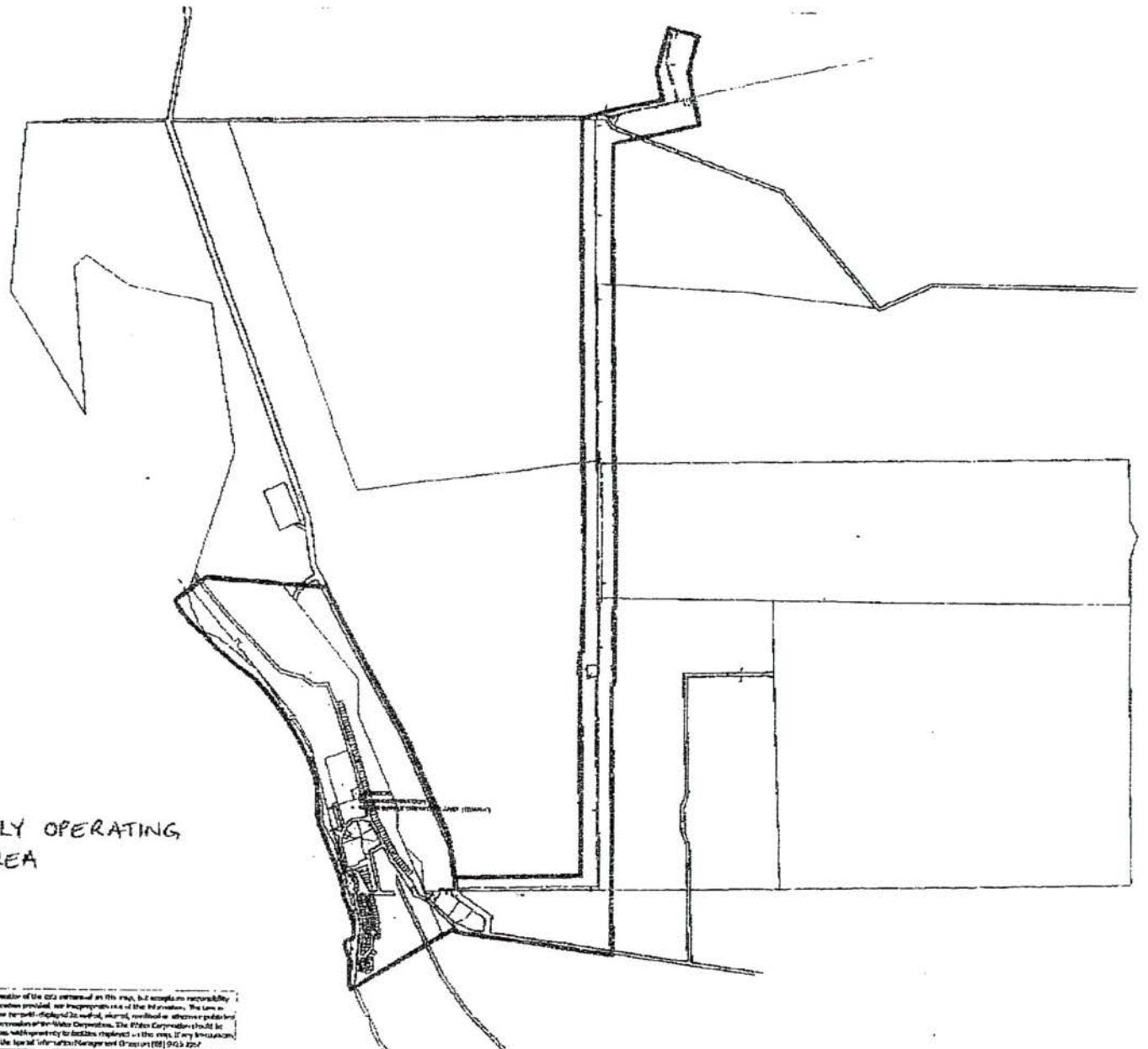
Wastewater

The Corporation has wastewater planning for the Horrocks Beach Structure Plan with the Urban Residential land entirely within the wastewater operating license area.

The developer will be required to provide all reticulation mains and contribute to water supply headworks and may also be required to prefund headworks infrastructure as needed.

Should you have any queries, please do not hesitate to contact the Enquiries Officer.

PHIL GALE
LAND DEVELOPMENT OFFICER
MID WEST REGION



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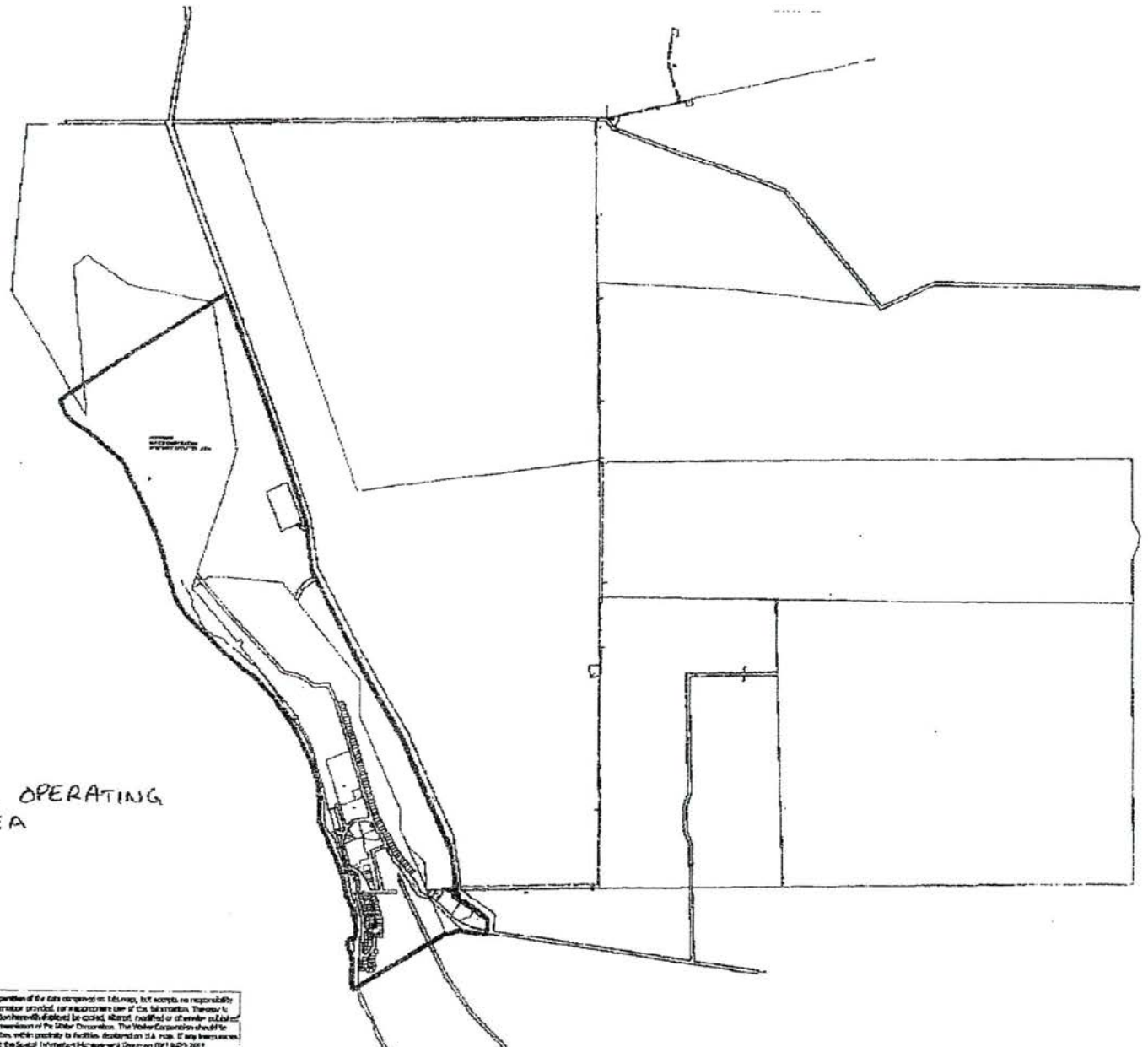

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Annexure 10

Correspondence from Water Corporation

POSTED

WATER CORPORATION

Your Ref: 10.5.10/OCR17045
Our Ref: GN1 2006 00618 V01 Doc 563398
Enquiries Phil Gale
Direct Tel: 08 9923 4942 Fax: 08 9923 4966

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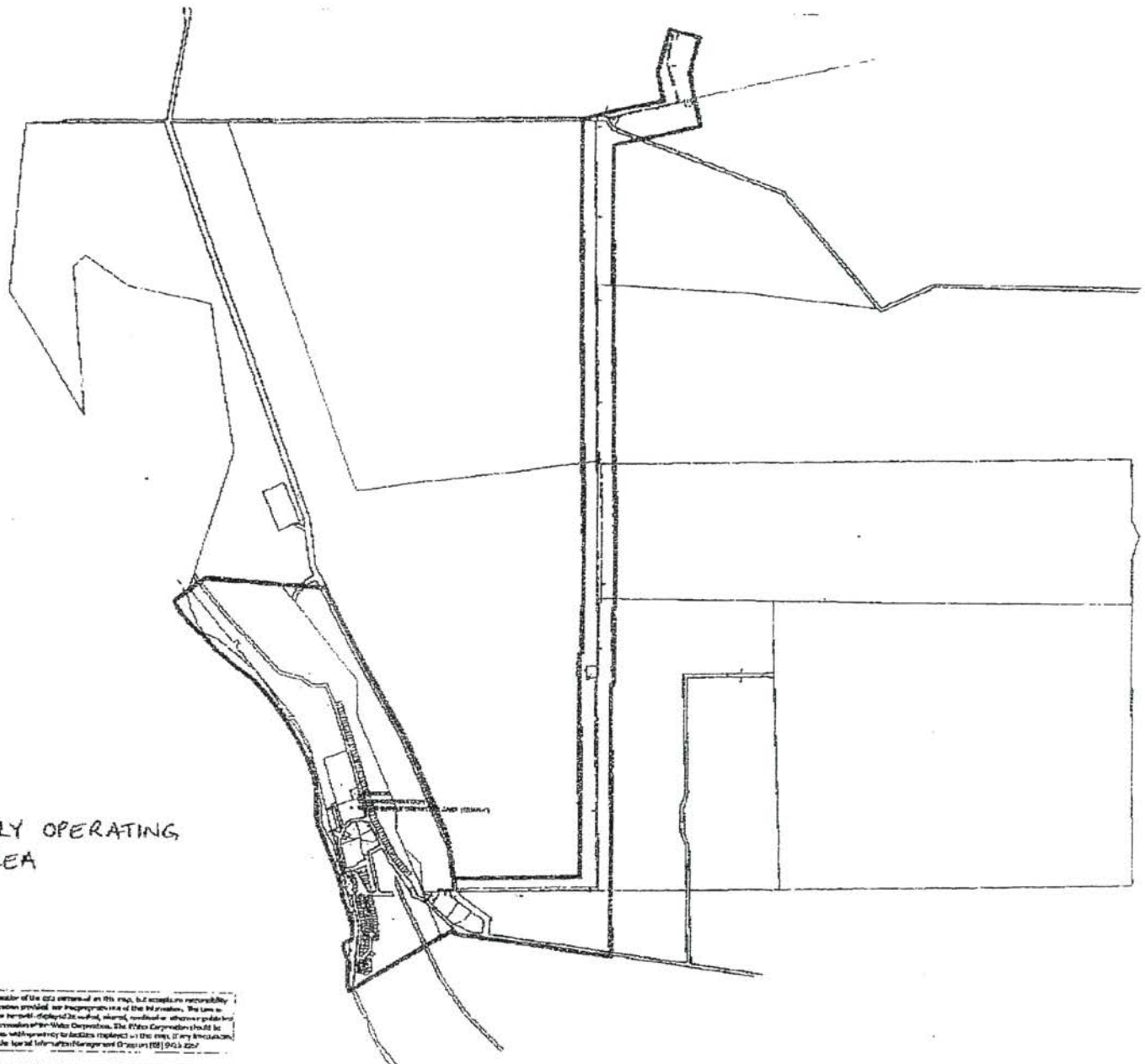

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ANNEXURE 11

LOCAL WATER MANAGEMENT STRATEGY

Department of Water
Government of Western Australia

Your Ref: Seaview Farms

Our Ref: RF351-04/WRD68752

Enquiries: Ms Kerry Wray

(08) 9965 7400

GHD
PO Box 164
GERALDTON WA 6531

Attn: Andrew Nagle

Dear Andrew

Local Water Management Strategy, Seaview Farms (July 2009)

The Department of Water (DoW) thanks you for addressing and including the additional information as requested. The additions and revisions have been assessed as adequate and we have no further comments. The Western Australian Planning Commission may now be advised.

If you wish to discuss this issue further please contact the Midwest Gascoyne Region office on (08) 8865 7400.

Yours sincerely,

Damien Coleman
A/Program Manager, Water Resource Management
Midwest Gascoyne Region

September 7, 2009

Midwest Gascoyne Region 81 Forrest Street Geraldton Western Australia 6530
PO Box 73 Geraldton Western Australia 6531
Telephone (08) 9965 7400 Facsimile (08) 9964 5983
www.water.wa.gov.au

CLIENTS | PEOPLE | PERFORMANCE

Seaview Farms

Report for Seaview Farms, Horrocks Land Development

Local Water Management Strategy

July 2009

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

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Appendices

A Horrocks Townsite Expansion Strategy

B Geotechnical Investigation Results

C Lot 12005 Landfill Site

1. Introduction

GHD Pty Ltd were commissioned by Seaview Farms to prepare a Local Water Management Strategy (LWMS) in response to advice from the Western Australian Planning Commission. The preparation of such a plan was necessary to ensure the issue of water management on the site was properly addressed and the LWMS be prepared prior to endorsement of the structure plan.

The LWMS will also satisfy the Town Planning Scheme No. 8 Horrocks where it is stated under Section 6.7.6.1;

- "A proposed structure plan is to contain the following details";

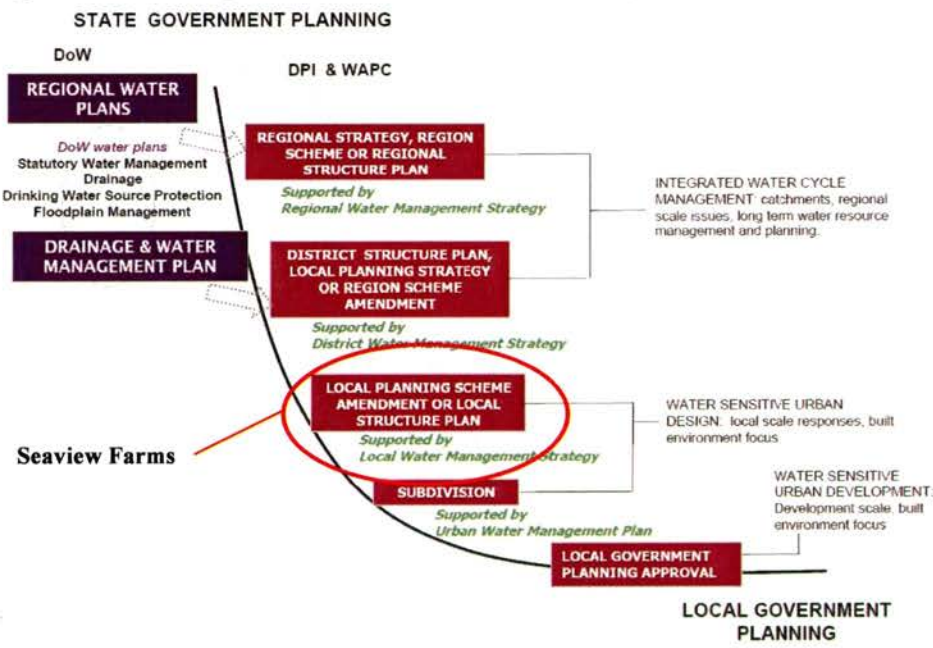
  (e) "a written report to explain the mapping and to address the following"

  (viii) "urban water management".

1.1 Planning Context

The LWMS has been prepared in accordance with Water Sensitive Design for the Shire of Northampton and State Government Policy framework, as illustrated in Figure 1.

Figure 1 Planning Framework Water Sensitive Design



The preparation of this LWMS is not supported by a preceding District Water Management Strategy (DWMS) or Regional Water Management Strategy (RWMS). However this document has been prepared according to *Better Urban Water Management (2008) and Developing a Local Water Management Strategy – Draft (2008)* to address the issues of water management for the site.

1.2 Principles and Objectives

The following documentation defines the key points and objectives for the LWMS:

State Government Policies

- Liveable Neighbourhoods Edition 4 (WAPC 2004a);
- State Water Plan 2007 (Government of WA 2007);
- State Water Strategy (Government of WA 2003); and
- Policy Position Acid Sulphate Soils and the Contaminated Sites Act 2003 (DEC 2007).

State Government Guidelines and Standards

- Stormwater Management Manual for Western Australia (DoE 2004-2007);
- Decision Process for Stormwater Management in Western Australia (DoE & SRT 2005);
- National Water Quality Management Strategy (ANZECC & ARMCANZ 2000);
- Better Urban Water Management (WAPC October 2008); and
- Developing a Local Water Management Strategy – Draft (EES 2008).

Shire of Northampton Guidelines for Development

- Shire or Northampton Town Planning Scheme No 6 Northampton District (2004); and
- Shire of Northampton Town Planning Scheme No 8 Horrocks (2004).

The Western Australian Stormwater Management Manual (DoE, 2004-2007) guiding principles in relation to stormwater are as follows:

- Water quality and quantity: maintain or improve the surface and groundwater quality and the water cycle balance within development areas relative to pre-development conditions;
- Water Conservation: To maximise the reuse of stormwater;
- Ecosystem Health: To retain natural drainage systems and protect ecosystem health;

- Economic Viability: To implement stormwater systems that are economically viable in the long term;
- Public Health: To minimise the public risk, including risk of injury or loss of life to the community;
- Protection of Property: To protect the built environment from flooding and waterlogging;
- Social Values: To ensure that social aesthetic and cultural values are recognised and maintained when managing stormwater; and
- Development: To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles.

1.3 Previous Studies

Little documentation is currently available for the proposed development site. Further, there are little known environmental studies that have been conducted in the nearby area. The following documents are relevant to the preparation of this LWMS:

- Proposed Structure Plan, Lots 110, 112, 114 & 115 Horrocks and White Cliffs Road, Horrocks, Shire of Northampton (2008);
- Horrocks Spring Vegetation Survey, Seaview Farms (2006); and
- Desktop Environmental Assessment for Horrocks Structure Planning (2004).

2. Proposed Development

2.1 Key Elements of the Structure Plan

The development area is located approximately 25 km west of the Northampton town site, 70 km north of the City of Geraldton and adjacent to the town site of Horrocks.

Under the Shire of Northampton's Town Planning Scheme 8, Lots 110, 112, 114 and 115 Horrocks and White Cliffs Road, Horrocks; have been zoned 'development' for the purpose of the Horrocks Townsite Expansion. Currently 166 ha of the 441 ha for Lot 112 is proposed for future development. The area abuts a range of other zones and reserves including parks and recreation, residential, rural, town centre and conservation zoning. A draft plan for the Horrocks Townsite Expansion Strategy is presented in Appendix A.

The prepared and submitted Horrocks structure plan provides guidance for the development of approximately 400 residential lots at an average density of R20 and 42 rural residential lots at an average density of 4-40 ha within the identified development zone.

This LWMS is focussed on the residential development that begins 600 m from the White Cliffs Road and Horrocks Road intersection and runs adjacent to White Cliffs Road for approximately 2.8 km. The area is approximately 79 ha of which approximately 18.8 ha will be public open space (POS).

2.2 Public Open Space Landscape

Public open spaces are located adjacent to and interface with the designated conservation areas. POS areas within the development will act as community corridors and as such all POS areas will be surrounded by residential allotments. 18.8 ha of the designated development site have been set aside for public open space use.

2.3 Previous Landuse

The study area is mostly a green field site consisting of sand dunes, limestone outcrops and native vegetation. Some existing low density residential housing is found at the southern edge of the study area closest to White Cliff Road.

LEGEND

Groundwater Monitoring Bore
WIN Site ID

Surface Water Monitoring Bore
WIN Site ID

Road

Topography

Sub Catchments - GHD

Lots

POS

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

GHD
CLIENTS|PEOPLE|PERFORMANCE

Client Name
Horrocks LWMS

Job Number | 61-23926
Revision | A
Date | 09 Jun 2009

Seaview Farms environmental features

Figure 2

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: Data Custodian. Data Set Name/Title. Version/Date. Created by: M Bushridge

3. Design Criteria

The design criteria adopted for this LWMS have been based on the design objectives outlined in *Better Urban Water Management* (Western Australia Planning Commission 2008). This criteria is further outlined in the sections below.

3.1 Water Conservation

The overall intention of this Seaview Farms LWMS is to achieve the sustainable management of all aspects of the water cycle within the development. Specifically the objectives for integrated urban water management for the development are:

- Minimise total water use. The Western Australian *State Water Plan* (Government of Western Australia 2007) sets a target of reducing unrestricted annual water consumption to 100 kL/person, including not more than 40 – 60 kL/person/year scheme water.
- Substitute drinking quality water with fit-for-purpose water for nondrinking water uses. The *State Water Strategy* (Government of Western Australia 2003) sets a target of 20% reuse by 2012. The development aims to reduce the use of scheme water by providing an alternative fit for purpose water supply for nondrinking use.

3.2 Water Quantity Management

Principle

The post development peak flows are to be maintained relative to pre-development conditions, unless otherwise established through determination of ecological water requirements for sensitive environments.

To achieve the above principle the following criteria will be applied:

- **Ecological protection** - For the critical one year average recurrence interval (ARI) event, the post-development discharge volume and peak flow rates shall be maintained relative to pre-development conditions in all parts of the catchment. Where there are identified impacts on significant ecosystems, maintain or restore desirable environmental flows and/or hydrological cycles as specified by DoW.
- **Flood Management** - Manage the catchment run-off for up to the 1 in 100 year ARI event in the development area to pre-development peak flows, unless otherwise indicated in an approved strategy or as negotiated with the relevant drainage service provider.

  Protect infrastructure and assets from inundation and flooding. Urban development usually results in the removal of significant areas of vegetation and replacement of permeable areas with buildings, roads and paved areas. This results in increased

volumes and flows of surface runoff, which has the potential to cause flooding and inundation.

3.3 Water Quality Management

Principle

Maintain surface and groundwater quality at pre-development levels (winter concentrations) and if possible, improve the quality of water leaving the development area to maintain and restore ecological systems in the sub catchment in which the development is located.

To achieve the above principle the following criteria will be applied:

- If the pollutant outputs of development (measured or modelled concentrations) exceed catchment ambient conditions, the proponent shall achieve water quality improvements in the development area or, alternatively, arrange equivalent water quality improvement offsets inside the catchment. If these conditions have not been determined, the development should meet relevant water quality guidelines stipulated in the *National Water Quality Management Strategy* (ANZECC and ARMCANZ 2000).
- Ensure that all run-off contained in the drainage infrastructure network receives treatment prior to discharge to a receiving environment consistent with the *Stormwater Management Manual.*
- All outflows from subsoils should receive treatment prior to discharge to the stormwater system.
- Protect groundwater as a resource.

Table 1 summarises the objectives and strategies for this LWMS.

Table 1 Water management objectives and strategies

Objective	Strategy	Design Criteria
Minimise total water use in the study area.	Limit potable water use within building and outside the house.	• Reduce the average per capita potable water consumption to 100 kL/year.

Objective	Strategy	Design Criteria
Protect infrastructure and assets from inundation and flooding.	Maximise infiltration opportunities though out the drainage system.	◗ Maximising infiltration by adopting a stormwater retention system to contain the 1 year ARI storm. ◗ Infiltration swales / open basins located in POS areas will be designed to accommodate the 100 year storm event. ◗ Floor levels of all habitable building pad levels 0.3 m above the 100 year event flood level.
Protect environmental values.	Reduction in the average annual loads of pollutants compared to traditional systems, discharging to the surface water and groundwater.	◗ Runoff from impervious surfaces shall be directed to infiltration devices and areas. ◗ Using structural controls such as swales, in combination with non-structural controls such as education campaigns, to minimise potential pollution of groundwater. ◗ Achieve 60% reduction in TP and 45% reduction in TN relative to developments that do not actively manage stormwater quality.

3.4 Commitment to best management practice

In order to meet the design criteria of reductions in total phosphorus, total nitrogen, total suspended solids and gross pollutants as compared to developments in which water treatment is not undertaken, it is necessary to use a combination of best management practice strategies.

In addition, best management practice strategies reduce risks of flooding on housing and infrastructure while maximising the potential for stormwater to be treated as a resource.

The hierarchy of Best Management Practices (BMP) principles is as follows:

1. Implement controls at or near the source to prevent pollutants entering the system and/or treat stormwater;
2. Install in-transit measures to treat stormwater and mitigate pollutants that have entered the conveyance system; and
3. Implement end-of-pipe controls to treat stormwater, addressing any remaining pollutants prior to discharging to receiving environments.

Structural and non-structural BMP strategies must be used in combination to achieve the required stormwater treatment outcomes. Recommended BMPs in increasing order of scale relevant to Seaview Farms are presented in Table 2.

Table 2 Recommended BMPs for varying levels of development

Development Scale	Recommended BMPs
Residential Lot	◗ On site soakage devices, with overflow outlets (Detention); ◗ Water-wise and Nutrient-wise landscaping; ◗ Porous pavements; ◗ Amended topsoils; and ◗ Rainwater tanks for harvesting, detention and re-use.
Street Scale	◗ Infiltration measures; ◗ Sediment traps; ◗ Porous pavements (car parking); and ◗ Conveyance bioretention systems.
Estate Scale	◗ Maximising infiltration by adopting a stormwater retention system to contain the 1 year ARI storm; ◗ Retention / detention (including water quality treatment) within POS, in accordance with the objectives and requirements of Elements 4 (Public Parkland) and 5 (Urban Water Management) of *Liveable Neighbourhoods Edition 4;* ◗ Using imported fill material with a high phosphorous retention capacity; ◗ Retain existing waterways and aim to restore a pre-development ecology and channel morphology in new and existing waterways; and ◗ Non-structural BMPs such as interpretive signage, garden education programs, publishing a WSUD web-page for the estate and involving residents to engage with existing community catchment groups.

4. Pre-Development Environment

4.1 Existing Information

Due to the relative isolation of the proposed development from nearby communities and its separation from the surrounding catchments (Bowes River and Hutt River), no detailed surface or groundwater investigations have been undertaken for this site.

4.2 Site Conditions

The existing topography of the site is shown in Figure 2.

The coastline north and south of Horrocks represents a diversity of landforms ranging from flat mobile dune sets to step foredunes backed by vegetated ridges and rocky cliffs. The site for the most part lies in an elevated position atop a limestone plateau and slopes mildly east to west from 60 m AHD towards the exposed limestone cliff at 50 m AHD approximately 20 m above the general elevation below. The northern extent of the site lies above an old landfill site and gently slopes from 60 m AHD to 10 m AHD at Three Mile Beach.

Most of the site is covered in moderate to dense natural vegetation ranging from small grasses and shrubs to medium size trees. Various fauna lives throughout the site, including rabbit's, reptiles, foxes etc. Throughout the site are a number of paths approximately 3 m wide heading in north, south and westerly directions. The paths are generally sandy and accessible through the use of a four wheel drive vehicle

One major watercourse, the Bowes River, exists approximately 4 km from the southern boundary of the proposed site.

4.3 Geotechnical Investigation

Geotechnical works were undertaken by GHD (2009). Major findings indicate near shore the site area is comprised of calcareous sands of marine origin; typically dunes and/or beach deposits stabilised by vegetation and other means. Further east, exposed limestone forms a plateau inland from the above mentioned dunes. Laterite with underlying quartz sands and weathered rock lie further inland.

Aeolian sand, residual sand and coastal limestone was intersected over 53 test pits across the site. Table 3 summarises the order of deposition and permeability of each soil layer.

Table 3 Seaview Farms soil characteristics

Soil Layer	Depth (m)	Permeability (m/day)
Aeolian Sand	0.5 – 1.4	6.0

Residual Sand	0 – 2.5	6.0
Coastal Limestone	0.15 – 2.6	0.012

The Department of Environment and Conservation has not classified the risk of acid sulphate soils in and around the site. Acid sulphate soils commonly occur in waterlogged soils such as floodplains, swamps and wetlands. Given that none of these environments exist within the study area, it is unlikely acid sulphate soils will be an issue within the site. This is supported by the fact groundwater was not intercepted by bore holes during the geotechnical investigation, which were sunk to a maximum depth of approximately 6 m below natural surface.

The results of the geotechnical investigation are presented in Appendix B.

4.4 Environmental

Environmental Sensitive Areas (ESA) are protected under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and are determined for their environmental values at state or national levels. ESA include:

- Bush Forever sites;
- World Heritage Sites;
- Areas covered by a threatened ecological community;
- A defined wetland and the area within 50 m of the wetland; and
- The area covered by vegetation within 50 m of rare flora.

The proposed development site has undergone a vegetation survey due to the presence of possible Declared Rare Flora (DRF), *Caladenia Bryceana ssp. Cracens*. It is understood an additional flora assessment is being undertaken by GHD. The results of this investigation will determine the impact of development on rare flora within the site. Current documentation on existing vegetation surveys can be found in:

- Horrocks Spring Vegetation Survey (Connell Wagner, 2006); and
- Lot 155 Horrocks Beach Survey for Caladenia Bryceana ssp. Cracens (Declared Rafe Flora) (ENV Australia, 2009).

No other ESA needs investigating for the proposed development.

Historically, there has been a significant Aboriginal presence along the Batavia coast, which is reflected in the number of identified sites which occur in the vicinity of the study area, including Horrocks Beach (No. S00003); listed an ethnographic and archaeological site of significance. However Aboriginal Heritage sites do not exist within the development boundary.

Further, the site does not lie on any existing wetlands and consequently, there is no

risk of acid sulphate soils.

A landfill site exists within Lot 114 (Lot 12005) that operated for six years and was closed in 2004. Its location and boundary are presented in Appendix C. Test pit 35 within the geotechnical report recorded household waste rubbish from 0.2 – 1.6 m (GHD 2009). Consequently, under the Contaminated Sites Act 2003, a contaminated sites investigation is recommended to assess this.

4.5 Surface and Groundwater Flows and Quality

Surface water flow from within the study area is likely to occur in the form of overland flow primarily sheet flow across the site predominately in high sloping areas. Sheet flow is also likely to enter the site from the catchments draining the minor scarp further inland directing flow towards the eastern boundary. Sheet flow is unlikely to be generated in large volumes due to the high permeability of surface soils over the site. This is supported by an absence of defined drainage lines evident within the development area.

The catchment model CatchmentSIM v2.20 was used to calculate the size of catchments impacting the study area, which was used as input data for calculation of runoff into the proposed site. Nine catchments were identified and summarised below in Table 4 (Shown Figure 2).

Table 4 Identified catchment parameters

Catchment	Area (ha)	Average Slope (%)
1	9.8	9.2
2	10.2	6.3
3	65.0	3.0
4	16.2	5.6
5	320.7	2.0
6	16.9	7.8
7	9.6	5.5
8	3.7	10.3
9	13.0	10.9

The quality of surface water flows generated within and upstream of the site is unmeasured. Surface water quality data of nearby streams receiving water from surrounding catchments have been measured however are not likely to reflect the

water quality at the proposed development site due to differences in landuse.

100 year flood mapping indicated by the SLIP database positions the proposed development well outside of this zone and is at no flooding risk from the nearby Bowes River.

Due to the shallow nature of limestone bedrock in some places within the study area, seepage of superficial groundwater is likely immediately around these areas. A geotechnical investigation of the site by GHD (2009) did not intersect groundwater in 53 test pits and six boreholes to a maximum depth of approximately 6 m (GHD 2009).

Nearby bores from the Department of Water (DOW) WIN database identified 10 bores within 1 km of the study area boundary, of which eight have recorded groundwater level data. Groundwater levels range from 8.53 m below natural surface at Horrocks Beach to 45.72 m below natural surface approximately 0.8 km directly east of the most south eastern point of the development. WIN site 20,000,740, located outside of the development site but in a similar geomorphologic position provides a good indication of groundwater levels around the south western area of the site (18.29 m below natural surface).

Therefore it is likely that depth to groundwater within the study area will vary from approximately 8.5 m below ground level to 40 m below ground level, although local geology will also exert influence on these levels.

Inferred groundwater quality from surrounding WIN Sites indicates the groundwater in the region is mildly saline with an average salt content of 1400 mg/L, generally being mildly cloudy and slightly stained. Nutrient and contaminant levels were unmeasured.

5. Water Conservation Strategy

5.1 Background

Best Management Practice (BMP) strategies are incorporated into urban design to assist meeting criteria of total phosphorous (TP), total nitrogen (TN), total suspended solids (TSS) and gross pollutant reductions. These strategies occur in various forms, all working towards improving the water quality of a given site. BMP strategies are comprised of source, in-transit and end-of-pipe controls.

A series of simple water conservation strategies relevant to the proposed development are listed below. Whilst not mandatory, the following strategies are recommended waterwise practices that both save water and maintain water quality of existing and downstream environments. The Seaview Farms development is capable of incorporating the listed strategies.

- Rainwater tanks for household water re-use;
- Efficient landscaping and irrigation measures; and
- Water efficient fixtures and fittings.

5.2 Relevance to development

The nature of the proposed development is such that it is capable of accommodating the above strategies. The lot sizes are also of sufficient size to accommodate rainwater tanks of varying sizes. Further, rainwater tanks are designed for urban use with limited space, streamlined to fit under eaves of houses (Figure 3).

The use of water efficient fixtures and fittings extends to household appliances such as washing machines, dishwashers, toilets, showers and taps. The installation of these fixtures represents in-house strategies the individual landowner can incorporate for total in-house water savings.

The incorporation of these strategies is the responsibility of the landowner. Implementation is usually a result of public education campaigns delivered by public bodies such as the Water Corporation.

5.3 Wastewater

A reticulated sewer is available for residential lots but not required for rural residential lots. These lots will be serviced through on-site effluent disposal systems. As this development is of a residential nature, it is likely the reticulated sewer will be utilised for wastewater disposal.

Figure 3 Examples of a streamline design rainwater tank

6. Stormwater Management Strategy

6.1 Surface Water Quantity

The stormwater management strategy for the proposed development will incorporate BMP strategies to mitigate surface water flows and maintain surface water quality. This will include minimising surface water flows entering the site upslope of the eastern boundary.

Specifically structural controls proposed herein will be designed to carry low frequency (minor) ARI storms, namely 1 in 1 and 1 in 5 ARI, whilst also conveying and providing flow paths for 1 in 100 ARI flows.

Surface water runoff control will be managed using a series of different structural controls. Examples of these include:

- Open swales;
- Open drains;
- Infiltrations / bioretention basins;
- Roadside soakwells;
- Culverts;
- Soakwells for roof runoff; and
- Rainwater tanks.

To calculate pre and post development stormwater flows within the proposed development, the site was divided into nine catchments (labelled 1 – 9). These catchments are listed in Table 5. Pre development flows were calculated using the Rational Method. Post development flows off impervious areas were also calculated using the Rational Method with a modified runoff coefficient to account for impervious areas.

These flow volumes should be used for the appropriate sizing and spacing of stormwater management control structures such as roadside infiltration pits and bioretention basins; and are presented in Table 6. These storages were calculated using DRAINS v2008.08, a hydraulic modelling package used to simulate stormwater drainage systems.

Total post development flows are the addition of pre development and additional post development flows (impervious surfaces) minus the pre development flows for the area covered by impervious surfaces.

Table 5 Pre and post development flows (m^3/s) for Seaview Farms

Catchment	Flows (m^3/s)	Design Average Recurrence Interval (ARI)			
		1 in 1	1 in 5	1 in 10	1 in 100
1	Pre Dev.	0.055	0.147	0.255	1.178
	Ad Post Dev.	0.161	0.492	0.883	4.543
	Total Post Dev.	0.161	0.492	0.883	4.543
2	Pre Dev.	0.056	0.149	0.259	1.193
	Ad. Post Dev.	0.083	0.254	0.455	2.337
	Total Post Dev.	0.122	0.359	0.637	3.182
3	Pre Dev.	0.143	0.375	0.647	2.94
	Ad. Post Dev.	0.043	0.137	0.248	1.310
	Total Post Dev.	0.181	0.498	0.872	4.147
4	Pre Dev.	0.058	0.153	0.265	1.22
	Ad. Post Dev.	0.082	0.248	0.445	2.274
	Total Post Dev.	0.130	0.378	0.669	3.308
5	Pre Dev.	0.332	0.865	1.486	6.688
	Ad. Post Dev.	0.235	0.744	1.346	7.086
	Total Post Dev.	0.597	1.685	2.964	14.368
6	Pre Dev.	0.095	0.253	0.438	2.013
	Ad. Post Dev.	0.165	0.515	0.929	4.850
	Total Post Dev.	0.186	0.573	1.030	5.318
7	Pre Dev.	0.058	0.154	0.267	1.232
	Ad. Post Dev.	0.104	0.320	0.576	2.983
	Total Post Dev.	0.130	0.391	0.699	3.553
8	Pre Dev.	0.034	0.092	0.161	0.744

	Ad. Post Dev.	0.076	0.229	0.409	2.073
	Total Post Dev.	0.076	0.229	0.409	2.073
9	Pre Dev.	0.066	0.176	0.306	1.409
	Ad. Post Dev.	0.114	0.352	0.632	3.270
	Total Post Dev.	0.130	0.395	0.708	3.625

Table 6 Total storage required to maintain pre-development flows

Catchment	Required Storage (m^3)			
	1 Year ARI	5 Year ARI	10 Year ARI	100 Year ARI
1	73.1	179.1	304.6	1306.1
2	20.0	64.3	116.8	627.6
3	23.0	62.8	113.9	617.3
4	18.5	59.3	107.6	572.5
5	103.4	329.8	598.5	3250.1
6	96.1	300.2	510.7	2204.1
7	44.0	107.9	183.7	791.2
8	58.7	142.2	240.9	1019.1
9	22.7	55.7	94.8	408.1

6.1.1 1 year ARI event

- To retain and treat the 1 year ARI event, roofs will be connected to soakwells and where adopted, rainwater tanks.
- Road runoff will be infiltrated as close to source as practical using water sensitive urban design (WSUD) measures such as roadside infiltration pits.

6.1.2 5 year ARI event

- Will be collected in an open drain or swale on the eastern side of White Cliffs Rd

to prevent overland flow entering the development.

- Road runoff will be collected by a piped drainage system including roadside infiltration pits.
- Open drains and swales will contain intermittent rock structures, particularly in high sloping areas, to reduce flow velocities and be vegetated where possible.
- The piped drainage system will overflow to POS areas where possible for additional treatment and infiltration in shallow open bioretention basins via bubble up pits.

6.1.3 100 year ARI event

- Events greater than the 5-year ARI event will be conveyed via overland flow paths to either POS areas or enter the land immediately to the west of the development as sheet flow where flows are likely to dissipate.
- Overland flow paths will be in the form of the proposed road network road reserve, which connect to either POS areas or the land immediately to the west of the development in all sub catchments, allowing conveyance of large flows.
- Details of the 1 in 100 yr ARI post-development indicative flow paths and bioretention basin locations are presented in Figure 4.

6.1.4 Best Management Practices

Swales / Open Drains

Swales or open drains are suggested along the eastern most boundary to intercept flows entering the site from POS and will be best positioned upslope of White Cliffs Rd. The structures will be open and vegetated where possible to reduce flow velocities.

Road Runoff

The proposed road network, which covers an area of 9.60 ha, has a main access road (White Cliffs Rd), that runs along the eastern boundary of the development with 13 access roads entering the elongated development. Due to the residential nature of the development, roads will be kerbed with drainage inlets (with grates) and stormwater runoff will be treated through a connected network of pipes and drainage pits with infiltration and retention capacity designed to both manage stormwater volumes for 5 year ARI events and filter contaminants.

The option of a flush kerbing draining to adjacent swales was considered, however slopes within individual sub catchments ranging from 2 – 11 % indicate a more controlled stormwater management system described above represents a more suitable method of containing stormwater flows.

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

GHD
CLIENTS|PEOPLE|PERFORMANCE

Client Name
Horrocks LWMS

Job Number | 61-23926
Revision | A
Date | 09 Jun 2009

Seaview Farms 100 yr Indicative Flows

Figure 4

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: Data Custodian; Data Set Name Title, Version/Date. Created by: M Burbridge

Bioretention Basins

Bioretention basins should be located within POS areas where available in the form of shallow grassed depressions with bubble up pits. An example of a "bubble up" pit is presented in Figure 5.

Figure 5 Bubble up pit examples

Roof Runoff

Runoff generated from roofs will be detained on site within soak wells. Re-use of stormwater through capture in rainwater tanks is also recommended. Additional flow will form overland flow.

Soakwells should be sized at 2% of the constructed impervious area they receive runoff from. Where sizing soakwells to 2% of the constructed impervious area is not possible, soakwells will contain nutrient retention materials to enhance treatment of roof runoff and will be sized to accommodate the 1 in 5 ARI flows. The treatment will achieve at least the following recommendations when compared to untreated runoff:

- 80% reduction of total suspended solids;
- 60% reduction of total phosphorous;
- 45% reduction of total nitrogen; and
- 70% reduction of gross pollutants.

6.1.5 Summary

Water quality and quantity management has been addressed within Section 6 to

ensure the proposed development will not adversely impact the flow of natural drainage running through the site. The adoption of recommended water management practices detailed within this section will maintain pre-development flows within the site and ensure the quality of surface water does not fall below acceptable levels addressed in Section 8.

6.2 Surface Water Quality

Urban runoff is a significant source of nutrients and other contaminants that discharge to the shallow aquifer. Runoff water quality from roads and other paved surfaces can be variable and is dependent on local soil types, land use, climate, the density of surrounding development and road traffic volumes. There are no significant waterways within the study area, however, the surface water quality is to be managed to ensure that the quality of the receiving groundwater is upheld.

Maintaining predevelopment discharge rates and volumes from developed catchments is expected to prevent the majority of contaminants from reaching the receiving environment by ensuring the majority of flows from high frequency events are detained or infiltrated on site. Provided the initial flow of more significant events is subject to the same detention and treatment received by high frequency events, surface runoff that occurs during more significant events represents a lower risk to water quality. This is because nutrients and other contaminants that represent a threat to water quality are typically transported within the 'first flush' of an event.

As there are no significant waterways present within the study area, water quality criteria based upon waterway water quality targets are not applicable. An alternative approach is to develop catchment water quality related design objectives that adopt best management practices (BMPs) for Water Sensitive Urban Design (WSUD).

The quality of the stormwater infiltration and runoff relative to Seaview Farms can be maximised through the following treatment options (Table 7).

Table 7 Suitable BMP options for Seaview Farms

Development Scale	Treatment Option
Residential Lot Scale	◗ Rainwater tanks (water re-use); ◗ On site soakage devices; ◗ Porous pavements; ◗ Water wise landscaping / minimise lawns; and ◗ Use of low water soluble fertiliser.

Street Scale	◗ Infiltration devices (roadside soakwells / swales); and ◗ Porous pavements / asphalt.
Estate Scale	◗ Use of bioretention /infiltration basins within POS areas; ◗ Imported fill with high phosphorous retention capacity; and ◗ Publishing WSUD web page educating estate landowners on WSUD practices.

7. Groundwater Management Strategy

7.1 Groundwater Levels

There are currently no known groundwater levels within the Seaview Farms development. No groundwater bores exist within the development boundary. Geotechnical investigations undertaken by GHD (2009) did not intercept groundwater in any of the 53 test pits or six bore holes drilled to a maximum depth of approximately 6 m.

Inferred groundwater levels within the development are likely to be between 8.5 and 40 m below natural surface, as described in Section 4.5. Groundwater flow direction is generally to the south west. Due to depth of groundwater, it is expected the proposed development will not negatively impact groundwater levels within or immediately surrounding the site.

7.2 Groundwater Quality

Groundwater quality management should reflect current levels of best practice in the Perth metropolitan area, which represents a reasonable level of management. A Regional or District Water Management Strategy does not pre-cede this LWMS and thus there are no direct recommendations for the management of groundwater quality. However, the following recommendations are provided as a guide for managing groundwater quality within the Seaview Farms development.

Non structural controls

- Planning practices (POS locations and configuration, WSUD promotion in local structure planning);
- Construction practices (construction sites, soil amendment, use of native plantings); and
- Maintenance practices (street sweeping, stormwater system, POS areas).

Structural Controls

- Retention and infiltration of frequent events where possible (soakwells, swales, bottomless manholes);
- Creation of ephemeral retention/detention areas within community park/wetland buffers/POS areas; and
- Use of Park Avenues for overland conveyance, infiltration, and water quality treatment (bioretention).

Monitoring

- Establishment of regional pre and post-development monitoring network; and
- Annual reporting, including ongoing assessment of BMP's performance and suitability to provide ongoing guidance and review for future WSUD planning within the Study Area.

Of most relevance to Seaview Farms are structural controls. The use of bioretention basins or swales with infiltration capacity in POS areas, roadside infiltration pits and rainwater tanks will ensure the safe natural removal of urban contaminants prior to groundwater recharge. Furthermore, the area of structural controls will be sized at 2% of the constructed impervious area they receive runoff from.

8. Monitoring

8.1 Recommended program pre and post-development

It is recommended that monitoring during construction and post-development for a period of two years should occur to determine the management measures for stormwater quality are meeting the design objectives. It is therefore recommended monitoring for 18 months leading to the construction phase be undertaken to establish baseline water quality data for comparison during the construction and post development phases. This should be inclusive of two winter periods.

Surface water samples are recommended to be taken from three locations within the site. It is most suitable for these samples to be taken from the inlet structures of roadside infiltration pits. It is most appropriate for three roadside pits to be selected at the discretion of a qualified technician under supervision from a reasonably qualified professional with knowledge of water monitoring programmes. It is recommended these locations be spaced evenly over the site and determined in the UWMP. It is likely pre-development surface water monitoring will not be possible due to the absence of a road drainage system. Sampling should therefore begin at the earliest possible time following construction of the drainage system.

Sampling should occur during periods of high flow; however attempts should be made to capture the first flush event (often during summer). One sample taken during first flush and two samples taken in the winter period will be sufficient to measure surface water quality at these sites.

Filtered and unfiltered samples of total nutrient concentrations should be measured to quantify the proportion of dissolved and particulate nutrients generated within the development site, and the method recorded.

There is no groundwater bore network within the site. It is recommended four groundwater bores be installed to measure groundwater levels and quality prior to, during and after the construction phase of the development. One groundwater bore should be installed each in sub catchments 8 and 9, both in the south western most corner of each POS area. Two groundwater bores are recommended within close proximity of one another due to the higher density of residential development up gradient of the proposed bores. In addition, one bore should be installed in sub catchment 6 on the south western most point of the POS area to measure the impact of development up gradient, in the southern area of the site. A bore should also be installed in sub catchment 4 in the southern most corner of the POS area.

To avoid direct reference to ANZECC guidelines, baseline surface and groundwater data established where possible during an 18 month period leading to the construction phase will create reference water quality for later comparison. Groundwater samples should be taken seasonally (January, April, July, October) to measure groundwater

quality with a full chemical analysis to be undertaken. Groundwater levels should also be measured at this time. Monitoring reports and results should be submitted to DoW and the Shire of Northampton annually.

8.2 Contingency Action Plan

A site specific contingency action plan with associated trigger values should be developed. As a minimum, the contingency action plan must include communication with DoW and the Shire of Northampton as a priority action when trigger values are breached.

When developing trigger values for water quality, ANZECC recommends a minimum of 24 months data be available. Due to insufficient data relating to the groundwater quality at the site, trigger values cannot be calculated as per the ANZECC guidelines (80^{th} percentile for moderate level of protection and 95^{th} percentile for high level of protection) (Table 8). As such, interim guidelines will be developed based on the average concentration identified by water quality measured from the site in during the 18 months leading to the construction phase.

It is recommended pre-development monitoring is undertaken based on the proposed post-development monitoring program outlined in Section 8.1 to enable the development of a set of more representative trigger values.

A suggested action plan once the trigger levels have been re-evaluated is if the trigger levels are exceeded in two consecutive monitoring events, is to hold a meeting between the developer, DoW, DEC and other relevant parties to discuss appropriate ways forward.

Table 8 ANZECC guidelines for water quality parameters

	Units	ANZECC Guideline
Nutrients		Freshwater
Chlorophyll a	ug/L	3-5
Filterable reactive phosphate	ug/L	5
Total Nitrogen*	ug/L	350
Total Phosphorus	ug/L	10
Oxides of nitrogen	ug/L	10
Ammonium	ug/L	10

	Units	ANZECC Guideline	
Total kjeldahl nitrogen		-	
Metals		95 % protection	80 % protection
Arsenic	ug/L	13	140
Cadmium	ug/L	0.2	0.8
Chromium	ug/L	1.0	40.0
Copper	ug/L	1.4	2.5
Lead	ug/L	3.4	9.4
Mercury	ug/L	0.6	5.4
Nickel	ug/L	11	17
Zinc	ug/L	8.0	31.0
Other			
Electrical conductivity (EC) [a]	uS/cm	300-1500	
Turbidity [b]	NTU	10-100	
Dissolved oxygen	% saturation	90 (lower limit)	
pH	-	6.5-8.0	
Total suspended solids		-	

a: Lower EC values are typically associated with rainfall events. During summer, higher values are common due to water being lost to evaporation.

b: Deep water bodies typically are low in turbidity. Shallow water bodies generally have a higher turbidity due to wind induced mixing of sediments.

Source. ANZECC (2000)

9. The Next Stage

9.1 Commitments

The next stage for water management is to be an UWMP. The UWMP is to be prepared to be consistent with the designs and strategies proposed in this LWMS. The UWMP should address:

- Detail to the design proposed in the LWMS and compliance with the objectives;
- Detailed stormwater management design; and
- Specific structural and non structural methods to be implemented.

9.2 Roles & Responsibilities

The roles and responsibilities for the actions outlined in the LWMS for the proposed Seaview Farms development are presented in Table 9.

Table 9 Roles and Responsibilities

Role	Responsibility	Requirement and Period
Urban Water Management Plan	Landowner	At subdivision application
Design and Construction of Drainage System	Landowner	Handover to Shire of Northampton at the end of the 12 months defects liability period.
Maintenance of Drainage System	Landowner then Council	Drainage structures to be cleared bi-annually and will become the responsibility of the local authority when the works are handed over at the end of the 12 months defects liability period.
Non-Structural Controls: *Land use and Management*	Landowner	Sediment and erosion control during construction.

Role	Responsibility	Requirement and Period
Non-Structural Controls: *Public Awareness Campaign*	Landowner	Sustainable information packs, including educational information regarding non-structural control measures, such as fertiliser application, native gardens, herbicide use, weed control and waste management, to be provided at settlement.
Water Quality Monitoring and Reporting	Landowner	Monitoring Program (Section 8.1). An annual report is to be prepared by the Landowner to be submitted to the Shire of Northampton for review for a period of 2 years from practical completion.

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Department of Housing and Works, 2007. 5 Star Plus, Energy Use in House Code, Water Use in House Code, Perth.

Appendix A

Horrocks Townsite Expansion Strategy

Terrace coffee shop / cafe
Stairway to Little Bay

Caravan / Camping Park
Maximise retention of native vegetation
Full facilities & services inc sewer

Little Bay
Day Use Area
Eco-caravan / camping area
Ref "Coronation Beach"

Relocate Little Bay Road to base of cliff
Construct to 6m gravel from Mitchell Street
Close & re-habilitate existing track

Eco-Chalets

Bushland Living
Minimum 2ha lots
Maximum 7,500m2 Building & Fire Protection Zone
Encourage re-vegetation with broader range of indigenous species
Strategic Firebreaks
No boundary fencing - No stock

Expanded Wastewater Treatment Plant
500m buffer
Treated Wastewater to irrigate Golf Course

Mixed Residential Living
Residential R10 / 30
Connect to sewer

Horrocks Town Centre
Shopping Centre / Supermarket
Tavern
Cafe / Coffee Shop
Service Offices / Telecentre
Medical consulting / Nursing Post
Al Fresco & Public Terraces overlooking Town
Short stay accommodation adjoining

Mobile Living

Refer Plan 2
Old Horrocks Town Centre Strategy

Golf Course

Caravan Chalet Park

Old Horrocks Town Centre

Chalet Park

Car Park

Mixed Residential Living
Residential R10 / 30
Connect to sewer
Manage building heights North
Precinct to protect views from beach

Mixed Residential Living
Residential R20 / 40
Connect to sewer
Assess coastal reserve required
Connection to existing Townsite

Coastal Foreshore Reserve
Assess to determine extent of reserve
Control ORV's
No link road from Horrocks to River mouth

Conservation Living
Minimum 5ha lots
Maximum 9,000m2 Building & Fire Protection Zone
Flora Conservation beyond B&FPZ
Onsite effluent disposal - ATU's
Strategic Firebreaks
No boundary fencing - No stock

Balance of Lot 112 to be subdivided & amalgamated with adjacent farmlands

Low Density Residential Living - R1
Minimum lot size 1ha
On-site effluent disposal - ATU's
Encourage re-vegetation with indigenous species

Low Density Residential Living - R2.5
Minimum lot size 4,000m2
On-site effluent disposal - ATU's
Encourage re-vegetation with indigenous species

Low Density Residential Living - R1 / R2
Lot size range 5,000m2 to 1ha
On-site effluent disposal - ATU's
Encourage re-vegetation with indigenous species

Low Density Residential Living - R1
Minimum lot size 1ha
On-site effluent disposal - ATU's
Encourage re-vegetation with indigenous species

PS
POS

Rural Tourism Enterprises
Minimum lot size 5ha
Maximum 5,000m2 Building & Fire Protection Zone
On-site effluent disposal - ATU's
Encourage tourism oriented rural based enterprises
eg : Olive Farm
Date Farm
Camel Rides
Fauna Park
Herbarium / Coastal Nursery

Resort Living
Residential R2 - minimum lot size 5,000m2
On-site effluent disposal - ATU's
Encourage re-vegetation with indigenous species
Resort Clubhouse to include local deli / cafe

Club
POS

Service & Trades Area
Light trades & services, storage
On-site effluent disposal - ATU's
Enhance existing roadside screening with indigenous species

Heritage Conservation

Conservation Living
Minimum 5ha lots
Maximum 9,000m2 Building & Fire Protection Zone
Flora Conservation beyond B&FPZ
On-site effluent disposal - ATU's
Strategic Firebreaks
No boundary fencing - No stock
No access to Bowes River Road

Low Density Residential Living - R2.5
Minimum lot size 4,000m2
On-site effluent disposal - ATU's
Encourage re-vegetation with indigenous species

General Criteria

All dwellings to be subject to Climate, Building and Landscape guidelines including controls on building style, materials choices and limiting second storey construction to no more than 50% of the dwelling ground floor area
All dwellings to incorporate minimum 2KW self solar or wind power generation plant with grid feed.
All dwellings on lots of 2,000m2 or greater to incorporate minimum 80KL rainwater tank plumbed to toilets and washing machine
All dwelling on lots between 450m2 and 2,000m2 to incorporate 25KL rainwater tank plumbed to toilets
All lots subject to Council "per lot contribution" to following works :
- Primary School land
- POS land and development
- Cliff POS development
- White Hills Road bitumenising
- Bowes River Road bitumenising
- Little Bay Road gravelling
- Horrocks Community Centre

Bushland Living
Minimum 2ha lots
Maximum 7,500m2 Building & Fire Protection Zone
Require re-vegetation of slopes with with indigenous species
Strategic Firebreaks
No boundary fencing - No stock
No access to Bowes River Road

Bowes River Mouth
Day Use Area
Picnic / playground facilities
Shade
Parking

plan 1 : draft expansion strategy

0 300 600 900 1200 1500m

Base data supplied by Landgate
Aerial Photography dated January 2006, accuracy +/- 4m, Projection MGA50

horrocks beach
expansion strategy

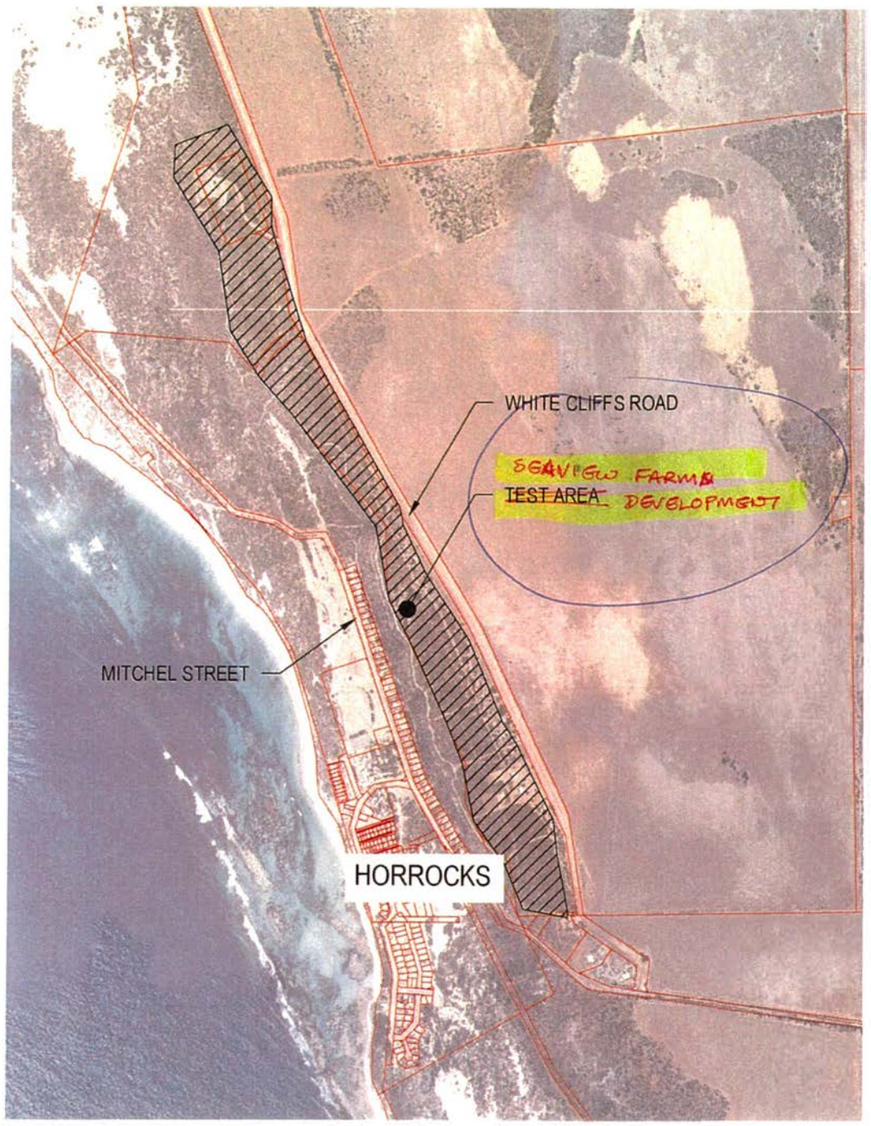
shire of northampton	:	CLIENT
1:15,000@A1	:	SCALE
may, 2009	:	DATE
089105-2-001-expa-0509	:	PLAN No
-	:	REVISION
LS	:	PLANNER
LS	:	DRAWN

larry smith
planning

Appendix B

Geotechnical Investigation Results

Figures

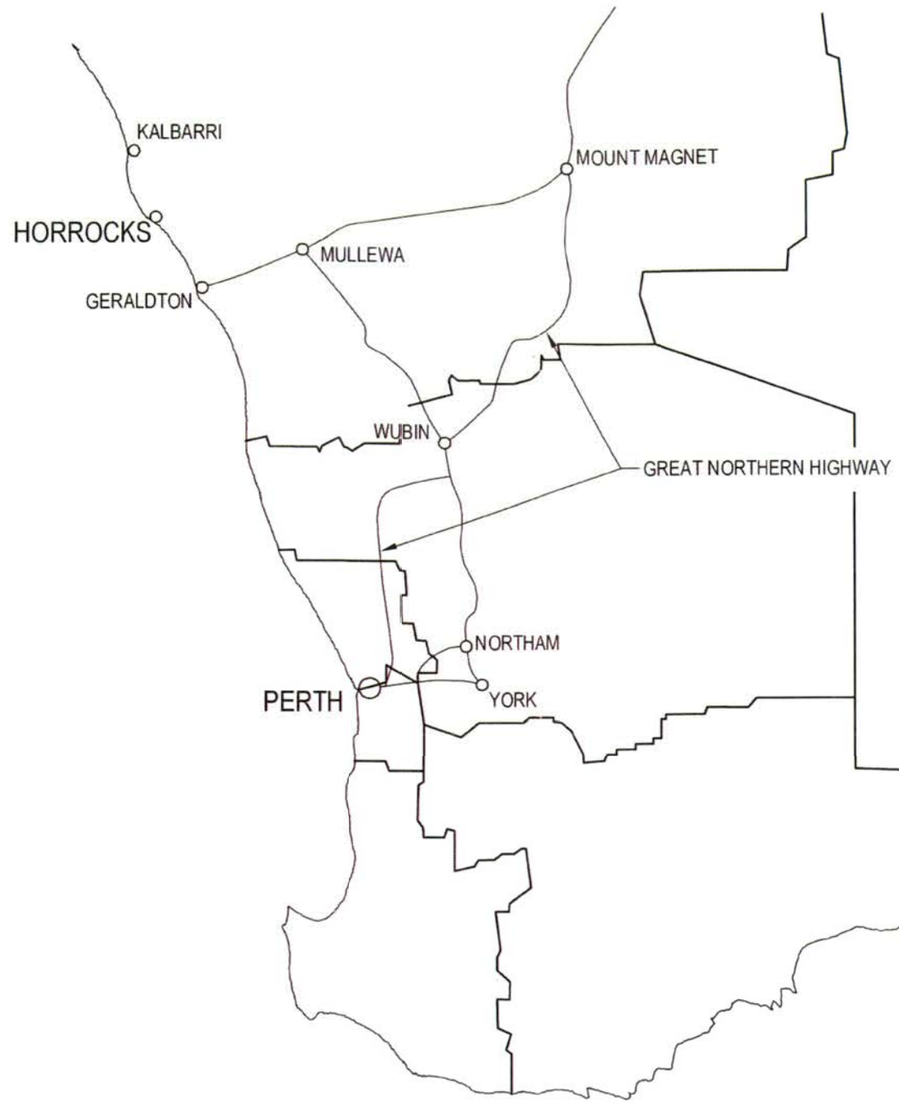


SITE PLAN
SCALE 1:20000

PRINT!

0 200 400 600m
SCALE 1:20,000 AT ORIGINAL SIZE

Plot Date: 29 May, 2009 - 9:59 AM Cad File No: 61-23926-QF1.dwg



LOCALITY PLAN
SCALE: DIAGRAMMATIC

GHD CLIENTS | PEOPLE | PERFORMANCE

GHD GEOTECHNICS

Seaview Farms
Seaview Farms Geotechnical Investigation
Locality Plan

job no. 61-23926
rev no. A

scale | N.T.S for A3 date | MAY 2009

Figure 01

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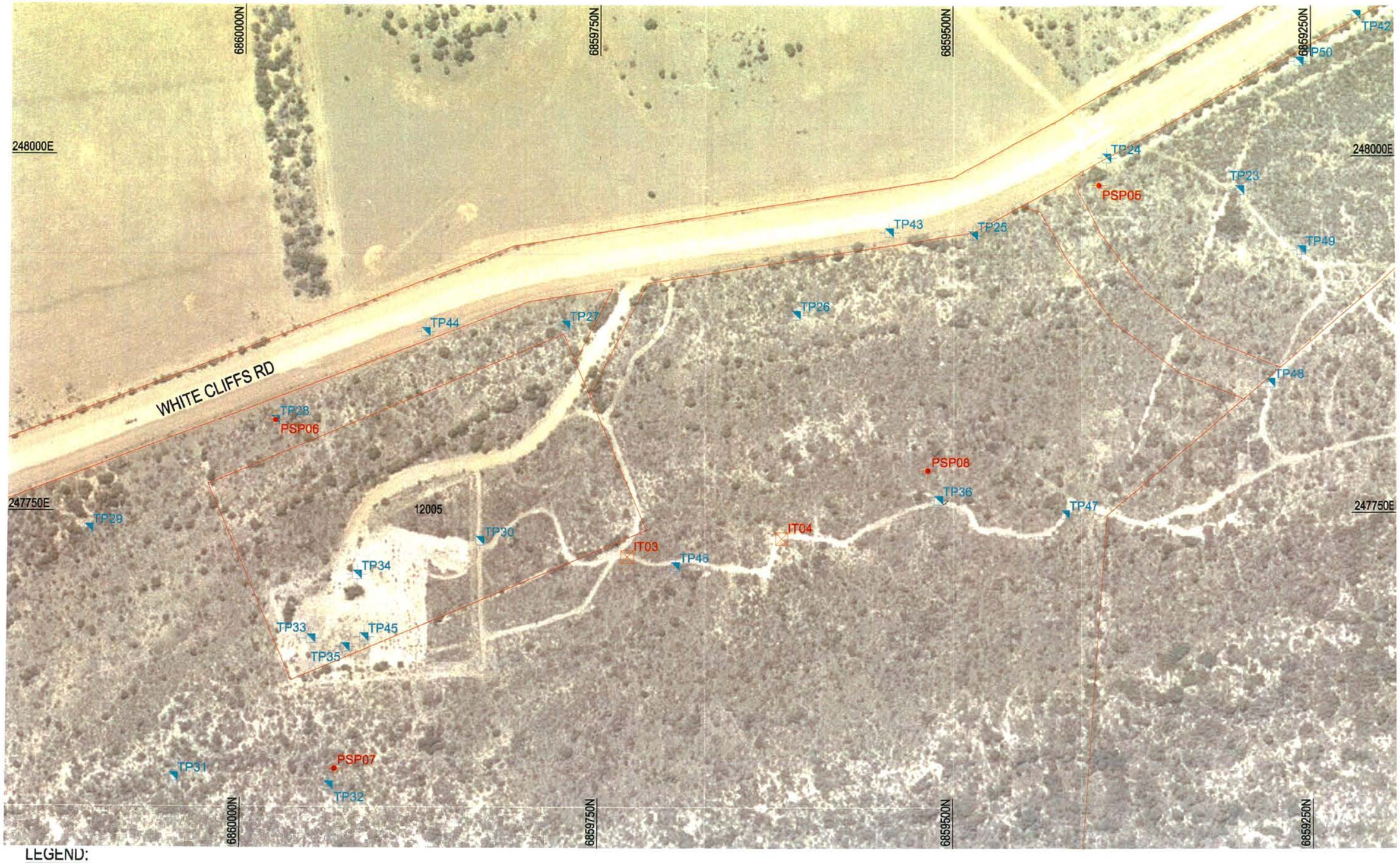

LEGEND:

- BH01 — BOREHOLE LOCATION
- TP01 — TEST PIT LOCATION
- PSP01 — PERTH SAND PENETROMETER LOCATION
- IT01 — INFILTRATION TEST LOCATION
- INDICATIVE LOCATION OF CLIFFLINE (NOT SURVEYED)

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

Plot Date: 25 June, 2009 - 4:49 PM Cad File No: 61-23926-QF2.dwg

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GHD GEOTECHNICS

Seaview Farms
Seaview Farms Geotechnical Investigation
Geotechnical Test Locations
Sheet 1 of 4
scale | 1:2500 for A3 date | MAY 2009

job no. | 61-23926
rev no. | A

Figure 02

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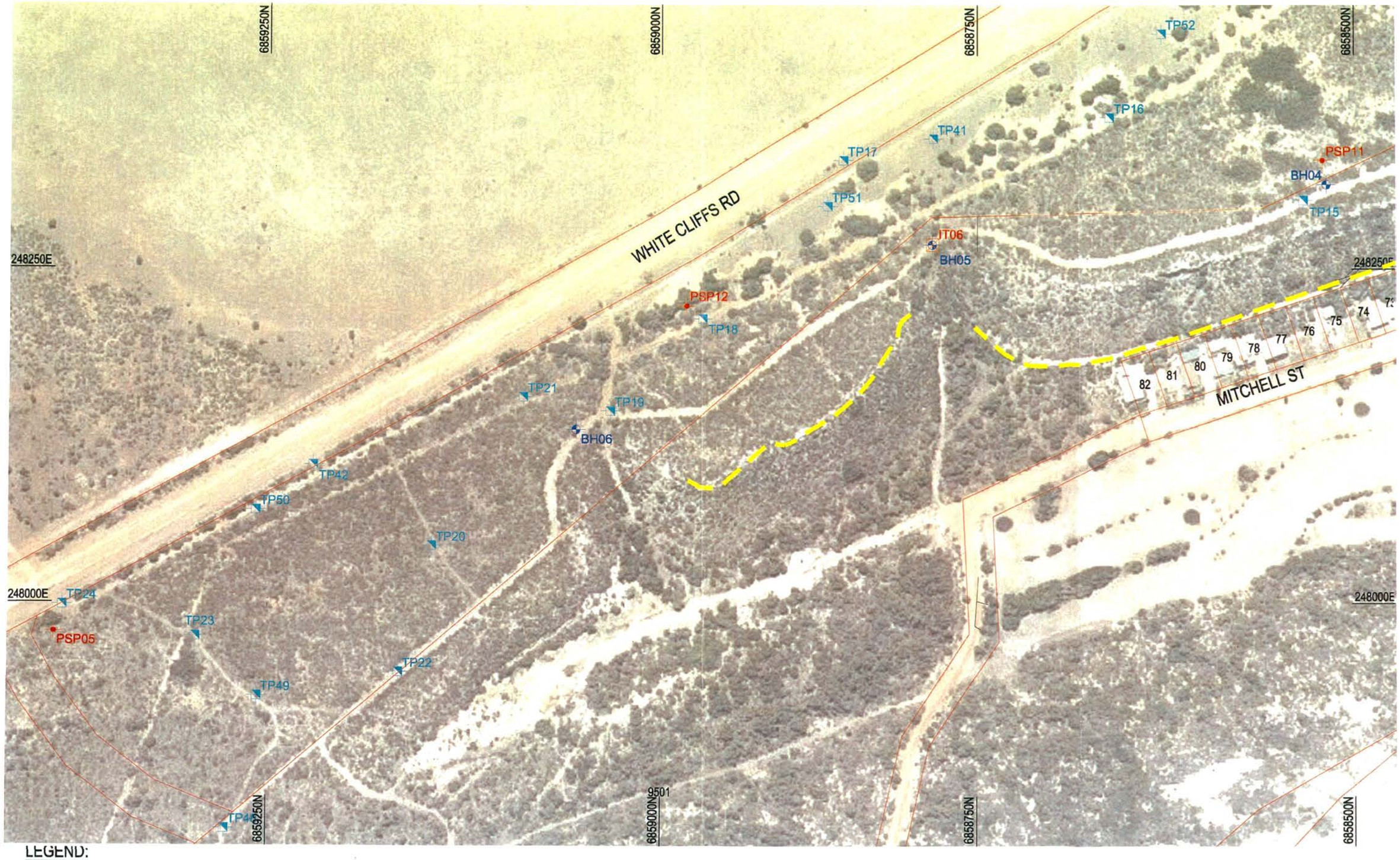

LEGEND:

- BH01 BOREHOLE LOCATION
- TP01 TEST PIT LOCATION
- PSP01 PERTH SAND PENETROMETER LOCATION
- IT01 INFILTRATION TEST LOCATION
- INDICATIVE LOCATION OF CLIFFLINE (NOT SURVEYED)

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

Plot Date: 25 June, 2009 - 1:19 PM Cad File No: 61-23926-QF3.dwg

GHD CLIENTS | PEOPLE | PERFORMANCE

GHD GEOTECHNICS

Seaview Farms
Seaview Farms Geotechnical Investigation
Geotechnical Test Locations
Sheet 2 of 4
scale | 1:2500 for A3 date | MAY 2009

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rev no. | A

Figure 03

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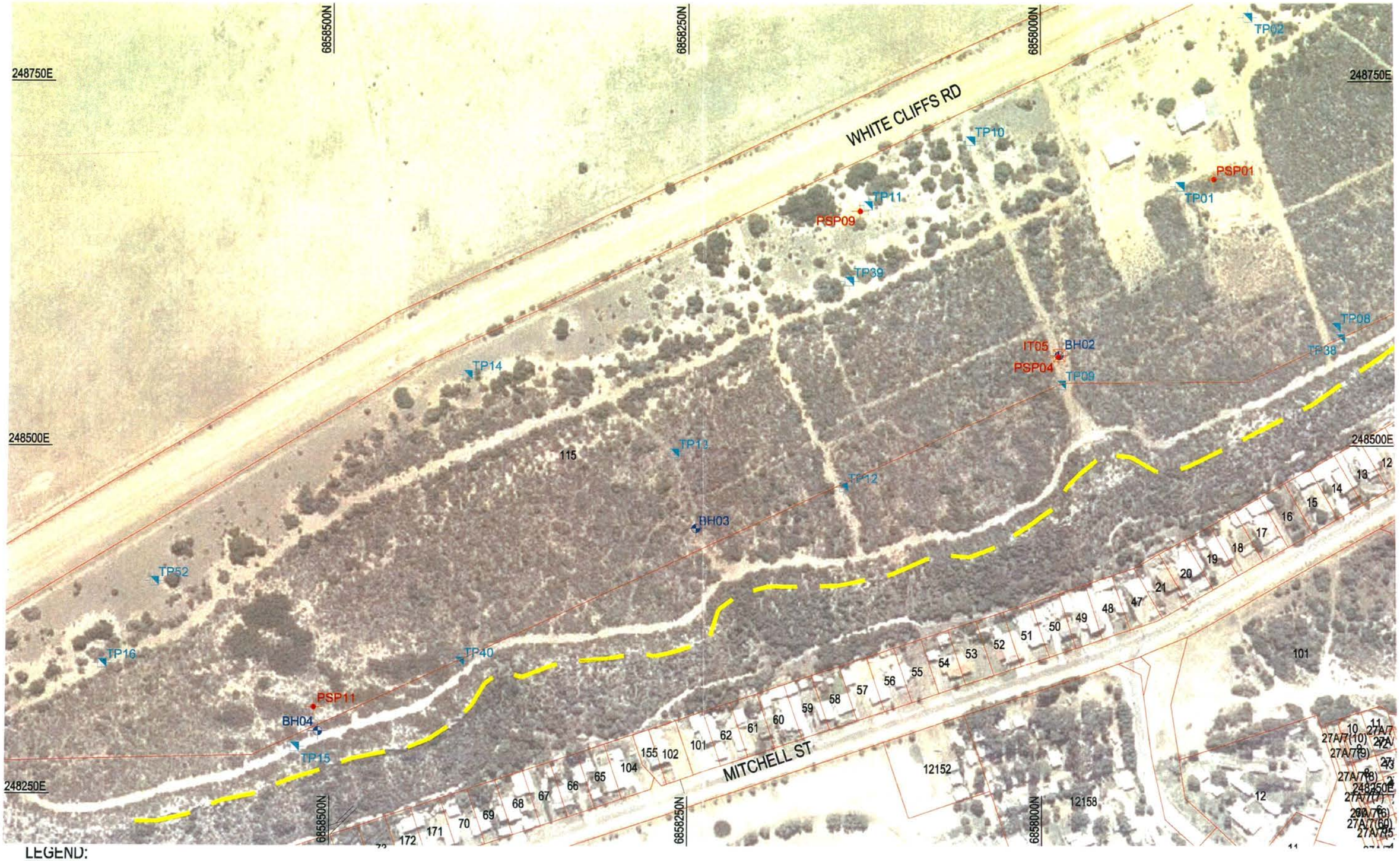

LEGEND:

- BH01 — BOREHOLE LOCATION
- TP01 — TEST PIT LOCATION
- PSP01 — PERTH SAND PENETROMETER LOCATION
- IT01 — INFILTRATION TEST LOCATION
- INDICATIVE LOCATION OF CLIFFLINE (NOT SURVEYED)

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

Plot Date: 25 June, 2009 - 1:23 PM Cad File No: 61-23926-QF4.dwg

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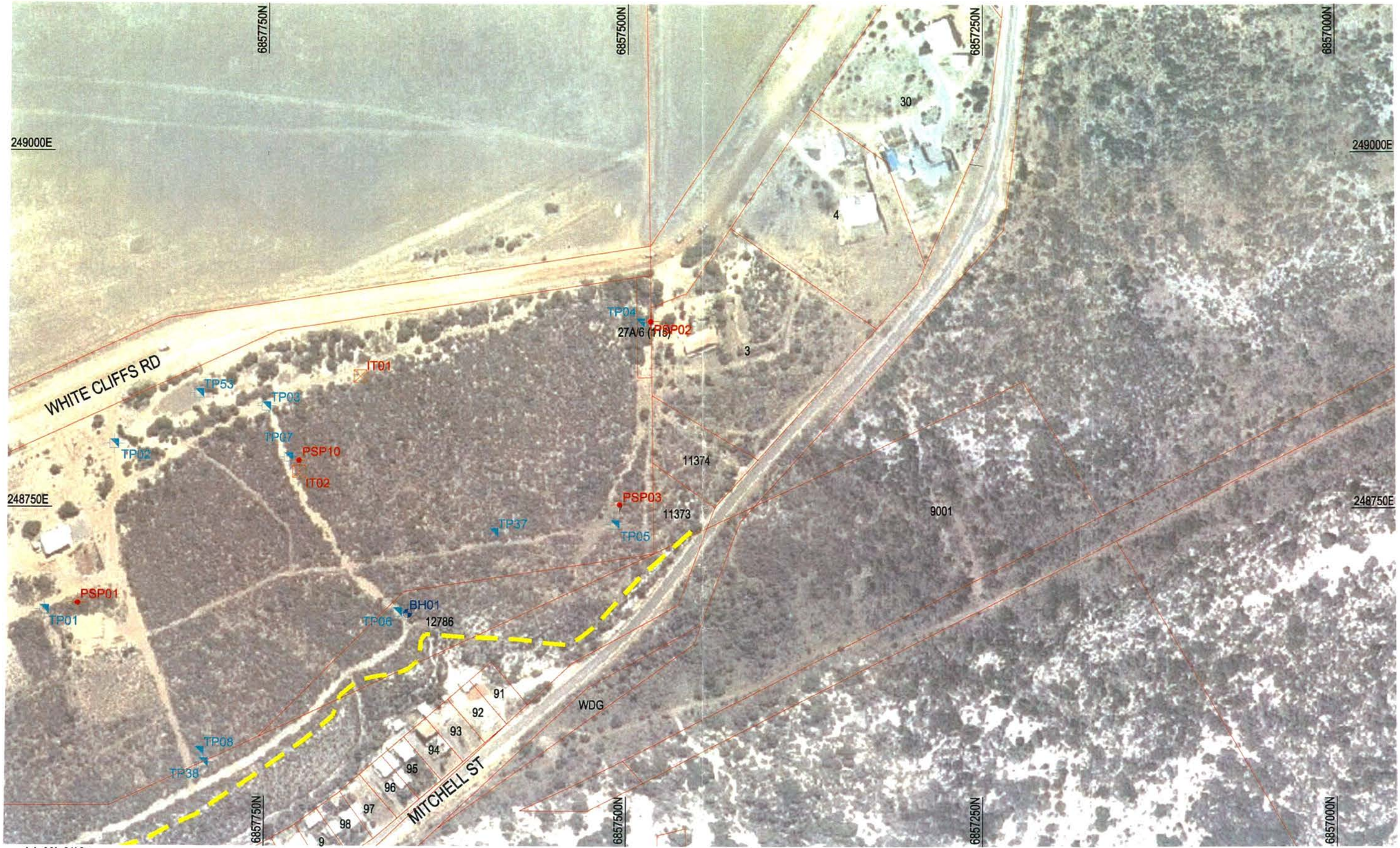
Seaview Farms
Seaview Farms Geotechnical Investigation
Geotechnical Test Locations
Sheet 3 of 4
scale | 1:2500 for A3 date | MAY 2009

job no. | 61-23926
rev no. | A

Figure 04



LEGEND:

- BH01 — BOREHOLE LOCATION
- TP01 — TEST PIT LOCATION
- PSP01 — PERTH SAND PENETROMETER LOCATION
- IT01 — INFILTRATION TEST LOCATION
- INDICATIVE LOCATION OF CLIFFLINE (NOT SURVEYED)

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

Plot Date: 25 June, 2009 - 1:28 PM Cad File No: 61-23926-GF5.dwg

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GHD GEOTECHNICS

Seaview Farms
Seaview Farms Geotechnical Investigation
Geotechnical Test Locations
Sheet 4 of 4
scale | 1:2500 for A3 date | MAY 2009

job no. | 61-23926
rev no. | A

Figure 05

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Appendix A

Test Pit Logs

TP01 to TP53

Explanatory Notes to Soil Logs

All geotechnical logging is carried out in general accordance with Australian Standard AS 1726 - 1993 "Geotechnical site investigations". The description of ***soils*** is based on the Unified Soil Classification System (Table A1, AS 1726-1993).

The top section of the log is self explanatory giving details of the project including the client, location, date, equipment type, job number, contractor, test pit dimensions and survey data. The main part of the log provides details and physical parameters of the material (soil and rock) relative to a depth scale. This also includes the depth of the standing water tables and geological units intersected.

Rock material weathering terms are defined below. Note that the terms are a combination of those used in AS 1726 - 1981 & 1993. The description of carbonate rock types and soils in accordance with the classification given in Clark, A.R. and Walker, B.F. *Geotechnique*, 1977, 27(1), 93-99.

Residual Soil (RS)

Soil developed on extremely weathered rock, the mass structure and substance fabric are no longer evident, there is a large change in volume but the soil has not been significantly transported.

Extremely Weathered Rock (EW)

Rock is weathered to such an extent that it has "soil" properties i.e. it either disintegrates or can be remoulded in water.

Highly Weathered Rock (HW)

Rock is weathered to such an extent that it shows considerable change in appearance and loss in strength. Material is still a rock but normally very weak.

Moderately Weathered Rock (MW)

Rock is weathered to such an extent that it shows a visible change in appearance with significant loss in strength.

Slightly Weathered Rock (SW)

Rock is slightly discoloured but shows little or no change of strength from fresh rock.

Fresh Rock (FR)

Rock shows no sign of decomposition or staining.

Rock strength terms are defined below based on Point Load Strength Index. Note that in the absence of point load testing, estimated strengths are used based on the field guide in AS 1726 - 1993.

Term	Letter Symbol	Point Load Strength Index $I_{S(50)}$ MPa
Extremely Low	EL	≤0.03
Very Low	VL	>0.03 ≤ 0.1
Low	L	>0.1 ≤ 0.3
Medium	M	>0.3 ≤ 1
High	H	>1 ≤ 3
Very High	VH	>3 ≤ 10
Extremely High	EH	>10

Table 1

Moisture Condition

Terms used to describe the moisture condition of the soils encountered, based on appearance and feel, include:

- Dry (D); Looks and feels dry. Cohesive soils usually hard, and friable or powdery, well dry of plastic limit. Granular soils are cohesionless and free-running.
- Moist (M); Feels cool, darkened in colour. Cohesive soils can be moulded by hand. Granular soils tend to cohere.
- Wet (W); Feels cool, darkened in colour. Cohesive soils usually weakened and free water forms on hands when remoulding. Granular soils tend to cohere.

Consistency / Relative Density

The consistency of cohesive soils is based on the undrained shear strength and is generally estimated, with or without the aid of a pocket penetrometer or hand vane testing. Terms used to describe consistency include:

Term	Abbreviation	Undrained Shear Strength kPa
Very Soft	VS	≤12
Soft	S	>12 ≤ 25
Firm	F	>25 ≤ 50
Stiff	St	>50 ≤ 100
Very Stiff	VSt	>100 ≤ 200
Hard	H	>200

Table 2

The relative density of non-cohesive soils is described in terms of the density index. It is not possible to make an assessment of the density index without some form of test on an undisturbed or in situ sample. Terms used to describe relative density include:

Term	Abbreviation	Density Index (%)
Very Loose	VL	≤15
Loose	L	>15 ≤ 35
Medium Dense	MD	>35 ≤ 65
Dense	D	>65 ≤ 85
Very Dense	VD	>85

Table 3

Where consistency or relative density has not been determined this is noted by the abbreviation "ND".

Sample Type

Details of laboratory testing and retrieved sample intervals. Disturbed samples are indicated with the abbreviation "D". Rock lump samples are indicated with the abbreviation "R".

Field Records / Comments

Details the type and value of field testing in accordance with the following format:

- SPT - Standard Penetration Test
- U63 - 63mm diameter Thin Walled Tube Sample
- SV - Hand Shear Vane Test
- PP - Pocket Penetrometer Test

This section also details additional observations such as excavation rates and sample numbers.

Water Observations

Groundwater seepage from the sides of the excavation is indicated in the "Water" column, with arrows pointing into the pit. Ponded water levels, observed in the base of the excavation, are indicated by a conventional surface water indicator.

GHD | MANAGEMENT ENGINEERING ENVIRONMENT

SYMBOLS LEGEND FOR GEOTECHNICAL LOGS

SOIL TYPES:

GRAVEL — Poorly Graded; Well Graded

SAND — Poorly Graded; Well Graded

SILT — High Plasticity; Low Plasticity

CLAY — High Plasticity; Low Plasticity

COBBLES & BOULDERS

HIGHLY ORGANIC/ PEAT

MADE GROUND/ FILL

Composite soil types signified by combined symbols; eg. Silty SAND

ROCK TYPES:

Sedimentary:

- SHALE
- CLAYSTONE/ MUDSTONE
- SILTSTONE
- SANDSTONE
- CONGLOMERATE
- BRECCIA

Core Loss:

Carbonates:

- LIMESTONE
- Carbonate CLAYSTONE/ CALCILUTITE
- Carbonate SILTSTONE/ CALCISILTITE
- Carbonate SANDSTONE/ CALCARENITE
- Carbonate CONGLOMERATE/ CALCIRUDITE
- CHALK

Evaporites:

- GYPSUM or HALITE

Igneous:

- Coarse Grained
- Medium Grained
- Fine Grained
- DOLERITE

Metamorphic:

- Coarse Grained
- Medium Grained
- Fine Grained

GROUNDWATER OBSERVATIONS:

- Permanent water level
- Temporary water level
- Inflow into excavation or borehole
- Outflow/ water loss in borehole
- Slow inflow/ seepage into excavation

SAMPLE TYPES:

- Disturbed bag sample — D
- Bulk disturbed (>20kg) — B
- Auger flight cuttings — A
- Hollow stem auger core — AX
- Standard Penetration Test (SPT), with disturbed split-spoon sample — S
- SPT with no sample recovery — N
- Rock fragment — R
- Rock core — RX
- Thin walled tube, with diameter "xx" generally 50 to 100 (mm) — U(xx)
- Small diameter (35mm) thin walled tube — U(35)
- Attempted sample with no recovery — NR

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP01**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 678, N 6857 904
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.8m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.30 [+0.70]			SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
0.5					SP	SAND Red brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND						0.5
		0.76 [+0.24]				Refusal on limestone Termination Depth = 0.76m (Refusal)						
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP02**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 795, N 6857 856
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.5m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments
0					SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L			
		0.20 [+0.80]			SP	SAND Yellow brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND					
0.5	No groundwater encountered										
1.0								MD - D	1.00 - 1.20	B	
1.5							M	D			
2.0											
2.5		2.50 [-1.50]				Termination Depth = 2.50m (Target Depth)					
3.0											

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP03**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 822, N 6857 750
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.1m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	No groundwater encountered	0.70 [+0.30]			SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / RESIDUAL SAND	D	L				0.5
1.0		1.10 [-0.10]				CALCARENITE White, fine to medium grained, sub angular to angular. Contained strongly cemented nodules to 30mm inside a weakly cemented sandy matrix. COASTAL LIMESTONE						1.0
1.5						Refusal on limestone Termination Depth = 1.10m (Refusal)						1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP04**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 881, N 6857 488
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.7m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots.	D	L				0
		0.15 [+0.85]			SP	TOPSOIL / SUBSOIL						
0.5	No groundwater encountered					SAND Yellow brown, fine to medium grained, sub rounded to sub angular. RESIDUAL SAND						0.5
1.0								L-MD				1.0
1.5		1.70 [-0.70]				Refusal on limestone Termination Depth = 1.70m (Refusal)						1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP05**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 739, N 6857 505
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.3m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	N.G.E.				SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / RESIDUAL SAND	D	L			N.G.E. = No groundwater encountered	
		0.30 [+0.70]				Refusal on limestone Termination Depth = 0.30m (Refusal)						
0.5												0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP06**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 677, N 6857 657
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.3m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	N.G.E.	0.34 [+0.66]			SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / RESIDUAL SAND	D	L			N.G.E. = No groundwater encountered	
						Refusal on limestone Termination Depth = 0.34m (Refusal)						
0.5												0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP07**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 786, N 6857 734
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.3m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.40 [+0.60]			SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
0.5					SP	SAND Yellow brown, fine to medium grained, sub rounded to sub angular. RESIDUAL SAND			0.90 1.10	D		0.5
1.0		1.30 [-0.30]				Refusal on limestone Termination Depth = 1.30m (Refusal)						1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP08**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 579, N 6857 795
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.3m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	N.G.E.				SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / RESIDUAL SAND	D	L			N.G.E. = No groundwater encountered	
		0.30 [+0.70]				Refusal on limestone Termination Depth = 0.30m (Refusal)						
0.5												0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP09**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 539, N 6857 988
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.4m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	N.G.E.				SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / RESIDUAL SAND	D	L			N.G.E. = No groundwater encountered	
		0.36 [+0.64]				Refusal on limestone Termination Depth = 0.36m (Refusal)						
0.5												0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP10**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 710, N 6858 051
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.5m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.20 [+0.80]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
					SP	SAND Yellow, fine to medium grained, sub rounded. RESIDUAL SAND		MD-D				
0.5												0.5
1.0												1.0
1.5							M					1.5
2.0												2.0
2.5		2.50 [-1.50]				Termination Depth = 2.50m (Target Depth)						2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD | MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP11**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 665, N 6858 123
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.2m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.25 [+0.75]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
					SP	SAND Yellow brown, fine to medium grained, sub rounded. RESIDUAL SAND		MD				
0.5												0.5
1.0							M	D				1.0
1.5									1.30 1.50	B		1.5
2.0		2.20 [-1.20]				Termination Depth = 2.20m (Target Depth)						2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP12**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 467, N 6858 140
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.6m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	No groundwater encountered	0.60 [+0.40]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / RESIDUAL SAND 0.3m: Contains white grey, fine grained, sub rounded limestone cobbles and boulders up to 400mm in size.	D	L				0.5
						Refusal on limestone Termination Depth = 0.60m (Refusal)						
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

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GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP13**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 491, N 6858 259
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.8m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	No groundwater encountered				SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / RESIDUAL SAND	D	L				0.5
		0.75 [+0.25]				Refusal on limestone Termination Depth = 0.75m (Refusal)						
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

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GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP14**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 546, N 6858 404
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.2m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots.	D	L				0
		0.15 [+0.85]			SP	TOPSOIL / SUBSOIL						
0.5	No groundwater encountered					SAND Yellow brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND		MD				0.5
1.0		1.20 [-0.20]				Refusal on limestone Termination Depth = 1.20m (Refusal)						1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

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GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP15**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 284, N 6858 524
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.2m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	N.G.E.				SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots and white fine grained limestone cobbles up 150mm in size.	D	L			N.G.E. = No groundwater encountered	
		0.20 [+0.80]				TOPSOIL / RESIDUAL SAND						
						Refusal on limestone Termination Depth = 0.20m (Refusal)						
0.5												0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

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GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP16**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 342, N 6858 659
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.3m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				
		0.35 [+0.65]			SP	SAND Yellow brown, fine to medium grained, sub rounded. RESIDUAL SAND						
0.5												0.5
1.0	No groundwater encountered							MD				1.0
1.5								MD-D				1.5
2.0												2.0
		2.30 [-1.30]				Termination Depth = 2.30m (Target Depth)						
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP17**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 312, N 6858 846
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.1m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments
0					GP	SANDY GRAVEL White, sand is fine to medium grained, sub angular to sub rounded, gravel is fine to coarse. RESIDUAL SAND / COASTAL LIMESTONE	D	MD			
		0.20 [+0.80]			SP	SAND Red brown, fine to medium grained, sub rounded to sub angular. RESIDUAL SAND		D-VD			
0.5	No groundwater encountered								0.60	D	
1.0		1.10 [-0.10]							0.80		
						Refusal on limestone Termination Depth = 1.10m (Refusal)					
1.5											
2.0											
2.5											
3.0											

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP18**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 201, N 6858 945
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.9m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	No groundwater encountered	0.20 [+0.80]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0.5
					SP	SAND Red brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND		MD	0.50 0.70	B		
		0.85 [+0.15]				Refusal on limestone Termination Depth = 0.85m (Refusal)						
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

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GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP19**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 136, N 6859 010
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.4m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	N.G.E				SM	SILTY SAND Brown, fine to medium grained, sub rounded. Has a high content of white fine grained limestone cobbles up to 200mm in size. TOPSOIL / RESIDUAL SAND	D	L-MD			N.G.E. = No groundwater encountered	
		0.40 [+0.60]				Refusal on limestone Termination Depth = 0.40m (Refusal)						
0.5												0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

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GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP20**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 041, N 6859 135
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.5m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	N.G.E.				SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots and white fine grained limestone cobbles up to 150mm in size. TOPSOIL / RESIDUAL SAND	D	L			N.G.E. = No groundwater encountered	
		0.45 [+0.55]				Refusal on limestone Termination Depth = 0.45m (Refusal)						
0.5												0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP21**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 146, N 6859 071
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.5m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	N.G.E.	0.50 [+0.50]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / RESIDUAL SAND	D	L-MD			N.G.E. = No groundwater encountered	0.5
						Refusal on limestone Termination Depth = 0.50m (Refusal)						
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP22**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 952, N 6859 158
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.2m
Commenced: 04-May-09 **Completed:** 04-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	04-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	N.G.E.				SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains high organic content.	D	L			N.G.E. = No groundwater encountered	
		0.15 [+0.85]				TOPSOIL / SUBSOIL						
						Refusal on limestone Termination Depth = 0.15m (Refusal)						
0.5												0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP23**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 977, N 6859 300
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.5m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	N.G.E.	0.54 [+0.46]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains high organic content and white fine grained limestone cobbles and boulders up to 400mm in size. TOPSOIL / RESIDUAL SAND	D	L			N.G.E. = No groundwater encountered	0.5
						Refusal on limestone Termination Depth = 0.54m (Refusal)						
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP24**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 999, N 6859 393
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.0m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains high organic content. TOPSOIL / SUBSOIL	D	L				0
		0.30 [+0.70]			SM	SAND Brown, fine to medium grained, sub rounded. Contains white fine grained limestone cobbles up to 200mm in size. RESIDUAL SAND						
0.5	No groundwater encountered											0.5
		1.00 [+0.00]				Refusal on limestone Termination Depth = 1.00m (Refusal)						
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP25**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 945, N 6859 487
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.1m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.25 [+0.75]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains high organic content. TOPSOIL / SUBSOIL	D	L				0
0.5					SP	SAND Brown grey, fine grained, sub angular. AEOLIAN SAND						0.5
1.0												1.0
1.5		1.65 [-0.65]			SP	SAND Yellow brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND		MD				1.5
2.0		2.10 [-1.10]				Termination Depth = 2.10m (Collapsing)						2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP26**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 889, N 6859 611
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.2m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains high organic content. TOPSOIL / SUBSOIL	D	L			
		0.30 [+0.70]			SP	SAND Grey, fine grained, sub angular to sub rounded. AEOLIAN SAND					
0.5	No groundwater encountered								0.70	D	
1.0							M		0.90		
1.5								MD			
2.0		2.20 [-1.20]				Termination Depth = 2.20m (Collapsing)					
2.5											
3.0											

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP27**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 882, N 6859 774
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.7m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
		0.20 [+0.80]			SP	SAND Yellow brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND						
0.5	No groundwater encountered											0.5
1.0												1.0
1.5								MD				1.5
		1.70 [-0.70]				Termination Depth = 1.70m (Refusal)						
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP28**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 815, N 6859 977
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.3m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.20 [+0.80]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
					SP	SAND Grey, fine, sub angular to sub rounded. AEOLIAN SAND		MD				
0.5												0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.3		2.30 [-1.30]				Termination Depth = 2.30m (Target Depth)						2.3
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP29**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 738, N 6860 107
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.3m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.20 [+0.80]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
0.5					SM	SILTY SAND Brown, fine to medium grained, sub rounded. AEOLIAN / RESIDUAL SAND						0.5
		0.70 [+0.30]			SP	SAND Yellow brown, fine to medium grained, sub rounded to sub angular. RESIDUAL SAND		MD				
1.0												1.0
1.5												1.5
2.0								MD - D				2.0
		2.30 [-1.30]				Termination Depth = 2.30m (Target Depth)						
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP30**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 730, N 6859 833
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.4m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
		0.25 [+0.75]			SP	SAND Grey, fine to medium grained, sub angular to sub rounded. AEOLIAN SAND						
0.5	No groundwater encountered											0.5
1.0		1.20 [-0.20]			SP	SAND Yellow brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND		MD				1.0
1.5												1.5
2.0								MD-D				2.0
		2.40 [-1.40]				Termination Depth = 2.40m (Target Depth)						
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP31**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 564, N 6860 046
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.3m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	No groundwater encountered	0.20 [+0.80]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0.5
1.0					SP	SAND Grey, fine, sub angular to sub rounded. AEOLIAN SAND						1.0
		1.30 [-0.30]				Termination Depth = 1.30m (Collapsing)			1.30 1.50	B		
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP32**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 558, N 6859 938
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.6m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
		0.30 [+0.70]			SP	SAND Grey, fine, sub angular to sub rounded. Contains occasional dead roots. AEOLIAN SAND		MD				
0.5	No groundwater encountered											0.5
1.0												1.0
1.5		1.60 [-0.60]				Termination Depth = 1.60m (Collapsing)						1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP33**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 661, N 6859 951
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.0m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
		0.30 [+0.70]			SP	GRAVELLY SAND Red brown, sand is fine to medium grained, sub angular to sub rounded, gravel is medium to course grained, sub rounded to rounded limestone. AEOLIAN / RESIDUAL SAND						
0.5	No groundwater encountered	0.50 [+0.50]			SP	SAND Grey brown, fine to medium grained, sub angular to sub rounded. AEOLIAN / RESIDUAL SAND		MD				0.5
1.0												1.0
1.5								MD-D				1.5
2.0		2.00 [-1.00]				Termination Depth = 2.00m (Target Depth)						2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP34**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 706, N 6859 919
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.2m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SP	SAND Grey, fine grained, sub rounded. AEOLIAN SAND	D	L				0
0.5	No groundwater encountered											0.5
1.0												1.0
1.5												1.5
2.0								MD				2.0
		2.20 [-1.20]						MD-D				
2.5						Termination Depth = 2.20m (Target Depth)							2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP35**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 655, N 6859 927
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.4m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5

Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
		0.20 [+0.80]				SILTY GRAVELLY SAND Brown, fine to course grained, sub angular to rounded. Contains household waste. FILL / RUBBISH						
0.5	No groundwater encountered											0.5
1.0												1.0
1.5		1.60 [-0.60]			SP	SAND Grey, fine, sub angular to sub rounded. AEOLIAN SAND						1.5
2.0												2.0
		2.40 [-1.40]				Termination Depth = 2.40m (Target Depth)						
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP36**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 759, N 6859 511
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.8m
Commenced: 05-May-09 **Completed:** 05-May-09
Contractor: - **Operator:** Stuart

Equipment: JCB Backhoe
Bucket Size (m): 0.5
Excavation Width (m): 0.7
Excavation Length (m): 3.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	05-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains roots. TOPSOIL / SUBSOIL	D	L				0
	No groundwater encountered	0.40 [+0.60]			SP	SAND Grey, fine grained, sub angular to sub rounded. AEOLIAN SAND		MD				
0.5												0.5
1.0												1.0
1.5												1.5
		1.80 [-0.80]				Termination Depth = 1.80m (Collapsing)						
2.0												2.0
2.5												2.5
3.0												3.0

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP37**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 733, N 6857 590
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.5m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	N.G.E.				SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / AEOLIAN SAND	D	L			N.G.E. = No groundwater encountered	
0.5		0.47 [+0.53]				Refusal on limestone Termination Depth = 0.47m (Refusal)						0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP38**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 571, N 6857 792
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.5m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.0	N.G.E.				SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots and very high content of white fine grained limestone cobbles and boulders up to 300mm in size. TOPSOIL / RESIDUAL SAND	D	L-MD			N.G.E. = No groundwater encountered	0.0
0.5		0.50 [+0.50]				Refusal on limestone Termination Depth = 0.50m (Refusal)						0.5
1.0												1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP39**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 612, N 6858 136
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.2m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.30 [+0.70]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
0.5					SP	SAND Yellow brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND		MD				0.5
1.0		1.00 [+0.00]				CALCARENITE White, fine to course grained, sub angular to angular. Contained strongly cemented nodules to 30mm inside a weakly cemented sandy matrix. COASTAL LIMESTONE						1.0
1.5												1.5
2.0		2.20 [-1.20]				Refusal on limestone Termination Depth = 2.20m (Refusal)						2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP40**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 344, N 6858 409
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.6m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	N.G.E.	0.60 [+0.40]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots and high content of white fine grained limestone cobbles up to 200mm in size. TOPSOIL / RESIDUAL SAND	D	L			N.G.E. = No groundwater encountered	0.5
1.0						Refusal on limestone Termination Depth = 0.60m (Refusal)						1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP41**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 327, N 6858 783
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.7m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments
0.5	No groundwater encountered	0.20 [+0.80]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots and white fine grained limestone cobbles up to 150mm in size.	D	L			
					SP	TOPSOIL / SUBSOIL					
						SAND Red brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND		L - MD	0.50	B	
		0.70 [+0.30]				Refusal on limestone Termination Depth = 0.70m (Refusal)			0.70		

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP42**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 098, N 6859 218
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.9m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	No groundwater encountered	0.85 [+0.15]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots and white fine grained limestone cobbles up to 300mm in size.. TOPSOIL / RESIDUAL SAND	D	L-MD				0.5
1.0						Refusal on limestone Termination Depth = 0.85m (Refusal)						1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP43**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 947, N 6859 546
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.6m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.25 [+0.75]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
0.5					SP	SAND Grey brown, fine to medium grained, sub angular to sub rounded. AEOLIAN / RESIDUAL SAND		MD				0.5
1.0												1.0
1.5		1.50 [-0.50]			SP	SAND Red brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND		MD-D				1.5
2.0												2.0
2.5		2.60 [-1.60]				Refusal on limestone Termination Depth = 2.60m (Refusal)						2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD | MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP44**

Sheet 1 of 2

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 877, N 6859 872
Ground Surface Elevation: +1.0m AHD **Total Depth:** 3.5m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
		0.30 [+0.70]			SP	SAND Grey brown, fine grained, sub angular to sub rounded. AEOLIAN / RESIDUAL SAND						
0.5												0.5
1.0								MD				1.0
		1.20 [-0.20]			SP	SAND Yellow brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND						
1.5	No groundwater encountered											1.5
2.0								MD-D				2.0
2.5												2.5
3.0		3.50										3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP44**

Sheet 2 of 2

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 877, N 6859 872
Ground Surface Elevation: +1.0m AHD **Total Depth:** 3.5m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
					SP	SAND Yellow brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND		D				
3.5		3.50 [2.50]				Termination Depth = 3.50m (Target Depth)						3.5
4.0												4.0
4.5												4.5
5.0												5.0
5.5												5.5
6.0												6.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD | MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP45**

Sheet 1 of 2

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 662, N 6859 914
Ground Surface Elevation: +1.0m AHD **Total Depth:** 3.0m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SAND Grey, fine grained, sub angular to sub rounded. Contains occasional roots. AEOLIAN SAND / TOPSOIL	D	L				0
		0.30 [+0.70]				SAND Grey, fine to course grained, angular to rounded. Contains mostly tip fill consisting of household rubbish, tree logs, limestone boulders etc. FILL / RUBBISH						
0.5												0.5
1.0	No groundwater encountered											1.0
1.5												1.5
2.0												2.0
2.5		2.50 [-1.50]			SP	SAND Grey, fine, sub angular to sub rounded. AEOLIAN SAND		L - MD				2.5
3.0		3.00				Termination Depth = 3.00m (Collapsing)						3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP45**

Sheet 2 of 2

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 662, N 6859 914
Ground Surface Elevation: +1.0m AHD **Total Depth:** 3.0m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
		[-2.00]										
3.5												3.5
4.0												4.0
4.5												4.5
5.0												5.0
5.5												5.5
6.0												6.0

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP46**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 712, N 6859 696
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.1m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0
Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments
0.0	No groundwater encountered	0.20 [+0.80]			SM	SILTY SAND Brown, fine to medium grained, sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	M	L			
					SP	SAND Grey, fine grained, sub angular to sub rounded. AEOLIAN SAND					
0.5											
1.0		1.10 [-0.10]				Refusal on limestone Termination Depth = 1.10m (Refusal)					
1.5											
2.0											
2.5											
3.0											

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP47**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 749, N 6859 423
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.1m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0
Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
					SP	SAND Grey, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				
		0.30 [+0.70]			SP	SAND Grey, fine grained, sub angular to sub rounded. AEOLIAN SAND						
0.5	No groundwater encountered											0.5
1.0												1.0
1.5								L - MD				1.5
2.0		2.10 [-1.10]				Termination Depth = 2.10m (Collapsing)						2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP48**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 842, N 6859 279
Ground Surface Elevation: +1.0m AHD **Total Depth:** 2.2m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0	No groundwater encountered	0.20 [+0.80]			SP	SAND Grey, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
					SP	SAND Grey, fine grained, sub angular to sub rounded. AEOLIAN SAND		L - MD				
0.5												0.5
1.0												1.0
1.5												1.5
2.0		2.20 [-1.20]				Termination Depth = 2.20m (Target Depth)						2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP49**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 247 935, N 6859 257
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.7m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains roots. TOPSOIL / SUBSOIL	D	L				0
		0.25 [+0.75]			SP	SAND Grey, fine grained, sub angular to sub rounded. Contains occasional white fine grained limestone cobbles up to 300mm in size. AEOLIAN / RESIDUAL SAND						
0.5	No groundwater encountered											0.5
1.0								L - MD				1.0
1.5												1.5
		1.70 [-0.70]				Refusal on limestone Termination Depth = 1.70m (Refusal)						
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP50**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 066, N 6859 258
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.6m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.5	N.G.E.	0.60 [+0.40]			SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots and white fine grained limestone cobbles up to 250mm in size. TOPSOIL / RESIDUAL SAND	D	L			N.G.E. = No groundwater encountered	0.5
1.0						Refusal on limestone Termination Depth = 0.60m (Refusal)						1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP51**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 280, N 6858 857
Ground Surface Elevation: +1.0m AHD **Total Depth:** 0.9m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments
0.5	No groundwater encountered	0.15 [+0.85]			SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L			
					SP	SAND Red brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND					
		0.60 [+0.40]				CALCARENITE White, fine to course grained, sub angular to angular. Contained strongly cemented nodules to 30mm inside a weakly cemented sandy matrix. COASTAL LIMESTONE					
1.0		0.90 [+0.10]				Refusal on limestone Termination Depth = 0.90m (Refusal)					
1.5											
2.0											
2.5											
3.0											

GHD MANAGEMENT ENGINEERING ENVIRONMENT

TEST EXCAVATION LOG

Test Pit No.: **TP52**

Sheet 1 of 1

Client: Reg Reynolds
Project: Seaview Farms, Horrocks
Job No.: 61/23926

Coordinates: E 248 400, N 6858 623
Ground Surface Elevation: +1.0m AHD **Total Depth:** 1.2m
Commenced: 06-May-09 **Completed:** 06-May-09
Contractor: - **Operator:** Geoff

Equipment: 20t CAT Excavator
Bucket Size (m): 1.0

Excavation Width (m): 1.4
Excavation Length (m): 4.0
Orientation/ Bearing: Not Recorded

Logged:	CMH	06-May-09
Processed:	CMH	25-Jun-09
Checked:		

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0					SM	SILTY SAND Brown, fine grained, sub angular to sub rounded. Contains occasional roots. TOPSOIL / SUBSOIL	D	L				0
		0.30 [+0.70]			SP	SAND Yellow brown, fine to medium grained, sub angular to sub rounded. RESIDUAL SAND						
0.5	No groundwater encountered											0.5
1.0		1.20 [-0.20]				Refusal on limestone Termination Depth = 1.20m (Refusal)						1.0
1.5												1.5
2.0												2.0
2.5												2.5
3.0												3.0

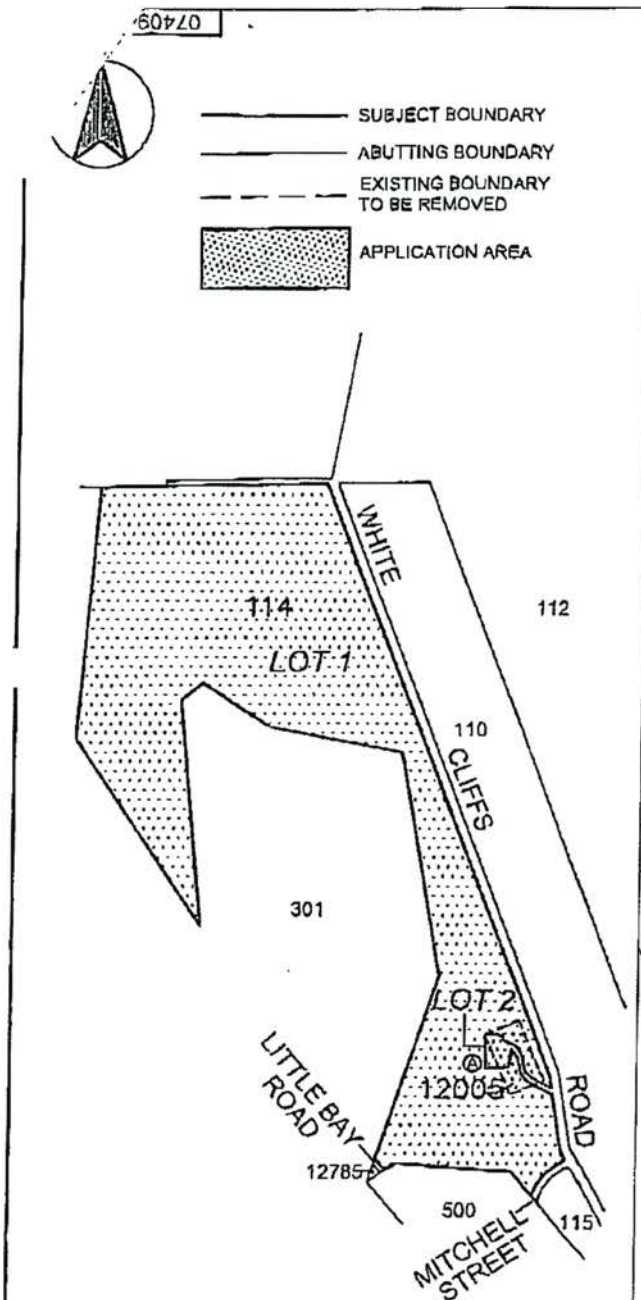
GENERAL LOG 6123926.GPJ GHDPER.GDT 25/6/09

Appendix C

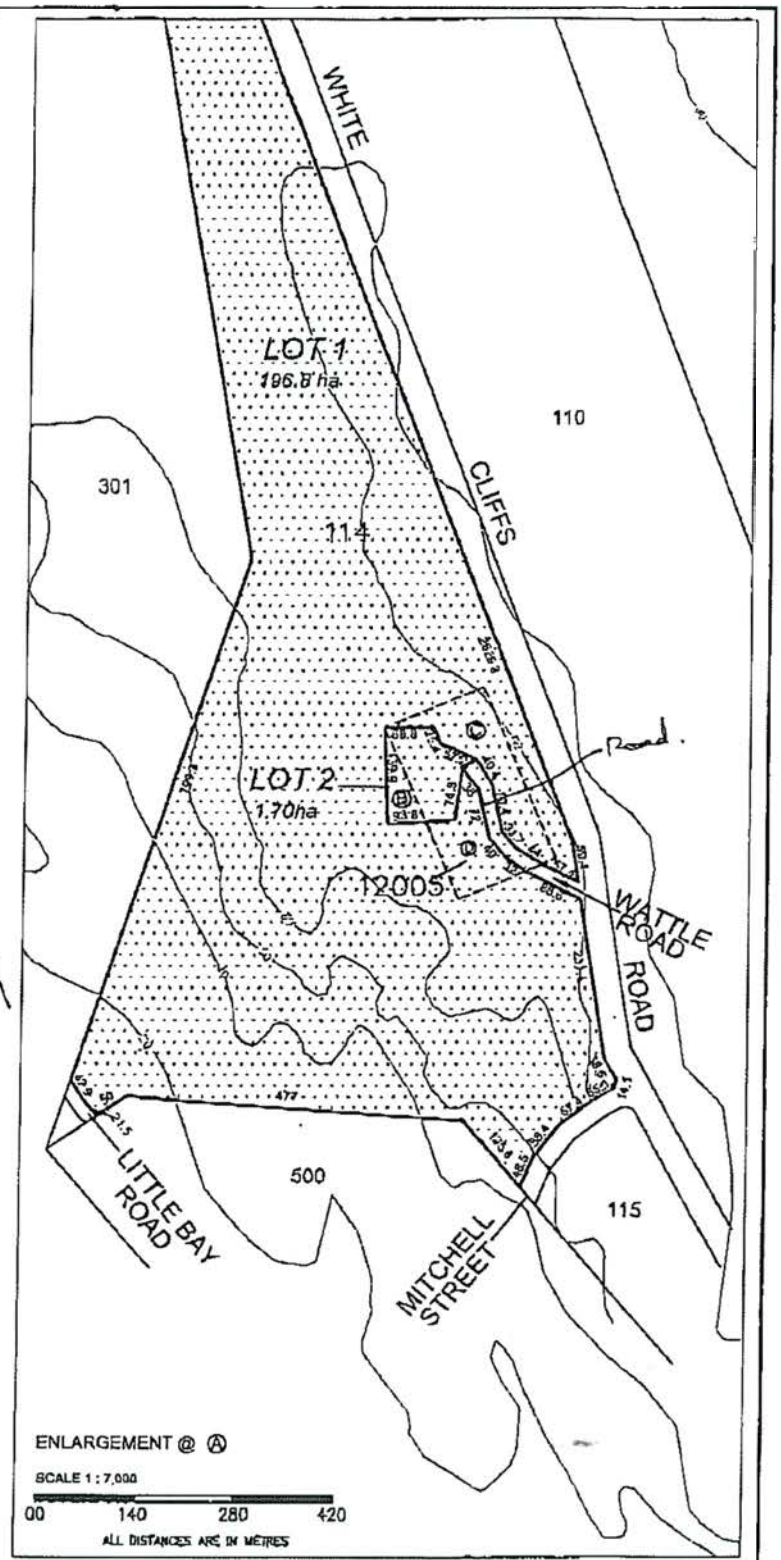
Lot 12005 Landfill Site

07409

SUBJECT BOUNDARY
ABUTTING BOUNDARY
EXISTING BOUNDARY TO BE REMOVED
APPLICATION AREA



LOCATION PLAN
SCALE 1 : 20,000
00 400 800 1200
ALL DISTANCES ARE IN METRES



ENLARGEMENT @ Ⓐ
SCALE 1 : 7,000
00 140 280 420
ALL DISTANCES ARE IN METRES

No. OF EXISTING LOTS : 2

LOT 114 : 194.8ha

LOT 12005 : 4.05ha

TOTAL AREA : 198.5ha

No. OF PROPOSED LOTS : 2

LAND SWAP
AREA Ⓑ = 3725 m²
AREA Ⓒ&Ⓓ = 2.71 ha

TO BE CONFIRMED BY SURVEY

DISCLAIMER

THIS PLAN WAS PREPARED TO ACCOMPANY AN APPLICATION TO THE WESTERN AUSTRALIAN PLANNING COMMISSION FOR APPROVAL TO SUBDIVIDE THE LAND DESCRIBED IN THE PLAN AND IS NOT TO BE USED FOR ANY OTHER PURPOSE OR BY ANY OTHER PERSON. HILLE, THOMPSON & DELFOS ACCEPT NO RESPONSIBILITY FOR ANY LOSS OR DAMAGE CAUSED TO ANY PERSON WHO MAY RELY ON THE INFORMATION ON THIS PLAN FOR A PURPOSE FOR WHICH IT WAS NOT INTENDED.

SURVEYED BY:		AREA FILE: 107	
DRAWN BY: DR	03/03/09	CONT. INTVAL: 20m	
CHECKED BY:		V DATUM: AHD	
APPROVED BY:		H DATUM: MGA'94	
		FIELD BK:	

HTD SURVEYORS & PLANNERS
HILLE, THOMPSON & DELFOS
PO Box 820, GERALDTON WA 6531
PHONE: (08) 9921 3111 FAX: (08) 9921 8072

benchmark

CLIENT: SHIRE OF NORTHAMPTON

LOT 114 ON DP38640 & LOT 12005 ON DP218679
PROPOSED SUBDIVISION
WHITE CLIFFS ROAD, SANDY GULLY - SHIRE OF NORTHAMPTON

SCALE AS SHOWN | SHEET SIZE A3 | DWG No. 07409AS1-1-0

GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box Y3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	M Stovold	H Brookes		H Brookes		26/08/09

ANNEXURE 12

CORRESPONDENCE FROM WESTERN POWER

Feasibility Study

Feasibility Study

Project Name:	**Lot 110, 114, 115, Horrocks Road and White Cliffs Road**
DQM NO:	**NF010008**
Customer Name:	**Seaview Farms**
Proposed Load:	**3 MVA**
Anticipated Connection Date:	**2010**

1. Introduction

Western Power has been requested to conduct a feasibility study for the connection of a 3000 kVA (see DM#: 6601410) residential subdivision at Lot 110, 114, 115, Horrocks Road and White Cliffs Road, Horrocks. There are a total of 10 stages and 600 lots, i.e. a number of 60 lots per stage. The subdivision is expected to begin in the North where rural lots will be developed and towards south over time, where the development will be urban lots.

Figure 1 below shows the location of the proposed new load and the surrounding distribution network.

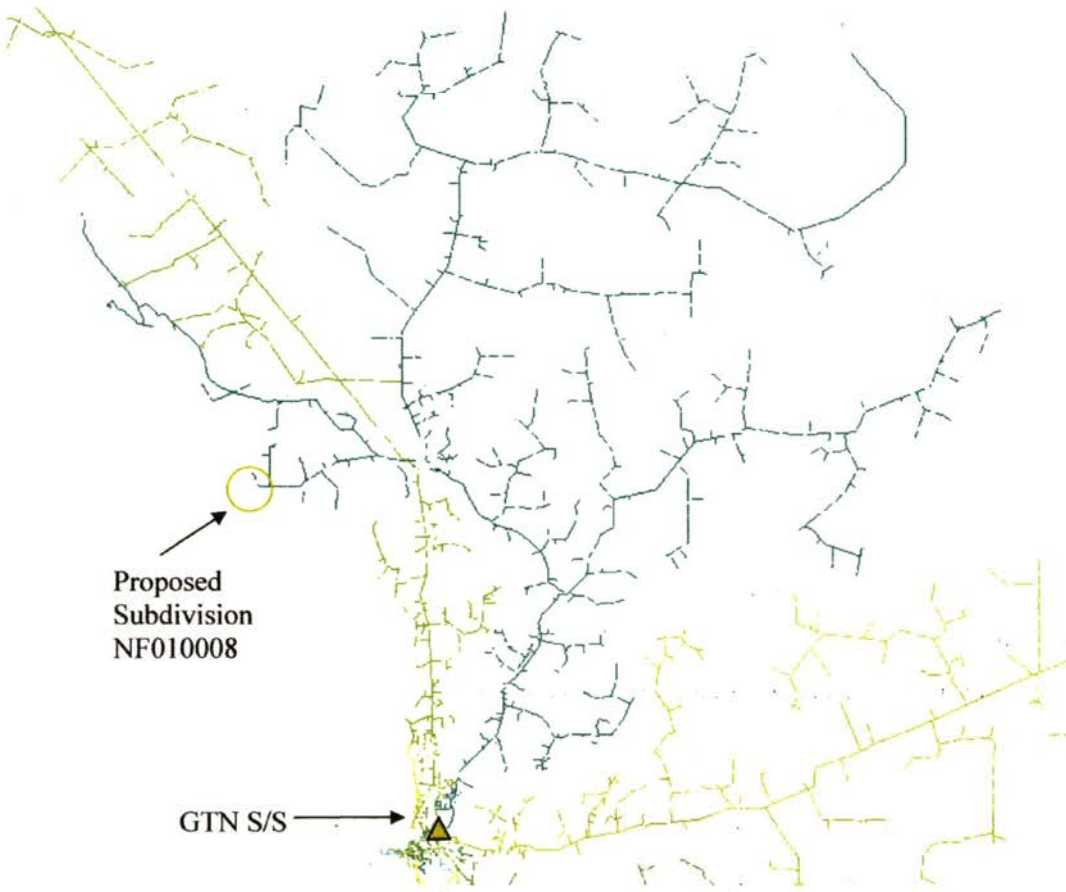


Figure 1 – Location of the proposed 3 MVA load.

2. Study Details

Transmission Planning section have advised that at present there is sufficient substation capacity in Geraldton substation (DM# 6615931). However, the Northampton feeder is currently rated at 190A. The feeder will not be able to supply the proposed load without the following reinforcements:

1. Install a 2MVA Statcom at the Port Gregory leg of Northampton feeder; OR
2. Install a ERG at customer's location where its generation will vary over time according to the load take-up; OR
3. Build a 33kV feeder from the newly proposed Northampton substation. The substation is anticipated to complete in year 2018. A new circuit breaker may be required at the new Northampton substation.

3. Conclusion

It is anticipated that the proposed load could not be supplied from the Geraldton substation via the Northampton feeder.

A Statcom, an ERG or a new 33kV feeder will be required to supply the proposed load. If the customer decided to go with the Statcom or ERG solution, they would be required to pay full cost for the Statcom or ERG as they are not covered under the Distribution Headwork Policy. Customer should take note that the idea of Statcom installation is still new and being assessed by Western Power.

If a new 33kV feeder was to be built, the customer would be required to pay a marginal capacity contribution cost towards the new feeder construction and new feeder circuit breaker if required. Capacity created by the new feeder would be approximately 15 MVA. Therefore the estimated marginal capacity contribution of the new customer would be approximately 20%.

Due to the dynamic nature of the transmission and distribution network, if the new development were to proceed, further studies would be required at the time to determine the final network requirements.

Note that the details in this feasibility study are only **indicative** and **non-binding**. To provide a firm connection proposal and cost, a formal application to Western Power will need to be made, in accordance with our current connection policies.

Prepared by:
Josephine Nga
Date: 11/11/2009

Approved by:
Sisira Jayaratne
Date: 11/11/2009

Annexure 13

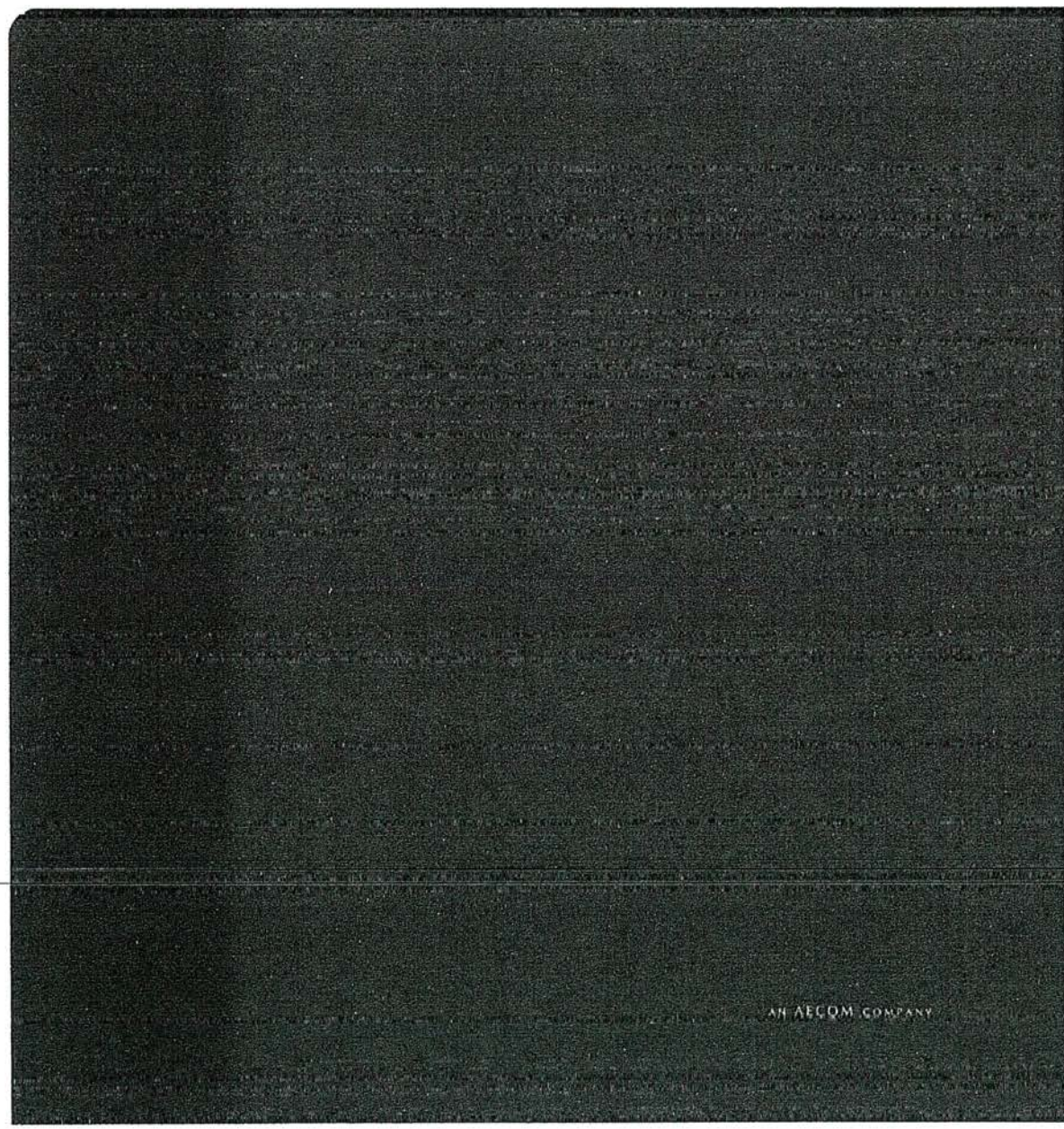
Maunsell Environmental Report 2004

maunsell

Desktop Environmental Assessment for Horrocks Structure Planning

Hille, Thomson and Delfos Surveyors and Planners

August 2004



maunsell

Desktop Environmental Assessment for Horrocks Structure Planning

Prepared for

Hille, Thompson and Delfos Surveyors and Planners

Prepared by

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perth@maunsell.com

August 2004

71100600

Quality Information

Document	Desktop Environmental Assessment for Horrocks Structure Planning
Ref	71100600 u:\pjh\horrocks\report\horrocks structure planning.doc
Date	August 2004
Prepared by	Paul Holmes
Reviewed by	Jane Wilshaw

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
C	16/08/2004		Chris Tatam Director Transport Infrastructure / Environmental	

Table of Contents

1.0 Introduction

1.1 Purpose/Background Information

Maunsell Australia Pty. Ltd. has been commissioned to undertake a desktop environmental assessment of an area surrounding the existing Horrocks Townsite. The subject land is being rezoned to "Special Control Area" allow the preparation of a Structure Plan to facilitate further development of the Townsite. Outcomes from the environmental assessment as documented here will contribute to preparation of the Horrocks Structure Plan.

1.2 Study Objectives/Scope

The Scope of Works for the Desktop Environmental Assessment encompasses:

- review of available literature, including a search of relevant databases, summarising the extent of known biological information and environmental policy areas;
- desktop flora survey, including search of the Department of Conservation and Land Management (CALM) Threatened Flora databases, CALM State Threatened Ecological Communities (TECs) database, the Department of Environment and Heritage (DEH) National TEC database and the WA Herbarium records of flora known in the vicinity of the study area;
- desktop fauna survey, including search of CALM and WA Museum databases;
- description of wetland and coastal values and appropriate buffers;
- database search of known sites of Aboriginal and European Heritage; and
- provision of a report incorporating a constraints and opportunities analysis using all existing information about the natural values of the site, recommendation for further survey work and maps.

1.3 Study Area

The study area is within the Shire of Northampton, north of the Bowes River, immediately east of the Horrocks Townsite (Figure 1.1). The study area, for the purposes of this investigation, is bounded by the following co-ordinates (unless otherwise specified):

240 000mE, 6 870 000mN
260 000mE, 6 850 000mN (GDA 94 Zone 50).

2.0 Background Biological Information

2.1 Geology and Soils

As a function of its near coastal location, soils within the study area are of relatively recent origin. Calcareous sands of marine origin form dunes and beach deposits. A variety of characteristic dune formations occur typically stabilised by herbfield vegetation and enhanced by artificial stabilisation techniques (Halpern Glick Maunsell 1995).

Tamala Limestone of Pleistocene origin is exposed as near shore platforms and forms a plateau inland of the active dune areas. To the north of the study area the Tamala Limestone has developed into spectacular cliffs rising up to 76m from sea level (Playford *et al.* 1970).

Further inland laterite with overlying quartz sands and underlying highly weathered rock occurs (Playford *et al.* 1970). This area is known as the Northampton Block which is characterised by rounded undulating hills of Precambrian rocks and flat topped mesas of Jurassic and Triassic sediments. These mesas are commonly capped with laterite and represent remnants of the Victoria Plain which are now known as the Moresby Range.

To the south there are areas of recent alluvial and colluvial soils and palaeozoic sandstone associated with the Bowes River.

2.2 Flora and Vegetation

Beard (1976):

The study area is located in the Irwin Botanical District of the South Western Botanical Province (Beard 1976). Beard (1976) describes the Irwin Botanical District in terms of vegetation systems based on the concept of a *"particular series of plant communities recurring in catenary sequence or mosaic pattern linked to topographic, pedological and/or geological features"*. The current study area is located in the Greenough System and may also contain elements of the Northampton System.

The Greenough System is associated with coastal limestone and extends along the coast from Kalbarri to Dongara. Beard (1976) describes the vegetation of this system as comprising *Acacia rostellifera* and *Melaleuca cardiophylla* thickets on rocky ridges, Acacia-Banksia scrub on sand covered limestone, *Acacia rostellifera* low forest on alluvial flats and *Acacia ligulata* scrub on recent (coastal) dunes.

The Northampton System comprises remnants of the Victoria Plain visible as flat topped mesas (the Moresby Range), surrounded by dissected undulating country on rocks of the Northampton Block. This landscape results in a well-marked catenary sequence, scrub heath on mesa tops, *Melaleuca-Hakea* thicket on steep scarp slopes and *Acacia acuminata* scrub with *Hakea* and *Eucalyptus loxophleba* on lower undulating country on Proterizoic granites and granulites. The dominant species of the mesa top scrub heaths is determined by the presence/absence of laterite. Where laterite is present Beard (1976) recorded *Gastrolobium oxylobioides* and *Casuarina campestris* (now *Allocasuarina campestris*) as abundant accompanied by species of *Dryandra, Bossiaea, Calothamnus, Hakea, Melaleuca and Verticordia.* On sand, the community is taller and more open

and includes Banksia spp., *Acacia rostellifera, Dryandra, Casuarina, Conospermum, Eremaea* and *Gastrolobium.*

Beard's (1976) broad scale (1:1,000,000) mapping of the Murchison identifies the following vegetation units as occurring within the study area:

- abSi – *Acacia-Banksia* shrubland;
- e_6Mr.a_{19}Si –*Acacia acuminata* (jam) scrub with scattered *Eucalyptus loxophleba* (York Gum);
- mhSc – *Melaleuca* thicket; and
- x_2SZc – heterogeneous, mixed *Proteaceae-Myrtaceae* scrub heath.

Other Studies:

Regional scale descriptive information about vegetation appears to be limited. The Draft Batavia Coast Strategy (Landvision 2001) provides a brief description of vegetation which is taken from Beard (1974, 1976).

The Horrocks Beach Coastal Plan (Department of Planning and Urban Development 1993) provides descriptions of dune vegetation. Species such as *Spinifex hirsutes, Spinifex longifolius, Tetragonia decumbens* and *Salsola kali* are identified as colonisers of primary dunes. Swales behind the foredunes are reported to support a greater number of species including *Tetragonia decumbens, Calocephalus brownii, Carpobrotus virescens, Isolepis nodosa* and *Spinifex longifolius.* A thicket of *Acacia rostellifera, Dioscoria, Melaleuca, Clematis microphylla* and *Hardenbergia comptoniana* occurs on the slopes of stable dunes. Taller shrubs such as *Scaevola crassifolia* and *Pimelea pauciflora* also occur in this association on leeward slopes.

Halpern Glick Maunsell (1995) describes the vegetation of the coastal dunes in similar terms to those used in the Horrocks Beach Coastal Plan. Vegetation associations identified are foredune herbfields, sheltered swales and stable dune climax communities with similar species as those detailed above.

Ecologia (1995) also provide broad descriptions of the vegetation in their study of proposed road alignment options between Horrocks and Kalbarri. Within the current study area vegetation associations identified include *Acacia/Banksia* scrub, scrub heath coastal association and *Eucalyptus* sclerophyll woodland.

2.3 Fauna

The components of the terrestrial vertebrate fauna of Western Australia can generally be considered as having affinities to one of three biogeographic zones that occur across the continent (Tyler 1979; Beard 1990; Schrodde 1989). These are the Torresian (Northern), Eyrean (Central) and Bassian (Southern) divisions. Within Western Australia these zones correspond to the Kimberley division, the south-west in the area of reliable winter rainfall, and the arid zone in the intervening area which is characterised by irregular rainfall, high temperatures and high evaporation rates. The study area lies within the southern Bassian zoogeographic region.

Storr *et al* (1983) provide a comprehensive list of Herptofauna in the Geraldton region (the study area extending from the Houtman Abrolhos east 30-50km inland, south to Green Head and north to Kalbarri). The study listed 46 genera and 97 species of amphibians and reptiles from 12 families *(Leptodactylidae, Hylidae, Chelonidae, Gekkonidae, Pygopodidae, Agmidae, Scincidae, Varanidae, Typhlopidae, Boidae, Elapidae* and *Hydrophiidae*). Storr *et al.* (1983) note that this region experiences a marked latitudinal gradient in rainfall from the north-east to south-west (doubling in annual rainfall). Therefore many species in this region are south-west species at the northern extent of their distribution or arid zone species at the southern limit of their distribution.

A field survey of the Horrocks to Kalbarri Coastal Road (Ecologia 1995) recorded 56 species of birds, three native and six introduced mammals, 12 reptiles and no amphibians.

The survey found the highest number of avifauna in *Acacia* shrublands and the lowest in farmland, woodland and heath habitats. Many of the bird species were recorded within wetland habitats north of Port Gregory

Skink species (family Scincidae) comprised 50% of the total number of reptiles recorded followed by the elapids (front fanged snakes) comprising 12% of all reptiles.

A total of 18 species of native mammals potentially occur in the region (representing the families *Vespertilionidae, Muridae, Tarsipedoidea, Dasyuridae* and *Macropodidae*) (Ecologia 1995). However, only three native mammals were confirmed during the Ecologia (1995) survey, the Echidna (*Tachyglossus aculeatus*), the Spinifex Hopping Mouse (*Notomys alexis*) and the Western Grey Kangaroo (*Macropus fuliginosus*).

Storr *et al.* (1983) a number of reptiles were limited to a coastal distribution in the south-west zone (predominantly skinks, pygopodids and gekkos) and other species that were known to be primarily arid zone (Eryean) species.

3.0 Evaluation of Existing Environment

3.1 Flora of significance

3.1.1 Method of Evaluation

A search was undertaken for Declared Rare and Priority flora via CALM's Threatened (Declared Rare) Flora database, Declared Rare and Priority Flora list and the Western Australian Herbarium database.

3.1.2 Existing Environment

A search of CALM's Threatened Flora database revealed seven Declared Rare Flora, six Priority 1, three Priority 3 and one Priority 4 species within the vicinity of the project area (Appendix A). These are described in Table 3.1.

Table 3-1 Summary of threatened flora known to occur within the vicinity of the study area

Family	Taxon	Common Name	CALM Listing	Description (Florabase 2003)
Mimosaceae	*Acacia pelophila* R.S.Cowan & Maslin	-	P1	Dense, spreading shrub, 0.9-2 m high. Fl. yellow, Jul-Aug. Clay. Saline creeklines.
Orchidaceae	*Caladenia bryceana* R.S.Rogers subsp. *cracens* Hopper & A.P.Br.	-	DRF	Tuberous, perennial, herb, 0.03-0.08 m high. Fl. green, yellow, Aug-Sep. Sand over limestone. South of Kalbarri in low heath on limestone hills; north in winter-moist flats
Orchidaceae	*Caladenia elegans* Hopper & A.P.Br	-	DRF	Tuberous, perennial, herb, 0.2-0.3 m high. Fl. yellow, Jul-Aug. Clayey loam. Winter-wet clay flats.
Orchidaceae	*Caladenia hoffmanii* Hopper & A.P.Br. subsp. *hoffmanii*	-	DRF	Tuberous, perennial, herb, ca 0.18 m high. Fl. white, red, cream, Aug. Clay over laterite. Lateritic ridges, swamps and gullies.
Rhamnaceae	*Cryptandra nudiflora* F.Muell.		P3	Shrub, ca 0.3 m high. Fl. white, pink, Sep. Loamy clay, sandy clay.
Orchidaceae	*Diuris recurva* D.L.Jones		P4	Tuberous, perennial, herb, 0.2-0.3 m high. Fl. yellow, brown, Jul-Aug.
Myoporaceae	*Eremophila brevifolia* (A.DC.)F.Muell.	Spotted Eremophila	P1	Erect, spindly shrub, 0.9-2(-3.6) m high. Fl. white, pink, blue, Jul-Sep.
Proteaceae	*Eucalyptus blaxellii* L.A.S.Johnson & K.D.Hill	-	DRF	Mallee, 1-4 m high, bark smooth. Fl. white, cream, Aug-Nov. Grey sand, clay. Rocky hillsides, creek flats.

Family	Taxon	Common Name	CALM Listing	Description (Florabase 2003)
Proteaceae	*Eucalyptus cuprea* Brooker & Hopper	Mallee Box	DRF	Mallee, 2.5-5 m high, bark rough to 1.5 m, box-type. Fl. white, Aug-Nov. Shallow soils over granite.
Papilionaceae	*Gastrolobium propinquum* C.A.Gardner	Hutt River Poison	P1	Erect, slender shrub, 0.3-1.5 m high. Fl. orange, yellow, purple, Jul-Aug. Sandy or clayey soils. Drainage lines, winter-wet areas.
Rutaceae	*Geleznowia verrucosa* Turcz. subsp. *formosa* L.M.Broadh. ms		P3	Rounded, erect, branching, woody shrub, to 1.5 m high. Fl. yellow, Aug-Oct. White/orange-brown sand, gravel, laterite, sandstone, limestone. Disturbed edges of quarries, slopes.
Myrtaceae	*Melaleuca huttensis* Craven Austral.Syst.Bot.12:881-882(1999)		P1	Description unknown.
Orchidaceae	*Oligochaetochilus sp.Northampton(S.D.Hopper 3349)*		DRF	
Orchidaceae	*Pterostylis sp. Northampton*		Not current	
Goodeniaceae	*Scaevola oldfieldii* F.Muell.		P3	Erect shrub, to 2.3 m high. Fl. white, Aug-Dec. Sand, loam, clay. Near rivers.
Rhamnaceae	*Stenanthemum gracilipes* Diels		P1	Shrub, 0.3-0.7 m high. Fl. white, cream, Aug-Sep. Sandy loam & sandstone conglomerate. Rocky gullies, hillslopes.

Of the threatened flora listed in Table 3.1 the DRF *Caladenia bryceana subsp. bryceana* occurs within the project area (Figure 3.1).

A search of the Western Australian Herbarium database revealed no additional threatened flora species. A total of 188 vascular plant taxa representing 119 genera and 56 families have previously been recorded for the study area (a full list is provided in Appendix A).

3.2 Threatened Ecological Communities & Conservation Significance of Vegetation

3.2.1 Method of Evaluation

A search of both CALM's State Threatened Ecological Communities (TEC's) database and DEH's National TEC database was undertaken for any TEC's in the study area.

TEC's

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (Government of Western Australia, 2000). English and Blyth (1997, 1999) have developed a procedure for identifying and assigning TECs to one of four categories depending on the threat to the community (Table 3.2).

Table 3-2 Conservation categories for Threatened Ecological Communities recognised by CALM and the WA Minister for the Environment (English and Blyth 1997)

Code	Definition
Presumed Totally Destroyed	An ecological community which has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.
Critically Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

Code	Definition
Vulnerable	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

Commonwealth legislation also protects vegetation communities classified as threatened. Under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, a person must not take an action that is likely to have a significant impact on a listed TEC without approval from the Minister for the Environment and Heritage. The three categories of TEC listed in the *EPBC Acts* are summarised in Table 3.3.

Table 3-3 Conservation categories for Threatened Ecological Communities under the EPBC Act 1999

Code	Definition
Critically Endangered	A community can be included in the Critically Endangered category if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	A community can be included in the Endangered category 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.
Vulnerable	A community can be included in the Vulnerable category 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

Possible TECs that do not meet survey criteria or are not adequately defined are added to CALM's Priority Ecological Community Lists under Priorities 1, 2 and 3. These categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as TECs. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in the Priority 4 category. These communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Alternate Evaluation of Vegetation Significance

A vegetation community is considered to have regional conservation significance if it supports populations of DRF, is restricted to specific geomorphological features or is isolated in the landscape. A vegetation community is considered to have local conservation significance when it supports priority flora, provides refuge to flora and fauna in times of drought or represents an uncommon species assemblage or structural diversity.

3.2.2 Existing Environment

A study by English and Blyth (1997) listed the Community 'Moresby Range', which occurs in the vicinity of Horrocks Beach as "under consideration" as a TEC. This community is described as *'Melaleuca megacephala* and *Hakea pycnoneura* thicket on stony slopes of the Moresby Range'. This community was not listed as a TEC due to insufficient information at the time of evaluation. Communities listed as TEC's by English and Blyth from this study form the basis of the CALM TEC database (Appendix C) and a search of the current CALM database does not include the 'Moresby Range' Community, or any other TEC's in the vicinity of the Horrocks Beach area. Results of the DEH TEC database (Appendix D) search for the project area indicates that no nationally listed TEC's occur within or in the immediate vicinity of Horrocks Beach.

It appears that no regional scale vegetation studies have been undertaken and accordingly, it is difficult to draw firm conclusions about the conservation significance of vegetation within the project area. The coastal dune vegetation communities are likely to be well replicated beyond the area and are therefore not likely to be regarded as having a high conservation value. They are, however, of considerable importance in maintaining dune stability and preserving coastal processes.

Further inland, where large scale clearing has occurred as a result of agriculture, intact remnant vegetation is likely to be of greater conservation significance.

The role of areas of remnant vegetation in providing linkages/corridors may also be important. The Batavia Coast Strategy (Landvision 2001) identifies coastal areas of Unallocated Crown Lands between Port Gregory and Horrocks as having conservation and coastal landscape significance. The granulite country east of the Horrocks coastal area is also identified as having "important landscape values in both its natural and modified states".

3.3 Weeds

3.3.1 Method of Evaluation

The Department of Agriculture (Geraldton Office) was contacted for information regarding declared and noxious weeds in the area.

3.3.2 Existing Environment

The following Declared Plants (DP) occur within the local area, although the infestations are restricted to the immediate Bowes River environs and/or are located more than10km from the study area (A. Howitt *pers.comm.*):

- Thorn Apple (*Datura spp.* P3);
- Variegated Thistle (*Silybum marianum* P2&3); and

- Skeleton weed (*Chondrilla juncea* P1&2).

An explanation of the Control Codes P1, P2 etc is provided in Appendix B.

Additional low priority and non-declared weeds potentially occurring in the study area include (A Howitt *pers. comm.*):

- Paterson's Curse (*Echium plantagineum* P1);
- Saffron Thistle (*Carthamus lanatus* P1);
- Caster-oil (*Ricinus communis*);
- African Box thorn (*Lycium ferocissimum*); and
- Soursob (*Oxalis pes-caprae*)

3.4 Fauna and Fauna Habitats

3.4.1 Method of Evaluation

A search of CALM's Threatened Fauna database and the WA Museum's database for reptiles, mammals, birds and amphibians was undertaken to identify fauna species likely to be found in the vicinity of the project area.

Threatened Fauna

Fauna species that are rare, threatened with extinction or considered to have high conservation value are protected by law under the *Western Australian Wildlife Conservation Act 1950*. Classification of Rare and Endangered fauna under the Wildlife Conservation (Specially Protected Fauna) Notice 2001 recognises four distinct schedules of taxa (Table 3.4).

Table 3-4 Western Australian Threatened Fauna categories

Code	Category	
S1	Schedule 1	Fauna which is rare or likely to become extinct.
S2	Schedule 2	Fauna which are presumed to be extinct.
S3	Schedule 3	Birds which are subject to an agreement between Australia and the governments of China (CAMBA) and Japan (JAMBA) relating to the protection of migratory birds and birds in danger of extinction.
S4	Schedule 4	Fauna that is otherwise in need of special protection.

In addition to the lists of Scheduled Fauna CALM also maintains a list of Priority Fauna. This includes species that have been removed from the Scheduled list and other species that are poorly known or infrequently recorded. Four classifications are recognised (Table 3.5).

Table 3-5 CALM Priority Fauna categories

Code	Category	
P1	Priority 1	Taxa with few, poorly known populations on threatened lands.
P2	Priority 2	Taxa with few, poorly known populations on conservation lands.
P3	Priority 3	Taxa with several, poorly known populations, some on conservation lands.
P4	Priority 4	Taxa in need of monitoring.

Commonwealth Environment Protection and Biodiversity Conservation Act 1999

Fauna that are considered Rare and Endangered at a national level are listed under Schedule 1 of the *EPBC Act 1999*. The species classifications under the Act are indicated in Table 3.6.

Table 3-6 Categories of threatened species under the *EPBC Act 1999*

Code	Category	Criteria
Ex	Extinct	There is no reasonable doubt that the last member of the species has died.
E	Endangered	The species is facing a very high risk of extinction in the wild in the near future.
V	Vulnerable	The species is not considered endangered but is facing a high risk of extinction in the wild in the medium-term future.

Estimates of risk of extinction are based on prescribed criteria that include an assessment of population size and threatening processes. Additional categories exist under the *EPBC Act 1999* for listed threatened species and ecological communities (critically endangered, conservation dependant and extinct in the wild) but none of these apply to the fauna of the study area.

Migratory Bird Agreements

At a national level the *EPBC Act* provides for protection of migratory waterbirds through the Convention on Migratory Species (Bonn Convention) and international treaties such as the Japan-Australia and China-Australia Migratory Bird Agreements (JAMBA and CAMBA). In addition, the Ramsar Convention protects wetlands of international importance. Species listed under JAMBA are also protected under Schedule 3 of the *Western Australian Wildlife Conservation Act 1950*.

JAMBA and CAMBA cover certain species of avifauna, particularly transequatorial waders. These agreements are intended to secure the *"protection of migratory birds and birds in danger of extinction and also for the management and protection of their environments"*.

3.4.2 Existing Environment

The results of the desktop search indicate that one Schedule 1, one Schedule 4 and three Priority fauna (P4) species potentially occur within the study area. A summary of their habitats and status is provided below. Unless otherwise stated, the following information is provided by CALM (2002) (Appendix E).

Schedule 1 (Fauna which is Rare or likely to become Extinct)

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) – this species moves in flocks to feeding areas throughout the coastal plain and forest areas, but breeding occurs mainly in the eastern forests and wheatbelt.

Schedule 4 (Fauna which is Otherwise Specially Protected)

Peregrine Falcon (*Falco peregrinus*) – this species is an occasional visitor to areas of open woodland and along margins with cleared land. It may occur sporadically in the vicinity of the study area.

Priority Taxa

Tammar Wallaby (*Macropus eugenii derbiansus*) P4 – this species prefers thickets of Melaleuca, Sheoak or other large shrubs associated with grassland. There are two records north of Horrocks Beach from about 1970 and it is possible but unlikely that the species still occurs in the area.

Bush Stonecurlew (*Burhinus grallarius*) P4 – this species is a well camouflaged, ground nesting bird which prefers to 'freeze' rather than fly when disturbed. It inhabits open woodland rangelands and may occur in the vicinity of the study area.

Hooded Plover (*Thinornis rubricolis rubricolis*) P4 – this species occurs along the margins and shallows of salt lakes and along sandy beaches and could again, therefore occur in the vicinity of the study area.

A search of the WA Museum's database did not reveal any additional threatened fauna. A total of 7 mammals, 11 birds, 5 amphibians and 24 reptiles have been recorded in the vicinity of the project area. The results of this search are provided in Appendix E.

3.5 Coastal Values

3.5.1 Method of Evaluation

The coastal environment was assessed by reviewing the Batavia Coast Strategy (Landvision 2001), the State Coastal Planning Policy (Policy No. 2.6, June 2003) and through a site familiarisation visit undertaken in 2003.

3.5.2 Existing Environment

The coastline north and south of Horrocks represents a diversity of coastal landforms ranging from flat mobile dune sets to steep foredunes backed by vegetated ridges and rocky cliffs (Landvision 2001). The shoreline is constantly changing in configuration influenced by coastal processes, predominantly longshore currents transporting sediment to the inshore zone and aeolian transport of sand.

The Horrocks Beach coastal area is characterised by sandy beaches of variable width protected by offshore reefs and backed by unstable vegetated dunes. The parabolic dune systems are highly mobile fed by sediments derived from erosion of unstable foredunes to the south. Sediment accretion is typical at rivermouths such as the Bowes and floods accelerate shoreline deposition and erosion as sediments from river catchments are transported into the coastal environment (Landvision 2001).

There are no wetlands within the project area, however several locally and regionally important wetlands (eg Utcha Swamp Reserve) occur north of Port Gregory. These wetlands are known to support a diversity of avifauna (Ecologia 1995).

One major watercourse, the Bowes River, occurs on the southern border of the project area.

Coastal Values

The coastline from Bowes River to Little Bay has high local significance because of its ecological and recreational value. Infrastructure, recreational and commercial fishing and tourism are examples of the competing pressures on the central Batavia coast. The Horrocks coastline (Bowes River mouth to Little Bay) remains relatively unaffected by coastal infrastructure (eg port operations) that occurs in other localities (eg Geraldton and Port Gregory).

The inshore lagoon surrounded by fringing reef at Horrocks provides a natural anchorage and is of high value as a recreational and tourist area providing protected waters for swimming, fishing and other activities. The inshore lagoon and outer reefs are also of ecological value providing a nursery for juvenile fish and western rock lobster and supporting a diverse marine flora and fauna (Landvision 2001).

The Bowes rivermouth is an important area for recreational fishing and surfing, and is an area of potential Aboriginal Heritage significance (Landvision 2001).

At present these areas are subject to increased recreational use on weekends and public holidays. Further increase in the number of users on a regular basis is likely to place pressure on the ecological values of the area. Activities such as off-road driving will impact on already unstable dune systems and is likely to increase dune and shoreline erosion. Visual amenity and the lifestyle and character of the Horrocks Beach Townsite may also be affected.

In the event of development of the Horrocks Beach Townsite, the planning framework established to guide such development, including the proposed Structure Plan, will need to incorporate measures responding to constraints associated with the susceptibility of the adjacent coastal zone to disturbance and damage as a result of inappropriate human activity within the zone. In this regard, if there is an existing Coastal Management Plan for the Horrocks Beach area, the Structure Plan should demonstrate how future development will be integrated with initiatives presented in the management plan. However, if a Coastal Management Plan for the Horrocks Beach area does not already exist, such plan should be prepared as an adjunct of the Structure Plan, thereby ensuring effective integration of the two plans

The Coastal Management Plan will also need to address requirements for coastal setbacks in accordance with Department of Planning and Infrastructure (DPI) *Development Control Policy 6.1 Country Coastal Planning Policy* (DC 6.1) (DPI, 2003) and the *State Coastal Planning Policy No 2.6* (June 2003). In this regard, DPI (2003) indicates the following in relation to coastal setback distances:

- setback areas are required to conserve and enhance coastal values and to protect development from coastal processes in the 1 in 100 year planning period;
- the setback area is defined by the minimum distance from the Horizontal Setback datum (HSD). The HSD is the line, determined in regard to physical or biological features of the coast, from which a setback can be applied and will vary depending on shoreline characteristics (eg. dunal systems, rocky shorelines, low energy mangroves, cyclonic storm inundation areas);
- setback areas are calculated by adding the distance for absorbing acute erosion (extreme storm sequence), distance to allow for historic trend (chronic erosion or accretion) and the distance to allow for sea level change;
- setback distance should also take into account ecological values, landscape, seascape, visual amenity, heritage, public access, recreation and safety as well as the specific physical processes outlined above. In the case of the coastline adjacent to the proposed development area a total setback of 100m from the HSD is expected.

3.6 Heritage

3.6.1 Method of Evaluation

Several searches of the Department of Indigenous Affairs' Sites Register to establish the existence of any sites in the vicinity of the project area have been undertaken, the most recent in June 2004.

The Native Title Tribunal was also contacted.

3.6.2 Existing Environment

Eight known sites of Aboriginal Heritage significance occur in the vicinity of the study area. Information on these sites is provided in Table 3.7. Historically, there has been a significant Aboriginal presence along the Batavia coast (Landvision 2001) and although this is reflected in the number of known sites in the vicinity of Horrocks, it is possible that other as yet unrecorded sites of ethnographic or archaeological significance may exist, particularly in the vicinity of the Bowes River.

Table 3-7 Sites of Aboriginal Heritage Significance

Site No / ID	Site Name	Site Type	Site Reliability	Status
S02494	Gray Gorge	Engraving	Unreliable	Interim Register
S01714	Bowes River Mouth South	Burial, Artefact, Midden	Unreliable	Permanent Register
S00003	Horrocks Beach	Artefact	Unreliable	Permanent Register
S00004	Willi Gulli Complex	Painting	Reliable	Permanent Register
S00403	Bowes River	Burial, Artefact, Midden	Reliable	Interim Register
17164 (ID)	Horrocks Beach	Artefact	Reliable	Permanent Register
17464 (ID)	Horrocks – N'hampton Rd	Burial, Artefact, Midden	Reliable	Interim Register
18433 (ID)	Horrocks Midden	Artefact, Midden	Reliable	Interim Register

Native Title refers to the rights and interests of Aboriginal and Torres Strait Islander people in land and waters, according to their traditional laws and customs, and is promulgated through the *Native Title Act 1993*. The Native Title Tribunal administers Native Title applications and assists in matters pertaining to the Act. Three Native Title Applications have been lodged with the Tribunal over the broader region that includes the project area. These are:

- Mullewa Wadjati Community (NNTT number WC96/93);
- Naaguja Peoples (NNTT number WC97/73); and
- Hutt River People (NNTT number WC001/1).

In this instance, it is understood that the project area is held in freehold title and accordingly, Native Title would not normally apply. However, to eliminate any uncertainty, it would be prudent for the landholders / proponents of the Structure Plan to seek specific legal advice on this matter.

3.7 European Heritage

3.7.1 Method of Evaluation

To identify any sites of European Heritage significance in the vicinity of the project area, searches of the Heritage Council of Western Australia's database, the Australian Heritage Commission's Register of the National Estate, and of the Shire of Northampton's Municipal Inventory have been undertaken.

3.7.2 Existing Environment

Two sites of heritage significance are located in the vicinity of the study area.

The Willow Gully Homestead (consisting of the main house, outbuildings and stone fences also referred to as Willi Gulli) is listed on the WA Heritage Council Register and the Register of the National Estate. This homestead is located close to, although not within, the study area.

Willi Gulli Homestead is located on Horrocks Beach Road about 5.5km ESE of Horrocks Townsite. This homestead is regarded as the second oldest homestead in the district and is considered significant due to its association with early settlement of the Northampton region and development of the pastoral and agricultural industry in the local area. The homestead is constructed from local materials and has survived with much of its original fabric and cultural landscape intact.

Horrocks beach is listed under the Shire's Municipal Inventory as a site of "very high social significance as the holiday and summer recreation location for Northampton". Horrocks beach is not, however, listed under the Register of the National Estate by the WA Heritage Commission. The Shire's management recommendations include the addition of interpretive material and signage to provide an understanding of the heritage significance to the community (Refer to Appendix F).

4.0 Constraints and Opportunities Analysis

For the purpose of this study environmental constraints are defined as environmentally sensitive areas of ecological and heritage significance in a local and/or regional context. The following analysis aims to identify the known constraints within the Horrocks Beach project area so that environmental impacts on sensitive areas may be avoided wherever possible.

Environmental constraints associated with the Horrocks project fall into two categories:

- constraints with the potential to affect structure plan and subdivision design; and
- constraints with the potential to affect site development and the use of individual allotments.

4.1 Constraints Potentially Affecting Structure Plan and Subdivision Design

Constraints potentially affecting structure plan and subdivision design are most appropriately addressed prior to initiation of the rezoning process as they have the potential to affect the overall suitability of the project area for human development and structure plan and subdivision design.

Based on desktop analyses undertaken, the presence of declared rare flora (DRF) *Caladenia bryceana* subsp. *cracens* is regarded as the only environmental issue with the potential to constrain to development opportunity (i.e. Structure Plan and subdivision design) within parts of the study area.

Declared Rare Flora

As discussed there is a previously recorded population of the Declared Rare Flora (DRF) species *Caladenia bryceana* subsp. *cracens* within the study area. Discussions with CALM have indicated that surveys in the previous two years have been unable to relocate the population of (A Chant *pers comm.*). CALM has indicated that the site is regarded as still protected.

Disturbance or destruction of a DRF population is prohibited under the *Wildlife Conservation Act 1950, National Parks and Wildlife Act 1972* and *EPBC Act 1999*. Should the development impact on the DRF population a potentially lengthy formal approvals process would be required before the development could proceed. Extensive local and regional DRF searches (outside areas proposed to be disturbed) may be required to locate other populations. In the event that insufficient additional occurrences of the species were found to enable CALM to determine that its protection within the project area was no longer necessary, formal State and Commonwealth Government approvals processes (including preparation of management plans to ensure protection of the known DRF population/s) would be required.

Alternatively, the design of the Structure Plan and subsequent development could be modified to avoid the risk of impact on the DRF. In this regard, a 200m buffer around known locations would be required as a minimum (A Chant *pers. comm.*). Additionally a field survey to relocate the species and identify additional areas of suitable habitat will be required prior to any ground disturbing activities. This survey will need to be undertaken in August/September to ensure identification of orchid species if possible. It is also likely that preparation of a

Threatened Species Management Plan in consultation with CALM would be required to ensure suitable management of the Declared Rare *Caladenia bryceana* subsp. *cracens*.

Other Environmental Issues

Although no specific constraints associated with the following environmental issues have been identified, these factors still have the potential to affect the Structure Plan and subsequent development. Accordingly, it is appropriate that they should also be addressed prior to the initiation of the rezoning process:

- vegetation of significance;
- fauna;
- Aboriginal Heritage; and
- European Heritage.

Vegetation

No constraints associated with vegetation communities or areas of regionally significant vegetation (aside from areas containing DRF) have been identified through the current desktop study. However, there is some potential for vegetation communities of regional significance to occur within the project area. This possibility therefore needs to receive further attention through field investigation.

Fauna

Several Scheduled and Priority species could possibly occur within or in the vicinity of the project area (Section 2.3). Again, this possibility therefore needs to receive further attention through field investigation.

Aboriginal Heritage

An electronic search of the Department of Indigenous Affairs' (DIA) Sites Register conducted on 01 June 2004 identified seven known sites in the near environs of the Structure Plan area as follows:

- four sites within the Sensitive Coastal Area, two adjacent to the Bowes River mouth (the more easterly of which appears to be within the area identified for future development) and two in the vicinity of Whaleboat Cove;
- one site within the south eastern extremity of the area identified for future development; and
- two sites adjacent to the Bowes River mouth, although these appear to be beyond the Structure Plan area.

All of these sites could be prone to disturbance either as a direct result of the proposed development or (more probably) as a result of increased human activity in the area as a consequence of this development. It should also be noted that an eighth site occurs approximately 1.8 kilometres east of the north eastern extremity of the Structure Plan area although because of this separation, it should not be as susceptible as the other sites to development related disturbance.

Desirably, disturbance of the sites should be avoided and measures implemented in this regard could include:

- design of any subsequent subdivision within the Future Development area to accommodate the sites;
- integration of the sites within the coastal zone with management strategies for the zone;
- integration of the sites in the vicinity of the Bowes River with management strategies for the river;
- clear demarcation of the sites in the event of any nearby ground disturbing development related activities that could result in their inadvertent disturbance (it may also be desirable to have any such works supervised by a suitably qualified person to ensure that appropriate action would be initiated in the event that any material of Aboriginal origin was encountered).

In the event that disturbance of a known site cannot be avoided, prior approval would be required from the Minister for Indigenous Affairs pursuant to Section 18 of the *Aboriginal Heritage Act 1972* for its disturbance. The Section 18 process requires submission of appropriate documentation to the DIA for initial review and this would normally include information from specialist archaeological and ethnographic investigations undertaken for the particular project.

If the Department regards the documentation submitted as adequate, it forwards it to the Aboriginal Cultural Materials Committee (ACMC) for formal consideration. Having considered the information submitted, the Committee then provides its advice on the application to the Minister. The Minister is not obliged to accept the Committee's advice but cannot determine the application prior to receiving this advice.

From the time of lodgement, processing of a Section 18 application to the point of determination by the Minister could take about nine weeks and as the ACMC meets only every second month, the overall process can be time-consuming.

When it provides written advice regarding know Aboriginal Heritage sites within a particular area, the DIA always emphasises that as yet unknown sites may also exist within the area and that it is an offence under the *Aboriginal Heritage Act* to knowingly or unknowingly disturb a site of Aboriginal Heritage significance without prior approval from the Minister. In this instance, because of the number of already recorded sites within and adjacent to the Structure Plan area, it would probably be appropriate to acknowledge the probability that other as yet unrecorded sites may also occur. As such, it is probable that the DIA would recommend that specialist archaeological and ethnographic surveys should be undertaken prior to commencement of development to reduce the risk of inadvertent disturbance of any unrecorded site through development related activity. Outcomes from these surveys would then provide the basis for management of any newly identified sites in consultation with the DIA.

An alternative but less secure approach to managing the possibility of as yet unidentified sites of Aboriginal Heritage significance occurring within the Structure Plan area would be for all ground disturbing development related activities to be supervised by an appropriately qualified and experienced person, the objective being to ensure:

- immediate identification of any material of Aboriginal origin encountered; and
- initiation of appropriate consequent action/s.

This approach is regarded as a less secure option than completion of prior surveys as it will only enable identification of sites at which there is some residual physical material (eg remnant artefacts). Additionally, if a new site is encountered, reacting to consequent requirements could have time and cost implications for the project. Conversely, completion of prior surveys enables a more proactive approach to management of any additional site/s encountered.

4.2 Constraints Potentially Affecting Site Development and Allotment use

Constraints potentially affecting site development and allotment use relate to:

- maintenance of landform and soil stability during development related site earthworks (and the related issue of native vegetation clearing);
- management of human pressures on the coastal zone Conservation Areas;
- management of rural type land uses within proposed Rural Residential and Rural Smallholding lots.

These constraints also need to be considered at the rezoning stage, principally in terms of ensuring that the rezoning amendment incorporates provisions that will enable the issues to be adequately addressed during subsequent stages of the land use development process.

Maintenance of landform and soil stability

Landforms and soils throughout the project area are prone to mobilisation following disturbance of the stabilising vegetation cover. Initial development within the project area will result in direct disturbance through earthworks and clearing. Measures to restabilise disturbed areas will therefore need to be implemented as part of the initial development process. To ensure this occurs, the proposed rezoning amendment should incorporate provisions requiring the preparation and implementation of a landform/soil/earthworks management plan.

Management of human pressures on the coastal zone Conservation Areas

The project area adjoins the area designated for coastal conservation over a distance of about nine kilometres and as allotments within the project area are taken up, there is the potential for human pressures on the adjacent coastal zone to increase.

It is recognised that this issue is appropriately addressed through the rezoning and development management processes. However, as previously indicated, the Structure Plan should identify the need for these matters to be addressed in this way.

5.0 Conclusions

The desktop environmental assessment of the Horrocks Structure Plan area indicates that potential environmental constraints need to be considered in the following contexts:

- issues such as the occurrence of Declared Rare Flora and existence of Aboriginal Heritage sites which have the potential to influence where development can occur within the Structure Plan area; and
- issues such as the maintenance of landform and soil stability and the control of rural type uses which have the potential to influence how development within the Structure Plan area should be managed.

While issues relating to where development can occur within the Structure Plan area will need to be resolved during the process of finalising the Plan, it is recognised that those relating to how development within the Structure Plan should be managed are appropriately addressed through zoning provisions. However, as it will form part of the overall planning and management framework for future development at Horrocks, the Structure Plan needs to establish an appropriate context for subsequent phases of the planning and development control processes (the subsequent rezoning amendment for example).

As indicated in Section 4, there are several issues that will need to be addressed in responding to these potential constraints and completion of the following further investigations would assist in this regard:

- Spring flora and vegetation survey undertaken in the months of August-September when flowering of DRF and priority species is prominent – this survey should fulfil the requirements of EPA Position Statement No. 3 (EPA 2002) appropriate to the Geraldton Sand plain bioregion.

- A brief fauna survey of the project area prior to construction to determine if threatened fauna are utilising the area – the fauna survey should be incorporated into the flora and vegetation survey and if direct or indirect evidence of threatened species is identified, CALM should be consulted regarding appropriate management.

- Archaeological and Ethnographic Aboriginal Heritage surveys – because of the historical indigenous use of the area and the proximity to Bowes River, proactive surveys would reduce the risk of delay as a result of encountering previously unrecorded material or site/s during development.

Additionally, preparation of the following management plans prior to the commencement of initial site development would also assist in safeguarding against adverse impacts associated with the potential constraints:

- Landform/soil/earthworks management plan – this should be prepared in consultation with the relevant State and Local Government bodies (eg Shire of Northampton, Agriculture WA and the Departments of CALM and Environment).

- Management plan for the coastal conservation area – in the event that such a plan does not already exist, it should be prepared in consultation with the relevant State and Local

Government bodies (eg Shire of Northampton and the Departments of Planning and Infrastructure, CALM and Environment) to cater for increased pressure on these areas.

Documentation supporting the proposed amendment would also need to address environmental issues associated with the provision of services and infrastructure, particularly in the event that the larger Rural Residential and Rural Smallholding lots were to depend on on-site facilities. Relocation of the tip site and the buffer around the sewage treatment plant should also need to be addressed in this context.

It also needs to be recognised that, for the following reasons, any rezoning amendment providing for further development within the Horrocks Townsite, once adopted by the Shire of Northampton, would probably require referral to the Department of Environment / Environmental Protection Authority for determination of environmental review requirements:

- the extent of the project area and its proximity to the coastal zone;
- the known occurrence of Declared Rare Flora within the project area; and
- the requirement for clearing of remnant native vegetation to facilitate the proposed development.

To facilitate consideration of assessment requirements, the rezoning amendment would need to be supported by appropriate environmental documentation incorporating for example outcomes from the Aboriginal Heritage and the flora, vegetation and fauna surveys.

Depending on the outcome of the referral, application to the Commissioner of Soil and Land Conservation may need to be made prior to clearing.

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Figures

Figure 1.1 Location Map Horrocks Beach Structure Plan

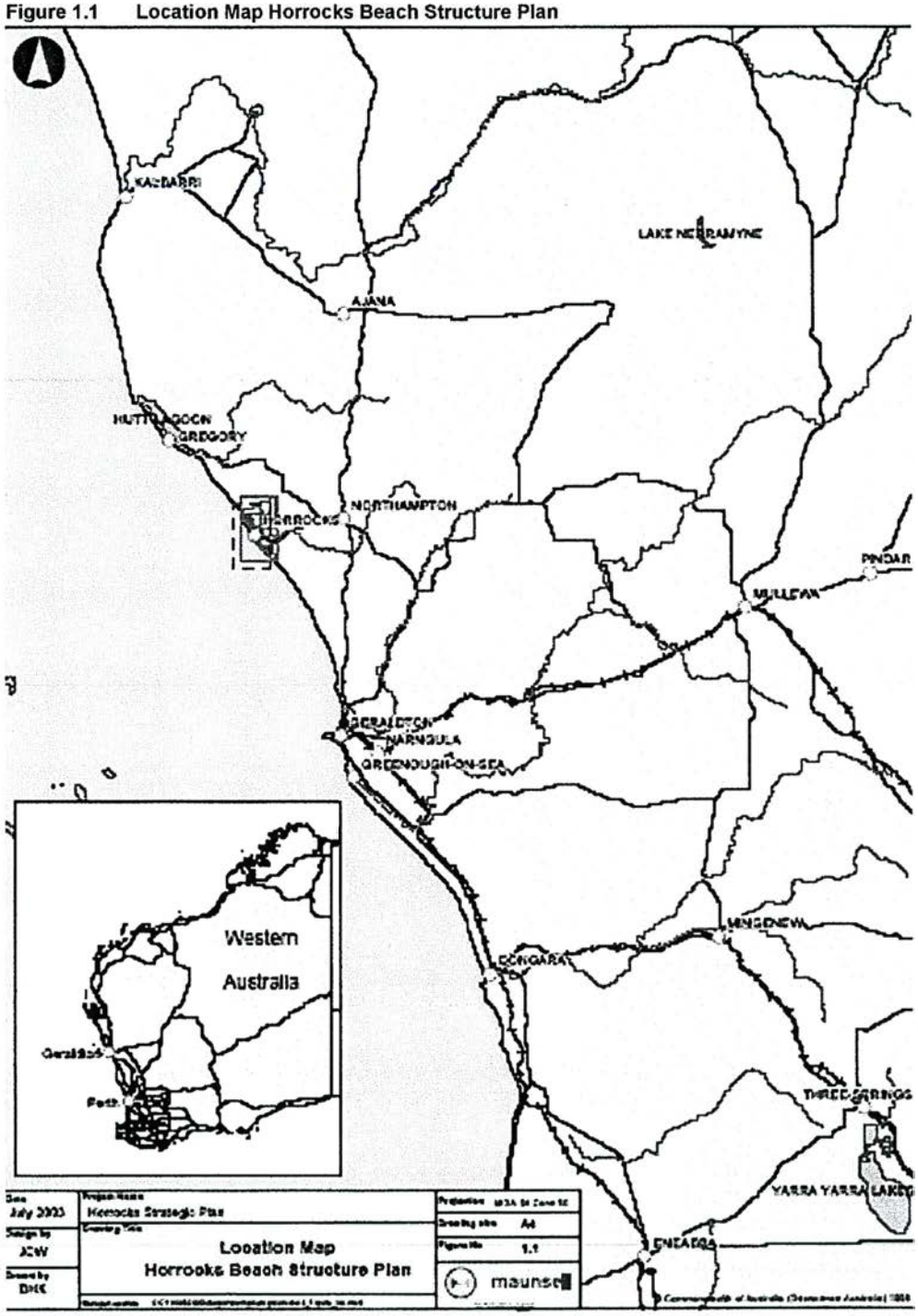
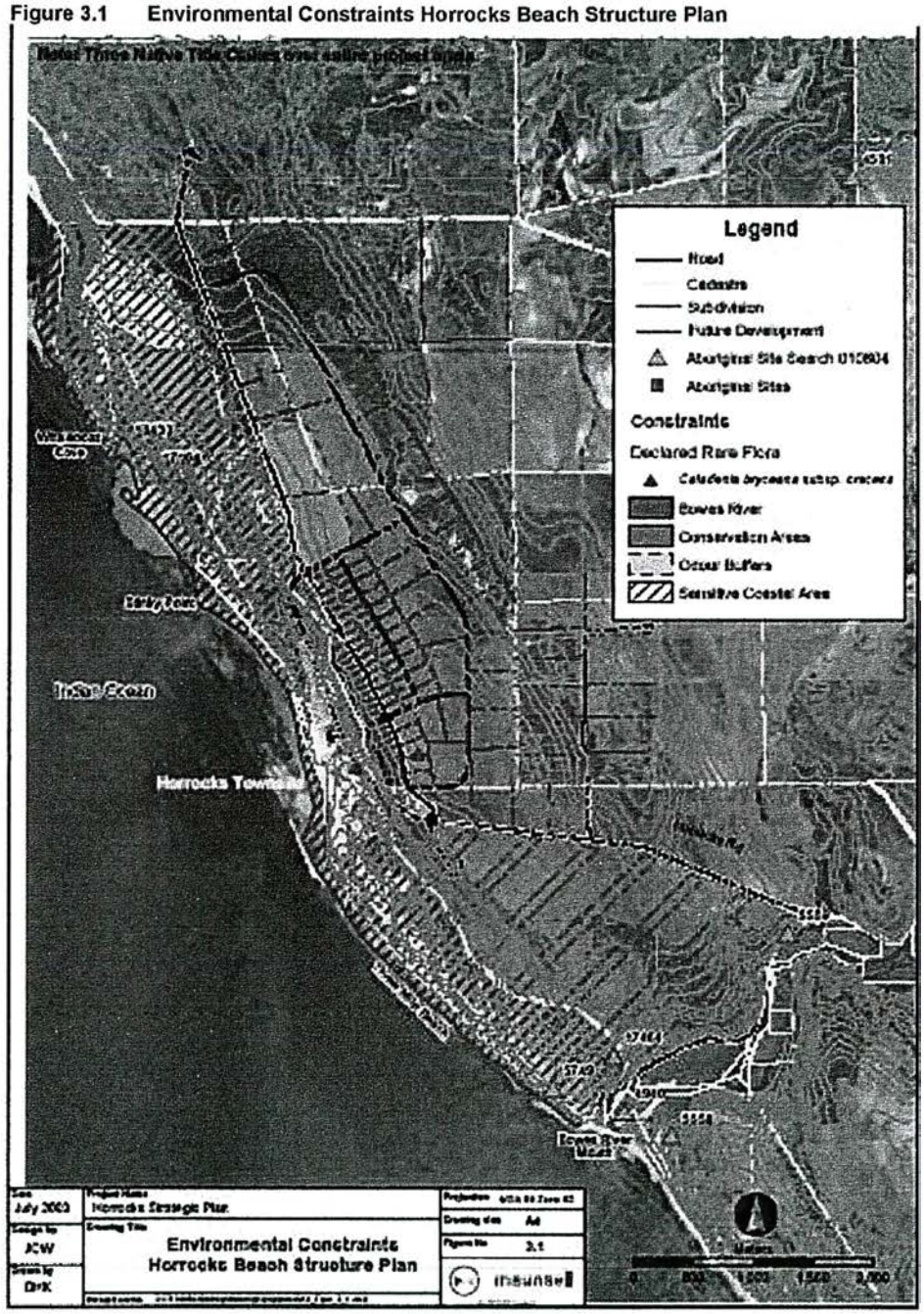


Figure 3.1 Environmental Constraints Horrocks Beach Structure Plan



Appendix A Flora and Vegetation - Database Results and List of Vascular Flora

WESTERN AUSTRALIAN HERBARIUM DATABASE RESULTS

Family		Taxon				Status
Algae		*Algae*	sp.			
		Callophycus	*oppositifolius*			
		Codium	*dimorphum*			
		Cystophyllum	sp.			
		Dictyopteris	*secundispiralis*			
		Lenormandia	*muelleri*			
		Padina	*fraseri*			
		Platythalia	sp.			
		Zonaria	*turneriana*			
Aizoaceae		*Carpobrotus*	*virescens*			
		Disphyma	*crassifolium*	subsp.	*clavellatum*	
	*	*Tetragonia*	*decumbens*			
		Tetragonia	*implexicoma*			
Amaranthaceae		*Ptilotus*	*eriotrichus*			
		Ptilotus	*helichrysoides*			
		Ptilotus	*manglesii*			
		Ptilotus	*villosiflorus*			
Anthericaceae		*Arthropodium*	sp.			
		Dichopogon	*capillipes*			
		Thysanotus	*manglesianus*			
		Tricoryne	*elatior*			
Apiaceae		*Eryngium*	*pinnatifidum*			
		Trachymene	*pilosa*			
Asteraceae		*Angianthus*	*cunninghamii*			
		Brachyscome	*iberidifolia*			
		Cephalosorus	*carpesioides*			
		Gnephosis	*tenuissima*			
		Hyalosperma	*cotula*			
		Olearia	*dampieri*			ms
		Podotheca	*gnaphalioides*			
	*	*Reichardia*	*tingitana*			
		Rhodanthe	*chlorocephala*	subsp.	*rosea*	
		Rhodanthe	*manglesii*			
		Rhodanthe	*spicata*			
	*	*Ursinia*	*anthemoides*			
		Vittadinia	*cervicularis*	var.	*occidentalis*	P1
		Waitzia	*nitida*			
Boraginaceae	*	*Echium*	*plantagineum*			
		Halgania	*bebrana*			

WESTERN AUSTRALIAN HERBARIUM DATABASE RESULTS

Family		Taxon				Status
		Halgania	*sericiflora*			
Caesalpiniaceae		*Labichea*	*lanceolata*	subsp.	*lanceolata*	
Caryophyllaceae	*	*Polycarpon*	*tetraphyllum*			
Casuarinaceae		*Casuarina*	*obesa*			
Chenopodiaceae		*Rhagodia*	*preissii*	subsp.	*obovata*	
		Salsola	*tragus*			
		Salsola	*tragus*	subsp.	*tragus*	
		Threlkeldia	*diffusa*			
Colchicaceae		*Wurmbea*	*densiflora*			
		Wurmbea	*monantha*			
Cunoniaceae		*Aphanopetalum*	*clematideum*			
Cyperaceae		*Cyperus*	*gymnocaulos*			
Dasypogonaceae		*Lomandra*	*maritima*			
Dilleniaceae		*Hibbertia*	*acerosa*			
		Hibbertia	*hypericoides*			
		Hibbertia	*potentilliflora*			
		Hibbertia	*spicata*			
		Hibbertia	*spicata*	subsp.	*spicata*	
Dioscoreaceae		*Dioscorea*	*hastifolia*			
Euphorbiaceae		*Phyllanthus*	*calycinus*			
		Phyllanthus	*scaber*			
	*	*Ricinus*	*communis*			
Geraniaceae	*	*Erodium*	*cicutarium*			
Goodeniaceae		*Dampiera*	*altissima*			
		Dampiera	*lindleyi*			
		Goodenia	*berardiana*			
		Scaevola aff.	*humifusa*			
		Scaevola	*canescens*			
		Scaevola	*crassifolia*			
		Scaevola	*humifusa*			
		Scaevola	*phlebopetala*			
		Scaevola	*porocarya*			
		Scaevola	*tomentosa*			

WESTERN AUSTRALIAN HERBARIUM DATABASE RESULTS

Family	Taxon				Status
	Scaevola	*virgata*			
Gyrostemonaceae	*Tersonia*	*cyathiflora*			
Haemodoraceae	*Anigozanthos*	*humilis*	subsp.	*humilis*	
	Conostylis	*candicans*	subsp.	*calcicola*	
	Conostylis	*prolifera*			
	Conostylis	*stylidioides*			
Iridaceae	*Patersonia*	*occidentalis*			
Juncaceae	*Juncus*	*radula*			
Lamiaceae	*Lachnostachys*	*eriobotrya*			
	Pityrodia	*loxocarpa*			
	Westringia	*dampieri*			
Lauraceae	*Cassytha*	*racemosa*			
Loganiaceae	*Logania*	*litoralis*			
Loranthaceae	*Amyema*	*fitzgeraldii*			
	Amyema	*linophylla*	subsp.	*linophylla*	
Mimosaceae	*Acacia*	Sect. Phyllod. *(microbotrya sens lat)*			
	Acacia	*alata*	var.	*biglandulosa*	
	Acacia	*blakelyi*			
	Acacia	*brumalis*			
	Acacia	*ericifolia*			
	Acacia	*idiomorpha*			
	Acacia	*microbotrya*			
	Acacia	*pelophila*			P1
	Acacia	*pulchella*	var.	*goadbyi*	
	Acacia	*restiacea*			
	Acacia	*rostellifera*			
	Acacia	*xanthina*			
Myoporaceae	*Eremophila*	*glabra*	subsp.	*albicans*	
Myrtaceae	*Calytrix*	*fraseri*			
	Chamelaucium	*uncinatum*			
	Eremaea	*ebracteata*	var.	*ebracteata*	
	Eucalyptus	*arachnaea*	subsp.	*arachnaea*	
	Eucalyptus	*camaldulensis*	var.	*obtusa*	
	Eucalyptus	*cuprea*			R

WESTERN AUSTRALIAN HERBARIUM DATABASE RESULTS

Family		Taxon					Status
		Eucalyptus	*obtusiflora*				
		Eucalyptus	*subangusta*	subsp.	*subangusta*		
		Hypocalymma	*angustifolium*				
		Melaleuca aff.	*megacephala*				
		Melaleuca	*cardiophylla*				
		Melaleuca	*depressa*				
		Melaleuca	*huttensis*				P1
		Melaleuca	sp.				
		Melaleuca	*teretifolia*				
		Melaleuca	*uncinata*				
		Melaleuca	*viminea*	subsp.	*viminea*		
		Scholtzia	*laxiflora*				
		Thryptomene	*baeckeacea*				
Oleaceae		*Jasminum*	*calcarium*				
Orchidaceae		*Caladenia*	*bryceana*	subsp.	*cracens*	ms	R
		Caladenia	*elegans*			ms	R
		Caladenia	*hoffmanii* x *longicauda*				
		Caladenia	*longicauda*	subsp.	*borealis*		
		Cyanicula	*gemmata*				
		Diuris	*recurva*				P4
		Oligochaetochilus	sp.*Northampton*(S.D.Hopper 3349)			PN	R
Oxalidaceae	*	*Oxalis*	*corniculata*				
Papilionaceae		*Bossiaea*	*eriocarpa*				
		Bossiaea	*spinescens*				
		Chorizema	*racemosum*				
		Daviesia	*hakeoides*	subsp.	*hakeoides*		
		Daviesia	*pedunculata*				
		Gastrolobium	*oxylobioides*				
		Gastrolobium	*propinquum*				P1
		Gompholobium	*glutinosum*			ms	
		Indigofera	*occidentalis*			ms	
		Isotropis	sp.*Shark Bay*(M.E.Trudgen 7170)			PN	
		Leptosema	*macrocarpum*				
		Lotus	*australis*				
		Mirbelia	*spinosa*				
		Nemcia	*reticulata*				
		Swainsona	*canescens*				
Phormiaceae		*Stypandra*	*glauca*				
Poaceae		*Austrostipa*	*nitida*				
		Eriachne	*ovata*				

WESTERN AUSTRALIAN HERBARIUM DATABASE RESULTS

Family		Taxon					Status
		Neurachne	*alopecuroidea*				
	*	*Rostraria*	*pumila*				
		Spinifex	*longifolius*				
		Themeda	*triandra*				
Polygalaceae		*Comesperma*	*calymega*				
		Muehlenbeckia	*adpressa*				
Primulaceae	*	*Anagallis*	*arvensis*	var.	*caerulea*		
Proteaceae		*Banksia*	*attenuata*				
		Dryandra	*borealis*	subsp.	*borealis*		
		Dryandra	*sessilis*	var.	*flabellifolia*		
		Grevillea	*argyrophylla*				
		Grevillea	*commutata*	subsp.	*commutata*		
		Grevillea	*intricata*				
		Grevillea	*leucopteris*				
		Grevillea	*pinaster*				
		Isopogon	*divergens*				
Ranunculaceae		*Clematis*	*linearifolia*				
Restionaceae		*Desmocladus*	*asper*				
Rhamnaceae		*Cryptandra*	*arbutiflora*	var.	*borealis*		
		Cryptandra	*nudiflora*				P3
		Stenanthemum	*gracilipes*				P1
Rutaceae		*Boronia*	*cymosa*				
		Diplolaena	*grandiflora*				
		Geleznowia	*verrucosa*				
		Geleznowia	*verrucosa*	subsp.	*formosa*	ms	P3
Santalaceae		*Anthobolus*	*foveolatus*				
		Exocarpos	*sparteus*				
Sapindaceae		*Diplopeltis*	*huegelii*	subsp.	*subintegra*		
		Diplopeltis	*petiolaris*				
		Dodonaea	*pinifolia*				
Solanaceae		*Anthocercis*	*ilicifolia*	subsp.	*ilicifolia*		
		Anthocercis	*littorea*				
		Solanum	*oldfieldii*				
		Solanum	*symonii*				
Sterculiaceae		*Commersonia*	*gaudichaudii*				

WESTERN AUSTRALIAN HERBARIUM DATABASE RESULTS						
Family		**Taxon**				**Status**
		Lasiopetalum	*angustifolium*			
		Rulingia	*malvifolia*	var.	*borealis*	
Stylidiaceae		*Stylidium*	*brunonianum*			
		Stylidium	*elongatum*			
		Stylidium	*piliferum*			
		Stylidium	*septentrionale*			
Surianaceae		*Stylobasium*	*spathulatum*			
Thymelaeaceae		*Pimelea*	*angustifolia*			
		Pimelea	*floribunda*			
		Pimelea	*gilgiana*			
Urticaceae		*Parietaria*	*debilis*			
Verbenaceae	*	*Lantana*	*camara*			
Violaceae		*Hybanthus*	*calycinus*			
Vitaceae		*Clematicissus*	*angustissima*			
Zygophyllaceae		*Zygophyllum*	*fruticulosum*			
		Zygophyllum	*simile*			

SPECIES	LOCLOCATION	LAT			LONG			HABITAT1	HABITAT2
Acacia pelophila	P1 Between Northampton and Lynton	28	16	56.5	114	27	54	E Shrub 3-4 ft	Acacia pelophila ms
Gastrolobium grandiflorum	P4 22 km NW of Northampton, on Port Gregory Road	28	17	20.5	114	24	30.5	E 1-2 m shrub, flowering -Red, winter creek spreading to floodway, grey clay soil. Large shrub	Gastrolobium grandiflorum
Seawinia orthotricha	P3 Web Road, 13 km W of North West Coastal Highway	28	16	8.5	114	31	2.5	E 4m t, compact shrub 70 cm high x 40 cm wide. Flowers white, purple stripes in throat. Hard, smooth bark. Deep, tight backed tap root. Nondescript small. Hill, dry. Brown gravelly sandy clay. Scrub	
Calothamnia elegans ms	R Road.	28	16	0.5	114	30	0.5	E Tall plants with lemon yellow flowers. On gradual slope W aspect, near crest of low hill 200 metres N of low breakaway. In brown clay loam over laterite. winter wet. Area burnt two years previous. Growing in remnant Acacia, Melaleuca scrub over open dwarf scrub. 200+ in flower, some grow to	Calothamnia elegans ms
Eucalyptus cupres	R 15 miles along the Northampton - Lynton (Lynton) Road	28	17	0.5	114	24	0.5		Eucalyptus cupres ms
Cryptandra nudiflora	P4 Between Northampton and Lynton	28	16	56.5	114	27	54	E Shrub 1 ft flowers reddish brown	Brachyloma bilobum
Stenanthemum precipes	P1 2.1 km S of Port Gregory Road on farm track opposite junction with Swamp Road, rocky rise in centre of Reserve, S of Gully	29	19	0.5	114	25	31.5	E aspect edge, mossl yellow brown sandy loam & sandstone conglomerate & boulders. Low heath assoc. with Thryptomene sp., Acacia acuminata, Gastrolobium Stylandra glauca	Cryptandra precipes
Dicrastylis reticulata	P4 2.1 km S of Port Gregory Road on track opposite junction with Swamp Road, Shire Reserve 9106	29	19	0.5	114	25	31.5	C Upright plant, 30 cm high. Damp gentle slope above gully, yellow brown sandy clay. Heath to 0.5 m with open Acacia scrub, assoc. with Thryptomene sparsa	
Dicrastylis reticulata	P4 Narrow strip of bush on S side of Port Gregory road, ca 17 km W/NW of Northampton	29	19	0.5	114	29	0.5	E Erect tuberous herb to 30 cm high. Flowers garish, fleshfred with brown markings. In wet clay-swamp at foot of laterite hill. Amongst low shrubs including Acacia sp., Hypocalymma sp. and Hakea obliqua	Dicrastylis longifolia
Calothamnia tryssena subsp. crassa ms	R Horrocks Beach, W of Northampton Hills above cataract pipe	28	22	0.5	114	24	0.5	E Dwarf tuberous herb to 5 cm high, in calcareous sand over heavy limestone, in shrubland of Acacia	
Villadiclis serviculata var. occidentalis	SR Between Northampton and Lynton	28	18	0.5	114	28	0.5	E Flowers blue	Villadiclis pen ovalis
Cryptandra nudiflora	P4 & S road verges at 17.3 km W along Port Gregory Road from turnoff North West Coastal Highway at Northampton for 900 m W or 17.5 km	29	17	15.5	114	28	34.5	E St slope low plain with yellow-orange & grey loamy clay. Open low heath to 0.5 m, Thryptomene sp. with emergent Acacia sp. & Hakea preissii assoc. with Calothrinia elegans, Dicrastylis sp. Northampton, Borya sp., Stylidium sp.	
Oligochaetochilus sp Northampton(S.D.Hopper 3349) PN	R Picnic ground & Pine Shire Reserve, S of Northampton-Port Gregory Road, opp. intersection with Swamp Road, at 2.1 km S down farm track	29	18	0.5	114	29	9.5	E Is aspect slope, brown yellow sand clay. Open Acacia scrub with Thryptomene sp. to 0.5 m, assoc with Hakea recurva, Gastrolobium sp., Phebalium gracile, Calothrinia elegans, Dicrastylis reticulata, Hypocalymma sp., Hibbertia sp., Mirbelia sp.	Pterostylis sp Northampton(S.D.Hopper 3349)
Oligochaetochilus sp Northampton(S.D.Hopper 3349) PN	R 16 km WNW of Northampton, 12 km NE of Horrocks, on Port Gregory Road	29	18	0.5	114	30	9.5	E In full flower, orenulate leaves. Gradual slope, W aspect, near crest of low hill, 200 m N of low breakaway. Brown clay loam over laterite, some wet. Growing in remnant Acacia, Melaleuca scrub over open dwarf scrub. 20+ plants. Area burnt two years previous	Pterostylis sp Northampton(S.D.Hopper 3349)
Eucalyptus blaseki	R Swamp Road 3.6-4.8 km N of Port Gregory Road just W of Port Road, treestrigen and flats below Trace of Mount Mosher	29	16	6	114	29	1	E clumps of Mallee Eucalyptus spp	Eucalyptus blaseki
Eucalyptus cupres	R HUt River, between Northampton and Lynton	28	17	0.5	114	24	0.5	E Tree 20-25 feet, trunk barked. Clay flat	Eucalyptus cupres ms
Acacia pelophila	P1 Property of R. Keen, Port Gregory Road. N. of Northampton	29	16	56.5	114	27	54.5	E Low plain, moist grey fluviatile gravel and sandstone. Dense low shrubland with scattered emergent Shrub to 2 m tall. Flowers globular (flowering commencing late July). Along creekline. In white clay with some red/brown silt over white saline clay. With Eucalyptus wandrawa, Gastrolobium and	Acacia sp.
Oligochaetochilus sp Northampton(S.D.Hopper 3349) PN	R 16 km WNW of Northampton, 12 km NE of Horrocs, on Port Gregory Road	29	18	0.5	114	30	9.5	E In full flower, orenulate leaves. Gradual slope, W aspect, near crest of low hill, 200 m N of low breakaway. Brown clay loam over laterite, some wet. Growing in remnant Acacia, Melaleuca scrub over open dwarf scrub. 20+ plants. Area burnt two years previous	Pterostylis sp Northampton(S.D.Hopper 3349)
Calothamnia elegans ms	R 2.1 km S of Port Gregory Road on track opposite junction with Swamp Road, Shire Reserve 9106	29	19	0.5	114	29	31.5	E Upright plant, 30 cm tall. Damp gentle slopes above gully, yellow brown sandy clay. Heath to 0.5 m with open Acacia scrub, assoc. with Thryptomene sparsa	Calothamnia elegans ms
Calothamnia elegans ms	R Narrow strip of bush on S side of Port Gregory Road, ca 17 km W/NW of Northampton	29	19	0.5	114	29	0.5	E Erect tuberous herb to 30 cm high with pale yellow flowers, usually one but occasionally two. In wet clay swamp at foot of laterite hill. Amongst low shrubs including Acacia sp., Hypocalymma sp. and Hakea	Calothamnia elegans ms
Calothamnia elegans ms	R 16 km WNW of Northampton, 12 km NE of Horrocs on Port Gregory Road	29	19	0.5	114	30	0.5	E Small plant. Flowers crimson with a faint tinge of yellow in throat, clay loam over laterite on series wet, granular slope with W aspect, near crest of low hill. Area burnt two years previous. Growing in remnant Acacia, Melaleuca scrub over open dwarf scrub. 20+ plants in full flower	Calothamnia denticulata
Gastrolobium propinquum	P1 Port Road, 18.5 km W of North West Coastal Highway	29	16	10.5	114	30	56.5	E Erect, compact shrub 80 cm high x 80 cm wide. Standard yellow red at base, keel and wings red	
Gastrolobium propinquum	P1 19 km (10 miles) W of Northampton road to Port Gregory	29	19	0.5	114	29	0.5	E Smooth, hard bark. Deep, tight barked tap root. Nondescript small. Hill, dry yellow stony slopes	
Calothrinia elegans ms	R Ca 13 km WNW of Northampton, on road to Port Gregory	29	16	0.5	114	29	0.5	E 50 cm bush. Flowers orange and red-brown. In creek wash, brown sand	Gastrolobium propinquum
Calothrinia elegans ms	R 13.5 W along Port Gregory Road from North West Coastal	29	16	0.5	114	29	0.5	E Erect tuberous herb 30 cm high, flowers yellow, fetid/turn with red striping. Wet sticky clay. Amongst low shrubs, common	Calothamnia denticulata subsp. lanuta
Galeichrysea verticillata subsp. formosa ms	P2 Highway Northampton	29	17	19.5	114	30	37.5	E Erect perennial, shrub. Yellow flowers. Tap roots with tight knot bark texture. Strong root bark smell. Growth prime active. Gravel pit. Gravelly brown sandy clay over laterite. Scrubland. Frequent	
Melaleuca huttoniana	P1 Between Northampton and Lynton	28	16		5	114	27	0 Loose straggling shrub. 2-4 m creamy-white	Melaleuca viridiflo

SPECIES	CONS	POPID	LAT	LONG	VESTING	PURPOSE
Acacia pelophila	1	1	28^16'39.5"	114^28'42.1"		PRI
Caladenia bryceana subsp. cracens	R	3	28^22'56.5"	114^26'19.1"		PRI
Caladenia elegans	R	1	28^18'00.2"	114^29'16.0"	VER	SHI
Caladenia elegans	R	6	28^19'05.0"	114^29'34.0"	PIC	SHI
Caladenia elegans	R	7A	28^17'55.5"	114^27'53.1"	VER	SHI
Caladenia elegans	R	7B	28^17'55.5"	114^27'53.1"		PRI
Caladenia elegans	R	7C	28^17'55.5"	114^27'53.1"		PRI
Caladenia elegans	R	10A	28^21'37.0"	114^29'24.0"	VER	SHI
Caladenia elegans	R	10B	28^21'37.0"	114^29'24.0"		PRI
Caladenia hoffmanii subsp. hoffmanii	R	3	28^17'57.5"	114^29'19.1"	VER	SHI
Diuris recurva	4	2	28^18'06.5"	114^29'50.1"	VER	SHI
Eremophila brevifolia	1	4A	28^21'01.1"	114^29'23.1"		PRI
Eremophila brevifolia	1	4B	28^21'37.0"	114^29'24.0"	VER	SHI
Eucalyptus blaxellii	R	15A	28^16'39.5"	114^28'42.1"		PRI
Eucalyptus blaxellii	R	15B	28^16'39.5"	114^28'42.1"		PRI
Pterostylis sp.Northampton(S.D.Hopper 3349) pn		4	28^19'00.5"	114^29'39.1"	PIC	SHI
Pterostylis sp.Northampton(S.D.Hopper 3349) pn		5	28^20'35.6"	114^29'24.8"		PRI
Stenanthemum gracilipes	1	1	28^18'55.5"	114^29'36.1"	PIC	SHI

Appendix B Control Codes for Declared Plants

DEPARTMENT OF AGRICULTURE WESTERN AUSTRALIA

DECLARED PLANT LIST

Standard Control Codes (these may vary for individual plants)

P1 **REQUIREMENTS** Prohibits movement	The movement of plants or their seeds is prohibited within the State. This prohibits the movement of contaminated machinery and produce including livestock and fodder.
P2 **REQUIREMENTS** Aim is to eradicate infestation	Treat all plants to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.
P3 **REQUIREMENTS** Aims to control infestation by reducing area and/or density of infestation	The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants:- • within 100 metres inside of the boundaries of the infestation • within 50 metres of roads and highwater mark on waterways • within 50 metres of sheds, stock yards and houses Treatment must be done prior to seed set each year. Of the remaining infested area:- • where plant density is 1-10 per hectare treat 100% of infestation • where plant density is 11-100 per hectare treat 50% of infestation • where plant density is 101-1000 per hectare treat 10% of infestation Properties with less than 2 hectares of infestation must

	treat the entire infestation. Additional areas may be ordered to be treated.
P4 **REQUIREMENTS** Aims to prevent infestation spreading beyond existing boundaries of infestation.	The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants:- • within 100 metres inside of the boundaries of the infested property • within 50 metres of roads and highwater mark on waterways • within 50 metres of sheds, stock yards and houses Treatment must be done prior to seed set each year. Properties with less than 2 hectares of infestation must treat the entire infestation. Additional areas may be ordered to be treated.
Special considerations	In the case of P4 infestations where they continue across property boundaries there is no requirement to treat the relevant part of the property boundaries as long as the boundaries of the infestation as a whole are treated. There must be agreement between neighbours in relation to the treatment of these areas.
P5 **REQUIREMENTS**	Infestations on public lands must be controlled.

Appendix C CALM State Threatened Ecological Community Database

List of Communities on CALM's Threatened Ecological Community data base

Community Identifier	Community name	Category of Threat and criteria met under WA criteria	Category under Commonwealth *Environmental Protection and Biodiversity Act*
1. SCP20a	Banksia attenuata woodland over species rich dense shrublands	EN B) ii)	
2. TOOLIBIN	Perched wetlands of the Wheatbelt region with extensive stands of living Swamp Sheoak (*Casuarina obesa*) and Paperbark (*Melaleuca strobophylla*) across the lake floor.	CR A) i); CR A) 11), CR C)	EN
3. SCP10b	Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)	CR B) ii)	EN
4. SCP19	Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	CR B) ii)	EN
5. Clifton-microbialite	Stromatolite like freshwater microbialite community of coastal brackish lakes (Lake Clifton)	CR B) i), CR B) ii)	
6. Richmond-microbial	Stromatolite like microbialite community of coastal freshwater lakes (Lake Richmond)	CR B)i), CR B) ii)	EN
7. Mound Springs SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	CR A) i), CR A) ii), CR B) i), CR B) ii)	EN
8. SCP20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain	CR B) ii)	EN
10. NTHIRON	Perth to Gingin Ironstone Association	CR A) ii), CR B) ii), CR C)	EN
11. MUCHEA LIMESTONE	Shrublands and woodlands on Muchea Limestone	EN B) ii)	EN
12. Augusta-microbial	Rimstone Pools and Cave Structures Formed by Microbial Activity on Marine Shorelines	EN B) ii)	
13. SCP30a	Callitris preissii (or Melaleuca lanceolata) forests and woodlands, Swan Coastal Plain	VN B)	
14. SCP18	Shrublands on calcareous silts of the Swan Coastal Plain	VN B)	
15. SCP02	Southern wet shrublands, Swan Coastal Plain	EN B) ii)	
16. SCP3a	*Eucalyptus calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain	CR B) ii)	EN
17. SCP3c	*Eucalyptus calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain	CR B) ii)	EN
18. Thetis-microbialite	Stromatolite community of stratified hypersaline coastal lakes	VN B)	
19. SCOTT IRONSTONE	Scott River Ironstone Association	EN B) i), EN B) ii)	
20. SCP20b	Banksia attenuata and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain	EN B) i), EN B) ii)	
21. SCP15	Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain	VN C)	
22. SCP1b	*Eucalyptus calophylla* woodlands on heavy soils of the southern Swan Coastal Plain	VN B)	
23. SCP3b	*Eucalyptus calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain	VN B)	
24. CAVES SCP01	Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain	CR B) i), CR B) ii)	EN
29. CAVES LEEUWIN01	Aquatic Root Mat Community Number 1 of Caves of the Leeuwin Naturaliste Ridge	CR B) i), CR B) ii)	EN

30. CAVES LEEUWIN02	Aquatic Root Mat Community Number 2 of Caves of the Leeuwin Naturaliste Ridge	CR B) i), CR B) ii)	EN
31. CAVES LEEUWIN03	Aquatic Root Mat Community Number 3 of Caves of the Leeuwin Naturaliste Ridge	CR B) i), CR B) ii)	EN
32. CAVES LEEUWIN04	Aquatic Root Mat Community Number 4 of Caves of the Leeuwin Naturaliste Ridge	CR B) i), CR B) ii)	EN
33. MONTANE01	Montane Thicket and Heath of the South West Botanical Province, above approximately 900m above sea level.	CR B) ii)	EN
34. MEELUP GRANITES	Calothamnus graniticus heaths on south west coastal granites	VN B)	
36. SCP07	Herb rich saline shrublands in clay pans	VN B)	
37. SCP08	Herb rich shrublands in clay pans	VN B)	
38. SCP09	Dense shrublands on clay flats	VN B)	
39. SCP10a	Shrublands on dry clay flats	EN B) ii)	
42. Monilla swamp	Perched fresh-water wetlands of the northern Wheatbelt dominated by extensive stands of living *Eucalyptus camaldulensis* (River Red Gum) across the lake floor.	PD B)	
43. Camerons	Camerons Cave Troglobitic Community	CR B) i), CR B) ii)	
44. Brydo	Unwooded freshwater wetlands of the southern Wheatbelt of Western Australia, dominated by *Muehlenbeckia horrida* subsp. *abdita* and *Tecticornia verrucosa* across the lake floor	CR B) i), CR B) ii)	
45. Bundera	Cape Range Remipede Community	CR B) iii)	
46. Greenough River Flats	*Acacia rostellifera* low forest with scattered *Eucalyptus camaldulensis* on Greenough Alluvial Flats.	CR C)	
50. Themeda Grasslands	Themeda grasslands of Pilbara Region. Grassland plains dominated by the perennial Themeda (kangaroo grass) and many annual herbs and grasses.	VN A)	
61. Coombardale chert hills	Heath dominated by one or more of *Rogelia megacephala*, *Kunzea praestans* and *Allocasuarina campestris* on ridges and slopes of the chert hills of the Coombardale floristic region.	EN B) ii)	
62. Billoranga System	Plant assemblages of the Billoranga System (Beard 1976): *Melaleuca filifolia – Allocasuarina campestris* thicket on clay sands over laterite on slopes and ridges; open mallee over mixed scrub on yellow sand over gravel on western slopes; *Eucalyptus loxophleba* woodland over sandy clay loam or rocky clay on lower slopes and creeklines; and mixed scrub or scrub dominated by Dodonaea inaequifolia over red/brown loamy soils on the slopes and ridges	VN A), VN B)	
63. Irwin River Clay Flats	Clay flats assemblages of the Irwin River: Sedgelands and grasslands with patches of Eucalyptus loxophleba and scattered *E. camaldulensis* over *Acacia acuminata* and *A. rosellifera* shrubland on brown sand/loam over clay flats of the Irwin River.	PD A), PD B)	
65. Koolanooka System	Plant assemblages of the Koolanooka System (Beard 1976): Allocasuarina campestris scrub over red loam on hill slopes; Shrubs and emergent mallees on shallow loam red over massive ironstone on steep rocky slopes; *Eucalyptus obbanoensis* subsp. *obbanoensis* mallee and *Acacia* sp. scrub with scattered *Allocasuarina huegeliana* over red loam and ironstone on the upper slopes and summits; *Eucalyptus loxophleba* woodland over scrub on the footslopes; and mixed *Acacia* sp. scrub on granite	VN A), VN B)	

60. Moonagin System	Plant assemblages of the Moonagin System (Beard 1976): Acacia scrub on red soil on hills; Acacia scrub with scattered Eucalyptus loxophleba and Eucalyptus oleosa on red loam flats on the foothills.	VN A), VN B)
62. Limestone ridges (SCP 26a)	*Melaleuca huegelii - Melaleuca acerosa* shrublands on limestone ridges (Gibson *et al.* 1994 type 26a)	EN B) iii)
67. Vine thickets	Vine thickets on coastal sand dunes of Dampier Peninsula	VU C)
70. Mt Lindesay	Mt Lindesay – Little Lindesay Vegetation Complex	EN B) ii)
71. Russell Range	Russell Range mixed thicket complexes	VN B), VN C)
72. Fortescue	Fortescue floristic community (Rocky Springs type)	VU B)
74. Herblands and Bunch Grasslands	Herblands and Bunch Grasslands on gypsum lunette dunes alongside saline playa lakes	VU B)
75. Inoring System	Plant assemblages of the Inoring System (Beard 1976)	VN A)
76. Lesueur-Coomallo Floristic Community D1	Lesueur-Coomallo Floristic Community D1	CR B) i) CR B) ii)
77.Lesueuor-Coomallo Floristic Community A1.2	Lesueur-Coomallo Floristic Community A1.2	EN B) ii)
80. Theda Soak	Theda Soak rainforest	VU A), VU B)
81. Walcott Inlet	Walcott Inlet rainforest swamps	VU B)
82. Roe River	Roe River swamp rainforest	VU B)

Appendix D DEH National Threatened Ecological Community Database

Australian Government
Department of the Environment and Heritage

Threatened Species and Ecological Communities

You are here: DEH Home > Biodiversity > Threatened Species & Ecological Communities

National List of Threatened Ecological Communities

At the commencement of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) the national list of threatened species, ecological communities and threatening processes consisted only of those previously listed under the Endangered Species Protection Act 1992.

Under the EPBC Act new categories have been added for listed threatened species and ecological communities. Critically endangered, conservation dependant and extinct in the wild have been added to the previous categories of endangered, vulnerable and extinct for threatened species and critically endangered and vulnerable have been added to the previous category of endangered for ecological communities.

New nominations for species and ecological communities will be assessed under the EPBC Act by the Threatened Species Scientific Committee (TSSC) according to the criteria for the new categories and listed accordingly. The TSSC will reconsider the status of the initial national list of threatened species and communities in line with the new refined EPBC categories as information is updated and made available for assessment.

Community	Status	Effective	View
Aquatic Root Mat Community 1 in Caves of the Leeuwin Naturaliste Ridge	Endangered	16 Jul 00	Details
Aquatic Root Mat Community 2 in Caves of the Leeuwin Naturaliste Ridge	Endangered	16 Jul 00	Details
Aquatic Root Mat Community 3 in Caves of the Leeuwin Naturaliste Ridge	Endangered	16 Jul 00	Details
Aquatic Root Mat Community 4 in Caves of the Leeuwin Naturaliste Ridge	Endangered	16 Jul 00	Details
Aquatic Root Mat Community in Caves of the Swan Coastal Plain	Endangered	16 Jul 00	Details
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	16 Jul 00	Details
Bluegrass (*Dichanthium* spp.) dominant grasslands of the Brigalow Belt Bioregions (North and South)	Endangered	04 Apr 01	Details
Brigalow (*Acacia harpophylla* dominant and co-dominant)	Endangered	04 Apr 01	Details
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	16 Jul 00	Details
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	16 Jul 00	Details
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	16 Jul 00	Details
Cumberland Plain Woodlands	Endangered	16 Jul 00	Details

Eastern Stirling Range Montane Heath and Thicket	Endangered	16 Jul 00	Details
Eastern Suburbs Banksia Scrub of the Sydney Region	Endangered	16 Jul 00	Details
Grassy White Box Woodlands	Endangered	16 Jul 00	Details
Mabi Forest (Complex Notophyll Vine Forest 5b)	Critically Endangered	08 Oct 02	Details
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	Endangered	16 Jul 00	Details
Perched Wetlands of the Wheatbelt region with extensive stands of living sheoak and paperbark across the lake floor (Toolibin Lake)	Endangered	16 Jul 00	Details
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Endangered	16 Jul 00	Details
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	04 Apr 01	Details
Shale/Sandstone Transition Forest	Endangered	04 Apr 01	Details
Shrublands and Woodlands of the eastern Swan Coastal Plain	Endangered	16 Jul 00	Details
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	16 Jul 00	Details
Shrublands and Woodlands on Perth to Gingin ironstone (Perth to Gingin ironstone association) of the Swan Coastal Plain	Endangered	16 Jul 00	Details
Shrublands on southern Swan Coastal Plain ironstones	Endangered	16 Jul 00	Details
Silurian Limestone Pomaderris Shrubland of the South East Corner and Australian Alps Bioregions	Endangered	16 Jul 00	Details
Swamps of the Fleurieu Peninsula	Critically Endangered	21 Mar 03	Details
The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	Endangered	04 Apr 01	Details
Thrombolite (microbial) community of coastal freshwater lakes of the Swan Coastal Plain (Lake Richmond)	Endangered	16 Jul 00	Details

Last updated:

Department of the Environment and Heritage
GPO Box 787 Canberra ACT 2601 Australia
Telephone: +61 (0)2 6274 1111

Appendix E Fauna - Database Search Results

Your Ref:
Our Ref: 2001F001096V03
Enquiries: Peter Orell
Phone: (08) 9334 0454
Fax: (08) 9334 0278
Email: petero@calm.wa.gov.au

DEPARTMENT OF Conservation AND LAND MANAGEMENT

Mr Mike Braimbridge
Halpern Glick Maunsell Pty Ltd
PO Box 81
LEEDERVILLE WA 6902

Dear Mr Braimbridge

REQUEST FOR THREATENED FAUNA INFORMATION

I refer to your request of 12 March for information on threatened fauna occurring in the Horrocks Beach area.

A search was undertaken for this area of the Department's Threatened Fauna database, which includes species which are declared as *'Rare or likely to become extinct* (Schedule 1)', *'Birds protected under an international agreement* (Schedule 3)', and *'Other specially protected fauna* (Schedule 4)'. Attached are print outs from these databases where records were found.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the sixth point that refers to the requirement to undertake field investigations for the accurate determination of threatened fauna occurrence at a site. The information supplied should be regarded as an indication only of the threatened fauna that may be present.

An invoice for $110.00 (includes GST), being the set charge for the supply of this information, will be forwarded.

It would be appreciated if any populations of threatened fauna encountered by you in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss threatened fauna management, please contact my Senior Zoologist, Dr Peter Mawson on 08 93340421.

Yours sincerely

.....

for Keiran McNamara
ACTING EXECUTIVE DIRECTOR

19 March, 2003

WILDLIFE BRANCH: 17 Dick Perry Avenue, Technology Park, Western Precinct, Kensington, Western Australia 6151
Phone: (08) 9334 0455 Fax: (08) 9334 0278 Website: www.naturebase.net
Postal Address: Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983

Attachment

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

THREATENED FAUNA INFORMATION

Conditions In Respect Of Supply Of Information

* All requests for data to be made in writing to the Executive Director, Department of Conservation and Land Management, Attention: Senior Zoologist, Wildlife Branch.

* The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided without the prior consent of the Executive Director, Department of Conservation and Land Management.

* Specific locality information for Threatened Fauna is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for Threatened Fauna may not be used in reports without the written permission of the Executive Director, Department of Conservation and Land Management. Reports may only show generalised locations or, where necessary, show specific locations without identifying species. The Senior Zoologist is to be contacted for guidance on the presentation of Threatened Fauna information.

* Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data, they may be present. The Department of Conservation and land Management accepts no responsibility for this.

* Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.

* It should be noted that the supplied data do not necessarily represent a comprehensive listing of the Threatened Fauna of the area in question. Its comprehensiveness is dependent of the amount of survey carried out within a specified area. The receiving organisation should employ a biologist/zoologist, if required, to undertake a survey of the area under consideration.

* Acknowledgment of the Department of Conservation and Land Management as the source of data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Conservation and Land Management, Attention: Senior Zoologist, Wildlife Branch.

The search of the database indicated that the following threatened and priority fauna occur in the area in question.

Schedule 1 (Fauna which is Rare or likely to become Extinct)

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) This species frequents proteaceous scrubs and heaths and adjacent eucalypt woodlands and also feeds in pine plantations. Breeding occurs mainly in the eastern forests and wheatbelt south of Three Springs.

Schedule 4 (Fauna which is Otherwise Specially Protected)

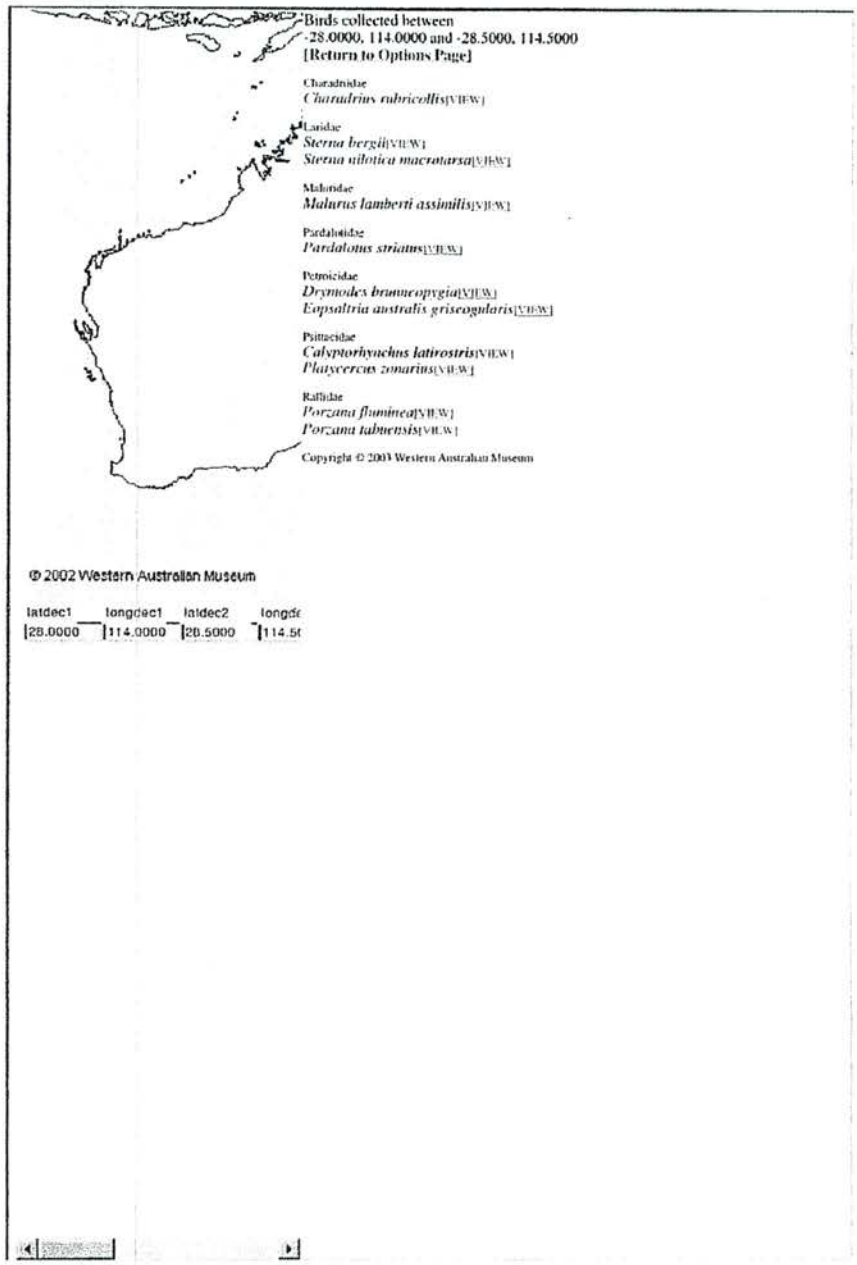
Peregrine Falcon (*Falco peregrinus*) This species is uncommon and prefers areas with rocky ledges, cliffs, watercourses or open woodland. May occur in the area in question.

Priority Taxa

Tammar Wallaby (*Macropus eugenii derbianus*) P4 This species prefers thickets of Melaleuca, Sheoak or other large shrubs associated with grassland. There are two records north of Horrocks Beach from about 1970 and it is possible but unlikely that the species still occurs in the area.

Bush Stonecurlew (*Burhinus grallarius*) P4 A well camouflaged, ground nesting bird which prefers to 'freeze' rather than fly when disturbed. It inhabits open wooded rangelands and may occur in the area in question.

Hooded Plover (*Thinornis rubricolis rubricolis*) P4 This species occurs along the margins and shallows of salt lakes and along sandy beaches.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Charadriidae
Charadrius rubricollis[VIEW]
Laridae
Sterna bergii[VIEW]
Sterna nilotica macrotarsa[VIEW]
Maluridae
Malurus lamberti assimilis[VIEW]
Pardalotidae
Pardalotus striatus[VIEW]
Petroicidae
Drymodes brunneopygia[VIEW]
Eopsaltria australis griseogularis[VIEW]
Psittacidae
Calyptorhynchus latirostris[VIEW]
Platycercus zonarius[VIEW]
Rallidae
Porzana fluminea[VIEW]
Porzana tabuensis[VIEW]
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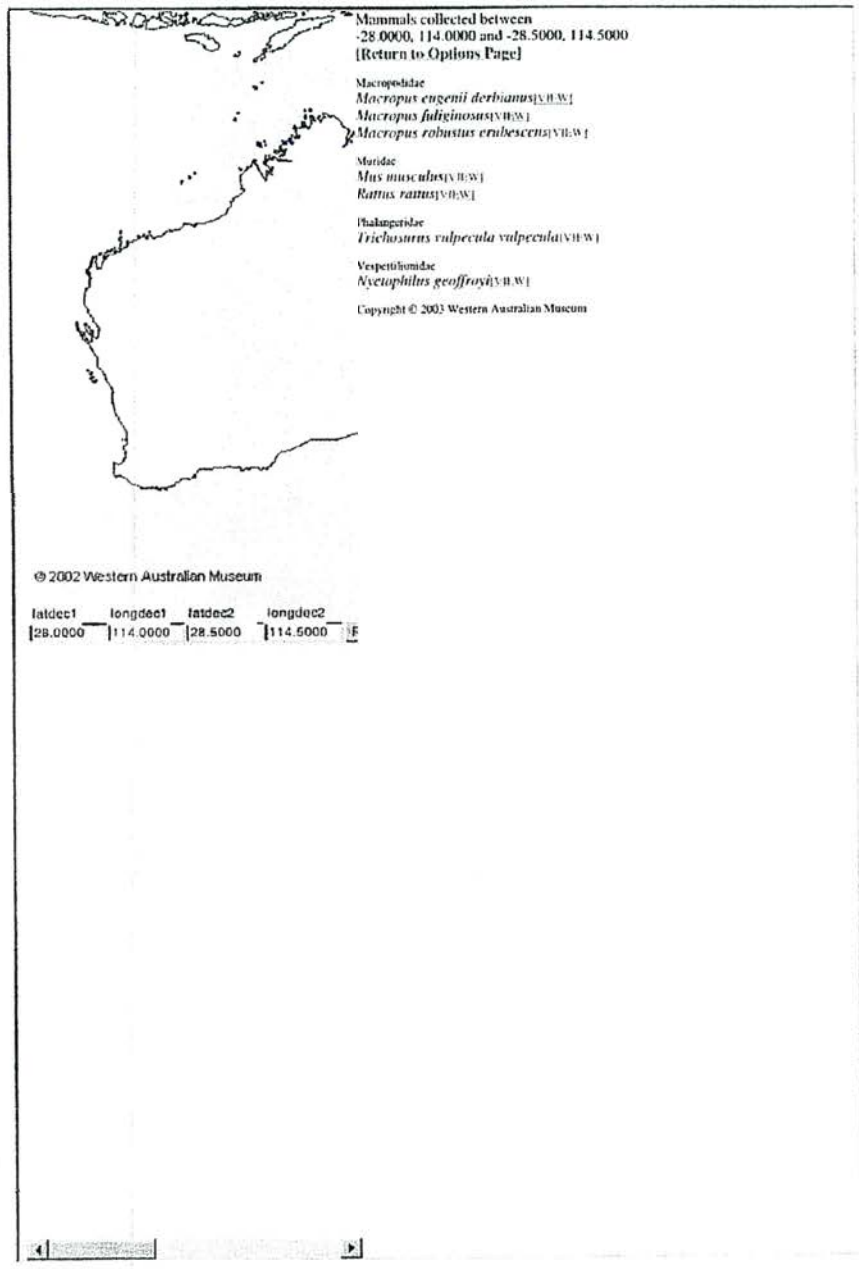
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Macropus robustus erubescens[VHW]
Muridae
Mus musculus[VHW]
Rattus rattus[VHW]
Phalangeridae
Trichosurus vulpecula vulpecula[VHW]
Vespertilionidae
Nyctophilus geoffroyi[VHW]
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© 2002 Western Australian Museum
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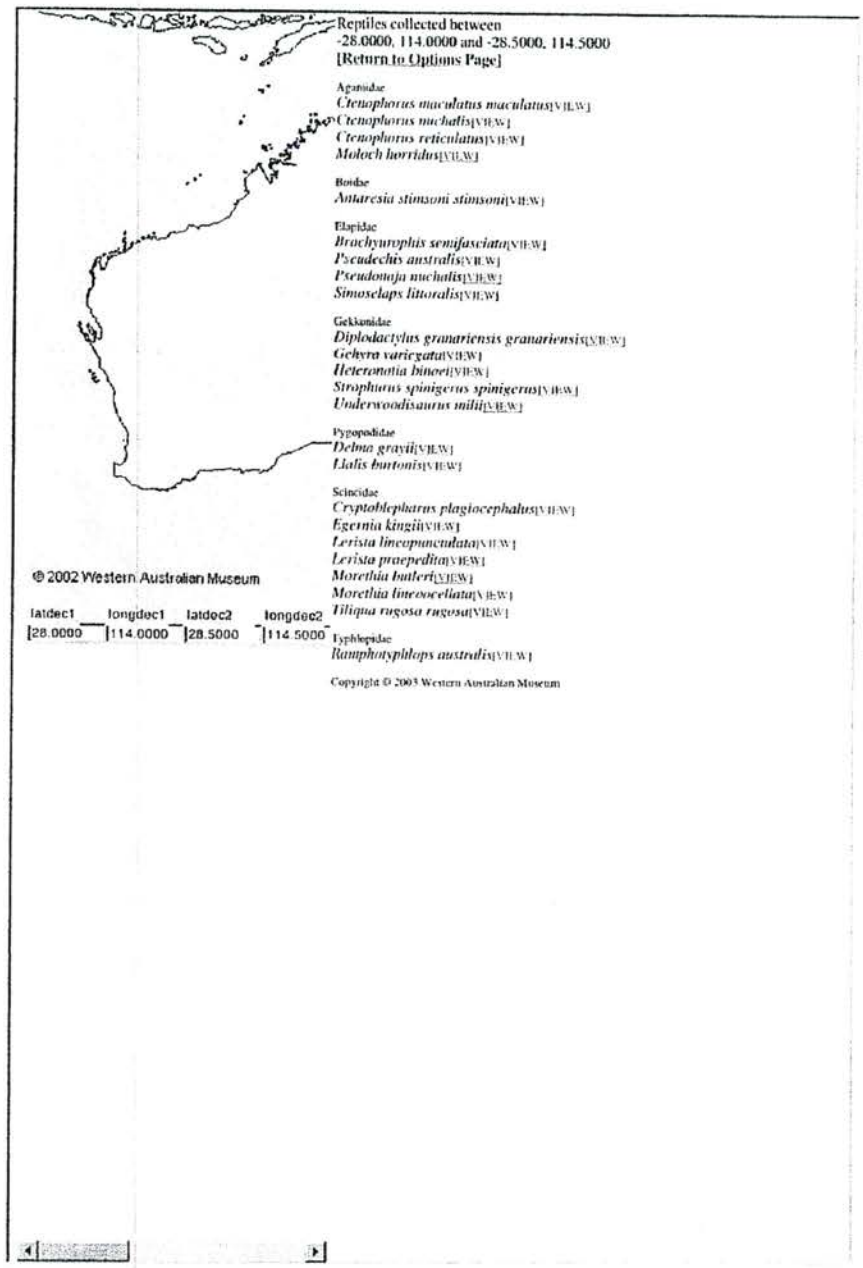
-28.0000 114.0000 -28.5000 114.5000


Reptiles collected between
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Agamidae
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Ctenophorus nuchalis[VIEW]
Ctenophorus reticulatus[VIEW]
Moloch horridus[VIEW]
Boidae
Antaresia stimsoni stimsoni[VIEW]
Elapidae
Brachyurophis semifasciata[VIEW]
Pseudechis australis[VIEW]
Pseudonaja nuchalis[VIEW]
Simoselaps littoralis[VIEW]
Gekkonidae
Diplodactylus granariensis granariensis[VIEW]
Gehyra variegata[VIEW]
Heteronotia binoei[VIEW]
Strophurus spinigerus spinigerus[VIEW]
Underwoodisaurus milii[VIEW]
Pygopodidae
Delma grayii[VIEW]
Lialis burtonis[VIEW]
Scincidae
Cryptoblepharus plagiocephalus[VIEW]
Egernia kingii[VIEW]
Lerista lineopunctulata[VIEW]
Lerista praepedita[VIEW]
Morethia butleri[VIEW]
Morethia lineocellata[VIEW]
Tiliqua rugosa rugosa[VIEW]
Typhlopidae
Ramphotyphlops australis[VIEW]
Copyright © 2003 Western Australian Museum
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Appendix F Heritage - Database Search Results

HERITAGE COUNCIL OF WESTERN AUSTRALIA

HERITAGE COUNCIL | PLACES DATABASE | HERITAGE TRAILS | HELP | MEDIA | WHAT'S NEW | LINKS | FAQS |

| ABOUT US | DEVELOPMENT | INSURANCE | ASSISTANCE | PUBLICATIONS | CASE STUDIES | EDUCATION |

QUICK SEARCH
ADVANCED SEARCH
RESULTS LIST

WHAT IS THE REGISTER
HOW ARE PLACES NOMINATED
ASSESSMENT PROCESS
IMPLICATIONS OF REGISTRATION

Comprehensive Report

HELP

[Back to Place Record]

Place Name: Horrocks Beach
HCWA Place No: 08920
Other Name: Three Mile Beach/Bay
Location: Horrocks Rd, Horrocks
LGA: Northampton

Land:

Reserve	Lot/Location	Plan/Diagram	Vol/Folio

Construction Date:

Place Type:

Use:

	General	Specific
Present Use	SOCIALRECREATIONAL	Other
Historical	SOCIALRECREATIONAL	Other

Architectural Style: Array

Construction Materials:

Historic Themes:

General	Specific
DEMOGRAPHIC SETTLEMENT & MOBILITY	Settlements

Registration

Details:

Status	Date

Listing Details (other):

Listing Type	Status	Date
Municipal Inventory	Adopted	1996-04-19

Associations:

Bibliography:

Register of the National Estate Database

AUSTRALIAN HERITAGE COMMISSION

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Sites within or near 'horrocks'

Found 5 records:

- **Houtman Abrolhos Marine Area**, Geraldton, WA (Registered)
- **Indigenous Place**, Horrocks, WA (Registered)
- **Lynton Convict Hiring Depot**, Henderson Tce, Lynton, WA (Registered)
- **Moore River to Murchison River Area**, Geraldton Hwy, Geraldton, WA (Indicative Place)
- **Willow Gully Homestead Complex**, Horrocks Rd, Horrocks, WA (Registered)

The Register of the National Estate has been compiled since 1976. The Commission is in the process of developing and/or upgrading official statements of significance for places listed prior to 1991.

Report produced : 17/3/2003
RNEDB URL : http://www.ahc.gov.au/register/easydatabase/database.html

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AUSTRALIAN HERITAGE COMMISSION

Register of the National Estate Database

[RNE search | AHC Home | Disclaimer | ©]

Willow Gully Homestead Complex, Horrocks WA

Class: Historic
Legal Status: Registered (24/06/1997)

Database Number: 009687
File Number: 5/03/144/0004

Statement of Significance : As the second oldest homestead in the Northampton district, Willi Gulli Homestead (which includes the main house, several outbuildings and stone fences), is significant for its association with the settlement of the Northampton region and the development of its pastoral and agricultural industry. The extensive use of local building material illustrates the relative remoteness of the area in the mid-nineteenth century. The availability of labour at that time, particularly cheap convict and ticket-of-leave labour, is reflected in the extensive use of hand worked stone, both in the buildings and the substantial stonewall fencing (Criterion A.4). Willi Gulli is a rare example of an intact pastoral homestead that has survived with much of its original fabric and cultural landscape intact (Criterion B.2). Willi Gulli is a cohesive complex that is unified by a consistency in its period of construction, in its form and in the finish of its built elements. These aesthetic values are further reinforced by the unusual stone walling that, by physically linking the buildings and defining the paddocks, articulates the homestead within the wider cultural landscape (Criterion E.1).

Description : History:
Willi Gulli Homestead is part of a property called the Bowes that was initially established in 1850 by William Burges who, with his brother Lockier in 1849, was one of the first white settlers to come to the district. It was from the Bowes, in 1853, that William Burges lobbied the Governor to improve the availability of labour and to modify the restrictive land tenure system. Both these issues were subsequently addressed. To alleviate the labour shortage a convict hiring depot was established at Lynton, Port Gregory, with convicts brought there principally to build roads and permanent buildings. Convicts also worked in the mines and as shepherds and farm hands for local settlers and, in time, those with tickets-of-leave moved into private employment throughout the district. One notable convict from this time was Joseph Lucas Horrocks who was sent to Lynton as a medical superintendent after formerly being convicted of forgery. The nearby beach bears his name. In the late 1850s John Williams, who was a former overseer for Burges from 1854-61, took up Willi Gulli as a separate run and a lease was eventually granted in 1861. The property is situated on the Bowes River, near Sandy Gully, 3 miles (4.8kms) from the coast. Construction of the homestead began in the 1860s to house the growing Williams family. Most of the buildings were erected over the following ten years; making this homestead the second oldest in the district after Bowes Estate. Williams had married Honora Morrissey of the pioneer family at Mount Erin Station and they had twelve children, not all of whom survived. It is possible that the local stone used in the construction of the homestead may have been quarried by ticket-of-leave men from the Lynton convict hiring depot, though it is likely that a good deal of the stone is field rock. Ticket-of-leave men were employed to build the house, cottages, barns, servants quarters, stables and walled gardens. The government of the day influenced the way in which land could be subdivided, sold and used. In 1896 Governor John Forrest introduced the Agricultural Purchase Land (APL) Act, allowing for closer settlement in the colony and providing for non-renewal of some leases and for the resumption of others. Pastoral land generally was divided into small farms and taken for agriculture. John Williams property was broken into smaller holdings in the early 1900s, following the non-renewal of pastoral leases resulting from the APL Act of 1896. The Williams family bought the homestead block, while family members bought farms that were previously part of the pastoral lease, such as Sylvan Vale, Eastbrook, Inga Vale, Sleepy Farm and Riverdew. The homestead block remained in the Williams family until c 1938, when it was purchased by Arthur Johnson, whose family retained control until 1989, when the farm was divided up into four parcels. In 1989 a smaller homestead block was excised and sold in 1992 under the new heritage provisions in Northampton Shire Council's Town Planning Scheme. Over the life of the farm, a large complex of buildings in stone and framed construction developed. While some of these have fallen into ruin, Willy Gully nevertheless reflects a significant component of the European pastoral settlement of the Port Gregory/Northampton region. The magnitude of the complex and the quantity of buildings that have survived is

comparable to other significant local properties such as Oakabella which also had its origins in Burges' initial settlement at the Bowes.
Physical description:
Willi Gulli Homestead comprises several stone vernacular farm buildings and structures that are in a simple colonial Georgian style. The complex, dating from the 1860s, consists of an original cottage, a present main house, several outbuildings including Olive Cottage and the smoke house, an associated set of stone walls, some significant plantings and various features associated with the history and use of the site. The setting is picturesque with the tree lined Bowes River nearby. The main house is positioned to enjoy the views toward the river, while at the same time taking advantage of cooling sea breezes. Random rubble stone walls are a fundamental element within the complex. They link the various buildings and provide both visual and spatial definition to the range of attached gardens and paddocks. The walls are about 1m high and 23cms thick and at several places steps have been erected on each side to allow easy access. The original cottage is of local limestone construction with shingles under the corrugated iron roof. This three roomed building, which appears to have been built in sections, features two distinctive fireplaces. It has had various uses including blacksmith shop and worker's quarters and traces of flagstone floor remain. The main house, also of local limestone, is of linear construction set out along the north-south axis. The building is arranged along a spine wall with an enclosed verandah, bath and laundry on the west side. The verandah is believed to have been enclosed in the 1950s-60s. All other rooms are built off the east side as is an open verandah which in turn opens onto a garden that is enclosed by a stone wall beyond. The rooms have no direct connection from one to the other, the access being along the verandahs. The original floors were of timber although some of these have been replaced in concrete. The original shingle roof remains under the more recent corrugated iron. The vestibule, bathroom and laundry are all accretions of uncertain date and appear to be built onto an existing garden wall. A large covered space along the spine wall links the house to the two storey barn. The two storey barn attached to the main house has an attic that was used formerly as a school room and for parties and dances when entertaining. The upper floor is reached by a solid external stone staircase at the top of which is the original wooden door. Evidence of an earlier portico and stair rail remain. The original flagstone flooring has been removed from one room, but flagging remains external to the barn on the east side. The upper floor is timber and the whole roofed in corrugated iron. Attached at an oblique angle to the corner of the barn is another stone building described as the smoke house. The former kitchen to the south-west is now known as Olive Cottage. This building is of a neatly coursed stone finish with a corrugated iron roof. The framed corrugated iron shearing shed adjacent to the road dates from c 1910. An earlier woolshed/shearing shed collapsed (possibly as a result of fire) and no longer exists. Apart from a partially ruined stable block all the other buildings are in fairly sound condition with various floor materials including flagstone, timber and rammed ants nest. Willi Gulli is the Aboriginal name, it is said to mean salt gully. All the trees in the orchard which Williams planted died from the salt which seeped up from the underlying soil. Nearby sandstone caves contain Aboriginal rock art and have been entered into the Register of the National Estate.

As yet, the Indigenous cultural values of the homestead complex have not been identified, documented or assessed by the Australian Heritage Commission.

Condition and Integrity : First Cottage: highly authentic, fair to poor condition.
Main House: medium to high authenticity, predominantly good to very poor.
Barn and Smokehouse: medium to high authenticity, fair condition, floor poor.
Olive Cottage: highly authentic, fair condition, poor areas.
Stables: authentic, poor condition, now stabilised.
Shearing Shed: highly authentic, fair condition.
(1996)

Location : About 5ha, Horrocks Road, 5.5km east-south-east of Horrocks, including: original cottage; present house; stone outbuildings; stone walls; and plantings. The road forms the eastern and southern boundary, the Bowes River forms the western boundary and the northern boundary is a shared fence line.

Bibliography:
CONSERVATION PLAN 1995
CONSIDINE AND GRIFFITHS, TOWN PLANNING SCHEME 6, 1995,
NORTHAMPTON SHIRE COUNCIL.
MUNICIPAL INVENTORY, NORTHAMPTON, 1992-5 BRUCE CALLOW & ASSOCIATES.

Report produced : 17/3/2003
RNEDB URL : http://www.ahc.gov.au/register/easydatabase/database.html

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SHIRE OF NORTHAMPTON MUNICIPAL INVENTORY

DATE OF ASSESSMENT: 14/10/93 **HCWA NO.** **SITE NO.** 30
LAST REVISION DATE:

PLACE DETAILS

Name of Place: Horricks Beach
Any Former or Other Names: Three Mile Beach / Bay
Type of Place: Townsite and beach.
Address/Location: Horrocks Road, Horrocks.
Local Government Authority: Shire of Northampton.
Map Reference:
Area of Site:

PHOTOGRAPH/SKETCH

Film No.: Not Photographed.
Neg No.:
Date:

OWNERSHIP AND OTHER SITE DETAILS

Owner Name: Shire of Northampton.
Address/phone/faes:
C/T: Vol/Folio: **Lot/Location:**
Diagram/Plan: **Reserve Details:**
Vesting: by the Johnson Family of Willi Gulli **Purpose:**
Occupied (Yes/No) **Occupier Name:**
Public Accessibility: Open **Has owner been contacted?**
Lease Details (e.g. mining):

DATES

Construction Date(s): from c1900 **Estimated/Known** **Design Date:**
Indicate Sources e.g. foundation stone, dated plans:

HISTORIC THEME: Population: Settlement and Mobility.

USE(S) OF PLACE
Original Use: Holiday Campsite and beach. **Later and Current Use(s):** Holiday town and beach.

ARCHITECT/DESIGNER/BUILDER (indicate sources of information)

Site No. 30
Page No. 1 of 2

DESCRIPTION

Construction Materials: **Walls- N/A** **Roof-**
Modifications:
Extent of original fabric remaining intact:
General Condition:

Description of the place and its setting: Horrocks Beach is located some 2 km north of the mouth of the Bowes River. The township comprises several streets, principally of holiday houses, that look out across the beach. There is a caravan park, general store and recreation facilities.

(Add History comments when appropriate)
Originally known as Three Mile Beach, Horrocks Beach has been the traditional holiday location for the people of the Northampton district since the very early days of settlement. People camped in the same locations each year in tents and later make shift shacks which existed until quite recent times when larger and more substantial houses were built following the subdivision of land into residential lots. Most of the houses are for holiday accommodation although there are now many permanent residents. Old photographs in the Northampton Historical Society's collection illustrate the substantial and ordered nature of the holiday shacks and tents in the early days when a large proportion of the families from surrounding districts spent the summer camped at the beach.

During the 1920s accommodation generally consisted of bough and ti-tree "camps", renewed each year. In the late 1930s the camping ground was vested by the owners in the Northampton Road Board. Throughout the 1950s and 60s Horrocks continued to be a major holiday destination and work commenced on the caravan park. Health and planning concerns resulted in the removal of foreshore dwellings in the late 1970s. The name "Horrocks" came into general use after the 1964 centenary of Northampton as the result of research and at the suggestion of Mr A.C. Henville.

STATEMENT OF SIGNIFICANCE (Addressing the significance criteria)
Horrocks Beach has *very high historic and social significance* as the holiday and summer recreation location for Northampton.

MANAGEMENT CATEGORY and RECOMMENDATIONS:
Horrocks Beach needs to be identified under the Municipal Inventory as *a site of important social and historic heritage* to the Northampton district. Interpretive material and signage should be located at appropriate locations to provide an understanding of the heritage significance of the place.

SUPPORTING INFORMATION
Photographs: Northampton Historical Society
Bibliography: Toni Mahony, "Camping at Horrocks", *Northampton News*, Dec 1993. Horrocks Coastal Plan, July 1993, DPUD.

PREVIOUS LISTINGS
Classified by The National Trust (yes/no) **Date:**
Register of the National Estate (yes/no) **Date:**
Local authority (yes/no) **Date:**

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SHIRE OF NORTHAMPTON MUNICIPAL INVENTORY

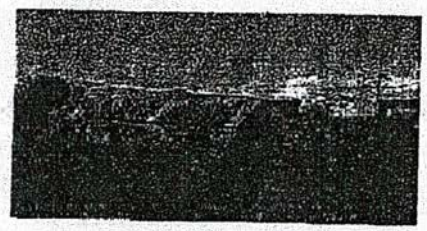
DATE OF ASSESSMENT: 14/10/1993 **HCWA NO.** 1914 **SITE NO.** 31
LAST REVISION DATE : 13/02/96

PLACE DETAILS

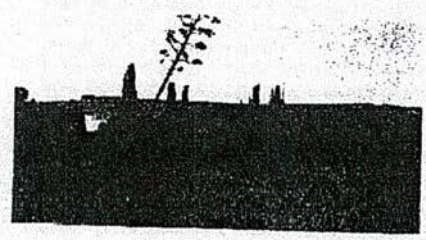
Name of Place: Willow Gully Homestead and Outbuildings
Any Former or Other Names: Willi Gulli.
Type of Place: Homestead, Outbuildings and walled yards
Address/Location: Horrocks Road, adjacent to the Bowes River, near Sandy Gully.
Local Government Authority: Shire of Northampton
Map Reference: Bowes S.E. 1:25000, 856 N, 254 E AMG
Area of Site:

PHOTOGRAPH/SKETCH

Film No.: 4
Neg No.: 9A, 10A, 11A, 12A.
Date: 14/10/1993



Left: View of two storey barn with external access stair.
Right: View of outbuilding, possibly the original homestead.



Left: Old dairy & kitchen
Right: view of front of the homestead.

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Description cont'd

Further to the north of the two storey barn is a separate 3 roomed rectangular building. Anecdotal evidence from the current owners suggests it could have been the original homestead and was later used as staff quarters, blacksmith shop and stores. On the east of this building is another (third) walled garden/orchard or animal yard running up towards the main road and a more recent corrugated iron, shearing shed, thought to be c1959 built by Gus Hosken [*Source: A. Sellers*].

The homestead itself has a simple plan form, similar to others in the district (said to be based on the Bowes model, (see Site No.141), with the rooms all adjacent in a long row with no interconnecting doors, but with an access verandah down both long sides (east and west). On the front (east), the verandah ends have been enclosed, either originally or very early on, with masonry. The rear verandah has been enclosed with timber studwork and sheet asbestos on the west, possibly for weather control as well as providing covered, internal access.

All the buildings are stone however, over time, the homestead walls have been cement rendered. This was probably an attempt to control damp but has only caused the stone walls to fret and deteriorate. The present owners are currently removing the render and concrete and restoring the original stone work. The three main rooms and verandahs have concrete floors which may have replaced original floor finishes. The concrete may be adding to deterioration of walls by trapping moisture. Recently the concrete floors to verandas has been broken back and removed along the walls to allow them to breathe and ultimately all concrete against walls should be removed.

The separate dining/kitchen building has been cement rendered and the render may have to be removed and restored to arrest the deterioration that is occurring. The dairy room, where cheeses were made and stored is of particular interest in terms of the day to day activities and self sufficiency of homestead life. The stables at the bottom of the rear walled yard have the roof and walls collapsing and are in urgent need of repair or stabilisation. The collection of buildings to the north of the homestead, comprising two storey barn, laundry, storerooms and the separate staff quarters, cum original homestead, all need further investigation and study as does the whole complex.

(Add History comments when appropriate)
Willi Gulli was originally part of William Burges' lease - The Bowes (Site 141). However, in the late 1850s Mr John Williams, who was a former overseer for Burges, took it up as a separate run, of which the lease was granted in 1861. The property is situated on the Bowes River near Sandy Gully, three miles from the coast. The Willi Gulli homestead and outbuildings were built during the 1860s to house the growing Williams family. It is thought (anecdotal) that the local stone used to build the homestead was quarried by ticket-of-leave men from the Lynton Hiring Station (Site 25). They were employed to build the house, cottages, barns, servants' quarters, stables and walled gardens.

The property was broken up in the early 1900s following the non-renewal of pastoral leases resulting from the Agricultural Purchase Land Act of 1896. The Williams family bought the homestead block, while family members purchased farms that were previously part of the pastoral lease, such as Sylvan Vale, Eastbrook, Inga Vale, Sheppy Farm and Riverdew. The homestead block remained in the Williams family until c1938 when it was purchased by Mr Arthur Johnson. (Lyn Diepeveen, Northampton Historical Society)

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STATEMENT OF SIGNIFICANCE (Addressing the significance criteria)

The Willi Gulli Homestead complex has *aesthetic, historic* and *social* significance within both the region and the State because of the excellent authenticity and integrity of its buildings. Its significance is strengthened for its associations with the development of the district, the pastoral industry in the State, and locally with the Williams family.

MANAGEMENT CATEGORY and RECOMMENDATIONS:

Protect the Willi Gulli complex with the *highest level* of protection under the Municipal Inventory. In early 1996 Willow Gully, with the owners support, was being assessed for entry onto the *State Register of Heritage Places*.

A conservation plan for the site was recommended in the "Draft" report and was carried out in 1994 by Griffiths & Considine in the report "*The Four Homesteads*". All future development applications for the site should refer to the Conservation Report for guidance.

SUPPORTING INFORMATION

Photographs:
Bibliography: Feilman (111); Considine & Griffiths, 1994, *The Four Homesteads.*

PREVIOUS LISTINGS

Heritage Council of WA (yes/no) **Interim Listing** **Date:** 23/01/96
Classified by The National Trust (yes/no) **Classified** **Date:** 06/12/82
Register of the National Estate (yes/no) DB No. 009687 File No. 5/03/144/0004
Local authority (yes/no) **Date:**

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