

# GOLDEN BAY

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## MINISTERIAL IMPLEMENTATION STATEMENT NO. 297 COMPLIANCE ASSESSMENT REPORT YEAR 2019

Prepared for: Peet Golden Bay Pty Ltd/Department of Communities

Report Date: 30 August 2020

Version: 1

Report No. 2020-525

The logo for pgv ENVIRONMENTAL is located at the bottom of the page. It features the letters 'pgv' in a large, bold, white sans-serif font. Below 'pgv', the word 'ENVIRONMENTAL' is written in a smaller, all-caps, white sans-serif font. The background of the bottom half of the page is a vibrant orange with a subtle, wavy pattern of thin white lines.

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# **1 INTRODUCTION**

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## **1.1 Background**

The proposal to develop Part Lot 12 and Reserve 34664, Golden Bay for urban development was referred to the Environmental Protection Authority (EPA) under the *Environmental Protection Act 1986* (EP Act) in 1992 by H & B Developments. The EPA set the level of assessment as a Public Environmental Review (PER) (Assessment No. 604). The Minister for the Environment approved the proposal through Ministerial Statement 297 subject to environmental conditions in January 1993 (Attachment A).

Ministerial Statement 297 gave environmental approval subject to conditions to develop the landholding then known as Part Lot 12 and Reserve 34664, Golden Bay.

The Minister for the Environment confirmed on 30 July 1997 that the project had been substantially commenced, and as a result the environmental approval remains valid.

The Department of Environmental Protection (now the Department of Water and Environmental Regulation (DWER)) recognised the change in ownership to the Department of Housing and Works (now known as the Department of Communities (DoC)) and issued an Audit Table detailing the status of the Environmental Conditions and Commitments on 3 April 2001 (Attachment B).

The landholding is now referred to as Lot 2 Warnbro Sound Avenue and Lot 3 Dampier Drive, Golden Bay.

## **1.2 Golden Bay Project Description**

Golden Bay is located on the coast, approximately 62km south of the Perth Central Business District and 20km south of The City of Rockingham (Figure 1).

The landholding covers an area of approximately 161 hectares (ha) and is situated west of Mandurah Road (Figure 2). Lot 2 has approximately 800m of coastal frontage and the foreshore reserve covers an area of 10.61ha with vegetation that is largely in Excellent condition. Lot 3 has a Landscape Protection Area that conserves the parabolic dunal formation associated with Mandurah Hill, the highest point in the region.

The key environmental elements of the Golden Bay Proposal as described in the PER were listed as:

- Foreshore Reserve designation;
- Foreshore Reserve management;
- Landscape protection;
- Southern Brown Bandicoot Protection; and
- Protection of the heritage site.

## **1.3 Proponent**

Peet Golden Bay Pty Ltd (Peet) and the Housing Authority (now DoC) formed a co-ownership in November 2014. The change in Proponent was endorsed by the OEPA (now DWER) on 1 August 2016.



## **1.4 Environmental Approval to Implement the Project**

The proposal to develop the site was assessed through a Section 38 Public Environmental Review (PER) assessment process under the WA *Environmental Protection Act 1986* (EP Act). The project was approved through Ministerial Statement 297 in January 1993 (Appendix 1).

The Minister for the Environment confirmed on 30 July 1997 that the project had been substantially commenced.

## **1.5 Scope of the Report**

Condition 8 of MS297 states the following:

### *8. Compliance Auditing*

*In order to ensure that environmental conditions and commitments are met, an audit system is required.*

*8-1 The Proponent shall prepare periodic 'Progress and Compliance Reports' to help verify the environmental performance of this project, in consultation with the Environmental Protection Authority.*

### *Procedure*

*The Environmental Protection Authority is responsible for verifying compliance with the conditions contained in this statement, with the exception of conditions stating that the proponent shall meet the requirements of the Minister for the Environment or any other government agency.*

*If the Environmental Protection Authority, other government agency or proponent is in dispute concerning compliance with the conditions contained in this statement, that dispute will be determined by the Minister for the Environment.*

The reporting requirements set out in the Audit Table indicated that the first compliance report was due before clearing activities commenced and the second one year after the clearing had commenced. Thereafter the submission of compliance reports was as required by the OEPA.

The OEPA advised in correspondence dated 8 April 2016 (Appendix 2) that a CAR was required to be submitted by 30 August 2016 and annually thereafter and to report on the period of the previous calendar year.

This is the eighth Compliance Assessment Report (CAR), the previous CARs were submitted on the following dates:

- 20 May 2010;
- 30 May 2011;
- 30 May 2012;
- 30 August 2016 (Report Period Year 2015);
- 30 August 2017 (Report Period Year 2016);
- 20 August 2018 (Report Period 2017);

- 30 August 2019 (Report Period 2018); and
- 30 August 2020 (Report Period 2019).

This CAR has been prepared in accordance with the OEPA *Guidelines for Preparing a Compliance Assessment Report, August 2012*. This report is based on the Proponent's assessment of compliance with the conditions in accordance with the MS297 and MS297 Audit Table. This CAR covers the period between January 2019 to December 2019.

## **2 CURRENT STATUS OF PROJECT IMPLEMENTATION**

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### **2.1 Golden Bay Project**

Peet is delivering the urban development project on behalf of the landowners in accordance with the approved Comprehensive Development Plan (Figure 2) will deliver the following:

- Residential Lots;
- Commercial Precinct;
- Primary and Secondary Schools;
- Local Public Open Space (recreational and drainage functions);
- Landscape protection area; and
- A Foreshore Reserve.

### **2.2 Current Project Activities**

Development construction has progressed over Lot 2 both east and west of Warnbro Sound Avenue and progressed on Lot 3 Dampier Drive (Figure 3). The following tasks have been undertaken to date:

- The Foreshore Reserve adjacent to Lot 2 has been surveyed and demarcated with flagging tape;
- Phase 1 works have been completed in the Foreshore Reserve in accordance with the FMP;
- The Southern Brown Bandicoots are being managed on the site and monitored twice yearly within the foreshore reserve;
- Feral cat, fox and rabbit control has been undertaken in the Foreshore Reserve;
- The wetlands within the foreshore reserve have been monitored annually;
- Rehabilitation works have commenced in the southern portion of the foreshore reserve adjacent to the existing Golden Bay;
- A small section of clearing on the southern end of the Foreshore Reserve has been cleared to make way for the construction of the Wastewater Pump Station. The 2m wide strip of clearing was approved through the Addendum 1 of the Foreshore Management Plan. A Regulation 10 was approved by the Department of Planning, Lands and Heritage for these works;
- The landscape protection area on Lot 3 has been fenced off on the eastern perimeter; and
- Stage 5 earthworks have commenced on Lot 3.

### **3 INSTANCES OF POTENTIAL NON-COMPLIANCE AND PREVENTATIVE ACTIONS UNDERTAKEN**

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In accordance with Condition 8-1 of MS 297, all instances of potential non-compliance with the conditions of MS 297 that are identified during the reporting period are to be reported in the annual CAR, and corrective and preventative actions taken are to be described. The status of all conditions is presented in Table 1 and Appendix 3.

There were no non-compliance issues during this reporting period.

## **4 PUBLIC AVAILABILITY OF REPORT**

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This CAR will be made publicly available within one month of being submitted to the OEPA. A copy of the most recent CAR will be placed on the Proponent's website until the subsequent annual CAR is placed on the website.

The website URL is [www.peet.com.au/GoldenBay](http://www.peet.com.au/GoldenBay)

## **5 COMPLIANCE**

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### **5.1 Compliance Assessment Method**

An audit of the Golden Bay project was conducted in July 2020 to facilitate the assessment of compliance against MS 297 and the implementation of actions to meet environmental conditions. The audit was conducted by Belinda Heath of PGV Environmental.

The compliance status terminology to define the level of compliance used during the audit follows the EPA *Post Assessment Guideline for Preparing an Audit Table* and is listed below:

- C = Compliant;
- CLD = Completed;
- NC = Non – compliant
- NR = Not Required at this stage;
- IP = In Process may only be used by the proponent in circumstances outlined in Section 2.8 of the guideline

The information reviewed and the evidence obtained during this audit has been presented within the Compliance Assessment Audit Table (Appendix 3), along with additional information gathered during a desktop study/investigation.

### **5.2 Statement of Compliance**

The Statement of Compliance and the Compliance Assessment Audit Table are attached at Appendix 3.

### **5.3 Summary Audit Table**

Details on compliance with the MS297 conditions and management plans are presented below in a summary audit table (Table 1). The detailed Compliance Assessment Audit Table is provided in Appendix 3.

**Table 1: Summary Audit Table Status**

<b>Audit Code</b>	<b>Requirement</b>	<b>Status</b>	<b>Comment</b>
297:M1-1	Fulfil the commitments	CLD	All commitments have been fulfilled
297:M2-1	Adhere to the Proposal	C	
297:M2-2	Seek approval for modifications to the Proposal	C	No modifications sought
297:M3-1	Provide a foreshore reserve for conservation and recreation which: <ul style="list-style-type: none"> <li>1. Protects the Peelhurst Wetlands and the Southern Brown Bandicoot (<i>Isoodon obesulus</i>) population; and</li> <li>2. Includes landscape and recreation values at least equivalent to the area affected by this proposal which is within System 6 Recommendation M107 Area.</li> </ul>	CLD	4 June 1993
297:M3--2	Transfer to public ownership the proposed foreshore reserve as required by M3-1.	CLD	4 June 1993
297:M4-1	Liaise with the Department of Planning and Urban Development and the CoR to incorporate planning measures which recognise and protect the landscape value of the parabolic ridge on the eastern edge of Golden Bay.	CLD	5 April 1994
297:M5-1:1	Establish the regional implications of disturbing the population of the Southern Brown Bandicoot ( <i>Isoodon obesulus</i> ) at Golden Bay.	CLD	6 February 1996
297:M5-1:2	Initiate management of the population of the Southern Brown Bandicoot ( <i>Isoodon obesulus</i> )	CLD	Submitted 20 May 2010
297:M5-2:1	Carry out the ongoing management of the population of the Southern Brown Bandicoot ( <i>Isoodon obesulus</i> ) at Golden Bay as proposed in M5-1.	C	All stages of development have included a relocation program prior to any clearing activity.
297:M5-2:2	Carry out the ongoing management of the population of the Southern Brown Bandicoot ( <i>Isoodon obesulus</i> ) at Golden Bay as proposed in M5-1.	NR	Post development management
297:M6-1	Seek approval for transfer of ownership, control or management of this project.	C	Proponents are DoC and Peet Golden Bay Pty Ltd
297:M7-1	Seek approval to extend approval to implement proposal.	CLD	Minister for Environment confirmed project has commenced on 30 July 1997
297:M8	Prepare a periodic 'Progress and Compliance Report' to help verify the environmental performance of this project.	C	OEPA has requested (Appendix 2) that from August 2016 compliance reports are to be submitted annually by 30

			August for the previous calendar year.
297:P1	Provide in exchange for the development of the currently proposed System 6 Area M107, additional Regional and Public Open Space adjacent the Coastal Reserve as shown in the Structure Plan, in excess to that which would normally be required by DPUD.	CLD	26 October 1995 Not Audited (duplicated by condition M3-1) – Audit Branch
297:P2	Prepare a Management Plan for the coastal reserve at Golden Bay.	CLD	Golden Bay Foreshore Management Plan approved by the OEPA on 30 March 2012 (on advice from DoP and CoR) An addendum to the FMP to address the interface between the development and foreshore reserve was submitted and approved by the OEPA on 29 September 2016
297:P3	Include the historic aboriginal camping site within the proposed Public Open Space for the development.	CLD	13 December 1995
297:P4	Protect against Bushfire	CLD	Fire Management Plan for the Golden Bay Structure Plan Area was approved by the City of Rockingham in March 2012.
297:P5	Provide reticulated sewerage and stormwater drainage designated to infiltrate stormwater into the soil within the development site.	CLD	A Local Water Management Strategy (LWMS) has been prepared for the Structure Plan Area and approved by the Department of Water and the City of Rockingham. Urban Water Management Plans are being prepared in accordance with the



			LWMS for each stage of subdivision.
297:P6	Liaise with CALM regarding the presence of bandicoots at Golden Bay and examine feasibility of relocating bandicoots if required by CALM.	CLD	13 December 1995

## 5.4 Compliance with Management Plans

Commitment 2 of the Ministerial Statement required that a management plan be prepared for the foreshore reserve on advice from the Department of Planning and the City of Rockingham.

The Golden Bay Foreshore Management Plan was prepared in consultation with the Department of Planning and the City of Rockingham and approved by the OEPA on 30 March 2012 (Appendix 3).

An addendum to the FMP to address the interface between the development and foreshore reserve was submitted and approved by the OEPA on 29 September 2016 (Appendix 8).

The FMP provides for the management and conservation of the Peelhurst Wetlands, Southern Brown Bandicoot, TEC 19a (Sedgeland in Holocene Dune Swales) and the Indigenous Heritage site located within the approved Foreshore Reserve. In addition, the FMP details the proposed infrastructure, recreational activities and relevant management strategies as proposed in the Public Environmental Review.

Implementation of the FMP has commenced and a status update on the management actions are provided in Appendix 4.

### 5.4.1 TEC19a Photo Point Monitoring

The condition of the TEC19a (*Sedgeland in Holocene Dune Swales*) has been recorded annually through photo point monitoring survey conducted in late September/October. The survey records the overall condition of the TEC and provides a basis to determine if the TEC is improving/degrading over time.

The photo point monitoring survey results are provided in Appendix 5.

**Plate 1: TEC19a (Sedgeland in Holocene Dune Swales)**



#### **5.4.2 Southern Brown Bandicoot Monitoring**

The local population of Quenda within the foreshore reserve have been monitored in autumn and spring for six years. The monitoring reports for 2019 are provided at Appendix 6.

Based on the results of the Spring 2019 trapping program, there has been a decrease in the number of individuals (29) surveyed in the Foreshore Reserve in comparison to the previous four surveys. Of the 29 individuals captured 15 were male and 14 were female (Terrestrial Ecosystems, 2019). The decrease could be due to a combination of factors including predation, illness (Sarcoptic Mange), aging population, people walking dogs off lead or increased human activity in the adjacent Coastal Node.

Similar to previous monitoring surveys, there was a lack of subadults caught during the 2019 surveys. Juveniles and subadults are the most susceptible to predation by feral cats and foxes. The continuation of a management program for cats and foxes in cooperation with the City of Rockingham for the coastal dune system is recommended to assist in maintaining a viable population of Quenda in the Foreshore Reserve.

There was no evidence of Sarcoptic Mange in the Quenda population during the current survey. The individual who had it in autumn 2019 appeared mange free when caught in spring 2019.

**Plate 2: Southern Brown Bandicoot (photo source G. Thomson Terrestrial Ecosystems)**



#### **5.4.3 Groundwater Levels Monitoring**

The groundwater levels in the foreshore reserve are monitored each month. The levels for the period July 2012 to December 2019 are provided at Appendix 7.

**Plate 3: Groundwater Monitoring Bore (WB02)**



#### **5.4.4 Landscape Protection Management Plan**

Development on the northern end of Lot 3 Dampier Drive commenced in 2017.

The Landscape Protection Area (LPA) has been fenced along the north east to protect it from construction activity.

The recently approved CDP over Lot 3 includes a condition for the original Landscape Protection Area Management Plan (1994) to be revised to represent contemporary management of bushland areas. As part of these works a baseline flora, vegetation and weed survey will be conducted in Spring 2020. The findings of the surveys will inform the revision of the original Landscape Protection Area

Management Plan. Importantly, the area of dunes protected under the Landscape Protection Area set in 1994 will not change.

Rehabilitation works will commence as per the as part of subdivisional works.

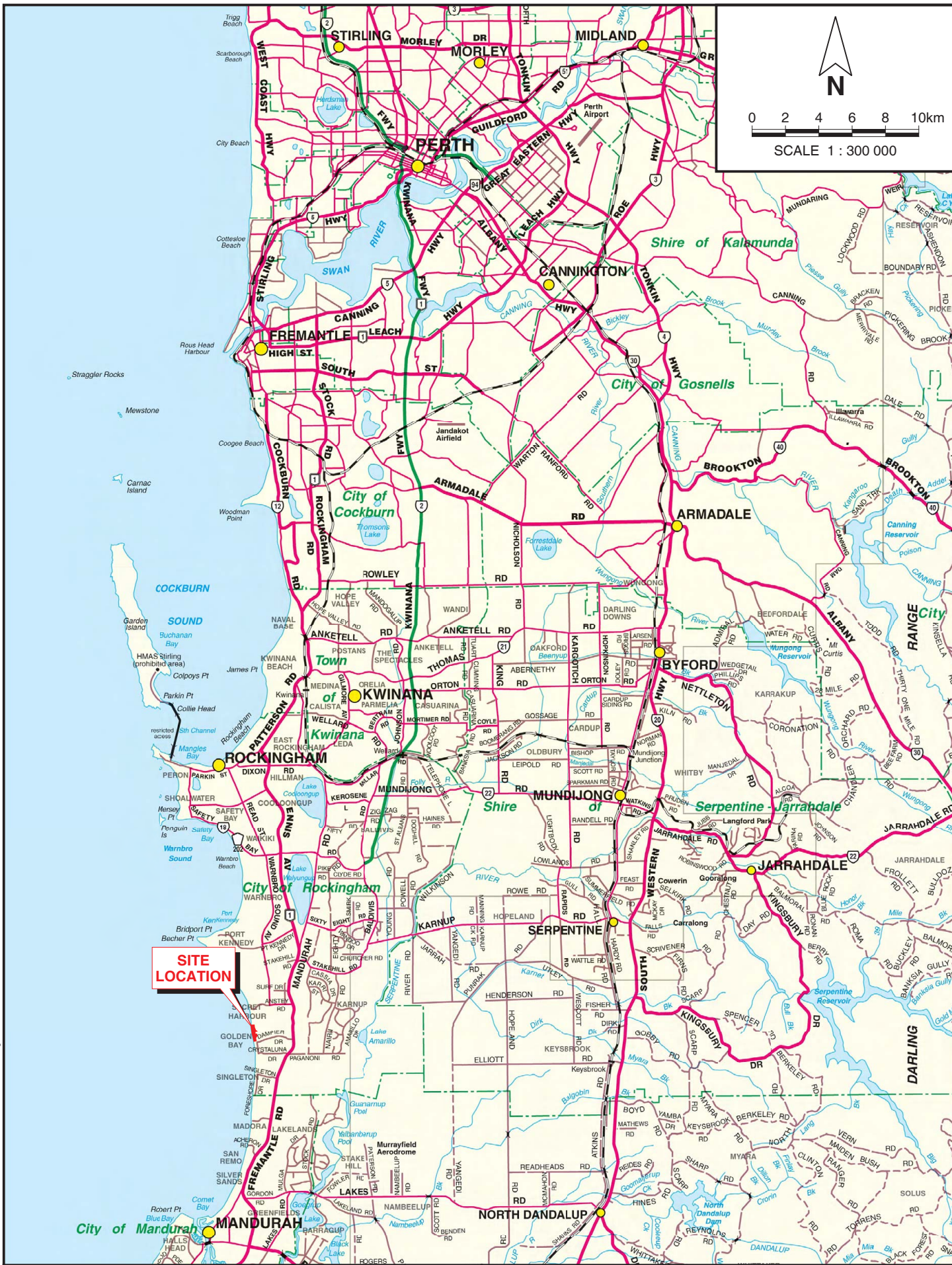
## 6 REFERENCES

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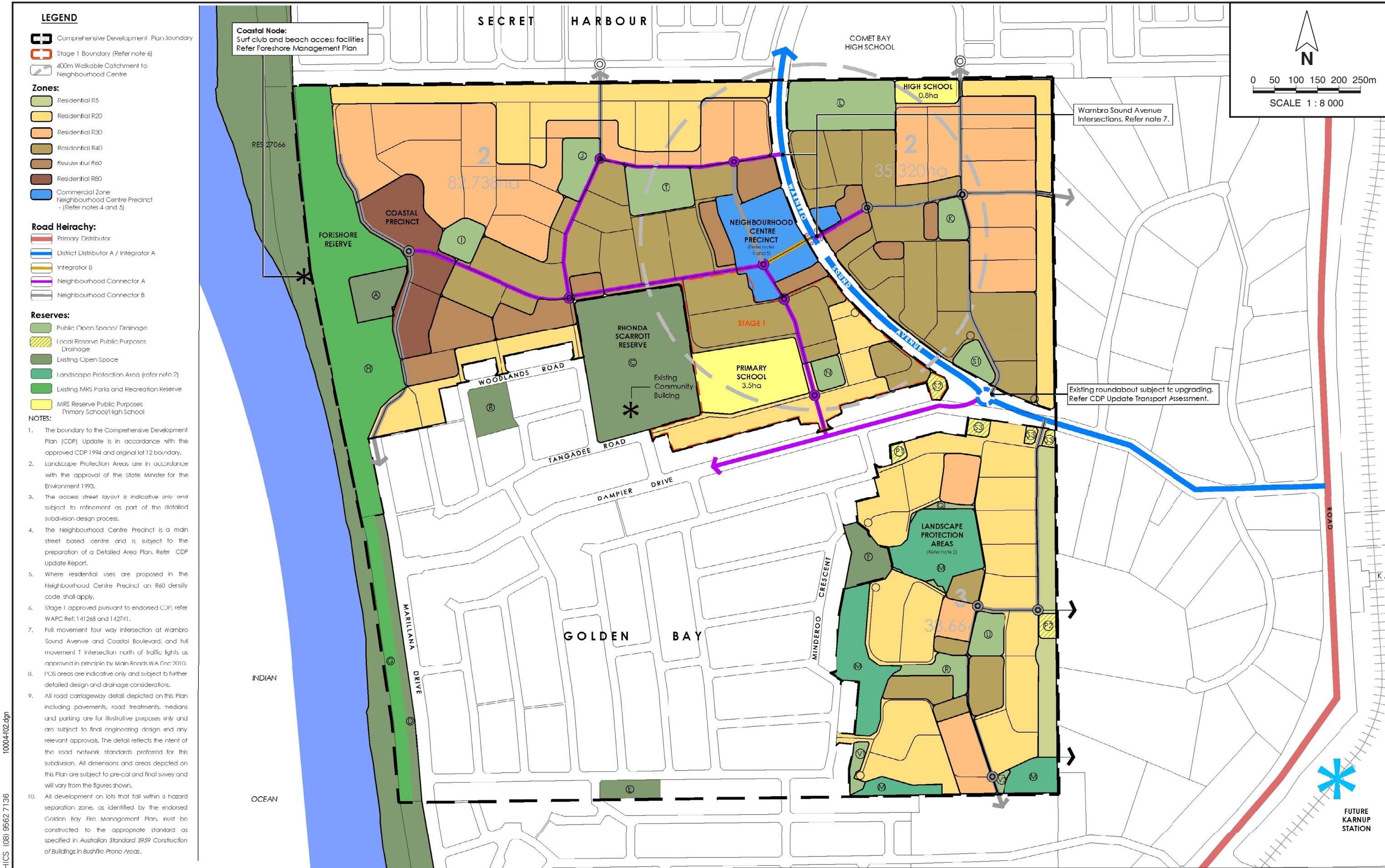
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# FIGURES









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PINPOINT CARTOGRAPHICS (08) 9562 7136



SOURCE: Chappell Lambert Everett, Plan No. 2187-29U-01, 28-02-2011.



Drawn: B. Heath  
Date: 10 Aug 2011  
Job: 10004  
Revision: A

Department of Housing  
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GOLDEN BAY

### COMPREHENSIVE DEVELOPMENT PLAN

Figure 2

**APPENDIX 1**  
**MINISTERIAL STATEMENT 297**



WESTERN AUSTRALIA  
MINISTER FOR THE ENVIRONMENT

Ass # 604  
Bull # 648  
State # 297

**STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED  
(PURSUANT TO THE PROVISIONS OF THE  
ENVIRONMENTAL PROTECTION ACT 1986)**

**URBAN DEVELOPMENT OF PART LOT 12 & RESERVE 34664 (AFFECTING PART OF  
SYSTEM SIX RECOMMENDATION M107), GOLDEN BAY (604)**

**H & B DEVELOPMENTS PTY LTD**

This proposal may be implemented subject to the following conditions:

**1 Proponent Commitments**

The proponent has made a number of environmental management commitments in order to protect the environment.

- 1-1 In implementing the proposal, the proponent shall fulfil the commitments (which are not inconsistent with the conditions or procedures contained in this statement) made in the Consultative Environmental Review and included in Environmental Protection Authority Bulletin 648. (A copy of the commitments is attached.)

**2 Implementation**

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

- 2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal. Where, in the course of that detailed implementation, the proponent seeks to change those designs, specifications, plans or other technical material in any way that the Minister for the Environment determines on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

**3 Foreshore Reserve**

- 3-1 The proponent shall provide a foreshore reserve for conservation and recreation which:

- 1 protects the Peelhurst wetlands and the Southern Brown Bandicoot (*Isodon obesulus*) population; and
- 2 includes landscape and recreation values at least equivalent to the area affected by this proposal which is within System 6 Recommendation M107 Area.

- 3-2 Prior to the lifting of Urban Deferment, the proponent shall identify the foreshore reserve as required by condition 3-1, and at subdivision the proponent shall transfer to public ownership the proposed foreshore reserve, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

Published on  
12 JAN 1993

**4 Landscape Protection**

The landscape value of the parabolic dune ridge on the eastern edge of Golden Bay should be recognised.

- 4-1 Prior to subdivision approval, the proponent shall liaise with the Department of Planning and Urban Development and the City of Rockingham to incorporate planning measures which recognise and protect the landscape value of the parabolic dune ridge on the eastern edge of Golden Bay, to the requirements of the Minister for the Environment and the Minister for Planning on advice of the Department of Planning and Urban Development, the City of Rockingham and the Environmental Protection Authority.

**5 Southern Brown Bandicoot (*Isoodon obesulus*)**

The population of the Southern Brown Bandicoot (*Isoodon obesulus*) at Golden Bay requires special consideration.

- 5-1 Prior to the commencement of development and in consultation with the Department of Conservation and Land Management, the proponent shall establish the regional implications of disturbing the population of the Southern Brown Bandicoot (*Isoodon obesulus*) at Golden Bay and shall initiate management of the population, to the requirements of the Minister for the Environment on advice of the Department of Conservation and Land Management.
- 5-2 The proponent shall carry out the on-going management of the population of the Southern Brown Bandicoot (*Isoodon obesulus*) at Golden Bay to the requirements of the Department of Conservation and Land Management.

**6 Proponent**

These conditions legally apply to the nominated proponent.

- 6-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

**7 Time Limit on Approval**

The environmental approval for the proposal is limited.

- 7-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced. Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period, to the Minister for the Environment by way of a request for a change in the condition under Section 46 of the Environmental Protection Act. (On expiration of the five year period, further consideration of the proposal can only occur following a new referral to the Environmental Protection Authority.)

**8 Compliance Auditing**

In order to ensure that environmental conditions and commitments are met, an audit system is required.

- 8-1 The proponent shall prepare periodic "Progress and Compliance Reports", to help verify the environmental performance of this project, in consultation with the Environmental Protection Authority.

### **Procedure**

The Environmental Protection Authority is responsible for verifying compliance with the conditions contained in this statement, with the exception of conditions stating that the proponent shall meet the requirements of either the Minister for the Environment or any other government agency.

If the Environmental Protection Authority, other government agency or proponent is in dispute concerning compliance with the conditions contained in this statement, that dispute will be determined by the Minister for the Environment.

Jim McGinty, MLA  
MINISTER FOR THE ENVIRONMENT

12 JAN 1993

## **PROPONENT'S COMMITMENTS**

**URBAN DEVELOPMENT OF PART LOT 12 & RESERVE 34664  
(AFFECTING PART OF SYSTEM SIX RECOMMENDATION M107)  
GOLDEN BAY (604)**

**H & B DEVELOPMENTS PTY LTD**

**The proponent has made the following environmental commitments:**

## CONSOLIDATED LIST OF COMMITMENTS FOR GOLDEN BAY

1. The proponent will provide, in exchange for the development of the currently proposed System 6 Area M107, additional Regional and Public Open Space adjacent to the Coastal Reserve as shown in the Structure Plan, in excess to that which would normally be required by DPUD. This will be done to the satisfaction of the EPA, DPUD and the Local Authority at the rezoning stage.
2. The proponent will prepare a Management Plan for the Coastal Reserve at Golden Bay prior to development commencing. This will be done to the satisfaction of DPUD and the Local Authority.
3. The proponent will include an historic aboriginal camping site within the proposed Public Open Space for the development. This will be done to the satisfaction of the Local Authority.
4. The proponent will continue to provide and maintain a network of firebreaks and access tracks to protect against bushfire until the Local Authority takes on this responsibility. This will be done to the satisfaction of the Local Authority.
5. The proponent will provide reticulated sewerage and will design the development so that stormwater drainage is disposed of on site. This will be done during the installation of services within the development to the satisfaction of DPUD and the Local Authority.
6. The proponent will liaise with CALM regarding the presence of bandicoots at Golden Bay and if required by CALM will examine the feasibility of relocating the bandicoots to an appropriate location elsewhere. This will be done prior to any disturbance of the vegetation at Golden Bay and will be done to the satisfaction of both CALM and the EPA.

## **APPENDIX 2**

# **OEPA CORRESPONDENCE**





Government of **Western Australia**  
Office of the **Environmental Protection Authority**



Mr Alex Horsburgh  
Senior Project Manager  
Department of Housing  
169 Hay Street  
**EAST PERTH WA 6175**

Our Ref: 16-006294  
Enquiries: Rowan Inglis, 6145 0849  
Email: rowan.inglis@epa.wa.gov.au

3RD HAY ST.

Dear Mr Horsburgh

**MINISTERIAL STATEMENT 297 – URBAN DEVELOPMENT OF PART LOT 12 & RESERVE 34664, GOLDEN BAY – ANNUAL COMPLIANCE ASSESSMENT REPORT REQUIRED**

Ministerial Statement 297 places conditions on the implementation of the proposal above. Condition 8-1 of Statement 297 requires preparation and submission of a Compliance report.

The Office of the Environmental Protection Authority (OEPA) advises the Department of Housing that a Compliance Report reporting on the period of the previous calendar year (January to December 2015) is required to be submitted by **30 August 2016** and annually thereafter to demonstrate compliance with Statement 297.

The CAR must be developed in accordance with the following:

- Post Assessment Guideline for Preparing a Compliance Assessment Report
- Post Assessment Guideline for Preparing an Audit Table

These documents are available on the OEPA website [www.epa.wa.gov.au](http://www.epa.wa.gov.au)

If you have any queries regarding this matter, or wish to align the submission of the Compliance Report with reporting submitted to other government agencies, please contact Rowan Inglis on 6145 0849.

Yours sincerely

**Mr Ian Munro**  
MANAGER COMPLIANCE BRANCH

31 March 2016



**APPENDIX 3**

**STATEMENT OF COMPLIANCE AND**

**AUDIT TABLE**

## Statement of Compliance

### 1. Proposal and Proponent Details

Proposal Title	<i>Urban Development of Part Lot 12 and Reserve 34664</i>
Statement Number	<i>Ministerial Statement 297</i>
Proponent Name	<i>Peet Golden Bay Pty Ltd and Department of Communities</i>
Proponent's Australian Company Number (where relevant)	94 600325 175 56 167 671 885

### 2. Statement of Compliance Details

Reporting Period	<i>1/01/19 to 31/12/19</i>
------------------	----------------------------

Implementation phase(s) during reporting period (please tick ✓ relevant phase(s))							
Pre-construction		Construction	✓	Operation	✓	Decommissioning	

Audit Table for Statement addressed in this Statement of Compliance is provided at Attachment:	3
<p>An audit table for the Statement addressed in this Statement of Compliance must be provided as Attachment 2 to this Statement of Compliance. The audit table must be prepared and maintained in accordance with the Department of Water and Environmental Regulation (DWER) <i>Post Assessment Guideline for Preparing an Audit Table</i>, as amended from time to time. The 'Status Column' of the audit table must accurately describe the compliance status of each implementation condition and/or procedure for the reporting period of this Statement of Compliance. The terms that may be used by the proponent in the 'Status Column' of the audit table are limited to the Compliance Status Terms listed and defined in Table 1 of Attachment 1.</p>	

Were all implementation conditions and/or procedures of the Statement complied with within the reporting period? (please tick ✓ the appropriate box)			
No (please proceed to Section 3)		Yes (please proceed to Section 4)	✓

Each page (including Attachment 2) must be initialed by the person who signs Section 4 of this Statement of Compliance.  
INITIALS: gc

**3. Details of Non-compliance(s) and/or Potential Non-compliance(s)**

The information required Section 3 must be provided for each non-compliance or potential non-compliance identified during the reporting period covered by this Statement of Compliance.

**Non-compliance/potential non-compliance 3-1**

Which implementation condition or procedure was non-compliant or potentially non-compliant?
Was the implementation condition or procedure non-compliant or potentially non-compliant?
On what date(s) did the non-compliance or potential non-compliance occur (if applicable)?

Was this non-compliance or potential non-compliance reported to the Chief Executive Officer, DWER?	
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> Reported to DWER verbally      Date _____ <input type="checkbox"/> Reported to DWER in writing      Date _____	<input type="checkbox"/> No

What are the details of the non-compliance or potential non-compliance and where relevant, the extent of and impacts associated with the non-compliance or potential non-compliance?
What is the precise location where the non-compliance or potential non-compliance occurred (if applicable)? (please provide this information as a map or GIS co-ordinates)
What was the cause(s) of the non-compliance or potential non-compliance?
What remedial and/or corrective action(s), if any, were taken or are proposed to be taken in response to the non-compliance or potential non-compliance?
What measures, if any, were in place to prevent the non-compliance or potential non-compliance before it occurred? What, if any, amendments have been made to those measures to prevent re-occurrence?
Please provide information/documentation collected and recorded in relation to this implementation condition or procedure: <ul style="list-style-type: none"> <li>• in the reporting period addressed in this Statement of Compliance; and</li> <li>• as outlined in the approved Compliance Assessment Plan for the Statement addressed in this Statement of Compliance.</li> </ul> (the above information may be provided as an attachment to this Statement of Compliance)

*For additional non-compliance or potential non-compliance, please duplicate this page as required.*

Each page (including Attachment 2) must be initialed by the person who signs Section 4 of this Statement of Compliance.  
INITIALS:   OK

**4. Proponent Declaration**

I, Craig Raynor (Project Director)

declare that I am authorised on behalf of Peet Golden Bay Pty Ltd

(being the person responsible for the proposal) to submit this form and that the information contained in this form is true and not misleading.

Signature:  .....

Date: .....

Please note that:

- it is an offence under section 112 of the *Environmental Protection Act 1986* for a person to give or cause to be given information that to his knowledge is false or misleading in a material particular; and
- the Chief Executive Officer of the DWER has powers under section 47(2) of the *Environmental Protection Act 1986* to require reports and information about implementation of the proposal to which the statement relates and compliance with the implementation conditions.

**5. Submission of Statement of Compliance**

One hard copy and one electronic copy (preferably PDF on CD or thumb drive) of the Statement of Compliance are required to be submitted to the Chief Executive Officer, DWER, marked to the attention of Manager, Compliance (Ministerial Statements).

Please note, the DWER has adopted a procedure of providing written acknowledgment of receipt of all Statements of Compliance submitted by the proponent, however, the DWER does not approve Statements of Compliance.

**6. Contact Information**

Queries regarding Statements of Compliance, or other issues of compliance relevant to a Statement may be directed to Compliance (Ministerial Statements), DWER:

**Manager, Compliance (Ministerial Statements)**

**Department of Water and Environmental Regulation**


Postal Address: Locked Bag 33  
Cloisters Square  
PERTH WA 6850

Phone: (08) 6364 7000

Email: [compliance@dwer.wa.gov.au](mailto:compliance@dwer.wa.gov.au)

**7. Post Assessment Guidelines and Forms**

Post assessment documents can be found at [www.epa.wa.gov.au](http://www.epa.wa.gov.au)

Each page (including Attachment 2) must be initialed by the person who signs Section 4 of this Statement of Compliance.  
INITIALS: 



## ATTACHMENT 1

Table 1 Compliance Status Terms

Compliance Status Terms	Abbrev	Definition	Notes
Compliant	C	Implementation of the proposal has been carried out in accordance with the requirements of the audit element.	This term applies to audit elements with: <ul style="list-style-type: none"> <li>ongoing requirements that have been met during the reporting period; and</li> <li>requirements with a finite period of application that have been met during the reporting period, but whose status has not yet been classified as 'completed'.</li> </ul>
Completed	CLD	A requirement with a finite period of application has been satisfactorily completed.	This term may only be used where: <ul style="list-style-type: none"> <li>audit elements have a finite period of application (e.g. construction activities, development of a document);</li> <li>the action has been satisfactorily completed; and</li> <li>the DWER has provided written acceptance of 'completed' status for the audit element.</li> </ul>
Not required at this stage	NR	The requirements of the audit element were not triggered during the reporting period.	This should be consistent with the 'Phase' column of the audit table.
Potentially Non-compliant	PNC	Possible or likely failure to meet the requirements of the audit element.	This term may apply where during the reporting period the proponent has identified a potential non-compliance and has not yet finalized its investigations to determine whether non-compliance has occurred.
Non-compliant	NC	Implementation of the proposal has not been carried out in accordance with the requirements of the audit element.	This term applies where the requirements of the audit element are not "complete" have not been met during the reporting period.
In Process	IP	Where an audit element requires a management or monitoring plan be submitted to the DWER or another government agency for approval, that submission has been made and no further information or changes have been requested by the DWER or the other government agency and assessment by the DWER or other government agency for approval is still pending.	<p><b>The term 'In Process' may not be used for any purpose other than that stated in the Definition Column.</b></p> <p>The term 'In Process' may not be used to describe the compliance status of an implementation condition and/or procedure that requires implementation throughout the life of the project (e.g. implementation of a management plan).</p>

Each page (including Attachment 2) must be initialed by the person who signs Section 4 of this Statement of Compliance.  
INITIALS: AL

## Urban Development of Part Lot 12 and Reserve 34664, Golden Bay (Assessment 604, Statement 297)

### Ministerial Statement 297 Audit Table

Note:

Phases that apply in this table = Pre-Construction, Construction, Operation, Decommissioning, Overall (several phases)

This audit table is a summary and timetable of conditions and commitments applying to this project. Refer to the Minister's Statement for full detail/precise wording of individual elements.

Code prefixes: M = Minister's condition; P = Proponent's commitment; A = Audit specification; N = Procedure.

Abbreviations: CAR = Compliance Assessment Report; LPA= Landscape Protection Area; FMP- Foreshore Management Plan; CEO = Chief Executive Officer of OEPA; Minister for Env = Minister for the Environment; OEPA = Office of the Environmental Protection Authority; CoR - City of Rockingham; DoT - Department of Transport; CALM Conservation and Land Management (now known as Department of Parks and Wildlife); DPUD = Department of Planning and Urban Development (now Department of Planning)

Compliance Status: C = Compliant, **CLD = Completed**, NC = Non – compliant, NR = Not Required at this stage. Please note the terms NA = Not Audited and VR = Verification Required are only for OEPA use. IP = In Process may only be used by the proponent in circumstances outlined in Section 2.8 of the *Post Assessment Guideline for Preparing an Audit Table*.

Audit Code	Subject	Requirement	How	Evidence	Phase	To requirements of On advice from	Timeframe	Status	Comment
297: M1-1	Commitments	Fulfil the commitments	As per attachment to the Minister's statement.	CAR	Overall	EPA DPaW		C	
297: M2-1	The Proposal	Adhere to the Proposal	In accordance with any designs, specifications, plans or other technical material submitted by the Proponent to the OEPA.	CAR	Overall	EPA DPaW	Throughout life of the project	C	No changes proposed
297: M2-2	The Proposal	Seek approval for modifications to the Proposal	Submit a written request to the Minister for Env. Detailing changes to designs, specifications, plans or other technical material.	Correspondence to OEPA	Overall	Minister for Env. EPA	Throughout life of the project	C	No changes proposed
297: M3-1	Foreshore Reserve	Provide a foreshore reserve for conservation and recreation which: 3. Protects the Peelhusrt Wetlands and the Southern Brown Bandicoot ( <i>Isoodon obesulus</i> ) population; and 4. Includes landscape and recreation values at least equivalent to the area affected by this proposal which is within System 6 Recommendation M107 Area.	Make a submission to the Minister for Env. For approval on advice of the EPA.	Submission to the Minister for Env.	Pre development	Minister for Env. EPA	Prior to lifting of 'Urban Deferred'	CLD	4 June 1993
297: M3--2	Foreshore Reserve	Transfer to public ownership the proposed foreshore reserve as required by M3-1.	Make a submission to the Minister for Env. On advice of the Department of Conservation and Land Management	Submission to the Minister for Env.	Pre development	Minister for Env. EPA	Prior to lifting of 'Urban Deferred'	CLD	4 June 1993
297: M4-1	Landscape Protection	Liaise with the Department of Planning and Urban Development and the CoR to incorporate planning measures which recognise and protect the landscape value of the parabolic ridge on the eastern edge of Golden Bay.	Make a submission to the Minister for Env. And the Minister for Planning for approval on advice of the DPUD, CoR, EPA	Submission to the Minister for Env. And Minister for Planning	Pre development	Minister for Env Minister for Planning DPUD CoR EPA.	Before or as a condition of subdivision	CLD	5 April 1994

Audit Code	Subject	Requirement	How	Evidence	Phase	To requirements of On advice from	Timeframe	Status	Comment
297: M5-1:1	Southern Brown Bandicoot	Establish the regional implications of disturbing the population of the Southern Brown Bandicoot (Isoodon obesulus) at Golden Bay.	Make a submission to the Minister for Env. On advice of the Department of Conservation and Land Management	Correspondence with Minister for Env.	Pre development	Minister for Env CALM	Prior to any clearing/construct ion activities commencing	CLD	6 February 1996
297: M3-1:2	Southern Brown Bandicoot	Initiate management of the population of the Southern Brown Bandicoot (Isoodon obesulus)		Report on this in the first report required under M8	Pre development	Minister for Env CALM	Prior to any clearing/construct ion activities commencing	CLD	CAR Submitted 20 May 2010
297: M5-2:1	Southern Brown Bandicoot	Carry out the ongoing management of the population of the Southern Brown Bandicoot (Isoodon obesulus) at Golden Bay as proposed in M5-1.	Agreement with CALM	Report on this under M8	Development	CALM	Ongoing	C	All stages of development have included a relocation program prior to any clearing activity.
297: M5-2:2	Southern Brown Bandicoot	Carry out the ongoing management of the Southern Brown Bandicoot (Isoodon obesulus) at Golden Bay as proposed in M5-1.	Agreement with CALM	Report on this under M8	Post Development	CALM	Ongoing	C	Southern Brown Bandicoots are monitored in Autumn and Spring each year in the Foreshore Reserve in accordance with the FMP.
297: M6-1	Project Ownership, management, control	Seek approval for transfer of ownership, control or management of this project.	Letter to the Minister for Env. Together with the new proponent's endorsement of the Ministerial Statement	Letter and statement endorsed by the replacement proponent	overall	Minister for Env. EPA	Before transfer of ownership	C	DoC and Peet Golden Bay Pty Ltd were recognised by the OEPA as joint Proponents 1 August 2016.
297: M7-1	Time limit on approval	Seek approval to extend approval to implement proposal.	Application to be made before the end of five years (from the publish date of the Minister's statement)	Letter application	Overall	Minister for Env. EPA	Before 12 January 1998 if project has not commenced substantially	CLD	
297: M8	Compliance auditing	Prepare a periodic 'Progress and Compliance Report' to help verify the environmental performance of this project.	The report (CAR) should be an update on the project giving evidence of how compliance has been achieved. It should list each condition and commitment to be reported on showing for each: its code no. Form the audit table; what action it requires; what has been done to meet the condition or commitment including any problems that may have arisen and what the proponent has done to address them; how compliance can be verified.	CAR providing evidence of compliance for each relevant audit element in the audit table.	Overall	EPA	First report before clearing activities commence, second report one year after clearing has commenced, then as required by the OEPA.	C	OEPA has requested (Appendix 2) that from August 2016 compliance reports are to be submitted annually in August for the previous calendar year.
297: P1	Foreshore Reserve	Provide in exchange for the development of the currently proposed System 6 Area M107, additional Regional and Public Open Space adjacent the Coastal Reserve as shown in the Structure Plan, in excess to that which would normally be required by DPUD.	Duplicated by M3-1		Predevelopm ent	EPA, DPUD CoR	At the rezoning stage	CLD	26 October 1995 Not Audited (duplicated by condition M3-1) – Audit Branch



Audit Code	Subject	Requirement	How	Evidence	Phase	To requirements of On advice from	Timeframe	Status	Comment
297: P2	Management Plan	Prepare a Management plan for the coastal reserve at Golden Bay.	In a submission to the local authority, Minister for Planning and EPA.	Management Plan for foreshore reserve to be submitted	Predevelopment	EPA, Minister for planning, local authority, DEP	before clearing/construction activities commence	CLD	Golden Bay Foreshore Management Plan approved by the OEPA on 30 March 2012 (on advice from DoP and CoR). An addendum to the FMP to address the interface between the development and foreshore reserve was submitted and approved by the OEPA on 29 September 2016.
297: P3	Historic Site	Include the historic aboriginal camping site within the proposed Public Open Space for the development.	Present a submission to the local authority		Predevelopment	EPA Local Authority	before clearing/construction activities commence	CLD	13 December 1995
297: P4	Fire	Protect against Bushfire	By providing and maintaining a network of firebreaks and access tracks until the local authority takes on this responsibility	Report on this under M8	overall	EPA DEP	until the local authority takes on this responsibility	CLD	Fire Management Plan for the Golden Bay Structure Plan Area has been approved by the City of Rockingham in March 2012.
297: P5	Reticulated sewerage and stormwater drainage:	Provide reticulated sewerage and stormwater drainage designated to infiltrate stormwater into the soil within the development site.	To the satisfaction of Minister for planning and local authority	Report on this under M8	Development	EPA Minister for Planning Local Authority	During provision of services within the development	CLD	A Local Water Management Strategy (LWMS) has been prepared for the Structure Plan Area and approved by the Department of Water and the City of Rockingham. Urban Water Management Plans will be prepared in accordance with the LWMS for each stage of subdivision.
297: P6	Bandicoots	Liaise with CALM regarding the presence of bandicoots at Golden Bay and examine feasibility of relocating bandicoots if required by CALM.	Duplicated by M5			EPA CALM	Prior to any disturbance of the vegetation at Golden Bay	CLD	13 December 1995

**APPENDIX 4**

**FORESHORE MANAGEMENT PLAN  
MANAGEMENT ACTION TABLE**

## FORESHORE MANAGEMENT PLAN

### MANAGEMENT COMMITMENTS AND RESPONSIBILITIES

Compliance Status: C = Compliant, CLD = Completed, NC = Non – compliant, NR = Not Required at this stage.

Task	Responsibility	Timeframe FMP Stages	Priority	Status
Locate roads, access tracks and DUPs, and the Coastal node along existing routes where possible, or realign them to move through areas of disturbed vegetation	Developer	Stage 4	2	CLD
Erect temporary fencing between the Foreshore Reserve vegetation and proposed development	Developer	Stage 2	1	C
Survey and peg the Foreshore Reserve area to ensure this is protected from potential impacts of subdivision development	Developer	Stage 2	1	CLD
Replace temporary fencing in appropriate areas with a permanent barrier once earthworks have been completed, to prevent unauthorised access to areas of native vegetation (embedded limestone and native vegetation can be used for this purpose)	Developer	Stage 3	3	NR
Erect interpretative signage on access paths near the TEC to inform DUP users of the conservation value of the vegetation	Developer	Stage 4	3	NR
Maintain grassed parkland area, toilets and showers, access paths, DUPs and fences.	Developer (2 years post- construction)	Stage 3-5	3	C

	then City of Rockingham			
Transfer of proposed Foreshore Reserve to public ownership (to the City of Rockingham)	Developer	Post Stage 5	3	NR
Machinery and vehicles will use the cleared, degraded areas for access, and must be clean on entry to the site.	Developer	Stage 2-5	2	C
Vegetation clearing will be undertaken in weather conditions that are conducive to effective dust control.	Developer	Stage 2-5	1	C
Wind-fencing will be used as required in conjunction with water sprays and tankers to control and limit excessive dust from earthworks operations and roads.	Developer	Stage 2-5	2	C
The size of soil stockpiles will be limited and water or stabilising agents used to control dust.	Developer	Stage 2-5	2	C
Soil stabilisation methods will be used to reduce the risks associated with wind erosion through the use of mulches, dust suppression agents or by revegetation as appropriate.	Developer	Stage 2-5	2	C
Work will be planned to ensure construction or stabilisation follows demolition wherever possible.	Developer	Stage 2-5	2	C
Dust suppression equipment and/or agents will be regularly inspected and maintained as required to prevent unacceptable dust emissions.	Developer	Stage 2-5	2	C
Regular inspections of adjacent roads will be undertaken for dust creating materials.	Developer	Stage 2-5	2	C

Excessive build-up of mud, debris or any other deleterious matter deposited on any road used for access to or egress from the project site will be removed.	Developer	Stage 2-5	2	C
Construction staff will be made aware of issues relevant to dust control and will be familiar with the requirements prescribed in this management plan.	Developer	Stage 2-5	2	C
Revegetate areas not likely to be impacted during construction as indicated in Figure 5	Developer	Stage 1	1	C
Apply brush to large dune “blowout” area	Developer	Stage 1-3	1	NR
Revegetate areas impacted during construction with species consistent with City of Rockingham’s <i>Coastal Rehabilitation Policy</i> (CoR, 2002a)	Developer	Stage 2-5	2-3	C
Implement a monitoring program using visual inspections and photographs to monitor the progress of revegetation plans.	Developer (2 years post- construction) then City of Rockingham	Stage 1-5  Monitoring will be undertaken on a six-monthly basis, reviewed annually	3	C
Replace failed plants if coverage is not adequately achieved.	Developer (2 years post- construction) then City of Rockingham	As required, on a yearly basis post-construction	3	C
Carry out a visual inspection onsite to determine the success of weed control applied as determined in above task, and establish a weed control program for the following two years.	Developer	Stage 2-5	2	C

		Six monthly following initial weed management		
Carry out the weed control program devised in the above task. Potentially regular spot-spraying or removal by hand, done periodically over several years.	Developer (2 years post- construction) then City of Rockingham	Stage 2-5 Pre-, during and post-construction	3	C
Erect a dog-proof fence between the residential subdivision and the Foreshore Reserve to protect Bandicoots within the conservation areas from domestic pets and feral animals.	Developer	Stage 2 During Construction	2	NR
Construct fauna access underpasses beneath paths intersecting known Bandicoot habitat vegetation.	Developer	Stage 3	2	NR
Ensure site crew are aware of the 24hr Wildcare Helpline number to call ((08) 9474 9055) in the case of wildlife being encountered during clearing of construction.	Developer	Stage 2-5	2	C
Erect signage indicating the conservation status of the Bandicoot nearby to their known habitat areas.	Developer	Stage 4	3	NR
Educate landowners on the effect of domestic animals on native fauna, such as by erecting signs addressing responsible pet ownership and protection of habitat for Bandicoot. Signs should also include information on the general biology of Bandicoots.	Developer (2 years post- construction) then City of Rockingham	Stage 3-5	2	NR
Consider seeking community consent for the trapping of cats (particularly after Bandicoot breeding) within conservation areas in the Foreshore Reserve	Developer (2 years post- construction)	Ongoing	3	NR

	then City of Rockingham			
Conserve and rehabilitate any good quality, dense wetland habitat which is planned for protection and provides protection for Bandicoots. The addition of further vegetation and cover (such as hollow logs) may assist with the survival of Bandicoot within protected areas at the Golden Bay site. (Such management actions should continue in parallel with the population monitoring.)	Developer (2 years post- construction) then City of Rockingham	Ongoing	1	C  TEC19a Photo Point Monitoring Survey
Undertake an annual bandicoot trapping survey of seven nights in spring and autumn each year within the Foreshore Reserve (targeting conservation areas with known Bandicoot habitat).	Developer	Stage 2-5 During construction and for a period of 2 years post-construction.	1	C  Bandicoot Monitoring Survey
Continue to rehabilitate areas degraded as a result of construction and implement weed control.	Developer (2 years post- construction) then City of Rockingham	Ongoing	3	C
Removal of debris from bandicoot underpasses to prevent blockages.	Developer (2 years post- construction) then City of Rockingham	Ongoing (monthly)	3	NR
Remove all rubbish from conservation areas.	Developer (2 years post- construction) then City of Rockingham	Ongoing (monthly)	3	NR

Have regard to the Aboriginal Heritage site reserve boundary and erect signage to indicate the significance of the site.	Developer	Stage 1-5 Construction	2	C
Ensure adequate provision of emergency vehicle access through the Foreshore Reserve.	Developer	Ongoing	2	C
Provide suitable drainage infrastructure such as soakwells for hardstand areas (e.g. Car parks)	Developer	Stage 2-5 Construction	2	C
Provision of passive surveillance such as lighting within the Foreshore Reserve.	Developer	Stage 2-5 Construction	2	C



**APPENDIX 5**

**TEC19A PHOTO POINT MONITORING**

# GOLDEN BAY FORESHORE RESERVE

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## 2019 VEGETATION PHOTO POINT MONITORING REPORT

Prepared for: Peet Golden Bay Pty Ltd and Department of Communities

Report Date: 30 August 2020

Version: 1

Report No. 2020-526

The logo for pgv ENVIRONMENTAL is located at the bottom of the page. It features the letters 'pgv' in a large, bold, white sans-serif font. To the right of 'pgv', the word 'ENVIRONMENTAL' is written in a smaller, all-caps, white sans-serif font. The background of the bottom half of the page is a solid orange color with a subtle, wavy pattern of thin white lines.

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Appendix 1:	Vegetation Photo Point Monitoring Proforma
Appendix 2:	Site Photos
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# 1 INTRODUCTION

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## 1.1 Background

The urban development of Lots 2 and 3, Golden Bay was subject to a Public Environmental Review (EPA Assessment 604) and was approved in Ministerial Statement 297 in January 1993 (Appendix A). Ministerial Statement 297 contains three conditions relevant to the Foreshore Reserve at Golden Bay as follows:

*Condition 3-1 The proponent shall provide a foreshore reserve for the conservation and recreation which:*

*1 Protects the Peelhurst wetlands and the Southern Brown Bandicoot (Isoodon obesulus) population; and*

*2 Includes landscape and recreation values at least equivalent to this proposal which is within System 6 Recommendation M106 Area.*

*Commitment P-2 The proponent will prepare a Management Plan for the Coastal Reserve at Golden Bay prior to development commencing. This will be done to the satisfaction of the DPUD [now Department of Planning, Lands and Heritage] and the Local Authority.*

## 1.2 Location

The Golden Bay Foreshore Reserve (the study area) is situated 50km south of Perth and 16km south of the Rockingham Town Centre, within the City of Rockingham (Figure 1). The site is bounded by Secret Harbour to the north, the developing residential area on Lots 2 Warnbro Sound Avenue to the east and the existing Golden Bay Township to the south.

### 1.2.1 Foreshore Reserve Description

The Foreshore Reserve covers an area of approximately 10.61ha, is 800m in length and incorporates the beach, foredune and near-coastal dune systems. The width of the reserve from the back of the beach to its eastern extent ranges between approximately 400m (centre), 200m (southern end) and 250m (northern end). The western boundary of the reserve is marked by the high-water mark, the northern and southern boundaries in line with the northern and southern Lot 2 property boundaries and the eastern boundary marks the western limit of urban zoning. The extent of the reserve is shown in Figure 3.

### 1.2.2 Foreshore Reserve Ecological Values

The Foreshore Reserve contains wetlands that belong to the Peelhurst suite of wetlands. These wetlands form in low lying depressions within the Quindalup Dunes which have intercepted the water table and are typically small, seasonally inundated sumplands or seasonally wet damplands. The Golden Bay wetlands have been listed as Conservation Category in the *Geomorphic Wetlands of the Swan Coastal Plain* database.

The Threatened Ecological Community (TEC) 19a *Sedgelands in Holocene Dune Swales* is located in all the wetlands in the Foreshore Reserve at Golden Bay. This TEC is listed as “Critically Endangered” under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and is also recognised as a TEC at State level.

The vegetation in the Foreshore Reserve supports a population of Southern Brown Bandicoot (*Isoodon fusciventer*). Bandicoots have been identified as a species of state significance and are listed as a Priority 5 species by the Department of Biodiversity, Conservation and Attractions (DBCA).

An indigenous heritage site (DIA 2519) is located in the southern end of the Foreshore Reserve.

### **1.3 Report Purpose**

A Foreshore Management Plan (FMP) was prepared for the study area by the developers of Lot 2 Warnbro Sound Ave (Peet Golden Bay Pty Ltd and Department of Housing now Department of Communities) and approved on 30 March 2012. An addendum to the FMP to address the interface between the development and foreshore reserve was submitted and approved by the OEPA on 29 September 2016.

The FMP contained a commitment to monitor the health of the vegetation in the wetlands using permanent photo points.

The initial photo point monitoring assessment was conducted in October 2012. This report documents the methods and results of the annual photo point monitoring undertaken in the Golden Bay Foreshore Reserve over the period from 2012 to 2019.

The objectives of the photo point monitoring report are to:

- Provide a qualitative assessment of the condition of the TEC19a vegetation in the wetlands;
- Assess any requirement for weeding;
- Assess any requirement for grazing control; and
- Determine if any erosion control is required.

## 2 EXISTING ENVIRONMENT

---

### 2.1 Topography

The topography of the Foreshore Reserve ranges from 1 to 10m AHD. The dunes closest to the coast are part of a recent parallel dune ridge system with dune crests up to 5-6m AHD. The eastern half of the Foreshore Reserve contains a low linear flat swale at an elevation of 1-2m AHD with some taller dunes up to 10m AHD.

### 2.2 Wetlands

The eastern half of the Foreshore Reserve contains a number of small wetlands within the flat swale directly behind the frontal dunes. The wetlands are described as sumplands and contain shallow freshwater above-ground in spring during an average rainfall season. The wetlands are rated as Conservation Category wetlands.

### 2.3 Vegetation

The Foreshore Reserve was subject to a bushfire on 1 January 2016. The fire was reported as being ignited by fireworks/boat flares. The area of the Foreshore Reserve impacted by the fire was estimated to be approximately 7ha. The northern section was burnt in patches and the eastern part of the central section was largely burnt.

The area burnt by the January 2016 bushfire was monitored in accordance with the FRP to assess the progress of regeneration. The monitoring program concluded in October 2018 and it was determined that supplementary planting would not be required. The Post Fire Vegetation Monitoring Survey results are provided in Appendix 4.

#### 2.3.1 Vegetation Types

A variety of coastal Quindalup vegetation types occur in the Foreshore Reserve as listed below:

##### Western Half

- *Spinifex hirsutus* Grassland: Located on the foredune with *Spinifex longifolius*, *Tetragonia decumbens* and *Cakile maritima* present on the seaward facing slopes and *Ficinia nodosa* and *Carpobrotus virescens* frequent near the crest and leeward sides.
- *Olearia axillaris* Shrubland: Located immediately behind the foredune and forms a wide band parallel to the coast, containing *Cassytha* sp., *Pelargonium capitatum* and *Trachyandra divaricata*. It grades into the *Spyridium globulosum* Open Heath.
- *Spyridium globulosum* Open Heath: Located on the lower dunes and containing *Acacia cyclops*, *Hibbertia cuneiformis*, *Alyxia buxifolia*, *Pelargonium capitatum* and the creeper *Hardenbergia comptoniana*.

##### Eastern Half

- *Acacia rostellifera*/*Spyridium globulosum* Closed Shrub: An intermediate unit located in the central part of the site.



- *Juncus kraussii* Sedgeland: Located within the eastern low linear flat swale in the wetland areas, containing *Baumea juncea*, *Centella asiatica*, *Ficinia nodosa*, *Dampiera alata* and *Lepidosperma gladiatum*. Mature Paperbark trees (*Melaleuca raphiophylla* and *Melaleuca cuticularis*) also occur in the wetlands. The 2016 fire caused a multitude of *M. raphiophylla* seedlings to germinate from one mature tree in one of the wetlands in the reserve.
- *Spyridium globulosum* Closed Heath: Making up the majority of the transitional vegetation on slightly higher ground within the swale, it contains similar species to the *Spyridium globulosum* Open Heath on the low dunes and additionally a dense ground coverage of the Sword Sedge *Lepidosperma gladiatum*.

The *Juncus kraussii* Sedgeland vegetation type generally describes the vegetation in the wetlands.



**Plate 1: TEC19a Vegetation**

### **2.3.2 Vegetation Condition**

The vegetation in most of the Foreshore Reserve was rated as mostly being in Excellent condition with only a few tracks through it. Some wetland areas had previously been impacted by off road vehicles. These tracks have been closed off to allow for natural regeneration of the wetlands.

A weed survey of the Foreshore Reserve conducted by PGV Environmental in May 2015, identified the most prevalent introduced species in the area as Rose Pelargonium (*Pelargonium capitatum*) and False Onion Weed (*Trachyantha divaricata*). Both species were more common on the western part of the Foreshore Reserve on sand dunes than in the eastern swales. Hares Tail Grass (*Lagurus ovatus*) and Geraldton Carnation Weed (*Euphorbia terracina*) were also present in parts of the Foreshore Reserve.

The wetlands on the site contained few weeds.

## **2.4 Native Fauna**

The Foreshore Reserve at Golden Bay contains a population of Quenda (*Isoodon fusciventer*). The size and health of the Quenda population has been monitored by the developers for six years. The number of Quenda recorded during surveys in the foreshore reserve declined in 2016 after much of the bushland was burnt which resulted in reduced habitat and an increased exposure of Quenda to predators. Since 2016, the number of bandicoots has increased. This is partially a result of ten additional individuals being relocated into the Foreshore Reserve from other sites in East Rockingham, Florida and Madora Bay, but also post-fire recovery of the habitat. The Quenda population now has Sarcoptic Mange.

The Foreshore Reserve contains a population of Western Grey Kangaroos (*Macropus fuliginosus*). The condition of the wetland vegetation is being adversely impacted by kangaroos moving through or resting in the dense sedgelands. It is anticipated there will be a progressive increase in the kangaroo population.

## **2.5 Pest Fauna**

The Foreshore Reserve contains an abundance of rabbits as evidenced by the quantity and distribution of scats and diggings. Foxes and cats are also common in the Foreshore Reserve.

Fox and cat trapping were undertaken post the 2016 fire event and additional cat trapping is undertaken during the biannual Quenda monitoring surveys. The number of foxes has increased, and it is likely that the Sarcoptic Mange, which can be carried by foxes, has infected some of the Quenda. This disease can kill foxes within 2-4 months if left untreated and it is thought to be the same for Quenda (Terrestrial Ecosystems, 2018). Fox management is best done in cooperation with surrounding landholders as foxes move freely through the remnant vegetation.

The City of Rockingham undertakes annual fox trapping in the region, with one fox and 1 cat were trapped in Autumn 2019. A broad scale RHDV K5 deployment was undertaken to remove small pockets of rabbits during Autumn 2019 (TE, 2019).

### 3 MONITORING RESULTS

---

#### 3.1 Photo Point Monitoring

Photo point monitoring was undertaken on 23 October 2019 at the eight monitoring sites established in the wetland vegetation in 2012 (Plate 1). Sites 5 and 7 have been combined into one site due to their proximity (4m apart).

Four photos (east, north, west, south) were taken from the permanent photo points which are marked with a metal dropper and flagging tape. The location of markers is recorded in eastings and northings as shown in Table 1 and shown in Plate 1.

**Table 1: Photo Point Locations.**

Site	Eastings	Northings
1	382545	6411987
2	382527	6412049
3	382544	6412057
4	382501	6412185
5	382469	6412279
6	382507	6412293
8	382458	6412346

#### 3.2 Condition Assessment Method

The condition of the vegetation in the wetland areas was assessed using key indicators to facilitate comparison between the results from different years. A number of indicators were considered in the condition assessment, each of which were allocated a score using a three-point scoring system of 1 to 3 (Table 2). Relevant comments on condition indicators were also recorded as supplementary information. The scoring system will enable broad comparison over time between results, however, due to the subjective nature of the method, the scores are indicative only.

The nature of many of the indicators for the condition assessment is such that they will not change over the short term, for example surface water and fire history. The attributes most likely to change over time include weed invasion, grazing and flattening.

A standard proforma is used to document the condition assessment to ensure consistency across the subsequent monitoring events. The proforma is provided at Appendix 1.

**Table 2: Condition Indicators**

Indicator	Rating	Measure
Grazing	1	Severe/heavy
	2	moderate (limited but evident)
	3	nil very low
Clearing	1	30% +cleared
	2	10-30% cleared
	3	<10% cleared
Weeds	1	30% +cover
	2	1-30% cover
	3	<10% cover
Erosion	1	severe impacting >30% of site
	2	moderate (limited but evident)
	3	nil very low (minimal impact)
Fire History	1	<10 years
	2	10 to 20 years
	3	>20 years
Surface Water	1	Damp at Surface
	2	<10cm
	3	>10cm

### 3.3 Condition Assessment Results

The results of the qualitative condition assessment for each monitoring point are provided in Table 3. The condition assessment photos are shown in Appendix 2.

The vegetation has continued to recover to pre-fire cover levels.

Three of the seven monitoring sites had surface water greater than 10cm deep. Site 1 had an approximate water depth of 40cm. Site 3 and 6 were damp at the surface but did not contain any above ground water. The groundwater levels (JHD, 2018) in the ground water monitoring bore WB01 in the foreshore wetlands showed maximum levels of around 1.1m AHD in September 2019 (Appendix 3). Ground Water monitoring bore WB02 had maximum levels 0.99m AHD in September 2019 (Appendix 3). The ground water levels were slightly lower than the preceding two years but higher than the two lowest readings in October 2012 and October 2015.

The number of kangaroo trails and resting places were higher in wetlands 2, 4, and 5 than the numbers from 2018. There was evidence of grazing on the sedges in Sites 4, 5, and 6.

Weed invasion has not changed significantly since 2012.

Erosion rating has not changed significantly since 2012.

Site 3 is a wetland that has had a 4WD track through it for many years and, as such, started with a low condition score and high rating for clearing. The sedge *Isolepis nodosus* is regenerating on the track and the vegetation to the north is recovering well. There is some evidence of an increase in weed species such as *Pelargonium capitatum* (Ro) *Euphorbia terracina* (Geraldton Carnation Weed), *Cynodon dactylon* (Couch Grass) and *Carpobrotus edulis* (Hottentot Fig) to the north of the wetland.



**Plate 2: Site 3 Area regeneration after cleared for fire management purposes**

**Table 3: Condition Assessment (2018)**

Condition Attribute	Site	1	2	3	4	5	6	8
<b>Grazing/flattening by rabbits or kangaroos</b>	2019	3	2	3	1	1	2	3
	2018	2	2	3	2	2	2	3
	2017	2	2	3	2	2	2	3
	2016	2	3	3	3	3	3	3
	2015	2	2	2	2	2	3	3
	2012	1	2	3	3	3	3	2
<b>Clearing</b>	2019	3	3	2	3	3	3	3
	2018	3	3	1	3	3	2	3
	2017	3	2	1	3	3	2	3
	2016	3	1	1	2	2	2	2
	2015	3	3	1	3	3	2	3
	2012	3	3	1	3	3	1	2
<b>Weed Invasion</b>	2019	3	3	2	3	3	2	3
	2018	3	2	2	3	3	2	3
	2017	3	2	2	3	3	2	3
	2016	3	2	2	2	2	2	2
	2015	3	3	2	3	2	2	3
	2012	3	3	2	3	3	2	2
<b>Erosion</b>	2019	3	3	3	3	3	3	3
	2018	3	3	2	3	3	3	3
	2017	3	3	2	3	3	3	3
	2016	3	3	1	3	3	3	3
	2015	3	3	2	3	3	3	3
	2012	3	3	1	3	3	2	2
<b>Fire History</b>	2019	2	1	1	1	1	1	1
	2018	2	1	1	1	1	1	1
	2017	2	1	1	1	1	1	1
	2016	2	1	1	1	1	1	1
	2015	2	2	2	2	2	1	2
	2012	2	2	2	2	2	2	2
<b>Surface Water</b>	2019	3	1	1	2	2	1	2
	2018	3	3	1	2	3	1	3
	2017	3	2	1	3	3	1	2
	2016	2	1	1	1	1	1	1
	2015	1	1	1	1	1	1	1
	2012	2	1	1	1	2	1	2

### **3.4 Photo Point Monitoring Results**

The full set of photos for each site year 2019 is provided in Appendix 2.



### 3.4.1 Site 1

Comparison of photos from 2015, 2016, 2017, 2018 and 2019 showed that there was similar damage by kangaroos passing through and/or sleeping in the wetland at Site 1. There was approximately 40cm of standing water in the wetland.

**Plate 3: Year 2015**



**Plate 4: Year 2016**



**Plate 5: Year 2017**



**Plate 6: Year 2018**



**Plate 7: Year 2019**





### 3.4.2 Site 2

Comparison of photos from 2015, 2016, 2017, 2018 and 2019 shows the site is recovering from the fire. The sedges in the wetland have regrown to approximately 50cm in height. The surrounding vegetation is also regenerating. The wetland was dryer than previous years with no standing water.

**Plate 8: Year 2015**



**Plate 9: Year 2016**



**Plate 10: Year 2017**



**Plate 11: Year 2018**



**Plate 12: Year 2019**



### 3.4.3 Site 3

Comparison of photos from 2015, 2016, 2017, 2018 and 2019 shows the recovery of the vegetation after the fire.

**Plate 13: Year 2015**



**Plate 14: Year 2016**



**Plate 15: Year 2017**



**Plate 16: Year 2018**



**Plate 17: Year 2019**



#### **3.4.4 Site 4**

Comparison of photos from 2015, 2016, 2017, 2018 and 2019 show the vegetation within the wetland has recovered completely from the fire event. The sedges in the wetland have regenerated and were approximately 40-50cm in height. The wetland had approximately 10cm of surface water in places on the day of the survey. The level of surface water was less than in previous years. There was evidence of increased kangaroo activity passing through the wetland.

**Plate 18: Year 2015**



**Plate 19: Year 2016**



**Plate 20: Year 2017**



**Plate 21: Year 2018**



**Plate 22: Year 2019**





### 3.4.5 Site 5

Comparison of photos from 2015, 2016, 2017, 2019 shows the impact of the fire on the wetland and good regrowth in year 2019. There was approximately 10cm of surface water across the wetland which was less than previous year. There was more evidence of kangaroo activity in the wetland

**Plate 23: Year 2015**



**Plate 24: Year 2016**



**Plate 25: Year 2017**



**Plate 26: Year 2018**



**Plate 27: Year 2019**



### 3.4.6 Site 6

Comparison of photos from 2015, 2016, 2017, 2018 and 2019 shows good vegetation recovery across the wetland and surrounding areas.

**Plate 28: Year 2015**



**Plate 29: Year 2016**



**Plate 30: Year 2017**



**Plate 31: Year 2018**



**Plate 32: Year 2019**



### 3.4.7 Site 8

Comparison of photos from 2015, 2016, 2018 and 2019 shows good regeneration of vegetation across the wetland. There was greater than 10cm of standing water in parts of the wetland.

**Plate 33: Year 2015**



**Plate 34: Year 2016**



**Plate 35: Year 2017**



**Plate 36: Year 2018**



**Plate 37: Year 2019**



## **4 CONCLUSIONS**

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The photo monitoring of vegetation in the wetlands of the Golden Bay Foreshore Reserve shows the vegetation regeneration after the impact of the fire on 1 January 2016. The sedges in the wetlands have regrown and the surrounding vegetation is at pre-fire density and condition.

There has been little change in the condition of the wetland in site 1 which wasn't impacted by the fire.

The impact of the fire in increasing weeds in the fire-affected areas is being monitored and, if required, weed control will be implemented. Currently, monitoring has not detected an increase in weed density or species richness after the fire. With the rapid recovery of the native vegetation the status of weeds in the wetlands is unlikely to change.

There is continued evidence of kangaroos resting and passing through wetlands 2, 4, 5, and 6. There is some evidence of grazing on the new sedges. The impact of kangaroos on the vegetation will be monitored further. If the impact is considered to be having long-term adverse effects, a programme to remove the kangaroos from the Foreshore Reserve will need to be investigated. Any kangaroo management in the Foreshore Reserve, however, will need to be a collaborative effort between all developers in the area, the City of Rockingham and the Department of Biodiversity, Conservation and Attractions.

## 5 REFERENCES

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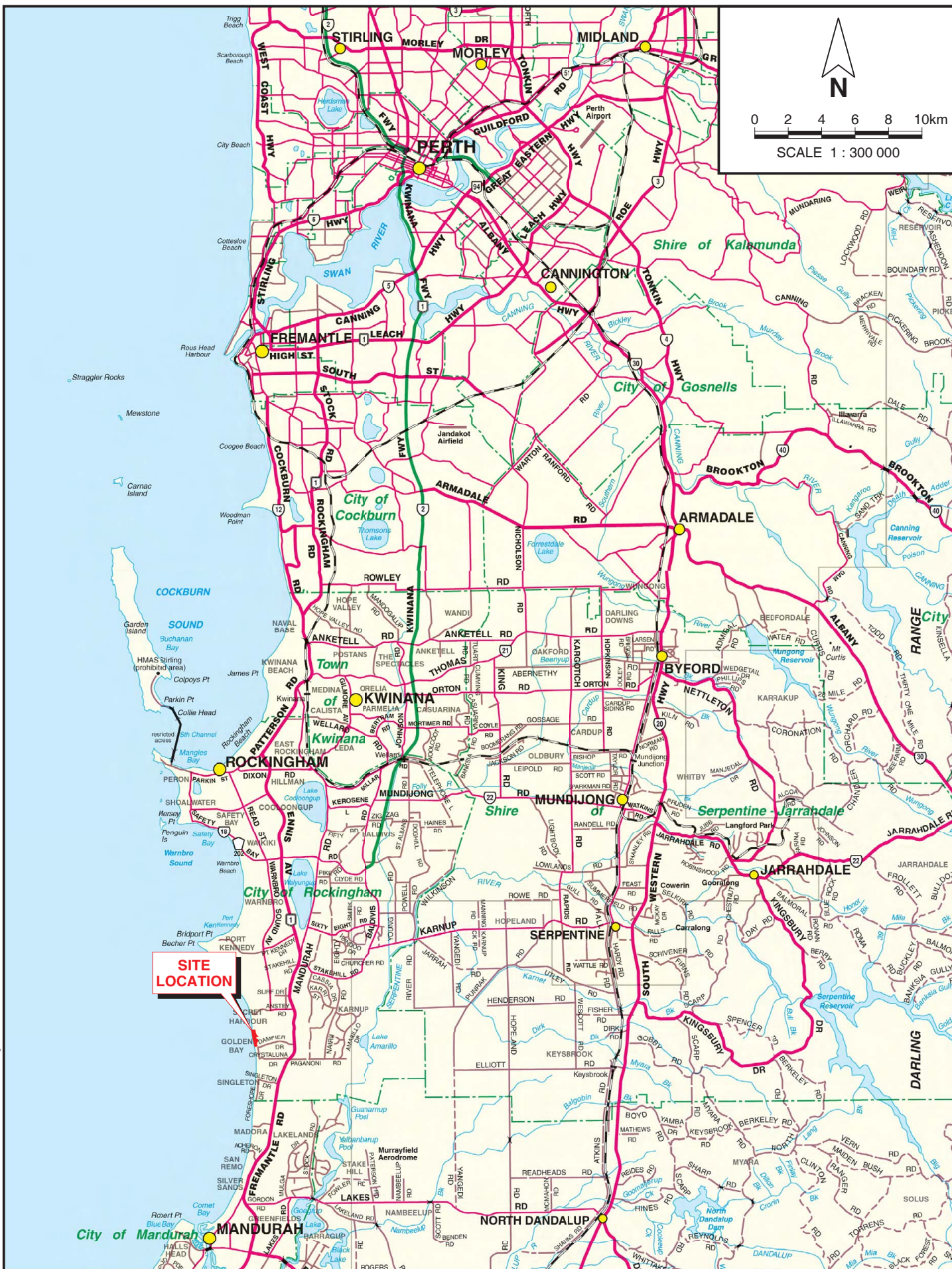
JDA Consultant Hydrologists (2020). *Golden Bay – Wetland Groundwater Levels to end of 2019*.

PGV Environmental (2011). *Lots 2 and 3 Warnbro Sound Avenue Golden Bay Foreshore Management Plan*. Prepared for the Department of Housing. Report No. 2011-13 V6.

Terrestrial Ecosystems (2019). *Quenda Monitoring Golden Bay – Spring 2019*. Report prepared for Peet Limited.



# FIGURES





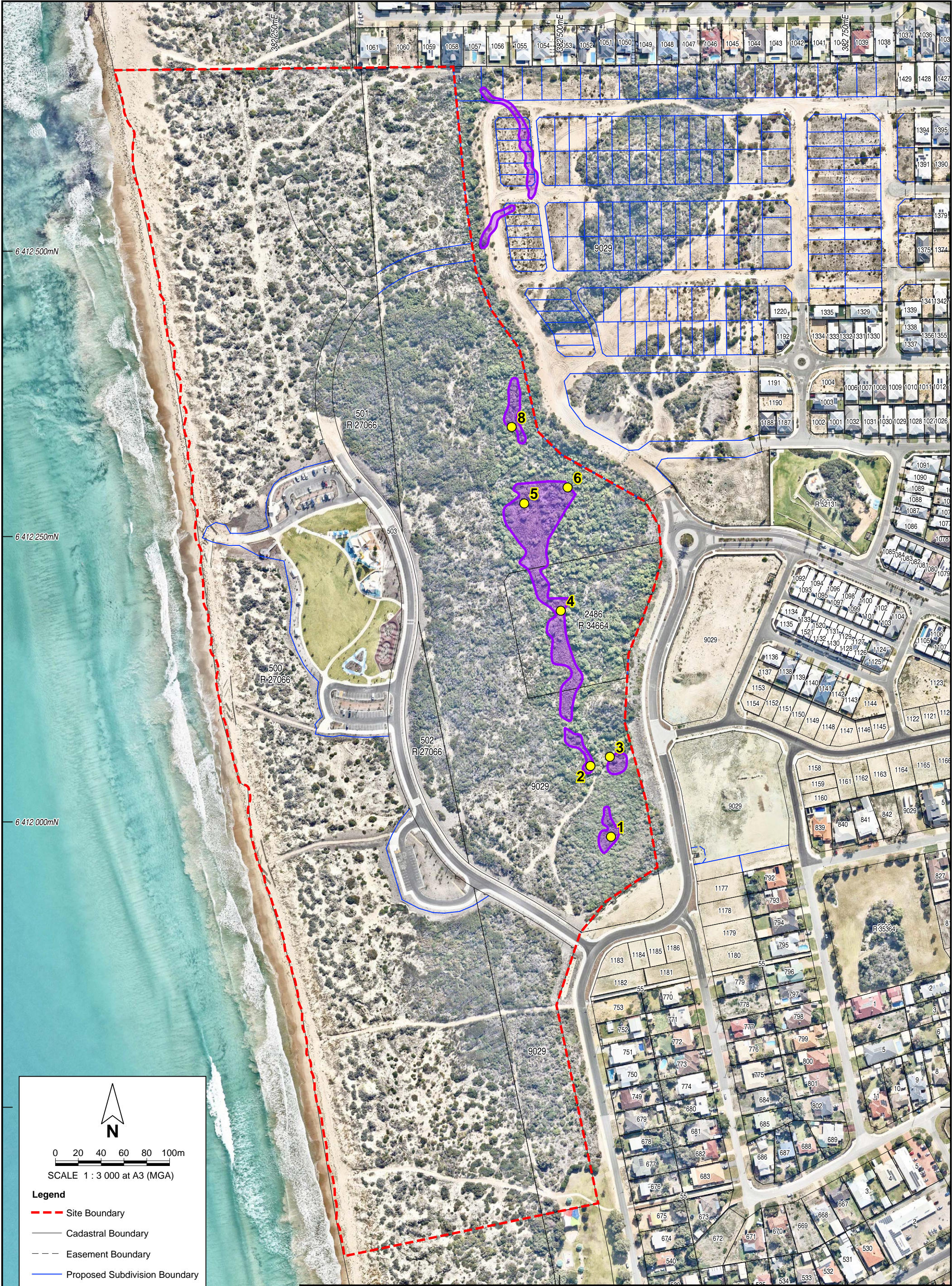


Figure 1



**APPENDIX 1**

**SITE ASSESSMENT PROFORMA**

Site No.	Recorder (s)		Date	
GPS Point	Easting		Northing	
Fencing: fully/partial/not fenced	Current Land Use			
Monitoring Photos No. (taken from Stake)	East	South	West	North
Position of Marker in TEC				
Attribute of Site	Score	Comments		
Grazing				
1 = severe/heavy				
2= moderate (limited but evident)				
3=nil very low				
Clearing				
1 = 30% + cleared				
2 = 10-30% cleared				
3 = <10% cleared				
Weed Invasion				
1 = 30% + cover				
2 = 1--30%				
3 = <10%				
Erosion				
1 = severe impacting >30% of site				
2= moderate (limited but evident)				
3=nil very low (minimal impact)				
Fire History				
1 = <20 years				
2 = 20-50 years				
3 = > 50 years				
Surface Water				
1 = Damp at surface (no standing water)				
2 = < 10cm				
3 = >10cm				

# **APPENDIX 2**

## **SITE PHOTOS**

## Site Photos 2018 – Taken from permanent marker in each of the wetlands

### Site 1

382545 m E

6411987 m S

-32 25 22.93

115 45 2.08

Plate 1: Looking East



Plate 2: Looking south



Plate 3: Looking west



Plate 4: Looking north



**Site 2**

**382527 m E**

**6412049 m N**

**32 25 21.10**

**115 45 1.90**

**Plate 5: Looking East**



**Plate 6: Looking south**



**Plate 7 Looking west**



**Plate 8: Looking north**





**Site 3**

**382544 m E**

**6412057 m S**

**32 25 20.61**

**115 45 2.79**

**Plate 9: Looking East**



**Plate 10: Looking south**



**Plate 11: Looking west**



**Plate 12: Looking north**



**Site 4**

**382501 m E**

**6412185 m S**

**32 25 16.6**

**115 45 1.03**

**Plate 13: Looking East**



**Plate 14: Looking south**



**Plate 15 Looking west**



**Plate 16: Looking north**



**Site 5 and 7 combined**

**382469 m E**

**6412279 m S**

**32 25 13.6**

**115 44 59.78**

**Plate 17: Looking East**



**Plate 18: Looking south**



**Plate 19: Looking west**



**Plate 20: Looking north**



**Site 6 -**

**382507 m E**

**6412293 m S**

**32 25 12.93**

**115 45 1.5**

**Plate 21: Looking East**



**Plate 22: Looking south**



**Plate 23 Looking west**



**Plate 24: Looking north**





**Site 8**

**382458.00 m E**

**6412346.00 m S**

**Plate 29: Looking East**



**Plate 30: Looking south**



**Plate 31: Looking west**



**Plate 32: Looking north**



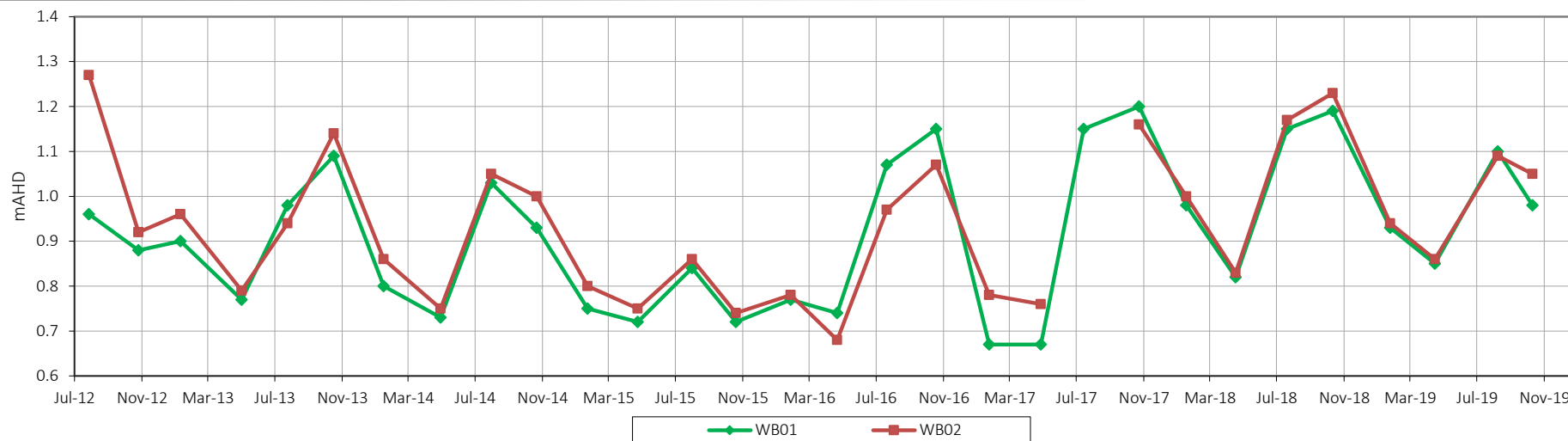
**APPENDIX 3**

**GROUNDWATER LEVELS IN  
WETLAND BORES**

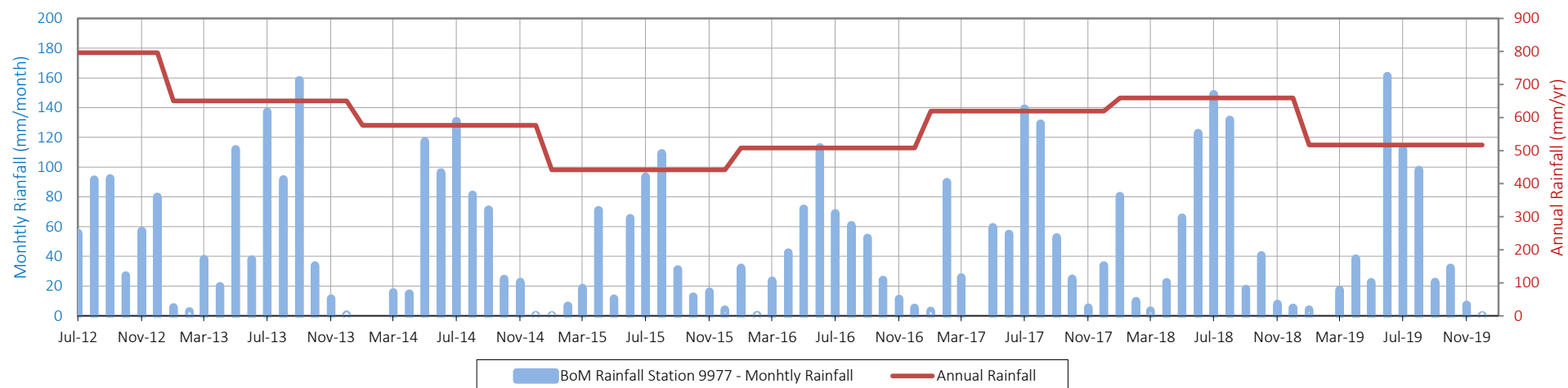
# Wetland Bores - Groundwater Levels

2019

## Groundwater Levels (mAHD)



## Rainfall (mm)



Job No. J6903

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Peet Golden Bay Pty Ltd and Housing Authority  
Golden Bay Groundwater Monitoring

**Figure 1: Groundwater Levels in Wetland Bores 2012 - 2019**

**APPENDIX 6**

**SOUTHERN BROWN BANDICOOT  
MONITORING SURVEY REPORTS**



## Quenda Monitoring Golden Bay – Autumn 2019



Version 2. May 2019

Prepared for:

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Front Cover: Regeneration of the burnt vegetation in the Foreshore Reserve

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## Figure

1. Trapping sites

## Appendix

- A. Trapping site locations

# 1 INTRODUCTION

Peet Ltd, on behalf of the Peet Ltd and the Department of Housing, requested a follow up monitoring survey of the Quenda (*Isoodon fusciventer*) population in the Foreshore Reserve adjacent to Lot 2, Warnbro Sound Ave, Golden Bay (i.e. 'project area'). This follows on from an initial survey in spring 2012 and subsequent monitoring surveys in spring 2012, and autumn and spring of 2013, 2014, 2015, 2016, 2017 and 2018 (Terrestrial Ecosystems 2012, 2013b, a, 2014a, b, 2015a, b, 2016a, b, 2017b, a, 2018a, b). Quenda (formerly part of the Southern Brown Bandicoot complex) monitoring is a requirement under the Ministerial Statement 150 and compliance reports are provided to the Office of the Environmental Protection Authority on an annual basis.

The Foreshore Reserve includes the foredune and swale, and the hinterland vegetation inland for about 400m from the ocean (Figure 1). The Foreshore Reserve includes a Conservation Category Wetland and a Threatened Ecological Community (TEC) that supported dense vegetation before it was burnt. The project area was extensively burnt in January 2016 and the only continuous unburnt habitat that remained was in the southern end of the foreshore reserve. Since the burn in January 2016, there has been significant vegetation growth across the entire burnt area.

There is a sand track that runs the length of the reserve east of the fore dune and along the fence line, with numerous tracks running at right angles to the beach in the southern section. Some of these dune tracks are overgrown but many are frequently used by members of the public. There are two tracks from the cleared area along the eastern boundary to the fence that runs north-south behind the foredunes. One of these tracks is now partially overgrown.

## 1.1 Scope of this Quenda survey for long-term monitoring

The Foreshore Reserve will remain public open space and the developer has made a commitment to monitor the health of the Quenda population on a twice yearly basis during the construction and development stages (PGV Environmental 2011).

Coffey Environments recorded eight Quenda in the reserve during its survey in mid-February 2010 (PGV Environmental 2011). It was reported that Quenda preferred scrubby, often swampy vegetation with a dense understorey of cover up to one metre high. The TEC and wetland areas within the Foreshore Reserve were considered suitable habitat to sustain a bandicoot population in the long-term (PGV Environmental 2011).

A Quenda relocation program has been undertaken for each stage of development prior to vegetation clearing from Lot 2, Warnbro Sound Ave and Lot 3, Dampier Drive as required under Ministerial Statement 150. This program was implemented to minimise the impact of vegetation clearing on bandicoots residing in these lots. All Quenda caught prior to the last vegetation clearing program in July 2016 were relocated out of the area as there would have been insufficient habitat remaining to sustain this population given the area that had been burnt in January 2016.

The results of 13 previous monitoring surveys are shown in Table 1. This report provides the outcomes of the fourteenth monitoring survey of Quenda in the Foreshore Reserve.

**Table 1. Number of Quenda in the previous monitoring programs**

	Spring 2012	Winter 2013	Spring 2013	Winter 2014	Spring 2014	Autumn 2015	Spring 2015	Autumn 2016	Spring 2016	Autumn 2017	Spring 2017	Autumn 2018	Spring 2018
# of indiv. captured	31	30	28	39	48	53	36	26	12	15	15	12	46
# of males	13	10	7	12	10	16	14	8	3	9	9	8	28
# of females	15	20	21	27	25	34	22	18	3	5	5	3	18
# of juveniles	3	-	-	1	12	3	6	-	6	1	1	1	1

The January 2016 fire corresponded with a reduction in the population of Quenda in the reserve. The autumn 2018 survey report (Terrestrial Ecosystems 2018a) indicated that the vegetation in the burnt area had regenerated and much of the burnt section of the Foreshore Reserve could now support Quenda. To supplement the low Quenda population in the reserve, Quenda were relocated into the foreshore reserve from vegetation clearing projects at sites in east Rockingham, Florida and Madora Bay. All relocated Quenda had a microchip and were measured in a similar manner to those at Golden Bay.

## 2 BIOLOGY AND ECOLOGY OF QUENDA

The Quenda (*I. fusciventer*) is a medium-sized, ground-dwelling marsupial that belongs to the Peramelidae family (Van Dyck and Strahan 2008, Travouillon and Phillips 2018). Populations of Quenda occur widely throughout southern Western Australia (Rees and Paull 2000, Van Dyck and Strahan 2008). In 2018, Quenda was elevated to a full species and is now commonly called a Quenda in WA (Travouillon and Phillips 2018).

*Isoodon fusciventer* was listed as a Schedule 1 species (Fauna that is rare or likely to become extinct) under the Western Australian *Wildlife Conservation Act 1950* until 1998. An increase in the population, which was attributed to the implementation of fox baiting throughout the state, meant that in 1998 Quenda was removed from the threatened species list. Quenda is now listed as a Priority 4 species ('Taxa in need of monitoring') on the Department of Biodiversity, Conservation and Attractions' (DBCAs) Priority Fauna List.

Quenda are found in the wetter sections of the south-west of Western Australia, mostly along the Swan Coastal Plain from the Moore River to Walpole and the Fitzgerald River area. Populations of Quenda are found in a variety of habitats in this region and appear to be able to survive a level of habitat destruction and live close to urban and industrial developments. Quenda prefer habitats with a dense shrub understorey up to one metre high, but they are found in a variety of habitats including Banksia, Eucalypt and Melaleuca woodlands, but often in close proximity to a wetland where the vegetation is often more dense (Stoddard and Braithwaite 1979, Ramalho et al. 2013). In areas of thick undergrowth, Quenda are able to establish runways that are difficult to detect beneath the interlocking vegetation (Craven 1981). They are vulnerable to cat, fox and dog predation and are occasionally seen dead on the roads in urban environments, with the result that they are increasingly under threat due to the clearing of bushland leading to habitat fragmentation, bushland degradation and predation by introduced predators including foxes, cats and dogs (Friend 1991).

Quenda and Southern Brown Bandicoots are both nocturnal and diurnal, but are mostly active during the day early in the morning or late afternoon (Van Dyck and Strahan 2008). Individuals are mostly solitary, but with overlapping home ranges. The home range size of Quenda decreases with increasing population size (Broughton and Dickman 1991). The smallest home range estimates of 2.1ha for males and 1.4ha for females were recorded for a high density population (1.3–1.4 animals ha<sup>-1</sup>) on Franklin Island, South Australia (Copley et al. 1990). The largest home range estimates of 5.3ha for males and 2.3ha for females and were calculated for a low density population (0.07–0.2 animals ha<sup>-1</sup>) in Tasmania (Heinsohn 1966). A study of Quenda in the Perth metropolitan area found that animals' increased their home range size and grazed in more open habitats in areas when predator control was implemented, compared to areas where there was no predator control (Gardner 2004).

Quenda are omnivorous, feeding on invertebrates (including earthworms, beetles and larvae), underground fungi, subterranean plant material, and occasionally small vertebrates such as lizards (Broughton and Dickman 1991). Quenda build a nest consisting of a heap of ground litter over a shallow depression providing an internal chamber with loose regions at both ends for entry and exit. The dense vegetation probably protects the nest from extremes in temperature and wind, rain and predators.

Heinsohn (1966) reported Southern Brown Bandicoots reach sexual maturity at five to six months of age when they weigh approximately 600g. As males produce sperm throughout the year, it is the reproductive activity of the female that determines the beginning and length of the breeding season (Heinsohn 1966). Breeding peaks in spring (Thomas 1987, Mallick et al. 1998) and females have a gestation period of 12 to 13 days and litters of one to six young are produced, although litters of two to four are most common. Two or three litters may be reared during a single breeding season, although this is dependent upon the availability of food resources (Friend 1991, Mallick et al. 1998) and rainfall (Barnes and Gemmell 1984).

Studies have reported the sex ratio of Southern Brown Bandicoots populations to be from 1.7 males to one female to 0.33 males to one female (Craven 1981, Thomas 1987, Mallick et al. 1998). The lifespan of the Quenda in the wild is estimated to be two to three years (Craven 1981).



### 3 METHODOLOGY

One hundred and twenty-eight baited wire cage traps were set in locations shown in Figure 1 (Appendix A). Traps were positioned in a similar location to the surveys undertaken in autumn and spring 2018. All cage traps were baited with a peanut butter sandwich and were set for 10 nights between 17-27 March 2019. Traps were located in the vegetated areas that were likely to support Quenda. The layout of traps incorporated the pattern for autumn and spring surveys of 2016 and 2017 and also surveys undertaken before the fire in January 2016.

In addition, five large wire cage traps were set to catch feral cats. These traps had an internal, spring loaded door and were baited with a tin of sardines. These traps were placed in the southern area and in the north-eastern area of native vegetation.

All traps were baited when they were opened, when they had no bait and on every other day if they had bait. All traps had a hessian cover and were placed under vegetation. Traps were cleared from first light each morning. Staff in the Department of Biodiversity, Conservation and Attractions (DBCA) requested that tissue samples were taken from caught bandicoots, which was done, and the tissue samples will be given to DBCA at a later date.

Trapping was conducted under License 11-000925-3. Captured Quenda were measured, weighed, sexed and released near the point of capture. All Quenda that had not previously been caught had a microchip inserted on the dorsal surface near the shoulder blades. Captured bandicoots were identified and released near their site of capture.

#### 3.1 Data analysis

Trap success rate was determined by dividing the trapping effort by the number of bandicoots caught per trap-night. There were 128 cage traps targeting Quenda and the trapping effort was therefore 1,280 small trap-nights and 50 cat trap-nights. Quenda were caught in the small cage traps and the cat traps. Trapping data are compared with previous survey data.

#### 3.2 Signs

As recommended in the winter 2014 monitoring report (Terrestrial Ecosystems 2014a) signs (Plates 1 and 2) were prepared by Peet and Terrestrial Ecosystems and placed on each track leading into the survey area. These signs were designed to reduce the number of people and dogs interfering with traps and captured bandicoots.



**Plate 1. Sign placed near the end of an access track**



**Plate 2. Sign placed near the end of an access track**

## 4 RESULTS AND DISCUSSION

### 4.1 Survey monitoring

The Quenda trapping results are shown in Table 2 and 3. Forty-four individual bandicoots were caught with 24 females and 20 males. No Quenda were caught weighing less than 200g (i.e. a juvenile). One female had two pouch young (Plate 5), and one showed evidence of recent breeding (i.e. enlarged teats). The overall trapping success was 25.5.0% and for Quenda it was 21.6%. The Quenda trapping success is higher than the last two survey rates of 11.2% and 18.6% (autumn and spring 2018 respectively).

**Table 2. Number of Quenda in autumn 2019**

	Spring 2018
# of indiv. captured	44
# of males	20
# of females	24
# of juveniles	-

Eight Quenda caught during this survey had been relocated into the foreshore reserve from sites in east Rockingham, Florida and Madora Bay in winter 2018, indicating the relocation program had been partially successful.

There were 276 separate Quenda capture events (i.e. an individual was caught) with the number of times an individual being caught varying between 1 and 10 (i.e. caught every day).

Fresh fox and cat tracks and scats were observed on multiple occasions (Plates 3 and 4). Shade covers on numerous cage traps were dislodged, probably by foxes. Feral cats and foxes would be predating on young Quenda and other small vertebrate fauna in the reserve.



**Plate 3. Fox scat**



**Plate 4. Fox tracks**

In addition to the Quenda, four (*Rattus rattus*), four Western Blue Tongue Lizards (*Tiliqua occipitalis*), twelve house mice (*Mus musculus*), one cat (*Felis catus*) (Plate 8); two Silvereyes (*Zosterops lateralis*) and 28 bobtails (*Tiliqua rugosa*; Plate 6) were caught in the traps.

The cat had no collar, identification tags or ear tattoo but did have a microchip (chip# 953 010002266638). This is the same cat caught in spring 2018. It was delivered to the Shenton Park Cat Haven who would have contacted the owners.



Several Quenda had Sarcoptic Mange (Plates 9) which is caused by the parasitic burrowing mite *Sarcoptes scabiei*. Due to the burrowing activity of the mite the host develops a range of symptoms, the most common of which are a thickening of the skin, irritation of the skin, dermatitis and patchy hair loss (Bornstein et al. 1995, Little et al. 1998, Davidson et al. 2008). This parasite is typically found on foxes but will infect other native mammals. When untreated an infected fox will usually die within two to four months (Borg 1987, Newman et al. 2002), so it is probably the same for Quenda. The high mortality rate can result in a severe population decline and previous outbreaks of Sarcoptic Mange in fox populations in Sweden and Bristol in the United Kingdom have resulted in >70% and >95% reduction in population density (Lindström et al. 1994, Soulsbury et al. 2007). Environmental stress (i.e. lack of food, predation pressure etc) can increase the chances of Quenda having Sarcoptic Mange.



**Plate 5. Quenda with young**



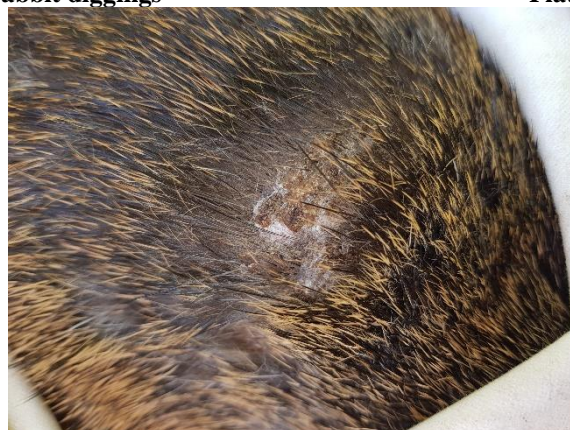
**Plate 6 Bobtail**



**Plate 7. Fresh rabbit diggings**



**Plate 8. Cat**



**Plate 9. Quenda with mange**



All but one male Quenda weighed more than 700g and a high proportion of the females (i.e. 16 of 24) weighed more than 600g. These data, in conjunction with the very low recruitment of juveniles into the adult population, would suggest that there is predation on Quenda, and in particular the juveniles and young adults.

A small number of local people walk their dog(s) through the area, but this was reduced by using the warning signs. A few of the traps had been closed and moved within 24 hours of deployment but this was almost certainly done by people walking through the area or their dogs, as the interference with traps was most common in the easily accessible areas. In other areas where the public don't access the bushland a large proportion of the traps had been dug out or moved. The diggings and tracks would indicate that foxes are causing this interference and in one case a Quenda was stressed to death by a fox trying to get into the cage.

We indicated in previous reports that the rabbit population was on the increase, and again observed rabbit scat piles in numerous locations. Without an active management program, the rabbit population is expected to increase as the new vegetation becomes established and provides a significantly greater area of vegetation cover and food source.

Western Grey Kangaroos were observed during the survey, and their tracks and scats were observed on most days, indicating there continues to be population of kangaroos in the Foreshore Reserve. Even though there is partial habitat linkage, it is unlikely that the Western Grey Kangaroos are moving north to the golf course or south to Madora Bay.

#### *Status of the population*

The total number of Quenda caught during this monitoring program (44) is similar to spring 2018 (46) and a significant increase on that recorded in the earlier surveys (spring 2016- autumn 2017). This is partly due to the relocation of Quenda from other sites in east Rockingham, Florida and Madora Bay that have subsequently been cleared of vegetation and is also due to an increase in the local resident population as the vegetation has regrown to provide a substantial increase in suitable habitat.

The abundance of large Quenda and lack of juveniles highly likely reflects predation by foxes and feral cats on the smaller Quenda and the larger individuals being able to escape or avoid foxes and feral cats. Dense vegetation around the wetland will provide additional suitable habitat for Quenda and better protection from feral predators.

Very few of the adult females had pouch young or evidence of recently nursing pouch young. Our previous data has indicated there is very low recruitment of juveniles into the adult population, almost certainly because of predation by feral predators. Continuation of a management program for rabbits, cats and foxes in cooperation with the City of Rockingham for the coastal dune system is essential to maintaining a viable population of Quenda in the Foreshore Reserve.

The presence of Sarcoptic Mange in the Quenda population is of concern, as it could significantly reduce or even eradicate Quenda from the Foreshore Reserve, when considered in conjunction with feral predator predation. Spring 2018 is the first time Sarcoptic Mange has been recorded in this population of Quenda since surveys have been undertaken (i.e. February 2010). It is probable that if the fox population has mange, then it is foxes that are transmitting and moving the mange mite between natural areas. There is little that can be done to address this problem, other than to reduce the population of foxes and stop the spread of *Sarcoptes scabiei* mites.

#### *Western Grey Kangaroos*

Western Grey Kangaroos in the Foreshore Reserve and surrounds are very wary and largely remain out of sight, however, it could be anticipated there are 20 plus individuals living in the area. Given the presence of water in winter, abundant foraging resources and shelter this population will increase by 25-30% each year.

## *Rabbits*

The population of rabbits in the Foreshore Reserve and the adjacent beach dunes has increased and will continue to increase as the vegetation regrows. Rabbit control is important in maintaining populations of native mammals (Pedler et al. 2016). Rabbits are also likely to impact on the regenerating native vegetation, by eating the emerging vegetation.

Rabbit control should be undertaken in spring or autumn to coincide with the optimum delivery period for RHDV (i.e. maximum abundance of dispersal vectors). Recent information suggests that the effectiveness of RHDV K5 is less than first thought as it acts more like a biocide than a biological control (i.e. lacks a mechanism to spread quickly over a large area). Use of Pindone to control rabbits should be avoided in all areas of native vegetation due to the negative impacts on native fauna (Lohr and Davis 2018) including Western Grey Kangaroos, Quenda and numerous birds. Other complimentary rabbit control approaches will be required if RHDV K5 is not effective on site.

## **4.2 Conclusion**

The regrowth in the vegetation since the January 2016 fire has provided good habitat for Quenda, particularly around the wetland area. The quality of habitat for Quenda will continue to improve as the vegetation grows. The impact of the January 2016 fire on the fauna habitat in the Foreshore Reserve was evident in the reduction in the population of Quenda. Reducing suitable habitat for native fauna also disproportionately increases predation pressure on native fauna due to improved access to the remaining animals. A significant fire in the Foreshore Reserve that burns most of the native vegetation could eradicate Quenda from the reserve and force the kangaroos into the residential areas. There is a Bushfire Attack Level (BAL-Assessment) completed for the proposed Foreshore Reserve Kiosk area (Natural Area Consulting Management Services 2018), however, it is suggested that a fire management plan or BAL-Assessment is prepared and implemented for the Foreshore Reserve and proposed remnant habitat, which focusses on reducing the spread of a fire should one be ignited and provides suitable and quick access for fire-fighting equipment and personnel.

Based on the results of this trapping program, there has been a significant increase in the population of Quenda in the Foreshore Reserve since it was surveyed in autumn 2018. The numbers initially remained low after the fire (i.e. 12-15) probably due to feral cat and fox predation and the limited area of suitable habitat (i.e. 4ha).

There is a high turnover of Quenda between survey periods and very few pouch young are remaining in the population to become breeding adults. This is almost certainly attributed to predation by fox and cats. Cats have been recorded during most surveys in the Foreshore Reserve. Some of these cats are feral, whereas, many are domestic cats that can roam free at night and are roaming through the Foreshore Reserve. Domestic cats will predate on juvenile Quenda and are therefore likely to be contributing to the low level of recruitment of juveniles into the adult population. It is therefore suggested that the City of Rockingham invests in a promotional campaign that encourages its residents to keep their cats at home and restrained from roaming beyond their yard boundaries at night. The domestic cat caught in Autumn 2019 was also caught in spring 2018, indicating that some cat owners in the adjacent community have failed to understand the importance of confining their cat to their premises.

Spring 2018 was the first survey in which Sarcoptic Mange has been recorded in Quenda and it was recorded again during autumn 2019. The combined effects of Sarcoptic Mange and predation by feral predators could reduce or eradicate Quenda from the Foreshore Reserve.

We understand that there is an annual feral and pest animal management program being undertaken by the City of Rockingham, however, foxes and cats continue to be a problem for this Quenda population. It is strongly recommended that a high intensity fox and cat management program is implemented and the rabbit hemorrhagic disease virus (RHDV K5) is released in combination with other complimentary techniques to reduce the current abundance of rabbits. These programs should be coordinated by the City of Rockingham.

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### Table 3. Quenda trapping results

						Trapping days and number of trapped individuals											
Sex	Mass (g)	HL (mm)	HW (mm)	Pes (mm)	Chip N°	18/03/2019	19/03/2019	20/03/2019	21/03/2019	22/03/2019	23/03/2019	24/03/2019	25/03/2019	26/03/2019	27/03/2019	Grand Total	
Female	840	88	38	58	6B3B383		1									1	
Female	780	78	40	57	6B3D38E/783BFC5	1			1		1	1		1	1	6	
Male	790	78	31	59	6E2270D		1	1	1	1	1	1	1	1		8	
Male	980	88	37	63	6E2536A/7AFEB1D		1	1	1	1	1	1	1	1		7	
Male	720	73	33	59	7838DD4						1		1		1	3	
Male	1240	96	40	66	783AE34	1	1	1	1	1	1	1	1	1	1	10	
Male	1580	89	44	62	783B9E9	1	1	1	1	1	1	1	1	1	1	10	
Female	1080	77	34	54	783BE64		1	1	1		1	1	1	1	1	8	
Female					783D198	1	1		1	1	1	1	1	1	1	8	
Male	1600	92	38	65	783D5BA					1	1	1	1	1	1	6	
Female	640	71	29	52	783D913				1	1	1		1	1		4	
Male	1070	85	43	65	783E19C	1				1		1	1		1	5	
Male	1560	87	40	65	783E4E3	1	1	1	1	1	1		1	1	1	9	
Female	900	82	37	54	783EF57	1		1		1		1		1		5	
Male	560	77	28	55	79D560F	1	1		1	1	1	1		1	1	8	
Female	570	74	34	51	79D5624	1		1	1		1	1	1		1	7	
Female	240	62	29	43	79D5626	1		1		1		1		1		5	
Female	660	83	35	55	79D58F7	1	1	1		1	1	1			1	7	
Male	500	56	31	50	79D5B63		1							1		2	
Female	260	59	30	46	79D5CA3							1				1	
Female	600	76	35	54	7ABCA55				1		1	1	1	1	1	6	
Female	860	84	35	32	7ABE1D7	1	1	1	1	1		1		1		7	
Female	340	69	28	52	7ABECFF							1				1	
Female	640	71	35	53	7ABF6A6	1			1		1		1		1	5	
Female	940	82	35	34	7ABFA06			1		1		1		1	1	5	
Male	1100	80	35	60	7AC06AD		1	1	1	1	1	1	1	1	1	9	
Male	980	84	41	62	7AC091C	1		1	1		1		1		1	6	
Female	740	74	33	56	7AC1287					1		1	1			3	
Male	1090	85	39	59	7AC1B0E				1	1	1	1			1	5	
Female	830	79	35	56	7AC260C			1	1	1		1			1	5	
Female	580	72	30	51	7AC27B1		1			1				1	1	4	
Male	1260	85	43	53	7AC2C87		1			1	1	1	1	1	1	7	
Male	1120	89	35	62	7AC3144	1	1	1	1	1	1	1	1		1	9	
Male	1340	87	40	64	7AC3DB7		1	1		1	1	1	1	1		7	
Female	680	77	35	50	7AC5102	1	1	1	1	1		1	1	1	1	8	
Female	440	70	30	51	7AC5228	1		1		1		1	1	1	1	7	
Female	570	67	36	53	7AC529F	1			1		1	1		1	1	6	
Female	590	72	34	55	7AC59A9	1	1	1	1		1		1	1	1	8	
Male	1840	96	44	65	7AC5A91	1		1	1	1	1				1	6	
Male	1040	74	43	60	7AC84DD	1	1	1	1	1	1	1	1	1	1	10	
Female	900	81	35	59	7AC851E	1		1	1	1	1	1	1	1	1	9	

[illegible]





CADASTRAL SOURCE: Landgate, April 2019.  
AERIAL PHOTOGRAPH SOURCE: NearMap, flown February 2019.



**TERRESTRIAL  
ECOSYSTEMS**

Drawn: S. Thompson

Date: 18 Apr 2019

Peet Ltd and Department of Housing  
QUENDA TRAPPING SITES  
GOLDEN BAY - AUTUMN 2019

**TRAPPING SITES**

**Figure 1**

Job: 2019-0009



## **Quenda Monitoring Golden Bay – Spring 2019**



Version 1 September 2020

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Front Cover: Adult quenda being released from bag

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## Figure

1. Trapping sites

## Appendix

- A. Trapping results

# 1 INTRODUCTION

Peet Ltd, on behalf of the Peet Ltd and the Department of Housing, requested a follow up monitoring survey of the Quenda (*Isoodon fusciventer*) population in the Foreshore Reserve adjacent to Lot 2, Warnbro Sound Ave, Golden Bay (i.e. 'project area'). This follows on from an initial survey in spring 2012 and subsequent monitoring surveys in spring 2012, autumn and spring of 2013, 2014, 2015, 2016, 2017, 2018 and autumn 2019 (Terrestrial Ecosystems 2012, 2013a, b, 2014b, a, 2015b, a, 2016a, b, 2017a, b, 2018a, b, 2019). Quenda (formerly part of the Southern Brown Bandicoot complex) monitoring is a requirement under the Ministerial Statement 150 and compliance reports are provided to the Office of the Environmental Protection Authority on an annual basis.

The Foreshore Reserve includes the foredune and swale, and the hinterland vegetation inland for about 400m from the ocean. The Foreshore Reserve includes a Conservation Category Wetland and a Threatened Ecological Community (TEC) that supported dense vegetation before it was burnt. The project area was extensively burnt in January 2016 and the only continuous unburnt habitat that remained was in the southern end of the Foreshore Reserve. Since the burn in January 2016, there has been significant vegetation growth across the entire burnt area.

In June 2019 vegetation was cleared for the construction of a sealed road and grassed area in the Foreshore dune area. The new sealed road enters from the southern end of the Foreshore Reserve, and there is now a large cleared area between the wetland vegetation and foredunes (Figure 1).

As part of this construction program, some areas that we had previously trapped were cleared of vegetation.

## 1.1 Scope of this Quenda survey for long-term monitoring

The Foreshore Reserve will remain public open space and the developer has made a commitment to monitor the health of the Quenda population on a twice yearly basis during the construction and development stages (PGV Environmental 2011).

Coffey Environments recorded eight Quenda in the reserve during its survey in mid-February 2010 (PGV Environmental 2011). It was reported that Quenda preferred scrubby, often swampy vegetation with a dense understorey of cover up to one metre high. The TEC and wetland areas within the Foreshore Reserve were considered suitable habitat to sustain a bandicoot population in the long-term (PGV Environmental 2011).

A Quenda relocation program has been undertaken for each stage of development prior to vegetation clearing from Lot 2, Warnbro Sound Ave and Lot 3, Dampier Drive as required under Ministerial Statement 150. This program was implemented to minimise the impact of vegetation clearing on bandicoots residing in these lots. All Quenda caught prior to the last vegetation clearing program in July 2016 were relocated out of the area as there would have been insufficient habitat remaining to sustain this population given the area that had been burnt in January 2016.

The results of 14 previous monitoring surveys are shown in Table 1. This report provides the outcomes of the fifteenth monitoring survey of Quenda in the Foreshore Reserve.

**Table 1. Number of Quenda in the previous monitoring programs**

	Spring 2012	Winter 2013	Spring 2013	Winter 2014	Spring 2014	Autumn 2015	Spring 2015	Autumn 2016	Spring 2016	Autumn 2017	Spring 2017	Autumn 2018	Spring 2018	Autumn 2019
# of indiv. captured	31	30	28	39	48	53	36	26	12	15	15	12	46	44
# of males	13	10	7	12	10	16	14	8	3	9	9	8	28	20
# of females	15	20	21	27	25	34	22	18	3	5	5	3	18	24
# of juveniles	3	-	-	1	12	3	6	-	6	1	1	1	1	-

The January 2016 fire corresponded with a reduction in the population of Quenda in the reserve. The autumn 2018 survey report (Terrestrial Ecosystems 2018a) indicated that the vegetation in the burnt area had regenerated and much of the burnt section of the Foreshore Reserve could now support Quenda. To supplement the low Quenda population in the reserve, Quenda were relocated into the foreshore reserve from vegetation clearing projects at sites in east Rockingham, Florida and Madora Bay. All relocated Quenda had a microchip and were measured in a similar manner to those at Golden Bay.

## 2 BIOLOGY AND ECOLOGY OF QUENDA

The Quenda (*I. fusciventer*) is a medium-sized, ground-dwelling marsupial that belongs to the Peramelidae family (Van Dyck and Strahan 2008, Travouillon and Phillips 2018). Populations of Quenda occur widely throughout southern Western Australia (Rees and Paull 2000, Van Dyck and Strahan 2008). In 2018, Quenda was elevated to a full species and is now commonly called a Quenda in WA (Travouillon and Phillips 2018).

*Isoodon fusciventer* was listed as a Schedule 1 species (Fauna that is rare or likely to become extinct) under the Western Australian *Wildlife Conservation Act 1950* until 1998. An increase in the population, which was attributed to the implementation of fox baiting throughout the state, meant that in 1998 Quenda was removed from the threatened species list. Quenda is now listed as a Priority 4 species ('Taxa in need of monitoring') on the Department of Biodiversity, Conservation and Attractions' (DBCAs) Priority Fauna List.

Quenda are found in the wetter sections of the south-west of Western Australia, mostly along the Swan Coastal Plain from the Moore River to Walpole and the Fitzgerald River area. Populations of Quenda are found in a variety of habitats in this region and appear to be able to survive a level of habitat destruction and live close to urban and industrial developments. Quenda prefer habitats with a dense shrub understorey up to one metre high, but they are found in a variety of habitats including Banksia, Eucalypt and Melaleuca woodlands, but often in close proximity to a wetland where the vegetation is often more dense (Stoddard and Braithwaite 1979, Ramalho et al. 2013). In areas of thick undergrowth, Quenda are able to establish runways that are difficult to detect beneath the interlocking vegetation (Craven 1981). They are vulnerable to cat, fox and dog predation and are occasionally seen dead on the roads in urban environments, with the result that they are increasingly under threat due to the clearing of bushland leading to habitat fragmentation, bushland degradation and predation by introduced predators including foxes, cats and dogs (Friend 1991).

Quenda and Southern Brown Bandicoots are both nocturnal and diurnal, but are mostly active during the day early in the morning or late afternoon (Van Dyck and Strahan 2008). Individuals are mostly solitary, but with overlapping home ranges. The home range size of Quenda decreases with increasing population size (Broughton and Dickman 1991). The smallest home range estimates of 2.1ha for males and 1.4ha for females were recorded for a high density population (1.3–1.4 animals ha<sup>-1</sup>) on Franklin Island, South Australia (Copley et al. 1990). The largest home range estimates of 5.3ha for males and 2.3ha for females and were calculated for a low density population (0.07–0.2 animals ha<sup>-1</sup>) in Tasmania (Heinsohn 1966). A study of Quenda in the Perth metropolitan area found that animals' increased their home range size and grazed in more open habitats in areas when predator control was implemented, compared to areas where there was no predator control (Gardner 2004).

Quenda are omnivorous, feeding on invertebrates (including earthworms, beetles and larvae), underground fungi, subterranean plant material, and occasionally small vertebrates such as lizards (Broughton and Dickman 1991). Quenda build a nest consisting of a heap of ground litter over a shallow depression providing an internal chamber with loose regions at both ends for entry and exit. The dense vegetation probably protects the nest from extremes in temperature and wind, rain and predators.

Heinsohn (1966) reported Southern Brown Bandicoots reach sexual maturity at five to six months of age when they weigh approximately 600g. As males produce sperm throughout the year, it is the reproductive activity of the female that determines the beginning and length of the breeding season (Heinsohn 1966). Breeding peaks in spring (Thomas 1987, Mallick et al. 1998) and females have a gestation period of 12 to 13 days and litters of one to six young are produced, although litters of two to four are most common. Two or three litters may be reared during a single breeding season, although this is dependent upon the availability of food resources (Friend 1991, Mallick et al. 1998) and rainfall (Barnes and Gemmell 1984).

Studies have reported the sex ratio of Southern Brown Bandicoots populations to be from 1.7 males to one female to 0.33 males to one female (Craven 1981, Thomas 1987, Mallick et al. 1998). The lifespan of the Quenda in the wild is estimated to be two to three years (Craven 1981).

### 3 METHODOLOGY

One hundred and twenty-eight baited wire cage traps were set in locations shown in Figure 1. Some of the historical trapping locations in the southern section of the Foreshore Reserve had been cleared of vegetation so it was necessary that new trapping locations were found to replace these trapping sites. Traps were positioned in a similar location to the surveys undertaken in autumn 2019, with the exception of those areas cleared of vegetation in June 2019. All cage traps were baited with a peanut butter sandwich and were set for 10 nights between 17-27 September 2019. Traps were located in the vegetated areas that were likely to support Quenda.

In addition, five large wire cage traps were set to catch feral cats. These traps had an internal, spring loaded door and were baited with a tin of sardines. These traps were placed in the southern area and in the north-eastern area of native vegetation.

All traps were baited when they were opened, when they had no bait and on every other day if they had bait. All traps had a hessian cover and were placed under vegetation. Traps were cleared from first light each morning.

Trapping was conducted under License FR28000058. Captured Quenda were measured, weighed, sexed and mostly released near the point of capture. All Quenda that had not previously been caught had a microchip inserted on the dorsal surface near the shoulder blades. Recaptured Quenda were identified and released near their site of capture.

#### 3.1 Data analysis

Trap success rate was determined by dividing the trapping effort by the number of Quenda caught per trap-night. There were 128 cage traps targeting Quenda, but 11 traps were taken on the last night of trapping, so the trapping effort was therefore 1,269 trap-nights and 50 cat trap-nights. Quenda were caught in the small cage traps and the cat traps. Trapping data are compared with previous survey data.

#### 3.2 Signs

As recommended in the winter 2014 monitoring report (Terrestrial Ecosystems 2014a) signs (Plate 1) were prepared by Peet and Terrestrial Ecosystems and set up on each track leading into the survey area. These signs were designed to reduce the number of people and dogs interfering with traps and captured Quenda.



**Plate 1. Sign placed near the end of an access track**

## 4 RESULTS AND DISCUSSION

### 4.1 Survey monitoring

The Quenda trapping results are shown in Appendix A. Twenty-nine individual Quenda were caught with 14 females and 15 males. No Quenda were caught weighing less than 200g (i.e. a juvenile). Initially twelve females had pouch young (Plate 2), however, nine of these ejected their young and one ate one of her joeys, so by the end of the survey period only three females had pouch young. A lone joey was found and taken into Native Arc. The overall trapping success was 21.6% and for Quenda 14.7%. The Quenda trapping success is lower than the last two survey rates of 18.6 and 21.6% (spring 2018 and autumn 2019 respectively).

**Table 2. Number of Quenda in spring 2019**

	Spring 2019
# of individuals captured	29
# of males	15
# of females	14
# of juveniles	-

There were 187 separate Quenda capture events (i.e. an individual was caught) with the number of times an individual being caught varying between 1 and 10 (i.e. caught every day).

In addition to the Quenda, 66 bobtails (*Tiliqua rugosa*; Plate 3), nine silvereyes (*Zosterops lateralis*), five house mice (*Mus musculus*), two rats (*Rattus rattus*), one moaning frog (*Heleioporus eyrei*), one rabbit (*Oryctolagus cuniculus*; Plate 4), one dugite (*Pseudonaja affinis*; Plate 5), one white-browed scrubwren (*Sericornis frontalis*), one Western blue tongue lizard (*Tiliqua occipitalis*; Plate 6) and one cat (*Felis catus*; Plate 7) were caught.

The cat had no collar, identification tags or ear tattoo and it was delivered to Comet Bay Vet Hospital who would have contacted the pound or the owners if it were microchipped.

Fresh fox, cat and rabbit tracks were observed on multiple occasions. Cats and foxes would be predated on young Quenda and other small vertebrate fauna in the reserve. The vegetation clearing in the southern and central sections of the Foreshore Reserve will have increased predator access to Quenda in the bushland.

Some of the male Quenda appeared unwell over the course of the survey and four were taken to Native Arc for assessment; one subsequently died. Unlike previous surveys, no Quenda were found with Sarcoptic Mange. One individual who had mange in autumn 2019 showed no signs anymore, which is surprising as very few animals recover from mange.

All male Quenda weighed more than 700g and all but one of the females weighed more than 600g. The very low recruitment of juveniles into the adult population would suggest that there is predation on Quenda and in particular, the juveniles and young adults.

A small number of local people walk their dog(s) through the area, but this was reduced by using the warning signs. It is presumed that people walk their dogs through the Foreshore Reserve during the non-trapping periods, and with the construction of the access road and the new grassed area, this activity is likely to increase. Dogs off leads are likely to negatively impact on Quenda if they are allowed to run free in the bushland.

We indicated in previous reports that the rabbit population was on the increase and again observed a large number of rabbit tracks and scat piles in the area. Without an active management program, the rabbit population is expected to increase as the new vegetation becomes established and provides a significantly greater area of vegetation cover and food source. The presence of an abundant population of rabbits also attracts foxes to the area which in turn predate on Quenda.

Western Grey Kangaroos were observed on most days during the survey, as well as their tracks and scats, indicating there continues to be population of kangaroos in the Foreshore Reserve. Even though there is partial



habitat linkage to other areas of remnant native vegetation, it is unlikely that the Western Grey Kangaroos are moving north to the golf course or south to Madora Bay.



**Plate 2. Quenda with young**



**Plate 3. Bobtail**



**Plate 4. Rabbit**



**Plate 5. Dugite**



**Plate 6. Western blue tongue lizard**



**Plate 7. Cat**

Tracks of large snakes were often seen in the sandy areas to the east of the Foreshore Reserve. Although, not counted, it appears if there has been an increase in the number of dugites in the Foreshore Reserve. Snakes could therefore be an issue when the grassed area becomes established and people and their pets are using this area.

### *Status of the population*

The total number of Quenda caught during this monitoring program (29) is much lower than the previous two surveys (46 and 44, respectively). This decrease is concerning and could be due to a combination of factors including predation, illness, aging population, the construction of the road and grassed area, contaminated water running off the road into the wetland or other unknown factors. The poor health of some Quenda appears to have resulted in increased stress associated with trapping. Terrestrial Ecosystems has trapped the Quenda population on a twice-yearly basis since 2012 and we have not seen this level of stress or poor health in the Quenda before.

The loss of joeys during the trapping program is of concern and has not been experienced in previous monitoring surveys. Similar to previous monitoring surveys there was a lack of subadults caught during this survey. Juveniles and subadults are the most susceptible to predation by feral cats and foxes. The continuation of a management program for cats and foxes in cooperation with the City of Rockingham for the coastal dune system is essential to maintaining a viable population of Quenda in the Foreshore Reserve.

We did not find any evidence of Sarcoptic Mange in the Quenda population during the current survey. The individual who had it in autumn 2019 appeared mange free when caught in spring 2019. We will continue to monitor for the presence of mange in the Quenda population as it has the potential to significantly reduce or even eradicate Quenda from the Foreshore Reserve, when considered in conjunction with feral predator predation.

The veterinary assessments of the adult male Quenda taken to Native Arc indicates that they are elderly compromised individuals. All had external and internal parasites (high coccidia and worm burdens), one had a tail injury and skin damage consistent with breeding and fighting injuries, and one had abscesses and scarring on its back consistent with predation.

### *Western Grey Kangaroos*

Western Grey Kangaroos in the Foreshore Reserve and surrounds are very wary and largely remain out of sight, however, it could be anticipated there are at least 10 plus individuals living in the area. Given the presence of surface water, abundant foraging resources and shelter, this population will increase by 25-30% each year.

### *Rabbits*

The population of rabbits in the Foreshore Reserve and the adjacent beach dunes has increased and will continue to increase as the vegetation regrows. Rabbit control is important in maintaining populations of native mammals (Pedler et al. 2016). Rabbits are also likely to impact on the regenerating native vegetation, by eating the emerging vegetation.

Rabbit control should be undertaken in spring or autumn to coincide with the optimum delivery period for RHDV (i.e. maximum abundance of dispersal vectors). Recent information suggests that the effectiveness of RHDV K5 is less than first thought as it acts more like a biocide than a biological control (i.e. lacks a mechanism to spread quickly over a large area due to the rapid lethal control of rabbits). Use of Pindone to control rabbits should be avoided in all areas of native vegetation due to the negative impacts on native fauna (Lohr and Davis 2018) including Western Grey Kangaroos, Quenda and numerous birds. Other complimentary rabbit control measures can be implemented in conjunction with the implementation of a RHDV K5 distribution program.

## **4.2 Conclusion**

The regrowth in the vegetation since the January 2016 fire has provided good habitat for Quenda, particularly around the wetland area. The quality of habitat for Quenda will continue to improve as the vegetation grows.

The impact of the January 2016 fire on the fauna habitat in the Foreshore Reserve was evident in the reduction in the population of Quenda. Reducing suitable habitat for native fauna also disproportionately increases predation pressure on native fauna due to improved access to the remaining animals. Another significant fire in

the Foreshore Reserve that burns most of the native vegetation could eradicate Quenda from the reserve and force the kangaroos into the residential areas. There is a Bushfire Attack Level assessment (BAL-Assessment) completed for the proposed Foreshore Reserve Kiosk area (Natural Area Consulting Management Services 2018), however, it is suggested that a fire management plan or BAL-Assessment is prepared and implemented for the Foreshore Reserve and remaining remnant habitat, which focuses on reducing the spread of a fire should one be ignited and provides suitable and quick access for fire-fighting equipment and personnel.

The results of this trapping program highlight a notable decrease in the population of Quenda since autumn 2019. A combination of factors could have contributed to this, including predation by feral predators, illness, aging population, contaminated road run-off, habitat fragmentation and a reduction in overall habitat areas. As stated above, reducing suitable habitat for native fauna increases predation pressure due to improved access to the remaining animals for foxes and cats. The construction of the road through the reserve could have had a two-fold impact on the Quenda population by decreasing available habitat and improving access for predators (i.e. foxes and cats). The illness affecting this Quenda population is concerning, as the cause is unclear; whether it is natural or introduced, or whether it is something they can recover from without human intervention. Further investigation is required.

There is a low turnover of Quenda between survey periods, low recruitment of new individuals and very few young and sub-adults. Predation by foxes and cats is likely to be a major contributor. Cats have been recorded during most surveys in the Foreshore Reserve. Some of these cats are stray, whereas, many are domestic cats that roam free at night. Domestic cats predate on juvenile Quenda and are therefore likely to be contributing to the low level of recruitment of juveniles into the adult population. It is therefore suggested that Peet approaches the City of Rockingham and encourages the Council to invest in a promotional campaign encouraging residents to keep their cats at home and restrained from roaming at night. An example of domestic cats freely roaming in the bushland areas is demonstrated by a domestic cat caught in spring 2018 and autumn 2019 programs was again observed roaming in the bushland during this survey; although legal due to the lack of containment laws for cats, the pet's owners clearly don't understand the importance of the foreshore reserve bushland for native fauna or conservation value in confining their cat to their premises.

### **4.3 Future monitoring programs**

With additional planned vegetation clearing, construction of access roads, the development of grassed areas, loss of some trapping sites and the regrowth of vegetation since the 2016 fire, it is time to reassess the location of trapping sites used in the monitoring program. Our data indicate that Quenda in the Foreshore Reserve move throughout the reserve and are not staying in a small area. With the construction of the new access road and the fragmentation of habitat, it is suggested that a new layout is designed for the placement of traps for future monitoring surveys. This alternate placement will allow better monitoring of the entire Foreshore Reserve.

### **4.4 Recommendations**

It is recommended that:

- a) a rabbit reduction program is implemented in the Foreshore Reserve;
- b) in addition to the normal annual City of Rockingham's feral pest species reduction program, additional feral and pest animal control is undertaken targeting the Golden Bay Foreshore Reserve;
- c) Peet approaches the City of Rockingham and encourages them to undertake an educational program encouraging the community to keep their cats at home and restrained from roaming at night;
- d) Peet encourages and supports the City of Rockingham to investigate introducing by-laws or regulations that makes it an offence to allow domestic cats to enter the Foreshore Reserve;
- e) the existing Bushfire Attack Level assessment is reassessed to confirm it is appropriate for the development area and Foreshore Reserve; and
- f) the illness affecting Quenda is further investigated to determine a cause, and if it isn't a natural phenomenon options for mitigating the problem are developed.

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**FIGURE**







# Appendix A. Quenda trapping results

						Trapping days and number of trapped individuals										
Sex	Mass (g)	HL (mm)	HW (mm)	Pes (mm)	Chip N°	18/09/2019	19/09/2019	20/09/2019	21/09/2019	22/09/2019	23/09/2019	24/09/2019	25/09/2019	26/09/2019	27/09/2019	Grand Total
Male	880	69	28	50	6E2270D	1	1	1	1	1 - NA						5
Female	1120	78	37	59	6E23254			1		1			1	1		4
Male	1280	82	34	54	783AE34	1	1	1	1	1 - NA						5
Male	1640	89	40	66	783B9E9	1	1		1	1	1	1	1	1	1 -NA	9
Female	1040	78	35	56	783BE64			1	1		1	1	1	1		6
Female	1060	80	33	59	783D198	1	1	1		1	1	1				6
Female	680	81	37	56	783D913		1		1	1	1		1	1	1	6
Male	1510	87	40	62	783E4E3	1		1		1		1	1	1	1	7
Male	810	79	32	59	783EB0A		1	1		1	1	1	1	1	1	8
Male	1230	86	38	62	783F6F3		1						1			2
Female	860	76	34	49	79D58F7	1	1	1	1		1	1	1	1	1	9
Male	820	80	37	53	79D5B63	1	1	1	1	1	1	1	1	1	1	10
Male	950	85		60	7ABA170						1					1
Female	960	80	39	58	7ABE1D7		1	1	1	1	1	1		1	1	8
Female	800	72	34	55	7ABF6A6		1	1		1	1	1			1	6
Female	1100	80	33	56	7ABFA06		1				1		1		1	4
Male	1320	75	40	58	7AC06AD	1	1	1	1	1	1					6
Female					7AC1287		1				1	1			1	4
Male	1310	81	36	56	7AC1B0E	1		1	1	1	1	1	1	1	1	9
Female	700	82	33	56	7AC260C				1		1	1	1	1		5
Female	670	71	36	52	7AC27B1		1			1	1			1	1	5
Male	1450	86	40	58	7AC2C87	1	1	1	1	1		1	1	1	1	9
Male	1150	85	39	54	7AC3144	1	1	1	1	1		1	1	1	1	9
Male	1480	76	37	61	7AC3DB7	1	1	1	1	1	1	1	1 - NA			8
Female	830	78	31	54	7AC5102	1		1	1	1		1	1		1	7
Female	570	63	31	49	7AC529F	1			1	1			1	1		5
Female	780	71	34	56	7AC59A9	1	1	1	1	1		1	1	1	1	9
Male	1050	82	37	62	7AC84DD		1	1	1		1	1	1	1	1	8
Male	1370	86	39	58	7ACCCDB	1	1	1	1	1	1					6
					Total											187

NA - taken to Native Arc

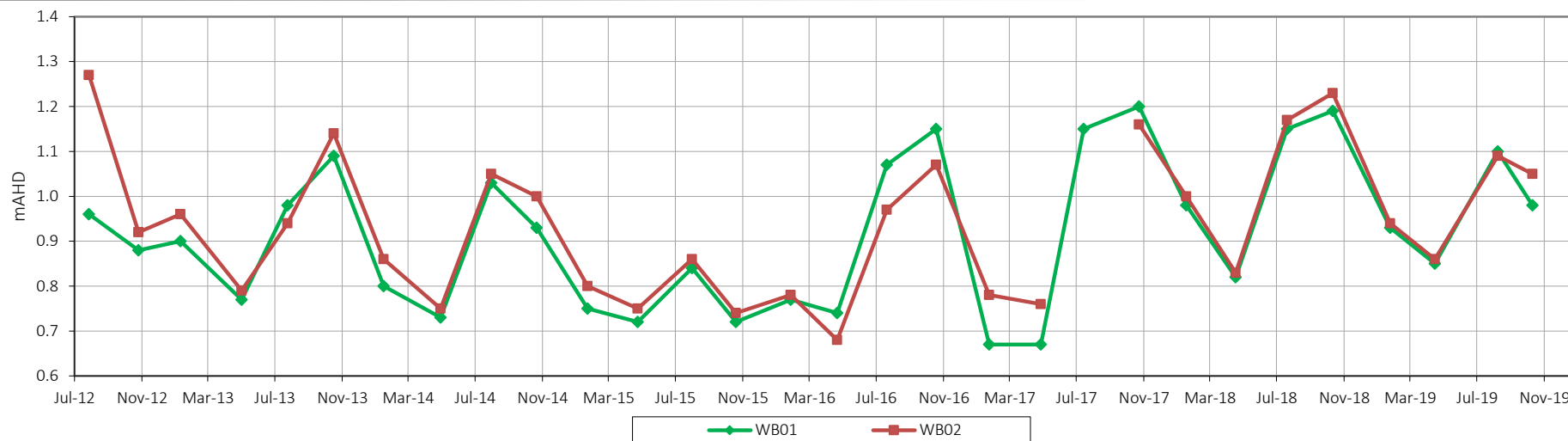
**APPENDIX 7**

**FORESHORE RESERVE  
GROUNDWATER LEVELS**

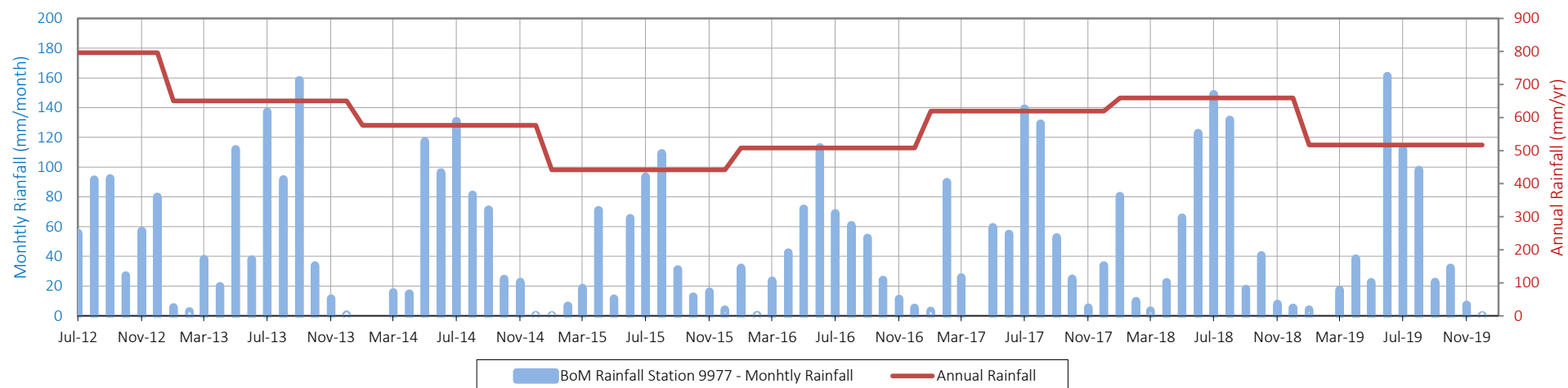
# Wetland Bores - Groundwater Levels

2019

## Groundwater Levels (mAHD)



## Rainfall (mm)



Job No. J6903

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Peet Golden Bay Pty Ltd and Housing Authority  
Golden Bay Groundwater Monitoring

**Figure 1: Groundwater Levels in Wetland Bores 2012 - 2019**