

strategen

**Wonganin Iron Ore
Project, Irvine Island,
Buccaneer Archipelago**

Quarantine Management Plan

Prepared for
Pluton Resources Ltd
by Strategen

September 2009

Wonganin Iron Ore Project, Irvine Island, Buccaneer Archipelago

Quarantine Management Plan

Strategen is a trading name of
Strategen Environmental Consultants Pty Ltd
Suite 7, 643 Newcastle Street Leederville WA
ACN: 056 190 419

September 2009

Disclaimer and Limitation

This report has been prepared for the exclusive use of the Client, in accordance with the agreement between the Client and Strategen (“Agreement”).

Strategen accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any person who is not a party to the Agreement.

In particular, it should be noted that this report is a qualitative assessment only, based on the scope of services defined by the Client, budgetary and time constraints imposed by the Client, the information supplied by the Client (and its agents), and the method consistent with the preceding.

Strategen has not attempted to verify the accuracy or completeness of the information supplied by the Client.

Copyright and any other Intellectual Property arising from the report and the provision of the services in accordance with the Agreement belongs exclusively to Strategen unless otherwise agreed and may not be reproduced or disclosed to any person other than the Client without the express written authority of Strategen.

Client: Pluton Resources Ltd

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Draft Report	V1	A.Williams	L.Crossing	Email	30/11/2007
Draft Report	V2	A.Williams	L.Crossing A. Reed (Client)	Email	5/12/2007
Draft Report	V3	A.Williams	C.Welker A. Reed (Client)	Email	7/12/2007
Final Draft Report	V4	A. Williams	L.Crossing A. Reed (Client)	2 hard copies to EPASU	10/12/2007
Final Report	Final	A. Williams	L.Crossing A. Reed (Client) P. Kaye (Client)	Electronic to DEC Environmental Management Branch	13/5/2008
Final Report 2	Final 2	A. Williams	DEC Quarantine Western Australia	1 electronic to DoIR 1 hard copy to DEC Kununurra 2 hard copies to Pluton 1 electronic to Quarantine Western Australia	6/6/2008
Final Report 3	Final 3	A.Williams	P. Kaye	2 hard copies to EPASU 2 hard copies to Pluton	12/11/2008
Final Report 4	Final 4	I.Mullins	A.Williams R. Keogh J.McDougall P. Kaye	1 electronic to Pluton 1 electronic to DMP 1 electronic to DEC Kununurra	28/9/2009

TABLE OF CONTENTS

1.	INTRODUCTION	1
1.1	PURPOSE	1
1.2	BACKGROUND	1
1.3	ENVIRONMENT DESCRIPTION	2
1.3.1	Current quarantine status	2
1.4	DESCRIPTION OF PROPOSED WORKS	3
1.5	SCOPE	4
1.6	QUARANTINE RISK AND MANAGEMENT APPROACH	7
1.7	OBJECTIVES OF THE QUARANTINE MANAGEMENT PLAN	7
1.8	REGULATORY FRAMEWORK AND APPLICABLE LEGISLATION	7
1.9	REVIEW OF EXISTING INFORMATION	8
1.10	QUARANTINE ASPECTS TO BE MANAGED	9
2.	MANAGEMENT PLAN FOR EXPLORATION EQUIPMENT SUPPLY CHAIN	10
2.1	SUPPLY CHAIN DESCRIPTION	10
2.2	OBJECTIVES, TARGETS AND KEY PERFORMANCE INDICATORS	10
2.3	MANAGEMENT STRATEGY AND ACTIONS	11
2.3.1	Quarantine awareness training and inspectors	11
2.3.2	Cleaning and inspections (pre-shipment to Irvine or Cockatoo Island)	12
2.3.3	Preparation of used equipment from previous Irvine Island exploration operations	12
2.3.4	New exploration equipment purchased in Australia	12
2.3.5	Used exploration equipment from interstate	12
2.3.6	Exploration equipment imported from overseas	13
2.3.7	Quarantine containment facilities	13
2.3.8	Mobilisation of exploration equipment to and from Irvine Island	13
2.4	MONITORING	16
2.4.1	Treatments and surveillance upon receiving freight at Derby Port and Cockatoo Island	16
2.4.2	Flour trays	16
2.4.3	Surveillance for introduction of QRM on Irvine Island	16
2.5	CONTINGENCIES	18
2.5.1	Treatments	20

2.5.2	Quarantine cleaning areas	20
3.	FOOD AND WASTE MANAGEMENT PLAN	21
3.1	INTRODUCTION	21
3.2	OBJECTIVES, TARGETS AND KEY PERFORMANCE INDICATORS	21
3.3	MANAGEMENT ACTIONS	21
3.4	MONITORING	23
3.5	CONTINGENCIES	23
4.	MANAGEMENT PLAN FOR MOVEMENT OF TRANSPORT VESSELS, PERSONNEL AND PERSONAL EFFECTS TO IRVINE ISLAND	25
4.1	INTRODUCTION	25
4.2	OBJECTIVES, TARGETS AND KEY PERFORMANCE INDICATORS	25
4.3	MANAGEMENT ACTIONS	25
4.3.1	Personal effects	25
4.3.2	Transport of personnel to Irvine Island	26
4.3.3	Marine vessels	26
4.3.4	Inspections	26
4.4	MONITORING PROGRAM	28
4.5	CONTINGENCIES	29
5.	REPORTING	30
5.1	AT COMPLETION OF EXPLORATION OPERATIONS	30
5.2	LONG TERM SURVEILLANCE ON IRVINE ISLAND	30
5.3	COMPLIANCE	30
6.	REFERENCES	31

LIST OF TABLES

1. Objectives, environmental targets and performance indicators for the management of the exploration equipment supply chain	10
2. Quarantine management actions for exploration equipment	13
3. Monitoring program for the exploration equipment supply chain.	18
4. Exploration equipment supply chain management contingency actions	19
5. Objectives, environmental targets and performance indicators for the management of food and waste	21
6. Quarantine management actions for food and waste	22
7. Prohibited food on Irvine Island	22
8. Monitoring program for food and waste	23
9. Contingency actions applicable during management of food and waste	24
10. Objectives, environmental targets and performance indicators for the movement of transport vessels, personnel, and PEs to Irvine Island	25
11. Quarantine management actions for the movement of equipment, personnel, PEs and vessels to and from Irvine Island	26
12. Monitoring program for movement of transport vessels, personnel and PEs to and from Irvine Island	28
13. Contingency actions for movement of transport vessels, personnel and PEs	29

LIST OF FIGURES

1. Regional location of Irvine Island	5
2. Overview of Phase I and Phase II exploration programs	6

LIST OF APPENDICES

1. DEC (2006) Island Quarantine Protocol
2. DEC (2007) Biosecurity Plan
3. Mattiske (2008) Vegetation Report

1. INTRODUCTION

1.1 PURPOSE

In July 2008, Pluton Resources Limited (Pluton) commenced Phase I exploration for iron ore on Irvine Island in the Buccaneer Archipelago. A Phase II program proposed to commence in 2009 consists of a similar program of works. The Phase II program will expand exploration operations on the Hardstaff Peninsula with follow up drilling at the Isthmus region and is expected to take up to two years to complete.

This document describes the nature and key characteristics of the proposed exploration; the quarantine management for the relevant pathways for introducing Quarantine Risk Material (QRM); potential environmental impacts and the controls and contingencies that will be put in place to mitigate these impacts.

1.2 BACKGROUND

Pluton briefed the Department of Environment and Conservation (DEC), Environs Kimberley and the Conservation Council of Western Australia on the Phase I exploration proposal in 2007. The groups supported Pluton's intention to prepare quarantine management strategies to maintain the high conservation values of Irvine Island.

This Quarantine Management Plan was originally developed to support the Phase I exploration referral to the Environmental Protection Authority (EPA) specifically to outline quarantine measures for preventing the introduction of QRM onto Irvine Island for the duration of the proposed iron ore exploration activities. During the environmental level of assessment process, the Quarantine Management Plan was reviewed by the EPA Services Unit and DEC Environmental Management Branch. The Quarantine Management Plan as implemented (version Final 2) incorporates recommendations made by the DEC Environmental Management Branch. Implementation of the Quarantine Management Plan is also a condition of Tenement No. E04/1172.

Key revision changes

Final Version 3 supported the Phase II exploration referral. Final Version 3 incorporated recommendations suggested by a Quarantine Western Australia (QWA) review and minor improvements implemented during the Phase I exploration program. The following aspects of the revised Quarantine Management Plan should be noted:

1. The terminology was simplified. Quarantine Risk Material and Non Indigenous Species were combined under one name - Quarantine Risk Material (QRM). QRM includes all plant material, animals, soils or contaminants that could carry pests or disease.
2. The wording of the document was modified to incorporate the two phases of exploration.
3. Quarantine breaches were split into three levels: Minor incident; Major quarantine breach; Critical quarantine breach. Each level has an appropriate form of contingency.
4. Removal of all references to Darwin freight forwarding companies.

5. Quarantine Western Australia (QWA) does not certify inspectors at Freight Forwarding Companies.
6. pontoons are not required for boat landings for either phase of exploration.
7. There is no reliance on the assumption that equipment inspected by Australian Quarantine and Inspection Service (AQIS) or QWA will meet the cleanliness standards required for Irvine Island. AQIS and QWA may release goods that while no threat to Australia or the Western Australian mainland may still harbour threats to the biodiversity of Irvine Island.

Final Version 4 provides additional quarantine management measures to allow for operational changes proposed for the Phase II exploration program. Aspects to be managed include re-deployment of equipment stored on the mainland from the Phase I operations, direct uplift of equipment from a barge to Irvine Island and accommodating staff (ie. camping) on Irvine Island.

1.3 ENVIRONMENT DESCRIPTION

The Buccaneer Archipelago is a collection of approximately 800 islands off the Kimberley coast of Western Australia. The islands are rugged and sparsely vegetated with patches of rain forest in moist areas, fringes of vine thickets, and mangroves in protected areas where silt has accumulated.

The Buccaneer Archipelago supports an economically important pearling industry and other activities including tourism, iron ore mining on Cockatoo Island and Koolan Island, and a small number of coastal Aboriginal communities. Koolan Island was once an important iron ore mining centre with several hundred staff, but was closed down in the early 1990's. The island was rehabilitated by BHP, but mining has resumed in recent years through Aztec Resources (now Mount Gibson Resources). Similarly, Cockatoo Island was originally mined by BHP and, after a brief period as a resort, mining re-commenced under Portman Iron Ore Ltd (now Cliffs Natural Resources) in joint venture with HWE Mining.

Despite these activities, the region's remoteness and relative inaccessibility due to its extremely large tidal ranges (up to 12 metres) and rugged coastline mean that many of the islands in the archipelago are generally pristine as they have not been developed and are seldom visited.

Irvine Island is located within the Buccaneer Archipelago and is approximately 140 km north of Derby, and approximately 4 km northwest of Cockatoo Island. Irvine Island is approximately 918 ha in area (Figure 1).

BHP undertook iron ore exploration on Irvine Island from the 1950's until the mid-1980's. Ore deposits were identified in two distinct areas on Irvine Island; the Isthmus and Hardstaff Point iron deposits which are contiguous at depth. Given the preliminary nature of this historic data, Pluton requires further exploration to verify the extent of the iron mineralisation.

1.3.1 Current quarantine status

There are several domestic gardens, feral weeds and animals found on Cockatoo and Koolan Islands, and Silvergull Creek on the mainland. No commercial agriculture currently operates in the Buccaneer Archipelago. Feral pigs, mangoes and bananas were introduced to Sunday Island by mission staff in the early 1900's. Mice and rats are thought to occur on several islands.

The Department of Environment and Conservation (DEC) and the Northern Australia Quarantine Strategy (NAQS) have undertaken some survey work within the Buccaneer Archipelago, but have very little information on the status of exotic weeds, plant diseases and vertebrate or invertebrate pest species on Irvine Island. DEC Broome noted weed infestations around the lighthouse immediately off the south coast of Irvine Island. Recent reconnaissance level fauna habitat studies by Biota (2007) did not detect any pest species in the Hardstaff or Isthmus regions. Flora surveys of the exploration area by Mattiske in 2007 (Appendix 3) recorded only one weed species, *Passiflora foetida* (passion vine). Passion vine is commonly spread by birds and is found extensively in the Buccaneer Archipelago and Kimberley mainland.

BHP transported vehicles to Irvine Island and cut vehicle tracks in the 1960's which may have introduced other weeds or other QRM to Irvine Island. There have been no specific flora and fauna surveys of these areas.

There are anecdotal reports of Indonesian fisherman visiting Irvine Island.

Although detailed surveys of the island are yet to be undertaken, for the purposes of this Quarantine Management Plan, it has been assumed that Irvine Island is in pristine condition. Detailed baseline flora and fauna studies surveys are scheduled for 2009/2010.

1.4 DESCRIPTION OF PROPOSED WORKS

The exploration program has been developed to minimise environmental impact at Irvine Island. A barge and helicopter will be used for transporting exploration equipment and personnel to and from Irvine Island. Boats may be used to transport workforce to and from Irvine Island with personnel transferred by means of beach landings. No vehicles will be required on the island (Pluton Resources Limited 2009). The disturbance footprint on the island will consist of drill sites, walking tracks, helicopter pads, a camp and laydown areas for associated infrastructure.

The operation is expected to deploy up to two drill rigs on Universal Drilling Platforms (UDPs) (ie. one drill rig between two UDPs). The Phase I operation included up to 31 drill sites. Phase II includes up to 29 drill sites and possibly up to 20 additional drill sites within the indicative area of interest (Figure 2) for baseline studies for any future environmental impact assessment.

Drill cores will be logged, cut and bagged on site then mobilised from the site possibly via Cockatoo Island, or via helicopter lift direct to the barge which will then transport samples to Derby. Cores will be bagged and batched for laboratory analysis on the mainland.

Desalination units will supply water for the drill rigs. Water will be pumped to a main tank and then piped to the operating drill rigs. The desalination units will be located near Hardstaff Beach (Figure 2). Return water from the drill rigs will be collected and recirculated via settling tanks. Generators and pumps will be used to circulate water.

Fuel will be stored at Cockatoo Island and transported to Irvine Island to supply the drill rigs, generators and pumps. Fuel for the drill rigs will be stored inside bunds on site and replenished weekly.

All food and exploration equipment will be transported from the mainland by barge or aeroplane via Cockatoo Island. Food and exploration equipment will then be mobilised by helicopter or boat to Irvine Island.

During this phase of the exploration project it is expected that a total of up to 30 staff will be directly employed in the exploration process. Staff will fly by helicopter to Irvine Island from Derby, Cockatoo Island or Broome. Staff will camp on Irvine Island or alternatively be accommodated at Cockatoo Island as per the Phase I exploration program.

1.5 SCOPE

This Quarantine Management Plan applies to the Phase I and Phase II exploration programs to be conducted on Irvine Island in the Buccaneer Archipelago by Pluton. The Quarantine Management Plan focuses on prevention of the direct and indirect introduction of quarantine risk material to Irvine Island. The plan also includes monitoring, surveillance, contingencies and reporting required for the proposed exploration activities.

Quarantine management will apply to all personnel involved in the exploration project, including goods suppliers, freight forwarders, contractors, sub-contractors, traditional owners, vessel owners coxswains and captains, helicopter owners and pilots. This means that the quarantine management will apply to the exploration and associated operations at Irvine Island, Cockatoo Island, Broome, Derby and Perth.

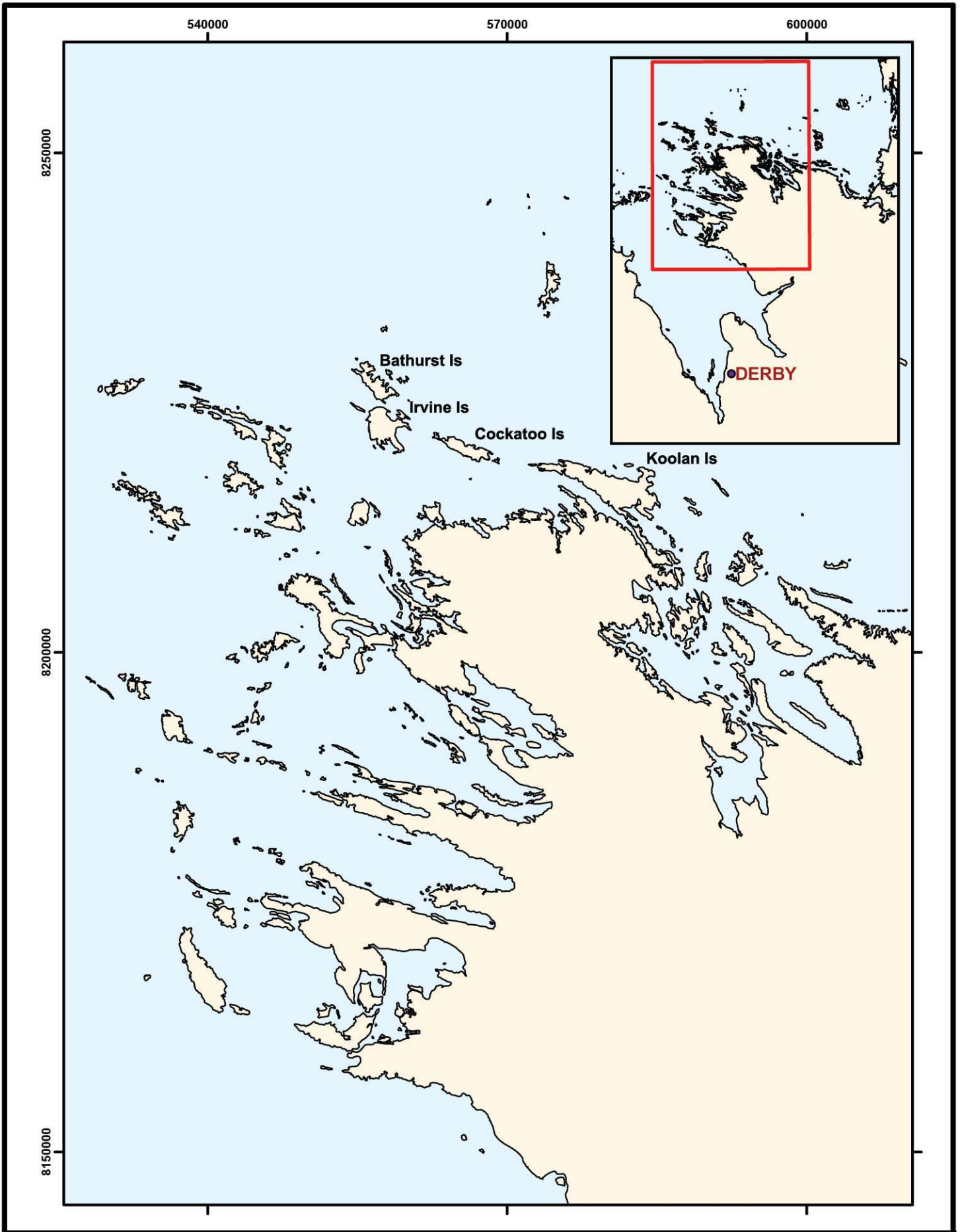
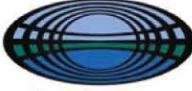



Figure 1: Regional location - Irvine Island

	<p>Scale</p> <p>0 10 20 30</p> <p>_____</p> <p>Kilometres</p>			<p>1:500,000 at A4</p>
	<p>Horizontal Datum: GDA 94</p>	<p>Projection: MGA Zone 51</p>		
<p>Date: 28/11/2007</p>	<p>Note that positional errors may occur in some areas</p>			<p>Source: ESRI 2005</p>

Regional Map



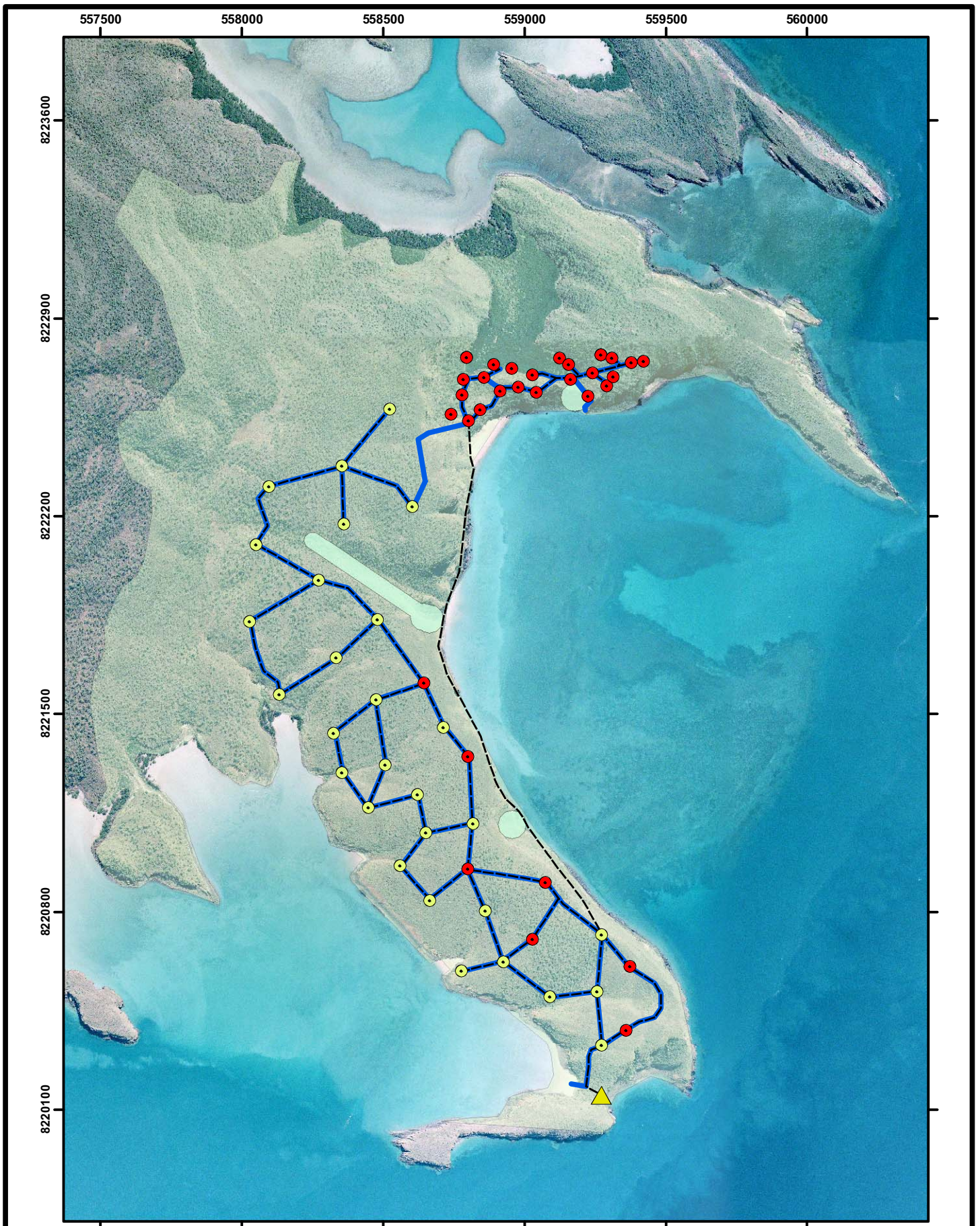
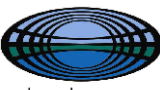




Figure 2: Overview of Phase I and II exploration programs

	<p>Scale</p> <p>0 125 250 500</p> <p>Meters</p>		<p>N</p>  <p>1:18,000 at A4</p>
	<p>Horizontal Datum: GDA 94</p> <p>Author: AW</p>		

Locality Map



Legend

- Phase I sites
- Indicative Phase II sites (within a 50 m radius)
- ▲ Desalination units
- Phase I and II water line
- Phase I and II tracks
- Indicative area of interest
- Heritage sites

1.6 QUARANTINE RISK AND MANAGEMENT APPROACH

Quarantine management that focuses on preventing the introduction, and early detection surveillance for exotic pests, weeds and diseases, is the most cost effective option available. Once established, unwanted exotic pests, weeds and diseases are often difficult and expensive to eradicate.

Quarantine Risk Material (QRM) includes live invertebrates and vertebrates, viable seeds, and plant diseases as well as soil, mud, clay, animal faeces, animal material, plant material and other debris. QRM can also hitchhike or be hidden can include the following examples:

- live insect borers or termites in a wooden pallet
- a viable ant nest within a clump of soil attached to the bottom of a sea container
- viable weed seeds attached to the socks of contractors
- viable gecko eggs inside survey equipment.

The tolerance of QRM in an area can vary depending on the ability to detect and identify the QRM, and the known status of existing local endemic species in that area. In cases where the QRM cannot be identified to a high level of confidence, or the status of existing local endemic species is not known, then the tolerance of QRM should be low and imported goods treated before being released to that area.

In the case of the proposed exploration on Irvine Island, a 'low tolerance' approach to QRM is required because:

- there will be insufficient expertise onsite to assess any intercepted QRM to a high level of confidence
- it is unlikely that visual quarantine inspections will detect minute organisms (such as adult mites and insect eggs)
- the status of the fauna, flora and pathogens on Irvine Island is not fully known and so is conservatively assumed to be pristine.

1.7 OBJECTIVES OF THE QUARANTINE MANAGEMENT PLAN

The overall quarantine management objectives for this project :

- Prevent the introduction of QRM during the movement of personnel and operational equipment to Irvine Island
- minimise the risk of QRM being inadvertently transferred to the island along with materials, machinery or personnel
- maximise the likelihood of early detection and eradication of any QRM in the event that any does arrive on the island.

1.8 REGULATORY FRAMEWORK AND APPLICABLE LEGISLATION

Quarantine restrictions into Australia provide significant levels of control at the border, preventing the establishment and spread of exotic pests, weeds and diseases from overseas. The Australian

Government is responsible for quarantine management of significance to Australia and is managed by the AQIS.

Western Australia is free from many pests, weeds and diseases found in other parts of Australia. The status of some species within Western Australia also varies, and there are a number of quarantine measures in place to prevent the spread of these species. The State government is responsible for inspection and certification services for the interstate movement of items of quarantine concern entering Western Australia. State quarantine is managed by QWA.

The DEC manages quarantine to protect the biodiversity of Western Australia's off-shore islands which are often free of pests and diseases found on the mainland or adjacent islands. Individuals seeking entry to some Western Australian islands including Irvine Island require DEC permits. Such permits involve the implementation of strict quarantine protocols to prevent the entry of QRM.

The proposed exploration operations at Irvine Island will potentially invoke aspects of the following legislation and protection mechanisms:

- DEC (2006) Island Quarantine Protocol (Appendix 1)
- DEC (2007) Kimberley Islands Biological Survey Biosecurity Plan (Appendix 2)
- *Mining Act 1978*
- *Plant Diseases Regulations 1989*
- *Plant Diseases Act 1914*
- *Environmental Protection Act 1986*
- *Biosecurity and Agriculture Management Act 2007.*

1.9 REVIEW OF EXISTING INFORMATION

A desktop review of the project investigations and relevant documentation relating to quarantine was undertaken in assessing the significance of quarantine management for the proposed exploration. This included the following documents:

- Pluton (2007) Proposed work program and budget estimate for Irvine Island, Kimberley Region, Western Australia
- DEC (2006) Island Quarantine Protocol (Appendix 1)
- DEC (2007) Kimberley Islands Biological Survey Biosecurity Plan (Appendix 2)
- Chevron Australia Pty Ltd (2005) Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Gorgon Development, prepared for Gorgon Joint Venturers, September 2005
- The vegetation survey report by Mattiske (2008) (Appendix 3)
- The level 1 fauna survey report by Biota (2007).

1.10 QUARANTINE ASPECTS TO BE MANAGED

The following key pathways for potential introduction of QRM to Irvine Island have been identified:

- supply chain for exploration equipment
- food supplies
- movement of transport vessels (aircraft and tenders), personnel and personal effects (PEs) to and from Irvine Island

Section 2 discusses the entire supply chain management for exploration equipment through to deployment on Irvine Island.

The supply chain management for food, transport vessels, personnel and personal effects will be managed from the barge or Cockatoo Island before the final movement to Irvine Island. Pluton staff will camp on Irvine Island. There is potential for food, personnel and PEs to be infected with QRM found on the Australian mainland or Cockatoo Island. The management of these aspects are included separately in Sections 3 and 4.

2. MANAGEMENT PLAN FOR EXPLORATION EQUIPMENT SUPPLY CHAIN

2.1 SUPPLY CHAIN DESCRIPTION

A supply chain is the system of organisations, people, activities, information and resources involved in moving a product or service from supplier to customer. This section will outline quarantine measures to be implemented during supply of the exploration equipment (drill rigs, drilling platforms, desalination plants, pipes etc) to Irvine Island from the mainland or Cockatoo Island.

QRM may enter the supply chain at one of the following points of exchange:

- the supplier of goods
- transfer of goods from supplier to freight departure depot
- assembly of goods at freight departures depot (Perth)
- road transport of goods to freight arrivals depot (Derby or Broome)
- freight arrivals depot (unload)
- quarantine storage at Curtin Airbase
- goods transfer to barge transport
- transfer of goods from barge to Irvine Island
- barge transport to Cockatoo Island quarantine storage on Cockatoo Island.

2.2 OBJECTIVES, TARGETS AND KEY PERFORMANCE INDICATORS

The following objectives, targets and performance indicators will apply to the management of the supply chain for the proposed exploration (Table 1).

Table 1 Objectives, environmental targets and performance indicators for the management of the exploration equipment supply chain

Management objectives	Target	Key Performance Indicator
Keep the supply chain free of QRM.	Equipment is clean before final journey to Irvine Island (i.e. before it leaves Derby Port or Cockatoo Island) .	Records of cleaning/inspection for QRM before shipment of freight from the mainland or Cockatoo Island. No visual detections of QRM on receipt of freighted equipment.
Prevent the introduction of QRM to Irvine Island.	All parties involved in the supply chain are supplied with information on quarantine management.	Information distribution records. Induction and training records.
	All exploration equipment free of QRM before transport to Irvine Island.	Inspection records show no visual detections of QRM on equipment before transport to Irvine Island.
	Any QRM is eradicated in the event that they are detected on Irvine island.	Early detection and eradication. No visual detection of QRM on Irvine Island.

2.3 MANAGEMENT STRATEGY AND ACTIONS

The aspects of quarantine management relating to the exploration equipment supply chain are explained below and are presented in Table 2.

2.3.1 Quarantine awareness training and inspectors

Prior to the commencement of exploration operations, Pluton will prepare and deliver quarantine awareness material to all parties involved in the supply chain (goods suppliers, freight forwarders, contractors, sub-contractors, traditional owners, vessel owners and captains, helicopter owners and pilots). The quarantine awareness will cover the requirements of the DEC (2006) Island Quarantine Protocol and requirements of this Quarantine Management Plan as relevant to each party's role in the supply chain. For example, a goods supplier will simply be informed of the importance of clean materials and secure packaging, while a helicopter pilot would undergo training to minimise daily quarantine risks.

Quarantine awareness will help staff to understand the conservation significance of Irvine Island and the ways that they will contribute to maintaining the island's QRM-free status.

Pluton quarantine inspectors

Selected Pluton staff will attend a quarantine inspection course run by a suitable consultant. The quarantine inspection course will instruct the selected staff on the procedures applying to the conduct of quarantine inspections for freight, personal effects and on the roles and requirements for quarantine management specific to the Pluton exploration project.

Pluton quarantine inspectors will then be responsible for the day to day inspection of exploration equipment, food, PEs, personnel, and transport vessels at Cockatoo and Irvine Islands, for the life of the exploration project. They will also be responsible for the surveillance for QRM on Irvine Island during exploration.

Assistant quarantine inspectors

The Pluton quarantine inspectors may require other Pluton staff and contractors to assist in various quarantine management procedures. The Pluton quarantine inspectors will train or supervise these assistant quarantine inspectors for specific roles as required. Specific training for assistant quarantine inspectors may include:

- the cleaning and treatment of exploration equipment for QRM on the mainland or Cockatoo Island
- the pilots for inspecting helicopters and tenders for QRM
- Pluton contract staff inspecting food for QRM during food preparation.

Freight forwarding quarantine inspectors

Some freight forwarding companies in Australia provide experienced quarantine inspectors who prepare and inspect freight and PEs for overseas shipment, and mining operations in high conservation areas such as the Gorgon Project on Barrow Island, Western Australia.

2.3.2 Cleaning and inspections (pre-shipment to Irvine or Cockatoo Island)

Major items of equipment such as drilling rigs and drilling platforms represent prime potential sources of QRM. It is proposed to thoroughly clean, inspect and treat (if necessary) this equipment in Perth at freight forwarding depots where specialised facilities and quarantine inspectors are available to undertake the work.

All goods will then be declared free of QRM before being prepared for shipment. High risk exploration equipment such as used drilling equipment and UDPs will be disinfected using Virkon®S (as per manufacturer's directions) to prevent the movement of plant pathogens. Virkon®S (Dupont 2007) or an equivalent may be used as some disinfectants may cause damage to some products. Freight declared free of QRM will be sealed and/or packaged into clean, secure, air tight containers (eg. pressure tested sea-containers).

New exploration equipment purchased in Australia (see 2.3.4), and equipment inspected by AQIS and QWA inspectors (see 2.3.5 and 2.3.6) may not require cleaning and interior inspection prior to shipment to Irvine Island or Cockatoo Island.

2.3.3 Preparation of used equipment from previous Irvine Island exploration operations

Some exploration equipment used during earlier phases of the Irvine Island exploration project may be stored on the mainland (eg. Curtain Airbase hanger near Derby). Any bulk stored equipment proposed to be re-deployed to Irvine Island will be cleaned and inspected by Pluton quarantine inspectors for QRM before being transferred to a QRM free sea container. Any bulk stored equipment found to contain QRM will not be packed until cleaned, re-inspected and declared free of QRM. All QRM free items will remain in the (sealed) sea container until mobilised to Irvine Island. The exterior base of the sea-container will be cleaned using compressed air or high pressure water on departure from the storage facility (eg. after being loaded onto the flat bed trailer).

2.3.4 New exploration equipment purchased in Australia

If exploration equipment has been purchased new in Australia and remains in its original sealed packaging, it will not require thorough internal inspections or disinfectant treatment at the freight forwarding company. Packaged equipment will be subject to an exterior visual inspection for QRM at the freight forward assembly area before being loaded into the sea container. If packaging is not intact (damaged, seal not intact, or open) or QRM is detected, then the new equipment will be subject to full clean and inspection as per requirements in Section 2.3.2.

2.3.5 Used exploration equipment from interstate

Goods imported into Western Australia from interstate may be subject to quarantine inspection by State inspectors (QWA) under the *Biosecurity and Agriculture Management Act 2007* and the *Plant Diseases Act 1914*. Under these Acts, QWA may release goods that contain pests, weeds and diseases of no threat to the WA mainland but which may still harbour threats to Irvine Island.

Exploration equipment imported by Pluton from interstate will be subject to inspection at the freight forwarding depot prior to shipment to Irvine Island or Cockatoo Island as per requirements in Section 2.3.2.

2.3.6 Exploration equipment imported from overseas

Goods imported into Australia may be ordered into quarantine under the *Quarantine Act 1908*. New and used exploration equipment imported from overseas may be subject to inspection by quarantine inspectors (AQIS) upon entry into Australia. AQIS may release goods that contain pests, weeds and diseases already found in mainland Australia that may be of threat to Irvine Island. Some goods may be fumigated or treated before cleared for release in Australia depending on the composition of materials in the consignment. Most fumigants recommended by AQIS have no residual properties.

Once in Australia, exploration equipment imported by Pluton from overseas will be subject to an inspection at the freight forwarding company prior to shipment to Irvine Island or Cockatoo Island as per Section 2.3.2.

2.3.7 Quarantine containment facilities

Quarantine containment facilities will be set up on Cockatoo Island and/or the mainland (eg. Curtin Airbase) as designated clean inspection storage and treatment areas. Each facility will include:

- a secure quarantine area (such as a pressure tested sea container) of a size that will provide sufficient storage and inspection space during the project
- a weather-proof inspection area with good natural or artificial light (at least 600 lux intensity)
- a white topped inspection bench of appropriate size for the type and nature of the imports to be inspected.

Each quarantine containment facility will be used for the:

- the preparation and cleaning of equipment before shipping and uplift to Irvine Island
- conducting inspections of equipment before shipping and uplift to Irvine Island
- storage of equipment
- treatment of equipment found to carry QRM.

2.3.8 Mobilisation of exploration equipment to and from Irvine Island

All equipment being mobilised from the barge or Cockatoo Island to Irvine Island will be visually inspected for QRM by the Pluton quarantine inspectors immediately prior to uplift. Pieces of exploration equipment detected with QRM or suspect QRM will not be mobilised until cleaned and declared free of QRM.

At the end of the operation, all equipment deployed from Irvine Island will be cleaned prior to storage at either at Cockatoo Island or on the mainland.

Table 2 Quarantine management actions for exploration equipment

Topic	Action	Timing	Responsibility
Quarantine awareness and training	Prepare quarantine awareness material and training package.	To be completed prior to commencement of operations.	Pluton Exploration Manager.
	Provide quarantine awareness material and training package to DEC.	Prior to commencement of operations.	Pluton Exploration Manager.

Topic	Action	Timing	Responsibility
	Delivery of quarantine awareness material/training to all parties in the supply chain.	Prior to and during project.	Pluton Exploration Manager.
Supply chain	Clean and inspect all exploration equipment for QRM. Goods will on completion of this process be declared free of QRM by the inspectors.	Prior to shipment from mainland (eg. Perth or Curtin Airbase)	Freight forwarding quarantine inspectors/Pluton quarantine inspectors
	Apply shrink wrap to equipment that cannot be transported in sea containers – shrink wrap equipment on plastic pallets (completely) using heavy duty shrink wrap. Place shrink wrapped equipment onto a second plastic pallet to minimise puncturing of shrink wrap.	Prior to shipment from Perth	Freight forwarding company
	All small exploration equipment (including hand tools) to be inspected and treated as per PEs in Section 4.3.1 and Table 11.	Prior to shipment to Irvine Island.	Site Exploration Supervisor, Pluton quarantine inspectors.
	All high risk equipment including used drilling rigs and UDPs will be disinfected using Virkon@S (or equivalent) as per manufacturer's directions.	Prior to shipment to Irvine Island or Cockatoo Island.	Freight forwarding quarantine inspectors.
	Quarantine inspectors inspect all containers for QRM.	Prior to loading exploration equipment.	Freight forwarding quarantine inspectors.
	Pack and seal exploration equipment declared free of QRM in a neat and organised fashion into clean secure airtight containers.	Immediately after inspection and prior to uplift.	Freight forwarding quarantine inspectors.
	Complete chain of custody documentation for all items of exploration equipment cleaned, inspected and declared free of QRM.	At the completion of every inspection at freight forwarding company.	Freight forwarding quarantine inspectors.
	Provide chain of custody documentation to freight receiver.	Before arrival of freight at destination.	Freight forwarding quarantine inspectors.
	Application of knockdown insecticide and flour trays inside each container (see Table 3). Use knockdown insecticide such as Callington 1-Shot (2% Permethrin & 2% d-Phenothrin) or equivalent, as per manufacturer's directions.	Before departure from mainland, or at least 24 hours before unloading for transport to Irvine Island.	Freight forwarding quarantine inspectors, Pluton quarantine inspectors.
New exploration equipment purchased in Australia	Conduct exterior inspection for QRM at freight forwarder provided that the integrity of the original packing is intact, otherwise, a full clean and internal/external inspection for QRM is required.	Prior to transport to Irvine Island or Cockatoo Island.	Freight forwarding quarantine inspectors.
Large items unable to be sealed in containers	Inspect integrity of shrinkwrapped exploration equipment for QRM at Derby Port or Cockatoo Island.	Upon arrival/prior to transport to Irvine Island.	Pluton quarantine inspectors.
Overseas imported exploration equipment	Conduct inspection for QRM at freight forwarder.	Prior to shipment from Perth.	Freight forwarding quarantine inspectors.
Interstate imported exploration equipment	Conduct inspection for QRM at freight forwarder.	Prior to shipment from Perth.	Freight forwarding quarantine inspectors.

Topic	Action	Timing	Responsibility
Quarantine containment facilities on Cockatoo Island and/or mainland (eg. Curtin Airbase)	Provide secure clean rooms (e.g. pressure tested sea-containers) for preparing, inspecting and storing equipment.	Prior to commencement of exploration operations.	Site Exploration Supervisor.
	Install and thoroughly clean the quarantine containment facilities interiors and exteriors with high pressure cleaners.	Prior to commencement of exploration operations.	Pluton quarantine inspectors.
	Disinfect surfaces used for storage and inspections using Virkon®S (or equivalent) as per manufacturer's directions.	Prior to commencement of exploration operations.	Pluton quarantine inspectors.
	Inspect visually unused, empty quarantine storage areas for QRM and declared free of QRM.	Before being loaded with equipment.	Pluton quarantine inspectors.
	Keep doors closed unless moving, preparing, or inspecting equipment.	At all times.	All Pluton staff and contractors.
	Ensure the quarantine containment facilities are baited with fresh rodenticides and regularly sprayed with residual insecticide as per manufacture's directions.	At all times.	Pluton quarantine inspectors.
	Locate dedicated QRM waste bins at the quarantine containment facilities.	At all times.	Site Exploration Supervisor.
	Dispose of QRM waste on the mainland or Cockatoo Island unless the suspected QRM does not occur on either the mainland or Cockatoo Island.	At all times.	Site Exploration Supervisor.
	Maintain quarantine containment facility in a clean hygienic state and free of QRM.	At all times.	Site Exploration Supervisor.
	Apply knockdown insecticide inside quarantine containment facilities (ie. insect bomb) according to manufacturer's directions.	Every 24 hours (eg. at the end of each day).	Pluton quarantine inspectors.
	Supply contingency equipment at the quarantine containment facility for emergency response for the detection of live QRM (vertebrates and invertebrates). The minimum requirements for the contingency equipment shall be as follows: <ul style="list-style-type: none"> • knockdown insecticide as high volume spray, spray cans and bombs • rodenticide • ant bait (with broad spectrum insecticide) • Virkon®S disinfectant (or equivalent) • spare inspection kits, torches and batteries • cockroach baits (Premise or equivalent) • spare flour trays and flour (at Cockatoo Island only, see section 2.4.2). 	At all times.	Site Exploration Supervisor.
	Maintain contingency equipment.	At all times.	Site Exploration Supervisor.
Transfer from mainland to barge	Prior to uploading of equipment from the mainland, wash the hold area of the barge with sea-water and inspect for QRM.	Prior to loading barge	Barge crew Pluton quarantine inspectors.
	During loading of equipment from the mainland to the barge, minimise ground contact, of the packaged equipment.	During loading of barge	Barge crew Pluton quarantine inspectors.

Topic	Action	Timing	Responsibility
	During loading of equipment onto the barge, segregate Pluton Resources equipment from other consignments stored in barge hold area	During loading of barge	Barge crew Pluton quarantine inspectors.
	If barge not available for shipment, store wrapped equipment or sealed containers at a suitable quarantine storage area (eg Curtin Airbase or Cockatoo island).	At all times	Pluton Quarantine inspectors
Mobilisation of equipment (to Irvine Island)	Prior to each movement of equipment from the barge, unwrap and inspect all equipment for QRM (including viable weed seeds).	Prior to each movement of equipment to Irvine Island.	Pluton quarantine inspectors.
	Store any equipment not immediately shipped to Irvine Island in a quarantine storage area located at either Curtin Airbase or Cockatoo Island.	At all times.	All Pluton staff and contractors.
Mobilisation of equipment (returning from Irvine Island).	Take all equipment returned to Cockatoo Island or mainland to a quarantine containment facility. Segregate equipment returned to Cockatoo Island or mainland from QRM free equipment until inspected by quarantine inspectors and declared free of any QRM (from Irvine Island).	Upon arrival of equipment returned from Irvine Island.	All Pluton staff and contractors. Pluton quarantine inspectors.

2.4 MONITORING

The monitoring requirements for the supply chain of exploration equipment are presented below and in Table 3.

2.4.1 Treatments and surveillance upon receiving freight at Derby Port and Cockatoo Island

Flour trays will be installed and knockdown insecticide applied either prior to the departure of sea containers from the freight forwarding depot or at least 24 hours before unloading containers from the barge or on Cockatoo Island. A gate inspection will be conducted before unloading and the flour tray checked for any live QRM. If no QRM activity is detected in the container, it will be re-sealed until the equipment is transferred to Irvine Island.

2.4.2 Flour trays

Flour trays are to be used for monitoring the presence of rodents in all sea-containers received by Pluton at either Derby Port or Cockatoo Island. Flour trays consist of a metal tray filled to rim with white flour. Commercially available rodent baits are placed in the centre of the flour tray, which are then placed into the sea-container which is then closed. After twenty four hours the flour trays are checked for activity and the goods area released if no rodent tracks are detected in the flour trays.

2.4.3 Surveillance for introduction of QRM on Irvine Island

During the project

Pluton quarantine officers will be responsible for detection of introduced QRM on Irvine Island during the life of the project. While they are the sites are of active operations the surrounds of disturbed areas will be visually inspected daily for easily identifiable QRM. Any suspected introduced QRM (such as

geckos) will be collected and identified as soon as possible. The reporting mechanisms for the QRM surveillance during the project are presented in section 5.

Long term (post exploration)

After completion of the project, flora and fauna specialists will survey the exploration area to determine whether any QRM exist. These surveys will be conducted towards the end of the wet season (March to May) which will allow for the detection of newly emerged weeds and is a favourable time for the surveillance of invertebrate pests and plant pathogens. The surveys will be conducted 12 months and 24 months and 5 years post exploration operations, which will allow for any potential weed seed dormancy and seasonal variation.

Personnel conducting the long term surveillance program on Irvine Island will adhere to the requirements of this Quarantine Management Plan and the DEC (2006) Island Quarantine Management Protocol.

All suspected detections of QRM will be formally identified. The reporting mechanisms for the long term QRM surveillance is presented in section 5.

Table 3 Monitoring program for the exploration equipment supply chain.

Topic	Parameter	Frequency	Location	Purpose
Supply chain Arrival of sea container of exploration equipment	Chain of custody documentation to be checked to ensure that freight has been cleaned, inspected and declared free of QRM.	Upon arrival	Derby Port or Cockatoo Island.	To determine the potential for the entry of QRM into the container.
	Installation of flour trays baits and knockdown insecticide inside container.	Before departure from Perth or at least 24 hours before unloading.	Freight forwarding depot, Derby Port or Cockatoo Island	To determine presence of live QRM (vertebrates and invertebrates).
	Gate and flour tray inspection of sea container for live QRM.	Upon arrival.	Derby Port or Cockatoo Island.	To determine presence of live QRM (vertebrates and invertebrates).
	Internal visual inspection of sea container for live QRM.	During unpack.	Barge or Cockatoo Island.	To determine the presence of live QRM (vertebrates and invertebrates).
Quarantine containment facilities.	Surveillance (visual inspection) around facility perimeters.	Daily while quarantine containment facilities are in use.	Immediate area surrounding quarantine containment facilities.	To identify potential quarantine breaches within facilities.
	Check integrity of seals of quarantine containment facilities.	Daily while quarantine containment facilities are in use.	Quarantine containment facilities.	Prevent the potential entry of QRM into the quarantine containment facilities.
Surveillance for QRM.	Quarantine inspectors to visually assess all disturbed areas for obvious QRM.	Daily at active sites. For the life of the proposal.	Disturbed areas on Irvine Island.	Early detection for QRM establishment on Irvine Island.
Long term surveillance for QRM establishment on Irvine Island.	Transect survey of all disturbed areas for establishment of QRM by flora and fauna consultants.	Wet season surveys (March-May) 12 and 24 months and 5 years post exploration.	All disturbed areas on Irvine Island.	Long term surveillance for QRM establishment on Irvine Island.

2.5 CONTINGENCIES

Detections of QRM are categorised as either minor incidents, major quarantine breaches or critical quarantine breaches depending on the nature and circumstances of the detection. The various contingencies arising from detections of QRM and failures of supply chain integrity are outlined in Table 4. Pluton quarantine inspectors and staff use an incident record sheet to document all minor quarantine incidents. Major and critical quarantine breaches are documented using a non-compliance record sheet. All recorded breaches will be included in the final Quarantine Management Report submitted to DEC at the end of the exploration project.

Table 4 Exploration equipment supply chain management contingency actions

Topic	Trigger	Action
Major Quarantine Breach		
Derby Port or Cockatoo Island Arrival of container of exploration equipment.	Hole in the container. Chain of custody documentation indicates no cleaning or inspections for QRM.	<ol style="list-style-type: none"> 1. Monitor and treat container for QRM (flour trays, apply knockdown insecticide) for 24 hour period. 2. Identify reason for failure of container security and remediate. 3. Document quarantine interception.
	Detection of live invertebrate pest inside container upon arrival or during post arrival inspections.	<ol style="list-style-type: none"> 1. Apply knockdown insecticide to container. 2. Re-inspect 1 hour later. 3. Treat again/re-inspect until no live QRM detected. 4. Document quarantine interception.
Derby Port or Cockatoo Island Arrival of shrink wrapped equipment stored on plastic pallets	Hole/tear in shrink wrap.	<ol style="list-style-type: none"> 1. Inspect hole/tear for QRM 2. Repair tears to shrink wrap using gaffer tape (or equivalent) 3. Document quarantine interception
Barge. During unpack of exploration equipment prior to uplift.	QRM detected on equipment prior to uplift from barge.	<ol style="list-style-type: none"> 1. Inspect Barge laydown area for QRM and clean until all QRM removed 2. Clean and reinspect equipment until equipment is clean 3. If QRM cannot be effectively cleaned then mobilise to Cockatoo Island or mainland for thorough cleaning and inspection prior to uplift to Irvine Island.
Cockatoo Island. During unpack of exploration equipment prior to uplift.	Detection of live vertebrate and invertebrate inside container upon arrival or during unpack.	<ol style="list-style-type: none"> 1. Contain QRM (close container gates). 2. Catch and destroy QRM using humane means. 3. Re-pack equipment into container. 4. Apply flour trays and baits or knockdown insecticide where appropriate for 24 hour periods until no further tracks in flour or no live invertebrates detected on inspection. 5. Dispose of QRM in QRM waste bins. 6. Document quarantine interception.
	Detection of vegetative and other QRM (viable seeds, plant disease symptoms or propagules, soil, mud, clay, animal faeces, animal material, plant material and other debris).	<ol style="list-style-type: none"> 1. Contain, remove and treat QRM. 2. Dispose of QRM in QRM waste bins. 3. Clean exploration equipment in quarantine containment facility and re-inspect for QRM until declared free of QRM. 4. Document quarantine interception.
Critical Quarantine Breach		
Irvine Island.	Detection of QRM in project area during project or during long term surveillance for QRM.	<ol style="list-style-type: none"> 1. Catch remove/destroy QRM if possible. 2. Implement emergency response if required (see below).

Topic	Trigger	Action
Critical Quarantine Breach Emergency response.	Critical Quarantine Breach	<ol style="list-style-type: none"> 1. Emergency responses and containment for quarantine breaches include the following procedures: <ol style="list-style-type: none"> i. prevent further spread - contain the QRM ii. determine the extent and nature of the quarantine breach iii. notify the appropriate Pluton supervisors iv. alert other Pluton staff in the area v. notify the DEC within 24 hours of the breach (West Kimberley District Office – Broome) vi. cleanup and disposal of the quarantine risk material vii. incorporate site into long term QRM monitoring program viii. document quarantine interception. 2. Review management procedures to prevent further breaches.

2.5.1 Treatments

Contingency equipment for live vertebrate and invertebrate QRM will consist of commercially available baits and insecticides.

2.5.2 Quarantine cleaning areas

Quarantine cleaning areas will be provided on Cockatoo Island and mainland (eg. Curtin Airbase) to implement the cleaning of items detected with QRM such as viable seeds, plant disease symptoms or propagules, soil, mud, clay, animal faeces, animal material, plant material and other debris. Brushing, compressed air, high pressure water and vacuums will be used for cleaning items found with QRM.

3. FOOD AND WASTE MANAGEMENT PLAN

3.1 INTRODUCTION

The food management plan applies only to the movement of food from Cockatoo Island to Irvine Island as the food supply chain requires particular management.

Food products are a common source for invertebrate and vertebrate pests, plant diseases and viable weed seeds. Dried food products are often associated with common stored grain insect pests such as weevils, moths and grain borers. Fresh food products can be infested with a wide variety of insect pests, mites and plant diseases. Unhygienic food storage can attract cockroaches and other vertebrate pests such as mice and rats.

Most pests associated with food products are not able to survive in new environments. However, there are pests, weeds and diseases that are adaptable and thrive in the absence of natural predators. Tramp ants, rodents and tropical weeds are commonly distributed through northern Australia through human commerce and have been the direct cause of environmental decline and biodiversity in many pristine environments.

All food for Pluton's proposed exploration operation will be supplied from the mainland. All meals will be consumed on the Island within the staff camping area and shift work sites.

Waste management applies to the collection and treatment of waste material generated on Irvine Island. Portable toilets will be provided on Irvine Island for human waste. All waste will be removed to an appropriate facility on the mainland by helicopter, barge or boat.

3.2 OBJECTIVES, TARGETS AND KEY PERFORMANCE INDICATORS

The following objectives, targets and performance indicators apply to food and waste management on Irvine Island (Table 5).

Table 5 Objectives, environmental targets and performance indicators for the management of food and waste

Management objectives	Target	Key Performance Indicator
Prevent the introduction of QRM to Irvine Island.	No recorded incidences of prohibited food (Table 7) found on Irvine Island.	Recorded incidents.
	No recorded incidences of QRM found on Irvine Island.	Recorded incidents.

3.3 MANAGEMENT ACTIONS

The relevant quarantine management actions for preventing the introduction of QRM to Irvine Island through food and waste pathways are provided in Table 6.

Table 6 Quarantine management actions for food and waste

Topic	Action	Timing	Responsibility
Quarantine awareness training.	Conduct specific quarantine awareness training for all staff directly involved in food supply and preparation.	Prior to commencement of project and/or during Pluton induction process.	Pluton Exploration Manager.
Movement of food onto Irvine Island.	Pack QRM free food in sealed clean containers.	At all times	All Pluton staff.
	Ban prohibited food on Irvine Island.	For the life of the project.	Pluton quarantine inspectors, assistant quarantine inspectors, cooks, staff and suppliers.
	Inspect all food taken to Irvine Island for QRM and prohibited foods (Table 7).	Prior to departing Cockatoo Island or the mainland - for the life of the project.	Pluton quarantine inspectors and assistant quarantine inspectors.
Movement of food onto Irvine Island.	Freeze any dried goods for minimum of 3 days prior to being taken to Irvine Island.	For the life of the project.	Pluton quarantine inspectors, assistant quarantine inspectors, cooks, staff and suppliers.
Disposal of food waste.	Contain all food waste and dispose at Cockatoo Island (not in the quarantine disposal bins).	At all times.	All Pluton staff
Human waste.	Provide portable toilets on Irvine Island for solid waste.	At all times.	Site Exploration Supervisor.
	Collect waste for disposal on Cockatoo Island.	At all times.	Site Exploration Supervisor.

Table 7 Prohibited food on Irvine Island

Prohibited food
Nuts in the shells
Any fruit with viable seeds including: <ul style="list-style-type: none"> • citrus • tomatoes • passionfruit • melons • avocado • berry fruits (blackberry, etc)
Any vegetables with viable seeds including: <ul style="list-style-type: none"> • cucumber • capsicum, chillies • sweet corn
Other vegetables with potentially hidden seeds including <ul style="list-style-type: none"> • broccoli • brussels sprouts • cabbage and lettuce (unless the leaves have been separated and thoroughly cleaned)

Source: DEC (2006) Island Quarantine Protocol.

Please note that tinned fruit and vegetables, peeled and de-seeded fruit and vegetables (eg. avocado in sandwiches), peeled root vegetables, dried fruit and vegetables, bread, etc. are all permitted foods.

3.4 MONITORING

The monitoring requirements for food are presented in Table 8.

Table 8 Monitoring program for food and waste

Topic	Parameter	Frequency	Location	Purpose
Movement of food onto Irvine Island.	Quarantine inspectors to record the number and type of detections of QRM. Review management procedures if number of detections becomes excessive.	During the life of the project.	Cockatoo Island.	Prevent introduction or establishment of QRM on Irvine Island.
	Quarantine inspectors to record the number of detections of prohibited foods intercepted during food inspections. Review management procedures if number of detections becomes excessive.	All food to be inspected prior to movement.	Cockatoo Island.	Prevent potential introduction of QRM on Irvine Island.

3.5 CONTINGENCIES

Detections of QRM are categorised as either minor incidents, major quarantine breaches or critical quarantine breaches depending on the nature and circumstances of the detection. The various contingencies for detection of QRM in food or waste are outlined in Table 9. Pluton quarantine inspectors and staff use an incident record sheet to document all minor quarantine incidents. Major and critical quarantine breaches are documented using a non-compliance record sheet. All recorded breaches will be included in the final Quarantine Management Report submitted to DEC at the end of the exploration project.

Table 9 Contingency actions applicable during management of food and waste

Topic	Trigger	Action
Minor Quarantine Incident		
Food (prior to departure to Irvine Island).	Detection of QRM on food.	<ol style="list-style-type: none"> 1. QRM infected food to remain on Cockatoo Island. 2. Document quarantine interception.
	Detection of prohibited food.	<ol style="list-style-type: none"> 1. Prohibited food to remain on Cockatoo Island. 2. Document quarantine interception.
Major Quarantine Breach		
Food (already taken ashore on Irvine Island).	Detection of prohibited food.	<ol style="list-style-type: none"> 1. Contain or treat (eg. double bag and treat with insecticide). 2. Returned infected food item to Cockatoo Island or mainland for consumption or disposal. 3. Counsel personnel involved. 4. Document quarantine interception.
Critical Quarantine Breach		
Food (already taken ashore on Irvine Island).	Detection of QRM on food.	<ol style="list-style-type: none"> 1. Catch remove/destroy QRM if possible. 2. Implement emergency response if required (see below).
Critical Quarantine Breach Emergency response.	Critical Quarantine Breach	<ol style="list-style-type: none"> 1. Emergency responses and containment for quarantine breaches include the following procedures: <ol style="list-style-type: none"> i. prevent further spread - contain the QRM ii. determine the extent and nature of the quarantine breach iii. notify the appropriate Pluton supervisors iv. alert other Pluton staff in the area v. notify the DEC within 24 hours of the breach (West Kimberley District Office – Broome) vi. cleanup and disposal of the quarantine risk material vii. incorporate site into long term QRM monitoring program viii. document quarantine interception. 2. Review management procedures to prevent further breaches.

4. MANAGEMENT PLAN FOR MOVEMENT OF TRANSPORT VESSELS, PERSONNEL AND PERSONAL EFFECTS TO IRVINE ISLAND

4.1 INTRODUCTION

The supply chain management for transport vessels, personnel, personal effects also require particular management. Pluton and contract staff will be camping on Irvine Island and there is potential for transport vessels, personnel, and PEs to be infected with QRM found on the mainland and Cockatoo Island.

4.2 OBJECTIVES, TARGETS AND KEY PERFORMANCE INDICATORS

The following objectives, targets and performance indicators will apply to the management of the movement of transport vessels, personnel and PEs to Irvine Island (Table 10).

Table 10 Objectives, environmental targets and performance indicators for the movement of transport vessels, personnel, and PEs to Irvine Island

Management objectives	Target	Key Performance Indicator
Prevent the introduction of QRM to Irvine Island.	No recorded incidences of QRM going ashore to Irvine Island.	Recorded incidents.
Maximise the likelihood of early detection of QRM on Irvine Island.	No new records of QRM on Irvine Island.	Recorded incidents.

4.3 MANAGEMENT ACTIONS

All quarantine management actions for the movement of vessels, personnel and PEs to and from Irvine Island, are presented in Table 11.

4.3.1 Personal effects

Personnel will camp on Irvine Island during the course of the Phase II Exploration Drilling Program. Personnel will be given brand new tents/accommodation units and camping gear prior to the beginning of the exploration program to reduce the risk of QRM transport onto the Island.

Personnel will be responsible for inspecting and cleaning their own PEs for QRM and prohibited items during preparation and packing. All items will be checked by Pluton quarantine inspectors before mobilisation to Irvine Island. All contractors will be briefed about quarantine of PEs before their involvement in the program.

All outer clothing, boots and any PE items will be visually inspected while being worn by a Pluton quarantine inspector prior to movement to Irvine Island. All PE items not being worn that are declared free of QRM will be loaded and sealed into clean, air-tight containers or physically held by each person until they board the boat/helicopter.

Small items of exploration equipment including hand tools may potentially contain traces of soil and plant pathogens (eg. secateurs and picks) and will be disinfected using Virkon®S (or equivalent) as per manufacturer's directions prior to movement to Irvine Island.

Socks can be a major source of viable weeds seeds. New socks will be provided by Pluton for use only on Irvine Island. When personnel return from Irvine Island, socks will be stored and washed separately to prevent the potential contamination of QRM from Cockatoo Island or the mainland. Washed clean socks will be supplied at the start of each shift rotation.

No domestic pets will be permitted on Cockatoo Island or Irvine Island.

4.3.2 Transport of personnel to Irvine Island

Staff being mobilised to Irvine Island by helicopter or boat will depart from Cockatoo Island or the mainland via a quarantine containment facility where PEs will be inspected by Pluton quarantine inspectors immediately before departure.

On rare occasions, personnel may require transfer directly by helicopter from the mainland to Irvine Island (eg. special visitors or emergency situations). In most situations, the personnel will be accompanied by a Pluton quarantine inspector. The helicopter, personnel and PEs will be inspected for QRM prior to departure from the mainland. Pluton will provide quarantine awareness training to the helicopter contractor to ensure that pilots conduct pre-flight inspections/cleaning for QRM prior to departure from the mainland.

4.3.3 Marine vessels

All marine vessels supporting the Pluton exploration project are likely to be locally sourced from Broome, Derby or Perth. The supply barge (from Derby) may anchor near Irvine Island and moor or land at Cockatoo Island.

All non-locally sourced marine vessels will be subject to a risk based assessment of the history vessel to determine potential spread of marine pests within WA. This assessment will be conducted in consultation with the Department of Fisheries.

No marine vessels from overseas or outside State waters will be required for the exploration program.

4.3.4 Inspections

Inspection kits will be provided to all quarantine inspectors. Spare inspection kits will be included in the contingency equipment.

Table 11 Quarantine management actions for the movement of equipment, personnel, PEs and vessels to and from Irvine Island

Topic	Action	Timing	Responsibility
Inspection kits	Make quarantine inspection kits available for all quarantine inspectors	At commencement of exploration and for the life of the project.	Site Exploration Supervisor.
Inspection of PEs	Inspect all clothing and PEs for QRM (including viable weed seeds)	Prior to each movement of PEs to Irvine Island.	Pluton quarantine inspectors.
Personal Effects (bags)	Supply new bags to all staff.	Prior to commencement of exploration.	Site Exploration Supervisor.

Topic	Action	Timing	Responsibility
	Dedicate bags for transport of PEs to and from Irvine Island and store them in the quarantine containment facilities at Cockatoo Island and mainland when not in use.	For the life of the project.	Pluton quarantine inspectors.
Personal Effects (socks)	Prohibit socks on Irvine Island that are not supplied by Pluton. Supply new unseparated washed socks for all personnel for use specifically on Irvine Island. Collect socks at the end of each visit to Irvine. Washed separately. Store new or washed socks only in the quarantine containment facilities or at Irvine Island.	For the life of the project.	Site Exploration Supervisor and Pluton quarantine inspectors.
Personal Effects (Velcro)	Clean and inspect all equipment with Velcro for QRM.	Prior to each movement of PEs to Irvine Island.	Pluton quarantine inspectors.
Personal Effects (boots)	Clean boots of QRM and treat with Virkon®S (or equivalent) as per manufacturer's directions.	Prior to each movement of PEs to Irvine Island.	All staff.
Personal Effects (small items of exploration equipment)	Clean small items of exploration equipment of QRM and if suspected to contain traces of soil, or plant pathogens, treat with Virkon®S (or equivalent) as per manufacturer's directions).	Prior to each movement of PEs to Irvine Island.	Pluton quarantine inspectors.
Personnel (clothing)	Inspect all clothing and boots worn by personnel for QRM.	Prior to each movement of personnel to Irvine Island.	Pluton quarantine inspectors.
Personal Effects (loose items of PEs - post inspection)	Seal all QRM free loose items of PEs that are not being worn in clean, air-tight containers or have them hand-held until on the helicopter/boat.	Prior to each movement of loose PEs to Irvine Island.	Pluton quarantine inspectors and assistant quarantine inspectors.
Unloading of loose PE items (returning from Irvine Island) into quarantine containment facilities.	Segregate PEs returned from Irvine Island from QRM free material in containers until inspected by quarantine inspectors and declared free of any QRM.	Post each movement of PEs returning from Irvine Island .	Pluton quarantine inspectors.
Wooden articles permitted on Irvine Island.	Allow only wooden articles that are made of Laminated Veneer Lumber (LVL) or treated timber (e.g. CCA treated) and subject to inspection for QRM are to be taken ashore to Irvine Island. Use wood alternatives where possible - such as rubber matting for walkways, plastic moulded pallets.	At all times during the life of the project.	Site Exploration Supervisor.
Vessels (helicopter).	Inspect skids and flooring of helicopter for QRM.	Before loading personnel and PEs. Before each deployment to Irvine Island.	Pluton quarantine inspectors and assistant quarantine inspectors.
Vessels (tenders).	Inspect inner hull, ropes and storage areas on tender for QRM.	Before loading personnel and PEs. Before each deployment to Irvine Island.	Pluton quarantine inspectors and assistant quarantine inspectors.
	Risk assessment of the potential for spread of marine pests for all non-locally sourced marine vessels (see 4.3.2). Conduct assessment in consultation with Department of Fisheries.	At all times during the life of the project.	Site Exploration Supervisor.
Contingency equipment.	Provide contingency kits (see 2.3.7) at the site of operating drill rigs, helicopter pads, tenders, desalination plants and camping area.	Prior to commencement of operation and for the duration of the project.	Site Exploration Supervisor.

Topic	Action	Timing	Responsibility
Disposal of QRM.	Dispose of all detected QRM into quarantine disposal bins on Cockatoo Island.	For the life of the project.	All Pluton staff.
Camping by contract staff.	Camp only on bare areas. Do not damage native vegetation.	For life of the project.	All Pluton staff.
	Collect all garbage in sealed containers and return it to the mainland. Separate inorganic (cans and bottles) from organic wastes. Ensure all waste is stored where animals cannot access it.	For life of the project	All Pluton staff.
	Remove all human waste from the island.	For life of the project	Site Exploration Supervisor.
	No lighting of open fires. All cooking to be done with gas stoves.	For life of the project	All Pluton staff.
	Prevent equipment and food boxes being contaminated by organic materials while on the island. Do not transport viable organisms between islands and the mainland.	For life of the project	All Pluton staff.

4.4 MONITORING PROGRAM

The monitoring requirements for the movement of transport vessels, personnel and PEs to and from Irvine Island are presented in Table 12.

Table 12 Monitoring program for movement of transport vessels, personnel and PEs to and from Irvine Island

Topic	Parameter	Frequency	Location	Purpose
Movement of helicopters.	Quarantine inspectors to record the number of detections of QRM. Review management procedures if number of detections becomes excessive.	Before each deployment to Irvine Island.	Barge, Cockatoo Island and Irvine Island.	Prevent introduction or establishment of QRM on Irvine Island.
Movement of tenders.	Quarantine inspectors to record the number of detections of QRM. Review management procedures if number of detections becomes excessive.	Before each deployment to Irvine Island.	Barge, Cockatoo Island and Irvine Island.	Prevent introduction or establishment of QRM on Irvine Island.
Movement of PEs.	Quarantine inspectors to record the number of detections of QRM. Review management procedures if number of detections becomes excessive.	Before each deployment to Irvine Island.	The quarantine containment facilities at Curtin Airbase and Cockatoo Island.	Prevent introduction or establishment of QRM on Irvine Island.
Surveillance for QRM	Quarantine inspectors to survey all disturbed areas.	Daily at active sites and camp area - for the life of the project.	Disturbed areas on Irvine Island.	Early detection for QRM establishment on Irvine Island.
Long term surveillance for QRM establishment on Irvine Island.	Transect all disturbed areas for establishment of QRM by flora and fauna consultants.	Wet season surveys (March-May) 12 and 24 months and 5 years post exploration.	All disturbed areas on Irvine Island.	Long term surveillance for QRM establishment on Irvine Island.

4.5 CONTINGENCIES

Detections of QRM are categorised as either minor incidents, major quarantine breaches or critical quarantine breaches depending on the nature and circumstances of the detection. The various contingencies for detection of QRM relating to transport vessels, personnel and PEs are outlined in Table 13. Pluton Quarantine Inspectors and staff use an incident record sheet to document all minor quarantine incidents. Major and critical quarantine breaches are documented using a non-compliance record sheet. All recorded breaches will be included in the final Quarantine Management Report submitted to DEC at the end of the exploration project.

Table 13 Contingency actions for movement of transport vessels, personnel and PEs

Topic	Trigger	Action
Minor Quarantine Incident		
Movement of transport vessels, personnel and PEs (prior to movement to Irvine Island)	Detection of QRM on transport vessels, personnel and PEs.	<ol style="list-style-type: none"> 1. Contain, remove and treat QRM. 2. Dispose of QRM in QRM waste bins. 3. Clean item in a suitable cleaning area and re-inspect for QRM until declared free of QRM. 4. Counsel personnel involved. 5. Document quarantine interception.
Transport vessels, personnel and PEs (on Irvine Island)	Detection of QRM on transport vessels, personnel and PEs.	<ol style="list-style-type: none"> 1. Contain and treat QRM. 2. Remove and dispose QRM in QRM bins at Cockatoo Island as soon as possible. 3. Counsel personnel involved. 4. Document quarantine interception.
Critical Quarantine Breach		
Surveillance for QRM on Irvine Island.	Detection of QRM in project area.	<ol style="list-style-type: none"> 1. Catch remove/destroy QRM if possible. 2. Implement emergency response if required.
Critical Quarantine Breach Emergency response	Critical Quarantine breach.	<ol style="list-style-type: none"> 1. Emergency responses and containment for quarantine breaches include the following procedures: <ol style="list-style-type: none"> i. prevent further spread - contain the QRM ii. determine the extent and nature of the quarantine breach iii. notify the appropriate Pluton supervisors iv. alert other Pluton staff in the area v. notify the DEC within 24 hours of the breach (West Kimberley District Office – Broome) vi. cleanup and disposal of the quarantine risk material vii. incorporate site into long term QRM monitoring program viii. document quarantine interception. 2. Review management procedures to prevent further breaches.

5. REPORTING

5.1 AT COMPLETION OF EXPLORATION OPERATIONS

Pluton will prepare a report on the exploration operation on Irvine Island within three months of completion. The report will advise of:

- any quarantine breaches
- any non-compliances with this management plan
- the frequency and type of QRM detected during quarantine inspections
- the status of QRM resulting from the surveillance conducted on Irvine Island during the exploration operation.

The report will be submitted to the DEC branch in Broome.

5.2 LONG TERM SURVEILLANCE ON IRVINE ISLAND

Pluton will prepare reports for each wet season survey conducted as part of the long term surveillance for QRM following the completion of the exploration operation. These reports will advise of the status of QRM at the disturbed sites within the project area. These reports will be provided to DEC branches in Broome.

5.3 COMPLIANCE

Ignoring the requirements of this Quarantine Management Plan may result in serious consequences including possible prosecution (DEC 2006).

6. REFERENCES

- DEC, 2006, *Island Quarantine Protocol*. Department of Environment and Conservation, Western Australia.
- Dupont 2007, *Virkon S, the ultimate broad spectrum virucidal disinfectant*,
<http://www.antecint.co.uk/main/virkons.htm> 7/11/2007
- EPA (1993). Red Book Status Report; on the Conservation Reserves for Western Australia, as recommended by the Environmental Protection Authority (1976-1984). Environmental Protection Authority, Perth, Western Australia.
- Pluton Resources Limited, 2009, *Program of Works for Irvine Island, Kimberley Region, Western Australia*.
- Strategen 2007, *Approval Strategy for an Iron Ore Mine on Irvine Island – Buccaneer Archipelago*, Prepared for Pluton Resources Limited, April 2007.

Appendix 1
DEC (2006) Island
Quarantine Protocol

ISLAND QUARANTINE PROTOCOL

WHY IS THIS PROTOCOL NECESSARY?

This quarantine (biosecurity) protocol is necessary to prevent introductions of non-local species to Western Australia's islands. WA's more than 3 400 islands conserve an amazing array of indigenous plants, animals and microorganisms. Some are unique; others are extinct or threatened with extinction on the mainland. Islands are also valuable as breeding places for seals, turtles and seabirds, and as examples of ecosystems unaltered since European settlement.

Most of the world's extinctions during the past 500 years have been on islands. Most of these are due to the introduction of animals, plants and diseases. Local extinctions of island animals have already happened in WA because of the introduction of alien species. Let's ensure this does not happen again.

TO WHICH ISLANDS DOES THIS PROTOCOL APPLY?

This protocol applies to all islands that have been designated as Nature Reserve, National Park or Conservation Park. Most islands south of the Kimberley are conservation reserves and camping on them is prohibited or permitted only with a licence or where specifically approved under a management plan.

Islands where camping is permitted under a management plan or other arrangements include Woody Island (Archipelago of the Recherche Nature Reserve), some islands in the Dampier Archipelago and some islands in the Montebello Islands. Contact the nearest CALM office for advice.

Islands that are commonly visited that are not conservation reserves include Rottnest Island, Garden Island, the Houtman Abrolhos, and Koolan and Cockatoo Islands (Buccaneer Archipelago). Approval to visit these islands may be necessary from the managers. Even if the island you are visiting is not a conservation reserve, please follow this protocol to protect its biodiversity. Many Kimberley islands are Aboriginal reserves and approval to visit them is required from the Department of Indigenous Affairs.

WHO IS THIS PROTOCOL FOR?

This protocol is to be followed by any person camping on an island conservation reserve or taking equipment to an island conservation reserve for any purpose, including research. The object is to prevent any organic material being taken to the island, as this may lead to the establishment of introduced species. Table 1 provides some examples of species that could be taken to islands unless quarantine rules are followed.

WHAT WILL HAPPEN IF YOU DO NOT OBSERVE THE RULES IN THIS PROTOCOL?

Ignoring the rules laid down in this protocol will result in the immediate suspension of approval for your trip, no approval for future work and, possibly, prosecution. The organisation arranging your work may also be prosecuted.

PLANNING THE TRIP

Seek approval

- The trip leader must notify CALM of the proposed visit and seek approval. Applications must be in writing. Write to Executive Director, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, WA 6983, Australia, seeking a licence. Allow at least two months for consultation and approval. Note that you will require Animal Ethics approval if working with vertebrate animals other than fish.
- Special approval is required for visits to Barrow Island (and nearby islets), Varanus Island and Thevenard Island. Note that consideration of applications for these islands may take several months.

Train trip personnel

- Hold a training session for all members of the party. Ensure all personnel sign the agreement to abide by this Protocol (Appendix 1).

Trip preparation

- Review all the quarantine rules and ensure that you will comply with them.
- Check all equipment to be taken onto the island and ensure it has been cleaned and packed properly.
- Ensure the vessel or aircraft to be used for transport to the island meets with the quarantine rules. Make sure the vessel's owners and captain or aircraft's owners and pilots are aware of island quarantine procedures before contracting them. If not, arrange to brief them on what is required. If vessel/aircraft hygiene is unsatisfactory, use another vessel or postpone the trip until the vessel meets quarantine standards.
- If using an aircraft (including a helicopter) to land on an island, ensure it is clean (including the landing gear) and is not carrying anything that would contravene these quarantine rules.
- Check all food and ensure it is packed and checked according to the quarantine rules.
- Check personnel luggage, clothing and footwear before loading onto the vessel or aircraft.
- Make sure there is enough time to do all trip preparation activities – rushing may lead to mistakes.

Table 1. Possible carriers of introduced species

CARRIER	EXAMPLES OF ORGANISMS THAT COULD BE TRANSPORTED
Packages, boxes, field equipment, tents, backpacks	Rats, mice, reptiles (eg, geckoes), frogs, insects (eg, ants), spiders and other invertebrates, seeds, bacteria
Soil	Mites, collembolans and other insects, nematodes, earthworms, microorganisms including <i>Phytophthora</i>
Clothing and shoes	Seeds, mites, bacteria, <i>Phytophthora</i>
Animal traps	Animal diseases and other microorganisms, seeds
Food	Mice, invertebrates, seeds, fungi, bacteria
Human and animal faeces	Seeds, bacteria, viruses
Rubbish	Every type of organism

Equipment

- A secure, sealed room should be designated for checking and storing equipment once prepared and packed. The room should be baited with fresh rodenticide and sprayed with residual insecticide (eg, permethrin-based insecticide).
- Thoroughly inspect all equipment. Wash and clean as necessary. Check camping equipment, including tents and bedrolls, and ensure they are clean.
- All traps and other field equipment must be scrupulously clean with no soil, animal, plant or bait residue. Small traps must be packed in sealed (eg, with duct tape) rodent- and insect-proof boxes. Large (cage) traps must be wrapped in plastic or placed in sealed containers after cleaning. Hessian or cloth used for shade or shelter in traps must be brand new and checked for cleanliness.
- Check all equipment and store in rodent- and insect-proof boxes (eg, aluminium or plastic). Spray inside the box before sealing and leave for at least 12 hours before loading. Computers, cameras, GPS receivers, and radios must be individually checked and placed into clean air-tight containers.
- Take equipment boxes directly to the departure point, keeping under cover and preventing contamination along the way. Check external surfaces of boxes before loading and re-clean if necessary.
- Do not take wood to islands unless it has been fumigated or otherwise treated to eliminate boring insects. If wood is essential, CALM will require a fumigation certificate.

Personal clothing and footwear

- All clothing must be clean and free from soil and seeds. Look carefully in pockets and trouser cuffs. Normal washing may not kill all organisms.
- Boots and other footwear must be completely free from soil. Clean them with a stiff brush and wash with a disinfectant.

Food and water

- Water must be transported in clean plastic containers.
- Do not take prohibited food (see Table 2).
- All vegetables and fruit must be inspected. Any that appears diseased or appear to contain insects must be discarded. Remove any leaves and remove soil-contaminated outer layers of onions and garlic. Wash everything.
- Bananas should be separate (not in bunches) and free from any old leaves or flowers.
- Freeze any dry food (flour, noodles, rice, popcorn, etc.) for three days before the trip to kill weevils and other organisms.
- Pack all food into sealed, clean containers. Do not use cardboard boxes or plastic bags.
- Keep containers in the quarantine store – do not set them down on soil or other dirty areas before loading.
- Do not eat fruits and vegetables that could contain viable seeds within 72 hours of departure.

Table 2. Prohibited and permitted food

PROHIBITED	PERMITTED
Any fruit with viable seeds, including citrus, tomatoes, passion fruit, melons, avocado, berry fruits (blackberry, etc.).	Dried fruit and vegetables. Washed apples and bananas. Tinned fruit.
Any vegetables with viable seeds, including cucumber, capsicum (peppers), sweet corn.	Carrots, potatoes, radish, beetroot. Peeled onion and garlic. Tinned vegetables.
Broccoli and Brussel Sprouts. Cabbage and lettuce, unless the leaves have been separated and thoroughly cleaned.	
Nuts in their shells.	Processed nuts.

Animals

- Taking animals to islands is prohibited.

The vessel

- Make sure the vessel’s captain is aware of this protocol and ensure that all crew have signed the declaration of responsibility to abide by it.
- Check that the vessel has been inspected and is clean. Arrange fumigation or spraying as necessary. Ensure that rodenticide is in place.
- Ensure that crew members do not throw garbage containing seeds into the sea when they are close to an island, and that they carry all garbage back to the port of origin.
- If travelling at night, minimise the use of lights so that flying insects are not attracted to the vessel. If the vessel has attracted insects while in port before departure, spray all surfaces and spaces where insects could be hiding.

DURING THE TRIP

Landing

- Carry only the minimum equipment necessary to do your work.
- Never throw soil, plants (including seeds) or animals into the sea near an island – place contaminants in a sealed container and return to the mainland.
- Check that all equipment taken ashore is yours and meets quarantine requirements.

Camping, if approved

- Camp only on bare areas – do not damage native vegetation.
- Collect all garbage in sealed containers and return it to the mainland. Separate inorganic (cans, bottles) from organic waste. Ensure all waste is stored where animals can not access it.
- Human wastes. Use the sea where possible. Otherwise dig a deep hole and cover completely and immediately.
- Do not light fires. All cooking is to be with fuel stoves.
- Prevent your equipment and food boxes from being contaminated by organic materials while on the island. It is important not to transport viable organisms between islands and to the mainland.

AFTER THE TRIP

Reporting

- Provide a report on the trip to CALM. Please advise of any problems you encountered with this protocol, of any unauthorised camps or other structures on the island and of any sightings of introduced species.

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

ISLAND QUARANTINE PROTOCOL

DECLARATION OF RESPONSIBILITY

I, (full name)
of (institution/group/company)
being the designated leader of a party authorised to visit Island

agree to supervise and check that all the members of my team/group, adhere to the island quarantine protocol. I understand that if this obligation is not fulfilled, the Department of Conservation and Land Management could initiate appropriate legal actions.

.....
(signature) (date)

.....
(witness)

.....
(witness full name and address)

For legal authentication, all the participants of the trip must sign their name and provide their address, being aware that each member of the group is mutually responsible.

.....
(full name) (signature) (date)
address

.....
(full name) (signature) (date)
address

.....
(full name) (signature) (date)
address

.....
(full name) (signature) (date)
address

.....
(full name) (signature) (date)
address

ISLAND QUARANTINE PROTOCOL

NOTES TO AID INSPECTION OF EQUIPMENT AND FOOD

The quarantine store

There should be adequate space in the store for:

- storage and maintenance of equipment used on islands;
- checking and packing supplies needed for the programmes on the islands;
- cleaning and checking items returned from the islands.

Design

- The store must be well lit with no dark corners.
- All removable items need to be taken out and the entire store checked for any gaps and sign of pest damage.
- For rodent proofing, all entrances and holes > 5 mm must be securely sealed, including; under doors (e.g. by using a metal “lip”), around holes for drainpipes or wiring, around windows etc.
- For invertebrate proofing, all gaps must be sealed, however this will probably be impractical and other invertebrate detection and control will be required.
- All windows and doors must shut securely (vents or fly-screen mesh may be required).
- The floor should be sealed (painted) to enable easier cleaning.

Maintenance

- The store must be clean before use and all rubbish removed.
- No perishable foods to be kept in the store, except those about to be taken to an island.

Vertebrates

Rats and mice are the main targets, but watch out for reptiles (eg, geckoes, skinks, small snakes) and their eggs, and for frogs. The quarantine store should be secure and clean and continuously baited with fresh rodenticide (use a second generation poison such as brodifacoum – pellets are fine, but use wax blocks in damp areas). Follow inspection procedures as laid down below for invertebrates.

When checking gear, place set, unbaited Elliott traps against the walls in the corners of the store, so that a rat or mouse emerging from equipment will run into them.

Invertebrates

Awareness and careful inspection are the most important things for invertebrate biosecurity. It comes down to being aware that invertebrates could be a problem and that **everything** needs to be inspected closely to ensure there are no free-loading passengers.

Ensure that no food sources, which may attract animals like ants, are in or around the quarantine gear store. Water-tight plastic barrels are excellent, as they will be insect-proof as well as waterproof. (These should also largely prevent post-packing infestation.) A clean store area is also important, as this makes it much easier to detect any new arrivals. Pest control should be in

operation around the perimeter of the building and should prevent ants establishing inside however, it cannot be relied upon entirely; there is always the need for inspection as well.

Inspecting and packing gear in a clean, open, indoor area is really important. Any pest that pops out is easily seen and can be dealt to quickly, before it escapes. The inspection area should be large enough to allow tents to be unfolded away from the already inspected gear, so that any discovered pest cannot escape into the inspected gear pile. Make sure that the inspection area is clean: if you cannot see an ant on the floor before you begin, then you won't know whether your inspection was successful, neither will you be able to prevent it jumping right back into the inspected gear!

When undertaking the inspection, most invertebrates will be dislodged by shaking or sharply tapping the gear with a timber pole or something similar.

- For items like tents, the more eyes looking the better. If an Argentine ant or a similar threat is present, it should make itself very obvious when shaken or tapped but you have to look to see it!
- Most invertebrates will be hiding in folds in material or against the seams, so carefully check these high-risk areas.
- Any holes or recesses in gear should be tapped/hit up-side down, e.g., check for ants in a spade handle. (If you pick up two spades and bang them together while looking for animals the size of ants, you will see them straight away.)
- Check any areas where invertebrate frass is found.
- Ants are good to concentrate on, as the animal to look for, because they are likely to be the smallest invertebrate present.

Clearly, if something does fall out then a closer inspection is warranted and possibly the use of an insecticide spray. Permethrin-based sprays should be used as they have a residual effect, and will kill bugs that walk over the treated surface for up to a couple of months, depending on exposure to weather, etc. Pyrethroid (pyrethrum) based products are knock-down only, and have no residual life beyond about an hour.

In particularly high risk sites (where Argentine ants, etc. may be present), keeping a can of fly-spray handy when packing gear, is an excellent idea. This way, any invertebrates that fall out can be sprayed immediately, as opposed to trying to squash a thousand ants running in every direction when a nest is discovered.

With bigger items like the boat itself, bang the hull, pontoon, whatever and look. Do this in several places as invertebrates generally hate foreign noise, and will attempt to move, away from it. Slow-moving animals like slugs and snails are the exception rather than the rule. For them, it comes down to careful inspection. On charter boats, increasing awareness is important. "Take no prisoners" is the rule, squash first and ask questions later!

Weeds

Seeds stowing away on machinery, equipment, containers, backpacks, clothing or boots have been the mode of entry for some weeds becoming established on islands in the past. Visually check all such items and ensure they are clean and seed-free. Wash large items with a high-pressure hose.

Diseases and microorganisms

Ensure all equipment, etc. is dry and free of soil. Do not take equipment previously used for animal trapping or handling unless it has been sterilised. Sterilise secateurs. Use clean paper and clean metal (not cardboard) separators in plant presses.

These notes are adapted from the New Zealand Department of Conservation island biosecurity standard operating procedures. CALM thanks NZ DoC for permitting their use.

Appendix 2
DEC (2007) Biosecurity
Plan

KIMBERLEY ISLANDS BIOLOGICAL SURVEY

BIOSECURITY PLAN

The Department of Environment and Conservation (DEC) requires people seeking to work on islands under its control to prepare and implement a biosecurity (quarantine) plan. Kimberley Islands to be surveyed in 2007 – 2009 are not conservation reserves, being reserves for ‘The Use and Benefit of Aborigines’ or unallocated Crown land. The biodiversity conservation values of these islands are known to be high, and these values will be protected during work by DEC and collaborators by the implementation of a quarantine plan.

The DEC Island Quarantine Protocol is attached and will be followed during the Kimberley Islands Biological Survey. The points below are provided as explanation or expansion of the protocol and do not negate anything in it.

Quarantine Store

The quarantine store will be located at the Wildlife Research Centre, Woodvale, and the person in charge will be Bill Muir. At least two weeks before departure of equipment to the Kimberley, the store will be cleaned and treated with insecticide and rodenticide, as provided by the protocol. All equipment will be inspected for contamination before being packed into boxes and the interior of boxes will be sprayed unless such spraying might damage sensitive equipment, in which case it will be inspected by two people before packing into a sealed, insect-proof container.

Equipment

- Velcro should be avoided. Equipment with Velcro must be new and not used until on the islands. Used Velcro is prohibited.
- Wood is prohibited. New, processed wooden materials such as MDF are permitted subject to inspection.
- Animal traps must be new or cleaned and free of all soil, plant and animal material before placing into the quarantine store. Hessian used for shading traps must be new.
- Collecting gear. All scientific equipment must be clean and boxes used to store and carry equipment must be clean. Calico or other collecting bags must be new.
- Secateurs will be cleaned and sterilised before shipping.
- Paper used for pressing plants must be new and not previously used to press plants. Cardboard is prohibited.

Tents, mosquito domes, bedding and clothing

- Tents, etc. and bedding must be new or if used, scrupulously clean. Tents, mosquito domes and bedding must be inspected by the PIC Quarantine Store before storage and transport.
- Personal clothing must be clean and free from soil and plant propagules. Socks, trouser cuffs and pockets, in particular, must be clean. Washing does not necessarily destroy plant propagules or microorganisms. Boots must be clean. Check that there is no soil or other foreign material on the soles or between the tongue and lace holes. Boots and any clothing being trucked to Mitchell Plateau (MIP) will be inspected by the PIC Quarantine

DRAFT 1.0 – 14 MARCH 2007

Store before placing in the store. It is the personal responsibility of each expediting member to ensure that clothing, etc. carried via aircraft is clean.

Trucking to Mitchell Plateau

- Vehicles will be cleaned with a high pressure water jet before packing. Cabins must be cleaned.
- Vehicles must be kept clean during loading, driving and at MIP. Using insect-proof containers and covering the load with tarpaulins should maintain cleanliness. Tyres will be sprayed with a Permethrin-based spray when the vehicle is parked. Inspection will be carried out at Mitchell Plateau to confirm that there has been no contamination during transport.

Sorting and loading gear at MIP

- Equipment, camping gear, etc. must be kept clean at MIP. Keep containers off the ground where possible; clean anything that has been put on the ground. Clean soil from boots before entering the helicopter.

Helicopters

- DEC will require the helicopters being used to transport personnel and equipment to islands to be clean and free of contamination by organisms or soil. Pilots' boots will be clean before departure from Mitchell Plateau.
- Cardboard or wooden boxes may not be used to transport food or equipment.
- Boxes and equipment must be clean before loading into helicopters.

Moving between islands

- Team members will ensure that equipment, etc. being transported between islands is as clean as possible.

Food

- Prescriptions laid down in the Protocol will be followed.

Personnel

- All personnel will be briefed on quarantine procedures and will be required to sign the 'Declaration of Responsibility'.
- Personnel travelling from sites other than Perth must develop and follow their own quarantine plan. Equipment sourced from sites other than Woodvale will be inspected at Mitchell Plateau before transport to islands.

Appendix 3
Mattiske (2008)
Vegetation Report

**FLORA AND VEGETATION
SURVEY OF PART OF
IRVINE ISLAND**

Prepared for:

Stratagen Environmental

On behalf of:

Pluton Resources

Prepared by:

Mattiske Consulting Pty Ltd

September 2008



MATTISKE CONSULTING PTY LTD

TABLE OF CONTENTS

	Page
1. SUMMARY	1
2. INTRODUCTION.....	2
2.1 LOCATION.....	2
2.2 FLORA AND VEGETATION	2
2.3 CLIMATE.....	2
2.4 RARE AND PRIORITY FLORA	3
2.5 THREATENED ECOLOGICAL COMMUNITIES (TEC's).....	3
2.6 LOCAL AND REGIONAL SIGNIFICANCE	4
3. OBJECTIVES	5
4. METHODS	5
5. RESULTS.....	6
5.1 DESKTOP SURVEY FOR POTENTIAL RARE AND PRIORITY FLORA SPECIES IN THE SURVEY AREA	6
5.2 FLORA.....	7
5.3 VEGETATION.....	7
6. DISCUSSION	9
7. LIST OF PERSONELL	9
8. REFERENCES.....	10

TABLES

- 1: Climatic Data for Cape Leveque (1917-2008) (BOM, 2008)
- 2: Priority Species Recorded by Department of Environment and Conservation (2008a)
- 3: Locations of *Passiflora foetida* in drillsites

APPENDICES

- A1: Definition of Rare and Priority Flora species (Department of Environment and Conservation 2008a)
- A2: Definition of Threatened Flora species (Environment Protection and Biodiversity Conservation Act 1999 [Commonwealth])
- A3 : Definition of Threatened Ecological Communities (Department of Environment and Conservation 2008c)
- A4: Definition of Priority Ecological Communities (Department of Environment and Conservation 2008e)
- B. Summary of Vascular Plant Species recorded at Irvine Island June and September 2007
- C: Comparison of Vascular Plant Species recorded on Irvine Island with Koolan and Cockatoo

FIGURE

1. Irvine Island Vegetation mapping

1. SUMMARY

Mattiske Consulting Pty Ltd was commissioned by Straten Environmental Consultants, on behalf of Pluton Resources, to undertake a flora and vegetation survey on the eastern side of Irvine Island. Three botanists conducted field surveys on the eastern island during two field trips, between the 25th – 28th June 2007 and 22nd – 28th September 2007.

Flora

A total of 86 taxa from 40 families were recorded from drill site locations, adjacent areas and opportunistic collections (Appendix B). Species representation was greatest among the Papilionaceae (9 taxa), Myrtaceae (8 taxa), Mimosaceae (6 taxa), Proteaceae (6 taxa) and Poaceae (6 taxa) families.

One introduced (weed) species (*Passiflora foetida*) was recorded during the survey.

Rare, Priority and Threatened Flora

No Declared Rare Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act, 1950* (WA) and as listed by the Department of Environment and Conservation were located during the survey.

No plant taxa pursuant to section 179 of the *Environment Protection Biodiversity Conservation Act, 1999* (Commonwealth) were located in the survey area.

No Priority flora species as defined by the Department of Environment and Conservation were located during the survey.

Vegetation

Fourteen plant communities were observed within and adjacent to the proposed drilling areas.

The majority of drill sites on Irvine Island are located in inaccessible areas. The condition of vegetation at all surveyed drill sites is Pristine – Excellent.

No Threatened Ecological Communities (TEC's) or Priority Ecological Communities (PEC's) were observed in the survey area.

2. INTRODUCTION

Mattiske Consulting Pty Ltd was commissioned by Stragen Environmental Consultants, on behalf of Pluton Resources, to undertake a flora and vegetation survey on Irvine Island. Three botanists conducted field surveys on the eastern island during two field trips, between the 25th – 28th June 2007 and 22nd – 28th September 2007.

4.1 Location

Irvine Island is located approximately 100km north of Derby in the Kimberley region of Western Australia, within the Buccaneer Archipelago.

4.2 Flora and Vegetation

Earlier works by Beard (1979) place the survey area within the Yampi Peninsula, located within the Fitzgerald Botanical District. Beard (1979) stated that at the time the more rugged areas of the Yampi Peninsula had not been examined by botanists, due to the severity of the landscape and inaccessibility.

Beard (1990) described the Fitzgerald Botanical District as being comprised of curly spinifex with low trees of *Eucalyptus phoenicea* and *E. ferruginea* or *E. brevifolia* and *E. dichromophloia* on sandstones; and ribbon grass (*Chrysopogon*) with *Eucalyptus tectifera* on basalt.

More recent work on the Interim Biogeographic Regionalisation for Australia (IBRA) which divides the Australian continent into 85 bioregions has placed the survey area within the Northern Kimberley Region of the Northern Botanical Province (Thackway & Cresswell, 1995). This region consists of Savanna *Eucalyptus* and *Corymbia* woodlands over grasses and hummock grasses; closed forests along drainage lines, mangroves in estuaries and sheltered bays and patches of monsoon rainforest.

The long winter dry period in the Northern Botanical Province plays a dominant role in the composition of species and communities in the area. Beard (1990) groups species into three categories: perennial drought resistant species (including most of the trees, shrubs and spinifex species); perennial drought-evading species (including most perennial tussock grasses and deciduous trees and shrubs) and annual drought-evading species (including forbs and short grasses, and a small number of tall annual grasses).

Climate, in combination with a frequent fire history and human influences in the Kimberley area is also thought to have greatly influenced the dominance of grass in the ground layer of a majority of vegetation communities. Deliberate lighting of fires by pastoralists and hunters, as well as a climate of frequent thunderstorms in the long dry season “must have had the effect of selecting fire-resistant species among the woody plants and of rendering the tree and shrub layers more open” (Beard 1979).

4.3 Climate

The Fitzgerald Botanical District is characterised by a dry hot tropical climate (Beard, 1990). Precipitation of 400-800mm per annum occurs during the wet summer season, which lasts for approximately four months.

The nearest operational Bureau of Meteorology (BOM) weather station to Irvine Island, is located at Cape Leveque. There is a marked seasonal variation in rainfall and temperature, with rainfall being influenced markedly by cyclonic events. Climatic averages for Cape Leveque can be seen in Table 1.

Table 1: Climatic Data for Cape Leveque (1917-2008) (BOM, 2008)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean Daily Max. Temp (°C)	32	32	32	32	30	28	27	28	30	31	32	32	31
Mean Daily Min. Temp (°C)	26	26	26	25	22	20	19	20	22	24	26	27	23
Mean Monthly Rainfall (mm)	211	194	140	47	46	20	13	2	1	2	6	80	761

4.4 Rare and Priority Flora

Species of flora and fauna are defined as Rare or Priority conservation status where their populations are restricted geographically or threatened by local processes. The Department of Environment and Conservation recognises these threats of extinction and consequently applies regulations towards population and species protection.

Rare Flora species are gazetted under subsection 2 of section 23F of the *Wildlife Conservation Act 1950* [WA] and therefore it is an offence to “take” or damage rare flora without Ministerial approval. Section 23F of the *Wildlife Conservation Act 1950* [WA] defines “to take” as “... to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora to cause or permit the same to be done by any means.”

Priority Flora are under consideration for declaration as ‘Rare Flora’, but are in urgent need of further survey (Priority One to Three) or require monitoring every 5-10 years (Priority Four). Appendix A1 presents the definitions of Declared Rare and the four Priority ratings under the *Wildlife Conservation Act 1950* [WA] (Department of Environment and Conservation, 2008a).

The *Environment Protection and Biodiversity Conservation Act 1999* [Commonwealth] lists Threatened Flora species which are considered of national environmental significance (Department of Environment, Water, Heritage and the Arts 2008a). A person must not take an action that has, will have, or is likely to have a significant impact on a listed threatened species or an ecological community, without approval from the Commonwealth Minister for the Environment, Water, Heritage and the Arts. Appendix A2 presents the definitions of the categories of Threatened Flora Species, defined by the *Environment Protection and Biodiversity Conservation Act 1999* [Commonwealth].

4.5 Threatened Ecological Communities (TEC’s)

Communities in Western Australia can be listed as ‘Threatened Ecological Communities’ (TEC’s) (Department of Environment and Conservation 2008c) once they have been defined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee. TEC’s are listed under four categories; Presumed Totally Destroyed (PD), Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) (Department of Environment and Conservation 2008d). Appendix A3 presents a summary of the definitions of Threatened Ecological Communities as extracted from the Department of Environment and Conservation (2008d). Some Western Australian TEC’s are also listed under the *Environment Protection and Biodiversity Conservation Act 1999* [Commonwealth] (Department of the Environment, Water, Heritage and the Arts 2008b).

Possible Threatened Ecological Communities can be listed as Priority Ecological Communities (PEC’s) by the Department of Environment and Conservation (2008e). PEC’s are listed under five categories based on survey criteria and current knowledge, Priority 1, 2, 3, 4 and 5 Department of Environment and Conservation (2008b). Appendix A4 presents a summary of the definitions of Priority Ecological Communities as extracted from the Department of Environment and Conservation (2008d).

2.6 Local and Regional Significance

Flora or vegetation may be locally or regionally significant in addition to statutory listings by the State or Federal Government.

In regards to flora; species, subspecies, varieties, hybrids and ecotypes may be significant other than as Declared Rare Flora or Priority Flora, for a variety of reasons, including:

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

- . local endemism/a restricted distribution;
- . being poorly reserved” (Environmental Protection Authority 2004).

Vegetation may be significant because the extent is below a threshold level and a range of other reasons, including:

- “ . scarcity;
- . unusual species;
- . novel combinations of species;
- . a role as a refuge;
- . a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species;
- . being representative of the range of a unit (particularly, a good local and/or regional example of a unit in “prime” habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- . a restricted distribution” (Environmental Protection Authority 2004).

Vegetation communities are locally significant if they contain Priority Flora species or contain a range extension of a particular taxon outside of the normal distribution. They may also be locally significant if they are very restricted to one or two locations or occur as small isolated communities. In addition, vegetation communities that exhibit unusually high structural and species diversity are also locally significant.

Vegetation communities are regionally significant where they are limited to specific landform types, are uncommon or restricted plant community types within the regional context, or support populations of Declared Rare Flora.

Determining the significance of flora and vegetation may be applied at various scales, for example, a vegetation community may be nationally significant and governed by statutory protection as well as being locally and regionally significant.

3. OBJECTIVES

The general objective was to survey and assess the flora and vegetation values of the proposed development on Irvine Island

The specific objectives of the flora and vegetation survey were to:

- review the literature for the area.
- search current databases for the area (DEC and DEWHA) databases).
- desktop review of potential issues
- initial reconnaissance of issues as highlighted in desktop review
- record the vascular plant species and the plant communities on the Island (including mangroves), with a concentrated effort on the proposed exploration areas.
- define the vegetation in the survey area and compare with nearby Islands (if needed undertake targeted work on Cockatoo Island).
- review the significance of the values as defined on the survey area.
- define any management issues related to flora and vegetation values
- prepare three copies of a report summarising the findings.

4. METHODS

Three botanists from Mattiske Consulting Pty Ltd undertook the flora and vegetation survey between the 25th – 28th June 2007 with the aid of three biologists from Strategen. Traditional Owners provided guidance and knowledge of the local plants and their uses. Two botanists conducted an additional survey from 22nd – 28th September 2007. The survey area was traversed on foot.

Surveys were concentrated predominantly at proposed drill and infrastructure sites within the Isthmus and Hardstaff Point areas. Sampling was sparser in other areas on the island. The flora and vegetation was described and sampled systematically at each survey site in accordance with Environmental Protection Authority (2004) Guidance Statement 51. Additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were noted: GPS location, topography, percentage litter cover, soil type and colour, percentage of bare ground, outcropping rocks and their type, gravel type and size, time since fire and the percentage cover and average height of each vegetation stratum. For each vascular plant species, the average height and percent cover (both live and dead material) were recorded. For each survey site, the flora was systematically recorded and collections of plant specimens were made where further identification was required.

All plant specimens collected during the field survey were handled and identified in accordance with the requirements of the Western Australian Herbarium. Where necessary, specimens were compared with pressed specimens housed at the Western Australian Herbarium, and plant taxonomists with specialist skills were consulted. Nomenclature of recorded species follows that recommended by the Western Australian Herbarium (Department of Environment and Conservation 2007a, 2007b).

Aerial photographs were used to interpret and map the plant communities.

5. RESULTS

5.1 Desktop Survey for Potential Rare and Priority Flora Species in the Survey Area

Two database searches were completed as part of the desktop review. A search for Irvine Island within a 10 km buffer using the Department of Environment, Water, Heritage and Arts database did not reveal any listed flora species. A database search of the Department of Environment and Conservation threatened flora databases and State Herbarium records revealed three potential species of rare and priority species that may occur within the survey area (Table 2).

Table 2: Priority Species Recorded by Department of Environment and Conservation (2008a)

Species	Location (approximate)	Description
<i>Eucalyptus kenneallyi</i> (P1) MYRTACEAE	<ul style="list-style-type: none"> • Koolan Island • Storr Island 	<i>Eucalyptus kenneallyi</i> is known from one record from the State Herbarium, from Storr Island. It has also been recorded as occurring on Koolan Island. It has been described as a tree growing to 800cm tall, with smooth white to grey, brown or pink bark, shedding in large flakes or plates. It has been recorded as growing on skeletal sandy soils on hard siliceous outcrops in coastal areas.
<i>Phyllanthus aridus</i> (P3) EUPHORBIACEAE	<ul style="list-style-type: none"> • Junction Pool • Pardoo Roadhouse • Hamersley Range • Walgamungun Creek • Gantheaume Point • Mitchell Falls • Thangoo Hsd • Beverley Springs • Mount Parker Plateau • Long Island • Carson Escarpment • Durack River • Cockburn Range • Augustus Island 	<i>Phyllanthus aridus</i> is known from 23 records from the State Herbarium, with the majority scattered throughout the Northern Botanical province and one record from the Pilbara region. It has been described as an erect, much branched shrub to 25cm tall, flowering cream and green from May to June. It has been recorded as growing on sandstone, gravel and red sand, predominantly in coastal areas or adjacent to inland waterbodies.
<i>Solanum leopoldense</i> (P3) SOLANACEAE	<ul style="list-style-type: none"> • King Leopold Ranges • Silver Gully Creek • Worjalum Reserve • Prince Regent Nature Reserve • Hidden Island 	<i>Solanum leopoldense</i> is known from 28 records from the State Herbarium, all from the Northern Kimberley IBRA Region. It has been described as an intricate, spreading shrub, 50-100cm tall, flowering blue, purple from May to August. It has been recorded as growing on sandstone in rocky gullies and creek lines.

5.2 Flora

A total of 86 taxa from 40 families were recorded from drill site locations, adjacent areas and opportunistic collections (Appendix B). Species representation was greatest among the Papilionaceae (9 taxa), Myrtaceae (8 taxa), Mimosaceae (6 taxa), Proteaceae (6 taxa) and Poaceae (6 taxa) families.

No Declared Rare Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act, 1950* (WA) and as listed by the Department of Environment and Conservation were located during the survey.

No plant taxa pursuant to section 179 of the *Environment Protection Biodiversity Conservation Act, 1999* (Commonwealth) were located in the survey area.

No Priority flora species as defined by the Department of Environment and Conservation were located during the survey.

One introduced (weed) species was recorded during the survey. **Passiflora foetida* was observed from the following drill sites:

Table 3: Locations of **Passiflora foetida* in drillsites

Site	EASTING MGA 94 (ZONE 51K)	NORTHING MGA 94 (ZONE 51K)
Isthmus 1	558755	8222522
Isthmus 2	558797	8222531
Isthmus 4	558785	8222632
Isthmus 8	558800	8222695
Isthmus 9	558866	8222686
Isthmus 24	559310	8222816
Hardstaff 4	558800	8220952

**Passiflora foetida* is not listed as a declared weed pursuant to Section 37 of the *Agriculture and Related Resources Act, 1976* (WA).

5.3 Vegetation

Fourteen plant communities were observed within and adjacent to the proposed drilling areas:

- E1 Low Woodland – Open Low Woodland of *Eucalyptus miniata* over *Corymbia cadophora*, *Eucalyptus tectifica*, *Acacia neurocarpa* over *Triodia bynoei* with *Calytrix exstipulata*, *Flueggea virosa* subsp. *melanthesoides* and *Distichostemon hispidulus*. This community occurs on upper slopes and mid slopes with loamy-clay soils.
- E2 Low Open Woodland of *Eucalyptus tectifica* over *Hakea arborescens*, *Buchanania obovata*, *Flueggea virosa* subsp. *melanthesoides*, *Brachychiton viscidulus*, *Ficus aculeata* and mixed shrubs over *Triodia bynoei* and *Acacia translucens*. This community occurs on mid slopes
- E3 Low Open Woodland of *Eucalyptus tectifica* and *Corymbia confertiflora* over *Eucalyptus obconica*, *Buchanania obovata*, *Ficus platypoda* over *Triodia bynoei* with *Calytrix exstipulata*. This community occurs on ridges.

- E4 Low Open Woodland of *Eucalyptus tectifica* and *Buchanania obovata* over *Calytrix exstipulata*, *Flueggea virosa* subsp. *melanthesoides*, *Templetonia hookeri*, *Acacia translucens* and *Exocarpos latifolius* over *Triodia bynoei*. This community occurs on lower slopes, adjacent to the mangroves.
- E5 Low Open Woodland of *Eucalyptus tectifica* with *Ficus aculeata* over *Buchanania obovata*, *Hakea arborescens*, *Corymbia confertiflora* with *Flagellaria indica* over *Triodia bynoei* and mixed low shrubs. This community occurs in a valley floor, south-west of the mangroves.
- E6 Low Woodland of *Eucalyptus miniata* with *Eucalyptus tectifica* and *Melochia umbellata* over *Hakea arborescens*, *Grevillea agrifolia* subsp. *agrifolia* with *Terminalia canescens* and *Distichostemon hispidulus* over *Triodia bynoei*. This community occurs in valley floors.
- S1 Low Shrubland of *Acacia translucens* with *Calytrix exstipulata* and other mixed shrubs over *Triodia bynoei* with emergent *Hakea arborescens*. This community occurs on upper slopes.
- S2 Low Shrubland of *Ficus aculeata* with *Buchanania obovata* over *Cajanus cinereus* and *Calytrix exstipulata* over *Triodia bynoei* with *Cymbopogon procerus*. This community occurs on mid slopes with outcropping.
- S3 Scrub – Open Scrub of *Acacia tumida* over *Grevillea agrifolia* subsp. *agrifolia* with *Templetonia hookeri*, *Distichostemon hispidulus* and *Calytrix exstipulata* over *Triodia bynoei*. This community occurs on mid and upper slopes with numerous outcropping.
- S4 Low Shrubland of *Terminalia canescens* and *Melochia umbellata* with *Flagellaria indica*, *Gonocarpus leptothecus* over *Triodia bynoei*. This community occurs on steep lower slopes.
- S5 Open Scrub of *Pandanus spiralis* and *Hakea arborescens* with *Ficus aculeata* and *Grevillea pyramidalis* subsp. *pyramidalis* over *Triodia bynoei* and *Acacia translucens*. This community occurs in swales.
- G1 Low Open Shrubland of *Calytrix brownii* with *Triodia bynoei* over *Eriachne ciliata* and *Cyperus microcephalus* subsp. *microcephalus*. This community occurs on massive outcropping.
- M1 Mangroves of *Rhizophora stylosa* with *Ceriops tagal* which occur on the landward edge of mangroves
- M2 Mangroves dominated by *Avicennia marina*, which occur in the inter-tidal area.

The majority of drill sites on Irvine Island are located in inaccessible areas. The condition of vegetation at all surveyed drill sites is Pristine – Excellent (Keighery, 1994).

No Threatened Ecological Communities (TEC's) as defined by the EPBC Act (1999) or the Department of Environment and Conservation (2008c) were observed in this survey area.

No Priority Ecological Communities (PEC's) as defined by the Department of Environment and Conservation (2008e) were observed in this survey area.

6. DISCUSSION

Of the 86 taxa recorded by Mattiske Consulting from Irvine Island, none were found to be of conservation significance.

Whilst no species of conservation significance have been recorded to date, three Priority Flora species may potentially occur on the Island. *Eucalyptus kenneallyi* (P1) occurs on skeletal sandy soils on hard siliceous outcrops, *Solanum leopoldense* (P3) occurs on sandstone in rocky gullies and creek lines and *Phyllanthus aridus* occurs on sandstone, gravel and red Pindan sands. Further proposed surveys on the Island will determine the presence of these species.

The Western Australian State Herbarium has records of 44 taxa previously collected from Irvine Island [DEC 2008a, Appendix C]. Mattiske Consulting collected 23 of these during 2007 surveys. There are 268 Herbarium records from Koolan Island, which reflects the greater numbers of botanical surveys completed on Koolan Island, and limited surveys on Irvine Island.

One introduced (weed) species was recorded during the survey. *Passiflora foetida* was recorded from seven drill sites and from coastal areas on the eastern side of the island. The seeds of *Passiflora foetida* are eaten by birds and animals (Smith, 2002) and are likely to have spread *Passiflora foetida* on Irvine Island. The locations of *Passiflora foetida* on the island should be monitored, to limit further spread.

There are 49 Herbarium records of introduced (weed) species from Koolan Island (41 taxa) and Cockatoo Island (13 taxa), whilst none from Irvine Island [DEC 2008a, Appendix C]. Of the 49 taxa, four are listed as declared weeds pursuant to Section 37 of the *Agriculture and Related Resources Act, 1976* (WA). These are *Cryptostegia madagascariensis* (garden escapee), *Jatropha gossypifolia*, *Lantana camara* (garden escapee) and *Senna alata*. Strict quarantine procedures should be implemented upon Irvine Island to prevent the introduction of introduced weeds species, and maintain a Pristine-Excellent condition.

To date, field surveys have been predominantly concentrated within or adjacent to the Isthmus and Hardstaff Point areas. This is due to Aboriginal Heritage reasons and available access. As a result replication of sample points within some vegetation communities was not possible and therefore will have to be targeted in further ground surveys. These communities are stipulated on Figure 1. Further surveys will also ascertain the local and regional significance of vegetation communities.

Phase Two drilling is proposed for 2009. On the basis of fieldwork completed and aerial images, it is unlikely that new communities will be encountered for the majority of the drill sites. However, this cannot be confirmed until ground surveys of the proposed drill sites are completed.

7. LIST OF PERSONELL

The following personnel from Mattiske Consulting Pty Ltd were involved in this project:

Principal Ecologist	Dr E.M. Mattiske
Senior Botanist	Mrs B Koch
Botanists	Mr D. Angus Mr S. Reiffer Mr T. Sleigh Ms F. Smith

8. REFERENCES

Agriculture and Related Resources Act 1976 (WA)

Beard, J.S. (1973)

Vegetation Survey of Western Australia – The vegetation of the Kimberley area, Western Australia. Map and explanatory memoir, 1:1 000 000 series. University of Western Australia Press, Perth.

Beard, J.S. (1990)

Plant Life of Western Australia. Kangaroo Press, Kenthurst NSW.

BOM (2008)

Bureau of Meteorology *Climate Data for Cape Leveque*
http://www.bom.gov.au/climate/averages/tables/cw_003004.shtml

Department of Agriculture (2008)

Declared Plants List.
http://agspsrv34.agric.wa.gov.au/programs/app/dec_pl/declaredplants.htm

Department of Environment and Conservation (2008a)

Florabase. Department of Environment and Conservation (<http://www.dec.wa.gov.au>)

Department of Environment and Conservation (2008b)

Max. Department of Environment and Conservation, Perth.

Department of Environment and Conservation (2008c)

Threatened Ecological Communities Database. Department of Environment and Conservation
<http://www.naturebase.net/content/view/849/1210/>

Department of Environment and Conservation (2008d)

List of Threatened Ecological Communities on the Department of Conservation and Land Management's Threatened Ecological Community (TEC) Database endorsed by the Minister for the Environment. Department of Environment and Conservation
<http://www.naturebase.net/content/view/849/1210/>

Department of Environment and Conservation (2008e)

Priority Ecological Communities for Western Australia. Department of Environment and Conservation

Department of the Environment, Water, Heritage and the Arts (2008a)

EPBC Act list of Threatened Flora.
<http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora>

Department of the Environment, Water, Heritage and the Arts (2008b)

Environment Protection and Biodiversity Conservation Act 1999 List of Threatened Ecological Communities.
<http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl>

English, V. and Blyth, J. (1997). *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province.* Project N702, Final Report to Environment Australia. Department of Conservation and Land Management. Perth, Western Australia.

English, V. and Blyth, J. (1999) Development and Application of Procedures to Identify and Conserve Threatened Ecological Communities in the South-west Botanical Province of Western Australia. *Pacific Conservation Biology*, 5: 124-138.

Environmental Protection Act 1986

-
- Environmental Protection Authority (2004)
Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia. No 51.
www.epa.wa.gov.au/docs/1839_GS51.pdf
- Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
- Environmental Protection (Clearing of Native Vegetation) Regulations 2004* [WA]
- Keighery, B.J. (1994)
Bushland Plant Survey. A Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc.), Western Australia.
- Smith, N.M. (2002)
Weeds of the wet/dry tropics of Australia – a field guide. Environment Centre NT.
- Thackway, R. & Cresswell, I.D. (eds) 1995
An Interim Biogeographic Regionalisation for Australia: A Framework for Establishing the National System of Reserves, Version 4.0, Australian Nature Conservation Agency, Canberra
- Wildlife Conservation Act, 1950* (WA)

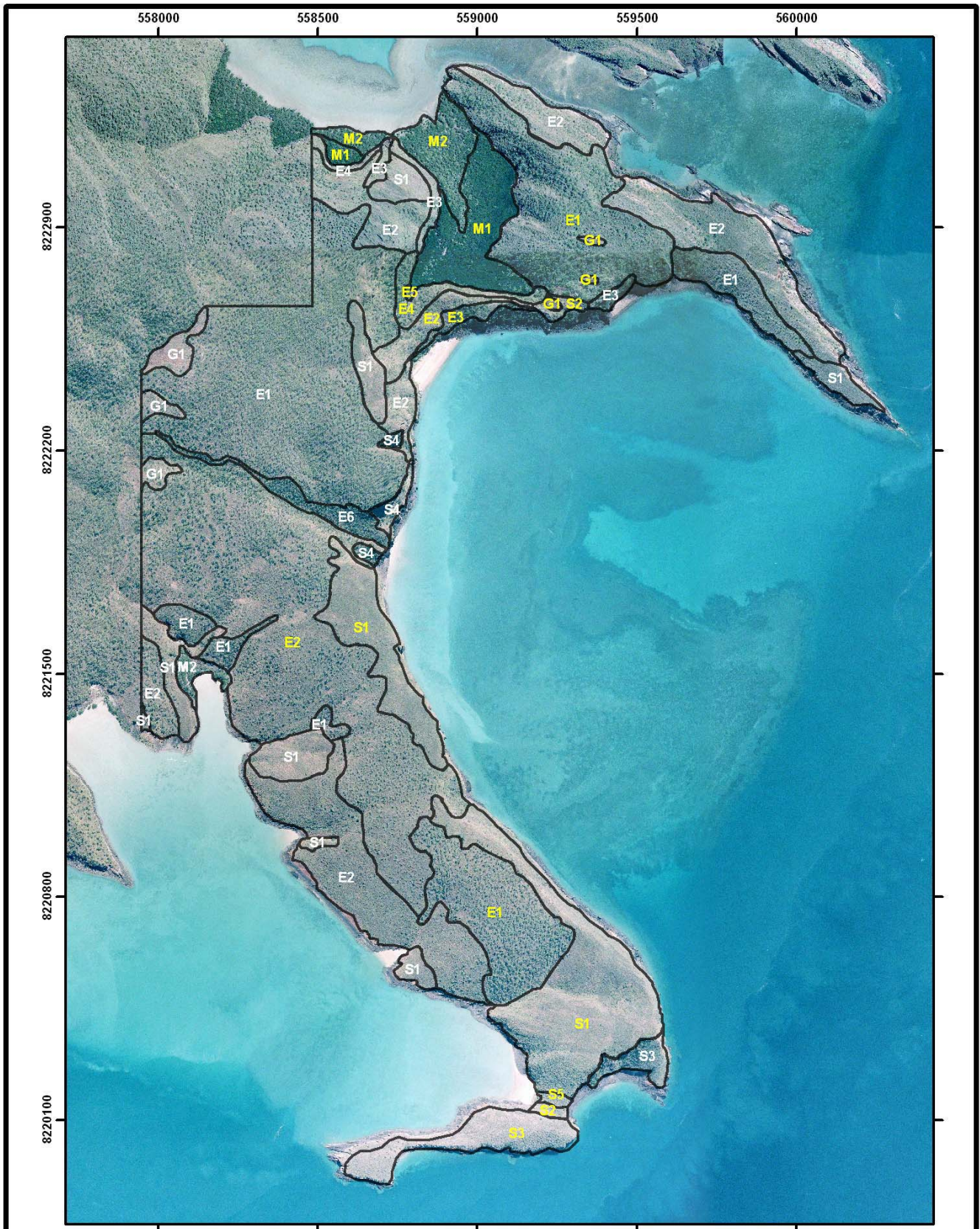


Figure 1: Irvine Island vegetation mapping



Scale
0 100 200 300 400
Metres



1:16,000
at A4

Horizontal Datum: GDA 94

Projection: MGA Zone 51

Date: 8/9/2008

Author: AW

Note that positional errors may occur in some areas

Locality Map



Vegetation communities labelled white are lower confidence than those labelled in yellow

- E1 Low Woodland – Open Low Woodland of *Eucalyptus miniata* over *Corymbia cadophora*, *Eucalyptus tectifica*, *Ficus aculeata*, *Acacia neurocarpa* over *Triodia bynoei* with *Calytrix exstipulata*, *Flueggea virosa* subsp. *melanthesoides* and *Distichostemon hispidulus*. This community occurs on upper slopes and mid slopes with loamy-clay soils.
- E2 Low Open Woodland of *Eucalyptus tectifica* over *Hakea arborescens*, *Buchanania obovata*, *Flueggea virosa* subsp. *melanthesoides*, *Brachychiton viscidulus*, *Ficus aculeata* and mixed shrubs over *Triodia bynoei* and *Acacia translucens*. This community occurs on mid slopes
- E3 Low Open Woodland of *Eucalyptus tectifica* and *Corymbia confertiflora* over *Eucalyptus obconica*, *Buchanania obovata*, *Ficus platypoda* over *Triodia bynoei* with *Calytrix exstipulata*. This community occurs on ridges.
- E4 Low Open Woodland of *Eucalyptus tectifica* and *Buchanania obovata* over *Calytrix exstipulata*, *Flueggea virosa* subsp. *melanthesoides*, *Templetonia hookeri*, *Acacia translucens* and *Exocarpos latifolius* over *Triodia bynoei*. This community occurs on lower slopes, adjacent to the mangroves.
- E5 Low Open Woodland of *Eucalyptus tectifica* with *Ficus aculeata* over *Buchanania obovata*, *Hakea arborescens*, *Corymbia confertiflora* with *Flagellaria indica* over *Triodia bynoei* and mixed low shrubs. This community occurs in a valley floor, south-west of the mangroves.
- E6 Low Woodland of *Eucalyptus miniata* with *Eucalyptus tectifica* and *Melochia umbellata* over *Hakea arborescens*, *Grevillea agrifolia* subsp. *agrifolia* with *Terminalia canescens* and *Distichostemon hispidulus* over *Triodia bynoei*. This community occurs in valley floors.
- S1 Low Shrubland of *Acacia translucens* with *Calytrix exstipulata* and other mixed shrubs over *Triodia bynoei* with emergent *Hakea arborescens*. This community occurs on upper slopes.
- S2 Low Shrubland of *Ficus aculeata* with *Buchanania obovata* over *Cajanus cinereus* and *Calytrix exstipulata* over *Triodia bynoei* with *Cymbopogon procerus*. This community occurs on mid slopes with outcropping.
- S3 Scrub – Open Scrub of *Acacia tumida* over *Grevillea agrifolia* subsp. *agrifolia* with *Templetonia hookeri*, *Distichostemon hispidulus* and *Calytrix exstipulata* over *Triodia bynoei*. This community occurs on mid and upper slopes with numerous outcropping.
- S4 Low Shrubland of *Terminalia canescens* and *Melochia umbellata* with *Flagellaria indica*, *Gonocarpus leptothecus* over *Triodia bynoei*. This community occurs on steep lower slopes.
- S5 Open Scrub of *Pandanus spiralis* and *Hakea arborescens* with *Ficus opposita* and *Grevillea pyramidalis* subsp. *pyramidalis* over *Triodia bynoei* and *Acacia translucens*. This community occurs in swales.
- G1 Low Open Shrubland of *Calytrix brownii* with *Triodia bynoei* over *Eriachne ciliata* and *Cyperus microcephalus* subsp. *microcephalus*. This community occurs on massive outcropping.
- M1 Mangroves of *Rhizophora stylosa* with *Ceriops tagal* which occur on the landward edge of mangroves
- M2 Mangroves dominated by *Avicennia marina*, which occur in the inter-tidal area.

Figure 2 Irvine Island vegetation mapping legend

APPENDIX A1: DEFINITION OF RARE AND PRIORITY FLORA SPECIES (Department of Environment and Conservation 2008a)

Conservation Code	Category
R	<p>Declared Rare Flora – Extant Taxa</p> <p>“Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such.”</p>
P1	<p>Priority One – Poorly Known Taxa</p> <p>“Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.”</p>
P2	<p>Priority Two – Poorly Known Taxa</p> <p>“Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as ‘rare flora’, but urgently need further survey.”</p>
P3	<p>Priority Three – Poorly Known Taxa</p> <p>“Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as ‘rare flora’ but need further survey.”</p>
P4	<p>Priority Four – Rare Taxa</p> <p>“Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.”</p>

APPENDIX A2: DEFINITION OF THREATENED FLORA SPECIES (Environment Protection and Biodiversity Conservation Act 1999 [Commonwealth])

Conservation Code	Category
Ex	<p>Extinct</p> <p>Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.</p>
ExW	<p>Extinct in the Wild</p> <p>Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.</p>
CE	<p>Critically Endangered</p> <p>Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.</p>
E	<p>Endangered</p> <p>Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.</p>
V	<p>Vulnerable</p> <p>Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.</p>
CD	<p>Conservation Dependent</p> <p>Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.</p>

APPENDIX A3 : DEFINITION OF THREATENED ECOLOGICAL COMMUNITIES (Department of Environment and Conservation 2008c)

Conservation Code	Category
PTD	<p>Presumed Totally Destroyed</p> <p>An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies:</p> <ul style="list-style-type: none"> (i) records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; (ii) all occurrences recorded within the last 50 years have since been destroyed.
CE	<p>Critically Endangered</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria:</p> <ul style="list-style-type: none"> (i) The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; (ii) The current distribution is limited ie. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the immediate future.
E	<p>Endangered</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria:</p> <ul style="list-style-type: none"> (i) The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; (ii) The current distribution is limited ie. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the short term future.
V	<p>Vulnerable</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria:</p> <ul style="list-style-type: none"> (i) The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; (ii) The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; (iii) The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

APPENDIX A4: DEFINITION OF PRIORITY ECOLOGICAL COMMUNITIES (Department of Environment and Conservation 2008e)

Conservation Code	Category
P1	<p>Poorly-known ecological communities</p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.</p>
P2	<p>Poorly-known ecological communities</p> <p>Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.</p>
P3	<p>Poorly known ecological communities</p> <p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</p> <p>(iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.</p>
P4	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p>
P5	<p>Conservation Dependent ecological communities</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT IRVINE ISLAND, JUNE AND SEPTEMBER 2007

Note: * denotes introduced species; P1, P2, P3 and P4 denote - Priority Flora Species (DEC, 2007a)

FAMILY	SPECIES
PANDANACEAE	<i>Pandanus spiralis</i>
POACEAE	<i>Cymbopogon procerus</i> <i>Eriachne ciliata</i> <i>Eriachne obtusa</i> <i>Panicum decompositum</i> <i>Spinifex longifolius</i> <i>Triodia bynoei</i>
CYPERACEAE	<i>Cyperus microcephalus</i> <i>Cyperus microcephalus</i> subsp. <i>microcephalus</i>
FLAGELLARIACEAE	<i>Flagellaria indica</i>
ASPARAGACEAE	<i>Asparagus racemosus</i>
MORACEAE	<i>Ficus aculeata</i> <i>Ficus brachypoda</i> <i>Ficus platypoda</i>
PROTEACEAE	<i>Grevillea agrifolia</i> subsp. <i>agrifolia</i> <i>Grevillea heliosperma</i> <i>Grevillea pyramidalis</i> subsp. <i>pyramidalis</i> <i>Grevillea refracta</i> subsp. <i>refracta</i> <i>Hakea arborescens</i> <i>Stenocarpus acacioides</i>
SANTALACEAE	<i>Exocarpos latifolius</i> <i>Santalum lanceolatum</i>
LORANTHACEAE	<i>Amyema bifurcata</i> <i>Dendrophthoe acacioides</i>
AMARANTHACEAE	<i>Ptilotus fusiformis</i>
AIZOACEAE	<i>Sesuvium portulacastrum</i>
LAURACEAE	<i>Cassytha candida</i>
CAPPARACEAE	<i>Capparis spinosa</i> var. <i>nummularia</i> <i>Cleome viscosa</i>
MIMOSACEAE	<i>Acacia hippuroides</i> <i>Acacia multisiliqua</i> <i>Acacia neurocarpa</i> <i>Acacia stigmatophylla</i> <i>Acacia translucens</i> <i>Acacia tumida</i>

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT IRVINE ISLAND, JUNE AND SEPTEMBER 2007

Note: * denotes introduced species; P1, P2, P3 and P4 denote - Priority Flora Species (DEC, 2007a)

FAMILY	SPECIES
PAPILIONACEAE	<i>Abrus precatorius</i> subsp. <i>precatorius</i> <i>Cajanus cinereus</i> <i>Canavalia</i> ? <i>papuana</i> <i>Christia australasica</i> <i>Glycine tomentela</i> <i>Gompholobium subulatum</i> <i>Nomismia rhomboidea</i> <i>Templetonia hookeri</i> <i>Tephrosia rosea</i> var. <i>rosea</i>
EUPHORBIACEAE	<i>Euphorbia kimberleyensis</i> <i>Flueggea virosa</i> subsp. <i>melanthesoides</i> <i>Microstachys chamaelea</i> <i>Phyllanthus maderaspatensis</i>
ANACARDIACEAE	<i>Buchanania obovata</i>
SAPINDACEAE	<i>Distichostemon hispidulus</i> <i>Dodonaea lanceolata</i> <i>Dodonaea</i> ? <i>platyptera</i>
RHAMNACEAE	<i>Ventilago viminalis</i>
TILIACEAE	<i>Triumfetta</i> sp.
MALVACEAE	<i>Thespesia populneoides</i>
STERCULIACEAE	<i>Brachychiton diversifolius</i> <i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i> <i>Brachychiton viscidulus</i> <i>Melhania oblongifolia</i> <i>Melochia umbellata</i>
DILLENIACEAE	<i>Hibbertia</i> sp. A Kimberly Flora (T.E.H. Aplin <i>et al</i> 898)
COCHLOSPERMACEAE	<i>Cochlospermum fraseri</i>
PASSIFLOACEAE	* <i>Passiflora foetida</i>
RHIZOPHORACEAE	<i>Ceriops tagal</i> <i>Rhizophora stylosa</i>
COMBRETACEAE	<i>Terminalia canescens</i>

APPENDIX B: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT IRVINE ISLAND, JUNE AND SEPTEMBER 2007

Note: * denotes introduced species; P1, P2, P3 and P4 denote - Priority Flora Species (DEC, 2007a)

FAMILY	SPECIES
MYRTACEAE	<i>Calytrix brownii</i> <i>Calytrix exstipulata</i> <i>Corymbia cadophora</i> <i>Corymbia cadophora</i> subsp. <i>cadophora</i> <i>Corymbia confertiflora</i> <i>Corymbia ?dampieri</i> <i>Eucalyptus miniata</i> <i>Eucalyptus obconica</i> <i>Eucalyptus tectifera</i>
HALORAGACEAE	<i>Gonocarpus leptothecus</i>
APIACEAE	<i>Trachymene didiscoides</i>
SAPOTACEAE	<i>Sersalisia sericea</i>
ASCLEPIADACEAE	<i>Marsdenia viridiflora</i> <i>Sarcostemma viminale</i> subsp. <i>australe</i>
CONVOLVULACEAE	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>
BORAGINACEAE	<i>Ehretia saligna</i>
AVICENNIACEAE	<i>Avicennia marina</i>
SCROPHULARIACEAE	<i>Stemodia lythrifolia</i>
ACANTHACEAE	<i>Dicliptera armata</i>
GOODENIACEAE	<i>Scaevola macrostachya</i>
STYLIDIACEAE	<i>Stylidium leptorrhizum</i>
ASTERACEAE	<i>Pterocaulon serrulatum</i> <i>Pterocaulon sphacelatum</i>

APPENDIX C: COMPARISON OF VASCULAR PLANT SPECIES RECORDED ON IRVINE ISLAND WITH KOOLAN AND COCKATOO

Note: * denotes introduced species; P1, P2, P3 and P4 denote - Priority Flora Species (DEC, 2008a)

FAMILY	SPECIES	Koolan (DEC, 2008a)	Irvine (DEC, 2008a)	Cockatoo (DEC, 2008a)	Mattiske, Irvine Island 2007
ADIANTHACEAE	<i>Cheilanthes brownii</i>	x			
	<i>Cheilanthes caudata</i>	x			
PTERIDACEAE	<i>Acrostichum</i> sp.	x			
CUPRESSACEAE	<i>Callitris columellaris</i>	x			
PANDANACEAE	<i>Pandanus spiralis</i>				x
POACEAE	* <i>Bothriochloa pertusa</i>	x			
	* <i>Cenchrus echinatus</i>	x			
	<i>Cenchrus elymoides</i> var. <i>elymoides</i>	x	x		
	* <i>Cenchrus setigerus</i>	x			
	* <i>Chloris barbata</i>	x			
	* <i>Chloris gayana</i>	x			
	<i>Chrysopogon latifolius</i>	x			
	<i>Cymbopogon procerus</i>	x	x		x
	<i>Digitaria</i> sp.			x	
	* <i>Eleusine indica</i>	x			
	* <i>Eragrostis amabilis</i>	x			
	<i>Eriachne avenacea</i>	x			
	<i>Eriachne ciliata</i>		x	x	x
	<i>Eriachne obtusa</i>				x
	<i>Eriachne sulcata</i>	x			
	<i>Heteropogon contortus</i>	x			
	* <i>Megathyrsus maximus</i>	x			
	* <i>Melinis repens</i>	x		x	
	<i>Panicum decompositum</i>	x	x		x
	<i>Paspalum scrobiculatum</i>	x			
	<i>Pseudopogonatherum contortum</i>			x	
	<i>Sacciolepis myosuroides</i>	x			
	* <i>Setaria pumila</i> subsp. <i>pumila</i>	x			
	<i>Sorghum ecarinatum</i>	x			
	<i>Sorghum plumosum</i>	x			
	<i>Spinifex longifolius</i>	x			x
	<i>Thaumastochloa</i> sp.	x			
	<i>Triodia bynoei</i>	x			x
	<i>Triodia pungens</i>	x			
	<i>Triodia</i> sp.	x			
	* <i>Urochloa mosambicensis</i>	x			
<i>Urochloa subquadripata</i>	x				
<i>Whiteochloa cymbiformis</i>	x				
CYPERACEAE	<i>Bulbostylis barbata</i>			x	
	<i>Cyperus bulbosus</i>	x			
	<i>Cyperus microcephalus</i>				x
	<i>Cyperus microcephalus</i> subsp. <i>microcephalus</i>	x			x
	<i>Cyperus microcephalus</i> subsp. <i>saxicola</i>			x	
	<i>Fimbristylis cymosa</i>	x			
	<i>Scleria</i> sp.		x		
SCROPHULARIACEAE	<i>Buchnera linearis</i>	x			
FLAGELLARIACEAE	<i>Flagellaria indica</i>		x		x
COMMELINACEAE	<i>Cartonema spicatum</i>	x			
	<i>Cartonema spicatum</i> var. <i>humile</i>	x			
	<i>Commelina ensifolia</i>	x			
	<i>Murdannia graminea</i>	x			
ASPARAGACEAE	<i>Asparagus racemosus</i>		x		x
TACCACEAE	<i>Tacca leontopetaloides</i>	x			
	<i>Tacca maculata</i>	x			
DIOSCOREACEAE	<i>Dioscorea bulbifera</i>	x			

APPENDIX C: COMPARISON OF VASCULAR PLANT SPECIES RECORDED ON IRVINE ISLAND WITH KOOLAN AND COCKATOO

Note: * denotes introduced species; P1, P2, P3 and P4 denote - Priority Flora Species (DEC, 2008a)

FAMILY	SPECIES	Koolan (DEC, 2008a)	Irvine (DEC, 2008a)	Cockatoo (DEC, 2008a)	Mattiske, Irvine Island 2007
ORCHIDACEAE	<i>Cymbidium canaliculatum</i>			x	
CASUARINACEAE	* <i>Casuarina equisetifolia</i>			x	
ULMACEAE	<i>Celtis australiensis</i>	x			
MORACEAE	<i>Ficus brachypoda</i>				x
	<i>Ficus aculeata</i>	x			x
	<i>Ficus aculeata</i> var. <i>indecora</i>		x		
	<i>Ficus platypoda</i>	x	x		x
	<i>Ficus virens</i> var. <i>virens</i>	x			
PROTEACEAE	<i>Banksia dentata</i>			x	
	<i>Grevillea agrifolia</i>		x		
	<i>Grevillea agrifolia</i> subsp. <i>agrifolia</i>	x		x	x
	<i>Grevillea cunninghamii</i>	x			
	<i>Grevillea heliosperma</i>		x	x	x
	<i>Grevillea pyramidalis</i> subsp. <i>pyramidalis</i>	x	x		x
	<i>Grevillea refracta</i> subsp. <i>refracta</i>	x		x	x
	<i>Hakea arborescens</i>		x		x
	<i>Persoonia falcata</i>	x			
	<i>Stenocarpus acacioides</i>	x			x
SANTALACEAE	<i>Exocarpos latifolius</i>	x		x	x
	<i>Santalum lanceolatum</i>	x			x
LORANTHACEAE	<i>Amyema bifurcata</i>			x	x
	<i>Amyema thalassia</i>	x			
	<i>Dendrophthoe acacioides</i>	x			x
	<i>Diplatia grandibractea</i>	x			
	<i>Lysiana spathulata</i> subsp. <i>spathulata</i>	x			
AMARANTHACEAE	<i>Amaranthus cf. undulatus</i>			x	
	<i>Amaranthus undulatus</i>	x			
	* <i>Amaranthus viridis</i>	x			
	<i>Gomphrena</i> sp.	x			
	<i>Ptilotus capitatus</i>			x	
	<i>Ptilotus exaltatus</i> var. <i>exaltatus</i>	x		x	
	<i>Ptilotus fusiformis</i>				x
	<i>Ptilotus fusiformis</i> var. <i>gracilis</i>	x			
NYCTAGINACEAE	<i>Boerhavia dominii</i>	x			
AIZOACEAE	<i>Sesuvium portulacastrum</i>				x
	<i>Zaleya galericulata</i> subsp. <i>galericulata</i>	x			
PORTULACACEAE	<i>Portulaca pilosa</i>	x			
CARYOPHYLLACEAE	<i>Polycarpaea involucrata</i>		x		
	<i>Polycarpaea longiflora</i>	x			
LAURACEAE	<i>Cassytha candida</i>	x			x
	<i>Cassytha capillaris</i>	x			
CAPPARACEAE	<i>Capparis spinosa</i> var. <i>nummularia</i>				x
	<i>Cleome viscosa</i>				x
MORINGACEAE	* <i>Moringa oleifera</i>	x		x	
DROSERACEAE	<i>Drosera broomensis</i>	x			
	<i>Drosera burmanni</i>	x			
	<i>Drosera petiolaris</i>	x			
	<i>Drosera</i> sp.	x			

APPENDIX C: COMPARISON OF VASCULAR PLANT SPECIES RECORDED ON IRVINE ISLAND WITH KOOLAN AND COCKATOO

Note: * denotes introduced species; P1, P2, P3 and P4 denote - Priority Flora Species (DEC, 2008a)

FAMILY	SPECIES	Koolan (DEC, 2008a)	Irvine (DEC, 2008a)	Cockatoo (DEC, 2008a)	Mattiske, Irvine Island 2007
BYBLIDACEAE	<i>Byblis filifolia</i>	x			
	<i>Byblis liniflora</i>		x		
	<i>Byblis</i> sp.	x			
MIMOSACEAE	<i>Acacia ampliceps</i>	x			
	<i>Acacia deltoidea</i> subsp. <i>deltoidea</i>	x		x	
	<i>Acacia hippuroides</i>	x	x	x	x
	<i>Acacia multisiliqua</i>	x	x		x
	<i>Acacia neurocarpa</i>	x			x
	<i>Acacia oligoneura</i>	x		x	
	<i>Acacia plectocarpa</i> subsp. <i>plectocarpa</i>	x	x		
	<i>Acacia stigmatophylla</i>	x			x
	<i>Acacia translucens</i>			x	x
	<i>Acacia tumida</i> var. <i>tumida</i>	x	x		x
	<i>Acacia wickhamii</i>		x		
	<i>Acacia</i> sp.	x			
	* <i>Leucaena leucocephala</i>			x	
	* <i>Leucaena leucocephala</i> subsp. <i>leucocephala</i>	x			
<i>Neptunia gracilis</i> forma <i>gracilis</i>	x				
CAESALPINACEAE	<i>Bauhinia cunninghamii</i>	x			
	* <i>Bauhinia purpurea</i> (planted)	x			
	<i>Chamaecrista mimosoides</i>	x			
	<i>Chamaecrista symonii</i>	x			
	* <i>Delonix regia</i>	x			
	<i>Erythrophleum chlorostachys</i>	x			
	* <i>Senna alata</i>	x			
	<i>Senna goniodes</i>	x			
PAPILIONACEAE	<i>Abrus precatorius</i> subsp. <i>precatorius</i>				x
	* <i>Alysicarpus ovalifolius</i>	x		x	
	<i>Cajanus acutifolius</i>	x			
	<i>Cajanus cinereus</i>		x		x
	<i>Cajanus reticulatus</i> var. <i>grandifolius</i>	x			
	<i>Cajanus viscidus</i>	x			
	<i>Cajanus</i> sp.	x			
	<i>Canavalia ?papuana</i>				x
	<i>Canavalia rosea</i>	x			
	<i>Christia australasica</i>	x			x
	* <i>Clitoria ternatea</i>	x			
	<i>Crotalaria alata</i>	x	x		
	<i>Crotalaria montana</i> var. <i>angustifolia</i>	x			
	<i>Cullen badocanum</i>			x	
	<i>Desmodium filiforme</i>	x			
	* <i>Desmodium tortuosum</i>	x			
	<i>Galactia tenuiflora</i>	x			
	<i>Galactia</i> sp.	x			
	* <i>Gliricidia sepium</i>	x			
	<i>Glycine tomentella</i>				x
	<i>Gompholobium subulatum</i>	x	x	x	x
	<i>Indigofera hirsuta</i>	x			
	<i>Indigofera linifolia</i>	x			
	<i>Indigofera mackinlayi</i>	x			
	<i>Indigofera polygaloides</i>	x			
	<i>Indigofera</i> sp.			x	
	<i>Indigofera</i> sp. A Kimberley Flora (G.J. Keighery & N. Gibson 70)	x			
	* <i>Macroptilium lathyroides</i> var. <i>semierectum</i>	x			
	<i>Nomismia rhomboidea</i>				x
	* <i>Stylosanthes hamata</i>	x			
	* <i>Stylosanthes scabra</i>	x			
<i>Templetonia hookeri</i>	x		x	x	
<i>Tephrosia coriacea</i>			x		
<i>Tephrosia leptoclada</i>	x				
<i>Tephrosia rosea</i> var. <i>rosea</i>				x	
<i>Tephrosia</i> sp.			x		

APPENDIX C: COMPARISON OF VASCULAR PLANT SPECIES RECORDED ON IRVINE ISLAND WITH KOOLAN AND COCKATOO

Note: * denotes introduced species; P1, P2, P3 and P4 denote - Priority Flora Species (DEC, 2008a)

FAMILY	SPECIES	Koolan (DEC, 2008a)	Irvine (DEC, 2008a)	Cockatoo (DEC, 2008a)	Mattiske, Irvine Island 2007
MALVACEAE	<i>Abutilon indicum</i> var. <i>australiense</i>	x			
	<i>Decaschistia occidentalis</i>			x	
	<i>Fioria vitifolia</i>			x	
	<i>Gossypium costulatum</i>	x			
	* <i>Gossypium hirsutum</i>			x	
	<i>Gossypium</i> aff. <i>populifolium</i>			x	
	<i>Gossypium</i> sp.	x			
	<i>Hibiscus fryxellii</i>	x			
	<i>Hibiscus fryxellii</i> var. <i>mollis</i>	x		x	
	<i>Hibiscus geranioides</i>			x	
	<i>Hibiscus leptocladus</i>	x			
	<i>Hibiscus marenitensis</i>	x			
	<i>Sida</i> sp. A Kimberley Flora (P.A. Fryxell & L.A. Craven 3900)			x	
<i>Thespesia populneoides</i>			x	x	
STERCULIACEAE	<i>Brachychiton diversifolius</i>				x
	<i>Brachychiton diversifolius</i> subsp. <i>diversifolius</i>	x		x	x
	<i>Brachychiton viridiflorus</i>	x			
	<i>Brachychiton viscidulus</i>	x	x		x
	<i>Melhania oblongifolia</i>	x			x
	<i>Melochia umbellata</i>	x	x	x	x
	<i>Waltheria indica</i>	x			
DILLENIACEAE	<i>Hibbertia lepidota</i>	x		x	
	<i>Hibbertia oblongata</i>	x		x	
	<i>Hibbertia</i> sp. A Kimberley Flora (T.E.H. Aplin et al. 898)				x
CLUSIACEAE	<i>Calophyllum inophyllum</i> (planted)			x	
COCHLOSPERMACEAE	<i>Cochlospermum fraseri</i>	x	x		x
VIOLACEAE	<i>Hybanthus aurantiacus</i>	x	x		
	<i>Hybanthus enneaspermus</i>	x			
	<i>Hybanthus enneaspermus</i> subsp. <i>enneaspermus</i>	x			
TURNERACEAE	* <i>Turnera ulmifolia</i>	x			
PASSIFLORACEAE	<i>Adenia heterophylla</i>	x			
	* <i>Passiflora foetida</i>	x			x
LYTHRACEAE	<i>Lagerstroemia archeriana</i> var. <i>divaricatiflora</i>	x			
RHIZOPHORACEAE	<i>Carallia brachiata</i>			x	
	<i>Ceriops tagal</i>	x			x
	<i>Rhizophora stylosa</i>	x			x
COMBRETACEAE	<i>Quisqualis indica</i>			x	
	<i>Terminalia canescens</i>	x	x		x
	<i>Terminalia ferdinandiana</i>	x			
	<i>Terminalia</i> sp.	x			
MYRTACEAE	<i>Calytrix achaeta</i>			x	
	<i>Calytrix brownii</i>	x			x
	<i>Calytrix exstipulata</i>	x			x
	<i>Corymbia cadophora</i>				x
	<i>Corymbia cadophora</i> subsp. <i>cadophora</i>	x	x		x
	<i>Corymbia confertiflora</i>	x			x
	<i>Corymbia dendromerinx</i>			x	
	<i>Corymbia ?greeniana</i>	x			x
	<i>Corymbia polycarpa</i>	x			
	<i>Eucalyptus confluens</i>			x	
	<i>Eucalyptus miniata</i>	x	x	x	x
	<i>Eucalyptus obconica</i>	x			x
	<i>Eucalyptus tectifera</i>	x			x
	<i>Melaleuca viridiflora</i>	x			
	<i>Melaleuca</i> sp.			x	

APPENDIX C: COMPARISON OF VASCULAR PLANT SPECIES RECORDED ON IRVINE ISLAND WITH KOOLAN AND COCKATOO

Note: * denotes introduced species; P1, P2, P3 and P4 denote - Priority Flora Species (DEC, 2008a)

FAMILY	SPECIES	Koolan (DEC, 2008a)	Irvine (DEC, 2008a)	Cockatoo (DEC, 2008a)	Mattiske, Irvine Island 2007
MELASTOMATACEAE	<i>Melastoma affine</i>			x	
HALOGORACEAE	<i>Gonocarpus leptothecus</i>	x	x		x
	<i>Gonocarpus</i> sp.	x			
APIACEAE	<i>Trachymene didiscoides</i>	x		x	x
SAPOTACEAE	<i>Mimusops elengi</i>	x		x	
	<i>Pouteria arnhemica</i>	x			
	<i>Planchonella arnhemica</i>	x			
	<i>Sersalisia sericea</i>				x
EBENACEAE	<i>Diospyros maritima</i>	x		x	
OLEACEAE	<i>Jasminum didymum</i>	x			
LOGANACEAE	<i>Jasminum didymum</i> subsp. <i>didymum</i>			x	
	<i>Mitrasacme connata</i>	x			
	<i>Mitrasacme nummularia</i>	x			
APOCYNACEAE	* <i>Allamanda cathartica</i>	x			
	* <i>Cascabela thevetia</i>	x			
	* <i>Catharanthus roseus</i>	x			
	<i>Tabernaemontana orientalis</i>	x			
	<i>Wrightia saligna</i>	x			
ASCLEPIADACEAE	* <i>Cryptostegia madagascariensis</i>			x	
	* <i>Cryptostegia madagascariensis</i> var. <i>glaberrima</i>	x		x	
	<i>Cynanchum carnosum</i>	x			
	<i>Marsdenia angustata</i>	x			
	<i>Marsdenia viridiflora</i>				x
	<i>Marsdenia viridiflora</i> subsp. <i>tropica</i>	x			
	<i>Sarcostemma viminalis</i> subsp. <i>australe</i>	x			x
	<i>Secamone timoriensis</i>	x			
	<i>Tylophora cinerascens</i>		x		
	<i>Tylophora flexuosa</i>	x			
CONVOLVULACEAE	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	x			x
	<i>Evolvulus</i> sp.	x			
	<i>Ipomoea macrantha</i>	x			
	* <i>Ipomoea quamoclit</i>	x			
	<i>Jacquemontia paniculata</i>	x	x		
	* <i>Merremia aegyptia</i>			x	
	* <i>Merremia dissecta</i>	x			
	<i>Operculina brownii</i>	x	x		
	<i>Polymeria ambigua</i>	x			
	<i>Xenostegia tridentata</i>	x			
HYDROPHYLLACEAE	<i>Cynanchum puberulum</i>	x			
BORAGINACEAE	<i>Ehretia saligna</i>				x
	<i>Heliotropium glabellum</i>	x		x	
	<i>Heliotropium ventricosum</i>			x	
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>		x		
	<i>Heliotropium</i> sp.		x		
VERBENACEAE	* <i>Lantana camara</i>			x	
	* <i>Stachytarpheta cayennensis</i>	x		x	
AVICENNIACEAE	<i>Avicennia marina</i>	x			x

APPENDIX C: COMPARISON OF VASCULAR PLANT SPECIES RECORDED ON IRVINE ISLAND WITH KOOLAN AND COCKATOO

Note: * denotes introduced species; P1, P2, P3 and P4 denote - Priority Flora Species (DEC, 2008a)

FAMILY	SPECIES	Koolan (DEC, 2008a)	Irvine (DEC, 2008a)	Cockatoo (DEC, 2008a)	Mattiske, Irvine Island 2007
LAMIACEAE	<i>Anisomeles malabarica</i>			x	
	<i>Callicarpa candicans</i>	x		x	
	<i>Clerodendrum floribundum</i>	x			
	<i>Clerodendrum floribundum</i> var. <i>coriaceum</i>	x			
	<i>Plectranthus</i> sp.	x			
	<i>Premna acuminata</i>	x			
	<i>Vitex acuminata</i>	x			
	<i>Vitex glabrata</i>	x			
SOLANACEAE	* <i>Physalis angulata</i>	x			
	<i>Solanum echinatum</i>		x		
	<i>Solanum leopoldense</i> (P3)	x		x	
SCROPHULARIACEAE	<i>Stemodia lythrifolia</i>			x	x
	<i>Striga curviflora</i>	x			
	<i>Striga</i> sp.		x		
BIGNONIACEAE	<i>Dolichandrone heterophylla</i>	x			
	* <i>Tecoma stans</i>	x			
LENTIBULARIACEAE	<i>Utricularia chrysantha</i>			x	
ACANTHACEAE	<i>Dicliptera armata</i>	x	x		x
	<i>Hypoestes</i> sp.	x			
RUBIACEAE	<i>Aidia racemosa</i>	x			
	<i>Gardenia</i> sp.			x	
	<i>Oldenlandia corymbosa</i> var. <i>corymbosa</i>	x			
	<i>Pavetta kimberleyana</i>	x			
	<i>Psydrax pendulina</i>	x			
	<i>Spermacoce dolichosperma</i>	x			
	<i>Spermacoce leptoloba</i>	x			
	<i>Spermacoce occidentalis</i>	x			
	<i>Tarenna pentamera</i>	x			
<i>Timonius timon</i>			x		
CUCURBITACEAE	* <i>Cucumis melo</i> subsp. <i>agrestis</i>	x			
	<i>Cucumis</i> sp. Gunlom (J.L. McKean 864 b)	x			
GOODENIACEAE	<i>Goodenia sepalosa</i> var. <i>sepalosa</i>	x			
	<i>Scaevola macrostachya</i>				x
STYLIDIACEAE	<i>Stylidium leptorrhizum</i>	x			x
	<i>Stylidium pachyrrhizum</i>	x			
	<i>Stylidium semipartitum</i>	x			
	<i>Stylidium</i> sp. A (aff. <i>leptorrhizum</i>)	x			
ASTERACEAE	<i>Cyanthillium cinereum</i>	x		x	
	<i>Pentalepis ecliptoides</i>	x			
	<i>Pterocaulon serrulatum</i>				x
	<i>Pterocaulon sphacelatum</i>	x	x		x
	* <i>Tridax procumbens</i>	x			
	* <i>Wedelia trilobata</i>			x	