EPA REFERRAL FORM
Proponent

Environmental Protection Authority

Referral of a Proposal to the Environmental Protection Authority under Section 38(1) of the Environmental Protection Act.

Referral by the Proponent

PURPOSE OF THIS FORM

Section 38(1) of the *Environmental Protection Act 1986* provides that where a development proposal is likely to have a significant effect on the environment, a proponent may refer the proposal to the Environmental Protection Authority (EPA) for a decision on whether or not it requires assessment under the Act.

A referral to the EPA by a proponent under Section 38(1) must be made on this form.

Before completing this form, proponents are encouraged to familiarise themselves with the EPA's *General Guide for Referral of Proposals to the EPA under section 38(1) of the EP Act 1986* (accessed at the EPA's website at www.epa.wa.gov.au or by contacting the EPA on 6467 5419).

Proponents need to complete Parts A and B of the form by marking the appropriate boxes and providing explanatory or additional information where requested. Part B should be completed based on information known to the proponent. Only those sections of Part B that are pertinent to the proposal need to be completed. If space is insufficient, attach additional pages. Where information is contained in a report that is to be submitted with the referral form, the proponent may complete sections of the form by referring to the pertinent section of the report.

Proponents are encouraged to attach any other environmental information they consider may be relevant to the EPA for making a decision on whether or not to assess the proposal, and, if it is to be assessed, the level of assessment. In general, referrals should contain information on the potential environmental impacts of the proposal, the proposed management mechanisms to be implemented to minimise and mitigate for these impacts, and how the principles of the EP Act have been addressed by the proposal.

In addition to providing a hard copy of referral documentation, proponents are also requested to provide an electronic copy of the referral document, noting that section 39(2) of the EP Act provides for a proponent to request that matters of a confidential nature not be kept on the public record. If confidential matters are included in the referral, proponents are requested to identify the confidential information at this stage of the process, specifically request that it be treated as confidential, and submit the confidential information in a separate hard copy attachment to the referral document. The electronic copy of the referral should be identical to the hard copy of the referral document, excluding any confidential attachment.

You may need to contact government agencies or local authorities to obtain information required by this form. A list of key agencies and their contact details is provided in Attachment 1.

Where the EPA decides that a proposal will be assessed at the level of Public Environmental Review or Environmental Review and Management Programme, it will also require the proponent to prepare an Environmental Scoping Document (refer *Environmental Impact Assessment (Part IV Division 1) Administrative Procedures 2002*).

Proponents should also be aware of the need to determine their obligations under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act is separate legislation to the Environmental Protection Act and it identifies a number of matters of national environmental significance which are subject to assessment and approval by the Commonwealth. The matters identified as triggers for the Commonwealth assessment and approval regime are World Heritage properties, Ramsar wetlands, nationally threatened species and ecological communities, migratory species, Commonwealth marine areas, and nuclear actions (refer to the Department of Environment and Water Resources website at www.environment.gov.au). Questions in this referral form that may be relevant to matters of national environmental significance are marked with a #.

PART A - PROPONENT AND PROPOSAL INFORMATION

1. PROPONENT DETAILS, PROPOSAL DESCRIPTION AND LOCATION

1.1 Proponent information

- Proposal title

  Irvine Island Iron Ore Exploration Program - Phase II

- Name of the Shire in which the proposal is located

  Derby / West Kimberley

- Name of proponent (Person or entity proposing to implement the proposal)

  Pluton Resources Ltd. (Pluton)

- Names of Joint Venture entities (if applicable)

  Portman Iron Ore Ltd. (Portman)

- Address of proponent

  Ground floor
  470 St Kilda Rd
  Melbourne VIC 3004

- Key contact for the proposal

  Dr Alistair Reed
  Executive Director – Exploration
  Pluton Resources Ltd.
  C/- PO Box 426
  Rosny Park
  Tasmania 7018
  Phone: 03 6234 4177
  Facsimile: 03 6234 4755
  areed@plutonresources.com

- Does the proponent own the land on which the proposal is to be established? If not, what other arrangements have been established to access the land?

  The proposed exploration program is a joint venture between Pluton and Portman.

  Irvine Island is almost wholly contained within Tenement No. E04/1172, which is held by Portman. Pluton has earned a 50% beneficial interest in this tenement and is entitled to be the registered holder of a 50% interest.

- Is rezoning of any land required before the proposal can be implemented?

  (please tick) ☐ Yes **If yes**, please provide details.
  ☑ No

  Tenement No. E04/1172 is subject to Exploration Licence 04/1172, issued in accordance with the *Mining Act 1978* (Mining Act).

- Is approval required from any Commonwealth or State Government agency or Local Authority for any part of the proposal?

  ☑ Yes ☐ No **If yes**, name all Agencies and Local Authorities from which any approval is required.

  State approval

  The proposal will require approval from the Department of Industry and Resources (DoIR) under the *Mining Act 1974*. The proposed drilling includes an exploration program and an allowance for environmental drilling for the purpose of providing

baseline data for any future mining proposal. Each of the programs of work will require approval by DoIR.

Each program of works will also require heritage clearing under s18 of the *Aboriginal Heritage Act 1972* prior to approval by DoIR.

Commonwealth approval

The proposal is considered unlikely to have a significant effect on any matter of National Environmental Significance and will therefore not be referred to the Department of the Environment, Water, Heritage and the Arts (DEWHA) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Native Title

The Phase II exploration proposal is situated within land and waters subject to the Mayala Native Title Claim. Portman, the Mayala people and the Kimberley Land Council (KLC) have entered into a Heritage Protection Agreement (HPA). The HPA provides a process for having Mayala people approve exploration activities. Pluton will not conduct any exploration activities on Irvine Island which have not been cleared by the Mayala Traditional Owners. The HPA was executed on 21 September 2007.

Pluton has worked alongside the KLC and representatives of the Mayala people during the planning and implementation of the Phase I exploration program at Irvine Island. The Phase I exploration program was cleared to proceed by the Mayala people on 20 November 2007 and preliminary site preparations commenced on 1 July 2008.

The potential impact to heritage values of the proposed Phase II exploration program has been assessed under the HPA agreement. As part of this process, a heritage survey was undertaken in August 2008 with representatives of the KLC, the Mayala people and Nicholas Green (anthropologist) and Daniel Monks(archaeologist) from Anthropos Australis Pty Ltd. The Mayala people have subsequently advised, through the KLC, that the Phase II exploration program has been cleared to proceed and have endorsed the conditions of the Heritage Report (Anthropos Australis Pty Ltd 2008, see executive summary Appendix 2).

- ❑ If yes above, have you lodged any of the necessary applications or have you discussed the proposal with any person(s) at the Agency or Local Authority?

  ☑ Yes ☐ No **If yes**, name all Agencies and Local Authorities for which applications have been submitted or with whom the proposal has been discussed.

Pluton met with DoIR on 10 September 2008 to discuss the proposed Phase II exploration program. An update on the implementation of Phase I operations was provided as the exploration methods used in Phase 1 are proposed to be continued for Phase II.

Pluton has also met with the Environmental Management Branch of the Department of Environment and Conservation (DEC) in Perth and with DEC Broome office and Kununurra office (by phone hook up) on 12 September 2008.

Both DoIR and DEC have agreed with the approach of self referral of the Phase II exploration program to the EPA.

Details of the agency and stakeholder consultation are provided in Section 3.3.

- ❑ What is the current land use on the property, and the extent (area in hectares) of the property?

Pluton commenced Phase I of a mineral exploration program across eastern Irvine Island in August 2008 (Figure 2).

The remainder of Irvine Island is herein considered an undisturbed environment with no current land use. Tracks have previously been established on the island as part of exploration undertaken by BHP during the late 1960s.

The waters and bays of the Buccaneer Archipelago are informally used by commercial barges, recreational yachts, other tourist vessels, recreational fisherman. There is a single pearl lease on the north side of Bathurst Island (to the north of Irvine Island) but

no pearl farming occurs in the area. Export iron ore carriers pass within approximately 500 m of Irvine Island, transporting iron ore from Koolan and Cockatoo Islands.

Tenement No. E04/1172 covers an area of approximately 2,520 ha; Irvine Island covers an area of approximately 918 ha.

1.2 Proposal Description *(Please attach extra pages where necessary)*

- ❑ Provide a description of the proposal.

Background – approved Phase I exploration project

Irvine Island is located within the Buccaneer Archipelago in the Kimberley region of Western Australia, approximately 140 km north of Derby and 8 km from the mainland (Figure 1).

Irvine Island is located adjacent to both Koolan Island (approximately 3 kms away) and Cockatoo Island (800 metres away) (Figure 1). The same body of ore passes through these three islands and comprise the principal deposits of the Kimberley Iron Ore Province (Department of Minerals and Energy 1995). Other nearby islands (e.g. Bathurst) are not prospective for iron ore.

Both Koolan and Cockatoo Islands have been mined since the 1950s and are currently producing iron ore mines. The iron ore mine on Cockatoo is currently being expanded with an extension of the seawall begin constructed over the next 12 months.

Pluton commenced Phase I of a mineral exploration program across eastern Irvine Island in August 2008. The approved Phase I program includes 26 drill sites in the Isthmus region and seven drill sites along Hardstaff Peninsula (Figure 2).

Pluton has commenced drilling at the Hardstaff Peninsula area and to date (5 November 2008) has undertaken the following:

- quarantine training and inductions for staff and established a quarantine inspection facility on Cockatoo Island
- installation of two desalination units at Hardstaff Peninsula with discharge pipes to the deep water off the end of Hardstaff Peninsula
- clearing by hand of all approved drill sites, tracks, helicopter landing sites and areas required for water infrastructure
- mobilised all required equipment to Irvine Island following quarantine management processes
- commencement of Phase 1 drilling program (seven holes have been completed). Each site takes approximately two weeks to drill although actual timing is variable due to depth required and the hardness of the rock.

All mobilisation of equipment and access has been undertaken by helicopter or on foot between sites. A full description of Phase 1 implementation and environmental management is provided in Appendix 1.

Proposal overview

Pluton proposes to undertake Phase II of a mineral exploration program on Irvine Island to refine the definition of the iron ore resource in the south-east part of the island and to undertake drilling for the purpose of environmental investigations. The Phase II exploration program will include:

- drilling 29 sites along the Hardstaff Peninsula using a diamond core rig at the approximate locations shown in Figure 2
- drilling an additional 10 holes in the Isthmus region at existing Phase 1 work sites
- drilling for the purpose of environmental investigations (hydrogeology and subterranean fauna) within the area of interest shown on Figure 2 at up to approximately 20 sites
- supplying water for drilling.

The Phase II exploration program will be undertaken using the same low impact drilling techniques as approved for Phase I and will be subject to the same quarantine

management. Water will be sourced from desalinations units, however, provision for alternative sources of water supply for the drill rigs will be investigated.

The key characteristics of the proposal are provided in Table 1 and are outlined in full below.

Table 1 Key characteristics of the Irvine Island Phase II exploration proposal

Proposal characteristic	Detail
Proposal life	Approximately two years
Area of interest	397 ha across Hardstaff Peninsula (Figure 2)
Drilling	29 new sites for exploration Re-drill 10 holes at existing Phase I Isthmus region sites Up to approximately 20 sites for supplementary environmental investigations
Disturbance footprint	1.2 ha exploration footprint over and above that approved for Phase I. Additional disturbance of up to 1.2 ha for supplementary environmental investigations
Infrastructure	One to two drill rigs operating on Universal Drilling Platforms Settling tanks, reservoirs, generators, water pumps, water piping
Workforce	Up to 20 personnel transported to Irvine Island daily.

Access

Access to the island will be by helicopter or boat. Movement between sites and within the island will be by foot and helicopter only; no vehicles will be used. Walking tracks between work sites will be cut by hand, using hand-held machinery, where required (Plates 1-4, Appendix 1).

All work sites will include sufficient space for helicopter landing if the terrain allows it. This is both for operational ease and to allow fast emergency access. The helicopter(s) will be based at the existing Cockatoo Island airstrip or other suitable alternative sites (off Irvine Island) for the duration of the Phase II exploration program.

Boat access to the island would involve beach landings. Boats shall preferentially be sourced locally from Western Australia. Non-locally sourced marine vessels would be subject to a risk based assessment of the vessel history to determine potential spread of marine pests. This assessment would be conducted in consultation with the Department of Fisheries.

Exploration drilling

Diamond drilling will be undertaken at each of the 29 proposed work sites using a diamond drill rig. The drilling program allows for one vertical hole and (if required) one or more angled holes at each site. The final work sites have been checked. However, locations may vary within a 50 m radius from the indicative locations, depending on the slope, surface geology and opportunities for minimising ground disturbance. The areas within the 50 m radius have been inspected by the traditional owners and received heritage clearance.

Environmental investigation drilling

The Phase I and Phase II vertical exploration drill holes will be used for hydrogeological and subterranean fauna investigations. However, it is expected that additional drilling will be required as part of baseline investigations for any future environmental impact assessment of a mining proposal if pursued. This program allows for up to approximately 20 additional holes to be drilled for this purpose within the area of interest delineated in Figure 2. The actual number and location will depend on:

- presence or absence of subterranean fauna in Phase 1 and Phase II exploration programs
- hydrogeology information required for impact assessment of dewatering and water supply
- consultation with DEC.

Diamond drilling process description

The proposed drilling program will involve one to two drill rigs operating day and possibly night using Universal Drilling Platforms (UDPs) (Plates 9-13, Appendix 1). The UDP provides a level working surface above ground on which a drill rig can be operated over uneven terrain. The ground surface and soil profile (including vegetation rootstock) under the UDP remain largely undisturbed. A description of the Phase I implementation program including photos of the UDP with operational drill rigs is included in Appendix 1.

Two drill rigs and four UDPs have already been transported to Irvine Island for the Phase I program. The UDP's have remained on Irvine Island over the wet season for the purposes of maintaining quarantine. Should additional drill rigs, UPDs and supporting equipment be required, they will be mobilised (in pieces) by barge from Derby to Cockatoo Island, and then by helicopter to Irvine Island, where they will be assembled by hand. Drill rigs and supporting equipment will be mobilised (in pieces) between work sites by helicopter, which will prevent the need for vehicles and vehicular tracks on Irvine Island.

Each UDP will be assembled and disassembled at each work site by two personnel, and is able to be rotated by hand without the need for heavy lifting machinery, allowing multiple holes to be drilled at a single site with no cumulative disturbance.

Each UDP can operate as a free-floating platform, or may be attached to the ground. Where the UDP is required to be attached to the ground, each leg will be bolted to the ground and, for slopes greater than 10 degrees, the UDP may be further secured via chains linking the platform to anchors (split sets or similar) set in the rock face or large boulders. The drill rigs will be independently attached to the ground via one or two anchor holes.

All site preparation will be undertaken by hand using hand-held tools and machinery.

Drill core will be progressively mobilised by helicopter from each work site to either Cockatoo Island or the mainland. Core will be cut and logged, before being bagged and shipped on pallets for analysis.

Water supply and circulation system

The drilling program using one to two drill rigs is likely to require between 50 and 100kL/day water. Actual use may be substantially less if drilling below the water table or if the hole is not 'losing' water. The water required for drilling will be supplied by desalination units. A contingency to utilise groundwater or possibly untreated seawater will be investigated.

The desalination operation would continue as for Phase 1 with up to two desalination units with intake and hoses located near the end of the Hardstaff Peninsula where there is deep, well-flushed water with no corals in the vicinity (Figure 3).

Water pumped to the desalination units will first pass through a filter that will remove coarse particulate material. Water will be pumped from the desalination units to short-term water storage tanks (capacity approximately 30 kL), then to drilling reservoirs (capacity approximately 3 kL) located at the drill sites (Figure 4). Shortshort-term water storage tanks will be located adjacent to the desalination units; a drilling reservoir will be located near each operating drill rig. Photos of the desalination units and main reservoirs used in the Phase I exploration program are shown in Appendix 1.

Water from the short-term water storage tanks will be pumped via a feed line to the drilling reservoirs located at the work sites. Water is pumped directly from the drilling reservoir to the drill rig. Water is circulated down the hole and acts to cool the drill bit and prevent sticking of the drill rods. Any return water that might be recovered from the drilling process sites will feed into a primary settling tank, where heavy particles will be caught in a liner. Water will then be gravity-fed back to the drilling reservoir and recycled (Figure 4).

Water supply contingency 1

Pluton proposes to investigate groundwater abstraction as a backup option for water supply if the desalination units break down or require maintenance. The maximum

required abstraction rate of 100 kl/day equates to less than 1.2 L/s which is a low pump rate and would have very small and localised drawdowns. Pluton will only install and use a groundwater production bore if the following criteria are met:

- the bore is not located near a groundwater dependent ecosystem (i.e. is >100 m from any area of vegetation where the groundwater is likely to be within 3 m of the ground surface)
- the groundwater is fresh
- the abstraction would not cause significant groundwater drawdowns (i.e. <3 m drawdown with a cone of depression <50 m)
- the bore is within the area of interest shown in Figure 2.

Water supply contingency 2

If sampling of all Phase 1 holes drilled at Hardstaff Peninsula record no subterranean fauna, Pluton may use untreated seawater as a contingency for desalinated water. The subterranean fauna sampling would be undertaken at least six months after drilling in accordance with EPA Draft Guidance Statement 54a.

Circulation of water from contingency sources is the same as that described for water derived using desalination equipment.

Fuel and power supply

Fuel is required at Irvine Island for operating the drill rigs, desalination units, generators and water pumps. The majority of the fuel will be stored at the Cockatoo Island airstrip.

Fuel will be transported regularly to Irvine Island to minimise the amount of fuel stored on the island. Up to a weeks fuel supply will be stored at Irvine Island at any time. Fuel will be transported between Irvine Island and Cockatoo Island in 200 L drums using purpose-built helicopter cages sleeved with water-tight aluminium bunds (Plate 12, Appendix 1). Fuel drums will remain in the cages and bunds at all times, including during use on Irvine Island and refuelling on Cockatoo Island. Each bund will be capable of taking greater than 133% of the combined capacity of all fuel drums, exceeding Australian Standard 1940.

The major consumers of fuel will be the desalination units and the drill rigs. Neither will have their own fuel tanks, but will be supplied directly from the fuel drums. Spill matting will be placed under the drill rigs and desalination units and will be wrapped around the fuel supply hoses. Sufficient spill matting will be placed under each piece of machinery to absorb the maximum amount of fuel that could be spilled (Plate 12, Appendix 1). Commercially available spill matting can absorb greater than 5 L/m^2. Use of the UDP's also allows for placement of spill matting and/or bunds beneath drill rigs. Fuel drums will be stored close to the drilling platform to minimise the length of fuel hose required.

Spill kits will be provided at every site where fuel or oil is being used or stored. Spill kits will include absorbent materials for different circumstances such as pellets, booms and matting. At least one person trained in the use of the spill kits will be present at each site at all times during operation.

Generators and pumps will be used to circulate drilling water on work sites (Figure 4) and will be kept within prefabricated and lined bunds.

Drilling is not expected to continue into cyclone season. In the event of a cyclone, should the Buccaneer Archipelago region be put on Blue Alert[1] (for any category cyclone), drilling operations will cease and all fuel, oil and sediment accumulated in separation tanks on Irvine Island will be returned immediately to Cockatoo Island. Operations at Irvine Island will only recommence once the region is no longer on cyclone alert.

[1] A Blue Alert is given when a cyclone has formed and may affect the area within 48 hours. A Yellow Alert is given when the cyclone is moving close to the area and appears inevitable in 12 hours. A Red Alert is given when the cyclone is imminent.

Workforce and accommodation

Up to 25 personnel may be required for the proposed exploration activities, with up to 20 working on Irvine Island. Personnel comprise:

- geologists
- field assistants (including Mayala representatives)
- personnel to operate the drill rigs
- personnel to
    - prepare and decommission work sites
    - move the drilling platforms and pipe-work
    - cut and ship drill core
    - helicopter pilot(s).

Personnel will be accommodated at Cockatoo Island with support personnel located in Broome and/or Derby.

Clearing methods

The proposal will use the same clearing and drilling techniques as the Phase I program (described below) to minimise the disturbance footprint and potential environmental impacts as far as practicable. The majority of proposed disturbance is limited to hand- or hand-held machinery assisted trimming of vegetation; very little actual ground disturbance will occur (Section 2.1). Examples of areas cleared during the Phase I program are shown in Appendix 1.

The total disturbance required for the 29 exploration work sites is approximately 1.2 ha. No more than 1.2 ha of further clearing will be undertaken for the additional environmental investigations.

Walking tracks

Walking tracks will be required to provide access between work sites. Establishment of walking tracks will involve hand-clearing or hand-held machinery assisted trimming of overhanging and obtrusive vegetation where present, but will not involve disturbance to the ground surface.

Walking tracks will be kept to a working width of <1 m. Walking tracks established across the proposed exploration area will also be used to run water lines for the water circulation system.

Work sites

Use of the UDP at each work site enables the landform, soil profile and vegetation rootstock in the vicinity of the UDP to remain largely undisturbed during drilling. Ground disturbance associated with drilling is thus limited to that associated with the UDP legs, drill collar and up to two optional anchor points.

Work sites have been preferentially located in areas requiring minimal removal or trimming of trees.

Where required for set up of the UDP, trees will be cut off approximately 0.3 m above ground to maximise the chance of regeneration.

Decommissioning and vegetation recovery

Use of the helicopter and UDP avoids the requirement to establish vehicular tracks and drill pads. The low level of disturbance associated with walking tracks and work sites allows these areas to naturally recover (Plate 5 and Plate 13, Appendix 1).

Drill holes are collared with PVC pipe and temporarily caped so they can be used for monitoring. The drill holes will be plugged with concrete, subject to the completion of any scientific studies, and work sites will be left in a clean state. Used spill kits, matting, settling tanks, bunds and reservoir liners will be transported back to Cockatoo Island for disposal during the program. Sediment accumulated in the settling tanks will be transferred to bulk bags and flown to Cockatoo for disposal during, or on completion of the program.

- What is the proposed ultimate extent (area in hectares) of the activity?

  Approximately 2.4 ha of disturbance may be required for the proposal. Approximately 99% of this disturbance involves hand- or hand-held machinery assisted trimming of vegetation; less than 1% (or 0.024 ha) involves actual ground disturbance (Section 2.1).

- Provide the timeframe in which the activity or development is proposed to occur. (Include start and finish dates where applicable)

  The proposed exploration activities are scheduled to commence in March/April 2009. The proposed drilling program is estimated to take two years to complete.

- Provide details of any staging of the proposal.

  The proposed Phase II exploration program will comprise two stages. The known exploration drilling will commence in 2009 with any additional environmental investigation drilling undertaken in 2010.

- Indicate whether, and in what way, the proposal is related to other proposals in the region.

  The proposal is a joint venture between Pluton and Portman. Portman currently mines the iron ore deposit on Cockatoo Island in joint venture with Henry Walker Eltin.

  Iron ore mineralisation on Irvine Island is understood to be an extension of mineralisation located on the adjacent Cockatoo and Koolan Islands. This band of mineralisation is not known to occur in any quantity on other islands within the Buccaneer Archipelago.

1.3 Location information

- Provide proposal location details in the following two ways:

  a) Electronic spatial data

  GIS or CAD on CD, depicting the proposal extent, geo-referenced and conforming to the following parameters:

  - datum: GDA94
  - projection: Geographic (latitude/longitude) or Map Grid of Australia (MGA)
  - format: Arcview shapefile, Arcinfo coverages, Microstation or AutoCAD.

  AND

  b) Maps and/or directions

  Any maps or diagrams of the proposal, together with the following directions:

  - for urban areas: street address, lot number, the suburb and nearest road intersection;
  - for remote localities: the nearest town, together with distance and direction from that town to the proposal site.

  Please also attach the following map/plans, clearly showing the location of the development in its regional and local context.

  - **Locality plan – Broad Scale**

    Provide a locality plan (preferably superimposed on an aerial photograph) to identify:

    - proposed development site and any associated infrastructure
    - main roads
    - urban centres
    - wetlands and watercourses
    - remnant native vegetation

- adjoining land uses (including recreation)
- sensitive marine areas

❖ **Site Plan – Proposal Details**

Provide a site plan to scale and indicate the location of:

- lot boundaries
- road frontages
- extent of the proposed development area
- extent of the proposed buffer area (if applicable)

❖ **Site Plan – Existing Environment**

Provide a site plan to scale (the same scale as above) and indicate the location of:

- lot boundaries
- road frontages
- any information required to be shown from Section 2.2 of this form
- extent of native vegetation of the site (the extent of overlap between the proposed development area and the area of native vegetation must be highlighted)
- extent of hydrological features on the site (this includes wetlands, watercourses, creek lines, seasonal creeks and artificial drainage lines)
- sensitive marine areas

PART B - ENVIRONMENTAL IMPACTS AND MANAGEMENT COMMITMENTS

2. ENVIRONMENTAL IMPACTS

Describe the impacts of the proposal on the following elements of the environment, through the questions below:

(i) flora and vegetation #;

(ii) fauna #;

(iii) rivers, creeks, wetlands and estuaries;

(iv) significant areas and/ or land features;

(v) coastal zone areas;

(vi) marine areas and biota #;

(vii) water supply and drainage catchments;

(viii) pollution;

(ix) greenhouse gas emissions;

(x) contamination;

(xi) social surroundings; and

(xii) risk.

These features should be shown on the site plan, where appropriate)

For all information, please indicate:

(a) the source of the information; and

(b) the currency of the information.

2.1 Flora and Vegetation

- Do you propose to clear any native flora and vegetation as a part of this proposal?

  (A proposal to clear native vegetation may require a clearing permit under Part V of the EP Act *(Environmental Protection (Clearing of Native Vegetation) Regulations 2004)*. Please contact the Department of Environment and Conservation (DEC) for more information.

  (please tick) ☑ Yes ***If yes, complete the rest of this section***

  ☐ No ***If no, go to the next section***

- How much vegetation are you proposing to clear (in hectares)?

  The proposal will require disturbance to approximately 2.4 ha of native vegetation, which includes disturbance for drill platforms, walking tracks, helicopter landing sites and fuel bunds. Approximately 99% of vegetation disturbance required for the proposal involves hand- or hand-held machinery assisted trimming of vegetation with little or no associated ground disturbance to the soil horizon or seed bank (Appendix 1).

  The clearing/disturbance footprint will consist of:

  - 1 ha work site disturbance (<0.02 ha of disturbance at up to 49 sites)
  - 1.4 ha walking track disturbance (6.6 km of known tracks for the exploration program and an allowance for 7.4 km of tracks for environmental investigation drilling at a width of 1 m)

  Helicopter landing sites and water circulation system disturbance have been allowed for within the work site and working track disturbance respectively. The desalination water supply infrastructure sites were cleared as part of Phase 1. If a groundwater abstraction bore is deemed feasible and required, it will be drilled within the disturbance footprint of one of the work sites.

  In many cases, the actual vegetation disturbance will be less than the calculated figures as infrastructure will be preferentially located in areas of minimal vegetation cover (e.g. areas dominated by bare rock or low grasses).

- Have you submitted an application to clear native vegetation to the DEC (unless you are exempt from such a requirement)?

  ☐ Yes ☑ No **If yes**, on what date and to which office was the application submitted of the DEC?

  Irvine Island is not an Environmentally Sensitive Area (ESA) within the meaning of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and therefore the clearing for exploration is exempt from requiring a clearing permit.

- Are you aware of any recent flora surveys carried out over the area to be disturbed by this proposal?

  ☑ Yes ☐ No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey/s. (If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.)

  Pluton engaged Mattiske Consulting Pty Ltd (Mattiske) to undertake a vegetation and flora survey across eastern Irvine Island. The survey was conducted over two visits (during June and September 2007) and included mapping of vegetation types across eastern Irvine Island (Figure 5 and Figure 6) as well as systematic searches for significant flora and weeds at each of the Phase I drilling locations. A copy of the Mattiske (2008) report is provided in Appendix 3.

As no listed threatened or Priority flora species or vegetation communities were recorded on the island or identified as potentially occurring on the island; no further investigation are proposed prior to Phase II exploration drilling.

A government funded biological survey of the islands of the Buccaneer Archipelago, including Irvine Island, was undertaken over one month in June 1982. This survey resulted in approximately 20 islands being recommended for Class A reservation.

- Has a search of DEC records for known occurrences of rare or priority flora or threatened ecological communities been conducted for the site? #

  ☑ Yes ☐ No — If you are proposing to clear native vegetation for any part of your proposal, a search of DEC records of known occurrences of rare or priority flora and threatened ecological communities will be required. Please contact DEC for more information.

A search of DEC records for known occurrences of rare or priority flora was conducted prior to the 2007 Mattiske survey. There were no records of rare or priority flora occurring on Irvine Island. As discussed, none were found during subsequent on ground surveys.

Searches on Florabase indicated no threatened flora species from Irvine Island have been lodged at the WA Herbarium.

Pluton will liaise with the WA Museum and DEC to determine whether any new records of rare or priority flora species were recorded in the vicinity of Irvine Island during the 2008 DEC regional survey.

- Are there any known occurrences of rare or priority flora or threatened ecological communities on the site? #

  ☐ Yes ☑ No — **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

No Declared Rare Flora species, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act* 1950 (WA) and as listed by the DEC, were located during the 2007 Mattiske survey.

No plant taxa pursuant to section 179 of the EPBC Act were located during the 2007 Mattiske survey.

No Priority flora species as defined by the DEC were located during the 2007 Mattiske survey.

No threatened ecological communities as listed under the EPBC Act or by the DEC were recorded within or adjacent to the proposed drilling area during the 2007 Mattiske survey.

- If located within the Perth Metropolitan Region, is the proposed development within or adjacent to a listed Bush Forever Site? (You will need to contact the Bush Forever Office, at the Department for Planning and Infrastructure)

  ☐ Yes ☑ No — **If yes**, please indicate which Bush Forever site is affected (site number and name of site where appropriate).

NA

- What is the condition of the vegetation at the site?

The condition (after Keighery 1994) of vegetation at Irvine Island is Pristine to Excellent (Mattiske 2008).

One introduced species (*Passiflora foetida*) was recorded during the 2007 Mattiske survey. *Passiflora foetida* is not listed as a declared weed pursuant to Section 37 of the *Agriculture and Related Resources Act* 1976 (WA).

The introduction and spread of exotic flora species within Irvine Island is recognised as a significant risk issue associated with the proposed exploration program requiring

particular attention. The detailed Quarantine Management Plan prepared and implemented for the Phase I exploration program has been updated to incorporate recommendations from the DEC Environmental Management Branch and Quarantine Western Australia. The Quarantine Management Plan ensures all practicable measures are taken to protect existing vegetation and flora values at Irvine Island (Appendix 4).

2.2 Fauna

- Do you expect that any fauna or fauna habitat will be impacted by the proposal?

  (please tick) ☑ Yes ***If yes, complete the rest of this section***

  ☐ No ***If no, go to the next section***

- Describe the nature and extent of the expected impact.

  The proposed drilling activities will have a very low impact to fauna and fauna habitat at Irvine Island. Vegetation disturbance will be limited to 2.4 ha and will comprise mainly hand- or hand-held machinery assisted trimming of vegetation; very little actual ground disturbance will occur (Section 2.1).

  There will be no direct impact to the marine environment as a result of this proposal. Discharge of untreated salt water, or reject water from desalination units will occur in areas away from coral communities and is not anticipated to affect the marine environment given the small volumes involved.

  The introduction and spread of exotic fauna species within Irvine Island is recognised as a significant risk management issue. The detailed Quarantine Management Plan prepared and implemented for the Phase I exploration program has been updated to incorporate recommendations from reviews by the Department of Environment and Conservation Environmental Management Branch and Quarantine Western Australia (Appendix 4). The Quarantine Management Plan ensures all practicable measures are taken to protect existing fauna values at Irvine Island.

- Are you aware of any recent fauna surveys carried out over the area to be disturbed by this proposal?

  ☑ Yes ☐ No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey/s. (If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.)

  Pluton engaged Biota Environmental Sciences (Biota) to undertake a preliminary fauna and fauna habitat investigation across the Isthmus Region and Hardstaff Peninsula.

  The investigation involved a site visit conducted over four days between 25 – 28 June 2007, review of previous surveys undertaken on nearby islands and various database searches. A copy of the Biota (2007) report is included in Appendix 5.

- Has a search of DEC records for known occurrences of Specially Protected (Threatened) fauna been conducted for the site?

  ☑ Yes ☐ No (please tick)

  The Biota (2007) investigation involved a search of the:

  - DEC Threatened and Priority Fauna Database
  - Department of the Environment and Water Resources Protected Matters Database
  - WA Museum "Faunabase" Database
  - WA Museum records of herpetofauna and mammals from the Kimberley Islands: Bathurst, Cockatoo, Koolan and Irvine Islands

- Biota Environmental Sciences internal database

Results of searches are provided in the Biota (2007) report (Appendix 4).

❑ Are there any known occurrences of Specially Protected (Threatened) fauna on the site? #

☑ Yes ☐ No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

The majority of threatened species identified in database searches were considered unlikely to inhabit Irvine Island. Other species potentially occurring at Irvine Island were considered unlikely to be affected by the proposed drilling program (Biota 2007). Biota (2007) concluded that the potential impacts of the Phase 1 exploration program would be unlikely to affect the conservation status of any threatened species if they did occur on the island. As the Phase II exploration program is undertaken using the same low impact methodology, this conclusion is expected also to apply to this proposal.

Crocodylus porosus (Saltwater Crocodile) was recorded at Irvine Island during the Biota (2007) site visit. This species is listed under Schedule 4 of the *Wildlife Conservation Act 1950* (WA). Biota (2007) concluded that the potential impacts of the Phase 1 exploration program would be unlikely to affect the conservation status of this species. As the Phase II exploration program is undertaken using the same low impact methodology, this conclusion is expected also to apply to this proposal.

Hydromys chrysogaster (Water Rat) was observed on beaches at Irvine Island during the Biota (2007) site visit. This species is listed as 'Priority 4' under the *Wildlife Conservation Act 1950* (WA). Biota (2007) concluded that the potential impacts of the Phase 1 exploration program would be unlikely to affect the conservation status of this species. As the Phase II exploration program is undertaken using the same low impact methodology, this conclusion is expected also to apply to this proposal.

2.3 Rivers, Creeks, Wetlands and Estuaries

❑ Will the development occur within 200m of a river, creek, wetland or estuary?

(please tick) ☐ Yes ***If yes, complete the rest of this section***

☑ No ***If no, go to the next section***

❑ Will the development result in the clearing of vegetation within the 200 m zone?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

❑ Will the development result in the filling or excavation of a river, creek, wetland or estuary?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

❑ Will the development result in the impoundment of a river, creek, wetland or estuary?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

❑ Will the development result in draining to a river, creek, wetland or estuary?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

❑ Are you aware if the proposal will impact on a river, creek, wetland or estuary (or its buffer) within one of the following categories? (please tick)

Conservation Category Wetland	☐ Yes	☑ No	☐ Unsure
Draft Environmental Protection (Swan Coastal Plain	☐ Yes	☑ No	☐ Unsure

Wetlands) Policy 2004			
Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998	☐ Yes	☑ No	☐ Unsure
Perth's Bush Forever site	☐ Yes	☑ No	☐ Unsure
Environmental Protection (Swan & Canning Rivers) Policy 1998	☐ Yes	☑ No	☐ Unsure
The management area as defined in s4(1) of the Swan River Trust Act 1988	☐ Yes	☑ No	☐ Unsure
Which is subject to an international agreement, because of the importance of the wetland for waterbirds and waterbird habitats (e.g. Ramsar, JAMBA, CAMBA) #	☐ Yes	☑ No	☐ Unsure

2.4 Significant Areas and/ or Land Features

- Is the proposed development located within or adjacent to an existing or proposed National Park or Nature Reserve?

  ☑ Yes ☐ No **If yes**, please provide details.

  Several islands within the Buccaneer Archipelago, including Irvine Island, have been recommended for A Class reservation (EPA 1993); the marine environment of the Buccaneer Archipelago has been recommended to be considered for reservation as a multiple-use marine park (CALM 1994).

  In 1978, the Conservation Through Reserves Committee recommended to the EPA that a biological survey of the Buccaneer Archipelago be undertaken with a view to recommending the creation of specific reserves. The biological survey was carried out in June 1982, after which the Department of Fisheries and Wildlife recommended to the EPA and the Department of Lands and Surveys that a number of islands (including Irvine Island) be declared Class A reserves for the conservation of flora and fauna. This recommendation was reiterated by the EPA in the Red Book Status Report (EPA 1993).

  The level of impact associated with the proposal is extremely limited and considered unlikely to affect environmental values of Irvine Island or the waters of the Buccaneer Archipelago.

- Are you aware of any Environmentally Sensitive Areas (as declared by the Minister under section 51B of the EP Act) that will be impacted by the proposed development?

  ☐ Yes ☑ No **If yes**, please provide details.

  There will be no impact to any Environmentally Sensitive Areas (as declared by the Minister under section 51B of the EP Act) as a result of the proposal.

- Are you aware of any significant natural land features (e.g. caves, ranges etc) that will be impacted by the proposed development?

  ☐ Yes ☑ No **If yes**, please provide details.

  There are no significant land features that will be affected by the proposal.

2.5 Coastal Zone Areas (Coastal Dunes and Beaches)

- Will the development occur within 300m of a coastal area?

  (please tick) ☑ Yes ***If yes, complete the rest of this section***

  ☐ No ***If no, go to the next section***

- What is the expected setback of the development from the high tide level and from the primary dune?

  Proposed work sites along Hardstaff Peninsula are located at or greater than approximately 50 m from the high tide level. Three work sites are located above the rock edge flanking the western side of the Hardstaff Peninsula (Figure 3).

  There are no sand dune systems at Irvine Island.

- Will the development impact on coastal areas with significant landforms including beach ridge plain, cuspate headland, coastal dunes or karst?

  ☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

  The proposal will not affect any coastal areas with significant landforms.

- Is the development likely to impact on mangroves?

  ☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

  Additional drill holes may be drilled at several of the previously referred Phase I work sites in the Isthmus Region, which are adjacent to mangroves. The additional holes can be drilled without moving the drilling platform or creating any additional disturbance. Therefore, there will be no additional impact on the mangroves.

  Mangroves do not occur in any concentration along Hardstaff Peninsula where the majority of the Phase II program will take place.

  Although the exact location of the Phase II environmental investigation drill sites are not known, all objectives of a subterranean fauna or hydrogeological drilling investigation will be able to be met without drilling within mangrove areas. Therefore, the area of potential drilling for environmental investigations will not impact on mangrove areas.

2.6 Marine Areas and Biota

- Is the development likely to impact on an area of sensitive benthic communities, such as seagrasses, coral reefs or mangroves?

  ☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

  There will be no disturbance to any areas of sensitive benthic communities.

- Is the development likely to impact on marine conservation reserves or areas recommended for reservation (as described in *A Representative Marine Reserve System for Western Australia*, CALM, 1994)?

  ☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

  The marine environment of the Buccaneer Archipelago has been nominated as worthy of consideration in developing a marine reserve system for Western Australia (CALM 1994). Potential sources of impact to the marine environment near Irvine Island will be limited to discharge of reject water from desalination units.

  Water supply options

  Drilling will require a water supply of up to 100 kL/day for up to four drill rigs to operate on the island.

  Pluton proposes to supply fresh water from desalination units to the drilling rigs. The desalination units consume significant quantities of fuel, and require constant maintenance and supervision. Consequently Pluton has also proposed two contingency options, which will be investigated to supplement desalination if necessary (Section 1.2). Neither of the contingencies have the potential to affect the marine environment.

Supply of up to 100 kL/day of fresh water from the desalination units will require intake of approximately 200 kL/day of seawater and will produce approximately 100 kL/day of reject water with total dissolved solids (TDS) at approximately 65 parts per thousand (ppt), which is approximately twice the salt concentration of seawater. The saline reject water will be discharged to the eastern side of the Hardstaff Peninsula where there is deep, exposed water with no corals in the vicinity (Figure 3). The small volume of discharge is expected to have no significant adverse impact on water quality as strong tide induced currents in excess of an estimated 3 knots are expected to provide sufficient mixing.

- ❑ Is the development likely to impact on marine areas used extensively for recreation or for commercial fishing activities?

  ☐ Yes ☑ No **If yes**, please describe the extent of the expected impact, and provide any written advice from relevant agencies (e.g. Fisheries WA).

The marine environment surrounding Irvine Island is not used extensively for recreation or commercial fishing activities. No significant effects are anticipated on the marine environment due to this proposal so there should be no change in the recreation or commercial fishing opportunities around the island.

2.7 Water Supply and Drainage Catchments

- ❑ Are you in a proclaimed or proposed groundwater or surface water protection area?

  (You may need to contact the Department of Water (DoW) for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

  ☐ Yes ☑ No **If yes**, please describe what category of area.

- ❑ Are you in an existing or proposed Underground Water Supply and Pollution Control area?

  (You may need to contact the DoW for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

  ☐ Yes ☑ No **If yes**, please describe what category of area.

- ❑ Are you in a Public Drinking Water Supply Area (PDWSA)?

  (You may need to contact the DoW for more information or refer to the DoW website. A proposal to clear vegetation within a PDWSA requires approval from DoW.)

  ☐ Yes ☑ No **If yes**, please describe what category of area.

- ❑ Is there sufficient water available for the proposal?

  (Please consult with the DoW as to whether approvals are required to source water as you propose. Where necessary, please provide a letter of intent from the DoW)

  ☑ Yes ☐ No (please tick)

Pluton proposes to utilise desalination as the water source for the proposal. If either are shown to be feasible, Pluton will use either groundwater abstraction or untreated seawater as a contingency water source.

- Will the proposal require drainage of the land?

  ☐ Yes ☑ No **If yes**, how is the site to be drained and will the drainage be connected to an existing Local Authority or Water Corporation drainage system? Please provide details.

- Is there a water requirement for the construction and/ or operation of this proposal?

  (please tick) ☑ Yes ***If yes, complete the rest of this section***

  ☐ No ***If no, go to the next section***

- What is the water requirement for the construction and operation of this proposal, in kl/year?

  The estimated maximum water consumption for two diamond drill rigs operating concurrently at Irvine Island is less than 100 kL in any 24 hour shift. Over the anticipated program duration of approximately 2 years, maximum total water consumption would be less than approximately 40 ML.

  As water is recirculated during drilling, maximum consumption would occur only if all water circulated was lost down hole. By contrast, the majority of the proposed drilling is below sea-level, where water consumption is reduced.

- What is the proposed source of water for the proposal? (eg dam, bore, surface water etc.)

  Pluton proposes to supply fresh water from desalination units to the drilling rigs. The desalination units consume significant quantities of fuel and require constant maintenance and supervision. Pluton has proposed two contingency options; groundwater abstraction and seawater supplementation, which will be investigated to supplement desalination if necessary. The process that will be undertaken to determine whether each of these contingencies are feasible is outlined in Section 1.2.

2.8 Pollution

- Is there likely to be any discharge of pollutants from this development, such as noise, vibration, gaseous emissions, dust, liquid effluent, solid waste or other pollutants?

  (please tick) ☑ Yes ***If yes, complete the rest of this section***

  ☐ No ***If no, go to the next section***

  The proposal will result in discharge of up to 100 kL/day of saline water.

- Is the proposal a prescribed premise, under the Environmental Protection Regulations?

  (Refer to the EPA *General Guide for Referral of Proposals to the EPA under section 38(1) of the EP Act 1986* for more information)

  ☐ Yes ☑ No **If yes**, please describe what category of prescribed premise.

- Will the proposal result in gaseous emissions to air?

  ☑ Yes ☐ No **If yes**, please briefly describe.

  The proposal will result in helicopter and generator exhaust emissions to air.

- Have you done any modelling or analysis to demonstrate that air quality standards will be met, including consideration of cumulative impacts from other emission sources?

  ☐ Yes ☑ No **If yes**, please briefly describe.

  The proposal will not be a significant source of gaseous emissions to air and is not anticipated to approach or exceed the relevant air quality standard thresholds.

  Emission sources will include a single helicopter operating intermittently throughout the exploration program, as well as a number of generators to supply power for the desalination units, water pumps and various other uses (e.g. lighting). Many of these generators may not be required to operate continuously throughout the proposal and will be used only as required (e.g. following the initial stages of drilling, desalination units will operate only as required to keep the water circulation system topped-up).

- Will the proposal result in liquid effluent discharge?

  ☑ Yes ☐ No **If yes**, please briefly describe the nature, concentrations and receiving environment.

  Desalination discharge

  The major source of liquid effluent discharge to the environment resulting from the proposal will be hypersaline reject water produced from the desalination units. Supply of 100 kL of fresh water from the desalination units will produce approximately 100 kL/day of reject water with TDS of approximately 65 ppt. It is anticipated that the discharge will be rapidly diluted by the receiving environment and should not significantly alter the salinity of nearshore waters.

  Neither groundwater abstraction or seawater supply contingency options will result in liquid effluent discharge.

  Hydrogeological testing

  Hydrogeological investigation may result in the discharge of groundwater for a period of several hours at each bore. Establishing the permeability of an aquifer requires the removal of groundwater so that either the maximum flow rate or the rate of recovery can be measured. The discharge will be temporary and is likely to be undertaken only once at each bore. The water quality will be tested prior to pumping and if the water is saline it will be contained in a tank and discharged to the ocean. If it is fresh it will be discharged directly to the ground (with measures in place to ensure that erosion does not occur).

  Water circulation system overflow

  The potential for excess water to enter the recirculation system is minimised and controlled through regulation of production from the desalination units.

  The maximum rate of potential overflow from reservoirs is estimated to be no more than 100 – 1000 L/day.

- If there is likely to be discharges to a watercourse or marine environment, has any analysis been done to demonstrate that the State Water Quality Management Strategy or other appropriate standards will be able to be met?

  ☐ Yes ☑ No **If yes**, please describe.

  The proposal will not result in significant discharges to watercourses or the marine environment and is not anticipated to approach or exceed the relevant water quality standard thresholds.

- Will the proposal produce or result in solid wastes?

  ☑ Yes ☐ No **If yes**, please briefly describe the nature, concentrations and disposal location/ method.

  Solid wastes produced as a result of the proposal will comprise:

- food scraps and general rubbish
- sediment accumulated in settling tanks
- oil-absorbent matting and any used spill kits
- solid human waste.

Portable toilets and rubbish bins will be provided at each work site. All food scraps, general rubbish and solid human waste generated at Irvine Island will be captured and transported to Cockatoo Island for disposal at existing facilities.

Sediment accumulated in settling tanks will be removed and buried when each tank is relocated to a new work site. Any sediment will be transferred to bulk bags and flown to Cockatoo Island for disposal. Similarly, oil-absorbent matting and any used spill kits will be transported to Cockatoo Island for disposal in existing facilities.

❑ Will the proposal result in significant off-site noise emissions?

☐ Yes ☑ No **If yes**, please briefly describe.

Noise levels in the immediate vicinity of the drill rigs are estimated to be approximately <85 dB when the rigs are operating at full capacity. The proponent's previous experience at other sites is that this noise diminishes rapidly with increasing distance from the source, up to around 500 m. There are no sensitive premises within 500 m of the drilling.

Pluton has agreed with Cockatoo Island management on appropriate helicopter flight paths to minimise noise in the vicinity of the existing accommodation area.

❑ Will the development be subject to the Environmental Protection (Noise) Regulations?

☑ Yes ☐ No **If yes**, has any analysis been carried out to demonstrate that the proposal will comply with the Regulations?

Please attach the analysis.

The proposed exploration activities will comply with the requirements of the Environmental Protection (Noise) Regulations 1997.

Irvine Island is unoccupied and in a remote location. The nearest occupied premise is the Cockatoo Island mine site accommodation village, located approximately 3 – 4 km from Irvine Island. Noise generated as a result of the proposed exploration activities will be minor in relation to noise generated at Cockatoo Island.

❑ Does the proposal have the potential to generate off-site, air quality impacts, dust, odour or another pollutant that may affect the amenity of residents and other "sensitive premises" such as schools and hospitals (proposals in this category may include intensive agriculture, aquaculture, marinas, mines and quarries etc.)?

☐ Yes ☑ No **If yes**, please describe and provide the distance to residences and other "sensitive premises".

There will be no significant impact to air quality as a result of the proposal. There are no sensitive premises in the vicinity of Irvine Island.

❑ If the proposal has a residential component or involves "sensitive premises", is it located near a land use that may discharge a pollutant?

☐ Yes ☐ No ☑ Not Applicable **If yes**, please describe and provide the distance to the potential pollution source

2.9 Greenhouse Gas Emissions

- Is this proposal likely to result in substantial greenhouse gas emissions (greater than 100 000 tonnes per annum of carbon dioxide equivalent emissions)?

  ☐ Yes ☑ No **If yes**, please provide an estimate of the annual gross emissions in absolute and in carbon dioxide equivalent figures.

- Further, if yes, please describe proposed measures to minimise emissions, and any sink enhancement actions proposed to offset emissions.

2.10 Contamination

- Has the property on which the proposal is to be located been used in the past for activities which may have caused soil or groundwater contamination?

  ☐ Yes ☑ No ☐ Unsure **If yes**, please describe.

  There is no historical land use at Irvine Island that may have caused soil or groundwater contamination. No incidents with the potential to cause soil or groundwater contamination have occurred during the Phase I exploration program.

- Has any assessment been done for soil or groundwater contamination on the site?

  ☐ Yes ☑ No **If yes**, please describe.

- Has the site been registered as a contaminated site under the Contaminated Sites Act 2003? (on finalisation of the CS Regulations and proclamation of the CS Act)

  ☐ Yes ☑ No **If yes**, please describe.

2.11 Social Surroundings

- Is the proposal on a property which contains or is near a site of Aboriginal ethnographic or archaeological significance that may be disturbed?

  ☑ Yes ☐ No ☐ Unsure **If yes**, please describe.

  Irvine Island is recognised as a significant site under the *Aboriginal Heritage Act 1972* and it is understood that the island is the birth place of the Dreaming Snake, an important spiritual site.

  A search of the Department of Indigenous Affairs online database indicated there are a number of Aboriginal heritage sites on Irvine Island, including artefact scatters, paintings, burial sites, mythological sites and ceremonial sites. Approval under section 18 of the Aboriginal Heritage Act 1972 was given to conduct Phase I. An application has been made for consent to conduct Phase II. The Mayala Native Title Claimants have consented to both applications.

  Irvine Island is incorporated in the Native Title Claim of the Mayala Native Title Claimant Group (the Mayala), which covers approximately 3,815 km^2 of the Buccaneer Archipelago. Pluton and joint venture partner Portman have successfully negotiated a Native Title, Heritage Protection and Mineral Exploration Agreement with the Kimberley Land Council (as agents for the Mayala) for Irvine Island.

Pluton is committed to engaging and employing Mayala traditional owners during its operations. Representatives of the Mayala, the Kimberley Land Council and Pluton have visited Irvine Island on many occasions during 2007 and 2008. Mayala representatives are assisting with the Phase I exploration operations as field assistants and cultural observers and will continue to assist with the Phase II program.

In August 2008, representatives of the Mayala, KLC and an archaeologist and anthropologist from Anthropos Australis, conducted a heritage survey of the proposed Phase II exploration program area. Consent has been given by the Mayala (through their representatives the Kimberley Land Council [KLC]) for the proposed Phase II exploration program to proceed.

- ❑ Is the proposal on a property which contains or is near a site of high public interest (for example, a major recreation area or natural scenic feature)?

  ☑ Yes ☐ No **If yes**, please describe.

Even though Irvine Island is in close proximity to working iron ore mines and is one of three islands which comprise the Kimberley Iron Ore Province it is herein considered a relatively pristine environment and has been recommended for A Class reservation (EPA 1993). In acknowledgement of the intrinsic conservation value of Irvine Island and the likely high level of public interest in the Phase II proposal, Pluton has based the proposed exploration on the proven methodology of the very low impact Phase I exploration program, which is "better than best practice". Pluton has undertaken extensive stakeholder consultation (Section 3.3) to ensure consideration of relevant aspects in the planning and design of the proposal.

- ❑ Will the proposal result in or require substantial transport of goods, which may affect the amenity of the local area?

  ☐ Yes ☑ No **If yes**, please describe.

2.12 Risk

- ❑ Is the proposal located near a hazardous industrial plant or high-pressure gas pipeline?

  ☐ Yes ☑ No **If yes**, please describe.

- ❑ Does the proposal have the potential to generate off-site risk?

  ☐ Yes ☑ No **If yes**, will the proposal be a major hazardous facility regulated under the *Explosives and Dangerous Goods Act*?

3. MANAGEMENT

3.1 Principles of Environmental Protection

- ❑ Have you considered how your project gives attention to the following Principles, as set out in section 4A of the EP Act? (For information on the Principles of Environmental Protection, please see EPA Position Statement No. 7, available on the EPA web.)

1.	The precautionary principle.	☑ Yes	☐ No
2.	The principle of intergenerational equity.	☑ Yes	☐ No

3.	The principle of the conservation of biological diversity and ecological integrity.	☑ Yes	☐ No
4.	Principles relating to improved valuation, pricing and incentive mechanisms.	☑ Yes	☐ No
5.	The principle of waste minimisation.	☑ Yes	☐ No

- Is the proposal consistent with the EPA's Position Statements (available on the EPA web)?

  ☑ Yes ☐ No

3.2 Management Commitments

- How has the proposal been developed to avoid, minimise and manage potential impacts?

  Please describe any specific commitments you make as the proponent to minimising the potential environmental impacts of this development.

  The proposal has been based on the methodology and management approach adopted for the Phase I exploration program. This is a proven very low impact program that goes above and beyond current best practice in mineral exploration.

  Disturbance has been prevented and/or minimised first and foremost through the use of custom-designed UDPs, which facilitate drilling with little to no associated disturbance. The UDPs have been designed to be helicopter-transportable and assembled by hand to prevent the need for vehicles and vehicular tracks on Irvine Island (Appendix 1). The UDP's performed extremely well during Phase I exploration.

  Use of existing facilities at Cockatoo Island for accommodation and waste disposal prevents the requirement to establish additional facilities that may affect the environmental values of Irvine Island and/or the surrounding marine environment.

  Disturbance required with the proposal will be mainly limited to hand- or hand-held machinery assisted trimming of vegetation; complete removal of vegetation will be prevented where possible and very little actual ground disturbance will occur. Where required, ground disturbance will be preferentially located in areas of minimal vegetation cover.

  The risk of hydrocarbon contamination will be minimised through the utilisation of bunding, oil-absorbent matting and/or booms in reservoirs and tanks. The volume of fuel stored at Irvine Island will be up to one weeks supply. Minor hydrocarbon spills will be captured on spill matting located under UDPs and remediated at existing Cockatoo Island facilities. Spill kits will be stored with each pump, generator and drill rig. Measures are in place to prevent accidental release of any loads by the helicopter.

  The potential for introduction and spread of exotic species at Irvine Island will be minimised and managed through the implementation of the Quarantine Management Plan.

3.3 Consultation

- Has public consultation taken place (such as with other government agencies, community groups or neighbours), or is it intended that consultation shall take place?

  ☑ Yes ☐ No **If yes**, please list those consulted and attach comments or summarise response on a separate sheet.

  Pluton has undertaken substantial upfront stakeholder consultation and discussed the proposed Phase II program with government agencies, non-government organisations,

local government and industry. The details of who was consulted, the comments received and Pluton's responses are outlined below.

Department of Industry and Resources (10 September 2008)

Pluton briefed Justin Robins, Danielle Risbey, Tyler Sujdovic (DoIR) of the Phase II exploration proposal on 10 September 2008. DoIR's comments and Pluton's response are included in Table 1

Table 1 DoIR comments and Pluton responses

DoIR Comments	Pluton Response
DoIR recommended self-referral under the EP Act by Pluton Resources of the Phase II program	Agreed
DoIR recommended consulting with NGOs (esp. Environs Kimberley, Save The Kimberley), MPs and Conservation Council (Tim Nicol)	Agreed (see below)
DoIR would like to see photographic evidence that Phase I has been successful	Included in Appendix 1
DoIR would like to see drill holes plugged below ground, but stated that they did not consider any further rehabilitation of the drill sites necessary, given the minimal impact and evidence to date of resprouting, etc.	Pluton commits to doing this after environmental investigations are complete at each hole. In the mean time they will be capped above ground to ensure that no fauna are trapped.
Where there is uncertainty in staging of the Phase II program, DoIR advised indicating an 'envelope of influence' and an approximate number of additional holes, as well as providing a management plan	Agreed. See 'Area of interest' Figure 2.
DoIR agreed in principle with the staged approach – as long as the above point is taken into consideration.	Noted.

Department of Environment and Conservation

Pluton briefed Sandra Thomas and Daniel Coffey from the Environmental Management Branch of DEC regarding the exploration proposal on 9 September 2008.

Pluton Resources provided an update on the 2008 drilling program and discussed the intended referral of the Phase 2 drilling program.

The issues raised by the DEC and Pluton's response are included in Table 2.

Table 2 DEC comments and Pluton responses

DEC Comments	Pluton Response
DEC requested that information on the performance on the Phase 1 drilling program in relation to the commitments made in the previous referral be included in the Phase 2 referral	A document outlining the performance of the Phase 1 drilling program is included in Appendix 1.
DEC requested that a final report from Mattiske be provided as part of the Phase 2 referral	Included in Appendix 3
DEC gave in principle support for allowing flexibility for 2010 drilling for the purpose of environmental investigations and possible exploration.	Noted

Pluton briefed Sharon Ferguson and Alan Byrne from DEC Broome and Troy Sinclair joined the meeting by teleconference from DEC Kununurra on 12 September 2008. In addition to the specific comments raised below, DEC were interested in the description of the implementation of the quarantine management plan and noted that they would be visiting the site in October to inspect the process.

The issues raised by the DEC and Pluton's response are included in Table 3.

Table 3 DEC Broome comments and Pluton responses

DEC Broome Comments	Pluton Response
DEC raised the issue of increased fire risk when operating or storing equipment during the cyclone season.	Fire prevention measures are a key aspect of management on the island. Only small amounts of fuel are kept on site. The ore itself is conductive so it is unlikely that drilling equipment would significantly increase the occurrence of lightning strike on the island. No drilling will be undertaken when the area is on cyclone alert.
DEC asked about human waste including sewage.	All waste is removed from the island and port-a-loos are provided for human waste.
DEC requested further information on the identification of the land snails found on Irvine Island	The species was identified as Torresitrachia bathurstensis and according to Solem (1979) is also known from Heywood Island, Kimbolton area and near Doubtful Bay. The taxonomy is based on shell morphology and limited dissections. Molecular analyses carried out to date on snails from the islands surveyed by DEC are showing a much more complex picture. Solem, A. (1979). *Camaenid land snails from Western and central Australia (Mollusca: Pulmonata: Camaenidae) I. Taxa with trans-Australian distribution*. Records of the Western Australian Museum Supplement No. 10.
DEC supportive of Pluton's environmental investigations contributing to the survey work being undertaken at the moment by DEC.	Noted

Conservation Council of WA (15 September 2008)

Pluton briefed Tim Nicol from the Conservation Council of Western Australia regarding the Phase II exploration proposal on 15 September 2008. Pluton outlined the progress of the implementation of the Phase 1 program including spills, quarantine breaches (Appendix 1) and the planned visit by DEC and DoIR in October 2008. Pluton Resources also informed the Conservation Council of a hydrocarbon spill incident that occurred on Sunday 14 September 2008, and of the visit to Irvine Island by the DEC and DoIR scheduled for October 2008.

The disturbance footprint of the exploration activities was discussed. The Conservation Council commended the exploration methodology employed by Pluton, but stated the Conservation Council was nevertheless opposed to the activities being conducted on Irvine Island. The proponent understand that the Conservation Council's position is that Irvine Island should not be disturbed as it is a pristine part of the significant West Kimberley area.

Environs Kimberley (12 September 2008)

Pluton briefed Maria Mann from Environs Kimberley on 12 September 2008 on the implementation of the Phase 1 drilling program and the proposed Phase II program.

The issues raised by the Environs Kimberley and Pluton's response are included in Table 4.

Table 4 Environs Kimberley comments and Pluton responses

Environs Kimberley Comments	Pluton Response
No specific issues regarding the drilling program as it was recognised that the drilling program was designed to be low impact and appeared to be achieving that. However, Environs Kimberley opposes the exploration as they oppose mining on the island and the two are linked.	Pluton note the opposition.
Concerned that as the three islands have similar geology and they are the only ones with those resources, Irvine Island should not be mined as the other two have already been disturbed. Irvine Island is likely to be the only undisturbed island of that type with a unique flora and fauna associated with that type of geology.	Irvine Island contains concentrations of iron at depth. Other islands and mainland sites contain iron mineralisation at surface but not in economic quantities. The geology of Irvine forms part of the same package and is similar to many islands and mainland sites in the region.

Opposes mining as it is an island that has been recommended for heritage listing for its natural values, its cultural heritage, it is undisturbed, there is sufficient iron ore being mined in WA, there is no world shortage of iron ore and the island has been recommended for protection as a reserve.	The exploration program is designed to be low impact and will not leave any lasting effect on the natural or cultural values of the island.
Consultation with environmental NGO's should continue beyond the approvals process (if project is approved). They could be involved with auditing etc instead of this just being done by Pluton's consultants.	Agreed. Pluton will work with Environs Kimberley to develop an ongoing relationship including some having Environs Kimberley visit the site to provide community input into audit processes.

Department of Fisheries (10 September 2008)

Pluton discussed details of the proposed Phase II exploration program with Lindsay Joll from Department of Fisheries on 10 September 2008. No concerns were raised regarding the proposal, given there would be no runoff into the ocean.

The issues raised by the Department of Fisheries and Pluton's response are included Table 5.

Table 5 Department of Fisheries comments and Pluton responses

Department of Fisheries Comments	Pluton Response
Department of Fisheries jurisdiction relates to water rather than land so the only potential impact of interest to DoF is the desalination discharge. Given the tidal flows and depth where the discharge is situated, the department had no concerns that this would create any adverse effects	Noted

Kailis (10 September 2008)

Pluton met with Stephen O'Keefe from Kailis on 10 September 2008 as the Pearl Producers Association had indicated that they had a pearling lease north of Bathurst Island. Kailis indicated they do not run the pearling operation north of Bathurst Island. It was suggested that it may be an old Kailis pearling lease that is no longer used. Unlikely that pearling could occur there as the environmental at Bathurst is too exposed and so is not conducive to pearl farming anyway.

Kailis operates the "Kailis Cove" pearling operation off the mainland, between Cockatoo Island and Koolan Island. Kailis noted that they have not had any problems at Kailis Cove as a result of the existing mining operations on Cockatoo or Koolan.

Shire of Broome (12 September 2008)

Pluton briefed Shire of Broome Councillors Shelley Eaton, Chris Maher, Chris Mitchell and Rob Landers and the Shire of Broome CEO Kenn Donahoe and the Shire President Graham Campbell on the proposed exploration program on 12 September 2008.

The Council representatives were generally supportive of the proposal and raised no issues regarding drilling. Their primary interest related to the potential impacts on Broome if a mining project was to go ahead on the island.

Shire of Derby/West Kimberley (11 September 2008)

Pluton briefed seven Shire of Derby/West Kimberley Councillors and four Shire staff regarding the proposed exploration program on 11 September 2008. The Shire was generally supportive of the project, especially the level of involvement and employment of traditional owners. The Shire raised no concerns regarding the exploration proposal and were supportive of the low impact innovations that Pluton has made to their drilling techniques.

The Shire were interested in facilitating Pluton's use and support of facilities in Derby.

Mayala people and Kimberley Land Council

Representatives of the Mayala people and KLC have been engaged in the development of the Phase II exploration proposal and heritage assessment of the proposed impact zone of Phase II operations.

Pluton has:

- Attended a Mayala Community meeting (convened by the Kimberley Land Council at One Arm Point) and provided photographs, maps and information about the Phase II work program. Pluton estimates that about 50 people attended the meeting.
- Engaged Anthropos Australis (through the Kimberley Land Council) to conduct an ethnographic survey of the area the eastern side of Irvine Island and an archaeological survey of all proposed worksites. The Aboriginal heritage assessment also included an ethnographic assessment of any indirect impacts on Aboriginal sites on the western side of the island.
- The ethnographic survey included site visits and consultation with 3 senior Mayala elders and a number of younger men. The survey also included consultation with 4 senior Mayala women at One Arm Point. The heritage assessment took approximately 1 week.
- Informants for the above surveys were chosen by the Mayala community and nominated to Pluton by the Kimberley Land Council.
- Employed 20 Mayala men as field hands (clearing worksites, constructing and deconstructing drilling platforms, building water infrastructure, core processing and core cutting, geological sampling, driller's offsiders etc). Pluton continuously consults with these workers about aspects of its exploration program. The Mayala men also act as cultural monitors. They are integrally involved in and familiar with the exploration project including Phase II.

4. REFERENCES

Anthropos Australia Pty Ltd, 2008, *The Report of an Aboriginal Heritage Survey of the proposed exploration drilling program on E04/1172, Eastern Irvine Island, West Kimberley, Western Australia*, prepared for the Mayala Native Title Claimanats Kimberley Land Council Aboriginal Representatives Body and Pluton Resources Ltd.

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Department of Conservation and Land Management (CALM) 1994, *A Representative Marine Reserve System for Western Australia*, report of the Marine Parks and Reserves Selection Working Group, Perth.

Department of Minerals and Energy, 1995, *Iron Ore in Western Australia,* Geological Survey of Western Australia, Government of Western Australia, Perth.

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Environmental Protection Authority (EPA) 2007, *Draft Guidance Statement 54a, Sampling methods and survey considerations for subterranean fauna in Western Australia, (Technical guidance for Guidance Statement 54)*, Government of Western Australia, August 2007.

Keighery, B. 1994, *Bushland Plant Survey - a guide to plant community survey for Community*, Wildflower Society of WA (Inc.), Nedlands.

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Figures

1. Regional location – Irvine Island
2. Overview of Phase I and II exploration programs
3. Phase II Hardstaff Peninsula desalination units
4. Water infrastructure and circulation plan, Hardstaff Peninsula, Irvine Island
5. Irvine Island vegetation mapping
6. Irvine Island vegetation mapping legend

Appendices

1. Phase 1 implementation progress
2. Heritage Survey Executive Summary (Anthropos Australia Pty Ltd 2008)
3. Mattiske (2008) vegetation report
4. Quarantine management plan
5. Biota (2007) Level 1 fauna assessment

CHECKLIST AND DECLARATION

Before you submit this form, have you:	YES	NO
Completed all the questions on this form?	☒	☐
Have you attached any extra information, such as:		
Site plans?	☒	☐
Detailed explanations?	☐	☒
Comments obtained during consultation?	☐	☒
Have you included any electronic information, such as:		
A CD of the referral and documentation, in PDF format, excluding any confidential information?	☒	☐
A CD of the spatial data?	☒	☐
Any other relevant information?	☒	☐

Following a review of the information presented in this form, please consider the following question. (Your response is Optional)

❑ DO YOU CONSIDER THE PROPOSAL REQUIRES FORMAL ENVIRONMENTAL IMPACT ASSESSMENT?
(Information on the levels of environmental impact assessment is available on the EPA website at www.epa.wa.gov.au)

☐ YES ☒ NO ☐ NOT SURE

IF YES, WHAT LEVEL OF ASSESSMENT?

☐ ASSESSMENT ON REFERRAL INFORMATION

☐ ENVIRONMENTAL PROTECTION STATEMENT

☐ PUBLIC ENVIRONMENTAL REVIEW

☐ ENVIRONMENTAL REVIEW AND MANAGEMENT PROGRAMME

☐ STRATEGIC ENVIRONMENTAL ASSESSMENT

I, Lisa Crossing *(full name)* declare that I have completed all of the questions in this form and attached the requested information and declare that the information contained in this form is, to my knowledge, true and not misleading.

Name	Lisa Crossing
Position	Associate
Date	

Government Agency Contact Details — Attachment 1

Environmental Protection Authority
Level 8, The Atrium
168 St Georges Tce
PERTH WA 6000

Please mail completed referrals to:
Postal address:
Locked Bag 33
CLOISTERS SQUARE WA 6850
Website: www.epa.wa.gov.au

EPA Service Unit
Level 8, The Atrium
168 St Georges Tce
PERTH WA 6000

Telephone: (08) 6467 5000
Facsimile :(08) 6467 5562
Website: www.dec.wa.gov.au

Contact details for the head offices of the primary agencies involved in development proposals follow. You may need to contact your relevant district or regional office (details of all State Government agencies are available on the website of the Department of the Premier and Cabinet, www.dpc.wa.gov.au). You will also need to contact your Local Government Authority in the first instance. For some proposals, consultation with or referral to Commonwealth agencies may be required.

Department of Environment and Conservation
The Atrium
168 St Georges Tce
Perth WA 6000

For Licensing and Clearing Permits under Part V -
Telephone: (08) 6467 5000
Website: www.dec.wa.gov.au

Department of Water
The Atrium
168 St Georges Terrace
Perth WA 6000

Telephone: (08) 6364 7600
Website: www.water.wa.gov.au

Department of Industry & Resources
Mineral House
100 Plain St
East Perth WA 6004

Telephone: (08) 9327 5555
Website: www.doir.wa.gov.au

Department of Fisheries
3rd floor, SGIO Atrium
168 St George's Terrace
Perth WA 6000

Telephone: (08) 9482 7333
Website: www.wa.gov.au/westfish

Department for Planning and Infrastructure (including Bush Forever Office)
Albert Facey House
469 Wellington Street
Perth WA 6000

Telephone: (08) 9264 7777
Telephone: 1800 626 477 (Bush Forever Office)
Website: www.planning.wa.gov.au

Department of Indigenous Affairs
Level 1, 197 St George's Terrace
PERTH WA 6000

Telephone: (08) 9235 8000
Website: www.dia.wa.gov.au

Health Department of Western Australia
189 Royal St
EAST PERTH WA 6004

Telephone: (08) 9222 4222
Website

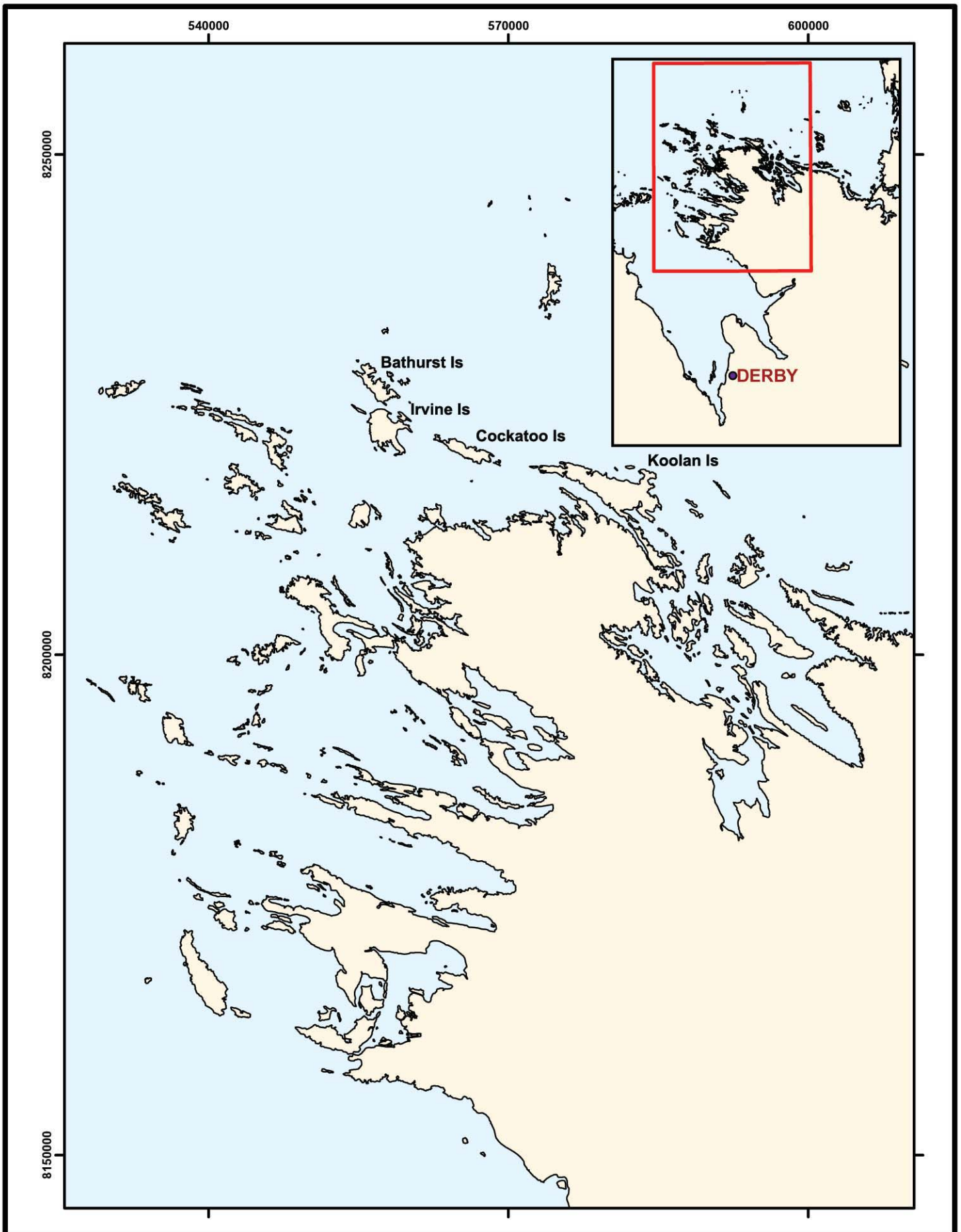

Figure 1: Regional location - Irvine Island

strategen

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Horizontal Datum: GDA 94 | Projection: MGA Zone 51 | Author: AW

Date: 28/11/2007

Note that positional errors may occur in some areas

Regional Map

Source: ESRI 2005

Source: Geoscience Australia database 2006

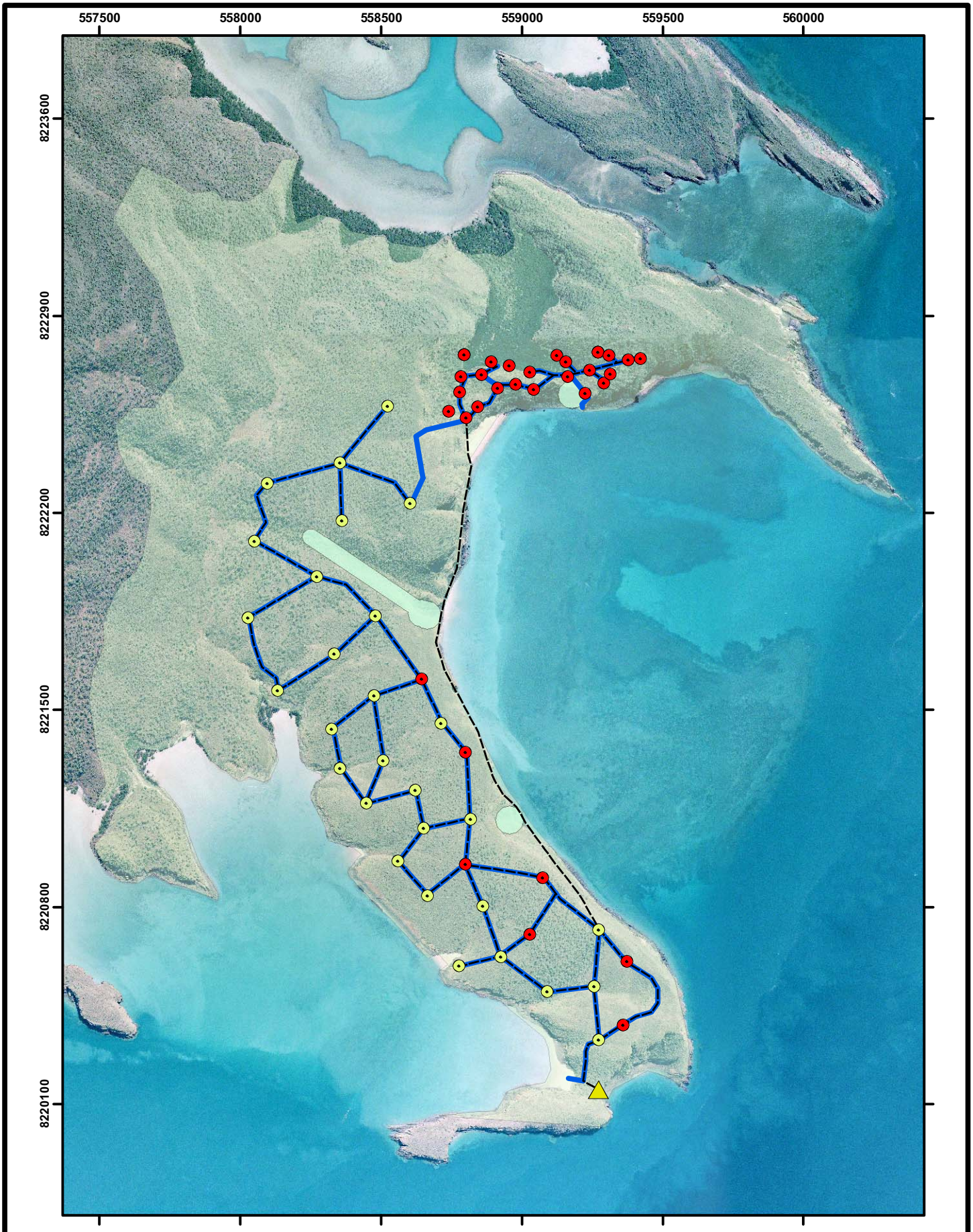

Figure 2: Overview of Phase I and II exploration programs

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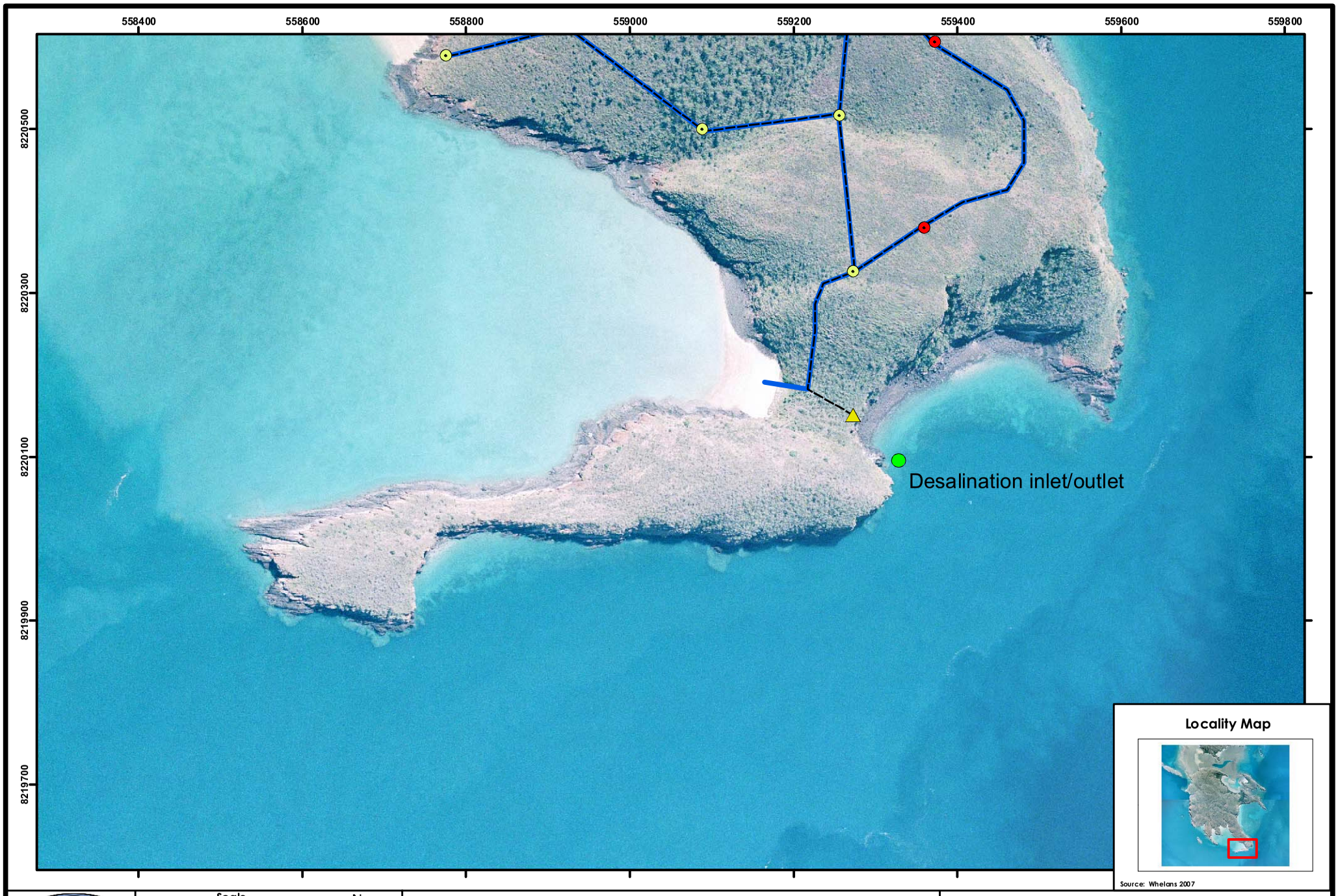
at A4

Horizontal Datum: GDA 94	Projection: MGA Zone 51
Date: 6/10/2008	Author: AW
	Note that positional errors may occur in some areas

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



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Horizontal Datum: GDA 94

Projection: MGA Zone 51

Source: Whelans 2007

Note that positional errors may occur in some areas

Author: AW

Figure 3: Phase II Hardstaff Peninsula desalination plant

Legend

- Desalination units
- Phase I and II tracks
- Phase I and II water line
- Phase I sites
- Indicative Phase II sites (within a 50 m radius)

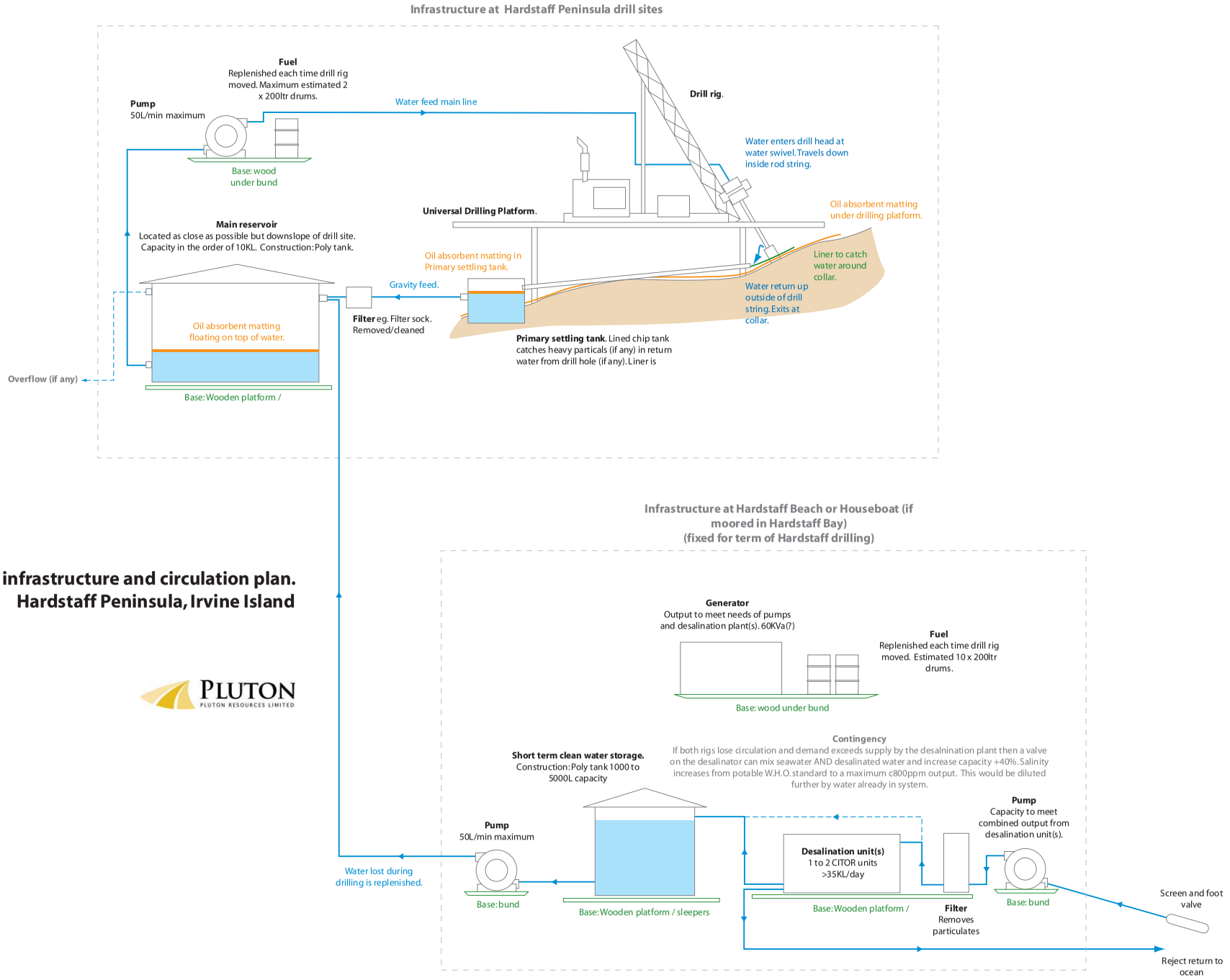


Figure 4 **Water infrastructure and circulation plan. Hardstaff Peninsula, Irvine Island**

PLUTON
PLUTON RESOURCES LIMITED

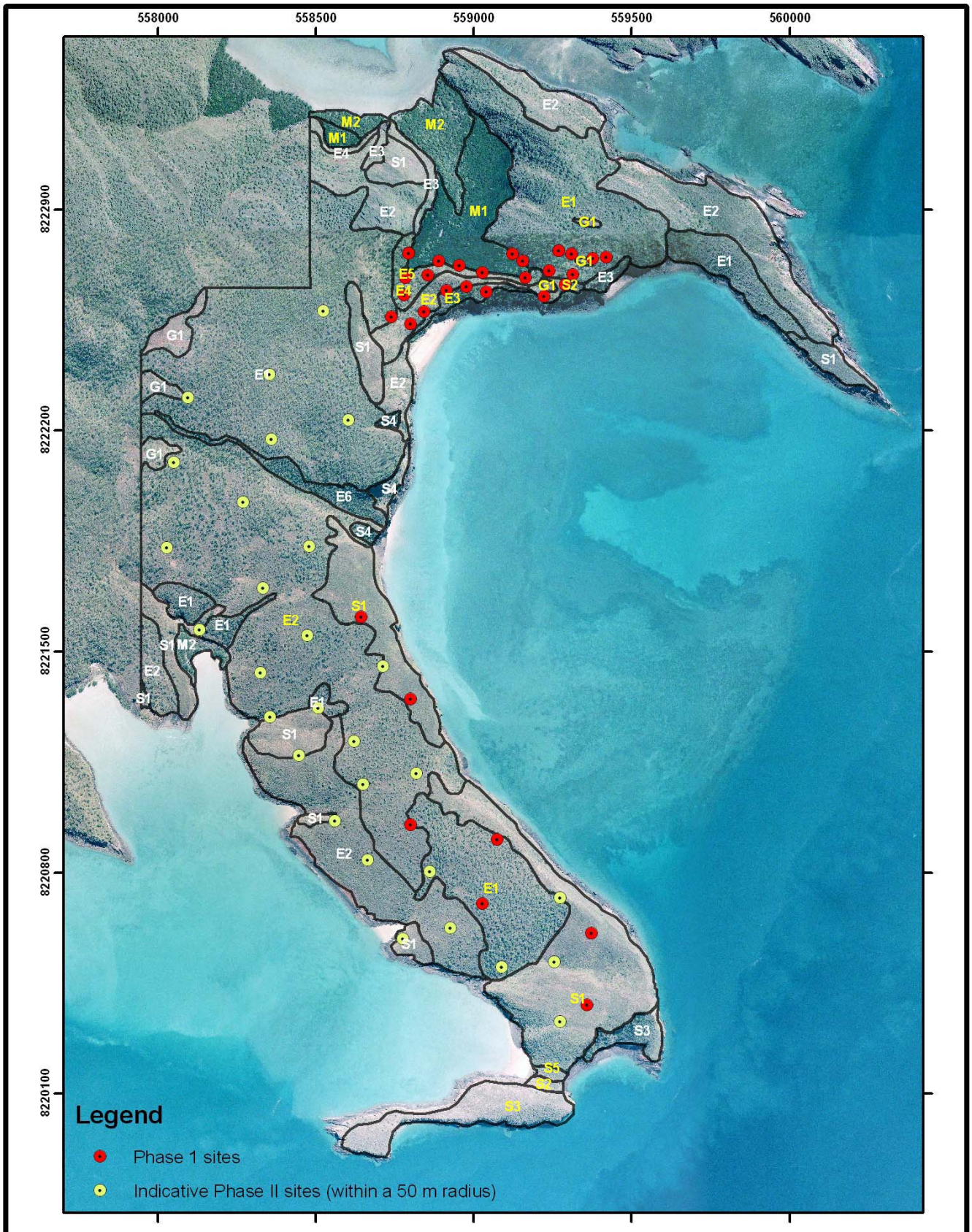
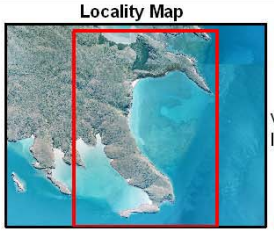


Figure 5: Irvine Island vegetation mapping

Locality Map



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

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Horizontal Datum: GDA 94	Projection: MGA Zone 51
Date: 7/10/2008	Author: AW
	Note that positional errors may occur in some areas

Source: Vegetation map - Mattiske 2008
Aerial map - Whelans 2007

E1	Low Woodland – Open Low Woodland of *Eucalyptus miniata* over *Corymbia cadophora*, *Eucalyptus tectifica*, *Ficus opposita*, *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 opposita* 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 opposita* 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 opposita* 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 umbella*ta 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 6 Irvine Island vegetation mapping legend

Appendix 1
Phase 1 implementation progress

Irvine Island Iron Ore Exploration Program - Phase 1

Interim Environmental Management Report

Prepared for
Pluton Resources
by Strategen

November 2008

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.

Client: Pluton Resources

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Preliminary Draft Report	1	GW	LC	1 electronic	16.10.08
Final Report	Final	GW		To be submitted with Phase II Referral	

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1. ABOUT THIS DOCUMENT

1.1 BACKGROUND

Pluton Resources Ltd (Pluton Resources) commenced Phase I of a mineral exploration program across eastern Irvine Island in August 2008. The approved Phase I program includes 26 drill sites in the Isthmus region and seven drill sites along Hardstaff Peninsula (Figure 1).

This document is an interim report describing the implementation of the Phase 1 exploration program and environmental management requirements. The environmental management requirements are based on the following:

1. Commitments made in the referral of the project under the *Environmental Protection Act 1986* (EP Act)
2. Exploration licence conditions
3. Quarantine Management Plan.

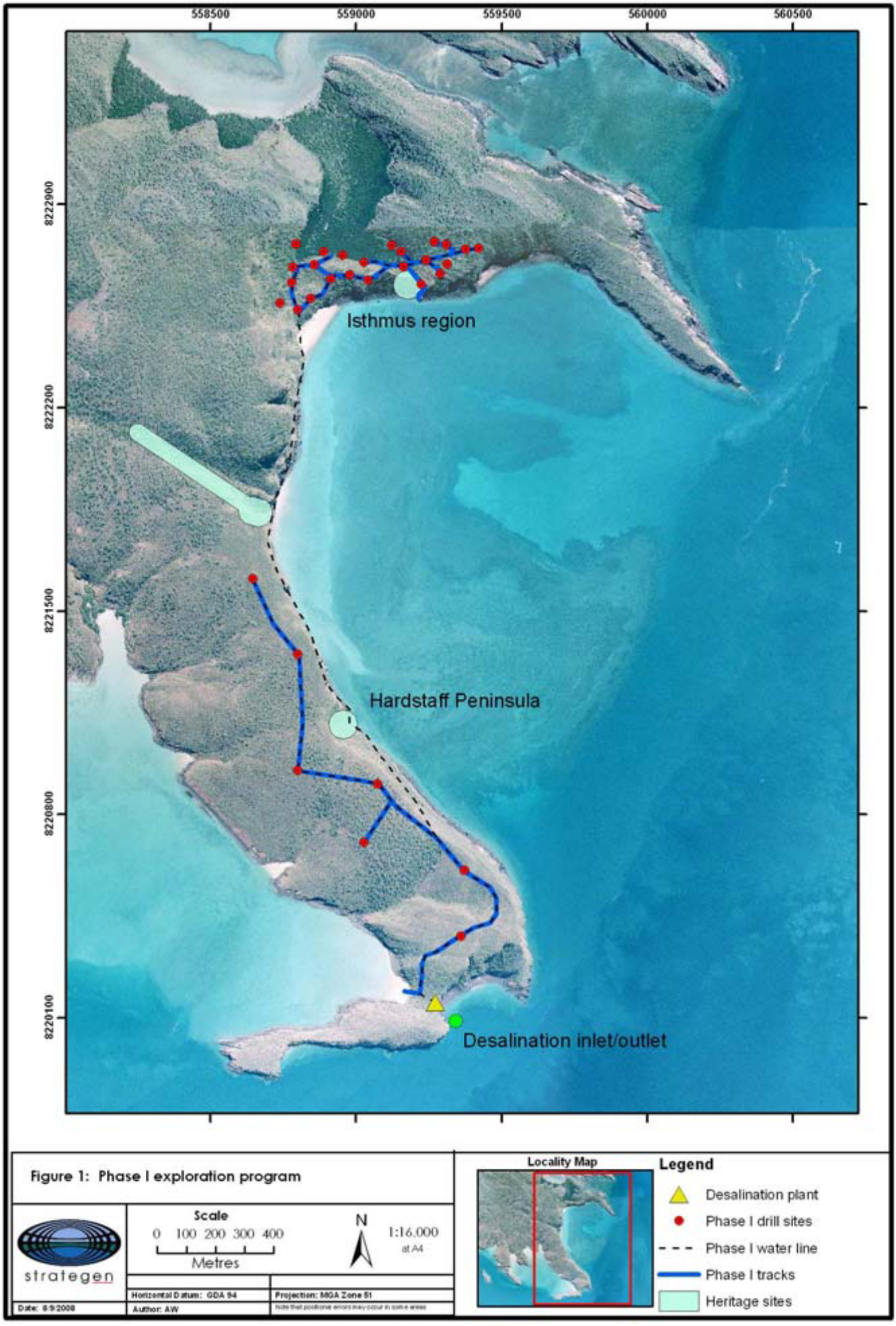
1.2 PURPOSE AND STRUCTURE OF THIS DOCUMENT

This Interim Environmental Management report applies to the Phase I exploration operations at Irvine Island that are largely managed from the operational base camp at Cockatoo Island. The review period includes the processes implemented since 17 June 2008 (when the program of works was approved), to the present 8 October 2008.

This document will be used as supporting information for the proposed Phase II exploration program referral at Irvine Island. The Phase II proposal will use the same environmental management as the Phase I program to minimise the disturbance footprint and potential environmental impacts.

This interim environmental management report includes:

- a description of the Phase I environmental management as implemented
- photos of the new technologies being used at Irvine Island, key infrastructure and examples of the environmental management strategies described in the Phase I referral being carried out
- detailed overview of environmental management performance and compliance to date and implementation of changes to management based on feedback from environmental performance.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Isthmus region
Hardstaff Peninsula
Desalination inlet/outlet
Figure 1: Phase I exploration program
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at A4
stategen
Horizontal Datum: GDA 94
Projection: MGA Zone 51
Date: 8/9/2008
Author: AW
Locality Map
Legend
Desalination plant
Phase I drill sites
Phase I water line
Phase I tracks
Heritage sites

2. ENVIRONMENTAL MANAGEMENT

2.1 PROJECT OVERVIEW

Pluton mobilised equipment by barge from Derby to Cockatoo Island during June and assembled the exploration operational base at the Cockatoo Island airstrip. Preliminary site preparation on Irvine Island commenced in early July 2008. Walking tracks, drill sites and helicopter landing sites were cleared using chainsaws and brushcutters. Vegetation debris and rocks were moved away from the cleared areas by hand. Details of cleared sites were recorded for monitoring vegetation recovery.

By late July, the desalination plant and water circulation equipment were mobilised in pieces to the Hardstaff site by helicopter. The desalination plant was assembled on Irvine Island and commissioned. Aboriginal Heritage sites were fenced or otherwise flagged to prevent access. All site preparation and assembly of plant and infrastructure has been conducted during daylight hours.

During August, Universal Drilling Platforms and drill rigs were mobilised to Irvine Island by helicopter. Twenty four hour exploration drilling commenced in mid August with all drill cores and samples logged and mobilised back to the mainland for analysis.

All staff are accommodated at Cockatoo Island and are mobilised daily to Irvine Island by helicopter.

2.2 WORKFORCE TRAINING

During the review period, all Pluton Resources staff and contractors were inducted internally for exploration operations at Irvine Island and separately by HWE Mining Pty Limited (HWE) for the mining operations and accommodation camp at Cockatoo Island. Any Pluton visitors were accompanied by Pluton inducted staff members at all times.

The Pluton and HWE induction programs include training and awareness for safety and emergencies, environmental procedures, heritage, quarantine management, general protocols and administration for operations at Irvine Island. The combined induction takes approximately one full day.

2.3 CLEARING AND SITE PREPARATION

Approximately 5.5 km of walking track has been cleared in the Hardstaff and Isthmus regions, amounting to a total of 0.55 ha. An additional 0.5 ha of vegetation was cleared for drill sites, helicopter landing sites and desalination site (Plate 1 to Plate 4). The referral allowed for 1.1 ha of clearing to be undertaken for Phase 1.

Variations to the Phase 1 program that have resulted in a reduced footprint include:

1. Four drill sites proposed in the Isthmus region have been placed on hold due to safety reasons; the sites are adjacent to the mangroves and a crocodile has been seen in this area.
2. A desalination plant will no longer be located at the Isthmus region. Instead, the Hardstaff desalination plant will service the entire Phase I drilling program. A water pipe has been run along the east coastline of Irvine Island to supply water to the Isthmus as shown in Figure 1. The

pipe has been laid above the high tide mark along the rocky coastline. No vegetation clearing was required to lay the pipe.

2.3.1 Vegetation recovery

Clearing has been undertaken through the use of chainsaws to trim vegetation. The cleared vegetation has already started to regenerate even though it is the dry season and no rainfall has occurred since clearing. Monitoring of vegetation has shown some substantial regrowth over a six week period following the track cutting process (Plate 5).

Plate 1 Track for walking access between sites and laying water circulation pipe

Plate 2 Track cutter refuelling station (bunded cage)

Plate 3 Clearing of a helipad landing/drill site (before and after)

Plate 4 Aerial of Hardstaff peninsula showing walking track and drill site 27 (Phase I)

Plate 5 Vegetative regrowth six weeks after track cutting process

2.4 WATER CIRCULATION SYSTEM AND DRILLING

Two desalination units and associated water circulation infrastructure have been installed at the Hardstaff Peninsula. The desalination units are situated on a wooden elevated platform constructed of Copper Chromium Arsenic (CCA) treated timber (Plate 6 to Plate 8). The platform provides a level and stable operating surface and minimises soil disturbance. The desalination inlet and outlet are located in deep water located on the eastern side of the Hardstaff Peninsula (Plate 8).

Four Universal Drilling Platforms (UDP), one new drill rig and one second-hand drill rig have been mobilised to Irvine Island (Plate 9 to Plate 11). Drilling commenced in August at the Hardstaff peninsula (Plate 12). So far, two drill holes have been completed and drilling continues in the Hardstaff region.

The drill rigs are operated from the UDPs which sit above the ground surface and result in little disturbance to the soil horizon and seed bank. Only trimming of vegetation is required to allow them to be set up. The adjustable feet also allow for drilling on an uneven surface (Plate 13). Each drill rig utilises two UDPs. While one UDP is in use, the other is dismantled and relocated to the next drill site. At the completion of the sampling, the drill is dismantled and heli-lifted to the next site. The water circulation system (storage tanks etc) is also relocated.

Plate 6 Desalination plant at Hardstaff peninsula and deep water inlet/outlet point

Plate 7 Desalination CCA treated platform

Plate 8 Desalination saltwater inlet during installation

Plate 9 Universal Drilling Platform, walking track, water circulation pipe and main reservoir tank

Plate 10 Universal Drilling Platform on uneven surface

Plate 11 Close-up of Universal Drilling Platform support leg and anchor points

Plate 12 Operating drill rig on Universal Drilling Platform and helicopter cage with bunded fuel

Plate 13 Ground disturbance underneath the Universal Drilling Platforms shown restricted to anchoring feet (vegetation regrowth at ~6 weeks)

2.5 QUARANTINE MANAGEMENT

A Quarantine Management Plan has been developed and implemented to ensure that all practicable measures are taken to protect existing vegetation and flora values at Irvine Island by preventing direct and indirect quarantine risk to Irvine Island. The plan also includes monitoring, surveillance, contingencies and reporting required for the exploration activities. Pluton Resources has successfully implemented the Quarantine Management Plan since 1 July 2008 when site preparations commenced at Irvine Island.

2.5.1 Quarantine process description

Exploration equipment was sourced from overseas and from various states within Australia. New equipment was preferentially purchased to minimise the potential for introducing new insect pests, weeds and plant diseases. All second hand equipment was cleaned to high specification.

All new and second hand exploration equipment was consolidated at Toll Energy in Perth. The equipment was inspected for Quarantine Risk Material (QRM) and cleaned if required. All equipment known to have had contact with soil was disinfected chemically to prevent the potential introduction of new plant diseases. Toll Energy provided quarantine inspection declarations to Pluton Resources.

A quarantine container facility is located at the Cockatoo Island airstrip, consisting of two secure sea containers. Quarantine inspections of all equipment, staff clothing, personnel effects and food take place at the quarantine container facility before being mobilised to Irvine Island. The facility is also used for storage of equipment and personnel effects known to be free of QRM. Preparation of the quarantine facility included thorough cleaning and insecticide treatment of sea containers, removal of weeds surrounding the facility and cleaning of storage boxes (Plate 14 to Plate 18).

Inside the quarantine containers, operational staff are allocated two storage containers for separating their Cockatoo Island clothes and their Irvine Island clothes and personnel effects. The doors of the containers are closed at all times except when in use. Both containers are maintained daily and treated with insecticide bombs at the end of each day shift.

Training

A quarantine consultant was engaged to develop quarantine procedures and quarantine awareness training in accordance with the Quarantine Management Plan. Training modules were delivered to staff and more intensive training was delivered to a select group of Pluton staff who undertake the quarantine inspections. The objectives of the training broadly included:

- general quarantine awareness
- ensure that all items going to Irvine Island are inspected and free of QRM
- QRM inspection techniques
- management and maintenance of the quarantine container facility
- processes to conduct quarantine monitoring program
- processes to conduct monthly internal audits and reporting to Operations Manager
- how to manage and respond to quarantine minor incidents, and major and critical breaches.

Monitoring and quarantine preventative measures

All sea containers are treated with insecticide bombs and monitored for rodents using flour trays and baits for at least 24 hours prior to unloading (Plate 20). The containers are inspected prior to any activity and all equipment is inspected for quarantine risk material before being transported by helicopter to Irvine Island.

Monitoring also includes daily maintenance of the quarantine containers, helicopter, daily inspections for QRM risk of the operational area at the Cockatoo Island airstrip and active drill sites at Irvine Island.

Quarantine breaches

The inspection process is set up to identify any quarantine breach from the identification of a tomato seed in a sandwich prior to departing Cockatoo Island (minor incident) to a critical breach which would be the identification of a tomato plant growing on Irvine Island for example. A description of the incidents to date and action taken is included in Section 3.1 and Appendix 1.

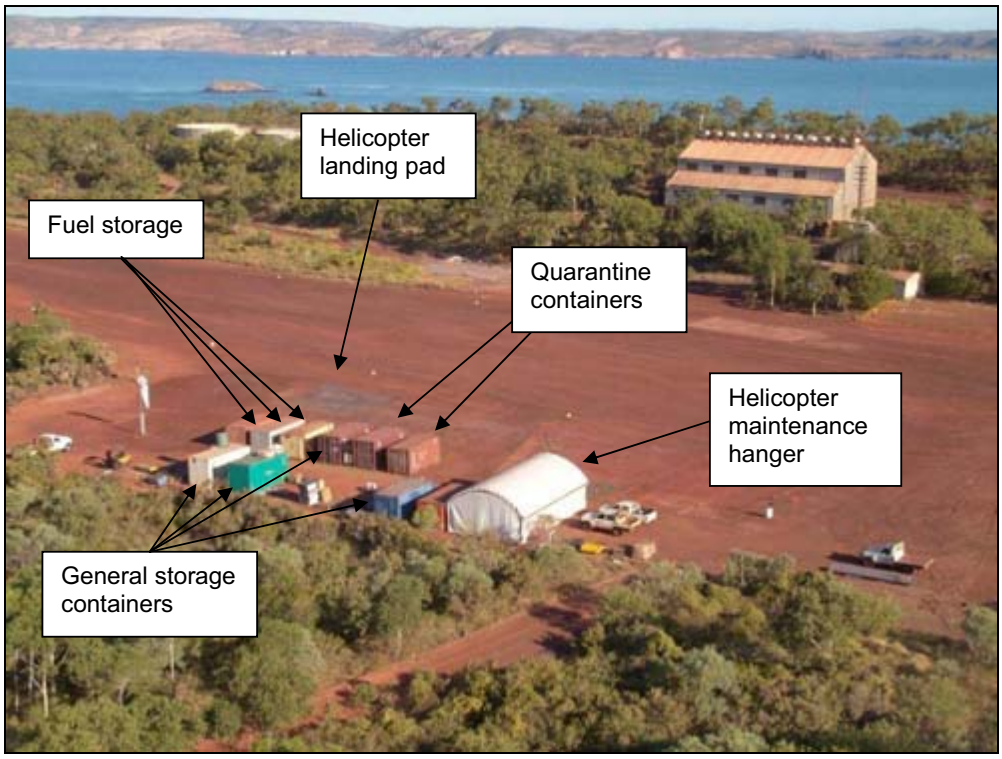

Plate 14 Pluton Resources operations at the Cockatoo Island airstrip

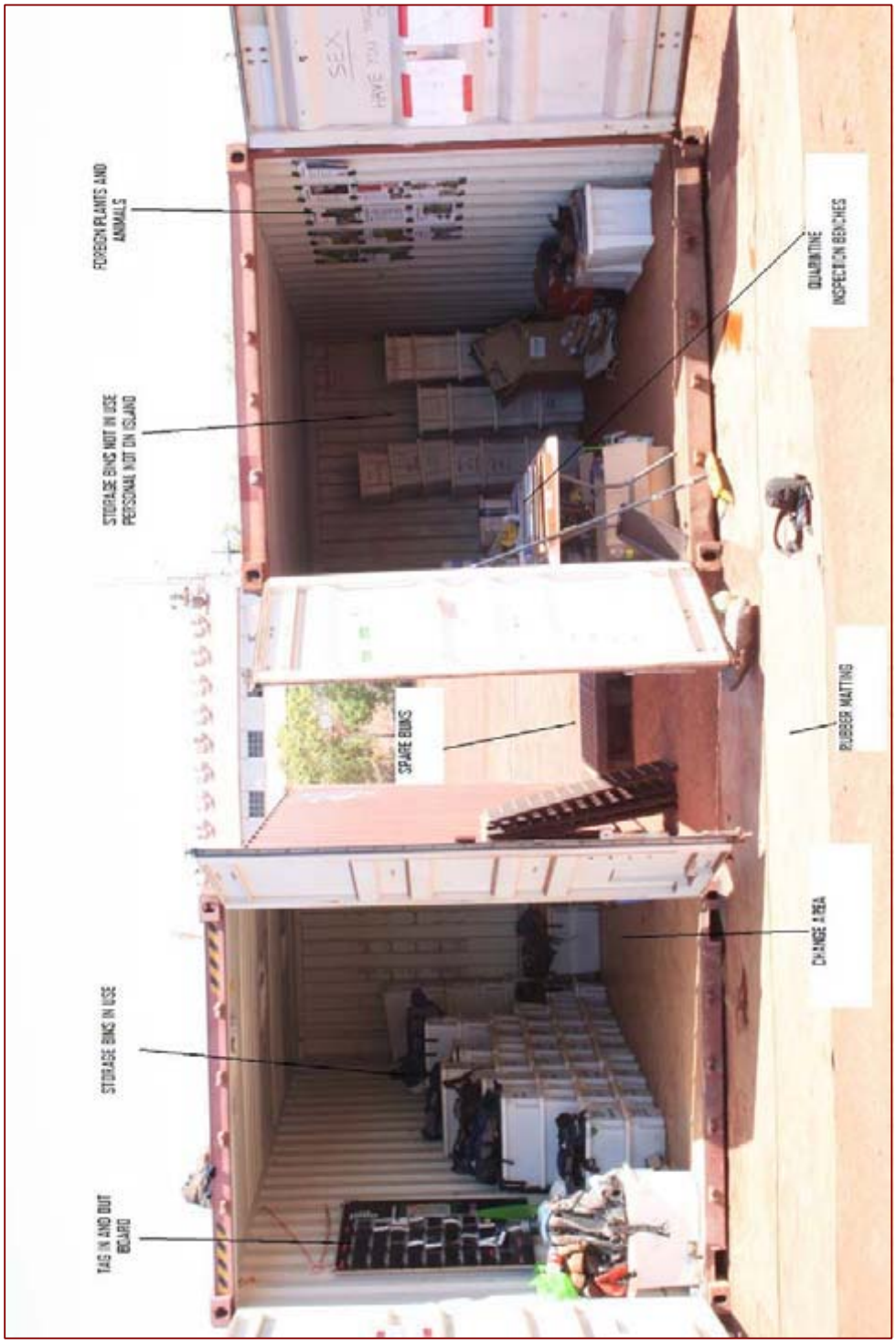

Plate 15 Quarantine container facility

Plate 16 Quarantine inspection of lunches for prohibited food items on Irvine Island

Plate 17 Pressure cleaning and disinfecting storage boxes prior to use in quarantine facility

Plate 18 Storage boxes for separating Cockatoo and Irvine Island clothing and personnel effects

Plate 19 Quarantine facility site preparation – weed and weed seed removal

Plate 20 Flour tray and bait for rodent monitoring

2.6 HERITAGE MANAGEMENT

A group of skilled Traditional Owners (Mayala people) are employed by Pluton Resources. The Traditional Owners are currently employed as cultural observers, field operators, logistics and heritage surveyors. The Traditional Owners have also conducted heritage inductions and educated the other Pluton Resources staff about the cultural values of Irvine Island.

Aboriginal Heritage sites have been surveyed extensively in the Phase I exploration area and surrounds. Areas of high significance have been fenced to prevent access (Plate 21).

Plate 21 Demarcating heritage protected areas

2.7 WASTE MANAGEMENT

Hydrocarbon absorbent matting and bunds are used as preventative measures for fuel transport, fuel storage, fuel transfer points and operational machinery at Irvine Island (Plate 6 and Plate 12). Oil absorbent matting is also used in the main water reservoir and primary settling tank (for water captured returning from the drill rig collar).

All sediment and soiled absorbent matting is returned to Cockatoo Island for disposal at the HWE hydrocarbon remediation facility.

Most human waste is managed under the HWE septic system at Cockatoo Island. Portable loos are provided as a contingency for operational staff on Irvine Island. All human waste at Irvine Island is contained for disposal at Cockatoo Island.

2.8 STAKEHOLDER CONSULTATION

Pluton Resources has engaged the Kimberley Land Council and Mayala elders throughout the operational phase of the Phase I exploration operations. Pluton Resources has arranged for officers from the Department of Industry and Resources and Department of Environment and Conservation to inspect the environmental and quarantine management procedures.

3. ENVIRONMENTAL INCIDENTS

3.1 QUARANTINE INCIDENTS

The various contingencies and triggers for detections of QRM are categorised as minor incidents, and major and critical quarantine breaches. Records of all quarantine incidents and breaches are provided in Appendix 1 and are summarised below.

Quarantine Inspectors and staff record all minor incidents internally using an incident record sheet. Minor incidents largely consist of prohibited food items intercepted at Cockatoo Island during inspection and QRM contamination on clothing items. The occurrence of minor incidences has shown to increase following a shift rotation or introduction of new staff. Pluton Resources remind all staff about this trend at the daily morning meetings, particularly following staff rotation.

Major breaches are quarantine breaches that are deemed to be significant, but not of serious threat to Irvine Island and can be resolved internally by the Quarantine Inspectors and Operations Manager. Major breaches are documented using a non-compliance record sheet. All major breaches are reported to and signed off by the Operations Manager.

Four major breaches have occurred since the commencement of the program:

1. Prohibited food was taken ashore to Irvine Island. The food item was accidentally spilled on the ground at Irvine. All traces of the food were contained and disposed of back at Cockatoo. The remaining prohibited food was consumed. The Operations Manager discussed the breach at the staff meeting the following morning.
2. Treated pallets were to be mobilised to Irvine Island in batches. Quarantine inspections of the second batch of pallets detected a number of insect borer holes in the wood (possibly Cerambycids or Bostrychids). All pallets previously mobilised to Irvine Island were reinspected - no additional holes were detected. As a precautionary measure, all pallets were returned to Cockatoo Island. The entire supply of pallets was then loaded and stored in a secure empty sea container and monitored for borer activity. No active frass or additional holes were detected in the pallets. No further action was taken.
3. A sea container mobilised to Cockatoo Island from the mainland was inspected on arrival and found to be contaminated inside with weed seeds. The breach occurred after being declared free of QRM prior to shipment from Tasmania and at the Toll West depot. All seeds were contained and removed prior to unpack. All equipment was inspected during unpack as per the Quarantine Management Plan. No further seeds were detected on the equipment. It was concluded that the weeds entered the container after being inspected in Perth. The container was possibly opened at the Derby holding depot. No further action was taken.
4. A gecko was found in an open tool bin which had been located on Irvine Island for approximately 1 week. The gecko was placed in a container and taken to Cockatoo Island for identification. The Mayala traditional owners identified the gecko as a native species which is found on Irvine Island.

Critical breaches are quarantine breaches that are deemed to be of significant threat to Irvine Island. Critical breaches involve a specific procedure including a stop work action and liaison with the DEC for advice. Critical breaches are documented using the non-compliance records sheet. No critical breaches have occurred since the project commenced.

All recorded incidents and breaches will be included in the final Quarantine Management Report submitted to DEC at the end of Phase 1 of the exploration project.

3.2 SPILLS

One significant hydrocarbon spill occurred during the review period. Two 200 L drums of diesel fuel were accidentally dropped onto into shallow water off the coast of Irvine Island during mobilisation by helicopter. The incident occurred near the end of the day. The fuel spilled into the ocean. The drums and helicopter cage were transported back to Cockatoo Island the same day (Plate 22). The spill could not be contained due to limited remaining daylight and the rate at which the fuel was being dispersed by the strong current. The following morning investigations revealed no visible signs of fuel either on the coast or in the water, or any visible signs of any impact to the reef or surrounding area. Drilling operations were suspended and the incident independently investigated by Heli-Logistics. The incident was found to be largely the result of pilot error. Recommendations made by Heli-Logistics have been implemented and no further incidents have occurred. A full copy of the incident report is contained in Appendix 2.

Plate 22 Damaged helicopter cage, bund and fuel drums

Appendix 1
Quarantine incidents and breaches

Incident record sheet example (for minor breaches)

Incident	Commodity or item	Date	Location	Inspection officer	Details	Remediation/ action
QRM	Boots	12/2/2008	Cockatoo Is	Gus Williams	Soil on Jims boots	Removed soil. Boots treated with Virkon Counselled Jim
Prohibited Food	Food	12/2/2008	Cockatoo Is	Gus Williams	Nuts in shell	Not transported to Irvine Is
QRM	Helicopter flooring	13/2/2008	Cockatoo Is	Pilot	Whole seeds	Removed all seeds. Disposed in QRM bin
QRM	KINCHROME TOOL KIT IN CARDBOARD BOX.	1/7/08	Cockatoo Is	IAN ROGERS	CKKROACH	KILLED, BOX DISCARDED
QRM	BOOTS	2/7/08	Cockatoo Is	DICKO	WEED SEED	REMOVE/ SPRAY
QRM	CONTAINER	2/7/08	Cockatoo Is	Gus	LIVE INSECT	SQUASHED
QRM	BOOT	2/7/08	Cockatoo Is	Gus	Seed + mud on Kevins Boot	seed removed brushed - sprayed
QRM	BOOT	3/7/08	Cockatoo Is	Gus	Seed on Stevens new boot	seed removed
PROHIB FOOD	FOOD	4/7/08	COCKATOO	JOHN GUS	TOMATO & CUCUMBER	BAG/BIN
QRM	BAG + PICK HOSE MAP POUCH	5/7/08	COCKATOO	AL/GUS	WEED/ SEED	REMOVED/ bagged
QRM	Map Pouch	5/7/08	Cockatoo	Gus Willms	Weedseed	Removed/bagged
Broken seal on container door	Container	6/7/08	Cockatoo	Al Read	Rubber seal frayed - prob not breached.	Toll notified Container bonded + bailed
Prohib. Food x2.	Food x2	07/07/08	Cockatoo	John McD	Watermelon seed in lunch x2	Remove all seeds

(2)

Incident record sheet example (for minor breaches)

Incident	Commodity or item	Date	Location	Inspection officer	Details	Remediation/ action
PROHIB FOOD	Food x2	9/7	Cockatoo	Stan	Watermellon seed	Removed
"	Food	"	"	Al Stan	Orange	Removed
"	"	9/7	"	Al/Pam	Food in quarantine bin.	Removed
Prohib Food	Food	10/7	Cockatoo	Pam	Rockmelon seed	Removed
Food in Bin		10/7	Cockatoo	Pam	Coke can in QRM bin	Removed
Spider in 2nd Quarantine Container	Spider (Dark Brown) (Long legs.)	12/07	Cockatoo	John	spider ran from rack (maybe from Irvine)	Container Bombed.
FOREIGN MATTER IN SHIPPING CONTAINER	SEEDS & DIRT	14/7/08	COCKATOO	LINDSAY	SEEDS & OTHER MATTER AMONGST PLATFORM * COMPONENTS	MATERIAL CLEANED & BRUSHED FREE OF SEEDS
Prohib Food	tomato	21/7/08	Cockatoo	Rod	Cherry [illegible]	Removed & [illegible]
Spider & [illegible]	[illegible]	21/7/08	Cockatoo	Rod	on power pump	Removed & Sprayed [illegible]
Food	Food x2	22/7/08	Cockatoo	Al + John	Tomato + grapes	Removed
Procedural	Clothes cont not bombed	22/7/08	Cockatoo	PK		Container Bombed

* IT IS BELIEVED FOREIGN MATTER ENTERED CONTAINER AFTER IT WAS SHIPPED FROM BURNIE & QUARANTINED IN WELSHPOOL.

(3)

Incident record sheet example (for minor breaches)

Incident	Commodity or item	Date	Location	Inspection officer	Details	Remediation/ action
Seeds	~~[illegible]~~ tools	22/7/08	Cockatoo	Ken	Water bottle	Removed
Plant Material	Contractors Boots	21/7/08	Cockatoo	Pam		Plant Material Removed Sanitised
Weed Seeds	Contractors Work Pants	28/07/08	Lockatoo	Alistair		Removed
Plant Material	Contractors Gaters	28/07/08	Lockatoo	Pam	Unknown - in velcrose	Gaters Left on Lockatoo
Suspect Prohib Food.	Sun-Dried Tomatos	4/08/08	Cockatoo	John	Did not Know if seeds visible in Sun-Dried Tom after	Removed from lunches, advice from other quarantine officers sought
Plant Material	Contractors Boots	05/08/08	Lockatoo	Pam		Removed
Suspect Prohib Food.	Sun-Dried Tomatos	18/08/08	"	JOHN	SUN DRIED TOMATOS	WHEN IN DOUBT CHUCK IT OUT!
Seed	Camera Gear	18/8/08	"	Al	~~Seed~~ Seed stuck to Velcro Packing.	Removed - all Seed checked.
Seed	Technological	"	"	Pam	Seed in camera bag	Removal + all checked
Seed	Gaiters	"	"	Al	Seeds of gaiters	Removed + all checked

Orange Orange 21/8 Cockatoo Al Orange Removed

(4)

Incident record sheet example (for minor breaches)

Incident	Commodity or item	Date	Location	Inspection officer	Details	Remediation/ action
Food in Quarantine container	Orange	21/8	Quarantine container	Pam		Removed.
Food QRM.	Cantaloupe	23/08	11	John.	Seeds not removed	- Scraped off and disposed of.
Food	Watermelon	25/08	Cockatoo	Ali Pam	Seeds	Confiscated.
Food	Rockmelon	26/08	Cockatoo	Pam	Seeds	Removed.
Food	Lemons Watermelon	26/8	"	Ali	Seeds	Removal
Food	Rockmelon	27/8	Cockatoo	Pam	seeds	Removed
Fruits	ORANGES	1/9	/	LMC	SEEDS	REMOVED

Pluton Resources Limited - Non-compliance Report
(for major and critical quarantine breaches)

DATE OF BREACH 3/7/08	PHOTO OF NON-COMPLIANCE TAKEN: ☐YES ☒NO
Name of Quarantine Inspector GUS WILLIAMS	Documentation reference (eg freight company documentation) N/A

Description of Non-compliance

① PROHIBITED FOOD ACCIDENTALLY TAKEN TO IRVINE ISLAND

② SOME PERMITTED FOOD WAS SPILLED ON THE GROUND DURING LUNCH.

Breach Classification: ☒ Major ☐ Critical If Critical DEC notified Yes/no	Non compliance report enclosed: ☐YES ☒NO

Corrective action details

① PROHIBITED FOOD WAS CONSUMED

② ALL SPILLED FOOD WAS PICKED UP & BROUGHT BACK.

Acknowledgement of Non-compliance (Operations Manager)

Name AC REED

Signature

Date 4-7-08

Proposed follow up date: 4-7-08

Follow up date and close out details

Brought up at morning meeting.

Follow up Audit Date	7/4/08
Details	DISCUSSED AT TEAM MEETING FOLLOWING DAY

Pluton Resources Limited - Non-compliance Report
(for major and critical quarantine breaches)

DATE OF BREACH ~ 17/07/08	PHOTO OF NON-COMPLIANCE TAKEN: ☐YES ☑NO
Name of Quarantine Inspector: Lindsay McDougall	Documentation reference (eg freight company documentation)

Description of Non-compliance

Seeds in container, newly arrived on ~~location~~ Catalan
It is believed that seeds entered container after shipping from Burnie & quarantined in Welshpool. Container may have been opened at Derby.

Breach Classification: ☑ Major ☐ Critical If Critical DEC notified Yes/(No)	Non compliance report enclosed: ☐YES ☐NO

Corrective action details

Seeds removed, gear inspected carefully

Acknowledgement of Non-compliance (Operations Manager)

Name: Pamela Kaye
Signature: PKaye
Date: 22 July 08.

Proposed follow up date:

Follow up date and close out details

Follow up Audit Date Details	

Pluton Resources Limited - Non-compliance Report
(for major and critical quarantine breaches)

DATE OF BREACH 24/07/08	PHOTO OF NON-COMPLIANCE TAKEN: ☑ YES ☐ NO
Name of Quarantine Inspector JOHN / LINDSAY . MCD	Documentation reference (eg freight company documentation)

Description of Non-compliance

GECKO LOCATED IN TOOL BIN AFTER SEVERAL MOVEMENTS ON IRVINE, POTENTIALLY A HOUSE GECKO. CAPTURED FOR ID.

Breach Classification: ☒ Major ☐ Critical If Critical DEC notified Yes (no)	Non compliance report enclosed: ☐ YES ☑ NO

Corrective action details

CAPTURED GECKO & PLACED IN QUARANTINE CONTAINER

Acknowledgement of Non-compliance (Operations Manager)

Name

Signature

Date

Proposed follow up date: 25/07

Follow up date and close out details GET ID FROM PHOTO.
Mayala TO's identified gecko as a native.
No further follow up

Follow up Audit Date Details	#

Appendix 2
Spill incident

Investigation into Pluton Incident (HWE No. 26405)

Load release and diesel spill

An investigation was carried out by Lindsay McDougall (Project Manager) with assistance from Tom Hennicke, (supervisor) Ben Carpenter (supervisor), Tony Feller (pilot) and Nathan Badcock (engineer).

Facts found

As outlined in the initial incident report and notification:

- Helicopter departed Cockatoo Island approximately 4.45pm on 14 September 2008 with a load of 2 X 200 litre drums of diesel fuel for delivery to Irvine Island
- Fuel was carried in the approved manner in a bunded cage designed specifically for the purpose of carrying fuels and oils
- Pilot was unsure of where the load was to go
- Once in the air the pilot was unable to communicate with the receiving rig for some time due to noise on the radio described as a "squelch" problem
- As the pilot neared Irvine Island he was concerned that the load was spinning badly and feared that the long line could be twisted excessively and damaged or even break.
- The pilot was still trying to communicate with the receiving drilling rig whilst readying himself to drop the load if it became necessary.
- The pilot inadvertently pulled the wrong switch, the load was released prematurely instead of activating the comms button, releasing the load onto the fringing reef [AGD84 zone 51, E 0559490 N 8221355 (S 16°05' 18.3", E 123°33' 17.9")].
- On realizing what had happened the pilot returned to Cockatoo Island and picked up the engineer
- The engineer was dropped onto the drying reef and hooked up the remainder of the load
- The remainder of the load was returned to Cockatoo Island where it was placed on a bunded pallet
- The pilot returned to pick up the engineer and crews awaiting pickup from Irvine Island before last light

Immediate actions following the incident

- There was no chance to contain any spill as daylight was running out and the pilot was concerned for the safety of contractors who may be stranded on Irvine Island after dark
- The sling setup was inspected and it was found that the swivel attached to the safety hook was only partially operating when under load
- A further swivel was added to the sling which appears to have resolved the spinning issue – that is, allowing the sling line not to tangle if the load spins

- The reef was examined for damage the following morning and there were no signs of physical damage to the reef
- There was no visible sign of the diesel spill the following day and a combination of evaporation and tidal action appears to have dispersed it quickly

Result of Investigation

A combination of factors appear to have lead to the incident:

- The pilot had insufficient information on the load destination when he left the helipad
- The failure of the radio communications added to the confusion and placed further stress on the pilot who was unable to raise anyone on the radio to clarify the destination, etc
- The pilot's stress was further compounded by the partial failure of the swivel to stop the sling winding up
- The pilot was aware of the shortage of daylight hours to complete the task and pick up personnel before last light
- A combination of these events appears to have resulted in the pilot releasing the load unintentionally, although he may have had to come to that decision later anyway if the load had continued to spin uncontrollably.

Recommendations to prevent a recurrence or similar incident

1. Replace the swivel with a more suitable one.
2. Alter the flight path from Cockatoo Island to Irvine Island when carrying sling loads to avoid any areas where personnel could be at risk if a load had to be dropped.
3. Establish radio contact with the receiver of the load on Irvine Island before taking off.
4. Have an agreed set of loads and destinations before setting out.
5. Have one contact person. The agreed loads and destinations only to be changed by the contact person for that round of deliveries/pickups.
6. Other personnel not directly involved in attaching or receiving loads should stay off the working channel for helicopter operations (Ch 39) until the cycle of deliveries/pickups is complete.
7. Operating procedures will be updated where applicable to reflect these recommendations.

Lindsay McDougall

16 September 2008

Further Follow up:

Helicopter operations were shut down on 15th September until an independent company (Heli-Logistics investigated cause of incident and identified corrective actions and reviewed Osborne procedures and technical competence. Investigations occurred on 19 and 20 September on Cockatoo Island.

The independent investigation found:

- That pilot(s) are highly experienced and exceed industry standards in experience.
- A high level of professionalism is observed.
- Air craft was properly loaded and operated.
- The swivel being used experienced significant binding and partial seizure under load resulting in destabilization and 'climbing' load, which distracted the pilot.
- Radio communications (squelching because of faulty radio) added to pilot distraction. Combined distraction resulted in pilot erroneously pressing the electrical load-release switch rather than the radio 'press to talk'.

No adverse findings were made against the pilot or owners of helicopter.

Heli-Logisics provided a report which included recommendations.

Summary of main practical recommendations implemented:
(For full details see Heli-Logistics report)

- Current swivel arrangement was replaced with double ball bearing type swivel;
- Radio equipment checked for serviceability and correct function prior to being used within flight operations.
- Reminder/instruction that there is to be no unnecessary chatter on heli frequency;
- Amend SOP so that load plans are received prior to accepting a load.
- Pilot to endeavour to establish 2 way communication with destination prior to departure.
- Amend SOP to disengage electrical load release when air craft is above 300ft and mandatory re-engage and check prior to descending through 300ft.

Pamela Kaye
2 October 2008

Appendix 2
Heritage Survey
Executive Summary
(Anthropos Australia Pty Ltd 2008)

EXECUTIVE SUMMARY

- Pluton Resources Ltd is seeking to expand its current Exploration Drilling Program on E04/1172, on the eastern side of Irvine Island into 2009.

- This Report details the results of an Aboriginal heritage survey that used a Work Program Clearance methodology to examine Stage Two of the Survey Area.

- The Survey Area is entirely located within the *Mayala* native title claim (*Mayala*-WC98/39).

- The Survey was undertaken in two Field Trips:

1. Field Trip One – ethnographic and archaeological Survey on Irvine Island, was conducted from Sunday the 17th of August to Sunday the 24th of August 2008 inclusive, by Nicholas Green and Daniel Monks of Anthropos Australis Pty Ltd. Glenn Taylor of Stellar Productions Pty Ltd filmed the conduct of the Survey. Robert Houston (Future Acts Lawyer-KLC), Tony Schoer, Pamela Kaye, Alistair Reed, Anthony Dickson and Rod Campbell (Pluton) supported the conduct of the Survey. Corinna Martin and Annie Phillips (Lawyers-KLC) supported the conduct of the Survey. The Survey was conducted with the cooperation and involvement of the *Mayala* native title claimants nominated by the *Mayala* Claim Group (the *Mayala* Consultants);

2. Field Trip Two - ethnographic Consultations at One Arm Point, was conducted on Tuesday the 16th of September 2008, by Kyoko Metz and Alison James of Anthropos Australis Pty Ltd. Corina Martin (Lawyer-KLC) supported the conduct of the Consultations.

- The Survey was conducted with the cooperation and involvement of the *Mayala* native title claimants nominated by the *Mayala* Claim Group (the *Mayala* Consultants).

- The *Mayala* Consultants that participated in the Survey have had the opportunity to systematically walk through the Survey Area and to view the proposed and existing Work Sites and Walking Tracks the subject of the 2009 Exploration Drilling Program.

- The Conditions in this Report were discussed and endorsed by the *Mayala* Consultants that participated in the Survey on Saturday 23rd August 2008.

- It is a **requirement** that Pluton acknowledges and ensures that its employees and contractors, as appropriate, are advised that:

1. The twenty nine proposed Work Sites and associated Walking Tracks are ethnographically and archaeologically **cleared** to proceed;

2. The fifteen proposed Infill Drill Holes in existing Work Sites are archaeologically **cleared** to proceed;

3. Any additional ground disturbing and non-ground disturbing work that Pluton wishes to conduct on Irvine Island will need to be the subject of an additional ethnographic and archaeological Survey;

4. The extant 'Not Cleared Work Areas' on Irvine Island identified during the 2007 ethnographic survey are to remain in force until the *Mayala* Traditional Owners have had the opportunity to revisit those areas to discuss them with other Senior *Mayala* Traditional Owners; and

5. *Mayala* Heritage Monitors (a minimum of two) are to be engaged by Pluton to monitor the clearance of the vegetation from the proposed Work Sites in the 2009 Exploration Drilling Program.

- It is a **requirement** that Pluton complies with the Native Title Heritage Protection Agreement between Portman Iron Ore Ltd with the Kimberley Land Council and the Side Letter Agreement between Pluton and the Kimberley Land Council.

- It is a **requirement** that Pluton avoids all registered Aboriginal sites on Irvine Island. However, this Report provides Pluton with the agreement of the *Mayala* Traditional Owners to access registered Aboriginal site ID 13317 and ID 13466 for the proposed stated 2009 Exploration Drilling Program only subject to the stated requirements.

- It is a **requirement** that Pluton ensures that it informs its workforce that it is exploring on a significant Aboriginal site and that constraint and respect must be shown by that workforce at all times.

- Finally, it is a **requirement** that Pluton ensures that there is no activity of any sort undertaken on the western side of Irvine Island.

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

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APPENDICES

FIGURE

1. SUMMARY

Mattiske Consulting Pty Ltd was commissioned by Strategen 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 Strategen 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 tectifica* 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
Eucalyptus kenneallyi (P1) MYRTACEAE	• Koolan Island • Storr Island	*Eucalyptus kenneallyi* 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.
Phyllanthus aridus (P3) EUPHORBIACEAE	• 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	*Phyllanthus aridus* 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.
Solanum leopoldense (P3) SOLANACEAE	• King Leopold Ranges • Silver Gully Creek • Worjalum Reserve • Prince Regent Nature Reserve • Hidden Island	*Solanum leopoldense* 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 umbella*ta 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

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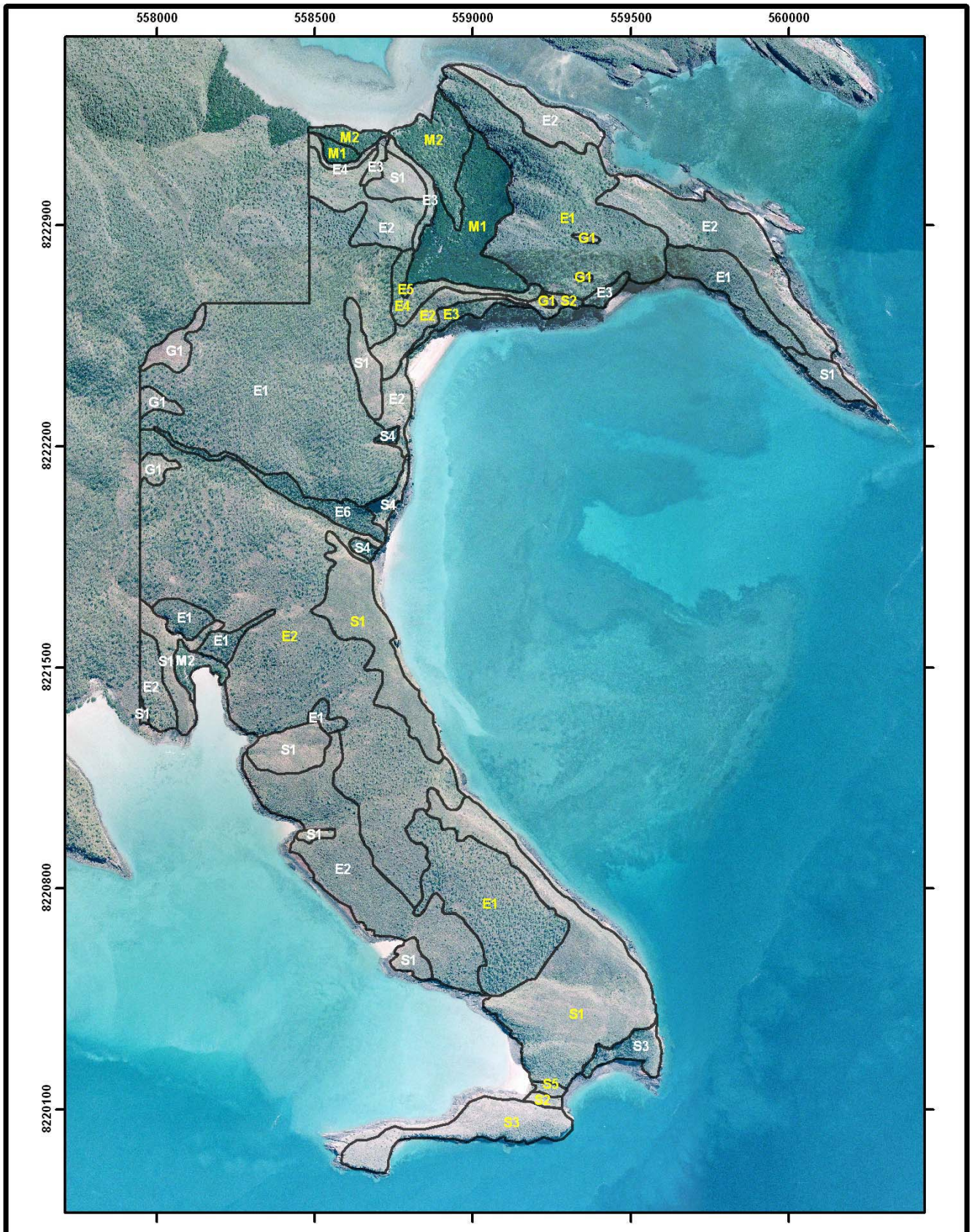
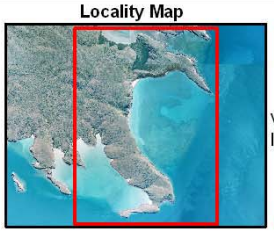


Figure 1: Irvine Island vegetation mapping

Locality Map



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

stategen

Scale

0 100 200 300 400

Metres

N

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

Source: Vegetation map - Mattiske 2008
Aerial map - Whelans 2007

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

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

Conservation Code	Category
Ex	**Extinct** Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** 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.
CE	**Critically Endangered** 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.
E	**Endangered** 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.
V	**Vulnerable** 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.
CD	**Conservation Dependent** 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.

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

Conservation Code	Category
PTD	**Presumed Totally Destroyed** 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: (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	**Critically Endangered** 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: (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	**Endangered** 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: (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	**Vulnerable** 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: (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	**Poorly-known ecological communities** 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.
P2	**Poorly-known ecological communities** 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.
P3	**Poorly known ecological communities** (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: (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; (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.
P4	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.
P5	**Conservation Dependent ecological communities** 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.

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

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

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

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	*Cheilanthes brownii*	x			
	Cheilanthes caudata	x			
PTERIDACEAE	*Acrostichum* sp.	x			
CUPRESSACEAE	*Callitris columellaris*	x			
PANDANACEAE	*Pandanus spiralis*				x
POACEAE	* *Bothriochloa pertusa*	x			
	* *Cenchrus echinatus*	x			
	Cenchrus elymoides var. *elymoides*	x	x		
	* *Cenchrus setigerus*	x			
	* *Chloris barbata*	x			
	* *Chloris gayana*	x			
	Chrysopogon latifolius	x			
	Cymbopogon procerus	x	x		x
	Digitaria sp.		x		
	* *Eleusine indica*	x			
	* *Eragrostis amabilis*	x			
	Eriachne avenacea	x			
	Eriachne ciliata		x	x	x
	Eriachne obtusa				x
	Eriachne sulcata	x			
	Heteropogon contortus	x			
	* *Megathyrsus maximus*	x			
	* *Melinis repens*	x		x	
	Panicum decompositum	x	x		x
	Paspalum scrobiculatum	x			
	Pseudopogonatherum contortum			x	
	Sacciolepis myosuroides	x			
	* *Setaria pumila* subsp. *pumila*	x			
	Sorghum ecarinatum	x			
	Sorghum plumosum	x			
	Spinifex longifolius	x			x
	Thaumastochloa sp.	x			
	Triodia bynoei	x			x
	Triodia pungens	x			
	Triodia sp.	x			
	* *Urochloa mosambicensis*	x			
	Urochloa subquadripara	x			
	Whiteochloa cymbiformis	x			
CYPERACEAE	*Bulbostylis barbata*			x	
	Cyperus bulbosus	x			
	Cyperus microcephalus				x
	Cyperus microcephalus subsp. *microcephalus*	x			x
	Cyperus microcephalus subsp. *saxicola*			x	
	Fimbristylis cymosa	x			
	Scleria sp.		x		
SCROPHULARIACEAE	*Buchnera linearis*	x			
FLAGELLARIACEAE	*Flagellaria indica*		x		x
COMMELINACEAE	*Cartonema spicatum*	x			
	Cartonema spicatum var. *humile*	x			
	Commelina ensifolia	x			
	Murdannia graminea	x			
ASPARAGACEAE	*Asparagus racemosus*		x		x
TACCACEAE	*Tacca leontopetaloides*	x			
	Tacca maculata	x			
DIOSCOREACEAE	*Dioscorea bulbifera*	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		*Cymbidium canaliculatum*			x	
CASUARINACEAE	*	*Casuarina equisetifolia*			x	
ULMACEAE		*Celtis australiensis*	x			
MORACEAE		*Ficus brachypoda*				x
		Ficus aculeata	x			x
		Ficus aculeata var. *indecora*		x		
		Ficus platypoda	x	x		x
		Ficus virens var. *virens*	x			
PROTEACEAE		*Banksia dentata*			x	
		Grevillea agrifolia		x		
		Grevillea agrifolia subsp. *agrifolia*	x		x	x
		Grevillea cunninghamii	x			
		Grevillea heliosperma		x	x	x
		Grevillea pyramidalis subsp. *pyramidalis*	x	x		x
		Grevillea refracta subsp. *refracta*	x		x	x
		Hakea arborescens		x		x
		Persoonia falcata	x			
		Stenocarpus acacioides	x			x
SANTALACEAE		*Exocarpos latifolius*	x		x	x
		Santalum lanceolatum	x			x
LORANTHACEAE		*Amyema bifurcata*			x	x
		Amyema thalassia	x			
		Dendrophthoe acacioides	x			x
		Diplatia grandibractea	x			
		Lysiana spathulata subsp. *spathulata*	x			
AMARANTHACEAE		*Amaranthus cf. undulatus*			x	
		Amaranthus undulatus	x			
	*	*Amaranthus viridis*	x			
		Gomphrena sp.	x			
		Ptilotus capitatus			x	
		Ptilotus exaltatus var. *exaltatus*	x		x	
		Ptilotus fusiformis				x
		Ptilotus fusiformis var. *gracilis*	x			
NYCTAGINACEAE		*Boerhavia dominii*	x			
AIZOACEAE		*Sesuvium portulacastrum*				x
		Zaleya galericulata subsp. *galericulata*	x			
PORTULACACEAE		*Portulaca pilosa*	x			
CARYOPHYLLACEAE		*Polycarpaea involucrata*		x		
		Polycarpaea longiflora	x			
LAURACEAE		*Cassytha candida*	x			x
		Cassytha capillaris	x			
CAPPARACEAE		*Capparis spinosa* var. *nummularia*				x
		Cleome viscosa				x
MORINGACEAE	*	*Moringa oleifera*	x		x	
DROSERACEAE		*Drosera broomensis*	x			
		Drosera burmanni	x			
		Drosera petiolaris	x			
		Drosera 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	*Byblis filifolia*	x			
	Byblis liniflora		x		
	Byblis sp.	x			
MIMOSACEAE	*Acacia ampliceps*	x			
	Acacia deltoidea subsp. *deltoidea*	x		x	
	Acacia hippuroides	x	x	x	x
	Acacia multisiliqua	x	x		x
	Acacia neurocarpa	x			x
	Acacia oligoneura	x		x	
	Acacia plectocarpa subsp. *plectocarpa*	x	x		
	Acacia stigmatophylla	x			x
	Acacia translucens			x	x
	Acacia tumida var. tumida	x	x		x
	Acacia wickhamii		x		
	Acacia sp.	x			
	* *Leucaena leucocephala*			x	
	* *Leucaena leucocephala* subsp. *leucocephala*	x			
	Neptunia gracilis forma *gracilis*	x			
CAESALPINACEAE	*Bauhinia cunninghamii*	x			
	* *Bauhinia purpurea* (planted)	x			
	Chamaecrista mimosoides	x			
	Chamaecrista symonii	x			
	* *Delonix regia*	x			
	Erythrophleum chlorostachys	x			
	* *Senna alata*	x			
	Senna goniodes	x			
PAPILIONACEAE	*Abrus precatorius* subsp. *precatorius*				x
	* *Alysicarpus ovalifolius*	x		x	
	Cajanus acutifolius	x			
	Cajanus cinereus		x		x
	Cajanus reticulatus var. *grandifolius*	x			
	Cajanus viscidus	x			
	Cajanus sp.	x			
	Canavalia ?papuana				x
	Canavalia rosea	x			
	Christia australasica	x			x
	* *Clitoria ternatea*	x			
	Crotalaria alata	x	x		
	Crotalaria montana var. *angustifolia*	x			
	Cullen badocanum			x	
	Desmodium filiforme	x			
	* *Desmodium tortuosum*	x			
	Galactia tenuiflora	x			
	Galactia sp.	x			
	* *Gliricidia sepium*	x			
	Glycine tomentella				x
	Gompholobium subulatum	x	x	x	x
	Indigofera hirsuta	x			
	Indigofera linifolia	x			
	Indigofera mackinlayi	x			
	Indigofera polygaloides	x			
	Indigofera sp.			x	
	Indigofera sp. A Kimberley Flora (G.J. Keighery & N. Gibson 70)	x			
	* *Macroptilium lathyroides* var. *semierectum*	x			
	Nomismia rhomboidea				x
	* *Stylosanthes hamata*	x			
	* *Stylosanthes scabra*	x			
	Templetonia hookeri	x		x	x
	Tephrosia coriacea			x	
	Tephrosia leptoclada	x			
	Tephrosia rosea var. *rosea*				x
	Tephrosia 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
ZYGOPHYLLACEAE	*Tribulopis angustifolia*	x			
RUTACEAE	*Boronia wilsonii*	x			
BURSERACEAE	*Canarium australianum*	x			
	Canarium australianum var. *glabrum*			x	
MELIACEAE	*Owenia vernicosa*	x			
POLYGALACEAE	*Comesperma secundum*	x			
EUPHORBIACEAE	*Acalypha wilkesiana* (planted)	x			
	Breynia cernua	x			
	Bridelia tomentosa	x	x	x	
	* *Euphorbia cyathophora*	x			
	Euphorbia distans		x	x	
	* *Euphorbia hirta*	x			
	Euphorbia kimberleyensis	x			x
	* *Euphorbia tirucalli*			x	
	Excoecaria ovalis	x			
	Flueggea virosa	x			
	Flueggea virosa subsp. *melanthesoides*	x			x
	* *Jatropha gossypifolia*	x			
	Microstachys chamaelea				x
	Petalostigma pubescens	x			
	Petalostigma quadriloculare	x			
	* *Phyllanthus amarus*	x			
	Phyllanthus exilis	x			
	Phyllanthus maderaspatensis	x			x
	Phyllanthus aridus (P3)	x			
	Phyllanthus reticulatus	x			
	Phyllanthus sp.			x	
	Sauropus sp.	x			
	Sebastiania chamaelea	x			
ANACARDIACEAE	*Buchanania obovata*				x
CELASTRACEAE	*Denhamia obscura*	x		x	
STACKHOUSIACEAE	*Stackhousia intermedia*	x			
SAPINDACEAE	*Distichostemon hispidulus*				x
	Distichostemon hispidulus var. *aridus*	x			
	Distichostemon hispidulus var. *phyllopterus*	x		x	
	Dodonaea lanceolata				x
	Dodonaea lanceolata var. *lanceolata*	x			
	Dodonaea ?platyptera				x
	Ganophyllum falcatum			x	
RHAMNACEAE	*Cryptandra intratropica*			x	
	Ventilago viminalis				x
VITACEAE	*Cayratia trifolia*	x		x	
TILIACEAE	*Corchorus aestuans*			x	
	Corchorus leptocarpus	x			
	Corchorus puberulus	x		x	
	Grewia breviflora	x			
	Grewia glabra		x		
	Grewia retusifolia	x			
	Triumfetta carteri			x	
	Triumfetta coronata	x		x	
	Triumfetta ryeae subsp. *brevipetala*	x			
	Triumfetta simulans	x			
	Triumfetta sp.	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
MALVACEAE	*Abutilon indicum* var. *australiense*	x			
	Decaschistia occidentalis			x	
	Fioria vitifolia			x	
	Gossypium costulatum	x			
	* *Gossypium hirsutum*			x	
	Gossypium aff. *populifolium*			x	
	Gossypium sp.	x			
	Hibiscus fryxellii	x			
	Hibiscus fryxellii var. *mollis*	x		x	
	Hibiscus geranioides			x	
	Hibiscus leptocladus	x			
	Hibiscus marenitensis	x			
	Sida sp. A Kimberley Flora (P.A. Fryxell & L.A. Craven 3900			x	
	Thespesia populneoides			x	x
STERCULIACEAE	*Brachychiton diversifolius*				x
	Brachychiton diversifolius subsp. *diversifolius*	x		x	x
	Brachychiton viridiflorus	x			
	Brachychiton viscidulus	x	x		x
	Melhania oblongifolia	x			x
	Melochia umbellata	x	x	x	x
	Waltheria indica	x			
DILLENIACEAE	*Hibbertia lepidota*	x		x	
	Hibbertia oblongata	x		x	
	Hibbertia sp. A Kimberley Flora (T.E.H. Aplin et al. 898)				x
CLUSIACEAE	*Calophyllum inophyllum* (planted)			x	
COCHLOSPERMACEAE	*Cochlospermum fraseri*	x	x		x
VIOLACEAE	*Hybanthus aurantiacus*	x	x		
	Hybanthus enneaspermus	x			
	Hybanthus enneaspermus subsp. *enneaspermus*	x			
TURNERACEAE	* *Turnera ulmifolia*	x			
PASSIFLORACEAE	*Adenia heterophylla*	x			
	* *Passiflora foetida*	x			x
LYTHRACEAE	*Lagerstroemia archeriana* var. *divaricatiflora*	x			
RHIZOPHORACEAE	*Carallia brachiata*			x	
	Ceriops tagal	x			x
	Rhizophora stylosa	x			x
COMBRETACEAE	*Quisqualis indica*			x	
	Terminalia canescens	x	x		x
	Terminalia ferdinandiana	x			
	Terminalia sp.	x			
MYRTACEAE	*Calytrix achaeta*			x	
	Calytrix brownii	x			x
	Calytrix exstipulata	x			x
	Corymbia cadophora				x
	Corymbia cadophora subsp. *cadophora*	x	x		x
	Corymbia confertiflora	x			x
	Corymbia dendromerinx			x	
	Corymbia ?greeniana	x			x
	Corymbia polycarpa	x			
	Eucalyptus confluens			x	
	Eucalyptus miniata	x	x	x	x
	Eucalyptus obconica	x			x
	Eucalyptus tectifica	x			x
	Melaleuca viridiflora	x			
	Melaleuca 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	*Melastoma affine*			x	
HALOGORACEAE	*Gonocarpus leptothecus*	x	x		x
	Gonocarpus sp.	x			
APIACEAE	*Trachymene didiscoides*	x		x	x
SAPOTACEAE	*Mimusops elengi*	x		x	
	Pouteria arnhemica	x			
	Planchonella arnhemica	x			
	Sersalisia sericea				x
EBENACEAE	*Diospyros maritima*	x		x	
OLEACEAE	*Jasminum didymum*	x			
LOGANACEAE	*Jasminum didymum* subsp. *didymum*			x	
	Mitrasacme connata	x			
	Mitrasacme nummularia	x			
APOCYNACEAE	* *Allamanda cathartica*	x			
	* *Cascabela thevetia*	x			
	* *Catharanthus roseus*	x			
	Tabernaemontana orientalis	x			
	Wrightia saligna	x			
ASCLEPIADACEAE	* *Cryptostegia madagascariensis*			x	
	* *Cryptostegia madagascariensis* var. *glaberrima*	x		x	
	Cynanchum carnosum	x			
	Marsdenia angustata	x			
	Marsdenia viridiflora				x
	Marsdenia viridiflora subsp. *tropica*	x			
	Sarcostemma viminale subsp. *australe*	x			x
	Secamone timoriensis	x			
	Tylophora cinerascens		x		
	Tylophora flexuosa	x			
CONVOLVULACEAE	*Evolvulus alsinoides* var. *decumbens*	x			x
	Evolvulus sp.	x			
	Ipomoea macrantha	x			
	* *Ipomoea quamoclit*	x			
	Jacquemontia paniculata	x	x		
	* *Merremia aegyptia*			x	
	* *Merremia dissecta*	x			
	Operculina brownii	x	x		
	Polymeria ambigua	x			
	Xenostegia tridentata	x			
HYDROPHYLLACEAE	*Cynanchum puberulum*	x			
BORAGINACEAE	*Ehretia saligna*				x
	Heliotropium glabellum	x		x	
	Heliotropium ventricosum			x	
	Trichodesma zeylanicum var. *zeylanicum*		x		
	Heliotropium sp.		x		
VERBENACEAE	* *Lantana camara*			x	
	* *Stachytarpheta cayennensis*	x		x	
AVICENNIACEAE	*Avicennia marina*	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	*Anisomeles malabarica*			x	
	Callicarpa candicans	x		x	
	Clerodendrum floribundum	x			
	Clerodendrum floribundum var. *coriaceum*	x			
	Plectranthus sp.	x			
	Premna acuminata	x			
	Vitex acuminata	x			
	Vitex glabrata	x			
SOLANACEAE	* *Physalis angulata*	x			
	Solanum echinatum		x		
	Solanum leopoldense (P3)	x		x	
SCROPHULARIACEAE	*Stemodia lythrifolia*			x	x
	Striga curviflora	x			
	Striga sp.		x		
BIGNONIACEAE	*Dolichandrone heterophylla*	x			
	* *Tecoma stans*	x			
LENTIBULARIACEAE	*Utricularia chrysantha*			x	
ACANTHACEAE	*Dicliptera armata*	x	x		x
	Hypoestes sp.	x			
RUBIACEAE	*Aidia racemosa*	x			
	Gardenia sp.			x	
	Oldenlandia corymbosa var. *corymbosa*	x			
	Pavetta kimberleyana	x			
	Psydrax pendulina	x			
	Spermacoce dolichosperma	x			
	Spermacoce leptoloba	x			
	Spermacoce occidentalis	x			
	Tarenna pentamera	x			
	Timonius timon			x	
CUCURBITACEAE	* *Cucumis melo subsp. agrestis*	x			
	Cucumis sp. Gunlom (J.L. McKean 864 b)	x			
GOODENIACEAE	*Goodenia sepalosa* var. *sepalosa*	x			
	Scaevola macrostachya				x
STYLIDIACEAE	*Stylidium leptorrhizum*	x			x
	Stylidium pachyrrhizum	x			
	Stylidium semipartitum	x			
	Stylidium sp. A (aff. *leptorrhizum)*	x			
ASTERACEAE	*Cyanthillium cinereum*	x		x	
	Pentalepis ecliptoides	x			
	Pterocaulon serrulatum				x
	Pterocaulon sphacelatum	x	x		x
	* *Tridax procumbens*	x			
	* *Wedelia trilobata*			x	

Appendix 4
Quarantine
Management Plan

Wonganin Iron Ore Project, Irvine Island, Buccaneer Archipelago

Quarantine Management Plan

Prepared for
Pluton Resources Ltd
by Strategen

November 2008

Wonganin Iron Ore Project, Irvine Island, Buccaneer Archipelago

Quarantine Management Plan

Strategen is a trading name of
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November 2008

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

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

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1. INTRODUCTION

1.1 PURPOSE

Pluton Resources Limited (Pluton) commenced Phase I exploration for iron ore on Irvine Island in the Buccaneer Archipelago in July 2008. A Phase II program is proposed to commence in 2009 consisting of a similar program of works. The Phase II program will expand exploration operations on the Hardstaff Peninsula 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 changes in this version

The Quarantine Management Plan Version Final 2 has since been reviewed by Quarantine Western Australia. This document version includes minor changes as suggested by QWA and some minor improvements that have occurred since the implementation of the Phase I exploration program. The following aspects of the revised Quarantine Management Plan should be noted:

1. The terminology has been simplified. Quarantine Risk Material and Non Indigenous Species have both been combined under one name - Quarantine Risk Material (QRM). QRM includes all plant material, animals and soils are contaminants that could carry pests or disease.
2. The wording of the document has been modified to incorporate the two phases of exploration.
3. Splitting of quarantine breaches 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) do not certify inspectors at Freight Forwarding Companies.
6. Pontoons for boat landings are not required for either phase of exploration.

7. There is no reliance on 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.

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 town 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 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, 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 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, 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.

1.4 DESCRIPTION OF PROPOSED WORKS

The exploration program has been developed to minimise environmental impact at Irvine Island. A 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. Personnel would be transferred by means of beach landings. No vehicles will be required on the island (Pluton Resources Limited 2007). The disturbance footprint on the island will consist of drill sites, walking tracks, helicopter pad 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 includes 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 mobilised from each site via Cockatoo Island. Cores will be cut and logged before being shipped for laboratory analysis on the mainland.

Desalination units will supply the 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 mainland Australia by barge or aeroplane directly to Cockatoo Island.

The project expects to employ a total of up to 30 staff who will be directly involved in the exploration process. Staff will fly to Cockatoo Island from Broome or Derby, and will be accommodated at Cockatoo Island.

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 the prevention of 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 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 .

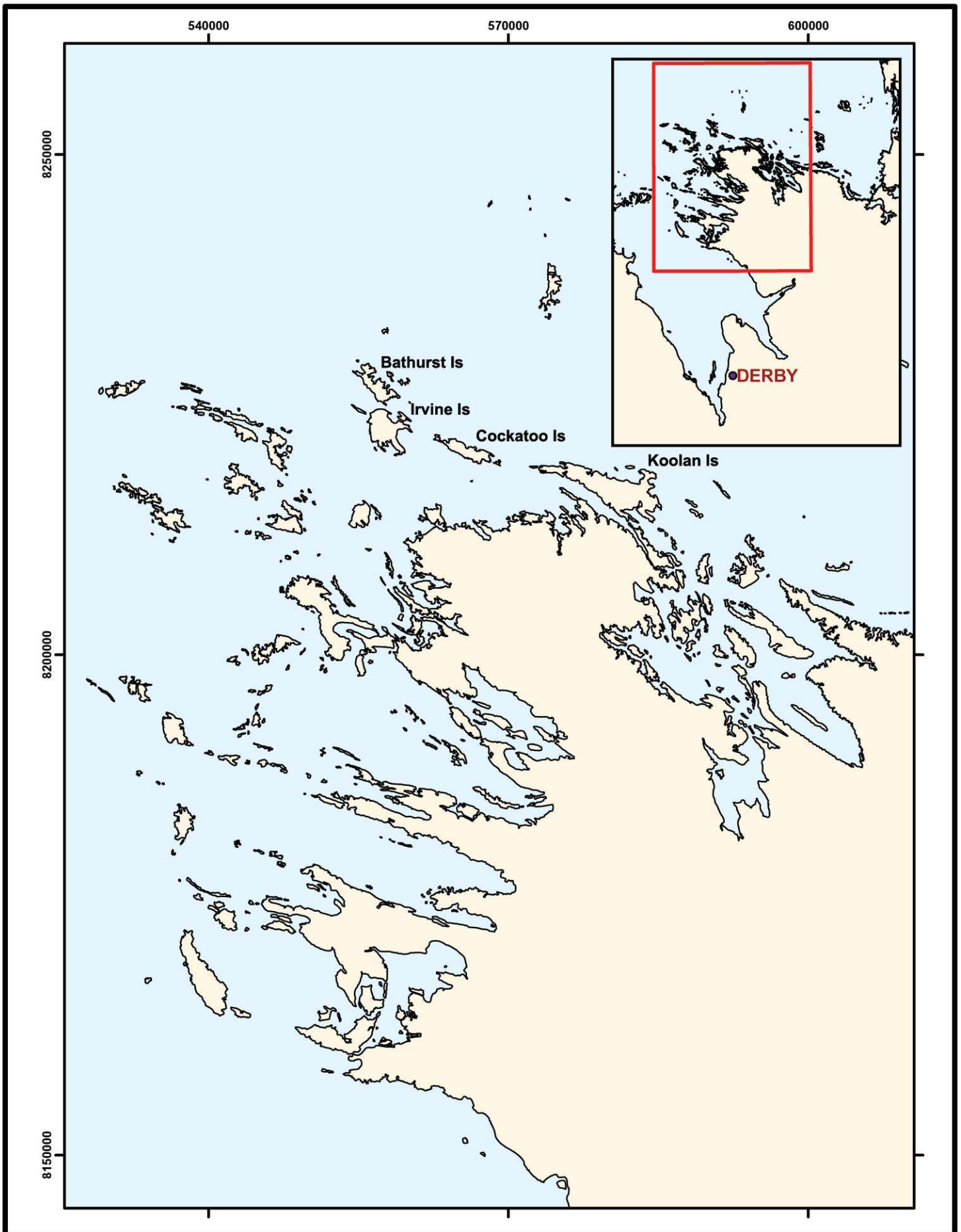

Figure 1: Regional location - Irvine Island

strategen

Scale

0 10 20 30

Kilometres

N

1:500,000 at A4

Horizontal Datum: GDA 94 | Projection: MGA Zone 51 | Author: AW

Date: 28/11/2007

Note that positional errors may occur in some areas

Regional Map

Source: ESRI 2005

Source: Geoscience Australia database 2006

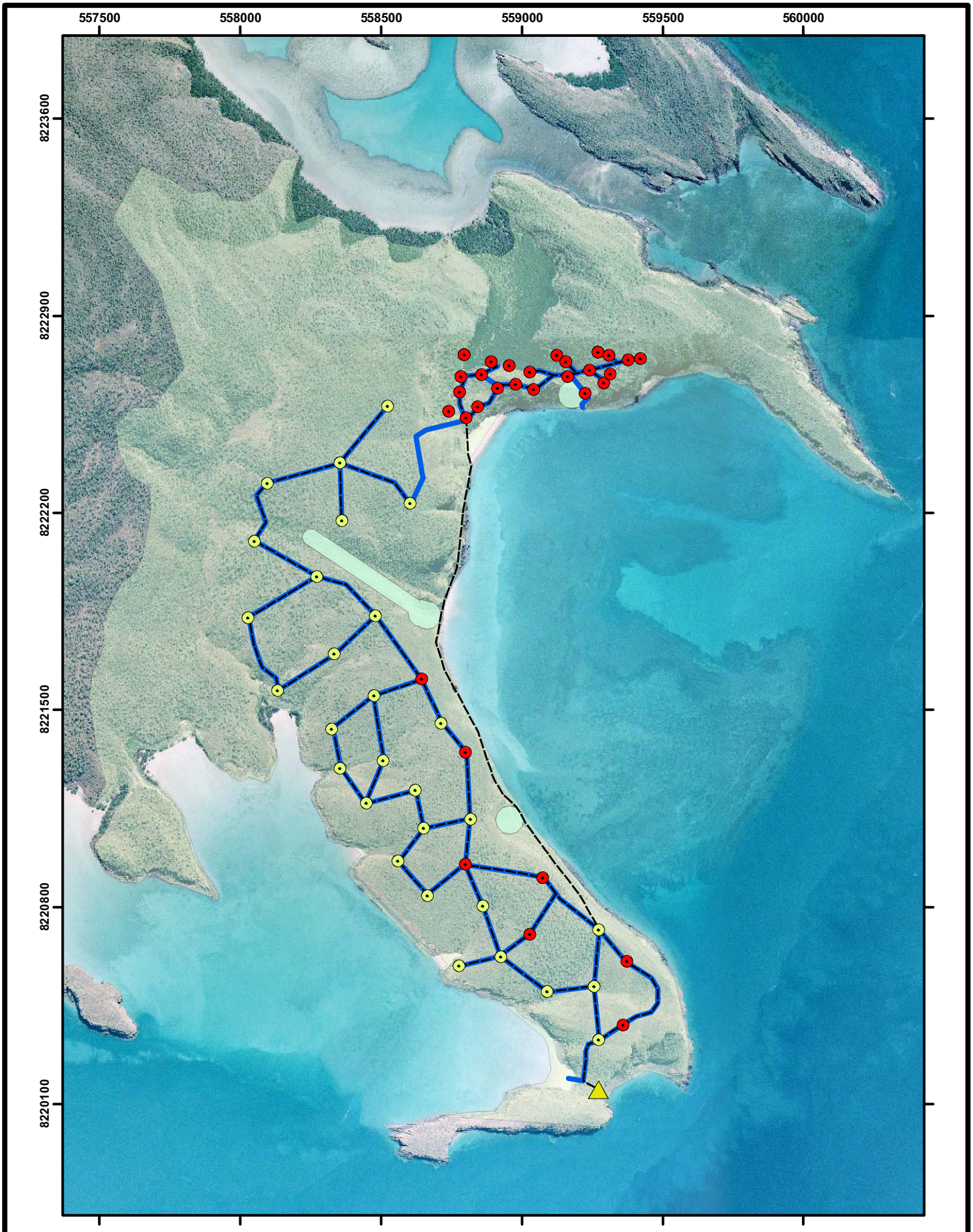

Figure 2: Overview of Phase I and II exploration programs

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Scale
0 125 250 500
Meters

N

1:18,000
at A4

Horizontal Datum: GDA 94	Projection: MGA Zone 51
Date: 6/10/2008	Author: AW
	Note that positional errors may occur in some areas

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 means of quarantine management. 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 hitchhike or be hidden as follows:

- 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 permitted into certain areas can vary depending on the ability to detect and identify the QRM, and the known status of existing local endemic species in those certain areas. 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 imported goods need to be treated before being released.

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 objectives of the project for quarantine management include:

- 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 spread and establishment 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 Australian Quarantine and Inspection Service (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 Quarantine Western Australia (QWA).

The DEC manages quarantine to protect the biodiversity of Western Australia's islands. Individuals seeking entry to some Western Australian islands including Irvine Island require DEC permits, which involves the implementation of strict quarantine protocols to prevent the entry of QRM.

The proposed exploration operations at Irvine Island will potentially be addressed by 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 from Cockatoo Island to 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 during the final movement from Cockatoo Island to Irvine Island. Pluton staff will be accommodated on Cockatoo Island and there is potential for food, personnel and personal effects to be infected with QRM found on Cockatoo Island. The management of these aspects are included separately in Sections 3 and 4.

2. SUPPLY CHAIN MANAGEMENT PLAN FOR EXPLORATION EQUIPMENT

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 Cockatoo Island storage on Cockatoo Island and then transport to Irvine 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)
- goods transfer to barge transport
- barge transport to Cockatoo Island quarantine storage
- storage on Cockatoo Island
- transport to Irvine 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 supply chain for exploration equipment

Management objectives	Target	Key Performance Indicator
Keep the supply chain free of quarantine risk material.	Equipment is clean when it arrives on Cockatoo Island. No visual detections of QRM on receival of freighted equipment.	Records of cleaning/inspection for QRM before shipment of freight to Cockatoo Island.
	Any QRM is eradicated in the event that they are detected on Irvine island.	No visual detection of QRM on Irvine Island.
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.

2.3 MANAGEMENT STRATEGY AND ACTIONS

The aspects of quarantine management relating to the supply chain of exploration equipment 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 parties 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 free of QRM.

Pluton quarantine inspectors

Selected Pluton staff will attend a quarantine inspection course run by a suitable consultant. The quarantine inspection course will instruct clients on the procedures in conducting quarantine inspections for freight, personal effects and 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, personal effects, personnel, and transport vessels at Cockatoo and Irvine Islands, for the life of the exploration project. They will also be responsible for the surveillance of 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 instruct 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 at 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 personal effects for overseas shipment, and mining operations in high conservation areas such as the Gorgon Project on Barron Island, Western Australia.

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

Major equipment such as drilling rigs and drilling platforms represent one of the major potential sources of QRM. It is proposed to thoroughly clean, inspect and treat (if necessary) this equipment in Perth at freight forwarding companies 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 2.3.3), and equipment inspected by AQIS and QWA inspectors (see 2.3.4 and 2.3.5) may not require cleaning and interior inspection prior to shipment to Cockatoo Island.

2.3.3 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. The 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.

2.3.4 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, however, may still harbour threats to Irvine Island.

Exploration equipment imported by Pluton from interstate will be subject to an inspection at the freight forwarding company prior to shipment to Cockatoo Island provided as per Section 2.3.2.

2.3.5 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 released 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 Cockatoo Island as per Section 2.3.2.

2.3.6 Quarantine containment facility

A quarantine containment facility will be set up on Cockatoo Island as a designated clean inspection storage and treatment area. The facility will include:

- a secure quarantine area (such as a pressure tested sea container) of a suitable area 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.

The quarantine containment facility will be used for the:

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

2.3.7 Mobilisation of exploration equipment between Cockatoo Island and Irvine Island

All equipment being mobilised from 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 returned to Cockatoo Island will be cleaned at Cockatoo Island, prior to the mobilisation back to 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.
	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 by freight forwarding company quarantine inspectors in Perth. All goods will then be declared free of QRM by the inspectors.	Prior to shipment to Cockatoo Island.	Freight forwarding quarantine inspectors.
	All small exploration equipment (including hand tools) to be inspected and treated as per personal effects 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 Cockatoo Island.	Freight forwarding quarantine inspectors.
	Quarantine inspectors to inspect all containers for QRM.	Prior to loading exploration equipment.	Freight forwarding quarantine inspectors.

Topic	Action	Timing	Responsibility
	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 Perth or at least 24 hours before unloading at Cockatoo Island.	Freight forwarding quarantine inspectors, Pluton quarantine inspectors.
	Prohibit personnel and freight from the mainland going directly to Irvine Island. If exceptional circumstances require direct access to Irvine Island, only trained personnel will be allowed onto the island and the same equipment and personnel inspection requirements will apply.	At all times.	Site Exploration Supervisor.
New exploration equipment purchased in Australia	Conduct exterior inspection for QRM at freight forwarded 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 Cockatoo Island.	Freight forwarding quarantine inspectors.
Large items unable to be sealed in containers	Inspect exploration equipment for QRM at 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 to Cockatoo Island.	Freight forwarding quarantine inspectors.
Interstate imported exploration equipment	Conduct inspection for QRM at freight forwarder..	Prior to shipment to Cockatoo Island.	Freight forwarding quarantine inspectors.
Quarantine containment facility at Cockatoo Island	Provide a secure clean room (e.g. a pressure tested sea-container) at Cockatoo Island for preparing, inspecting and storing equipment.	Prior to commencement of exploration operations.	Site Exploration Supervisor.
	Install and thoroughly clean the quarantine containment facility interior and exterior with a high pressure cleaner.	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.
	Bait the quarantine containment facility with fresh rodenticide and regularly spray residual insecticide as per manufacture's directions.	At all times.	Pluton quarantine inspectors.
	Locate a dedicated QRM waste bin at the quarantine containment facility.	At all times.	Site Exploration Supervisor.
	Dispose of QRM waste on Cockatoo Island unless the suspected QRM does not occur on Cockatoo Island.	At all times.	Site Exploration Supervisor.

Topic	Action	Timing	Responsibility
	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 facility (ie. insect bomb).	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: • 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.
Mobilisation of equipment (to Irvine Island)	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 Cockatoo Island.	At all times.	All Pluton staff and contractors.
Mobilisation of equipment (returning from Irvine Island).	Take all equipment returned to Cockatoo Island to the quarantine containment facility. Segregate equipment returned to Cockatoo Island 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 to Cockatoo 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 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 at 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 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 is inserted into the sea-container and then closed for twenty four hours. The flour trays are then checked for activity and the goods area released if no 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. The surrounds of disturbed areas will be visually inspected for easily identifiable QRM, each day while those sites are in active operation. 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 the 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 supply chain of exploration equipment

Topic	Parameter	Frequency	Location	Purpose
Supply chain Arrival of sea container of exploration equipment	Chain of custody document to be checked that freight has been cleaned, inspected and declared free of QRM.	Upon arrival	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 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.	Cockatoo Island.	To determine presence of live QRM (vertebrates and invertebrates).
	Visual inspection of inside sea container for live QRM.	During unpack.	Cockatoo Island.	To determine the presence of live QRM (vertebrates and invertebrates).
Quarantine containment facility.	Surveillance (visual inspection) around perimeter.	Daily while quarantine containment facility is in use.	Immediate area surrounding quarantine containment facility at Cockatoo Island.	To identify potential quarantine breaches within the facility.
	Check integrity of seals of quarantine containment facility.	Daily while quarantine containment facility is in use.	Quarantine containment facility.	Prevent the potential entry of QRM into the quarantine containment facility.
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 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 minor incidents, major quarantine breaches or critical quarantine breaches. The various contingencies for detection of QRM and failure 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 Contingency actions during supply chain management of exploration equipment

Topic	Trigger	Action
Major Quarantine Breach		
Cockatoo Island. Arrival of container of exploration equipment.	Hole in the container. Chain of custody documentation indicates no cleaning or inspections for QRM.	1. Monitor and treat container for QRM (flour trays, apply knockdown insecticide) for 24 hours 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.	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.
Cockatoo Island. During unpack of exploration equipment.	Detection of live vertebrate and invertebrate inside container upon arrival or during unpack.	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.
Upon arrival to Cockatoo Island, or during unpack of exploration equipment.	Detection of vegetative and other QRM (viable seeds, plant diseases, soil, mud, clay, animal faeces, animal material, plant material and other debris).	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.	1. Catch remove/destroy QRM if possible. 2. Implement emergency response if required.

Topic	Trigger	Action
Critical Quarantine Breach Emergency response.	Critical Quarantine Breach	1. Emergency responses and containment for quarantine breaches include the following procedures: 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 area (Cockatoo Island)

A quarantine cleaning area will be provided on Cockatoo Island to implement the cleaning of items detected with QRM such as viable seeds, plant diseases, 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 only applies to the movement of food from Cockatoo Island to Irvine Island as the supply chain of food 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 many 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. Most meals will be prepared and consumed at Cockatoo Island. However, some meals will be taken and consumed on Irvine Island during shift work.

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.

3.2 OBJECTIVES, TARGETS AND KEY PERFORMANCE INDICATORS

The following objectives, targets and performance indicators apply to food and waste management on Cockatoo and Irvine Islands (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 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.
	Inspect all food taken to Irvine Island for QRM and prohibited foods (Table 7). Ban prohibited food on Irvine Island.	During food preparation by cook/staff - for the life of the project. Quarantine inspectors are responsible for inspecting all food for QRM prior to departing Cockatoo Island - 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.	During preparation by cook staff – for the life of the project.	Assistant quarantine inspectors.
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: • citrus • tomatoes • passionfruit • melons • avocado • berry fruits (blackberry, etc)
Any vegetables with viable seeds including: • cucumber • capsicum, chillies • sweet corn
Other vegetables with potentially hidden seeds including • 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 minor incidents, major quarantine breaches or critical quarantine breaches. The various contingencies for detection of QRM for food and 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 during management of food and waste

Topic	Trigger	Action
Minor Quarantine Incident		
Food (prior to departure to Irvine Island).	Detection of QRM on food.	1. QRM infected food to remain on Cockatoo Island. 2. Document quarantine interception.
	Detection of prohibited food.	1. Prohibited food to remain on Cockatoo Island. 2. Document quarantine interception.
Major Quarantine Breach		
Food (already taken ashore to Irvine Island).	Detection of QRM on food.	1. Contain or treat (eg. double bag and treat with insecticide). 2. Returned infected food item to Cockatoo Island for consumption or disposal. 3. Counsel personnel involved. 4. Document quarantine interception.

4. MANAGEMENT PLAN FOR MOVEMENT OF TRANSPORT VESSELS, PERSONNEL AND PERSONAL EFFECTS BETWEEN COCKATOO ISLAND AND 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 accommodated on Cockatoo Island and there is potential for transport vessels, personnel, and personal effects (PEs) to be infected with QRM found on 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 personal effects between Cockatoo Island and 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 from Cockatoo Island to Irvine Island and return, are presented in Table 11.

4.3.1 Personal effects

All personnel will live on Cockatoo Island and will only be transported to Irvine Island for short periods at a time. Therefore PEs will be limited to items such as protective clothing, any associated equipment, and small items of exploration equipment (eg. hand tools). Personnel will be responsible for inspecting and cleaning their own PEs for QRM during preparation and packing before departing to Irving Island.

Very few PEs will be taken ashore to Irvine Island and will often be limited to the clothing being worn by the personnel. All outer clothing, boots and any loose items of PEs will be visually inspected while being worn by a Pluton quarantine inspector prior to movement to Irvine Island. Loose items of PEs 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 to Cockatoo Island, socks will be stored and washed separately to prevent the potential contamination of QRM on Cockatoo Island. Washed clean socks will be supplied at the start of each movement to Irvine Island.

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

4.3.2 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) will only moor or land at Cockatoo Island, consistent with current practises for the supply employed by HWE Mining at Cockatoo Island.

All non-locally sourced marine vessels will be subject to a risk based assessment for 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.

4.3.3 Inspections

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

Table 11 Quarantine management actions for the movement of equipment, personnel, PEs and vessels between Cockatoo Island and 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 Personal Effects (not being worn)	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. Dedicate bags for transport of PEs to and from Irvine Island and store them in the quarantine containment facility at Cockatoo Island when not in use.	Prior to commencement of exploration. For the life of the project.	Site Exploration Supervisor. 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 facility or at Irvine Island.	For the life of the project.	Site Exploration Supervisor and Pluton quarantine inspectors.

Topic	Action	Timing	Responsibility
Personal Effects (Velcro)	Clean and inspect all equipment with Velcro of 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 (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.	Pluton quarantine inspectors and assistant 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 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 items of PEs (returning from Irvine Island) into quarantine containment facility.	Segregate PEs returned to Cockatoo Island from QRM free material in containers until inspected by quarantine inspectors and declared free of any QRM (from Irvine Island).	Post each movement of PEs returning from Irvine Island to Cockatoo Island.	Pluton quarantine inspectors.
Wooden articles permitted on Irvine Island.	Allow only wooden articles taken ashore to Irvine Island that are Laminated Veneer Lumber (LVL) or treated timber (e.g. CCA treated) subject to inspection for QRM. 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 from Cockatoo 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 from Cockatoo Island.	Pluton quarantine inspectors and assistant quarantine inspectors.
	Risk assess the potential 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 2.3.6) at the site of operating drill rigs, helicopter pads, tender, jetty and desalination plants.	Prior to commencement of operation and for the duration of the project.	Site Exploration Supervisor.
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.	Prohibit camping on Irvine Island (except in the case of emergency such as extreme weather events preventing boat or helicopter access to remove staff).	For life of the project.	Site Exploration Supervisor.

4.4 MONITORING PROGRAM

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

Table 12 Monitoring program for movement of transport vessels, personnel and PEs between Cockatoo Island and 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 from Cockatoo Island.	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 from Cockatoo Island.	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 from Cockatoo Island.	The quarantine containment facility on 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. 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 minor incidents, major quarantine breaches or critical quarantine breaches. 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.

The contingencies for the detection of QRM and failure of supply chain integrity are outlined in Table 13.

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.	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.	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.	1. Catch remove/destroy QRM if possible. 2. Implement emergency response if required.
Critical Quarantine Breach Emergency response	Critical Quarantine breach.	1. Emergency responses and containment for quarantine breaches include the following procedures: 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 DEC branches 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, 2007, *Proposed work program and budget estimate for Irvine Island, Kimberley Region, Western Australia,* October 2007.

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

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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 *Phytophthora*
Clothing and shoes	Seeds, mites, bacteria, *Phytophthora*
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 ……..

Original to CALM, copy to be retained by trip leader

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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

DRAFT 1.0 – 14 MARCH 2007
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

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

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

Refer to Appendix 3 of the Referral

Appendix 5
Biota (2007) Level 1
Fauna Assessment

Biota Environmental Sciences

Irvine Island
Level 1
Fauna Assessment

Prepared for

Strategen

Prepared by

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December 2007

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Irvine Island Level 1 Fauna Assessment

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1.0 Summary

1.1 Project Background

Pluton Resources plan to undertake exploration activities on Irvine Island aimed at defining an iron ore resource. Estimated target size is an open-cutable 10Mt to 23Mt at >60% Fe for the Isthmus Region and 30Mt at >55% for the Hardstaff Peninsula. Estimates are considered conservative and mineralisation remains open in both target areas.

In view of the pristine nature of Irvine Island and given that it potentially supports fauna species of conservation significance, a Level 1 Fauna Assessment was requested for the purpose of evaluating potential impacts arising from the exploration program. This document outlines the findings of a four-day site visit and subsequent review of existing literature and data considered relevant to Irvine Island.

1.2 Methods

This Level 1 assessment for the Irvine Island study area was conducted through the use of database searches including the DEH Protected Matters Database, the WA Museum FaunaBase Database, the DEC Threatened Fauna Database and Biota Environmental Sciences internal database.

An initial site visit was also conducted over four days between the 25/6/07 and 28/6/07.

1.3 Fauna Habitats

Fauna habitats identified during the survey included: beaches and small adjacent sandy areas; Low Open Woodland; Low Open Shrubland; and Mangroves.

None of the habitats encountered during the survey are considered to be restricted to just the exploration areas.

1.4 Fauna Species of Conservation Significance Potentially Occurring in the Locality

Although several fauna of conservation significance are known from adjacent islands (eg. Koolan Island), none are known from Irvine Island and it is considered unlikely that any would be restricted to the exploration areas.

1.5 Recommendations

On cessation of exploration activities all drill holes need to be appropriately capped.

A breach of quarantine is considered the most significant potential impact arising from the proposed exploration activities. This will be managed via a Quarantine Management Plan, which will build on DEC's standard operating procedures for working on islands.

2.0 Introduction

2.1 Project Background

Pluton Resources plan to undertake exploration activities on Irvine Island aimed at defining an iron ore resource. Estimated target size is an open-cutable 10Mt to 23Mt at >60% Fe for the Isthmus Region and 30Mt at >55% for the Hardstaff Peninsula (see Figure 2.1). Estimates are considered conservative and mineralisation remains open in both target areas.

In view of the pristine nature of Irvine Island and give that it potentially supports species of conservation significance, a Level 1 Fauna Assessment was requested for the purpose of evaluating potential impacts arising from the proposed exploration program. This document outlines the findings of a four-day site visit and subsequent review of existing literature and data considered relevant to Irvine Island.

2.2 Outline of Proposed Exploration Activities

2.2.1 Drilling

The proposed exploration activities will target two main areas on Irvine Island, the Isthmus area and Hardstaff Peninsula (see Figure 2.1). In total, 33 diamond drill holes are planned for these two areas, comprising 26 in the Isthmus area and seven on Hardstaff Peninsula. Drill spacing on the Isthmus Region is largely controlled by the rugged and variable topography.

Access to the island will be by boat and/or helicopter. Access within the island will be by foot and helicopter only; no vehicles (or vehicular tracks) will be required. It is expected that all drill-site preparation will be by hand using hand-held tools and machinery. To accommodate drilling on rugged and commonly sloping sites, Pluton has worked with engineers to design and develop a helicopter transportable drilling platform referred to as the Universal Drilling Platform (UDP).

The UDP provides a level working surface on which a drill rig can be located. The ground surface and even the vegetation under the drill rig can remain undisturbed, further reducing the exploration footprint. The surface underlying the UDP does not have to be level. It can slope at angles of up to 18 degrees and can be of varying roughness. Each UDP can be assembled by 2 people, with each component weighing less than the maximum permissible under WA OH&S guidelines.

The UDP has the facility to rotate the drill rig by hand. This means that a drill rig of up to 10t can be rotated to drill in multiple directions safely and without need for heavy lifting machinery. The UDP can operate as a free floating platform or may be attached to the ground. Each leg may be bolted to the ground and, for slopes of greater than 10 degrees, may be further secured via chains linking the platform to anchors (split sets) set in the rock face or large boulders. The drill rig is located to the platform and one or two anchor holes drilled. By this mechanism, the drill rig and UDP are each anchored to the ground and each other. The UDP has the additional advantage in that any oil that might escape from drilling machinery can be captured on spill matting located under the platform.

It is expected that 2 drill rigs will operate by mobilizing between 4 UDPs. Each drill rig will be mobilized directly from one platform to the next. Four of the seven drill sites at Hardstaff Peninsula will include a helicopter landing site. Helicopter access to the Isthmus Region will require one dedicated landing site located to the north-east of the proposed Isthmus Region drill sites. If necessary, a drill site at the south-eastern end of the Isthmus Region may also be used as a helicopter landing site.

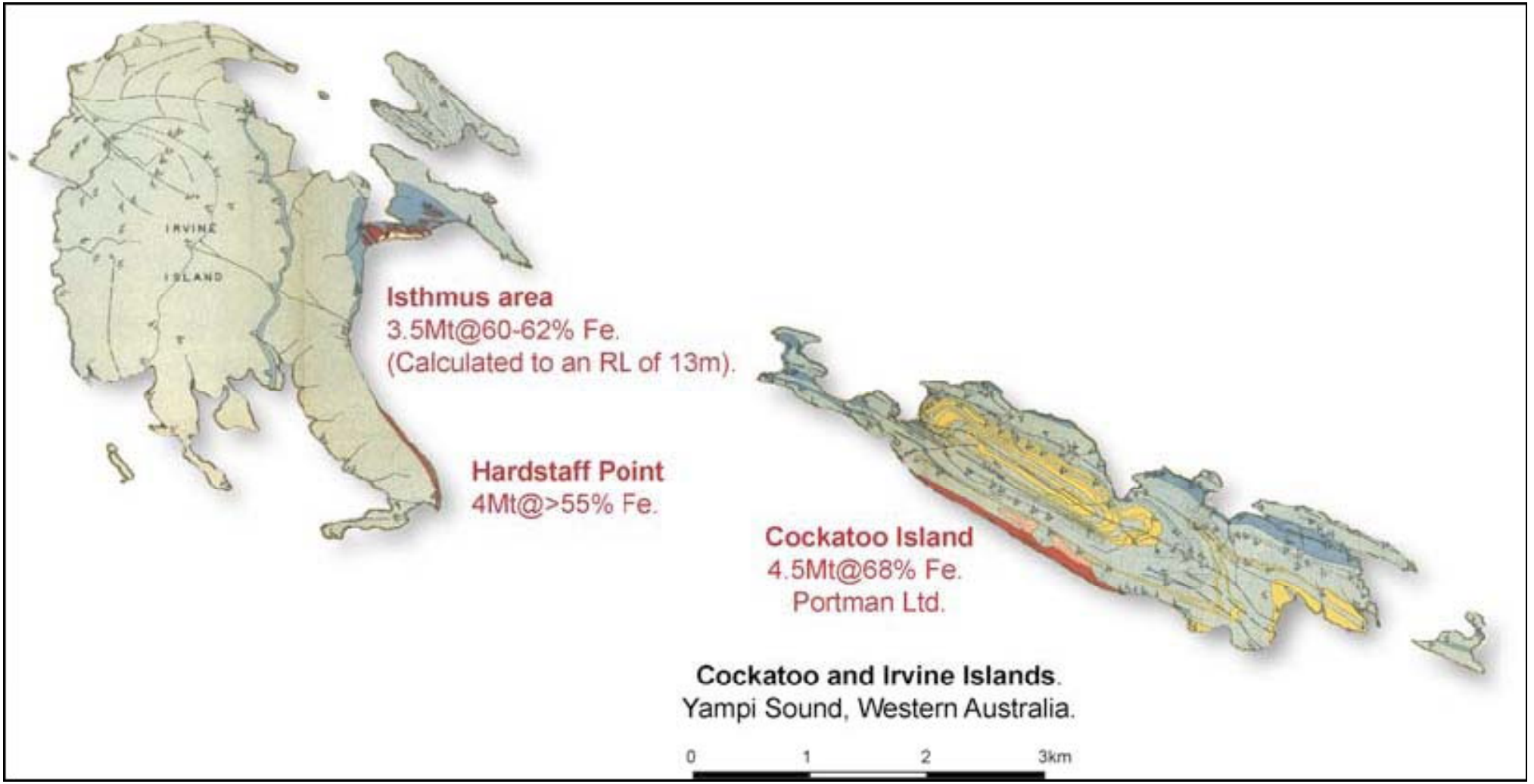

Figure 2.1: Cockatoo and Irvine Islands, Western Australia.

2.2.2 Provision of Drilling Water

Diamond drilling requires water, with two drill rigs using up to an estimated maximum 60,000 ltrs in any 24 hour shift. Water is recirculated during drilling, so maximum consumption would only occur if all water circulated was lost down hole.

Several sources of drilling water were considered, including seawater, bore water and water from desalination plants. Seawater is not desirable given its high wear rate on equipment, possible contamination of samples and unknown effect on groundwater. Bore water is viable for the Isthmus Region (albeit this remains an unknown) but is difficult to provide to drill sites on Hardstaff Peninsula. It is therefore proposed that water for drilling is provided using 1 or 2 desalination plants. For the Isthmus Region, the desalination plants will be located at Jonas Point (to the east of the area of exploration focus). Water can be pumped to a central reservoir (tank or above ground pool) located adjacent to drill site 15. A central feed pipe will run from the reservoir along the north-western flank of the Isthmus, off which spur pipes can be connected and fed directly to drill sites.

Return water from drill sites will feed into an above ground sump, from there down flexible agricultural pipe to a settling tank with oil absorbent matting, and from there back into the reservoir. The water can then be re-circulated back to the drill rigs. Excess treated and/or fresh water will flow from the reservoir down the natural drainage pathway and exit via the mangroves. This set-up does not require sumps to be dug at each drill site. There is also minimal movement of tanks and other water treatment infrastructure between sites.

It is unlikely that maximum water usage will be experienced by both drill rigs at the same time. Most drilling is below sea-level where total loss of water circulation is highly unlikely.

Desalination plants offer the best solution to providing water for drilling on Hardstaff Peninsula. Each drill site there will comprise a mud tank and reservoirs/tanks through which drilling water will be recirculated. Water lost on circulation will be replaced by that pumped from the desalination plants.

2.2.3 Tracks

Foot tracks between sites will be cut by hand (or using hand-held machinery) where required. These tracks will also be used to run water lines.

2.2.4 Accommodation

All personnel will be accommodated in existing Cockatoo Island accommodation. Access to the island will be by boat and/or helicopter. Personnel transported by boat to the Isthmus Region will disembark at either of two landing pontoons; personnel transported by boat to Hardstaff Peninsula will disembark at Hardstaff Beach. Boats and helicopters will undergo fumigation to ensure no vermin are transported to the island.

2.3 Biological Context of the Study Area

2.3.1 IBRA Bioregions

The Biodiversity Audit of Western Australia (IBRA) recognises 53 Biogeographical Subregions (May and McKenzie 2003). Irvine Island lies within the Mitchell subregion of the North Kimberley Bioregion.

2.3.2 Conservation Reserves in the Locality

One formally gazetted conservation reserve is located in close proximity to Irvine Island:

- Tanner Island Nature Reserve (2.08 ha) is located approximately 400 metres to the south-west of Irvine Island (see Plate 2.1 and Plate 2.2).

Plate 2.1: **Google imagery of Irvine Island showing proximity of Tanner Island (source: google earth).**

Plate 2.2: **Google imagery of Tanner Island and proximity of south-western end of Irvine Island (source: google earth)**

3.0 Approach and Methodology

3.1 Scope of Review

This Level 1 Assessment utilises a range of sources to identify likely constraints to the proposed exploration program, including information from:

- previous surveys (Section 3.2);
- database searches (Section 3.3); and
- a brief site visit (Section 3.4).

This document focuses primarily on potential Threatened fauna and restricted range taxa (including Short Range Endemics) that may occur in habitats of the project area, and is intended as a first pass review of the likely nature of fauna related issues for the Irvine Island exploration proposal.

3.2 Previous Fauna Surveys

There have been limited vertebrate collections from Irvine Island in the past, or at least few specimens have been lodged with the WA Museum as evidence of collecting trips (see Appendix 4). The site visit in June 2007, which largely appraised potential habitat for fauna, also yielded few vertebrate records. Therefore, in order to predict what species[1] may be occurring on Irvine Island, this report summarises information from the surrounding islands including Bathurst, Cockatoo and Koolan. Whilst Cockatoo and Bathurst Islands also yielded few records, Koolan Island has been well surveyed and has a relatively complete list of vertebrate species (see Appendix 4). References relevant to Koolan Island include:

- Ecologia (2005). Koolan Island Iron Ore Mine and Port Facility, Environmental Referral Document. Unpublished Document for Aztec Resources Limited.
- McKenzie et al. (1995) Biological Inventory of Koolan Island, WA: Zoological Notes. *Records of the Western Australian Museum* 17: 249-266.

Other references considered relevant to this review include:

- How, R.A., L.H. Schmitt, R.J. Teale and M.A. Cowan (2006). Appraising vertebrate diversity on Bonaparte islands, Kimberley, Western Australia. *Western Australian Naturalist,* 25(2): 92-110.
- May, J.E. and N.L. McKenzie (eds.) (2003). *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Western Australian Department of Conservation and Land Management.
- Graham, G. (2001). North Kimberley 1 (NK1 – Mitchell subregion). pp 497-505 in May, J.E. and N.L. McKenzie (Eds.) (2003). *A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002*. Western Australian Department of Conservation and Land Management.
- Miles, J.M. and A.A. Burbidge (Eds.) (1975). A biological survey of the Prince Regent River Reserve, North-west Kimberley, Western Australia in August 1974. *Wildlife Research Bulletin of Western Australia,* No 3.
- Burbidge, A. A. and N.L. McKenzie (1978). The Islands of the North-West Kimberley. *Wildlife Research Bulletin of Western Australia,* No 7.

[1] Particularly those species of conservation significance that may need to be considered during the exploration program.

3.3 Database Searches

Searches (using a 50 km buffer around Irvine Island) were commissioned of the:

1. Western Australian Museum's FaunaBase for records of vouchered vertebrate specimens (Appendix 1);
2. Federal DEH Protected Matters database (Appendix 2); and
3. DEC Threatened Fauna Database (as of August 2007) for Threatened and Priority fauna records (Appendix 3).

The bounding coordinates used were:

- 124°00'12"S, -15°37'24"E; and
- 123°04'11"S, -16°31'30"E.

3.4 Site Visit

A reconnaissance site visit was undertaken in June 2007 by Mr Roy Teale and Mr Paul Hoffman (both of Biota Environmental Sciences) in order to determine habitat types in the Irvine Island area.

During the site visit several traverses were made to various locations predominantly on the eastern and southern parts of the island. Much of the remainder of the island that was readily accessible was considered to be of cultural significance by the Mayala people and was not accessed during the current survey.

In total, 10 sites were investigated during the reconnaissance survey (Table 3.1). Sites were selected from aerial photography to sample a range of vegetation types that were readily accessible from safe beach landings. No vertebrate collections were made during the site visit as an agreement between the proponent and the traditional landholders had not been made in respect of vouchering fauna. However, some key Short Range Endemic (SRE) taxa were collected and lodged with the WA Museum.

Table 3.1: Location of sites sampled for potential SRE taxa.

Site No.	Easting	Northing
IRVSN-01	559161	8220261
IRVSN-02	558805	8222496
IRVSN-03	558729	8222533
IRVSN-04	558784	8222588
IRVSN-05	558779	8222717
IRVSN-06	558652	8221850
IRVSN-07	558599	8221912
IRVSN-08	558490	8221985
IRVSN-09	558118	8221602
IRVSN-10	557979	8221732

Isthmus area and Part of Hardstaff Peninsula

Isthmus area and mangal community

Interface between mangal community and low woodland behind the Isthmus area

Accumulation of leaf litter and debris under open woodland

Steep sloping terrain near Hardstaff Peninsula

Typical rocky scree

3.5 Limitations of this Review

The main limitation of this review is that the ground survey of the island was limited, both due to the rugged nature of the terrain precluding access to some areas, and because some potentially accessible areas were not surveyed in deference to the wishes of the local Traditional Owners.

4.0 Fauna and Fauna Habitats

4.1 Fauna Habitats of the Study Area

A flora and vegetation survey of the island recorded six vegetation communities within areas adjacent to the proposed drill-holes (Mattiske pers comm. 2007). The descriptions for these associations as provided by Mattiske are included below:

- Low Woodland – Open Low Woodland of *Eucalyptus miniata* over *Corymbia cadophora*, *Eucalyptus tectifica*, *Ficus opposita*, *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.
- Low Open Woodland of *Eucalyptus tectifica* over *Hakea arborescens*, *Buchanania obovata*, *Flueggea virosa* subsp. *melanthesoides*, *Brachychiton viscidulus*, *Ficus opposita* and mixed shrubs over *Triodia bynoei* and *Acacia translucens*. This community occurs on mid slopes.
- 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.
- 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.
- 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.
- Mangroves consisting of *Rhizophora stylosa* and *Ceriops tagal* which occur on the landward edge of mangroves and *Avicennia marina* which occurs in the inter-tidal area.

For the purpose of identifying fauna habitats, these communities have been grouped into three main habitats: Low Woodland; Low Shrubland and Mangroves. A fourth habitat comprising the beach and adjacent sandy areas is also recognised.

4.2 Vertebrate Fauna

The combined WA Museum database searches and results of previous fauna surveys recorded a total of 97 species of vertebrate fauna for the search area (see Appendix 1). Several of the vertebrate species from the FaunaBase search were also yielded by the DEC Threatened and Priority fauna database search and these are addressed further in Section 4.4.

The database searches also yielded four species of birds for the region that are listed as 'Migratory' under the *EPBC Act 1999* and are also discussed briefly in Section 4.4.

Records from the WA Museum indicate that only three species of mammals and six species of reptiles have been vouchered from Irvine Island in the past (see Appendix 4). On Bathurst Island seven species of herpetofauna and four species of mammals have been vouchered (Appendix 4) and on Cockatoo Island four species of herpetofauna and only one species of mammal has been vouchered (Appendix 4). As a contrast, Koolan Island, which has been intensively surveyed as a result of mining operations, has yielded 31 species of herpetofauna and eight species of mammals (Appendix 4). Whilst the number of species recorded from Koolan Island may in part reflect the intensity of fauna surveys that have been carried out there, it would also reflect the large size of this island and its proximity to the coast.

The vertebrate assemblages recorded to date from Irvine and Bathurst Islands are typical of those gathered by short site visits that do not utilise pit traps. For example, many of the species were also recorded from the 35 islands throughout the Bonaparte Archipelago visited by How et

al. (2006). Similarly, these same taxa were also recorded as part of a recent DEC site visit to Katers and Middle Osborne Island (R. Teale, Biota, pers. obs.). None of the vertebrate taxa recorded are included as either Schedule or Priority taxa, though populations on islands may be important because they represent distinct lineages.

4.3 Short Range Endemic Taxa

Taxonomic groups with naturally small distributions are described as Short Range Endemics (SREs) and are in part characterised by poor dispersal capabilities, confinement to disjunct habitats and low fecundity (Harvey 2002, Ponder and Colgan 2002). In the context of the assessment process in Western Australia, SREs have largely been taken to encompass several key invertebrate groups, principally because vertebrates and flora with naturally small distributions have historically been considered (whereas invertebrates have typically not been considered). Given the importance of short-range endemism to the conservation of biodiversity, the assessment of such invertebrate taxa is a potentially important component of this assessment. Examples of taxonomic groups that show high levels of short-range endemism in this respect include mygalomorph spiders, millipedes, pseudoscorpions and freshwater and terrestrial molluscs. However, other groups may well support species with naturally small distributions, and where taxonomic information is readily available these are also considered.

The distributional extent of SRE taxa may be further restricted where they occur on islands. Little information is available on invertebrates of Irvine Island.

The search of the DEC Threatened Fauna database yielded only two short-range endemic invertebrates of conservation significance occurring in the vicinity of the study area: these were the Kimberley land snails *Amplirhagada astuta* (Schedule 1) and *Amplirhagada herbertena* (Priority 1).

4.3.1 Land Snails

Of the land snails occurring along the Kimberley coast, it is the camaenids that tend to have restricted distributions (eg. *Amplirhagada astuta* is known only from Koolan Island); in contrast, the non-camaenids tend to be smaller species with much larger distributions. Given this, the site visit focussed on searching for camaenids only (further survey work would involve searches for non-camaenid groups). Only one camaenid, *Torresitrachia* sp., was collected from Irvine Island and this taxon was noted at all sites visited.

4.4 Fauna Species of Conservation Significance Potentially Occurring in the Project Area

This section describes the statutory framework under which species are assigned special protection and addresses known species of conservation significance that were yielded by the various database searches.

Native fauna species that are rare, threatened with extinction, or have high conservation value are specially protected by law under the Western Australian *Wildlife Conservation Act 1950*. In addition, many of these species are listed under the Federal *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)*.

4.4.1 *EPBC Act 1999*

Fauna species of national conservation significance are listed under the *EPBC Act 1999*, and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'conservation dependent' (consistent with IUCN categories http://www.iucn.org/themes/ssc/redlist2006/categories.htm).

Migratory wader species are also protected under the *EPBC Act 1999*. The national List of Migratory Species consists of those species listed under the following International Conventions:

- Japan-Australia Migratory Bird Agreement (JAMBA);
- China-Australia Migratory Bird Agreement (CAMBA); and
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

4.4.2 *Wildlife Conservation Act 1950-1979*

Classification of rare and endangered fauna under the *Wildlife Conservation (Specially Protected Fauna) Notice 2006* recognises four distinct schedules of taxa:

1. Schedule 1 taxa are fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection;
2. Schedule 2 taxa are fauna which are presumed to be extinct and are declared to be fauna in need of special protection;
3. Schedule 3 taxa are birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, which are declared to be fauna in need of special protection; and
4. Schedule 4 taxa are fauna that are in need of special protection, otherwise than for the reasons mentioned in paragraphs (1), (2) and (3).

In addition to the above, fauna are also classified under five different Priority codes:

Priority One	Taxa with few, poorly known populations on threatened lands. Taxa which are known from a few specimens or sight records from one or a few localities on lands not managed for conservation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna
Priority Two	Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Three	Taxa with several, poorly known populations, some on conservation lands. Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Four	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed or for which sufficient knowledge is available and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. Taxa which are declining significantly but are not yet threatened.
Priority Five	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation programme, the cessation of which would result in the species becoming threatened within five years.

Table 4.1: Schedule and Priority fauna listed at State and Federal levels that were yielded by the various database searches for the Irvine Island locality.

Species	State *Wildlife Conservation Act 1950-1979*	Federal *Environment Protection and Biodiversity Conservation Act 1999*
Northern Quoll *Dasyurus hallucatus* †Δ *Amplirhagada astuta* Δ Crested Shrike-tit (northern subsp) *Falcunculus frontatus whitei* Δ Buccaneer Burrowing Skink *Lerista prefrontalis* †Δ	Schedule 1 Endangered	Endangered
Saltwater Crocodile *Crocodylus porosus* *	Schedule 4	Migratory
Amplirhagada herbertena Δ	Priority 1	
Skink *Ctenotus yampiensis* †Δ	Priority 2	–
Northern Leafnosed-bat *Hipposideros stenotis* †Δ	Priority 2	
Koolan Blind Snake *Ramphotyphlops yampiensis* †Δ	Priority 2	
Scaly-tailed Possum *Wyulda squamicaudata* Δ	Priority 3	–
Ghost Bat *Macroderma gigas* Δ	Priority 4	
Golden-backed Tree-rat *Mesembriomys macrurus* †Δ	Priority 4	
Bush Stonecurlew *Burhinus grallarius* Δ	Priority 4	–
Water Rat *Hydromys chrysogaster* *	Priority 4	–
Eastern Curlew *Numenius madagascariensis* Δ	Priority 4	

* Denotes species recorded during site visit.
† Denotes species recorded in the Western Australian Museum FaunaBase database(Appendix 1).
Δ Denotes species recorded in DEC's threatened and priority fauna database search (see Appendix 3).

In addition to the above list, work on Koolan Island has also recorded the Orange Leafnosed-bat *Rhinonicteris aurantius*, which is a Schedule 1 species.

4.4.3 Schedule One Species

- **Northern Quoll *Dasyurus hallucatus***

Endangered under the State *Wildlife Conservation Act 1950-1979* and Endangered under the Federal *EPBC Act 1999*.

Distribution: The Northern Quoll, *Dasyurus hallucatus*, was once the most widespread and common marsupial carnivore in northern Australia. Its former distribution was trans-tropical but it has now become restricted to small isolated populations in eastern Queensland and the Northern Territory, with larger populations in the northwest Kimberley and probably the Pilbara regions of Western Australia (Braithwaite and Griffiths 1994). It also occurs on numerous islands off the Australian coast (Abbott and Burbidge 1995, Burbidge and McKenzie 1978).

In addition to its fragmented distribution, there are growing concerns as to the continued persistence of the species in northern Australia, where the impact of grazing and fires (Woinarski et al. 2001) has been shown to have an adverse effect on population numbers and distribution. Recent studies have also found Cane Toads (*Bufo marinus*) extremely detrimental to the persistence of the Northern Quoll in Queensland and the Northern Territory, with the local extinction of many populations (Burnett 1997). The markedly changed range of the Northern Quoll in recent years has prompted the Federal Government to list the species as endangered under the *EPBC Act 1999*. It is also considered 'rare and likely to become extinct' (endangered status) under Schedule 1 of the *Wildlife Conservation Act 1950*.

The predicted arrival of the Cane Toad in the Kimberley in the next few years has further highlighted the significance of the Northern Quoll populations of Western Australia where they persist in both the Kimberley and Pilbara (Figure 4.1). The Kimberley populations show marked seasonal fluctuations in numbers (Schmitt et al. 1989) and also longer-term changes in

abundance (Kenneally et al. 2003). However, there is limited published information on Quoll populations in the more arid Pilbara region of tropical Western Australia (How et al. 1991, How and Cooper 2002).

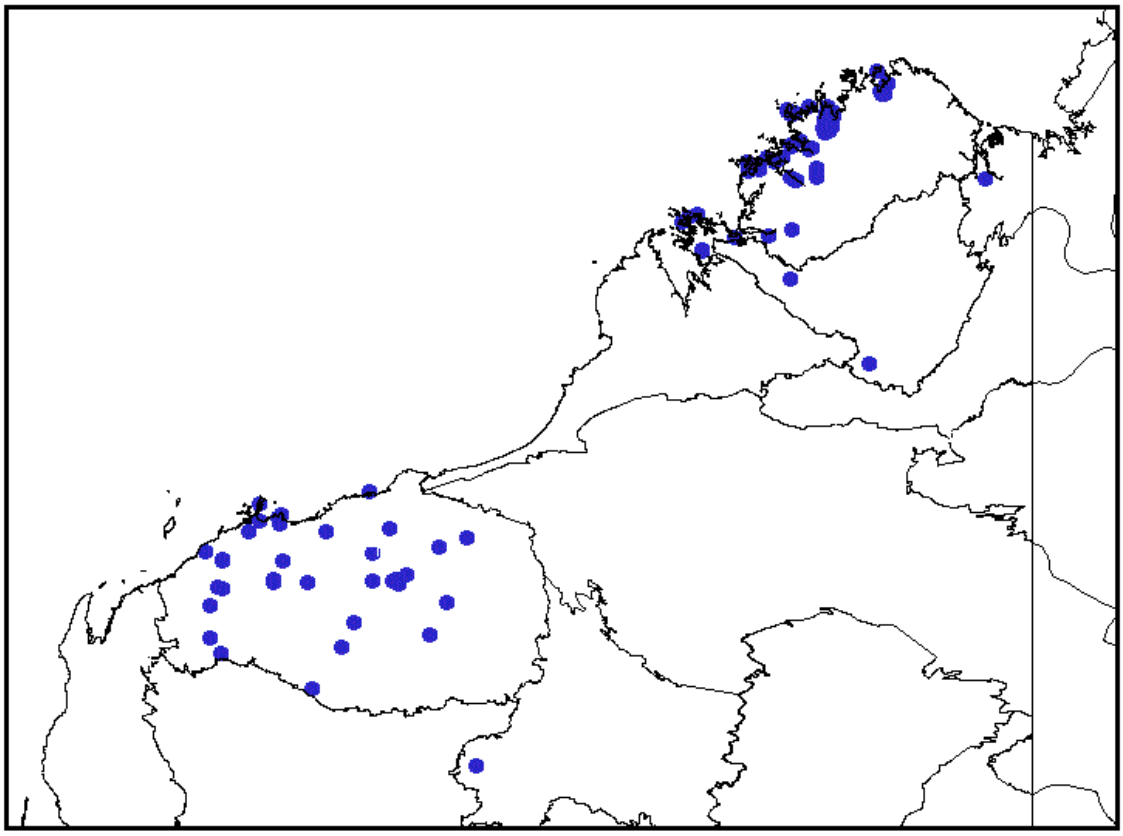

Figure 4.1: Distribution of WA Museum specimens of the Northern Quoll, *Dasyurus hallucatus*, from Western Australia.

Ecology: The Northern Quoll is classed as a medium-sized marsupial, with adult weight ranging from 300 g up to 1,200 g. It is considered a partially arboreal and aggressive carnivore, preying on a varied diet of small invertebrates and vertebrates, including lizards, birds, snakes, small mammals and frogs (Oakwood 1997). It is also known to feed on fleshy fruit. The Northern Quoll is mostly nocturnal, although crepuscular (dusk and dawn) activity is common.

The Northern Quoll is a short-lived mammal, with both sexes maturing at 11 months. Females reproduce only once each year, and all males die shortly after reproducing (Dickman and Braithwaite 1992, Oakwood 2000). The discrete male cohorts that arise within populations make quolls vulnerable to extinction: if no juvenile male quolls survive to adulthood, there will be no males available for mating the following year, and the local population will rapidly go extinct (Braithwaite and Griffiths 1994, Oakwood 2000). Therefore, any factor that results in significant increases in mortality rates of female and juvenile quolls could cause local extinction of quoll populations.

Likelihood of Occurrence: This species has been recorded on Koolan Island. There is a potential that this species may also occur on Irvine Island, however the size of the island and the distance from the mainland suggest that this is unlikely. Northern Quolls have a large home range and only occur at relatively low densities, utilising most habitat types.

Potential Impacts: The conservation status of this species would be unlikely to be altered by the proposed exploration activities should it occur on the island.

- ***Amplirhagada astuta* (Kimberley Land Snail)**

Distribution: The land snail *Amplirhagada astuta* has been recorded from Koolan Island, Yampi Sound, Western Australia (Solem 1981).

Ecology: This species has been described on shell characteristics alone, as no live specimens have been collected (Solem 1981). No information regarding the species' anatomy or ecology is known.

Likelihood of Occurrence: Shells of this species have only been collected from Koolan Island. It is unlikely that this species occurs on Irvine Island. To date no *Amplirhagada* have been collected from Irvine Island.

Potential Impacts: The conservation status of this species is unlikely to be affected by the current exploration proposal.

- **Crested Shrike-tit (northern subsp) *Falcunculus frontatus whitei***

Distribution: This northern subspecies occurs in the semi-arid north Kimberley hinterland of Napier Broome Bay, south to Phillips Range, east to Ellenbrae and Pentecost Range, and west to Beverley Springs (Johnstone and Storr 2004). This subspecies also occurs in the far north of the Northern Territory (Johnstone and Storr 2004).

Ecology: Inhabits open eucalypt forests and woodlands especially of *Eucalyptus tetrodonta* and *Corymbia ferruginea* on sandstone hills (Johnstone and Storr 2004). It feeds on mainly insects, including tree crickets and beetles, also spiders. Most food is prised from under bark or crevices, also in foliage from close to ground to highest branches (Johnstone and Storr 2004). The species has been recorded feeding on upper branches of wandoo, yate (*Eucalyptus occidentalis* and *E. cornuta*), flooded gums, karri, salmon gums, gimlet and York gum.

There are few breeding records of this subspecies. A pair has been observed building a nest about 7 m up in outer foliage of a *Eucalyptus tetradonta* on 6th November 1997 and adults were reported feeding fledged young in October 1998 and November 2000 (Johnstone and Storr 2004). Nests have been reported to hold a clutch of two eggs similar to the southern subspecies but smaller (Johnstone and Storr 2004). The eggs are white, dotted, spotted and blotched with dark brown and underlying grey and are short to long oval in shape (Johnstone and Storr 2004).

Likelihood of Occurrence: Not recorded from Irvine island and the preferred habitat is absent.

Potential Impacts: The conservation status of this species is unlikely to be affected by the current exploration proposal.

- **Buccaneer Burrowing Skink *Lerista prefrontalis***

Distribution: This species is known from a single specimen at King Hall Island in Yampi Sound, Western Australia (Wilson and Swan 2004).

Ecology: The single collected specimen was uncovered in litter among sand at the base of a cliff (Wilson and Swan 2004).

Likelihood of Occurrence: This species has been recorded only from King Hall Island in Yampi Sound, it is unlikely that it occurs on Irvine Island.

Potential Impacts: The conservation status of this species is unlikely to be affected by the current exploration proposal.

4.4.4 Schedule Four Species

- **Saltwater Crocodile *Crocodylus porosus***

Distribution: Inhabits coastal rivers, mangrove, swamps and open sea in northern Australia. Saltwater crocodiles extend inland via major rivers and floodplains (Wilson and Swan 2004).

Ecology: Adult saltwater crocodiles feed on fish, turtles, birds and mammals. The breeding season occurs during the wet season between October and May. Females construct a mound of grasses and reeds, usually close to permanent water.

Likelihood of Occurrence: This species was recorded during the site visit to Irvine Island in June 2007.

Potential Impacts: The conservation status of this species would be unlikely to be altered by the proposed development.

4.4.5 Priority One Species

- ***Amplirhagada herbertena* (Kimberley Land Snail)**

Distribution: The single known specimen of *Amplirhagada herbertena* is known from the Buccaneer Archipelago, Western Australia (Solem 1981).

Ecology: The anatomy and ecology of this species is unknown as the single collection of this species is of a shell only (Solem 1981).

Likelihood of Occurrence: No *Amplirhagada* shells have been collected from Irvine Island.

Potential Impacts: The conservation status of this species would not be affected by the current exploration program.

4.4.6 Priority Two Species

- ***Ctenotus yampiensis***

Distribution: Until a recent fauna survey near Kuri Bay (Biota unpublished data), this species was only known from three records from the early 1970s at Wotjulum Mission on the Yampi Peninsula, and additional records from Mt Elizabeth Station in the western Kimberley (Wilson and Swan 2004).

Ecology: Very little is known about this species though its general ecology is likely to be similar to *Ctenotus decaneurus,* with which it may be synonymous. Recent specimens were collected from *Triodia* associations on sandstone.

Likelihood of Occurrence: Not known from Irvine Island though little survey effort has been directed towards recording *Ctenotus* species.

Potential Impacts: The conservation status of this species would be unlikely to be altered by the proposed exploration program.

- **Northern Leafnosed-bat *Hipposideros stenotis***

Distribution: This bat is a tropical species restricted to the western Kimberley, the Top End of the Northern Territory and the Gulf of Carpentaria in north-west Queensland. It is endemic to Australia (Churchill 1998). The distribution is affected by the availability of suitable roost sites.

Ecology: Northern Leafnosed-bats have not been found in limestone caves despite extensive searches in the Northern Territory. It seems that they use only sandstone caves, boulder piles and disused mines (Churchill 1998). Most specimens have been found in cracks and caves along the western escarpment of the Arnhem Land plateau, an area typified by sandstone cliffs, gorges and waterholes bordered by paperbark trees (Strahan 2004). Other specimens have come from Derby, Western Australia, and from abandoned mines in the gulf country of the Northern Territory near the Queensland border and the vicinity of Mt Isa, Queensland. The wide separation of these localities indicates that the species can tolerate a wide range of environmental conditions (Strahan 2004). Individuals roost alone or in well-separated pairs in the less humid twilight zone (their preferred roost temperature is 27°C with 46% relative humidity). They are easily overlooked in surveys and can be relatively inconspicuous. They are seldom caught in mist nets or bat traps in the open (Churchill 1998).

In the Kimberley, stomach contents of the species that have been examined have contained mostly moths and beetles (chafers) and some ants. They have a slow fluttering butterfly-like flight and fly close to the ground, darting between grass tussocks and tree trunks in search of small insects (Churchill 1998).

In the Kimberley there is an extended birth season from October to at least the end of January and some individuals are in the early stages of pregnancy in July. This is earlier than Northern Territory populations: females caught in June and July in the Northern Territory were not pregnant. Single young are born and these bats do not form maternity colonies (Churchill 1998).

Likelihood of Occurrence: It is uncertain as to whether this species would occur on Irvine Island. However the current exploration program will not impact on any cave features.

Potential Impacts: The conservation status of this species is unlikely to be affected by the current proposal.

- **Koolan Blind Snake *Ramphotyphlops yampiensis***

Distribution: This species is known only from a single specimen from Koolan Island, Yampi Sound, in the subhumid north-western Kimberley region, Western Australia (Cogger 2000, Wilson and Knowles 1988, Wilson and Swan 2004).

Ecology: Nothing is known about the ecology of this species.

Likelihood of Occurrence: This species has only been recorded from Koolan Island to date. As no systematic pit-trapping has been conducted on Irvine Island, it is not known whether this species is resident on the island.

Potential Impacts: The conservation status of this species is unlikely to be affected by the current study.

4.4.7 Priority Three Species

- **Scaly-tailed Possum *Wyulda squamicaudata***

Distribution: The Scaly-tailed Possum is a Kimberley endemic, with a distribution that appears to coincide with areas receiving greater than 900 mm rainfall between King Sound and Admiralty Gulf (Strahan 2004). The species is known from just 24 specimens in the collection of the WA Museum. The current listing as a Priority 3 taxon reflects the paucity of information on this species and its relatively small distribution.

Ecology: This medium sized possum appears to shelter deep within rock piles from which it emerges at night to feed. It has been observed to forage on blossoms in the wild and to take

fruit, nuts and leaves in captivity (Strahan 2004). Females have been recorded carrying a single pouch young between March and August.
Likelihood of Occurrence: It is considered unlikely that this species occurs on Irvine Island.

Potential Impacts: Not relevant as the species is unlikely to occur.

4.4.8 Priority Four Species

- **Ghost Bat *Macroderma gigas***

Distribution: Previously distributed across most of inland and northern Australia, but now restricted to the tropical north of the continent (Churchill 1998). Occurs in a broad range of habitats, with their distribution being influenced by the availability of suitable caves and mines for roost sites (Churchill 1998). The distribution of Ghost Bats is fragmented, with each population showing some genetic differentiation (Armstrong and Wilmer 2004; Biota 2004; Dr. Kyle Armstrong, pers. comm. 2004). Populations in the Pilbara bioregion appear to be isolated from those in the Kimberley and Northern Territory.

Ecology: Ghost Bats are efficient predators of small birds, mammals and reptiles, and large insects, and they have highly developed echolocation, visual and hearing systems (Churchill 1998). Vocalisations audible to humans are used in their complex social interactions (Churchill 1998). Bats forage over large distances (ranges of ~60 ha; Churchill 1998), and the size of their foraging area is probably inversely related to the productivity of their landscape. Bats are known to have overlapping ranges (Churchill 1998).

Scat material from *M. gigas* is quite distinctive and can be used to identify temporary roosts or feeding sites. Fairy Martin (*Hirundo ariel*) nests within culverts provide a roosting substrate for *M. gigas* and the culverts may function either as a night or feeding roost or (probably less commonly) as a temporary day roost. This is an example of where man-made habitat has benefited bats (Biota 2002).

Likelihood of Occurrence: Suitable roost sites were not recorded during the current site visit.

Potential Impacts: Not relevant as no roosts were detected in the study area.

- **Golden-backed Tree-rat *Mesembriomys macrurus***

Vulnerable under the Federal *EPBC Act 1999*.

Distribution: Previously distributed throughout much of the Kimberley and the northern section of the Northern Territory, this species is now restricted to the north-west Kimberley (Menkhorst and Knight 2001).

Ecology: The Golden-backed Tree-rat is semi arboreal, inhabiting tropical woodland and adjacent vine thickets, rainforest and beaches. It roosts in tree hollows and less commonly in loosely woven nests under *Pandanus* crowns.

Likelihood of Occurrence: This species is represented by 47 specimen records in the WA Museum collection obtained from the north-east Kimberley. It has been recorded previously on small near-shore islands in the north-west Kimberley, and may occur in the study area.

Potential Impacts: The conservation status of this species would be unlikely to be altered by the proposed exploration program.

- **Bush Stonecurlew *Burhinus grallarius***

Distribution: This species is widespread in Australia and southern New Guinea. It remains common in tropical Australia, but has declined alarmingly in temperate Australia and has disappeared from many regions (Marchant and Higgins 1993). It is found in the Kimberley and

western portion of the remainder of the State (west of a line joining Port Hedland, Leonora and Albany). Populations are apparently secure in the Pilbara (Ron Johnstone, WA Museum, pers. comm. 2003). The Australian population has been estimated at c. 15,000 individuals. This species was once found throughout most of the south-west of Western Australia, but has disappeared from many areas.

Ecology: The nocturnal Bush Stone-curlew inhabits sparsely grassed, lightly timbered forest or woodland. In southern Australia, they persist most often where there is a well-structured litter layer and fallen timber debris. Individuals have an estimated home range of about 250 ha (Johnson and Baker-Gabb 1993). This species is typically most easily detected by calls, which are given most frequently in Spring (Marchant and Higgins 1993). This species breeds from July to January. The eggs are either laid directly on the ground or in a small scrape (Johnstone and Storr 1998). The Bush Stone-curlew is a terrestrial feeder and is quite wide-ranging in its diet. It feeds primarily on invertebrates, particularly beetles, but also eats small lizards, frogs, snakes, vegetation and seeds (Marchant and Higgins 1993). Foxes are usually considered to be the primary cause for their decline, hence their relative abundance in the tropics, but habitat clearance has also been identified as a threatening process (Garnett and Crowley 2000).

Likelihood of Occurrence: Not recorded during the current survey and little suitable habitat.

Potential Impacts: Not relevant as considered unlikely to be resident on Irvine Island.

- **Water Rat *Hydromys chrysogaster***

Distribution: The Water Rat has a broad distribution around much of coastal Australia and inland up the more substantial rivers. In WA the species has a disjunct distribution that includes the Kimberley, Pilbara coast and offshore islands, Bernier and Dorre Islands, and the South-west. This species generally occurs in permanent fresh or brackish water, but can also be found in marine environments.

Ecology: *H. chrysogaster* is a rodent specialised for an aquatic existence. It is mostly nocturnal, foraging in water or adjacent vegetation. It feeds on aquatic invertebrates, fish, frogs and small birds (Menkhorst and Knight 2001). It is known to forage on land and may move considerable distances when doing so. Water rats undertake regular movements along shorelines, where their tracks and runs may be readily seen, and also follow regular routes when crossing bodies of water (Harris 1978).

Breeding can occur throughout the year, but young are typically born from September through January. Nesting occurs in burrows in banks of lakes, streams, and other bodies of water (Strahan 2004).

Likelihood of Occurrence: Water Rat tracks were observed during the site visit on beaches at Irvine Island. It is likely to occur within the Irvine Island study area.

Potential Impacts: The conservation status of this species would be unlikely to be altered by the proposed development.

- **Eastern Curlew *Numenius madagascariensis***

Distribution: The Eastern Curlew migrates from far north-eastern Asia to Australia during August and September and returns from late March to early May. The north-west coast is the main staging ground for arrivals, few come through Torres Strait. The Eastern Curlew occurs throughout coastal Western Australia, south to Bunbury (Johnstone and Storr 1998).

Ecology: Most curlews spending the northern winter in Australian summer seem to concentrate on the east coast, where they may occur in their hundreds. In Western Australia and the Northern Territory the birds are present in much smaller numbers, usually single individuals or flocks of up to 30 birds (Readers Digest 1976).

The breeding range of the Eastern Curlew is poorly known, but the few areas reported are all in eastern Siberia and Manchuria. In April and May courtship and pair formation take place (Readers Digest 1976).

In Australia, Eastern Curlews prefer estuaries and mudflats and soft sandy beaches (Johnstone and Storr 1998). They feed alone or in dispersed groups by probing the mud or sand with their long bills, probably eating mostly worms and small crabs. In Siberia, insects, particularly the larvae of beetles and soldier flies and amphipod crustaceans called sand fleas, are important food items, and there are also records of the birds eating small frogs and crabs and berries (Readers Digest 1976).

Likelihood of Occurrence: May occur on exposed mudflats.

Potential Impacts: The project is unlikely to present any significant habitat loss for this species as intertidal habitats will not be affected by the proposed exploration program.

4.5 Fauna Habitats of Conservation Significance

Fauna habitats may be of conservation significance because they are uncommon, support unique vegetation or faunal assemblages, support fauna of special conservation significance (those listed in Section 4.4), or any combination of these three factors.

4.5.1 Distribution of Habitats

At a broad level, the habitats investigated within the proposed exploration area were comparable to those seen elsewhere on Irvine Island (as determined by investigation from the air using a helicopter).

As it is understood that the exploration pads will be hand-cut and that equipment will be dropped in using helicopters, there will be only minimal potential impacts from the proposed exploration activities beyond the immediate drill sites.

4.5.2 Unique Vegetation or Faunal Assemblages – TECs, Priority Listed Communities and Ecosystems at Risk

There are no Threatened Ecological Communities within the current project area.

4.5.3 Caves

No caves were noted in areas proposed for drilling.

5.0 Potential Impacts

5.1 Breach of Quarantine

Introduction of foreign species onto Irvine Island is perhaps the most significant impact that could result from exploration activities. A Quarantine Management Plan is proposed for the exploration activities and to date Pluton staff and contractors have been abiding by the quarantine guidelines developed by DEC for working on islands.

5.2 Clearing

It is expected that clearing requirements will be significantly reduced by the use of the transportable drilling platforms. This will mean that other than the drilling itself, minimal additional ground disturbing activities will be required. Hand-cutting of vegetation will occur at the drill sites and for foot tracks between drill sites. Foot tracks will be used to run water lines.

5.3 Water Spills

Fresh water will be recirculated during drilling and will be treated for sediment and hydrocarbons within the recirculation system.

5.4 Vibration and Noise

Vibration and noise associated with drilling activities are considered to be localised temporary impacts with no long-term implications.

5.5 Uncapped Drill Holes

Uncapped drill holes can act as pitfall traps for terrestrial animals and will need to be capped on completion of drilling activities.

6.0 Conclusion and Recommendations

6.1 Features of Significance

6.1.1 Conservation Significant Taxa

Relatively little fauna survey work has been carried out on Irvine Island (reflected in the low species count from the WA Museum database) and statements about the likely occurrence (or otherwise) of taxa of conservation significance (Schedule or Priority) are speculative. Most data for the region has come from Koolan Island (where considerable effort has been employed) and includes several Schedule taxa (see Appendix 4). Further insights on the likely assemblage of Irvine Island can also be obtained by examination of nearby Cockatoo Island, which has a long history of occupancy. For example, although the Northern Quoll is known from Koolan, it is not known from Cockatoo and likewise appears to be absent from Irvine Island.

No species of conservation significance were observed during the site visit to Irvine Island, which was predominantly focussed on reviewing habitats and collecting potential SRE taxa. However, should listed species occur it is unlikely that the proposed exploration program will adversely affect populations. This statement is supported by observations that:

- a Quarantine Management Plan will be developed for the exploration program based on DEC Island Quarantine Protocol;
- the nature and scale of the impacts are relatively small given the size of the island and distribution of habitats; and
- actual ground disturbance will be minor and all clearing activities will be done by hand.

6.1.2 Short Range Endemics

It is likely that Irvine Island will support genetically distinct lineages (populations) of taxa from groups known to support Short Range Endemics (eg. camaenid land snails). However, without a broad taxonomic appraisal (beyond the scope of the current proposal), assigning these populations to existing or novel species will be difficult. Given the proximity of Bathurst Island and its shallow connection to Irvine Island, it is probable that closely related populations will occur across the two islands. Bathurst Island therefore seems an appropriate candidate for providing context to the fauna populations on Irvine Island. Given the relatively small area of disturbance of the proposed drilling program when compared to the size of the island and the area of faunal habitats, as well as the low impact (ie. hand clearing as apposed to earthworks), it is considered unlikely that the conservation status of SRE taxa will be altered by the proposed exploration program.

6.1.3 Habitats

None of the habitats encountered during the survey are considered to be restricted to just the exploration areas.

6.2 Recommendations

On cessation of exploration activities all drill holes need to be appropriately capped.

A breach of quarantine is considered the most significant potential impact arising from the proposed exploration activities. This will be managed via a Quarantine Management Plan, which will build on DEC's standard operating procedures for working on islands.

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Appendix 1

Results of the WA Museum "FaunaBase" Database Search

Reptiles collected between -15.623333, 124.003333 and -16.525, 123.069722

Agamidae
Chelosania brunnea
Chlamydosaurus kingii
Diporiphora bennettii
Lophognathus gilberti gilberti

Boidae
Antaresia childreni

Cheloniidae
Chelonia mydas
Eretmochelys imbricata bissa

Cheluidae
Chelodina rugosa

Colubridae
Boiga irregularis
Dendrelaphis punctulata

Elapidae
Acanthophis praelongus
Demansia olivacea
Demansia papuensis
Demansia psammophis cupreiceps
Furina ornata
Oxyuranus scutellatus
Pseudechis australis
Pseudonaja modesta
Pseudonaja nuchalis

Gekkonidae
Diplodactylus conspicillatus
Gehyra australis
Gehyra nana
Gehyra occidentalis
Gehyra pilbara
Heteronotia binoei
Heteronotia planiceps
Oedura gracilis
Oedura obscura
Oedura rhombifera

Pygopodidae
Delma borea
Lialis burtonis

Scincidae
Carlia amax
Carlia triacantha
Cryptoblepharus carnabyi
Cryptoblepharus plagiocephalus
Ctenotus inornatus
Ctenotus militaris
Ctenotus robustus
Ctenotus serventyi
Ctenotus yampiensis
Cyclodomorphus maximus
Egernia douglasi
Glaphyromorphus isolepis
Lerista griffini
Lerista praefrontalis
Morethia ruficauda ruficauda
Notoscincus ornatus wotjulum
Tiliqua scincoides intermedia

Typhlopidae
Ramphotyphlops kimberleyensis
Ramphotyphlops yampiensis

Varanidae
Varanus acanthurus
Varanus glauerti
Varanus glebopalma
Varanus mertensi
Varanus scalaris
Varanus tristis tristis

Mammals collected between -15.623333, 124.003333 and -16.525, 123.069722

Dasyuridae
Dasyurus hallucatus
Planigale ingrami

Emballonuridae
Saccolaimus flaviventris
Taphozous georgianus

Hipposideridae
Hipposideros ater gilberti
Hipposideros stenotis
Rhinonicteris aurantius

Macropodidae
Petrogale brachyotis
Petrogale concinna monastria

Megadermatidae
Macroderma gigas

Muridae
Melomys burtoni
Mesembriomys macrurus
Mus musculus
Pseudomys delicatulus
Rattus rattus
Rattus tunneyi
Zyzomys argurus
Zyzomys woodwardi

Peramelidae
Isoodon auratus auratus
Isoodon macrourus

Petauridae
Petaurus breviceps ariel

Phalangeridae
Trichosurus vulpecula arnhemensis
Wyulda squamicaudata

Pteropodidae
Macroglossus minimus
Pteropus alecto
Pteropus scapulatus

Vespertilionidae
Chalinolobus nigrogriseus
Miniopterus schreibersii orianae
Nyctophilus arnhemensis
Pipistrellus westralis
Vespadelus caurinus

Amphibia collected between -15.623333, 124.003333 and -16.525, 123.069722

Hylidae
Cyclorana australis
Litoria bicolor
Litoria caerulea
Litoria coplandi
Litoria rothii
Litoria rubella
Litoria tornieri
Litoria wotjulumensis

Myobatrachidae
Crinia bilingua
Limnodynastes ornatus

Appendix 2

Results of the *EPBC Act 1999* Protected Matters Database Search

Threatened Species	Status	Type of Presence
Birds		
Red Goshawk *Erythrotriorchis radiatus*	Vulnerable	Species or species habitat likely to occur within area
Gouldian Finch *Erythrura gouldiae*	Endangered	Species or species habitat may occur within area
Partridge Pigeon (western) *Geophaps smithii blaauwi*	Vulnerable	Species or species habitat likely to occur within area
Australian Painted Snipe *Rostratula australis*	Vulnerable	Species or species habitat may occur within area
Masked Owl (northern) *Tyto novaehollandiae kimberli*	Vulnerable	Species or species habitat may occur within area
Mammals		
Blue Whale *Balaenoptera musculus*	Endangered	Species or species habitat may occur within area
Northern Quoll *Dasyurus hallucatus*	Endangered	Species or species habitat may occur within area
Golden Bandicoot (mainland) *Isoodon auratus auratus*	Vulnerable	Species or species habitat likely to occur within area
Humpback Whale *Megaptera novaeangliae*	Vulnerable	Breeding known to occur within area
Golden-backed Tree-rat *Mesembriomys macrurus*	Vulnerable	Species or species habitat may occur within area
Reptiles		
Loggerhead Turtle *Caretta caretta*	Endangered	Species or species habitat may occur within area
Green Turtle *Chelonia mydas*	Vulnerable	Species or species habitat may occur within area
Leathery Turtle, Leatherback Turtle, Luth *Dermochelys coriacea*	Vulnerable	Species or species habitat may occur within area
Hawksbill Turtle *Eretmochelys imbricata*	Vulnerable	Species or species habitat may occur within area
Flatback Turtle *Natator depressus*	Vulnerable	Species or species habitat may occur within area
Sharks		
Freshwater Sawfish *Pristis microdon*	Vulnerable	Species or species habitat likely to occur within area
Whale Shark *Rhincodon typus*	Vulnerable	Species or species habitat may occur within area

Migratory Species	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Gouldian Finch *Erythrura gouldiae*	Migratory	Species or species habitat may occur within area
White-bellied Sea-Eagle *Haliaeetus leucogaster*	Migratory	Species or species habitat likely to occur within area
Barn Swallow *Hirundo rustica*	Migratory	Species or species habitat may occur within area
Rainbow Bee-eater *Merops ornatus*	Migratory	Species or species habitat may occur within area
Western Partridge Pigeon *Petrophassa smithii blaauwi*	Migratory	Species or species habitat likely to occur within area
Derby White-browed Robin *Poecilodryas superciliosa cerviniventris*	Migratory	Species or species habitat likely to occur within area
Migratory Wetland Species		
Birds		
Great Egret, White Egret *Ardea alba*	Migratory	Species or species habitat may occur within area
Cattle Egret *Ardea ibis*	Migratory	Species or species habitat may occur within area
Oriental Plover, Oriental Dotterel *Charadrius veredus*	Migratory	Species or species habitat may occur within area
Oriental Pratincole *Glareola maldivarum*	Migratory	Species or species habitat may occur within area
Little Curlew, Little Whimbrel *Numenius minutus*	Migratory	Species or species habitat may occur within area
Painted Snipe *Rostratula benghalensis s. lat.*	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Fork-tailed Swift *Apus pacificus*	Migratory	Species or species habitat may occur within area
Great Egret, White Egret *Ardea alba*	Migratory	Species or species habitat may occur within area
Cattle Egret *Ardea ibis*	Migratory	Species or species habitat may occur within area
Streaked Shearwater *Calonectris leucomelas*	Migratory	Species or species habitat may occur within area
Streaked Shearwater *Puffinus leucomelas*	Migratory	Species or species habitat may occur within area
Little Tern *Sterna albifrons*	Migratory	Species or species habitat may occur within area
Bridled Tern *Sterna anaethetus*	Migratory	Breeding known to occur within area
Migratory Marine Species		
Mammals		
Bryde's Whale *Balaenoptera edeni*	Migratory	Species or species habitat may occur within area
Blue Whale *Balaenoptera musculus*	Migratory	Species or species habitat may occur within area
Dugong *Dugong dugon*	Migratory	Species or species habitat likely to occur within area
Humpback Whale *Megaptera novaeangliae*	Migratory	Breeding known to occur within area
Irrawaddy Dolphin *Orcaella brevirostris*	Migratory	Species or species habitat may occur within area

Killer Whale, Orca *Orcinus orca*	Migratory	Species or species habitat may occur within area
Indo-Pacific Humpback Dolphin *Sousa chinensis*	Migratory	Species or species habitat may occur within area
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) *Tursiops aduncus* (Arafura/Timor Sea populations)	Migratory	Species or species habitat likely to occur within area
Reptiles		
Loggerhead Turtle *Caretta caretta*	Migratory	Species or species habitat may occur within area
Green Turtle *Chelonia mydas*	Migratory	Species or species habitat may occur within area
Estuarine Crocodile, Salt-water Crocodile *Crocodylus porosus*	Migratory	Species or species habitat likely to occur within area
Leathery Turtle, Leatherback Turtle, Luth *Dermochelys coriacea*	Migratory	Species or species habitat may occur within area
Hawksbill Turtle *Eretmochelys imbricata*	Migratory	Species or species habitat may occur within area
Flatback Turtle *Natator depressus*	Migratory	Species or species habitat may occur within area
Sharks		
Whale Shark *Rhincodon typus*	Migratory	Species or species habitat may occur within area

Listed Marine Species [Dataset Information]	**Status**	**Type of Presence**
Birds		
Magpie Goose *Anseranas semipalmata*	Listed - overfly marine area	Species or species habitat may occur within area
Fork-tailed Swift *Apus pacificus*	Listed - overfly marine area	Species or species habitat may occur within area
Great Egret, White Egret *Ardea alba*	Listed - overfly marine area	Species or species habitat may occur within area
Cattle Egret *Ardea ibis*	Listed - overfly marine area	Species or species habitat may occur within area
Streaked Shearwater *Calonectris leucomelas*	Listed	Species or species habitat may occur within area
Oriental Plover, Oriental Dotterel *Charadrius veredus*	Listed - overfly marine area	Species or species habitat may occur within area
Oriental Pratincole *Glareola maldivarum*	Listed - overfly marine area	Species or species habitat may occur within area
White-bellied Sea-Eagle *Haliaeetus leucogaster*	Listed	Species or species habitat likely to occur within area
Barn Swallow *Hirundo rustica*	Listed - overfly marine area	Species or species habitat may occur within area
Silver Gull *Larus novaehollandiae*	Listed	Breeding known to occur within area
Rainbow Bee-eater *Merops ornatus*	Listed - overfly marine area	Species or species habitat may occur within area
Little Curlew, Little Whimbrel *Numenius minutus*	Listed - overfly marine area	Species or species habitat may occur within area
Painted Snipe *Rostratula benghalensis s. lat.*	Listed - overfly marine area	Species or species habitat may occur within area
Little Tern *Sterna albifrons*	Listed	Species or species habitat may occur within

		area
Bridled Tern *Sterna anaethetus*	Listed	Breeding known to occur within area
Crested Tern *Sterna bergii*	Listed	Breeding known to occur within area
Roseate Tern *Sterna dougallii*	Listed	Breeding known to occur within area
Mammals		
Dugong *Dugong dugon*	Listed	Species or species habitat likely to occur within area
Ray-finned fishes		
Three-keel Pipefish *Campichthys tricarinatus*	Listed	Species or species habitat may occur within area
Pacific Short-bodied Pipefish, Short-bodied Pipefish *Choeroichthys brachysoma*	Listed	Species or species habitat may occur within area
Pig-snouted Pipefish *Choeroichthys suillus*	Listed	Species or species habitat may occur within area
Fijian Banded Pipefish, Brown-banded Pipefish *Corythoichthys amplexus*	Listed	Species or species habitat may occur within area
Yellow-banded Pipefish, Network Pipefish *Corythoichthys flavofasciatus*	Listed	Species or species habitat may occur within area
Roughridge Pipefish *Cosmocampus banneri*	Listed	Species or species habitat may occur within area
Indian Blue-stripe Pipefish, Blue-stripe Pipefish *Doryrhamphus excisus*	Listed	Species or species habitat may occur within area
Cleaner Pipefish, Janss' Pipefish *Doryrhamphus janssi*	Listed	Species or species habitat may occur within area
Brock's Pipefish *Halicampus brocki*	Listed	Species or species habitat may occur within area
Mud Pipefish, Gray's Pipefish *Halicampus grayi*	Listed	Species or species habitat may occur within area
Spiny-snout Pipefish *Halicampus spinirostris*	Listed	Species or species habitat may occur within area
Ribboned Seadragon, Ribboned Pipefish *Haliichthys taeniophorus*	Listed	Species or species habitat may occur within area
Beady Pipefish, Steep-nosed Pipefish *Hippichthys penicillus*	Listed	Species or species habitat may occur within area
Spiny Seahorse *Hippocampus histrix*	Listed	Species or species habitat may occur within area
Spotted Seahorse, Yellow Seahorse *Hippocampus kuda*	Listed	Species or species habitat may occur within area
Flat-face Seahorse *Hippocampus planifrons*	Listed	Species or species habitat may occur within area
Hedgehog Seahorse *Hippocampus spinosissimus*	Listed	Species or species habitat may occur within area
Tidepool Pipefish *Micrognathus micronotopterus*	Listed	Species or species habitat may occur within area
Pipehorse *Solegnathus hardwickii*	Listed	Species or species habitat may occur within area
Indonesian Pipefish, Gunther's Pipehorse *Solegnathus lettiensis*	Listed	Species or species habitat may occur within area
Blue-finned Ghost Pipefish,	Listed	Species or species habitat may occur within

Robust Ghost Pipefish *Solenostomus cyanopterus*		area
Double-ended Pipehorse, Alligator Pipefish *Syngnathoides biaculeatus*	Listed	Species or species habitat may occur within area
Bend Stick Pipefish, Short-tailed Pipefish *Trachyrhamphus bicoarctatus*	Listed	Species or species habitat may occur within area
Long-nosed Pipefish, Straight Stick Pipefish *Trachyrhamphus longirostris*	Listed	Species or species habitat may occur within area
Reptiles		
Horned Seasnake *Acalyptophis peronii*	Listed	Species or species habitat may occur within area
Short-nosed Seasnake *Aipysurus apraefrontalis*	Listed	Species or species habitat may occur within area
Dubois' Seasnake *Aipysurus duboisii*	Listed	Species or species habitat may occur within area
Spine-tailed Seasnake *Aipysurus eydouxii*	Listed	Species or species habitat may occur within area
Olive Seasnake *Aipysurus laevis*	Listed	Species or species habitat may occur within area
Stokes' Seasnake *Astrotia stokesii*	Listed	Species or species habitat may occur within area
Loggerhead Turtle *Caretta caretta*	Listed	Species or species habitat may occur within area
Green Turtle *Chelonia mydas*	Listed	Species or species habitat may occur within area
Freshwater Crocodile *Crocodylus johnstoni*	Listed	Species or species habitat may occur within area
Estuarine Crocodile, Salt-water Crocodile *Crocodylus porosus*	Listed	Species or species habitat likely to occur within area
Leathery Turtle, Leatherback Turtle, Luth *Dermochelys coriacea*	Listed	Species or species habitat may occur within area
Spectacled Seasnake *Disteira kingii*	Listed	Species or species habitat may occur within area
Olive-headed Seasnake *Disteira major*	Listed	Species or species habitat may occur within area
Turtle-headed Seasnake *Emydocephalus annulatus*	Listed	Species or species habitat may occur within area
Beaked Seasnake *Enhydrina schistosa*	Listed	Species or species habitat may occur within area
Hawksbill Turtle *Eretmochelys imbricata*	Listed	Species or species habitat may occur within area
Black-ringed Seasnake *Hydrelaps darwiniensis*	Listed	Species or species habitat may occur within area
Elegant Seasnake *Hydrophis elegans*	Listed	Species or species habitat may occur within area
Hydrophis mcdowelli	Listed	Species or species habitat may occur within area
Ornate seasnake *Hydrophis ornatus*	Listed	Species or species habitat may occur within area
Spine-bellied Seasnake *Lapemis hardwickii*	Listed	Species or species habitat may occur within area
Flatback Turtle	Listed	Species or species habitat may occur within

Natator depressus		area
Yellow-bellied Seasnake *Pelamis platurus*	Listed	Species or species habitat may occur within area

Whales and Other Cetaceans	**Status**	**Type of Presence**
Bryde's Whale *Balaenoptera edeni*	Cetacean	Species or species habitat may occur within area
Blue Whale *Balaenoptera musculus*	Cetacean	Species or species habitat may occur within area
Common Dolphin *Delphinus delphis*	Cetacean	Species or species habitat may occur within area
Risso's Dolphin, Grampus *Grampus griseus*	Cetacean	Species or species habitat may occur within area
Humpback Whale *Megaptera novaeangliae*	Cetacean	Breeding known to occur within area
Irrawaddy Dolphin *Orcaella brevirostris*	Cetacean	Species or species habitat may occur within area
Killer Whale, Orca *Orcinus orca*	Cetacean	Species or species habitat may occur within area
Indo-Pacific Humpback Dolphin *Sousa chinensis*	Cetacean	Species or species habitat may occur within area
Spotted Dolphin, Pantropical Spotted Dolphin *Stenella attenuata*	Cetacean	Species or species habitat may occur within area
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) *Tursiops aduncus* (Arafura/Timor Sea populations)	Cetacean	Species or species habitat likely to occur within area
Spotted Bottlenose Dolphin *Tursiops aduncus*	Cetacean	Species or species habitat likely to occur within area
Bottlenose Dolphin *Tursiops truncatus s. str.*	Cetacean	Species or species habitat may occur within area

Appendix 3

Results of the DEC Threatened Fauna Database Search

Threatened and Priority Fauna Database

15.6233 °S 124.0033 °E / 16.525 °S 123.0697 °E Irvine Island (plus ~50km buffer)

*	Date	Certainty	Seen	Location Name	Method
Schedule 1 - Fauna that is rare or is likely to become extinct					
Dasyurus hallucatus				**Northern Quoll**	*14 records*
	2006	1	6	Koolan Island	Caught or trapped
	2006	1	7	Koolan Island	Caught or trapped
	2006	1	6	Koolan Island	Caught or trapped
	2006	1	4	Koolan Island	Caught or trapped
	2006	1	5	Koolan Island	Caught or trapped
	2006	1	3	Koolan Island	Caught or trapped
	2007	1	1	Koonlan Island	Caught or trapped
	2007	1	1	Koonlan Island	Caught or trapped
	2007	1	1	Koonlan Island	Caught or trapped
	2007	1	1	Koonlan Island	Caught or trapped
	2007	1	1	Koonlan Island	Caught or trapped
	2007	1	1	Koonlan Island	Caught or trapped
	2007	1	1	Koonlan Island	Caught or trapped
	2007	1	1	Koonlan Island	Caught or trapped
	2007	1	1	Koonlan Island	Caught or trapped
Rhinonicteris aurantius				**Orange Leaf-nosed Bat**	*1 records*
This species of bat occurs in a few scattered locations in the Pilbara, as well as the Kimberley. It roosts in caves and is sensitive to human disturbance.					
	1965	1	1		
Falcunculus frontatus whitei				**Crested Shrike-tit (northern subsp)**	*1 records*
This species is a rare inhabitant of woodlands.					
	1940	2	1	Wotjulum	
Lerista praefrontalis				**Buccaneer Burrowing Skink**	*1 records*
	1982	1	1	King Hall Island	Caught or trapped
Amplirhagada astuta				**Amplirhagada astuta**	*2 records*
		1		Koolan Island	Caught or trapped
	1966	1	4	Koolan Island	Caught or trapped
Priority One: Taxa with few, poorly known populations on threatened lands					
Amplirhagada herbertena				**Amplirhagada herbertena**	*1 records*
		1		Buccaneer Archipelago	
Priority Two: Taxa with few, poorly known populations on conservation lands					

Friday, 24 August 2007 Department of Environment and Conservation

Appendix 4

WAM Records of Herpetofauna and Mammals from the Kimberley Islands: Bathurst, Cockatoo, Koolan and Irvine Islands

			Island			
Family	**Genus**	**Species**	BATHURST	COCKATOO	KOOLAN	IRVINE
Herpetofauna						
AGAMIDAE	DIPORIPHORA	BENNETTII			✓	
BOIDAE	ANTARESIA	CHILDRENI			✓	
COLUBRIDAE	BOIGA	IRREGULARIS			✓	
COLUBRIDAE	DENDRELAPHIS	PUNCTULATA			✓	
ELAPIDAE	ACANTHOPHIS	PRAELONGUS			✓	
ELAPIDAE	DEMANSIA	OLIVACEA			✓	
ELAPIDAE	FURINA	ORNATA			✓	
ELAPIDAE	OXYURANUS	SCUTELLATUS			✓	
ELAPIDAE	PSEUDECHIS	AUSTRALIS		✓	✓	✓
GEKKONIDAE	GEHYRA	AUSTRALIS			✓	
GEKKONIDAE	GEHYRA	NANA			✓	
GEKKONIDAE	GEHYRA	OCCIDENTALIS	✓		✓	✓
GEKKONIDAE	HERERONOTIA	PLANICEPS	✓		✓	
GEKKONIDAE	HERERONOTIA	SPELAEA				✓
GEKKONIDAE	HETERONOTIA	BINOEI			✓	
GEKKONIDAE	OEDURA	GRACILIS	✓		✓	✓
GEKKONIDAE	OEDURA	OBSCURA	✓		✓	✓
GEKKONIDAE	OEDURA	RHOMBIFERA			✓	
HYLIDAE	LITORIA	RUBELLA			✓	
PYGOPODIDAE	DELMA	BOREA		✓	✓	
PYGOPODIDAE	LIALIS	BURTONIS			✓	
SCINCIDAE	CARLIA	AMAX			✓	
SCINCIDAE	CARLIA	TRIACANTHA	✓	✓	✓	✓
SCINCIDAE	CRYPTOBLEPHARUS	CARNABYI			✓	
SCINCIDAE	CRYPTOBLEPHARUS	PLAGIOCEPHALUS			✓	
SCINCIDAE	CTENOTUS	INORNATUS	✓		✓	
SCINCIDAE	CYCLODOMORPHIS	MAXIMUS			✓	
SCINCIDAE	GLAPHYROMORPHUS	ISOLEPIS		✓	✓	
TYPHLOPIDAE	RAMPHOTYPHLOPS	KIMBERLEYENSIS			✓	
TYPHLOPIDAE	RAMPHOTYPHLOPS	YAMPIENSIS			✓	
VARANIDAE	VARANUS	ACANTHURUS			✓	
VARANIDAE	VARANUS	GLEBOPALMA	✓		✓	
Mammals						
DASYURIDAE	DASYURUS	HALLUCATUS			✓	
MURIDAE	ZYZOMYS	WOODWARDI	✓			✓
PTEROPODIDAE	PTEROPUS	ALECTO			✓	
PTEROPODIDAE	MACROGLOSSUS	MINIMUS				✓
MEGADERMIDAE	MACRODERMA	GIGAS			✓	
HIPPOSIDERIDAE	HIPPOSIDEROS	ATER			✓	
HIPPOSIDERIDAE	HIPPOSIDEROS	STENOTIS	✓			
HIPPOSIDERIDAE	RHINONICTERIS	AURANTIUS			✓	
EMBALLONURIDAE	TAPHOZOUS	GEORGIANUS	✓	✓	✓	
VESPERTILIONIDAE	CHALINOLOBUS	NIGROGRISEUS			✓	
VESPERTILIONIDAE	PIPISTRELLIS	WESTRALIS			✓	
VESPERTILIONIDAE	VESPADELUS	CAURINUS	✓			✓