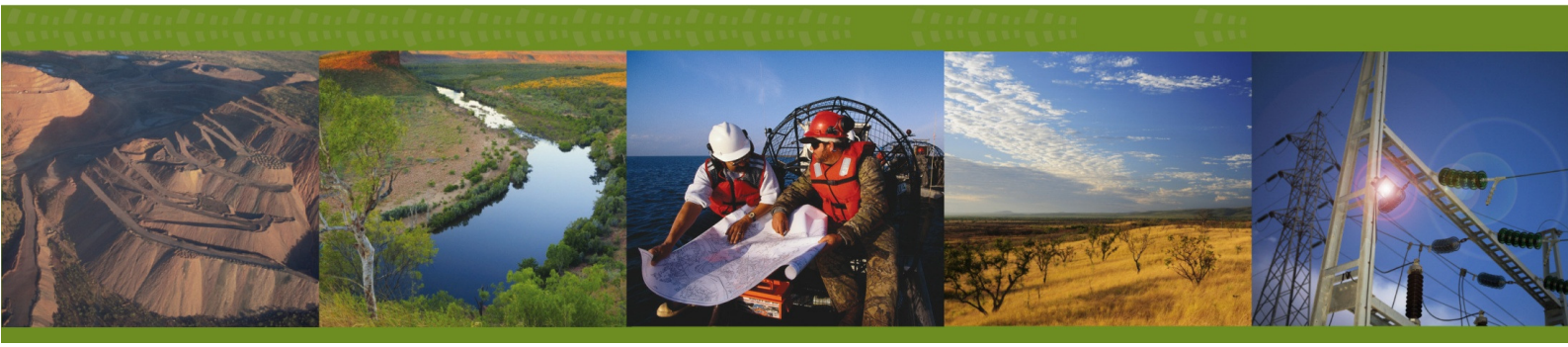

Irvine Island Project

Explanatory Document for Referral

Prepared for
Pluton Resources Limited
by Strategen

August 2011

STRATEGEN
environmental consultants

Irvine Island Project

Explanatory Document for Referral

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Client: Pluton Resources Limited

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Executive summary

Purpose

Pluton Resources Limited (Pluton) proposes to mine iron ore at Irvine Island in the Kimberley region of Western Australia. The Proposal involves the mining and shipping of iron ore through the development of two mine pits on the Hardstaff Peninsula and Isthmus Region of Irvine Island, dry ore processing and materials offloading and transhipment facilities, as well as waste rock disposal areas, a borefield and a range of other ancillary support infrastructure.

Irvine Island is one of three islands forming the Kimberley Iron Ore Hub and is within the Yampi Sound Port area. It is located about 3 km and about 10 km from the Cockatoo Island and Koolan Island mines, respectively. The Yampi Sound Port was proclaimed as a port in 1982 in recognition of the shipping of iron ore from the region.

There will be no dredging required to construct the materials offloading facility at Irvine Island and the workforce accommodation facilities on Cockatoo Island will be used for this Proposal.

The Irvine Island Project represents an opportunity to build upon the well-established local iron ore industry. The iron ore from the three islands is typically high grade and low in impurities and therefore requires less processing than many ore deposits found in other mining areas. The first exports of iron ore occurred from Cockatoo Island and this mine is scheduled to close in 2013 based on current mining approvals.

Traditional Owners

Irvine Island is within Mayala people's native title claim and is recognised as an important site under Aboriginal traditional law and customs. Many Mayala people also identify as Bardi and Jawi or Dambimangari People. Where "Mayala" people are referred to in this document the term includes Bardi, Jawi and Dambimangari people who have association with Irvine Island under Aboriginal traditional law and custom.

Mayala people were historically opposed to mining on Irvine Island as intrusion by mining companies was seen as a threat to the cultural values. In 2007, prior to exploration, Pluton consulted extensively with Mayala people who determined that exploration and the cultural values could co-exist. Pluton proposed an inclusive program, which gave Mayala people a role in the planning and development and a right of veto over unacceptable exploration practices.

On 28 June 2011, Pluton received Mayala people's support for a mining project on the central and eastern side of Irvine Island. The north western part of the island (Cultural Heritage Protection Area) has been identified by Mayala people as having very significant cultural heritage importance and mining and access to this area will be prohibited under the agreement between Pluton and Mayala people.

Environmental values

The Red Book status report (EPA 1993) recommended that Irvine Island, and about 20 other islands from the Buccaneer Archipelago should be "declared 'A' Class reserves for Conservation of Flora and Fauna and be vested in The National Parks and Nature Conservation Authority (NPNCA)". The recommendation by the Department of Conservation and Land Management (CALM)/Environmental Protection Authority (EPA) was based on the 1982 biological survey of the islands of the Buccaneer Archipelago, which was conducted over a single one-month period only and therefore involved a relatively limited sampling effort. This work was not sufficiently detailed to fully evaluate the significance of Irvine Island and now further studies are being undertaken to define the significance of Irvine Island in relation to the wider context of the Buccaneer Archipelago. The recently released Kimberley Science and Conservation Strategy has indicated that conservation reserves or joint management arrangements will be established to protect

priority islands in the Kimberley (Government of Western Australia 2011). These priority islands have yet to be identified by the Government.

Further, detailed studies vegetation and fauna studies have been conducted by Pluton (see below).

No Threatened Ecological Communities (TEC's) or Priority Ecological Communities (PEC's), Declared Rare Flora or flora listed under the EPBC Act 1999 were recorded (Onshore 2011a and b). Three Priority species were recorded (Onshore 2011a and b):

- *Ipomoea* sp. A Kimberley Flora (LJ Penn 84) (P1)
- *Phyllanthus aridus* (P3)
- *Haemodorum gracile* (P4).

The vertebrate fauna assemblage of Irvine Island is considered typical of other regional islands (Biota 2011, in prep.).

Noteworthy findings from survey work to date is the presence of:

1. A *Lerista* (skink) species which has been rarely encountered species group during broader island surveys.
2. The gecko genus *Gehyra* has been recorded from several other islands of the Buccaneer Archipelago, and is currently undergoing taxonomic review. There are indications that *G. occidentalis* is a species complex, with the Irvine Island form remaining unresolved.
3. Camaenid snails, with recent indications that at least one species surveyed on Irvine Island may be of elevated conservation significance.

Confirmation of potential conservation status of all unresolved species is pending Australian and Western Australian Museum testing and results.

Based on the survey results gathered to date, the biodiversity of Irvine Island is generally considered typical of other regional islands. All identified species have been recorded from other nearby islands, which have also yielded very similar species compositions.

Pluton environmental studies

Flora, fauna and marine studies have been or are being undertaken to provide the detail required to review the significance of the biodiversity of Irvine Island. Studies conducted so far have included:

- level 1 and 2 flora (including mangroves)
- level 1 and 2 fauna studies (including Short-range Endemic [SRE] invertebrates)
- marine benthic primary producer habitat surveys, ground truthing and mapping
- bathymetry
- desktop marine fauna study and EPBC protected matters search
- preliminary surface water hydrology characterisation
- initial hydrogeological investigations including pump testing, bore development and ground water modelling for Hardstaff Peninsula and the Isthmus Region (including investigating impacts on mangroves)
- meteorological data collection
- tide and current data collection and preliminary modelling.

Studies to be completed to provide data for a Public Environmental Review (PER) level impact assessment include, subterranean fauna studies, marine fauna study, marine water quality baseline, tidal, wave and marine current modelling, surface water modelling and assessment and groundwater modelling.

Project justification

Irvine Island is within the Derby-West Kimberley local government area. The population of Derby-West Kimberley has not grown over the period 2000-2010. Approximately half the population is Aboriginal. Extremely high rates of unemployment exist, particularly amongst the Aboriginal population.

Additional developments sensitive to the protection of environmental values are required in the Derby-West Kimberley area to achieve the necessary economic growth to support its population. An Irvine Island mining operation is likely to inject $35 million per annum directly into Kimberley household incomes.

The Irvine Island Project will provide Mayala people and other Kimberley Aboriginal people as well as the wider Kimberley community with employment, a steady income stream and new business opportunities while protecting significant cultural and heritage values on Irvine Island. Pluton has binding commitments to provide Kimberley Aboriginal people with 30% of the jobs created by the Proposal.

Agreements with Mayala People

At the end of 2010, Pluton Resources entered into a legally binding agreement with the Mayala people for the development of Irvine Island, in partnership. The Mayala people support the Proposal and have agreed to the grant of M04/452, the mining lease that will replace the existing exploration licence. The negotiations were conducted with a team of senior Mayala representatives from the Kimberley Land Council (KLC) elected by the Mayala community, with the agreement unanimously ratified at a community meeting in June 2011.

Pluton and the Mayala people are partners in this Proposal and will work together to develop the Project, which will deliver significant benefits to the traditional owners whilst protecting heritage and cultural values.

Net conservation benefit

Pluton Resources is in the process of developing an Environmental Management Plan (EMP) aligned to ISO 14001:2004 environmental management principles. The EMP includes discrete management plans to consider site-specific issues for both construction and operation of the Proposal and will be based on best practice and an adaptive management approach. The EMP will also address environmental aspects of the Proposal to ensure that it will protect adjoining environmental, heritage and cultural values.

Pluton is aware of the sensitivity of the region in which it operates and has a record of applying world's best environmental practice in its conduct of Island exploration. Pluton is committed to continuing to establishing high environmental benchmarks in the design, construction, operation and closure phases of the Proposal. These commitments will be detailed in the PER.

Closure planning in conjunction with the Mayala people will be an important component of providing a net conservation and environmental benefit by ensuring that all disturbed areas are rehabilitated and returned to the State as agreed by the Mayala people.

Some of the works associated with the Proposal are likely to result in residual impacts to environmental assets on Irvine Island. Whilst preparing the PER, Pluton is developing a mitigation package to address residual impacts and to obtain a net regional conservation benefit to the Kimberley islands in the Buccaneer Archipelago as a whole. These benefits will be determined in accordance with the EPA Position Statement No. 9 and Guidance Statement No. 19 on environmental offsets (EPA 2006 and 2008) and in consultation with the Department of Environment and Conservation and the Office of EPA.

Some measures that may be considered include:

- assistance with management planning and on-ground management of conservation values of selected islands in the Archipelago
- research of key marine fauna species.

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1. Introduction and project background

1.1 Introduction

Pluton Resources Limited (Pluton) proposes to mine iron ore at Irvine Island, located approximately 130 km north of Derby in the Kimberley region of Western Australia. Ore will be pre-concentrated by a dry method on Irvine Island then shipped from the island to third parties in Asia for final beneficiation (the Proposal).

1.2 Location and history of iron ore mining in the area

Irvine Island is one of three islands, along with Koolan and Cockatoo Island, forming the Kimberley Iron Ore Hub, located in the wider Buccaneer Archipelago (Figure 1). The Kimberley Iron Ore Hub is within the Yampi Sound Port. The Port was proclaimed as such in 1982 in recognition of the shipping for export of iron ore from the region. The islands enjoy deep water access thereby avoiding the need for dredging for the construction of trans-shipment facilities. The three islands are located near existing seaways and relatively close to major Asian customers.

Irvine Island is located about 3 km from the Cockatoo Island mine and about 10 km from the Koolan Island mine (Figure 2). The Kimberley Iron Ore Hub is about 50 km^2 in size, much of which is occupied by ocean. Irvine Island is approximately 950 ha in area and is one of more than 2500 Kimberley near-shore islands, 20 of which exceed 1000 ha, the largest being Augustus Island at 18 990 ha (Government of Western Australia 2011).

Rich deposits of ore were identified within the Hub by pearlers operating their luggers in 1870. The geology was assessed by various mining interests from the period between 1907–1937 when the Australian Government introduced an embargo on the export of iron ore. Iron ore mining began at Cockatoo Island in 1951 and was the location from where iron ore was first exported from Australia.

Australian Iron and Steel was first granted mining tenure over Irvine Island in 1936. Tenure was granted under the now repealed *Broken Hill Proprietary Steel Industry Act 1952* (WA), which provided for the development of a steel industry utilising ore from Koolan, Cockatoo and Irvine Island.

BHP explored Irvine Island in the late 1960s and early 1970s and recommended drilling in the early 1970s and again in the mid 1980s. Remnants of the BHP tracks and exploration camps remain.

The high concentrations of iron on Koolan, Cockatoo and Irvine Islands are thought to be unique to the Kimberley Iron Ore Hub area. Despite more than 50 years of mining and exploration, there have not been any similar concentrations of iron found on other Kimberley islands.

Koolan and Cockatoo Island continue to be the centre of iron ore mining in the Kimberley, with Cockatoo being mined by HWE Mining and Cliffs Natural Resources Pty Ltd and Koolan being mined by Mt Gibson Iron Ltd. Based on existing approvals, Cockatoo Island is scheduled to close in 2013.

1.3 Traditional Owners

Irvine Island is within Mayala people's native title claim and is recognised as an important site under Aboriginal traditional law and customs. Many Mayala people also identify as Bardi and Jawi or Dambimangari People. Where "Mayala" people are referred to in this document, the term includes Bardi, Jawi and Dambimangari people who have association with Irvine Island under Aboriginal traditional law and custom.

Northern parts of the island have been identified by Mayala people as having very significant cultural heritage importance and these areas are excluded from any potential impact of this Proposal (Figure 3).

1.4 Purpose of document

The 'Irvine Island Project' Proposal is to be referred to the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* (EP Act). The level of assessment for the Project is expected to be set at a Public Environmental Review (PER).

To support the referral, this document provides a description of the Proposal, the partnership with the Mayala people, peer review mechanisms, summary of environmental studies completed, potential methods of achieving a net conservation benefit, closure and management measures.

1.5 Proponent details

The Proponent is Pluton Resources Limited. The company was listed on the Australian Stock Exchange in 2006. Pluton is a progressive and innovative company, which is characterised by a commitment to a strong relationship and a genuine respect for native title holders and traditional owners, the Mayala people, and genuine passion for the environment. The Mayala People will be one of the largest shareholders of the Company.

The key proponent contact details for the Proposal are:

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General Counsel
Pluton Resources Limited
Level 2, 322 Hay Street, Subiaco WA 6008
Phone: 6142 0390 Facsimile: 03 6244 1887 (Tasmania)
Email: pamelakaye@plutonresources.com

1.6 Tenure and existing environmental approvals

Pluton conducts its exploration operations on E04/1172, which was granted pursuant to the *Mining Act 1972* (WA) (Mining Act) on 1 November 2007. Pluton has applied for M04/452, which has yet to be granted.

Pluton has twice referred exploration proposals to the EPA under section 38 of the EP Act and on both occasions the EPA decided not to assess the exploration programs (EPA 2007a).

Conditions of Exploration Lease E04/1172, applied under the Mining Act, require Pluton to conduct exploration under a Quarantine Management Plan (Strategen 2009) and in an environmentally sensitive manner. As part of this world's best practice environmental management, Pluton prepares conservation management plans for each exploration Program of Works.

1.7 Project justification

The Proposal will deliver economic, social and a net conservation benefit to regional, State and Australian communities.

Irvine Island is within the Derby-West Kimberley local government area, which in 2010 had a population of 8 092. Approximately half the population is Aboriginal. The median household income is $903 per week (ABS 2006) and extremely high rates of unemployment exist, particularly amongst the Aboriginal population.

The population of Derby-West Kimberley has not grown over the period 2000-2010. Additional developments sensitive to the protection of environmental values are required in the Derby-West Kimberley area to achieve the necessary economic growth to support the growing population. Where there are projects with finite lives sufficient new projects and associated jobs are needed to replace lost jobs and stimulate new growth. Mining projects like Irvine Island are crucial in the growth process (ERA 2011).

An Irvine Island mining operation is likely to inject $35 million per annum directly into Kimberley household incomes.

Locally, the Irvine Island Project and the Co-operation Agreement for the development of the Proposal reached between Pluton and the Mayala people on 28 June 2011 (Co-operation Agreement) will provide Mayala and other Kimberley Aboriginal people as well as the wider Kimberley community with employment, a steady income stream and new business opportunities while protecting significant cultural and heritage values on Irvine Island. Pluton has binding commitments to provide Kimberley Aboriginal people with 30% of the jobs created by the Proposal.

For the remainder of the State and the Nation, the Proposal will add to royalty and tax revenues and provide direct and indirect business and employment opportunities through the project workforce and supply contracts.

The Irvine Island Project represents an opportunity to build upon the well-established local iron ore industry within the Kimberley Iron Ore Hub. The Proposal is within the Yampi Sound Port area so will complement the existing facility. Cockatoo Island was the location from which iron ore was first exported in Australia but is currently scheduled for closure in 2013.

The Proposal is free from rail or major road network constraints that generally typify deposits within the Pilbara Region. Irvine Island also has the advantage of being located near existing seaways and is close to major Asian customers (approximately 1500 km less per round trip than for ships from Port Hedland).

Irvine Island enjoys immediate deepwater access, such that no dredging is required. The load out facility will accommodate shipping requirements - a major materials offloading facility is not required, therefore the marine footprint is minimal. The biodiversity of Irvine Island does not appear to be unique, sharing a similar fauna assemblage and vegetation and flora characteristics with other islands in the Buccaneer Archipelago.

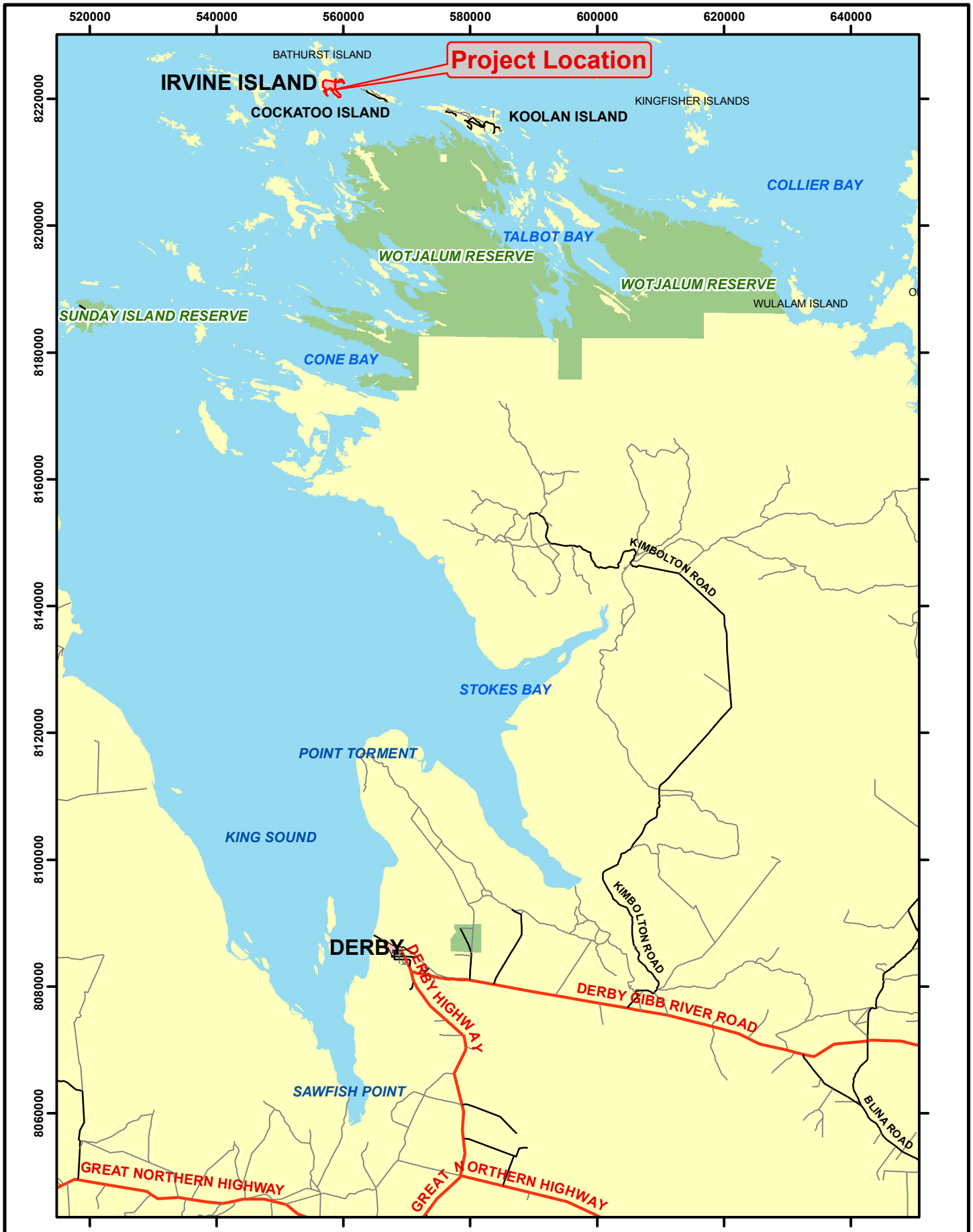

Figure 1: Regional Location

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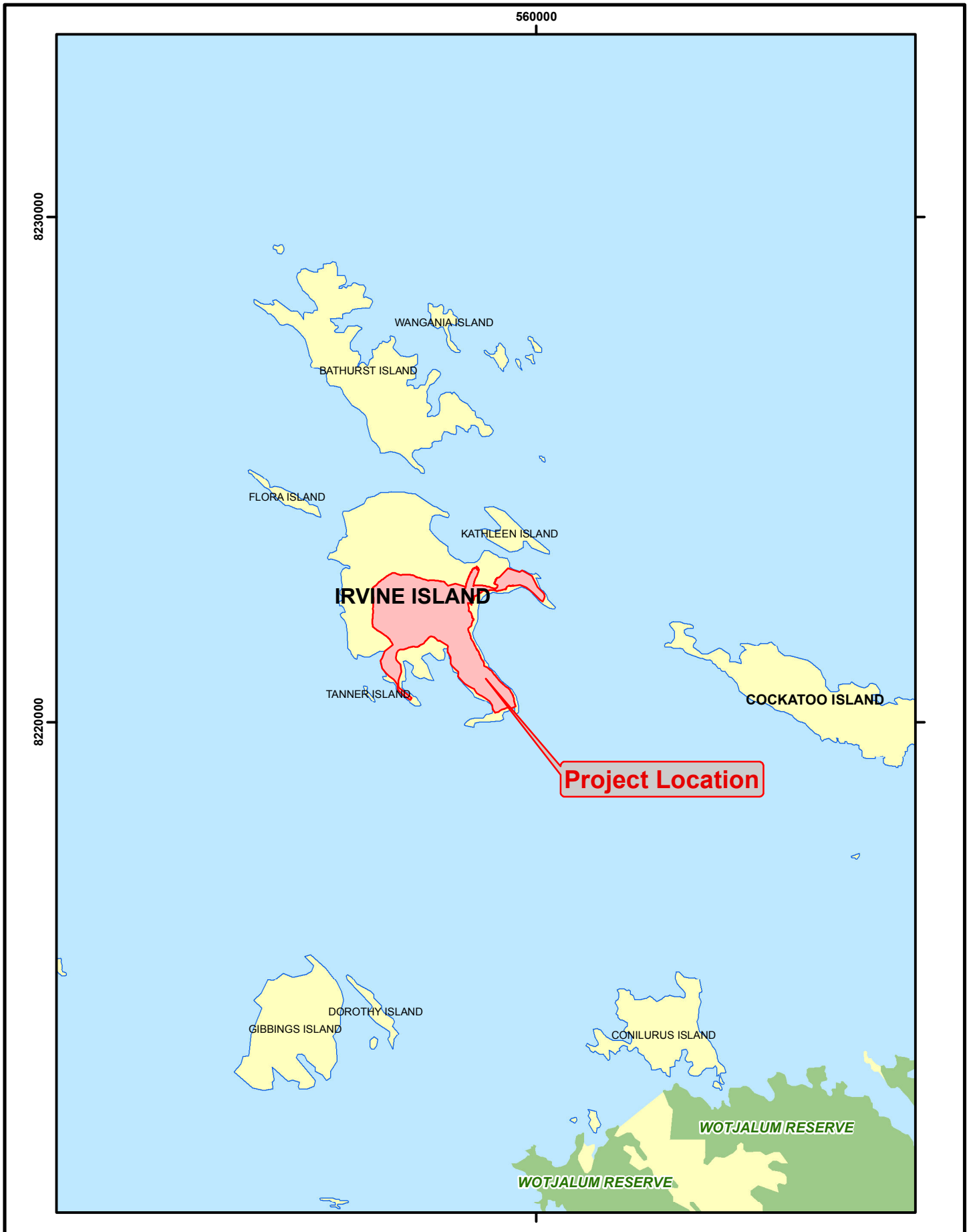
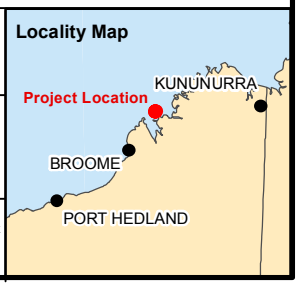


Figure 2: Project Location



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Geoscience Austrlia, Mapsheet SE5103 Yampi, 250k

Note that positional errors may occur in some areas

2. Conservation status of Irvine Island

2.1 Past decisions regarding Irvine Island conservation status

Following the formation of the EPA in 1971, the Conservation Through Reserves Committee (CTRC) was appointed to review and make recommendations to the EPA on the adequacy of existing reserves and proposals for additional national parks and nature reserves in Western Australia (EPA 1993). The CTRC divided the State into 12 regions (referred to as Systems) and the Kimberley region was classified as System 7. CTRC reviewed reserve needs and public comments in System 7 and released the CTRC Green Book for System 7 for public comment in 1978 (EPA 1993).

In terms of the Buccaneer Archipelago, the CTRC considered the data insufficient to justify recommending the creation of specific reserves and that the EPA should commission a biological survey to enable a firm decision to be reached (Burbidge *et al*. 1991).

In September 1981 the EPA considered the CTRC recommendations, together with all comments and submissions and other available information before making its own recommendations for System 7 to Government in a report known as a 'Red Book' (EPA 1993). It was accepted by the Government as a 'guide' for the establishment of conservation reserves in the Kimberly with the implementation of each recommendation to be on the basis of separate Cabinet decisions (Burbidge *et al.* 1991).

In June 1982 a biological survey of the islands of the Buccaneer Archipelago was conducted over a single one-month period which is a relatively limited amount of sampling effort. Following completion of the survey (the results of which have not been published) the Department and Fisheries and Wildlife made recommendations to the EPA and Department of Lands and Surveys (Burbidge *et al*. 1991). Included in these recommendations was that Irvine Island and about 20 other islands be declared an 'A' Class Reserve for Conservation of Flora and Fauna.

These recommendations were accepted by the EPA which published them in the Red Book Status Report in 1993 (EPA 1993).

2.2 Importance of islands

Some offshore islands harbour animals that are rare or extinct on the Australian mainland; some have unique assemblages, species or sub-species of animals and plants; almost all have been unaffected by the exotic animals introduced into Australia (Burbidge and McKenzie 1978).

Some Kimberley islands support undisturbed populations of many mainland species that will probably persist regardless of increased development on the mainland and the impacts of introduced species, such as cattle and cats, which are common in the Kimberley. The value of islands to conservation in WA is dramatically evident on the coastal islands of the Pilbara and Shark Bay where a number of species persist that are rare or extinct on the mainland (McKenzie *et al.* 1978).

2.3 Likely survey limitations

A number of biological surveys were conducted on numerous Kimberley Islands in the 1970s (Burbidge and McKenzie 1978). These surveys generally did not include the Buccaneer Archipelago, although Koolan Island was included in some surveys (avifauna and herpetofauna). The June 1982 survey of the islands of the Buccaneer Archipelago involved a relatively limited amount of sampling effort.

Further, much of the conservation planning is based on vegetation association mapping of Beard (1979). Beard's mapping was completed at a relatively coarse scale and based solely on interpretation for the Yampi Peninsula Unit. Vegetation communities identified as being of high conservation significance such as rainforest patches and

mound springs require high-resolution mapping and confirmation by ground truthing to confirm distribution owing to their small size.

2.4 Current status

Very few of the 'Red Book' recommendations have been further considered by Cabinet, mainly because of delays while various enquiries were completed and unresolved issues to address Aboriginal and mining interests (Burbidge *et al*. 1991). Consequently Irvine Island or other islands of the Buccaneer Archipelago have not yet been declared 'A' Class reserves (DEC 2011). Considering this recommendation was put forward 18 years ago it is to be expected that it will be reviewed in the light of more recent information becoming available (such as the biological surveys undertaken by Pluton and the DEC Kimberley Island Survey group).

Irvine Island is not an Environmentally Sensitive Area as listed under Regulation No. 6 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004; however, Pluton Resources recognises the significant environmental values of the islands of the Buccaneer Archipelago.

2.5 Results of Pluton surveys

2.5.1 Fauna

Fauna habitats identified in the Proposal area during the first Pluton-commissioned survey included beach dunes and small adjacent sandy areas, low open woodland, low open shrubland, deciduous forest and mangroves (Biota 2007). None of the habitats encountered during the survey are considered to be restricted solely to the Proposal area nor restricted regionally to Irvine Island as similar habitats have been observed throughout the Buccaneer Archipelago (Biota 2007).

Based on the survey results gathered to date, the vertebrate fauna assemblage of Irvine Island is considered typical of other regional islands (Biota 2010). All identified species have been recorded from other islands, which have also yielded very similar species compositions. Amongst the vertebrates, a *Lerista* (skink) species is noteworthy, as the island surveys undertaken to date rarely encounter members of this species group. Also of note is the presence of the gecko genus *Gehyra*, recorded from several other islands of the Buccaneer Archipelago. The gecko is currently undergoing taxonomic review, which indicates that *G. occidentalis* is a species complex with the Irvine Island form remaining unresolved (Biota 2010). Taxonomic work is also continuing on Camaenid snails, with recent indications that at least one species surveyed on Irvine Island may be of elevated conservation significance. Confirmation of potential conservation status of all unresolved species is pending Australian and Western Australian Museum testing and results.

Further details are contained in Section 4.2.2.

2.5.2 Flora and vegetation

Pluton has undertaken comprehensive vegetation and flora surveys, which overcome some of the limitations of previous surveys (Mattiske 2008, Onshore 2011a and b). Species have been collected and identified. Vegetation associations have been mapped and ground truthed.

Surveys of Irvine Island in April and October 2010 did not identify any vegetation associations to be of State or Australian Government conservation significance (Onshore 2011a). Examples of all Priority Flora were also found on adjacent islands (Kathleen and Bathurst) and in the Cultural Heritage Protection Area. Vegetation associations found on Irvine Island are a subset of those found on surrounding islands.

Further details are contained in Section 4.2.1.

2.5.3 Mangroves

The condition of the mangrove vegetation was rated as 'pristine' to 'excellent' (Onshore 2011a). An assessment of species richness of the mangrove associations found the Irvine Island mangroves to have low species richness. None of the mangrove plant taxa occurring on Irvine Island were determined to be of conservation significance. Similar mangrove associations have previously been recorded at neighbouring Cockatoo and Koolan Islands (Onshore 2011a).

3. Project description of the Irvine Island Proposal

The Proposal involves the mining and shipping of iron ore through the development of two mine pits on Irvine Island - both located on the eastern side of the island:

1. Isthmus Region - a narrow neck of land, which is the northernmost of the two areas.
2. Hardstaff Peninsula - which is the southernmost of the two areas.

Ore is mined by an open cut method and then pre-concentrated via a dry magnetic separation process. The processed or then transported from the processing plant by road or conveyor to covered stockpiles before being transported to customers in Asia via a materials offloading facility (MOF) and transhipment facilities. Other ancillary and support infrastructure include waste rock and dry tailings disposal areas, a borefield, administration and workshop facilities, fuel storage, power generation facilities and a small desalination plant. The key characteristics of the Proposal are summarised in Table 1 and further described in Section 3.1.

3.1 Key project characteristics

The key characteristics relevant to the Irvine Island Project are identified in Table 1. Refer to Figure 3 for conceptual layout of the Proposal.

The terrestrial disturbance footprint will be approximately 400 ha for mine pits, waste rock landforms, borefield, haul and access roads, load out facilities, helicopter landing and other support infrastructure. The marine disturbance footprint will be sufficient to support a material offload facility (MOF), transhipment and other support infrastructure. No dredging will be required because marine infrastructure is located within deep water immediately adjacent to Irvine Island.

Table 1 Key characteristics of the Proposal

Proposal characteristic	Description
Non-spatial elements	
Project life	Approximately 20-25 years
Ore feed rate	Approximately 17 Mtpa
Dewatering	Required for deeper pit levels (determined upon completion of hydrogeological studies)
Ore transport	Onshore – haul trucks from pits to processor, conveyors from processor to MOF facility Offshore – to ships via barge at transhipment facility in deep water channel
Ore processing	Dry magnetic separation to produce pre-concentrate ore
Processed ore storage	At MOF in sheds
Waste	Overburden and dry tailings – approximately 15 Mtpa
Power station	Diesel powered generators approximately 40 MW
Water supply	Borefield on Island OR desalination OR a combination of both Demand approximately 3 GL/yr
Accommodation	Located on Cockatoo Island (existing facilities)
Workforce	Construction: approximately 500
	Operation: approximately 200
Workforce transport	Via helicopter and/or watercraft (from Cockatoo Island or mainland)
Spatial elements	
Pit area and depth (approximate)	Hardstaff: • Area at surface: up to 130 ha • Pit depth: up to 300 mbgl

Proposal characteristic	Description
	Isthmus: • Area at surface: up to 30 ha • Pit depth: up to 110 mbgl
Area of vegetation disturbance	Approximately 400 ha for mine pits, waste rock landforms, dry tailings, borefield, haul and access roads, load out facilities, processed ore storage, helicopter landing and other terrestrial support infrastructure
Height of waste rock landform	Not more than approximately 150 m AHD

3.2 Project schedule and life

Construction is anticipated to commence in the last quarter of 2013 with the first export of ore occurring early-mid 2014 depending upon receipt of approval for implementation of the Proposal from the Minister for the Environment.

The Project is expected to have a life of approximately 20–25 years.

3.3 Mining operations

3.3.1 Mine design and methodology

The mining methodology proposed is based on best industry practice for a hard rock open pit mining operation in sensitive areas, utilising conventional hydraulic excavators and trucks for the primary load and haul fleet. The primary rock breakage will be achieved by conventional drill and blast techniques, with secondary breakage completed by either mobile rock breakers or secondary drill and blast. Excavation staging and direction will be undertaken in such a way as to push materials away from any interface between sea and land (shorelines and cliff areas) or other sensitive areas (e.g. mangroves) to avoid rock fall or other secondary impacts on these areas. The construction of seawalls will not be required as is the case a Cockatoo Island.

3.3.2 Ore processing and shipping

Dry processing of ore feedstock will occur on Irvine Island to produce a pre-concentrate ore for export. Trucks will deliver the unprocessed ore from the pit to a primary crusher (via a Run of Mine [ROM] stockpile). All ore will be crushed and screened to a particle size suitable (1-3 mm) for dry magnetic separation. Sufficient water will be injected into the separation process to suppress dust. Crushing and screening will be a series of primary, secondary and tertiary systems using advanced high pressure grinding rollers to achieve the final particle size.

Approximately 8.5 Mtpa of processed pre-concentrate will be delivered via covered conveyor or trucks to stockpiles adjacent to the MOF (Section 3.5).

The pre-concentrate ore would be then transferred by barges to a transhipment facility, which is likely to be located in the deeper channel south of the peninsula near Tanner Island (Figure 3). A MOF will be constructed on this peninsula to accommodate barges to transfer the processed ore to offshore Cape Class ships.

Refer to Figure 3 for indicative locations of processing and stockpiling facilities.

3.3.3 Overburden and dry tailings management

Where suitable, pre-stripped overburden will be used in the construction of other facilities and infrastructure, with the remainder placed in waste rock landforms and used in pit backfilling as pit development and staging allows. As well as being used as backfill in the source pit, materials from the Hardstaff pit may be used to backfill the Isthmus pit, and vice versa.

Waste from the dry processing of ore will be temporarily stockpiled prior to transport and incorporated into waste rock landforms or in pit backfilling.

3.3.4 Surface and groundwater management

Pit dewatering will be required to counter inflows from groundwater (when pits are at watertable depths) and significant rainfall events. This is expected to be based on a combination of both bore abstraction external to the pit area and in pit sumps from where water will be pumped to retention ponds and used primarily for dust suppression. Stormwater runoff and groundwater in excess of storage capacity and site requirements will only be discharged to the ocean following treatment in order to meet ANZECC water quality guidelines.

All waste rock and dry tailing landforms will be subject to careful drainage design, such as bunding, contour drains and retention ponds as well as rock armouring to capture, contain and settle run off to prevent sediment being transported to island waterways or the marine environment. Design parameters will be based on 100 year Annual Recurrence Interval (ARI) flood events. Collected water will be re-used as far as practicable.

3.4 MOF and shipping

3.4.1 Location

A temporary landing facility will be constructed for initial works and is likely to be on a beach located on the west coast of the peninsula adjacent to Tanner Island, allowing the delivery of materials and plant necessary to commence construction (Figure 3). This initial landing facility will be tidally constrained, such that barges and boats will only be able to arrive on tide levels which provide adequate draft depth. The landing site will initially involve the construction of a temporary, purpose-built landing ramp and a long-term MOF will be installed as a priority (Figure 3). The MOF will be used for all further materials and plant to be delivered to and from the island during construction and operation. Other options for temporary load out/landing facilities are being explored in the Isthmus Region on the southern sides of Jonas Point (Figure 3).

All landing and MOF components will be constructed to ensure that the size is restricted to accommodate only the required number of vessels in order to minimise the disturbance footprint.

Other marine facilities that will be constructed include:

- cyclone mooring for tugs (in a deep water channel)
- transhipment facility
- refuelling mooring buoys (refer to Section 3.5).

No dredging will be required for the construction or operation of the proposed load out facilities, but pile driving will be required. Blasting is also unlikely to be required; however, this is to be confirmed pending further design studies. Tug and refuelling moorings and the transhipment facility will be anchored by large concrete blocks placed on the seabed with chains attached that are designed to withstand cyclonic conditions.

3.4.2 Barge and ship loading

All ore processed on Irvine Island will be transferred via barge from the MOF and loaded onto ships moored to a transhipment facility anchored in the deep water channel off the western side of the island. Ore barges will have a capacity of approximately 10 000 DWT, resulting in approximately 2–3 barge movements on average per day, which is required to transfer the approximate 8.5 Mtpa of ore pre-concentrate processed. Dust management will be managed according to best practice.

Cape Class ships (typical capacity above 140 000 DWT) will be used to transport the ore from the transhipment facility abroad. This larger capacity will enable a reduced level of ship traffic relative to the equivalent utilisation of Handymax vessels (capacity up to 50 000 DWT) as per the Cockatoo Island operation (i.e. there will be approximately one ship docking per week for Cape Class vessels compared to approximately three per week should Handymax ships be utilised).

All ore barges will be towed and manoeuvred into position by tugs at their respective destinations. A personnel transfer vessel will be required to transfer the tug crew to and from shore.

3.5 Project services and infrastructure

3.5.1 Site preparation

Bulk earthworks pads for support infrastructure (where required if cut-and-fill is inadequate) will be sourced only from areas which are to be disturbed for implementation of the Proposal (e.g. pre-stripped overburden).

All roads and support infrastructure areas will be subject to drainage design, such as bunding, contour drains and retention ponds as well as rock armouring to capture, contain and settle run off to prevent sediment loads being transported to island waterways or the marine environment. Design parameters will be based on 100 year ARI flood events.

3.5.2 Quarantine control measures

Pluton has undertaken strict quarantine measures during exploration activities and has formulated a quarantine management plan for the Island. Details are in Section 4.4. Pluton's efforts have been recognised in Australia and overseas (Section 4.4). In September 2010, Pluton won the 2010 Golden Gecko Award for Environmental Excellence in recognition of its leading practice.

3.5.3 Stockpiles

Ore stockpiles at the MOF area will be designed to store an adequate volume of product to allow the mining and/or processing operation to run continuously. Ore stockpiles at Irvine Island will be fully enclosed in sheds to minimise fugitive dust emissions to the environment and to protect the product stockpiles from erosion and runoff of sediment to adjoining sensitive areas during high rainfall events.

Product will be reclaimed from the stockpiles in the sheds by mobile equipment such as a front end loader.

3.5.4 Power generation and transmission

Power generation is required to support construction, ore processing and associated mining operation support infrastructure. Power will be generated via on-site diesel generator engines located within the Proposal development area. The total maximum power requirement and output is not expected to exceed 40 MW. Gas powered electricity generation has been discounted as it would result in a significant increase in the disturbance footprint due to the large storage facilities required and will also necessitate additional out-loading facilities with associated safety hazards.

3.5.5 Water supply and wastewater treatment

Total water supply requirements (potable, construction and operation) are expected to be approximately 3 GLpa.

Raw water for construction and then for operational requirements will be sourced from either a borefield or desalination plant, both located on the island. Water will be distributed to storage tanks where required at each facility via pumps and a steel and high density polyethylene pipe network.

Potable water supplies will also be sourced from either groundwater resources (preferably) or desalination plant (should the borefield prove to be below required capacity). Potable water will be treated with appropriate filtration and chemical conditioning to comply with the Australian Drinking Water Guidelines (NHRMC & MRMMC 2004). Fire water reserves shall be stored in the lower section of the potable water storage tanks and remain dedicated for fire fighting purposes. A dedicated fire water pump station incorporating an electrical pump, diesel back-up pump and a jacking pump will also be available.

Brine generated by the desalination process (if desalination is required) will be discharged offshore at a location away from sensitive benthic habitats. Final location will be determined from modelling of marine hydrodynamics and desalination discharge to ensure satisfactory and timely brine dilution and dispersion.

A small wastewater treatment plant will be located on Irvine Island to support the low level ablutions at the MOF and process plant areas (as the accommodation facility will not be located on the island). During construction and where required, waste water will be accumulated and stored in local holding tanks. Each tank will be emptied on a daily basis, with the contents trucked to the wastewater treatment plant. Treated water will be re-used for dust suppression or discharged with desalination brine off shore.

3.5.6 Workforce

The construction workforce is expected to number up to around 500, with operations requiring up to approximately 200 personnel.

A priority is to engage local people in the Project, particularly Aboriginal people who reside on the Dampier Peninsula and in Derby. The Co-operation Agreement gives Kimberley Aboriginal people priority for employment. The Agreement also includes Aboriginal employment and training targets with penalties imposed on Pluton for failing to meet these targets.

Skills audits and training programs have already commenced to ensure that Kimberley Aboriginal people have the skills and experience to work on the Project.

This will be an extension of the current approach, where nearly half of the exploration workforce is comprised of Mayala employees.

3.5.7 Accommodation facilities

All construction and operational workforce will be transported daily to Irvine Island and accommodated on Cockatoo Island, utilising its existing facilities (which will be upgraded to suit contemporary mine village standards). The village will be managed to accommodate the peak construction workforce based on a policy of 'motelling' and 12 hour shifts. During operations, the peak workforce will be accommodated based on a combination of sole occupancy and motelling. Recreational facilities (e.g. gym, swimming pool, tavern, barbeques, retail store) will be located on Cockatoo Island. There are currently up to 200 rooms available on Cockatoo Island.

Appropriate cyclone refuges will also be provided. Crib and associated ablution facilities will be constructed on Irvine Island (e.g. near the MOF and process plant) to meet the needs of the workforce for on-site meals and work breaks.

3.5.8 Fuel supply and storage

Facilities for the unloading, transporting, storage and distribution of fuel from sea-borne fuel deliveries to the fuel storage and distribution facilities located on shore will be required.

The key components of the refuelling and fuel storage system that will reduce the probability and size of spills in sensitive areas (analogous to that applied in ports elsewhere in the Pilbara and Kimberley regions) include:

- fuel supply vessel will moor to buoys anchored to the seabed off shore (Figure 3)
- a discharge pump will be located on the vessel
- flexible hoses will be coupled on shore and towed to the supply vessel, with the hose pressure tested with seawater prior to each use
- fuel shall be delivered to onshore bulk storage tanks via steel pipes
- fuel pipes will be cleaned out with seawater immediately following fuel delivery, with the seawater directed into the fuel tanks and then decanted into an oil/water separator

- fuel shall be pumped from the bulk storage tanks to the day tanks located at the power station and process plant via a steel pipe system
- fuel flow rates will be monitored by pressure monitoring devices to ensure leaks are detected immediately
- heavy and light vehicle re-fuelling facilities are likely to be located adjacent to the power station
- helicopter re-fuelling facilities will be located at the helipad
- all storage tanks and refuelling areas will be bunded in accordance with Australian Standards to eliminate spillage to the environment
- oil/water separators will be installed to treat all spillage and water collected from bunded areas.

To minimise the number of transfers of fuel from ship to shore (thereby minimising the risk of spillage during transfer), large fuel tankers will be utilised.

Spill control measures (designed to prevent and control spills) and measures for spill clean-up are provided in Appendix 4. A detailed spill risk assessment will be conducted by a specialist engineer on the proposed fuel supply system. Best practice spill management and chemical storage procedures will be implemented as part of staff inductions, including training in spill response procedures.

3.5.9 Refuse and Disposal/Treatment

All general and quarantine waste (including putrescible waste) will be transported to Cockatoo Island or the mainland for recycling (preferred) or, where recycling is not feasible, for disposal at a licensed landfill facility, in accordance with a waste management plan and quarantine management plan.

3.5.10 Administration and workshop

General administration offices will be located on Cockatoo Island, utilising the existing facilities. Maintenance workshops (light and heavy vehicle, mechanical and electrical, washdown) will be required on Irvine Island and will be located within the general supporting infrastructure footprint.

3.5.11 Telecommunications

Communications requirements are most likely to be met through the installation of co-located equipment at the Telstra facility at Datum Bay and Cape Leveque. Service infrastructure will be located at the camp and administration areas connected to the transmission facility on Irvine Island. Communications services will be via a microwave link to deliver Voice over Internet Protocol (VoIP), internet and TV services and radio trunk and mobile services will also be provided.

3.6 Design measures to avoid environmental impact

A number of design and process measures have already been applied to the Project to avoid environmental impacts on the environmental values associated with Irvine Island:

1. There will be no construction of seawalls for the mining of ore thereby avoiding disturbance to the marine environment.
2. The MOF has been located adjacent to a deep water channel to eliminate dredging and to avoid damage to corals and marine habitat with high conservation value on the coast of other parts of Irvine Island. This comes at an additional capital cost to Pluton.
3. The construction of a transhipment facility to reduce the footprint on the marine environment.
4. The Isthmus pit area has been scaled back significantly (with a proportional result on future project finances) in order to avoid any impact on the adjacent mangrove community. The Isthmus Region prospective ore zone identified to date extends wider and deeper than the proposed Isthmus pit, underlying the large mangrove embayment directly to the north.

5. Dry processing of ore on Irvine Island to a pre-concentrate form, which will be later subject to final beneficiation to a high-grade concentrate offshore at export destinations. A fully-beneficiated product is of higher sale value, however full beneficiation is a wet process, which requires a larger waste storage facility and water use which would have resulted in a greater environmental impact on the Island.
6. Backfilling of the pits which will require some double handling of waste (which comes at additional cost) to reduce disturbance on the Island.
7. Location of tailings and overburden that cannot be backfilled into pits will be stored in the central parts of the Island to avoid impacts on marine and mangrove habitats. Locations, for example to the north of the island, have been discounted because of the risk of surface water run-off damaging areas of high conservation value.
8. Storage of processed ore in sheds to avoid dust emissions and turbid runoff from stockpile areas.

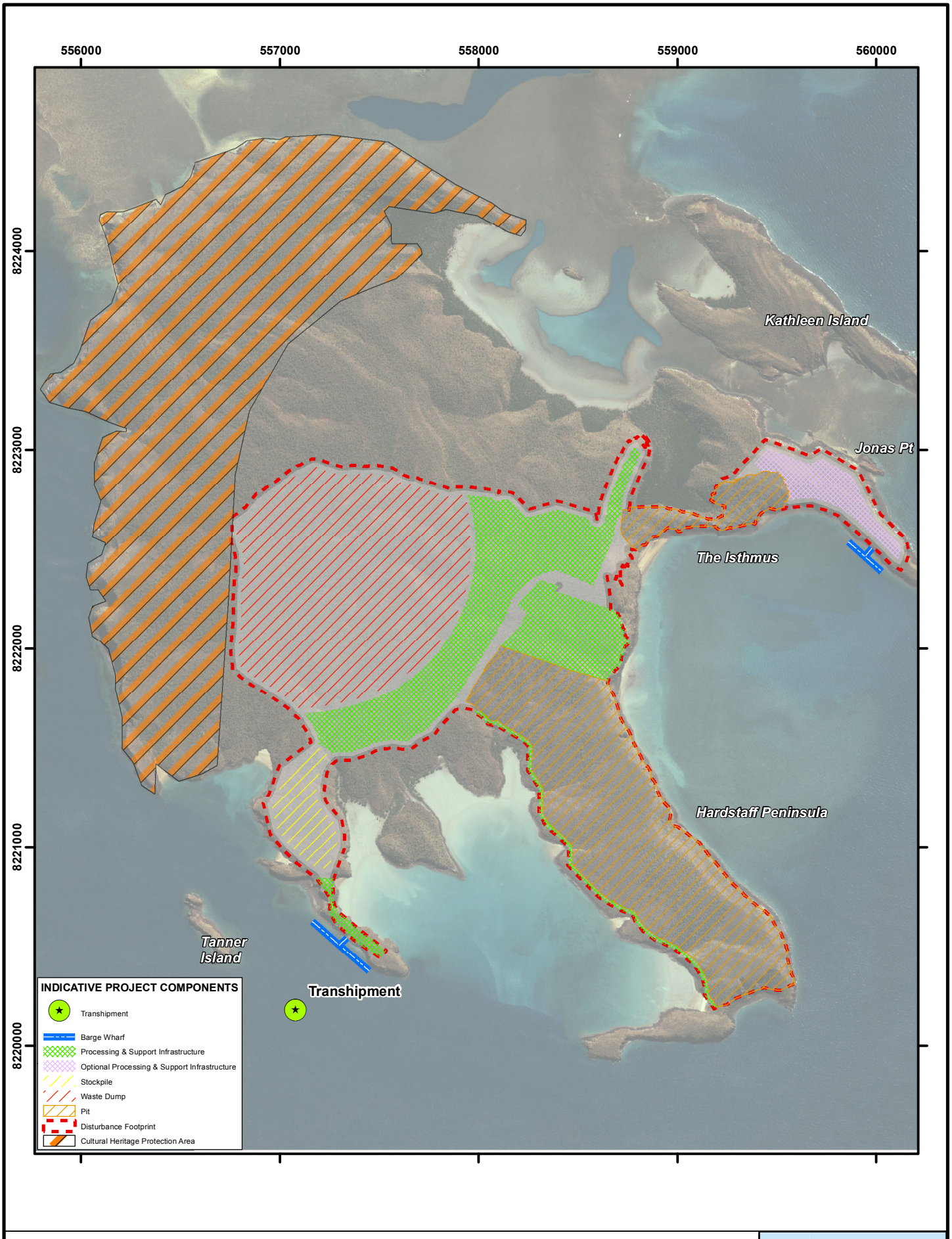
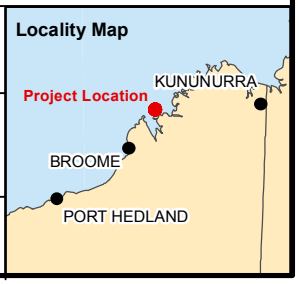


Figure 3: Conceptual project layout



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4. Regional setting of the proposal

4.1 Physical environment

4.1.1 Climate

The region surrounding Irvine Island experiences a hot, tropical, sub-humid climate with long term annual rainfall averaging 794.1 mm at the nearest Bureau of Meteorology (BoM) weather station located at Cygnet Bay (BoM 2011). Annual rainfall for Irvine Island may be higher than the Cygnet Bay figures, with records from nearby Koolan Island and Cockatoo Island suggesting a higher annual average of approximately 960 mm (BoM 2011). The majority of precipitation occurs in the wet season between the summer months from December to March (82%), and is typically associated with cyclone activity.

4.1.2 Geology and soils

Early Proterozoic Kimberley Group rocks crop out within the Irvine Island area and include the Yampi Formation, Pentecost Sandstone and the Elgee Siltstone. The Pentecost Sandstone has been further locally subdivided and renamed to the Wonganin Sandstone and Sandfly Schist to more accurately reflect the geology of the Proposal area.

Irvine Island mineralisation is hosted by basal conglomerates and sandstones of the Proterozoic Yampi Member. The Yampi Member contains predominantly hematite (martite) close to surface, with magnetite increasing at depth. The Yampi Member is stratigraphically overlain by about 20 m of schist (Sandfly Schist) and then by the thick (>100m) sequence of magnetite-hematite-bearing quartz iron sandstone, locally referred to as the Wonganin Sandstone. The Yampi Member on Irvine Island unconformably overlies the Elgee Siltstone and is characterised primarily by dark grey hematite and magnetite quartz sandstone and quartz pebble conglomerate.

Outcrops of the Yampi Member occur in two locations on Irvine Island, namely the Hardstaff Peninsula and the Isthmus Region. At the Isthmus Region, the formation has been tightly folded sub-vertically and outcrops as a localised but very high grade series scarps and ridges. Petrographically the Isthmus Region is characterised by coarse grained specular hematite.

At the Hardstaff Peninsula, the Yampi Member outcrops sub-horizontally, and extensively, in the eastern cliffs of the Peninsula. The cliff line runs roughly parallel to strike (NW-SE) and the rocks dip at 20-25 degrees to the southwest. The unit has not undergone the level of alteration of the Isthmus Region and is dominated by hematite and magnetite rich quartz sandstone and quartz pebble conglomerate. The lower grade but much thicker iron bearing quartz sandstone and quartz pebble conglomerate, the Wonganin Sandstone, overlies the Yampi Member at the Hardstaff Peninsula.

The Yampi Member is between approximately 20 m and 60 m thick. It contains a number of higher grade as well as lower grade lenses. Lower grade lenses normally comprise quartz-pebble conglomerate in an iron rich matrix. Higher grade lenses tend to comprise iron rich sandstone.

4.1.3 Topography

The island's topography is characterised by coastal cliffs surrounding an undulating central plateau, which drains to the coast through a series of indistinct valleys.

Hardstaff Peninsula on Irvine Island has high cliffs on the eastern side and undulating terrain to the west and south. Either side of the Hardstaff Peninsula are large shallow bays which empty to varying extents depending on tidal movements.

The Isthmus Region separates the large shallow bay to the east of Hardstaff Peninsula from a shallow mangrove covered bay on the northern side of the Island. The Isthmus Region is approximately 150 m across and comprises sandy beach and rocky cliff face on the southern side and undulating rocky terrain to the north.

The coastal cliffs are up to 100 m high and the highest part of the island has an elevation of about 150 m AHD. The ground surface is rock or is otherwise heavily protected by rock with few incised stream channels. Stormwater flows down drainage lines defined by the island's valleys, often cascading over the coastal cliffs as waterfalls. Most drainage lines discharge directly to the ocean and drain quickly after rainfall events.

4.1.4 Surface water and groundwater

Further detail of the surface water and groundwater characteristics of Irvine Island, and proposed investigations, is provided in Appendix 5.

Surface water features in the Kimberley, including permanent water courses and pools and their riparian zones, are an important resource for waterbirds and provide refugia during the dry season for many species, however Irvine Island does not cover an extensive enough area, being 950 ha, to have developed significant surface water features. Surface flow on the island is restricted to rainfall events.

Historical daily rainfall totals have exceeded 250 mm but could reach 480 mm in a 100 year average recurrence interval event. Average intensity for a 100 year ARI event is predicted to be 150 mm/h (GHD 2011a). Rainfall is highly variable and yearly totals depend on the occurrence of cyclones. The average number of cyclones passing near the island is between 0.4 and 0.6. Annual rainfall has been recorded as low as 115 mm and as high as 1250 mm.

Experience from mining formations similar to those found on Irvine Island at Cockatoo and Koolan Islands suggest low aquifer permeability in the Elgee Siltstone. Groundwater in the proposed pit area at the Hardstaff Peninsula may be in connection with the sea along strike to the south of the peninsula and to the north where the Elgee Siltstone dips down below sea level. The potential connection of the mining area to the western side of the peninsula will depend on the mine plan adopted and the site hydrogeology, particularly the hydraulic properties of the Sandfly Schist which overlies the orebody. The Isthmus area is understood to be comprised of the same geological units and is structurally complex.

Current hydrogeological site investigations undertaken for the site indicate that:

1. The depth to groundwater reflects the topography with water level controlled by sea level close to the coast. Ground water elevation approximates sea level in the bores measured around the Isthmus and Hardstaff Peninsula, although these need to be mapped in greater detail.
2. Conductivity of the sequence on Hardstaff Peninsula and the Isthmus Region is low with relatively consistent values of 10^{-6} m/sec or lower.
3. Based on the known geology including work undertaken on Koolan and Cockatoo Island it is hypothesised that a fresh water lens is likely to be present overlying more saline water at depth.
4. Groundwater yield is estimated to be 1.5 GL/year.

A preliminary review was undertaken using available metals and sulfur analyses to identify metals with potential to be elevated in the waste rock and ore leachate and to identify the potential for acidic drainage (GHD 2011b). Metal concentration analysis indicated that, based on its toxicity to aquatic environments, arsenic is likely to be the most critical of the metal toxicants detected. Other metals detected at higher levels included manganese, copper and lead (GHD 2011b). The preliminary testing indicated that the overall risk of sulphur acidity is generally low, but there may be some PAF material present. The testing also indicated that calcium and magnesium appears to be present excess to sulphur levels in the Elgee Siltstone (overburden material), which will provide some acid neutralising capacity (the level of which is yet to be determined).

4.2 Biological environment

Further detail of the biological environment of Irvine Island and associated studies is provided in Appendix 5.

Pluton has undertaken a number of detailed studies specific to Irvine Island. These studies include flora and vegetation, fauna, benthic habitat characterisation and initial groundwater investigations. A detailed table of proposed and continuing studies can be found in Appendix 3. Documents pertaining to completed and ongoing studies can be found in Appendix 6.

4.2.1 Vegetation and flora

The Proposal area is located in the Mitchell subregion of the Northern Kimberley bioregion, within the Northern Botanical Province (Thackway and Cresswell 1995; Beard 1990). Irvine Island is located at the western edge of the Fitzgerald Botanical District in the Central Kimberley Natural Region of the Northern Province (also referred to as the Yampi Peninsula unit) (Beard 1979). The area is described broadly as 'Tree savanna on sandstone ranges' and mapped as '*Eucalyptus dichromophloia* (Bloodwood) and *Eucalyptus miniata* (Woollybutt) Low Trees over *Plectrachne pungens* (Hummock Grass) and Chrysopogon (Bunch Grass)'.

A flora and vegetation survey was undertaken on the eastern side of Irvine Island with a total of 86 plant taxa recorded (Mattiske 2008). Fourteen vegetation associations were identified, the condition of which were rated as 'Pristine - Excellent' (against the Keighery vegetation scale). No Threatened Ecological Communities (TEC's) or Priority Ecological Communities (PEC's) and no DRF or Priority Flora were recorded during this study. One weed species, *Passiflora foetida*, was identified (Mattiske 2008).

A Level 2 flora and vegetation survey of Irvine Island and selected areas of neighbouring islands was undertaken during 2010 and 2011 (Onshore 2011a and b; Figure 4). A total of 172 plant taxa were recorded during a 2010 wet season survey of Hardstaff Peninsula and 204 plant taxa during a 2010 dry season survey of Irvine Island and surrounds (Figure 4). Results from an April 2011 survey are not yet available. A total of 17 vegetation associations were described (Onshore 2011a and b).

No TEC's or PEC's, DRF or flora listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded (Onshore 2011a and b). Three Priority species were recorded (Onshore 2011a and b; Figure 4):

- *Ipomoea* sp. A Kimberley Flora (LJ Penn 84) (P1)
- *Phyllanthus aridus* (P3)
- *Haemodorum gracile* (P4).

Two weed species (*Passiflora foetida* and *Melinis repens*) were identified (Onshore 2011a).

One vegetation association, 1d (*Pandanus spiralis*), was identified as potentially groundwater dependent (Figure 4).

Vegetation condition assessed ranged from 'Pristine' to 'Very Good' (against the Keighery vegetation scale), with only minor disturbance noted as a result of previous BHP exploration activities and tracks and camp laydown established during Pluton's ongoing exploration program. Surveys of Irvine Island in April and October 2010 did not identify any vegetation associations to be of State or Federal conservation significance (Onshore 2011a). Examples of all Priority Flora were also found on adjacent islands (e.g. Kathleen and Bathurst) and in the Cultural Heritage Protection Area.

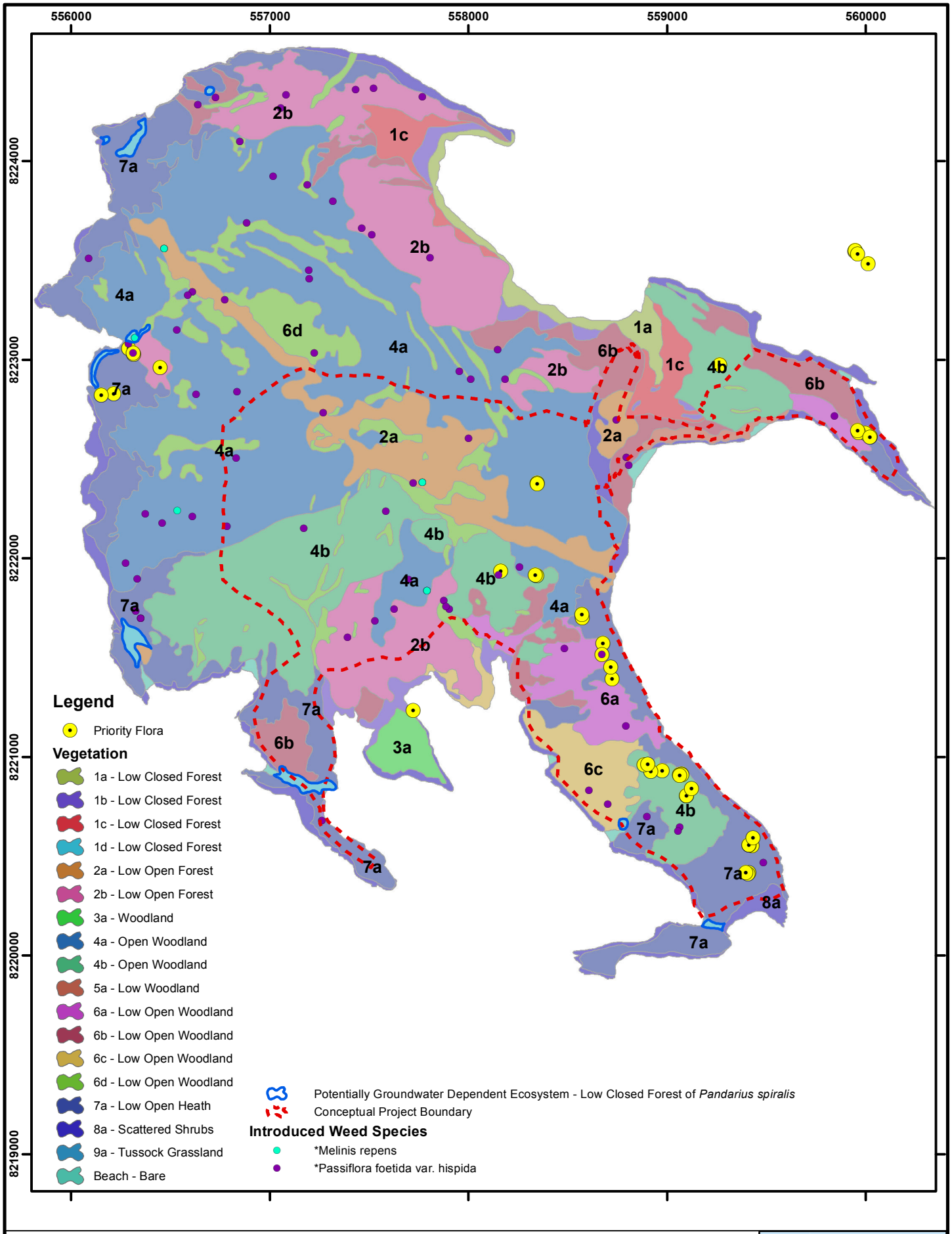
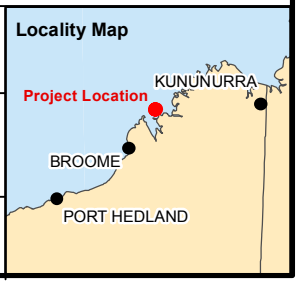


Figure 4: Irvine Island vegetation and flora



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4.2.2 Fauna

Knowledge of the terrestrial biodiversity of most Kimberley islands is generally limited (CCWA 2010). The fauna assemblage of the archipelago islands is a subset of the biota of the mainland from which it was isolated and is generally reduced in variety dependent on the size of the island, the interactions between the species that were isolated, and chance (CCWA 2010). Irvine Island is relatively small (950 ha) and is therefore expected to support a limited fauna assemblage.

A number of extensive terrestrial fauna surveys have been undertaken across Irvine Island with the aim of mapping fauna habitat and species, including species of conservation significance (Biota 2007). These included surveying for vertebrates and Short Range Endemic (SRE) invertebrates. Completion of the final report for the most recent study is dependent on receiving the contextual information from the DEC-led survey of the Kimberley Islands, which is expected shortly. These findings will be available for the PER.

Fauna habitats identified in the Proposal area during the earlier survey included beach dunes and small adjacent sandy areas, low open woodland, low open shrubland, deciduous forest and mangroves (Biota 2007). None of the habitats encountered during the survey are considered to be restricted to just the Proposal area or restricted regionally to Irvine Island as similar habitats have been observed throughout the Buccaneer Archipelago (Biota 2007).

Based on the survey results gathered to date, the vertebrate fauna assemblage of Irvine Island is considered typical of other regional islands (Biota 2011, in prep.). All identified species have been recorded from other islands, which have also yielded very similar species compositions. Amongst the vertebrates, a *Lerista* (skink) species is noteworthy, given it has been rarely encountered species group during broader island surveys. Also of note is the presence the gecko genus *Gehyra*, recorded from several other islands of the Buccaneer Archipelago, which is currently undergoing taxonomic review. There are indications that *G. occidentalis* is a species complex, with the Irvine Island form remaining unresolved (Biota 2010). Taxonomic work is also continuing on Camaenid snails, with recent indications that at least one species surveyed on Irvine Island may be of elevated conservation significance. Confirmation of potential conservation status of all unresolved species is pending Australian and Western Australian Museum testing and results.

Subterranean fauna

A subterranean fauna survey of Irvine Island has not yet been completed. Interim results on the first phases of sampling will be available to support the PER.

4.2.3 Marine habitat

Pluton has undertaken, or commenced, separate mangrove and marine benthic primary producer habitat (BPPH) studies.

Three mangrove associations were identified along the coastline of Irvine Island (Figure 4 and Figure 5; Onshore 2011a). The condition of the mangrove vegetation was rated as ‘pristine’ to ‘excellent’ (Onshore 2011a). An assessment of species richness of the mangrove associations found the Irvine Island mangroves to have low species richness. None of the mangrove plant taxa occurring on Irvine Island were determined to be of conservation significance. Similar mangrove associations have previously been recorded at neighbouring Cockatoo and Koolan Islands (Onshore 2011a).

A preliminary survey surrounding Irvine Island was undertaken to produce a map showing BPPH distribution, and identified the following BPPH, covering an area of 1906 ha (MScience 2007):

- coral
- seasonal macroalgae
- mangrove
- abiotic (comprises intertidal/shallow subtidal sand or rubble flats and limestone pavement with little macro-biological cover).

Another preliminary investigation was conducted in March 2010 to provide an overview of the BPPH in the near-shore and coastal environments surrounding Irvine Island (Oceanica & MScience 2010).

A comprehensive ground-truthing assessment of the key marine benthic habitats (coral, microalgae, sediment, filter feeder and seagrass) was undertaken in January 2011 to expand the area covered in the previous preliminary investigation (Oceanica & MScience 2010).

Results of the assessment are separated into the following four areas and are summarised below (Figure 5; Oceanica 2011):

North of Jonas Point (not affected by the proposal)

This area is dominated by a large continuous intertidal reef, which extends from the southern tip of Jonas Point, to a larger reef platform in the north east, which links Bathurst and Irvine Islands (Oceanica 2011). The macroalgae and coral assemblages recorded in this area of the island were the highest density in the study area. Percent cover for macroalgae was estimated to range from 40-60%, with Corals 10-30% (Oceanica 2011).

Two permanently inundated saltwater lagoons are located within this reef area and comprise the main feature within the northern embayment. The depth of the lagoons exceeds 18 m, with the walls made up of a steep band of *Acropora* coral. The inshore boundaries of the lagoons consist of tidal mudflats that are exposed at low tide and feed into the mangrove communities on the shoreline (Oceanica 2011).

The area to the north of Kathleen Island consists of a narrow band of intertidal corals, with a coral slope occurring on the northern extremity of the narrow band. The coral habitat in this area is of sparse to moderate density, characterised by an increase in water depth of 13 m over a horizontal plane of 20 m (Oceanica 2011).

Embayment to east of Hardstaff Peninsula

The eastern embayment is dominated by rock-rubble with sparsely distributed intertidal coral colonies and patches of macroalgae. Intertidal corals were mapped as occurring with an estimated cover of between 5–10%, consisting of soft and hard coral taxa. Coral slopes were identified in a narrow northerly trending band, running from Jonas Point to the southwest tip of Hardstaff Point. Coral cover along slopes was estimated as ranging from 10–20% (Oceanica 2011).

Embayment to west of Hardstaff Peninsula

Mixed assemblages of macroalgae (*Sargassum*), coral and seagrass (*Halophila*) were identified as occurring in two locations: adjacent to the southern tip of Hardstaff Point; and on the western extremity of the embayment at the tip of the Western Peninsula (Oceanica 2011). Protection from the two peninsulas provides stable substrate conditions that enable the mixed assemblages to occur year round, although densities are likely to seasonally fluctuate (Oceanica 2011).

A narrow band of intertidal coral and coral slope habitat occurs around the southern edge of Hardstaff Point, characterised by an increase in water depth of 13 m over a horizontal plane of 20 m (Oceanica 2011).

Western Peninsula (where MOF is located)

BPPH along the seaward fringe of western peninsula of Irvine Island has been mapped as a narrow band of sparse to moderately dense intertidal corals, with coral slope occurring on the seaward edge (Oceanica 2011). An intertidal reef also exists within a small embayment midway along the peninsula. The seaward side of the embayment is dominated by dense assemblages of macroalgae, with the landward side largely uninhabited by macroalgae (*Sargassum*) (Oceanica 2011).

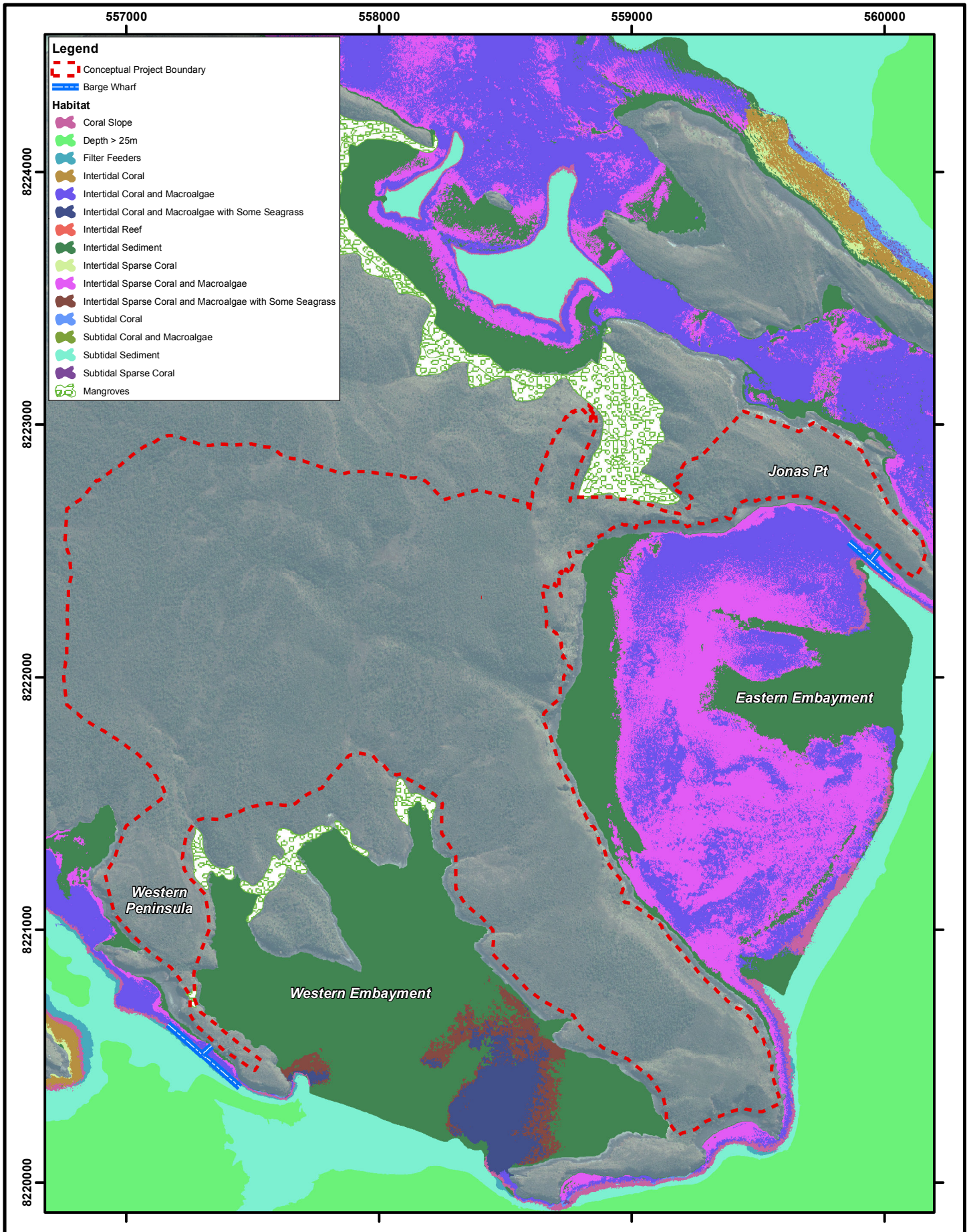
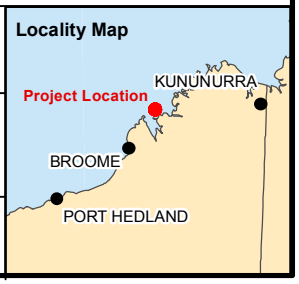


Figure 5: Bethnic habitats of Irvine Island



STRATEGEN
info@strategen.com.au
www.strategen.com.au

Scale
0 100 200 400 600 800 1,000 m
N
1:20,000
at A4

Coordinate System: GDA 1994 MGA Zone 51
Date: 4/08/2011
Author: atomeo
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Source:Data provided by Oceanica.

Note that positional errors may occur in some areas

4.2.4 Marine fauna

Detailed studies of the marine fauna assemblage which inhabit the waters adjacent to Irvine Island are yet to commence. A 'state of knowledge' report regarding humpback whales has been prepared for Pluton by the Centre for Whale Research and a search of the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) Protected Matters of Search Tool has also been undertaken to characterise EPBC Act listed species which may occur in the area (see below). Scoping work for other potential future studies is currently underway. Studies undertaken to characterise bathymetry, BPPH and hydrodynamics will be used to inform studies examining marine fauna.

A desktop search for potential EPBC Act-listed fauna was conducted for the Proposal Area using the Protected Matters search tool. This search identified a number of matters of National Environmental Significance including 13 mammal species, 22 reptile species and 3 shark species which are either known to breed in the area or have potential to occur within the area (Appendix 5).

A report has been prepared on the current knowledge available on the Humpback Whale presence in the Kimberley (CWR 2011). The Kimberley Humpback Whale population is the largest in the world and is considered to be one of the world's most successfully recovered populations following whaling pressures. The Humpback whales of the southern hemisphere have been categorised into separate feeding and breeding stocks, with the Kimberley waters forming "Breeding Stock D", a calving area for the Group IV whales (which feed in Area IV during summer).

The peak density of Humpback Whales within Kimberley waters is during mid-late August, with migrations into the area starting around late July, and cow/calf pairs migrating south by mid September. Males have been noted to stay within the area for longer than the females and calves.

There is little literature available regarding other cetacean species (apart from Humpback Whales) found in the western Kimberley, although a list of likely present cetacean species has been developed (Appendix 5).

4.3 Social environment

The Kimberley region comprises four shires: the Shire of Broome, the Shire of Derby-West Kimberley, the Shire of Halls Creek and the Shire of Wyndham-East Kimberley.

The Kimberley region maintains a broad-based economy, with mining, retail, building and construction and tourism contributing to economic output (KDC 2011).

Mining and tourism are currently prevalent in the Proposal area, with mining being conducted on Koolan Island and Cockatoo Island, in proximity to Irvine Island (Figure 2).

Tourism activities in the area include scenic flights, boat charters, bush walking and fishing. The Kimberley has the highest representation of Aboriginal people of all the regions in the state (47%) (KDC 2011). Based on the high Aboriginal representation, there is a strong impetus to develop appropriate economic and social activities that reflect this regional characteristic (DRDL 2011). A range of programs administered through State and Federal governments and increasingly through industry, target and promote Aboriginal economic participation and employment (DRDL 2011).

Aboriginal heritage in the area is significant and also forms an important part of the region's social values.

Land tenure in the Kimberley consists of Aboriginal and leasehold reserves, national parks and reserves and crown land which fall under a range of pastoral and mining leases. The dominant land uses in the Kimberley (mainland) are pastoralism in the form of cattle grazing on native pastures, unallocated crown land and crown reserves, and conservation (Graham 2001). There has been little development on the islands of the Buccaneer Archipelago outside of concentrated development in a few locations specifically to support the mining and pearling industries.

4.3.1 Aboriginal and European heritage

Irvine Island is recognised as a significant site under the *Aboriginal Heritage Act 1972* (WA) (the Heritage Act). The Island is registered as Aboriginal site ID 13466 (Wonganin) with the Department of Indigenous Affairs. There are an additional 22 registered Aboriginal sites on Irvine Island, including artefact scatters, paintings, burial sites, mythological sites and ceremonial sites.

Irvine Island lies wholly within the Mayala Native Title Claim (WC98/39), which covers approximately 3815 km^2 of land and sea in King Sound and the Buccaneer Archipelago. Pluton has successfully negotiated Native Title, Exploration, Mining and Heritage Protection Agreements with the Kimberley Land Council (KLC; as agents for the Mayala claim) for Irvine Island.

There are no known European heritage sites on Irvine Island.

In 2007, consent was given by the Mayala group to the granting of an exploration licence on Irvine Island (E04/1172) and for exploration to proceed.

Under section 17 of the Heritage Act, it is an offence to disturb any Aboriginal site without consent under section 18 of the Act.

Prior to conducting the Phase I, II and III exploration programs at Irvine Island, Pluton Resources applied for and received approval under section 18 of the Heritage Act for the proposed works. As part of the approval process, Pluton, senior Mayala men and their representatives, visited Irvine Island on numerous occasions to inspect the island and assess the potential impacts of exploratory work on potential archaeological and ethnographic sites.

At the end of 2010 Pluton Resources entered into a legally binding Heads of Agreement with the Mayala for the development of Irvine Island (Pluton Resources 2010). Mayala people support the Proposal and agree to the grant of MLA04/452, the mining lease that replaces the existing exploration licence. The negotiations were conducted with a team of senior elected Mayala representatives with the agreement ratified at a community meeting in June 2011. Pluton and Mayala people will work together to develop the Project, which will deliver significant benefits to the traditional owners.

Pluton Resources is committed to engaging and employing Mayala people and other Kimberley Aboriginal people during its mining operations and have them participate in environmental studies and management. Four Aboriginal heritage surveys have been undertaken to date (Appendix 5).

4.4 Existing environmental management

Pluton is guided by the following environmental policy in undertaking its development projects:

> *Pluton Resources is committed to excellence in managing the impact of its operations on the environment. At each stage of development it proactively aims to avoid or to minimise environmental impacts.*

Pluton's efforts have been recognised in Australia and overseas. In September 2010, Pluton won the prestigious 2010 Golden Gecko Award for Environmental Excellence in recognition of its leading practice.

In March 2011 Pluton presented at Prospectors and Developer's Association of Canada's (PDAC) annual conference in Toronto. Scott Jobin-Bevans, President of the PDAC and respected member of the geological community, visited the island in June 2011. He identified the Irvine Island project as an example of world's best practice for several important reasons.

> *The company has been able to explore the island without any significant environmental impact by using innovative technology and drilling strategies. In a similar context, the environmental management plans are progressive and comprehensive. Pluton's commitment to respect the environment of Irvine Island led to the development of impressive new technology for drilling. Portable platforms developed by the company are taking the industry close to zero impact exploration. A whole range of quarantine and conservation measures has made the exploration program an excellent example of sound environmental a management. In addition I have been impressed by the thorough way the company has been doing its*

environmental studies for future operations management. Pluton is planning to set very high standards in reclamation once the mining is finished (Scott Jobin-Bevans 2011).

The key priorities for managing exploration drilling programs include:

- quarantine management
- vegetation clearing and ground disturbance
- hydrocarbon management
- waste water management
- waste disposal
- water supply
- decommissioning.

The risks to conservation values associated with the exploration drilling programs are managed by the following operational controls prepared by Pluton Resources:

- quarantine measures to prevent the introduction of Quarantine Risk Material (QRM) are implemented under a Quarantine Management Plan (QMP)
- vegetation clearing and ground disturbance, hydrocarbons, waste disposal and water supply follow methodologies outlined within a Conservation Management Plan (CMP)
- drilling rigs are mounted onto a helicopter-transportable Universal Drilling Platform (UDP) which further reduced ground disturbance and vegetation removal associated with drilling
- decommissioning of the drill sites is undertaken in accordance with the following DMP guidance: *Guidelines for Mineral Exploration and Rehabilitation Activities* (DMP 2007).

Proposed environmental management is detailed in Appendix 4.

Quarantine Management Plan (QMP)

Quarantine management applies to all personnel involved in the Irvine Island exploration project and associated operations at Cockatoo Island, Broome, Derby and Perth. Personnel include goods suppliers, freight forwarders, contractors, sub-contractors, traditional owners, vessel owners and captains, helicopter owners and pilots. Quarantine measures are employed in relation to all transport vessels, which travel to the island and to all personnel effects, food and waste. The QMP includes a detailed supply chain management program for exploration equipment brought onto the Irvine Island.

Management objectives 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.

The QMP, which was subject to review by DEC, describes the performance indicators, management actions, monitoring, contingencies and reporting required for the exploration activities to meet these objectives. Pluton has instituted an extensive program, from inductions and training to on-ground management, to ensure that the QMP is fully and correctly implemented.

Conservation Management Plan

Pluton Resources prepared a Conservation Management Plan (CMP), reviewed by DEC, which is implemented with the aim of minimising the impacts of the exploration drilling program on ecological and landscape processes on Irvine Island.

The CMP includes:

- a summary of the elements of the exploration program
- assessment of the risks of impacts of the exploration drilling on conservation values occurring within the project area
- design aspects and management practices to avoid, adequately reduce or mitigate the impacts
- performance criteria, monitoring and reporting commitments.

The CMP covers all the key elements of the exploration program with potential to affect the Irvine Island environment including:

- access
- drilling
- water supply
- fuel and power supply
- workforce and accommodation
- clearing
- decommissioning.

Of particular note, under the terms of the CMP, access to the island is by boat and helicopter only (no airstrip). Access within the island is also by foot and helicopter only and walking tracks between sites are only cut by hand (or using hand-held machinery) where necessary. The only wheeled vehicle on the island is a small motorised buggy which remains only on the historical BHP tracks.

All waste including food scraps, rubbish and sewerage is removed from the island for disposal at appropriate mainland facilities.

Universal Drilling Platform (UDP)

To minimise ground disturbance and facilitate diamond drilling on rugged and steep terrain, Pluton has worked with engineers to design and develop a helicopter-transportable UDP. The UDP provides a level working surface on which a drill rig can be operated over uneven terrain. The ground surface (including low vegetation) under the UDP remains largely undisturbed. Ground disturbance associated with drilling is limited to that associated with the UDP legs, drill collar and up to two optional anchor points. Typical disturbance at each site is <5 m^2 in comparison to a regular drill pad disturbance of up to 30 m^2.

Decommissioning

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 drill sites allows these areas to naturally recover.

Drill holes are collared with PVC pipe and temporarily capped so they can be used for monitoring. The drill holes will be plugged with concrete, subject to the completion of any scientific studies, and drill sites will be left in a clean state as per DMP (2007) rehabilitation guidelines.

Accommodation

As part of its broader environmental management strategy, Pluton has also adapted accommodation technology used in the Antarctic, to the tropical Kimberley. Pluton is using polar "pods" to provide insulated shelter for the drill teams. The level of clearing required for the pods and associated camp facilities is minimal and as such the camp has little environmental impact in comparison to standard exploration camps of similar capacity.

5. Peer review

A Peer Review Panel will be established to provide independent, expert advice to the Proponent on the methodologies, approaches and findings of studies supporting the impact assessment. The Peer Review Panel advice will be made available to the EPA and the public.

The role of the Peer Review Panel will be to:

- provide independent technical advice to enhance the rigour of the environmental assessment process
- review proposed methodologies and findings of environmental and Aboriginal heritage investigations and compare proposed approaches to national and international best practice standards and any new benchmarks being set
- publically report findings. Reports will be prepared on an as needed basis but will as a minimum address the scoping, draft PER and response to submissions phases
- present expert and independent advice to other working groups or stakeholder groups as agreed by Pluton Resources.

The Panel will be steered by an independent Chairperson. The role of the Chair will be to:

- chair panel review meetings
- liaise with the other panel members as required
- be the principal spokesperson for the panel
- sign off on any reports, advice or documents prepared as a result of the Panel's deliberations.

The scope of the Peer Review will include assessments of:

- the adequacy of environmental investigations and mitigation, in terms of their nature, extent and scope, ensuring that all areas of environmental concern identified in the scoping document are adequately addressed
- the robustness of investigation and assessment methodology, in particular ensuring these are scientifically and technically rigorous
- proposed environmental and social practices against international and national benchmarks as required
- providing an expert review of investigation outcomes and advising whether the technical interpretation of outcomes can be supported by data presented
- appropriate actions to overcome any identified gaps in knowledge, including further investigation requirements.

6. Offsets strategy

Pluton has identified the need to potentially provide environmental offsets for potential residual environmental impacts to high value environmental assets remaining after on-site mitigation efforts to avoid, minimise, rectify and reduce impacts have been applied.

6.1 Relevant policy and guidance

6.1.1 Federal offsets policy

The Australian Government has provided advice on the use of environmental offsets in *Draft Policy Statement: Use of environmental offsets under the Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment and Water Resources [DEWR] [now Department of Sustainability, Environment, Water, Population and Community], August 2007) and a discussion paper from August 2007 – *Use of Environmental Offsets Under the Environment Protection and Biodiversity Conservation Act 1999*.

Environmental offsets are used when a development will result in impacts on a matter protected by the EPBC Act. Environmental offsets are defined as *'actions taken outside a development site that compensate for the impacts of that development - including direct, indirect or consequential impacts'*.

6.1.2 State offsets policy and guidance

The State Environmental Protection Authority (EPA) is of the opinion that where impacts must occur, environmental offsets should be used with an aspirational goal of achieving a '*net environmental benefit.* ' Environmental offsets represent the 'last line of defence' for the environment, ensuring that adverse impacts are counterbalanced by an environmental gain somewhere else (EPA 2006). Environmental offsets should be a component of the environmental impact assessment procedure, and the EPA expects proponents to put forward commitments for offsets as part of their Proposal.

The EPA have prepared two reference papers in relation to offsets, *EPA Guidance Statement No. 19 Guidance for the Assessment of Environmental Factors - Environmental Offsets – Biodiversity* (EPA 2008) and *Position Statement No. 9 Environmental Offsets* (EPA 2006). Both documents define a series of guiding principles for proponents to follow when developing an offsets package.

6.2 Net conservation benefit

Potential residual impacts and risks associated with the Irvine Island mining proposal have been identified at this stage to include marine fauna (whales, dugongs), vegetation and Aboriginal culture and heritage.

As part of the PER process, offsets will be developed to address any residual impacts to marine values as well as the general loss of biodiversity values associated with the clearing of vegetation.

A priority task is to prepare an 'Irvine Island Mitigation Strategy' with input from the Commonwealth and State agencies. The mitigation package includes accurate details regarding potential impact and the proposed offset measures to achieve a net conservation benefit for the Buccaneer Archipelago, to protect Aboriginal heritage and culture values and to assist the Kimberley Science and Conservation strategy to achieve its objectives.

Some measures that may be considered include:

- assistance with management planning and on ground management of conservation values of selected islands in the Archipelago
- research of key marine fauna species.

7. Mine closure

Amendments to the Western Australian *Mining Act 1978* (Mining Act) in 2010 included the requirement for mine closure planning to be undertaken at the project planning stage and to be included as a component of the Mining Proposal to be submitted to the Department of Mines and Petroleum (DMP) for approval and/or to be submitted as an Appendix to a PER document when seeking environmental approval from the EPA. Amendments to the Mining Act were implemented to ensure closure planning is considered at project planning stages to enable the identification and management of closure and decommissioning risks. Accordingly, a Closure and Decommissioning Plan (Closure Plan) will be prepared to satisfy the requirements of the ANZMEC/MCA *Strategic Framework for Mine Closure* (ANZMEC/MCA 2000) and to refer to methodology and approaches outlined in the DMP/EPA Guidelines for Preparing Mine Closure Plans (DMP and EPA 2011) and the Department of Industry, Tourism and Resources (DITR) *Leading Practice Sustainable Development in Mining* handbooks and the *Planning for Integrated Mine Closure: Toolkit* (ICMM 2008). Initially, a preliminary Closure Plan will be prepared which will be updated throughout the life of the mine as project components and environmental conditions are better understood.

The Closure Plan will be prepared with all available environmental and social information considered. The Closure Plan will be subject to review and amendments throughout the life of the Proposal and incorporate the following:

- planning of post-mining land use and development of closure objectives to ensure impacts on the post-mining landscape are minimised
- a summary of legal obligations for closure of the project
- a risk assessment to identify and evaluate potential closure issues and assess their significance
- details of closure data collected (based on existing data and any supporting environmental assessments)
- development of management strategies to manage closure issues
- determination of closure outcomes and goals (i.e. completion criteria)
- development of a rehabilitation strategy to be incorporated progressively throughout the project life
- development of a closure implementation program
- closure costing
- development of a monitoring and maintenance program upon completion of decommissioning and closure
- a summary of closure specific stakeholder consultation to date.

8. Community and other stakeholder consultation program

Pluton extensively and regularly engages with key stakeholders about the Proposal, building on the consultation program undertaken before exploration commenced (Appendix 1). This early engagement allowed Pluton to identify stakeholder issues and concerns about the Project, to focus consultation and project development on matters raised during exploration, and to plan consultation to be undertaken during formal environmental impact assessment.

Pluton respects the Mayala People as the traditional owners and native title claimants for Irvine Island and has recently focused on obtaining their fully informed consent to the Project. Pluton also maintains regular dialogue with government (local, State and Federal) representatives and decision-makers. Pluton has maintained transparency with other stakeholders and the public, producing and distributing information materials on project developments at regular intervals.

Pluton intends to escalate its consultation program during the environmental impact assessment, with broader engagement of the general public, non-government sector and other regional stakeholders.

8.1 Mayala People - Pluton Partnership

An important element of the Pluton consultation program has been the ongoing development of a partnership with the Mayala people and other traditional owners for Irvine Island.

Mayala people were traditionally opposed to mining on Irvine Island. Intrusion by mining companies was seen as a threat to cultural values. In 2007, prior to exploration Pluton consulted extensively with Mayala people who determined that exploration and the cultural values could co-exist. Pluton proposed an inclusive program, which gave Mayala people a role in the planning and development and a right of veto over unacceptable exploration practices.

Since commencement of exploration, Pluton and the Mayala people have met more than 20 times.

On 28 June 2011, Pluton received Mayala people's support for a mining project on Irvine Island via the execution of a Co-operation Agreement.

Final consent was received via a three step process:

- senior Mayala and Bardi and Jawi men visited Irvine Island and viewed the contemplated mining footprint with 2 anthropologists and an archaeologist (*heritage survey*).
- the results of the heritage survey were discussed at a meeting of senior Kimberley Law Bosses (*madja meeting*).
- the results of the heritage survey and the madja meeting were presented to a Mayala claimant meeting.

At each of the three stages of consultation, the traditional owners for Irvine Island unanimously consented to Pluton's mining operations on Irvine Island. A letter from the KLC, who represent the Mayala People, expressing their sentiment about the Project has been included in Appendix 2.

The Co-operation Agreement ensures that Mayala people and other Kimberley Aboriginal people receive long-term benefits from the Project.

The Co-operation Agreement provides that traditional owners become equity holders in the Project and receive an innovative and substantial package of benefits and opportunities designed to bring meaningful, long-term and sustainable improvements to their economic and social well-being.

The package commits Pluton to preferential employment among the Mayala people and includes training, health and other services and support to optimise employment outcomes. The Project has already achieved excellent employment outcomes for the Mayala people with 30 jobs created during the exploration phases, representing 50 per cent of the exploration workforce.

The Co-operation Agreement ensures that traditional owners have a significant say in the development of the Project in the following ways:

- Mayala people publically report on Pluton's performance.
- Pluton will assist Mayala people to develop a Mayala Rangers program.
- approximately one third of the island is set aside for the protection of cultural heritage.
- an 'implementation committee' has been set up to monitor compliance with the agreement and assist Pluton to develop employment strategies etc.
- the Co-operation Agreement sets a new benchmark for native title agreement making in the Kimberley.

During the negotiation process, Pluton demonstrated respect for the traditional decision-making processes of the traditional owners and has acknowledged their right to make decisions about developments on their country. This principle is embedded in the Co-Operation Agreement. The Co-operation Agreement strikes the balance between the protection of cultural heritage and economic development opportunities.

9. References

Australian and New Zealand Minerals Energy Council/Mineral Council of Australia (ANZMEC/MCA) 2000, *Strategic Framework for Mine Closure*, Canberra

Australian Bureau of Statistics (ABS) 2006, *2006 Census of Population and Housing*. Commonwealth of Australia, Canberra, ACT.

Beard, J.S 1979, *Vegetation Survey of Western Australia: Kimberley 1:1 000 000 Vegetation Series*, University of Western Australia Press, Nedlands.

Beard, J.S. 1990, *Plant Life of Western Australia*, Kangaroo Press, Kenthurst, NSW

Biota Environmental Sciences (Biota) 2007, *Irvine Island Level 1 Fauna Assessment*, unpublished report prepared for Pluton Resources, December 2007.

Biota Environmental Sciences (Biota) 2010, *A Summary of the Irvine Island Fauna Survey*, unpublished memo prepared for Pluton Resources, 4 May 2010.

Biota Environmental Sciences (Biota) 2011, *Preliminary results of 2010 Fauna surveys*, unpublished draft report section prepared for Pluton Resources.

Bureau of Meteorology (BoM) 2011, *Climate Data Online*, [Online], Australian Government Bureau of Meteorology, Available from: http://www.bom.gov.au/climate/data, [19 April 2011].

Burbidge, A. A. and McKenzie, N. L. 1978, 'Conclusions and recommendations', in Burbidge, A. A. and McKenzie, N. L. (Eds), *The islands of the North-west Kimberley Western Australia*, Wildlife Research Bulletin of Western Australia No. 7, pp. 46 – 47, Department of Fisheries and Wildlife, Perth.

Burbidge AA, McKenzie NL & Kenneally KF 1991, *Nature Conservation Reserves in the Kimberley Western Australia*, Department of Conservation and Land Management, Western Australia.

Centre for Whale Research Western Australia (CWR) 2011, *State of Knowledge: Humpback Whales in the Kimberleys' Irvine Island Area*, Fremantle, May 2011.

Conservation Commission of Western Australia (CCWA) 2010, *Status Performance Assessment: Biodiversity Conservation on Western Australian Islands Phase II – Kimberly Islands*, Conservation Government of Western Australia, Perth.

Department of Environment and Conservation (DEC) 2011, *Park Finder: An online visitor's guide to Western Australia's parks, reserves and other recreation areas*, [Online], DEC, Available from: *http://www.dec.wa.gov.au/component/option,com_hotproperty/task,viewtype/id,5/Itemid,1584/* [8 July 2011].

Department of Environment and Water Resources (DEWR) 2007, *Use of Environmental Offsets Under the Environment Protection and Biodiversity Conservation Act 1999, Draft Policy Statement,* Canberra.

Department of Mines and Petroleum 2007, *Guidelines for Mineral Exploration and Rehabilitation Activities*, Government of Western Australia, Perth.

Department of Mines and Petroleum (DMP) and Environmental Protection Authority (EPA) 2011, *Guidelines for Preparing Mine Closure Plans,* Government of Western Australia, Perth, Western Australia, June 2011.

Department of Regional Development and Lands (DRDL) 2011, *Kimberley: A Region in Profile 2011*, Government of Western Australia, Perth.

Environmental Protection Authority (EPA) 1993, *Red Book Status Report; on the implementation of Conservation Reserves for Western Australia, as recommended by the Environmental Protection Authority (1976-1984)*, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority (EPA) 2006, Position Statement 9. Environmental Offsets, Environmental Protection Authority, Perth, Western Australia, January 2006.

Environmental Protection Authority (EPA) 2007a, *Level of assessment set*, [Online] URL: http://www.epa.wa.gov.au, 24 December 2007, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority (EPA) 2007b, *Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia*, Draft Guidance Statement No 54a, Environmental Protection Authority, Perth, Western Australia, August 2007.

Environmental Protection Authority (EPA) 2008, *Guidance Statement No. 19 Guidance for the Assessment of Environmental Factors - Environmental Offsets – Biodiversity,* Environmental Protection Authority, Perth, Western Australia

GHD 2011a, *Report for Irvine Island Surface Water Investigation*, draft report prepared for Pluton Resources Ltd, April

GHD 2011b, *Irvine Island Mine Preliminary AMD Assessment – Interim Report*, unpublished memo prepared for Pluton Resources Ltd, 30 June 2011.

Government of Western Australia 2011, *Kimberley Science and Conservation Strategy*, May 2011.

Graham, G 2001, *Bioregion: North Kimberley 1 (NK1 – Mitchell Sub-region), Department of Conservation and Land Management*, Perth

International Council on Mining and Metals (ICMM) 2008, *Planning for Integrated Mine Closure: Toolkit*.

Kimberley Development Commission (KDC) 2011, *The Kimberley* [Online], Available at: http://www.kdc.wa.gov.au/kimberley/tk_econ.asp*,* [25 July 2011].

Mattiske Consulting Pty Ltd (Mattiske) 2008, *Flora and Vegetation Survey of Irvine Island*, unpublished report for Pluton Resources.

McKenzie, N. L., Burbidge, A. A., Chapman, A. and Youngson, W. K. 1978, 'Mammals', in Burbidge, A. A. and McKenzie, N. L. (Eds), *The islands of the North-west Kimberley Western Australia*, Wildlife Research Bulletin of Western Australia No. 7, pp. 22 – 28, Department of Fisheries and Wildlife, Perth.

MScience Pty Ltd (MScience) 2007, *Marine Habitat Survey Irvine and Bathurst Islands*, unpublished report prepared for Pluton Resources.

National Health and Medical Research Council (NHRMC) & Natural Resource Management Ministerial Council (MRMMC) 2004, *Australian Drinking Water Guidelines*, Australian Government, Canberra

Oceanica Consulting Pty Ltd (Oceanica) & MScience (2010) *Irvine Island Marine Investigations – Survey of Marine Benthic Habitat*s, unpublished report prepared for Pluton Resources.

Oceanica Consulting Pty Ltd (Oceanica) 2011, *Irvine Island Marine Investigations - Survey of Marine Benthic Marine Habitats: Habitat Map Extension*, unpublished report prepared for Strategen Environmental Consultants Pty Ltd.

Onshore Environmental (Onshore) 2011a, *Flora and Vegetation Survey Irvine Island October 2010*, unpublished report prepared for Pluton Resources.

Onshore Environmental (Onshore) 2011b, *Irvine Island Iron Ore Project - Flora & Vegetation Survey, Wet Season 2011 Preliminary Report* unpublished letter prepared for Pluton Resources, 15 June 2011.

Pluton Resources 2010, Media Release: *Native title mining agreement for Pluton's Irvine Island project*, 23 December 2010, Pluton Resources Ltd, Melbourne, Victoria.

Strategen 2009, *Wonganin Iron Ore Project, Irvine Island, Buccaneer Archipelago, Quarantine Management Plan*, report prepared for Pluton Resources Ltd, September 2009.

Thackway and Cresswell 1995, *An Interim Biogeographic Regionalisation for Australia: A framework for setting priorities in the National Reserves System Cooperative Program Version 4*, Australian Nature Conservation Agency, Canberra.

Appendix 1
Stakeholder consultation

Stakeholder consultation

Beyond the extensive engagement by Pluton with the Mayala people, since the completion of Phase 2 Pluton has concentrated on maintaining open communication channels with all levels of government to provide regular opportunities to report progress and discuss concerns. This has occurred while the project design has proceeded so that feedback could be incorporated into the design and proposed management measures to minimise environmental impacts.

State, federal and local government

State government

Pluton has maintained regular contact with key State government decision-making authorities throughout the project design phase through face-to-face meetings, and telephone and email conversations. The purpose of this consultation has been to solicit feedback on progress on an ongoing basis and to report how that feedback had been incorporated into project design. Meetings and discussion have been held with the following agencies to date:

- Department of Mines and Petroleum
- Department of Environment and Conservation (Kimberley Region)
- Department of Indigenous Affairs
- Department of Transport
- Department of State Development

Issues raised include:

- the Kimberley Science and Conservation Strategy.
- integrating marine research with a Mayala Ranger's program.
- the cultural sensitivity of Irvine Island.
- detail of operations in Yampi Sound Port.

In addition to consulting with State government agencies, Pluton has met Western Australian Minister for Mines and Petroleum, Hon Norman Moore MLC, to report progress in project design and related developments.

Federal government

Pluton has consulted with the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) throughout the development of the Proposal, building on extensive consultation undertaken during Phases 1 and 2. Since completion of Phase 2, Pluton has met with SEWPAC to provide progress reports on project development and solicit feedback for incorporation into project design.

Pluton has also consulted with Indigenous Business Australia (IBA) during project development. The purpose of this consultation was to solicit IBA's input and report how Pluton had sought to maximise Aboriginal involvement and resultant opportunities in the Proposal.

In addition to consulting with the above Commonwealth government agencies, Pluton has met with the Hon Tony Burke MP, Minister for Sustainability, Environment, Water, Population and Communities and the Hon Martin Ferguson AM, MP, Minister for Resources and Energy; Minister for Tourism to report progress in project design and related developments.

Local government

Pluton has maintained consultation with Local Government Authorities established during Phases 1 and 2 of the Proposal. Councillors and other representatives of the Shire of Broome and the Shire of Derby/West

Kimberley had previously expressed general support for the Proposal while mindful of the need to understand and manage potential social impacts on towns and surrounds. As a result, Pluton is undertaking a Social Impact Assessment to examine possible social impacts and opportunities for regional communities, including through the use and support of facilities in Derby.

Aboriginal stakeholders

In addition to consultation with the Mayala people as the registered native title claimant group, Pluton has consulted extensively with the Kimberley Land Council (KLC) as the representative body for the Kimberley Region. Pluton has held discussions with the KLC either by face-to-face meetings or teleconference more than 50 times. The content of those meetings included the distribution of benefits and opportunities to the broader group of Aboriginal stakeholders potentially affected by the Project, and ongoing Aboriginal involvement in the Project during operations. It has also met and discussed the Proposal with Dambimangari Native Title claimants, the Bardi and Jawi PBC and Ardyaloon Community Inc, Kullari Regional CDEP Inc and many other individuals.

Non-government organisations

Pluton has commenced consultation with the non-government sector, in particular with Environs Kimberley and the Conservation Council of WA. It has endeavoured to meet with Save the Kimberley Representatives. Pluton involved these organisations in issues identification early in the overall process, extending the scope of exploration consultations to encompass issues relevant to the current Proposal.

Key matters raised during consultation with the non-government sector were the conservation status of Irvine Island, improvement on practices at nearby islands, subterranean fauna, quarantine, and cumulative impacts. The consulted organisations were generally opposed to the Project because the island has been recommended for protection as a reserve, that it has intrinsic natural and cultural heritage values, that it is undisturbed, and more generally that there is sufficient iron ore being mined in WA and there is no world shortage of iron ore.

Other stakeholders and community

Pluton attended and held a stall at the 2010 and 2011 North West Expos to increase awareness of the Irvine Island Project among regional stakeholders and members of the public. It distributed information brochures about the Proposal and collected contact details from people who were interested in receiving future project updates or participating in future engagement.

The Pluton project team visits the West Kimberley regularly for formal meetings and discussions, and have used these trips to enable informal discussions with other potentially interested stakeholders including other industries. In addition to building awareness for the Irvine Island Project among Australian and regional stakeholders and public, the Proposal has attracted international attention. Pluton executives and Mayala elders were invited to the 2011 Prospectors and Developers Association of Canada (PDAC) Convention in Toronto to make a series of presentations. The convention, this year attended by 27 000 delegates, is the world's largest mining conference. The Pluton-Mayala group hosted three sessions on corporate social responsibility (CSR). PDAC's CSR coordinator Leslie Williams later wrote that the Irvine Island Project was "a shining example of best practice".

Table 1 Summary of discussions with NGOs.

Issues raised	Pluton response
Environs Kimberley	
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 Island forms part of the same package and is similar to many islands and mainland sites in the region.

Issues raised	Pluton response
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 having Environs Kimberley visit the site to provide community input into audit processes.
Conservation Council of WA	
CCWA opposed mining on Irvine Island. Its position is that Irvine Island should not be disturbed as it is a pristine part of the significant West Kimberley area.	

Appendix 2
Letter from the Kimberley Land Council to the Environmental Protection Authority

Dr Paul Vogel

Chairman

Environmental Protection Authority

Locked Bag 33

Cloisters Square

PERTH WA 6850

By email: paul.vogel@epa.wa.gov.au

Confidential

Dear Dr Vogel

Pluton Resources Limited – Irvine Island Project

I understand that Pluton Resources Limited (**Pluton**) is about to refer its Irvine Island Project (**Project**) to the Environmental Protection Authority (**EPA**) for environmental impact assessment.

The Kimberley Land Council represents the Mayala People who are the Native Title claimants for Irvine Island. It also represents Bardi and Jawi, Dambimangari and other groups who have cultural affiliation to Irvine Island.

On behalf of these groups, I wish to express support for the Project and consider the Project should be permitted to go through the full statutory environmental impact assessment process under the *Environmental Protection Act 1986* (WA).

Pluton has been negotiating with the traditional owners for Irvine Island and on 28 June 2011 received their support for a mining project on Irvine Island via the execution of a Co-operation Agreement. The Co-Operation Agreement ensures that Mayala people and other Kimberley Aboriginal people receive long-term benefits from the Project. Regional benefits include:

- Shares to be held on trust for Mayala people and by the Ambooriny Burru Foundation;
- A multifunctional cultural centre on the Dampier Peninsula;
- Financial compensation via a royalty to Mayala people and the Ambooriny Burru Foundation;
- Annual support for Bardi law and culture;
- Real jobs and business opportunities (Pluton's workforce currently comprises 50% local Aboriginal people. Pluton currently runs a successful indigenous employment and recruitment program).

The Co-operation Agreement ensures that traditional owners have a significant say in the development of the Project:

- Mayala people publically report on Pluton's performance;
- Benchmark for environmental protection is set very high;
- Pluton will assist Mayala people to develop a Mayala Rangers program;
- Approximately 1/3 of the island is set aside for the protection of cultural heritage;
- An 'implementation committee' has been set up to monitor compliance with the agreement and assist Pluton to develop employment strategies etc.

The Co-operation Agreement sets a new benchmark for Native Title Agreement making in the Kimberley.

During the negotiation process, Pluton demonstrated respect for the traditional decision-making processes of the traditional owners and has acknowledged their right to make decisions about developments on their country. This principle is embedded in the Co-Operation Agreement. The Co-operation Agreement strikes

the balance between the protection of cultural heritage and economic development opportunities.

At a recent claimant meeting the traditional owners for Irvine Island unanimously consented to Pluton's mining operations on Irvine Island.

I urge the EPA to set a level of assessment for the Project, which provide allows the Project to be fully assessed. In my view, the Public Environmental Review level of assessment is most appropriate for the Project.

Should the EPA require any further information, please contact me on 0417 900 255.

Yours faithfully

NOLAN HUNTER

Executive Director

Kimberley Land Council

Appendix 3
Proposed environmental investigations

Study topic	Study description
Benthic primary producer habitat	Further investigations relevant to BPPH of the near-shore and coastal environments of Irvine Island that may potentially be impacted by the Proposal include: • undertaking a comprehensive 12-month water quality monitoring program characterising the current occurrence of exotic marine organisms, if present.
Visual amenity	Pluton is undertaking a visual amenity assessment through the development of 3D imaging to exhibit the changes to landform from mining throughout the life of the Proposal. The imagery will enable the visualisation of the Proposal from various points of view from around the island and from numerous angles from sea level to a bird's eye perspective. The 3D imagery will be captured in both still and fly-through formats and will cover a timeframe from pre-development to the stages of mining in both pits to rehabilitation and closure.
Marine fauna	Further investigations of marine fauna include: 1. Literature review and gap analysis, which will involve: • correspondence with experts for each of the key fauna taxa identified as being of particular interest, particularly humpback whales, blue whales, dugongs, snubfin dolphins, turtles, fish and invertebrates • review of potential project monitoring requirements • establishing a selection process and criteria for prioritising marine fauna in the context of the Proposal • cataloguing available information for key taxa • review of the significance and sensitivity of marine fauna relevant to Irvine Island and the Proposal • identification of key knowledge gaps. 2. Design of a targeted baseline and/or ongoing monitoring program in the context of Step 1, above. 3. Peer review of proposed baseline/monitoring program and implementation. Further investigations relevant to marine fauna which are being reviewed include: • undertaking a comprehensive 12-month water quality monitoring program • characterising the current occurrence of exotic marine organisms, if present • investigating marine hydrodynamics around Irvine Island • modelling desalination intake and brine discharge dispersion • investigating and modelling underwater noise • MOFactivity and shipping traffic risk assessment.

Additional supporting investigations and studies

The Proposal will require the transport and transfer to, and use and storage of hydrocarbons (mainly fuels and lubricants) on Irvine Island for operation of vehicles, machinery, barges and other vessels and power generation purposes during the construction and operational phase of the Project. Lesser volumes of other hazardous chemicals may also be required for miscellaneous purposes.

No specific studies have been conducted at this stage regarding hydrocarbon and hazardous material use and storage.

A detailed spillage risk assessment will be conducted by a specialist engineer on the proposed approach to transfer fuel from fuel supply vessels to Irvine Island.

Preliminary analysis of drill core samples will be conducted to assess the presence and risk of fibrous minerals.

Preventative management measures for hydrocarbon transfer, transport, storage and machinery and vehicle use will be implemented to protect groundwater and surface water values of Irvine Island and the surrounding marine environment.

Other impact and management matters which will be carefully considered and addressed through the environmental impact assessment process and preparation of the project's Environmental Management Plan include:

- Waste
- Quarantine
- Dust
- Noise and vibration
- Greenhouse gases
- Storage of dangerous goods
- Fire
- Cumulative impacts
- Closure and rehabilitation.

Appendix 4 Proposed management measures

Proposed Environmental Management Measures

Proposed management (Construction and Operation)

Pluton Resources is in the process of developing an Environmental Management Plan (EMP) aligned to ISO 14001:2004 environmental management principles. A key supporting document to the PER will be the EMP as the plan considers site specific issues for both construction and operation of the Proposal. The EMP prepared for the Proposal will be based on an adaptive approach and includes discrete management plans for the following:

- terrestrial flora and vegetation
- terrestrial fauna
- weeds and feral animals
- subterranean fauna
- benthic primary producer habitat
- marine fauna
- groundwater
- surface water
- hydrocarbons, chemical and explosives
- noise and vibration
- fire
- waste
- Aboriginal heritage
- dust
- quarantine
- visual amenity
- rehabilitation
- closure and decommissioning.

Each management plan will be based on the following indicative structure:

- Introduction
- Purpose of document
- Related documents
- Description of factor
- Environmental aspects and potential impacts
- Management objectives, targets and key performance indicators
- Management actions, including key actions, timing and responsibility
- Monitoring actions
- Contingency framework
- Review and reporting requirements.

Implementation of the EMP will include the following key steps:

- communications and training (includes induction)
- stakeholder consultation
- performance review and continuous improvement (includes incident reporting).

Proposed management measures

Flora and vegetation

Flora and vegetation within the project area will be protected through the implementation of measures outlined in an Environmental Management Plan, which will be prepared to support the PER document.

These measures will include:

1. Flora and vegetation management actions to:
    - ensure that clearing is as approved and is kept within the Proposal area
    - minimise disturbance through planning and location of infrastructure within already disturbed areas or off the island, wherever possible
    - backfill waste rock and tailings and locate stockpiles in open pit voids
    - undertake progressive rehabilitation of disturbed areas
    - minimise dust generation within disturbance areas
    - avoid Priority Flora locations wherever possible
    - establish exclusion zones to protect vegetation of moderate or higher conservation significance within the Proposal footprint.
2. Fire management actions in all operational and adjacent areas.
3. Weed management actions in all operational and adjacent areas, including to:
    - identify and map the extent and distribution of target weed species occurring within the Proposal area
    - establish and maintain an inventory recording the location of weed species within the Proposal area
    - inspect sites to record new observations of weed infestations
    - control weed occurrences prior to disturbance at the site
    - undertake staff inductions to include information on identification and reporting of weeds and procedures to prevent the introduction and spread of weeds
    - implement strict weed quarantine and hygiene measures for all people, parts, plant, machinery and supplies entering and leaving the Proposal area
    - minimise site disturbance by preventing unnecessary clearing of vegetation
    - implement a weed control program for targeted weed species.
4. Quarantine management to prevent the introduction of weeds to the island.

Terrestrial fauna

Terrestrial fauna within the project area will be protected through the implementation of measures outlined in an Environmental Management Plan, which will be prepared to support the PER document.

These measures will include:

- vegetation clearing will be minimised where possible and restricted to designated areas
- natural drainage lines will be maintained wherever possible
- progressive rehabilitation will be undertaken to re-establish fauna habitat
- guns and pets will be prohibited onsite
- feeding of and/or direct interaction with fauna will be prohibited
- appropriate speed limits will be implemented and sign posted
- options for mitigation of light and noise emissions will be investigated
- inductions will include information about significant species and management responsibilities.

Subterranean fauna

Subterranean fauna within the project area will be protected through the implementation of measures outlined in an Environmental Management Plan, which will be prepared to support the PER document.

These measures will include:

- locating infrastructure and transport routes preferentially in previously disturbed areas to minimise clearing of undisturbed native vegetation
- preparation of a clearing works plan to define clearing limits and areas of vegetation and habitat that should not be cleared
- monitoring the extent of groundwater drawdown at drill holes used for subterranean fauna sampling
- containing and bunding hydrocarbon storage facilities, re-fuelling locations and areas of stationary hydrocarbon usage in compliance with corporate policy, relative standards and legal requirements
- rehabilitation of terrestrial ecosystems in accordance with a Final Closure Plan and the Decommissioning and Rehabilitation Plan.

Marine fauna

Marine fauna will be protected through the implementation of measures outlined in an Environmental Management Plan, which will be prepared to support the PER document.

Environmental management measures are likely to include:

1. Limitation of marine vessel movement speeds to reduce risk of collision and limit generation of underwater noise.
2. Control of blasting for MOF construction (such as, for example, employing a single controlled blast at a specified time of day, and/or no blasting if at-risk species are observed within blast buffer limits).
3. Investigation and implementation of infrastructure design to minimise impact to marine fauna.
4. Careful consideration of location of MOF and transhipment infrastructure to minimise impact to marine fauna.
5. Implementation of quarantine and inspection procedures to prevent and monitor the introduction of introduced marine organisms.
6. Investigation and implementation of controls on vessel types, shipping volume, location and timing to avoid disturbance or collision with significant marine fauna.
7. Implementation of waste management procedures to ensure that no harmful marine debris is released by the Proposal.
8. Installation of sediment management infrastructure prior to run-off discharge points.
9. Implementation of best practice spill management and chemical storage procedures.
10. Prohibition of recreational fishing and maintenance of strict controls on access by personnel to marine habitat areas.
11. Ensuring desalination intake pipe design incorporates prevention of the intake of marine fauna.
12. Ensuring desalination discharge is located in areas of appropriate hydrodynamic characteristics to ensure swift and satisfactory brine dispersion.
13. Investigation and implementation of appropriate lighting at MOF and areas near to shore to minimise light spill into the marine environment.
14. Ensuring mooring infrastructure is located on areas uninhabitated by benthic primary producers.

15. Inclusion of information about marine fauna values in inductions.

Surface water

The following potential management measures may be required to address/minimise the potential impacts to surface water:

- applying appropriate engineering stormwater management design i.e. cyclonic events, to manage surface water flows in accordance with latest best practice and/or Australian Standards
- realigning creeks appropriately so as not to affect the drainage capacity of the creek for that area
- ensuring a smooth transition with natural creek and entries of realignments
- constructing on-site drainage in a manner which directs flows from disturbed areas to sedimentation traps to minimise turbidity prior being discharged off site
- installing appropriate bunding and hydrocarbon management in hydrocarbon storage facilities re-fuelling locations and stationary hydrocarbon usage areas
- treating and stockpiling any potentially acid forming or non-acid metalliferous materials appropriately to avoid surface water contamination
- constructing and using hydrocarbon treatment facilities at wash down and workshop areas.

Groundwater

Groundwater resources within the project area will be protected through the implementation of measures outlined in an Environmental Management Plan, which will be prepared to support the PER document. These measures will include:

- regular assessment of potable water requirements and implementing opportunities for water use efficiency
- development and implementation of a bore maintenance schedule to minimise seepage into the mine pit
- development and implementation of a water quality and depth to water table monitoring program and schedule
- include hydrocarbon and waste management spill response procedures within staff inductions
- install appropriate bunding and hydrocarbon management at hydrocarbon storage facilities, re-fuelling locations, and stationary hydrocarbon usage areas
- construct and use hydrocarbon treatment facilities at wash down and workshop areas
- store, handle and dispose ablution effluent and waste in a safe manner.

Aboriginal Heritage

Under section 17 of the *Aboriginal Heritage Act 1972* (WA), it is an offence to disturb any Aboriginal site without consent under section 18 of that Act. It is recommended that more detailed archaeological and ethnographic Aboriginal heritage surveys are conducted to determine the occurrence of any Aboriginal sites within and nearby the Proposal area. If Aboriginal sites are identified within the development areas and they cannot be avoided, an approval to disturb the sites will need to be sought in accordance with section 18 of the *Aboriginal Heritage Act 1972* (WA).

An Aboriginal Heritage Management Plan will be prepared to protect heritage values in the Proposal area through implementation of the following measures:

- ensuring that ethnographic and archaeological surveys cover all areas where ground disturbance is proposed
- continuing consultation with the traditional owners regarding the Proposal
- educating staff/workforce about heritage values of Proposal area, and the importance of protecting these values

- avoiding all Aboriginal heritage sites unless specifically permitted to access or disturb a site for the purposes of implementing the Proposal in agreement with traditional owners and in accordance with the *Aboriginal Heritage Act 1972*
- fencing/signposting, or otherwise clearly demarcating exclusion zones around, Aboriginal heritage sites within and around the Proposal area that are not proposed to be disturbed
- seeking clearance to disturb sites that cannot otherwise be avoided (as aforementioned).

Visual amenity

The management of visual amenity impacts will be addressed by an Environmental Management Plan and include the following proposed management actions:

- implementation of vegetation and flora management measures, as described in a Flora and Vegetation Management Plan, which will include numerous actions pertinent to visual amenity such as:
  - limiting and minimising clearing and disturbance
  - backfilling of waste rock and tailings in pit voids (to reduce footprints and perceived impact on landform)
  - minimising dust generation
  - avoiding significant flora and vegetation
  - fire and weed management
- implementation of progressive rehabilitation under a Rehabilitation Management Plan with the objective of achieving safe, stable, self-sustaining landforms sympathetic to the visual character of the island
- implementation of a Closure Plan with the objective of the mine being closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed post-mining outcomes and land uses, and without unacceptable liability to the State.

Acid and Metalliferous Drainage

AMD will be assessed in the PER and management and mitigation measures, if required, will include:

- constructing bunding in accordance with the surface water management design to reduce surface runoff flowing over exposed PAF material in the pit face
- constructing dedicated waste dumps for different PAF material types if necessary that may present different levels of AMD risk
- stockpiling net neutralising material, if available, in specific waste dumps to use in PAF material waste dumps
- implement mine waste and material management systems
- monitoring water that is abstracted by dewatering for quality and diverting it for treatment if it does not meet baseline water quality.

Hydrocarbons and hazardous materials

Storage and handling of hydrocarbons and hazardous materials will be managed in a manner outlined in an Environmental Management Plan to protect the environmental values of the project area.

Management and mitigation measures for hydrocarbons and other chemicals will include:

- containing and bunding hydrocarbon and other chemical storage and refuelling facilities in accordance with best practice and to relevant Australian legislation and standards
- use of hydrocarbon absorbent matting and spill kits at each hydrocarbon storage facility
- minor hydrocarbon spills will be captured on spill matting and remediated

- all workshop areas will be built to the highest standard to contain spills and will be fitted with oil-water separators
- sub-surface and above-ground pipework and storage tanks containing hydrocarbons will be periodically inspected, pressure-tested and maintained to ensure that leakages are prevented or detected as early as possible
- vessels used to transport fuel to Irvine Island will be periodically inspected and maintained to ensure that leakages are prevented or detected as early as possible
- marine facilities including wharf infrastructure and fuel offloading equipment will be periodically inspected and maintained to ensure infrastructure integrity is of the highest standard and that leakages are prevented or detected as early as possible.

Management and mitigation measures for asbestiform minerals, if present, will be undertaken in accordance with best practice and the *Management of Fibrous Minerals in Western Australian Mining Operations* (DMP 2010) draft guideline.

Appendix 5
Supporting information

This section expands on Section 4 of the report and consists of summary information from the studies indicated in Appendix 6, plus other sources.

Vegetation and flora

Irvine Island is located at the western edge of the Fitzgerald Botanical District in the Central Kimberley Natural Region of the Northern Province (also referred to as the Yampi Peninsula unit) (Beard 1979). The area is described broadly as 'Tree savanna on sandstone ranges' and mapped as 'Eucalyptus dichromophloia (Bloodwood) and Eucalyptus miniata (Woollybutt) Low Trees over Plectrachne pungens (Hummock Grass) and Chrysopogon (Bunch Grass)'.

The Northern Kimberley region is described as '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'.

Several flora and vegetation surveys have been undertaken and include:

- Mattiske 2008, Flora and vegetation survey of part of Irvine Island, unpublished report prepared for Pluton Resources
- Onshore 2011, Irvine Island Study Area – Level 2 Flora and Vegetation survey, unpublished report prepared for Pluton Resources.

Mattiske (2008)

A flora and vegetation survey was undertaken on the eastern side of Irvine Island (Mattiske 2008). The survey was required for the exploration drilling program and was completed in June and September 2007.

A total of 86 plant taxa were recorded from a study area restricted to exploratory drilling locations on Hardstaff Peninsula and Isthmus Point (Mattiske 2008). 14 vegetation associations were identified, the condition of which were rated as 'Pristine - Excellent' (against the Keighery vegetation scale). No threatened Ecological Communities (TEC's) or Priority Ecological Communities (PEC's) were recorded. No DRF or Priority Flora were recorded during this study. One weed species, Passiflora foetida, was identified (Mattiske 2008).

Onshore (2011)

A Level 2 flora and vegetation survey of Irvine Island and selected areas of neighbouring islands was undertaken during 2010 and 2011. The Level 2 survey included desktop searches of:

- DEC Threatened (Declared Rare) Flora database
- DEC Rare and Priority Flora List
- EPBC Act 1999 (C'wlth) Protected Matters Database.

A ground survey was conducted over two seasons during 2010 as follows:

- wet season (8-10 April) survey of Hardstaff Peninsula
- dry season (13-26 October) survey of Irvine Island, Flora Island, and parts of Bathurst and Kathleen Islands.

A further wet season survey was conducted in April 2011. This survey targeted Declared Rare and Priority Flora, other conservation significant flora, declared and noxious weeds and assessment of nuisance weeds. It also included a review of previous mapping and description of vegetation associations.

A total of 172 plant taxa were recorded during the 2010 wet season survey of Hardstaff Peninsula and 204 plant taxa during the 2010 dry season survey of Irvine Island and surrounds. Results from the April 2011 survey are not yet available.

No TEC's or PEC's, Declared Rare Flora or flora listed under the EPBC Act 1999 were recorded (Onshore 2011a and b). Three Priority species were recorded (Onshore 2011a and b):

- *Ipomoea sp.* A Kimberley Flora (LJ Penn 84) (P1)
- *Phyllanthus aridus* (P3)
- *Haemodorum gracile* (P4).

A significant proportion of specimens of *Ipomoea sp.* A Kimberley Flora (LJ Penn 84) recorded were found in disturbed areas associated with the existing historical BHP track (note linear nature of Priority Flora locations on Hardstaff Peninsula in Figure 4).

Two weed species (*Passiflora foetida* and *Melinis repens*) were identified (Onshore 2011).

One vegetation association, 1d (*Pandanus spiralis*), was identified as potentially groundwater dependent.

A total of 17 vegetation associations were described (Onshore 2011a and b). The associations were classified into nine formations based upon canopy structure (Onshore 2011a and b). Vegetation condition assessed ranged from 'Pristine' to 'Very Good' (against the Keighery vegetation scale), with only minor disturbance noted as a result of previous BHP exploration activities and tracks and camp laydown established during Pluton's ongoing exploration program.

A selection of Kimberley islands has been proposed for reservation since the 1970's. Much of the conservation planning is based on vegetation association mapping of Beard (1979). Beard's mapping was completed at a relatively coarse scale and based solely on interpretation for the Yampi Peninsula Unit. Vegetation communities identified as being of high conservation significance such as rainforest patches and mound springs require high-resolution mapping and confirmation by ground truthing to confirm distribution owing to their small size.

Survey of Irvine Island study in April and October 2010 did not identify any vegetation associations to be of State or Federal conservation significance (Onshore 2011). Examples of all priority flora were also found on adjacent islands (e.g. Kathleen and Bathurst) and in the Cultural Heritage Protection Area.

Fauna

Knowledge of the terrestrial biodiversity of most Kimberley islands is generally limited (CCWA 2010). The fauna assemblage of the archipelago islands is a subset of the biota of the mainland from which it was isolated, is generally reduced in variety dependent on the size of the island, the interactions between the species that were isolated, and chance (CCWA 2010). The islands provide breeding sites protected from terrestrial predators (including exotic predators such as pigs, cats and rats) and the islands are also relatively unaffected by most of the threatening processes causing decline of mainland biodiversity such as grazing, altered fire regimes, pests and diseases.

Terrestrial fauna investigations are currently underway. Completion of the final report for the most recent study is dependent on receiving the contextual information from the DEC led survey of the Kimberley Islands, which is expected shortly. These findings will be available for the PER.

A number of extensive terrestrial fauna surveys have been undertaken across Irvine Island with the aim of mapping fauna habitat and species including species of conservation significance (Biota 2007). These included surveying for vertebrates and Short Range Endemic (SRE) invertebrates.

<u>Biota 2007</u>

A Level 1 fauna assessment conducted in 2007 investigated fauna and fauna habitats from a range of sources including previous surveys, database searches and a brief site visit (Biota 2007).

A site visit in June 2007 appraised potential habitat for fauna, but yielded few vertebrate records. In order to predict what species may be present, the report summarised survey 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.

Biota 2011

More recently, an Irvine Island Seasonal Fauna Survey was conducted (Biota 2011, in prep.). The scope of the study was to:

- complete a level two terrestrial fauna survey of Irvine Island and contextual neighbouring islands including Bathurst Island, Kathleen Island, Gibbings Island, McIntyre Island and Margaret Island. Contextual mainland sites at the Yampi Peninsula were also surveyed
- identify and assess the local and regional conservation significance of the fauna assemblage and habitats present in the study area
- document the vertebrate and potential SRE terrestrial invertebrate fauna assemblage within the study area using established sampling techniques
- identify fauna of particular conservation significance (particularly Schedule and Priority listed species, as well as potential SRE taxa).

The survey involved a desktop review, followed by sampling events in March and July 2010 and June 2011.

The methodology of this is consistent with the approach used by the DEC. A targeted bat and reptile survey was also conducted to determine whether there were any significant bat roosts within the Proposal footprint and to place reptile records into further context.

Thirteen trapping sites were established on Bathurst Island, including four in the wet season and nine in the dry season. Sites were established at six locations, to represent the major habitat features of the island and to replicate the sites established on Irvine Island. These included creekline, heath, plateau, woodland, beach and gully habitat types.

As on Bathurst Island, trapping on the mainland was conducted over a shorter period than on Irvine Island, as the locations were chosen to provide context.

Hand foraging for reptiles was undertaken at one or more locations on several nearby islands including MacIntyre, Kathleen, Margaret and Gibbings.

Short-Range Endemic Fauna (SREs)

Sampling for SRE taxa was conducted in the vicinity of all systematic survey sites, with additional via pit traps installed for vertebrate fauna. Additionally, unbounded dedicated SRE searches were conducted at locations other than systematic survey sites. These dedicated SRE search sites represented the range of habitats present and were targeted at locations where SRE species were likely to occur, including deep leaf litter, vine thickets, deciduous forests, rock piles and drainages. SRE searches were conducted outside of the Proposal footprint and other areas with the aim of providing local context.

Specific invertebrate groups were targeted using both systematic and non-systematic collection methods.

Trapdoor spiders were targeted by searching for and excavating burrows. Other potential SRE taxa including millipedes, land snails and pseudoscorpions were searched for under leaf litter, bark, rocks, logs and in leaf litter samples.

Land snails

Land snails were identified as a group of interest by the DEC following the Kimberley Islands Survey. As a result, a team member was dedicated to sampling land snails during Phase 1 of the Irvine Island survey program.

All material collected during the survey was processed according to WA Museum protocols and tissue and specimens were then provided to the Australian Museum.

Molecular investigation of the land snails is not yet complete and preliminary advice on the taxonomic identity of all collected specimens based on the genetic and morphological studies is still to be finalised, but is expected to be available for the preparation of the PER.

Results of fauna surveys

A final report and results of the 2010-11 surveys are yet to be finalised. The report and results will be available to support the PER.

Fauna habitats identified in the Proposal area during the earlier survey included beach dunes and small adjacent sandy areas, low open woodland, low open shrubland, deciduous forest and mangroves (Biota 2007). None of the habitats encountered during the survey are considered to be restricted to just the Proposal area or restricted regionally to Irvine Island as similar habitats have been observed throughout the Buccaneer Archipelago (Biota 2007).

Based on the survey results gathered to date, the vertebrate fauna assemblage of Irvine Island is considered typical of other regional islands (Biota 2011, in prep.). All identified species have been recorded from other islands, which have also yielded very similar species compositions. Amongst the vertebrates, a *Lerista* (skink) species is noteworthy, as the island surveys carried out to date rarely encounter members of this species group. Also of note is the presence the gecko genus *Gehyra*, recorded from several other islands of the Buccaneer Archipelago, which is currently undergoing taxonomic review, and which indicates that *G. occidentalis* is a species complex with the Irvine Island form remaining unresolved (Biota 2010). Taxonomic work is also continuing on Camaenid snails, with recent indications that at least one species surveyed on Irvine Island may be of elevated conservation significance. Confirmation of potential conservation status of all unresolved species is pending Australian and Western Australian Museum testing and results.

Multiple protected fauna species occur or potentially occur at Irvine Island as they were either observed during surveys or yielded by various database searches.

Subterranean fauna

A subterranean fauna survey of Irvine Island has not yet been completed. Interim results on the first phases of sampling will be available to support the PER.

A comprehensive assessment of potential subterranean fauna at Irvine Island that is compliant with EPA guidance (EPA 2003 and 2007) commenced in June 2011. The investigation will include a desktop habitat assessment followed by up to three phases of subterranean fauna sampling from drill holes within and outside the potential impact area. These drill holes were constructed during the first phases of the mine exploration programs. The investigation will also include sampling from dedicated environmental monitoring bores located to the northwest and west of the potential mine areas that are being constructed during the current phase of the mine exploration program.

Collected specimens will be conventionally identified based on morphology, but molecular (DNA) methods may be necessary for more specific identification purposes.

Marine habitat

Pluton has undertaken, or commenced, separate mangrove and marine BPPH studies, listed below.

Mangroves:

- Onshore 2011, Irvine Island Study Area – Level 2 Flora and Vegetation survey, unpublished report prepared for Pluton Resources.

Marine BPPH:

- MScience 2007. Marine Habitat Survey Irvine and Bathurst Islands, unpublished report prepared for Pluton Resources.
- Oceanica and MScience 2010, Irvine Island Marine Investigations – Survey of Marine Benthic Habitats, unpublished report prepared for Pluton Resources
- Oceanica 2011, Irvine Island Marine Investigations - Survey of Marine Benthic Marine Habitats: Habitat Map Extension, unpublished report prepared for Strategen Environmental Consultants Pty Ltd.

Onshore (2011)

A Level 2 flora and vegetation survey of Irvine Island and selected areas of neighbouring islands was undertaken, which included mapping of mangrove vegetation. Three mangrove associations were identified along the coastline of Irvine Island (Onshore 2011):

1. Vegetation Association 1a; dominated by Sonneratia alba (Family Sonneratiaceae), occurring in the 'low' intertidal zone, with approximately 80% cover and between 7m to 15m in height. Other associated mangrove species include Avicennia marina, Rhizophora stylosa and Aegiceras corniculatum.
2. Vegetation Association 1b; comprised of a mosaic of mangrove species with the most common species typically being Rhizophora stylosa, Sonneratia alba and Avicennia marina forming a Low Closed Forest, with less common taxa including Aegiceras corniculatum, Aegialitis annulata and Camptostemon schultzii.
3. Vegetation Association 1c; dominated by a single species, Rhizophora stylosa, which provides up to 98% cover. Avicennia marina was also recorded as a minor component in the vegetation association.

The condition of the mangrove vegetation was rated as 'pristine' to 'excellent' (Onshore 2011). An assessment of species richness of the mangrove associations found the Irvine Island mangroves to have low species richness. None of the mangrove plant taxa occurring on Irvine Island were determined to be of conservation significance. Similar mangrove associations have previously been recorded at neighbouring Cockatoo and Koolan Islands (Onshore 2011).

MScience (2007)

A preliminary survey surrounding Irvine Island was undertaken to produce a map showing BPPH distribution. The habitats were assessed via a combination of marine charts, aerial photography satellite imagery and remote video (MScience 2007).

A field survey was undertaken between 4-5 April 2007, with a total of 69 sites surveyed (MScience 2007). The survey methodology included collecting video imagery and recording substrates at each location. The 2007 survey identified the following BPPH, covering an area of 1906 ha (Table 1; MScience 2007):

- coral
- seasonal macroalgae
- mangrove
- abiotic (comprises intertidal/shallow subtidal sand or rubble flats and limestone pavement with little macro-biological cover).

Table 1 BPPH type by area mapped

BPPH type	ha
Coral	982.1
Macroalgae	414.5
Mangrove	45.1
Abiotic	464.5
Total mapped	**1906**

Oceanica & MScience (2010)

A preliminary investigation was conducted in March 2010 to provide an overview of the BPPH in the near-shore and coastal environments surrounding Irvine Island (Oceanica & MScience 2010).

The investigation involved a review of digital images collected between 14 and 21 March 2010 for a bathymetric survey (Oceanica & MScience 2010). A total of 147 images were collected during the survey of Hardstaff Point, Yampi Sound and between Irvine Island and Cockatoo Islands and then classified to enable the production of BHHP distribution map.

Oceanica (2011)

A comprehensive ground-truthing assessment of the key marine benthic habitats (coral, microalgae, sediment, filter feeder and seagrass) was undertaken in January 2011 (Oceanica 2011). The assessment expanded the area covered in the previous preliminary investigation (Oceanica & MScience2010).

The assessment involved the following methodology (Oceanica 2011):

- analysis of multi-spectral satellite imagery
- ground-truthing camera surveys sites recorded in 2010
- towed underwater survey over three days (11-13 January 2011)
- classification of satellite imagery
- interpolation and compilation of maps from observations during the fieldwork.

BPPH distribution was mapped using information collected during the assessment. Results of the assessment are separated into the following four areas and are summarised below (Oceanica 2011):

North of Jonas Point (not affected by the proposal)

This area is dominated by a large continuous intertidal reef, which extends from the southern tip of Jonas Point, to a larger reef platform in the north east, which links Bathurst and Irvine Islands (Oceanica 2011). The macroalgae and coral assemblages recorded in this area of the island were the highest density in the study area. Percent cover for macroalgae was estimated to range from 40-60%, with Corals 10-30% (Oceanica 2011).

Two permanently inundated saltwater lagoons are located within this reef area and comprise the main feature within the northern embayment. The depth of the lagoons exceeds 18 m, with the walls made up of a steep band of *Acropora* coral. The inshore boundaries of the lagoons consist of tidal mudflats that are exposed at low tide and feed into the mangrove communities on the shoreline (Oceanica 2011).

The area to the north of Kathleen Island consists of a narrow band of intertidal corals, with a coral slope occurring on the northern extremity of the narrow band. The coral habitat in this area is of sparse to moderate density, characterised by an increase in water depth of 13 m over a horizontal plane of 20 m (Oceanica 2011).

Eastern Embayment (not affected by the proposal)

The eastern embayment is dominated by rock-rubble with sparsely distributed intertidal coral colonies and patches of macroalgae. Intertidal corals were mapped as occurring with an estimated cover of between 5-10%, consisting of soft and hard coral taxa. Coral slopes were identified in a narrow northerly trending band, running from Jonas Point to the southwest tip of Hardstaff Point. Coral cover along slopes was estimated as ranging from 10-20% (Oceanica 2011).

Western Embayment (area within which some disturbance may occur)

Mixed assemblages of macroalgae (*Sargassum*), coral and seagrass (*Halophila*) were identified as occurring in two locations: adjacent to the southern tip of Hardstaff Point; and on the western extremity of the embayment at the tip of the Western Peninsula (Oceanica 2011). Protection from the two peninsulas provides stable substrate conditions that enable the mixed assemblages to occur year round, although densities are likely to seasonally fluctuate (Oceanica 2011).

A narrow band of intertidal coral and coral slope habitat occurs around the southern edge of Hardstaff Point, characterised by an increase in water depth of 13 m over a horizontal plane of 20 m (Oceanica 2011).

Western Peninsula

BPPH along the seaward fringe of western peninsula of Irvine Island has been mapped as a narrow band of sparse to moderately dense intertidal corals, with coral slope occurring on the seaward edge (Oceanica 2011). An intertidal reef also exists within a small embayment midway along the peninsula. The seaward side of the embayment is dominated by dense assemblages of macroalgae, with the landward side largely uninhabited by macroalgae (*Sargassum*) (Oceanica 2011).

Marine fauna

Detailed studies of the marine fauna assemblage which inhabit the waters adjacent to Irvine Island have yet to commence. A 'state of knowledge' report regarding humpback whales has been prepared for Pluton by the Centre for Whale Research and a search of the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) Protected Matters of Search Tool has also been undertaken to characterise EPBC Act listed species which may occur in the area. Scoping work for other potential future studies is currently underway. Studies undertaken to characterise bathymetry and benthic primary producer habitat and hydrodynamics will be used to inform studies examining marine fauna.

EPBC Act Protected Matters Search

A desktop search for potential Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) listed fauna was conducted for the Proposal Area using the Protected Matters search tool. This search identified a number of matters of National Environmental Significance including 13 mammal species, 22 reptile species and 3 shark species which are either known to breed in the area or have potential to occur within the area (Table 1 and Table 2).

Table 1 Matters of National Significance (Marine Fauna) that may occur in the vicinity of the Proposal area – type of presence

Type of presence	Mammal	Reptile	Shark	Total
Breeding known to occur within area	1			1
Species or species habitat likely to occur within area	3	6		9
Species or species habitat may occur within area	9	16	3	28
Total potential	**13**	**22**	**3**	**38**

These species are protected under the EPBC Act under one or more of the following classifications:

- Threatened Species
- Migratory Species
- Whales and Other Cetaceans.

Migratory marine birds that may potentially occur within the Proposal Area are listed in Table 2.

Table 2 Potential EPBC Act protected marine fauna potentially present in the vicinity of the Proposal area (5 km radius) by listing category

Scientific Name	Common Name	Status	List
Breeding known to occur within area			
Megaptera novaeangliae	Humpback Whale	Vulnerable	Migratory, Whales / Cetaceans, Threatened

Scientific Name	Common Name	Status	List
Species or species habitat likely to occur within area			
Caretta caretta	Loggerhead Turtle	Endangered	Listed Migratory, Threatened
Lepidochelys olivacea	Olive Ridley Turtle	Endangered	Listed Migratory, Threatened
Chelonia mydas	Green Turtle	Vulnerable	Listed Migratory, Threatened
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable	Listed Migratory, Threatened
Natator depressus	Flatback Turtle	Vulnerable	Listed Migratory, Threatened
Dugong dugon	Dugong		Listed Migratory
Crocodylus porosus	Salt-water Crocodile		Listed Migratory
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted Bottlenose Dolphin		Migratory, Whales / Cetaceans
Tursiops aduncus	Indian Ocean Bottlenose Dolphin		Whales / Cetaceans
Species or species habitat may occur within area			
Dermochelys coriacea	Leatherback Turtle	Endangered	Listed Migratory, Threatened
Balaenoptera musculus	Blue Whale	Endangered	Migratory, Whales / Cetaceans, Threatened
Rhincodon typus	Whale Shark	Vulnerable	Migratory
Pristis clavata	Dwarf Sawfish	Vulnerable	Threatened
Pristis zijsron	Green Sawfish	Vulnerable	Threatened
Balaenoptera edeni	Bryde's Whale		Migratory, Whales / Cetaceans
Orcaella brevirostris	Irrawaddy Dolphin		Migratory, Whales / Cetaceans
Orcinus orca	Killer Whale		Migratory, Whales / Cetaceans
Sousa chinensis	Indo-Pacific Humpback Dolphin		Migratory, Whales / Cetaceans
Delphinus delphis	Common Dolphin		Whales / Cetaceans
Grampus griseus	Risso's Dolphin		Whales / Cetaceans
Stenella attenuata	Spotted Dolphin		Whales / Cetaceans
Tursiops truncatus s. str.	Bottlenose Dolphin		Whales / Cetaceans

Centre for Whale Research

A report has been prepared on the current knowledge available on the Humpback Whale presence in the Kimberley (CWR 2011). The Kimberley Humpback Whale population is the largest in the world and is considered to be one of the world's most successfully recovered populations following whaling pressures. The Humpback whales of the southern hemisphere have been categorised into separate feeding and breeding stocks, with the Kimberley waters forming "Breeding Stock D", a calving area for the Group IV whales (which feed in Area IV during summer).

The peak density of Humpback Whales within Kimberley waters is during mid-late August, with migrations into the area starting around late July, and cow/calf pairs migrating south by mid September. Males have been noted to stay within the area for longer than the females and calves.

There is little literature available regarding other cetacean species (apart from Humpback Whales) found in the western Kimberley, although a list of likely present cetacean species has been developed Table 3.

Table 3 List of species likely to inhabit the off-shore Kimberley region as listed in the Australian Cetacean Action Plan.

Species Name	Common Name
Tursiops truncates	Bottlenose dolphin
Stenella attenuate	Pan-tropical spotted dolphin
Steno bredanensis	Rough toothed dolphin
Stenella longirostris	Spinner dolphin
Stenella coeruleoalba	Striped dolphin
Delphinus delphis	Common dolphin
Lagenodelphis hosei	Frasers dolphin
Peponocephela electra	Melon headed whale
Feresa attenuate	Pygmy killer whale
Pseudorca crassidens	False killer whale
Orcinus orca	Killer whale
Globicephala macrorhynchus	Short finned pilot whale
Orcaella brevirostris	Snubfin dolphin
Physeter macrocephalus	Sperm whale
Kogia simus	Dwarf sperm whale
Balaenoptera acutorostrata	Minke whale
Balaenoptera borealis	Sei whale
Balaenoptera edeni	Bryde's whale
Balaenoptera musculus	Blue whale
Balaenoptera physalus	Fin whale
Megaptera novaeangliae	Humpback whale

Surface and groundwater

Surface water features in the Kimberley, including permanent water courses and pools and their riparian zones, are an important resource for waterbirds and provide refugia during the dry season for many species, however Irvine Island does not cover an extensive enough area, being 9 km^2, to have developed significant surface water features. Surface flow on the island is restricted to rainfall events.

Historical daily rainfall totals have exceeded 250 mm but could reach 480 mm in a 100-year average recurrence interval event. Average intensity for a 100-year ARI, 1 h event is predicted to be 150 mm/h (GHD 2011a). Rainfall is highly variable and yearly totals depend on the occurrence of cyclones. The average number of cyclones passing near the island is between 0.4 and 0.6. Annual rainfall has been recorded as low as 115 mm and as high as 1250 mm.

Surface water investigations already completed for the Proposal include:

16. Desktop characterisation of hydrology and establishment of baseline conditions. This assessment established the baseline hydrological conditions for the Proposal utilising existing topographic and imagery data for Irvine Island and climatic data for Derby.
17. Site inspection. A site inspection was undertaken of the Proposal area and included:
    - Inspection of various accessible components of the existing creek and tributary system including sedimentation areas, river channel features and floodplain areas
    - Inspection of the current activities in the catchment area to understand hydrology, key landscape values and any other potentially impacted areas.

The results of these investigations are summarised below.

Topography and drainage

The Irvine Island coast is characterised by cliffs of up to 100 m in height. The 9 km^2 s body of the island comprises of an undulating central plateau of about 150 m Australian Height Datum (AHD) at its highest elevation leading to a series of valley drainage lines contained within a number of generally small sub-catchments. In the area most likely to be occupied by processing infrastructure and the waste dump, drainage is generally toward the south and east and catchments tend to be larger. Drainage is divided between the Hardstaff Peninsula and the Isthmus by a low ridge (GHD 2011a).

The ground surface is made up of rock or armoured by rock with few deeply incised streams channels and turbidity from existing run off is likely to be low. Stormwater flows are often directed over the coastal cliffs as waterfalls and drainage generally discharges direct to the ocean, draining quickly after rainfall events. There are few, if any, permanent or long-lasting freshwater pools on the island (GHD 2011a).

Table 1 Characteristics of existing catchments

Catchment	Indicative area (ha)	Comment
Hardstaff Peninsula	2-15	Small catchments draining to the east and west.
The Isthmus	1-5	Small catchments draining to the north and south.
Mangroves north of the Isthmus	46	Catchments partly from the proposed Isthmus pit area and partly from the west.
Infrastructure and waste dump area	10-100	Plateau catchments draining to the south and east.

System conceptualisation (surface water model)

A surface water model will be completed as part of the hydrological assessment for the Proposal. Information gathered during the desktop investigation and site inspection will be synthesised into a conceptual understanding of the hydrologic system and a runoff model developed. The model will allow the estimation of design peak flows of 1 year, 10 year and 100 year return periods for proposed mine infrastructure.

Following the completion of surface water modelling, Pluton will use this information to develop and refine design specifications to ensure a best practice surface water management regime is implemented.

Groundwater

The Proposal involves mining below the watertable and therefore impacts on groundwater need to be considered. Experience from mining of formations similar to those found on Irvine Island at Cockatoo and Kooan Islands suggest low aquifer permeability in the Elgee Siltstone. Groundwater in the proposed pit area at the Hardstaff Peninsula may be in connection with the sea along strike to the south of the peninsula and to the north where the Elgee Siltstone dips down below sea level. The potential connection of the mining area to the western side of the peninsula will depend on the mine plan adopted and the site hydrogeology, particularly the hydraulic properties of the Sandfly Schist which overlies the orebody. The Isthmus area is understood to be comprised of the same geological units and is structurally complex.

Completed investigations

Ground water investigations have commenced but results are preliminary. Generally:

- Ground water reflects the topography with water level controlled by sea level close to the coast. Ground water elevation approximates sea level in the bores around the Isthmus Region and on Hardstaff Peninsula
- Aquifer testing suggests that the hydraulic conductivity of the sequence on Hardstaff Peninsula and on the Isthmus Region is low with relatively consistent values of 10^{-6} m/sec.

However, there are a number of investigations currently underway, which are outlined below.

Current or proposed investigations

The following groundwater investigations are underway, scheduled to be completed by October 2011.

Irvine Island hydrogeological assessment

The hydrogeological assessment currently underway includes:

- a fielding testing and sampling program
- packer testing
- water supply bore testing
- groundwater modelling.

Current hydrogeological site investigations undertaken for the site indicate that:

1. the depth to groundwater reflects the topography with water level controlled by sea level close to the coast. Ground water elevation approximates sea level in the bores measured around the Isthmus and Hardstaff Peninsula, although these need to be mapped in greater detail.
2. Aquifer hydraulic properties were obtained from 15 bores mostly on Hardstaff Peninsula. During bore development by airlifting changes in ground water level, especially the water level recovery were recorded using a pressure transducer. Data from the transducers has been analysed to estimate the hydraulic properties of the formations. Results are provided in Appendix 6 - GHD Draft Report for Irvine Island Mine Pre-Feasibility Study Groundwater Investigations July, page 32.
3. Packer testing has been undertaken on 5 exploration holes, testing hydraulic conductivity in each of the dominant geological layers. The aquifer testing using both the airlifting and the packer testing suggests that the hydraulic conductivity of the sequence on Hardstaff Peninsula and the Isthmus Region is low with relatively consistent values of 10^{-6} m/sec or lower.
4. Based on the known geology including work undertaken on Koolan and Cockatoo Island it is hypothesised that a fresh water lens is likely to be present overlying more saline water at depth. Saline profiles have been run on a number of bores. Results indicate that all wells show some degree of increasing salinity at depth. Some bores show signs of sea water intrusion. Salinity samples taken after airlifting suggest the likely mixing of waters from different aquifer intervals. Other haloclines are inconclusive and more testing is required.
5. a preliminary estimate of groundwater inflows (i.e. rates, volumes) into the proposed Hardstaff Peninsula pit over the development period has been conducted. Ground water is encountered in year 3 and from year 4 and is consistently estimated to be 1.5GL/year.

Further hydrogeological assessment will include:

- hydrogeological model of the site characterising the aquifers present and their hydraulic properties, groundwater flow patterns, recharge and discharge processes on groundwater quality
- an assessment of the groundwater quality of mine inflows to input in the mine water management treatment systems on environmental impacts (includes predicted drawdowns and preliminary assessment for the potential for saline groundwater intrusion into the aquifer over time); analysis of quality will include pH, TDS, major ions, nitrate and selected metals
- an assessment of the potential impact of the proposed mine development on groundwater dependent ecosystems if they are identified in the region
- identification of areas where additional hydrogeological investigation may be warranted to further assess mine dewatering requirements.

Proposal groundwater supply

The Proposal will require a water supply to successfully undertake both construction and operational phases of the Project. A potential water supply is groundwater from beneath Irvine Island. Investigations into the potential groundwater supplies for Irvine Island have commenced, with a drilling program running

between March to October 2011. Once information from the drilling program is available this will be used to conduct a desktop investigation to assess potential groundwater supply options.

Tidal movements and acid sulphate soil potential

The potential impact of pit dewatering on the mangrove community adjacent to the Isthmus deposit will be further investigated as the dependence of the mangrove on fresh or sea water or the degree and frequency of tidal ingress into the mangrove community has yet to be fully characterised. Three transducers in the mangrove community have been installed to collect information on tidal movements over a 2-3 month period.

Acid and metalliferous drainage

The Proposal may require acid and metalliferous drainage (AMD) to be addressed, however, initial geological results indicate the risk of AMD remains low at Irvine Island. The incidence of AMD is associated with the abundance of sulfide minerals (DITR 2007). The most common sulfide mineral is pyrite, which is used to identify the presence of Potentially Acid Forming (PAF) material. The presence of PAF material is determined by geotechnical investigations and testing, and if present, this Proposal will incorporate AMD management.

The following aspects of AMD may have an environmental impact:

- incorrect storage of PAF mineral waste has the potential to cause spontaneous combustion and could generate acidic water and/or metalliferous drainage if it comes in contact with infiltration or rainwater/runoff, which may result in groundwater or surface water contamination
- exposed PAF material in the pit wall has the potential to generate acid water and/or metalliferous drainage if it comes in contact with rainwater/runoff, which may result in groundwater or surface water contamination
- dewatering may expose PAF material as a result of the groundwater drawdown, which has the potential to make abstracted water acidic and/or metalliferous.

The production of AMD from the exposure of PAF material can also have significant adverse impacts on revegetation programs and other closure objectives if not properly managed.

A geotechnical and waste characterisation study is underway to assess the potential of exposing, extracting and handling PAF material in the pit walls, waste rock and tailings. Further investigation may be required to determine if there is an AMD risk associated with the closure of the mine and how PAF material should best be stored to minimise long term environmental impacts.

A preliminary review was carried out using available metals and sulfur analyses to identify metals with potential to be elevated in the waste rock and ore leachate and to identify the potential for acidic drainage (GHD 2011b). Metal concentration analysis indicated that, based on its toxicity to aquatic environments, arsenic is likely to be the most critical of the metal toxicants detected. Other metals detected at higher levels included manganese, copper and lead (GHD 2011b).

The preliminary testing indicated that the overall risk of sulphur acidity is generally low, but there may be some PAF material present. The testing also indicated that calcium and magnesium appears to be present excess to sulphur levels in the Elgee Siltstone (overburden material), which will provide some acid neutralising capacity (the level of which is to be determined).

In order to better define the potential for the generation of acidic or metalliferous drainage, including through oxidisation of non-sulfurous ferrous iron oxides, specific AMD testing has been initiated. Samples from previously analysed sections of drill core samples plus some additional samples have been submitted for analysis for:

- Net Acid Generation (NAG)
- Net Acid Producing Potential (NAPP)

- ICPMS[1] metals scan and electrical conductivity measurement of the NAG leachate.

On completion of the laboratory analyses, the data will be reviewed and the material classified according to its potential to generate acidic or metalliferous leachate. If PAF material is identified, additional testing, such as Acid Buffering Characteristic Curve (ABCC) and free-draining column leach tests will be carried out.

Aboriginal and European heritage

Irvine Island is recognised as a significant site under the *Aboriginal Heritage Act 1972* (WA) (the Heritage Act). The Island is registered as Aboriginal site ID 13466 (Wonganin) with the Department of Indigenous Affairs. There are an additional 22 registered Aboriginal sites on Irvine Island, including artefact scatters, paintings, burial sites, mythological sites and ceremonial sites.

Irvine Island lies wholly within the Mayala Native Title Claim (WC98/39), which covers approximately 3 815 km^2 of land and sea in King Sound and the Buccaneer Archipelago. Pluton has successfully negotiated Native Title, Exploration, Mining and Heritage Protection Agreements with the Kimberley Land Council (KLC; as agents for the Mayala claim) for Irvine Island.

There are no known European heritage sites on Irvine Island.

In 2007 consent was given by the Mayala group to the granting of an exploration licence on Irvine Island (E04/1172) and for exploration to proceed.

Under section 17 of the Heritage Act, it is an offence to disturb any Aboriginal site without consent under section 18 of the Act.

Prior to conducting the Phase I, II and III exploration programs at Irvine Island, Pluton Resources applied for and received approval under section 18 of the Heritage Act for the proposed works. As part of the approval process, Pluton, senior Mayala men and their representatives, visited Irvine Island on numerous occasions to inspect the island and assess the potential impacts of exploratory work on potential archaeological and ethnographic sites.

At the end of 2010 Pluton Resources entered into a legally binding Heads of Agreement with the Mayala for the development of Irvine Island (Pluton Resources 2010). Mayala people support the Proposal and agree to the grant of MLA04/452, the mining lease that replaces the existing exploration licence. The negotiations were conducted with a team of senior elected Mayala representatives with the agreement ratified at a community meeting in June 2011. Pluton and Mayala people will work together to develop the Project, which will deliver significant benefits to the traditional owners.

Pluton Resources is committed to engaging and employing Mayala people and other Kimberley Aboriginal people during its mining operations and have them participate in environmental studies and management. Four Aboriginal heritage surveys have been undertaken to date (Appendix 3)as summarised below:

- **Cox H, 2007,** *Work Program Clearance Report. Pluton Resources. Irvine Island (Wonganin).* Tenement (E04/1172). Mayala Native Title Claimants. Unpublished report prepared for the Kimberley Land Council.

  There were two Aboriginal heritage surveys conducted on Irvine Island in 2007. The survey team included Mayala representatives, Dr Guy Wright and Dr Henry Cox. Due to the inhospitable nature of the island and access issues, younger Malaya men who were part of the survey team inspected the island and reported back to the Mayala Elders at the end of each day.

[1] ICPMS: Inductively Coupled Plasma Mass Spectrometry

The second survey was conducted in September 2007 with 16 drill sites on the Isthmus Region cleared and seven on Hardstaff Peninsula cleared. This survey also recorded three new areas of interest; a burial site, a horizontal striated rock and a rock shelter.

- **Anthropos Australis 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.* Unpublished report for the Mayala Native Title Claimants, Kimberley Land Council and Pluton Resources Ltd.

  This survey was conducted in two parts, the first portion was a site inspection on Irvine Island and the second portion included consultation with senior Mayala women, conducted at One Arm Point. The survey team included Mayala representatives, Nicholas Green, Daniel Monks and representatives from the KLC and Pluton Resources. During the site inspection an archaeologist and younger Mayala representatives inspected proposed walking tracks and work sites and reporting back to the senior Mayala Consultants at the end of each day. 29 proposed work tracks and approximately 3km of walking tracks were ethnographically and archaeologically cleared. 15 proposed existing work sites (first inspected in 2007) were archaeologically cleared. No archaeological or ethnographic sites were recorded.

  The second part of the survey, an ethnographic consultation, was conducted in September 2008 by Kyoto Metz, Alison James and a KLC representative. The senior Mayala women supported results of the site inspection and the associated clearance for the exploration work to be conducted.

- **Anthropos Australis Pty Ltd, 2010.** *The Report of an Aboriginal Heritage Survey of the Proposed Work Program on Hardstaff Peninsula, Eastern Irvine Island, West Kimberley, Western Australia*. Unpublished report for the Mayala Native Title Claimants, Kimberley Land Council and Pluton Resources Ltd.

  The survey was conducted on Irvine Island in July 2010. The survey team included senior Mayala representatives, Nicholas Green, Andrew Dowding, Ian Scott and representatives from the KLC and Pluton Resources. The Report details the results of an Aboriginal heritage survey for an extension for the camp, core yard, water tank area, three new walking tracks to join existing drill holes and an existing BHP track. The work program was ethnographically and archaeologically cleared with no additional ethnographic or archaeological sites recorded.

- **Anthropos Australis Pty Ltd, 2010.** *The Report of an Aboriginal Heritage Survey of the Proposed Environmental Drilling Program on E04/1172, central Irvine Island, West Kimberley, Western Australia. Unpublished report for the Mayala Native Title Claimants and Pluton Resources.*

  The survey was conducted on Irvine Island in August 2010. The survey team included senior Mayala representatives, Andrew Dowding, Ian Scott and representatives from Pluton Resources. The report details the results of an archaeological and ethnographic Aboriginal heritage survey of walking tracks and worksites. Younger Mayala men walked to and inspected sites. Mayala Elders also inspected all work areas in a low flying helicopter. 18 work sites and approximately 3 km of walking track were ethnographically and archaeologically cleared. No additional archaeological or ethnographic sites were recorded.

- **Vachant D, (June 2011)** A ethnographic and archaeological Aboriginal heritage survey of the mining project foot print was recently undertaken. The areas were ethnographically and archaeologically cleared by senior Mayala men. The report is pending.

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 Claimants Kimberley Land Council Aboriginal Representatives Body and Pluton Resources Ltd.

Anthropos Australis Pty Ltd, 2010. *The Report of an Aboriginal Heritage Survey of the Proposed Work Program on Hardstaff Peninsula, Eastern Irvine Island, West Kimberley, Western Australia*. unpublished report for the Mayala Native Title Claimants, Kimberley Land Council and Pluton Resources Ltd.

Anthropos Australis Pty Ltd, 2010. *The Report of an Aboriginal Heritage Survey of the Proposed Environmental Drilling Program on E04/1172, central Irvine Island, West Kimberley, Western Australia*, unpublished report for the Mayala Native Title Claimants and Pluton Resources.

Beard, J.S 1979, *Vegetation Survey of Western Australia: Kimberley 1:1 000 000 Vegetation Series*, University of Western Australia Press, Nedlands.

Beard, J.S. 1990, *Plant Life of Western Australia*, Kangaroo Press, Kenthurst, NSW

Biota Environmental Sciences (Biota) 2007, *Irvine Island Level 1 Fauna Assessment*, unpublished report prepared for Pluton Resources, December 2007.

Biota Environmental Sciences (Biota) 2009, *Irvine Island Project Mangrove Impacts Position Paper*, unpublished report prepared for Pluton Resources.

Biota Environmental Sciences (Biota) 2010, *A Summary of the Irvine Island Fauna Survey*, unpublished memo prepared for Pluton Resources, 4 May 2010.

Biota Environmental Sciences (Biota) 2011, Preliminary results of 2010 Fauna surveys, unpublished report section prepared for Pluton Resources.

Cox H, 2007, *Work Program Clearance Report. Pluton Resources. Irvine Island (Wonganin). Tenement (E04/1172). Mayala Native Title Claimants*. Unpublished report prepared for the Kimberley Land Council.

Department of Industry, Tourism and Resources (DITR) 2007, *Managing Acid and Metalliferous Drainage*, Leading Practice Sustainable Development Program for the Mining Industry, Australian Government, Canberra, February 2007.

Environmental Protection Authority (EPA) 2003, *Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Impact Assessment in Western Australia*, Guidance Statement No. 54, December 2003.

Environmental Protection Authority (EPA) 2007, *Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia*, Draft Guidance Statement No 54a, August 2007.

Environmental Protection Authority (EPA) 2009, *Environmental Assessment Guideline No 3 – Protection of Benthic Primary Producer Habitats in Western Australia's Marine Environment*, prepared by Environmental Protection Authority, Perth, Western Australia.

GHD 2011a, *Report for Irvine Island Surface Water Investigation*, draft report prepared for Pluton Resources Ltd, April

GHD 2011b, *Irvine Island Mine Preliminary AMD Assessment – Interim Report*, unpublished memo prepared for Pluton Resources Ltd, 30 June 2011.

Graham, G 2001, *Bioregion: North Kimberley 1 (NK1 – Mitchell Sub-region), Department of Conservation and Land Management*, Perth

Mattiske Consulting Pty Ltd (Mattiske) 2008, *Flora and Vegetation Survey of Irvine Island*, unpublished report for Pluton Resources.

MScience Pty Ltd (MScience) 2007, *Marine Habitat Survey Irvine and Bathurst Islands*, unpublished report prepared for Pluton Resources.

Oceanica Consulting Pty Ltd (Oceanica) & MScience (2010) *Irvine Island Marine Investigations – Survey of Marine Benthic Habitat*s, unpublished report prepared for Pluton Resources.

Oceanica Consulting Pty Ltd (Oceanica) 2011, *Irvine Island Marine Investigations - Survey of Marine Benthic Marine Habitats: Habitat Map Extension*, unpublished report prepared for Strategen Environmental Consultants Pty Ltd.

Onshore Environmental (Onshore) 2011a, *Flora and Vegetation Survey Irvine Island October 2010*, unpublished report prepared for Pluton Resources.

Onshore Environmental (Onshore) 2011b, *Irvine Island Iron Ore Project - Flora & Vegetation Survey, Wet Season 2011 Preliminary Report* unpublished letter prepared for Pluton Resources, 15 June 2011.

Thackway and Cresswell 1995, *An Interim Biogeographic Regionalisation for Australia: A framework for setting priorities in the National Reserves System Cooperative Program Version 4*, Australian Nature Conservation Agency, Canberra.

Appendix 6
Supporting documents

The following reports have been saved to CD as supporting documents

1. Onshore Environmental (Onshore) 2011, *Flora and Vegetation survey, Irvine Island, October 2010*.
2. Biota Environmental Sciences (Biota) 2007, *Irvine Island Level 1 Fauna Assessment*.
3. Oceanica Consulting Pty Ltd (Oceanica) 2011, *Irvine Island Marine Investigations - Survey of Marine Benthic Marine Habitats: Habitat Map Extension*.
4. Strategen 2009, *Wonganin Iron Ore Project, Irvine Island, Buccaneer Archipelago, Quarantine Management Plan*.
5. Strategen 2010, *Conservation Management Plan – Phase III Environmental Drilling Program at Irvine Island*.
6. Pluton 2010, *Universal Drilling Platform*.
7. GHD 2011, Draft Report for Irvine Island Mine Pre-Feasibility Study Groundwater Investigations July 2011.