Agency Comment	BHPBIO Response
Marine Ecosystems Branch	
1. Section 2.4.1 lists the capital works to include construction of seawalls to 7 m AHD for DMMA B1 & B2 spoil reclamation areas and plans for these are shown in Figures 2.2 and 2.3. However, the construction of berms to 17 m AHD at these two reclamation areas are also listed with no explanation or diagram to show what they are, where they are and what they are for. This appears to be a very significant structure and more information is needed.	• **Attachment 1 and 2** provide a general overview of the configuration proposed for DMMA B1 and B2, including the berms that will be constructed to approximately 17m AHD. • The berm configuration and height take into account both visual screening and potential opportunities for dust reduction in design concept. The 17m AHD is similar to iron ore stockpile heights. • Please refer to **Section 2.5.1.2 o**f the Environmental Referral Document.
2. Dissolved oxygen data is more meaningful if provided as % saturation for comparison against ANZECC & ARMCANZ (2000) guideline trigger values. For example, DO concentrations in Table 4.2 would be better expressed as % saturation.	• Dissolved oxygen presented in Table 4.2 was cited from URS (2007) where only mg/L data were presented. • Dissolved oxygen values have now been converted into % saturation and a revised Table 4.2 is included in **Attachment 3**. • Please refer to **Section 4.2.2 (Table 4.2) o**f the Environmental Referral Document.
3. The metal concentrations recorded in Table 4.4 are exceptionally high. Are these total metal concentrations, and if so, what were the suspended sediment concentrations? The proponent should discuss their water quality sampling and storage methodology with Marine Ecosystems Branch (contact the Manager, Ray Masini on 6467 5494 in the first instance) as soon as practicable to ensure that the background water quality monitoring program is collecting useful data	• Values reported in Table 4.4 are Total Metal Concentrations. Similar patterns of exceedences were also detected in Soluble Metal Concentrations. • **Attachment 4** outlines QA procedure adopted for the Environmental Referral Document.

Agency Comment	BHPBIO Response
4. Section 8.1.3: Reference to the Revised Environmental Quality Criteria Reference Document (Cockburn Sound) (EPA 2002b) should be updated to the current document which was released in 2005. The current document can be downloaded from the following website: http://www.epa.wa.gov.au/article.asp?ID=1567&area=Policies&CID=35&Category=State+Environmental+Policies.	• Water quality sections of the Environmental Referral Document have been checked against the revised Cockburn Sound document released in 2005 to ensure that BHPBIO complies with current EPA guidelines and objectives. • Please refer to **Section 8.1.3** and **the Executive Summary (Table ES3)** of the Environmental Referral Document.
5. The discussion in this section, and Figure 4.13, suggests that the proponent has revised the area allocated a moderate level of ecological protection in Port Hedland to take into account its proposed facility. Any changes to the environmental quality objectives (including levels of ecological protection) need to be clearly shown against the original boundaries for the EPA's consideration. EPA endorsement of any such changes is required.	• A modified Figure 4-13 is included in **Attachment 5** for EPA consideration and endorsement that includes both the previously defined boundaries from the *Pilbara Coastal WQ Consultation Outcomes* document (2006) and the boundary revision proposed in the Environmental Referral Document. • Ecological Protection Levels were modified in accordance with: a) Boundary Revisions and Guiding statements within the *Pilbara Coastal Water Quality Consultation Outcomes: Environmental Outcomes and Environmental Quality Objectives* (EPA 2006) b) Guiding statements within the *State Water Quality Management Strategy No.6: Implementation Framework for Western Australia for the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Monitoring and Reporting (National Water Quality Management Strategy).* Report No. SWQ6, (DOE 2004). • Ecological Protection Level boundaries for *Moderate Ecological Protection* were modified for the Inner Harbour to include approved infrastructure developments at Utah Point as well as the proposed berth facilities at Harriet Point that are associated with this Environmental Referral Document. Boundaries have been redrawn within a distance of 250m from these approved and planned facilities. • Please refer to **Section 4.4** and **Figure 4.13** of the Environmental Referral Document.

Agency Comment	BHPBIO Response
6. The ecological consequences of removing the two shallow bays under the DMMA B1 and DMMA B2 reclamation areas has not be adequately addressed. For example, are these important habitat for any species, including migratory waders? Are they utilised as feeding or nursery areas for any marine species?	• The area encompassing DMMA B1 and B2 has been highly modified due to historical land reclamation and construction activities, and are exposed to constant shipping traffic and port activity. • Investigations and review of existing studies for DMMA B1 and B2 suggest there is no unique habitat for significant species including migratory waders. The following points elaborate on this assessment: 1. Some fish species would be expected to forage within sand/silt habitats within DMMA B1 and B2 as well as the small area of BPPH recorded within DMMA B2. However, since DMMA B1 and B2 are exposed on most tides, fish using these areas would likely be transient. As such it is reasonable to expect that these communities would be able to, and probably do use other similar habitats, such as intertidal areas elsewhere within the harbour and nearby inlets and bays if they are unable to access DMMA B1 and B2. 2. Similar alternative habitats occur nearby, including beaches at south-western Finucane Island, which provide a less disturbed habitat for visiting migratory wading birds and other fauna. 3. In all surveys that have been conducted for this Environmental Referral Document within DMMA B1 and B2, no migratory waders have been observed (SKM 2007, 2008). Biota (2002) recorded migratory wading birds foraging within the vicinity of a tidal creek pool on Finucane Island, indicating that other preferred habitat is present in the immediate vicinity of DMMA B1 and B2. In addition, a flora and fauna study performed by Biota (2007) concluded that the proposed reclamation site: “DMMA B1 is a relatively small area and is unlikely to intersect with a significant area of intertidal mudflat habitat used by the widely distributed species of migratory wading birds which visit the Port Hedland region”.

Agency Comment	BHPBIO Response
	4. The lack of significant feeding habitat (seagrass, algae, sponges and soft coral) within the Inner Harbour is likely to preclude adult turtles regularly using the area for foraging (Pendoley Environmental 2008). While flatback turtle hatchlings are known to use inshore areas for foraging, they are not likely to use the harbour waters as nursery habitat due to the alternating inundation and exposure regimes of these waters (Pendoley Environmental 2008). 5. Nesting habitat for female flatback turtles has been identified at several beaches outside the Harbour, but none within the harbour (Pendoley Environmental 2008). 6. Dugong sightings for the Port Hedland region were reported as being low during a survey by Prince et al. (2001). No significant seagrass beds were recorded during surveys of DMMA B1 and B2 (SKM 2008) suggesting that these areas are unlikely to provide foraging habitat for dugong. • Please refer to **Section 9.2.4**, **Section 9.2.5** and **Table 9.2** of the Environmental Referral Document.
7. Figures 8.1 and 8.2 suggest that modelling of spoil disposed at Spoil Ground 'I' has only considered disposal of the spoil at a single point rather than spread over the spoil ground. If true then this should be stated up-front as it has obvious consequences for the plume predictions. (By comparison Figures 8.3 and 8.4 appear to indicate that spoil was dumped all over the spoil ground.)	• Figures 8.1 and 8.2 depict the predicted contours of TSS values exceeded 95% of the time at Spoil Ground 'I' and are based on single point. Whereas Figures 8.3 and 8.4 depict the sediment load accumulating in Spoil Disposal Site 'I' over the entire disposal period. • Modelling indicated that any turbidity (TSS) created by the disposal of material at Spoil Ground 'I' would dissipate rapidly from the site between each disposal "event" (barge load of sediment) due to the large tidal range (up to 5m) and offshore water movements that flush Spoil Ground 'I'.

Agency Comment	BHPBIO Response
	• Due to batch disposal methods employed (barge) modelling indicates that there were no cumulative increase in TSS caused by subsequent disposal episodes • The presentation of modelling for one disposal episode, single point therefore, presents the worst case scenario for disposal at Spoil Ground 'I'. • The differences between Figure 8.1 and 8.2 are based on the application of a larger barge for batch disposal to Spoil Ground 'I'. • Modelling indicates that while finer fractions of the spoil are likely to disperse rapidly due to flushing, a minor quantity – the larger fractions of the disposed material - would fall out of the water column and accumulate on the sea floor (shown in Figures 8.3 and 8.4). However, these fractions are predicted to settle between disposal episodes. • Please refer to **Section 8.1.5** and **Figures 8.1 to 8.10** of the Environmental Referral Document.
8. It should be remembered that modelling results for the prediction of suspended sediment concentrations and sedimentation are not definitive, they provide some guidance as to likely outcomes. Definitive statements such as, for example, the last sentence of the first paragraph in section 8.1.5 are misleading.	• It is acknowledged that the use of definitive statements is inappropriate in reference to modelling predictions. Modelling will provide indicative outcomes and during dredging activities monitoring programs will be undertaken to evaluate and address potential impacts, as outlined in the Dredging and Mangrove Management Plans. • Please refer to **Section 8.1.5** of the Environmental Referral Document.

Agency Comment	BHPBIO Response
9. Benthic habitat maps need to be provided that include the entire area likely to be influenced by the suspended sediment plumes and areas in the vicinity beyond the predicted plume boundaries. Text in the ERD discusses the existence of corals northwest and northeast of Finucane Island and on page 4-23 reference is made to benthic habitat surveys undertaken offshore of Port Hedland which has identified rocky pavement and ridge lines that support hard corals, soft corals, sponges and macroaglae.	• As stated in the Environmental Referral Document, no significant BPPH, other than mangroves, occur in areas that are predicted to receive altered water quality, except for a small BPPH community on the north-eastern side of Finucane Island. This site will be used as a water quality monitoring location as indicated within Figure 7 and Table 9 of the Dredging Management Plan. • The habitat within the vicinity of Spoil Ground 'I' predominately constitutes a combination of rock and sandy habitat. Due to the disposal grounds historical and continues use as an area for disposal of dredge material this area does not support BPP of significance due to the lack of available hard substrate for colonisation by corals and macroaglae, and the shifting nature of the sediments which pose a significant challenge of colonisation by seagrasses. • Modelling does not predict a detectable buildup of sediment in any surrounding habitats, apart from a slight spillover into silt/sand habitats immediately adjacent to the spoil ground boundaries. • Reference to benthic habitat surveys undertaken offshore of Port Hedland which has identified rocky pavement and ridge lines that support hard corals, soft corals, sponges and macroaglae is part of the proposed Outer Harbour Development baselines studies that are currently in progress. The findings from these studies are still being processed but refer to a significantly broader area than that associated with Spoil Ground 'I'. • Please refer to **Section 4.3.1** of the Environmental Referral Document.
10. The scale for accumulated sediment in Figures 8.3, 8.4, 8.6, 8.8 and 8.10 should be revised to reflect the actual maximum sedimentation rates. For example the disposal of 1 million m^3 of spoil at Spoil Disposal Site 'I' should result in a maximum sedimentation rate of ~500,000 gm/m^2, but the sedimentation scale only goes up to 2,000 gm/m^2.	• It is acknowledged that Figures 8.3 and 8.4 do not show all of the accumulated sediment. • They show the distribution of sediment that may drift and accumulate outside the spoil ground boundaries (finer fractions).

Agency Comment	BHPBIO Response
	• Figures 8.3 and 8.4 have been revised to reflect maximum sedimentation rates (fine and coarse fractions) and are included in **Attachment 6**. • Please refer to **Section 8.1.5** of the Environmental Referral Document.
11. In figure 8.6 it is noted that there is no sedimentation predicted to occur below disposal site A. Is technical justification for this provided?	• Only very fine sediment is likely to be released in excess water from DMMA A into Salmon Creek, since most large sediment fractions will fall out of excess water in settling ponds. • Fine sediment fractions that may settle within the upper creek bed during slack tides are anticipated to be removed through scouring on larger tides. • Plume modelling indicates that excess water sediments would only accumulate in areas of the creek where the water current slows down sufficiently to allow these fractions to settle. The lower part of Salmon Creek, including a small bay created by construction of the causeway to Finucane Island appears to have sufficiently slow water flow to potentially allow this to occur. • Please refer to **Section 8.1.5** of the Environmental Referral Document.
12. In sections 8.1.5 and 8.1.6 the impacts and proposed management of the excess water discharged from the spoil disposal areas is discussed. Suspended sediment concentrations in the discharge is predicted to average 150 mg/L. One obvious management strategy that has not been considered in the document is the use of silt curtains inside the overflow point from the settlement ponds to minimise suspended sediment discharge. This should be considered as a routine management strategy.	• The option of silt curtains was considered early in the project. This included reviewing applications where silt curtains had been employed and considering operational factors. • A number of issues were raised during the review, including inability to maintain curtain operability in high flow scenarios, maintenance and potential safety related aspects when employing on a large scale; and in some cases employment of curtains also worsened water quality outcomes through preferential channelling. • On this basis BHPBIO's preferred measure for maintaining water quality is to focus on the configuration and use of DMMAs to minimise the quantity of suspended sediments entering the marine environment.

Agency Comment	BHPBIO Response
13. The proponent suggests on page 8-18 that the excess water will be released back to the marine environment via the discharge point when the quality of the water reaches 'required levels' and refers to Table 8.1 for these values. Table 8.1 represents acceptable quality water for the receiving environment, not the settlement pond discharge water. The ERD needs to describe how the release criteria for the discharge water will be derived and how will they be applied. The document also needs to explain how diurnal and seasonal variations to the trigger levels for the receiving environment (page 8-19) will be derived.	<u>Triggers for excess water:</u> • While Table 8-18 refers to trigger values for the receiving environment, as measured at "Impact" Monitoring Sites, the proponent also plans to measure water quality parameters of excess water before discharge, and these will also be maintained as a goal within 20th and 80th percentiles of the receiving environment for high protection areas and within the 5th and 95th percentiles for medium protection areas. (as per the Dredging Management Plan). • A tiered approach to excess water management has been presented in the Dredging Management Plan, as developed and revised from guiding documents: 1. *Environmental Quality Criteria Reference Document for Cockburn Sound (2003-2004), EPA, 2005; and* 2. *ANZECC/ ARMCANZ (2000)* • Water quality will be monitored at the discharge location twice daily to assist in understanding the relationship between the quality of the water being discharged and the "Impact" Monitoring Sites. This relationship will be established in the initial stages of the discharge of excess water from the DMMA and will be used as a proactive indicator to ensure that acceptable water quality (as outlined in Table 8-18) is achieved at the Impact Monitoring Sites. • Continued exceedences of water quality trigger values at Impact Sites would result in further management measures being implemented as per the Dredging Management Plan, including a reduction or stoppage of discharge water (as per the Dredging Management Plan) and an assessment of potential impacts to biological communities in the receiving environment.

Agency Comment	BHPBIO Response
	Trigger level calculations: • Trigger levels will be initially set using the 20th and 80th percentiles (60% saturation for dissolved oxygen) of seasonally derived data distributions for each parameter collected from potential impact sites (before dredging). This data is being collected currently through the water quality monitoring program outlined in Section 8.1 of the Environmental Referral Document and the Dredging Management Plan. • Once dredging has commenced, trigger levels will refined using data from suitable reference sites. • As in previous projects within Port Hedland (e.g. FMG and the Utah Point Project), trigger levels may need to be adjusted to account for diurnal and seasonal trends. Water quality at impact and reference sites will be measured every 30 minutes and downloaded every two weeks. If diurnal or seasonal medians of water quality parameters measured at reference sites are found to fall outside the 20th and 80th percentiles (60% saturation for DO), discrete data distributions will be used, and new percentiles calculated for each discrete time interval (e.g. diurnal. seasonal, or tidal) to ensure that management trigger levels are matched as closely as possible to the natural environment. • Please refer to **Section 8.1.6**, **Table 8.1** and the **Dredging Management Plan (Appendix C)** of the Environmental Referral Document.

Agency Comment	BHPBIO Response
14. Water quality monitoring using datalogger is proposed for turbidity, pH, DO, conductivity and temperature at four impact sites and at two reference sites. Trace metals and ammonia will also be monitored fortnightly by campaign monitoring, but the actual sites in Salmon Creek and Oyster Inlet have not been located on Figure 8.11. Given the distance of Impact Site 2 from the discharge at DMMA 'A', the proponent should undertake some intense baseline campaign monitoring at the discharge point and a similar reference point in Oyster Creek (over high tides given the intertidal nature of the locations) in an attempt to calibrate these sites to the outer monitoring sites.	• **Attachment 7** (Figure 8.11b) shows the location of campaign monitoring sites. • Following from discussions with the Marine Ecosystems Branch, BHPBIO has worked with data logger servicing agent (EnviroEquip) to locate an "Impact" monitoring site for DMMA 'A' that receives an acceptable level of inundation across all tides and is located closer to the discharge point for DMMA 'A' (see **Attachment 7**). • Data from a range of potential reference sites that are comparable to Impact Site 2 have also been examined (see **Attachment 7**) to find the closest possible match. • Please refer to **Section 8.1.6**, **Figure 8.11** and the **Dredging Management Plan** of the Environmental Referral Document.
15. Table 8.1: The trigger level should be Median >80th percentile or <20th percentile. For DO the criterion is ≤60% saturation - it is not a percentile based criterion.	• BHPBIO acknowledges that Medians of the impact site data should be compared against trigger levels of >80th or <20th percentiles of reference site data. • The reference to 60th percentile for DO is a typographical error. This table should refer to 60% saturation. A revised Table 8.1 is included in **Attachment 8**. • Please refer to **8.1.6**, **Table 8.1** and the **Dredging Management Plan o**f the Environmental Referral Document**. Table 8.1** and **Section 8.1.6** have also been modified to reflect the trigger levels of >95th or <5th percentile for areas with a Level of Ecological Protection of Medium.
16. Table 8.2: The likelihood of both impacts occurring is considered to be very high and should be 10, giving a residual risk of 30 in each case.	• The likelihood factors presented in Table 8.2 represent the probability of the impacts occurring after management measures have been implemented (as per the Dredging Management Plan).

Agency Comment	BHPBIO Response
	• While a likelihood factor of 10 might be expected without any management in place, BHPBIO believes that this likelihood would be significantly reduced (to 0.3) when strict water quality management guidelines are adhered to, as stated in the Dredging Management Plan. • A severity of 3 and likelihood factor of 10 would imply that "minor effects on biological and physical environments" would be expected to occur "more than once during the project". While it is possible that water quality parameters in the receiving environment may be altered during the project in close proximity to project activities, it is unlikely that these alterations would cause "minor effects on biological and physical environments" more than once with management measures in place. Therefore, BHPBIO believes that the residual risk ranking is appropriate if management measures are adhered to.
17. Section 8.3.4: The management area is classified as Category F (cumulative loss thresholds exceeded) and a small, but additional loss will be associated with this development, yet there is no discussion of the consequences of the loss for ecological integrity in the region. Where BPPH losses exceed 10% in Development Areas the EPA expects the proponent to consider the significance of the impact on ecosystem integrity in accordance with Guidance Statement 29.	• The project design phase included a risk analysis to determine the most suitable project design to minimise loss of high quality mangrove forest. • The footprints of the proposed Dredge Area at Harriet Point and DMMA were carefully designed and re-designed to minimise the quantity of high quality mangrove loss within engineering constraints. • Within engineering constraints there was a trade off in loss of "lower quality" habitat – for example sparse mangroves, salt marshes and cyanobacterial mats, with "high quality" habitat such as high canopy cover mangrove forest. • The "low quality" BPPH within proposed project areas exhibit lower rates of primary productivity and contain a low diversity of marine fauna than "high quality" habitats that the proponent has endeavoured to avoid (ENV 2008).

Agency Comment	BHPBIO Response
	• The exceedence of cumulative loss thresholds will be discussed further with the EPASU in a separate meeting. • Please refer to **Section 8.3.4 o**f the Environmental Referral Document.
18. Section 9.1 suggests that there will also be significant losses (11.19 ha) of intertidal salt marsh and cyanobacterial algal mats (unspecified area). These will both need to be considered within the context of Guidance Statement 29.	• In compiling information to assess BPPH distribution and loss, BHPBIO has referred to Guidance Statement 29 and precedents set in recent environmental referral documents that have been approved by the EPA. • There has been no precedent to date or indication in Guidance Statement 29 that cyanobacterial mats and salt marsh communities should be assessed as BPPH in the context of the Guidance Statement. • The Guidance Statement itself does not include these communities in calculations of BPPH historical loss since the “extent and ecological value” of these habitats (cyanobacterial mats in particular) “is difficult to ascertain”. • Cyanobacterial mats are highly variable in time and space, and the exact extent of these habitats (both present and past) is difficult to determine. Additionally, a lack of information on the ecological role of cyanobacterial mats limits our ability to define the ecological consequence of their removal. • Salt-marsh communities contain a limited faunal and floral diversity, are generally sparse in coverage and do not contribute significantly to primary production when compared to high canopy cover mangroves and other BPP, and are extremely low in faunal diversity (ENV 2008). • The loss of these habitats has been discussed in the Environmental Referral Document. Both are considered to be of limited importance to fauna (ENV 2008). They are present throughout the region and the limited fauna that may depend upon this habitat are able to utilise similar habitats in nearby locations.

Agency Comment	BHPBIO Response
	• Please refer to **Section 9.1.1** of the Environmental Referral Document.
19. It is noted in Appendix C 'Dredge Management Plan', Section 6.3, that a key performance indicator is minimal exceedance of water quality triggers at the monitoring sites. Minimal is undefined, but in any case it is incorrect. There should be no exceedances of water quality triggers.	• BHPBIO acknowledge that the key performance indicator should be "no exceedences" of water quality triggers. • Please refer to **Section 6.3** of the **Dredging Management Plan (Appendix C)** of the Environmental Referral Document.

Agency Comment	BHPBIO Response
Environmental Management Branch	
1. The regional significance of Cemetery Beach / Pretty Pool as a marine turtle rookery is largely under-estimated.	• BHPBIO acknowledges the importance of Cemetery Beach/Pretty Pool for nesting populations of flatback turtles. • The majority of dredging activities will be undertaken within the Port Hedland Inner Harbour, which is greater than 3-4 kilometres from Cemetery Beach. BHPBIO believes that the potential impacts to turtle nesting areas are low risk and can be easily managed. • Section 9.2 of the Environmental Referral Document and Section 6.7 of the Dredging Management Plan outlines management measures that BHPBIO has committed to undertaking to manage potential impacts on sea turtles associated with collision with vessels, light spill and hydrocarbons spills. • Please refer to **Section 9.2.4** of the Environmental Referral Document..
2. The impact of increased light emissions on marine turtles is not adequately addressed.	• Light emissions associated with dredging equipment is likely to have a negligible impact on cumulative light emissions at Cemetery Beach as the majority of dredging activities will be undertaken within the Port Hedland Inner Harbour, which is greater than 3-4 kilometres from Cemetery Beach and is separated by topographical features (eg dunal system) and existing residential, commercial and other industrial landuses within the West End of Port Hedland. • The removal of PASS material to Spoil Ground 'I' will result in additional shipping traffic within the existing Port Hedland Harbour shipping channel. To minimise the impact associated with light emissions from this increase in traffic on turtle nesting areas at Cemetery Beach, BHPBIO has committed to:

Agency Comment	BHPBIO Response
	1. Limiting lighting to those lights required for the safe and efficient operation of the dredging vessels. 2. Utilising down lights where practical and minimising the use of operational lights being shone directly onto the water. • These measures are outlined in Section 6.7 of the Dredging Management Plan. • Please refer to **Section 9.2.4** of the Environmental Referral Document.
3. Entrapment of turtles in suction / cutter head of dredge.	• BHPBIO agrees with the recommendation that entrapment of turtles in suction/cutter head of dredge should be listed as a potential direct impact although the residual risk is likely to be minor (ie rating = 0.9, with a severity of 3 and a likelihood of 0.3) when measures outlined in the Dredging Management Plan are implemented. • BHPBIO will ensure that prior to the start up of any dredge, a general observation of the water around the dredge will be made. If any sea turtle (or marine mammal) is sighted within 150m of the dredge, dredging will not commence until the sea turtle (or marine mammal) has moved beyond 150m of the dredge or has not been sighted for 10 minutes. These management measures are outlined in Section 6.7 of the Dredging Management Plan. • BHPBIO believes that the likelihood of entrapping turtles in the suction/cutter head during operation is minimal. The scale of the dredge and the length of pipeline requires a shutdown sequence, which can take up to 1 hour from the point at which a turtle or other marine mammal is observed. Failing to follow this sequence can result in equipment damage and pipeline blockages, which in themselves pose safety and environmental issues.

Agency Comment	BHPBIO Response
	• The sequence includes a step where the cutter head is raised to intake clean water for the flushing process. This step presents a risk should a sea turtle be in the immediate vicinity as it will be drawn into the point of suction. BHPBIO has reviewed similar issues with other dredging projects and has been advised this risk was reduced by continuing to operate the cutter head on the dredge within the substrate to act as a deterrent to prevent sea turtles from entering this area. • It is important to note that BHPBIO do not plan to use a trailing suction hopper dredge for the proposed works. Cutter Suction dredges are considered to present less risk to marine fauna in that they work form a fixed point and are slower in advancing the dredge face. • Please refer to **Section 9.2.5** and **Section 6.7** of the **Dredging Management Plan (Appendix C)** of the Environmental Referral Document.
4. Management Procedures for Start up of Dredge	• BHPBIO acknowledge the inconsistency - Section 9.2.5 should state 150m rather than 500m. • Please refer to **Section 9.2.5** and **Section 6.7 of the Dredging Management Plan (Appendix C) of** the Environmental Referral Document.
5. Inadequate desktop and field survey and related information regarding potential habitat and use of the project area by conservation significant avian fauna.	• Further to the assessment described in the Environmental Referral Document, additional fauna surveys have been undertaken as part of the proposed Outer Harbour Development. A two phased summer/winter fauna survey was undertaken, between 12th October to 9th November 2007 and the 5th-16th May 2008. This survey encompassed DMMA A.

Agency Comment	BHPBIO Response
	• Results from this survey identified twenty-three separate bird species that are listed as migratory species under the *Environmental Protection and Biodiversity Conservation Act 1999*. A majority of these species were recorded within mangroves and tidal flats habitat types. These species are largely aerial, with an extensive home range, and will not be entirely dependent on habitats in the project area, with the exception of the tidal mudflats and mangroves. These habitat types support most of the migratory waders found in the project area and many of these non-breeding migrants will use these habitats for foraging and roosting during the summer. The habitat within the project area is not unique and is adequately represented elsewhere in the Port Hedland region. • A copy of the "Port Hedland Outer Harbour Development – Fauna Assessment" is included in **Attachment 9.**. • Please refer to **Section 5.3.5 of** the Environmental Referral Document.
6. The proponent needs to discuss and evaluate the cumulative impacts of the development as well as surrounding approved developments on mangroves and other benthic primary producer habitat types in more detail with reference to EPA Guidance Statement 29.	• Refer to BHPBIO's response to comment #17 raised by the Marine Ecosytems Branch. • Please refer to **Section 8.3.4 o**f the Environmental Referral Document.
7. There is an apparent need for mitigation for the loss of mangroves and other benthic primary producer habitats.	• BHPBIO acknowledges the recommendation and has committed to investigating options for the development of a mangrove offsets package. • The proposed package will be developed in consultation with DEC and other stakeholders and will take into consideration BHPBIO's future growth program within the Port Hedland area, including the dredging associated with the Environmental Referral Document.
8. The proponent has not provided comprehensive evidence to demonstrate that indirect impacts of the project, such as excess water disposal, will not have an impact on mangrove communities.	• BHPBIO agrees with the recommendation regarding limits on the authorised extent of direct and indirect impacts on mangroves.

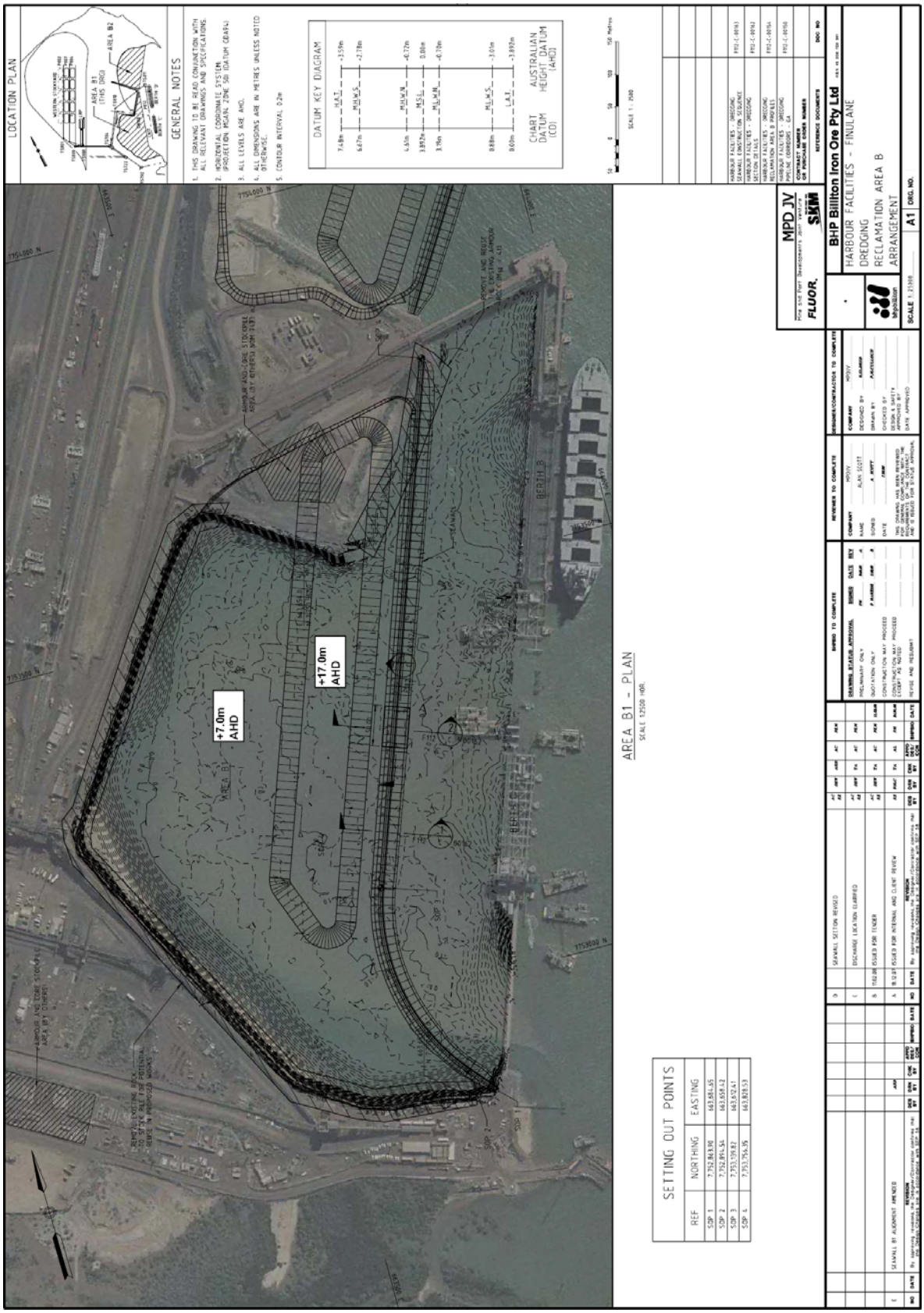
Agency Comment	BHPBIO Response
	• Details of the program to evaluate impacts on mangroves are outlined in Section 6 of the Mangrove Management Plan. In addition to water quality monitoring, the proposed monitoring program includes: 1. Mangrove mapping using aerial photography and field surveys to map the distribution and coverage of mangrove communities situated near the project area. This will be undertaken prior to the commencement of dredging, once clearing has been completed, and upon completion of the project 2. Mangrove health surveys utilising mangrove monitoring plots within the vicinity of the project area and reference sites. This will include monthly visual inspections (qualitative) and quantitative assessments prior to the commencement of dredging, six months after the commencement of the project and on completion of the project. 3. Sedimentation monitoring on a fortnightly basis to provide an early warning of any potential impacts

Agency Comment	BHPBIO Response
Contaminated Sites Branch	
1. **Assessing the toxicity of iron ore dust** – The sediments that will be dredged may contain a substantial component of iron ore dust which has not yet undergone iron(III) reduction processes in benthic sediments. Research over the last decade has indicated that iron ore dusts and leachate can cause damage to wildlife and aquatic organisms through the formation of oxyradicals that can cause lipid peroxidation and DNA damage (see e.g. Hamoutene et al., 2000; Payne et al., 2001). Given the amounts of dust from the port facility that is likely to be deposited in mangals, tidal flats and the shallow marine environment, it is recommended that the risk of this material to cause environmental harm is assessed with appropriate bioassay testing rather than just relying on chemical data obtained from elutriate testing to infer whether sediments are likely to be toxic.	• Iron ore dust (if any) is likely to be deposited in the surficial sediments or upper layers of marine sediments and is unlikely to be contained within deeper consolidated sediments. There is minimal evidence of iron ore dust deposition within the proposed dredge footprint. • As part of the proposed dredging program it is intended to remove the top 2 metres of marine sediment for offshore disposal. Therefore, the potential for iron ore dust to be deposited within DMMAs is considered to be low. • BHPBIO acknowledges international research that has been undertaken on this matter, however based on the information provided above, BHPBIO does not consider bioassay testing for iron ore is required.
2. **Inclusion of selenium in sediments and elutriate testing** – iron ores often contain substantial amounts of metalloids such as selenium. Selenium is of particular environmental concern because of the ability of this element to be biomagnified in local food webs and cause substantial harm to populations of "top predators" in ecosystems, especially to fish and bird species. It is recommended that at least limited additional sediment elutriate testing is undertaken to determine whether selenium is likely to be at levels of concern in the dredged materials.	• BHPBIO's iron ore products have been assayed for trace metals and results indicate that concentrations of selenium are less than detection levels (sub ppm) for solids. • In addition, the upper layers of the marine sediments that could potentially contain iron ore dust are proposed to be selectively dredged and disposed offshore (ie the upper 2m). Iron ore dust is not considered likely to be encountered below 2m, therefore the probability of having iron ore and hence metalloids such as selenium within the DMMAs is low. • However, BHPBIO recognise the significance of selenium on ecology and propose to sample material disposed within the DMMAs once dredging is completed. If required, results will be discussed with the Contaminated Sites Branch.

Agency Comment	BHPBIO Response
3. **Iron monosulphide management in onshore dredge spoil disposal areas** – although it is not proposed to deposit sulphidic materials in onshore dredge spoil management areas, it is likely that iron monosulphide oozes will progressively accumulate in these areas because the high iron content of dusts deposited in these areas combined with the presence of seawater-derived salts will provide suitable conditions for microbial sulphate and iron (III) reduction to take place in saturated sediments. Iron monosulphides have to ability to accumulate heavy metals and release these at high concentrations if these materials are allowed to dry out and acidify. Additionally, the discharge of effluent containing suspended iron monosulphide particles can cause anoxia and fish kills if allowed to discharge directly into the marine environment. These hazards may not become apparent for several years after dredging, and therefore long-term monitoring and management measures are generally required to ensure that onshore dredge spoil disposal areas do not cause environmental harm in the longer term. It is recommended that these issues are addressed as part of the current dredging proposal.	• BHPBIO propose to take potentially acid sulphate material offshore, as outlined in the Acid Sulphate Soil Management Plan. • BHPBIO acknowledges the potential for longer-term generation o f iron monosulphide within the DMMAs. Whilst this risk is considered low, BHPBIO will monitor for the presence of iron monosulphides and total acidity within the DMMAs. This will be undertaken on an annual basis for 5 years following completion of dredging. • Should levels require further management BHPBIO will investigate options to neutralise this material, including the possibility of lime treatment.

ATTACHMENT 1

CONFIGURATION OF DREDGE MATERIAL MANAGEMENT AREA B1



ATTACHMENT 2

CONFIGURATION OF DREDGE MATERIAL MANAGEMENT AREA B2

ATTACHMENT 3
REVISED TABLE 4.2 – BASELINE WATER QUALITY MONITORING IN SOUTH WEST CREEK (URS 2008)

Date	Tidal Cycle	20%ile [1]			80%ile [1]		
		Dissolved Oxygen % Saturation[2]	DO (mg/L)	pH	pH	NTU	Temp (°C)
22/06/06	Neap+1	76	6.78	7.66	7.97	15.0	20.5
23/06/06	Neap +2	73	6.61	7.65	8.00	16.8	19.6
24/06/06	Neap +3	69	6.30	7.62	8.03	17.9	19.2
25/06/06	Neap +4	66	6.08	7.59	8.06	16.5	18.9
26/06/06	Neap +5	65	5.99	7.58	8.06	15.6	18.9
27/06/06	Neap +6	65	5.93	7.58	8.09	14.6	19.2
28/06/06	Spring	65	5.94	7.56	8.10	14.3	19.5
29/06/06	Spring +1	66	6.07	7.58	8.12	14.2	18.9
30/06/06	Spring +2	68	6.35	7.59	8.11	13.5	18.1
01/07/06	Spring +3	69	6.44	7.59	8.10	11.6	18.0
02/07/06	Spring +4	70	6.51	7.61	8.05	11.3	18.4
03/07/06	Spring +5	72	6.66	7.63	8.02	11.3	18.7
04/07/06	Spring +6	75	6.81	7.64	7.99	11.1	19.4

1. The 20th and 80th percentiles were calculated from the baseline data in accordance with threshold limits set for the excess water discharge.
2. Calculated from URS 2008 (at pressure = 1ATM and Salinity = 35 ppt)

ATTACHMENT 4
QUALITY ASSURANCE PROCEDURES ADOPTED FOR THE ENVIRONMENTAL REFERRAL DOCUMENT

- The water quality control samples for the project, utilised to assess at which stage (if any) that contamination has occurred, were collected and sampled based on the Australian and New Zealand Standards 5667.1:1998.

- Initially, appropriate water samples from the project location (low analyte concentration) were provided to the laboratory to be split in two ways:

  - Transport blank –to estimate the amount of contamination that was introduced to the sample during the transport and storage stage, and

  - Field Blank – to estimate the contamination that was introduced to the sample during the collection procedure. This involves following the same sampling procedure utilising the lab water that is used for the sample water. SKM utilise a teflon Niskin bottle to collect the sample and then syringe and 0.45 um filter to filter the samples.

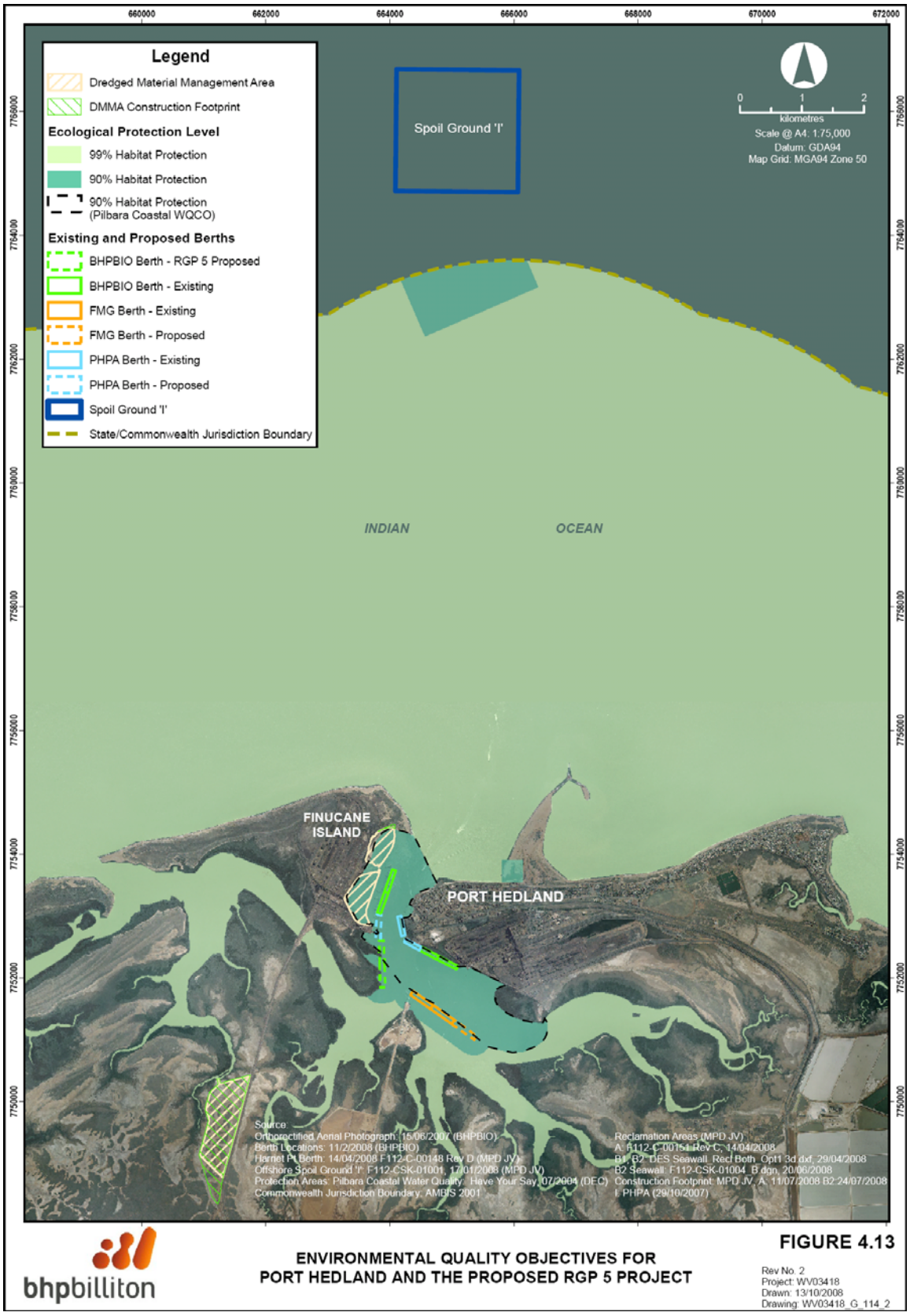
- While this is a baseline sampling program, reference sampling sites were also included in the monitoring to determine if there were any differences among control areas and potential impact areas.

  In addition, other control samples taken included:
  - Replicate samples – the collection and analysis of separate samples from the same sample site at the same time, to provide a measure of the sampling precision.

  - Duplicate samples - the collection and analysis of separate samples from the same sample container at the same time and a used to provide a measure of the laboratory's analysis precision.

ATTACHMENT 5

REVISED FIGURE 4-13 – ENVIRONMENTAL QUALITY OBJECTIVES FOR PORT HEDLAND AND THE PROPOSED RGP5 PROJECT



ATTACHMENT 6

MAXIMUM SEDIMENTATION RATES (FINE AND COURSE FRACTIONS) FOR FIGURES 8.3 AND 8.4

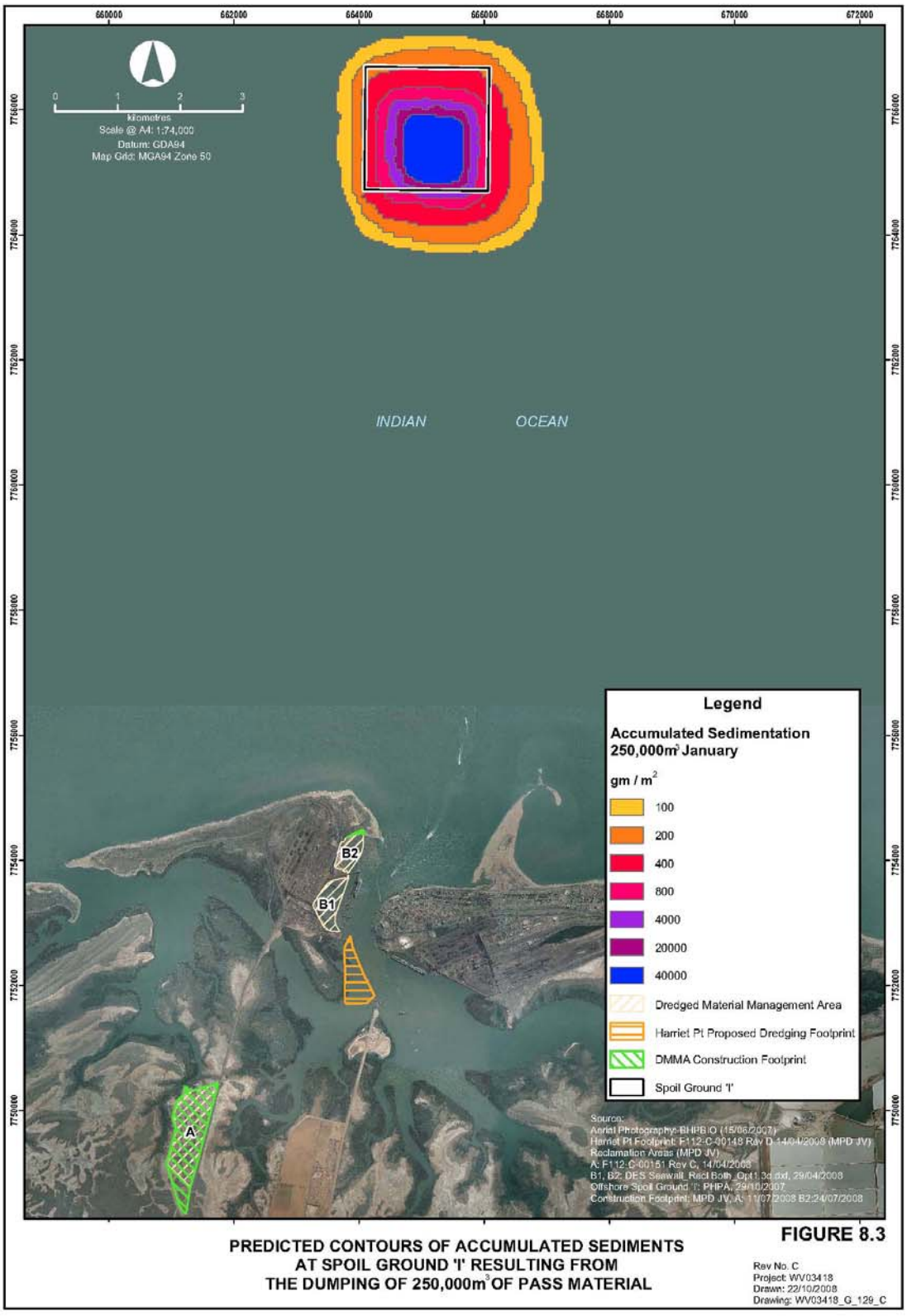


FIGURE 8.3

PREDICTED CONTOURS OF ACCUMULATED SEDIMENTS AT SPOIL GROUND 'I' RESULTING FROM THE DUMPING OF 250,000m³ OF PASS MATERIAL

Rev No. C
Project: WV03418
Drawn: 22/10/2008
Drawing: WV03418_G_129_C

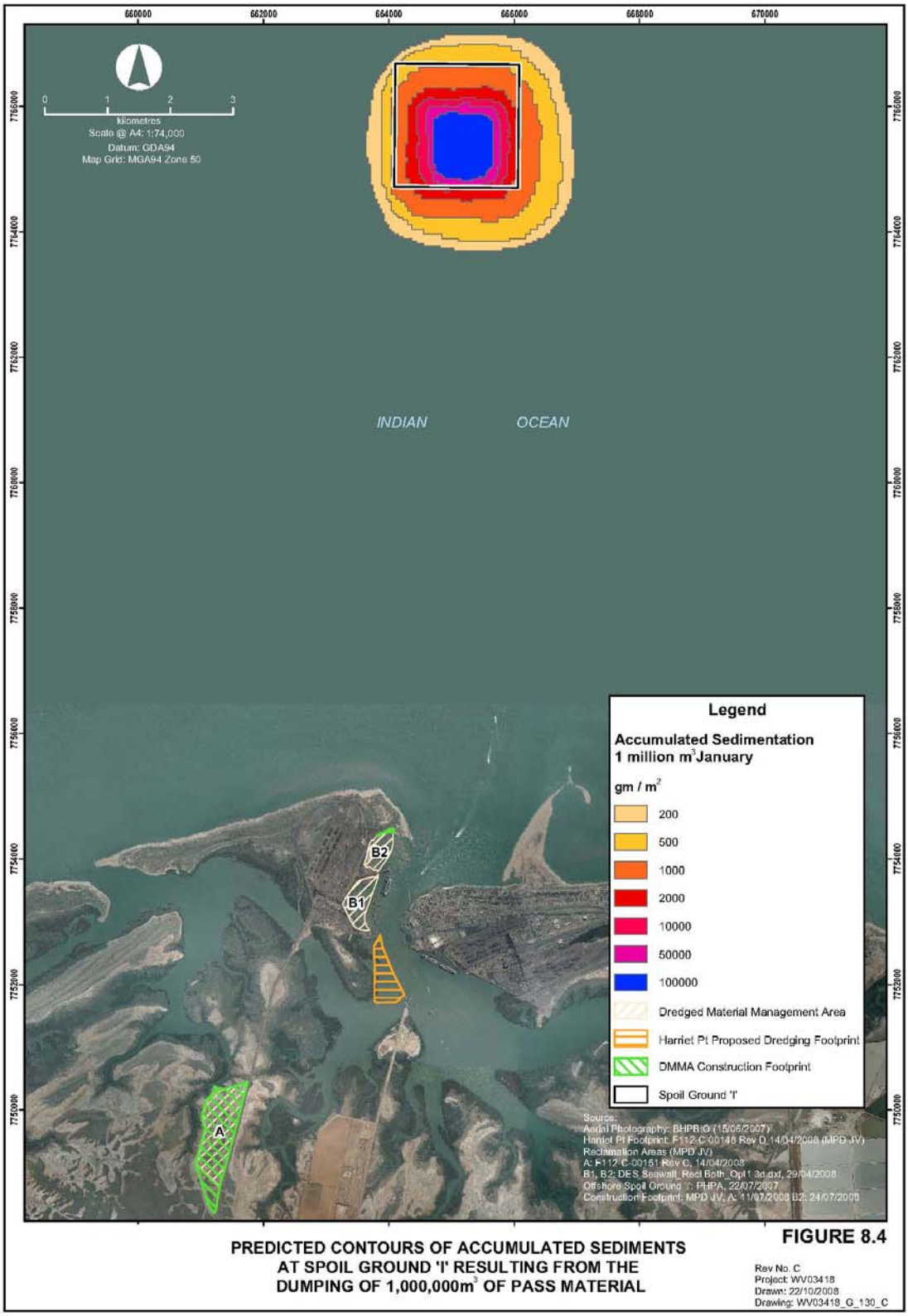


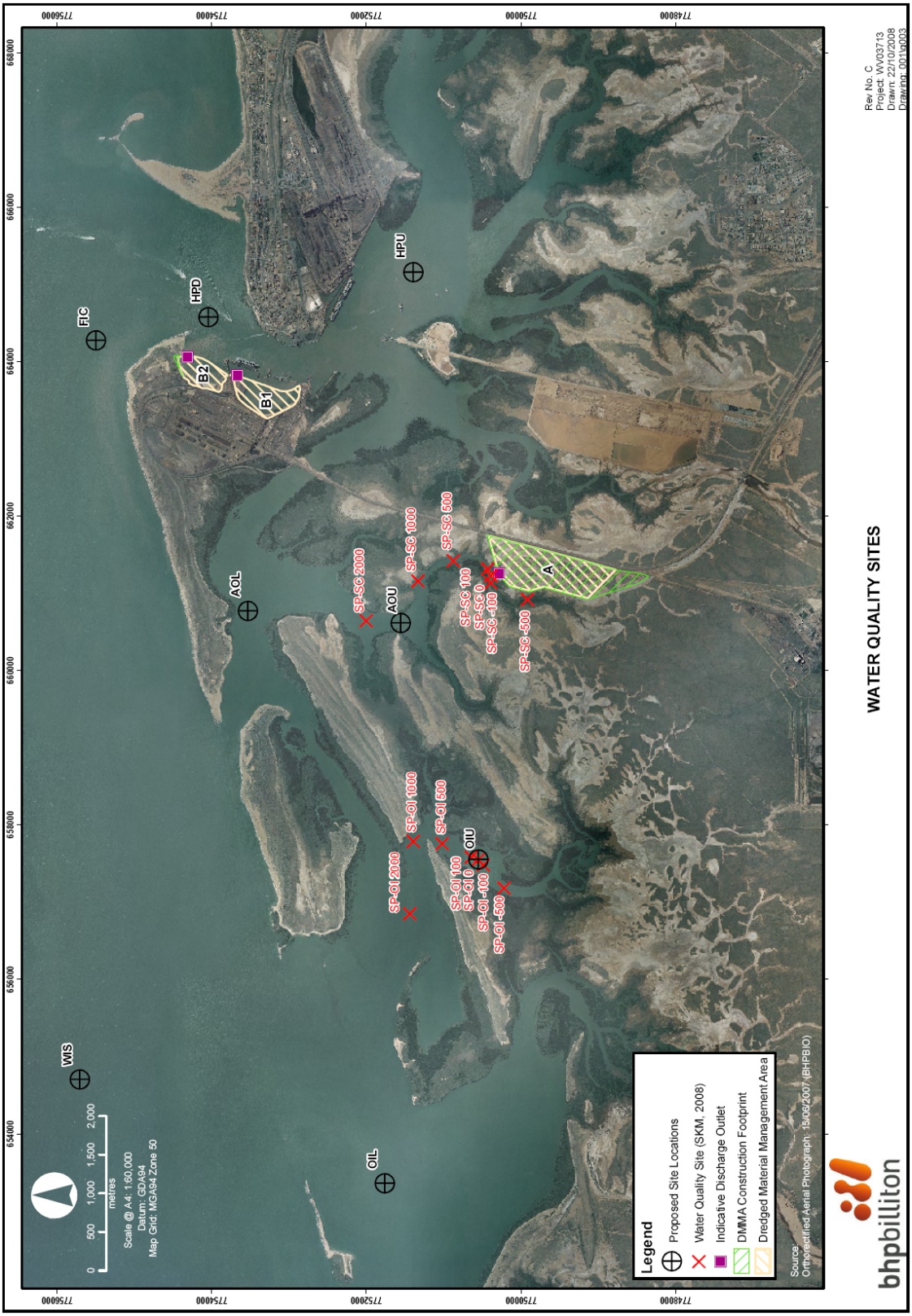
FIGURE 8.4

PREDICTED CONTOURS OF ACCUMULATED SEDIMENTS AT SPOIL GROUND 'I' RESULTING FROM THE DUMPING OF 1,000,000m^3 OF PASS MATERIAL

Rev No. C
Project: WV03418
Drawn: 22/10/2008
Drawing: WV03418_G_130_C

ATTACHMENT 7

FIGURE 8.11 – WATER QUALITY MONITORING SITES



ATTACHMENT 8

REVISED TABLE 8.1 – DISCHARGE WATER REACTIVE MANAGEMENT TRIGGER LEVELS

Parameter	Trigger Level (High Protection Areas)	Trigger Level (Medium Protection Areas)
Turbidity (NTU)	Median > 80th percentile of baseline or reference site data	Median > 95th percentile of baseline or reference site data
Temperature	Median < 20th or > 80th percentile of baseline or reference site data	Median < 5th or > 95th percentile of baseline or reference site data
pH	Median < 20th or > 80th percentile of baseline or reference site data	Median < 5th or > 95th percentile of baseline or reference site data
Dissolved Oxygen	< 60$^{\%}$ saturation	< 60$^{\%}$ saturation
Conductivity	Median < 20th or > 80th percentile of baseline or reference site data	Median < 5th or > 95th percentile of baseline or reference site data

ATTACHMENT 9

PORT HEDLAND OUTER HARBOUR DEVELOPMENT – FAUNA ASSESSMENT

PORT HEDLAND OUTER HARBOUR DEVELOPMENT

FAUNA ASSESSMENT

Prepared for

SINCLAIR KNIGHT MERZ PTY LIMITED

Job No: 08.216

Report No: RP002

env Australia

PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT

Prepared for

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Content Review:	*Ms Teresa Gepp*
Date:	*7 October 2008*

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STATEMENT OF LIMITATIONS

Scope of Services

This environmental site assessment report ('the report') has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed between the Client and ENV.Australia Pty Ltd (ENV) ('scope of services'). In some circumstances the scope of services may have been limited by factors such as time, budget, access and/or site disturbance constraints.

Reliance on Data

In preparing the report, ENV has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, ENV has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. ENV will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to ENV.

Environmental Conclusions

In accordance with the scope of services, ENV has relied on the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, express or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and for no other party. ENV assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including, without limitation, matters arising from any negligent act or omission of ENV or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely on the report or the accuracy or completeness of any conclusions, and should make their own enquiries and obtain independent advice in relation to such matters.

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Other Limitations

ENV will not be liable to update or revise the report to take into account any events or circumstances occurring or becoming apparent after the date of the report, or facts becoming apparent or available after the date of the report.

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EXECUTIVE SUMMARY

A two phase summer and winter fauna survey was undertaken of the Port Hedland Outer Harbour Development project area from the 12 October-9 November 2007 and 5-16 May 2008, respectively.

The project area comprises six fauna habitat types: dunal, riverine, mangrove, tidal mudflats, samphire and sand plain.

Six habitat types were assessed as occurring in the areas surveyed. High value fauna habitats were those displaying vegetation structure and habitat complexity, providing elements important to a variety of fauna (i.e. riverine), or those providing elements specific to fauna of conservation significance (i.e. mangals), or elements involved in ecological connectivity (i.e. riverine). The lack of vegetation structure and ground cover in the samphire habitat led to it being classed as of lower value as fauna habitat, as it lacks an array of microhabitats for fauna to exploit. The sand plain was deemed of medium value and was the most dominant habitat type of the project area.

Eight trapping sites were each subjected to an average of 64 trap-nights for pit, cage and Elliott traps, and 128 trap-nights for funnel and pot traps in the summer survey. A further two trap sites were established for the winter survey, comprising on average 80 trap-nights for pit, cage and Elliott traps, and 160 trap-nights for funnel and pot traps.

Of 362 fauna species potentially occurring in the project area, 199 species were recorded collectively from both the winter and summer surveys, consisting of 26 mammal species, 53 reptile species, seven amphibian species, and 113 bird species. Of these 199 recorded species, 67 are protected under legislation (i.e. listed under the *Environment Protection and Biodiversity Conservation Act 1999*, the *Wildlife Conservation Act 1950*, and or deemed as Priority by the Department of Environment and Conservation).

In reference to total number of mammal species, some seasonal difference was observed with 27% of species only recorded in summer, 12% only in winter and the remaining 61% recorded in both seasons. In reference to reptile species, minor seasonal differences occurred with 17% of species only recorded in summer, 11% in winter, with 72% in both seasons. There was no difference in the number of amphibians recorded by season, although the species composition varied by season. In reference to the total numbers of birds recorded, 35% were only recorded in summer, 8% only in winter and 57% in both seasons.

The seasonal differences in recorded species were not as pronounced as expected. The seasonal difference in birds reflects the seasonal visitation of migratory waders. The lack of summer rainfall may have played a part in the limited number of ground dwelling species (i.e. small mammals) recorded in winter, as the abundance of food may have been reduced. The current survey compares well, however, with other surveys completed in the area, such as those undertaken by Mattiske Consulting, Hope Downs and Biota, each recording a similar percentage of potentially occurring species.

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One species recorded in the survey, the Woma (*Aspidites ramsayi*) is listed as Schedule 4 under the Wildlife Conservation Act 1950, as Priority 1 by the Department of Environment and Conservation, and as Endangered on the IUCN Red List. This species was recorded opportunistically (sighted) during the winter survey only, and was within the sand plain habitat near the 2008 rail option, but not within the impact footprint of the project. The sand plain habitat is well represented within and outside of the project area, and even though direct habitat loss may result in localised mortalities, the broad representation of this species in the region is not likely to be compromised by the proposed developments.

Other recorded species of conservation significance are the Little North-western Freetail Bat (*Mormopterus loriae cobourgensis*), the Australian Bustard (*Ardeotis australis*), and the Eastern Curlew (*Numenius madagascariensis*). The Little North-western Freetail Bat and the Eastern Curlew were recorded using Anabat equipment in mangrove and tidal flat communities, within the project area. Their presence is noted from sound recordings and their use of habitat within the impact footprint, therefore further removal of these habitat types may impact on individuals of these species at the local scale.

Twenty-three bird species recorded during the survey are listed as Migratory species under the Environment Protection and Biodiversity Conservation Act, 18 are listed as Marine species, and 22 are listed in both categories. A majority of these species are largely aerial, with an extensive home range, and will not be entirely dependent on habitats in the project area, with the exception of species which utilise the tidal mudflats and mangroves. These habitat types support most of the migratory waders found in the project area and many of these non-breeding migrants will use these habitats for foraging and roosting during the summer.

It is the view of ENV.Australia Pty Ltd that habitats in the Port Hedland Outer Harbour Development project area were well surveyed, and are generally well represented in the Pilbara region. The current survey compares well with the efforts of past surveys in the area for other infrastructure projects (i.e. Mattiske 1994, Hope Downs 2002 and Biota 2004, and 2008).

The proposed disturbance is unlikely to significantly affect the representation of the habitats in the project area, and therefore the fauna they support. None of the habitats appear to be important in supporting fauna of conservation significance, except the mangroves and tidal mudflats, in which the Little North-western Freetail Bat and the Eastern Curlew were recorded. The proposed development will impact upon 16.14 ha of the mangroves and 42.57 ha of the tidal flats habitats within the project area, representing 8% and 3% respectively of their occurrence within the project area. Further removal of these habitat types will have an impact upon these species at the local level.

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1 INTRODUCTION

ENV.Australia Pty Ltd ('ENV') was commissioned in October 2007 by Sinclair Knight Merz Pty Limited ('SKM') to undertake a terrestrial biological assessment survey of the area known as BHP Billiton Iron Ore ('BHPBIO') Port Hedland Outer Harbour Development ('the project area'). The proposed disturbances to the project area relevant to the terrestrial environment are associated with the construction of rail infrastructure, stockyards, conveyors and access roads located on the mainland and Finucane Island.

This terrestrial biological assessment involves two seasons of fauna and flora survey work, in summer and in winter. This report contains the findings of the fauna surveys conducted in summer and in winter. The findings of additional areas surveyed in winter are also documented in this report. These areas were added to the survey schedule after changes were made to the infrastructure plans.

The objectives of the fauna component of the biological assessment were to:

- document the general habitat types of the project area as they relate to faunal assemblages;
- compile (from database searches) a list of terrestrial vertebrate fauna likely to occur in the project area;
- identify (from database searches) terrestrial vertebrate fauna of conservation significance that may occur in the project area;
- report on the likely occurrence of terrestrial vertebrate fauna, including that of conservation significance, in the project area, based on habitats present and their condition;
- document any opportunistic records of fauna observed onsite;
- document seasonal comparisons of data;
- undertake an impact assessment with reference to the project footprint; and
- develop recommendations for management of impacts.

1.1 LOCATION

The project area lies west and south-west of the towns of Port Hedland and South Hedland, and covers an area from Finucane Island to the BHPBIO rail line in the south-east (Figure 1).

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The project area consists of mangroves and samphire flats in the northern coastal areas, and sand plains with major (riverine) drainage lines in most of the remaining area.

The summer and winter surveys covered infrastructure areas consisting of a transfer pad on Finucane Island, conveyor system and Boodarie stockyards as well as rail loops and rail options. The summer survey covered the 2007 rail loop and rail options A and B. The winter survey revisited the areas survey during the summer survey and also included additional areas. Theses additional areas were surveyed in winter as the proposed PHOHD infrastructure changed between the summer and winter surveys, with the incorporation of two rail options into the project design in 2008 (rail options C and D). Additional areas were surveyed in winter to encompass the location of these two additional rail options.

Figure 2 shows the proposed rail options and stockyards and load out facilities. Currently the 2008 rail options are the preferred option. The impact footprint considered in this report refers to the infrastructure and rail options and a 15m buffer around these.

1.2 PHYSICAL ENVIRONMENT

Climate

The Pilbara region has an arid-tropical climate with two distinct seasons, a hot summer from October to April and a mild winter from May to September. The Port Hedland area experiences a wide range of temperatures throughout the year, with an average temperature of 33.2°C. In summer, maximum temperatures may reach 48.2°C, whilst in winter, minimum temperatures may reach 3.2°C (Bureau of Meteorology 2008).

Rainfall in the Pilbara is often sporadic, and can occur year-round. Port Hedland has an average annual rainfall of 303.8 mm (Figure 3). Summer rainfall is a result either of tropical storms or of tropical cyclones that cross the coast and move inland. Winter rainfall is generally lighter, and is the result of cold fronts moving across the State.

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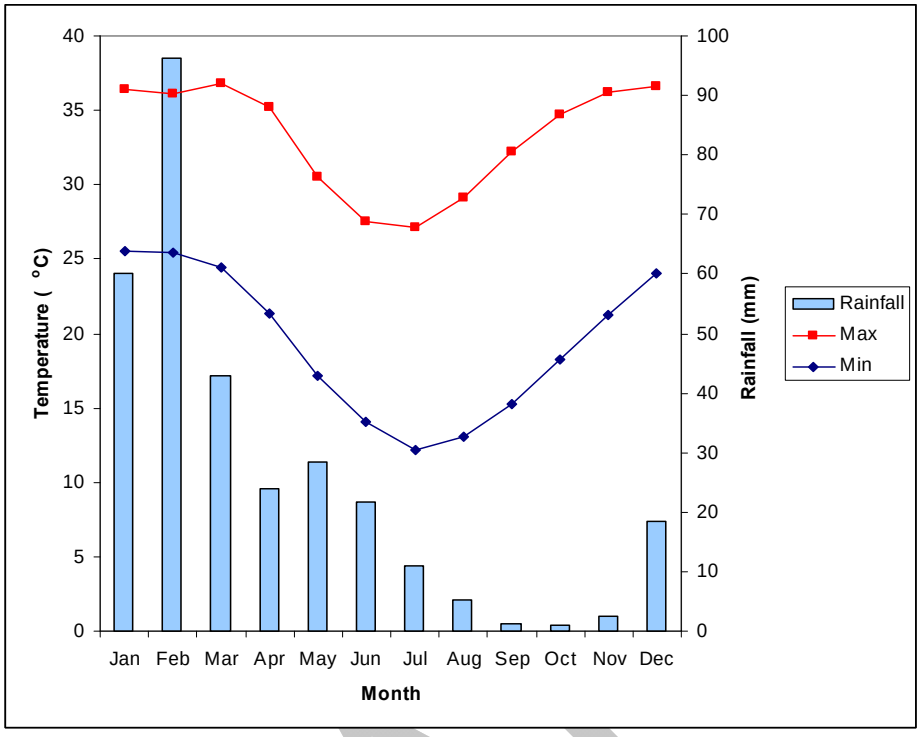

Figure 3: Average monthly rainfall and maximum and minimum temperatures for the Port Hedland area (Bureau of Meteorology 2008).

The summer season survey was completed in October and November 2007, while the winter season survey was completed in May 2008. The Port Hedland area had received relatively low amounts of rainfall preceding both surveys, with only 9.4 mm falling in the 3 months before the summer survey and 103.6 mm in the three months before the winter survey (Figure 4). The area received very little rainfall during the summer months as few cyclones crossed the WA coast in the 2007 – 2008 cyclone season (Bureau of Meteorology 2008). On average the area usually receives 224.6 mm over January to April, however, only received 110 mm for the same period in 2008.

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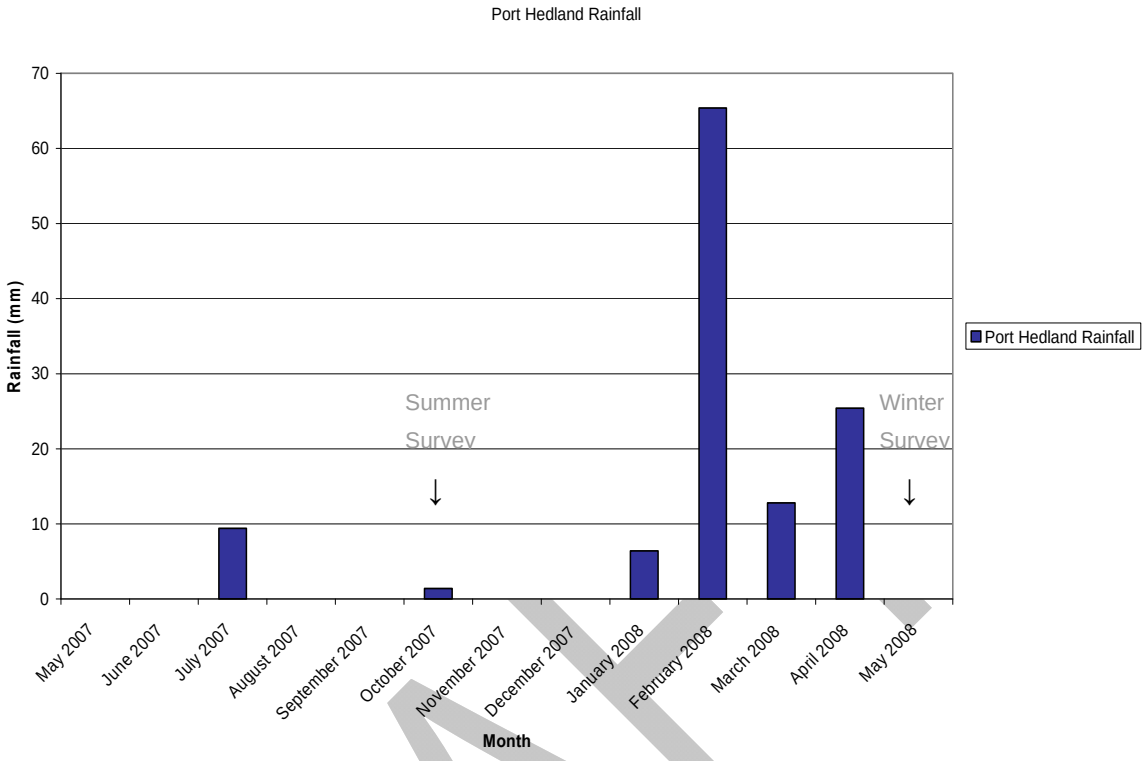

Figure 4: Rainfall received by the Port Hedland area from May 2007 to May 2008 (Bureau of Meteorology 2008).

Geology and Soils

The project area comprises landforms that include mangroves, samphire flats and sand plains. Hickman & Gibson (1982) mapped the geology of the area as consisting of six units:

Tm: Coastal (tide-dominated) mud and silt on mangrove flats.

$B2_bkk$: Carbonate-cemented coastal dune; shelly calcarenite, locally quartzose; local carbonate-cemented beach conglomerate; dissected by present-day drainage, and eroded by wave action.

Tf: Tidal flat deposits; silt and mud in intertidal and supratidal flats and lagoons.

$A1_f$: Floodplain deposits; sand, silt, clay, and gravel adjacent to main drainage channels.

$A1_i$: Mixed floodplain deposits; sand, silt, and clay adjacent to main drainage channels; numerous small claypans.

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ASRmy-gm: Myanna leucogranite: biotite-muscovite monzogranite; locally with quartz and K-feldspar phenocrysts; massive to weakly foliated; metamorphosed.

The geology of the project area is illustrated in Figure 5.

1.3 BIOLOGICAL ENVIRONMENT

Biogeography

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into 85 bioregions based on major biological and geographical/geological attributes (Thackway and Cresswell 1995). These bioregions are subdivided into 404 subregions, as part of a refinement of the IBRA framework (Department of Environment and Water, Heritage and Arts 2008).

The project area is in the Pilbara bioregion and Roebourne subregion (Thackway & Cresswell 1995). Coastal areas in the subregion typically contain alluvial and colluvial coastal and subcoastal plains with a grass savannah of mixed bunch and hummock grasses, and dwarf shrub steppe of *Acacia stellaticeps* or *Acacia pyrifolia* and *Acacia inaequilatera*. The subregion also contains areas of Samphire, *Sporobolus* and mangal on marine alluvial flats and river deltas.

The project area is in the Abydos Plain, which forms part of the Fortescue Botanical District in the Eremaean Botanical Province of Western Australia, as per Beard (1975).

Land Systems

Land system mapping is based on regional patterns in topography, soils and vegetation. The most recent land system mapping of the Pilbara bioregion was completed by van Vreeswyk *et al.* (2004). The mapping divides the Pilbara region into 102 land systems. The project area includes two main land systems, which are:

Lit: Littoral: Bare coastal mudflats with mangroves on seaward fringes, samphire flats, sandy islands, coastal dunes and beaches; forms 0.9% (1577 km^2) of the Pilbara bioregion; and

Uar: Uaroo: Broad sandy plains; supporting shrubby hard and soft Spinifex grasslands; forms 4.2% (7681 km^2) of the Pilbara bioregion.

Land system mapping for the project area is included in Figure 6.

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Beard Mapping

Beard (1975) broadly mapped the project area as Spinifex with no shrubs or trees and Mangroves on Finucane Island, dwarf shrub steppe and grass savanna mixed with Spinifex near the Boodarie Iron Plant and through the middle of the project area, and granite plains near the BHPBIO rail line in the south-east of the project area. Beard (1975) mapped the area as containing six vegetation associations:

t_1Hi: Hummock grasslands, grass steppe; soft Spinifex;

Mud: Bare areas; mud flats;

Mangroves: Thicket; mangroves;

a_{18}Zr.t_1Hi: Hummock grasslands, dwarf-shrub steppe; Acacia over Spinifex;

xGc/t_1Hi: Mosaic: short bunch grassland – savanna/grass plain; and

A_2Sr.t_1Hi: Hummock grasslands, shrub steppe; kanji over soft Spinifex.

Beard vegetation mapping has been incorporated into mapping undertaken by the Department of Agriculture (Shepherd *et al* 2002) and is illustrated in Figure 7.

1.4 PREVIOUS BIOLOGICAL SURVEYS

The flora and fauna of the Pilbara have not been systematically recorded to date, with the significant exceptions of flora studies by Burbidge (1959) and Beard (1975). More recently, the Western Australian Department of Agriculture (van Vreeswyk *et al.* 2004) conducted an inventory and condition survey of the Pilbara region. This report provides a regional inventory of flora species and a description of land resources. A comprehensive and systematic field review by the Department of Environment and Conservation ('DEC') of Pilbara regional fauna is under way (DEC Pilbara Biological Survey 2002-2007), and is due for public release shortly.

In recent decades, a boom in large-scale regional resource development projects has resulted in a significant amount of site-specific biological survey work being carried out in the Pilbara, most undertaken for formal environmental approvals. Near the project area (i.e. within 100 km), various biological surveys have been conducted within the last 10 years. Those most relevant to the current survey are as follows:

- Hedland HBI Project – Boodarie Site – Flora, Vegetation and Vertebrate Fauna Survey (Mattiske 1994);

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- Hope Downs Iron Ore Project (Hope Downs Management Services Pty Ltd 2000, 2002);
- Fortescue Metals Group (Biota 2004);
- Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour (Biota 2008); and
- Utah Point Berth Project level desktop assessment (Biota 2007).

A more comprehensive bibliography of biological survey work undertaken in the Pilbara is available at *http://science.dec.wa.gov.au/projects/pilbaradb/*.

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2 METHODOLOGY

2.1 BACKGROUND TO SURVEY METHODOLOGY

2.1.1 State and Federal Legislation

All surveys undertaken by ENV are designed to meet the requirements of the following State and Federal legislation:

- *Environmental Protection Act 1986* (WA) (EP Act 1986);
- *Wildlife Conservation Act 1950* (WA) (WC Act 1950); and
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act 1999).

The surveys were carried out in a manner designed to be compliant with the Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting of fauna surveys in Western Australia, as set out in the following documents:

- *Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3 (EPA 2002); and*
- *EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51 (EPA 2004).*

EPA Guidance Statement No. 56 (EPA 2004) outlines the expectations of the EPA and details the extent, design and intensity of field surveys for environmental assessments. Two formal levels of fauna survey are defined by the EPA Guidance Statement No. 56:

- ***Level One***: a desktop study to collate historical knowledge conducted in conjunction with a reconnaissance survey (site inspection); and
- ***Level Two***: a trapping and opportunistic field survey to characterise the fauna present, combined with a Level One survey.

Throughout most areas of the State where the scale and nature of the proposed impact is moderate to high, a Level Two survey will be required. This is typically the case for most resource development projects. As there is the potential for fauna habitats to be highly impacted upon as a result of the Port Hedland Outer Harbour Development project, a Level Two survey was developed for the project area.

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2.1.2 Fauna of Conservation Significance

Species are protected formally and informally by various legislative and non-legislative measures, which are as follows:

Legislative Protection

EPBC Act 1999:

- Threatened Fauna Species;
- Threatened Ecological Communities;
- Japan-Australia Migratory Bird Agreement (JAMBA);
- China-Australia Migratory Bird Agreement (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA); Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
- Marine Species List; and
- Migratory Species List.

WC Act 1950:

- Scheduled Fauna Species.

EP Act 1986:

- Offers protection to Threatened Ecological Communities and other environmentally sensitive areas.

Non-Legislative Protection

DEC Priority lists:

- Priority Fauna Species; and
- Priority Ecological Communities.

Informal recognition of locally significant populations:

- International Union for Conservation of Nature (IUCN) Red List;
- endemic species;
- range extensions; and

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- species under taxonomic review.

A short description of these acts and definitions of the species conservation codes and ecological community categories they use, and those used by the DEC and the IUCN, are provided in Appendix A.

2.2 SURVEY METHODOLOGY

2.2.1 Desktop Survey

The purpose of a desktop survey is to gather background information on the project area and the fauna it may support. A search of the Western Australian Museum's ('WAM') FaunaBase (WAM 2008) and a literature review of fauna surveys conducted in the vicinity of the project area were used to compile a list of potentially occurring fauna species for the project area.

Information on the habitats likely to occur in the project area was gained through studying aerials, maps and previous surveys conducted in the project area. This information was then used to refine the potentially occurring species list. This list was further refined once the field habitat assessment was completed.

2.2.2 Field Survey

The purpose of the field survey was to verify the accuracy of the desktop survey and to further delineate and characterise the fauna and faunal assemblages in the project area. The fauna field survey was undertaken in summer 2007 and winter 2008, and consisted of:

- a fauna habitat assessment;
- a trapping program;
- opportunistic searches;
- an ornithological census; and
- bat recordings.

Habitat Assessment

During the field survey, broad fauna habitats were identified, based on vegetation associations and landforms. These fauna habitats were then assessed for their potential to support species of conservation significance and the quality of habitat they provide to a wider suite of fauna.

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Habitats were assessed on the basis of their complexity, the presence of microhabitats, including significant trees with hollows, loose bark, fallen hollow logs and leaf litter, and their representation in the region.

Fauna habitats identified in the summer survey were reassessed as part of the winter survey, together with the additional project areas.

Trapping Program

In the summer survey, trapping sites were established in each fauna habitat type identified through the habitat assessment, except the mangroves (as it is understood that an assessment of this community is being undertaken separately). Trap sites were located in areas considered to be representative of the habitat types. Eight sites were established in the project area consisting of six sites within the sand plain, one site within the riverine habitat and one site within the dunal habitat. The summer field survey was conducted between the 12 October and the 9 November 2007 with traps open for eight nights (note that not all trapping sites were surveyed simultaneously). Each trapping site was subjected to an average of 64 trap-nights for bucket, cage and Elliott traps and 128 trap-nights for funnel traps and pot traps.

In the winter survey (5-16 May 2008) the eight summer sites were reopened, and two new sites within the sand plain habitats were established in additional project areas, incorporating the new rail line options not covered by the summer survey. The location and habitat details of each site are detailed in Appendices B1 and B2 respectively, and are illustrated in Figure 8, with site photographs presented in Appendix C.

Traps were open for eight nights during the winter trapping programme. Each trapping site was subjected to an average of 80 trap-nights for bucket, cage and Elliott traps, and 160 trap-nights for funnel traps and pot traps. Details of trap effort are presented in Appendix B4.

Each trapping site contained up to ten trapping units. Each unit consisted of 7-metre long fences, with one bucket trap at the centre of the fence, two pot traps halfway between the bucket trap and the end of the fence, and a funnel trap at each end. The trap units were approximately 30 m apart, with one Elliott trap and cage trap at each trapping line. Details of the trap units at each site are presented in Appendix B3.

Opportunistic Searches

Opportunistic diurnal and nocturnal searches of major habitats in the project area were undertaken to search for the presence and signs of fauna species. Searches included:

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- investigating burrows;
- investigating rock crevices;
- investigating scats, tracks and other traces;
- splitting exfoliated rock;
- turning rocks and fallen timber;
- opening standing timber crevices; and
- raking leaf litter.

Ornithological Census

Ornithological surveys were undertaken throughout the project area. Census locations were not specifically limited to site locations, but rather all habitats were surveyed across the entire site. The ornithologist specifically targeted habitats assessed as likely to support threatened species and unique or poorly represented habitat in an effort to record species not recorded in earlier surveys. Details of the ornithological census are presented in Appendix D.

Bat Recordings

Acoustic echolocation bat recordings were undertaken at dusk and early evening, using AnaBat II recording units to document the presence of bat species in the area. The detectors convert ultrasonic echolocation signals produced by bats into audible electronic signals, which are later analysed to determine the presence of species-specific calls. Trees and bridges identified as potential bat roosting or maternal nesting sites were subjected to AnaBat II recordings. In addition, AnaBat II units were set in areas likely to be utilised by bats for foraging (e.g. gullies and drainage lines). AnaBat II recording locations and details are presented in Appendix E and in Figure 9.

The site-specific data relevant to capture records are presented in Appendix F.

2.2.3 Taxonomic Identification

Where field identification of the species was not possible, specimens were collected systematically for later identification by expert taxonomists from the Western Australian Museum Collections and Research Facility.

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3 FAUNA SURVEY LIMITATIONS AND CONSTRAINTS

It is important to note the specific constraints and/or limitations imposed on individual surveys, as identified by the EPA under *Guidance Statement No. 56* (EPA 2004). Constraints and/or limitations are often difficult to predict, as is the extent to which they influence survey outcomes. The survey constraints and limitations experienced during the fauna survey are detailed in Table 1.

Table 1: Constraints Associated with the Fauna Surveys

Variable	Impact on Survey Outcomes
Experience levels/ Resources	The biologists who executed these surveys were practitioners suitably qualified in their respective fields. • Mr Mick Welsh – Senior Zoologist • Mr Mike Brown – Zoologist • Mr Stephen Reynolds – Ornithologist • Ms Katherine Chuk– Field Assistant • Mr Justin Freeman – Field Assistant • Ms Anyssa Tucker – Field Assistant • Mr Shane McAdam – Field Assistant
Scope: sampling methods/ Intensity	The survey was a Level Two survey, comprising a desktop review and site visits that included a habitat assessment, trapping program, and opportunistic observations.
Proportion of fauna recorded/ Completeness	The summer phase survey recorded 180 taxa, which is 49% of the expected fauna for the project area The winter phase survey recorded 142 taxa, which is 39% of the expected fauna for the project area. A combined result for both surveys recorded 199 taxa, which is 55% of the expected fauna for the project area. The combined previous surveys of the project area (Mattiske 1994, Hope Downs Management Services Pty Ltd 2002; and Biota 2004, 2008) recorded 72% of the expected fauna. The results of this survey compare well with other surveys completed by ENV which have typically recorded between 39% and 49% of the expected fauna for a project area (ENV.Australia 2007a & 2007c).
Sources of Information	At the bioregion level, the Pilbara has been the subject of many targeted biological surveys, primarily for the resources sector. Previous studies completed in the vicinity of the project area include those completed for

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Variable	Impact on Survey Outcomes
	the Hope Downs rail line, Fortescue Metals Group rail line and for the RGP5 Utah Point berth (Hope Downs 2000 and 2002, Biota 2004, Biota 2007 and Biota 2008).
Proportion of task completed	The field surveys were completed adequately, with the trapping program and opportunistic searches carried out to a sufficient level. Trapping and opportunistic searches were conducted for 28 nights for the summer phase survey and 12 nights for the winter phase survey.
Timing, weather, season.	The summer survey was undertaken in October 2007. The area had received 9.4 mm of rainfall in the three months preceding the survey (Bureau of Meteorology 2008). Day temperatures were in the mid-30s Celsius, with night temperatures falling just below 20°C (Bureau of Meteorology 2008). These temperature conditions were not likely to limit the activity of any faunal group. The winter survey was undertaken in May 2008. The area had received 110 mm of rain in the year to date (January-April). The area received very little rainfall during the summer months, as few cyclones crossed the WA coast in the 2007-2008 cyclone season (Bureau of Meteorology 2008). Day temperatures were in the mid-30s Celsius, with night temperatures falling just below 20°C (Bureau of Meteorology 2008). These temperature conditions were not likely to limit the activity of any faunal group.
Disturbances	No disturbances affected the outcomes of either fauna survey.
Access problems	The mangrove and tidal flat habitats were unsuitable for trapping sites because of the difficulties posed by tidal variations. Increased opportunistic effort was used to compensate for this. Access to the western side of the conveyor to Finucane Island was restricted during both surveys, and it was not possible to undertake trapping in this area. Aerial photography and visual confirmation during the survey was used to determine the habitats within this area.

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4 RESULTS

4.1 HABITAT ASSESSMENT

The project area consists of mangroves, tidal and samphire flats in the northern coastal areas, and sand plains with scattered riverine habitats throughout most of the remaining area. Most of the habitats in the project area, and in the greater Port Hedland area, have been disturbed to some degree by development and anthropogenic processes. Six broad habitat types were observed in the project area (Table 2 and Figure 10).

Table 2: Major Habitat Types for the Project Area

Habitat Type	Survey	Site Number
Dunal	Summer, Winter	9
Riverine	Summer, Winter	10, 6
Mangrove	Summer, Winter	(no trap site)
Tidal Mudflats	Summer, Winter	(no trap site)
Samphire	Summer, Winter	(no trap site)
Sand Plain	Summer, Winter	2, 3, 4, 5, 7
	Winter	13, 15

NB: Site numbering is not sequential it follows SKM fauna site numbering

The dunal areas of Finucane Island occur in the Littoral land system (van Vreeswyk *et al.* 2004). The vegetation of the north-facing dunes is primarily low *Acacia stellaticeps* shrublands over **Cenchrus ciliaris* grasslands, and the south-facing dunes consist of open *Crotalaria cunninghamii* shrublands over **Cenchrus ciliaris* grasslands. This habitat is considered of high conservation value, as it supports unique faunal assemblages as well as being under-represented within the Pilbara region. The vegetation of the dunes offers shelter to reptiles such as the Narrow-banded Sand Swimmer (*Eremiascincus fasciolatus*). This habitat type has the potential to be utilised by migrating bird species considered of conservation importance under the JAMBA, CAMBA, ROKAMBA and Bonn Convention.

The riverine habitat, with its thick vegetation dominated by *Eucalyptus* species, is also considered of high habitat value, as it provides an abundance of microhabitats such as trees, leaf litter, and soils suitable for burrowing species. The fauna species or assemblage within this habitat are not unique to the project area they are however diverse. The embankments of this habitat may also be suitable for nesting species such as the Rainbow Bee-eater. Riverine habitats are uncommon landforms in the Pilbara, and this habitat has value as an ecological

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linkage, as its drainage lines can serve as important corridors for fauna movement.

The Mangrove habitat also consists of the Littoral land system of van Vreeswyk *et al.* (2004). This habitat occurs in the tidal areas around the southern side of Finucane Island and on the mainland surrounding West Creek, and is dominated by *Avicennia marina*. The Mangrove habitat is considered of high conservation value as this habitat is uncommon in the Pilbara, and is known to support the Little North-western Bat (*Mormopterus loriae cobourgiana*) which is listed by the DEC as Priority 1. The Mangrove habitat supports a unique faunal assemblage although for a relatively small number of species.

The Tidal Mudflats habitat consists of the Littoral land system of van Vreeswyk *et al.* (2004). This habitat is located within the tidal areas and is characterised by large open bare areas and scattered *Avicennia marina* shrubs and scattered low samphire species. The Tidal Mudflat habitat is considered of high conservation value as this habitat is uncommon in the Pilbara, and is known to support non-breeding migratory waders many of which are of conservation importance. These species breed in the northern hemisphere and migrate to the southern hemisphere during summer mainly for foraging (Geering *et al.* 2007). The tidal mudflats are often subject to tidal changes in ocean levels therefore concentration of species changes frequently. During low tides, shorebirds or waders can spread broadly amongst this habitat, however during high tide these species must withdraw to more satisfactory foraging grounds and congregate together.

The Samphire habitat is closely associated with the Mangroves on Finucane Island. This habitat also consists of the Littoral land system of van Vreeswyk *et al.* (2004). This habitat type characterised by large open muddy areas with limited vegetation complexity reduces the shelter available for fauna. Although the Samphire is uncommon within the region it is still considered of low habitat value to fauna.

Most of the project area consists of the sand plain habitat type, which consists of the Uaroo land system of van Vreeswyk *et al.* (2004). The sand plain habitat, with its thick vegetation dominated by *Acacia* species, is considered of medium habitat value, as it provides an abundance of microhabitats such as shrubs, leaf litter, and soils suitable for burrowing species. This sand plain offers habitat for locally significant ground-dwelling reptiles such as *Diporiphora valens* and *Delma elegans*, and mammals such as the Little Red Kaluta (*Dasykaluta rosamondae*), and Spinifex-hopping Mouse (*Notomys alexis*). This habitat also supports conservation significant species such as the Woma (*Aspidites ramsayi*), and the Australian Bustard (*Ardeotis australis*), both of which were recorded in the survey. Therefore despite the commonality of this habitat within the region, it is

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important in supporting a diverse array of fauna species and in particular, species with conservation significance.

Isolated features existed in the project area as not necessary deemed as true fauna habitats but as a fauna environment still worth noting. Such small isolated features such as quartz outcrops, billabongs (i.e. Cooliarin Pool), rockpiles, and limestone hills can provide shelter and foraging capabilities for species in a fragmented landscape. Amphibian species will be attracted to permanent water bodies like Cooliarin Pool, some rock dwelling herpetofauna will be located in rockpiles and quartz outcrops.

4.2 RECORDED FAUNA

4.2.1 Mammals

Forty-five species of mammal potentially occur in the project area (Appendix G1). In the summer survey, 22 species were recorded in the project area and one from outside the project area, while 19 were recorded in the winter survey (Appendix H). Twenty-six species of mammal were recorded in the two phases of the survey (Appendix H), representing 57% of the potentially occurring mammals for the project area. No extra mammal species were recorded in the additional areas.

Seven mammal species were recorded in the summer survey that were not recorded in the winter survey, while the winter survey recorded three species not recorded in the summer survey (Appendix G1).

The 26 mammals recorded in the project area compared well with the 25 mammal species recorded by the surveys conducted by Mattiske Consulting (1994), Hope Downs Management Services (2002) and Biota (2004, 2008) (Appendix G1). This represented 55% of the potentially occurring mammal species within the project area. The current survey recorded 17 species not recorded in these previous surveys (Appendix G1).

Three of the 26 species recorded, the Little North-western Freetail Bat, the Little Red Kaluta and the Common Rock-rat, are considered to have some level of conservation importance and are discussed below.

DEC Priority List

One species on the DEC Priority list was recorded in the survey: the Little North-western Freetail Bat (*Mormopterus loriae cobourgensis*).

The Little North-western Freetail Bat is a DEC Priority 1 species. This species inhabits mangrove communities, roosting in crevices and spouts of the dead upper branches of the mangrove *Avicennia marina* (Strahan 1995). This species

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was recorded in the mangrove habitat on Finucane Island, including that in the project area, and probably moves amongst the coastal mangroves in the surrounding area (pers. comm. R. Bullen). This species was recorded in both seasons of the fauna survey within the same area of mangroves suggesting a permanent roosting spot is present in the area. The roosting hollow of this species, however, was not identified during the survey. The mangroves of this area will be impacted upon by the construction of the conveyor system and transfer pad. Little is known of the ecology of the Little North-western Freetail Bat, and they have also been recorded between Gales Bay to the south of Port Hedland and Pardoo to the north (pers. comm. R. Bullen). Details on locations and dates of this species recording can be seen in Appendix E and Figure 9.

IUCN Red List

Of the 26 species of mammal recorded in both seasons of the survey, all species were rated as Least Concern on the IUCN Red List (Appendix G1), except for the Little North-western Freetail Bat (*Mormopterus loriae cobourgensis*), due to the subspecies not being recognised.

Locally Significant

Two species determined as being locally significant were recorded in the survey:

- the Little Red Kaluta (*Dasykaluta rosamondae*); and
- the Common Rock-rat (*Zyzomys argurus*).

The Little Red Kaluta (*Dasykaluta rosamondae*) is confined to subtropical arid hummock grassland in the Pilbara (Menkhorst & Knight 2004), where it inhabits areas of dense Spinifex (Strahan 1995). This species is mainly nocturnal, feeding on invertebrates and small reptiles (Menkhorst & Knight 2004). Suitable habitat for the Little Red Kaluta is present in the project area, and it was recorded in both phases of the current survey, as well as in the surveys of the area by Hope Downs Management Services Pty Ltd (2002) and Biota (2004). This species was trapped at numerous sites within a variety of habitats (Appendix F).

The Common Rock-rat (*Zyzomys argurus*), although found in other regions of Western Australia such as the Kimberley, has a disjunct population in the Pilbara. Common Rock-rats inhabit rocky outcrops, breakaways and scree slopes (Strahan 1995). It is one of the most commonly-recorded species in the Pilbara, with individuals recorded in all the surveys conducted in the area surrounding Port Hedland for BHPBIO (Appendix G1). One individual was trapped at Site 9 on Finucane Island (see Figure 8; Appendix F).

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Introduced Fauna

Of the 26 mammal species recorded in the survey, seven are introduced species:

- House Mouse (**Mus musculus*);
- European Rabbit (**Oryctolagus cuniculus*);
- Wild Dog (**Canis lupus familiaris*);
- European Fox (**Vulpes vulpes*);
- Feral Cat (**Felis catus*);
- Horse (**Equus caballus*); and
- Cattle (**Bos taurus*).

The above introduced mammal species are widespread across much of Australia, occurring in an extensive range of habitats (Strahan 1995). These species are known to spread rapidly, occupying a variety of surroundings, preying on and competing with native species and destroying agricultural areas.

4.2.2 Reptiles

One hundred and nine species of reptile potentially occur in the project area (Appendix G2). In the summer survey, 47 species were recorded in the project area, and 44 were recorded in the winter survey (Appendix I). A total of 53 species of reptile were recorded across the two phases of the survey (Appendix I) representing 48% of the potentially occurring reptiles for the project area.

Nine species were recorded in the summer survey and not recorded in the winter survey, while six species were recorded in the winter survey that were not recorded in the summer survey (Appendix G2).

One species was recorded only from within the additional winter survey areas, the Woma (*Aspidites ramsayi*). This species was observed near the 2008 rail option, but outside the impact area. The species is not considered to be restricted to this location (Figure 10).

The 53 reptiles recorded in the project area compared well with the 82 reptile species recorded by the surveys conducted by Mattiske Consulting (1994), Hope Downs Management Services (2002) and Biota (2004, 2008) (Appendix G2). This represented 75% of the potentially occurring reptile species within the project area. The current survey recorded nine species not recorded in these previous surveys (Appendix G2).

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Twelve of the 53 reptile species recorded are considered to have some level of conservation importance, the most significant of these being the Woma. The other 11 species are considered locally significant and all are discussed below.

WC Act 1950

One species Scheduled under the WC Act 1950 was recorded in the survey: the Woma (*Aspidites ramsayi*).

The Woma (*Aspidites ramsayi*), is listed as Schedule 4 under the WC Act 1950, as Priority 1 by the DEC and as Endangered on the IUCN Red List. This species inhabits spinifex within woodlands, heaths and shrublands (Wilson & Swan 2003). It is restricted to arid areas, where it shelters in hollow logs, animal burrows or thick vegetation (Cogger 2000). Such habitats are generally well represented in the project area and in the Pilbara region. This species was opportunistically recorded from within the sand plain habitat during the survey of the additional winter areas. The Woma was observed to the east of the Great Northern Highway, near the 2008 rail options (50K 664207mE 7734443mN; shown on Figure 10). This species was also recorded during the Hope Downs rail corridor survey from two locations within 35 km of Port Hedland along the BHPBIO rail access track (Hope Downs Management Services 2002).

DEC Priority List

Only one recorded species is listed as Priority 1 on the DEC Priority list: the Woma (*Aspidites ramsayi*). As it is also listed as Schedule 4 under the WC Act 1950, it is discussed above (see WC Act 1950section).

IUCN Red List

Only one recorded species is listed as Endangered on the IUCN Red list: the Woma (*Aspidites ramsayi*). As it is also listed as Schedule 4 under the WC Act 1950, it is discussed above (see WC Act 1950 section).

Locally Significant

Eleven species of reptile recorded in the survey are considered to be of local conservation importance (Appendix G2):

- the Smooth Knob-tailed Gecko (*Nephrurus levis pilbarensis*);
- *Ctenotus duricola*;
- *Ctenotus grandis titan*;
- *Ctenotus rufescens*;

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- *Lerista bipes*;
- *Lerista muelleri*;
- *Morethia ruficauda exquisita*;
- the Pilbara Goanna (*Varanus bushi*);
- *Ramphotyphlops ammodytes*;
- the Pilbara Death Adder (*Acanthophis wellsi*); and
- the Rufous Whip-snake (*Demansia rufescens*).

These species are not protected by legislation, but are considered of local importance because of their restricted distribution and/or specific habitat requirements, because they are under taxonomic review or because they have disjunct populations occurring in the Pilbara.

Most of these species inhabit areas of dense shrubs, soft soil for burrowing and/or areas of plentiful leaf litter offering shelter. For example, *Lerista bipes*, *Ctenotus grandis titan* and *Ctenotus rufescens* often inhabit spinifex grasslands with soft sandy soils conducive to digging and burrowing (Wilson & Swan 2003). *Ctenotus duricola,* on the other hand, inhabits hard clay stony soils (Wilson & Swan 2003).

The Smooth Knob-tailed Gecko (*Nephrurus levis pilbarensis*), a skink *Morethia ruficauda exquisita*, the Pilbara Goanna (*Varanus bushi*), the blind snake *Ramphotyphlops ammodytes*, the Pilbara Death Adder (*Acanthophis wellsi*) and the Rufous Whip-snake (*Demansia rufescens*) occur only within the Pilbara making them endemic to the region.

Lerista muelleri is under taxonomic review (Western Australian Museum), and is therefore assessed as being of local conservation importance. The habitats of these species are well represented inside the project area and more broadly across the Pilbara.

4.2.3 Amphibians

Ten species of amphibians potentially occur in the project area (Appendix G3). In the summer survey, four species were recorded in the project area and one species outside it (Appendix J). The winter survey recorded five species in the project area. In total seven of the 10 potentially occurring species were recorded from both phases of the survey with three of these species being recorded in both the summer and winter surveys (Appendix J).

The summer survey recorded two species not recorded in the winter survey:

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- Roth's Tree-frog (*Litoria rothii*); and
- Russell's Toadlet (*Uperoleia russelli*).

Two species were recorded in the winter survey that were not recorded in the summer survey:

- the Giant Frog (*Cyclorana australis*); and
- Spencer's Frog (*Limnodynastes spenceri*).

The seven amphibians recorded in the project area compared well with the 9 amphibian species recorded by the surveys conducted by Mattiske Consulting (1994), Hope Downs Management Services (2002) and Biota (2004, 2008) (Appendix G3). This represented 90% of the potentially occurring amphibian species within the project area. The current survey recorded no species not recorded in these previous surveys (Appendix G3).

IUCN Red List

The seven amphibian species recorded for the survey are listed as Least Concern on the IUCN Red List. Such taxa are considered widespread and abundant, and not exclusively dependent on the project area at the local level. None of the recorded amphibian species are protected by legislation.

4.2.4 Birds

One hundred and ninety-eight species of bird potentially occur in the project area (Appendix G4). In the summer survey, 98 species were recorded within the project area and seven outside the project area, and 74 were recorded in the winter survey (Appendix K). One hundred and thirteen species of avifauna in total were recorded in both phases of the survey (Appendix K) representing 57% of the potentially occurring birds for the project area.

Thirty-nine species were recorded during the summer survey and not recorded in the winter survey. While eight species were recorded in the winter survey and not recorded in the summer survey (Appendix G4).

The 113 birds recorded in the project area compared well with the 146 bird species recorded by the surveys conducted by Mattiskie Consulting (1994), Hope Downs Management Services Pty Ltd (2002) and Biota (2004, 2008) (Appendix G4). This represented 73% of the potentially occurring mammals species for the project area. The current survey recorded 31 species not recorded in these previous surveys (Appendix G4).

All bird species recorded are protected under the EPBC Act 1999, listed as Priority species by the DEC, or are rated on the IUCN Red List, and they are

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discussed below. No bird species recorded were listed under the WC Act 1950 or are considered locally significant.

EPBC Act 1999

Twenty-three separate bird species recorded during the survey are listed as Migratory species under the EPBC Act 1999, 18 are listed as Marine species, and 22 are listed in both categories. A majority of these species were recorded within mangroves and tidal flats habitat types. These species are largely aerial, with an extensive home range, and will not be entirely dependent on habitats in the project area, with the exception of the tidal mudflats and mangroves. These habitat types support most of the migratory waders found in the project area and many of these non-breeding migrants will use these habitats for foraging and roosting during the summer.

DEC Priority List

Two DEC Priority List species were recorded in the survey:

- the Australian Bustard (*Ardeotis australis*); and
- the Eastern Curlew (*Numenius madagascariensis*).

The Australian Bustard (*Ardeotis australis*) is listed as Priority 4 by the DEC and as Near Threatened by the IUCN Red List. This species is typically widespread, but is locally scarce. It inhabits woodlands and grasslands, moving widely over large areas (Johnstone & Storr 1998). This species has been recorded at a variety of locations in the Abydos Plain (Biota 2002). The Australian Bustard was recorded from within the sand plain habitat during both seasons of the current survey.

The Eastern Curlew (*Numenius madagascariensis*) is listed on the DEC Priority Fauna List as Priority 4. This species is also listed as a Migratory and Marine species under the EPBC Act 1999 and as Least Concern on the IUCN Red List. The Eastern Curlew mainly inhabits tidal mudflats and mangrove areas, and is also known to occur at sandy beaches, this species was recorded only in the summer season within the tidal mudflats and mangroves.

IUCN Red List

Two species listed as Near Threatened on the IUCN Red List were recorded in the survey:

- the Darter (*Anhinga melanogaster*); and
- the Australian Bustard (*Ardeotis australis*).

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The Darter (*Anhinga melanogaster*) is rated as Near Threatened by the IUCN Red List. This species inhabits lakes, swamps and various other water bodies, nesting on twigs and sticks in forks of *Melaleuca* and *Eucalyptus* trees (Johnstone & Storr 1998). This species was recorded only in the summer season survey.

The Australian Bustard was recorded, and is discussed above (see DEC Priority List section).

The remaining 111 recorded bird species are listed as Least Concern on the IUCN Red List (Appendix G4). Such taxa are considered widespread and abundant, and not exclusively dependent on the project area at the local level. These species are not protected by legislation.

4.3 POTENTIALLY OCCURRING FAUNA

Species of conservation importance that potentially occur in the project area, but were not recorded during the field survey, are discussed in the following sections.

4.3.1 Mammals

Nineteen species (additional to those recorded) of mammal potentially occur in the project area, of which 15 are protected under the EPBC Act 1999, the WC Act 1950, are listed as Priority species by the DEC, are on the IUCN Red List or are considered of local conservation importance. These species are discussed below.

EPBC Act 1999

Three mammals listed as Threatened by the EPBC Act 1999 potentially occur in the project area:

- the Mulgara (*Dasycercus cristicauda*);
- the Northern Quoll (*Dasyurus hallucatus*); and
- the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*).

The Mulgara is listed as Vulnerable (EPBC Act 1999 and IUCN Red List) and as Schedule 1 (WC Act 1950). This species is found in central Australia in sandy regions, living in burrows, and has been recorded at Goldsworthy (BHP Iron Ore 2000) (Appendix G1). Several populations have been monitored over long periods in the northern Goldfields, and show fluctuating but persistent populations (pers. comm. M. Ladyman, ENV.Australia). The Mulgara is unlikely to occur in the project area, as the habitat is not optimal for this species.

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The Northern Quoll is listed as Endangered by the EPBC Act 1999 and as Schedule 1 by the WC Act 1950. It has been recorded in a range of vegetation types, but it favours rocky areas and is known to den in rock crevices. There has been a recent sighting of this species at Salt Creek, 100 km south-west of Port Hedland (ENV 2007d). However, no sightings have been made near the project area, and this, together with very little suitable habitat occurring in the project area, makes it unlikely that the Northern Quoll occurs in the project area.

One mammal species potentially occurring in the current survey, the Pilbara Leaf-nosed Bat, is rated as Vulnerable under the EPBC Act 1999, as Schedule 1 by the WC Act 1950, and as Priority 4 by the DEC. Pilbara Leaf-nosed Bats require deep caves or disused mine shafts in which to roost (Strahan 1995), at least in the dry season. These bats have been recorded in isolated populations in the Pilbara, and are present only where suitable roosting niches are available. Pilbara Leaf-nosed Bats have been found sporadically in iron ore project areas across the Pilbara, including Yarrie, Hashimoto and R Deposit (pers. comm. R. Bullen), where they are generally sparsely distributed. Suitable habitat was not located within the project area and therefore this species is unlikely to be found within the project area.

WC Act 1950

Three mammals listed as Scheduled under the WC Act 1950 potentially occur in the project area:

- the Mulgara (*Dasycercus cristicauda*);
- the Northern Quoll (*Dasyurus hallucatus*); and
- the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*).

These species are also listed as Threatened under the EPBC Act 1999, and are therefore discussed above (see EPBC Act 1999 section).

DEC Priority List

Four mammals listed as Priority under the DEC Priority list potentially occur in the project area:

- the Spectacled Hare-wallaby (*Lagorchestes conspicillatus*);
- the Ghost Bat (*Macroderma gigas*);
- the Lakeland Downs Mouse (*Leggadina lakedownensis*); and
- the Western Pebble-mound Mouse (*Pseudomys chapmani*).

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The Spectacled Hare-wallaby is listed as DEC Priority 3. There have not been any recent (<50 years) records of this species by WAM (WAM 2008) or by other environmental studies within the Pilbara. However, there are anecdotal historical records around Shay Gap (pers. comm. M. Ladyman, ENV.Australia), 180 km east of Port Hedland. The Spectacled Hare-wallaby is a widespread inhabitant of open forests, open woodlands, tall shrublands, over tussock grass and hummock grassland (Strahan 1995). Because of the low capture records and the limited amount of preferred habitat in the project area, this species is unlikely to occur.

The Ghost Bat (*Macroderma gigas*) is listed as Priority 4 by the DEC and as Vulnerable by the IUCN Red List. Ghost Bats occur in a wide variety of habitats, and require an undisturbed cave, deep fissure or disused mine shaft in which to roost. It is patchily distributed across Australia, and is sensitive to disturbance (Strahan 1995). As no roosting sites were recorded within the project area, this species is unlikely to occur.

The Lakeland Downs Mouse is listed as DEC Priority 4. It is known to prefer sand plains and clay pans (DEC 2007) with a good cover of Spinifex and shrubs. Such habitat is well represented outside the project area, and therefore if present the mouse is not likely to be dependent on the habitats in the project area.

The Western Pebble-mound Mouse is listed as Priority 4 by the DEC. This species is recognised as a Pilbara endemic. No individuals were observed from the project area, however, an abandoned pebble mound was located on a rocky outcrop at 50K 671217mE 7725777mN (Figure 10) which is located near rail options B and D. This species has been recorded in the surrounding area, and its habitat is well represented elsewhere in the Pilbara.

IUCN Red List

Three species listed as Vulnerable by the IUCN Red List potentially occur in the project area:

- the Mulgara (*Dasycercus cristicauda*);
- the Ghost Bat (*Macroderma gigas*); and
- the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*).

These species are discussed above (see EPBC Act 1999 and DEC Priority sections).

The remaining potentially occurring native mammal species are listed as Least Concern by the IUCN Red List. These species are widespread and abundant, and not necessarily dependent on habitat types in the project area.

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Locally Significant

Three mammal species potentially occurring in the project area are considered of local conservation importance as they are endemic to the Pilbara region:

- the Pilbara Ningaui (*Ningaui timealeyi*);
- the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*); and
- the Western Pebble-mound Mouse (*Pseudomys chapmani*).

The Pilbara Ningaui inhabits Mallee scrublands or dense hummock grasslands along drainage lines (Menkhorst & Knight 2004). This species was recorded in the biological survey carried out at Yarrie (*ecologia* Environment 2005). The preferred habitat of the Pilbara Ningaui is represented well inside and outside the project area boundaries, and therefore this species is likely to occur within riverine and associated sand plain habitats.

The Pilbara Leaf-nosed Bat and the Western Pebble-mound Mouse are discussed above (see EPBC Act 1999 and DEC Priority sections respectively).

4.3.2 Reptiles

Fifty-six species (additional to those recorded) of reptile potentially occur in the project area, of which 14 are listed as Priority species by the DEC or are considered of local conservation importance: these species are discussed below. No reptile species potentially occurring are listed under the EPBC Act 1999, the WC Act 1950 or the IUCN Red List.

DEC Priority List

One reptile species potentially occurring in the project area is listed on the DEC Priority Fauna List (Appendix G2) - a blind snake, *Ramphotyphlops ganei*.

The blind snake *Ramphotyphlops ganei* is listed as Priority 1 by the DEC. There are few previous records of this species, and no records for this species from studies carried out in the vicinity of the project area. Blind snakes are typically very hard to detect in biological surveys, yet common taxa such as *Ramphotyphlops grypus* (recorded in this survey) are usually recorded at least once per survey. It is intuitive that the blind snake does not occur at a high density: however, assessing this is made difficult by the secretive habit of this species, which results in few capture records. There are few records of this species, and little is known of its habitat requirements, although capture records suggest it prefers rocky or stony soils (Wilson & Swan 2003). As little is known of this species preferred habitat ENV cannot discount them occurring within the project area.

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Locally Significant

Fourteen reptile species potentially occurring in the project area are considered of local conservation importance as they are known to have specific habitat requirements, or are endemic to the Pilbara.

Some of these species have specific habitat requirements and inhabit areas of dense shrubs, soft soil for burrowing and/or areas of plentiful leaf litter offering shelter. For example, *Ctenotus rubicundus* and *Ctenotus rutilans* often inhabit soft sandy soils, and *Diporiphora valens* inhabits Spinifex grasslands. Other species, such as *Diplodactylus savagei* and *Lucasium wombeyi,* reside in gorge and rocky scree type habitats. The Pilbara Cave Gecko (*Heteronotia spelea*) and *Egernia pilbarensis* are also restricted to gorges and breakaways, inhabiting rocky outcrops.

Some of these species are endemic to the Pilbara region, including the Pilbara Rock Monitor (*Varanus pilbarensis*), a Blind Snake, *Ramphotyphlops ganei*, the Pilbara Blind Snake (*Ramphotyphlops pilbarensis*), the Spotted Snake (*Suta punctata*), and the Pilbara Bandy Bandy Snake (*Vermicella snelli*).

4.3.3 Amphibians

Three species (additional to those recorded) of amphibian potentially occur in the project area, all of which are rated as Least Concern on the IUCN Red List, and one species is considered of local significance (Appendix G3). No amphibian species potentially occurring are listed under the EPBC Act 1999 or the WC Act 1950 or are listed as Priority species by the DEC.

IUCN Red List

The amphibian species potentially occurring in the project area are listed as Least Concern on the IUCN Red List. Such taxa are generally considered widespread and abundant, and not exclusively dependent on the project area at the local level.

Locally Significant

One amphibian species potentially occurring in the project area, the Glandular Toadlet (*Uperoleia glandulosa)*, is considered of local conservation importance. It has a restricted distribution, and is confined to the coastal area surrounding Port Hedland (WAM 2008). This species has previously been recorded at Sunrise Hill, Cattle Gorge (180 km east of Port Hedland) and within the Ord Ridley tenement (65 km east of Port Hedland) (*ecologia* Environment 2005 and ENV.Australia 2007b). The Glandular Toadlet inhabits claypans and flooded depressions amongst surrounding grasses and sedges (Cogger 2000). Suitable habitat for

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this species is present within the sand plains of the project area; however, it is also well represented in the surrounding region.

4.3.4 Birds

Eighty-five species (additional to those recorded) of bird potentially occur in the project area, all of which are protected under the EPBC Act 1999, the WC Act 1950, are listed as Priority species by the DEC, are rated on the IUCN Red List and or are considered of local conservation importance. The potentially occurring species that were not recorded are discussed below.

EPBC Act 1999

Of the bird species potentially occurring in the project area, 10 are listed as Migratory species, five are listed as Marine species and 10 are listed under both categories (Appendix G4). These species are likely to reside within the mangroves and tidal flats of project area, as these species are mostly migratory shorebirds or waders.

One species, the Night Parrot (*Pezoporus occidentalis*), is listed as Endangered under the EPBC Act 1999. The Night Parrot is also listed as Schedule 1 by the WC Act 1950 and as Critically Endangered on the IUCN Red List. This species is known to inhabit inland plains and Spinifex breakaways (Simpson & Day 2004). There are few records of the Night Parrot, although its preferred habitat is well represented in the Pilbara region. This species given its historically low capture records is unlikely to occur within the project area.

WC Act 1950

Two bird species potentially occurring in the project area are listed as Scheduled species under the WC Act 1950 (Appendix G4):

- the Night Parrot (*Pezoporus occidentalis*); and
- the Peregrine Falcon (*Falco peregrinus*).

The potential occurrence of the Night Parrot is discussed above (refer to EPBC Act 1999 section).

The Peregrine Falcon is listed as Schedule 4 by the DEC and is rated as Least Concern on the IUCN Red List. This species is considered widespread, although uncommon, throughout Australia. The Peregrine Falcon utilises the ledges, cliff faces and large hollows/broken spouts of trees for nesting. This species also occasionally uses the abandoned nests of other birds of prey (Johnstone & Storr 1998). The Peregrine Falcon may utilise the project area as part of its foraging territory.

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DEC Priority List

Four bird species potentially occurring in the project area are on the DEC Priority Fauna List, (Appendix G4):

- the Grey Falcon (*Falco hypoleucos*);
- the Bush Stone-curlew (*Burhinus grallarius*);
- the Flock Bronzewing (*Phaps histrionica*); and
- the Star Finch (*Neochmia ruficauda clarescens*).

The Grey Falcon is listed as Priority 4 by the DEC, as a Migratory species under the EPBC Act 1999 and as Near Threatened under the IUCN Red List. Grey Falcons inhabit woodland areas in arid zones (Simpson & Day 2004), and may forage in the project area.

The Bush Stone-curlew is listed as Priority 4 by the DEC and is rated as Near Threatened by the IUCN Red List. This species is known to inhabit open woodlands with groundcover of small sparse shrubs, grass or litter consisting of twigs. It tends to avoid dense forest, closed-canopy habitats (Morcombe 2004). This habitat type is present within the project area and therefore this species is likely to occur.

The Flock Bronzewing is listed as a Priority 4 species by the DEC and as Least Concern on the IUCN Red List. This species inhabits areas of sparsely wooded grassy plain in close proximity to open water (Johnstone & Storr 1998). The Flock Bronzewing has a low capture record for the area and is therefore unlikely to occur.

The Star Finch is listed as Priority 4 by the DEC and as Near Threatened under the IUCN Red List. This species occurs in sparsely vegetated grasslands near water (Simpson & Day 2004). This species preferred habitat type is well represented within the project area and therefore is likely to occur.

IUCN Red List

All the bird species potentially occurring in the project area are listed on the IUCN Red List. One species, the Night Parrot, is listed as Critically Endangered. The potential occurrence of the Night Parrot is discussed above (refer to EPBC Act 1999 section).

Four bird species are rated as Near Threatened on the IUCN Red List:

- the Jabiru (*Ephippiorhynchus asiaticus*);

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- the Grey Falcon (*Falco hypoleucos*);
- the Bush Stone-curlew (*Burhinus grallarius*); and
- the Star Finch (*Neochmia ruficauda clarescens*).

The Jabiru is rated as Near Threatened by the IUCN Red List. This species' preferred habitat is freshwater river pools and lagoons, and pools in estuaries and sheltered bays and salt work ponds (Johnstone & Storr 1998). The Jabiru is likely to occur in the tidal mudflats, and mangroves of the project area because of the area's close proximity to Dampier Salt's salt works and mangrove communities.

The potential occurrence of the Grey Falcon, the Bush Stone-curlew and the Star Finch is discussed above (refer to DEC Priority List section).

The remaining bird species are rated on the IUCN Red List as Least Concern (Appendix G4). Such taxa are considered widespread and abundant, and not exclusively dependent on the project area at the local level. These species are not protected by legislation.

Locally Significant

Two bird species potentially occurring in the project area are considered of local conservation importance:

- the Rufous-crowned Emu-wren (*Stipiturus ruficeps*); and
- the Grey Honeyeater (*Conopophila whitei*).

The Rufous-crowned Emu-wren and Grey Honeyeater have restricted distributions south of Port Hedland. The Rufous-crowned Emu-wren inhabits sand plains, drainage line and watercourses with low open vegetation - typically *Triodia* hummock grasslands, whilst the Grey Honeyeater's preferred habitat is *Acacia* scrubs and thickets (Johnstone & Storr 1998). Both of these vegetation structures exist within the sand plains habitats and therefore these species are likely to occur in the project area.

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5 DISCUSSION

5.1 HABITAT ASSESSMENT

The project area consists of mangroves and intertidal flats in the northern coastal areas, and sand plains with scattered riverine habitats throughout most of the remaining area. Most of the habitats in the project area, and in the greater Port Hedland area, while maintaining habitat value, have been disturbed to some degree by development and anthropogenic processes. Six broad habitat types were observed in the project area (as shown on Figure 10):

- dunal;
- riverine;
- mangrove;
- tidal mudflats;
- sand plain; and
- samphire.

Habitats of high value for fauna were those displaying vegetation structures and habitat complexity, providing elements important to a variety of fauna (i.e. riverine) or those providing elements specific to fauna of conservation significance (i.e. mangrove and tidal mudflats). Well-vegetated drainage lines (i.e. riverine) can serve as important corridors to fauna movement by connecting otherwise fragmented landscapes. The dunal habitat is considered of high conservation value, as it supports unique faunal assemblages as well as being under-represented within the Pilbara region. Most of the project area is within the sand plain habitat. Despite the relative commonality of the sand plain habitat within the area it:

- supports species of conservation significance (the Woma);
- has a high level of fauna species diversity;
- has an abundance of microhabitats; and
- contributed to the vast majority of animal recordings.

The vegetation complexity within the sand plain habitat was limited, with little to no large trees available for roosting and foraging so this habitat was given the rating of medium value. The lack of vegetation structure and ground cover resulted in the samphire habitat being rated as of lower value, as it lacks an array of microhabitats for fauna to exploit.

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5.2 FAUNA OF CONSERVATION SIGNIFICANCE

Table 3 represents a comparison of total species recorded for the current survey and the total recorded species for past surveys of the area (Hope Downs Management Services Pty Ltd 2002; Biota 2004) in relation to potentially occurring taxa.

Table 3: Comparisons of Recorded Fauna

	Mammals	Reptiles	Amphibians	Birds
Fauna species potentially occurring	45	109	10	198
Percentage of potentially occurring species recorded in the current survey	57%	48%	70%	57%
Percentage of potentially occurring species recorded in past surveys	55%	75%	90%	73%

NB: Past biological surveys for the project area include Mattiske Consulting (1994), Hope Downs Management Services Pty Ltd (2002), Biota (2004), and Biota (2008).

Generally the current survey compares well with the combined efforts of past surveys. The current survey recorded a greater percentage of the potentially occurring mammals and amphibians than the other surveys, however, recorded a lower percentage of reptiles and birds. The reasons for these differences are difficult to determine but may be due to seasonal differences, differences in surveys timing, different habitats surveyed, different number of habitats surveyed, size of the project area surveyed (10000 ha surveyed for PHOHD compared to 324 km for the Hope Downs rail corridor) and differences in survey effort.

Mammals

Twenty-six mammal species were recorded in the project area, of which three are of conservation significance:

- the Little North-western Freetail Bat (*Mormopterus loriae cobourgensis*);
- the Little Red Kaluta (*Dasykaluta rosamondae*); and
- the Common Rock-rat (*Zyzomys argurus*).

The Little North-western Freetail Bat was recorded in both phases of the fauna survey, foraging in the mangroves of the project area. The Little North-western Freetail Bat was not recorded during the surveys of the project area conducted by Hope Downs Management Services Pty Ltd (2002) and Biota (2004). This

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species inhabits mangrove communities, roosting in crevices and spouts of the dead upper branches of the mangrove *Avicennia marina* (Strahan 1995).

The Little Red Kaluta and the Common Rock-rat are considered of local significance. Both species were recorded in the Hope Downs Management Services Pty Ltd (2002) and Biota (2004) survey, however, were recorded further south towards Newman. The Little Red Kaluta is confined to subtropical arid hummock grassland in the Pilbara (Menkhorst & Knight 2004), where it inhabits areas of dense Spinifex (Strahan 1995). This species is mainly nocturnal, feeding on invertebrates and small reptiles (Menkhorst & Knight 2004). This species was recorded a number of times across the project area mainly within the sand plain habitat, within the impact area.

The Common Rock-rat inhabits rocky outcrops, breakaways and scree slopes (Strahan 1995). One individual of this species was recorded on Finucane Island within the rocky outcrops located on the north-western side of the island. The location of this species record will not be impacted upon by the construction of the transfer pad on Finucane Island.

The survey completed by Hope Downs Management Services (2002) recorded two conservation significant species the Northern Quoll (*Dasyurus hallucatus*) and the Lakeland Downs Mouse (*Leggadina lakedownensis*) that were not recorded in the current survey. The Northern Quoll prefers rocky gorge like habitats, and the Lakeland Downs Mouse is known to prefer sand plains and clay pans with a good cover of Spinifex and shrubs. It is unlikely the Northern Quoll will be located in the project area, as aside from a small rock pile located near Cooliarin Pool this species' preferred habitat does not occur. The Lakeland Downs Mouse however was recorded within a sand plain which forms the vast majority of the project area. As this habitat is well represented within the region this species will not be dependent upon habitats found within the project area.

A survey completed by Biota (2004) recorded one conservation significant species, the Western pebble-mound Mouse (*Pseudomys chapmani*), that was not recorded during the current survey. Only active pebble mounds were recorded during the Biota survey on stony plains found within the Abydos Plain. No individuals were observed during the current survey, however, an abandoned pebble mound was located at 50K 671217mE 7725777mN. This species prefers scree slopes containing skeletal soils and pebbles and hummock grassland areas of *Triodia* and *Acacia* sp. Mounds are restricted to suitable-class stones, and are usually found on gentle slopes and spurs. Given the lack of preferred habitat available it is unlikely this species will be dependent upon habitats found within the project area.

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Reptiles

Fifty-three reptile species were recorded in the project area, of which 12 are of conservation significance:

- the Woma (*Aspidites ramsayi*).
- the Smooth Knob-tailed Gecko (*Nephrurus levis pilbarensis*);
- *Ctenotus duricola*;
- *Ctenotus grandis titan*;
- *Ctenotus rufescens*;
- *Lerista bipes*;
- *Lerista muelleri*;
- *Morethia ruficauda exquisita*;
- the Pilbara Goanna (*Varanus bushi*);
- *Ramphotyphlops ammodytes*;
- the Pilbara Death Adder (*Acanthophis wellsi*); and
- the Rufous Whip-snake (*Demansia rufescens*).

The Woma was recorded in the winter survey east of the Great Northern Highway near the 2008 rail option (Figure 10). The Woma was also recorded twice within 35 km of Port Hedland during the Hope Downs rail corridor survey (Hope Downs Management Services 2002). The Woma inhabits woodlands, heaths and shrublands in Spinifex (Wilson & Swan 2003). It is restricted to arid areas, where it shelters in hollow logs, animal burrows or thick vegetation (Cogger 2000). Such habitats are generally well represented in the project area and in the Pilbara region.

Eleven locally significant species inhabit areas of dense shrubs, soft soil for burrowing and/or areas of plentiful leaf litter offering shelter. For example, *Lerista bipes*, *Ctenotus grandis titan* and *Ctenotus rufescens* often inhabit spinifex grasslands with soft sandy soils conducive to digging and burrowing (Wilson & Swan 2003). *Ctenotus duricola,* on the other hand, inhabits hard clay stony soils (Wilson & Swan 2003). In addition, the Smooth Knob-tailed Gecko (*Nephrurus levis pilbarensis*), the blind snake *Ramphotyphlops ammodytes*, the Pilbara Death Adder (*Acanthophis wellsi*) and the Rufous Whip-snake (*Demansia rufescens*) occur only in disjunct populations in the Pilbara. *Lerista muelleri* is

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under taxonomic review, and therefore assumes local conservation importance. All of the aforementioned species except the Pilbara Goanna and the Rufous Whip-snake were recorded in the previous biological surveys for the area (Hope Downs Management Services Pty Ltd 2002; and Biota 2004).

There were no conservation significant reptile species recorded by the previous two surveys (Hope Downs Management Services Pty Ltd 2002; Biota 2004) that were not recorded during the current survey.

Amphibians

Seven amphibian species were recorded in the project area, of which no species are of conservation significance.

There were no conservation significant amphibian species recorded by the previous two surveys (Hope Downs Management Services Pty Ltd 2002; and Biota 2004) that were not recorded during the current survey.

Birds

Of the avifauna species recorded during the survey, two species listed as Priority by the DEC Priority List were recorded:

- the Australian Bustard (*Ardeotis australis*); and
- the Eastern Curlew (*Numenius madagascariensis*).

The Australian Bustard has been recorded at a variety of locations in the Abydos Plain (Biota 2002), and was recorded on both occasions by the surveys of the area conducted by Hope Downs Management Services Pty Ltd (2002) and Biota (2004). The Australian Bustard was also recorded in both phases of the current survey. This species is typically widespread, but is locally scarce. It inhabits woodlands and grasslands, moving widely over large areas (Johnstone & Storr 1998).

The Eastern Curlew was recorded by Hope Downs Management Services Pty Ltd (2002) in the survey of the area, and it was recorded only in the summer phase of the current survey. The Eastern Curlew mainly inhabits tidal mudflats and mangrove areas, and also is known to occur at sandy beaches.

Twenty-three bird species recorded in the survey are listed as Migratory species under the EPBC Act 1999, 18 are listed as Marine species, and 22 are listed under both categories. These species include those recognised under international treaties such as CAMBA, JAMBA and ROKAMBA. At low tide these species can disperse amongst the intertidal flats of the project area. However, at high tide these species converge at one spot at the far south-western end of Finucane Island (pers. comm. M. Welsh, ENV.Australia).This area is located

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outside of the impact footprint. Many of these are largely aerial species, have an extensive home range, and will not be reliant upon habitats found within the project area.

Two species listed as Near Threatened under the IUCN Red List were recorded in the survey:

- the Darter (*Anhinga melanogaster*); and
- the Australian Bustard (*Ardeotis australis*).

The Darter was recorded by the Hope Downs (2002) and Biota (2004) surveys of the area, and was recorded only in the summer phase of the current survey. This species inhabits lakes, swamps and various other water bodies, nesting on twigs and sticks in forks of *Melaleuca* and *Eucalyptus* trees (Johnstone & Storr 1998).

The survey completed by Hope Downs Management Services (2002) recorded one conservation significant species the Bush Stone-curlew (*Burhinus grallarius*) that was not recorded in the current survey. The Bush Stone-curlew is known to inhabit open woodlands with groundcover of small sparse shrubs, grass or litter consisting of twigs. It tends to avoid dense forest, closed-canopy habitats (Morcombe 2004). This type of vegetation complexity exists within the sand plain habitat which covers within the vast majority of the project area therefore this species is likely to occur.

A survey completed by Biota (2004) recorded two species, the Grey Falcon (*Falco hypoleucos*) and the Bush Stone-curlew (*Burhinus grallarius*), that were not recorded during the current survey. Grey Falcons inhabit woodland areas in arid zones (Simpson & Day 2004), and may forage in the project area. This species can be found roosting in riverside eucalypts in particular *Eucalyptus vitrix* and *E. camaldulensis* (Johnstone & Storr 1998). As this type of vegetation structure occurs within the riverine habitat it is likely these species will occur within the project area.

5.3 SEASONAL COMPARISON OF RECORDED FAUNA

It is important to note seasonal variations when compiling a fauna inventory for environmental impact assessment. Multiple surveys should be conducted across each season appropriate to the bioregion and faunal group (EPA 2004). Previous surveys in the area (i.e. Hope Downs 2000 and 2002, Biota 2004, 2007 and 2008) other than the FMG Rail Corridor fauna surveys do not assess seasonality. So a two season survey will give a good indication of faunal assemblages within the project area across a temporal scale.

One of the most important factors determining seasonal faunal activity is related to rainfall and temperature. Generally, a survey in the season that follows the season of maximum rainfall is the most productive and important survey time

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(EPA 2004). Therefore a two-phase survey across two different seasons was deemed likely to produce results giving a good representation of fauna and faunal assemblages of the project area. However, due to the low summer rainfall for the area (as few cyclones crossed the WA coast in the 2007-2008 cyclone season), the seasonal differences were not as pronounced as expected. Table 4 shows the species differences between recorded fauna after each current season's survey, and these are discussed below.

Table 4: Seasonal Comparisons of Recorded Fauna.

	Mammals		Reptiles		Amphibians		Birds	
Species recorded in Summer but not in Winter	7	27%	9	17%	2	28%	39	35%
Species recorded in Winter but not in Summer	3	12%	6	11%	2	28%	8	8%
Species recorded in both phases of the survey	16	61%	38	72%	3	42%	64	57%
Total species recorded for the survey	26	100%	53	100%	7	100%	113	100%

NB: Percentage figures are percentages of total recorded species.

Mammals

Seven species of mammal recorded in the summer survey were not recorded in the winter survey: the Little Red Flying-fox (*Pteropus scapulatus*), the Arnhem Long-eared Bat (*Nyctophilus arnhemensis*), the Common Rock-rat (*Zyzomys argurus*), and four species of introduced mammals. The Little Red Flying-fox was recorded outside the project area in fruit-bearing trees. This species is highly nomadic and is found across a vast array of habitat types (Strahan 1995). The Arnhem Long-eared Bat is not seasonal and records increase with more survey effort (pers. comm. R. Bullen), and the Common Rock-rat was an unexpected record made on Finucane Island and is not influenced by seasonal activity as breeding is intensive throughout the year (Strahan 1995).

Four of the mammal species recorded in summer were introduced species: the European Rabbit (**Oryctolagus cuniculus*), the Fox (**Vulpes vulpes*), the Feral Cat (**Felis catus*) and the Horse (**Equus caballus*). Unusually, the European Rabbit and Horse were recorded in the summer survey and not in the winter survey, i.e. after the summer rainfall. The Fox and Feral Cat are opportunistic predators, probably preying on reptiles during the active warmer summer months.

Three species of mammal were recorded in the winter survey and not in the summer survey: Beccari's Freetail-bat (*Mormopterus beccarii*), the Desert Mouse (*Pseudomys desertor*), and the Western Chestnut Mouse (*Pseudomys nanus*). Beccari's Freetail-bat is common in suitable habitat (Strahan 1995), and would

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have been expected to be recorded in the summer survey, often recorded near a permanent waterhole (pers. comm. R. Bullen). This discrepancy therefore cannot be explained by seasonal activity. However, despite the limited rainfall of the wet season, the flooding and rapid vegetation growth can provide patches of highly productive habitat which can readily be exploited by small fast-growing and fast-breeding rodents (Strahan 1995). Therefore this factor may explain the records of both species of mouse after the wet season and not in the summer survey, as they were invariably recorded foraging in highly productive habitat.

Reptiles

Nine species not recorded in the winter survey were recorded in the summer survey: the Ring-tailed Dragon (*Ctenophorus caudicinctus*), *Delma tincta*, Burton's Legless Lizard (*Lialis burtonis*), the Short-tailed Monitor (*Varanus brevicauda*), the Perentie (*Varanus giganteus*), the Pygmy Python (*Antaresia perthensis*), a Pilbara Death Adder (*Acanthophis wellsi*), a Shovel-nosed Snake (*Brachyurophis approximans*), and a Rufous Whip-snake (*Demansia rufescens*). This is not unexpected, as reptiles are more often more active in the warmer months for foraging and breeding purposes.

Six species of reptile were recorded in the winter survey that were not recorded in the summer survey: *Delma butleri*, *Ctenotus piankai*, *Ctenotus rufescens*, the Pilbara Goanna (*Varanus bushi*), a Black-headed Python (*Aspidites melanocephalus*), and the Woma (*Aspidites ramsayi*). The cryptic nature of the smaller reptiles may have contributed to these species being recorded in winter and not during summer. The Black-headed Python and especially the Woma are uncommon and are not always recorded in fauna surveys.

Amphibians

The summer survey recorded two species not recorded in the winter survey: Roth's Tree-frog (*Litoria rothii*), and Russell's Toadlet (*Uperoleia russelli*). Roth's Tree-frog was recorded outside the project area. It normally has a wide distribution across the Kimberley, so is likely to be a vagrant. Russell's Toadlet breeds in summer (Cogger 2000), and therefore a summer record is not unexpected.

Two species recorded in the winter survey were not recorded in the summer survey; the Giant Frog (*Cyclorana australis*) and Spencer's Frog (*Limnodynastes spenceri*). A billabong (Cooliarin Pool) at 50K 669158mE 7731730mN, located in the winter survey but not surveyed during summer, was the site where both species were recorded. Moreover, heavy rain in flooded areas invariably brings burrowing frogs to the surface. As the rainfall was significantly below average, these species will not occur and/or will be restricted to more permanent features, such as the billabong.

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Birds

The summer survey recorded 39 species not recorded in the winter survey, most of which were non-breeding migratory shorebirds. These animals are temporary residents during spring and summer, and migrate to the northern hemisphere to breed in the Australian autumn and winter (Geering *et al.* 2007). For example the Eastern Curlew (*Numenius madagascariensis*), the Whimbrel (*Numenius phaeopus*), Sandpipers, Stints, the Common Greenshank (*Tringa nebularia*), and Terns were all recorded in the tidal mudflats of the project area.

Eight species were recorded in the winter survey that were not recorded in the summer survey: the Emu (*Dromaius novaehollandiae)*, the Marsh Sandpiper (*Tringa stagnatilis*), the Black-fronted Dotterel (*Elseyornis melanops*), the Pallid Cuckoo (*Cuculus pallidus*), the Australian Owlet-nightjar (*Aegotheles cristatus*), the Black Honeyeater (*Certhionyx niger*), the White-browed Woodswallow (*Artamus superciliosus*), and the Painted Finch (*Emblema pictum*). This may have only been a function of survey effort as these species other than the wader species do not change behaviour due to seasonal activity.

Analysis of the results shows that the seasonal differences in recorded species were not as pronounced as expected. The large increase in migratory shorebirds and waders was not largely unexpected as these birds find temporary residence in Australia during the summer months. The lack of summer rainfall may have played a part in the limited number of ground dwelling species being recorded in winter as the abundance of food may have been restricted. Much of the variability is unexplained and/or not understood and can often be speculative to the extent in which it occurs.

Other reports completed in the area are either not multi-seasonal or do not discuss the seasonality of results recorded within the surveys and therefore comparisons between the results of the current survey and previous surveys can not be made.

5.4 ADDITIONAL AREAS

The winter survey included the survey of additional areas surrounding the 2008 rail option (Figure 2) towards the south-west of the project area. Systematic (trapping sites 13 and 15) and non-systematic (opportunistic) sampling in this new area resulted in one new species of reptile being recorded which was not recorded within the revisited areas. The Woma (*Aspidites ramsayi*) was recorded to the east of the Great Northern highway and is not considered to be restricted to this area as suitable habitat occurs elsewhere within and outside of the project area.

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6 IMPACT ASSESSMENT AND RECOMMENDATIONS

6.1 GENERAL

The broad potential impacts from the proposed development on terrestrial fauna in the project area are set out in Table 5.

Table 5: Potential Impacts on Terrestrial Fauna

Physical Effect	Ecological Consideration
Loss of Habitat	• Habitat destruction may reduce the habitat/resource available for the local fauna community, and in particular for rare or threatened species. • Loss of high-value habitat may result in the reduction of abundance of threatened and rare species. • Removal of mature vegetation and hollow-bearing trees will result in the loss of perching, foraging, den and nesting resources.
Barrier	• Disturbance of fauna movement corridors associated with riparian habitats. • Disturbance of fauna movement corridors associated with sand plain habitats connections via patches of wooded vegetation and scattered trees. • Reduction in the dispersal ability of animal species between remnant habitats on either side of the proposed rail corridor. • Physical barrier to fauna movement and a potential 'trap' provided by the rail line itself. The rail corridor will be a permeable barrier slowing or restricting the movement of fauna.
Dust	• Dust can result in secondary impacts on fauna (i.e. through direct impact on habitat quality, condition and availability).
Noise	• Increased noise may cause added stress on breeding populations of species.
Introduced Species	• Removal of habitat increases pressure on native species through competition and predation. • Indirect impacts, including the potential for introduced species to penetrate further into bushland areas by using the newly-constructed tracks and cleared corridors.
Changes due to construction	• Impacts on high-value habitats such as mangrove communities at Finucane Island and on the mainland. • Increased traffic may result in increased localised mortalities.

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6.2 HABITAT IMPACTS

The proposed disturbances to the project area relevant to the terrestrial environment are associated with the construction of rail infrastructure, stockyards, conveyors and access roads located on the mainland and Finucane Island. The project area surveyed included a number of different rail loop and rail options, the Boodarie stockyards, and a conveyor running to a transfer pad located at the end of Finucane Island (Figure 2). The proposed rail options, rail loops and stockyards will predominantly impact the sand plain habitat within the project area, while the proposed conveyor and transfer pad will impact upon the mangroves, tidal flats, and dunal systems within the project area. Due to the small scale of impact proposed however, the broad representation of the six types of habitats for the project area will not be compromised for the region.

The high value and under-represented habitats (dunal, mangroves and tidal flats) will be impacted upon by the proposed infrastructure corridor from the Boodarie stockyards to Finucane Island. The proposed development will impact upon 5.18 ha of the dunal habitat, 16.14 ha (3%) of the mangrove habitat and 42.57 ha (8%) of the tidal flats habitats within the project area. Given the small size of impact proposed, the representation of these habitats within the region will not be reduced. The sand plain habitat forms the vast majority of the project area and while having medium habitat value, as it is well represented outside of the project area, and the proposed disturbance is small, the broad representation will not be reduced.

Within the project area some isolated features exist that may be important to fauna taxa. Such small isolated features such as a quartz outcrop, billabong (Cooliarin Pool), rockpile, and limestone hill were not deemed as complete fauna habitat types but were important to fauna none the less. The billabong and rockpile is directly in line with a rail option A and therefore may be impacted upon heavily.

6.3 FAUNA IMPACTS

Of the 199 recorded species for the project area, 67 are protected under legislation (i.e. listed under the EPBC Act 1999, WC Act 1950, and or deemed as Priority by the DEC). Species recorded under legislation and priority listing during the current survey will be discussed.

The Woma inhabits spinifex within woodlands, heaths and shrublands (Wilson & Swan 2003). It is restricted to arid areas, where it shelters in hollow logs, animal burrows or thick vegetation (Cogger 2000). Even though direct habitat loss may result in localised mortalities, the broad representation of this species in the region is not likely to be compromised by the proposed development.

The Little North-western Freetail Bat was recorded in both phases of the fauna survey, foraging in the mangroves of the project area (pers. comm.

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R. Bullen). This species inhabits mangrove communities, roosting in crevices and spouts of the dead upper branches of the mangrove *Avicennia marina* (Strahan 1995). Therefore further removal of this type of habitat will have impacts on this species at the local level. However as the proposed development is small in scale, it is not expected this will impact this species' population numbers at a regional level.

The Australian Bustard inhabits woodlands and grasslands, moving widely over large areas (Johnstone & Storr 1998). This species has been recorded at a variety of locations in the Abydos Plain (Biota 2002). The Australian Bustard was recorded from within the sand plain habitat during both seasons of the current survey. Because of its nomadic behaviour and the fact that it is not reliant on habitats in the project area, no effects are expected upon this species.

The Eastern Curlew mainly inhabits tidal mudflats and mangrove areas, and is also known to occur at sandy beaches; this species was recorded only in the summer season within the above habitats. Further habitat destruction will have a negative effect on this species at the local scale, i.e. within the project area, but is not anticipated to effect the species at the regional scale.

Twenty-three separate bird species recorded during the survey are listed as Migratory species under the EPBC Act 1999, 18 are listed as Marine species, and 22 are listed in both categories. A majority of these species were recorded within mangroves and tidal flats habitat types. These habitat types support most of the migratory waders found in the project area and many of these non-breeding migrants will use these habitats for foraging and roosting during the summer. Many of these are largely aerial species, have an extensive home range, and will not be reliant upon habitats in the project area; therefore no impacts are expected upon them. However during low tide these species can disperse throughout tidal mudlfats of the project area to roost and forage. At high tide they converge and roost at one location at Finucane Island right at the far south-western tip of the island. Direct impact upon this site is not proposed.

6.4 MANAGEMENT RECOMMENDATIONS

ENV makes the following recommendations for fauna species of conservation significance:

- a management response be developed to minimise the impacts of design and construction of the proposed rail options upon the Woma (*Aspidites ramsayi*) occurring in the sand plain habitat of the project area; and
- a management response be developed to minimise the impacts of design and construction of the proposed developments upon mangrove communities to alleviate any negative effects on species of conservation significance such as

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the Little North-western Freetail Bat (*Mormopterus loriae cobourgensis*) and the Eastern Curlew (*Numenius madagascariensis*).

There are no specific management recommendations that apply to the Australian Bustard (*Ardeotis australis)*, because of the high mobility of this species.

General recommendations to conserve other fauna of conservation importance not specifically dependent on habitats in the project area include:

- clearing should be limited to that necessary for the proposed developments;
- where possible avoid clearing high value fauna habitats and isolated features, in particular the permanent water body (Cooliarin Pool) and rocky outcrop at coordinate 50K 669158mE 7731730mN;
- the design of the rail corridor should include culverts to allow for fauna movement under the rail line;
- tree hollows in mature vegetation should be preserved where possible, as these may serve as perching, nesting and/or roosting sites; and
- dust and waste should be managed to reduce secondary impacts on fauna habitats.

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7 CONCLUSIONS

Of the six habitats identified broadly across the project area, the dunal, riverine, mangrove and tidal flat habitats were identified as being of high value in supporting fauna. The dunal habitat has a large array of niches for fauna to exploit, and the riverine habitat has a significant buildup of woody debris, leaf litter and hollow logs, which provide microhabitats for fauna. In addition, the riverine habitat provides a fauna movement corridor that allows ecological linkage across habitat types.

A comparison of total species recorded for the current survey and the total recorded species for past surveys of the area (Hope Downs Management Services Pty Ltd 2002; Biota 2004) compares well with the combined efforts of past surveys for the project area.

The conservation-significant species recorded in the project area included the Woma (*Aspidites ramsayi*), the Little North-western Freetail Bat (*Mormopterus loriae cobourgensis*), the Australian Bustard (*Ardeotis australis*) and the Eastern Curlew (*Numenius madagascariensis*). The Woma is usually found in woodlands, heaths and shrublands with Spinifex, the Little North-western Freetail Bat often prefers roosting and foraging in mangal communities, the Australian Bustard is nomadic in habit, and the Eastern Curlew is a wading bird inhabiting intertidal flats amongst mangroves.

A management strategy for the Woma should be developed to assess the likelihood that this species will be impacted upon from the proposed developments. Avoiding the mangrove communities where possible will relieve the pressures on conservation-significant species and migratory species which use this scarce habitat. Furthermore, installing culverts will increase the ability of fauna species to cross the project area, therefore allowing uninterrupted breeding patterns and territorial boundaries.

In conclusion, the habitats in the project area have been well surveyed, and are generally well represented, except for the under-represented dunal, mangrove and tidal flat habitats, in the Pilbara region. However given the linear nature of the proposed developments and small scale of impact proposed the broad representation of these habitats in the Pilbara region will not be compromised.

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FIGURES

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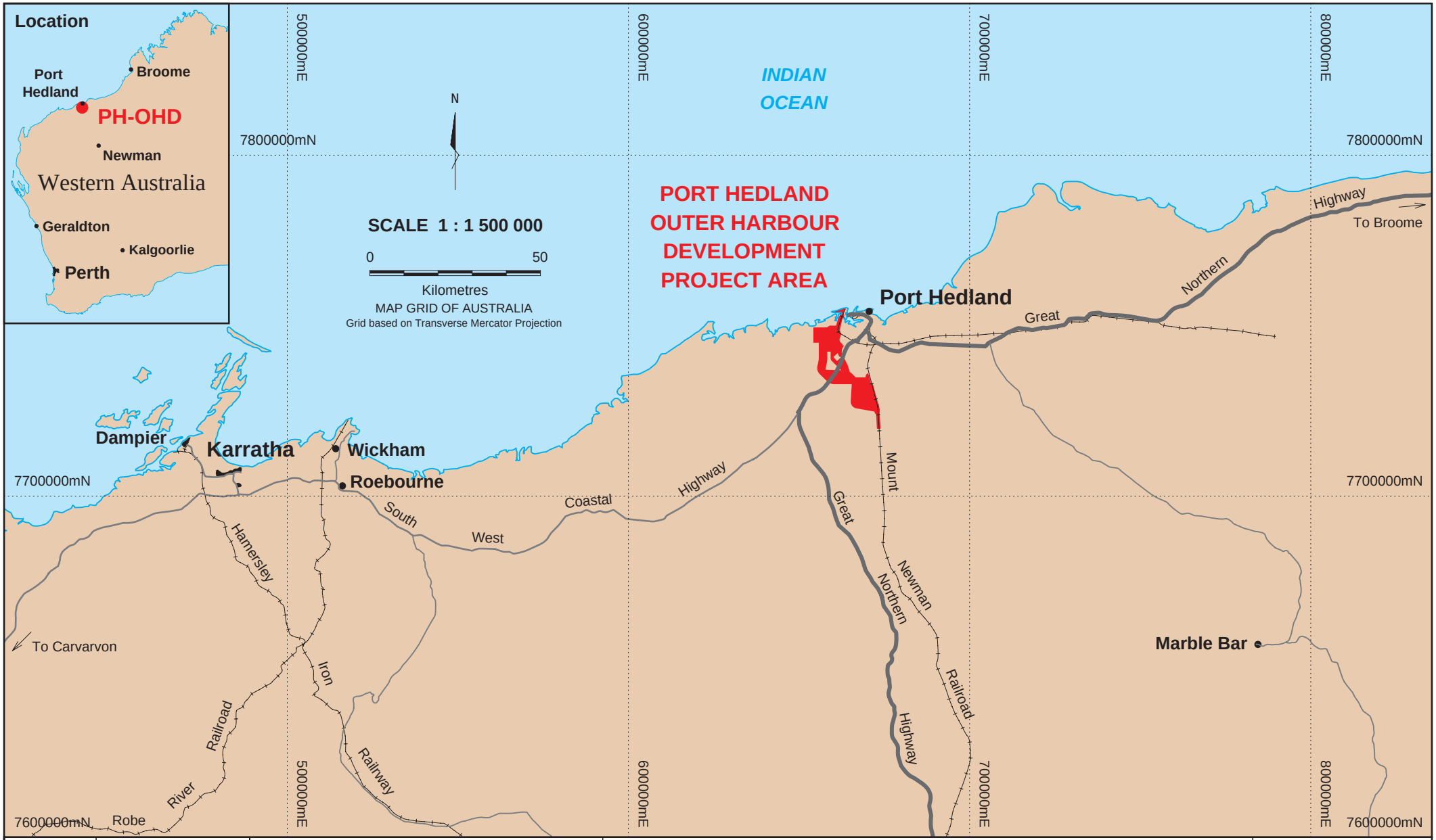

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	Drawn: S.Coleman	Project: PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT	Scale: 1: 1.5 Million
	Status:		Figure No. 1
	Job Number: 08.216		A4 Plan No. QM-001

REGIONAL LOCATION

INDIAN OCEAN

660000mE

670000mE

Port Hedland

Transfer Pad

Conveyor System

7750000mN

Boodarie Stockyards

Rail Loop 2007

Rail Loop 2008

South Hedland

Great Northern Highway

7740000mN

Mount Newman Railroad

Rail Option C

Rail Option A

7730000mN

Rail Option D

Rail Option B

7720000mN

N

SCALE 1 : 100 000

0 5

Kilometres

MAP GRID OF AUSTRALIA

Grid based on Transverse Mercator Projection

Legend

- BHPBIO Options
- 2007 Rail Options
- 2008 Rail Options

env Australia	Author: M.Brown	Client: **SINCLAIR KNIGHT MERZ PTY LTD**	Date: 27 August 2008
	Drawn: S.Coleman	Project: **PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT**	Scale: 1:100 000
	Status:		Figure No. **2**
	Job Number: 08.216	**PROPOSED INFRASTRUCTURE**	A3 Plan No. **QM-016**

INDIAN OCEAN

660000mE

670000mE

7750000mN

7740000mN

7730000mN

7720000mN

Site 9

Site 6

Site 7

Site 5

Site 4

Site 15

Site 3

Site 10

Site 2

Site 13

Port Hedland

South Hedland

Great Northern Highway

Mount Newman Railroad

N

SCALE 1 : 100 000

0 5

Kilometres

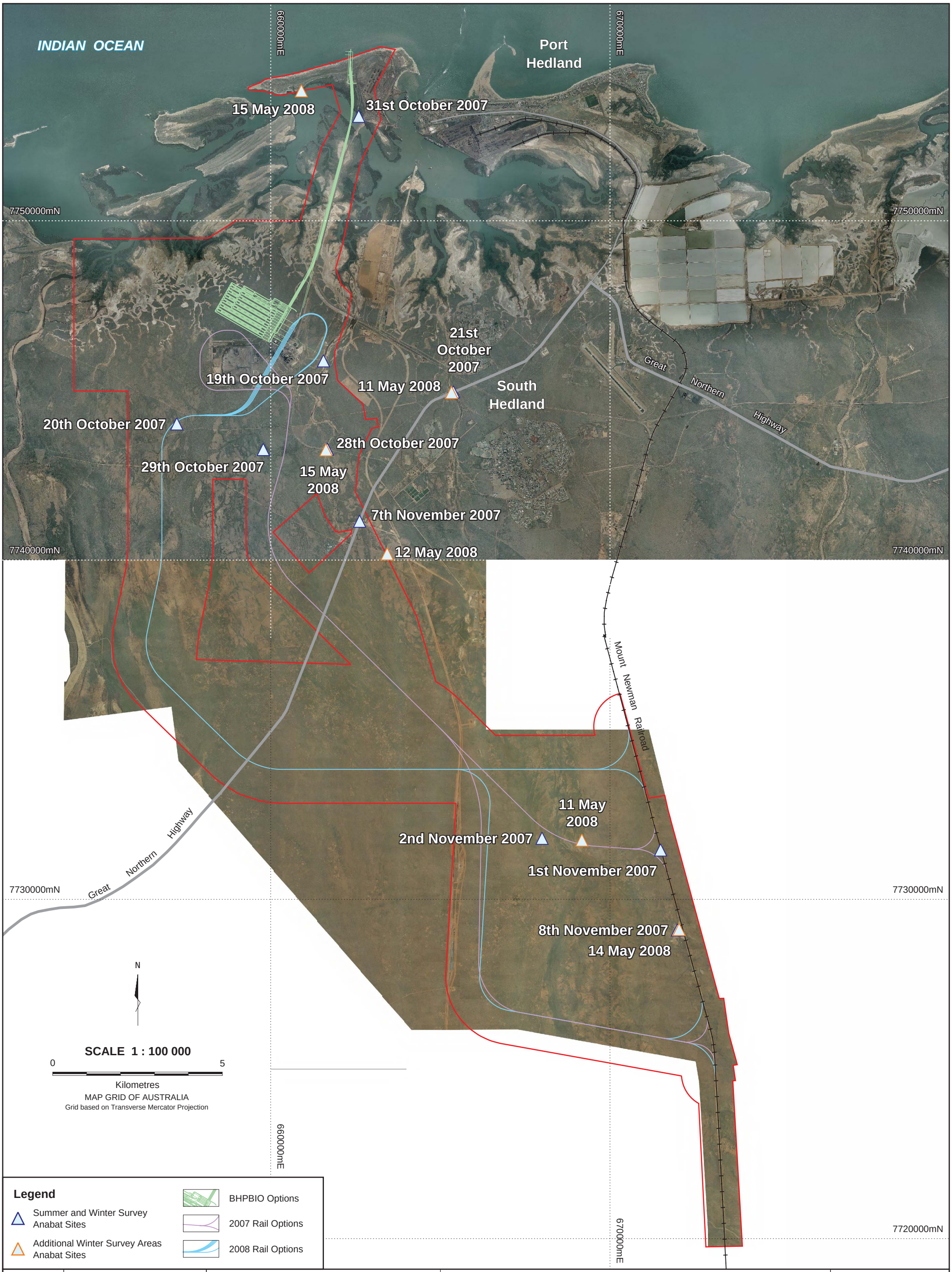
MAP GRID OF AUSTRALIA

Grid based on Transverse Mercator Projection

Legend

- Summer and Winter Survey Fauna Trap Sites
- Additional Winter Survey Areas Fauna Trap Sites
- BHPBIO Options
- 2007 Rail Options
- 2008 Rail Options

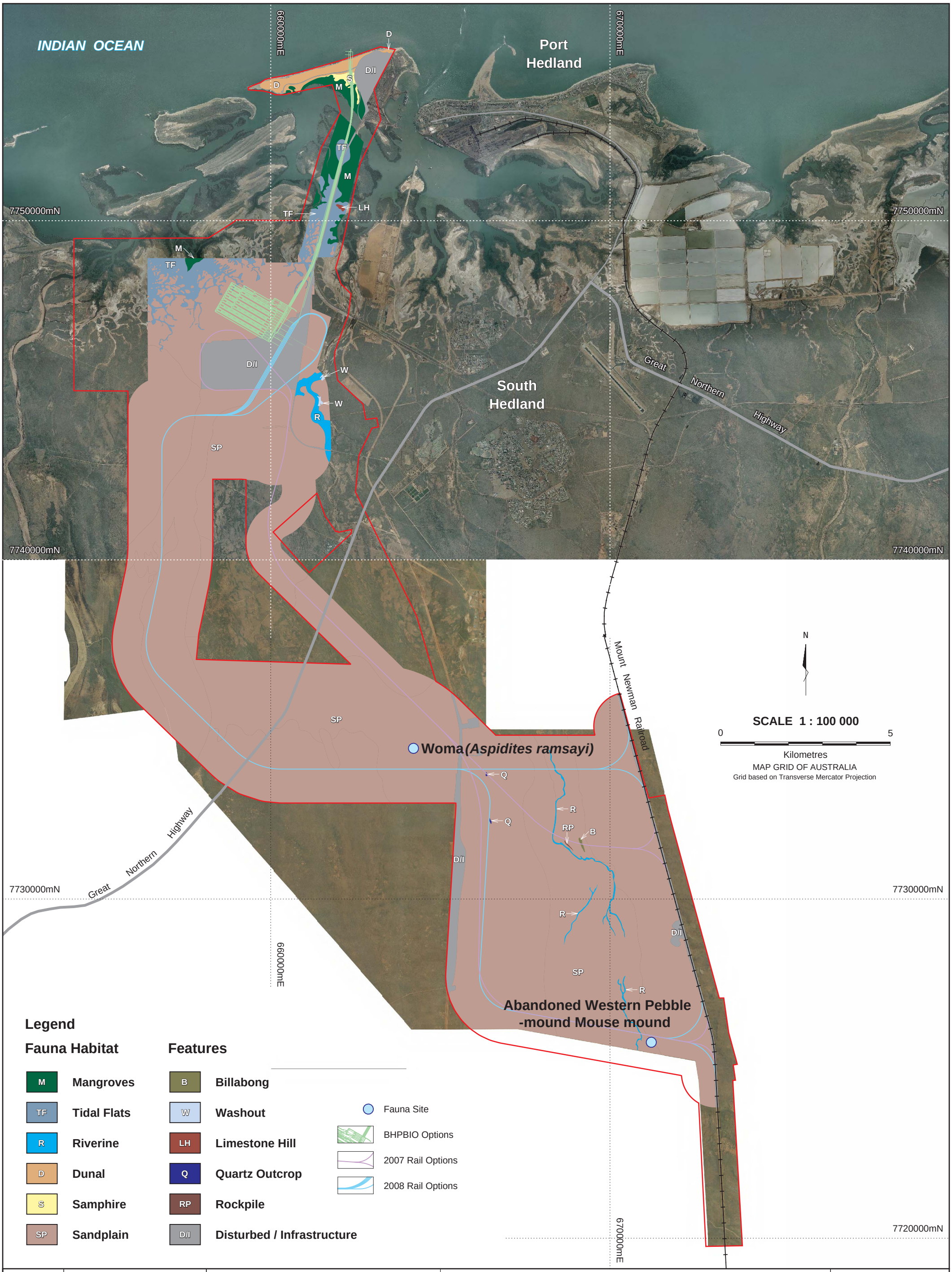
env Australia	Author: M.Brown	Client: **SINCLAIR KNIGHT MERZ PTY LTD**	Date: 27 August 2008
	Drawn: S.Coleman	Project: **PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT**	Scale: 1:100 000
	Status:		Figure No. **8**
	Job Number: 08.216	**TRAP SITE LOCATIONS**	A3 Plan No. **QM-005**



Legend

- Summer and Winter Survey Anabat Sites
- Additional Winter Survey Areas Anabat Sites
- BHPBIO Options
- 2007 Rail Options
- 2008 Rail Options

env Australia	Author: M.Brown	Client: **SINCLAIR KNIGHT MERZ PTY LTD**	Date: 27 August 2008
	Drawn: S.Coleman	Project: **PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT**	Scale: 1:100 000
	Status:	**ACCOUSTIC BAT RECORDING LOCATIONS**	Figure No. **9**
	Job Number: 08.216	14 May 2008	A3 Plan No. **QM-006**



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	Drawn: S.Coleman	Project: PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT	Scale: 1:100 000
	Status:	FAUNA HABITATS AND LOCATIONS OF CONSERVATION SIGNIFICANT SPECIES	Figure No. 10
	Job Number: 08.216	A3	Plan No. QM-014

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APPENDIX A

DEFINITION OF CONSERVATION CODES FOR FAUNA OF CONSERVATION SIGNIFICANCE

PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT

APPENDIX A

Definition of Conservation Codes for Fauna of Conservation Significance

Environment Protection and Biodiversity Conservation Act 1999 (Cth) Threatened Species and Threatened Ecological Communities Codes

The EPBC Act prescribes seven matters of national environmental significance:-

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance;
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

Species in the categories ExW, CE, E, E and V (see below), and threatened ecological communities in the CE and E categories are protected as matters of national environmental significance under the EPBC Act.

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

Wildlife Conservation Act 1950 (WA)

Category	Code	Description
Schedule 1	S1	Rare or likely to become extinct.
Schedule 2	S2	Presumed extinct.
Schedule 3	S3	Birds subject to an agreement between the governments of Australia and Japan, the People's Republic of China & the Republic of Korea relating to the protection of migratory birds and birds in danger of extinction.
Schedule 4	S4	Other specially protected fauna.

Department of Environment and Conservation (DEC) Fauna Priority Codes

Category	Code	Description
Priority 1	P1	Taxa with few, poorly known populations on threatened lands.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	P4	Taxa in need of monitoring: not currently threatened or in need of special protection, but could become so. Usually represented on conservation lands.
Priority 5	P5	Taxa in need of monitoring: not considered threatened, but the subject of a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

IUCN Red List of Threatened Species Codes

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range, and not recorded in known or expected habitat despite exhaustive survey over a timeframe appropriate to its lifecycle and form.
Critically endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing high risk of extinction in the wild
Near threatened	NT	Taxa which have been evaluated and do not qualify for CR, EN, or VU, but are close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which have been evaluated and do not qualify for CR, EN, VU or NT, but are likely to qualify for NT in the near future.
Data deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

International conventions and agreements

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

This is an intergovernmental treaty under the United Nations Environmental Program which lists migratory species that would significantly benefit from international cooperation on their conservation and management.

Japan-Australia Migratory Bird Agreement (JAMBA)

This is an agreement between the Government of Australia and the Government of Japan for the protection of migratory, threatened and birds in danger of extinction. It requires both parties to conserve and protect the birds and their habitats as well as exchange information and build a cooperative relationship.

China-Australia Migratory Bird Agreement (CAMBA)

This is an agreement between the Government of Australia and the Government of the People's Republic of China for the protection of migratory birds and their environment. It requires both parties to conserve and protect the birds and their habitats as well as exchange information and build a cooperative relationship.

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APPENDIX B
TRAPPING PROGRAM

PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT

APPENDIX B

TRAPPING PROGRAM

Appendix B1 – Trap Site Locations for Summer Survey

Site	#GPS Coordinates	
	Easting	Northing
Site 2 – Start	671526	7731265
Site 2 – End	671425	7731615
Site 3 – Start	664747	7735183
Site 3 - End	664551	7735203
Site 4 – Start	661639	7738270
Site 4 - End	661887	7738177
Site 5 - Start	662788	7739999
Site 5 - End	662805	7739770
Site 6 - Start	661418	7745816
Site 6 - End	661398	7745509
Site 7 - Start	656473	7744246
Site 7 - End	656708	7744201
Site 9 - Start	662156	7754542
Site 9 - End	662240	7754547
Site 10 - Start	666721	7734911
Site 10 - End	666558	7735047

Australian Geocentric 1994 (GDA94), Zone 50K.

Appendix B2 – Major Habitat Types and Vegetation Descriptions of Trap Sites for Summer Survey

Site Number	Habitat Type	Vegetation Description
2	Roadside Verge	An open *Acacia* shrubland over a *Triodia* hummock grassland.
3	Sand Plain	Scattered mixed *Acacia* shrubs over a low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
4	Sand Plain	A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
5	Sand Plain	A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
6	Tidal Drainage Line	Low *Eucalyptus* woodland over an *Acacia tumida* shrubland over a mixed herbland and mixed grassland. Some areas of Samphire.
7	Sand Plain	A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
9	Sand Dune	Scattered *Crotalaria cunninghamii* shrubs over a **Cenchrus ciliaris* grassland.
10	Riverine	A low open *Eucalyptus* woodland over a mixed shrubland over a mixed herbland.

Appendix B3 – Traps and Number of Replicates Used at Each Trap Site for Summer Survey

Site Number	# Cage Traps	# Elliott Traps	# Funnel Traps	# Bucket Traps	# Pot Traps	# Long Pot Traps	Total
2	8	8	16	8	5	3	**48**
3	8	8	16	8	5	3	**48**
4	8	8	16	8	5	3	**48**
5	8	8	16	8	5	3	**48**
6	8	8	16	8	5	3	**48**
7	8	8	16	8	5	3	**48**
9	8	8	16	8	5	3	**48**
10	8	8	16	8	5	3	**48**
TOTAL	**64**	**64**	**128**	**64**	**40**	**24**	**384**

Appendix B4 – Systematic Trapping Program for Summer Survey

Site Number	# nights Cage Traps	# nights Elliott Traps	# nights Funnel Traps	# nights Bucket Traps	# nights Pot Traps	# nights Long Pot Traps	Total nights
2	64	64	128	64	128	24	**472**
3	64	64	128	64	128	24	**472**
4	64	64	128	64	128	24	**472**
5	64	64	128	64	128	24	**472**
6	64	64	128	64	128	24	**472**
7	64	64	128	64	128	24	**472**
9	64	64	128	64	128	24	**472**
10	64	64	128	64	128	24	**472**
TOTAL	**512**	**512**	**1024**	**512**	**1024**	**192**	**3776**

Appendix B5 – Trap Site Locations for Winter Survey

Site	#GPS Coordinates	
	Easting	Northing
Site 2 – Start	671526	7731265
Site 2 – End	671425	7731615
Site 3 – Start	664747	7735183
Site 3 - End	664551	7735203
Site 4 – Start	661639	7738270
Site 4 - End	661887	7738177
Site 5 - Start	662788	7739999
Site 5 - End	662805	7739770
Site 6 - Start	661418	7745816
Site 6 - End	661398	7745509
Site 7 - Start	656473	7744246
Site 7 - End	656708	7744201
Site 9 - Start	662156	7754542

Site	#GPS Coordinates	
	Easting	Northing
Site 9 - End	662240	7754547
Site 10 - Start	666721	7734911
Site 10 - End	666558	7735047
Site 13 - Start	671538	7728188
Site 13 - End	671493	7728494
Site 15 - Start	656180	7737766
Site 15 - End	656238	7737631

Australian Geocentric 1994 (GDA94), Zone 50K.

Appendix B6 – Major Habitat Types and Vegetation Descriptions of Trap Sites for Winter Survey

Site Number	Habitat Type	Vegetation Description
2	Roadside Verge	An open *Acacia* shrubland over a *Triodia* hummock grassland.
3	Sand Plain	Scattered mixed *Acacia* shrubs over a low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
4	Sand Plain	A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
5	Sand Plain	A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
6	Tidal Drainage Line	Low *Eucalyptus* woodland over an *Acacia tumida* shrubland over a mixed herbland and mixed grassland. Some areas of Samphire.
7	Sand Plain	A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
9	Sand Dune	Scattered *Crotalaria cunninghamii* shrubs over a **Cenchrus ciliaris* grassland.
10	Riverine	A low open *Eucalyptus* woodland over a mixed shrubland over a mixed herbland.
13	Sand Plain	A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
15	Sand Plain	A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.

Appendix B7 – Traps and Number of Replicates Used at Each Trap Site for Winter Survey

Site Number	# Cage Traps	# Elliott Traps	# Funnel Traps	# Bucket Traps	# Pot Traps	Total
2	10	10	20	10	20	**70**
3	10	10	20	10	20	**70**
4	10	10	20	10	20	**70**
5	10	10	20	10	20	**70**
6	10	10	20	10	20	**70**
7	10	10	20	10	20	**70**
9	10	10	20	10	20	**70**
10	10	10	20	10	20	**70**
13	10	10	20	10	20	**70**
15	10	10	20	10	20	**70**
TOTAL	**100**	**100**	**200**	**100**	**200**	**700**

Appendix B8 – Systematic Trapping Program for Winter Survey

Site Number	# nights Cage Traps	# nights Elliott Traps	# nights Funnel Traps	# nights Bucket Traps	# nights Pot Traps	Total nights
2	80	80	160	80	160	**560**
3	80	80	160	80	160	**560**
4	80	80	160	80	160	**560**
5	80	80	160	80	160	**560**
6	80	80	160	80	160	**560**
7	80	80	160	80	160	**560**
9	80	80	160	80	160	**560**
10	80	80	160	80	160	**560**
13	80	80	160	80	160	**560**

Site Number	# nights Cage Traps	# nights Elliott Traps	# nights Funnel Traps	# nights Bucket Traps	# nights Pot Traps	Total nights
15	80	80	160	80	160	**560**
TOTAL	**800**	**800**	**1600**	**800**	**1600**	**5600**

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APPENDIX C
SITE PHOTOGRAPHS

PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT

APPENDIX C

SITE PHOTOGRAPHS

Site 2 – Roadside Verge

Site 3 – Sand Plain

Site 4 – Sand Plain

Site 5 – Sand Plain

Site 6 – Tidal Drainage Line

Site 7 – Sand Plain

Site 9 – Sand Dune

Site 10 – Riverine

Site 13 – Sand Plain

Site 15 – Sand Plain

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APPENDIX D
ORNITHOLOGICAL CENSUS

PORT HEDLAND OUTER HARBOUR DEVELOPMENT
FAUNA ASSESSMENT

APPENDIX D

ORNITHOLOGICAL CENSUS

D1 – Opportunistic Bird Searching Program for Summer Survey

Date	Location	Duration
28 October 2007	Finucane Island	8.5 h
29 October 2007	HBI plant	10 h
	Finucane Island	10 h
30 October 2007	East of Boodarie Landing	9 h
31 October 2007	East of Boodarie Landing	9.5 h
	Finucane Island	2 h
1 November 2007	HBI plant	4.5 h
2 November 2007	Riverine near Site 8	4 h
	Road verge near Site 1	2 h
	Plain near Site 2	2 h
3 November 2007	Riverine at Site 8	2 h
	Road verge along railway track	2 h
	Finucane Island	2 h
4 November 2007	Riverine near Site 8	5 h
Total		**72.5 h**

Appendix D2 – Opportunistic Bird Searching Program for Winter Survey

Date	Habitat Type	Duration
10 May 2008	Tidal Drainage Line	1 h
	Sand Plain	40 min
	Sand Plain	45 min

Date	Habitat Type	Duration
	Sand Plain	45 min
	Sand Dunes	50 min
	Riverine	30 min
	Billabong	50 min
11 May 2008	Riverine	45 min
	Roadside Verge	50 min
	Sand Plain	1 h
	Sand Plain	50 min
12 May 2008	Sand Dune	1 h
	Tidal Drainage Line	30 min
	Tidal Drainage Line	1 h
	Sand Dunes and Shoreline	2 h 30 min
13 May 2008	Sand Plain/Open Woodland	1 h
	Sand Plain	30 min
	Quarry	1 h
	Mangroves and mudflats	1 h
	Dunal	1h 30 min
	Minor Drainage	1h 30 min
	Water Hole	45 min
Total		**21 h**

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APPENDIX E
ACOUSTIC BAT RECORDINGS

PORT HEDLAND OUTER HARBOUR DEVELOPMENT
FAUNA ASSESSMENT

APPENDIX E

ACOUSTIC BAT RECORDINGS

Appendix E1 – AnaBat II Locations for Summer Survey

Date	GPS Coordinates	
	#Easting	#Northing
19 October 2007	661554	7745873
20 October 2007	657232	7744015
21 October 2007	665384	7744957
28 October 2007	661669	7743268
29 October 2007	659781	7743260
31 October 2007	662594	7753080
1 November 2007	671491	7731456
2 November 2007	667997	7731801
7 November 2007	662620	7741146
8 November 2007	671988	7729098

Australian Geocentric 1994 (GDA94), Zone 50K.

Appendix E2 – AnaBat II Recording Details for Summer Survey

Date	AnaBat II #	Duration	Habitat
19 October 2007	1	80 min	Site 5 – Adjacent to tidal creek.
20 October 2007	1	80 min	Under the bridge crossing the 'South West' River.
21 October 2007	1	80 min	Under the bridge crossing the 'South' River.
28 October 2007	1	80 min	Under the bridge crossing an ephemeral creek.

Date	AnaBat II #	Duration	Habitat
29 October 2007	1	80 min	Open eucalyptus woodland with no understorey.
31 October 2007	1	80 min	On causeway to Finucane Island.
1 November 2007	1	80 min	Roadside verge. *Triodia* with open *Acacia* shrubs.
2 November 2007	1	80 min	Site 8 – Riverine. *Eucalyptus* over *Triodia.*
7 November 2007	1	80 min	Bridge crossing ephemeral creek. Open *Eucalyptus* woodland over open *Triodia.*
8 November 2007	1	80 min	Quarry with standing water.

Appendix E3 – AnaBat II Locations for Winter Survey

Date	AnaBat II #	GPS Coordinates	
		#Easting	#Northing
11 May 2008	1	669171	7731747
11 May 2008	2	665330	7744940
12 May 2008	3	663432	7740184
14 May 2008	4	672037	7729112
14 May 2008	5	671008	7717595
15 May 2008	6	660903	7753831
15 May 2008	7	661628	7743250

Australian Geocentric 1994 (GDA94), Zone 50K.

Appendix E4 – AnaBat II Recording Details for Winter Survey

Date	AnaBat II #	Duration	Habitat
11 May 2008	1	610 min	Billabong
11 May 2008	2	610 min	Bridge
12 May 2008	3	610 min	Waterhole
14 May 2008	4	610 min	Quarry
14 May 2008	5	610 min	Mangroves
15 May 2008	6	610 min	Bridge
15 May 2008	7	610 min	Bridge

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APPENDIX F
SITE-SPECIFIC CAPTURES

PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT

APPENDIX F

SITE SPECIFIC CAPTURES

Appendix F1 – Site-Specific Captures for Summer Survey

Quantum SKM **Site:** 2

Described by MW **Date:** 12/10/07-09/11/07 **Type:** Trap Site 30x100m
Season: Summer
Location: Port Hedland
MGA Zone: 50 671526 **mE** 7731265 **mN**
Habitat: Roadside Verge.
Soil
Rock Type
Vegetation: Open *Acacia* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Ne	No	Opp
Mammals								
Dasykaluta rosamondae				1				
Mus musculus	2	2		10				
Pseudomys hermannsburgensis				1				
Reptiles								
Carlia triacantha		1						
Ctenophorus isolepis isolepis	1							1
Ctenotus duricola	1							
Ctenotus helenae		1			2			
Ctenotus pantherinus	6	2			9			
Ctenotus saxatilis	3	1			20			
Diplodactylus conspicillatus	6				1			
Diporiphora winneckei	2	1			1			
Heteronotia binoei		1						
Lialis burtonis					1			
Morethia ruficauda		1			1			
Proablepharus reginae	1							
Pseudonaja modesta					1			
Ramphotyphlops grypus		1						
Varanus acanthurus		2		4	2			
Varanus brevicauda	1							

Quantum SKM Site 3

Described by MW **Date:** 12/10/07-09/11/07 **Type:** Trap Site 30x100m
Season: Summer
Location: Port Hedland
MGA Zone: 50 664747 **mE** 7735183 **mN**
Habitat: Sand Plain.
Soil
Rock Type
Vegetation: Scattered mixed *Acacia* shrubs over a low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes

Habitat:	Logs:	Leaves:	Twigs:	Rocks:	Rock sheet:	Litter:	Bare:

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Ne	No	Opp
Mammals								
Notomys alexis				1				
Reptiles								
Ctenophorus isolepis isolepis		4			1			
Ctenotus duricola					1			
Ctenotus grandis	1				1			
Ctenotus helenae		1			1			
Ctenotus pantherinus	1	3			9			
Ctenotus saxatilis					1			
Diplodactylus conspicillatus	11	8			11			
Lucasium stenodactylum		2						
Diporiphora winneckei					1			
Eremiascincus fasciolatus		1						
Gehyra variegata	2	1			2			
Lerista bipes	12	13			3			
Lialis burtonis	1							
Pogona minor					1			
Pseudechis australis					2			
Pygopus nigriceps					1			
Simoselaps anomalus					1			
Varanus acanthurus				1	1			
Varanus eremius	1				1			

Quantum SKM Site 4

Described by MW **Date:** 12/10/07-09/11/07 **Type:** Trap Site 30x100m
Season: Summer
Location: Port Hedland
MGA Zone: 50 661639 **mE** 7738270 **mN**
Habitat: Sand Plain.
Soil
Rock Type
Vegetation: A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rocksheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Ne	No	Opp
Mammals								
Mus musculus				5				
Notomys alexis				1				
Pseudomys hermannsburgensis				1				
Reptiles								
Ctenotus grandis					1			
Ctenotus pantherinus	1	1			2			
Ctenotus saxatilis					1			
Diplodactylus conspicillatus	2	2			2			
Lucasium stenodactylum	1							
Eremiascincus fasciolatus	1	2			3			
Gehyra variegata					1			
Lerista bipes	16	6			1			
Pogona minor subsp. mitchelli					1			
Ramphotyphlops grypus	1							
Varanus acanthurus	1							
Varanus eremius	1				2			

Quantum SKM Site 5

Described by MW **Date:** 12/10/07-09/11/07 **Type:** Trap Site 30x100m
Season: Summer
Location: Port Hedland
MGA Zone: 50 662788 **mE** 7739999 **mN**
Habitat: Sand plain.
Soil
Rock Type
Vegetation: A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Ne	No	Opp
Mammals								
Pseudomys hermannsburgensis				1				
Reptiles								
Ctenophorus isolepis isolepis		2			1			
Ctenotus grandis		1						
Ctenotus pantherinus	1				3			
Diplodactylus conspicillatus	1	2						
Lucasium stenodactylum	2	4						
Eremiascincus fasciolatus		2						
Heteronotia binoei		1						
Lerista bipes	23	29			4			
Varanus eremius					1			
Varanus gouldii				1	1			

Quantum SKM Site 6

Described by MW **Date:** 12/10/07-09/11/07 **Type:** Trap Site 30x100m
Season: Summer
Location: Port Hedland
MGA Zone: 50 661418 **mE** 7745816 **mN**
Habitat: Tidal Drainage Line.
Soil
Rock Type
Vegetation: Low *Eucalyptus* woodland over an *Acacia tumida* shrubland over a mixed herbland and mixed grassland. Some areas of Samphire.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Ne	No	Opp
Amphibia								
Notaden nichollsi	1							
Mammals								
Pseudomys hermannsburgensis				1				
Reptiles								
Carlia triacantha	1	1			1			
Ctenophorus isolepis isolepis	2	2			1			
Ctenophorus nuchalis					1			
Ctenotus duricola	1	2			3			
Ctenotus grandis		1						
Ctenotus pantherinus	2	2			2			
Ctenotus saxatilis	8	4			12			
Delma tincta					1			
Demansia psammophis		1						
Demansia rufescens					1			
Diplodactylus conspicillatus	4	4						
Lucasium stenodactylum	1							
Diporiphora winneckei	1							
Gehyra variegata	1	2			6			
Heteronotia binoei		2						
Lerista bipes	17	31			7			
Menetia greyii	1							
Nephrurus levis pilbarensis		1						
Pogona minor subsp. minor	1							
Pseudechis australis					1			
Ramphotyphlops ammodytes	1							
Strophurus ciliaris aberrans	1				2			

Quantum SKM Site 7

Described by MW **Date:** 12/10/07-09/11/07 **Type:** Trap Site 30x100m
Season: Summer
Location: Port Hedland
MGA Zone: 50 656473 **mE** 7744246 **mN**
Habitat: Sand Plain.
Soil
Rock Type
Vegetation: A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Ne	No	Opp
Amphibia								
Notaden nichollsi		2						
Mammals								
Dasykaluta rosamondae				1	1			
Notomys alexis		1						
Pseudomys hermannsburgensis				1				
Sminthopsis youngsoni		1						
Reptiles								
Carlia triacantha	1	1			3			
Ctenophorus isolepis isolepis	2	1			1			
Ctenotus duricola	1	3						
Ctenotus grandis	2							
Ctenotus pantherinus	5	1			14			
Ctenotus saxatilis		1			1			
Ctenotus serventyi	1							
Demansia rufescens	1							
Diplodactylus conspicillatus					4			
Lerista bipes	2	13			2			
Menetia greyii		1						
Nephrurus levis pilbarensis		1			3			
Pogona minor		1						
Pseudechis australis					2			
Tiliqua multifasciata			1					
Varanus brevicauda	1	1						

Quantum SKM Site 9

Described by MB **Date:** 12/10/07-09/11/07 **Type:** Trap Site 30x100m

Season: Summer

Location: Finucane Island

MGA Zone: 50 662156 **mE** 7754542 **mN**

Habitat: Sand Dune.

Soil: Sandy.

Rock Type

Vegetation: Scattered *Crotalaria cunninghamii* shrubs over a **Cenchrus ciliaris* grassland. *Triodia* with sparse small shrubs.

Vegetation Condition

Fire Age

Notes

Habitat: **Logs:** 0 **Leaves:** 1 **Twigs:** 0 **Rocks:** 0 **Rock sheet:** 0 **Litter:** **Bare:** 50

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Ne	No	Opp
Mammals								
Pseudomys hermannsburgensis		1	1	38				
Zyzomys argurus		1						
Reptiles								
Ctenotus duricola		1						
Ctenotus saxatilis	4				8			
Ctenotus serventyi	1	1			2			
Eremiascincus fasciolatus	18	11			20			
Gehyra variegata	1							
Lerista bipes	23	63			7			
Lerista muelleri	6	5						
Menetia greyii	1				1			
Pseudechis australis					2			
Ramphotyphlops grypus	2							
Varanus gouldii			3		1			

Quantum SKM Site 10

Described by MW **Date:** 12/10/07-09/11/07 **Type:** Trap Site 30x100m
Season: Summer
Location: Port Hedland
MGA Zone: 50 666721 **mE** 7734911 **mN**
Habitat: Riverine.
Soil
Rock Type
Vegetation: A low open *Eucalyptus* woodland over a mixed shrubland over a mixed herbland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Ne	No	Opp
Amphibia								
Cyclorana maini		1						
Notaden nichollsi	3	5						
Uperoleia russelli	1							
Mammals								
Mus musculus				7				
Notomys alexis				2				
Reptiles								
Amphibolurus longirostris					3			
Ctenophorus nuchalis		1						
Ctenotus saxatilis	7			1	30			
Delma butleri	1							
Diporiphora winneckei	1							
Eremiascincus fasciolatus		7						
Gehyra variegata					1			
Lerista bipes	14	11			2			
Morethia ruficauda					3	3		
Morethia ruficauda subsp. exquisita		2						
Pseudechis australis					1			
Strophurus ciliaris aberrans	2	1			3			
Varanus acanthurus					1			

Appendix F2 – Site Specific Captures for Winter Survey

Quantum SKM **Site** Bat Observations
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Opportunistic
Season: Winter
Location: Port Hedland
MGA Zone **mE** **mN**
Habitat
Soil
Rock Type
Vegetation
Vegetation Condition
Fire Age
Notes: Data recorded using Anabat II bat recorders and analysed by Bob Bullen.
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Mammals								
Chaerephon jobensis								
Chalinolobus gouldii								
Mormopterus beccarii								
Mormopterus loriae subsp. cobourgiana								
Nyctophilus geoffroyi								
Saccolaimus flaviventris								
Scotorepens greyii								
Taphozous georgianus								
Vespadelus finlaysoni								

Quantum SKM **Site** Bird Observations
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Opportunistic
Season: Winter
Location: Port Hedland
MGA Zone **mE** **mN**
Habitat
Soil
Rock Type
Vegetation
Vegetation Condition
Fire Age
Notes: Avifauna observations and opportunistic observations made across the project area by Ornithologist.
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Birds								
Aegotheles cristatus							1	
Anthus australis								2
Aquila audax								2
Aquila morphnoides								1
Ardea alba								1
Ardea garzetta								5
Ardea novaehollandiae								6
Ardea sacra								3
Artamus cinereus								16
Artamus superciliosus								15
Cacatua roseicapilla								24
Cacatua sanguinea								20
Certhionyx niger								2
Charadrius leschenaultii								3
Charadrius melanops								7
Coracina novaehollandiae								8
Corvus orru								7
Cuculus pallidus								3
Dromaius novaehollandiae								1
Elanus caeruleus								2
Emblema pictum								1
Eopsaltria pulverulenta								3
Eremiornis carteri								2
Eurostopodus argus								1
Falco berigora								2
Falco cenchroides								5
Geopelia cuneata								1
Geopelia striata								6
Geophaps plumifera								21
Grallina cyanoleuca								14
Haematopus fuliginosus								6
Haematopus longirostris								4
Haliaeetus leucogaster								3
Haliastur indus								7
Haliastur sphenurus								1
Hirundo ariel								6
Hirundo nigricans								21
Lalage tricolor								2
Larus novaehollandiae								12
Lichenostomus penicillatus								11
Lichenostomus virescens								33
Lichmera indistincta								8
Malurus lamberti								11
Malurus leucopterus								44
Manorina flavigula								10
Melopsittacus undulatus								73
Merops ornatus								17

Milvus migrans	4
Mirafra javanica	1
Nymphicus hollandicus	25
Ocyphaps lophotes	28
Pachycephala lanioides	4
Pelecanus conspicillatus	2
Phalacrocorax melanoleucos	8
Phalacrocorax varius	12
Rhipidura leucophrys	12
Rhipidura phasiana	2
Sterna (albifrons) sinensis	1
Sterna bengalensis	56
Sterna caspia	1
Sterna nilotica subsp. affinis	2
Tachybaptus novaehollandiae	3
Taeniopygia guttata	96
Todiramphus chloris	2
Todiramphus pyrrhopygia	2
Todiramphus sanctus	2
Threskiornis molucca	1
Zosterops luteus	24
Arenaria interpres	2
Tringa breviceps	3
Tringa cinerea	3
Tringa stagnatilis	3
Numenius phaeopus	3
Reptiles	
Egernia depressa	4

Quantum SKM **Site** Opportunistic Observations
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Opportunistic
Season: Winter
Location: Port Hedland
MGA Zone **mE** **mN**
Habitat
Soil
Rock Type
Vegetation
Vegetation Condition
Fire Age
Notes: Opportunistic observations made across the project area by survey team.
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Amphibia								
Cyclorana australis							11	2
Cyclorana maini							3	2
Limnodynastes spenceri							1	1
Litoria rubella							4	2
Notaden nichollsi							4	
Birds								
Aegotheles cristatus								1
Ardeotis australis								3
Dromaius novaehollandiae								1
Eurostopodus argus								1
Falco berigora								1
Mammals								
Bos taurus								1
Canis lupus								1
Macropus robustus							2	7
Reptiles								
Amphibolurus longirostris								1
Aspidites melanocephalus								1
Aspidites ramsayi								1
Ctenophorus isolepis isolepis								1
Ctenophorus nuchalis								2
Gehyra punctata								1
Gehyra variegata							2	1
Tiliqua multifasciata								1
Varanus acanthurus								1

Quantum SKM **Site** 2
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Port Hedland
MGA Zone: 50 671526 **mE** 7731265 **mN**
Habitat: Roadside verge
Soil
Rock Type
Vegetation: Open *Acacia* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Mammals								
Dasykaluta rosamondae				5	2			
Mus musculus				1				
Pseudomys hermannsburgensis				1				
Pseudomys nanus				1				
Reptiles								
Ctenophorus isolepis isolepis					1			1
Ctenotus helenae	1	1						
Ctenotus pantherinus	5	8			12			
Ctenotus saxatilis	7	4		2	16			1
Delma butleri					1			
Lucasium stenodactylum		1						
Diporiphora winneckei	10	2						1
Eremiascincus fasciolatus					1			
Heteronotia binoei		3			3			
Morethia ruficauda		1						
Morethia ruficauda subsp. exquisita		1						
Pseudonaja modesta		1						
Varanus acanthurus					2			
Varanus gouldii								1

Quantum SKM **Site** 3
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Port Hedland
MGA Zone: 50 664747 **mE** 7735183 **mN**
Habitat: Sand Plain.
Soil
Rock Type
Vegetation: Scattered mixed *Acacia* shrubs over a low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Mammals								
Notomys alexis	1			5				
Pseudomys hermannsburgensis				2	1			
Reptiles								
Ctenophorus isolepis isolepis	6	2	1		1			
Ctenotus duricola		2			1			
Ctenotus grandis		1						
Ctenotus grandis subsp. titan		1			3			
Ctenotus helenae		2			3			
Ctenotus pantherinus	6	9			25			
Ctenotus piankai	2	4						
Ctenotus saxatilis	1	5			4			
Demansia psammophis					1			
Diplodactylus conspicillatus	2	1			2			
Lucasium stenodactylum					1			
Diporiphora winneckei	1	1						
Gehyra variegata					1			
Lerista bipes	5	5			1			
Pogona minor subsp. minor	1							
Pogona minor subsp. mitchelli					1			2
Pseudonaja modesta		2			5			
Pseudonaja nuchalis					1			
Varanus eremius	1				1			

Quantum SKM **Site** 4
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Port Hedland
MGA Zone: 50 661639 **mE** 7738270 **mN**
Habitat: Sand Plain.
Soil
Rock Type
Vegetation: A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Mammals								
Dasykaluta rosamondae				4				
Mus musculus	1			2	1			
Notomys alexis				1				
Pseudomys hermannsburgensis	1			4	1			
Reptiles								
Carlia triacantha		1			2			
Ctenophorus isolepis isolepis	1	2						2
Ctenotus grandis	1				1			
Ctenotus grandis subsp. titan					1			
Ctenotus helenae		1			1			
Ctenotus pantherinus	2	4			7			
Ctenotus rufescens		1						
Ctenotus saxatilis	4	3			2			
Ctenotus serventyi		2						
Diplodactylus conspicillatus	1							
Lucasium stenodactylum		1						
Diporiphora winneckei	1							
Eremiascincus fasciolatus		2						
Lerista bipes	2	4		1				
Pogona minor subsp. minor	1							
Ramphotyphlops ammodytes	1							
Ramphotyphlops grypus	1							
Varanus acanthurus					2			
Varanus eremius	1	1			1			

Quantum SKM **Site** 5
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Port Hedland
MGA Zone: 50 662788 **mE** 7739999 **mN**
Habitat: Sand Plain.
Soil
Rock Type
Vegetation: A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Amphibia								
Notaden nichollsi	1							
Mammals								
Dasykaluta rosamondae				2	3			
Notomys alexis				6				
Pseudomys desertor				1	1			
Pseudomys hermannsburgensis	1							
Pseudomys nanus				2				
Reptiles								
Carlia triacantha		2			1			
Ctenophorus isolepis isolepis	1							
Ctenotus grandis	1							
Ctenotus grandis subsp. titan		1						
Ctenotus pantherinus		3			1			
Ctenotus saxatilis	3	2			6			
Ctenotus serventyi					1			
Demansia psammophis					1			
Diplodactylus conspicillatus					1			
Diporiphora winneckei	1							
Eremiascincus fasciolatus		2			1			
Lerista bipes	6	12			1			
Morethia ruficauda	1							
Pseudonaja nuchalis					1			
Varanus acanthurus					2			
Varanus bushi	1							
Varanus gouldii					1			

Quantum SKM **Site** 6
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Port Hedland
MGA Zone: 50 661418 **mE** 7745816 **mN**
Habitat: Tidal Drainage Line.
Soil
Rock Type
Vegetation: Low *Eucalyptus* woodland over an *Acacia tumida* shrubland over a mixed herbland and mixed grassland. Some areas of Samphire.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Mammals								
Macropus robustus								2
Mus musculus				1				
Reptiles								
Carlia triacantha				1				
Ctenophorus isolepis isolepis	1	1						
Ctenotus duricola	1							
Ctenotus grandis	1							
Ctenotus helenae		1			1			
Ctenotus pantherinus					12			
Ctenotus rufescens		1			1			
Ctenotus saxatilis	3	7			2			
Ctenotus serventyi	1				1			
Delma butleri					1			
Diplodactylus conspicillatus		1			1			
Diporiphora winneckei	1							
Lerista bipes	8	18		1	3			
Menetia greyii	1	2						
Nephrurus levis pilbarensis	2				1			
Strophurus ciliaris aberrans					1			
Varanus acanthurus					1			
Varanus eremius	1							

Quantum SKM **Site** 7
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Port Hedland
MGA Zone: 50 656473 **mE** 7744246 **mN**
Habitat: Sand Plain.
Soil
Rock Type
Vegetation: A low open *Acacia stellaticeps* shrubland over a *Triodia* hummock grassland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Amphibia								
Notaden nichollsi	4	10						
Mammals								
Dasykaluta rosamondae			1	7				
Mus musculus				1				
Pseudomys hermannsburgensis				3				
Pseudomys nanus				1				
Reptiles								
Carlia triacantha	1	1			2			
Ctenophorus isolepis isolepis	2							
Ctenotus duricola	2							
Ctenotus grandis					1			
Ctenotus grandis subsp. titan					2			
Ctenotus helenae					1			
Ctenotus pantherinus	1	6			9			
Ctenotus rufescens	1							
Ctenotus saxatilis	3				1			
Delma tincta	1							
Diplodactylus conspicillatus	2	2			4			
Lerista bipes	1	3			1			

Quantum SKM Site 9

Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Finucane Island
MGA Zone: 50 662156 **mE** 7754542 **mN**
Habitat: Sand Dune
Soil: Sandy
Rock Type
Vegetation: Scattered *Crotalaria cunninghamii* shrubs over a **Cenchrus ciliaris* grassland. *Triodia* with sparse small shrubs
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** 0 **Leaves:** 1 **Twigs:** 0 **Rocks:** 0 **Rock sheet:** 0 **Litter:** **Bare:** 50

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Mammals								
Mus musculus	1			9				
Pseudomys hermannsburgensis		1		3				
Reptiles								
Ctenotus saxatilis	3	4		1	24			
Ctenotus serventyi	2	11			4			
Delma butleri	1							
Eremiascincus fasciolatus	3	9			9			
Heteronotia binoei		1						
Lerista bipes	22	22			4			
Lerista muelleri	5	6			2			
Menetia greyii	1							
Pseudonaja modesta					1			
Ramphotyphlops grypus	2							

Quantum SKM **Site** 10
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Port Hedland
MGA Zone 50 666721 **mE** 7734911 **mN**
Habitat: Riverine
Soil
Rock Type
Vegetation: A low open *Eucalyptus* woodland over a mixed shrubland over a mixed herbland.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Amphibia								
Notaden nichollsi	2	7						
Mammals								
Dasykaluta rosamondae				5				
Mus musculus				2				
Notomys alexis	1			2	1			
Pseudomys desertor				1				
Pseudomys hermannsburgensis				1				
Pseudomys nanus					1			
Reptiles								
Amphibolurus longirostris	1				4			
Ctenophorus isolepis isolepis	1	1						
Ctenotus pantherinus	2	2						
Ctenotus saxatilis	5	10			19			
Diporiphora winneckei	2	1			1			
Eremiascincus fasciolatus	6	4			3			
Lerista bipes	3	12			2			
Morethia ruficauda		1						
Pogona minor		1						
Tiliqua multifasciata				1				
Varanus acanthurus		1			1			

Appendix F3 – Additional Site Specific Captures for the Winter Survey

Quantum SKM **Site** 13
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Port Hedland
MGA Zone **mE** **mN**
Habitat
Soil
Rock Type
Vegetation
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** **Rocks:** **Rock sheet:** **Litter:** **Bare:**

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Mammals								
Dasykaluta rosamondae				5	2			
Pseudomys hermannsburgensis	1			7	2			
Sminthopsis youngsoni	1							
Reptiles								
Ctenophorus isolepis isolepis	3	2						1
Ctenotus duricola	2	2						
Ctenotus helenae	4	3			2			
Ctenotus pantherinus	4	9			8			1
Ctenotus piankai	1							
Ctenotus rufescens		1						
Ctenotus saxatilis	1	1			2			
Diplodactylus conspicillatus		1						
Lucasium stenodactylum	3							
Diporiphora winneckei	5							
Morethia ruficauda	2	2			1			
Pogona minor					1			
Pseudechis australis					1			
Pseudonaja modesta		1			1			
Ramphotyphlops ammodytes					1			
Varanus acanthurus	1				1			
Varanus eremius	1				1			

Quantum SKM **Site** 15
Described by: MB **Date:** 05/05/08-16/05/08 **Type:** Trap Site 30x100m
Season: Winter
Location: Port Hedland
MGA Zone: 50 656244 **mE** 7737652 **mN**
Habitat: Acacia/Spinifex Plains.
Soil: Sand
Rock Type
Vegetation: Scattered Desert Oak over a thick *Acacia stellaticeps* under storey with a moderate cover of spinifex.
Vegetation Condition
Fire Age
Notes
Habitat: **Logs:** **Leaves:** **Twigs:** 1 **Rocks:** **Rock sheet:** **Litter:** 5 **Bare:** 40

Effort:

Species List: Number of individuals by Observation Type

Name	Pit	Pot	Ca	Ell	Fu	Net	No	Opp
Mammals								
Dasykaluta rosamondae				2				
Notomys alexis				3				
Pseudomys hermannsburgensis				2				
Reptiles								
Ctenophorus isolepis isolepis	4	1						
Ctenotus duricola	1							
Ctenotus grandis	2				7			
Ctenotus grandis subsp. titan	1							
Ctenotus helenae	1	1						
Ctenotus pantherinus	1	2			3			
Ctenotus rufescens	1							
Ctenotus saxatilis		1			1			
Ctenotus serventyi	1	5			1			
Lucasium stenodactylum	1							
Lerista bipes	16	12			4			
Menetia greyii	1							
Pogona minor		1						
Simoselaps anomalus					1			
Varanus eremius	1	1			1			

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APPENDIX G

FAUNA SPECIES EXPECTED AND OBSERVED IN THE PROJECT AREA

PORT HEDLAND OUTER HARBOUR DEVELOPMENT
FAUNA ASSESSMENT

APPENDIX G

Fauna Species Expected and Observed in the Project Area and its Vicinity

Appendix G1 - Mammal Species Expected and Observed

Key:

Western Australian Museum Records: A = Western Australian Museum Records;

Within 50km of Project Area
B= Hedland HBI Project – Boodarie Site- Flora, Vegetation and Vertebrate Fauna (Mattiske 1994);
C= A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour (Biota 2008);
D = Hope Downs Environmental Review (Hope Downs 2002)
E = FMG Stage A Rail Corridor (Biota 2004);

Outside 50km of Project Area
F = Ord Ridley Fauna Assessment (ENV 2007b);
G = Sunrise Hill Biological Survey (cited in *ecologia* Environment 2005);
H = Nimingarra Project Biological Survey (cited in *ecologia* Environment 2005);
I = Cattle Gorge Biological Survey (cited in *ecologia* Environment 2005);
J = Yarrie Biological Survey (cited in *ecologia* Environment 2005);

Current Project Area
K = Port Hedland Outer Harbour Development – Summer Survey (ENV);
L = Port Hedland Outer Harbour Development – Winter Survey (ENV).

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Tachyglossidae (Echidnas)																		
Echidna	*Tachyglossus aculeatus*				LC		x			x						x		
Dasyuridae (Carnivorous Marsupials)																		
Mulgara	*Dasycercus cristicauda*	VU	S1		VU		x								x			
Little Red Kaluta	*Dasykaluta rosamondae*				LC	√	x	x		x	x					x	x	x
Northern Quoll	*Dasyurus hallucatus*	EN	S1		LC		x			x		x	x	x	x	x		
Wongai Ningaui	*Ningaui ridei*				LC						x							
Pilbara Ningaui	*Ningaui timealeyi*				LC	√	x			x	x					x		

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Planigale	*Planigale sp.*						x			x			x	x				
Rory's Pseudantechinus	*Pseudantechinus roryi*						x			x								
Stripe-faced Dunnart	*Sminthopsis macroura*				LC		x	x		x	x			x				
Lesser Hairy-footed Dunnart	*Sminthopsis youngsoni*				LC		x			x	x					x	x	x
Macropodidae (Kangaroos)																		
Spectacled Hare-wallaby	*Lagorchestes conspicillatus leichardti*			P3	LC		x											
Euro	*Macropus robustus*				LC		x	x	x			x	x	x	x	x	x	x
Red Kangaroo	*Macropus rufus*				LC		x	x		x		x			x	x		
Pteropodidae (Fruit bats, Flying Foxes)																		
Little Red Flying-fox	*Pteropus scapulatus*				LC		x										o	
Emballonuridae (Sheathtail-bats)																		
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*				LC		x					x		x			x	x
Common Sheathtail-bat	*Taphozous georgianus*				LC		x					x	x	x	x		x	x
Hill's Sheathtail-bat	*Taphozous hilli*				LC		x									x		
Megadermatidae (Ghost Bat)																		
Ghost Bat	*Macroderma gigas*			P4	VU		x											
Hipposideridae (Leafnosed-bats)																		
Pilbara Leaf-nosed Bat	*Rhinonicteris aurantia*	VU	S1		VU	√	x							x	x			
Vespertilionidae (Ordinary Bats)																		
Gould's Wattled Bat	*Chalinolobus gouldii*				LC		x					x	x	x	x		x	x
Arnhem Long-eared Bat	*Nyctophilus arnhemensis*				LC												x	
Lesser Long-eared Bat	*Nyctophilus geoffroyi*				LC		x					x		x	x		x	x
Little Broad-nosed Bat	*Scotorepens greyii*				LC		x					x	x	x	x		x	x

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Inland Forest Bat	*Vespadelus baverstocki*				LC								x					
Finlayson's Cave Bat	*Vespadelus finlaysoni*				LC		x					x	x	x	x		x	x
Molossidae (Freetail-bats)																		
Northern Freetail-bat	*Chaerephon jobensis*				LC		x					x			x		x	x
Beccari's Freetail-bat	*Mormopterus beccarii*				LC													x
Little Northern Freetail-bat	*Mormopterus loriae cobourgensis*			P1			x										x	x
Muridae (Rodents)																		
Lakeland Downs Mouse	*Leggadina lakedownensis*			P4	LC		x			x	x					x		
House Mouse	**Mus musculus*						x	x		x	x			x	x	x	x	x
Spinifex-hopping Mouse	*Notomys alexis*				LC		x					x					x	x
Western Pebble-mound Mouse	*Pseudomys chapmani*			P4	LC	√	x				x					x		
Delicate Mouse	*Pseudomys delicatulus*				LC		x			x						x		
Desert Mouse	*Pseudomys desertor*				LC		x			x	x				x	x		x
Sandy Inland Mouse	*Pseudomys hermannsburgensis*				LC		x	x		x		o			x	x	x	x
Western Chestnut Mouse	*Pseudomys nanus*				LC		x											x
Common Rock-rat	*Zyzomys argurus*				LC	√	x			x	x	x	x	x	x	x	x	
Leporidae																		
European Rabbit	**Oryctolagus cuniculus*						x										x	
Canidae (Dingo)																		
Dingo	**Canis lupus dingo*						x	x		x				x				
Wild Dog	**Canis lupus familiaris*							x	x								x	x
Fox	**Vulpes vulpes*						x		x								x	
Felidae (Cats)																		
Feral Cat	**Felis catus*						x	x	x	x			x			x	x	

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Equidae (Horses)																		
Donkey	**Equus asinus*						x											
Horse	**Equus caballus*						x	x		x							x	
Camelidae																		
Camel	**Camelus dromedarius*						x			x								
Bovidae (Cattle)																		
European Cattle	**Bos taurus*						x	x	x				x	x		x	x	x

Note: (o) denotes species recorded/observed outside the project area.
(*) denotes introduced species.

Appendix G2 - Reptile Species Expected and Observed

Key:

Western Australian Museum Records: A = Western Australian Museum Records;

Within 50km of Project Area
B= Hedland HBI Project – Boodarie Site- Flora, Vegetation and Vertebrate Fauna (Mattiske 1994);
C= A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour (Biota 2008);
D = Hope Downs Environmental Review (Hope Downs 2002)
E = FMG Stage A Rail Corridor (Biota 2004);

Outside 50km of Project Area
F = Ord Ridley Fauna Assessment (ENV 2007b);
G = Sunrise Hill Biological Survey (cited in *ecologia* Environment 2005);
H = Nimingarra Project Biological Survey (cited in *ecologia* Environment 2005);
I = Cattle Gorge Biological Survey (cited in *ecologia* Environment 2005);
J = Yarrie Biological Survey (cited in *ecologia* Environment 2005);

Current Project Area
K = Port Hedland Outer Harbour Development – Summer Survey (ENV);
L = Port Hedland Outer Harbour Development – Winter Survey (ENV).

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Chelidae (Turtles)																		
Plate-shelled Turtle	*Chelodina steindachneri*						x			x				x				
Agamidae (Dragons)																		
Long-nosed Water Dragon	*Amphibolurus longirostris*						x	x	x	x		x			x	x	x	x
Gilberts Dragon	*Amphibolurus gilberti*																	
Mulga Dragon	*Caimanops amphiboluroides*									x	x							
Ring-tailed Dragon	*Ctenophorus caudicinctus*						x			x	x	x	x	x	x	x	x	
Military Dragon	*Ctenophorus isolepis isolepis*						x	x		x	x	x				x	x	x
Central Netted Dragon	*Ctenophorus nuchalis*						x			x		x	x		x		x	x
Western Netted Dragon	*Ctenophorus reticulatus*						x			x								
	Diporiphora valens					√												
Common Two-lined Dragon	*Diporiphora winneckei*						x							x			x	x
Bearded Dragon	*Pogona minor minor*																x	x
Bearded Dragon	*Pogona minor mitchelli*						x			x		x			x		x	x

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Earless Pebble Dragon	*Tympanocryptis cephalus*						x											
Gekkonidae (Geckoes)																		
Clawless Gecko	*Crenadactylus ocellatus*						x						x					
Fat-tailed Gecko	*Diplodactylus conspicillatus*						x	x		x	x	o	x	x	x	x	x	x
Jewelled Gecko	*Diplodactylus mitchelli*					√	x			x								
	Diplodactylus savagei					√	x			x			x	x	x			
Pale-snouted Gecko	*Lucasium stenodactylum*						x	x		x	x	x		x	x		x	x
	Lucasium wombeyi					√	x			x	x			x	x			
Pilbara Dtella	*Gehyra pilbara*						x											
Spotted Dtella	*Gehyra punctata*						x			x		x	x	x	x	x	x	x
Purple Arid Dtella	*Gehyra purpurascens*						x									x		
Tree Dtella	*Gehyra variegata*						x	x		x	x	x	x	x	x		x	x
Bynoe's Gecko	*Heteronotia binoei*						x	x		x	x				x	x	x	x
Desert Cave Gecko	*Heteronotia spelea*					√	x			x			x	x	x	x		
Smooth Knob-tailed Gecko	*Nephrurus levis pilbarensis*					√	x			x			x	x			x	x
Banded Knob-tailed Gecko	*Nephrurus wheeleri cinctus*					√	x			x								
Marbled Velvet Gecko	*Oedura marmorata*						x			x								
Beaked Gecko	*Rhynchoedura ornata*						x	x		x			x					
Northern Spiny-tailed Gecko	*Strophurus cillaris aberrans*						x			x			x	x			x	x
Jewelled Gecko	*Strophurus elderi*						x			x	x							
	Strophurus jeanae						x			x	x							
	Strophurus wellingtonae									x	x							
Pygopodidae (Legless Lizards)																		
	Delma borea						x							x				
	Delma butleri						x	x										x
	Delma elegans					√	x			x								

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
	Delma haroldi						x			x								
	Delma nasuta						x			x	x							
	Delma pax						x	x		x	x		x					
	Delma tincta						x			x	x	x		x	x		x	x
Burtons snake-lizard	*Lialis burtonis*						x			x			x			x	x	
Hooded Scaly-foot	*Pygopus nigriceps*						x	x		x							x	
Scincidae (Skinks)																		
White-lipped Rainbow Skink	*Carlia munda*						x			x	x		x	x	x	x		
Desert Rainbow Skink	*Carlia triacantha*						x	x		x	x		x		x		x	x
Buchanan's snake-eyed Skink	*Cryptoblepharus buchani*																	
Peron's snake-eyed Skink	*Cryptoblepharus plagiocephalus*																	
Russet snake-eyed Skink	*Cryptoblepharus ustulatus*																	
Spiny-palmed Shining Skink	*#Cryptoblepharus carnabyi*						x											
	#Cryptoblepharus plagiocephalus						x			x						x		
	Ctenotus aff. *robustus*									x								
	Ctenotus aff. uber johnstonei									x								
	Ctenotus ariadnae									x	x							
	Ctenotus duricola					√	x			x	x						x	x
	Ctenotus grandis titan					√	x	x		x	x						x	x
	Ctenotus helenae						x			x	x			x			x	x
Leopard Skink	*Ctenotus pantherinus ocellifer*						x	x		x	x	x				x	x	x
	Ctenotus piankai						x	x							x			x
	Ctenotus robustus						x											
	Ctenotus rubicundus					√	x			x			x	x				
	Ctenotus rufescens					√	x			x								x
Rock Ctenotus	*Ctenotus saxatilis*						x	x		x	x	x	x	x	x	x	x	x
	Ctenotus serventyi						x										x	x

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Spinifex-slender Blue Tongue	*Cyclodomorphus melanops melanops*						x			x	x					x		
Pygmy Spiny-tailed Skink	*Egernia depressa*						x			x		x	x	x		x	x	x
Goldfields Crevice Skink	*Egernia formosa*						x											
	Egernia pilbarensis					√	x			x								
Nocturnal Desert Skink	*Egernia striata*						x											
Narrow-banded Sand Swimmer	*Eremiascincus fasciolatus*						x							x			x	x
Broad-banded Sand Swimmer	*Eremiascincus richardsonii*						x			x								
	Lerista aff. bipes									x								
	Lerista bipes					√	x	x		x	x		x	x	x	x	x	x
	Lerista muelleri					√	x			x	x		x	x	x		x	x
Common Dwarf Skink	*Menetia greyii*						x	x		x	x			x			x	x
	Menetia surda						x											
	Morethia ruficauda exquisita					√	x	x		x						x	x	x
	Notoscincus ornatus ornatus						x	x		x								
	Proablepharus reginae						x			x	x							
Desert Bluetongue	*Tiliqua multifasciata*						x	x		x							x	x
Varanidae (Monitors)																		
Ridge-tailed Monitor	*Varanus acanthurus*						x	x		x		x		x	x		x	x
	Varanus aff. gilleni									x								
Short-tailed Monitor	*Varanus brevicauda*						x			x							x	
Pilbara Goanna	*Varanus bushi*					√	x											x
Pygmy Monitor	*Varanus caudolineatus*						x							x				
Desert Pygmy Monitor	*Varanus eremius*						x			x	x			x			x	x
Perentie	*Varanus giganteus*						x			x		x	x	x	x		x	
Sand Monitor	*Varanus gouldii*						x	x		x	x		x				x	x
Yellow-spotted Monitor	*Varanus panoptes rubidus*						x			x				x		x		

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Pilbara Rock Monitor	*Varanus pilbarensis*					√	x						x			x		
Black-headed Monitor	*Varanus tristis tristis*						x			x			x		x			
Typhlopidae (Blind Snakes)																		
	Ramphotyphlops ammodytes					√	x	x		x	x						x	x
	Ramphotyphlops ganei			P1		√	x											
Beaked Blind Snake	*Ramphotyphlops grypus*						x			x	x					x	x	x
	Ramphotyphlops hamatus						x											
Pilbara Blind Snake	*Ramphotyphlops pilbarensis*					√	x											
Boidae (Pythons)																		
Pygmy Python	*Antaresia perthensis*						x			x		x	x		x		x	
Stimson's Python	*Antaresia stimsoni stimsoni*						x			x			x	x				
Black-headed Python	*Aspidites melanocephalus*						x			x								x
Woma	*Aspidites ramsayi*		S4	P1	EN		x			x								x
Elapidae (Front-fanged Snakes)																		
Desert Death Adder	*Acanthophis pyrrhus*						x					x			x			
Pilbara Death Adder	*Acanthophis wellsi*					√	x			x							x	
Shovel-nosed Snake	*Brachyurophis approximans*						x			x	x			x			x	
Yellow-faced Whip-Snake	*Demansia psammophis*						x			x	x	x	x	x		x	x	x
Rufous Whip-Snake	*Demansia rufescens*					√	x						x				x	
Moon Snake	*Furina ornata*						x			x	x			x		x		
Mulga Snake	*Pseudechis australis*						x			x					x	x	x	x
Ringed Snake	*Pseudonaja modesta*						x					x	x				x	x
Gwardar	*Pseudonaja nuchalis*						x			x					x		x	x
Desert Banded Snake	*Simoselaps anomalus*						x			x		x		x			x	x
Rosen's Snake	*Suta fasciata*						x			x	x							

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Spotted Snake	*Suta punctata*					√	x			x								
Pilbara Bandy Bandy Snake	*Vermicella snelli*					√	x			x								

Note: (o) denotes species recorded/observed outside the project area.
[#] Taxon name is no longer current (Horner 2007).

Appendix G3 - Amphibian Species Expected and Observed

Key:

Western Australian Museum Records: A = Western Australian Museum Records;

Within 50km of Project Area
B= Hedland HBI Project – Boodarie Site- Flora, Vegetation and Vertebrate Fauna (Mattiske 1994);
C= A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour (Biota 2008);
D = Hope Downs Environmental Review (Hope Downs 2002)
E = FMG Stage A Rail Corridor (Biota 2004);

Outside 50km of Project Area
F = Ord Ridley Fauna Assessment (ENV 2007b);
G = Sunrise Hill Biological Survey (cited in *ecologia* Environment 2005);
H = Nimingarra Project Biological Survey (cited in *ecologia* Environment 2005);
I = Cattle Gorge Biological Survey (cited in *ecologia* Environment 2005);
J = Yarrie Biological Survey (cited in *ecologia* Environment 2005);

Current Project Area
K = Port Hedland Outer Harbour Development – Summer Survey (ENV);
L = Port Hedland Outer Harbour Development – Winter Survey (ENV).

		Conservation Codes																
COMMON NAME	**SCIENTIFIC NAME**	**EPBC**	**WC**	**DEC**	**IUCN**	**Local**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
Hylidae (Tree Dwelling Frogs)																		
Giant Frog	*Cyclorana australis*				LC		x			x		x						x
Mains Frog	*Cyclorana maini*				LC		x			x		x				x	x	x
Water Holding Frog	*Cyclorana platycephala*				LC		x					x						
Roth's Tree-Frog	*Litoria rothii*				LC												o	
Desert Tree-Frog	*Litoria rubella*				LC		x			x		x	x	x	x	x	x	x
Myobatrachidae (Ground Frogs)																		
Spencers Frog	*Opisthodon spenceri*				LC		x			x					x	x		x
Northern Burrowing Frog	*Neobatrachus aquilonius*				LC		x					x						
Desert Spadefoot	*Notaden nichollsi*				LC		x			x	x	x					x	x
Glandular Toadlet	*Uperoleia glandulosa*				LC	√	x					x	x		x			
Russell's Toadlet	*Uperoleia russelli*				LC		x			x	x						x	

Note: (o) denotes species recorded/observed outside the project area.

Appendix G4 - Bird Species Expected and Observed

Key:

Western Australian Museum Records: A = Western Australian Museum Records;

Within 50km of Project Area
B= Hedland HBI Project – Boodarie Site- Flora, Vegetation and Vertebrate Fauna (Mattiske 1994);
C= A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour (Biota 2008);
D = Hope Downs Environmental Review (Hope Downs 2002)
E = FMG Stage A Rail Corridor (Biota 2004);

Outside 50km of Project Area
F = Ord Ridley Fauna Assessment (ENV 2007b);
G = Sunrise Hill Biological Survey (cited in *ecologia* Environment 2005);
H = Nimingarra Project Biological Survey (cited in *ecologia* Environment 2005);
I = Cattle Gorge Biological Survey (cited in *ecologia* Environment 2005);
J = Yarrie Biological Survey (cited in *ecologia* Environment 2005);

Current Project Area
K = Port Hedland Outer Harbour Development – Summer Survey (ENV);
L = Port Hedland Outer Harbour Development – Winter Survey (ENV).

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Casuariidae (Cassowaries and Emus)																		
Emu	*Dromaius novaehollandiae*				LC			x		x	x							x
Phasianidae (Pheasants and Quails)																		
Stubble Quail	*Coturnix pectoralis*				LC						x							
Brown Quail	*Coturnix ypsilophora*				LC							x	x	x	x	x	x	
Anatidae (Ducks, Geese and Swans)																		
Pacific Black Duck	*Anas superciliosa*	Mi			LC					x	x	x			x		o	
Grey Teal	*Anas gracilis*	Mi			LC					x		x			x		o	
Hardhead	*Aythya australis*	Mi			LC										x		o	
Australian Wood Duck	*Chenonetta jubata*	Mi			LC					x								
Black Swan	*Cygnus atratus*	Mi			LC												o	
Plumed Whistling-duck	*Dendrocygna eytoni*	Mi			LC												o	
Pink-eared Duck	*Malacorhynchus membranaceus*	Mi			LC												o	

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Podicipedidae (Grebes)																		
Australia Grebe	*Tachybaptus novaehollandiae*				LC					x							x	x
Anhingidae (Darters)																		
Darter	*Anhinga melanogaster*				NT		x	x		x	x	x					o	
Phalacrocoracidae (Cormorants and Darters)																		
Little Pied Cormorant	*Phalacrocorax melanoleucos*				LC					x		x			x		x	x
Little Black Cormorant	*Phalacrocorax sulcirostris*				LC					x								
Pied Cormorant	*Phalacrocorax varius*				LC			x		x							x	x
Fregatidae																		
Lesser Frigate Bird	*Fregata ariel*	Mi,Ma			LC												x	
Pelecanidae (Pelicans)																		
Australian Pelican	*Pelecanus conspicillatus*	Ma			LC					x		x			x		x	x
Ardeidae (Herons and Bitterns)																		
Great Egret	*Ardea alba*	Ma			LC										x		x	x
White-faced Heron	*Ardea novaehollandiae*				LC			x		x	x	x		x	x	x	x	x
White-necked Heron	*Ardea pacifica*				LC					x		x		x	x			
Striated Heron	*Butorides striatus*				LC					x							x	
Little Egret	*Egretta garzetta*	Ma			LC				x	x							x	x
Eastern Reef Egret	*Egretta sacra*	Mi,Ma			LC					x							x	x
Nankeen Night Heron	*Nycticorax caledonicus*	Ma			LC		x	x		x		x						
Threskiornithidae (Ibises and Spoonbills)																		
Yellow-billed Spoonbill	*Platalea flavipes*				LC		x								x			

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Royal Spoonbill	*Platalea regia*				LC										x			
Glossy Ibis	*Plegadis falcinellus*	Mi,Ma			LC										x			
Australian White ibis	*Threskiornis molucca*	Ma			LC				x	x							x	x
Straw-necked Ibis	*Threskiornis spinicollis*	Ma			LC		x			x					x			
Ciconiidae (Storks)																		
Jabiru	*Ephippiorhynchus asiaticus*				NT					x	x				x			
Accipitridae (Kites, Hawks and Eagles)																		
Collared Sparrowhawk	*Accipiter cirrhocephalus*	Mi			LC						x							
Brown Goshawk	*Accipiter fasciatus*	Mi,Ma			LC					x	x	x		x	x			
Wedge-tailed Eagle	*Aquila audax*	Mi			LC					x	x	x	x				x	x
Swamp Harrier	*Circus approximans*	Mi,Ma			LC				x		x	o						
Spotted Harrier	*Circus assimilis*	Mi			LC			x		x	x	x	x	x	x		x	
Black-shouldered Kite	*Elanus caeruleus*	Mi			LC			x		x	x	x		x		x	x	x
White-bellied Sea Eagle	*Haliaeetus leucogaster*	Mi,Ma			LC			x				x					x	x
Brahminy Kite	*Haliastur indus*	Mi, Ma			LC			x	x	x							x	x
Whistling Kite	*Haliastur sphenurus*	Mi,Ma			LC		x			x	x	x	x	x	x		x	x
Black-breasted Buzzard	*Hamirostra melanosternon*	Mi			LC					x	x							
Little Eagle	*Hieraaetus morphnoides*	Mi			LC					x	x	x	x		x		x	x
Square-tailed Kite	*Lophoictinia isura*	Mi			LC						x							
Black Kite	*Milvus migrans*	Mi			LC			x		x	x	o					x	x
Osprey	*Pandion haliaetus*	Mi,Ma			LC			x							x		x	
Falconidae (Falcons)																		
Australian Kestrel	*Falco cenchroides*	Mi,Ma			LC			x		x	x	x	x	x	x	x	x	x
Brown Falcon	*Falco berigora*	Mi			LC			x		x	x	x	x	x	x	x	x	x
Grey Falcon	*Falco hypoleucos*	Mi		P4	NT						x							
Australian Hobby	*Falco longipennis*	Mi			LC			x		x	x	x		x		x	x	

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Black Falcon	*Falco subniger*	Mi			LC													
Peregrine Falcon	*Falco peregrinus*	Mi	S4		LC					x	x	o						
Rallidae (Waterhens)																		
Buff-banded Rail	*Gallirallus philippensis*				LC		x								x			
Spotted Crake	*Porzana fluminea*				LC								x					
Otidae (Bustards)																		
Australian Bustard	*Ardeotis australis*			P4	NT			x		x	x				x		x	x
Turnicidae (Button-quails)																		
Little Button-quail	*Turnix velox*				LC			x		x	x	x		x		x	x	
Scolopacidae (Sandpipers and Snipes)																		
Common Sandpiper	*Actitis hypoleucos*	Mi,Ma			LC					x		o			x		x	
Ruddy Turnstone	*Arenaria interpres*	Mi,Ma			LC												x	x
Sharp-tailed Sandpiper	*Calidris acuminata*	Mi,Ma			LC		x											
Red Knot	*Calidris canutus*	Mi,Ma			LC												x	
Curlew Sandpiper	*Calidris ferruginea*	Mi,Ma			LC												x	
Pectoral Sandpiper	*Calidris melanotos*	Mi,Ma			LC													
Red-necked Stint	*Calidris ruficollis*	Mi,Ma			LC												x	
Long-toed Stint	*Calidris subminuta*	Mi,Ma			LC													
Great Knot	*Calidris tenuirostris*	Mi,Ma			LC			x									x	
Snipe sp.	*Gallinago sp.*	Mi,Ma					x								x			
Bar-tailed Godwit	*Limosa lapponica*	Mi,Ma			LC												x	
Eastern Curlew	*Numenius madagascariensis*	Mi,Ma		P4	LC			x	x	x							x	
Whimbrel	*Numenius phaeopus*	Mi,Ma			LC			x	x	x							x	x
Grey-tailed tattler	*Tringa brevipes*	Mi			LC					x							x	x
Wood Sandpiper	*Tringa glareola*	Mi,Ma			LC		x								x			

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Common Greenshank	*Tringa nebularia*	Mi,Ma			LC			x							x		x	
Marsh Sandpiper	*Tringa stagnatilis*	Mi,Ma			LC		x							x	x			x
Terek Sandpiper	*Xenus cinereus*	Mi,Ma			LC			x									x	x
Burhinidae (Stone-curlews)																		
Bush Stone-curlew	*Burhinus grallarius*			P4	NT		x			x	x			x	x			
Haematopodidae																		
Sooty Oystercatcher	*Haematopus fuliginosus*				LC												x	x
Pied Oystercatcher	*Haematopus longirostris*				LC					x							x	x
Recurvirostridae (Stilts)																		
Black-winged Stilt	*Himantopus himantopus*	Mi			LC					x	x	x						
Charadriidae (Plovers, Lapwings and Dotterels)																		
Greater Sand Plover	*Charadrius leschenaultii*	Mi			LC			x									x	x
Lesser Sand Plover	*Charadrius mongolus*	Mi			LC												x	
Red-capped Plover	*Charadrius ruficapillus*	Mi			LC					x					x		x	
Oriental Plover	*Charadrius veredus*	Mi			LC			x									x	
Black-fronted Dotterel	*Elseyornis melanops*	Mi			LC					x	x	o			x	x		x
Red-kneed Dotterel	*Erythrogonys cinctus*	Mi			LC		x								x			
Grey Plover	*Pluvialis squatarola*	Mi			LC												x	
Glareolidae (Pratincoles and Old-world Shore Birds)																		
White-winged Black Tern	*Chlidonias leucoptera*	Ma			LC		x					o						
Oriental pratincole	*Glareola maldivarum*	Mi,Ma			LC		x					x						
Silver Gull	*Larus novaehollandiae*	Ma			LC			x		x							x	x
Little Tern	*Sterna albifrons*	Mi,Ma			LC				x								x	x
Lesser Crested Tern	*Sterna bengalensis*	Mi,Ma			LC		x										x	x

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Crested Tern	*Sterna bergii*	Ma			LC		x			x		x					x	
Caspian Tern	*Sterna caspia*	Ma			LC		x			x		o					x	x
Common Tern	*Sterna hirundo*	Mi,Ma			LC		x					o						
Whiskered Tern	*Sterna hybrida*	Ma			LC		x					x					x	
Fairy Tern	*Sterna nereis*	Ma			LC												x	
Gull-billed Tern	*Sterna nilotica affinis*	Ma			LC			x		x							x	x
Columbidae (Pigeons and Doves)																		
Diamond Dove	*Geopelia cuneata*				LC		x			x	x	x	x	x	x	x	x	x
Bar-shouldered Dove	*Geopelia humeralis*				LC					x								
Peaceful Dove	*Geopelia striata placida*				LC		x		x	x		x		x	x		x	x
Spinifex Pigeon	*Geophaps plumifera*				LC		x		x	x	x	x	x	x	x	x	x	x
Crested Pigeon	*Ocyphaps lophotes*				LC			x	x	x	x	x	x	x	x	x	x	x
Common Bronzewing	*Phaps chalcoptera*				LC			x		x			x	x				
Flock Bronzewing	*Phaps histrionica*			P4	LC		x											
Cacatuidae (Cockatoos)																		
Galah	*Cacatua roseicapilla*				LC		x	x		x	x	x	x	x	x	x	x	x
Little Corella	*Cacatua sanguinea*				LC					x	x	x	x	x	x	x	x	x
Psittacidae (Lorikeets and Parrots)																		
Australian Ringneck	*Barnardius zonarius*				LC		x	x		x		x				x		
Budgerigar	*Melopsittacus undulatus*				LC		x	x		x	x	x					x	x
Bourke's Parrot	*Neopsephotus bourkii*				LC		x											
Cockatiel	*Nymphicus hollandicus*				LC			x		x	x	x					x	x
Night Parrot	*Pezoporus occidentalis*	EN	S1		CR		x											
Mulga Parrot	*Psephotus varius*				LC					x								
Cuculidae (Cuckoos)																		

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	Ma			LC		x	x		x	x	x		x	x	x	x	
Black-eared Cuckoo	*Chrysococcyx osculans*	Ma			LC		x			x								
Pallid Cuckoo	*Cuculus pallidus*	Ma			LC		x			x	x	x						x
Centropidae (Coucals)																		
Pheasant Coucal	*Centropus phasianus*				LC		x			x		o	x	x	x		x	
Strigidae (Hawk-owls)																		
Barking Owl	*Ninox connivens*				LC		x											
Southern Boobook Owl	*Ninox novaeseelandiae*	Ma			LC		x	x		x	x	x			x			
Tytonidae (Barn Owls)																		
Barn Owl	*Tyto alba*				LC		x										x	
Podargidae (Frogmouths)																		
Tawny Frogmouth	*Podargus strigoides*				LC		x			x	x						x	
Caprimulgidae (Nightjars)																		
Spotted Nightjar	*Eurostopodus argus*	Ma			LC		x	x		x	x	x	x	x	x	x	x	x
Aegothelidae (Owlet-nightjars)																		
Australian Owlet-nightjar	*Aegotheles cristatus*				LC		x			x	x	x	x	x				x
Apodidae (Swifts)																		
Fork-tailed Swift	*Apus pacificus*	Mi,Ma			LC						x	x						
Halcyonidae (Kingfishers)																		
Blue-winged Kookaburra	*Dacelo leachii*				LC		x			x	x	x	x	x	x			
Collared Kingfisher	*Todiramphus chloris*				LC			x									x	x

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Red-backed Kingfisher	*Todiramphus pyrrhopygia*				LC		x	x		x	x	x	x	x	x	x	x	x
Sacred Kingfisher	*Todiramphus sanctus*	Ma			LC		x	x		x	x	x		x	x		x	x
Meropidae (Bee-eaters)																		
Rainbow Bee-eater	*Merops ornatus*	Mi,Ma			LC		x	x	x	x	x	x	x	x	x	x	x	x
Climacteridae (Treecreepers)																		
Black-tailed Treecreeper	*Climacteris melanura*				LC		x					x						
Maluridae (Fairy-wrens)																		
Striated Grasswren	*Amytornis striatus*				LC		x						x	x	x	x		
Variegated Fairy-wren	*Malurus lamberti*				LC		x	x		x	x	x		x	x	x	x	x
White-winged Fairy-wren	*Malurus leucopterus*				LC		x	x	x	x	x	x	x				x	x
Splendid Fairy-wren	*Malurus splendens*				LC													
Rufous-crowned Emu-wren	*Stipiturus ruficeps*				LC	√	x			x								
Pardalotidae (Pardalotes, Scrubwrens, Gerygones and Thornbills)																		
Inland Thornbill	*Acanthiza apicalis*				LC					x								
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*				LC													
Slaty-backed Thornbill	*Acanthiza robustirostris*				LC					x	x							
Chestnut-rumped Thornbill	*Acanthiza uropygialis*				LC					x	x							
Western Gerygone	*Gerygone fusca mungi*				LC		x			x								
Mangrove Warbler	*Gerygone levigaster*				LC					x								
Dusky Gerygone	*Gerygone tenebrosa*				LC			x									x	
Red-browed Pardalote	*Pardalotus rubricatus*				LC		x	x		x	x	x	x	x	x		x	
Striated Pardalote	*Pardalotus striatus*				LC		x									x		
Redthroat	*Pyrrholaemus fuliginosus*				LC		x											
Weebill	*Smicrornis brevirostris*				LC		x		x	x	x	x						

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Meliphagidae (Honeyeaters)																		
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*				LC		x			x	x							
Black Honeyeater	*Certhionyx niger*				LC					x	x							x
Pied Honeyeater	*Certhionyx variegatus*				LC		x											
Grey Honeyeater	*Conopophila whitei*				LC	√	x											
Orange Chat	*Epthianura aurifrons*				LC													
Crimson Chat	*Epthianura tricolor*				LC		x			x	x							
Grey-headed Honeyeater	*Lichenostomus keartlandi*				LC		x			x			x	x	x	x		
White-plumed Honeyeater	*Lichenostomus penicillatus*				LC		x	x	x	x	x	x	x	x	x	x	x	x
Singing Honeyeater	*Lichenostomus virescens*				LC		x	x	x	x	x	x	x	x	x	x	x	x
Brown Honeyeater	*Lichmera indistincta*				LC		x	x	x	x	x	x	x	x	x	x	x	x
Yellow-throated Miner	*Manorina flavigula*				LC		x	x		x	x	x	x		x	x	x	x
Black-chinned Honeyeater	*Melithreptus gularis*				LC		x					x	x	x	x	x		
White-fronted Honeyeater	*Phylidonyris albifrons*				LC		x											
Petroicidae (Australian Robins)																		
Mangrove Robin	*Eopsaltria pulverulenta*				LC			x		x							x	x
Hooded Robin	*Petroica cucullata*				LC		x			x	x							
Red-capped Robin	*Petroica goodenovii*				LC		x			x	x							
Pomatostomidae (Australian Babblers)																		
White-browed Babbler	*Pomatostomus superciliosus*				LC					x	x							
Grey-crowned Babbler	*Pomatostomus temporalis*				LC		x			x		x			x			
Cinclosomatidae (Quail-thrushes)																		
Chestnut-breasted Quail-thrush	*Cinclosoma castaneothorax*				LC						x							
Neosittidae (Sittellas)																		
Varied Sittella	*Daphoenositta chrysoptera*				LC						x							

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Pachycephalidae (Whistlers)																		
Grey Shrike-thrush	*Colluricincla harmonica*				LC		x			x			x	x	x	x		
Crested Bellbird	*Oreoica gutturalis*				LC					x	x							
White-breasted Whistler	*Pachycephala lanioides*				LC			x	x								x	x
Mangrove Golden Whistler	*Pachycephala melanura*				LC			x		x							x	
Rufous Whistler	*Pachycephala rufiventris*				LC		x	x		x	x	x				x		
Dicruridae (Flycatchers)																		
Magpie-Lark	*Grallina cyanoleuca*	Ma			LC			x	x	x	x	x	x	x	x	x	x	x
Grey Fantail	*Rhipidura fuliginosa*				LC		x											
Willie Wagtail	*Rhipidura leucophrys*				LC		x	x	x	x	x	x	x	x	x	x	x	x
Mangrove Grey Fantail	*Rhipidura phasiana*				LC		x	x		x							x	x
Campephagidae (Cuckoo-shrikes)																		
Ground Cuckoo-shrike	*Coracina maxima*				LC													
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	Ma			LC			x	x	x	x	x	x	x	x	x	x	x
White-winged Triller	*Lalage tricolor*				LC		x			x	x	x	x	x	x		x	x
Artamidae (Woodswallows)																		
Black-faced Woodswallow	*Artamus cinereus*				LC		x	x		x		x	x	x	x	x	x	x
White-breasted Woodswallow	*Artamus leucorynchus*				LC		x	x	x		x						x	
Little Woodswallow	*Artamus minor*				LC					x		x	x	x	x	x		
Masked Woodswallow	*Artamus personatus*				LC					x	x							
White-browed Woodswallow	*Artamus superciliosus*				LC					x								x
Pied Butcherbird	*Cracticus nigrogularis*				LC			x		x	x	x	x	x	x	x		
Australian Magpie	*Gymnorhina tibicen*				LC		x			x	x							
Grey Butcherbird	*Cracticus torquata*				LC					x	x	x						

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Corvidae (Ravens and Crows)																		
Little Crow	*Corvus bennetti*				LC			x		x								
Torresian Crow	*Corvus orru*				LC		x		x		x	x	x	x	x	x	x	x
Western Crow	*Corvus orru cecilae*				LC					x								
Ptilonorhynchidae (Bowerbirds)																		
Western Bowerbird	*Chlamydera guttata*				LC		x			x		x	x	x	x	x		
Hirundinidae (Swallows)																		
Fairy Martin	*Hirundo ariel*				LC		x	x		x	x	x	x	x	x	x	x	x
Tree Martin	*Hirundo nigricans*	Ma			LC			x		x		x		x			x	x
Zosteropidae (White-eyes)																		
Yellow White-eye	*Zosterops luteus*				LC			x		x							x	x
Sylviidae (Old World Warblers)																		
Clamorous Reed Warbler	*Acrocephalus stentoreus*	Mi			LC					x								
Brown Songlark	*Cincloramphus cruralis*	Mi			LC			x		x	x	o		x			x	
Rufous Songlark	*Cincloramphus mathewsi*	Mi			LC		x			x	x	x			x		x	
Spinifex Bird	*Eremiornis carteri*	Mi			LC		x			x	x	x	x	x	x	x	x	x
Alauidae (Songlarks)																		
Singing Bushlark	*Mirafra javanica*				LC		x	x		x	x	x		x	x		x	x
Dicaeidae (Flower-peckers)																		
Mistletoebird	*Dicaeum hirundinaceum*				LC		x				x					x		
Passeridae (Finches and Allies)																		
Painted Finch	*Emblema pictum*				LC		x			x	x	x	x	x	x	x		x

COMMON NAME	SCIENTIFIC NAME	Conservation Codes					A	B	C	D	E	F	G	H	I	J	K	L
		EPBC	WC	DEC	IUCN	Local												
Star Finch	*Neochmia ruficauda clarescens*			P4	NT										x			
Zebra Finch	*Taeniopygia guttata*				LC		x	x	x	x	x	x	x	x	x	x	x	x
Motacillidae (Pipits and True Wagtails)																		
Australian Pipit	*Anthus novaeseelandiae*	Ma			LC			x	x	x	x	x	x		x	x	x	x

Note: (o) denotes species recorded/observed outside the project area.

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APPENDIX H
MAMMAL INVENTORY

PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT

APPENDIX H

MAMMAL INVENTORY

Appendix H1 - Complete Mammal Species Inventory for Survey

Family	Scientific Name	Common Name
DASYURIDAE	*Dasykaluta rosamondae*	Little Red Kaluta
	Sminthopsis youngsoni	Lesser Hairy-footed Dunnart
MACROPODIDAE	*Macropus robustus*	Euro
PTEROPODIDAE	*Pteropus scapulatus*	Little Red Flying-fox
EMBALLONURIDAE	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat
	Taphozous georgianus	Common Sheathtail-bat
VESPERTILIONIDAE	*Chalinolobus gouldii*	Gould's Wattled Bat
	Scotorepens greyii	Little Broad-nosed Bat
	Vespadelus finlaysoni	Finlayson's Cave Bat
	Nyctophilus geoffroyi	Lesser Long-eared Bat
	Nyctophilus arnhemensis	Arnhem Long-eared Bat
MOLOSSIDAE	*Chaerephon jobensis*	Northern Freetail-bat
	Mormopterus beccarii	Beccari's Freetail-bat
	Mormopterus loriae cobourgensis	Little Northern Freetail Bat
MURIDAE	*Mus musculus*	House Mouse
	Notomys alexis	Spinifex-hopping Mouse
	Pseudomys hermannsburgensis	Sandy Inland Mouse
	Pseudomys nanus	Western Chestnut Mouse
	Zyzomys argurus	Common Rock-rat
LEPORIDAE	*Oryctolagus cuniculus*	Rabbit
CANIDAE	*Canis lupus familiaris*	Wild Dog
	Vulpes vulpes	Fox
FELIDAE	*Felis catus*	Feral Cat

Family	Scientific Name	Common Name
EQUIDAE	*Equus caballus*	Horse
BOVIDAE	*Bos taurus*	Cattle

Appendix H2 - Mammal Species Inventory for Summer Survey

Family	Scientific Name	Common Name
DASYURIDAE	*Dasykaluta rosamondae*	Little Red Kaluta
	Sminthopsis youngsoni	Lesser Hairy-footed Dunnart
MACROPODIDAE	*Macropus robustus*	Euro
PTEROPODIDAE	*Pteropus scapulatus*	Little Red Flying-fox
EMBALLONURIDAE	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat
	Taphozous georgianus	Common Sheathtail-bat
VESPERTILIONIDAE	*Chalinolobus gouldii*	Gould's Wattled Bat
	Scotorepens greyii	Little Broad-nosed Bat
	Vespadelus finlaysoni	Finlayson's Cave Bat
	Nyctophilus geoffroyi	Lesser Long-eared Bat
	Nyctophilus arnhemensis	Arnhem Long-eared Bat
MOLOSSIDAE	*Chaerephon jobensis*	Northern Freetail-bat
	Mormopterus loriae cobourgensis	Little Northern Freetail Bat
MURIDAE	*Mus musculus*	House Mouse
	Notomys alexis	Spinifex-hopping Mouse
	Pseudomys hermannsburgensis	Sandy Inland Mouse
	Zyzomys argurus	Common Rock-rat
LEPORIDAE	*Oryctolagus cuniculus*	Rabbit
CANIDAE	*Canis lupus familiaris*	Wild Dog
	Vulpes vulpes	Fox
FELIDAE	*Felis catus*	Feral Cat
EQUIDAE	*Equus caballus*	Horse
BOVIDAE	*Bos taurus*	Cattle

Appendix H3 - Mammal Species Inventory for Winter Survey

Family	Scientific Name	Common Name
DASYURIDAE	*Dasykaluta rosamondae*	Little Red Kaluta
	Sminthopsis youngsoni	Lesser Hairy-footed Dunnart
MACROPODIDAE	*Macropus robustus*	Euro
VESPERTILIONIDAE	*Chalinolobus gouldii*	Gould's Wattled Bat
	Nyctophilus geoffroyi	Lesser Long-eared Bat
	Scotorepens greyii	Little Broad-nosed Bat
	Vespadelus finlaysoni	Finlayson's Cave Bat
MOLOSSIDAE	*Chaerephon jobensis*	Northern Freetail-bat
	Mormopterus beccarii	Beccari's Freetail-bat
	Mormopterus loriae cobourgensis	Little Northern Freetail-bat
MURIDAE	*Mus musculus*	House Mouse
	Notomys alexis	Spinifex-hopping Mouse
	Pseudomys desertor	Desert Mouse
	Pseudomys hermannsburgensis	Sandy Inland Mouse
	Pseudomys nanus	Western Chestnut Mouse
CANIDAE	*Canis lupus familiaris*	Wild Dog
BOVIDAE	*Bos taurus*	Cattle

Appendix H4 - Mammal Species Inventory for Additional Areas

Family	Scientific Name	Common Name
DASYURIDAE	*Dasykaluta rosamondae*	Little Red Kaluta
	Sminthopsis youngsoni	Lesser Hairy-footed Dunnart
MURIDAE	*Notomys alexis*	Spinifex-hopping Mouse
	Pseudomys hermannsburgensis	Sandy Inland Mouse

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APPENDIX I
REPTILE INVENTORY

PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT

APPENDIX I

REPTILE INVENTORY

Appendix I1 - Complete Reptile Species Inventory for Survey

Family	Scientific Name	Common Name
AGAMIDAE	*Amphibolurus longirostris*	Long-nosed Water Dragon
	Ctenophorus caudicinctus	Ring-tailed Dragon
	Ctenophorus isolepis isolepis	Military Sand Dragon
	Ctenophorus nuchalis	Central Netted Dragon
	Diporiphora winneckei	Common Two-lined Dragon
	Pogona minor minor	Bearded Dragon
	Pogona minor mitchelli	Bearded Dragon
GEKKONIDAE	*Diplodactylus conspicillatus*	Fat-tailed Gecko
	Gehyra punctata	Spotted Dtella
	Gehyra variegata	Tree Dtella
	Heteronotia binoei	Bynoe's Gecko
	Lucasium stenodactylum	Pale-snouted Ground Gecko
	Nephrurus levis pilbarensis	Common Knob-tailed Gecko
	Strophurus ciliaris aberrans	Northern Spiny-tailed Gecko
PYGOPODIDAE	*Delma butleri*	Unbanded Delma
	Delma tincta	
SCINCIDAE	*Carlia triacantha*	Desert Rainbow Skink
	Ctenotus duricola	
	Ctenotus grandis titan	
	Ctenotus helenae	
	Ctenotus pantherinus ocellifer	Leopard Ctenotus

Family	Scientific Name	Common Name
	Ctenotus piankai	
	Ctenotus rufescens	
	Ctenotus saxatilis	Rock Ctenotus
	Ctenotus serventyi	
	Egernia depressor	Pygmy Spiny-tailed Skink
	Eremiascincus fasciolatus	Narrow-banded Sand Swimmer
	Lerista bipes	
	Lerista muelleri	
	Menetia greyii	Common Dwarf Skink
	Morethia ruficauda exquisita	Fire-tailed Skink
	Tiliqua multifasciata	
VARANIDAE	*Varanus acanthurus*	Ridge-tailed Monitor
	Varanus brevicauda	Short-tailed Monitor
	Varanus bushi	Bush's Pygmy Monitor
	Varanus eremius	Desert Pygmy Monitor
	Varanus giganteus	Perentie
	Varanus gouldii	Sand Monitor
TYPHLOPIDAE	*Ramphotyphlops ammodytes*	
	Ramphotyphlops grypus	Beaked Blind Snake
BOIDAE	*Aspidites melanocephalus*	Black Headed Python
	Aspidites ramsayi	Woma
ELAPIDAE	*Acanthophis wellsi*	Pilbara Death Adder
	Brachyurophis approximans	Shovel-nosed Snake
	Demansia psammophis	Yellow-faced Whip-Snake
	Demansia rufescens	Rufous Whip-Snake

Family	Scientific Name	Common Name
	Pseudechis australis	Mulga Snake
	Pseudonaja modesta	Ringed Snake
	Pseudonaja nuchalis	Gwardar
	Simoselaps anomalus	Desert Banded Snake

Appendix I2 - Reptile Species Inventory for Summer Survey

Family	Scientific Name	Common Name
AGAMIDAE	*Amphibolurus longirostris*	Long-nosed Water Dragon
	Ctenophorus caudicinctus	Ring-tailed Dragon
	Ctenophorus isolepis isolepis	Military Dragon
	Ctenophorus nuchalis	Central Netted Dragon
	Diporiphora winneckei	Common Two-lined Dragon
	Pogona minor mitchelli	Bearded Dragon
GEKKONIDAE	*Diplodactylus conspicillatus*	Fat-tailed Gecko
	Lucasium stenodactylum	Pale-snouted Gecko
	Gehyra punctata	Spotted Dtella
	Gehyra variegata	Tree Dtella
	Heteronotia binoei	Bynoe's Gecko
	Nephrurus levis pilbarensis	Smooth Knob-tailed Gecko
	Strophurus cillaris abberans	Northern Spiny-tailed Gecko
PYGOPODIDAE	*Delma tincta*	
SCINCIDAE	*Carlia triacantha*	Desert Rainbow Skink
	Ctenotus duricola	
	Ctenotus grandis titan	
	Ctenotus helenae	
	Ctenotus pantherinus ocellifer	

Family	Scientific Name	Common Name
	Ctenotus saxatilis	Rock Ctenotus
	Ctenotus serventyi	
	Egernia depressa	Pygmy Spiny-tailed Skink
	Eremiascincus fasciolatus	Narrow-banded Sand Swimmer
	Lerista bipes	
	Lerista muelleri	
	Menetia greyii	Common Dwarf Skink
	Morethia ruficauda exquisita	
	Tiliqua multifasciata	
VARANIDAE	*Varanus acanthurus*	Ridge-tailed Monitor
	Varanus brevicauda	Short-tailed Monitor
	Varanus eremius	Desert Pygmy Monitor
	Varanus giganteus	Perentie
	Varanus gouldii	Sand Monitor
TYPHLOPIDAE	*Ramphotyphlops ammodytes*	
	Ramphotyphlops grypus	Beaked Blind Snake
ELAPIDAE	*Acanthophis wellsi*	Pilbara Death Adder
	Brachyurophis approximans	Shovel-nosed Snake
	Demansia psammophis	Yellow-faced Whip-Snake
	Demansia rufescens	Rufous Whip-Snake
	Pseudechis australis	Mulga Snake
	Pseudonaja modesta	Ringed Snake
	Pseudonaja nuchalis	Gwardar
	Simoselaps anomalus	Desert Banded Snake

Appendix I3 - Reptile Species Inventory for Winter Survey

Family	Scientific Name	Common Name
AGAMIDAE	*Amphibolurus longirostris*	Long-nosed Water Dragon
	Ctenophorus isolepis isolepis	Military Sand Dragon
	Ctenophorus nuchalis	Central Netted Dragon
	Diporiphora winneckei	Common Two-lined Dragon
	Pogona minor minor	Bearded Dragon
	Pogona minor mitchelli	Bearded Dragon
GEKKONIDAE	*Diplodactylus conspicillatus*	Fat-tailed Gecko
	Gehyra punctata	Spotted Dtella
	Gehyra variegata	Tree Dtella
	Heteronotia binoei	Bynoe's Gecko
	Lucasium stenodactylum	Pale-snouted Ground Gecko
	Nephrurus levis pilbarensis	Common Knob-tailed Gecko
	Strophurus ciliaris aberrans	Northern Spiny-tailed Gecko
PYGOPODIDAE	*Delma butleri*	Unbanded Delma
	Delma tincta	
SCINCIDAE	*Carlia triacantha*	Desert Rainbow Skink
	Ctenotus duricola	
	Ctenotus grandis titan	
	Ctenotus helenae	
	Ctenotus pantherinus ocellifer	Leopard Ctenotus
	Ctenotus piankai	
	Ctenotus rufescens	
	Ctenotus saxatilis	Rock Ctenotus
	Ctenotus serventyi	

Family	Scientific Name	Common Name
	Egernia depressor	Pygmy Spiny-tailed Skink
	Eremiascincus fasciolatus	Narrow-banded Sand Swimmer
	Lerista bipes	
	Lerista muelleri	
	Menetia greyii	Common Dwarf Skink
	Morethia ruficauda exquisita	Fire-tailed Skink
	Tiliqua multifasciata	
VARANIDAE	*Varanus acanthurus*	Ridge-tailed Monitor
	Varanus bushi	Bush's Pygmy Monitor
	Varanus eremius	Desert Pygmy Monitor
	Varanus gouldii	Sand Monitor
TYPHLOPIDAE	*Ramphotyphlops ammodytes*	
	Ramphotyphlops grypus	Beaked Blind Snake
BOIDAE	*Aspidites melanocephalus*	Black Headed Python
	Aspidites ramsayi	Woma
ELAPIDAE	*Demansia psammophis*	Yellow-faced Whip-Snake
	Pseudechis australis	Mulga Snake
	Pseudonaja modesta	Ringed Snake
	Pseudonaja nuchalis	Gwardar
	Simoselaps anomalus	Desert Banded Snake

Appendix I4 - Reptile Species Inventory for Additional Areas

Family	Scientific Name	Common Name
AGAMIDAE	*Ctenophorus isolepis isolepis*	Military Sand Dragon
	Ctenophorus nuchalis	Central Netted Dragon

Family	Scientific Name	Common Name
	Diporiphora winneckei	Common Two-lined Dragon
	Pogona minor minor	Bearded Dragon
GEKKONIDAE	*Diplodactylus conspicillatus*	Fat-tailed Gecko
	Lucasium stenodactylum	Pale-snouted Ground Gecko
SCINCIDAE	*Ctenotus duricola*	
	Ctenotus grandis titan	
	Ctenotus helenae	
	Ctenotus pantherinus ocellifer	Leopard Ctenotus
	Ctenotus piankai	
	Ctenotus rufescens	
	Ctenotus saxatilis	Rock Ctenotus
	Ctenotus serventyi	
	Lerista bipes	
	Menetia greyii	Common Dwarf Skink
	Morethia ruficauda exquisita	Fire-tailed Skink
VARANIDAE	*Varanus acanthurus*	Ridge-tailed Monitor
	Varanus eremius	Desert Pygmy Monitor
TYPHLOPIDAE	*Ramphotyphlops ammodytes*	
BOIDAE	*Aspidites ramsayi*	Woma
ELAPIDAE	*Pseudechis australis*	Mulga Snake
	Pseudonaja modesta	Ringed Snake
	Simoselaps anomalus	Desert Banded Snake

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APPENDIX J
AMPHIBIAN INVENTORY

PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT

APPENDIX J

AMPHIBIAN INVENTORY

Appendix J1 - Complete Amphibian Species Inventory for Survey

Family	Scientific Name	Common Name
HYLIDAE	*Cyclorana australis*	Giant Frog
	Cyclorana maini	Main's Frog
	Litoria rothii	Roth's Tree-frog
	Litoria rubella	Desert Tree-frog
MYOBATRACHIDAE	*Limnodynastes spenceri*	Spencer's Frog
	Notaden nichollsi	Desert Spadefoot
	Uperoleia russelli	Russell's Toadlet

Appendix J2 - Amphibian Species Inventory for Summer Survey

Family	Scientific Name	Common Name
HYLIDAE	*Cyclorana maini*	Main's Frog
	Litoria rothii	Roth's Tree-frog
	Litoria rubella	Desert Tree-frog
MYOBATRACHIDAE	*Notaden nichollsi*	Desert Spadefoot
	Uperoleia russelli	Russell's Toadlet

Appendix J3 - Amphibian Species Inventory for Winter Survey

Family	Scientific Name	Common Name
HYLIDAE	*Cyclorana australis*	Giant Frog
	Cyclorana maini	Main's Frog
	Litoria rubella	Desert Tree-frog
MYOBATRACHIDAE	*Limnodynastes spenceri*	Spencer's Frog
	Notaden nichollsi	Desert Spadefoot

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APPENDIX K
BIRD INVENTORY

PORT HEDLAND OUTER HARBOUR DEVELOPMENT FAUNA ASSESSMENT

APPENDIX K

Appendix K1 - Complete Bird Species Inventory for Survey

Family	Scientific Name	Common Name
CASUARIIDAE	*Dromaius novaehollandiae*	Emu
PHASIANIDAE	*Coturnix ypsilophora*	Brown Quail
ANATIDAE	*Anas superciliosa*	Pacific Black Duck
	Anas gracilis	Grey Teal
	Aythya australis	Hardhead
	Cygnus atratus	Black Swan
	Dendrocygna eytoni	Plumed Whistling-duck
	Malacorhynchus membranaceus	Pink-eared Duck
PODICIPEDIDAE	*Tachybaptus novaehollandiae*	Australia Grebe
ANHINGIDAE	*Anhinga melanogaster*	Darter
PHALACROCORACIDAE	*Phalacrocorax melanoleucos*	Little Pied Cormorant
	Phalacrocorax varius	Pied Cormorant
FREGATIDAE	*Fregata ariel*	Lesser Frigate Bird
PELECANIDAE	*Pelecanus conspicillatus*	Australian Pelican
ARDEIDAE	*Ardea novaehollandiae*	White-faced Heron
	Ardea alba	Great Egret
	Butorides striatus	Striated Heron
	Egretta garzetta	Little Egret
	Egretta sacra	Eastern Reef Egret
THRESKIORNITHIDAE	*Threskiornis molucca*	Australian White ibis
ACCIPITRIDAE	*Elanus caeruleus*	Black-shouldered Kite
	Milvus migrans	Black Kite

Family	Scientific Name	Common Name
	Haliastur indus	Brahminy Kite
	Haliastur sphenurus	Whistling Kite
	Circus assimilis	Spotted Harrier
	Aquila audax	Wedge-tailed Eagle
	Haliaeetus leucogaster	White-breasted Sea Eagle
	Hieraaetus morphnoides	Little Eagle
	Pandion haliaetus	Osprey
FALCONIDAE	*Falco cenchroides*	Australian Kestrel
	Falco berigora	Brown Falcon
	Falco longipennis	Australian Hobby
OTIDAE	*Ardeotis australis*	Australian Bustard
TURNICIDAE	*Turnix velox*	Little Button-quail
SCOLOPACIDAE	*Arenaria interpres*	Ruddy Turnstone
	Calidris canutus	Red Knot
	Calidris ferruginea	Curlew Sandpiper
	Calidris ruficollis	Red-necked Stint
	Calidris tenuirostris	Great Knot
	Actitis hypoleucos	Common Sandpiper
	Xenus cinereus	Terek Sandpiper
	Tringa nebularia	Common Greenshank
	Tringa stagnatilis	Marsh Sandpiper
	Limosa lapponica	Bar-tailed Godwit
	Numenius madagascariensis	Eastern Curlew
	Numenius phaeopus	Whimbrel
	Tringa brevipes	Grey-tailed tattler

Family	Scientific Name	Common Name
HAEMATOPODIDAE	*Haematopus longirostris*	Pied Oystercatcher
	Haematopus fuliginosus	Sooty Oystercatcher
CHARADRIIDAE	*Pluvialis squatarola*	Grey Plover
	Charadrius leschenaultii	Greater Sand Plover
	Charadrius mongolus	Lesser Sand Plover
	Charadrius ruficapillus	Red-capped Plover
	Charadrius veredus	Oriental Plover
	Elseyornis melanops	Black-fronted Dotterel
GLAREOLIDAE	*Sterna caspia*	Caspian Tern
	Sterna albifrons	Little Tern
	Sterna bergii	Crested Tern
	Sterna bengalensis	Lesser Crested Tern
	Sterna hybrida	Whiskered Tern
	Sterna nereis	Fairy Tern
	Sterna nilotica	Gull-billed Tern
	Larus novaehollandiae	Silver Gull
COLUMBIDAE	*Geopelia cuneata*	Diamond Dove
	Geophaps plumifera	Spinifex Pigeon
	Geopelia striata placida	Peaceful Dove
	Ocyphaps lophotes	Crested Pigeon
CACATUIDAE	*Cacatua roseicapilla*	Galah
	Cacatua sanguinea	Little Corella
PSITTACIDAE	*Melopsittacus undulatus*	Budgerigar
	Nymphicus hollandicus	Cockatiel
CUCULIDAE	*Chrysococcyx basalis*	Horsfield's Bronze-Cuckoo

Family	Scientific Name	Common Name
	Cuculus pallidus	Pallid Cuckoo
CENTROPIDAE	*Centropus phasianus*	Pheasant Coucal
TYTONIDAE	*Tyto alba*	Barn Owl
PODARGIDAE	*Podargus strigoides*	Tawny Frogmouth
CAPRIMULGIDAE	*Eurostopodus argus*	Spotted Nightjar
AEGOTHELIDAE	*Aegotheles cristatus*	Australian Owlet Nightjar
HALCYONIDAE	*Todiramphus chloris*	Collared Kingfisher
	Todiramphus pyrrhopygia	Red-backed Kingfisher
	Todiramphus sanctus	Sacred Kingfisher
MEROPIDAE	*Merops ornatus*	Rainbow Bee-eater
MALURIDAE	*Malurus lamberti*	Variegated Fairy-wren
	Malurus leucopterus	White-winged Fairy-wren
PARDALOTIDAE	*Pardalotus rubricatus*	Red-browed Pardalote
	Gerygone tenebrosa	Dusky Gerygone
MELIPHAGIDAE	*Certhionyx niger*	Black Honeyeater
	Lichenostomus penicillatus	White-plumed Honeyeater
	Lichenostomus virescens	Singing Honeyeater
	Lichmera indistincta	Brown Honeyeater
	Manorina flavigula	Yellow-throated Miner
PETROICIDAE	*Eopsaltria pulverulenta*	Mangrove Robin
PACHYCEPHALIDAE	*Pachycephala lanioides*	White-breasted Whistler
	Pachycephala melanura	Mangrove Golden Whistler
DICRURIDAE	*Grallina cyanoleuca*	Magpie-Lark
	Rhipidura phasiana	Mangrove Grey Fantail
	Rhipidura leucophrys	Willie Wagtail

Family	Scientific Name	Common Name
CAMPEPHAGIDAE	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
	Lalage tricolor	White-winged Triller
ARTAMIDAE	*Artamus cinereus*	Black-faced Woodswallow
	Artamus leucorynchus	White-breasted Woodswallow
	Artamus superciliosus	White-browed Woodswallow
CORVIDAE	*Corvus orru*	Torresian Crow
HIRUNDINIDAE	*Hirundo ariel*	Fairy Martin
	Hirundo nigricans	Tree Martin
SYLVIIDAE	*Cincloramphus mathewsi*	Rufous Songlark
	Cincloramphus cruralis	Brown Songlark
	Eremiornis carteri	Spinifex Bird
ALAUIDAE	*Mirafra javanica*	Singing Bushlark
PASSERIDAE	*Emblema pictum*	Painted Finch
	Taeniopygia guttata	Zebra Finch
MOTACILLIDAE	*Anthus novaeseelandiae*	Australian Pipit
ZOSTEROPIDAE	*Zosterops luteus*	Yellow White-eye

Appendix K2 - Bird Species Inventory for Summer Survey

Family	Scientific Name	Common Name
PHASIANIDAE	*Coturnix ypsilophora*	Brown Quail
ANATIDAE	*Anas superciliosa*	Pacific Black Duck
	Anas gracilis	Grey Teal
	Aythya australis	Hardhead
	Cygnus atratus	Black Swan
	Dendrocygna eytoni	Plumed Whistling-duck
	Malacorhynchus membranaceus	Pink-eared Duck

Family	Scientific Name	Common Name
PODICIPEDIDAE	*Tachybaptus novaehollandiae*	Australia Grebe
ANHINGIDAE	*Anhinga melanogaster*	Darter
PHALACROCORACIDAE	*Phalacrocorax melanoleucos*	Little Pied Cormorant
	Phalacrocorax varius	Pied Cormorant
FREGATIDAE	*Fregata ariel*	Lesser Frigate Bird
PELECANIDAE	*Pelecanus conspicillatus*	Australian Pelican
ARDEIDAE	*Ardea novaehollandiae*	White-faced Heron
	Ardea alba	Great Egret
	Butorides striatus	Striated Heron
	Egretta garzetta	Little Egret
	Egretta sacra	Eastern Reef Egret
THRESKIORNITHIDAE	*Threskiornis molucca*	Australian White ibis
ACCIPITRIDAE	*Elanus caeruleus*	Black-shouldered Kite
	Milvus migrans	Black Kite
	Haliastur indus	Brahminy Kite
	Haliastur sphenurus	Whistling Kite
	Circus assimilis	Spotted Harrier
	Aquila audax	Wedge-tailed Eagle
	Haliaeetus leucogaster	White-breasted Sea Eagle
	Hieraaetus morphnoides	Little Eagle
	Pandion haliaetus	Osprey
FALCONIDAE	*Falco cenchroides*	Australian Kestrel
	Falco berigora	Brown Falcon
	Falco longipennis	Australian Hobby
OTIDAE	*Ardeotis australis*	Australian Bustard

Family	Scientific Name	Common Name
TURNICIDAE	*Turnix velox*	Little Button-quail
SCOLOPACIDAE	*Arenaria interpres*	Ruddy Turnstone
	Calidris canutus	Red Knot
	Calidris ferruginea	Curlew Sandpiper
	Calidris ruficollis	Red-necked Stint
	Calidris tenuirostris	Great Knot
	Actitis hypoleucos	Common Sandpiper
	Xenus cinereus	Terek Sandpiper
	Tringa nebularia	Common Greenshank
	Limosa lapponica	Bar-tailed Godwit
	Numenius madagascariensis	Eastern Curlew
	Numenius phaeopus	Whimbrel
	Tringa brevipes	Grey-tailed tattler
HAEMATOPODIDAE	*Haematopus longirostris*	Pied Oystercatcher
	Haematopus fuliginosus	Sooty Oystercatcher
CHARADRIIDAE	*Pluvialis squatarola*	Grey Plover
	Charadrius leschenaultii	Greater Sand Plover
	Charadrius mongolus	Lesser Sand Plover
	Charadrius ruficapillus	Red-capped Plover
	Charadrius veredus	Oriental Plover
GLAREOLIDAE	*Sterna caspia*	Caspian Tern
	Sterna albifrons	Little Tern
	Sterna bergii	Crested Tern
	Sterna bengalensis	Lesser Crested Tern
	Sterna hybrida	Whiskered Tern

Family	Scientific Name	Common Name
	Sterna nereis	Fairy Tern
	Sterna nilotica	Gull-billed Tern
	Larus novaehollandiae	Silver Gull
COLUMBIDAE	*Geopelia cuneata*	Diamond Dove
	Geophaps plumifera	Spinifex Pigeon
	Geopelia striata placida	Peaceful Dove
	Ocyphaps lophotes	Crested Pigeon
CACATUIDAE	*Cacatua roseicapilla*	Galah
	Cacatua sanguinea	Little Corella
PSITTACIDAE	*Melopsittacus undulatus*	Budgerigar
	Nymphicus hollandicus	Cockatiel
CUCULIDAE	*Chrysococcyx basalis*	Horsfield's Bronze-Cuckoo
CENTROPIDAE	*Centropus phasianus*	Pheasant Coucal
TYTONIDAE	*Tyto alba*	Barn Owl
PODARGIDAE	*Podargus strigoides*	Tawny Frogmouth
CAPRIMULGIDAE	*Eurostopodus argus*	Spotted Nightjar
HALCYONIDAE	*Todiramphus chloris*	Collared Kingfisher
	Todiramphus pyrrhopygia	Red-backed Kingfisher
	Todiramphus sanctus	Sacred Kingfisher
MEROPIDAE	*Merops ornatus*	Rainbow Bee-eater
MALURIDAE	*Malurus lamberti*	Variegated Fairy-wren
	Malurus leucopterus	White-winged Fairy-wren
PARDALOTIDAE	*Pardalotus rubricatus*	Red-browed Pardalote
	Gerygone tenebrosa	Dusky Gerygone
MELIPHAGIDAE	*Lichenostomus penicillatus*	White-plumed Honeyeater

Family	Scientific Name	Common Name
	Lichenostomus virescens	Singing Honeyeater
	Lichmera indistincta	Brown Honeyeater
	Manorina flavigula	Yellow-throated Miner
PETROICIDAE	*Eopsaltria pulverulenta*	Mangrove Robin
PACHYCEPHALIDAE	*Pachycephala lanioides*	White-breasted Whistler
	Pachycephala melanura	Mangrove Golden Whistler
DICRURIDAE	*Grallina cyanoleuca*	Magpie-Lark
	Rhipidura phasiana	Mangrove Grey Fantail
	Rhipidura leucophrys	Willie Wagtail
CAMPEPHAGIDAE	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
	Lalage tricolor	White-winged Triller
ARTAMIDAE	*Artamus cinereus*	Black-faced Woodswallow
	Artamus leucorynchus	White-breasted Woodswallow
CORVIDAE	*Corvus orru*	Torresian Crow
HIRUNDINIDAE	*Hirundo ariel*	Fairy Martin
	Hirundo nigricans	Tree Martin
SYLVIIDAE	*Cincloramphus mathewsi*	Rufous Songlark
	Cincloramphus cruralis	Brown Songlark
	Eremiornis carteri	Spinifex Bird
ALAUIDAE	*Mirafra javanica*	Singing Bushlark
PASSERIDAE	*Taeniopygia guttata*	Zebra Finch
MOTACILLIDAE	*Anthus novaeseelandiae*	Australian Pipit
ZOSTEROPIDAE	*Zosterops luteus*	Yellow White-eye

Appendix K3 - Bird Species Inventory for Winter Survey

Family	Scientific Name	Common Name
CASUARIIDAE	*Dromaius novaehollandiae*	Emu
PODICIPEDIDAE	*Tachybaptus novaehollandiae*	Australasian Grebe
PHALACROCORACIDAE	*Phalacrocorax melanoleucos*	Little Pied Cormorant
	Phalacrocorax varius	Pied Cormorant
PELECANIDAE	*Pelecanus conspicillatus*	Australian Pelican
ARDEIDAE	*Ardea alba*	Great Egret
	Ardea novaehollandiae	White-faced Heron
	Egretta garzetta	Little Egret
	Egretta sacra	Eastern Reef Egret
THRESKIORNITHIDAE	*Threskiornis molucca*	Australian White ibis
ACCIPITRIDAE	*Aquila audax*	Wedge-tailed Eagle
	Elanus caeruleus	Black-shouldered Kite
	Haliaeetus leucogaster	White-bellied Sea Eagle
	Haliastur indus	Brahminy Kite
	Haliastur sphenurus	Whistling Kite
	Hieraaetus morphnoides	Little Eagle
	Milvus migrans	Black Kite
FALCONIDAE	*Falco cenchroides*	Australian Kestrel
	Falco berigora	Brown Falcon
OTIDIDAE	*Ardeotis australis*	Australian Bustard
SCOLOPACIDAE	*Arenaria interpres*	Ruddy Turnstone
	Numenius phaeopus	Whimbrel
	Tringa brevipes	Grey-tailed Tattler
	Tringa stagnatilis	Marsh Sandpiper

Family	Scientific Name	Common Name
	Xenus cinerus	Terek Sandpiper
HAEMATOPODIDAE	*Haematopus longirostris*	Pied Oystercatcher
	Haematopus fuliginosus	Sooty Oystercatcher
CHARADRIIDAE	*Charadrius leschenaultii*	Greater Sand Plover
	Elseyornis melanops	Black-fronted Dotterel
LARIDAE	*Larus novaehollandiae*	Silver Gull
	Sterna albifrons	Little Tern
	Sterna bengalensis	Lesser Crested Tern
	Sterna caspia	Caspian Tern
	Sterna nilotica affinis	Gull-billed Tern
COLUMBIDAE	*Geopelia cuneata*	Diamond Dove
	Geophaps plumifera	Spinifex Pigeon
	Geopelia striata placida	Peaceful Dove
	Ocyphaps lophotes	Crested Pigeon
CACATUIDAE	*Cacatua roseicapilla*	Galah
	Cacatua sanguinea	Little Corella
	Melopsittacus undulatus	Budgerigar
	Nymphicus hollandicus	Cockatiel
CUCULIDAE	*Cuculus pallidus*	Pallid Cuckoo
CAPRIMULGIDAE	*Eurostopodus argus*	Spotted Nightjar
AEGOTHELIDAE	*Aegotheles cristatus*	Australian Owlet Nightjar
HALCYONIDAE	*Todiramphus chloris*	Collared Kingfisher
	Todiramphus pyrrhopygia	Red-backed Kingfisher
	Todiramphus sanctus	Sacred Kingfisher
MEROPIDAE	*Merops ornatus*	Rainbow Bee-eater

Family	Scientific Name	Common Name
MALURIDAE	*Malurus lamberti*	Variegated Fairy-wren
	Malurus leucopterus	White-winged Fairy-wren
MELIPHAGIDAE	*Certhionyx niger*	Black Honeyeater
	Lichenostomus penicillatus	White-plumed Honeyeater
	Lichenostomus virescens	Singing Honeyeater
	Lichmera indistincta	Brown Honeyeater
	Manorina flavigula	Yellow-throated Miner
PETROICIDAE	*Eopsaltria pulverulenta*	Mangrove Robin
PACHYCEPHALIDAE	*Pachycephala lanioides*	White-breasted Whistler
DICRURIDAE	*Grallina cyanoleuca*	Magpie-Lark
	Rhipidura phasiana	Mangrove Grey Fantail
	Rhipidura leucophrys	Willie Wagtail
CAMPEPHAGIDAE	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
	Lalage tricolor	White-winged Triller
ARTAMIDAE	*Artamus cinereus*	Black-faced Woodswallow
	Artamus superciliosus	White-browed Woodswallow
CORVIDAE	*Corvus orru*	Torresian Crow
HIRUNDINIDAE	*Hirundo ariel*	Fairy Martin
	Hirundo nigricans	Tree Martin
SYLVIIDAE	*Eremiornis carteri*	Spinifex Bird
ALAUIDAE	*Mirafra javanica*	Singing Bushlark
PASSERIDAE	*Emblema pictum*	Painted Finch
	Taeniopygia guttata	Zebra Finch
MOTACILLIDAE	*Anthus novaseelandiae*	Australian Pipit
ZOSTEROPIDAE	*Zosterops luteus*	Yellow White-eye

Appendix K4 - Bird Species Inventory for Additional Areas

Family	Scientific Name	Common Name
ACCIPITRIDAE	*Aquila audax*	Wedge-tailed Eagle
	Haliastur indus	Brahminy Kite
FALCONIDAE	*Falco berigora*	Brown Falcon
CACATUIDAE	*Cacatua roseicapilla*	Galah
	Melopsittacus undulatus	Budgerigar
	Nymphicus hollandicus	Cockatiel
MEROPIDAE	*Merops ornatus*	Rainbow Bee-eater
MALURIDAE	*Malurus leucopterus*	White-winged Fairy-wren
MELIPHAGIDAE	*Lichenostomus virescens*	Singing Honeyeater
ARTAMIDAE	*Artamus cinereus*	Black-faced Woodswallow
CORVIDAE	*Corvus orru*	Torresian Crow
HIRUNDINIDAE	*Hirundo nigricans*	Tree Martin
PASSERIDAE	*Taeniopygia guttata*	Zebra Finch