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ENVIRONMENTAL REFERRAL DOCUMENT

North West Infrastructure

Multi-user Iron Ore Export Facility: Port Infrastructure Project

October 2011

EP2011/093, V5i

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MULTI USER IRON ORE EXPORT (LANDSIDE) FACILITY ENVIRONMENTAL REFERRAL DOCUMENT

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EXECUTIVE SUMMARY

Background

The North West Iron Ore Alliance (NWIOA), trading as North West Infrastructure (NWI), was formed in 2007 by a number of emerging iron ore companies with assets in the Pilbara region of Western Australia. NWI is developing the Multi-User Iron Ore Export (*Landside*) Facility, which includes the development of two berths within South West Creek to provide for the export capacity of 50 million tonnes per year, along with supportive infrastructure incorporating stackers and loaders, conveyors, stockyard, rail car dumper and rail loop.

NWI is seeking approval under Part IV of the *Environmental Protection Act 1986* for the development of the Multi-User Iron Ore Export (Landside) Facility. Discussions with the Office of the Environmental Protection Authority (OEPA) indicate that an Assessment on Proponent Information (API) may be appropriate for this project due to the extensive consultation undertaken, the environmental impacts associated with the project and their proposed management.

This document addresses the construction and operation of infrastructure within land either vested in or proposed to be vested in the Port Hedland Port Authority (PHPA). The rail component of the Multi-User Iron Ore Export Facility Project (Multi-User Iron Ore Export [Railside] Facility) and the supply of water for the operation for the project will be the subject of separate applications to the EPA.

Project Description

The proposal is to construct and operate port infrastructure to be located within existing PHPA vested land and the Boodarie Multiuser Stockyard Area. Iron ore (hematite and magnetite) is proposed to be unloaded at Boodarie and placed via conveyor / stackers into stockpiles before being reclaimed and delivered, via an elevated conveyor, to shipping berths in South West Creek for export. Infrastructure includes two berths, Stanley Point Berths 3 and 4 (SP3 and SP4) within South West Creek to provide for the export capacity of nominal 50 million tonnes per year, along with supportive infrastructure incorporating stackers and loaders, conveyors, stockyard, and a rail loop (**Figures 1 and 2**). The key characteristics of the project are provided in Table E1.

Table E1 Key Characteristics of NWI's Multi-User Iron Ore Export (Landside) Facility

Element	Description
Rail	[1] Railway comprising: • Western rail loop on Stockyard 2 providing possible connection to FMG, BHP-B or third party provider; • Eastern rail providing a possible connection to Roy Hill Iron Ore • Twin car train unloader.
Stockyard	Stockyard 2 comprising a rail loop, 2 stackers, 1 reclaimer and stockpile area of approximately 1500 m long by 400m wide – 8 x 210000t live stockpiles
Conveyors	• 1800mm wide by 5.2 km overland conveyors (1.5 km and 3.7 km long respectively) from the stockyard to a transfer station located on the Eastern side of the Finucane Island access causeway. • 1800mm wide by 1.0 km conveyor which runs from the overland conveyor transfer station to the berth shiploader conveyor.
Wharf	Wharf structures, two shipping berths and one ship loader at Stanley Point in South West Creek
Other infrastructure	Offices, workshops, access roads and service corridors
Life of project	50 years or more

Table E1 Key Characteristics of NWI's Multi-User Iron Ore Export (Landside) Facility (Cont'd)

Element	Description
Throughput	Nominal 50 million tonnes per annum
Disturbance footprint	290[2] ha within a development envelope of 350ha, comprising: • 149 ha within existing PHPA vested land; • 141 ha within land proposed to be vested in the PHPA.
Mangrove disturbance	4.46 ha

[1] Note rail limited to land proposed to be vested in PHPA. Final rail spur design and alignment will be determined following identification of a preferred rail solution and relevant agreement(s).

[2] Note 62.51 ha within DMMA Area G has previously been considered in EPA Report 1380 and approved under Ministerial Statement 856

Environmental Management

The project has been developed to avoid, minimise, manage and mitigate environmental impacts. The project was developed in close consultation with the PHPA and other stakeholders with the aim to minimise the cumulative impacts of development within the PHPA area. A number of alternatives were considered as part of the project planning. The layout is consistent with the Port Hedland Port Authority's Ultimate Development Plan (Worley Parsons, 2007), which considers the ultimate sustainable capacity of the port with respect to export demand, resources, land availability, transport infrastructure and environmental and social factors. Of the project options assessed during the prefeasibility study, the selected stockyard location (i.e., Stockyard 2) is the furthest from potential sensitive receptors. The overland conveyor corridor is consistent with the Port Hedland Port Authority's Ultimate Development Plan and meets the EPA's requirement that infrastructure from all projects in the vicinity are located within an infrastructure corridor.

The over-arching principles of sustainability and biodiversity have been considered within the context of the project and have been incorporated into the assessment of the identified environmental factors. These environmental and social factors have been identified through existing information, findings of investigative studies, consultation with relevant stakeholders and experience gained from similar projects being undertaken within the Port Hedland Harbour.

Key Environmental Factors

The key environmental factors associated with the project have been identified as

- Benthic primary producer habitat (BPPH);
- Surface water and coastal processes;
- Dust from construction and operation activities; and
- Noise from construction and operation activities.

The objective, potential impacts, proposed management measures and predicted outcome for each of the key factors are detailed in this document.

Disturbance of Benthic Primary Producer Habitat

The Project has been designed to minimise the impact on mangrove and other benthic primary producer habitats. The total disturbance to mangroves as a result of the project is 4.46 ha. The disturbance is required to construct the overland conveyor from the stockyard to the wharf. The

mangrove assemblages to be directly impacted by the project are located within the Port Hedland Industrial Area Management Unit, which includes the Port Hedland Harbour, South West Creek, the proposed conveyor corridor and Boodarie Estate. The project will have no direct impact on mangroves in the regionally significant and high conservation area of the Oyster Passage Barrier Mangrove Management Unit, which is classified as Category A in EPA (2009d).

The predicted loss of 4.46ha of mangrove assemblages represents approximately 0.15% of the total mangrove habitat within the Port Hedland Industrial Area Management Unit. The cumulative loss of mangroves has been calculated to be 12.95% when combined with historical losses and the potential losses from the Roy Hill Infrastructure proposal and the South West Creek Dredging and Reclamation Proposal. Indirect losses of mangrove habitat as a result of altered surface and ground water flows, sedimentation and dust impacts are not expected to occur as a result of the project.

The impact on other BPPHs will be limited. The construction of the rail loop will potentially impact on 1.37ha of cyanobacterial mats and 3.67ha of samphires in the Oyster Passage Barrier Mangrove Management Unit, and up to 29.4ha and 47.5ha of cyanobacterial mats and samphires respectively in the Port Hedland Industrial Area Management Unit. However the area of cyanobacterial mats affected by the project is likely to be significantly less as not all mudflats will support mats and not all of the development envelope will be disturbed by the final project footprint.

Management measures to limit impacts on BPPHs include:

- Preparing and implementing a Mangrove and other BPPH Management Plan prior to the commencement of construction. The Mangrove and other BPPH Management Plan will include a mangrove health risk assessment to provide baseline data on mangrove health and will detail ongoing monitoring of mangrove health;
- Workforce induction including information on the ecological significance of mangroves (and other BPPHs) and instructions on clearing procedures;
- Delineation of clearance boundaries through the use of flagging or other suitable techniques prior to commencement of clearing activities to prevent disturbance of mangroves outside the clearing footprint;
- Where practical, inclusion of a buffer area (10m) between infrastructure edge and disturbance boundary in site plans to avoid impacts on mangroves outside the approved area;
- Prohibiting access to mangroves outside the immediate disturbance footprint;
- Reporting incidents with the potential to impact on mangroves;
- Using construction methods such as scrub rolling where possible rather than removal of mangroves to provide maximum opportunity for vegetative recovery along the boundary of cleared areas;
- Managing and minimising dust deposition on mangroves through regular applications of water to working areas and road surfaces, minimising drop heights of material with the potential to generate dust and restricting vehicle speeds to control dust. Dust monitoring will be conducted to ensure dust control measures are implemented and effective;
- Design and implementation of a stormwater drainage system to capture surface water from operation areas in the stockyard. Discharge into established drainage lines to the north may only occur in long period return events during flow conditions. Runoff from the area east of the rail loop will follow the existing drainage pattern, passing through culverts at the neck of the rail loop;
- Design of infrastructure based on best practice to withstand a 1 in 100 year flood event and ensure unimpeded surface water flows;

- Inclusion of scour protection, particularly in the vicinity of the waterway openings in the conveyor and the culvert through the railway spur line to control erosion during flood and storm surge events;
- The composition and distribution of cyanobacterial mats in the vicinity of the project area will be surveyed prior to the commencement of operations, and the results provided to the EPA; and
- Establishment of a network of shallow groundwater monitoring bores adjacent to the northern and western boundaries of the rail loop to monitor potential salinity impacts to mangroves.

Surface Water and Coastal Processes

An assessment of the project's impact on surface water, flooding and storm surges was undertaken by SKM (SKM, 2011b); with the assessment considering cumulative impacts associated with the Roy Hill Iron Ore Port Infrastructure (RHIOPI) and NWI projects.

The majority of the project is located within the western part of the catchments of South and South West Creeks, however part of the rail alignment runs along the divide between the catchments of South West Creek and the Turner River. Due to the alignment of the project, no surface water flows are expected from the project into the Turner River and flows in the Turner River will not be modified by the project.

Floods and storm surges are known to occur in the vicinity of the project site. Under existing conditions combined storm surges and flood events with an AEP of 1 in 50 and 1 in 100 cause flooding of the floodplains of South and South West Creeks. The modelled simulations found that without mitigation measures, surface water flow would be impeded by the rail embankment, rail loop and stockpile and conveyors, and that adequate culvert capacity in the rail embankment for a 1 in 100 AEP event would ensure surface water flows are unimpeded by the rail loop or spur. The conveyor will be elevated on trestles except in the immediate vicinity of the Roy Hill stockpile and rail line, where there is no environmental benefit to a trestle design. In these areas appropriately sized culverts will be incorporated into the design. The location of culverts will be determined in consultation with Roy Hill Iron Ore Ltd (RHIO).

A regular program of inspection and maintenance of the culverts will be implemented to ensure the culverts continue to function effectively. Baseline and continuous monitoring of sediment and other pollutants will be conducted during construction and operation of the Multi-user Iron Ore Export (Landside) Facility to detect any changes in water quality due to the project.

On site stormwater management will be implemented to detain runoff produced from impervious areas and to minimise scour caused by direct runoff from these areas.

Dust

Ambient dust levels in Port Hedland are high and are of concern to the local community. Existing operations at the Port Hedland Port are a major contributor to these dust levels.

The potential impact of the Project on air quality in Port Hedland was assessed in isolation and cumulatively with other existing, approved and potential projects. The modelling results indicate that future dust sources (BHP Billiton RPG6, Outer Harbour, Utah Point, Nelson Point, FMG and Roy Hill operations) and the ambient background concentration, excluding NWI, contribute to a significant number of predicted exceedances of the 24-hour NEPM PM_{10} standard and $PM_{2.5}$ advisory standard at a number of discrete receptors.

Results of air dispersion modelling undertaken by NWI demonstrates that the addition of dust from the Project is unlikely to result in significant changes to the current ambient air quality profile in the Port Hedland region with emissions mostly influencing the immediate area around the stockyards and shiploading through South West Creek. However the development of the project will result in an increase in the number of days when the 24hour average PM_{10} value exceeds the proposed interim

guideline of 70 µg/m^3 specified in the Port Hedland Air Quality and Noise Management Plan. Including the Multi-user Iron Ore Export (Landside) Facility in modelling of future scenarios resulted in the interim guideline of 70 µg/m^3 would be exceeded on 5 days at the Harbour site in addition to the 96 days of predicted exceedances in the base case without the project.

As a member of the Port Hedland Industry Council, NWI is aware of the need to minimise dust emissions to the lowest practicable level and has incorporated a number of design and management measures to minimise dust emissions.

Dust emissions during construction will be managed through the preparation and implementation of a Construction Environmental Management Plan. Management measures to minimise the impact of dust during construction will include the regular application of water to working areas and road surfaces, minimising drop heights of material with the potential to generate dust, restricting vehicle speeds to control dust and daily monitoring to ensure dust control measures are implemented and effective.

NWI will prepare and implement a Dust Management Plan prior to the commencement of operation. The Dust Management Plan will include a number of dust control measures, including:

- Maintenance of high ore moisture levels, with the target moisture to be 7% and maintained above 4% at all times;
- Enclosure of key components at the rail car dumpers, use of fogging water sprays at the time of dumping and installation of a particulate extraction system around the wagon tipper;
- Total enclosure and utilisation of water sprays at conveyor transfer points and the use of belt scrapers to clean conveyor belts;
- Conveyors between the stockyard and the wharf will be covered to minimise dust (and noise) emissions;
- Minimising the ship loader discharge height and installation of water sprayers at the boom discharge and boom conveyor system;
- Stackers will be slewing, luffing types so that the drop height to the stockpile will be minimised;
- Identification of road/traffic areas that are likely to produce unacceptable particulates and ensuring they are sealed. Particulates in low traffic areas will be controlled by water carts and speed limits;
- Monitoring of the ore moisture content to reduce particular emissions and use of water cannons to dampen surfaces (as required) to prevent generation of fugitive dust; and
- Regular checks and maintenance of dust control equipment and removal of accumulated particulate material from under conveyors and around transfer points.

The Dust Management Plan will include a dust monitoring program, which will be developed in consultation with DEC and industry.

Noise

The results of the noise modelling of the proposed operations show that the project is predicted to exceed the *Environmental Protection (Noise) Regulations 1997* at one noise sensitive receptor (the hospital). The modelling predicted that the operations will exceed the noise level criterion of 32 dB at the Hospital site by 5.6dB. The noise level at all other noise sensitive receptors are below the maximum allowable level set by the Regulations.

Cumulative noise impacts including BHP Billiton's Iron Ore Outer Harbour project were modelled. However as the Outer Harbour referral predicted levels do not include any noise mitigation, the

predicted levels are therefore not a true reflection of what the received levels will be at the end of the project.

NWI will investigate noise mitigation measures to achieve a 5.6 dB noise reduction at the hospital. Potential options include the use of low noise idlers or shielding of idlers on conveyors and shielding or specifying 800kW drives to 82 dB(A) at 1m for a number of the drives.

Potential noise impacts from construction activities will be managed by the preparation of a Construction Noise Management Plan prior to the commencement of construction to ensure the requirements of the *Environmental Protection (Noise) Regulations 1997* are met. Impacts of pile driving and wharf construction on marine fauna, (e.g. turtles) will be managed through the use of soft start procedures, adequately trained marine fauna observers, a marine fauna exclusion zone of 300m and stop work procedures when marine fauna are sited within 100m of operations.

NWI will prepare and implement a Noise Management Plan prior to the commencement of operations. The Noise Management Plan will include a number of noise control measures, including:

- Educating and training NWI employees and contractors with respect to noise management;
- Ensuring noise emissions are considered when sourcing plant and equipment;
- Scheduled maintenance and monitoring of equipment with a view to minimising noise emissions;
- Noise monitoring and reporting annually;
- Preparing contingency plans; and
- Providing a complaints response procedure.

Following completion of construction of the project, noise emissions resulting from the operations of the project will be monitored to ensure compliance with the *Environmental Protection (Noise) Regulations 1997.* Should it be determined that the noise emissions from the Multi-user Iron Ore Export (Landside) Facility exceed the regulations, the noise sources will be identified and practicable noise control measures implemented to reduce emissions in accordance with best reasonable practice.

Relevant Environmental Factors

Other relevant environmental factors include:

- Marine fauna;
- Introduced marine species;
- Terrestrial flora and fauna;
- Acid sulphate soils
- Hydrocarbons and other chemicals;
- Waste management;
- Port area decommissioning and rehabilitation;
- Aboriginal heritage; and
- Access, recreational use and public safety.

This document describes the impacts of the project, and for each factor discusses the:

- Objective for the factor;
- Relevant guidance material;

- Potential impacts;
- Management of impacts; and
- Predicted outcome.

Marine Fauna

The impact of the project on marine biota will be within the limits for acceptable change identified in the Perth Coastal Waters Environmental Values and Objectives (EPA, 2000b). The Project is unlikely to have a significant impact on threatened or migratory marine species and the risk to other marine based fauna such as crustaceans and fish is expected to be minimal. In the event that any injuries to conservation significant marine fauna occur as a result of shipping activities, the incident will be recorded and reported to the DEC and SEWCaP. The requirements of the *Wildlife Conservation Act 1950* and the *EPBC Act 1999* will be met. Impacts of noise associated with pile driving and wharf construction on marine fauna, (e.g. turtles) will be managed through the use of soft start procedures, adequately trained marine fauna observers, a marine fauna exclusion zone of 300m and stop work procedures when marine fauna are sited within 100m of operations.

Introduced Marine Species

Shipping associated with the project has the potential to introduce additional marine pests into Port Hedland harbour.

NWI will work closely with the PHPA to ensure that protocols are consistent between operators in Port Hedland. NWI will operate in accordance with the Australian Quarantine Inspection Service (AQIS) guidelines for ballast water management, the ANZECC Code of Practice for Anti-fouling and In-water Hull Cleaning and Maintenance and the requirements of the Western Australian Department of Fisheries.

Terrestrial Flora and Fauna

The development of the Multi-user Iron Ore Export (*Landside*) Facility will result in the disturbance of 290ha of vegetation within a development envelope of 350ha, with the majority of the vegetation to be cleared being a mosaic of FCTs 1 (low shrubland to open shrubland of mixed *Acacia* spp. dominated by *Acacia stellaticeps* over low hummock grassland of *Triodia epactia*, on red sandy clay loams on plains and low lying areas, including supra tidal plains) and FCT 2 (low to mid sparse shrubland of *Acacia colei* var. *colei* and *Acacia stellaticeps* over low hummock grassland of *Triodia epactia* with *Eriachne mucronata*, on red sand to sandy-loam on plains, drainage lines and low lying areas including supra tidal plains), FCT 2 or FCT 5 (low open to sparse samphire shrubland dominated by *Tecticornia* spp. and *Muellerolimon salicorniaceum* with sparse tussock grassland of *Sporobolus virginicus* on brown clays on tidal zones).

Six species of priority flora occur within the study area: *Eragrostis crateriformis* (P3), *Gomphrena leptophylla* (P3), *Gomphrena pusilla* (P2), *Goodenia nuda* (P4), Gymnanthera cunninghamii (P3) and *Tephrosia rosea* ?var. *venulosa* (P1). Two of the six species of priority flora will be impacted by the project: *Eragrostis crateriformis* (P3) (one of two known locations within the study area) and *Tephrosia rosea*? var. *venulosa* (P1) (five of six known locations within the study area). The project will have a low impact on the regional conservation status of all these conservation significant flora taxa (Woodman, 2011b).

A total of 36 listed conservation significant vertebrate fauna species (26 migratory birds, 5 mammals, 2 reptiles and 3 other bird species) could potentially occur within the project area due to the presence of suitable habitat. However none of the species are anticipated to be significantly affected by the proposed Multi-user Iron Ore Export (Landside) Facility. No fauna habitats within the project area are spatially restricted or likely to support populations of significant species or fauna communities.

Management plans will be prepared and implemented to minimise the impacts on terrestrial flora and fauna and the requirements of the *Wildlife Conservation Act 1950* and the *Environment Protection and Biodiversity Conservation Act 1999* will be met.

Acid Sulphate Soils

For the most part, the proposed development entails filling and above ground construction, such as the 10km rail loop and the 5.8km conveyor corridor and thus has limited potential to impact on Potential Acid Sulphate Soils (PASS). However, PASS may be present during the construction of the proposed car dumping facility, stockyard area and wharf area. The occurrence of Acid Sulphate Soils (ASS) within the project area will be assessed in conjunction with geotechnical drilling and analysis prior to the commencement of construction.

A risk-based approach will be adopted in designing the scope of intrusive investigations for the project. Investigations will be tailored towards areas where PASS is most likely to exist and/ or areas where ground disturbance is greatest, in particular in the in the vicinity of the car dumper, stockyard and wharf area. Intrusive groundwater assessment will form part of the detailed investigative works. The general approach to the management of any PASS will be to avoid the use or handling of PASS materials. Where this cannot be avoided, the Construction EMP will include procedures for monitoring and management of materials that are potentially acid forming. Monitoring will include water quality from dewatering during the construction phase of the project.

Hydrocarbons and Other Chemicals

Hydrocarbons and other chemicals may spill into the marine environment as a result of ship collisions or grounding, discharge of oil in bilge water, during bunkering or deliberate discharge. NWI will liaise with PHPA to minimise the risk to the marine environment from hydrocarbon or chemical spillage. Spillages associated with shipping will be managed by PHPA.

NWI will develop a Construction EMP and an Operations EMP that will address, among other issues, the management of hydrocarbons and other chemicals.

Waste Management

Waste has the potential to pollute the environment and impact on human health if not managed appropriately. Waste management for the Project will be as for existing port operations within the Port of Port Hedland. NWI will prepare a Waste Management Plan to minimise the risk to the environment from waste to ensure that wastes associated with the Project do not adversely affect the health, welfare and amenity of people and land uses and are managed in accordance with the waste hierarchy.

Port Area Decommissioning and Rehabilitation of Land Based Disturbance

The Project has an indefinite operating life depending on continued exploration and development of the iron ore industry and use by other third parties. In the unlikely event that all or part of this infrastructure is no longer required, the facilities will be decommissioned in accordance with appropriate legislation. Through the preparation and implementation of a Port Area Rehabilitation Plan, NWI will ensure, as far as is practicable, that land not required for the long term use of the project will achieve a stable and functioning landform consistent with the surrounding landscape and environmental values.

Aboriginal Heritage

The PHPA has a Land Access Agreement (LAA) with the Native Title Claimants - the Kariyarra People - for land in the area currently managed by PHPA and the area to be managed by the PHPA in the future. This includes the area for the Multi-user Iron Ore Export (*Landside*) Facility. The PHPA has carried out comprehensive Aboriginal Heritage surveys over the Port area. There are 6 heritage sites within the project area. Approval to disturb the sites will be sought under Section 18 of the

Aboriginal Heritage Act 1972 as appropriate. Approval to disturb site(s) within DMMA G has been obtained by the PHPA under Section 18 of the *Aboriginal Heritage Act 197*2.

Access, Recreational Use and Public Safety

Given that the Multi-user Iron Ore Export (Landside) Facility will not restrict access or recreational use within the Port Hedland Harbour, except for the area immediately adjacent to the berths, access, recreational use and public safety is not considered to be a relevant factor in this proposal. An Emergency Response Plan will be prepared and implemented.

Table E2 summarises NWI's evaluation of each of the environmental factors, potential environmental impacts and outlines the proposed management actions to reduce environmental risk.

Conclusion

NWI is committed to minimising environmental impacts where possible and will ensure all impacts are managed through the implementation of construction and operation management plans. NWI has made a number of formal commitments with respect to the project to ensure the project's construction and operations are undertaken in an environmentally responsible manner. All formal commitments will be implemented to the satisfaction of the Minister for the Environment.

For all factors assessed it is considered that, with the implementation of the proposed management and mitigation elements, the EPA objectives can be met and environmental impacts will be minimised to 'As Low as Reasonably Practicable' (ALARP).

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Biophysical				
Benthic Primary Producer Habitat	To limit direct loss of BPPH associated with the Project, and to ensure the protection of BPPH of Port Hedland Harbour from indirect impacts associated with the project.	The project area contains a relatively small area of mangal associated with South West Creek containing a limited number of mangrove associations due to small area and limited habitat present. The mangal species in NWI's development area are *Avicennia marina* (dominant in most mangal assemblages in the study area) and *Rhizophora stylosa*. The mangrove associations present in the project area are among the most common recorded in previous studies of the Port Hedland Harbour, and are indicative of those associated with mid-high tidal flats. Limited areas of salt marshes and potential cyanobacterial mats occur in the Project area.	The Project has been designed to minimise the impact on mangrove and other benthic primary producer habitats. The total disturbance to mangroves as a result of the project is 4.46ha. The mangrove assemblages to be directly impacted by the project are located within the Port Hedland Industrial Area Management Unit. The project will have no direct impact on mangroves in the regionally significant and high conservation area of the Oyster Passage Barrier Mangrove Management Unit, which is classified as Category A in EPA (2009d). The predicted loss of 4.46ha of mangrove assemblages represents approximately 0.15% of the total mangrove habitat within the Port Hedland Industrial Area Management Unit. The cumulative loss of mangroves has been calculated to be 12.95% when combined with historical losses and the potential losses from the Roy Hill Infrastructure proposal and the South West Creek Dredging and Reclamation Proposal.	The Project was designed to minimise the impact on mangroves. A trestle type structure will be used for the wharves to allow unimpeded tidal flows to adjacent mangroves. • Prepare and implement a Mangrove and other BPPH Management Plan prior to the commencement of construction. The Plan will include a mangrove health risk assessment to provide baseline data on mangrove health and will detail ongoing monitoring of mangrove health. • Workforce induction including information on the ecological significance of mangroves (and other BPPHs) and instructions on clearing procedures; • Delineation of clearance boundaries prior to commencement of clearing activities to prevent disturbance of mangroves outside the clearing footprint;

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Biophysical (cont'd)				
Benthic Primary Producer Habitat (cont.)			Indirect losses of mangrove habitat as a result of altered surface and ground water flows, sedimentation and dust impacts are not expected to occur as a result of the project. The impact on other marine habitats will be limited. The construction of the rail loop will potentially impact on a small area of potential cyanobacterial mats (1.37ha) and samphires (3.67 ha) in the Oyster Passage Barrier Mangrove Management Unit and 29.4ha and 47.5ha respectively in the Port Hedland Industrial Area Management Unit.	• Where practical, inclusion of a buffer area (10m) between infrastructure edge and disturbance boundary in site plans to avoid impacts on mangroves outside the approved area; • Prohibiting access to mangroves outside the immediate disturbance footprint; • Reporting incidents with the potential to impact on mangroves; • Using construction methods such as scrub rolling where possible rather than removal of mangroves to provide maximum opportunity for vegetative recovery along the boundary of cleared areas; • Design of infrastructure based on best practice to withstand a 1 in 100 year flood event and ensure unimpeded surface water flows; • Inclusion of scour protection, particularly in the vicinity of the waterway openings in the conveyor and the culvert through the railway spur line to control erosion during flood and storm surge events;

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Biophysical (cont'd)				
Benthic Primary Producer Habitat (cont.)				• Design and implement a stormwater drainage system to capture surface water from operation areas in the stockyard. Discharge into established drainage lines to the north may only occur in long period return events during flow conditions. Runoff from the area east of the rail loop will follow the existing drainage pattern, passing through culverts at the neck of the rail loop. • The composition and distribution of cyanobacterial mats in the vicinity of the project area will be surveyed prior to the commencement of operations, and the results provided to the EPA. • Establishment of a network of shallow groundwater monitoring bores adjacent to the northern and western boundaries of the rail loop to monitor potential salinity impacts to mangroves.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Biophysical (cont'd)				
Marine Pests	Minimise the risk of introduction of unwanted marine organisms consistent with the Australian Quarantine Inspection Services (AQIS) guidelines for ballast water management and ANZECC Code of practice for anti-fouling and in-water hull cleaning and maintenance.	Port Hedland Harbour is currently recognised as an 'at risk' Australian Port for the introduction and establishment of marine pest species. Twelve introduced marine species are known from Port Hedland Harbour. None of the twelve species are included on the National Target List of Potential Introduced Marine Pest Species.	Possible introduction of marine pest species from another port during construction of the wharf or shipping during operations.	NWI will operate in accordance with the Australian Quarantine Inspection Service (AQIS) guidelines for ballast water management, the ANZECC Code of Practice for Anti-fouling and In-water Hull Cleaning and Maintenance and the requirements of the Western Australian Department of Fisheries. NWI will: • Ensure iron ore carriers selected for charter maintain a satisfactory record of reliable ballast water discharge; • Support AQIS in ballast water management checks; • Stay informed of the ratification status of the International Maritime Organisation ballast water convention and advances in ballast water treatment systems; and • Support the charter of ore carriers' trialling AQIS approved ballast water treatment systems and associated ballast tank monitoring.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Biophysical (cont'd)				
Marine Fauna	Maintain the ecological function, abundance, species diversity and geographic distribution of marine biota and habitat in order to protect ecosystem health, in accordance with the principles identified in the Perth Coastal Waters Environmental Values and Objectives (EPA, 2000b). Meet the requirements of the *Wildlife Conservation Act 1950* and the *EPBC Act 1999.*	The Port Hedland harbour has an extensive history of modification. The mangrove lined creeks of Port Hedland Harbour provide foraging habitat for juvenile green turtle (*Chelenia mydas*) and flat back turtles (*Natator depressus*). Flatback turtles are known to nest at Pretty Pool, Cooke Point and Cemetery Beach on the seaward side of the Port Hedland industrial and urban areas. Over one hundred species of fish have been recorded in the harbour. Marine mammals such as dolphins and whales may infrequently use the harbour; however dugongs (*Dugong dugong*) do not occur within the harbour due to the absence of seagrass beds.	As juvenile flatback and green turtles are known to occur within the mangrove lined creeks of Port Hedland Harbour, there is a small potential for some individuals to be affected by the Multi-user Iron Ore Export (Landside) Facility, particularly during construction. Light from the project is unlikely to disorientate newly hatching turtles as the nesting sites are located on the opposite (seaward) side of the industrial and urban area of Port Hedland. Impacts on marine fauna such as turtles are expected to be limited to the immediate vicinity (e.g. 20-30m). Any turtles in the area at the commencement of piling are expected to move away. The risk to other marine based fauna such as crustaceans and fish is expected to be minimal.	The loss of mudflats will be kept to a minimum by only disturbing mudflats required for permanent port facilities. All other disturbances will be confined to the terrestrial environment where possible. All requirements of the *Wildlife Conservation Act 1950* and the *EPBC Act 1999* will be met. Any incidents involving marine fauna of conservation significance resulting from shipping activities will be recorded and reported to the Department of Environment and Conservation. Impacts of noise associated with pile driving and wharf construction on marine fauna, (e.g. turtles) will be managed through the use of soft start procedures, adequately trained marine fauna observers, a marine fauna exclusion zone of 300m and stop work procedures when marine fauna are sited within 100m of operations.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Biophysical (cont'd)				
Terrestrial Flora and Fauna	Maintain the abundance, species diversity and geographic distribution of terrestrial flora and fauna; Protect conservation significant flora and fauna, consistent with the provisions of the *Wildlife Conservation Act 1950* and the *EPBC Act 1999*.	Five floristic community types (FCTs) and three coastal communities (not determined using floristic analysis) were identified by Woodman (2011a) in the project area. No Threatened or Priority Ecological Communities listed by the DEC occur within or near the project area. Six species of priority flora occur within the study area: *Eragrostis crateriformis* (P3), *Gomphrena leptophylla* (P3), *Gomphrena pusilla* (P2), *Goodenia nuda* (P4), *Gymnanthera cunninghamii* (P3) and *Tephrosia rosea* ?var. *venulosa* (P1). Coffey Environments completed a Level 1 fauna assessment. A total of 36 listed conservation significant vertebrate fauna species (26 migratory birds, 5 mammals, 2 reptiles and 3 other bird species) could potentially occur within the project area due to the presence of suitable habitat.	The project will result in the disturbance of up to 290ha of vegetation within a development envelope of 350ha, with the majority of the vegetation to be cleared being a mosaic of FCT 1 and 2 (low shrubland to open shrubland of mixed *Acacia* spp. dominated by *Acacia stellaticeps* over low hummock grassland of *Triodia epactia*, on red sandy clay loams on plains and low lying areas, including supra tidal plains) and FCT 2 (low to mid sparse shrubland of *Acacia colei* var. *colei* and *Acacia stellaticeps* over low hummock grassland of *Triodia epactia* with *Eriachne mucronata*, on red sand to sandy-loam on plains, drainage lines and low lying areas including supra tidal plains), FCT 2 or FCT 5 (low open to sparse samphire shrubland dominated by *Tecticornia* spp. and *Muellerolimon salicorniaceum* with sparse tussock grassland of *Sporobolus virginicus* on brown clays on tidal zones).	Management plans will be prepared and implemented to minimise the impacts on terrestrial flora and fauna and the requirements of the *Wildlife Conservation Act 1950* and the *Environment Protection and Biodiversity Conservation Act 1999* will be met.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Biophysical (cont'd)				
Terrestrial Flora and Fauna (cont'd)			Two of the six species of priority flora will be impacted by the project: *Eragrostis crateriformis* (P3) (one of two known locations within the study area) and *Tephrosia rosea* ?var. *venulosa* (P1) (five of six known locations within the study area). The project will have a low impact on the regional conservation status of all these conservation significant flora taxa (Woodman, 2011b). None of the 36 listed conservation significant fauna species are anticipated to be significantly affected by the project. No fauna habitats within the Project area are spatially restricted or likely to support populations of significant species or fauna communities.	

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Biophysical (cont'd)				
Port Area Decommissioning and Rehabilitation	To ensure that the environmental impact of the Project is minimised	The Project has an indefinite operating life depending on continued exploration and development of the iron ore industry and use by other third parties.	Failure to rehabilitate areas not required for infrastructure after completion of construction of the project could result in dust, erosion and loss of ecosystem function.	In the unlikely event that all or part of the infrastructure is no longer required, the facilities will be decommissioned in accordance with appropriate legislation. NWI will ensure as far as is practicable, that land not required for the long term use of the project will achieve a stable and functioning landform consistent with the surrounding landscape and environmental values through the preparation and implementation of a Port Area Rehabilitation Plan.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Pollution Management				
Surface Water and Coastal Processes	Maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance are protected. To maintain the integrity, ecological functions and environmental values of the seabed and coast.	The majority of the project is located within the western part of the catchments of South and South West Creeks, however part of the rail alignment runs along the divide between the catchments of South West Creek and the Turner River. Due to the alignment of the project, no surface water flows are expected from the project into the Turner River and flows in the Turner River will not be modified by the project. Floods and storm surges are known to occur in the vicinity of the project site. Under existing conditions combined storm surges and flood events with an AEP of 1 in 50 and 1 in 100 cause flooding of the floodplains of South and South West Creeks.	An assessment of the project's impact on surface water, flooding and storm surges was undertaken by SKM (SKM, 2011b); with the assessment considering cumulative impacts associated with the Roy Hill and NWI projects. The modelled simulations found that without mitigation measures, surface water flow would be impeded by the rail embankment, rail loop and stockpile and conveyors, and that adequate culvert capacity in the rail embankment for a 1 in 100 AEP event would ensure surface water flows are unimpeded by the rail loop or spur.	The conveyor will be elevated on trestles except in the immediate vicinity of the Roy Hill stockpile and rail line, where there is no environmental benefit to a trestle design. In these areas appropriately sized culverts will be incorporated into the design. The location of culverts will be determined in consultation with Roy Hill Pty Ltd. A regular program of inspection and maintenance of the culverts will be implemented to ensure the culverts continue to function effectively. Baseline and continuous monitoring of sediment and other pollutants will be conducted during construction and operation of the Multi-user Iron Ore Export (Landside) Facility to detect any changes in water quality due to the project. On site stormwater management will be implemented to detain runoff produced from impervious areas and to minimise scour caused by direct runoff from these areas.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Pollution Management (cont'd)				
Acid-forming Materials	Minimise the risk to the environment from acid sulphate soils (ASS).	Acid sulphate soils are known to occur in the Port Hedland Inner Harbour area within intertidal areas and at depths of approximately 2m below the sea bed surface. The preliminary ASS investigation confirmed that the northern portion of the project area is highly likely to contain PASS. PASS may be present during the construction of the proposed car dumping facility, stockyard area and wharf area. The occurrence of ASS within the project area will be assessed in conjunction with geotechnical drilling and analysis prior to the commencement of construction.	Acidity generated from acid-producing soils or groundwater may adversely affect soil and water quality.	A risk-based approach will be adopted in designing the scope of intrusive investigations for the project. Investigations will be tailored towards areas where PASS is most likely to exist and/ or areas where ground disturbance is greatest, in particular in the in the vicinity of the car dumper, stockyard and wharf area. Intrusive groundwater assessment will form part of the detailed investigative works. The general approach to the management of any PASS will be to avoid the use or handling of PASS materials. Where this cannot be avoided, the Construction EMP will include procedures for monitoring and management of materials that are potentially acid forming. Monitoring will include water quality from dewatering during the construction phase of the project.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Pollution Management (cont'd)				
Hydrocarbons and Chemicals	To maintain or improve the quality of surface and groundwater, to ensure that existing and potential uses, including ecosystem maintenance, are protected.	Port Hedland Port area abutting the harbour is heavily industrialised.	Hydrocarbons and other chemicals may spill into the marine environment as a result of ship collisions or grounding, discharge of oil in bilge water, during bunkering or deliberate discharge.	NWI will liaise with PHPA to minimise the risk to the marine environment from hydrocarbon or chemical spillage. Spillages associated with shipping will be managed by PHPA. NWI will develop a Construction EMP and an Operations EMP that will address, among other issues, the management of hydrocarbons and other chemicals.
Waste	To ensure that solid and liquid wastes do not adversely affect the health, welfare and amenity of people and land uses and are managed in accordance with the waste hierarchy outlined in DEC policy – Review of Waste Classification and Waste Definitions 1996 (as amended) (DoE, 2005).	Waste at existing facilities at the port is managed in accordance with legislative requirements and DEC policy of waste hierarchy.	If not managed appropriately, waste has the potential to pollute the environment and impact on human health.	NWI will prepare a Waste Management Plan to minimise the risk to the environment from waste to ensure that wastes associated with the Project do not adversely affect the health, welfare and amenity of people and land uses and are managed in accordance with the waste hierarchy.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Pollution Management (cont'd)				
Dust – Construction and Operation	Ensure that atmospheric emissions (dust) do not impact on environmental values or the health, welfare and amenity of the population and land uses; and Use all reasonable and practicable measures to minimise airborne dust.	Background dust levels are naturally high due to the arid environment and the meteorology of the region. Existing operations at the Port Hedland Port facilities are a major contributor to local ambient particulate concentrations, particularly in the vicinity of the port.	The potential impact of the Project on air quality in Port Hedland was assessed by SKM (2011c). This assessment considered the port expansion project in isolation and cumulatively with other existing, approved and potential projects. Results of air dispersion modelling demonstrate that the addition of dust from the Project is unlikely to result in significant changes to the current ambient air quality profile in the Port Hedland region. However the development of the project will result in an increase in the number of days when the 24hour average PM_{10} value exceeds the proposed interim guideline of 70 µg/m^3 specified in the Port Hedland Air Quality and Noise Management Plan. Including the Multi-user Iron Ore Export (Landside) Facility in modelling of future scenarios resulted in the interim guideline of 70 µg/m^3 would be exceeded on 5 days at the Harbour site in addition to the 96 days of predicted exceedances in the base case without the project.	Dust emissions during construction will be managed through the preparation and implementation of a Construction Environmental Management Plan. Management measures to minimise the impact of dust during construction will include the regular application of water to working areas and road surfaces, minimising drop heights of material with the potential to generate dust, restricting vehicle speeds to control dust and daily monitoring to ensure dust control measures are implemented and effective.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Pollution Management (cont'd)				
Dust – Construction and Operation (cont'd)			With the addition of dust from the project modelling predicts it is unlikely to result in significant changes to the current ambient air quality profile in the Port Hedland region. However the development of the project will result in an increase in the number of days when the 24hour average PM_{10} value exceeds the proposed interim guideline of 70 $\mu g/m^3$ specified in the Port Hedland Air Quality and Noise Management Plan.	NWI will prepare and implement a Dust Management Plan prior to the commencement of operation. The Dust Management Plan will include a number of dust control measures, including: • Maintenance of high ore moisture (target 7% never to fall below 4%): • Enclosure of key components at the rail car dumpers, use of fogging water sprays at the time of dumping and installation of a particulate extraction system around the wagon tipper; • Total enclosure and utilisation of water sprays at conveyor transfer points and the use of belt scrapers to clean conveyor belts; • Conveyors between the stockyard and the wharf will be covered to minimise dust (and noise) emissions; • Minimising the ship loader discharge height and installation of water sprayers at the boom discharge and boom conveyor system; • Stackers will be slewing, luffing types so that the drop height to the stockpile will be minimised;

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Pollution Management (cont'd)				
Dust – Construction and Operation (cont'd)				• Monitoring of the ore moisture content to reduce particular emissions and use of water cannons to dampen surfaces (as required) to prevent generation of fugitive dust; • Regular checks and maintenance of dust control equipment and removal of accumulated particulate material from under conveyors and around transfer points; and • Identification of road/traffic areas that are likely to produce unacceptable particulates and ensuring they are sealed. Particulates in low traffic areas will be controlled by water carts and speed limits. The Dust Management Plan will include a dust monitoring program, which will be developed in consultation with DEC and industry.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Pollution Management (cont'd)				
Noise – Construction and Operation	To ensure that noise emissions do not impact on environmental values or the health, welfare and amenity of the population and land uses; To ensure that noise emissions, both individually and cumulatively, comply with the relevant statutory requirements; To ensure design and procurement activities incorporate measures for minimising noise emissions during construction and operation; and To ensure that all reasonable and practicable measures are undertaken during construction and operations to minimise noise emissions.	Background night time noise levels at sensitive receptors in Port Hedland and surrounds currently exceed the *Environmental Protection (Noise) Regulations 1997*.	SVT (2011) assessed the potential noise impacts of the project on the Town of Port Hedland. The noise levels for port operations were compared with the criteria within the *Environmental Protection (Noise) Regulations 1977*. The results of the noise modelling of the proposed operations show that the project is predicted to exceed the *Environmental Protection (Noise) Regulations 1997* at one noise sensitive receptor (the hospital. The modelling predicted that the operations will exceed the noise level criterion of 32 dB by 5.6dB. The results of the noise modelling of the proposed operations show that the project is predicted to exceed the *Environmental Protection (Noise) Regulations 1997* at one noise sensitive receptor (the hospital. The modelling predicted that the operations will exceed the noise level criterion of 32 dB by 5.6dB at the Hospital site.	Potential noise impacts from construction activities will be managed by the preparation of a Construction Noise Management Plan prior to the commencement of construction to ensure the requirements of the *Environmental Protection (Noise) Regulations 1997* are met. Impacts of noise associated with pile driving and wharf construction on marine fauna, (e.g. turtles) will be managed through the use of soft start procedures, adequately trained marine fauna observers, a marine fauna exclusion zone of 300m and stop work procedures when marine fauna are sited within 100m of operations. NWI will investigate noise mitigation measures to achieve a 5.6 dB noise reduction at the hospital. Potential options include the use of low noise idlers or shielding of idlers on conveyors and shielding or specifying 800kW drives to 82 dB(A) at 1m for a number of the drives.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Pollution Management (cont'd)				
Noise – Construction and Operation (cont'd)				NWI will prepare and implement a Noise Management Plan prior to the commencement of operations. The Noise Management Plan will include a number of noise control measures, including: • Educating and training NWI employees and contractors with respect to noise management; • Ensuring noise emissions are considered when sourcing plant and equipment; • Scheduled maintenance and monitoring of equipment with a view to minimising noise emissions; • Noise monitoring and reporting annually; • Preparing contingency plans; and • Providing a complaints response procedure.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Pollution Management (cont'd)				
Noise – Construction and Operation (cont'd)				Following completion of construction of the project, noise emissions resulting from the operations of the project will be monitored to ensure compliance with the *Environmental Protection (Noise) Regulations 1997*. Should noise emissions from the project exceed the regulations, the noise sources will be identified and practicable noise control measures implemented to reduce emissions in accordance with best reasonable practice.

Table E2: Summary of Relevant Environmental Issues and Management for the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Environmental Factor	Management Objectives	Existing Environment	Potential Impacts	Management Strategies / Proponent Commitments
Social Surroundings				
Aboriginal Heritage	To comply with the requirements of the *Aboriginal Heritage Act 1972*.	The PHPA has a Land Access Agreement (LAA) with the Native Title Claimants (the Kariyarra People) for land in the area currently managed by PHPA and the area to be managed by the PHPA in the future, including the area for the Multi-user Iron Ore Export (*Landside*) Facility. The PHPA has carried out comprehensive Aboriginal Heritage surveys over the Port area. There are 6 heritage sites within the project area. Approval to disturb the sites will be sought under Section 18 of the *Aboriginal Heritage Act 1972* as appropriate. Approval to disturb the sites within DMMA G has been obtained by the PHPA under Section 18 of the *Aboriginal Heritage Act 1972*.	Given preparation and implementation of the Indigenous *Heritage Management Plan,* there is minimal potential to impact on sites of significance.	NWI will manage heritage issues in accordance with its *Indigenous Heritage Management Plan* and the requirements of the *Aboriginal Heritage Act 1972*

1 INTRODUCTION

1.1 Background

The North West Iron Ore Alliance (NWIOA), formed in 2007 and trading as North West Infrastructure (NWI – the Proponent), has been assigned two export berths within Port Hedland Port Authority's South West Creek in the Pilbara Region of Western Australia (**Figure 1**). The proposed NWI Multi-User Iron Ore Export Facility will provide an additional port facility at Port Hedland to receive and stockpile the product from emerging miners, specifically the various mines owned by the NWI shareholders, and load this product onto ships for delivery to customers (**Figure 2**) through these berths.

The current shareholders of NWI are Atlas Iron Limited, Brockman Resources Limited and FerrAus Limited. Each of the shareholders is exploring and developing new iron ore projects in the Pilbara, with Atlas Iron Limited currently the only company actively mining iron ore and exporting through existing facilities in the Port of Port Hedland.

Port Hedland Port Authority (PHPA) is proposing to expand port infrastructure in Port Hedland with the development of eight cape sized berths in South West Creek, a tributary of the Port Hedland Inner Harbour Estuary. Two of the eight berths proposed for the development of South West Creek (Berths SP3 and SP4) have been allocated to NWI, with two berths allocated to Roy Hill Iron Ore Pty Ltd (RHIO), one berth allocated to Fortescue Metals Group Pty Ltd (FMG) and three berths currently unallocated.

PHPA referred the South West Creek Dredging and Reclamation Project, which addressed the dredging campaign and onshore disposal of dredged material associated with the development of South West Creek, to the Environmental Protection Authority (EPA) on 8 November 2010. The South West Creek Dredging and Reclamation Project have been assessed by the EPA at the level of Assessment on Referral Information (ARI), and received ministerial approval on 15 March 2011 (Ministerial Statement 859).

The proposed NWI Multi-User Iron Ore Export (*Landside*) Facility, the subject of this referral, includes the development of two berths within South West Creek to provide for the export capacity of a nominal 50 million tonnes per year, along with supportive infrastructure incorporating stackers and loaders, conveyors, stockyard, rail car dumper and rail loop (**Figure 2**). The current proposal stops at the southern boundary of land proposed to be vested in the PHPA. The project accommodates a combination of haematite and a lesser quantity of magnetite iron ore product, depending on shareholder requirements.

The EPA has recently completed its assessment of RHIO's port infrastructure proposal to utilize the two more northern of the new berths in South West Creek immediately adjacent to NWI (EPA Report 1377, December 2010) and considered that the proposal can be managed to meet the EPA's environmental objectives subject to the EPA's recommended conditions being made legally binding. The Roy Hill Iron Ore Port Infrastructure (RHIOPI) project received ministerial approval (Ministerial Statement 856) on 11 March 2011. The RHIOPI project parallels the elements of the NWI proposal (**Figure 3**), with coordination between the two companies being undertaken to improve synergies and reduce environmental impacts.

NWI's *Railside* project involves a rail connection between the termination of western and eastern *Landside* rail connections located on land proposed to be vested in the PHPA and to any combination

of rail lines operated or proposed by FMG, BHP-Billiton Iron Ore Pty Ltd (BHP-BIO) and RHIO to accommodate iron ore delivery.

Given the dispersed geographic location of shareholder mine assets, the final rail solutions for each of the shareholders has yet to be determined. Accordingly the *Landside* proposal is limited to suitable infrastructure to be constructed and operating agreements to be developed within lands currently or proposed to be vested within PHPA.

The location of the rail spur between the rail provider and NWI rail connection will the subject of a separate referral to the EPA on resolution of the negotiations. A connection to FMG rail south of the Boodarie Industrial Precinct has been chosen as a reasonable worst case and used in modeling where the combined effect may be relevant to modeling conducted for the Multi-User Iron Ore Export (*Landside*) Facility, for example surface water flows and potential flooding impacts arising from the project.

The supply of potable and non-potable water to Port Hedland is operated and managed by the Water Corporation, with resources currently fully allocated. NWI is currently investigating a number of options for the supply of non-potable water to the facility, including cooperative developments within the West Canning Basin (with Water Corporation and other industrial users) and development of a desalination facility. In the event that water is not sourced from Water Corporation, the water supply for the Multi-user Iron Ore Export (Landside) Facility will be referred to the EPA for consideration.

A number of projects are located in close proximity to NWI's Multi-user Iron Ore Export (Landside) Facility.

The RHIOPI project is similar in scope to NWI's Multi-user Iron Ore Export (Landside) Facility, with the key elements including a railway and rail loop with a train unloader and stockyards at the end of the proposed Roy Hill railway at Boodarie, approximately 7km south west of the town of Port Hedland; a conveyor connecting the train unloader and stockyards to the wharf and ship loader (approximately 4km south–west of Port Hedland) and wharf and ship loading infrastructure at Stanley point within South West Creek in Port Hedland inner harbor. The RHIOPI project is immediately adjacent to NWI's Multi-user Iron Ore Export (Landside) Facility (**Figure 3**).

Atlas Iron Limited (Atlas) is seeking approval to develop the Turner River Hub Project (TRH Project) in the Pilbara region of Western Australia to achieve a corporate objective to export 12 million tonnes per annum (Mtpa). The TRH Project involves the development of a central processing hub adjacent to the Turner River, private off-highway haul roads, the Mt Webber (Mt Webber) minesite (a greenfield site), additional infrastructure at Wodgina minesite (a brownfield site), and a product stockyard and overland conveyor at the Port Hedland Port. Atlas intends to use the Boodarie multi-user stockyard area within Port Hedland Port as its port stockyard, which is in close proximity to NWI's Multi-user Iron Ore Export Facility: Port Component Project, including road transport in a common corridor. The TRH Project has been referred to the EPA, with the level of assessment set at Public Environmental Review (PER).

BHP-BIO proposes to develop an Outer Harbour facility adjacent to existing facilities at Port Hedland to meet increasing global demand for iron ore. The proposed development will provide an export capacity of approximately 240 Mtpa of iron ore. The project description includes a rail spur from the existing BHP-BIO mainline to the proposed stockyards at Boodarie; rail loops at the Boodarie stockyards; an infrastructure corridor from the Boodarie stockyards to the proposed wharf; jetty, wharf, dredged channel, basins and berth pockets to accommodate shipping vessels; supporting infrastructure and construction camp(s).

1.2 Purpose and Scope

The purpose of this document is to formally refer NWI's Multi-user Iron Ore Export (Landside) Facility to the EPA for setting a level of assessment under Section 38 of the *Environmental Protection Act* 1986. This document has been prepared in accordance with referral guidelines and provides key information about the Project. The referral has been prepared in accordance with EPA guidance and objectives, and accommodates advice provided on recent relevant projects.

Discussions with the Office of the EPA (OEPA) indicated that an Assessment on Proponent Information (API) may be appropriate for the project, due to the extensive consultation undertaken, the environmental impacts associated with the Project and their proposed management. An API level of assessment is usually applied to proposed developments that raise a small number of significant environmental factors that can be readily managed (EPA 2010a).

This document:

- Describes the proposed Multi-User Iron Ore Export (Landside) Facility;
- Provides details of consultation undertaken with external stakeholders, including relevant government agencies and interested parties;
- Details the existing environment;
- Provides an assessment of the environmental impact of the Project, based on technical information, policies and guidelines relevant to those effects;
- Details NWI's proposed environmental management; and
- Details NWI's environmental commitments.

This document addresses the Multi-user Iron Ore Export (Landside) Facility, which consists of port and associated facilities within the precincts of the Port Hedland Port Authority. This includes two berths within South West Creek to provide for the export capacity of 50 million tonnes per year, along with supportive infrastructure incorporating stackers and loaders, conveyors, stockyard, and rail loop.

The rail component of the Multi-User Iron Ore Export Facility Project and the possible supply of water for the operation for the Project may be the subject of separate applications to the EPA, depending on the final solution and potential to impact on the environment.

1.3 Proponent

The proponent for the Project is:

North West Infrastructure
46 Parliament Place, West Perth WA 6005
Phone: 9 226 1776 Fax: 9226 1779
www.nwioa.com.au

The key contact for this proposal is:

Mr A Considine
Chief Executive Officer
North West Infrastructure
Tel: 92261776 Fax: 9226 1779
Mobile 0405 514 421 Email: tony.considine@nwioa.com.au

1.4 Applicable Legislation and Standards

The implementation of the project will require compliance with Western Australian legislation and regulations, Commonwealth legislation and regulations, international environmental agreements, EPA position statements and guidelines, and Department of Environment and Conservation (DEC) guidelines. A summary of the key approvals required and status as at the time of referral is provided in Table 1.

1.4.1 State Legislation and Regulations

Key Western Australian legislation and regulations that apply to the proposal include, but are not limited to:

- *Aboriginal Heritage Act 1972.*
- *Agriculture and Related Resources Protection Act 1976*
- *Contaminated Sites Act 2003.*
- *Dangerous Goods Safety (Goods in Ports) Regulations 2007.*
- *Environmental Protection* (EP) *Act 1986.*
- *Environmental Protection (Controlled Waste) Regulations 2004.*
- *Environmental Protection (Noise) Regulations 1997.*
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.
- *Environmental Protection (Unauthorised Discharges) Regulations 2004.*
- *Land Administration Act 1997.*
- *Heritage of Western Australia Act 1990.*
- *Marine and Harbours Act 1981.*
- *Mining Act 1978.*
- *Pollution of Waters by Oil and Noxious Substances Act 1987.*
- *Pollution of Waters by Oil and Noxious Substances Regulations 1993*.
- *Port Authorities Act 1999.*
- *Rights in Water and Irrigation Act 1914.*
- *Soil and Land Conservation Act 1945.*
- *Wildlife Conservation Act 1950.*

Table 1: Key Approvals Required for the Multi –user Iron Ore Export (Landside) Facility and Their Status as at Referral

Element	Required Approval(s)	Legislation	Issuing Authority	Comments
Aboriginal Heritage	Section 18 Clearance to disturb sites impacted by project. Prepare heritage management plan – requirement of EPA and DIA	*Aboriginal Heritage Act 1972 (WA)*	Minister for Indigenous Affairs on advice from the Aboriginal Cultural Materials Committee (ACMC) OEPA/DIA	Preliminary advice report completed including results of field survey conducted and consultation with relevant aboriginal groups. Five potential intersections identified between known sites and project elements. S 18 application in preparation.
Native Title	To meet requirements of Native Title determination To meet requirements of agreement reached by government with Native Title claimants	*Native Title Act 1993*	NNTT	Negotiations with Native Title claimants are advanced with details of an agreement agreed. Legal documents being prepared.
European Heritage	Protection of any listed heritage identified on site	*Heritage of Western Australia Act 1990 (WA)*	Heritage Council of WA,	None found in search of register or during field visits.
Land tenure	1. Vesting of land from ownership of BHP-BIO to PHPA through Notice of Intention to Take (NOIT) protocol. 2. NWI enters into agreement for required land through lease and licence arrangements.	*Land Administration Act 1997 (WA)*	RDL	Process for vesting of land in PHPA commenced, with required land identified and submitted. Both lease and licence documents advanced with submission to government agencies pending.
Environmental (State)	EPA's Report & recommendations Issuance of Ministerial conditions	*Environmental Protection (EP) Act 1986* (WA) Part IV	Minister for Environment on advice from Environmental Protection Authority (EPA)	Consultation with Chairman of the EPA and OEPA officers identifying key factors. Specialist studies and referral prepared (this document).
Native Vegetation Clearing Permit	Clearing of land	EP (Clearing of Native Vegetation) Regulations 2004	DEC	Required if project is not formally assessed by EPA. Site investigations to present have not required disturbance of vegetation.

Table 1: Key Approvals Required for the Multi –user Iron Ore Export (Landside) Facility and Their Status as at Referral (cont'd)

Element	Required Approval(s)	Legislation	Issuing Authority	Comments
Environmental (Commonwealth)	Issue of Ministerial conditions	*Environmental Protection & Biodiversity Conservation (EPBC) Act 1999*	Department of Sustainability, Environment, Water, Communities and Population (SEWCaP) by delegation	The potential for the proposal if implemented to impact on matters of national environmental significance (NES) has been considered and it is concluded that no such triggers exist. Not referred.
Works Approval and Licences (Element specific)	Issue of works approval pre-construction and issue of licence pre-commencing operation.	*Environmental Protection (EP) Act 1986 (WA)* Part V	DEC	Category 86, ***Bulk material loading or unloading****: premises on which ….ore concentrate or any other bulk granular material is loaded onto or unloaded from vessels by a closed materials loading system.* Any project-specific utility (for example RO plant) will require works approvals and licences. Initial consultation with DEC Perth and Karratha to determine requirements.
Planning	None required if development fits within uses set by Town Planning Scheme (TPS) for zone covering site, or if location is exempt from TPS.	Town of Port Hedland (TPH) TPS 6 & *Planning & Development Act 2006 (WA)*	TPH & Western Australian Planning Commission (WAPC)	Elements of the land proposed for development are currently zoned conservation recreation and natural landscapes or rural. However on vesting to PHPA, area will be excluded from planning provisions. Initial consultation with TPH Planning Department to determine requirements.
Development	Approval to conduct operations	Town of Port Hedland (TPH) TPS 6 & *Planning & Development Act 2006 (WA)*	TPH & WAPC	Development approval for specific construction elements. Initial consultation with TPH Planning Department has occurred to determine requirements. Application will follow environmental approvals and detailed design.
Building Licences	Approval to construct buildings and possibly other elements	*Local Government (Miscellaneous Provisions) Act 1960*	TPH	Multiple building licences may be required. Initial consultation with TPH Building Department has occurred to determine requirements. Application will follow environmental approvals and detailed design.

1.4.2 EPA and DEC Guidelines

The EPA and DEC provide direction for environmental protection and impact assessment through published guidelines and position statements. NWI has referred to these publications in investigating and reporting on aspects of this Project. The key EPA position statements and guidelines that are of relevance to the Project include:

- EPA Position Statement 2: *Environmental Protection of Native Vegetation in Western Australia – Clearing of Native Vegetation with Particular Reference to the Agricultural Area* (EPA, 2000a).
- EPA Position Statement 7: *Principles of Environmental Protection* (EPA, 2004a).
- EPA Position Statement 6*: Towards Sustainability* (EPA, 2004b).
- EPA Position Statement 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA, 2002a).
- EPA Guidance Statement No. 1: *Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline* (EPA, 2001).
- EPA Guidance Statement No. 8: *Draft Environmental Noise* (EPA, 2007).
- EPA Guidance Statement No.12: Minimising Greenhouse Gases (EPA, 2002b).
- EPA Guidance Statement No. 18: Prevention of Air Quality Impacts from Land Development (EPA, 2000b).
- EPA Guidance Statement No 3: Protection of *Benthic Primary Producer Habitat in Western Australia's Marine Environment* (EPA, 2009).
- EPA Guidance Statement No. 41: *Assessment of Aboriginal Heritage* (EPA, 2004e).
- EPA Guidance Statement No. 51: *Terrestrial Fauna Surveys for Environmental Impact Assessment* (2004c).
- EPA Guidance Statement No. 55: *Implementing Best Practice in Proposals Submitted to the Environmental Impact Assessment Process* (EPA, 2003a).
- EPA Guidance Statement No. 56: *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2004d).
- EPA *Interim Industry Consultation Guide to Community Consultation* (EPA, 2003b).

DEC guidelines that are of relevance to the Project include:

- *Pilbara Coastal Water Consultation Outcomes Environmental Values and Environmental Quality Objectives* (DoE, 2006).
- *Identification and Investigation of Acid Sulphate Soils and Acidic Landscapes* (DEC, 2009a).
- *Draft Treatment and Management of Soils and Water in Acid Sulphate Soil Landscapes - Acid Sulphate Soils Guideline Series* (DEC, 2009b).

1.4.3 Commonwealth Legislation and Approvals

Key Commonwealth legislation and regulations and guidelines that may apply to the proposal include, but are not limited to:

- *Environment Protection and Biodiversity Conservation (EPBC) Act 1999.*
- *Environment Protection (Sea Dumping) Act 1981.*
- *Aboriginal and Torres Strait Islander Protection Act 1984.*
- *Australian Ballast Water Management Requirements and Australian Quarantine Regulations 2001.*
- *Australia Heritage Council Act 2003.*
- *Hazardous Waste (Regulation of Exports and Imports) Act 1989.*
- ANZECC Guidelines for Fresh and Marine Water Quality 2000.
- National Strategy for the Management of Coastal Acid Sulphate Soils ANZECC/ARMCANZ 2000.

1.4.4 International Agreements

Australia is a signatory to a number of international environmental agreements that are relevant to the Project including:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979.
- International Convention for the Prevention of Pollution from Ships (MARPOL Convention) 1973/1978.
- The China-Australia Migratory Bird Agreement (CAMBA) 1986.
- The Japan-Australia Migratory Bird Agreement (JAMBA) 1974.

1.4.5 Other Approvals

The potential for the proposal if implemented to impact on matters of national environmental significance has been considered and it is concluded that no such triggers exist. Accordingly the proposal has not been referred to the Department of Sustainability, Environment, Water, Communities and Population (SEWCaP) under the EPBC Act.

In accordance with the *Aboriginal Heritage Act 1972*, approval is required to use land or water on which Aboriginal sites or objects are located. All land and water has been surveyed and assessed. Approvals will be sought under Section 18 of the *Aboriginal Heritage Act 1972* to disturb sites identified.

A works approval and licence will be required under Part V of the *Environmental Protection Act 1986* for the bulk materials handling. An application for the works approval and licence will be made in due course.

Implementation of the NWI Multi-User Iron Ore Export Facility Project will require vesting within the PHPA of land currently held by BHP-BIO and comprising elements of Boodarie Estate and Boodarie Pastoral Station holdings. PHPA has agreed on a process with BHP-BIO that will enable land

required for Port uses to be identified and control transferred to the PHPA. Land required to be vested in the PHPA to accommodate the NWI project has been identified and a timetable identified.

Once vested within the PHPA, land required by NWI to implement this project will be subject to a number of lease and licence agreements. A licence and lease plan has been prepared and drafting of the licence and lease documents is well advanced.

2 PROJECT DESCRIPTION

2.1 Project Description

2.1.1 Overview

The proposal is to construct and operate port infrastructure located within existing PHPA vested land and the Boodarie Multiuser Stockyard Area, both within the locality of the Port Hedland Inner Harbour. Iron ore (hematite and magnetite) would be unloaded at Boodarie and placed via conveyor / stackers into stockpiles before being reclaimed and delivered, via an elevated overland conveyor, to shipping berths in South West Creek for export. Infrastructure includes two berths, Stanley Point 3 and Stanley Point 4 (SP3 and SP4) within South West Creek to provide for the export capacity of a nominal 50 million tonnes per year, along with supportive infrastructure incorporating stackers and loaders, conveyors, stockyard, and a rail loop (**Figure 2**).

2.1.2 Key Project Characteristics

The key characteristics of the proposal include:

- A two berth wharf and ship loading infrastructure at Stanley Point within South West Creek in the Port Hedland Inner Harbour to provide for the export capacity of 50 million tonnes per year;A single shiploader (long travelling, slewing, luffing);Overland conveyors1800mm wide for a total of 6.2 km between the stockpile area and a shiploader;
- Stockpile area enclosed within an embankment that supports the ballast, sleepers and rail for the car dumper rail loop at Stockyard 2, approximately 6km south west of the town of Port Hedland;
- Single twin cell rotary car dumper feeding to dual stacker; and
- Identification of two optional rail connections to the edge of land proposed to be vested in the PHPA (Boodarie Estate) allowing for access to rail providers.The key characteristics of the Multi-user Iron Ore Export (Landside) Facility are provided in **Table 2**.

Table 2 Key Characteristics of NWI's Multi-user Iron Ore Export (Landside) Facility

Element	Description
Rail	Railway[1] comprising: • Western rail loop on Stockyard 2 providing possible connection to FMG, BHP-B or third party provider; • Eastern rail providing a possible connection to Roy Hill Iron Ore • Twin car train unloader.
Stockyard	Stockyard 2 comprising a rail loop, 2 stackers, 1 reclaimer and stockpile area of approximately 1500 m long by 400m wide – 8 x 210000t live stockpiles

Table 2 Key Characteristics of NWI's Multi-user Iron Ore Export (Landside) Facility (cont'd)

Element	Description
Conveyors	• 1800mm wide by 5.2 km overland conveyors (1.5 km and 3.7 km long respectively) from the stockyard to a transfer station located on the Eastern side of the Finucane Island access causeway. • 1800mm wide by 1.0 km conveyor which runs from the overland conveyor transfer station to the berth shiploader conveyor.
Wharf	Wharf structures, two shipping berths and one ship loader at Stanley Point in South West Creek
Other infrastructure	Offices, workshops, access roads and service corridors
Life of project	50 years or more
Throughput	Nominal 50 million tonnes per annum
Disturbance footprint	290 ha[2] within a development envelope of 350ha comprising: • 149 ha within existing PHPA vested land; • 141 ha within land proposed to be vested in the PHPA.
Mangrove disturbance	4.46 ha

[1] Note rail limited to land proposed to be vested in PHPA. Final rail spur design and alignment will be determined following identification of a preferred rail solution and relevant agreement(s).

[2] Note 62.51 ha within DMMA Area G has previously been considered in EPA Report 1380 and approved under Ministerial Statement 856

2.1.3 Project Staging

The port facilities will commence construction in two stages. Export capacities are based on installed equipment capacities and exclude port limitations. The equipment quantities and the iron ore product capacity for each stage are listed in **Table 3.**

Table 3 Summary of Stage One and Stage Two Capacity and Equipment Quantities

Description	Stage One	Stage Two
Port Capacity	36 Mtpa	50 Mtpa
Car Dumpers	1	1
Stockyard	6 piles	8 piles
Stackers	2	2
Reclaimers	1	1
Shiploading Berths	1 loading, 1 lay-bye	2 loading

This referral document considers Stage Two (whole of project) port facility development.

2.2 Project Justification

Infrastructure constraints within Port Hedland Port are a bottleneck to growth. Completing the supply chain from mine to market is a key driver for NWI and assurance of port access, transport and handling is a critical issue in the context of large scale bulk commodity mining projects.

Currently, each of NWI's three shareholders is exploring and developing new iron ore projects, with Atlas Iron Limited having commenced exporting iron ore from Port Hedland Port. NWI's shareholders

have delineated combined high-grade hematite, channel iron deposit and detrital resources totalling approximately 2.62 billion tonnes and magnetite resources totalling approximately 1.96 billion tonnes.

To facilitate iron ore exports, NWI requires suitable infrastructure to be constructed and associated operating agreements to be developed. The geographic location of shareholder tenements dictates that the logical and most economic location for export facilities is Port Hedland. Exporting iron ore through other existing ports in the Dampier region would result in increased haulage distances of approximately 150 km with commensurate increases in capital and operating costs.

To meet the long-term needs of its shareholders, NWI is proposing to develop a new Multi-user Iron Ore Export Facility within the Port Hedland Port and to begin exporting iron ore from this facility in 2014. The project will include two berths in South West Creek, ship-loader, overland conveyor, stockyard and rail loop. The PHPA supports the facility and has provided NWI with a 50 Mtpa capacity allocation and assigned the closest available and accessible land for the associated infrastructure.

In developing the proposal for the Multi-user Iron Ore Export Facility, NWI appointed global engineers Sinclair Knight Mertz (SKM) to undertake a prefeasibility study (PFS) that considered a range of design options, infrastructure alternatives and locations. The study into the South West Creek based-project was completed in 2010 and found that the proposed project would be capable of meeting the shipping needs of NWI's shareholders (SKM, 2010). The Definitive Feasibility Study (DFS) has progressed the design of a base case that best fitted the objectives and production requirements of NWI whilst at the same time meeting the requirements of stakeholders such as the PHPA and to meet legislative requirements (SKM, 2011a).

An alternative to the development of new berths and infrastructure was to gain access to existing ship-loading facilities at Port Hedland Port. However, such a solution is precluded due to the severe capacity constraints already experienced at the port. The PHPA is anticipating continued strong growth in capacity requirements through its facilities, estimating that bulk export tonnages from its inner harbour will rise from the current 174 Mtpa to a maximum capacity of 490 Mtpa by 2020.

PHPA's decision to allocate additional capacity to BHP-BIO and FMG as part of the inner harbour expansion illustrates the lack of existing capacity. These two companies currently account for an estimated 97% of port trade.

Additional capacity for emerging Pilbara miners is being provided at the Utah Point multi-user bulk commodities berth operated by the PHPA. However, Utah Point cannot be viewed as a solution for NWI requirements with its total capacity limited to the export of between 15 and 17 Mtpa; and again, this capacity has already been fully allocated.

Hancock Prospecting Propriety Limited (HPPL), which is developing the Roy Hill Project, has also been granted an allocation to the proposed berths adjacent to those of NWI in South West Creek. While there may have been scope for the development of a single multi-user facility to be shared by NWI and Hancock Prospecting, such a solution has not been forthcoming.

Based on the above and results of the PFS and DFS, the development of its own multi-user berth at South West Creek remains the most effective and practical solution for NWI shareholders to achieve export certainty.

The layout is consistent with the Port Hedland Port Authority's Ultimate Development Plan (Worley Parsons, 2007), which considers the ultimate sustainable capacity of the port with respect to export demand, resources, land availability, transport infrastructure and environmental and social factors. PHPA is in the process of having all required project land vested in it and resumed for the purpose of 'public works'; hence PHPA is actively engaged in land planning issues with all relevant stakeholders.

NWI has, wherever possible, selected and orientated its proposed facility and infrastructure locations in accordance with PHPA development planning objectives. Such objectives have aimed to provide the best use of the ultimate sustainable capacity of the port matched to resources, land availability, transport infrastructure and environmental and social considerations.

Establishing guaranteed access to port facilities will eliminate a key hurdle for NWI and greatly assist its shareholders to achieve their potential to generate an estimated AUD$200 million in annual royalty payments and provide significant new employment and economic development opportunities for the Pilbara region.

2.3 Evaluation of Alternatives

A number of alternatives were evaluated as part of the prefeasibility assessment and are briefly summarised below.

2.3.1 Selection of Stockyard Area

Of the project options assessed during the prefeasibility study, the selected stockyard location (i.e., Stockyard 2) is the furthest from potential sensitive receptors. An alternative location for the stockyard area considered in the Prefeasibility Study was: located near the PHPA's Reclamation Area H, north of BHP-BIO HBI Plant. Under this option, the stockyard will be located on the proposed onshore dredge spoil area. The option of locating the Stockyard area at the PHPA's Reclamation Area G, east of the Finucane Island causeway and west of the Fortescue Metals Group stockyard was considered not viable. Design concepts considered for stockyard location and configuration are illustrated in **Figure 4.**

2.3.2 Conveyor Alignment

A number of alternative alignments were considered for the alignment of the overland conveyors. he alignments were assessed in terms of their impacts on mangrove communities and the efficient functioning of the port area. The selected alignment of the overland conveyor corridor is consistent with the PHPA's Ultimate Development Plan (Worley Parsons, 2007). The alignment of the overland conveyor alignment was specifically chosen to minimise closed canopy mangrove loss by:

- Paralleling NWI and RHIOPI alignments minimising footprint;
- Provision of a single maintenance road for parallel conveyor segments; and
- Alignment through thinly vegetated areas.

Other alignments that were considered and rejected included:

- An overland conveyor between the proposed car dumper and the proposed stockyard near Reclamation Area H, with a separate conveyor from the stockyard to the NWI berths;
- An overland conveyor and a service and access corridor alignment down West Creek north of SP3; and
- An overland conveyor aligned between the PHPA's Reclamation Area G and the NWI berths.

2.3.3 Design of Trestle / Conveyors

The conveyors for the project have been designed to carry material from the Car Dumper to the Stockyard and from the Stockyard to the Overland Conveyors. The tandem Overland Conveyors and the Approach Jetty Conveyor deliver ore to the Shiploading Conveyor located on the wharf. Conveyors are constructed on a combination of embankments and trestles depending on adjacent

facilities. Embankments being selected adjacent to impervious structures, (for example the RHIO stockyard), Trestles will be used to support the conveyors where storm water or tidal flows need to be maintained, or elevation across built structures (such as roads or railway infrastructure) is required. **Figure 5** diagrammatically presents conveyor elements to meet the above criterion. Considerable consultation has been undertaken with RHIO to ensure the paralleling of trestle support structures to maintain flows.

2.4 Rail Loop and Connections to Project Boundary

The rail component of the NWI Multi-user Iron Ore Export Facility Port Infrastructure is limited to land proposed to be vested in the PHPA and consists of a western rail loop on Stockyard 2 providing possible connection to FMG, BHP-BIO or third party rail provider, an eastern rail providing a possible connection to the Roy Hill rail and a twin car train unloader (**Figure 2**). The final rail spur alignment will be determined following identification of a preferred alignment to the south of PHPA vested land and relevant agreements, and will be the subject of a separate referral to the EPA, if necessary.

The rail embankment and stockyard will be constructed from grit and potentially other materials recovered from dredge spoil resulting from the South West Creek dredging program, and other locally sourced suitable material. Material recovered from the management of South West Creek dredge spoil will be used in part to construct the rail loop embankment, underlie stockpile areas or be stored within the rail loop. The typical rail formation will be in-fill to 8m AHD and will be approximately 22m wide, along with a 4m wide access road on either side of the formation. The total length of the rail loop is 11.9km.

Areas within the rail loop will be isolated from flood and storm surge events. The rail embankment includes provision for drainage so that water accumulating from rainfall within the loop will be stored (see **Figure 2**). Discharge into established drainage lines to the north could occur in long period return events during flow conditions. Runoff from the area east of the loop will follow the existing drainage pattern, passing through culverts at the neck of the loop.

The train unloader will consist of a twin cell rotary rail car dumper that will rotate two 160 tonne ore cars through an angle of approximately 160 degrees to unload the ore into hoppers below which will discharge to a conveyor. The train unloader will be an enclosed facility and will contain a dust collection system. The facility will be located approximately 12m below ground level (- RL5.5). During construction, dewatering will be required during the construction process. Water volume produced through dewatering is likely to be moderate (0.8 ML/day is estimated conservatively) and is proposed to either be:

- Pumped to the PHPA South West Creek Dredging and Reclamation Project dredge management area (DMMA G);
- Retained within an evaporation pond within the stockpile area.

Between five and seven trains will service the rail car dumper per day. Each train will consist of two locomotives and 240 rail cars. Rail cars will be sprayed with water immediately prior to dumping. Trains will enter the rail loop and the rail car dumper will unload the rail cars two at a time. Ore from the basement level of the rail car dumper will be conveyed to ground level and transferred to the stacking yard conveyors or directly to the overland conveyor. The rail car dumper will be fitted with dust extraction system. The rail car dumper conveyor will be fitted with an online moisture monitor.

2.5 Stockyard and Infrastructure

The stockyard will be located within the rail loop in Stockyard 2 and will be serviced by two travelling stackers and one reclaimer. The stockyard will be approximately 1500m long and 400m wide and will

provide a total storage capacity of eight 220,000 tonne live stockpiles and two 2,000,000 tonne dead stockpile rows. The stockyard will be constructed from dredge spoil material obtained from the South West Creek dredging program, and other suitable material.

The stacking yard conveyors will feed two travelling luffing slewing rail-mounted stackers which will be capable of forming eight 220,000 tonne live stockpiles. The stackers will be mounted with dust suppression sprays and the stockyard will be fitted with water cannons.

One travelling, luffing slewing rail-mounted reclaimer will be used to transfer the ore from the stockyard to the overland conveyor. The reclaimer will be mounted with dust suppression sprays.

The stockyard will be constructed to provide adequate site drainage, with provision for a 10.3ha detention basin in the North West of the stockyard area.

2.6 Conveyors

Ore will be moved from the stockyard to a transfer station located on the eastern side of the Finucane Island access causeway by overland conveyors 1800mm wide and 5.2km long (1.5km and 3.7km respectively). From the overland conveyor transfer station, ore will be transported approximately 1km by conveyor to the shiploader conveyor.

The NWI conveyor design minimises impacts on mangrove communities, maintains the existing ephemeral and tidal flows and reflects the design of the conveyors for the RHIOPI project. Conveyors will be elevated on trestles except in the immediate vicinity of the stockpile and rail line for the RHIOPI project, where there is no environmental benefit to a trestle design. In these areas the design parameter is for the conveyors to be low in height for noise control and ease in maintenance. **Figure 5** indicates the conveyor configuration relative to trestle construction or on embankment.

The conveyors will be covered along their entire length, with various configurations being indicated in **Figure 6**.

Vehicle access to the conveyors will be shared with the RHIOPI Project to their stockyard.

2.7 Berths and Ship Loader

The proposed berths and shiploader are located at Stanley Point Berths 3 and 4 (SP3 and SP4) within South West Creek (**Figure 2**) and will be supported by steel piles carrying modular steel frames.

Impacts resulting from dredging associated with the berth pockets were previously considered in the South West Creek Dredging and Reclamation Project which received ministerial approval on 15 March 2011 (Ministerial Statement 859). Previous modelling undertaken during specialist inputs to the RHIOPI Project (Roy Hill, 2010) indicated minimal interruption to tidal flows resulting from the wharf piles.

Pile drivers will be used to drive steel piles into the ground after which a concrete and steel deck, conveyor, ship loader and service access road will be constructed to form the wharf. The wharf will be 760m long and 30m wide and will cater for a maximum ship size of 205,000 deadweight tonnage.

The wharf deck will be constructed of concrete where there is vehicle access requirement. In other areas the wharf will be open or covered with mesh. Concrete areas will be designed to capture wash down water, which will be pumped onshore for treatment and reuse, or disposal.

The shiploader will be rail mounted to allow movement along the wharf and will be a long travelling luffing arrangement. The shiploader will deliver the ore direct to the berthed ship's hold at a maximum

rate of 11,000 tonnes per hour. The shiploader will be fitted with dust suppression water sprays and dust shutes.

Mooring dolphins will be independent of the wharf and shiploader.

2.8 Supporting Infrastructure and Services

2.8.1 Supporting Infrastructure

Supporting infrastructure includes administration facilities, workshop facilities and security facilities. The main administration facilities will be located within the rail loop and will include offices, training facility, crib room, laboratory and first aid facilities. Minor administrative facilities, security office and ablutions will also be located in the wharf facility.

Manned security stations will be located at the stockyard and wharf access roads.

The project will include a workshop suitable for undertaking routine minor and emergency maintenance.

Designated lay down areas will be allocated to all major facilities such as the car dumper, stock yard, transfer stations and wharf area. The lay down areas will be graded and compacted to accommodate truck and mobile equipment and maintained during the construction period. Hardstand areas will be established around areas with heavy crane movements such as around the car dumper and the stock yard machine assembly area.

2.8.2 Hydrocarbon and Chemical Storage

A light vehicle refuelling facilities and a vehicle wash down bay will be located adjacent to the workshop. The refuelling area and vehicle wash down facility will share a sump and oily water separator. On-site storage of fuel will be required for the operation of mobile plant and backup generators. The 55,000 l diesel fuel tank will be self bunded.

Spare lubricants, including lubricants for the conveyor drives, will be stored in the lubricant store located adjacent to the workshop.

Limited quantities of solvents, paints, cleaning products and bonding agents will also be required. All hazardous or dangerous goods will be stored and used in compliance with relevant legislation and standards.

2.8.3 Access Roads

Access roads will be required around the rail loop and within the stockyard. There will be an underpass under the rail to allow access to the stockyard.

Access to the eastern portion of the overland conveyor will be along an access road shared with the RHIOPI Project, previously approved under Ministerial Statement 856.

2.8.4 Power

The power requirement of the Multi-User Iron Ore Export (Landside) Facility is estimated to be 21.5MW. The necessary infrastructure for the port development will be provided by either Horizon Power as an extension of the North West Interconnected Grid system or by an alternative power provider.

2.8.5 Water

The Multi-user Iron Ore Export (Landside) Facility requires potable and process water for amenities and dust suppression. The project requires 12ML of potable water and 328MLpa of process water during construction; during operations the project will require 2.3MLpa of potable water and 1,320MLpa of process water.

The potable water demand will be met by the Water Corporation. A number of alternatives were investigated as part of the Detailed Feasibility Study to provide a sustainable water supply for the process water for the project including sourcing water from:

- Goldsworthy Mine pits;
- Turner River;
- Other groundwater bores;
- Water Corporation fit-for-purpose water; and
- Seawater desalination.

NWI is currently investigating the sustainability of each of these options (SKM, 2010), with the most prospective being cooperative development of water supply within the West Canning Basin (with Water Corporation and other industrial users) and development of a desalination facility. Depending on the solution adopted, supply of water for Project operation may be the subject of a separate referral to the EPA.

Additional options such as trucking from existing industrial sources and shallow bores along rail spur lines are being considered to meet construction phase requirements.

2.8.6 Waste

All solid and putrescible waste will be disposed of off-site. There will be no landfill or on-site waste disposal during construction or operations. Sewage from the main administration area (within the rail loop), the car dumper area, the main security gate house (within the rail loop), the wharf administration area (located off the wharf) and the wharf ablution block will be disposed of into Aerobic Treatment Units (ATUs). The effluent for the ATUs will be disposed of in accordance with Department of Health regulations into a leach drain system next to each ATU. Opportunities for recycling will be considered.

2.8.7 Workforce

The NWI Multi-user Iron Ore Export (Landside) Facility will have an operational workforce of approximately 70 and a construction workforce of approximately 500.

There will be no on-site accommodation. Opportunities to house construction and operation workforce and contractors within a combination of existing and new purpose built facilities within South Hedland are being developed.

2.9 Project Schedule

A Project Schedule was developed as part of the Detailed Feasibility Study to allow the identification of critical path activities for the development of the project. The project schedule shown in **Table 4** is dependent on the completion of technical investigations and regulatory approvals.

Construction is scheduled to commence Quarter 1, 2012, with the first shipment of ore scheduled for Quarter 1, 2014. Indicative project schedule dates are presented in **Table 4**.

Table 4 Indicative Project Schedule

Milestone	Date
Draft Definitive Feasibility Study completed	January 2011
Baseline studies completed	Q2, 2011
Referral to EPA	July 2011
Level of Assessment set	22 August 2011
EPA Report to Minister	14 November 2011
Approval of Detailed Feasibility Study	November 2011
Ministerial Approval	January 2012
Construction commences	Q1, 2012
First shipment	Q1, 2014

3 CONSULTATION

3.1 Background

Since 2004, extensive consultation has been undertaken with a wide range of stakeholders as part of the development of new and expanded facilities within Port Hedland Harbour including FMG's Anderson Point Development, the PHPA's Utah Point Project and BHPBIO's Finucane Island and Nelson Point Dredging Projects (Environ, 2004; SKM, 2008; BHPBIO, 2008; BHPBIO, 2009) and the Outer Harbour Development (BHP-BIO, 2011). Similar environmental, social and operational issues have been consistently raised by stakeholders during the consultation programs for each of these projects including:

- Accommodation/housing;
- Indigenous issues (i.e. community development, employment and training);
- Service provision (i.e. health, education and childcare);
- Social issues;
- Local employment opportunities;
- Township amenity;
- Work arrangements;
- Environmental issues (dust, noise, water, flora and fauna);
- Operational – road and rail traffic; and
- Regional sustainability.

In late 2007, PHPA updated the Port Planning Study and Ultimate Development Plan (Worley Parsons, 2007) to provide the best assessment of the ultimate sustainable capacity of the port matched to resources, land availability, transport infrastructure and industrial capacity. In addition to the economic benefits to port development and trade growth, the planning process placed a strong emphasis on environmental and social considerations.

Subsequent to the release of the 2007 Ultimate Development Plan, the PHPA worked closely with other Government Departments to accommodate the additional needs of potential users of the inner harbour whilst not impacting on existing arrangements. The PHPA identified a total of 4 berths on the western side of South West Creek; with two berths earmarked for NWI and two for Hancock Prospecting Pty Ltd (HPPL). FMG was allocated one berth on the eastern side of South West Creek (PHPA, 2009).

Discussions between the PHPA and the respective proponents for berths within South West Creek identified that each of the proponents had a similar schedule for construction of the berth facilities within South West Creek. In discussions with the PHPA, the EPA raised concerns about the likely adverse environmental impacts of multiple cutter suction dredges operating simultaneously within South West Creek. As a result, NWI, HPPL and FMG agreed that PHPA prepare a referral document to the EPA outlining the marine impacts of the cumulative development of South West Creek on their behalf, with each company responsible for referring and obtaining environmental approval for the terrestrial component of their respective proposals.

3.2 Consultation Program

Stakeholder consultation was integral in the planning and design stages of the Multi-user Iron Ore Export (Landside) Facility regarding the optimal layout of rail loop, stockyard and conveyors, with the consultation addressing environmental, engineering and commercial issues. NWI has consulted proactively with the PHPA, OEPA, companies with a direct interest in the project (Atlas Iron, Brockman and FerrAus), RHIO, FMG, BHP-BIO and relevant local and State government bodies, local indigenous groups and other stakeholders.

Major stakeholders were contacted for face-to-face meetings. Other stakeholders including holders of pastoral lease, mining tenements and other land vesting intersecting the project area were contacted in writing and given an opportunity to respond.

Information provided to stakeholders included:

- A brief history of the project;
- Justification for the project;
- Summary of the project and the alternatives considered;
- Summary of the results of investigations undertaken;
- The project schedule; and
- Opportunities for questions and discussions.

Key stakeholders with a significant interest in the project were identified as:

- PHPA;
- OEPA;
- RHIO;
- Atlas;
- FMG;
- BHP-BIO; and
- Department of State Development.

Other stakeholders requiring consultation included

- Federal Ministers for Trade, Infrastructure, States and the Treasurer;
- State Ministers for State Development, Transport, Regional Development, Lands, Planning, Mines, Environment and indigenous Affairs;
- MLA for the Pilbara; MLC;
- Conservation Council of Western Australia;
- EPA;
- Departments of Environment and Conservation, State Development, Transport, Infrastructure, Regional Development and Lands, Mines and Energy, Water;
- Landcorp;
- Water Corporation,

- Horizon Power;
- Pilbara Development Commission.
- Town of Port Hedland;
- Port Hedland Industry Council;
- Kariyarra.
- Leaseholders (PHPA, BHP-BIO entities, FMG entities, Croydon, CSR, Atlas, B.J. Young).

A summary of the consultation undertaken to date is provided in **Table 5**

Table 5 Summary of Stakeholder Consultation

Sector	Form of Consultation	Comment/Issues Raised
Federal Government		
Wayne Swan MP (Treasurer; Deputy Prime Minister)	Two discussions	• Aware and supportive • Invited NWI to come to Canberra for a meeting
Craig Emerson MP (Trade Minister)	Meeting with Minister and also with adviser	• Positive support
Anthony Albanese MP (Infrastructure Minister)	Meeting with Minister	• Positive support
Gary Gray MP (Special Minister for State)	Two project briefings	• Strong and active support
State Government		
Colin Barnett MP (Premier; State Development Minister)	Briefing, correspondence and meetings with Premier; also multiple separate meetings with Chief of Staff; and Senior Adviser	• Very strong support for NWI and emerging miners • Ongoing assistance provided to resolve issues
Simon O'Brien MLC (Transport; Finance Minister)	Briefing, correspondence and meetings with Minister; also separately with Chief of Staff and adviser	• Active assistance provided
Troy Buswell MP (Transport Minister)	Briefing, correspondence and meetings with Minister; also numerous meetings separately with Chief of Staff	• Absolute support provided • Extremely strong backing for emerging miners and NWI project
Brendan Grylls MP (Regional Development; Lands Minister; State Development Assistant Minister)	Briefing and meetings; separate briefing and meetings with Chief of Staff; also advisers	• Strongly supportive of project
Christian Porter MP (Treasurer)	Briefing; correspondence	• Active support
Norman Moore MLC (Mines Minister)	Minister – briefing and meetings; Chief of Staff – project briefing and meetings	• Strongly supportive of project
Tom Stephens (MLA Pilbara)	Discussions and correspondence	• Active support for project • Invitation to contact for assistance at any time
John Day (Planning Minister)	Meetings with Chief of Staff	• Well aware and supportive of NWI project

Table 5 Summary of Stakeholder Consultation (cont'd)

Sector	Form of Consultation	Comment/Issues Raised
• **State Government (cont'd)**		
Peter Collier (Indigenous Affairs Minister)	Two private luncheon meetings; also discussion with adviser	• Supportive of NWI • Aware of likely issues
Terry Redman MP (Cabinet Minister)	Discussions; ongoing discussions with Chief of Staff and advisers	• Very strong and active support
Bill Marmion MP (Environment MInister)	Full NWI project briefing to Chief of Staff	• Very supportive • Requested ongoing updates • Offered a direct avenue to resolve any issues
Terry Waldron MP (Cabinet Minister)	Numerous discussions	• Strong support
Eric Ripper MP (Leader of the Opposition)	Positive discussions held with Leader Full NWI project briefing to Chief of Staff	• Strong support • Offered to liaise with MPs as required
Mark McGowan MP (State Development Shadow Minister)	Briefing	• Strong support
Ken Travers MLC (Transport Shadow Minister)	Briefing	• Strong support
Jon Ford MLC	Briefing	• Strong support
Mia Davies MLC	Discussions, ongoing interaction	• Strong support
Vince Catania MP	Discussions	• Strong support
Colin Holt MLC	Discussions	• Strong support
Max Trenorden MLC	Project briefing, meetings	• Very strong and active supporter
State Government Agencies		
OEPA	Multiple briefings and project updates	• Project design and updates. • Discussion on key environmental factors and possible level of assessment. • Methodology to assess impacts. • Project assessment timeline.
EPA	Briefing	• Project design and updates. • Discussion on key environmental factors and possible level of assessment. • Methodology to assess impacts.

Table 5 Summary of Stakeholder Consultation (cont'd)

Sector	Form of Consultation	Comment/Issues Raised
State Government Agencies (cont'd)		
Premier's Office	Multiple briefings and project updates	• Ongoing support
Department of State Development	Numerous briefings and project updates DSD contact project officer appointed Correspondence regarding State Agreement Issues resolution	• Ongoing direct assistance provided
Transport	Numerous meetings with project officers; meetings held with senior staff; meetings and correspondence regarding corridors and development issues in the port	• Direct assistance provided
Mines and Energy	Correspondence, meetings with officials	• Consultation on planning/tenure matters and the project
LandCorp	Meeting with Chairman	• Very supportive
Dept of Regional Development and Lands	Correspondence, meetings and telephone calls with officials	• Support and advice provided over tenure issues
Water Corporation	Meetings held with officials	• Recognises NWI's priority needs
Horizon Power	Numerous meetings and correspondence	• Need to provide ready availability of power
Department of Water (Perth, Karratha)	Correspondence and telephone discussions, meetings following referral	• Identified water supply as a major constraint to significant users within the area. • Local supplied fully committed. • DoW trying to release potable supplies by replacing existing industrial users with industrial grade supply (release potable quality) • Cooperative scheme for West Canning.
Department of Indigenous Affairs	Correspondence, telephone discussions and meetings.	• S18 outcomes for DMMA G • Process for s18 referrals.

Table 5 Summary of Stakeholder Consultation (cont'd)

Sector	Form of Consultation	Comment/Issues Raised
State Government Agencies (cont'd)		
DEC (Perth and Karratha)	Correspondence and telephone discussions, meetings following referral	• General 'rush' of projects within the Port Hedland area at present. • Requirement to obtain works approval and licence; • Need to coordinate on Part V issues sooner rather than later; • Additional permits (hydrocarbon storage etc); • Source for water supply
Pilbara Agencies		
PHPA	Numerous; starting in 2007, interactions at all levels, regular weekly meetings held as well as offline discussions	• Very supportive
Pilbara Development Commission	Project briefings given; ongoing meetings	• Very supportive
Town of Port Hedland Council and officers	Multiple meetings with Mayor and CEO, presentation to full council Presentation to CEO and Technical officers Correspondence and telephone discussions with Planning Department, meetings following referral On-going liaison	• Project occurs within area defined in TPS 5. • Includes areas currently identified for conservation and landscape purposes. • Vesting in PHPA will modify TPH controls within area • Building permits required for construction, requirements under Health Act.
Port Hedland Community		
Kariyarra traditional owners (including Marapikurrinya)	Numerous meetings (PHPA has also had multiple meetings), consultation and negotiation	• Very supportive, excellent relationships • Need to maintain respect for cultural heritage
Media	Multiple media stories, including NW Telegraph front page Numerous ABC Radio stories	• Very supportive of new economic opportunity • Supportive of multi-user infrastructure to support emerging miners
Pilbara Area NGO body (PANGO)	Project briefings and provision of financial sponsorship	• Importance of financial support for body coordinating key NGO social services
Port Hedland Industries Council (PHIC)	Member of Executive Committee	• Actions over noise and dust monitoring • Future Environmental assessments

Table 5 Summary of Stakeholder Consultation (cont'd)

Sector	Form of Consultation	Comment/Issues Raised
Port Hedland Community (cont'd)		
Formal conference presentations	Mining in the Pilbara Conference Infrastructure Conference	• Full briefings provided • Questions answered
Sector Companies		
Atlas Iron Ltd	Ongoing meetings; collaboration and data sharing; development of shared options	• Excellent support
FMG/Hancock/PHPA	Multiple meetings since 2009 to deliver common dredging approvals and solutions	• Collaborative approach being adopted
Hancock (Roy Hill Iron Ore)	Multiple meetings, collaborative project footprints, data sharing, reduction of footprint to minimise cumulative impact; investigation of synergies	• High levels of collaboration
BHP Billiton	Numerous meetings and letters regarding rail corridors and infrastructure at the port; also received support for land access	• Offers of support have been provided
FMG	Meetings regarding port development options (NWI shareholder companies have also had separate discussions with FMG)	• Offers of support have been provided
AMEC	Project briefings, sector policy collaboration, financial support	• Importance of securing port infrastructure for emerging mining companies

Table 5 Summary of Stakeholder Consultation (cont'd)

Sector	Form of Consultation	Comment/Issues Raised
Leaseholders		
PHPA	Written correspondence to request access to facilitate site investigations	• No objections received
BHPB entities		
FMG entities		
Croydon		
CSR		
Atlas		
B.J. Young		
NGO's		
Conservation Council of Western Australia	Correspondence and telephone discussions, meetings following referral.	• Importance of maintaining mangrove communities, particularly as it relates to the pre-existing level of impacts within the Port Hedland area • Identification offsets as important in the mitigation of future impacts

4 EXISTING ENVIRONMENT

4.1 Regional Setting

4.1.1 Location

The project is located approximately 10km from the Town of Port Hedland in the Pilbara region of Western Australia, approximately 1,665km north of Perth.

The majority of the project is located within land managed by PHPA, with the remainder of the project located on land to be vested in the PHPA (**Figure 2**). The wharfs are located on South West Creek, in the inner harbour of Port Hedland Port. The project is located near the towns of Port Hedland and South Hedland, and the industrial precinct of Wedgefield (**Figure 7**).

4.1.2 Climate

The Pilbara region is classified as subtropical and is more arid inland. Maximum temperatures exceeding 40^0C and minimum temperatures exceeding 25^oC are often experienced in Port Hedland in the summer months. Average temperatures in winter range from 12^0C minima to 29^0C maxima (BoM, 2008).

Pilbara average annual rainfall varies between 250 mm and 400 mm, with many years reporting no significant rainfall events. The majority of the rain falls during the summer months and is generally associated with scattered thunderstorms and tropical cyclones. A secondary peak in rainfall occurs in May from tropical cloud bands that intermittently affect the Pilbara region (BoM, 2008). The coast from Port Hedland to Exmouth Gulf is considered the most cyclone prone area in Australia. The cyclone season generally lasts from November to April, although cyclones also occur outside this period.

Winds in Port Hedland vary in direction and strength seasonally, with the windiest conditions experienced in summer when the prevailing winds are from the northwest (**Figure 8**).

4.2 Physical Terrestrial Environment

4.2.1 Geology

The project area is located within the Pilbara Craton, which contain the oldest rocks in the Pilbara and is described as a metamorphosed basement of granitoid rocks and gneiss (Van Vreeswyk *et al*., 2004). The Pilbara Craton is subdivided into the Archaean granite-greenstone terrane of the north and the Archaean and Proterozoic Hamersley basin in the south. The greenstone sequences cover approximately 40% of the granite-greenstone terrane and comprise meta sedimentary and volcanic rocks that have been intruded by significant granitoid bodies. The granitic rocks comprise variously deformed and metamorphosed granitic phases that are locally interrupted by recently formed veins and dykes (Van Vreeswyk *et al*., 2004).

4.2.2 Geomorphology

The topography of the Port Hedland area is influenced predominately by the Abydos Plain, which rises from the coastal lowlands to around 300 to 400 m above mean sea level (Van Vreeswyk *et al*., 2004). The coastal area comprises open harbour, tidal creeks, intertidal mudflats, bare coastal mudflats and sandy lowlands (EPA, 2010b).

Port Hedland harbour comprises a dredged channel, 20 nautical miles in length, leading to a dredged basin between Nelson Point and Finucane Island. A number of creeks including Stingray Creek, South Creek, South East Creek, South West Creek and West Creek coalesce at Port Hedland harbour, and minor drainage tracts dissect the low lying areas. Several intertidal creeks converge in the harbour which has been highly modified by dredging activities and the development and operation of port related industry. The landscape within the project area drains to the north towards the coast along ephemeral drainage lines (EPA, 2010).

South West Creek and South Creek are the dominant watercourses draining into Port Hedland Harbour (SKM, 2008). Both these creeks flow northwards and cross under BHP Billiton's Port Hedland-Shay Gap railway to enter the harbour area. The creeks in the Port Hedland region are predominantly ephemeral and generally only hold water during extended period of above average rainfall, with short term flooding caused by cyclonic activity. Coastal inundation can occur due to storm surges when South West and South East creeks overflow during more extreme storm events.

The berths that form part of the project are located in close proximity to the developed areas of Anderson Point.

Tides at Port Hedland are predominately semidiurnal and range from 1.5 m during neap tides to 5.8 m at spring tides. The highest astronomical tide is 7.9 m (Environ, 2004). Peak tidal current velocities are approximately 1 knot; however currents of 3 knots are known to occur in some locations (HGM, 1997). The natural current direction in the Port Hedland area is north westerly to south easterly, and the natural littoral drift process transports sediments from west to east (BHP-BIO, 2008).

A number of tidal creeks, including Salmon Creek, occur to the north of the project area. West Creek, located to the west of Stanley Point and south of Finucane Island has been gradually silting up since a causeway to Finucane Island was built in the 1960s. South West Creek primarily flows under the Finucane Island access road (Roy Hill, 2010).

Turner River is located 10km west of the site, with the river catchment covering an area of approximately 4,700km^2. The Turner River divides into two main branches as it approaches the coast and fans out into a system of wide and braided flow paths before discharging to Oyster Passage and the Indian Ocean. Most of the drainage of the catchment is along the east and west branches of the river (URS, 2011).

4.2.3 Land Systems and Soils

The Multi-user Iron Ore Export (Landside) Facility is located in the Uaroo and Littoral Land Systems.

The Uaroo Land System is dominated by sandy/loamy plains with soils comprising a mosaic of stony and pebbly materials, red shallow sands, deep red sands, red loamy earths, calcareous shallow loams and deep sandy duplex soils. The vegetation is dominated by shrubby hard and soft grasslands. Landforms associated with the Uaroo Land system include low hills, low rises, pebbly plains, sandy/loamy plains calcrete plains and tracts receiving sheet flow (Outback Ecology, 2011).The southern part of the project area including the rail loop and stockyard is on the Uaroo Land System.

The Littoral Land System is characterised by depositional surfaces of saline coastal flats, estuarine and littoral surfaces with extensive bare saline tidal flats subject to infrequent tidal inundation. Mangroves occur on the seaward fringes. Landforms of the Littoral Land System includes beaches, coastal dunes, limestone ridges, tidal flats, mangrove outer margins, tidal channels, samphire flats, alluvial plains and

sandy plains and islands (Outback Ecology, 2011). The northern part of the project including the conveyors is located on the Littoral Land System.

Outback Ecology (2011) undertook a desktop assessment of the soils and landforms of the project area. The project area comprises coastal plains, low Acacia heath with Spinifex, drainage lines, maritime grasses and salt flats. The broad sandplain areas of the project area comprise quarternary colluvium and alluvium. The coastal zone of the project is characterised by quarternary, supratidal littoral deposits and old alluvium. The soil texture of the surface soils within much of the project area were characterised as sand with some areas of loamy sands. Soils were classified as structurally stable with no sodic or dispersive soils present (Outback Ecology, 2011).

4.2.4 Acid Producing Potential

Acid sulphate soils (ASS) are known to occur in the Port Hedland Inner Harbour area within intertidal areas and at depths of approximately 2m below the sea bed surface.

Coffey Environments undertook a preliminary investigation into the potential presence of acid sulphate soils that may be encountered as part of the Multi-user Iron Ore Export (Landside) Facility (Coffey Environments, 2011a). The preliminary ASS investigation was designed to satisfy 'Step 1: Desktop Assessment and Site Inspection' of the Department of Environment and Conservation's *Identification and Investigation of Acid Sulphate Soils and Acidic Landscapes* (DEC, 2009a).

A copy of the report is provided as **Appendix A** and is summarised below.

The preliminary ASS investigation confirmed that the northern portion of the project area is highly likely to contain Potential Acid Sulphate Soils (PASS). This conclusion was based on geomorpohology and vegetation indicators noted during the site inspection, the published ASS risk mapping and environmental studies completed nearby. Where PASS is present it is likely that its presence is strongly lithologically dependent, with previous intrusive studies nearby (Coffey 2010b) indicating a strong correlation between mangrove mud horizons and the presence of PASS.

The majority of infrastructure associated with the Multi-user Iron Ore Export (Landside) Facility will be positioned within the northern portion of the project area and therefore likely to interact with PASS.

Groundwater within the northern portion of the project area is likely to be relatively shallow and in the order of 3 metres below ground level (mbgl) within the footprint of the proposed car dumping facility (Coffey, 2010a).

The DEC mapping for ASS is shown in **Figure 9**.

4.2.5 Hydrogeology

The Port Hedland area is underlain by the Coastal Plain Alluvial Deposits (alluvial aquifer), which comprise permeable sand and gravel units, together with relatively impermeable weathered and fractured rocks such as sandstone found in South West Creek. The alluvial aquifer can be subdivided into three main water bearing units including:

- Upper aquifer – unconfined within alluvium and calcarenite;
- Middle aquifer – confined with red clays and sand beds of low permeability; and
- Lower aquifer – confined within low permeability conglomerate and highly permeable gravel lenses (PHPA, 2010).

Groundwater levels range from 2.4 to 18.4 mbgl, with shallower depths located close to the coast (URS, 2011). The depth to groundwater is approximately 2 mbgl in the vicinity of Lumsden Point, located immediately to the south east of Anderson Point and South West Creek (BHPBIO, 2009a, cited in PHPA, 2010). Groundwater contours and flows are indicated in **Figure 10**.

Groundwater monitoring at BHP Billiton Iron Ore's Hot Briquetted Iron Ore plant located south of DMMA A shows the depth to groundwater is approximately 3.5m, varying seasonally by up to 2m, with elevations peaking in April (BHPBIO, 2008).

The main alluvial aquifers are developed along the Yule, Turner and De Grey Rivers. These are the major aquifers which currently supply Port Hedland with potable water. The alluvium occupies the area close to the current river channels and is recharged directly from the rivers when they flow. The alluvium is up to 60m thick in the DeGrey valley. Salinity tends to be low along the river and increases outwards, with salinity variation generally between 1,000 and 3,000 mg/l (URS, 2011).

Due to the alluvial aquifer being shallow and within close proximity of the coastline, groundwater is likely to be influenced by tidal movements (BHPBIO, 2009a, cited in PHPA, 2010).

4.3 Biological Terrestrial Environment

4.3.1 Vegetation

The Multi-user Iron Ore Export (Landside) Facility is located in the Roebourne subregion of the Pilbara Bioregion (PIL4) as defined in the Interim Biogeographic Regionalisation of Australia (IBRA) (Government of Australia, 2005). The vegetation of the Roebourne subregion is comprised of 'grass savannah of mixed bunch and hummock grasses, and dwarf shrub steppe of *Acacia stellaticeps* or *A.pyrifolia* and *A.inaeqilatera*; uplands are dominated by *Triodia* hummock grasslands; ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands; samphire, *Sporobolus* and mangal occur on marine alluvial flats and rivers (Kendrick and Stanley, 2001).

The Pilbara IBRA region is the equivalent to the Fortescue Botanical District as defined by Beard (1975). The Fortescue Botanical District extends northwards from the *Acacia* dominated scrub in the south and is determined by a major biogeographic boundary, the *Acacia-Triodia* line. Spinifex vegetation is the characteristic landscape element north of the *Acacia-Triodia* line (Woodman, 2011).

Woodman Environmental Consulting Pty Ltd undertook a vegetation and flora survey of the original project layout in 2010, with a follow up survey of the modified project layout in 2011 (Woodman, 2011a, b). Copies of Woodman (2011a, b) are provided as **Appendix B** and are summarised below.

Five floristic community types (FCTs) and three coastal communities (not determined using floristic analysis) were identified in the project area and are shown in **Figure 11** and **Table 6**. No Threatened or Priority Ecological Communities listed by the DEC occur within or near the project area.

Table 6 Floristic Community Types in the Multi user Iron Ore Export (Landside) Facility Survey Area

Floristic Community Type	Description
Floristic Community Types	
FCT 1	Low shrubland to open shrubland of mixed *Acacia* spp. dominated by *Acacia stellaticeps* over low hummock grassland of *Trioda epactia* on red sandy clay loams on plains and low lying areas including supra-tidal plains
FCT 2	Low to mid sparse shrubland of *Acacia colei* var *colei* and *Acacia stellaticeps* over low hummock grassland of *Triodia epactia*, with *Eriachne mucronata* on red sand to sandy-loam on plains, drainage lines and low lying areas including supra-tidal plains
1/2	Mosaic of FCT 1 and 2
FCT 3	Tall open shrubland of *Acacia bivenosa* over low open shrubland dominated by **Aerva javanica, Myoporum montanum* and *Corchorus incanus* subsp. *incanus* over low grassland dominated by **Cenchrus cilaris* and *Triodia secunda* and/or *Triodia epactia* on brown sandy loam on limestone ridge
FCT 4	Low sparse shrubland of mixed spp. over low closed hummock grassland of *Triodia epactia* and/or *Triodia secunda* on red brown sandy loam on lower slopes and supra tidal
FCT 5	Low open to sparse samphire shrubland dominated by *Tecticornia* species and *Muellerolimon salicorniaceum* with sparse tussock grassland of *Sporobolus virginicus* on brown clays on tidal zones
Coastal Communities (not determined using floristic analysis)	
FCT10	Closed forest of *Rhizophora stylosa* occurring on brown silt on intertidal flats
FCT 11	Closed forest of *Avicennia marina* occurring on brown clay on intertidal flats
11/5	Mosaic of FCT 5 and 11
FCT 12	Cyanobacterial algal mat community with scattered samphire on red-brown sandy clays on intertidal flats

FCTs 1-4 can be classified into Supergroup 1, which was mapped primarily on red to red-brown sandy loam to clay loam on plains, depressions and drainage lines as well as on limestone. The vegetation of Supergroup 1 was represented by tall to low shrublands to open shrublands dominated by *Acacia* sp. over low hummock grasslands dominated by a variety of *Triodia* spp., primarily *Triodia epactia*. Supergroup 2 consisted of a single FCT (FCT 5), which was mapped on brown clay in tidal areas. And

consisted of the quadrats dominated by a sparse chenopod layer (*Tecticornia* spp.), occasionally also dominated by *Sporobolus virginicus* and *Muellerolimon salicorniaceum*.

The condition of the vegetation throughout the project area was generally Excellent to Very Good; with a small area classified as being in Poor condition (**Figure 12**).

4.3.2 Flora

A total of 176 discrete vascular flora species and one hybrid species from 43 families and 101 genera were recorded from the project area during 2010 - 2011. The most well represented families were, Poaceae and Fabaceae.

The 176 species recorded from the project area compares with 110 taxa recorded within the Utah Point survey area (Biota 2008b, cited in Woodman, 2011a), 24 taxa recorded from the DMMA A survey area (Biota 2008a cited in Woodman, 2011a) and 51 taxa recorded from the DMMA H survey area (ENV Australia 2009 cited in Woodman, 2011a).

4.3.3 Flora of Conservation Significance

Two species of Declared Rare Flora are known to occur in the Pilbara. However, neither of the species have been previously recorded near Port Hedland and it is considered unlikely they will occur in the project area. Neither species was recorded from within the project area during the flora surveys.

Database searches identified a number of priority flora potentially occurring in the project area, with six species of priority flora recorded within the study area (**Table 7**, **Figure 11**).

Table 7 Conservation Significant Flora Recorded from the Survey Area

Taxa	Conservation Code	Number of locations	Floristic Community Type
Eragrostis crateriformis	P3	2	4; 1/2
Gomphrena leptophylla	P3	1	1/2
Gomphrena pusilla	P2	2	3; 4
Goodenia nuda	P4	1	1/2
Gymnanthera cunninghamii	P3	2	5; 11/5
Tephrosia rosea ?var. *venulosa*	P1	6	1/2; 4

Eragrostis crateriformis (P3) is an annual grass growing to a height of 0.4m. The taxon's preferred habitat includes creek banks and depressions in clay-loam or clay. Although there are relatively few records of the taxon, the known locations occur in the Carnarvon, Tanami and Pilbara IBRA bioregions of Western Australia. It is known from several locations approximately 70km north-east of Port Hedland, the Millstream-Chichester National Park, Warralong Station and Yanrey Station. The taxon was recorded from 2 locations within the survey area (**Figure 11**).

Gomphrena leptophylla (P3) is an erect or prostate spreading annual herb, growing to a height of 0.15m and flowering from March to September. The taxon has a relatively widespread distribution through the Pilbara and the Kimberley regions in Western Australia, however collections are scattered. The taxon was recorded from one location within the survey area (**Figure 11**). As it is an annual taxon, it is likely to be more common than indicated by collections held in the WA Herbarium, and may be recorded in greater numbers following significant rainfall.

Gomphrena pusilla (P2) is an annual herb growing to 0.2m in height and flowering between March and June. It is known to occur behind foredunes, on limestone. Five collections of the taxon are held in the WA Herbarium, two of which were collected at Broome. The other three collections were made in the vicinity of Port Hedland. The taxon was recorded from 2 locations within the survey area (**Figure 11**).

Goodenia nuda (P4) is an erect to ascending herb growing to 0.5m high and flowering from April to August. The taxon is relatively widespread throughout the Pilbara, with only one record known from the Kimberley. The taxon is known from one historic DEC record in the survey area (**Figure 11**) and, like *Gomphrena leptophylla,* is likely to be relatively common following significant rainfall. There is some confusion at present regarding the presence of this taxon in the Port Hedland region. It is possible that records in this area are in fact the non-conservation significant taxon *Goodenia triodiophila*.

Gymnanthera cunninghamii (P3) is an erect shrub to 2m in height occurring on sandy soils and frequently in drainage lines in the Carnarvon, Great Sandy Desert and Pilbara IBRA regions. It is known from two locations within the survey area (historical DEC data) but was not recorded during the flora survey.

Tephrosia rosea var. venulosa (P1) is an erect shrub to 1.7m in height that flowers between August and September. Eleven of the fifteen specimens housed in the WA herbarium have been collected in the vicinity of Port Hedland. The taxon was recorded from 6 locations within the survey area (**Figure 11**). The identification of the taxon is incomplete due to the absence of flowering parts.

4.3.4 Introduced Flora

Four introduced species were recorded during the vegetation and flora surveys: *Aevrva javanica, Cenchrus ciliaris, Cenchrus setiger* and *Portulaca oleracea*.

Aevrva javanica (Kapok Bush) was recorded at 11 locations within the project area (**Figure 11**) and is considered a serious environmental weed. It is relatively widespread throughout the Pilbara region. *Cenchrus ciliaris* (Buffel Grass) has a wide distribution in pastoral areas where it has been planted as a pastoral grass and is regarded as a serious environmental weed. The species was recorded at 27 locations within the project area (**Figure 12**). *Cenchrus setiger* is widely distributed throughout Western Australia north of Geraldton and is considered to be of 'High' environmental significance. It was recorded from 1 location within the project area. *Portulaca oleracea* (Puslane) is widespread throughout Western Australia, in particular in the Pilbara bioregion. It was recorded in 3 locations within the project area (**Figure 12**).

None of the introduced species recorded within the project area are Declared Plants listed under the *Agriculture and Related Resources Act, 1976*. However the control of *Aevrva javanica, Cenchrus ciliaris* and *Cenchrus setiger* is desirable due to the taxon having a high rating under the Environmental Weeds Strategy for Western Australia (CALM, 1999).

4.3.5 Fauna Habitats

Coffey Environments completed a Level 1 fauna assessment (Coffey Environments, 2011b), which is attached as **Appendix C**. The Level 1 fauna assessment was designed in accordance with EPA Guidance Statements No.56 and 20 (EPA, 2004c; 2009a) and involved database searches, literature review and site assessment.

Seven fauna habitats were identified within the project area and are shown in **Figure 13**. The seven fauna habitats are:

1. Low Acacia Heath with Spinifex (Plate 1) – This contains a variety of low acacia shrubs at mixed densities with spinifex understorey;
2. Moist Eucalypt Depressions (Plate 2) – This contains eucalypt trees bordering a natural ephemeral depression;
3. Mangrove Forest/Woodland (Plate 3) – This contains a variety of mangrove species at mixed densities on a silty substrate within the intertidal zone;
4. Maritime Grassland (Plate 4) – This contains spinifex and low herbaceous species at mixed densities;
5. Salt Flats (Plate 5) – This contains no vegetation and is characterised by a salt crust on the substrate surface;
6. Coastal Floodplain (Plate 6) – This contains eucalypt trees, acacia shrubs and some grasses within a wide drainage line; and
7. Drainage Line Tidal (Plate 7) – This contains intertidal drainage lines with no vegetation.

Within the southern section of the project area, one fauna habitat type was dominant (Low Acacia Heath with Spinifex). A further two fauna habitat types were also recorded in small patches in the southern section of the project area (Moist Eucalypt Depressions and Coastal Floodplain). Mangrove Forest/Woodland, Maritime Grassland and Salt Flats were recorded along the coastal areas of the project area with small areas of Drainage Line Tidal also present (**Figure 13**).

PLATES

Plate 1. Low Acacia Heath on Spinifex

Plate 2. Moist Eucalypt Depressions

Plate 3. Mangrove Forest/Woodland

Plate 4. Maritime Grassland

Plate 5. Salt Flats

Plate 6. Coastal Floodplain

Plate 7. Drainage Line Tidal

4.3.5 Fauna

Based on the desktop review and fauna surveys undertaken in the region, up to 609 terrestrial vertebrate species are predicted to occur in the region (**Appendix C**).

Up to 20 species of amphibians are predicted to occur in the project area and are likely to be present when the drainage lines contain water. Most frog species recorded in previous surveys in the region are arid-adapted species and are not dependent on drainage lines.

Although up to 177 species of reptiles have been recorded in the region based on database searches, not all these species would be predicted to be present within the project area as a number of habitats that occur in the region such as granite outcrops and sand dunes are not present in the project area.

The abundance of small mammals within the project area is likely to be typical of previous surveys conducted in similar habitats within the region. Of the 81 species of mammals predicted to potentially occur in the vicinity of the project area, a number are unlikely to occur on site due to a lack of suitable habitat. This is particularly the case for species that are found in granite outcrops and dunes that are elsewhere in the region. The mammal species predicted to occur in the project area also includes several species of introduced mammals.

Up to 331 bird species are predicted to occur within the project area based on the database searches. However, some of these species are unlikely to be observed, forage or nest in the project area because of a lack of suitable habitat. A number of bird species predicted to occur are also likely to be seasonal visitors to the project area after rainfall or may be vagrants.

4.3.8 Fauna of Conservation Significance

A total of 36 listed conservation significant vertebrate fauna species (26 migratory birds, 5 mammals, 2 reptiles and 3 other bird species) could potentially occur within the project area due to the presence of suitable habitat (**Table 8**). Another 11 species of conservation significance have been recorded in the region but were assessed to be unlikely to occur in the project area due to a lack of suitable habitat (**Table 8**).

Table 8 Conservation Significant Fauna Species Potentially Occurring in the Project Area

Species	Common Name	Wildlife Conservation Act Schedule / DEC Priority	Status under Commonwealth *EPBC Act*	Likely Presence and reason
Dasyurus hallucatus	Northern Quoll	Schedule 1	Endangered	Unlikely – inappropriate habitat
Dasycercus cristicauda	Crest-tailed Mulgara	Schedule 1	Vulnerable	Possible – Spinifex habitat
Lagostrophus fasciatus	Banded Hare-wallaby	Schedule 1	Vulnerable	Unlikely – inappropriate habitat
Macrotis lagotis	Bilby	Schedule 1	Vulnerable	Unlikely – inappropriate habitat
Rhinonicteris aurantius	Pilbara Leaf-nosed Bat	Schedule 1	Vulnerable	Possible – flying through site
Liasis olivaceus barroni	Pilbara Olive Python	Schedule 1	Vulnerable	Possible – coastal drainage lines
Aspidites ramsayi	Woma	Schedule 4		Possible – coastal drainage lines
Mormopterus loriae	Little North-western Mastiff Bat	Priority 1		Possible – mangrove habitat
Ctenotus nigrilineatus		Priority 1		Unlikely – inappropriate habitat
Lagorchestes conspicillatus	Spectacled Hare-wallaby	Priority 3		Unlikely – inappropriate habitat
Casycercus blythi	Brush-tailed Mulgara	Priority 4		Possible – spinifex habitat
Macroderma gigas	Ghost Bat	Priority 4		Possible – flying through site
Leggadina lakedownensis	Lakeland Downs Mouse	Priority 4		Unlikely – inappropriate habitat
Pseudomys chapmani	Western Pebble-mound Mouse	Priority 4		Unlikely – inappropriate habitat
Ardeotis australis	Australian Bustard	Priority 4		Possible – heath/spinifex habitat
Burhinus grallarius	Bush Stonecurlew	Priority 4		Possible – heath/spinifex habitat
Neochmia ruficauda	Star Finch	Priority 4		Possible – coastal drainage lines
Haliaeetus leucogaster	White-bellied Sea-eagle		Migratory	Possible – mangrove habitat
Hirundo rustica	Barn Swallow		Migratory	Possible – heath/Spinifex habitat
Merops ornatus	Rainbow Bee-eater		Migratory	Possible – coastal drainage lines
Actitis hypoleucos	Common Sandpiper		Migratory	Possible – mangrove habitat
Ardea alba	Great Egret		Migratory	Possible – mangrove habitat
Ardea ibis	Cattle Egret		Migratory	Unlikely – inappropriate habitat
Arenaria interpres	Ruddy Turnstone		Migratory	Unlikely – inappropriate habitat
Calidris acuminate	Sharp-tailed Sandpiper		Migratory	Possible – mangrove habitat
Calidris alba	Sanderling		Migratory	Unlikely – inappropriate habitat
Calidris canutus	Red Knot		Migratory	Possible – mangrove habitat

Table 8 Conservation Significant Fauna Species Potentially Occurring in the Project Area (cont'd)

Species	Common Name	Wildlife Conservation Act Schedule / DEC Priority	Status under Commonwealth *EPBC Act*	Likely Presence and reason
Calidris ferruginea	Curlew Sandpiper		Migratory	Possible – mangrove habitat
Calidris ruficollis	Red-necked Stint		Migratory	Possible – mangrove habitat
Calidris tenuirostris	Great Knot		Migratory	Possible – mangrove habitat
Charadrius leschenaultia	Greater Sand Plover		Migratory	Possible – mangrove habitat
Charadrius mongolus	Lesser Sand Plover		Migratory	Possible – mangrove habitat
Charadrius veredus	Oriental Plover		Migratory	Possible – acacia heath/Spinifex
Glareola maldivarum	Oriental Pratincole		Migratory	Possible – eucalypt depression
Heteroscelus brevipes	Grey-tailed Tattler		Migratory	Unlikely – inappropriate habitat
Limicola falcinellus	Broad-billed Sandpiper		Migratory	Possible – mangrove habitat
Limosa lapponica	Bar-tailed Godwit		Migratory	Possible – mangrove habitat
Limosa limosa	Black-tailed Godwit		Migratory	Possible – mangrove habitat
Numenius madagascariensis	Eastern Curlew		Migratory	Possible – mangrove habitat
Numenius minutes	Little Curlew		Migratory	Possible – mangrove habitat
Numenius phaeopus	Whimbrel		Migratory	Possible – mangrove habitat
Pluvialis fulva	Pacific Golden Plover		Migratory	Possible – mangrove habitat
Pluvialis squatarola	Grey Plover		Migratory	Possible – mangrove habitat
Tringa glareola	Wood Sandpiper		Migratory	Possible – eucalypt depression
Tringa stagnatilis	Marsh Sandpiper		Migratory	Possible – eucalypt depression
Xenus cinereus	Terek Sandpiper		Migratory	Possible – mangrove habitat
Apus pacificus	Fork-tailed Swift		Migratory	Possible – entire project area

WC Act Conservation Status Definitions:

Schedule 1 (S1)	Fauna that is rare or likely to become extinct.
Schedule 2 (S2)	Fauna that is presumed to be extinct.
Schedule 3 (S3)	Birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds.
Schedule 4 (S4)	Fauna that is in need of special protection, otherwise than for the reasons mentioned above.
Priority 1 (P1)	Taxa which are known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority 2 (P2)	Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 3 (P3)	Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 4 (P4)	Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
Priority 5 (P5)	Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.
EPBC Act Conservation Status Definitions:	
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it is considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it is considered to be facing a high risk of extinction in the wild.
Migratory (M)	Species migrate to, over and within Australia and its external territories

4.3.9 Short Range Endemic Fauna

Limited sampling for short range endemic species has been undertaken in the Port Hedland area. Sampling for potential short range endemic taxa was undertaken in BHP Billiton Iron Ore's DMMA A, which adjoins the project area, with trapdoor spiders, psuedoscorpions and terrestrial snails targeted. No potential short range endemic taxa were recorded within DMMA A (BHP-BIO, 2008). A targeted search of limestone hill habitat in DMMA G was undertaken as part of the South West Creek dredging and Reclamation Project, with no SRE fauna identified (PHPA, 2010).

Given that no potential short range endemic taxa were recorded adjacent to the project area and that the seven habitat types recorded within the project area are well-represented in the region, it is considered unlikely that potential short range endemics would occur within the project area (Coffey Environments, 2011b).

4.3.10 Mangrove Communities and Other BPPH

Coastal habitats in the vicinity of the Multi-user Iron Ore Export (Landside) Facility are typical of arid coastal areas. Intertidal areas are dominated by dense stands of mangrove on the banks of creeks and coastal areas that are frequently inundated by tidal water. Mangrove communities are the dominant Benthic Primary Producer Habitat (BPPH) recorded in the Port Hedland region.

The project area contains a relatively small area of mangal associated with South West Creek **(Figure 11**). The mangals of Port Hedland have been studied extensively over the past 20 years with respect to impacts from development and operation of the various port infrastructure (Paling *et al.*, 2001; Paling *et al.*, 2003; Paling in Environ, 2004; VSCRG, 2007 all cited in Woodman, 2011a). The project area contains only a limited number of mangrove associations due to small area and limited habitat present. The mangrove associations of Port Hedland Harbour as described by Paling in Environ (2004) and the equivalent mangrove communities present in the project area are presented in **Table 9**.

Table 9 Mangrove Communities within the Project Area and Equivalent Associations from Port Hedland Harbour

Mangrove Associations of Port Hedland Harbour (after Paling in Environ, 2004)	Floristic Community Type in Project Area
Closed canopy of *R.stylosa*	FCT 10
Closed canopy woodland of *A. marina* (seaward fringe)	FCT 11
Closed canopy woodland of *A. marina* (landward margins)	FCT 11
Low open woodland of *A. marina* on saline flats	Mosaic of FCTs 11/5
Low scattered *A. marina* and scattered samphires	Mosaic of FCTs 11/5

The mangrove associations present in the project area are among the most common recorded in previous studies of the Port Hedland Harbour, and are indicative of those associated with mid-high tidal flats. This is consistent with the mapping of the inner harbour area undertaken by Worley Parsons (Worley Parsons, 2009; cited in Roy Hill, 2010). The mangrove communities within the harbour are likely to provide habitat for the majority of marine fauna species within the boundaries of the PHPA. Mangroves typically provide nursery habitat for fish, crustaceans and feeding habitat for a range of species including birds, reptiles, fish and invertebrates (Roy Hill, 2010).

As the distance from the shoreline increases, the mangrove habitats tend to be replaced by salt marsh and bare tidal flats as sediments become dryer and more saline. Cyanobacterial mats are present in suitably wet conditions such as between the mangrove and samphire dominated zones of the upper intertidal zone. Cyanobacterial mats within the project area are mapped as FCT 12 and shown in **Figure 11**, while samphires on intertidal flats are shown as FCT 5.

Cyanobacteria are blue green algae that obtain their energy through photosynthesis. Cyanobacteria have been found to occur in extensive mats between the mangrove and samphire dominated zones of the upper intertidal areas in the Pilbara region (Paling *et al*., 1986; cited in BHP-BIO, 2009). Within the Pilbara region, they have been observed to occur on the landward side of mangroves where, with the exception of two halophytic samphire genera, no other vegetation occurs.

Cyanobacterial mats are a naturally ephemeral community that are not present for a substantial period of the year. They develop into mats in areas of open canopy beneath mangroves and salt marsh plants and the open tidal pan, where sufficient light reaches the substrate. Mats are formed by the trapping of sediment between successive layers of cyanobacteria. In most areas where cyanobacteria form mats, there are periods when the mats dry out and become active again in response to tidal inundation and/or rainfall.

In contrast to cyanobacterial mats in Dampier and Onslow which commonly contain seven or more species, the cyanobacterial mat communities in the Pilbara region are typically found to have between one and three genera present. The lower diversity in the Pilbara is considered an indication of stress such as soil/sediment moisture content, salinity and temperature (Paling *et al*., 1986; cited in BHP-BIO, 2009).

Diverse cyanobacterial communities are known to colonise the leaves and roots of mangroves and form extensive mats on the surrounding sediment. The genera *Oscillatoria*, *Phormidium* and *Microcoleus* which have been observed in the Pilbara region are widespread in these habitats (Paling *et al*., 1986; cited in BHP-BIO, 2009).

There is limited data on the extent of cyanobacterial mats within the Port Hedland area. BHP Billiton Iron Ore identified approximately 3,034ha within the Port Hedland Industrial Management Unit as being potential habitat for cyanobacterial, terming it the 'cyanobacterial mats study area'. Given that cyanobacterial mats may extend into mangroves, the area of potential cyanobacterial habitat may be larger than that identified by BHP-BIO (Roy Hill, 2010). As part of the Ministerial Approval for the South West Creek Dredging and Reclamation Project, PHPA is required to undertake a benthic habitat survey to determine project specific and cumulative impacts on each BPPH type including cyanobacterial mats, saltmarsh, macroalgal and sub-tidal microphytobenthos within 12 months of the commencement of construction. The information from this survey will be used to estimate the cumulative impacts on each BPPH type in the context of the agreed Port Hedland industrial area local assessment unit.

Other potential BPPH such as macro algae are not common in the Port Hedland inner harbour due to the lack of hard substrates for colonisation. While sea grasses and corals have been identified offshore of Port Hedland, the communities have not been recorded in near shore areas in the vicinity of the project area (Roy Hill, 2010).

4.3.11 Marine Fauna

The mangrove lined creeks of Port Hedland Harbour provide foraging habitat for juvenile green turtle (*Chelenia mydas*) and flat back turtles (*Natator depressus*) (Pendoley Environmental, 2008; cited in Roy Hill, 2010). Flatback turtles are known to nest at Pretty Pool, Cooke Point and Cemetery Beach on the seaward side of the Port Hedland industrial and urban areas.

Over one hundred species of fish have been recorded in the harbour. Marine mamals such as dolphins and whales may infrequently use the harbour, however dugongs (*Dugong dugong*) do not occur within the harbour due to the absence of seagrass beds (Roy Hill, 2010).

Port Hedland Harbour is currently recognised as an 'at risk' Australian port for the introduction and establishment of marine pest species, due to the level of activity that occurs within the port environment. A total of 12 introduced marine species are known from Port Hedland Harbour. Of the introduced species, seven species are bryozans, four are barnacles and one is a hydroid. None of the 12 introduced marine species are included on the National Target List of Potential Introduced Marine Pest Species (FMG, 2008).

4.4 Social Environment

4.4.1 Regional context

Port Hedland Port is one of the largest iron ore shipping ports in the world. In addition to iron ore, minerals such as manganese ore, copper concentrate and chromite ore sourced from the east Pilbara region are exported through the port (PHPA, 2007). BHP-BIO, PHPA and FMG all operate berths within Port Hedland Harbour (see **Figure 7**). BHB-BIO exports iron ore from berths located at Finucane Island and Neslon Point, and FMG exports ore from Anderson Point. The PHPA manages three public berths in the west-end area of the harbour and recently commissioned a common user bulk export berth at Utah Point.

The closed BHP-BIO HBI Plant is located approximately 2.5km to the southeast of the nearest point of the stockyards. A railway line connecting existing BHPBIO operations to port facilities on Finucane Island intersects the conveyor alignment, as does the Funicane Island Road. Further infrastructure proposed for the outer harbour parallels this BHP-BIO infrastructure.

At its nearest point, the project is located approximately 3.5 km south west of Port Hedland town, 8km to the west of the residential area of South Hedland and approximately 7km to the west of Wedgefield industrial estate.

A portion of the project is located on Boodarie Pastoral lease, which is owned by BHPBIO.

The overland conveyor and a portion of the stockyard of the Multi-user Iron Ore Export (Landside) Facility is located on land vested in and managed by the PHPA. The balance of the stockyard area and the rail is located on land to be vested in the PHPA in the future (**Figure 7**). It is anticipated that all land required for the Multi-user Iron Ore Export (Landside) Facility will be under the control of the PHPA by the commencement of construction.

4.4.2 Recreation and Tourism

Coastal recreational activities are popular in Port Hedland, with the Department of Fisheries (Western Australia) estimating that there are approximately 2,000 recreational craft in the Port Hedland area (BHP-BIO, 2009). There are two major boat launching facilities in Port Hedland, one is located at the north western end of Finucane Island and the second is located to the north of the PHPA berths. The PHPA also has a jetty near the existing port area which allows commercial fishing boats access to the coast when commercial wharves are not available (BHP-BIO, 2009).

Tourism is expanding in the Pilbara and north-western Australia, with Port Hedland acting as the gateway to the Pilbara region.

4.4.3 Indigenous Heritage

The Multi-user Iron Ore Export (Landside) Facility is located within the Kariyarra Native Title Claimant Area (WC99/3) and contains a number of registered Aboriginal sites within or adjacent to the footprint (**Figure 14**).

Marapikurrinya Pty Ltd (MPL) manage all heritage surveys in the Port Hedland area on behalf of the Kariyarra native title claimants. Following an agreement with the PHPA to undertake a heritage survey of the area east of FMG's facilities at Anderson Point, to the south of Finucane Island, with the southern and western boundaries within Boodarie Pastoral Lease, MPL engaged Anthropos Australia Pty Ltd to undertake the survey (Anthropos Australia Pty Ltd, 2010). The survey was undertaken in September - November 2010 to identify ethnographic and archaeological sites in accordance with the requirements of the *Aboriginal Heritage Act 1972*. The survey area was separated into 3 areas, with the Multi-user Iron Ore Export (Landside) Facility located within Priority Area 2, (see inserts in **Figure 14**):

- Priority Area 1 – approximately 5.95 km^2 ;
- Priority Area 2 - approximately 23.55 km^2; and
- Priority 3a – approximately 2.78km^2.

The results from the aboriginal heritage survey of Priority Area 1, 2 and 3a on the Boodarie Project Area (Anthropos Australia Pty Ltd, 2010) identified two existing and four newly identified sites within and

immediately adjacent to the footprint of the Multi-user Iron Ore Export (Landside) Facility (see inserts in **Figure 15**). Relevant findings are presented in **Table 10**.

Table 10. Summary of Known Heritage Sites Within or Adjacent to the NWI Development Footprint

Identifier	Description	Location and Management
PORP2-10-30	Shell Midden	Within stockpile area, approval will be sought to disturb
PORP2-10-24	Shell Midden	Within stockpile area, approval will be sought to disturb
PORP2-10-25	Shell Midden	Within stockpile area, approval will be sought to disturb
PORP2-10-39	Shell Midden	Just outside stockpile area. While every effort will be made to conserve, it is likely some disturbance will occur and approval will be sought to disturb
20648	Shell Midden	Within stockpile area, approval will be sought to disturb
25621	Shell Midden	Occurs under conveyor alignment. While every effort will be made to conserve, it is likely some disturbance will occur and approval will be sought to disturb

4.4.4 European Heritage

Places of European heritage significance within the Port Hedland area are generally located within the western end of Port Hedland town. Thirty-nine places in the Port Hedland area are listed on the Heritage Council of Western Australia's State Register of Heritage Places (HCWA, 2009). Of the thirty-nine listings, four places are permanently listed: Dalgetty House, the (former) District Medical Officer's Quarter, Mundabullangana Station and St Mathew's Anglican Church.

No places listed as having European Heritage significance are located within or close to the project area.

4.4.5 Air Quality

The semi-arid landscape of the Pilbara is a naturally dusty environment with windblown dust a significant contributor to ambient dust levels within the region.

Ambient dust levels of total particulates are known to exceed the National Environmental Pollution Measure (NEPM) criteria for PM_{10} of 50 $\mu g/m^3$ on a number of occasions each year. The large volumes of mineral products held in stockpiles and loaded onto ships at Nelson Point, the Port Hedland Port Authority berths and Finucane Island are sources of dust that, when added to the ambient levels, create dust levels that regularly exceed the NEPM criteria in the western part of Port Hedland (Worley Parsons, 2007). Wind-generated dust emissions from stockpiles and open areas are typically low when wind speeds are below a certain threshold, but they increase rapidly as wind increases above the threshold. Winds in Port Hedland are predominantly east-southeasterly in winter and northwesterly in summer (SKM, 2008).

Dust in Port Hedland is a factor of significant concern to the Port Hedland Port Authority and the EPA (Worley Parsons, 2007; EPA, 2009b). The EPA has acknowledged that effective dust management is complicated in Port Hedland due to the range of dust sources and the lack of an adequate buffer

between existing port operations and sensitive premises. As such, the EPA has stated that dust in the industrial port location of Port Hedland is an issue that is most effectively managed under Part V of the *Environmental Protection Act*, rather than by applying conditions under Part IV of the Act (EPA, 2009b). Licensing allows for the continual review of dust management for all facilities in the affected area that generate dust. (EPA, 2009b).

Three committees have been established to address the issue of dust within the Town of Port Hedland:

- Port Hedland Air Quality Reference Group. Established and chaired by the DEC, this group was formed to consider issues related to the Port Hedland airshed. The group's membership comprises government and major industry groups, including BHP Billiton Iron Ore, the Fortescue Metals Group and the Port Hedland Port Authority. As dust monitoring is currently conducted by a number of organisations in Port Hedland independent of each other, one of the main aims of the group is to develop a cooperative air quality monitoring program for Port Hedland.
- Port Hedland Industries Council Incorporated (PHIC). The council was recently established by industry within Port Hedland. It is intended to provide a forum for industry to be proactive in managing the dust issue and to address other issues that may be of concern to the community. NWI is an associate member of PHIC.
- Port Hedland Dust Management Taskforce. This taskforce was established by the Department of State Development (DSD) in response to a directive from the Premier to release and implement the recommendations from various dust studies commissioned by the Western Australian Government.

The Port Hedland Dust Management Taskforce produced the Port Hedland Air Quality and Noise Management Plan in March 2010 (DSD, 2010). The Management Plan assesses the issues and drivers associated with dust and noise at Port Hedland, and document an implementation strategy and governance framework to guide future actions to support responsible development of Port Hedland, for its residents, the port and its users (PHPA, 2010). The Port Hedland Dust Management Taskforce recommended that an interim guideline measure for air quality in Port Hedland for particles measured as PM10 be established based on the following criteria (DSD, 2010):

- 70µg/m^3 (24hour average)
- 10 exceedances per calendar year;
- Applies to residential areas east of Taplin Street, Port Hedland; and
- Review five years after commencement of plan

4.4.6 Noise

The ambient noise levels in Port Hedland, particularly in the west end, are largely dominated by operational emissions from existing infrastructure that often operates continuously. Noise levels within town of Port Hedland currently exceed levels permitted under the *Environmental Protection (Noise) Regulations 1997* due to the close proximity of port operations to commercial and residential areas. Noise emissions are not continuous and can vary considerably depending on the activities being undertaken (EPA, 2009b).

Noise in Port Hedland is of significant concern to the Port Hedland Port Authority and the EPA (Worley Parsons, 2007; EPA, 2009b, 2009c). The EPA has called for a coordinated government and industry

approach to the development of a strategy that includes explicit exposure reduction strategies and strong and inclusive governance arrangements (EPA, 2009c).

The State Government established the Port Hedland Dust Management Taskforce to address dust and noise issues within Port Hedland. The Taskforce prepared the Port Hedland Air Quality and Noise Management Plan (DSD, 2010), which provides an implementation strategy and governance framework to guide future actions to support responsible development of Port Hedland, for its residents, the port and its users. Recommendations of the taskforce include the establishment of a State Environmental Policy for Port Hedland to monitor and manage noise using exemptions to the *Environmental Protection (Noise) Regulations* where appropriate (PHPA, 2010).

5 KEY ENVIRONMENTAL IMPACTS AND MANAGEMENT

The key environmental factors associated with the project have been identified as

- Benthic primary producer habitat (BPPH);
- Surface water and coastal processes;
- Dust from construction and operation activities; and
- Noise from construction and operation activities.

Other environmental factors associated with the project are addressed in Sector 6.

5.1 Benthic Primary Producer Habitats

5.1.1 Management Objectives, Applicable Standards and Guidelines

The EPA's objective for BPPH is to maintain the abundance, diversity, geographical distribution and productivity of mangroves and other benthic primary producer habitat at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

Two EPA guidance statements are relevant to the assessment and management of impacts on BPPH in Port Hedland Harbour:

- Guidance Statement 1: *Guidance Statement for the Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline* (EPA, 2001).
- Guidance Statement No 3: Protection of *Benthic Primary Producer Habitat in Western Australia's Marine Environment* (EPA, 2009d).

Other applicable legislation and guidelines for the management of mangroves include:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000a).
- *Pilbara Coastal Water Quality Consultation: Environmental Values and Environmental Quality Objectives* (DoE, 2006).

5.1.2 Potential Impact

The project will impact benthic primary producer habitats (defined as functional ecological communities that inhabit the seabed) (EPA, 2009d). Specifically, the project will impact mangroves and intertidal samphire (salt marsh) vegetation and cyanobacterial algal mats.

5.1.2.1 Direct Impacts

Mangroves

The total disturbance to mangroves as a result of the project is 4.46ha (**Figure 15**). The disturbance is required to construct the overland conveyor from the stockyard to the wharf. The mangrove assemblages to be disturbed consist of:

- Closed canopy woodland of *Rhizophora stylosa* (with occasional *Avicennia marina*)
- Closed canopy woodland of *A. marina* (landward margins); and
- Low scattered *A. marina* (with occasional *Ceriops tagal*) and scattered samphires,

and are summarised in **Table 11**.

Table 11. Impact on Mangrove Communities within the Project Area and Equivalent Associations from Port Hedland Harbour

Mangrove Communities in Project area	Mangrove Associations of Port Hedland Harbour (after Paling in Environ, 2004)	Area to be impacted (ha)
Community 10	Closed canopy woodland of *R. stylosa*	0.32
Community 11	Closed canopy woodland of *A. marina* (seaward fringe)	0.69
	Closed canopy woodland of *A. marina* (landward margins)	
Mosaic 11/5	Low open woodland of *A.marina* on saline flats	3.45
	Low scattered *A.marina* and scattered samphires	

Avicennia marina and *R. stylosa* are the most commonly occurring species in the Port Hedland region in terms of distribution and abundance.

The mangrove assemblages to be directly impacted by the project are located within the Port Hedland Industrial Area Management Unit, which includes the Port Hedland Harbour, South West Creek, the proposed conveyor corridor and Boodarie Estate. The Port Hedland Industrial Area Management Unit is classified as Category F. A classification as Category F defines the management unit as a degraded area where a substantial proportion (>10%) of the BPPH has been lost. **Figure 15** presents the remaining mangrove cover in each of the Port Hedland Industrial Area and adjacent Oyster Passage Barrier Mangrove Management Units. The project will have no direct impact on mangroves in the regionally significant and high conservation area of the Oyster Passage Barrier Mangrove Management Unit, which is classified as Category A in EPA (2009d).

The predicted loss of 4.46ha of mangrove assemblages represents approximately 0.15% of the total mangrove habitat within the Port Hedland Industrial Area Management Unit. The cumulative loss of mangroves has been calculated to be 12.95% when combined with the estimated historical losses and the potential losses from the Roy Hill Infrastructure proposal and the South West Creek Dredging and Reclamation Proposal. **Table 12** presents the loss of mangroves from the project in the context of the cumulative losses of mangroves in the Port Hedland Industrial Area Management Unit.

Table 12 Cumulative loss of Mangrove BPPH in Port Hedland Industrial Area Management Unit

BPPH (Mangroves)	Port Hedland Industrial Area Local Assessment Unit (ha)	% Impact
Total size of management unit	**15,430**	
Historical area of mangroves as defined by the EPA	**2,676**	
Current area of mangroves as defined by EPA (2011)	**2,378.9**	
Estimated historic loss of mangroves	297.1	11.1
Potential cumulative mangrove loss including Roy Hill Infrastructure and South West Creek Dredging and Reclamation Projects	342.1	12.8
Potential permanent mangrove loss due to this project	4.46	
Potential cumulative mangrove loss including this project,	346.6	12.95

Cyanobacterial Mats and Samphires (salt marshes)

The distribution of benthic primary producer habitats and bare tidal flats in the intertidal area surrounding Port Hedland Port is a mosaic. Cyanobacterial mats within the project area are mapped as FCT 12, while samphires on intertidal flats are shown as FCT 5 (**Figure 11**). The construction of the rail loop will potentially impact on 1.37ha of cyanobacterial mats and 3.67ha of samphires in the Oyster Passage Barrier Mangrove Management Unit, which is classified as Category A in EPA (2009d), and up to 29.4ha and 47.5ha of cyanobacterial mats and samphires respectively in the Port Hedland Industrial Area Management Unit (Category F). However with respect cyanobacterial mats, the area of cyanobacterial mats affected by the project is likely to be significantly less as not all mudflats will support mats and not all of the development envelope will be disturbed by the final project footprint. The boundaries of the Port Hedland Industrial Area and Oyster Harbour Passage Management Units are shown in **Figure 15**.

Environmental Protection Principles

In developing the project, NWI undertook extensive consultation with the PHPA and Roy Hill Pty Ltd to avoid or, where this was not possible, to minimise impacts to BHHP. NWI has addressed the four overarching environmental protection principles outlined in Environmental Assessment Guideline No. 3 *Protection of Benthic Primary Producer Habitats in Western Australia's Marine Environment* (EPA, 2009a) (**Table 13**).

Table 13 NWI Consideration of Environmental Protection Principles Relating to the Disturbance of BPPH

Principle	Application
Avoid loss/damage of BHHP	Impact on mangroves minimised where possible through the alignment of the conveyor. Unavoidable impact on 4.46ha of mangroves due to operational requirements including need to be consistent with the PHPA Ultimate Development Plan, and the need for a conveyor to link the stockpile with the wharf. Rail loop and stockpile positioned as far east as possible within Stockyard 2 to minimise impact on other BPPH (cyanobacterial mats and samphires) and mangroves.
Where avoidance of BPPH is not possible, design to minimise damage/loss	Impacts on mangroves minimised by conveyor being located on trestles, with disturbance limited to that required for construction of trestle. The wharf Is a braced structural steel girder design supported on tubular steel piles driven into the seabed. This design, a trestle type structure, provides for unimpeded tidal flows to adjacent mangroves.
Demonstrate 'best practicable' design, construction methods and environmental management aimed at minimising future loss/damage	Drainage design maintains the existing ephemeral and tidal flows and incorporates the design of the conveyors for the Roy Hill Iron Ore Port Infrastructure project to minimise cumulative impacts. Conveyors will be elevated on trestles except in the immediate vicinity of the Roy Hill stockpile and rail line, where there is no environmental benefit to a trestle design. Construction techniques will minimise damage to mangroves with scrub-rolling used where possible rather than removal of mangroves to provide maximum opportunity for vegetative recovery along the boundary of cleared areas.

5.1.2.2 Indirect Impacts

Apart from direct clearing, the project may have a number of indirect impacts on BPPH including:

(i) *Reduction in tidal flushing and inundation due to restriction of tidal exchange*.

Tidal movement cleanses the soil of accumulated salts and toxic sulphur compounds, and renews the supply of inorganic nutrients and oxygen to mangrove root tissues (Gordon, 1987, Paling, 1997 cited in Woodman, 2011). There will be no restriction to tidal exchange. The overland conveyor will be elevated on trestles, with the trestle design complementing that of the RHIOPI Project to ensure no impact on tidal flushing and inundation.

(ii) *Changes in patterns of erosion or accretion which can lead to undermining or burial of pneumatophores*

There is some potential for increased sediment mobilisation resulting from scouring in the vicinity of the proposed culvert crossing of South West Creek for a distance of approximately 1km downstream of the culvert in 1 in 100 AEP flood events. Scour protection will be included, particularly in the vicinity of the waterway openings in the conveyor and the culvert through the railway spur line to control erosion during flood and storm surge events. The sediment mobilisation is highly unlikely to be to such an extent that it results in a detectable impact on pneumatophores.

(iii) Impoundment of water at higher than natural levels leading to sustained inundation of pneumatophores and/or a decline in water quality

Given the inclusion of culverts in the rail embankment and elevation of the conveyor on trestles except in the immediate vicinity of the Roy Hill stockpile and rail line, where appropriately sized culverts will be incorporated into the embankment, there will be no impoundment of water that could potentially result in the sustained inundation of pneumatophores.

(iv) Release of contaminants from iron ore stockpiles into surface water runoff

There is minimal potential for contaminants from the stockyard area to be released into surface water runoff. The stockyard area will be located within the rail line embankment, and above the 1 in 100 AEP flood and storm surge level. The stockyard will be internally draining with silt traps and sedimentation basins established within the stockyard area to trap sediments washed off the stockpile areas. In the event of a large (>1 in 100 AEP) there would be large volumes of water inundating the flood plains of South and South West Creek so there would be considerable dilution of the potentially contaminated water, with the volumes of flood water sufficiently large that there will not be an appreciable increase in the concentration of contaminants (SKM, 2011b).

(v) *Alteration to fresh water surface drainage or changes in groundwater flow pattern*

Surface Water

The majority of the project is located within the western part of the catchments of South and South West Creeks, however part of the rail alignment runs along the divide between the catchments of South West Creek and the Turner River. An assessment of the project's impact on surface water was undertaken by SKM (SKM, 2011b; **Appendix D**) with the assessment considering cumulative impacts associated with the Roy Hill and NWI projects.

Due to the alignment of the project, no surface water flows are expected from the project into the Turner River and flows in the Turner River will not be modified by the project. The surface water flows will be maintained at acceptable levels by:

- The inclusion of culverts in the rail embankment. The culverts will be of sufficient capacity for a 1 in 100 AEP event to ensure surface water flows are unimpeded by the rail loop or spur;
- The conveyor will be elevated on trestles except in the immediate vicinity of the Roy Hill stockpile and rail line, where there is no environmental benefit to a trestle design. In these areas appropriately sized culverts will be incorporated into the design. The location of culverts will be determined consistent with RHIOPI.

Groundwater

The impact of dewatering associated with the construction of the car dumper and underground conveyor was assessed by URS (2011) (**Appendix E**). The assessment was undertaken to determine if

the cone of groundwater depression resulting from construction dewatering has the potential to impact groundwater receptors in particular:

- Along potential groundwater/seawater interface zones north and west of the rail loop should the potential cone of dewatering give rise to seawater intrusion, especially relating to impacts within the Oyster Passage Barrier Area Management Area (Category A); and
- A reduction of flow in the Turner River through a reduction in groundwater baseflow.

The calculated extent of the cone of depression from dewatering was calculated to be 500m and is shown in **Figure 16** (URS 2011). Although the cone of depression may extend into the south eastern corner of the Oyster Passage Barrier Area Management Unit, the dewatering is unlikely to result in any impact to mangroves, which are over 1km away or result in any seawater intrusion (**Figure 16**).

While the stockyard footprint occurs within the proposed north eastern extension of the Turner River PDWSA, prospective sediments occur several kilometres beyond the likely western extent of the cone of depression and that groundwater baseflow to the river is therefore unlikely to be affected by dewatering activities.

The placement of up to 5.7 million tonnes of ore stockpiles over an unconsolidated shallow aquifer has the potential to cause compression of the near surface, saturated soil structure and lead to the rapid lateral migration of a ‘slug’ or series of slugs of highly saline water into the nearby tidal zone, which in turn may result in a decline in mangrove health. As the distance from the ore stockpile within the rail loop to the nearest mangroves is in the order of 1km (or greater), the risk of a saline slug migrating to the mangroves is expected to be low. Furthermore should shallow groundwater salinity within the area of the stockpiles be at or less than adjacent seawater (around 25,000mg/L), the threat to mangrove health from a potential release from the project site is expected to be minimal (URS, 2011).

(vi) *Deposition of dust and other particulates on mangrove leaves*.

The presence of iron ore stockpiles, material handling, vehicle movement and other activities all have the potential to generate dust within the port area. Mangroves in the locality are currently in good condition and generally unaffected by the dust that coats mangroves in other parts of the harbour. Iron ore dust does not appear to cause structural damage to mangrove leaf structures. Given the existing and proposed dust suppression measures implemented at the Port, the risk of significant dust impacts occurring to mangroves as a result of the project is considered to be low.

5.1.3 Management and Mitigation Measures

The project has been designed to minimise impacts on mangroves and other BPPHs. The alignment of the conveyor and rail loop, the design of the wharf and the positioning of the stockyard was developed to minimise impacts to mangrove and other BPPH communities.

Other management measures to limit impacts on BPPHs include:

- Workforce induction including information on the ecological significance of mangroves (and other BPPHs) and instructions on clearing procedures;
- Delineation of clearance boundaries through the use of flagging or other suitable techniques prior to commencement of clearing activities to prevent disturbance of mangroves outside the clearing footprint;

- Where practical, inclusion of a buffer area (10m) between the infrastructure edge and disturbance boundary in site plans to avoid impacts on mangroves outside the approved area;
- Prohibiting access to mangroves outside the immediate disturbance footprint;
- Reporting incidents with the potential to impact on mangroves;
- Using construction methods such as scrub rolling where possible rather than removal of mangroves to provide maximum opportunity for vegetative recovery along the boundary of cleared areas;
- Managing and minimising dust deposition on mangroves through regular applications of water to working areas and road surfaces, minimising drop heights of material with the potential to generate dust and restricting vehicle speeds to control dust. Dust monitoring will be conducted to ensure dust control measures are implemented and effective;
- Design and implementation of a stormwater drainage system to capture surface water from operation areas in the stockyard. Stormwater will be directed to a 10ha pond located at the north western extent of the stockpile area for settling. Discharge off site may be required during long period return rainfall events in which case there will be significant inundation of the floodplain, and only to existing drainage channels;
- Design of infrastructure based on best practice to withstand a 1 in 100 year flood event and ensure unimpeded surface water flows;
- Inclusion of scour protection, particularly in the vicinity of the waterway openings in the conveyor and the culvert through the railway spur line to control erosion during flood and storm surge events;
- Preparing and implementing a Mangrove and other BPPH Management Plan prior to the commencement of construction. The Mangrove and other BPPH Management Plan will include a mangrove health risk assessment to provide baseline data on mangrove health and will detail ongoing monitoring of mangrove health.
- The composition and distribution of cyanobacterial mats in the vicinity of the project area will be surveyed prior to the commencement of operations, and the results provided to the EPA.
- Establishment of a network of shallow groundwater monitoring bores adjacent to the northern and western boundaries of the rail loop to monitor potential salinity impacts to mangroves.

5.1.4 Predicted Outcome

The total disturbance to mangroves as a result of the Multi-user Iron Ore Export (Landside) Facility is 4.46ha. Cumulative direct loss of mangrove habitat within the Port Hedland Industrial Area Management Unit (Category F) , including the losses due to this project, is 12.95% of the pre-European extent of mangrove coverage, of which 0.15% is due to the Multi-user Iron Ore Export (Landside) Facility. There will be no impact on mangroves in the Oyster Passage Barrier Management Unit (Category A). Indirect losses of mangrove habitat as a result of altered surface and ground water flows, sedimentation and dust impacts are not expected to occur as a result of the project.

The impact on other marine habitats will be limited, with up to 87ha of cyanobacterial mats and samphires impacted by the project. The area of cyanobacterial mats affected by the project is likely to be significantly less as not all mudflats will support mats. The area supporting cyanobacterial mats and

samphires is not considered to be significant within the context of the Port Hedland Industrial Area Management Unit or the Oyster Passage Barrier Management Unit. However, NWI will survey the composition and distribution of cyanobacterial mats in the vicinity of the project.

A Mangrove and Other BPPHs Management Plan will be prepared to minimise direct and indirect impacts resulting from the project. The Construction EMP will detail procedures to minimise disturbance during construction and maximise opportunities for the recovery of mangroves and cyanobacterial mats. Based on the relatively small amount of direct losses of mangrove and other BPPH, the prevention of indirect losses through management measures, the application of best practice approach to environmental management and the development and implementation of a Mangrove and Other BPPH Management Plan, it is considered that the requirements of EPA Guidance Statement No 1 (EPA, 2001) and EPA Guidance Statement No.3 (EPA, 2009d) will be met.

5.2 Surface Water and Coastal Processes

5.2.1 Management Objectives, Applicable Standards and Guidelines

The EPA objective for surface water and coastal process are to

- Maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance are protected; and
- To maintain the integrity, ecological functions and environmental values of the seabed and coast.

The key statutory requirements, policy and guidance relevant to surface water and coastal processes are:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000a).
- *Pilbara Coastal Water Quality Consultation: Environmental Values and Environmental Quality Objectives* (DoE, 2006).
- *Guidance Statement 1: Guidance Statement for the Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline* (EPA, 2001).

5.2.2 Potential Impact

An assessment of the project's impact on surface water was undertaken by SKM (SKM, 2011b; **Appendix D**), with the assessment considering cumulative impacts associated with the Roy Hill and NWI projects on tide, storm surge and flooding for the project site.

The majority of the project is located within the western part of the catchments of South and South West Creeks, however part of the rail alignment runs along the divide between the catchments of South West Creek and the Turner River. Due to the alignment of the project, no surface water flows are expected from the project into the Turner River and flows in the Turner River will not be modified by the project.

Floods and storm surges are known to occur in the vicinity of the project site. Under existing conditions combined storm surges and flood events with an AEP of 1 in 50 and 1 in 100 cause flooding of the floodplains of South and South West Creeks. Such events can result in the inundation of infrastructure and can modify the direction, depth and velocity of flows in areas around the project site. The modelled

simulations found that without mitigation measures, surface water flow would be impeded by the rail embankment, rail loop and stockpile and conveyors (**Figure 17**). With the incorporation of adequate culvert capacity in the rail embankment for a 1 in 100 AEP event, surface water flows are unimpeded by the rail loop or spur (**Figure 18**). The conveyor will be elevated on trestles except in the immediate vicinity of the Roy Hill stockpile and rail line, where there is no environmental benefit to a trestle design. In these areas appropriately sized culverts will be incorporated into the design. The location of culverts will be determined in consultation with Roy Hill Pty Ltd.

The modelling found that rail loops for NWI and Roy Hill impede the passage of storm surge for the 1 in 100 AEP storm surge event, resulting in widespread reductions in peak storm surge to the south east of the two rail loops (**Figure 19** Fig 4-14 SKM). The only area where the flood level for the 1 in 100 AEP was projected to increase with the NWI and Roy Hill developments is for a distance of approximately 7km downstream from the proposed culvert of the rail spur across South West Creek. The flow velocities for the 1 in 100 AEP would be virtually unchanged by the proposed developments (**Figure 20**), other than near the proposed culvert crossing of South West Creek for a distance of approximately 1km downstream of the culvert in 1 in 100 AEP flood events. Scour protection will be required, particularly in the vicinity of the waterway openings in the conveyor and the culvert through the railway spur line to control erosion during flood and storm surge events.

The impervious areas from the rail loop, stockyard, conveyor, wharf and ancillary facilities, represent 0.03% of the combined area of South and South West Catchments, and will cause an increase in runoff rates from that which would be observed under natural catchment conditions. The change in volume of runoff is insignificant compared with the overall total volume of runoff generated from the existing catchments of South and South West Creeks during flood events.

Rainfall on iron ore stockpiles and impervious surfaces around the rail loop and conveyor will cause runoff that may contain sediment and low levels of other contaminants. Silt trap and sedimentation basins will be incorporated within the stockpile area to trap sediments washed off the stockpiles during rainfall events.

5,2.3 Management and Mitigation Measures

On-site stormwater management will be implemented to detain runoff produced from impervious areas and to minimise scour caused by direct runoff from these areas. An appropriately sized detention basin (approximately 10.3ha) will be incorporated within the stockpile area to manage runoff.

The stockpiles, car dumper and conveyor loader will be located above the 1 in 100 AEP flood and storm surge level to minimise the probability of the infrastructure being inundated. In the event of a large flood (>1 in 100 AEP) or storm surge event that floods the car dumper and the facilities for retaining water released during the unloading of rail cars, any water contaminated with sediments will be diluted by the large volumes of water inundating the floodplains of South Creek and South West Creek. The volumes of flood water associated with such an extreme event would be so large that it would be highly unlikely there would be any increase in the concentration of contaminants.

Culverts will be designed to allow flood flows to pass through the rail spur line at South West Creek crossing during the 1 in 100 AEP events without causing inundation of the railway line. A regular program of inspection and maintenance of the culverts will be implemented to ensure the culverts continue to function effectively. Where the conveyor is located on an embankment (i.e. immediately adjacent to the Roy Hill stockpile and Roy Hill Rail embankment), the bridges or culverts in the conveyor embankment will be designed to pass the 1 in 100 AEP flood and storm event.

Baseline and continuous monitoring of sediment and other pollutants will be conducted during construction and operation of the Multi-user Iron Ore Export (Landside) Facility to detect any changes in water quality due to the project.

5.2.4 Predicted Outcome

Given the elevation of the overland conveyor and the inclusion of culverts or bridges in the rail and conveyor embankments, the project is unlikely to have a significant effect on surface water runoff or tidal flows. On site stormwater management will be implemented to detain runoff produced from impervious areas and to minimise scour caused by direct runoff from these areas.

5.3 Dust

5.3.1 Management Objectives, Applicable Standards and Guidelines

The EPA's objectives for the Project with regards to dust management are to:

- Ensure that atmospheric emissions (dust) do not impact on environmental values or the health, welfare and amenity of the population and land uses.
- Use all reasonable and practicable measures to minimise airborne dust

Applicable legislation and guidelines for the management of air quality include:

- EPA Guidance Statement No 18 *Prevention of Air Quality Impacts from Land Development Sites* (EPA, 2000b).
- *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* and *Environmental Protection (Kwinana) (Atmospheric Wastes) Regulations 1992*.
- *National Environmental Protection Measure* (NEPM) *for Ambient Air Quality 1998*.
- *Occupational Safety and Health Act 1984*.
- *Occupational Safety Regulations 1996.*
- EPA Environmental Protection Bulletin No 2 – *Port Hedland Noise and Dust* (EPA, 2009b).
- Port Hedland Air Quality and Noise Management Plan (DSD, 2010).

Regulatory instruments for the management of dust include:

- The NEPM PM_{10} standard of 50 µg/m^3 (24 hour average) as the criteria to assess potential health impacts at sensitive receptors.
- The Kwinana EPP Area C Total Suspended Particulate matter (TSP) limit of 150 µg/m^3 (24 hour average), as the criteria to assess potential amenity impacts.

The Interim guideline criteria for Port Hedland recommended by the Port Hedland Dust Management Taskforce (DSD, 2010) is yet to be established by the DEC. The ambient air standards and goals is summarised in **Table 14**

Table 14 Ambient Air Quality Standards and Goals

Pollutant	Averaging Period	Standard (µg/m^3)	Source
		-	
Particles as PM_{10} (Proposed interim guideline) – Port Hedland	1 day	70	Port Hedland Air Quality and Noise Management Plan
Particles as PM_{10} – sensitive receptors outside of Port Hedland (e.g. Wedgefield and South Hedland)	1 day	50	NEPM
Particles as $PM_{2.5}$	1 day	25	NEPM
Particles as $PM_{2.5}$	1 year	8	NEPM
Total Suspended Particulate Matter	1 year	90	NSW EPA

5.3.2 Potential Impact

Ambient dust concentrations at Port Hedland are of significant community and regulatory concern. Whilst background dust levels are naturally high due to the arid environment and meteorology of the region, existing operations at Port Hedland including BHP Billiton's iron ore operations, are a major contributor to local ambient particulate concentrations.

Construction of the project will have minimal impact on dust. Construction works have the potential to generate dust from earth works, unsealed areas and increased traffic, which may create a nuisance particularly near the town of Port Hedland.

During operation, the greatest potential dust generation is likely to be from:

- Unloading material from car dumpers;
- Vehicle generated dust;
- Wind erosion from product stockpiles and unsealed areas;
- Conveyor movements and transfer stations
- Ore stockpiling and reclaiming; and
- Shiploading.

The potential impact of the Multi-user Iron Ore Export (Landside) Facility on the air quality in Port Hedland was assessed by SKM (2011) (**Appendix F**), using predictive air dispersion techniques and the results of ambient dust modelling available for the Port Hedland area. The assessment considered the potential particulate impact from the project in isolation and cumulatively with other existing, approved and potential projects. Other projects included in the assessment included:

- BHP-BIO RGP6 (inner Harbour) at 240Mtpa;

- BHP-BIO Outer Harbour Development at 240Mtpa
- PHPA Utah Point and Nelson Point at a total of 17Mtpa;
- FMG at 120Mtpa;
- Roy Hill operations at 55Mtpa; and
- Background concentrations from the validated model scenario.

Air quality impacts were estimated using AUSPLUME (version 6) to ensure consistency with other modelling studies. This model has been used for dust modelling by other exporters in Port Hedland including PHPA, BHP Billiton Iron Ore and FMG.

The main sources of dust emissions from the NWI project are the stockyard and the shiploader.

The proposed project will have the greatest impact at the Harbour and St. Celicia receptors. However, the large difference between the predicted maximum concentrations and the 99th percentile statistics indicates that high impacts will only occur a few times a year. The addition of the Multi-user Iron Ore Export (Landside) Facility to the model resulted in an increase in the dust concentrations from the validated 2004-2005 Port Hedland dust model at most of the sensitive receptors. The exception is the Hospital site, where less extreme concentrations are predicted due to the removal of crushing screening sources from the RGP6 Project in the 2004-2005 model. The St Celica receptor appears to experience the greatest impact in the future, though a review of the 99th percentile statistics indicate that this is an extreme event, and that the Hospital and Harbour receptors will continue to experience the highest concentrations in the future.

Emissions from the Multi-user Iron Ore Export (Landside) Facility are not predicted to have a significant impact on Port Hedland, with emissions mostly influencing the immediate area around stockyards and shiploading through South West creek (**Figures 21** and **Figure 22)**.

Table 15 shows the predicted PM_{10} concentrations from the proposed project in isolation. The predicted PM10 concentrations in the future with and without the Multi-user Iron Ore Export (Landside) Facility is shown in **Table 16**.

Table 15. 24 hour PM10 Statistics for NWI in isolation (µg/m^3)

Receptor	Maximum	99th Percentile	95th percentile	90th Percentile	70th Percentile	Average	No of days >70 (µg/m^3)
Harbour	24	8	4	3	1	1	0
BMX	17	9	4	3	1	1	0
Hospital	11	6	4	2	1	1	0
St Celica's	15	5	3	2	1	1	0
Shops	11	4	2	2	1	1	0

Table 15. 24 hour PM10 Statistics for NWI in isolation (µg/m^3) (cont'd)

Receptor	Maximum	99th Percentile	95th percentile	90th Percentile	70th Percentile	Average	No of days >70 (µg/m^3)
Primary School	4	3	2	1	<1	<1	0
High School	3	2	1	1	1	<1	0
Wedgefield	7	4	3	2	1	1	0

Table 16. Summary of 24-hour PM10 Model Predictions by Scenario

Receptor	2004-05 Validated Model	Future (no NWI) (µg/m^3)	Future with NWI (µg/m^3)	Future (with NWI and Outer Harbour) (µg/m^3)
	106 Mtpa	**432 Mtpa**	**482 Mtpa**	**722 Mtpa**
	Maximum			
Harbour	152	166	170	172
BMX	-	146	147	147
Hospital	182	153	153	155
St Celicia's	-	184	199	201
Shops	-	109	120	123
Primary School	76	75	78	79
Secondary School	63	71	71	73
Wedgefield	63	83	84	84
	Average			
Harbour	49	60	62	63
BMX	-	51	52	53
Hospital	44	47	48	49
St Celica's	-	37	37	38
Shops	-	32	33	34
Primary School	22	25	26	26
Secondary School	19	23	23	24
Wedgefield	19	28	29	30

Table 16. Summary of 24-hour PM10 Model Predictions by Scenario (cont'd)

Receptor	2004-05 Validated Model	Future (no NWI) (µg/m^3)	Future with NWI (µg/m^3)	Future (with NWI and Outer Harbour) (µg/m^3)
	No Days/Year >70 µg/m^3			
Harbour	39	96	101	110
BMX	-	50	53	55
Hospital	39	54	60	61
St Celicia's	-	17	18	21
Shops	-	14	16	17
Primary School	1	2	2	2
Secondary School	0	9	9	10
Wedgefield	0	20	25	31
Taplin Street	-	19	23	25

5.3.3 Management and Mitigation Measures

NWI is committed to ensuring appropriate management techniques and monitoring are undertaken ensure that particulate emissions from the Project are minimised.

Dust emissions during construction will be managed through the preparation and implementation of a Construction Environmental Management Plan. Management measures to minimise the impact of dust during construction will include the regular application of water to working areas and road surfaces, minimising drop heights of material with the potential to generate dust, restricting vehicle speeds to control dust and daily monitoring to ensure dust control measures are implemented and effective.

NWI will prepare and implement a Dust Management Plan prior to the commencement of operation. The Dust Management Plan will include a number of dust control measures, including:

- Maintenance of high ore moisture levels, with the target moisture content of 7%, never to fall below 4%;
- Enclosure of key components at the rail car dumpers, use of fogging water sprays at the time of dumping and installation of a particulate extraction system around the wagon tipper;
- Total enclosure and utilisation of water sprays at conveyor transfer points and the use of belt scrapers to clean conveyor belts;
- Conveyors between the stockyard and the wharf will be covered to minimise dust (and noise) emissions;
- Minimising the ship loader discharge height and installation of water sprayers at the boom discharge and boom conveyor system;
- Stackers will be slewing, luffing types so that the drop height to the stockpile will be minimised;

- Identification of road/traffic areas that are likely to produce unacceptable particulates and ensuring they are sealed. Particulates in low traffic areas will be controlled by water carts and speed limits;
- Monitoring of the ore moisture content to reduce particular emissions and use of various applications to dampen surfaces (as required) to prevent generation of fugitive dust
- Regular checks and maintenance of dust control equipment and removal of accumulated particulate material from under conveyors and around transfer points.

The Dust Management Plan will include a dust monitoring program, which will be developed in consultation with DEC and industry.

5.3.4 Predicted Outcome

The air dispersion modelling predicted that the proposed Multi-user Iron Ore Export (Landside) Facility is unlikely to result in significant changes to the air quality profile in the Port Hedland region, with emissions mostly influencing the immediate area around stockyards and shiploading through South West creek. As a member of the Port Hedland Industry Council, NWI is aware of the need to minimise dust emissions to the lowest practicable level and has incorporated a number of design and management measures to minimise dust emissions. However the development of the project will result in an increase in the number of days when the 24hour average PM_{10} value exceeds the proposed interim guideline of 70 µg/m^3 specified in the Port Hedland Air Quality and Noise Management Plan. Including the Multi-user Iron Ore Export (Landside) Facility in modelling of future scenarios resulted in the interim guideline of 70 µg/m^3 would be exceeded on 6 days at the Harbour site in addition to the 104 days of predicted exceedances in the base case without the project.

5.4 Noise

5.4.1 Management Objectives, Applicable Standards and Guidelines

The EPA objectives for the Project with respect to noise are:

- To ensure that noise emissions do not impact on environmental values or the health, welfare and amenity of the population and land uses.
- To ensure that noise emissions, both individually and cumulatively, comply with the relevant statutory requirements.
- To ensure design and procurement activities incorporate measures for minimising noise emissions during construction and operation.
- To ensure that all reasonable and practicable measures are undertaken during construction and operations to minimise noise emissions.

Applicable legislation, regulations and guidelines for the management of noise emissions include:

- Australian Standard AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites 1981.
- *Environmental Protection (Noise) Regulations 1997*.
- EPA Guidance Statement No 8: *Environmental Noise* (Draft) (EPA, 2007).

- Port Hedland Air Quality and Noise Management Plan (DSD, 2010).
- EPA Environmental Protection Bulletin No 2 Port Hedland Noise and Dust (EPA, 2009b)

5.4.2 Potential Impact

An assessment of the noise impacts of the proposed project on the Town of Port Hedland was undertaken by SVT (2011) (**Appendix G**) and is summarised below.

Background night time noise levels at sensitive receptors in Port Hedland and surrounds currently exceed the *Environmental Protection (Noise) Regulations 1997*. The project will introduce a number of additional sources noise including:

- Rail operations, including train unloading;
- Conveyor operations, stockpiling and reclamation of ore; and
- Shiploading.

In addition, piling will be undertaken during the construction of the wharf structure.

A noise model of the Multi-user Iron Ore Export (Landside) Facility was developed using SOUNDPLAN noise modelling software. The noise model consists of approximately 50 noise sources comprising the major elements of the project including rail, car dumping, stacker, reclaimers, conveyors and shiploaders. Plant noise predictions were based on the CONCAWE methodology which explicitly deals with the influence of wind and stability of the atmosphere. Worst case meteorological conditions including wind direction, wind speed and temperature inversion were used. The modelling assumes all plant will operate simultaneously, which is a worst case scenario. As a result, the noise predictions are considered to be conservative.

The noise levels for the Multi-user Iron Ore Export (Landside) Facility were compared with the criteria within the *Environmental Protection (Noise) Regulations 1997*. In cases where the assigned level is already being exceeded such as in Port Hedland, the Regulations do not permit another noise source to 'significantly contribute to' the assigned level, thus ensuring cumulative emissions in the area are considered. A noise event is taken to 'significantly contribute to' a level of noise if the new noise emission exceeds a value of 5 dB below the assigned value at the point of reception. For noise sensitive premises such as residences, an 'influencing factor' is added to the assigned noise levels. Penalties are also applied for noise that has tonal characteristics.

The results of the noise modelling of the proposed operations show that the project is predicted to exceed the *Environmental Protection (Noise) Regulations 1997* at one noise sensitive receptor (Hospital Site). The modelling predicted that the operations will exceed the noise level criterion of 32 dB by 5.6dB (**Table 17**), (**Figure 23** and **Figure 24**). The noise level at all other noise sensitive receptors are below the maximum allowable level set by the Regulations.

Table 17. Predicted Noise Levels

Receiver Location	Assigned night time level L_{A10}	Predicted Received Level L_{A10}	Difference
Brearley St	32 dB	32.0 dB	0 dB
Hospital	32 dB	37.6 dB	+5.6 dB
Police Station	47 dB	42.3 dB	-4.7 dB
Pretty Pool	35 dB	23.5 dB	-11.5 dB
South Hedland	35 dB	23.8 dB	-11.2 dB
Wedgefield	65 dB	30.7 dB	-34.3 dB

Impacts of noise and vibration associated with piling during construction on marine fauna including turtles is expected to be limited to the immediate vicinity (20m-30m), as they are expected to move away from the area on the commencement of piling.

5.4.3 Management and Mitigation Measures

Potential noise impacts from construction activities will be managed by the preparation of a Construction Noise Management Plan prior to the commencement of construction to ensure the requirements of the *Environmental Protection (Noise) Regulations 1997* are met. Impacts of pile driving and wharf construction on marine fauna, (e.g. turtles) will be managed through the use of soft start procedures, adequately trained marine fauna observers, a marine fauna exclusion zone of 300m and stop work procedures when marine fauna are sited within 100m of operations.

NWI will investigate noise mitigation measures to achieve a 5.6 dB noise reduction at the hospital. Potential options include the use of low noise idlers or shielding of idlers on conveyors and shielding or specifying 800kW drives to 82 dB(A) at 1m for a number of the drives.

NWI will prepare and implement a Noise Management Plan prior to the commencement of operations. The Noise Management Plan will include a number of noise control measures, including:

- Educating and training NWI employees and contractors with respect to noise management;
- Ensuring noise emissions are considered when sourcing plant and equipment;
- Scheduled maintenance and monitoring of equipment with a view to minimising noise emissions;
- Noise monitoring and reporting annually;
- Preparing contingency plans; and
- Providing a complaints response procedure.

Following completion of construction of the project, noise emissions resulting from the operations of the project will be monitored to ensure compliance with the *Environmental Protection (Noise) Regulations 1997*. Should it be determined that the noise emissions from the Multi-user Iron Ore Export (Landside)

Facility exceeds the regulations, the noise sources will be identified and practicable noise control measures implemented to reduce emissions in accordance with best reasonable practice.

5.4.4 Predicted Outcome

The results of the noise modelling show that the project is predicted to exceed the *Environmental Protection (Noise) Regulations 1997* at one noise sensitive receptor. The modelling predicted that the project will exceed the noise level criterion of 32 dB at the Hospital by 5.6 dB. NWI will investigate and implement where practicable, noise mitigation measures to achieve a reduction of 5.6 dB. Noise impacts from the project will be managed by the preparation and implementation of a Construction Noise Management Plan and an Operations Noise Management Plan.

6 RELEVANT FACTORS – IMPACTS AND MANAGEMENT

6.1 Marine Fauna

6.1.1 Management Objectives, Applicable Standards and Guidelines

The EPA's objective is to maintain the ecological function, abundance, species diversity and geographic distribution of marine biota and habitat in order to protect ecosystem health, in accordance with the principles identified in *Perth Coastal Waters Environmental Values and Objectives* (EPA, 2000c).

Applicable legislation and guidelines include:

- *Wildlife Conservation Act 1950;*
- *Environment Protection and Biodiversity Conservation Act 1999*.
- EPA Environmental Assessment Guidelines No 5 (Draft) *Environmental Assessment Guidelines for Protecting Marine Turtles from light Impact*s (EPA, 2010b)

Given the highly modified environment of Port Hedland Harbour and the 'Heavy Industrial Use' zoning, the Project would need to meet the 'Moderate' (E3) level of protection outlined in the *Perth Coastal Waters Study* (EPA, 2000c). The limits for acceptable change according to that study are:

- Small changes in rates, but not types, of ecosystem processes.
- Biodiversity as measured on both local and regional scales remains at natural levels (i.e. no detectable change).
- Small changes in abundance and/or biomass of marine life.
- Moderate change in water quality, sediment quality and biota beyond the limits of natural variation, but not to exceed specified criteria.

6.1.2 Potential Impact

As juvenile flatback and green turtles are known to occur within the mangrove lined creeks of Port Hedland Harbour, there is a small potential for some individuals to be affected by the Multi-user Iron Ore Export (Landside) Facility, particularly during construction. Light from the project is unlikely to disorientate newly hatching turtles as the nesting sites are located on the opposite (seaward) side of the industrial and urban area of Port Hedland. Impacts of noise and vibration associated with piling during construction on marine fauna including turtles is expected to be limited to the immediate vicinity (20m-30m), as they are expected to move away from the area on the commencement of piling.

The risk to other marine based fauna such as crustaceans and fish is expected to be minimal.

6.1.3 Management and Mitigation Measures

NWI believes the project will not result in changes to the marine biota beyond the limits for acceptable change described in Section 6.1.1. The loss of mudflats will be kept to a minimum by only disturbing mudflats required for permanent facilities. All other disturbances will be confined to the terrestrial environment, where possible.

In the event that any injuries to conservation significant marine fauna occur as a result of shipping activities, the incident will be recorded and reported to the DEC and DSEWCaP. The requirements of the *Wildlife Conservation Act 1950* and the *EPBC Act 1999* will be met. . Impacts of pile driving and wharf construction on marine fauna, (e.g. turtles) will be managed through the use of soft start procedures, adequately trained marine fauna observers, a marine fauna exclusion zone of 300m and stop work procedures when marine fauna are sited within 100m of operations.

6.1.4 Predicted Outcome

The impact of the project on marine biota will be within the limits for acceptable change described in Section 6.1.1. The project is unlikely to have a significant impact on threatened or migratory marine species and the risk to other marine based fauna such as crustaceans and fish is expected to be minimal. The loss of mudflats will be kept to a minimum by only disturbing mudflats required for permanent facilities. All other disturbances will be confined to the terrestrial environment, where possible.

6.2 Introduced Marine Species

6.2.1 Management Objectives, Applicable Standards and Guidelines

The EPA objective is to minimise the risk of introduction of unwanted marine organisms consistent with the AQIS guidelines for ballast water management and ANZECC *Code of Practice* for anti-fouling and in-water hull cleaning and maintenance.

Shipping activities are required to comply with AQIS requirements in relation to ballast water control (AQIS, 2001).

6.2.2 Potential Impact

Shipping associated with the project has the potential to introduce additional marine pests into Port Hedland harbour.

6.2.3 Management and Mitigation Measures

NWI will work closely with the PHPA to ensure that protocols are consistent between operators in Port Hedland. NWI will operate in accordance with the Australian Quarantine Inspection Service (AQIS) guidelines for ballast water management, the ANZECC Code of Practice for Anti-fouling and In-water Hull Cleaning and Maintenance and the requirements of the Western Australian Department of Fisheries. In particular NWI will:

- Ensure iron ore carriers selected for charter maintain a satisfactory record of reliable ballast water discharge;
- Support AQIS's ballast water management checks;
- Stay informed of the ratification status of the International Maritime Organisation ballast water convention and advances in ballast water treatment systems; and
- Support the charter of ore carriers trialling AQIS approved ballast water treatment systems and associated ballast tank monitoring.

6.2.4 Predicted Outcome

Based on the existing operations within the Port of Port Hedland, the risk of introduction of unwanted marine organisms as a result of the project is considered to be low and will be minimised through adherence with the requirements of PHPA, AQIS, the ANZECC Code of Practice for Anti-fouling and In-water Hull Cleaning and Maintenance and the requirements of the Western Australian Department of Fisheries.

6.3 Terrestrial Flora and Fauna

6.3.1 Management Objectives, Applicable Standards and Guidelines

The EPA's objectives for the Project with regards to flora and fauna management are to:

- Maintain the abundance, species diversity, geographic distribution and productivity of terrestrial flora and fauna.
- Protect Specially Protected (Threatened) fauna, consistent with the provisions of the *Wildlife Conservation Act 1950.*
- Protect Declared Rare Flora and Priority flora, consistent with the provisions of the *Wildlife Conservation Act 1950.*

Applicable legislation and guidelines include:

- *Wildlife Conservation Act 1950*.
- *Environment Protection and Biodiversity Conservation Act 1999*.
- EPA Position Statement No 2 *Environmental Protection of Native Vegetation in Western Australia* (EPA, 2000a).
- EPA Position Statement No 3 *Terrestrial Biological Surveys as an element of Biodiversity Protection* (EPA, 2002a).
- EPA Guidance Statement No 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004c).
- EPA Guidance Statement No 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004d).

6.3.2 Potential Impact

The development of the Multi-user Iron Ore Export (*Landside*) Facility will result in the disturbance of 290ha of vegetation within a development envelope of 350ha, with the majority of the vegetation to be cleared being a mosaic of FCTs 1 (low shrubland to open shrubland of mixed *Acacia* spp. dominated by *Acacia stellaticeps* over low hummock grassland of *Triodia epactia*, on red sandy clay loams on plains and low lying areas, including supra tidal plains) and FCT 2 (low to mid sparse shrubland of *Acacia colei* var. *colei* and *Acacia stellaticeps* over low hummock grassland of *Triodia epactia* with *Eriachne mucronata*, on red sand to sandy-loam on plains, drainage lines and low lying areas including supra tidal plains), FCT 2 or FCT 5 (low open to sparse samphire shrubland dominated by *Tecticornia* spp. and *Muellerolimon salicorniaceum* with sparse tussock grassland of *Sporobolus virginicus* on brown clays on tidal zones) (**Table 18**).

Table 18 Vegetation to be Impacted by the Multi-user Iron Ore Export (Landside) Facility

Floristic Community Type	Description	Area to be Impacted (ha)
Floristic Community Types (determined using floristic analysis)		
FCT 1	Low shrubland to open shrubland of mixed *Acacia* spp. dominated by *Acacia stellaticeps* over low hummock grassland of *Trioda epactia* on red sandy clay loams on plains and low lying areas including supra-tidal plains	0
FCT 2	Low to mid sparse shrubland of *Acacia colei* var *colei* and *Acacia stellaticeps* over low hummock grassland of *Triodia epactia*, with *Eriachne mucronata* on red sand to sandy-loam on plains, drainage lines and low lying areas including supra-tidal plains	42.11
1/2	Mosaic of FCT 1 and 2	139.92
FCT 3	Tall open shrubland of *Acacia bivenosa* over low open shrubland dominated by **Aerva javanica, Myoporum montanum* and *Corchorus incanus* subsp. *incanus* over low grassland dominated by **Cenchrus cilaris* and *Triodia secunda* and/or *Triodia epactia* on brown sandy loam on limestone ridge	1.77
FCT 4	Low sparse shrubland of mixed spp. over low closed hummock grassland of *Triodia epactia* and/or *Triodia secunda* on red brown sandy loam on lower slopes and supra tidal	5.89
FCT 5	Low open to sparse samphire shrubland dominated by *Tecticornia* species and *Muellerolimon salicorniaceum* with sparse tussock grassland of *Sporobolus virginicus* on brown clays on tidal zones	53.76
Coastal Communities (not determined using floristic analysis)		
FCT10	Closed forest of *Rhizophora stylosa* occurring on brown silt on intertidal flats	0.32
FCT 11	Closed forest of *Avicennia marina* occurring on brown clay on intertidal flats	0.69
11/5	Mosaic of FCT 5 and 11	3.45
FCT 12	Cyanobacterial algal mat community with scattered samphire on red-brown sandy clays on intertidal flats	33.63

Woodman (2011b) assessed the impact of the project on FCTs 3, 5 and 12 and Mosaic 1/2 as having a Moderate local impact ranking. The impact of the project on the other FCTs and communities was ranked as low. FCT 3 was ranked as having a local conservation significance of '4' due to the relatively small area, the presence of the conservation significant taxon *Gomphrena pusilla* (P2) and the relatively

uncommon landform (coastal limestone ridge). Although there are other examples of the limestone ridge formation to the north, they are located outside the study area. The Multi-user Iron Ore Export (Landside) Facility will not reduce the vegetation system associations of the study area to below the 30% threshhold of pre-European extent.

Six species of priority flora occur within the study area: *Eragrostis crateriformis* (P3), *Gomphrena leptophylla* (P3), *Gomphrena pusilla* (P2), *Goodenia nuda* (P4), Gymnanthera cunninghamii (P3) and *Tephrosia rosea* ?var. *venulosa* (P1). Two of the six species of priority flora will be impacted by the project. The project will impact on one of the two known locations of *Eragrostis crateriformis* (P3) and five of the six known locations *of Tephrosia rosea* ?var. *venulosa* (P1) within the study area. In addition, the habitat area of all six conservation significant flora taxa from the study area will be impacted. There will be a Low local impact on *Gomphrena pusilla* (P3) and a Moderate local impact on *Eragrostis crateriformis* (P3), *Gomphrena leptophylla* (P3), *Goodenia nuda* (P3) and *Gymnanthera cunninghamii* (P3). The impact of the project on *Tephrosia rosea* ? var. *venulosa* (P1) will be a Moderate–High local impact. The project will have a low impact on the regional conservation status of all these conservation significant flora taxa (Woodman, 2011b).

The project area contained seven fauna habitats. However there were no significant features or specific habitats within the project area that indicated the area possessed ecological function values that are significantly different to many other areas surrounding it (Coffey, 2011b). A total of 36 listed conservation significant vertebrate fauna species (26 migratory birds, 5 mammals, 2 reptiles and 3 other bird species) could potentially occur within the project area due to the presence of suitable habitat. However none of the species are anticipated to be significantly affected by the proposed Multi-user Iron Ore Export (Landside) Facility. Coffey Environments is of the opinion that the proposed clearing is unlikely to substantially modify, destroy or isolate an area of important habitat for these species, or seriously disrupt the life cycle of an ecologically significant proportion of the population of any of these species (Coffey, 2011b).

In addition to direct impacts on vegetation and habitat, the project may have an indirect impact on vegetation and habitat as a result of:

- Introduction or spread of weeds or feral animals;
- Changed hydrological regimes;
- Increased fire risk;
- Introduction of rubbish and waste products (including hydrocarbon spills);
- Increased dust deposition;
- Fragmentation of habitat; and
- Noise during construction could potentially impact fauna species such as migratory birds and bat species.

6.3.3 Management and Mitigation Measures

The requirements of the *Wildlife Conservation Act 1*950 and the *EPBC Act 1999* will be met. Management plans will be prepared and implemented to minimise the impacts on terrestrial flora and fauna and will include the following measures:

- Clear demarcation of vegetated area to be cleared;

- Dust suppression program during construction to minimise the risk of dust deposition on vegetation or habitat;
- Surface water flows managed to prevent flooding and erosion;
- Spill contingency plan prepared and implemented;
- Waste management measures implemented to reduce the risk of liquid or solid waste affecting vegetation or fauna health;
- Application of speed restrictions, driver awareness and removal of road kill to minimise potential impacts through vehicle movements;
- Preparation and implementation of weed hygiene procedures including the use of weed free fill and washdown of equipment and vehicles prior to entry to the site; and
- Noise emissions and use of lighting during construction will be minimised where practicable.

6.3.4 Predicted Outcome

The construction of the Multi-user Iron Ore Export (Landside) Facility will require clearing within several vegetation communities. No habitats within the project area are spatially restricted or likely to support populations of significant species or communities. All species of conservation significance that may at risk form project activities will be assessed and managed in accordance with the *Wildlife Conservation Act 1950* and *EPBC Act 1999*.

6.4 Acid Sulphate Soils

6.4.1 Management Objectives, Applicable Standards and Guidelines

The EPA's objective for the project is to:

- Minimise the risk to the environment from acid sulphate soils.

Applicable legislation and guidelines include:

- Planning Bulletin No. 64/2009 Acid Sulphate Soils (WAPC, 2009).
- *Contaminated Sites Act 2003*.
- Policy Position Acid Sulphate Soils (DEC, 2006).
- *Draft Treatment and Management of Soils and Water in Acid Sulphate Soil Landscapes – Acid Sulphate Soils Guideline Series* (DEC, 2009b).
- National Strategy for the Management of Coastal Acid Sulphate Soils (ANZECC/ARMCANZ 2000b).

6.4.2 Potential Impact

Acid sulphate soils are known to occur in the Port Hedland Inner Harbour area within intertidal areas and at depths of approximately 2m below the sea bed surface. The preliminary ASS investigation confirmed that the northern portion of the project area is highly likely to contain PASS.

For the most part, the proposed development entails filling and above ground construction, such as the 10km rail loop and the 5.8km conveyor corridor and thus has limited potential to impact on PASS. However, the SKM (2011a) Definitive Feasibility Study estimates that significant volumes of soil that will be excavated (in excess of 1,000,000m^3) and more than 100ha of land will be disturbed to enable construction of the proposed car dumping facility, stockyard area and wharf area. It should be noted that these bulk earthwork estimates do not necessarily translate to equivalent PASS disturbance volumes since PASS may only be present within certain horizons or locations even within the higher portions of the project area.

Groundwater in the project area is likely to be relatively shallow within the footprint of the car dumper. Groundwater dewatering will be necessary during construction to at least 12mbgl and the proposed development has the potential to create a significant cone of depression in this area. Depending on any inherent acid buffering capacity within the groundwater, disturbance of ASS may also acidify groundwater resulting in unnaturally high metal concentrations such as arsenic and aluminium. Where the disturbance of ASS results in a risk to the environment or human health, such areas may be classified by the DEC as contaminated under the provisions of the *Contaminated Sites Act 2003*.

6.4.3 Management and Mitigation Measures

The occurrence of ASS within the project area will be assessed in conjunction with geotechnical drilling and analysis prior to the commencement of construction. A risk-based approach will be adopted in designing the scope of intrusive investigations for the project. A risk-based approach is commonly adopted when characterising large sites (e.g. >20ha) and, in accordance with DEC (2009a), such an approach may be acceptable providing the investigation program is designed to satisfactorily characterise the various geological/geomorphological units that exist within the project area.

Investigations will be tailored towards areas where PASS is most likely to exist and/ or areas where ground disturbance is greatest, in particular in the in the vicinity of the car dumper, stockyard and wharf area.

Intrusive groundwater assessment will form part of the detailed investigative works. As a minimum groundwater bores will be positioned in the vicinity of the car dumper to assess groundwater quality and the vulnerability of the groundwater to acidification. The groundwater assessment will include the collection of site specific hydrogeological parameters to assist in the accurate modelling of dewatering cone of depression and the prediction of any associated impacts.

A Sampling and Analysis Plan (Coffey, 2011c) has been developed in accordance with the intent of the DEC ASS Guideline Series to formalise the proposed investigative works and is provided in **Appendix A**.

The general approach to the management of any PASS will be to avoid the use or handling of PASS materials. Where this cannot be avoided, the Construction EMP will include procedures for monitoring and management of materials that are potentially acid forming. Monitoring will include water quality from dewatering during the construction phase of the project. In the event that water from dewatering needs to be released, water quality criteria will be developed in accordance with the appropriate standards.

6.4.4 Predicted Outcome

There is a risk that acid forming materials will be exposed during the construction of the Multi-user Iron Ore Export (Landside) Facility. Given the preparation and implementation of a Sampling and Analysis Plan and the inclusion of procedures for the assessment and management of materials that are

potentially acid forming in the Construction EMP, it is considered the risk to the environment from ASS will be minimised and that the environmental objectives can be met.

6.5 Hydrocarbons and Chemicals

6.5.1 Management Objectives, Applicable Standards and Guidelines

The EPA's objective in regard to the impact of hydrocarbons and other pollutants is to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

Applicable legislation and guidelines include:

- *Pollution of Waters by Oil and Noxious Substances Act 1987*.
- International Convention for the Prevention of Pollution from Ships (MARPOL Convention) 1973/78.
- *Western Australian Marine Act 1982*.
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000a).

6.5.2 Potential Impact

A light vehicle refuelling facility and a vehicle wash down bay will be located adjacent to the workshop. On-site storage of fuel will be required for the operation of mobile plant and back up generators. The 55,000 l diesel fuel tank will be self bunded.

The impact of spillage of hydrocarbons or chemicals from shipping in the marine environment can result in the contamination of marine waters, associated marine habitats and marine flora and fauna. These spillages may result from ship collisions or grounding, discharge of oil in bilge water, during bunkering or deliberate discharge.

In the event of such an incident resulting in spillage, PHPA carries the prime responsibility to take whatever action it deems appropriate to cope with that incident (PHPA, 1999). NWI's role is to support the PHPA in whatever way it can, including ensuring all NWI personnel are aware of the procedures associated with such an emergency.

There is also a minor risk that land based activities including activities in and around the settlement areas could result in a minor hydrocarbon spillage.

During construction of the rail embankment and stockyard, brackish water from local bores may be used for material conditioning and dust suppression. Uncontrolled use of brackish water can have an adverse effect on terrestrial vegetation, such as *Triodia* hummock grassland that is not adapted to saline conditions.

6.5.3 Management and Mitigation Measures

NWI will liaise with PHPA in the event of a marine hydrocarbon and chemical spill. NWI will develop a Construction EMP and an Operations EMP that will address, among other issues, the management of hydrocarbons and other chemicals. Key management actions detailed in the management plan include:

- Building to Australian Standards to prevent hydrocarbon storage leak/spill resulting in soil or groundwater contamination;
- Training and awareness of personnel;
- Providing spill kits;
- Providing designated areas for vehicle wash downs;
- Using oil/water separators;
- Using catch bunds in site drainage system;
- Ensuring negligible quantities of chemicals are stored and used at the port; and
- Implementing a procurement policy that encourages purchase of products that have the least potential harm to the environment.

NWI will include measures in the Construction EMP to prevent spraying or runoff of saline water onto vegetation adjacent to the project area.

In addition, as part of its responsibility for the management of hydrocarbon spillage, PHPA is installing quick response equipment in the harbour in 2011, which will include permanent booms throughout the harbour to protect mangrove areas.

6.5.4 Predicted Outcome

The risk of pollution from spillage of hydrocarbons or other pollutants is low as storage and use by NWI will be low. Spillages associated with shipping will be managed by PHPA. NWI will ensure it has the appropriate procedures in place to ensure any spillages can be managed in a timely and efficient manner.

6.6 Waste Management

6.6.1 Management Objectives, Applicable Standards and Guidelines

The environmental objective for solid and liquid waste is to ensure that wastes do not adversely affect the health, welfare and amenity of people and land uses, and are managed in accordance with the waste hierarchy outlined in DEC policy – *Review of Waste Classification and Waste Definitions 1996* (as amended).

Applicable legislation, policies and standards include:

- *Environmental Protection (Controlled Waste) Regulations 2004*.
- International Convention for the Prevention of Pollution from Ships (MARPOL Convention) 1973/78.
- *Litter Act 1979* (currently under review by the DEC and will be incorporated into the EP Act).
- Review of Waste Classification and Waste Definitions 1996 (as amended) (DoE, 2005).

6.6.2 Potential Impact

If not managed appropriately, waste has the potential to pollute the environment and impact on human health.

6.6.3 Management and Mitigation Measures

Waste management for the Project will be as for existing port operations within the Port of Port Hedland. All vessels berthing at NWI's facility will be required to comply with the International MARPOL Convention regulations and at no time will the vessel discharge waste such as sewage, bilge water or oily mixtures. Collection of garbage or discharge of oily waste from the vessels is arranged through the PHPA and is subject to AQIS approval.

Waste water to be managed includes slurry, storm water, oily water and sewage. Slurry will be collected from wash down within the car dumper. Slurry on the wharf will be collected from wash down and conveyor belts wash systems and then directed to local maintenance deck sumps. Slurry from both the car dumper area and the wharf area will be sent to an intermediate slurry tank before delivering to a sedimentation pond. The clarified overflow from the sedimentation pond will flow to a turkey nest dam (one each for the wharf and the car dumper area), which will include a water stand for filling the water trucks. In the event that the turkey nest dam overflows, the excess water will spill into a V drain running along the inside of the rail loop. The turkey nest dam in the wharf area is likely to overflow after lengthy rain periods. In this event the excess water will flow into a large leach drain, with the clarified water dispersed underground. The sedimentation ponds will be drained periodically and the sediment removed.

Storm water on the wharf will be either captured by the local maintenance deck sumps or overflow off the edge of the wharf deck. Storm water will also be captured in sumps in the rail underpass areas. The stormwater will either be pumped into the V drain that runs along the inside of the rail loop or will flow directly into the main stormwater dam.

An oily water sump and separator will be located at the car dumper and at the vehicle wash/ fuel storage area. The separated hydrocarbons will be stored in a small tank near the sump, and emptied intermittently by a licensed contractor. The treated water from the car dumper separator will be discharged into the intermediate slurry tank. Treated water from the vehicle wash down/fuel service area will be discharged into the Aerobic Treatment Unit (ATU) and leach drain system from the main administration area.

Sewage from the main administration area (within the rail loop), the car dumper area, the main security gate house (within the rail loop), the wharf administration areas (located off the wharf) and the wharf ablution block will all be disposed of into ATUs. The effluent from the ATUs will be disposed of through a leach drain system next to each of the ATUs.

NWI will prepare a Waste Management Plan to minimise the risk to the environment from waste. Key management actions in the management plan will include:

- A local waste management and recycling contractor will collect and remove waste from the port site, reusing and recycling waste, wherever practicable.
- Environmental awareness training for staff will encourage waste reduction, reuse and recycling.

- Waste that cannot be reused or recycled will be disposed of at Port Hedland (or other) landfill facilities in accordance with relevant legislation and standards.
- Potentially contaminated surface water runoff from the Project area, including runoff containing sediment and ore, will be collected and treated via an oil separator and sediment interceptor basin prior to reuse or release into the harbour under favourable tidal conditions.
- Some of the stormwater runoff will be harvested and used for dust control.

The management of hydrocarbons and other chemical wastes is described in Section 6.5.

6.6.4 Predicted Outcome

NWI will ensure that wastes associated with the Project do not adversely affect the health, welfare and amenity of people and land uses, and are managed in accordance with the waste hierarchy.

6.7 Port Area Decommissioning and Rehabilitation

6.7.1 Management Objectives, Applicable Standards and Guidelines

The EPA's objective for decommissioning of the Project is to ensure, as far as is practicable, that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other environmental values.

Applicable legislation and guidelines include:

- Guidance Statement No 1: *Guidance Statement for Protection of Tropical Arid Zone Mangroves along the Pilbara Coast* (EPA, 2001).
- Guidance Statement No 6: *Rehabilitation of Terrestrial Ecosystems* (EPA, 2006).
- Guidance Statement No 3*:* Protection of *Benthic Primary Producer Habitat in Western Australia's Marine Environment* (EPA, 2009d).

6.7.2 Potential Impact

The Project has an indefinite operating life depending on continued exploration and development of the iron ore industry and use by other third party users. In the unlikely event that all or part of this infrastructure is no longer required, the facilities will be decommissioned in accordance with appropriate legislation.

Potential impacts associated with the rehabilitation phase of the project (if required) include:

- Potential increases in dust generation due to failure to establish a stable soil surface and or effective vegetation cover.
- Introduction and establishment of weed species.
- Long term visual impacts associated with the failure to re-establish vegetation cover.
- Changes in surface water flows and soil stability which could result in erosion and damage to adjacent vegetation.

6.7.3 Management and Mitigation Measures

Cleared areas not required for infrastructure will be rehabilitated to re-establish a stable landform and promote regeneration of a self-sustaining ecosystem. Areas prone to erosion will be stabilised and where practical, similar substrates and hydrodynamic features to that present prior to construction will be re-established in the supra-tidal, intertidal and mangrove areas.

Effective vegetation cover will be utilised on areas to be rehabilitated so that wind erosion is no greater than from surrounding vegetated areas. Surface water runoff will be contained where appropriate and discharge controlled so there are no physical, off-site impacts. Declared weeds and significant environmental weeds will be controlled. A monitoring program will be implemented for areas to be rehabilitated, which will include visual inspection of wind borne dust during periods of high winds, surface water quality at discharge points, rehabilitation performance including the presence of weeds and the stability of the landform.

6.7.4 Predicted Outcome

Through the preparation and implementation of a Port Area Rehabilitation Plan, NWI will ensure, as far as is practicable, that land not required for the long term use of the project will achieve a stable and functioning landform consistent with the surrounding landscape and environmental values.

6.8 Aboriginal Heritage

6.8.1 Management Objectives, Applicable Standards and Guidelines

The EPA's objective for the management of Aboriginal heritage is to avoid impact and disturbance to historical and cultural associations and to comply with relevant heritage legislation.

The key statutory requirements, policy and guidance relevant to Aboriginal heritage are:

- *Aboriginal Heritage Act 1972.*
- EPA Guidance Statement No 41 *Assessment of Aboriginal Heritage* (EPA 2004e)

The PHPA has a Land Access Agreement (LAA) with the Native Title Claimants - the Kariyarra People - for land in the area currently managed by PHPA and the area to be managed by the PHPA in the future. This includes the area for the Multi-user Iron Ore Export (*Landside*) Facility. The LAA sets out a comprehensive process under which PHPA and the Kariyarra People manage Aboriginal Heritage in any project area, including the Multi-user Iron Ore Export (Landside) Facility. This process includes the conduct of archaeological and anthropological surveys over any proposed development area. The surveys are conducted with the participation of the Kariyarra People and relevant heritage professionals. After surveys have been completed there is a formal consultation process which includes meetings and further on site consultation.

The PHPA has carried out comprehensive Aboriginal Heritage surveys over the Port area. PHPA will manage any identified cultural heritage sites in consultation with the Kariyarra Native Title Claimants.

NWI acknowledges its responsibility to consult with indigenous groups during design and construction, undertake surveys (in association with the PHPA) and seek approval to disturb sites under Section 18 of the *Aboriginal Heritage Act 1972*.

6.8.2 Potential Impact

The results of preliminary advice of an aboriginal heritage survey of Priority Area 2 on the Boodarie Project Area (Anthropos Australia Pty Ltd, 2010) confirmed a number of existing and identified further sites located within and immediately adjacent to the footprint of the Multi-user Iron Ore Export (Landside) Facility (see **Figure 15**). Relevant findings are presented in **Table 9**. Specifically four sites were found to be within the project footprint and a further two immediately adjacent to the facility. All identified sites were described as shell middens.

6.8.3 Management and Mitigation Measures

NWI acknowledges its responsibility to consult with indigenous groups during project design and construction and has undertaken to minimise impacts on heritage sites. PHPA as owner of the land will seek approval to disturb sites under Section 18 of the *Aboriginal Heritage Act 1972*.

The Aboriginal Cultural Materials Committee (ACMC) makes recommendations to the Minister for Indigenous Affairs regarding the Heritage values of affected areas, with the Minister making the final decision on whether consent for a s18 application will be granted and under what, if any, conditions.

Recommendations may range from avoidance of selected sites through to excavation, analysis and salvage adopting agreed methodologies. Other sites may be removed from the register.

6.8.4 Predicted Outcome

NWI will manage the Multi-user Iron Ore Export (Landside) Facility in accordance with the requirements of the *Aboriginal Heritage Act 1972*.

6.9 Access, Recreational Use and Public Safety

Given that the Multi-user Iron Ore Export (Landside) Facility will not restrict access or recreational use within the Port Hedland Harbour, except for the area immediately adjacent to the berths. Access, recreational use and public safety is therefore not considered to be a relevant factor in this proposal. An Emergency Response Plan will be prepared and implemented.

7 SUSTAINABILITY ASSESSMENT

The State Government released a Sustainability Strategy for Western Australia: *Hope for the Future: the Western Australian State Sustainability Strategy* (Government of Western Australia, 2003). The broad goals of the State Sustainability Strategy are to:

- Ensure that the way we govern is driving the transition to a sustainable future.
- Play our part in solving the global challenges of sustainability.
- Value and protect our environment and ensure sustainable management.
- Plan and provide settlements that reduce the ecological footprint and enhance quality of life at the same time.
- Support communities to fully participate in achieving a sustainable future.
- Assist business to benefit from and contribute to sustainability.

The project will be planned, constructed, operated and decommissioned in a manner that meets the principles of sustainability. In managing impacts across the quadruple bottom line of Social Capital, Economic Wealth, Environmental Assets and Corporate Governance, NWI will address sustainability principles in a number of ways including:

- Establishing sustainability principles in purchasing and contracting.
- Ensuring efficient energy and water use.
- Minimising waste and encouraging recycling.
- Promoting and participating in industry and community partnerships.

A consideration of the Multi-user Iron Ore Export (Landside) Facility against the five sustainability principles as set out in Section 4A of the EP Act and the EPA's *Position Statement Number 7* on the Principles of Environmental Protection (EPA, 2004b) is shown in **Table 19**.

Table 19 Application of the Principles of Sustainability to the Multi-user Iron Ore Export (Landside) Facility

Principle	Relevant Yes/No	If yes, consideration	Addressed (Yes/No)	Refer to Section (s)
THE PRECAUTIONARY PRINCIPLE Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In application of this precautionary principle, decisions should be guided by: (a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and (b) an assessment of the risk-weighed consequences of various options.	Yes	Sufficient knowledge to address potential environmental impacts. Specialist studies (e.g. flora, fauna, acoustic modelling, dust modelling, hydrological, tidal and storm surge assessment, acid sulphate soil assessment) have been undertaken to assess the environment and potential impacts.	Yes	Section 4 Section 5 Section 6
THE PRINCIPLE OF INTER-GENERATIONAL EQUITY The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.	Yes	The design of the proposal is minimising the cumulative effect of the development on mangroves and other BPPH within the Port Hedland Industrial Area Management Unit and the Oyster Passage Barrier Management Unit. Impacts of the project will be minimised through the implementation of the Construction and Operational Environmental Management Plan, Mangrove and Other BPPH Management Plan, Dust Management Plan, Noise Management Plan and Acid Sulphate Soil Sampling and Analysis Plan	Yes	Section 6.9 5.1

Table 19 Application of the Principles of Sustainability to the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Principle	Relevant Yes/No	If yes, consideration	Addressed (Yes/No)	Refer to Section (s)
THE PRINCIPLE OF THE CONSERVATION OF BIOLOGICAL DIVERSITY AND ECOLOGICAL INTEGRITY The conservation of biological diversity and ecological integrity should be a fundamental consideration.	Yes	Conservation of mangroves and ecological integrity is an overriding consideration in the design of the Project. The Project will result in the additional disturbance of approximately 3.47 ha of mangroves. Baseline flora and fauna surveys have been undertaken. The Project will have minimal impact on marine fauna of conservation significance.	Yes	Section 5.1
PRINCIPLES RELATING TO IMPROVED VALUATION, PRICING AND INCENTIVE MECHANISMS (a) Environmental factors should be included in the valuation of assets and services. (b) The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance and abatement. (c) The user of goods and services should pay prices based on the life cycle of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste. (d) Environmental goals, having been established, should be pursued in the most effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.	Yes	Environmental factors played a significant part in determining the preferred option. The Project has been designed to ensure pollution impacts are minimised. The full life cycle costs of the use of natural resources and assets, the ultimate disposal of any wastes and decommissioning and closure of operations have been estimated. Costs are provided over the life of the operation on a production unit basis.	Yes	Section 6

Table 19 Application of the Principles of Sustainability to the Multi-user Iron Ore Export (Landside) Facility (cont'd)

Principle	Relevant Yes/No	If yes, consideration	Addressed (Yes/No)	Refer to Section (s)
THE PRINCIPLE OF WASTE MINIMISATION All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge to the environment.	Yes	All reasonable and practicable measures will be taken to minimise waste. The preferred management options are to avoid, reduce, reuse, recycle and recover waste management. The project will not generate a substantial volume of waste. Project contractors and service providers will need to demonstrate observance with the hierarchy of waste management. Waste management will be addressed in a Waste Management Plan	Yes	Section 2.8.8 6.6

8 SUMMARY OF ENVIRONMENTAL MANAGEMENT COMMITMENTS

A summary of environmental commitments made by NWI for the Multi-user Iron Ore Export (Landside) Facility is provided in **Table 20**.

Table 20 Summary of Environmental Commitments

Factor	Management Commitment
EMS	• Prepare and implement a Construction EMP and Operations EMP, and other specific management plans as required.
Biophysical	
Benthic Primary Producer Habitat	• A trestle type structure will be used for the wharves to allow unimpeded tidal flows to adjacent mangroves. • Prepare and implement a Mangrove and Other BPPH Management Plan prior to the commencement of construction. The Plan will include a mangrove health risk assessment to provide baseline data on mangrove health and will detail ongoing monitoring of mangrove health. • Workforce induction including information on the ecological significance of mangroves (and other BPPHs) and instructions on clearing procedures. • Delineation of clearance boundaries prior to commencement of clearing activities to prevent disturbance of mangroves outside the clearing footprint. • Where practical, inclusion of a buffer area (10m) between infrastructure edge and disturbance boundary in site plans to avoid impacts on mangroves outside the approved area. • Prohibiting access to mangroves outside the immediate disturbance footprint. • Reporting incidents with the potential to impact on mangroves. • Using construction methods such as scrub rolling where possible rather than removal of mangroves to provide maximum opportunity for vegetative recovery along the boundary of cleared areas. • Design of infrastructure based on best practice to withstand a 1 in 100 year flood event and ensure unimpeded surface water flows. • Inclusion of scour protection, particularly in the vicinity of the waterway openings in the conveyor and the culvert through the railway spur line to control erosion during flood and storm surge events. • Design and implement a stormwater drainage system to capture surface water from operation areas in the stockyard. Discharge into established drainage lines to the north may only occur in long period return events during flow conditions. Runoff from the area east of the rail loop will follow the existing drainage pattern, passing through culverts at the neck of the rail loop. • Survey the composition and distribution of cyanobacterial mats in the vicinity of the project area prior to the commencement of operations, and the results provided to the EPA.

Table 19 Summary of Environmental Commitments (cont'd)

Factor	Management Commitment
Biophysical (cont'd)	
Benthic Primary Producer Habitat (cont'd)	• Establish a network of shallow groundwater monitoring bores adjacent to the northern and western boundaries of the rail loop to monitor potential salinity impacts to mangroves.
Marine Pests	• Operate in accordance with the Australian Quarantine Inspection Service (AQIS) guidelines for ballast water management, the ANZECC Code of Practice for Anti-fouling and In-water Hull Cleaning and Maintenance and the requirements of the Western Australian Department of Fisheries. • Ensure iron ore carriers selected for charter maintains a satisfactory record of reliable ballast water discharge. • Support AQIS in ballast water management checks. • Stay informed about the ratification status of the International Maritime Organisation ballast water convention and advances in ballast water treatment systems. • Support the charter of ore carriers trialling AQIS approved ballast water treatment systems and associated ballast tank monitoring.
Marine Fauna	• Keep the loss of mudflats to a minimum by only disturbing mudflats required for permanent port facilities. All other disturbances will be confined to the terrestrial environment where possible. • Meet the requirements of the *Wildlife Conservation Act 1950* and the *EPBC Act 1999.* • Any incidents involving marine fauna of conservation significance resulting from shipping activities will be recorded and reported to the Department of Environment and Conservation. • Manage impacts of pile driving and wharf construction on marine fauna, (e.g. turtles) through the use of soft start procedures, adequately trained marine fauna observers, a marine fauna exclusion zone of 300m and stop work procedures when marine fauna are sited within 100m of operations.
Terrestrial Flora and Fauna	• Prepare and implement a Weed Hygiene and Management Plan and a Fauna Management Plan prior to the commencement of construction. • Meet the requirements of the *Wildlife Conservation Act 1950* and the *EPBC Act 1999* . • Undertake vegetation and flora surveys to determine the impact of the project on priority flora prior to the commencement of construction.

Table 19 Summary of Environmental Commitments (cont'd)

Factor	Management Commitment
Biophysical (cont'd)	
Port Area Decommissioning and Rehabilitation	• In the unlikely event that all or part of the infrastructure is no longer required, decommission the facilities in accordance with appropriate legislation. • Ensure as far as is practicable, that land not required for the long term use of the project will achieve a stable and functioning landform consistent with the surrounding landscape and environmental values. • Prepare and implement a Port Area Rehabilitation Plan prior to the commencement of construction.
Pollution Management	
Surface Water and Coastal Processes	• Elevate the conveyor on trestles except in the immediate vicinity of the Roy Hill stockpile and rail line, where there is no environmental benefit to a trestle design. • In areas where the conveyor is constructed on an embankment, incorporate appropriately sized culverts into the design. The location of culverts will be determined in consultation with Roy Hill Pty Ltd. • Implement a regular program of inspection and maintenance of the culverts to ensure the culverts continue to function effectively. • Undertake baseline and continuous monitoring of sediment and other pollutants during construction and operation of the Multi-user Iron Ore Export (Landside) Facility to detect any changes in water quality due to the project. • Implement site stormwater management to detain runoff produced from impervious areas and to minimise scour caused by direct runoff from these areas. • Prepare and implement a Surface Water Management and Monitoring Plan.
Acid Forming Materials	• Prepare and implement a Sampling and Analysis Plan in accordance with the intent of the DEC ASS Guideline series. • A risk-based approach will be adopted in designing the scope of intrusive investigations for the project. Investigations will be tailored towards areas where PASS is most likely to exist and/ or areas where ground disturbance is greatest, in particular in the vicinity of the car dumper, stockyard and wharf area. Intrusive groundwater assessment will form part of the detailed investigative works. • The general approach to the management of any PASS will be to avoid the use or handling of PASS materials. • The Construction EMP will include procedures for monitoring and management of materials that are potentially acid forming. • Monitoring will include water quality from dewatering during the construction phase of the project.

Table 19 Summary of Environmental Commitments (cont'd)

Factor	Management Commitment
Pollution Management (cont'd)	
Hydrocarbons and other chemicals	• Liaise with PHPA to minimise the risk to the marine environment from hydrocarbon or chemical spillage. Spillages associated with shipping will be managed by PHPA. • Prepare and implement a Construction EMP and an Operations EMP that will address the management of hydrocarbons and other chemicals.
Waste	• Prepare and implement a Waste Management Plan in accordance with the waste hierarchy prior to the commencement of construction.

Dust – Construction and Operation	• Prepare and implement a Construction Dust Management Plan prior to the commencement of Construction.
	• Management measures to minimise the impact of dust during construction will include the regular application of water to working areas and road surfaces, minimising drop heights of material with the potential to generate dust, restricting vehicle speeds to control dust and daily monitoring to ensure dust control measures are implemented and effective.
	• Prepare and implement a Dust Management Plan prior to the commencement of operation. The Dust Management Plan will include a number of dust control measures, including:
	  • Maintenance of high ore moisture levels, (target 7% never to fall below 4%);
	  • Enclosure of key components at the rail car dumpers, use of fogging water sprays at the time of dumping and installation of a particulate extraction system around the wagon tipper;
	  • Total enclosure and utilisation of water sprays at conveyor transfer points and the use of belt scrapers to clean conveyor belts;
	  • Conveyors between the stockyard and the wharf will be covered to minimise dust (and noise) emissions;
	  • Minimising the ship loader discharge height and installation of water sprayers at the boom discharge and boom conveyor system;
	  • Stackers will be slewing, luffing types so that the drop height to the stockpile will be minimised;
	  • Monitoring of the ore moisture content to reduce particular emissions and use of water canons to dampen surfaces (as required) to prevent generation of fugitive dust;
	  • Regular checks and maintenance of dust control equipment and removal of accumulated particulate material from under conveyors and around transfer points; and
	  • Identification of road/traffic areas that are likely to produce unacceptable particulates and ensuring they are sealed. Particulates in low traffic areas will be controlled by water carts and speed limits.

Table 19 Summary of Environmental Commitments (cont'd)

Factor	Management Commitment
Dust – Construction and Operation	• Develop and implement a dust monitoring program in consultation with DEC and industry.
Pollution Management (cont'd)	

Noise – Construction and Operation	• Prepare and implement a Construction Noise Management Plan prior to the commencement of construction in accordance with the requirements of the *Environmental Protection (Noise) Regulations 1997*.
	• Manage Impacts of pile driving and wharf construction on marine fauna, (e.g. turtles) through the use of soft start procedures, adequately trained marine fauna observers, a marine fauna exclusion zone of 300m and stop work procedures when marine fauna are sited within 100m of operations.
	• Investigate noise mitigation measures to achieve a 5.6 dB noise reduction at the hospital. Potential options include the use of low noise idlers or shielding of idlers on conveyors and shielding or specifying 800kW drives to 82 dB(A) at 1m for a number of the drives.
	• Prepare and implement a Noise Management Plan prior to the commencement of operations. The Noise Management Plan will include a number of noise control measures, including:
	  • Educating and training NWI employees and contractors with respect to noise management;
	  • Ensuring noise emissions are considered when sourcing plant and equipment;
	  • Scheduled maintenance and monitoring of equipment with a view to minimising noise emissions;
	  • Noise monitoring and reporting annually;
	  • Preparing contingency plans; and
	  • Providing a complaints response procedure.
	• Following completion of construction of the project, monitor noise emissions resulting from the operations of the project to ensure compliance with the *Environmental Protection (Noise) Regulations 1997*. Should noise emissions from the project exceeds the regulations, the noise sources will be identified and practicable noise control measures implemented to reduce emissions in accordance with best reasonable practice.

Social Surroundings	
Aboriginal Heritage	• Manage heritage issues in accordance with the requirements of the *Aboriginal Heritage Act 1972* • Prepare and implement an Indigenous Heritage Management Plan prior to the commencement of construction.

9 CONCLUSION

NWI considers that the Multi-user Iron Ore Export (Landside) Facility has been designed and will be undertaken in a manner that will minimise impacts on the surrounding biophysical and social environments.

The project has been developed to avoid, minimise, manage and mitigate environmental impacts. The Project was developed in close consultation with the PHPA to minimise the cumulative impacts of development. A number of alternatives were considered for the alignments of the overland conveyor, rail loop and stockyard. The alignment selected is considered to be the best compromise in terms of minimising the loss of marine habitat including mangroves and other BPPH, and is consistent with the PHPA's Ultimate Development Plan, which considers the ultimate sustainable capacity of the port with respect to export demand, resources, land availability, transport infrastructure and environmental and social factors.

The over-arching principles of sustainability and biodiversity have been considered within the context of the Project and have been incorporated into the assessment of the identified environmental factors. These environmental and social factors have been identified through existing information, findings of investigative studies, consultation with relevant stakeholders and experience gained from similar projects being undertaken within the Port Hedland Harbour.

This document describes the impacts of the Project, and for each factor discusses the:

- Objective for the factor.
- Relevant guidance material.
- Potential impacts.
- Management of impacts.
- Predicted outcome.

The key environmental factors were identified as:

- Marine habitat (mangroves and other BPPH).
- Surface Water and Coastal Processes.
- Dust from construction and operation.
- Noise from construction and operation.

Other relevant environmental factors include:

- Marine fauna.
- Introduced marine species.
- Terrestrial flora and fauna.

- Acid sulphate soils.
- Hydrocarbons and other chemicals.
- Waste management.
- Port area decommissioning and rehabilitation.
- Aboriginal heritage.
- Access, recreational Use and Public Safety.

NWI is committed to minimising environmental impacts where possible and will ensure all impacts are managed through the implementation of construction and operation management plans. NWI will develop the following management plans to specifically address the environmental impacts associated with the key factors.

- Mangrove and Other BPPH Management Plan.
- Dust Environmental Management Plan.
- Noise Management Plan.
- Surface Water Management and Monitoring Plan.

Other management plans relevant to the project include:

- Construction Environmental Management Plan.
- Acid Sulphate Soil Sampling and Analysis Management Plan.
- Port Area Rehabilitation Plan.
- Weed Hygiene and Management Plan.
- Fauna Management Plan.
- Chemical and Hydrocarbon Management Plan.
- Waste Management Plan.
- Indigenous Heritage Management Plan.

NWI believes that for all factors assessed and with the management and mitigation measures outlined, the EPA's objectives can be met and the project's impacts will be minimised to ALARP.

10 ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
AER	Annual Environmental Review
ATU	Aerobic Treatment Units
AHD	Australian Height Datum
ALARP	As Low as Reasonably Practicable
ANC	Acid Neutralising Capacity
ANZECC	Australian and New Zealand Environment and Conservation Council
AQIS	Australian Quarantine Inspection Services
ARI	Assessment on Referral Information
API	Assessment on Proponent Information
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
ASS	Acid Sulphate Soils
Atlas	Atlas Iron Limited
BHP-BIO	BHP-Billiton Iron Ore Pty Ltd
BPP	Benthic Primary Producer
BPPH	Benthic Primary Producer Habitat
CAMBA	China Australia Migratory Bird Agreement 1986
Cwlth	Commonwealth
dB	Decibels
DEC	Department of Environment and Conservation
DFS	Definitive Feasibility Study
DIA	Department of Indigenous Affairs
DMP	Department of Mines and Petroleum
DoE	Department of Environment
DoW	Department of Water
DRF	Declared Rare Flora
DWT	Deadweight tonnes
EMP	Environmental Management Plan
EP Act	Environmental Protection Act 1986
EPA	Environmental Protection Authority

Acronym	Meaning
EPBC Act	[Cwlth] Environment Protection and Biodiversity Conservation Act 1999
EQMF	Environmental Quality Management Framework
FIFO	Fly In Fly Out
FMG	Fortescue Metals Group Ltd Fortescue Metals Group Pty Ltd
GL	Gigalitre
ha	Hectares
HPPL	Hancock Prospecting Pty Ltd
HCWA	Heritage Council of Western Australia's
IBRA	Interim Biogeographic Regionalisation of Australia
JAMBA	Japan Australia Migratory Bird Agreement 1974
km	Kilometre
LAA	Land Access Agreement
m	Metre
m^3	Cubic metre
mmpa	millimetres per annum
Mm^3	Million cubic metres
MPL	Marapikurrinya Pty Ltd
Mtpa	Million tonnes per annum
NADG	National Assessment Guidelines for Dredging
NASS	Non Acid Sulphate Soils
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environmental Protection Measure
NWIOA	North West Iron Ore Alliance
NWI	North West Infrastructure (the Proponent)
OEPA	Office of the EPA
PASS	Potential Acid Sulphate Soils
PER	Public Environmental Review
PFS	Prefeasibility Study
PHIC	Port Hedland Industry Committee

Acronym	Meaning
PHPA	Port Hedland Port Authority
PIOI Project	Pilbara Iron Ore and Infrastructure Project
PM_{10}	Particulate matter less than 10 microns in size
$PM_{2.5}$	Particulate matter less than 2.5microns in size
PDWSA	Public Drinking Water Supply Area
RHIO	Roy Hill Iron Ore Pty Ltd
RHIOPI	Roy Hill Iron Ore Port Infrastructure project
RL	Relative Level
SKM	Sinclair Knight Merz
SEWCaP	(Cwlth) Department of Sustainability, Environment, Water, Communities and Population
SP3	Stanley Point Berth 3
SP4	Stanley Point Berth 4
TOC	Total Organic Carbon
TPH	Town of Port Hedland
TPH	Total Petroleum Hydrocarbons
tph	Tonnes per hour
TPS	Town Planning Scheme
TRH Project	Turner River Hub Project
TSP	Total Suspended Particulates (particles up to 50 microns in diameter)
TSS	Total Suspended Solids
TU	Train Unloader
UCL	Upper Confidence Limit
URS	URS Australia Ltd
$\mu g/m^3$	Micrograms per cubic metre
WAPC	Western Australian Planning Commission

11 REFERENCES

Anthropos Australia Pty Ltd, (2010) *Preliminary Advice of an Aboriginal Heritage Survey of Priority Area 1, 2 and 3a, Boodarie Project Area, South Hedland, Pilbara Region, Western Australia.* Unpublished report prepared for Marapikurrinya Pty Ltd and Port Hedland Port Authority.

ANZECC & ARMCANZ (2000a) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment Conservation Council and Agriculture and Resources Management Council of Australia and New Zealand, Canberra ACT.

ANZECC & ARMCANZ (2000b). *National Strategy for the Management of Coastal Acid Sulphate Soils.* Australian and New Zealand Environment Conservation Council and Agriculture and Resources Management Council of Australia and New Zealand, Canberra ACT.

AQIS (Australian Quarantine and Inspection Service) (2001) Australian Ballast Water Management Requirements

Beard J.S.(1975) *Vegetation Survey of Western Australia, Pilbara 1:1,000,000. Map and Explanatory Notes to Sheet 7*. Published by University of Western Australia Press, Perth.

BHP-BIO (BHP Billiton) (2008) Port Hedland Finucane Island Dredging – Environmental Referral Document. October 2008. http:///www.bhpbilliton.com/bb/ourBusinesses/ironore/healthSafetyandEnvironment/portHedlandFinucaneIslandDredgingEnvironmentalReferralDocument.jsp

BHP-BIO (BHP Billiton) (2009) Port Hedland Nelson Point Dredging. Environmental Referral Document. Report Prepared by BHP Billiton Ltd, Perth, Western Australia.

Biota (Biota Environmental Sciences Pty Ltd) (2008a) A Flora and Fauna Assessment of RGP 5 DMMA, Port Hedland Harbour. Unpublished report prepared for Sinclair Knight Merz, 2008.

Biota (Biota Environmental Sciences Pty Ltd) (2008b) A Biodiversity Assessment of the Utah Point Development, Port Hedland. Unpublished report prepared for Sinclair Knight Merz, 2008.

BoM (Bureau of Meteorology) (2008) http://www.bom.gov.au/weather/wa/port-hedland/

CALM (Department of Conservation and Land Mangement) (1999).*Environmental Weed Strategy for Western Australia*. Prepared by the Department of Conservation and Land Management, Perth, Western Australia.

Coffey Environments (2010a) *Draft Referral of a Proposal to the Environmental Protection Authority, Multi-user Iron Ore Export (Landside) Facility*. Report prepared by Coffey Environments for NWI. August 2010.

Coffey Environments (2010b) Acid Sulphate Soil Investigation Car Dumper 5, Finucane Island, Port Hedland, Coffey Environments Pty Ltd, Western Australia.

Coffey Environments (2011a) *Preliminary (Non Intrusive) Acid Sulphate Soil Investigation Proposed NWI Multi-user Iron Ore Export Facility*. Report No. EP2010/239 V1. Prepared for North West Infrastructure by Coffey Environments

Coffey Environments (2011b) *Multi-user Iron Ore Export (Landside) Facility Fauna Survey*. Report No 2010/151. Prepared for North West Infrastructure by Coffey Environments.

Coffey Environments (2011c) *Multi user Iron Ore Export (Landside) Facility Sampling and Analysis Plan – Acid Sulphate Soils.* Prepared for North West Infrastructure by Coffey Environments.

DEC (Department of Environment and Conservation) (2009a) *Identification and Investigation of Acid Sulphate Soils and Acidic Landscapes.* Prepared by Department of Environment and Conservation, Perth Western Australia.

DEC (Department of Environment and Conservation) (2009b) *Draft Treatment and Management of Soils and Water in Acid Sulphate Soil Landscapes - Acid Sulphate Soils Guideline Series.* Prepared by Department of Environment and Conservation, Perth Western Australia.

DoE (Department of Environment) (2005) *Review of Waste Classification and Waste Definitions 1996* (as amended). Prepared by Department of Environment, Perth Western Australia.

DoE (Department of Environment) (2006) *Pilbara Coastal Water Consultation Outcomes Environmental Values and Environmental Quality Objectives*. Prepared by Department of Environment, Perth Western Australia.

DSD (Department of State Development) (2010) *Port Hedland Air Quality and Noise Management Plan*. *The Port Hedland Dust Management Taskforce Report* prepared for Department of State Development by the Port Hedland Dust management Taskforce.

ENV Australia Pty Ltd (2009) *Port Hedland Nelson Point Dredging Approvals Flora and Vegetation Assessment DMMA H.* Unpublished report prepared for Sinclair Knight Merz Pty Ltd, April 2009.

Environ (2004) *Pilbara Iron Ore and Infrastructure Project: Stage A Port and North- South Railway Public Environmental Review*. Report prepared for Fortescue Metals Group Ltd by Environ Australia Perth Ltd

EPA (2000a) *EPA Position Statement 2: Environmental Protection of Native Vegetation in Western Australia – Clearing of Native Vegetation with Particular Reference to the Agricultural Area*

EPA (2000b) EPA Guidance Statement No. 18*: Prevention of Air Quality Impacts from Land Development*

EPA (2000c) *Perth Coastal Waters Environmental Values and Objectives*

EPA (2001) EPA Guidance Statement No. 1: *Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline*

EPA (2002a) EPA Position Statement 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection*.

EPA (2002b) EPA Guidance Statement No.12: Minimising Greenhouse Gases.

EPA (2003a) EPA Guidance Statement No. 55: *Implementing Best Practice in Proposals Submitted to the Environmental Impact Assessment Process*

EPA (2003b) EPA *Interim Industry Consultation Guide to Community Consultation*

EPA (2004a) EPA Position Statement 7: *Principles of Environmental Protection*

EPA (2004b) EPA Position Statement 6*: Towards Sustainability*.

EPA (2004c) EPA Guidance Statement No. 51: *Terrestrial Fauna Surveys for Environmental Impact Assessment*.

EPA (2004d) EPA Guidance Statement No. 56: *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment*).

EPA (2004e) EPA Guidance Statement No. 41: *Assessment of Aboriginal Heritage*

EPA (2004f) *Guidance Statement No 29: Bethnic Primary Producer Habitat Protection for Western Australia's Marine Environment*.

EPA (2006) *Guidance Statement No 6: Rehabilitation of Terrestrial Ecosystems*.

EPA (2007) EPA Guidance Statement No. 8: *Draft Environmental Noise*

EPA (2009a) Guidance Statement No 20: *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia*

EPA (2009b) Environmental Protection Bulletin No. 2 Port Hedland Dust and Noise.

EPA (2009c) *Utah Point Berth Project Stage B Report and Recommendations of the EPA*. Report 1311 January 2009.

EPA (2009d) EPA Guidance Statement No 3: Protection of *Benthic Primary Producer Habitat in Western Australia's Marine Environment*

EPA (2010a) Environmental Assessment Guidelines Number 6: *Timelines for the Environmental Impact Assessment of Proposals*.

EPA (2010b). *Roy Hill 1 Iron Ore Project Port Infrastructure - Report 1377, Roy Hill Iron Ore Pty Ltd*, Environmental Protection Authority, Perth.

EPA (2010c) EPA Environmental Assessment Guidelines No 5 *(Draft) Environmental Assessment Guidelines for Protecting Marine Turtles from light Impacts*

FMG 2008 Request to amend under Section 45C of the Environmental Protection Act. Dredging of the Third Berth Program Additions: Ministerial Statement 771, 25 September 2008. Document No 100-EN-RP-0007

Gordon, D.M. (1987) *Disturbance to mangroves in the tropical-arid Western Australia:hypersalinity and restricted tidal exchange as factors leading to mortality*. In Technical Series 12. Environmental Protection Authority.

Government of Western Australia (2003) Hope for the Future: The Western Australian State Sustainability Strategy.

Government of Australia (2005) *Interim Biogeographic Regionalisation for Australia, Version 6.1 Subregions.* Available: http://www.environment.gov.au/parks/nrs/science/pubs/map11.pdf. sourced February 2011.

HCWA (Heritage Council of Western Australia) (2009) Places database. A WWW publication accessed on 27 October 2009 at http://www.register.heritage.wa.gov.au/search_results.html. Heritage Council of Western Australia, East Perth, Western Australia.

HGM (1997) *Port Hedland Port Developments – Environmental Study*. Report prepared by Halpern Glick Maunsell for the Port Hedland Port Authority, Port Hedland, Western Australia.

Kendrick P and Stanley, F. (2001) *A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions in 2002 – Pilbara 1 (PIL4 – Roebourne Subregion*). Published by the Department of Conservation and Land Management, November, 2001.

Outback Ecology (2011) *North West Iron Ore Alliance, Port and Rail Project, Desktop Evaluation of Soils and Landforms.* Prepared for Coffey Environments, January 2011.

Paling, E. I. (1997) *Mangrove assemblages in Doctors Creek, Derby, their regional significance and the potential impacts of a tidal power station*. Unpublished report prepared for Derby Hydro Power Pty Ltd. cited in Woodman, 2011

Paling E.I., Humphreys G., McCardle I and Thomson G. (2001) *The Effects of Iron Ore Dust on Mangroves in Western Australia: Lack of Evidence for Stomatal Damage*. Wetlands Ecology and Management **9**:363-370.

Paling E.I., Humphreys G., McCardle I and Thomson G. (2003) *The Effect of Harbour Development on Mangroves in Northwestern Australia*. Wetlands Ecology and Management **54**:281-290

Paling E.I., (1986) *Ecological significance of blue-green algal mats in the Dampier mangrove ecosystem.* Technical Series 2. Department of Conservation and Environment, Perth, Westren Australia.

Pendoley Environmental (2008) *Utah Point Berth Project Sea Turtle Assessment*. Prepared for Sinclair Knight Merz and Port Hedland Port Authority.

PHPA (Port Hedland Port Authority) (1999) Port Emergency Plan. Port Hedland Port Authority, Port Hedland, April 1999.

PHPA (Port Hedland Port Authority) (2007) Draft Ultimate Development Plan

PHPA (Port Hedland Port Authority) (2010) *South West Creek Dredging and Reclamation Proposal. Environmental Referral Document.* November 2010.

Roy Hill Infrastructure Pty Ltd (2010) Roy Hill 1 Iron Ore Project Port Infrastructure Environmental Protection Statement. November 2010.

SKM (2008) Utah Point Berth Project Public Environmental Review. Prepared for Port Hedland Port Authority by Sinclair Knight Merz Pty Ltd, Perth.

SKM (2010) Prefeasibility Study for New Iron Ore Export Facility, Port Hedland. Report prepared by SKM for North West Iron Ore Alliance, Perth, Western Australia.

SKM (2010b*) NWIOA Definitive Feasibility Study for Multi-user Iron Ore Export Port Facility Port Hedland. Water Supply Desktop Study Report*. Report No. MW03518-EI-RP-0004. Unpublished report prepared for NWIOA

SKM (2011a) *NWIOA Definitive Feasibility Study for multi-user Iron Ore Export Port Facility – Port Hedland – Definitive Feasibility Study Report*. Report No MW03518MA-RP-0001

SKM (2011b) *NWI Environmental Study for Multi-user Iron Ore Export Port Facility. Surface Water Impact Assessment Component of Environmental and Social Impact Assessment.* Prepared for Coffey Environments. June 2011.

SKM (2011c) *NWI Environmental Study for Multi-user Iron Ore Export Port Facility – Port Hedland. Air Quality and Greenhouse Study – Port Operations*. Report prepared for Coffey Environments. June 2011.

SVT (2011) *North West Infrastructure Proposed Multi-user Iron Ore Export Facility*. Report prepared for Coffey Environments. June 2011.

URS (2011) *Hydrogeological Assessment, Proposed Port Development, Port Hedland, Western Australia*. Report prepared for Coffey Environments. June 2011.

Van Vreeswyk A.M.E., A.L. Payne, K.A. Leighton and P. Hennig (2004) *An inventory and condition survey of the Pilbara region, Western Australia. Department of Agriculture* Technical Bulletin No 92, December 2004.

VSCRG (V and C Seminuick Research Group) (2007) *The mangroves of Utah point, port Hedland – regional setting, description, process, significance, prediction of port construction impacts and mitigation*. Unpublished report prepared for Sinclair Knight Merz May 2007.

WAPC (Western Australian Planning Commission) (2009) *Planning Bulletin No. 64/2009 Acid Sulphate Soils*

Woodman (Woodman Environmental Consulting) (2011a) North West Iron Ore Alliance Port Project: Flora, Vegetation and Mangal Studies. July, 2011.

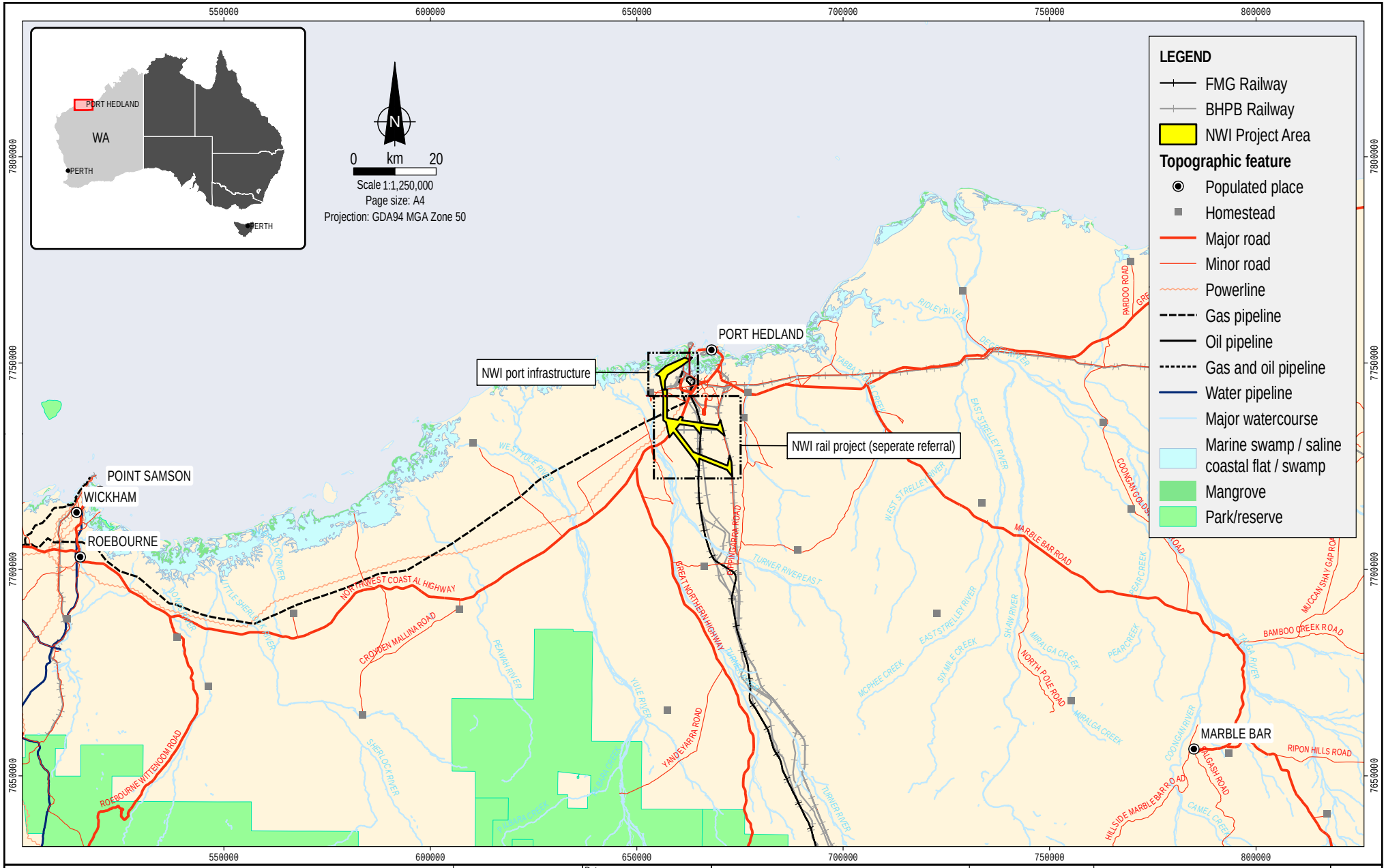
Woodman (Woodman Environmental Consulting) (2011b) North West Iron Ore Alliance Port Project: Flora and Vegetation Impact Assessment. July, 2011

Worley Parsons, (2007) *Port Hedland Port Authority's Ultimate Development Plan*

Worley Parsons (2009) *Stanley Point Dredging Project – Benthic Primary Producer Habitat Assessment*. Report prepared for Roy Hill Iron Ore Pty Ltd, March 2009.

Figures

Environmental Referral, North West Infrastructure Multi User Iron Ore Export (Landside) Facility



Source:
Topographic data from GEODATA TOPO 250K (optimum scale 1:250,000)
NWI study area (updated by Coffey 07.01.2011) and railways from SKM

coffey environments

Date: 12.07.2011
MXD: 8116_12EnvRef_GIS015_v0_2
File Name: 8116_12EnvRef_F001_GIS

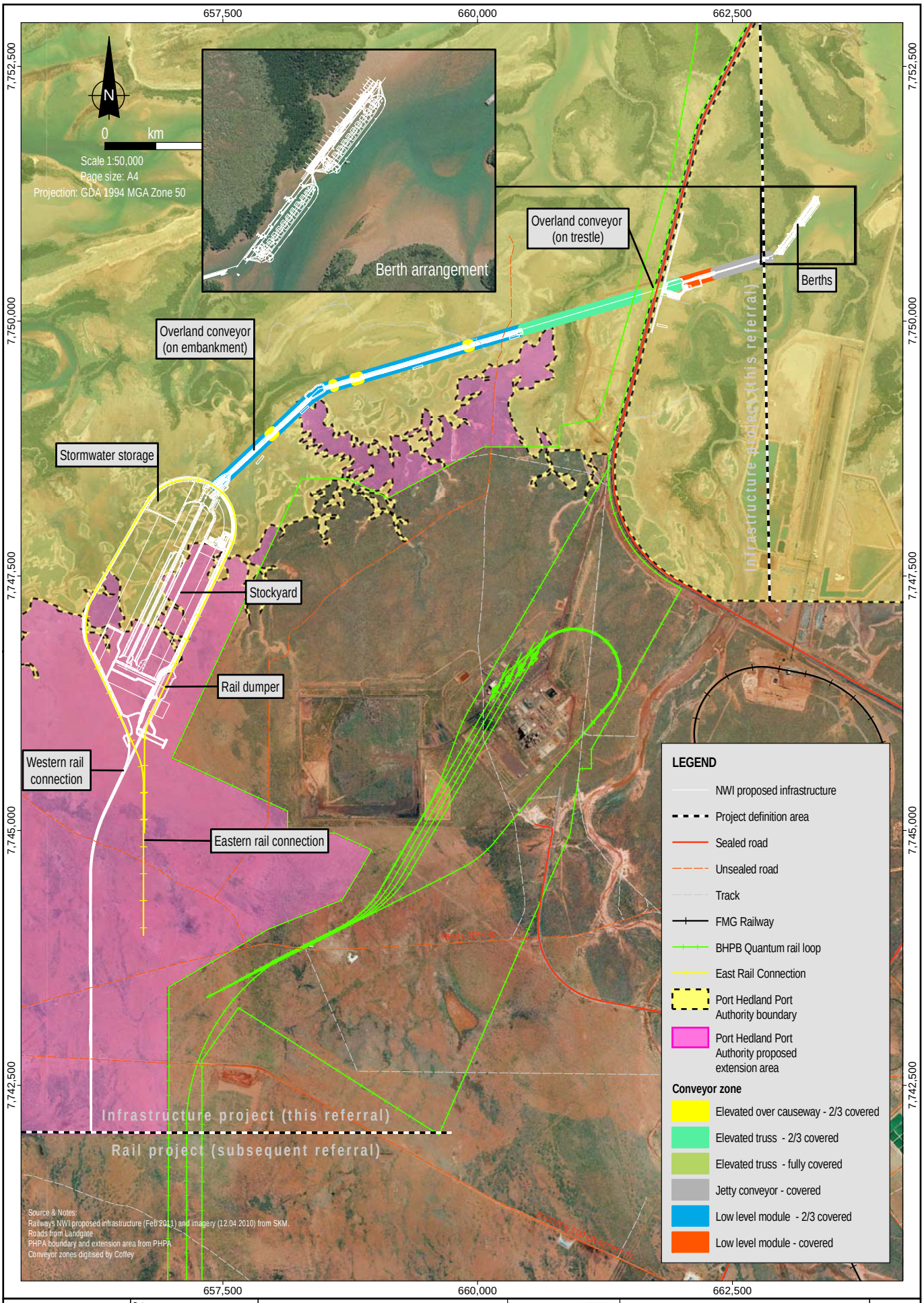
North West Infrastructure

NWI Landside Infrastructure Project Environmental Referral

North West Infrastructure

Regional Location

Figure No: **1**



coffey environments

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File Name: 8116_12EnvRef_F002_GIS

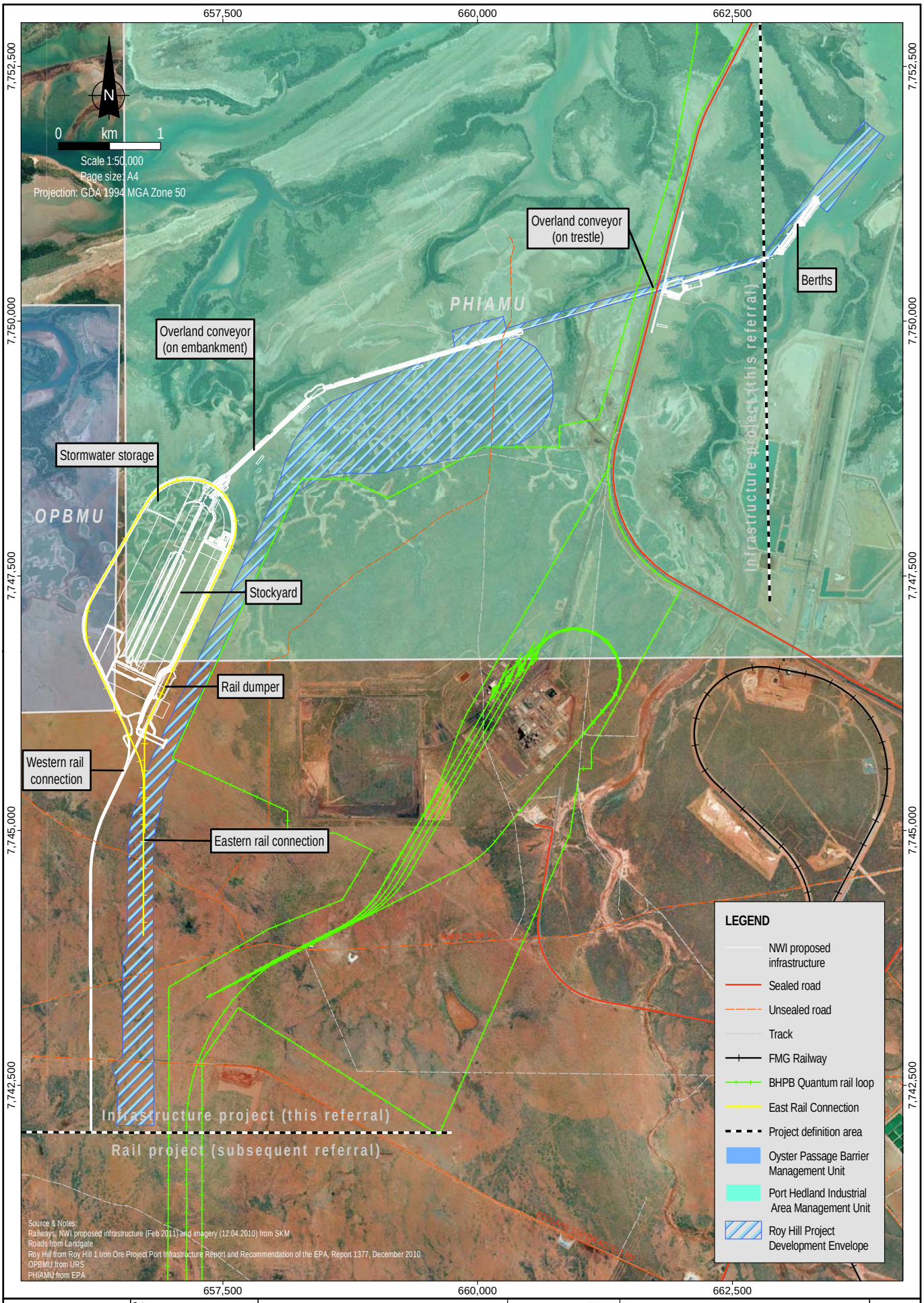
North West Infrastructure

NWI Landside Infastructure Project Environmental Referral

North West Infrastructure

Proposed Project - Boodarie Industrial Precinct

Figure No: **2**



coffey environments

Date: 17.08.2011
MXD: 8116_12EnvRef_GIS023_v0_6
File Name: 8116_12EnvRef_F003_GIS

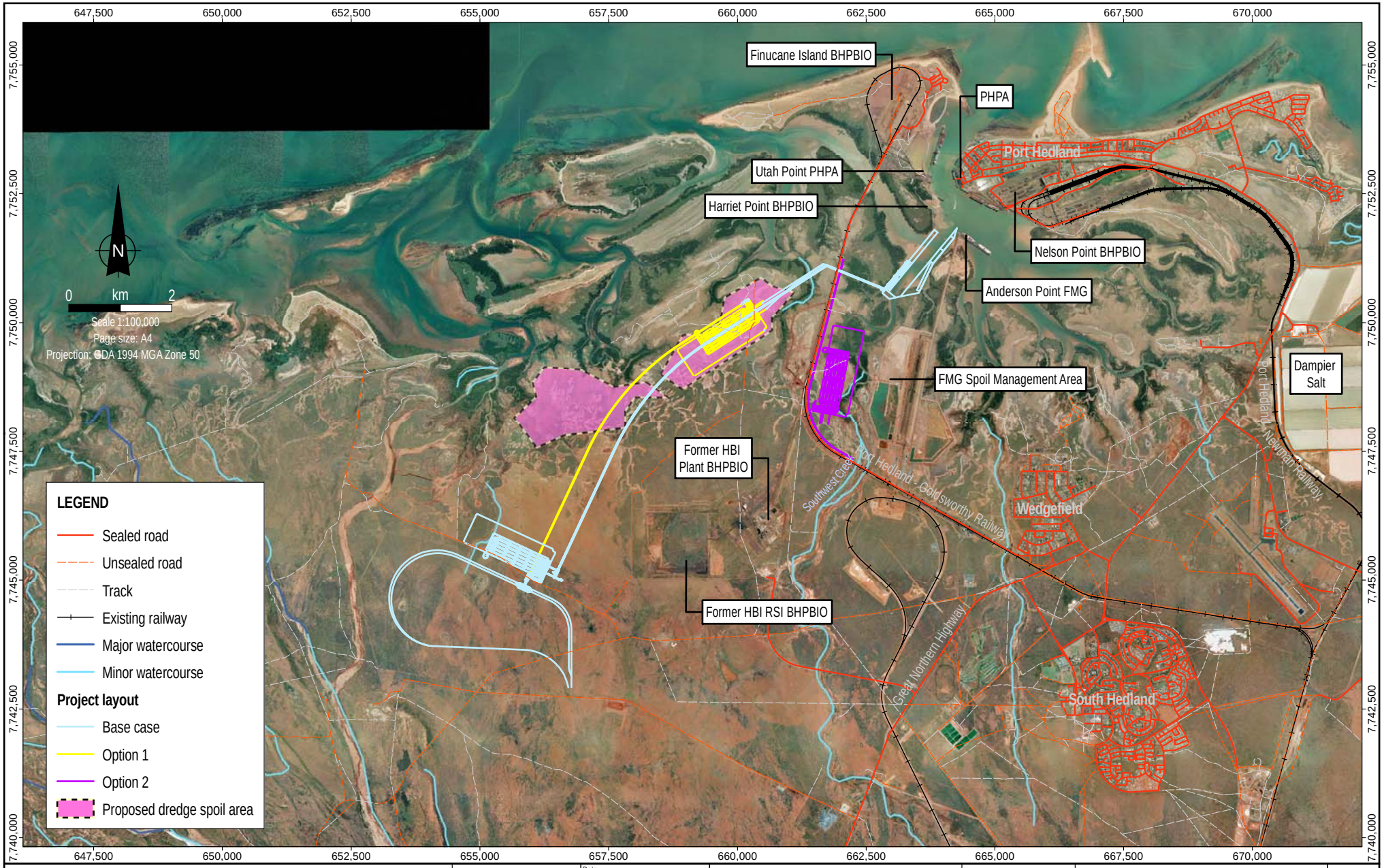
North West Infrastructure

NWI Landside Infastructure Project Environmental Referral

North West Infrastructure

Approved, Existing and Proposed Projects - Boodarie Industrial Precinct

Figure No: **3**



Source & Notes:
Project layout, existing railway and proposed dredge spoil area from SKM
Roads and imagery (2010) from Landgate
Watercourses from Geodata TOPO 250K (optimum scale 1:250,000)

coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS003_v0_4
File Name: 8116_12EnvRef_F004_GIS

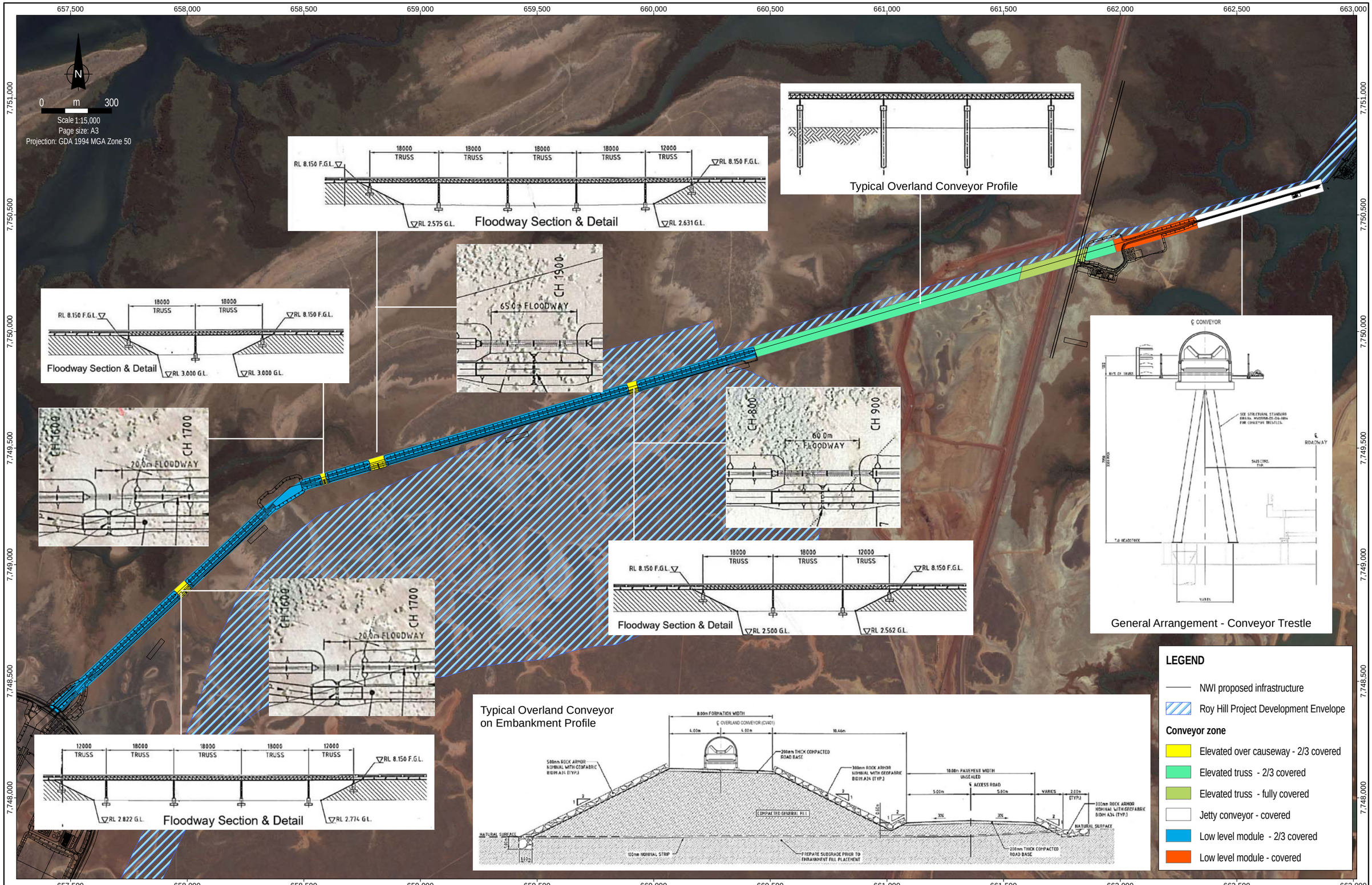
North West Infrastructure

NWI Landside Infrastructure Project
Environmental Referral

North West Infrastructure

Example Layout Alternatives Considered as Part of NWI Project Planning

Figure No: 4



Source:
Proposed infrastructure, imagery and inset boxes from SKM
Conveyor zones digitised by Coffey
Roy Hill digitised from Roy Hill 1 Iron Ore Project Port Infrastructure Report and Recommendation of the EPA, Report 1377, December 2010.

coffey environments

Date: 16.08.2011
MXT: 8116_12EnvRef_GIS028_v0_3
File Name: 8116_12EnvRef_F005_GIS

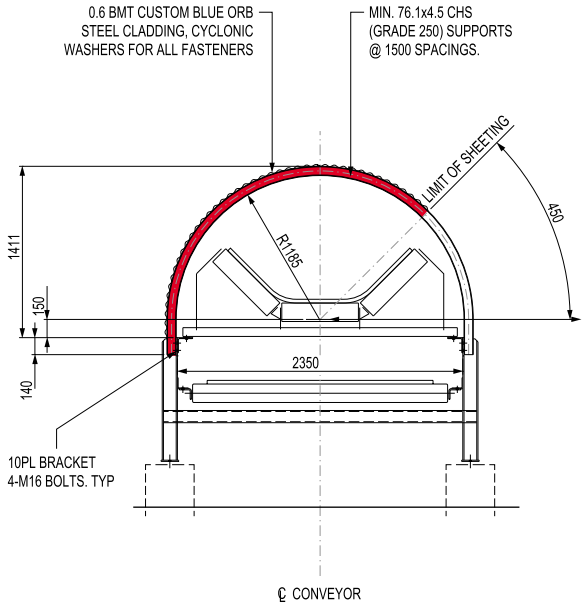
North West Infrastructure

NWI Landside Infrastructure Project Environmental Referral

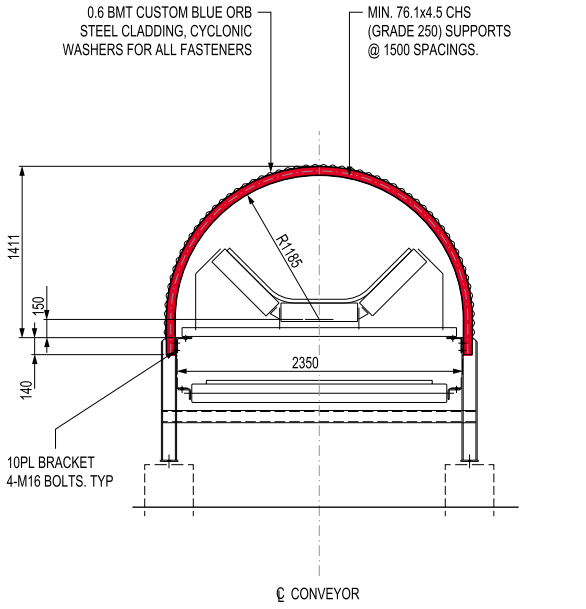
North West Infrastructure

Conveyor Configuration on Trestles and Embankments

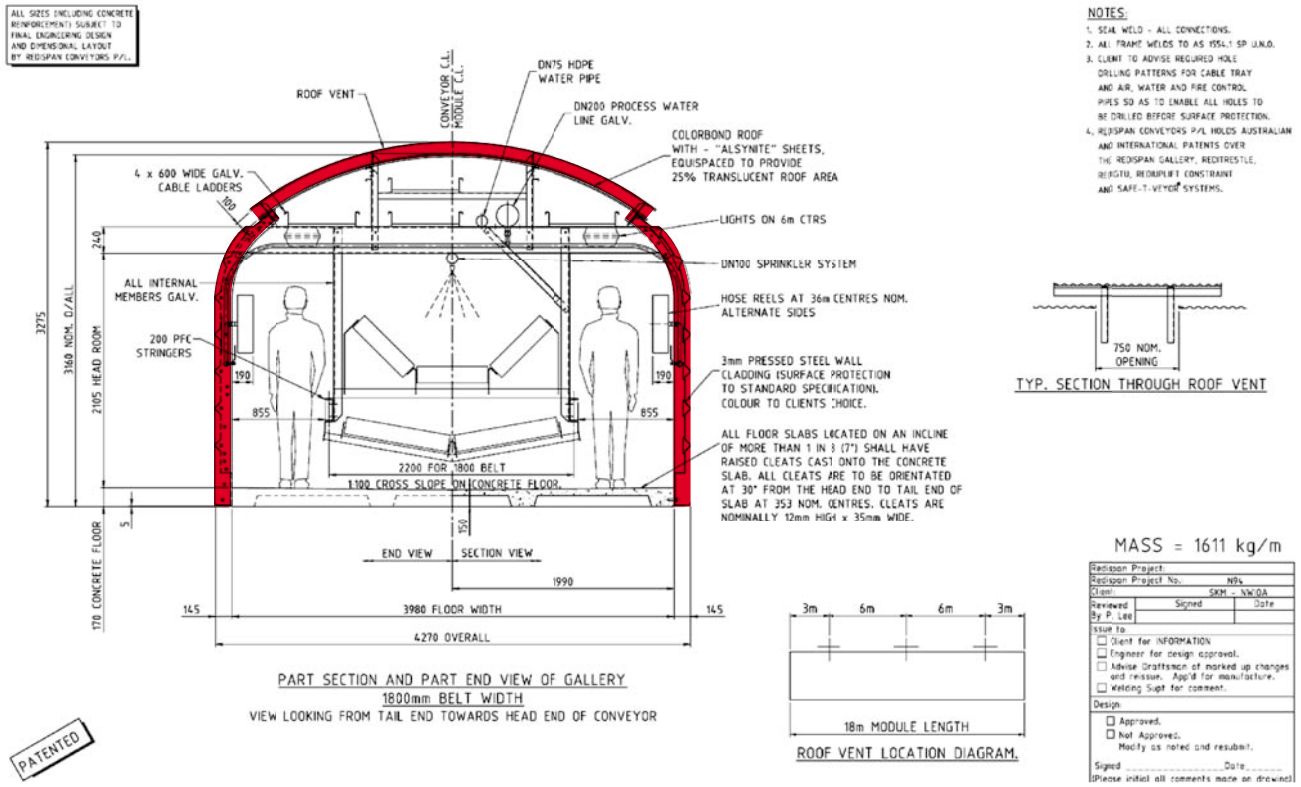
Figure No: **5**



SECTION A:
TYPICAL SECTION THROUGH PARTIAL CONVEYOR COVER



SECTION B:
TYPICAL SECTION THROUGH COMPLETE CONVEYOR COVER

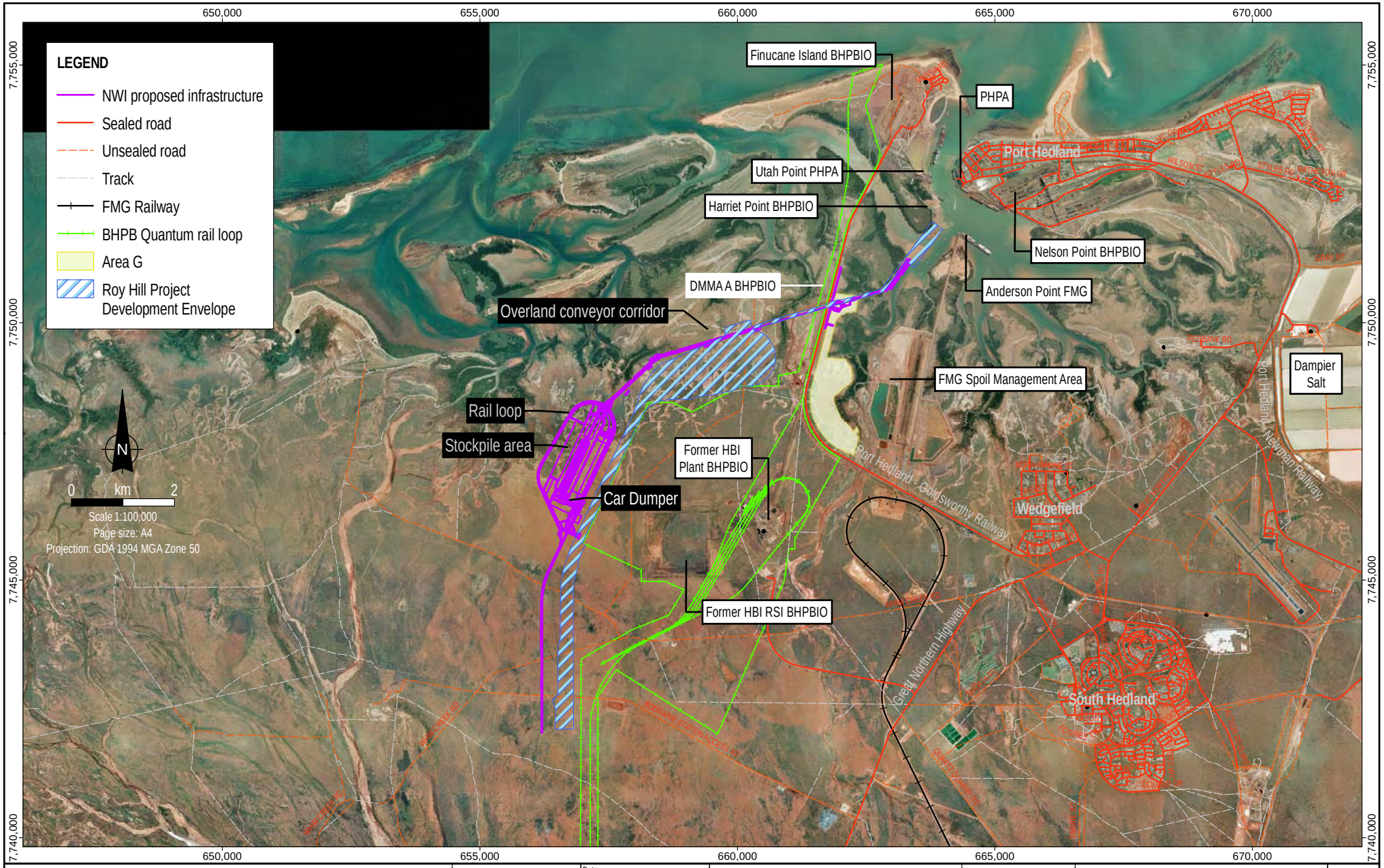


SECTION C: TYPICAL SECTION THROUGH FULLY ENCLOSED CONVEYOR

Extent of cover sheeting

Source:
Upper two drawings frrom SKM (MW03518-SK-206.dwg)
Lower drawing from Redispan Modular Conveyor Solutions

coffey environments	Job No: 8116	North West Infrastructure	North West Infrastructure	Sections Through Covered Conveyors	Figure No: 6
	File Name: 8116_12_F006_HB	NWI Landside Infrastructure Project Environmental Referral			



Source & Notes:
Railways, Area G and proposed infrastructure from SKM
Roads and imagery from Landgate
Roy Hill from Roy Hill 1 Iron Ore Project Port Infrastructure Report and Recommendation of the EPA, Report 1377, December 2010

coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS024_v0__4
File Name: 8116_12EnvRef_F007_GIS

North West Infrastructure

NWI Landside Infrastructure Project Environmental Referral

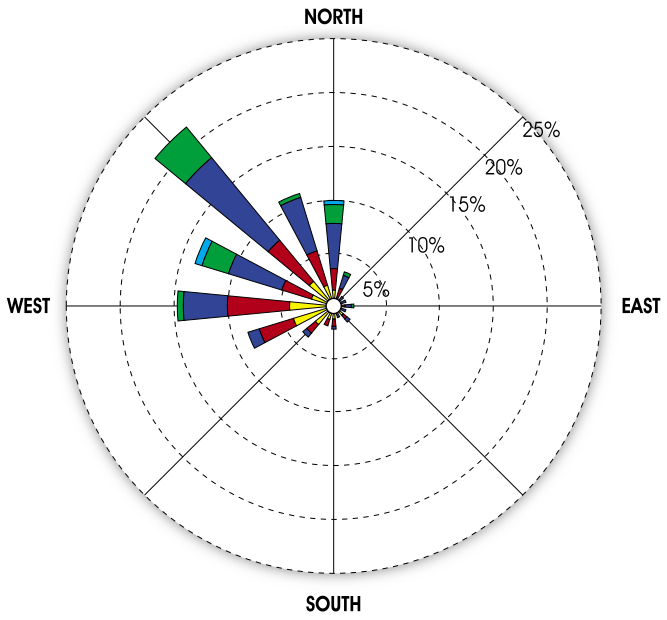
North West Infrastructure

Proximity of Project Elements to Built Environments

Figure No: **7**

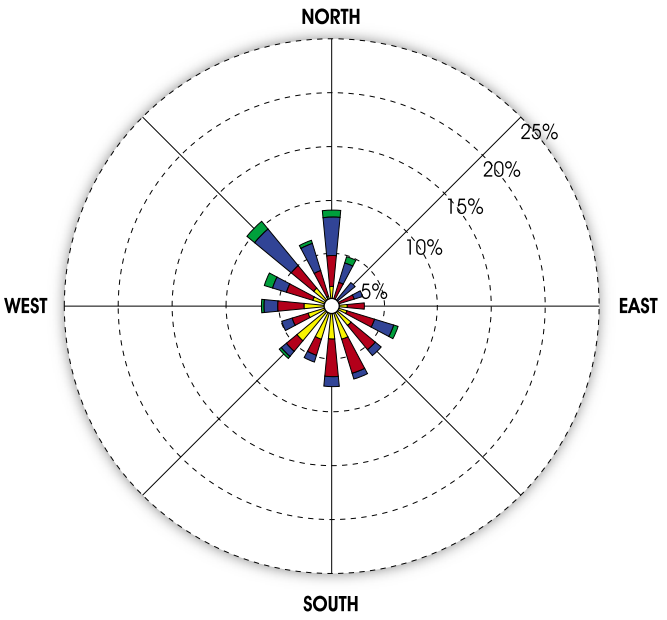
SUMMER

Calms : 0.00%



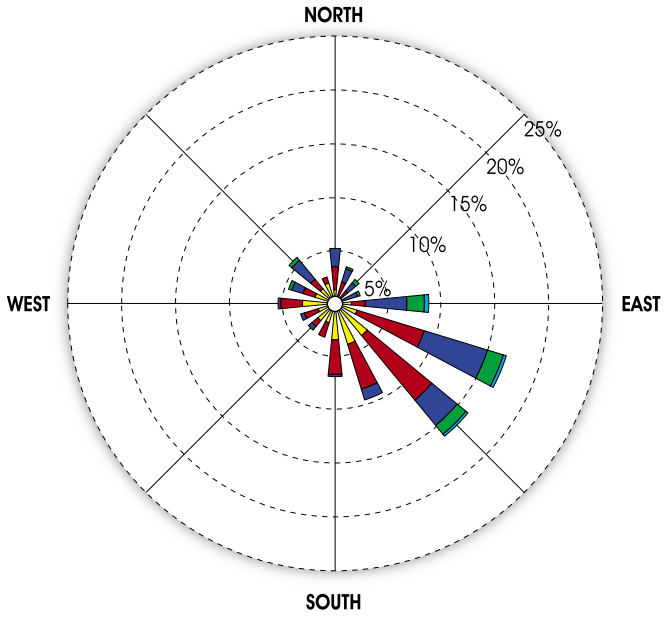
AUTUMN

Calms : 0.00%



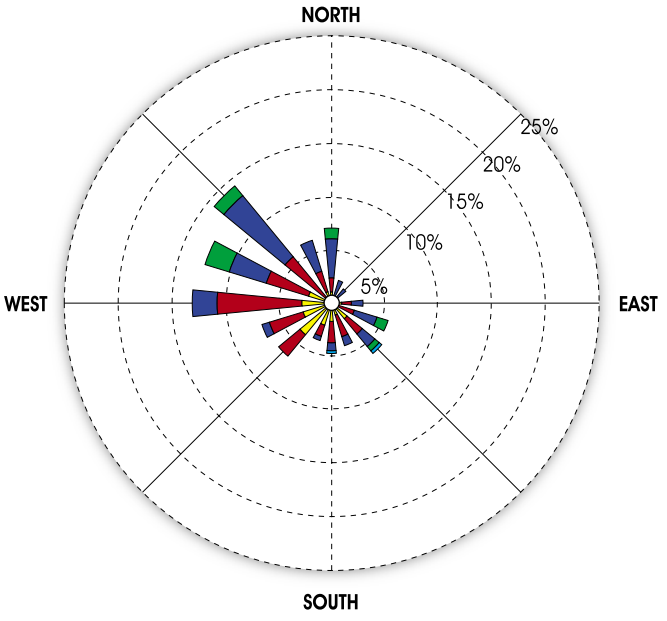
WINTER

Calms : 0.00%



SPRING

Calms : 0.00%

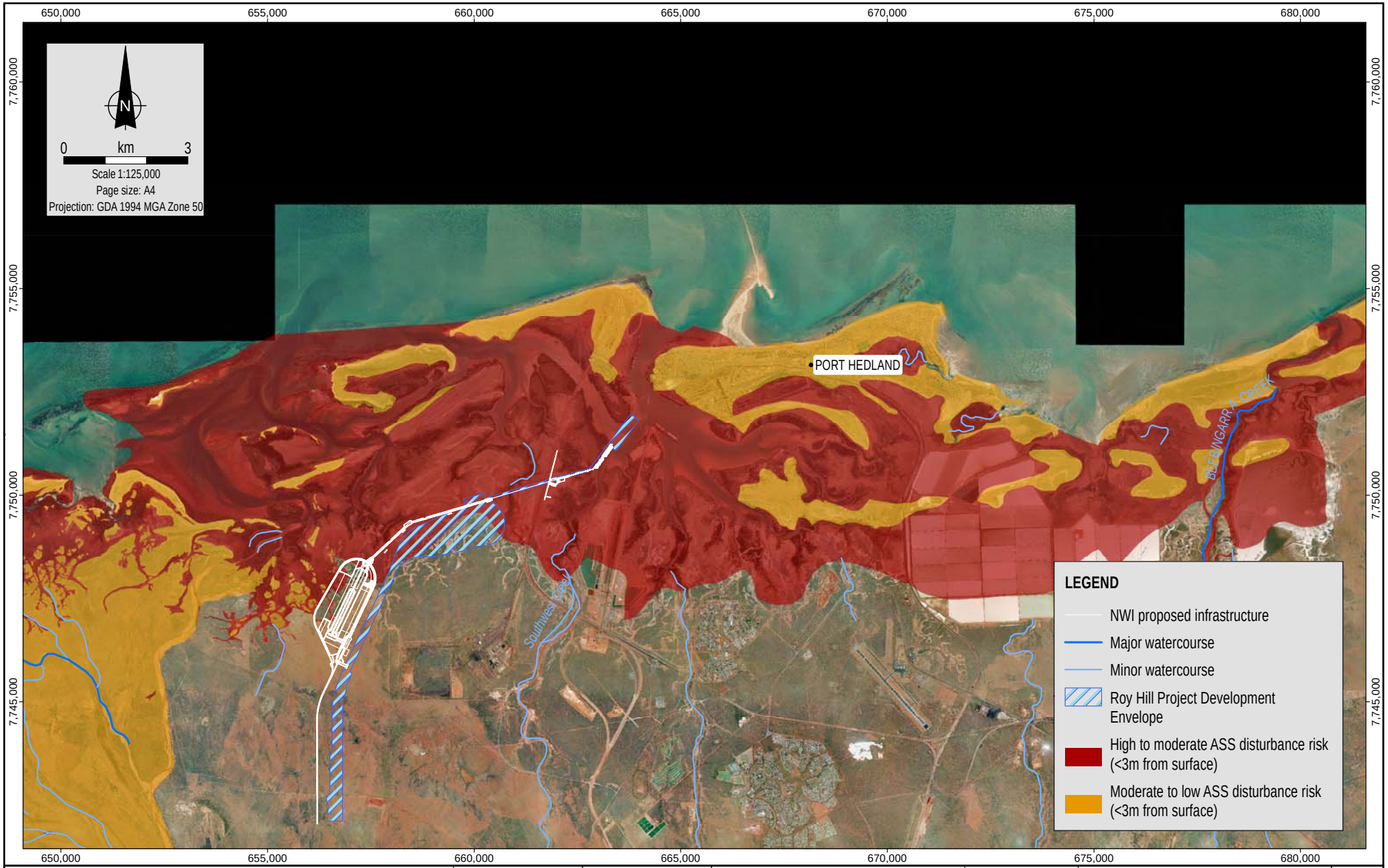


Wind Speed (m/s)

- >= 11.1
- 8.8 - 11.1
- 5.7 - 8.8
- 3.6 - 5.7
- 2.1 - 3.6
- 0.5 - 2.1

Source: BHPBIO 2009

coffey environments	Job No: 8116	North West Infrastructure	North West Infrastructure	Wind roses for Port Hedland	Figure No: 8
	File Name: 8116_12_F008_HB	NWI Port Infastructure Project Environmental Referral			



Source:
Imagery from Landgate
NWI proposed infrastructure from SKM
Watercourses from GEODATA TOPO 250K (optimum scale 1:250,000)
Acid Sulfate Soil data from DEC
Roy Hill from Roy Hill 1 Iron Ore Project Port Infrastructure Report and Recommendation of the EPA, Report 1377, December 2010.

coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS005_v0_2
File Name: 8116_12EnvRef_F009_GIS

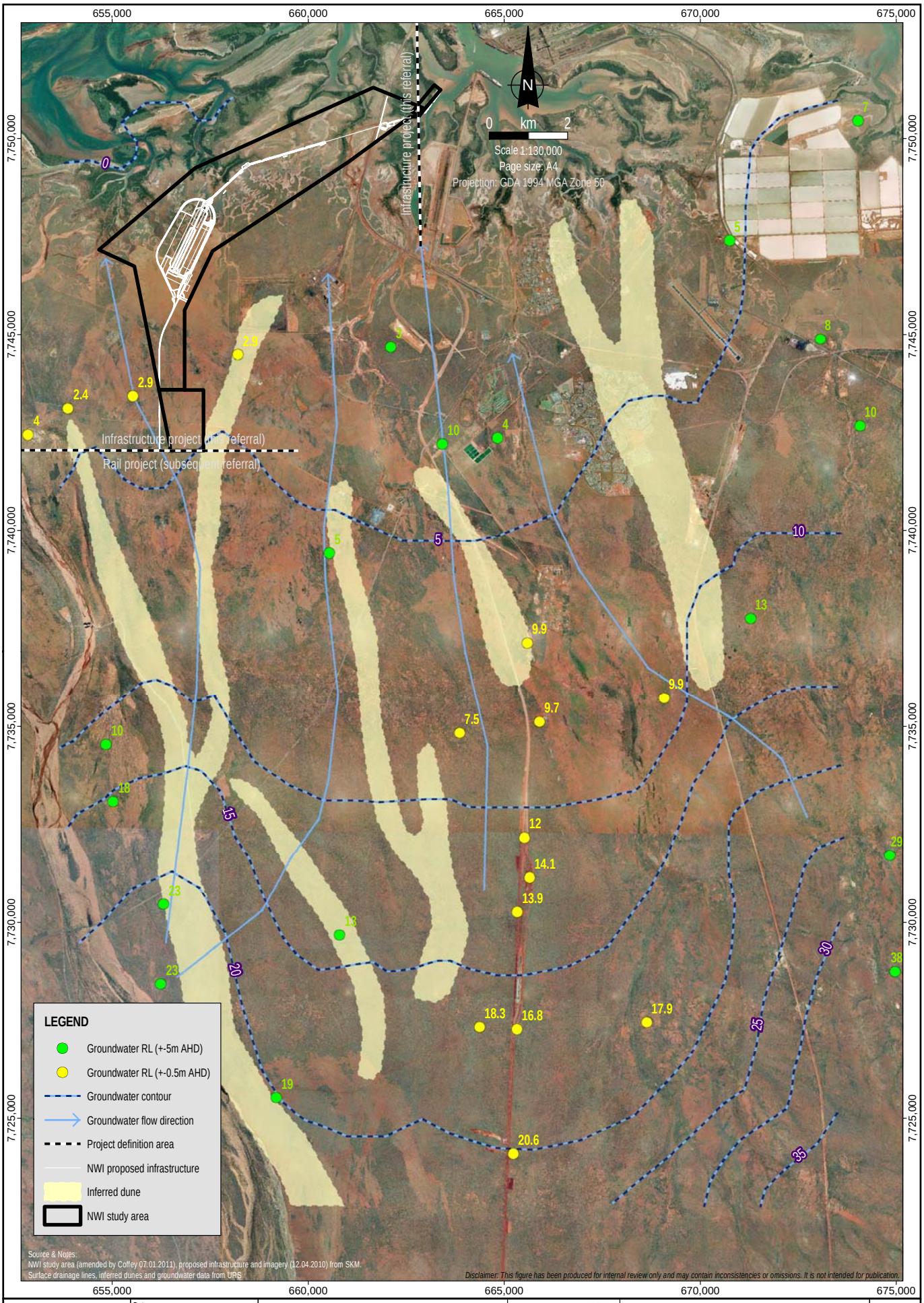
North West Infrastructure

NWI Landside Infastructure Project
Environmental Referral

North West Infrastructure

Acid Sulfate Soils Risk Mapping DEC

Figure No: **9**



coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS011_v0_4
File Name: 8116_12EnvRef_F010_GIS

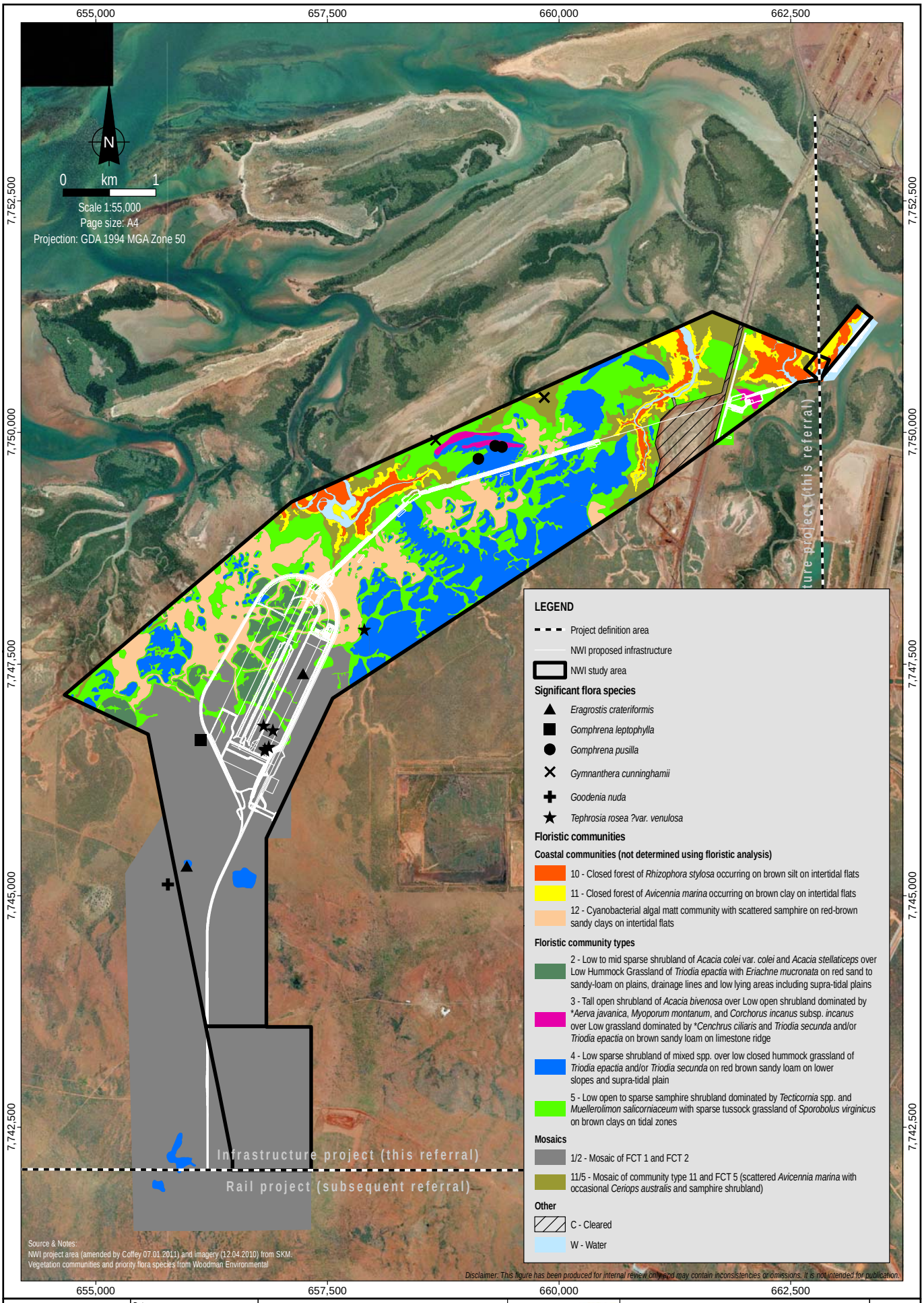
North West Infrastructure

NWI Landside Infastructure Project
Environmental Referral

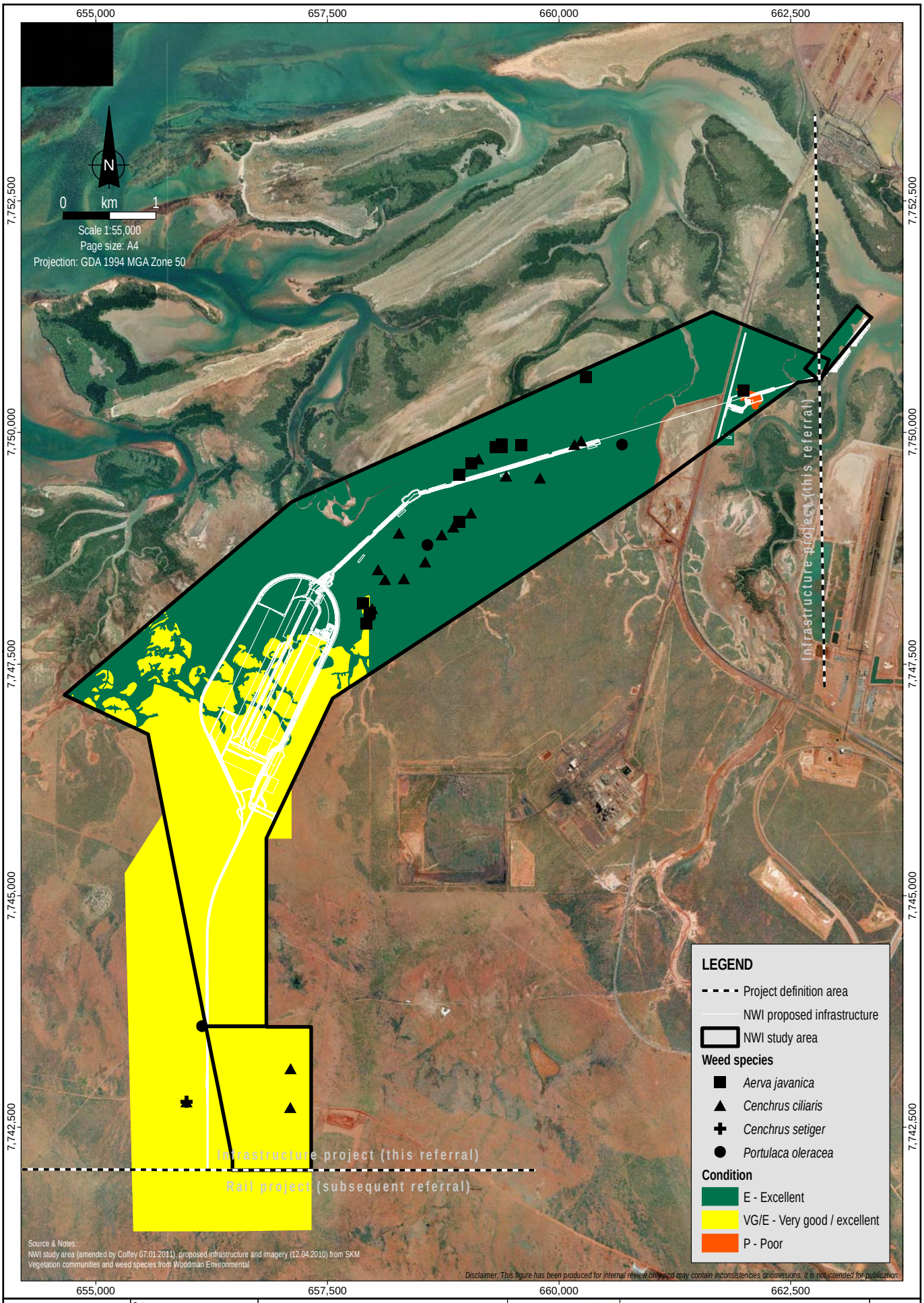
North West Infrastructure

Inferred groundwater contours (mAHD) and flow direction

Figure No: 10



coffey environments	Date: 16.08.2011 MXD: 8116_12EnvRef_GIS009_v0_3 File Name: 8116_12EnvRef_F011_GIS	North West Infrastructure NWI Landside Infastructure Project Environmental Referral	North West Infrastructure	Floristic Vegetation Types	Figure No: 11



coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS010_v0_4
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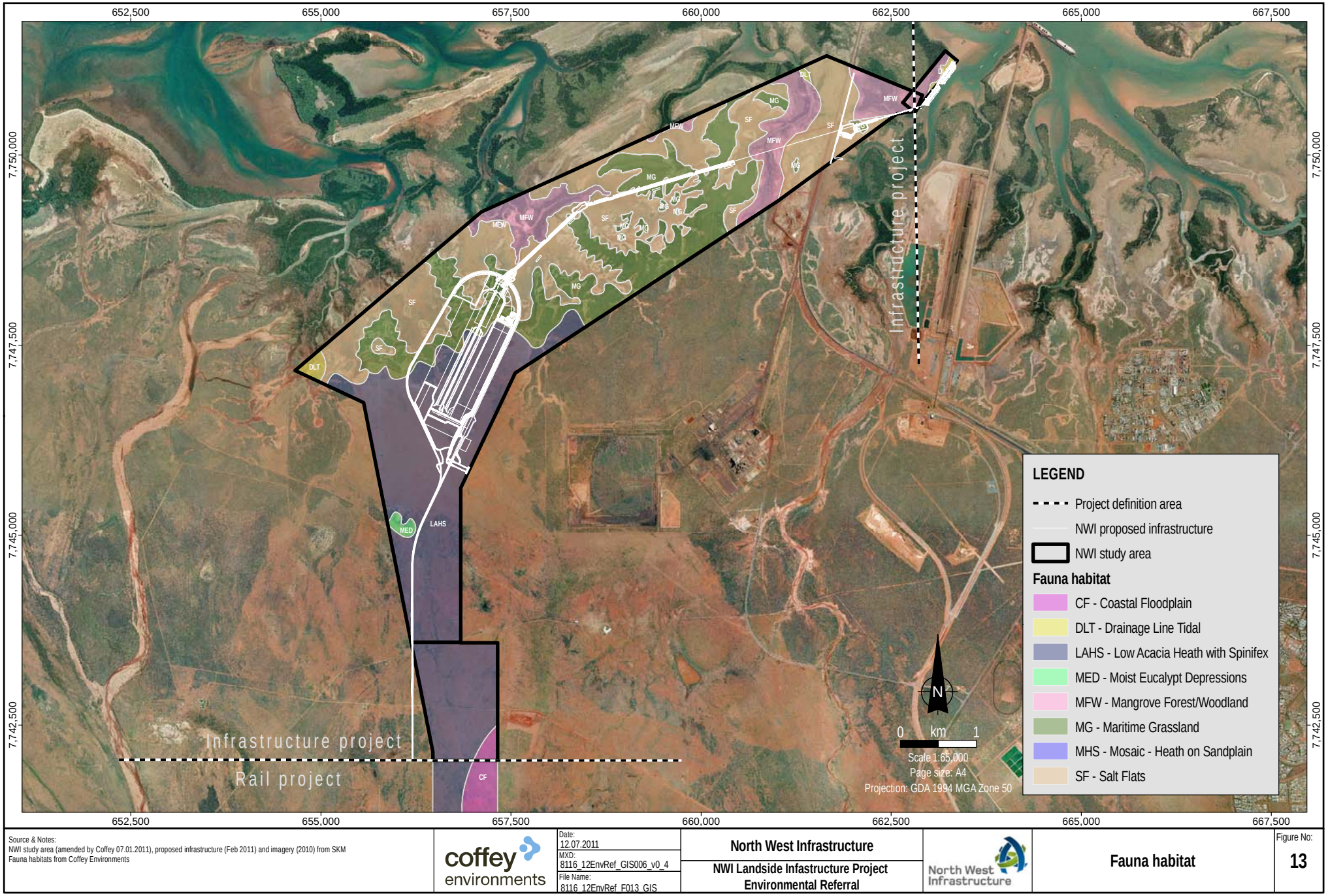
North West Infrastructure

NWI Landside Infastructure Project
Environmental Referral

North West Infrastructure

Vegetation Condition

Figure No: 12



Source & Notes:
NWI study area (amended by Coffey 07.01.2011), proposed infrastructure (Feb 2011) and imagery (2010) from SKM
Fauna habitats from Coffey Environments

coffey environments

Date: 12.07.2011
MXD: 8116_12EnvRef_GIS006_v0_4
File Name: 8116_12EnvRef_F013_GIS

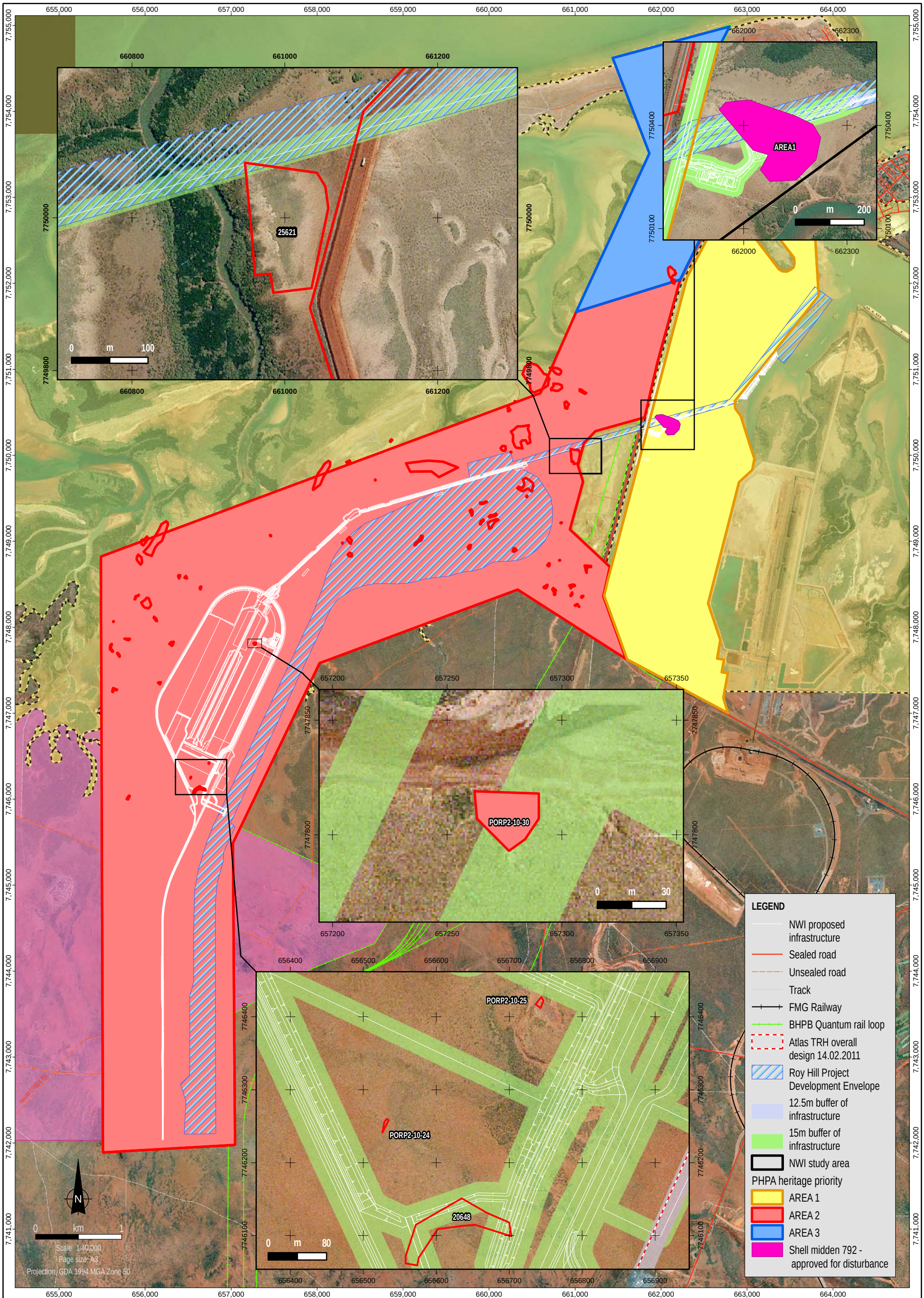
North West Infrastructure

NWI Landside Infastructure Project
Environmental Referral

North West Infrastructure

Fauna habitat

Figure No: **13**



Source & Notes:
Railways, NWI proposed infrastructure (Feb 2011) and imagery (12.04.2010) from SKM.
Port Hedland Port Authority boundary and extension area from PHPA. Watercourses from GEODATA TOPO 250K (optimum scale 1:250,000)
Roy Hill from Roy Hill 1 Iron Ore Project Port Infrastructure Report and Recommendation of the EPA, Report 1377, December 2010.
Aboriginal heritage digitised from data from Anthropos Australis Pty Ltd

coffey environments

Date: 15.08.2011
MXT: 8116_12EnvRef_GIS001_v0_5
File Name: 8116_12EnvRef_F014_GIS

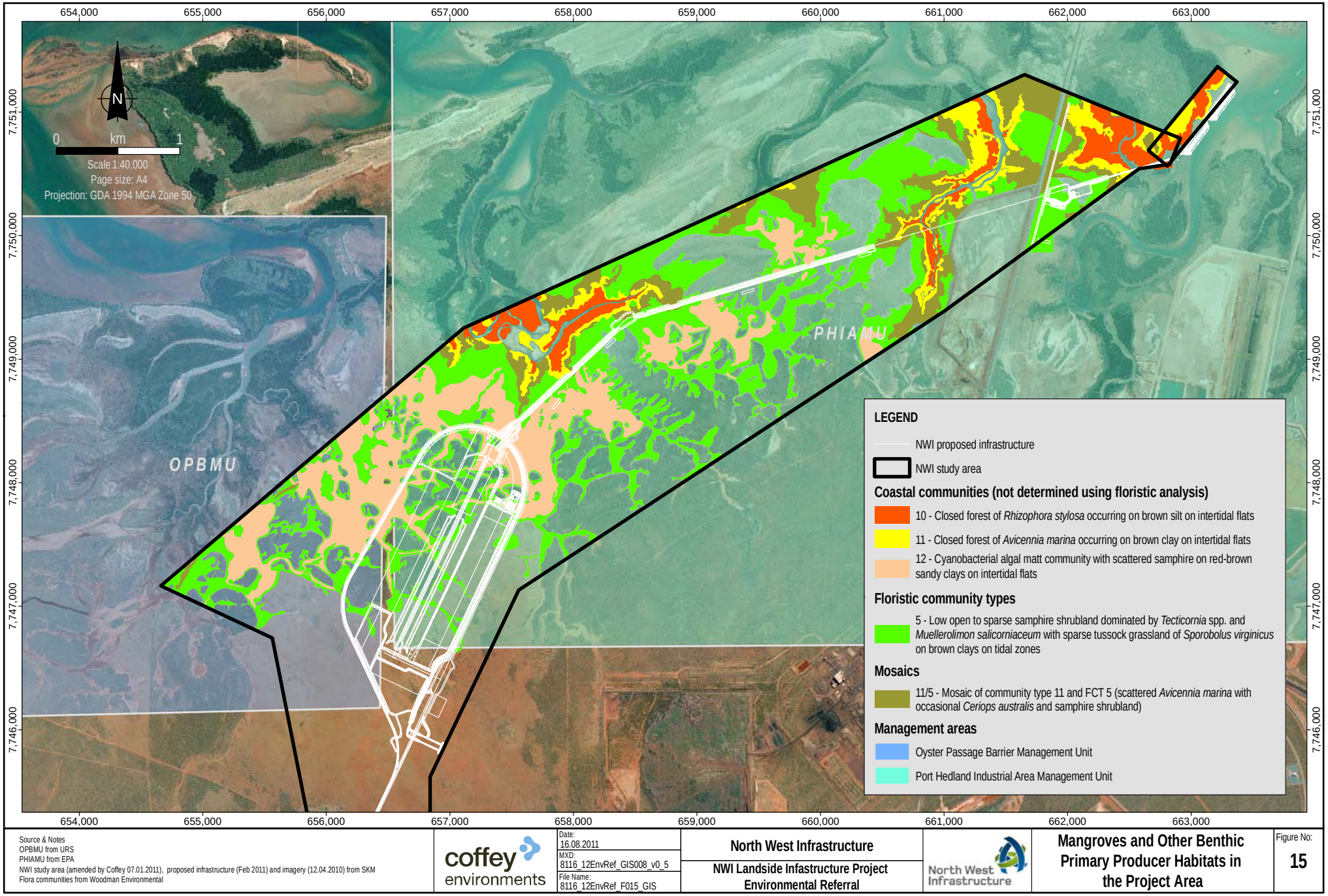
North West Infrastructure

NWI Landside Infastructure Project
Environmental Referral

North West Infrastructure

Aboriginal Heritage Survey Areas and Identified Sites

Figure No: 14



Source & Notes
OPBMU from URS
PHIAMU from EPA
NWI study area (amended by Coffey 07.01.2011), proposed infrastructure (Feb 2011) and imagery (12.04.2010) from SKM
Flora communities from Woodman Environmental

coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS008_v0_5
File Name: 8116_12EnvRef_F015_GIS

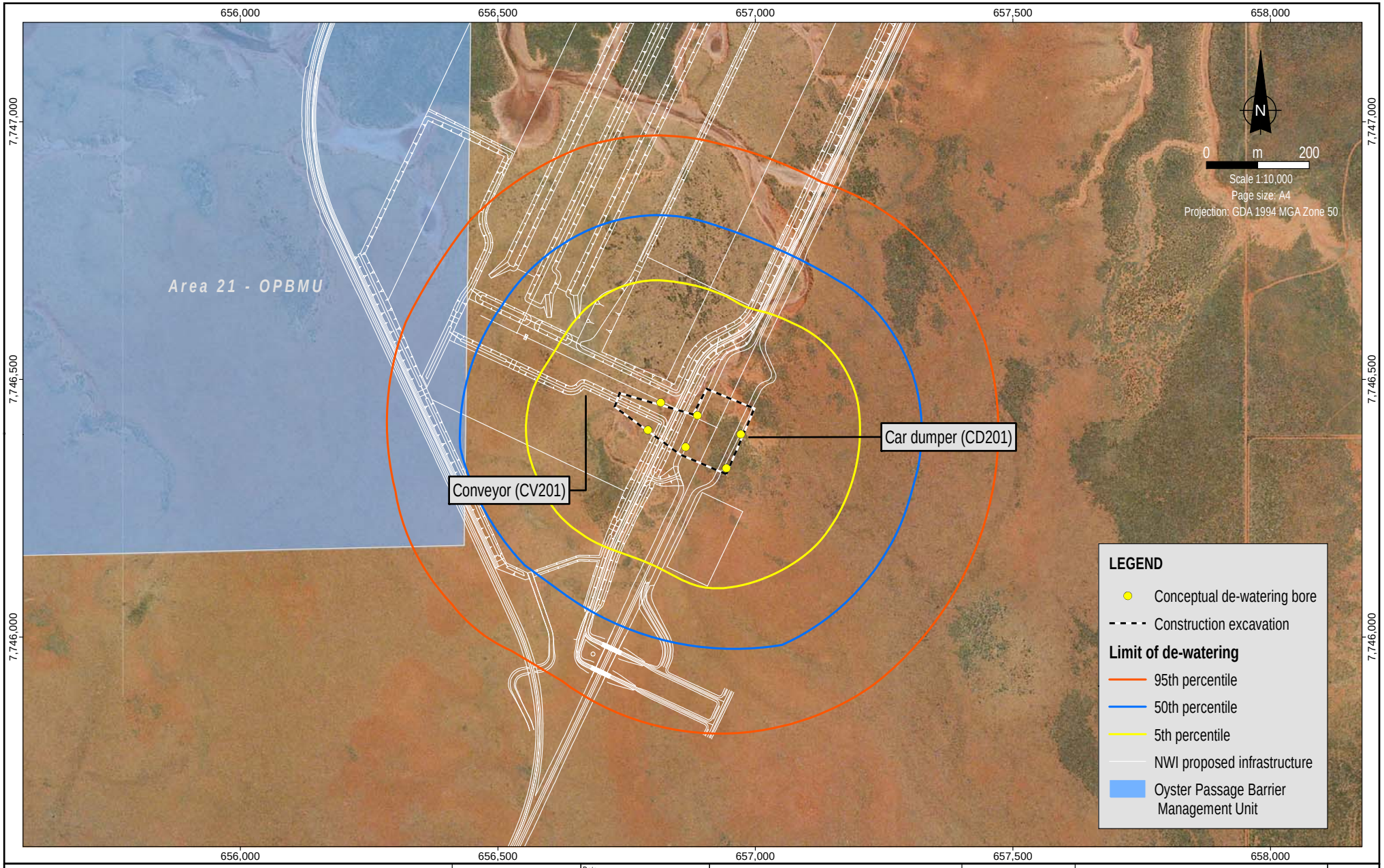
North West Infrastructure

NWI Landside Infastructure Project
Environmental Referral

North West Infrastructure

Mangroves and Other Benthic Primary Producer Habitats in the Project Area

Figure No: 15



Source:
Imagery from Landgate
NWI proposed infrastructure from SKM
Groundwater de-watering and construction excavation data from URS

coffey environments

Date: 12.07.2011
MXD: 8116_12EnvRef_GIS012_v0_4
File Name: 8116_12EnvRef_F016_GIS

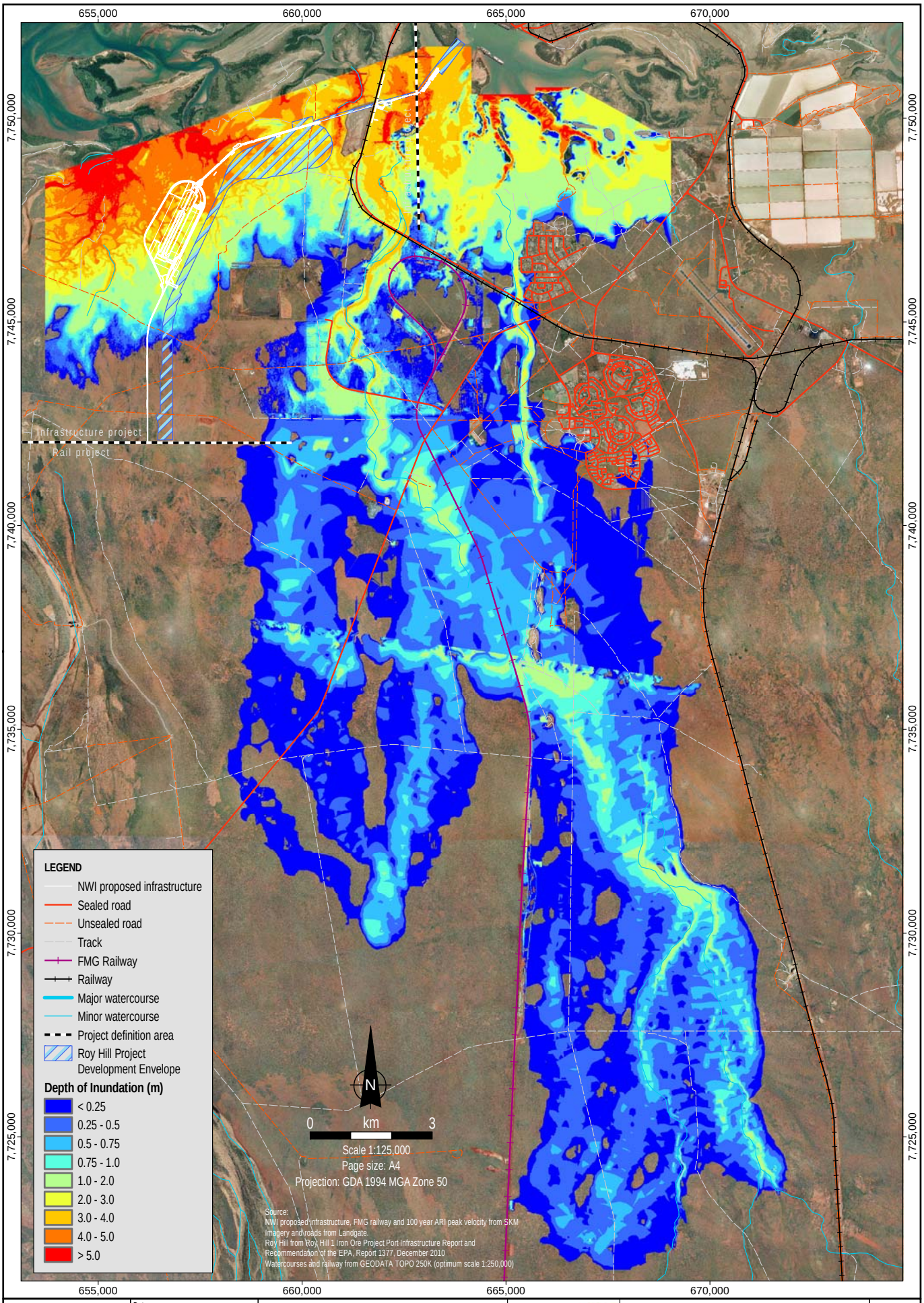
North West Infrastructure

NWI Landside Infastructure Project
Environmental Referral

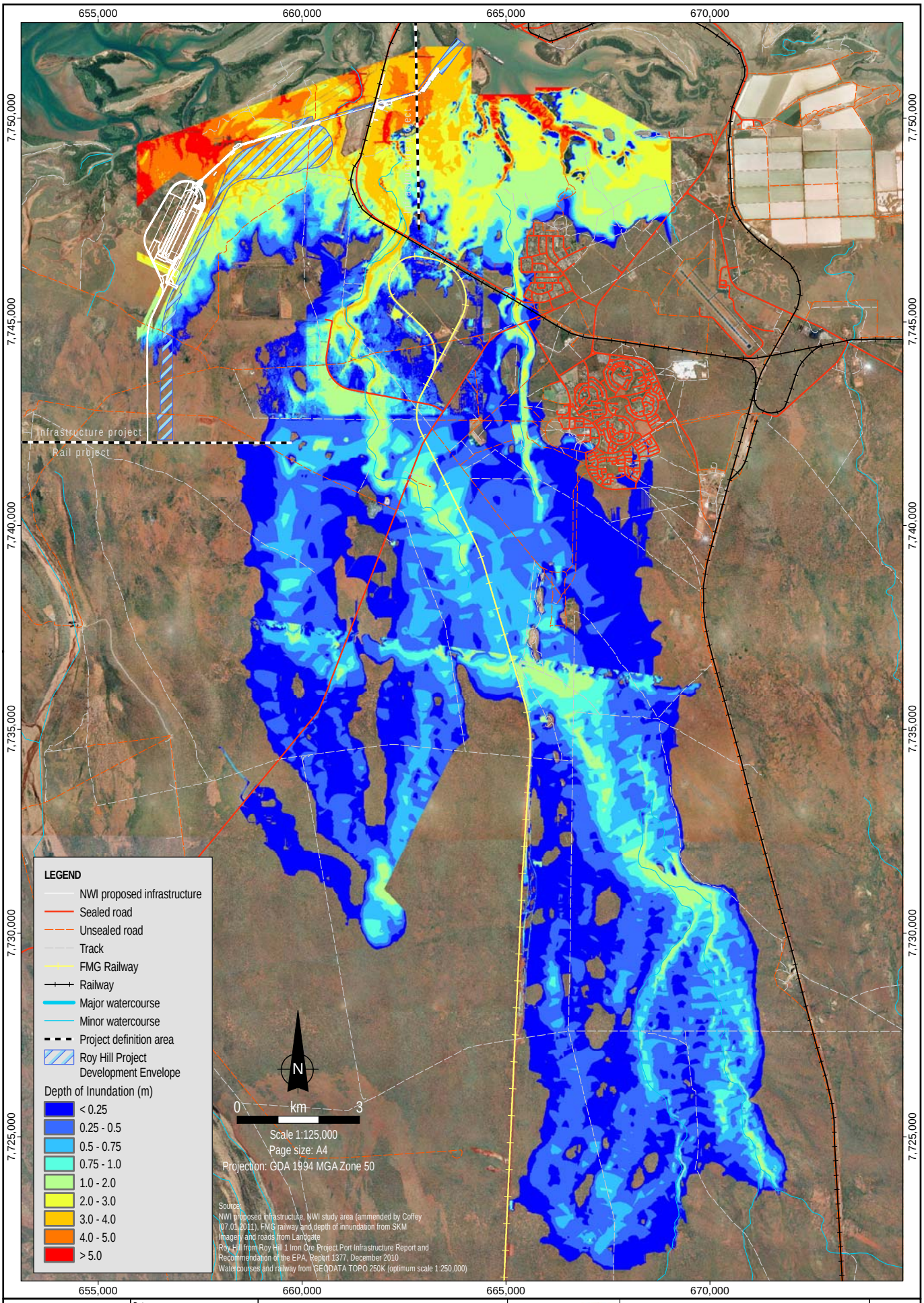
North West Infrastructure

Groundwater Cones of Depression - Car Dumper Construction

Figure No: **16**



coffey environments	Date: 12.07.2011 MXD: 8116_12EnvRef_GIS017_v0_5 File Name: 8116_12EnvRef_F017_GIS	North West Infrastructure NWI Landside Infrastructure Project Environmental Referral	North West Infrastructure	Existing Case 100 year ARI Peak Inundation and Peak Water Levels	Figure No: 17



coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS018_v0_4
File Name: 8116_12EnvRef_F018_GIS

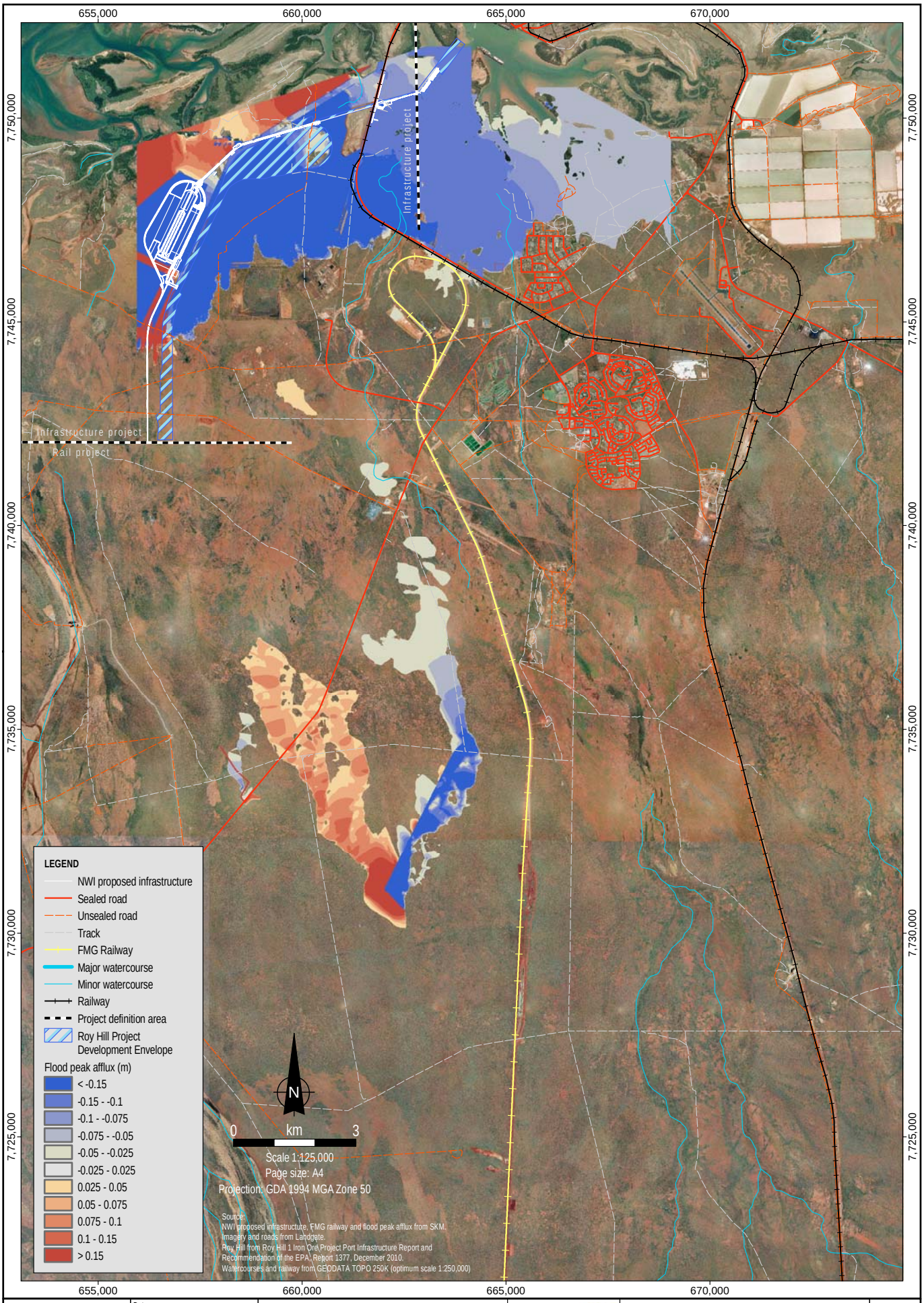
North West Infrastructure

NWI Landside Infastructure Project Environmental Referral

North West Infrastructure

Developed Case 100 year ARI Peak Inundation and Peak Water Levels

Figure No: **18**



coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS019_v0_4
File Name: 8116_12EnvRef_F019_GIS

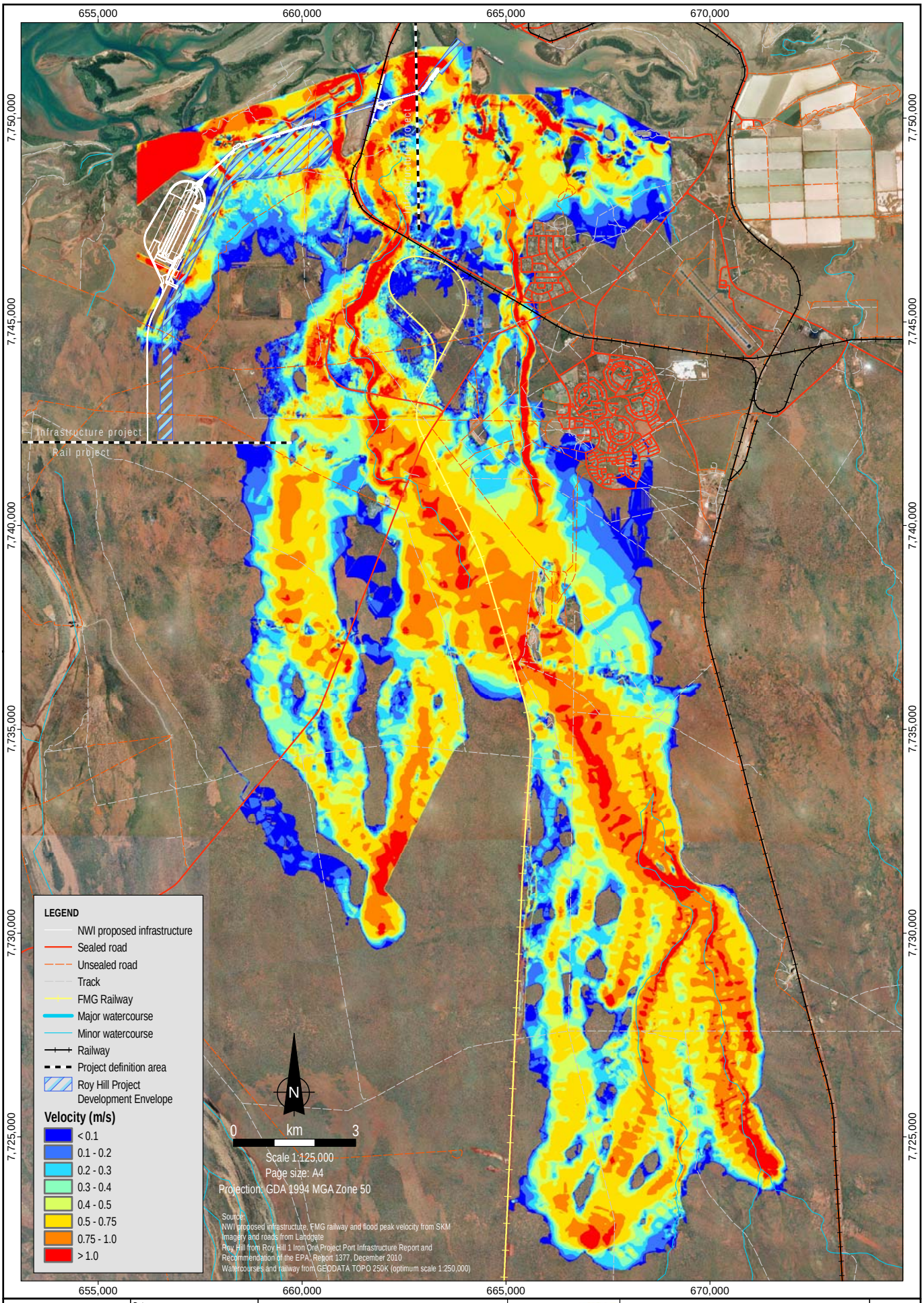
North West Infrastructure

NWI Landside Infastructure Project Environmental Referral

North West Infrastructure

Developed Case 100 Year ARI Afflux

Figure No: **19**



coffey environments

Date: 12.07.2011
MXD: 8116_12EnvRef_GIS025_v0__4
File Name: 8116_12EnvRef_F020_GIS

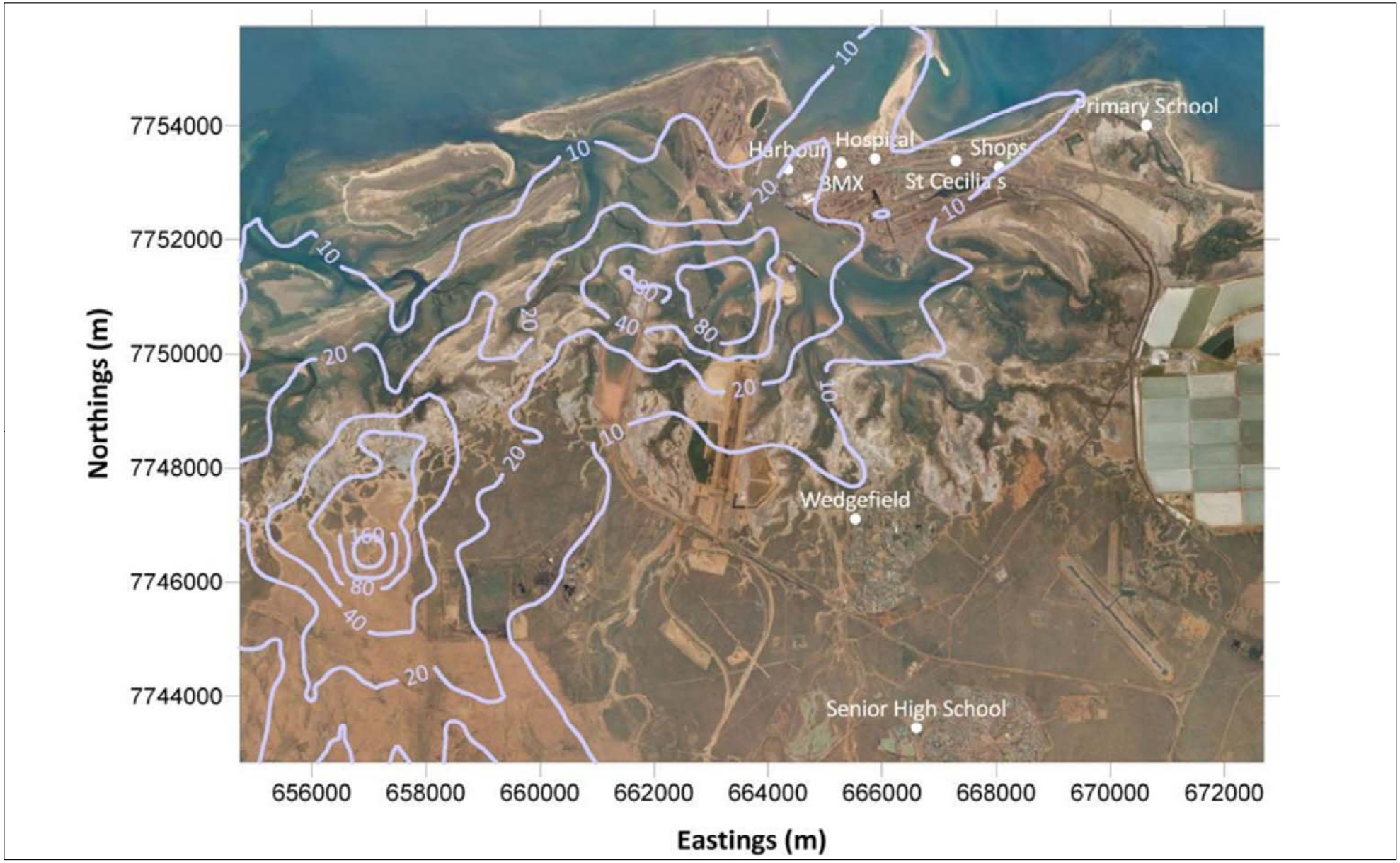
North West Infrastructure

NWI Landside Infastructure Project Environmental Referral

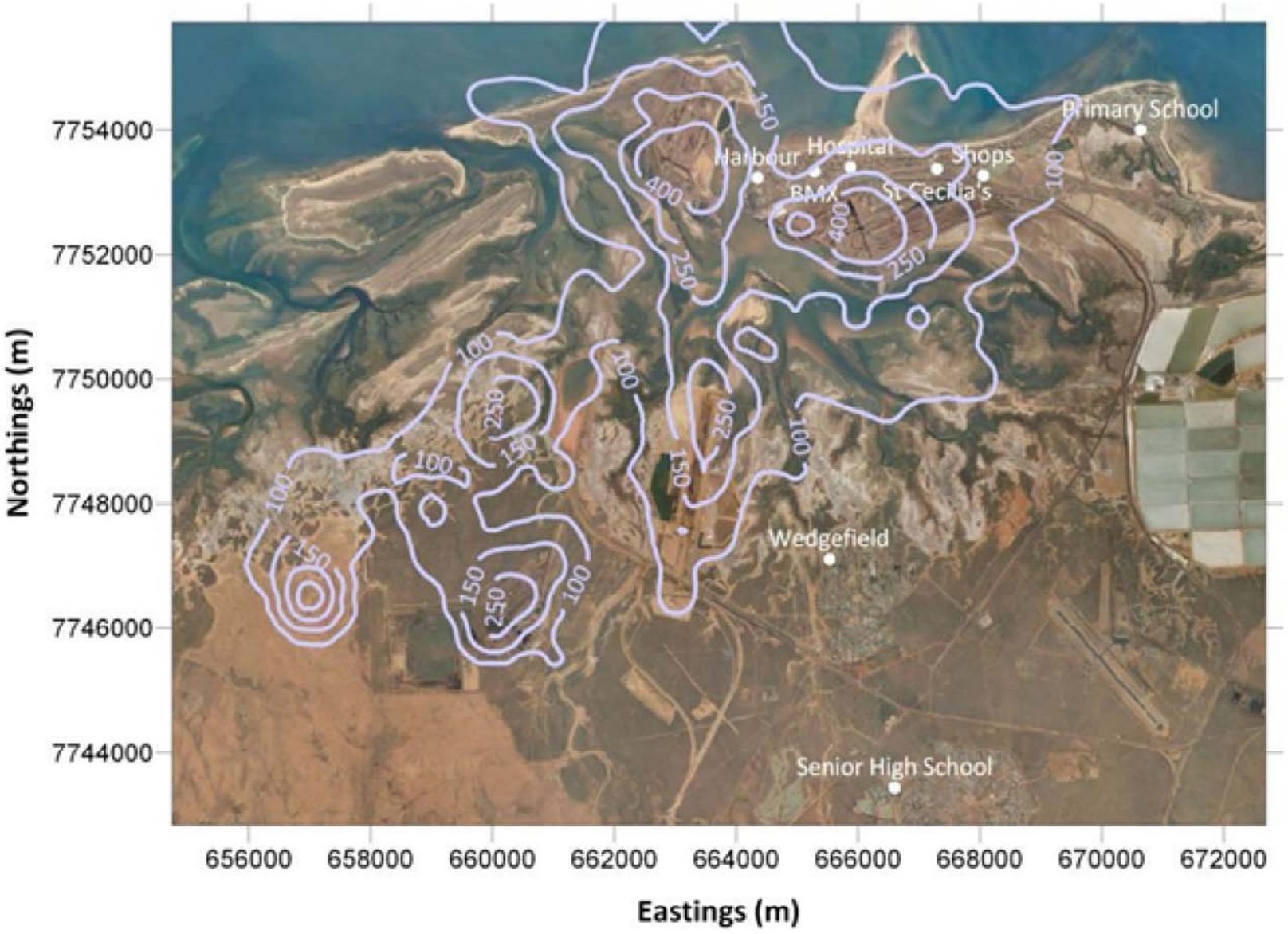
North West Infrastructure

Developed Case 100 year ARI Flow Velocities

Figure No: **20**



Source & Notes: SKM 2011	coffey environments	Date: 18.08.2011 MXD: 8116_12EnvRef_GIS020_v0_4 File Name: 8116_12EnvRef_F021_GIS	North West Infrastructure NWI Landside Infastructure Project Environmental Referral	North West Infrastructure	Maximum Predicted 24 Hour PM_{10} Ground Level Concentrations in Isolation (µg / m^3)	Figure No: 21



Source & Notes:
SKM 2011

coffey environments

Date: 18.08.2011
MXD: 8116_12EnvRef_GIS021_v0_4
File Name: 8116_12EnvRef_F022_GIS

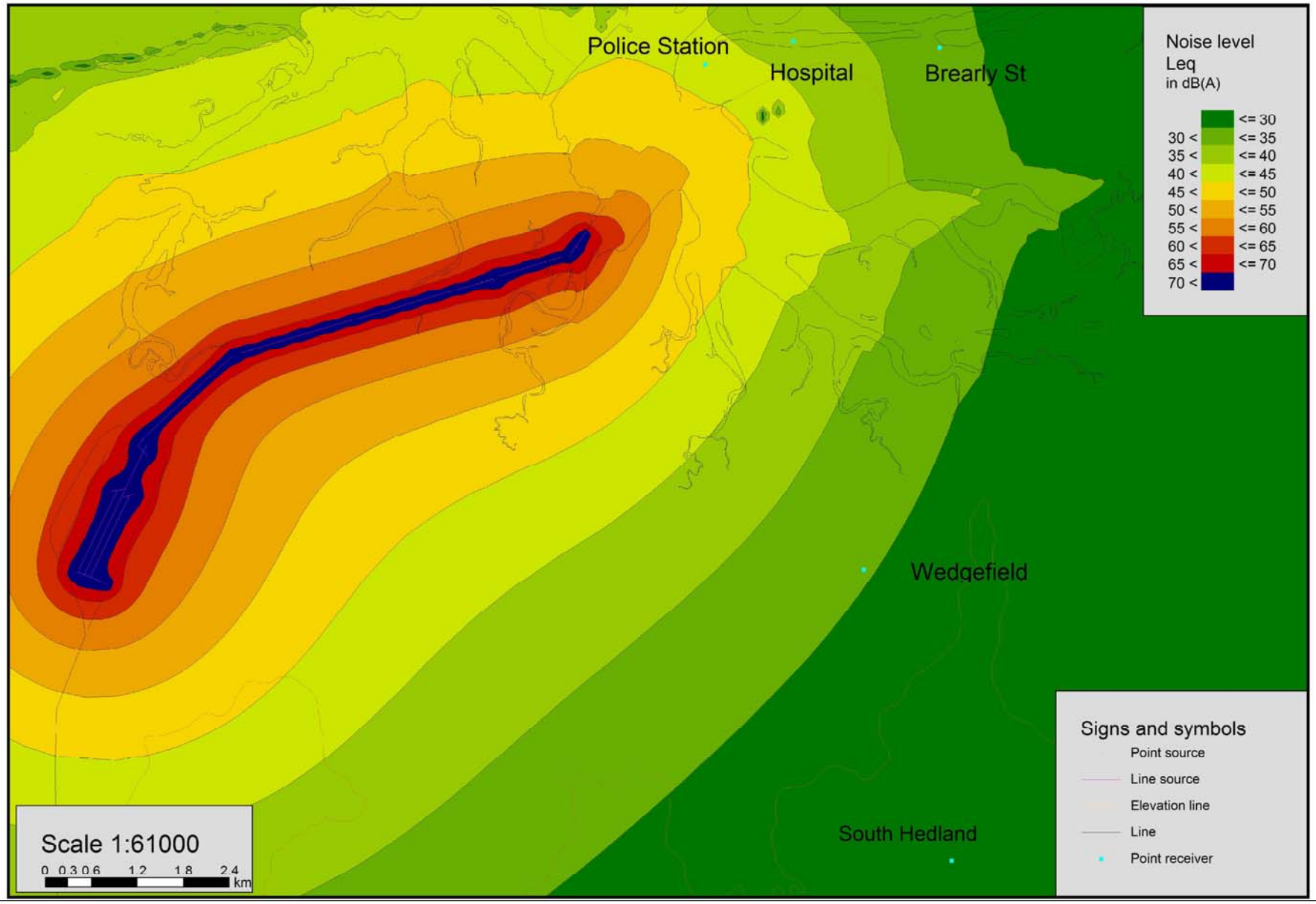
North West Infrastructure

NWI Landside Infastructure Project Environmental Referral

North West Infrastructure

Maximum predicted 24-hour PM_{10} ground level concentrations for NWI, RGP6, Outer Harbour, FMG, PHPA, and Roy Hill (µg / m^3)

Figure No: **22**



Source & Notes:
Noise contour image from SVT
NB: absolute scale is not correct due to resizing of image.

coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS013_v0_3
File Name: 8116_12EnvRef_F023_GIS

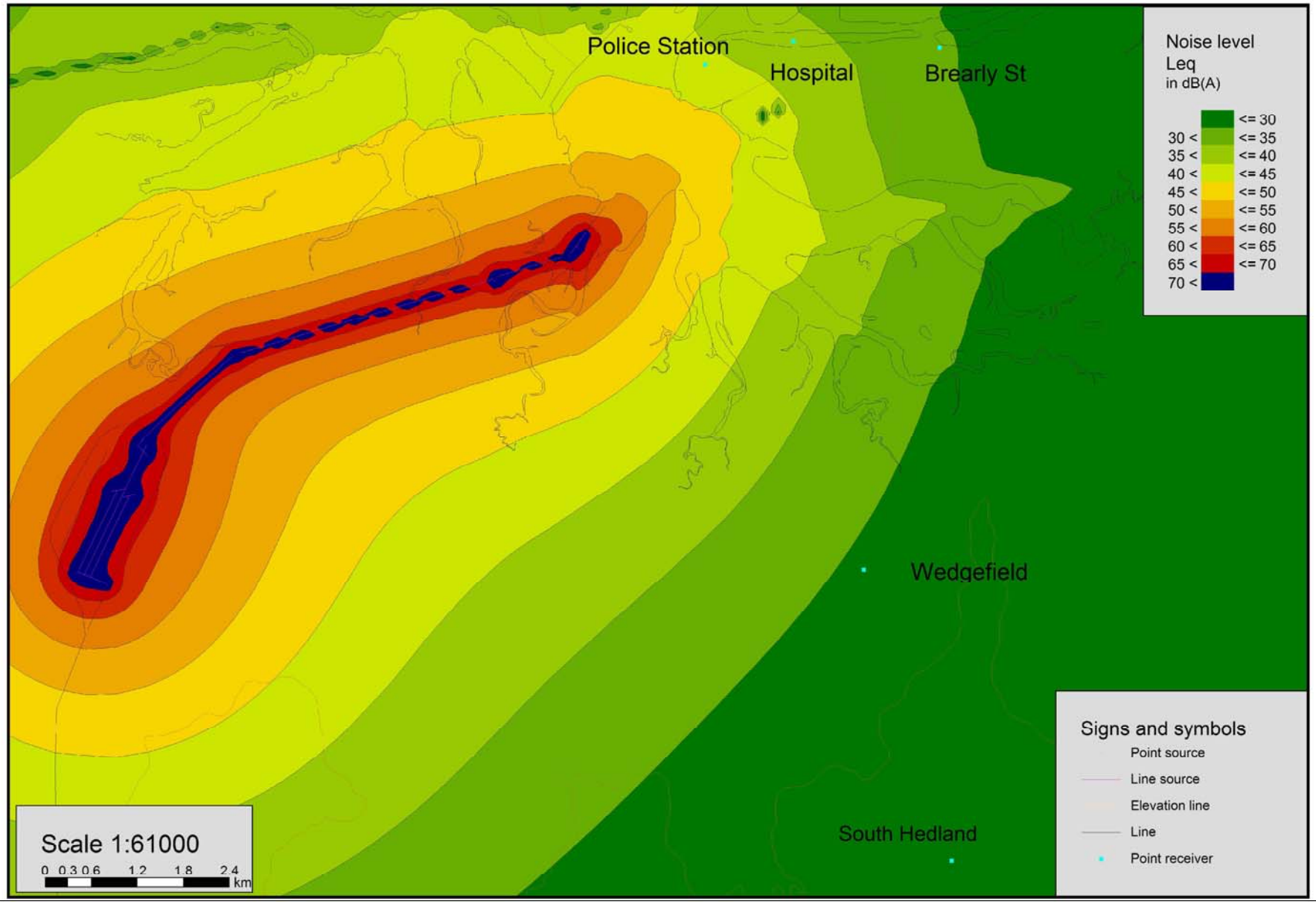
North West Infrastructure

NWI Landside Infastructure Project
Environmental Referral

North West Infrastructure

Noise Contours for NWI - Noise Contours Without Controls

Figure No: **23**



Source & Notes:
Noise contour image from SVT
NB: absolute scale is not correct due to resizing of image.

coffey environments

Date: 16.08.2011
MXD: 8116_12EnvRef_GIS014_v0_4
File Name: 8116_12EnvRef_F024_GIS

North West Infrastructure

NWI Landside Infastructure Project
Environmental Referral

North West Infrastructure

Noise Contours for NWI - Noise Contours with Control Implemented

Figure No: **24**

Appendices

Environmental Referral, North West Infrastructure Multi User Iron Ore Export (Landside) Facility

Appendices are provided on CD