



PROJECT SEA DRAGON STAGE 1 LEGUNE GROW-OUT FACILITY

EN-01-MP-EM4001


ENVIRONMENTAL MANAGEMENT PLAN

Rev: I, 24-Jul-2018

Project and Document Details

Proponent	Project Sea Dragon Pty ACN: 604 936 192
Project Title:	Project Sea Dragon Stage 1 Legume Grow-out Facility
Location:	Legume Station, Northern Territory
Report Title:	Environmental Management Plan
Document Ref:	EN-01-MP-EM4001
Date:	24-Jul-2018
Revision:	I
Author:	EMCA

Document Control and Authorisation

Revision	Description	Approved by	Signature	Date
H	Document submitted to regulators for review	Chris Mitchell - Managing Director		24-May-2018
I	Document amended based on feedback from regulators	Chris Mitchell - Managing Director		31-July-2018

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DECLARATION OF SUITABILITY

I certify that the information contained is, to the best of my knowledge and belief, true, accurate and complete, and that I have sufficient experience and qualifications to be able to assess the environmental risks associated with carrying out the licensed activity and to assess the adequacy of the EMP to facilitate compliance with the conditions of the relevant licences and approvals.

Signed



Full name (please print)

Marc Andrew Walker

Organisation (please print)

Environmental Management Compliance and Approvals

Date

25 July 2018

TERMS AND ABBREVIATIONS

AASS	Actual Acid Sulfate Soils
ASS	Acid Sulfate soils
ASTM	American Society for Testing and Materials
DIN	Deutsche Industrie Norm (standard)
EMP	Environmental Management Plan
EMS	Environmental Management System
NOI	Notice of Intent
NT EPA	Northern Territory Environment Protection Authority
PASS	Potential Acid Sulfate Soils
PDCA	Plan-Do-Check-Act
PL	post larvae
PSD	Project Sea Dragon
TPWC Act	Territory Parks and Wildlife Conservation Act (NT)
WQO	Water Quality Objective

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1. INTRODUCTION

1.1. PURPOSE AND SCOPE

This Environmental Management Plan (EMP) is the site specific EMP document for construction and operation of the Project Sea Dragon Stage 1 Legume Grow-out Facility, and exists under the Project Sea Dragon (PSD) Environmental Management System (EMS).

In this document, the term Project (capitalised) is defined as Stage 1 of the Legume Grow-out Facility.

The EMS Manual (EM-00-MN-0001) documents the overarching policies and procedures for the management of impacts on the environmental values for the whole of the PSD project, provides project wide commitments and details continual improvement measures. This EMP builds on these procedures by detailing the specific targets to meet the PSD project wide objectives mitigation measures and monitoring requirements, during the construction and operational phases.

The Environmental Impact Statement (EIS) and the Supplementary EIS (SEIS) includes detailed description of the existing environment assessment of impacts, and mitigation measures relevant to this EMP, which are summarised herein. This EMP is consistent with the Project scope outlined in Section 2, and has been prepared with reference to:

- NT EPA Guideline for the Preparation of an Environmental Management Plan (NT EPA, 2015)
- Commonwealth Environmental Management Plan Guidelines (DoE, 2014)
- AS/NZS ISO 14001:2004 Environmental Management Systems - requirements with guidance for use
- AS/NZS ISO 14004:2004 Environmental Management Systems - general guidelines on principles, systems and support techniques.

1.2. PROJECT SEA DRAGON OVERVIEW

Project Sea Dragon is a large-scale, integrated, land-based prawn aquaculture project in northern Australia designed to produce high-quality, year-round reliable volumes for export markets for Black Tiger prawns (*Penaeus monodon*).

The Project, including each of its components, has been designed in accordance with the Aquaculture Stewardship Council Shrimp Standard (ASC, 2014) and the Environmental Code of Practice for Australian Prawn Farmers (Donovan, 2013). It will also use husbandry practices that are well accepted by government and industry as outlined in the Australian Prawn Farmers' Manual (DPI&F, 2006).

Project Sea Dragon comprises of eight key components including:

Breeding Program Facilities

1. Founder Stock Centre and Back-up Breeding Centre (Exmouth, Western Australia)
2. Core Breeding Centre (Bynoe Harbour, Northern Territory)
3. Broodstock Maturation Centre (Bynoe Harbour, Northern Territory)
4. Commercial Hatchery (Gunn Point, Northern Territory).

Production Facilities

1. Grow-out Facility (Legume Station, Northern Territory) (this EMP)
2. Processing Plant (Kununurra, Western Australia)
3. Feed mill (Kununurra, Western Australia)

4. Export Facility (Initial stage(s) - Wyndham, Western Australia. Potential future stages Darwin, Northern Territory).

An overview of the integrated project is shown in Figure 1 and the location of key components in Figure 2.

The breeding, development and ultimate sale of prawns involves the following process:

- Capturing and selection of wild stock (the Founder Stock Centre)
- Developing and selecting high performing prawn stock (CBC and BMC) for use in the hatchery
- Commercial hatchery to develop prawns suitable for the grow-out facility (the Project)
- The grow out facility at Legume Station, to grow prawns to a size suitable for sale.

Prawns are harvested at Legume, and transported to the processing plant and then the export Facility for transport to markets. A feed mill is proposed to provide feed to the prawns once suitable scale has been reached. Stage 1 of the Legume Grow-out Facility comprises three grow-out Farms over 1,120ha and associated supporting infrastructure, and is described in more detail in Section 2.

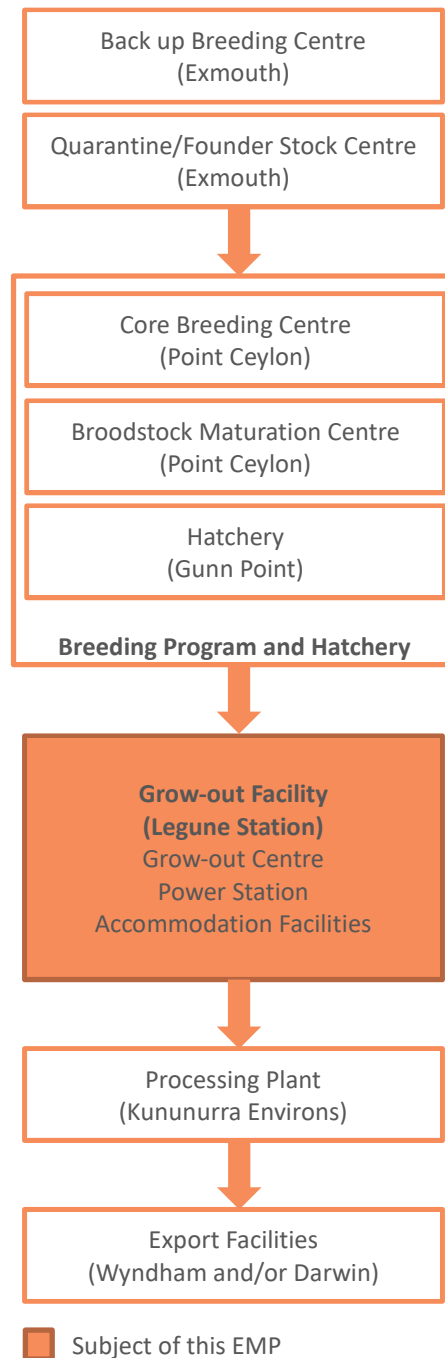


FIGURE 1 INTEGRATED PROJECT FRAMEWORK

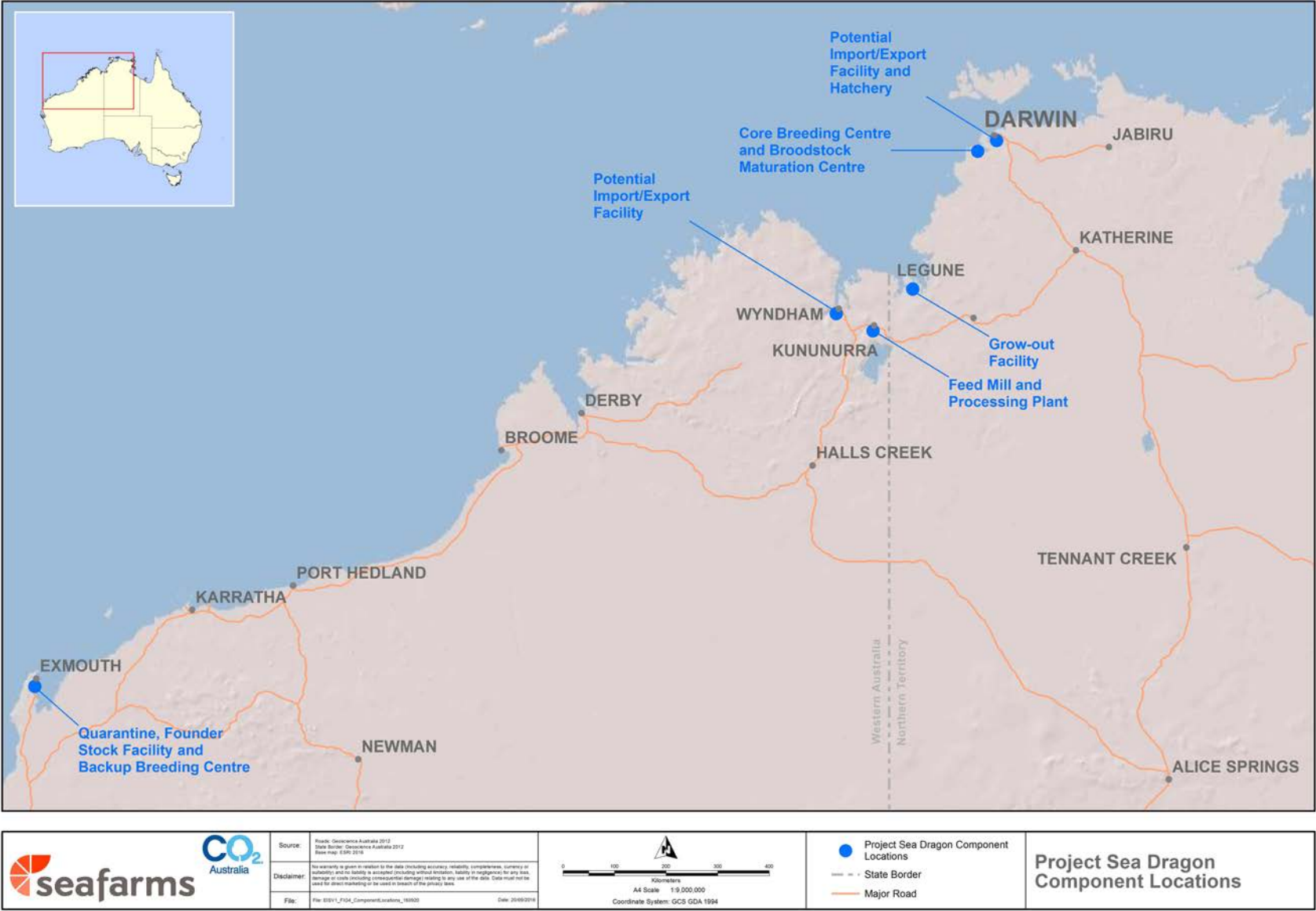


FIGURE 2 PROJECT COMPONENT LOCATIONS

1.3. EMS SCOPE AND FRAMEWORK

The EMS manual defines the overall management system components relevant to all sites, with additional site specific information contained in site specific management plans and documents. The system covers all actions and activities and achievement of policies, objectives and targets that are environmental in nature – natural environment, social and/or cultural heritage related issues.

The EMS documentation is organised into the hierarchy shown in Figure 1-3, implemented on a site by site basis guided by corporate level policy setting and common procedures and standards. Guidance documents are also provided within the EMS framework, but are not a required part of compliance with the EMS unless where specifically noted in EMS documentation. Refer to EN-RG-EM0901 Document Register in the EMS Manual which shows all EMS documentation, including this EMP.

Site specific documentation is nominated by site number, with this the Legume Station site being designated as Site 01.

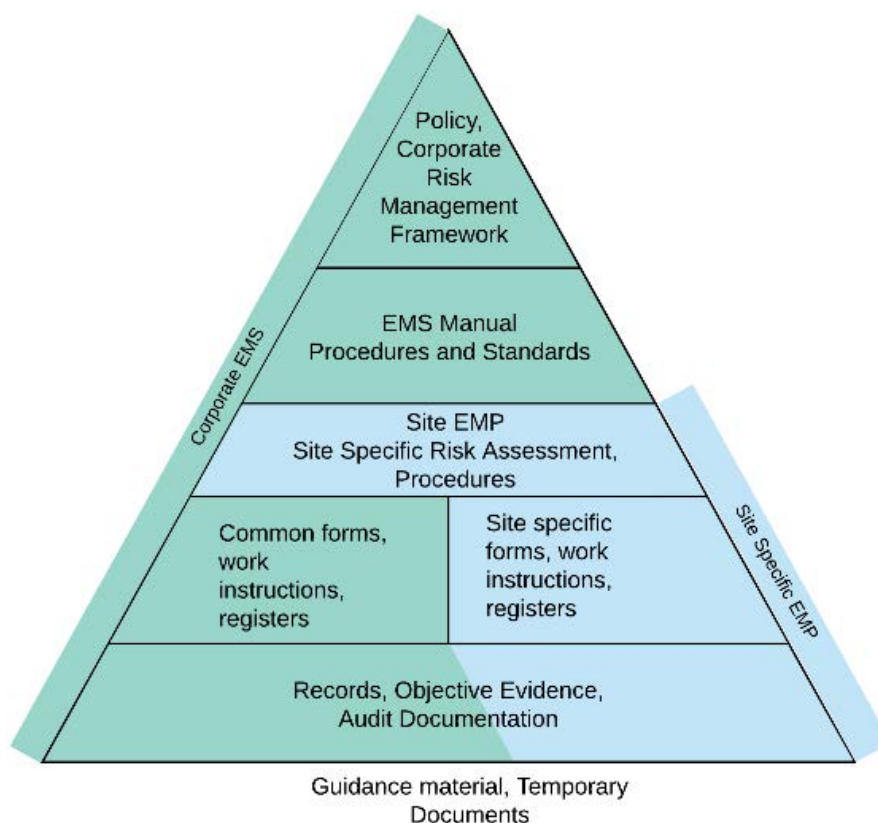


FIGURE 1-3 EMS FRAMEWORK

2. PROJECT DESCRIPTION

2.1. LEGUME STATION GROW OUT FACILITY - STAGE 1

The Project has been designed in accordance with the Aquaculture Stewardship Council Shrimp Standard and the Environmental Code of Practice for Australian Prawn Farmers. It will also use husbandry practices that are well accepted by government and industry as outlined in the Australian Prawn Farmers' Manual (DPI&F, 2006).

The main operations for Project Sea Dragon will be at the Grow-out Facility located on Legume Station, located approximately 106 km north-east of Kununurra near the western border of the Northern Territory. The Stage 1 Legume Grow-out Facility will produce nominally 14,000 tonnes of prawns per annum and consists primarily of the Grow-out Centre, plus the supporting infrastructure as illustrated in Figure 4. The Project layout is shown in Figure 5.

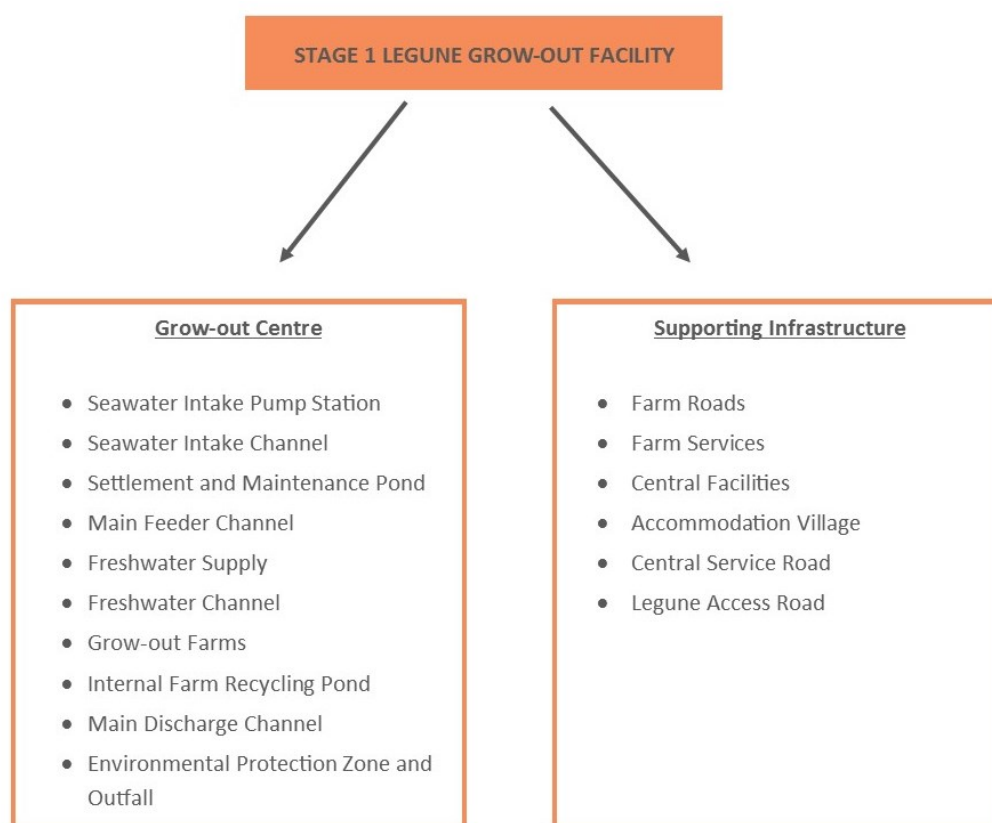
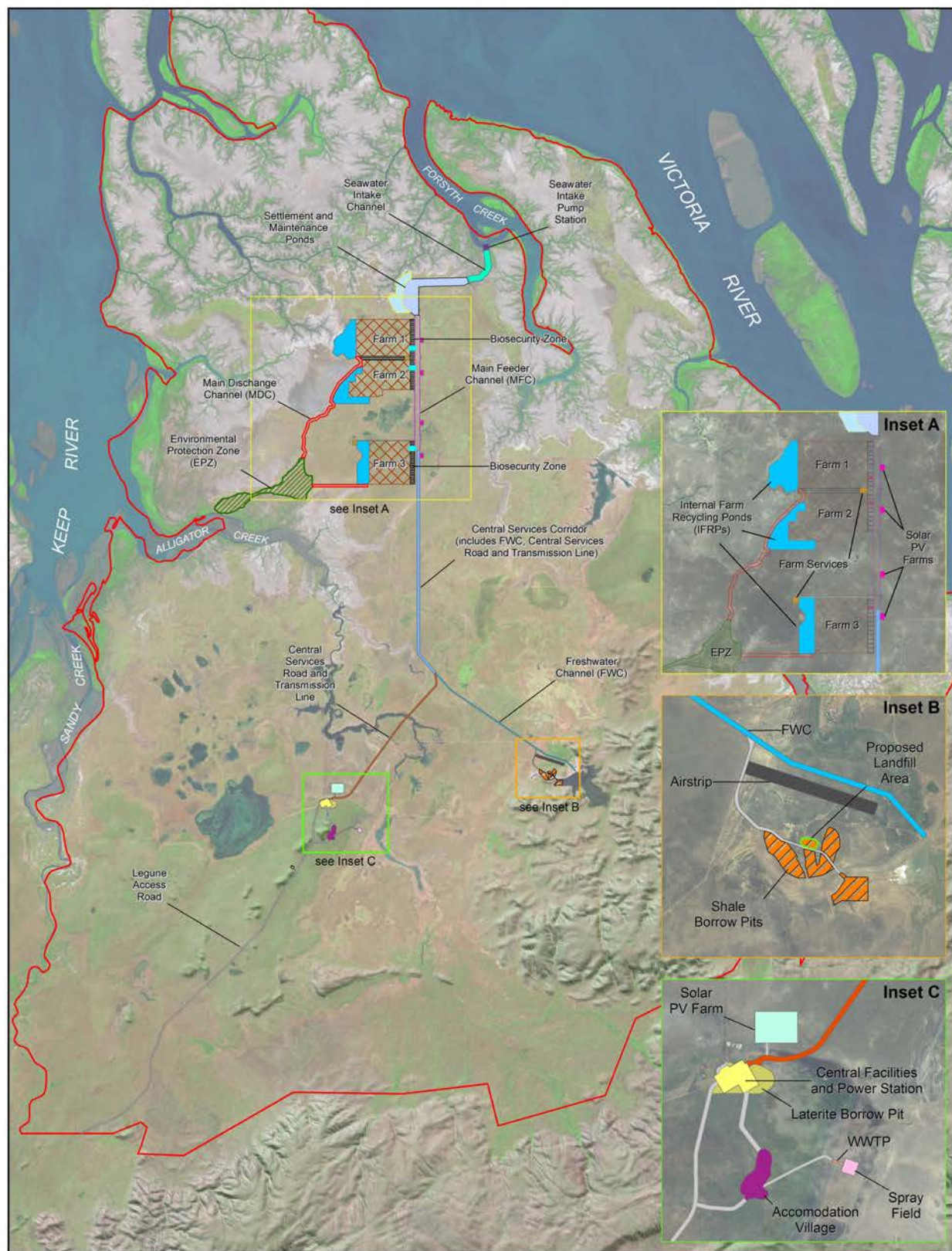


FIGURE 4 KEY COMPONENTS OF THE STAGE 1 LEGUME GROW-OUT FACILITY

Specifically, Stage 1 involves:

- Three farms with a total productive area of 1,120 ha, each consisting of up to 40 ponds, of 10 ha each. These are each serviced by feeder and discharge channels, an internal gravity fed Internal Farm Recycling Pond (IFRP) for storage, settlement and return of water to the farm feeder channel (FFC) for re-use, and supporting infrastructure



	<p>Source: Legume Station: NT Land Information Services 2015 Project Master Plan: Author: 2018 Legume Station: Author: 2005</p> <p>Disclaimer: No warranty is given in relation to the data (including accuracy, reliability, completeness, currency or suitability) and no liability is accepted (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damages) resulting in any way from the data. Data must not be used for direct monitoring or be used in breach of the primary uses.</p> <p>File: P101_0101_P101_ProjectMasterPlan_1010000 Date: 8/9/2018</p>	<p>At Scale: 1:250,000 Coordinate System: GDA 1994 MGA Zone 52</p>	<p> Legume Station</p>	<p>Project Master Plan</p>
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FIGURE 5 PROJECT LAYOUT

- A common water intake, comprising pump station and intake channel at Forsyth Creek for seawater supply, rotating drum filters to screen the intake, a settlement pond, a Main Feeder Channel (MFC) and a freshwater channel (FWC) (freshwater will be sourced from the existing Forsyth Creek Dam).
- A Main Discharge Channel (MDC), feeding into an Environmental Protection Zone (EPZ) - a wide, shallow retention area designed primarily to control outflow timing and velocity, but also to allow settlement of suspended solids and nutrient reduction before outfall to Alligator Creek
- Project supporting infrastructure, including:
 - Accommodation, offices and laboratory
 - Vehicle wash bays, workshops
 - Stores for fuel, oil, chemical and liquid waste (oil and chemicals) and feed inputs
 - A potable water treatment plant
 - Wastewater Treatment Plants (WWTP) and Land Application Areas (LAA), comprising one system for Central Facilities, and another larger system for the Central Village, plus small systems for the farm services areas
 - A landfill for putrescible and non-putrescible waste, constructed in a depleted gravel pit
 - Drainage and flood mitigation works, such as culvert and drainage channels
 - A central diesel power station, consisting of dual fuel generators and distributed solar PV generation
 - An overhead transmission line to transmit power to the farms and pump stations, distribution switchyards and step down transformers. Critical loads such as the pump stations will have self-contained standby diesel generating sets located adjacent to the Motor Load Centres.
 - All weather, unsealed gravel-sheeted in-farm access roads to and from the ponds, and unsealed access tracks to connect farms with other facilities

The main Project area is the Grow-out Centre, which will be situated on the estuarine-deltaic plain of Legume Station (i.e. the floodplain, above 4.5-5 m AHD), utilising the largely grassed areas currently used for cattle operations. The Grow-out Centre will be constructed on these areas to provide flood immunity, storm surge and sea level rise immunity, and to avoid the coastal erosion plain (nominally below 4.5-5 m AHD) containing wetlands, potentially acid-sulfate soils, and areas of environmental, heritage and cultural sensitivity.

Section 2.2 and 2.3 below summarise the construction and operational phases of the development, described in more detail in Volume 1, Chapter 3 – Project Description, of the EIS.

2.2. CONSTRUCTION

Early preparatory works are proposed to begin in the 2018 dry season, with substantive construction activities commencing early in the 2019 dry season. However, this is dependent upon receiving Final Investment Decision and all necessary secondary for the Project. It will involve site establishment, earthworks and construction, and site commissioning. Additionally, the commencement and duration of construction will be heavily influenced by wet season constraints and the provision of road infrastructure by the WA and NT governments outside of the Project footprint.

2.2.1. Site establishment

Site establishment will involve preparing the site for earthworks to commence, involving laydown areas, access roads, construction accommodation facilities and similar works. Two laydown areas will be developed and construction of linear or distributed infrastructure (service corridor, roads, etc.) will be developed using the appropriate laydown and service areas, with minor storage of raw materials along the route as required.

Basic amenities, wash bays, wastewater treatment systems, potable water treatment plant, diesel power station, waste storage, spill management, fuel storage, chemical/oil and supply/equipment storage areas will also be developed at this time and unsealed access tracks will be upgraded where required to obtain access to all construction areas.

2.2.2. Construction works

Following site establishment, construction of the Grow-out Centre and the supporting infrastructure will commence.

2.2.2.1. Grow-out Centre

- The farm areas will be control burned of pasture prior to commencement of earthworks, and the few trees removed
- Ponds, channels and berms will be constructed via a cut-to-fill operation to the designed levels
- The embankment walls for the ponds and the channels will be above-ground earthen structures. Farm walls will be ~2.0m above the natural ground level. Embankment walls for channels will be ~1.0- 5.0m above natural ground level
- Ponds and channels will not be lined with any other materials, as the surface soils (the black clay soils on the estuarine-deltaic plain) provide the impermeability needed to retain the water for operations
- Batter slopes will be designed to be suitable to obtain the required stability and re-vegetation of the batters will be encouraged by seeding with grasses to assist in achieving stability
- The tops of most berms will be sheeted with roadbase material and compacted for maintenance access, or where relevant will be incorporated into the site access roads (such as the central service road)
- Procedures will be followed to provide for appropriate management of PASS material that may be encountered, to avoid oxidation and acid production
- The intake will utilise a piling rig to install the required piles for the structure, with access to the site will be via an earthen access ramp from the floodplain out onto the coastal erosion plain to Forsyth Creek (reclaimed after use)
- The EPZ will be constructed on the estuarine-deltaic plain by placing minor bunds to direct flow within the EPZ where required
- A weir will be constructed at the outfall to Alligator Creek to guide the flow from the EPZ.

The major equipment utilised during the construction of these elements includes:

- Earthmoving equipment (Laser buckets, tractors, scrapers, trucks, excavators, compactor, graders, dozers, water carts)
- Cranes
- Trucks (delivery of materials, bitumen top-coat).

Once the earthworks have been completed for each area, construction of the associated structures (inlet, outlet, filters, culverts, on- farm facilities, electrical and controls, trenching) for that area will commence.

2.2.2.2. Supporting Infrastructure

In-farm access roads will be constructed on the trafficable bunds forming the ponds, channels and IFRPs.

Other works include the outlet to the existing dam on Forsyth Creek Dam, which will be modified to provide for seasonal control of outflows, by an additional valve and modified weir box on the downstream face of the wall.

Borrow pits on the site will be used for roadbase, and other construction materials.

The Central Facilities, Farm Services and the Accommodation Village will comprise vegetation clearing and bulk earthworks, followed by underground services, concrete foundations, building placement or erection, building fitout, electrical and controls and finishing civil works. Buildings will be prefabricated, transportable buildings that will come to site broken down in transportable sized units and then assembled on site.

A landfill will be established on the site at the location of the existing borrow pits near the Legume Station homestead. This, and the establishment of the Hazardous Waste Facility, and the Waste Transfer Facilities, will occur as soon as practicable during construction, to minimise issues with waste handling during construction.

2.3. OPERATIONS

Project Sea Dragon will grow black tiger prawns (*Penaeus monodon*) bred in an in-house captive breeding program. The prawns will be delivered from the commercial hatchery, proposed to be located in the Darwin environs, to Legume by truck, and stocked into the Grow out Ponds located in the Grow-out Centre, comprised of the three farms and associated services.

The flow of water through the Grow-out Centre is illustrated in Figure 6, from the supply of water through the intake channels, recirculation within the system, to the subsequent discharge of water at the outfall into Alligator Creek. Ponds are fed by the Pond Feeder Channel, which takes seawater from Forsyth Creek (after settling), freshwater from Forsyth Dam, and recirculated water from the Internal Farm Recycling Pond (IFRP). The water is conditioned to achieve the correct pH balance and mix of pond biota (chiefly algal species) before being stocked with juvenile prawns.

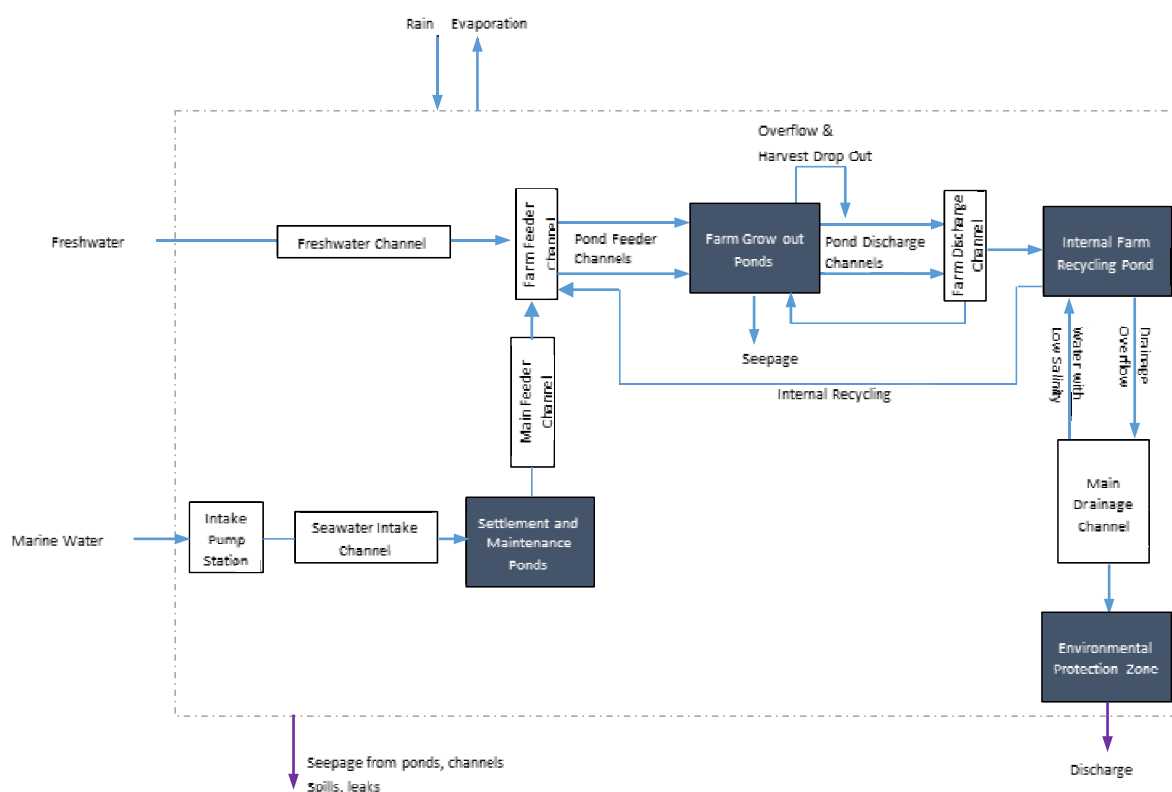


FIGURE 6 GROW-OUT CENTRE FLOW DIAGRAM

Water quality is controlled by:

- internal exchange (recirculation) of farm water via the IFRP to manage pond water nutrient levels and microalgae growth
- application of sea water and fresh water (from the Main Feeder Channel and the Freshwater Channel) to manage pond volumes and salinity levels
- drainage of water from the farms to the Main Discharge Channel to manage pond volumes and salinity levels
- aeration to manage levels of dissolved oxygen in the water

Prawns are fed a formulated feed diet to optimise growth and animal health, supplied by feed trucks equipped with blowers. Several times per day a truck will drive around each pond perimeter and project the prawn feed up to 20 – 30 m in from the edge of the pond. The feed sinks to the pond bottom where it is eaten by the prawns. The amount of feed eaten by the prawns is monitored to minimise feed wastage, and the feeding regime is continually updated to reflect prawn feeding requirements and behaviour.

Harvest involves draining the pond via the outlet structure. The bottom of the pond is shaped and sloped to allow harvest drainage within a 12 hour period. While water can recirculate within the farm, prawns are confined to the pond they are stocked in. Prawns are grown to marketable weight (typically 20+ grams) and harvested.

The water flow carries the prawns into the outlet structure where they are captured in a cage at the drainage point, lifted with a fish pump into a dewatering tower, and then deposited into ice slurry. The ice slurry both euthanizes and preserves the prawns for transport to the Processing Plant.

After harvest, the floor of the pond may be dried out as a fallow measure. This allows the pond floor to be cleaned, the soil conditioned with application of lime, and drainage grades re-cut for the next crop. The centre mound of pond spoil, generated from silt, algal matter and prawn faeces, can also be removed from the pond to a remediation stockpile. This material, with its high levels of organic material, can be used to help revegetate pond banks once leached of salt.

Supporting infrastructure and services will include:

- Farm services, Central Facilities and Accommodation Village:
 - The functions to be carried out at the Central Facilities broadly include: harvest equipment storage and maintenance; harvest handling; vehicle washing and maintenance; slurry ice-making; equipment maintenance and warehousing; power generation and switchyard; energy storage and fuel dispensing; management, administration, fire, security, safety and paramedic; communication and systems controls; security and biosecurity control and laboratory
 - two Farm Services areas will be constructed to service Farms 1, 2, and 3. Each farm services area includes administration; accommodation and laboratory buildings (manager's house, short-term accommodation units, common mess and living areas for day and night shift staff, administration office and laboratory); a wash bay for vehicle washing between biosecurity zones; workshops for light farm vehicles and aerators; fuel, chemical, molasses and other material and waste stores; transport of post larvae tub storage; a wastewater treatment facility and spray field for discharge of treated water; potable water treatment and storage, for human consumption electrical substations
 - the permanent Accommodation Village will be located approximately 1 km south of the Central Facilities comprising: accommodation units; mess, wet mess and the recreation building; laundry units; central toilet facilities and BBQ areas.
- An integrated waste management system, comprising:

- ▣ distributed waste receptacles and some sorting of waste at source
- ▣ A Waste Transfer Facility, located at the Accommodation Village, and used to further sort waste prior to disposal at landfill or removal off-site (for recycling, reuse, or disposal)
- ▣ An on-site landfill, for the disposal of general (non-recyclable) and putrescible waste.
- ▣ Wastewater management, including:
 - ▣ oil-water separator waste, and other liquid chemical waste which will be stored in the Hazardous Waste Facility before removal off-site, or removed directly from the sump or separator system off-site
 - ▣ effluent from farm services, Central Facilities, or Accommodation Village, which will be treated by on-site package treatment plants and irrigated into designated land application areas.
- ▣ Storage of chemicals and other hazardous materials in dedicated, spill proof (bunded, and depending on size roofed) stores. Minor quantities will be stored in accordance with AS 1940—Storage and handling of Flammable & Combustible Liquids.
- ▣ Airstrip - allowance has been made to extend the length of the existing unsealed runway to handle larger turbo-prop aircraft, in the event that flights to and from Kununurra and Darwin are justified.

3. OBJECTIVES AND TARGETS

The overarching Project environmental objectives and targets are provided in the EMS, which have been adopted for the Stage 1 Legume Grow-out Facility. Each of the environmental strategies provided in Appendix C to this EMP adopt and extend on these overarching Objectives and Targets.

4. IMPLEMENTATION

This EMP has been prepared as a sub-plan under the overarching PSD Environmental Management System (EMS). The PSD EMS Manual (EM-MN-EM4001) details general EMS and EMP implementation including:

- Risk Assessment
- Relevant Legislation and Statutory Requirements
- Roles and Responsibilities
- Training and Awareness
- Communication
- Supplier and Sub-contractor Management
- Monitoring and Review
- Non-compliance and Corrective Action
- Complaints Management
- Documentation and Records
- Reporting.

The following site specific elements have been prepared to supplement the above:

- A risk assessment has been conducted specific to the development and design of the Legume Station Grow Out Facility Stage 1, in order to define site and phase specific risks, and develop appropriate mitigation and management measures. This is shown in Appendix B.
- The Legislation and Approvals requirements are summarised in the legislation register for the site in Appendix B.
- Roles and responsibilities specific to this site have been provided in Appendix A.
- Monitoring requirements are shown in the Environmental Management Strategies for each element in Appendix C. These will be used in conjunction with the EMS monitoring and review requirements to prepare a site and phase specific monitoring and review schedule (refer to Monitoring and Review register in Appendix D)
- Complaints Management will remain as per the EMS Manual, with the inclusion of site details for lodgement of complaints, to be updated prior to works starting and as any changes occur.

5. SOCIAL AND ENVIRONMENTAL CONTEXT

5.1. OVERVIEW

The EIS provides a detailed overview and assessment of the existing environmental and social aspects, potential impacts, and mitigation measures, in Volume 2 – Environmental Assessment. This Section of the EMP summarises the key social and environmental context of the Project, including the key potential impacts.

5.2. ENVIRONMENTAL CONTEXT

5.2.1. Significant Sites or Features

Legume Station is bordered by the Keep River to the west, and Victoria River to the east, with the Project footprint situated within the Legume Coastal Floodplain Site of Conservation Significance.

The Legume Wetlands are also situated on Legume Station, and are recognised as a Nationally Important Wetland. The proposed services corridor and one of the proposed roads intersect the Legume Wetlands. Other significant natural features include seasonal / intermittent freshwater lakes and ponds, and swamps, floodplain lakes and ponded pastures; and the northern territory coastline.

Assessment of these features is detailed in the EIS, Volume 2 - Environmental Assessment, and summarised in Section 5.

Other nearby sites or features that will not be impacted by the Project, but that were considered include:

- The Keep River National Park, located 80 km southwest of the Project, with an extension proposed that would extend it to be approximately 17 km south of the nearest Project element
- The Spirit Hills Wilderness Conservation Area, which falls within the Keep River National Park extension
- The Joseph Bonaparte Gulf Marine Reserve, around 25km seawards from Turtle Point
- World Heritage Properties (nearest 250km south west) and National Heritage Places (nearest 130km west)
- No public or private reserves are located within or near the Project area, and the area is not designated as a conservation zone under a planning scheme
- The project area is not mapped as a storm surge zone.

5.2.2. Climate

The climate is tropical monsoonal, consisting of two predominant seasons:

- The dry season (April to September) influenced by easterly winds generated over inland Australia, resulting in dry and warm conditions, with very little rainfall and low relative humidity.
- The wet season (October to March) influenced by high humidity and thunderstorm activity caused by steady west to north-west winds, bringing moisture and consequent rainfall from the Timor Sea.

The closest long-term weather station to Legume is Timber Creek (BOM Station No. 014850) located 135 km south east of Legume. Temperature and rainfall statistics from the Timber Creek weather station are presented in Figure 7. Evaporation from the Victoria River Downs weather station (BOM Station No. 014825) is also shown (the closest available evaporation data).

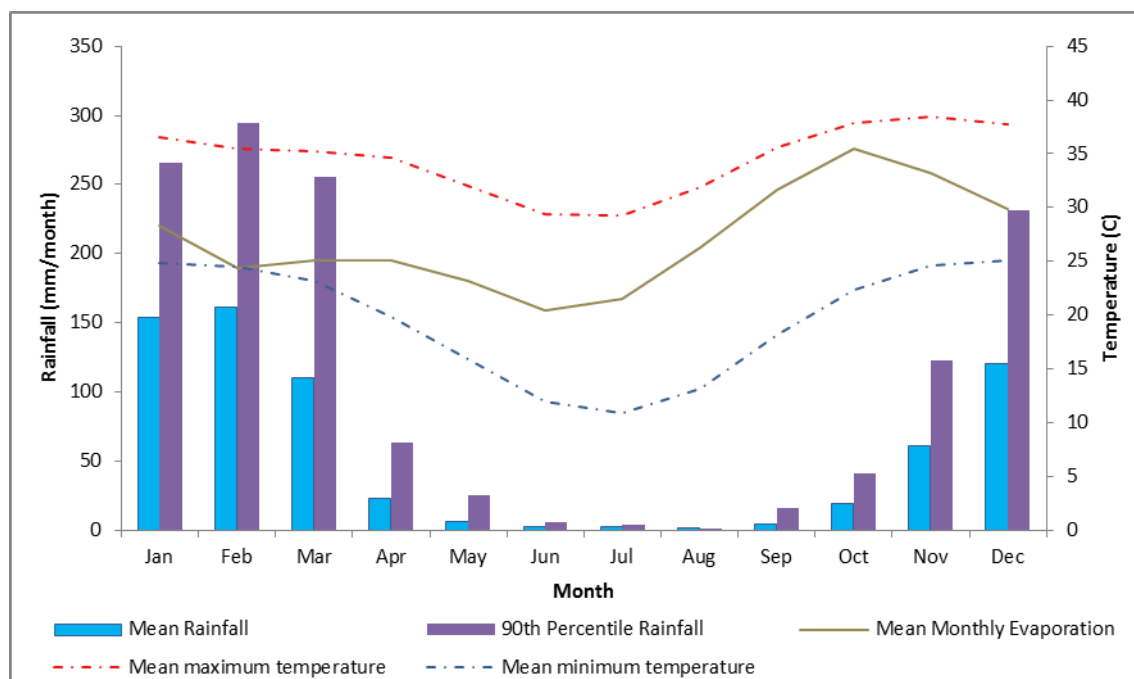


FIGURE 7 MONTHLY CLIMATE STATISTICS, BOM STATIONS 014850, 014825

5.2.3. Geology, Geomorphology and Soils

5.2.3.1. Existing Environment

Legune Station is located at the junction of two geological basins – the Bonaparte Basin in the north and west of Legune (where most of the Project is located), and the Fitzmaurice Basin in the south east. The surface geology of Legune Station is comprised primarily of the Cockatoo, Langfield and Kulshill Groups, with the Legune Formation present as the Legune Range, in the southeast of Legune Station, associated with Forsyth Dam.

In terms of soils and landforms, the Project footprint traverses four plain ‘tiers’, as it moves from north to south across Legune Station. The plains extend from the delta between the mouths of the Keep and Victoria Rivers to the foot of the Legune ranges and Spirit Hills, with the land systems and soils characterised as below:

- The Coastal plain, an area of tidal flats and low closed mangrove forest / samphire forbland vegetation, between sea level up to 4.5-5 m AHD. Soils are hydrosols - poorly drained silty clays and muds. Only the intake structure, intake channel, and part of the discharge structure are located on this plain
- The Estuarine Deltaic Plain, located between 4.5-5 m and 10 m AHD, with scattered residuals up to 30 m, comprised of poorly drained clay soils (Vertosols - self mulching cracking clays) with sandstone residuals, and grassland, open woodland and wetland/swamp areas. This area contains freshwater and tidal estuarine systems, typically saline shallow groundwater (~2-3m depth) and some deeper productive bores. The bulk of the Project infrastructure is located on this plain.
- The Coastal Erosional Plain is characterised as lateritic plains and rises, situated between 10 and 50 m AHD, with residuals rising to 100 m. Soils are Tenosols - Deep red and yellow sands and sandstone residuals, with Sclerophyll woodland, and minor wetland areas around playas. Only the Central Facilities, Accommodation Village and Legune Access Road are located in this land system. Minimal surface water systems are in proximity, although some productive or potentially productive bores are located in the vicinity.

- The Legume Access road traverses a fourth plain system, known as the Flood-out Plain. This plain is located below the Ranges and inland from the Coastal Erosional Plain, representing washout and deposition from local river systems. It is comprised of Hydrosols - Yellow podzolics and yellow earths (sandy clay loam, sandy loam).

The Ranges are located as the backdrop to the above systems, with only the Forsyth Dam, some borrow pits and scattered residuals being included in this land system. Soils are Lithosols, shallow sandy soils and rock outcrop on sedimentary rocks. Some productive groundwater bores, and surface freshwater systems are located in proximity to the works.

5.2.3.2. Acid Sulfate Soils

The Northern Territory Acid Sulfate Soils Risk 1:2M spatial mapping identifies most of the site within the medium risk area for Acid Sulfate Soils (ASS). Areas within the mapped high risk areas include the inlet, sediment pond and maintenance pond in the north, and the Main Discharge Channel (MDC) from farms 1 and 2, the Internal Farm Recirculation Pond (IFRP) in Farm 2 and the Environmental Protection Zone (EPZ).

The airstrip, dam and borrow pit, and the road south of the central facilities and the associated borrow pit are mapped as no risk, though the central facilities area itself is in the medium hazard area.

Sampling has shown that widespread and shallow Actual Acid Sulfate Soils (AASS), being ASS that have oxidised and are producing acidic leachate, are not present at the site, in the areas investigated. Results do confirm the presence of Potential Acid Sulfate Soils (PASS - could potentially oxidise) at a number of locations at or below 2.5 - 3m depth below ground level. In relation to reduced levels (relevant to Australian Height Datum, AHD) this equates to:

- ~1.3m AHD at the location of the intake channel and settlement/maintenance ponds, and the edges of the farms (soil site was northwest of Farm 1), where excavation is anticipated to end more than 2 metres above the PASS in this location, at ~3.7m AHD
- ~2.4m AHD along the MFC, with excavation expected to extend to no lower than 4.7m AHD, which is 2.3 m above the PASS in this location
- PASS material was encountered at 1.7 - 2.7m AHD within the farm areas, and an implied level from the MFC and a site northwest of farm 1 at 1.3 - 2.4m AHD. Excavation is expected to extend to no lower than 4.2m AHD, thus will be at least 1.5 m above any PASS material

Generally, this indicates that PASS is likely present across the site, but is below the level of proposed excavation at ~1.3 m AHD along the Coastal Plain / Estuarine-Deltaic plain boundary, and up to ~2.7 m AHD within the Estuarine-Deltaic plain. Specifically, the farm discharge channels (PDC and FDC), where the deepest excavations will occur, have been hydraulically designed by width, slope and depth (and hence farm shape) to avoid PASS and to minimise construction cost.

Results also indicate that where PASS was found, it naturally has sufficient Acid Neutralising Capacity to result in no Net Acidity (i.e. no chance for PASS to produce acid leachate or runoff), based on groundwater records and soil sampling results (this needs confirmation on a case by case basis).

5.2.3.3. Soil Salinity and Sodicity

Sampling and site observations on Legume Station indicate that the soils in the region of the proposed farm infrastructure and much of the Estuarine-deltaic and Coastal Plains, are saline-sodic, evidenced by elevated salinity and Exchangeable Sodium Percentage (ESP), although sodicity is somewhat patchy and does not show a clear pattern, other than stronger associations closer to the Coastal Plain. Sampling also indicates that some soils are potentially dispersive, though this is also relatively patchy.

The saline and sodic nature of soils in this area are a direct result of marine influence on these plains, which are subject to alternating drying out and large freshwater pulses onto, over, and through soils each wet season. Salinity profiles indicate generally increasing salinity with depth associated with a shallow, saline groundwater table, and relatively rapid leaching of salts through the profile. This is sourced from both tidal waters and saline deposits (from geologically recent deposition).

More generally, site soils appear naturally habituated to the salt/fresh cycle, without apparent breakdown. In particular, site investigations found no evidence of current dispersion or breakdown of sodic soils, even in areas that have previously been excessively worked such as turkey nest dams, embankments, roadways and channels.

5.2.3.4. Contaminated Land

Potentially contaminating past activities on the site include an operating landfill near the Legume homestead, cattle yards and one known cattle dip, all located outside of the Project footprint. Waste infrastructure on the site is limited to the existing landfill, off-site removal of other wastes, and the potential for unexpected findings of residual waste materials during construction, as a result of the long history of pastoral operations on the site. However, a site contamination assessment did not identify any residual contamination within the Project footprint.

5.2.3.5. Environmental Values

The key environmental values are:

- The ability of undisturbed land systems to be self-supporting, sustainable and stable soil-vegetation systems
- The ability of the soils and landforms to provide a stable landform and infrastructure, both during construction and post-construction
- The in-situ topsoils as a resource for land stabilisation and rehabilitation
- Ability of the land to continue to support pastoral uses during operation of the Project
- Post-Project beneficial landuses, notably pastoral uses

5.2.3.6. Potential Risks and Impacts to Environmental Values

Based on the above, the key potential risks can be summarised as:

- Direct disturbance of soils and landscapes through earthworks and traffic
- Soil erosion from vegetation clearing and batter / channel works, and bare or imperfectly stabilised surfaces
- Disturbance and oxidation of acid sulfate soils
- Soil contamination from leaks and spills, treated effluent land application areas
- Soil structural decline from working and exposure of sodic sub-soils, treated effluent land application areas
- Salinization and sodification of soils subject to saline Project waters (ponds, farm channels)
- Revegetation problems with poor rainfall infiltration and soil structure for plant root growth
- Instability, settlement / consolidation, and poor trafficability from weak soils or unsuitable embankment, berm and supporting materials
- Deterioration of in-situ concrete structures and footings from aggressive soils
- Sterilisation of potential economic mineral resources.

Dust generation and management is further discussed in Section 5.2.12 (Air Quality). Design has been undertaken in regards to geotechnical constraints, and is detailed in the EIS, Volume 1, Chapter 3 - Project Description.

5.2.4. Hydrology

5.2.4.1. Freshwaters and Floodplains

Freshwaters of Legume Station largely comprises freshwater creeks, Osmans Lake, ephemeral wetlands, spring-fed waterholes and man-made dams. The Forsyth and Alligator Creek catchments are the two major waterway catchments of the site. The floodplain hydrological conditions of both catchments have been substantially modified over time as part of the pastoral operations. Alligator Creek is bunded at several locations, and both Forsyth and Alligator Creeks are bunded such that there is no connectivity between the freshwater and estuarine reaches in the dry season. Since 2006, rainfall from the Forsyth Creek headwaters has been captured by Forsyth Creek Dam. The dam has altered the natural hydrology of the system, capturing wet season rainfall that would normally reach Forsyth Creek, and modifying dry season conditions through an annual release of water within both Forsyth and Alligator Creek catchments.

In the wet season, much of the lower plains (estuarine-deltaic plain and lower) are inundated, and as such the freshwater water bodies of the area are characteristically ephemeral, filling in the wet season and drying out in the dry season. While there are extensive floodplains in the wet season, in the dry season, surface water is confined to the bunded areas of Alligator Creek, small channels, billabongs and swamps. With the exception of the bunded areas of Alligator Creek, these water bodies gradually evaporate, becoming stagnant and commonly drying out. Storms in the early wet season result in turbid 'flushes' from surface run-off from the catchment, from stagnant pools in the riverbed, and from previously dried up water bodies. These flushes are further characterised by high concentrations of decayed organic matter, high bacterial pollution and low oxygen content, often resulting in a rapid deterioration of water quality and fish deaths.

A water quality sampling program was implemented between June 2015 and March 2016 to establish the baseline water quality across the site and to allow for future assessment of Project construction and operation on freshwater water quality. The results of the baseline sampling program showed water quality in the creeks on Legume Station was relatively poor and characterised by low dissolved oxygen (i.e. lower than the Australian Water Quality Guidelines), high turbidity and high nutrients in the dry and pre-wet seasons. In Forsyth Creek Dam water quality was poorest in the pre-wet season, with low dissolved oxygen and higher nutrients at this time. Water quality in the ephemeral wetlands was poor to moderate, and characterised by low dissolved oxygen and high turbidity, particularly in the remaining water in the dry season.

Direct impacts from the Project could include intersecting drainage lines and causing changes to flooding, flowpaths, flow velocities and volumes, and providing barriers to fish movement. These will generally be minor drainage lines, other than a crossing of Alligator Creek. However, all affected areas will be subject to culverts and floodways to mitigate any changes, and, with these in place, no significant changes are expected to floodplain hydrology.

The Project will also require that the Forsyth Creek Dam water be used solely to support farming operation. As such, the releases from Forsyth Dam that have occurred in the dry season for the past 10 years will to support pastoral operations will no longer occur, leading to a return to more natural dry season conditions in catchments that have received this water in the dry season.

In regard to freshwater quality, given the existing poor water quality of Legume Station and the implementation of the mitigation measures outlined in this EMP, it is concluded that construction and

operation of the Project will not further impact the freshwater water quality within the Project Area and its surrounds.

5.2.4.2. Estuarine and Marine Waters

The Project site is located in the lower part of Joseph Bonaparte Gulf, a relatively shallow marine area with a coastline dominated by sand banks, extensive mudflats, mangrove systems, tidal creeks and the estuaries of the Victoria River and Keep River systems. In the Joseph Bonaparte Gulf generally:

- Estuaries are well-mixed, macro-tidal (tides > 4m), with little or no vertical water column stratification
- There are extensive shifting unvegetated intertidal flats dominated by relatively fine sediment material
- The waterways typically experience high levels of bed and bank erosion due to strong tidal and wind generated currents
- Water is extremely and chronically turbid due to the large tides (~8 m) and periodic flow of sediment-laden water from the Victoria and Keep Rivers.
- While nutrient concentrations can be relatively high, the concentration of chlorophyll a (an indicator of phytoplankton biomass) and the phytoplankton count are relatively low.
- In the wet season, freshwater lenses may develop above the saline estuarine water, and variations between tidal cycles may be greatest, as there will be the greatest potential for interaction between fresh and tidal waters.
- Estuaries are typically lined with mangroves and extensive areas of hypersaline saltmarsh and saltflats. These flats tend to trap terrigenous sediment

The Project is intimately associated with the marine environment surrounding the site, with the inlet taking water from Forsyth Creek, treating it and using it in the farms, and discharging (again treated) water through the EPZ to Alligator Creek.

In general, Forsyth Creek has a meandering channel form, comprising a single main channel with smaller tidal creeks joining along its length. At the proposed intake location on Forsyth Creek, this changes to split into a series of channels forming a more braided morphology along this 3 km section. Upstream of the divided channels, the creek reverts to a single flow path, however the channel centreline follows a more meandering form than the downstream channel indicating lower current speeds are present.

The intake is to be located on the outside bend of the southern channel, which is significantly deeper than the central or northern channels and conveys the majority of the flood and ebb tide flows. Bank scour in this region has been estimated at around 15 m per year.

Alligator Creek is comprised of a series of sub-channels separated by braid bars, essentially low tide flats, which are flooded at high tide, and are highly dynamic with significant changes occurring over relatively short timeframes. The banks are typically sloping over much of the tidal range, transitioning abruptly to a near vertical bank at the channel margins.

In terms of hydrology, the volume of water extracted from Forsyth Creek and subsequently discharged to Alligator Creek represents a small percentage of the tidal prism. The extraction or discharge of water will be unlikely to impact water levels or current speed within the waterways.

The temperature of the discharge water may be elevated above the natural levels in Alligator Creek due to retention in the EPZ. As the volume of water compared to the tidal prism is minimal and as this discharge will be rapidly mixed into receiving waters, no adverse consequence of this temperature differential are expected.

5.2.4.3. Sediment Transport

The banks and beds around the project site are in a constant state of flux with channel migration and bank erosion observed at a number of locations. Accretion of the bank was also observed with juvenile mangroves extending seaward in places and thereby consolidating progressive bank migration. Tidal currents are the key driver of bed and bank erosion, although the macro tides result in the opportunity for wave erosion to occur across a large vertical profile of the bank.

Sediments in the region are typically a combination of muds, sands and gravels. Bed material at the site is a combination of very fine sands and muds. Banks around the site are the source of much of the mud material, with clay and silt banks in various states of erosion around the site. Tidal shoals within the waterways have a higher sand content than the banks as the larger and heavier particles of sand are more likely to settle than the fine clay and mud which remains in suspension, leading to the high turbidity found in the region.

5.2.4.4. Water Balance

A water balance was developed for the Project, described in the EIS, Volume 1, Chapter 4. The water balance was undertaken to track water and salt balances within the Grow-out Centre, and to determine the amount of inflow, outflow and reliability of water supply.

The modelling found that, while water and salt flows vary throughout the year, and from year to year, a steady state system (for simplification) would require a water exchange of 1.4% of maximum dry season total system volume, which represents an average 575ML/day inflow of seawater from Forsyth Creek, and 410 ML/day discharge into Alligator Creek.

The 35GL Forsyth Creek Dam was found to be suitable to reliably supply freshwater to the Project, with a dry season inflow of ~35ML/day.

5.2.4.5. Environmental Values

The key values to be protected are:

- Marine, estuarine and freshwater aquatic and floodplain ecosystems
- Water supplies for future pastoral uses (general water uses, stock drinking water)
- Recreation and aesthetics, in relation to water quality and fisheries resources in areas adjacent to the site for public use
- Human consumers (primarily for fish species, crabs and other fauna)
- Cultural and spiritual values of marine and estuarine waters, fresh waters and floodplains, including ecosystems and biota
- Suitable freshwater supply to support the Project, primarily related to the Forsyth Dam supply.
- Suitable salt water supply to support the Project (primary industries, aquaculture), primarily related to the intake waters.

5.2.4.6. Potential Impacts to Environmental Values

The key potential risks can be summarised as:

- Physical changes to the tidal areas and hydrodynamics associated with the Forsyth Creek inlet
- The proposed wastewater discharge from the EPZ into Alligator Creek, in terms of the amount and rate of flow.
- Potential erosion and changes to coastal landform and bathymetry in the vicinity of the proposed intake and discharge points

- Direct impacts from the Project intersecting drainage lines and causing changes to flooding, flowpaths, flow velocities and volumes, and providing barriers to fish movement. These will generally be minor drainage lines, other than a crossing of Alligator Creek (though all affected areas will be subject to culverts and floodways to mitigate any changes)
- Potential loss of ephemeral wetlands. Impacts would be associated with removal of temporary habitats for aquatic biota, although this occurs during the dry season when these systems dry up
- Lack of releases from Forsyth Dam, leading to extension of dry season conditions in catchments that have had dry season flows each year since the dam's construction 10 years ago

5.2.5. Surface water and sediment quality

5.2.5.1. Freshwaters

Freshwater water bodies in the area are characteristically ephemeral, filling in the wet season and drying out in the dry season. While there are extensive floodplains in the wet season, in the dry season, surface water is confined to the bunded areas of Alligator Creek, small channels, billabongs and swamps. With the exception of the bunded areas of Alligator Creek, these water bodies gradually evaporate, becoming stagnant and commonly drying out. Storms in the early wet season result in turbid 'flushes' from surface run-off from the catchment, from stagnant pools in the riverbed, and from previously dried up water bodies. These flushes are further characterised by high concentrations of decayed organic matter, high bacterial pollution and low oxygen content, often resulting in a rapid deterioration of water quality and fish deaths.

The Keep and Victoria River catchments, immediately adjacent to Legume Station, are subject to high fluctuations in salinity, turbidity and nutrient concentrations between and within the seasonal changes of dry and wet seasons. Electrical conductivity and turbidity in the Victoria River catchment at times exceeds AWQG.

In the wet season, water from the catchment enters the estuarine receiving environment from high flows created by heavy rainfall. This catchment run-off transports freshwater, sediment loads and detritus that have built up during the dry season. Within the freshwater and sediments, nutrients are transported and deposited further downstream. Despite nutrient availability, high turbidity limits primary production.

Freshwaters are generally characterised by:

- low dissolved oxygen
- high chlorophyll a
- high concentrations of ammonia

Water quality was generally poorest in the pre-wet season, when dissolved oxygen was typically low, and chlorophyll a concentrations high. Total Petroleum Hydrocarbons were below criteria, but were detected at several freshwater sites during surveys.

5.2.5.2. Estuarine and Marine waters

Estuarine and marine environments were generally turbid, with high concentrations of total phosphorus and oxides of nitrogen. Forsyth Creek and Alligator Creek in particular have extremely high levels of turbidity and suspended solids at all times. In addition, turbidity increased with depth in the wet season in Forsyth Creek.

In the dry season, currents driven by stronger offshore winds suspend the sediment, increasing turbidity and limiting primary production even further.

The high phosphorous but low total nitrogen load is consistent with a system which has low existing inputs of nitrogen and considerable particulate phosphorus sources, likely to be bound to the sediment and as such,

related to the high rates of sediment re-mobilisation occurring in the system due to the high tidal energy which dominates mixing and transport processes.

Sampling at different depths indicated that water quality was well mixed throughout the water column, with little variation between surface and deep water at any of the sites. Salinity was relatively stable at most sites, and but was lower in the wet and late wet season at sites in Forsyth Creek, as would be expected.

The concentration of potential toxicants was generally low, although there were some elevated levels of some total metals (dissolved metals were below the laboratory limit of reporting). However, the results indicated that Forsyth Creek can supply source waters to the operation without concern for metals or metalloids in the waters to be used in the farming process. Given that none of these substances will be present in the proposed discharge, it is also considered that Alligator Creek can receive wastewater flows with no associated environmental impact concerning metals and metalloids.

Sediments were dominated by silt / clay with sand, with nutrient levels consistent with other sites in the Keep River estuary, and metals and metalloids, and pesticides being generally low or below the laboratory limits of reporting. Hydrocarbons in the C15-C36 fraction were detected at most sites in June 2015; however, concentrations were mostly below laboratory limits of reporting in March 2016. While the C15 to C36 fractions include diesel, fuel oils and lubricating oils, they are also found in vegetation. Given the highly dynamic nature of these environments, and that none were not detectable in March 2016, the source of hydrocarbons in this survey were most likely natural.

5.2.5.3. Forsyth Creek Intake

The key potential impacts in this area would relate to construction phase works, however the construction methods used will avoid machinery contact with marine muds and clays, and given the short duration and small area of disturbance, overall impacts will be minimal. The intake bell-mouth at the inlet to the pump will be fitted with a 100 mm aperture mesh grille, to exclude all but small debris and aquatic fauna. This will be regularly cleaned of marine fouling by raising the pump assembly up and onto the jetty platform, so that personnel access can be afforded safely and the fouling wastes collected without any need for floating plant.

The intake pumps will terminate in the water at a level between Mean Low Water Neap and Mean Low Water Spring, and will only operate between mid to high tide daily. The operation of intake itself will have a negligible impact upon the local coastal morphological and sediment transport processes.

5.2.5.4. EPZ and Alligator Creek Discharge

The primary function of the EPZ is to regulate the flow of discharge water by reducing the velocity and holding the water so that discharge can be timed and discharged at a constant rate during ebb tides. The majority of the discharge will flow through a 100 m wide channel in the centre of the EPZ, but the EPZ is sized for 'overflow' of this channel, to enable it to hold the peak discharge and water from storm events, up to the 50 year ARI event. It is expected that this 'overflow' and the margins of the channel itself will be colonised by local samphire and/or mangrove species, which will assist in nutrient uptake.

Effluent from the farms will be discharged into the main drainage channel (MDC) before passing through the EPZ to the bank of Alligator Creek. Scour protection on the downstream side of the Alligator Creek weir will be provided by a rock blanket. An outflow weir (100 m wide and set back 30 m from the existing bank) will enable control of discharges.

The impacts on water quality from the proposed wastewater discharge from the project are primarily limited to the local waterway of Alligator Creek. Optimisation of the discharge flow regime has shown that timing discharges to the ebb tides can effectively mitigate impacts into these waters. There are unlikely to be any

unacceptable changes to nutrient, chlorophyll a or suspended sediment concentrations within Alligator Creek as a whole and there will be no detectable changes in the Keep River or the waterways beyond.

Suspended sediments and turbidity is likely to be either the same, or even lower, than receiving waters, as such, no impacts in relation to sediment and turbidity as a result of the operation of the Project, are anticipated.

5.2.5.5. Environmental Values

The key values to be protected are:

- Marine, estuarine and freshwater aquatic and floodplain ecosystems
- Primary industries - water supplies for future pastoral uses (general water uses, stock drinking water)
- Recreation and aesthetics, in relation to water quality and fisheries resources in areas adjacent to the site for public use
- Human consumers (primarily for fish species, crabs and other fauna)
- Cultural and spiritual values of marine and estuarine waters, fresh waters and floodplains, including ecosystems and biota

5.2.5.6. Potential Impacts to Environmental Values

The key potential risks can be summarised as:

- Changes to estuarine water quality due to discharges into Alligator Creek, both planned and unplanned
- Runoff of sediment laden water during construction, from erosion and sediment loss from exposed surfaces
- Leaching of oxidising acid sulfate soils into freshwaters (unlikely to be large enough volumes even at worst to significantly affect estuarine and marine tidal areas)
- Leaks and spills into fresh, estuarine and marine waters

5.2.6. Groundwater

5.2.6.1. Hydrogeology

Legume Station is primarily located in the Bonaparte Gulf Basin groundwater aquifer, with the south eastern section of the property in the Victoria River Basin aquifer. Groundwater generally flows from the ranges towards the coast in sandstone, fractured rock and sand / colluvial deposits, with a corresponding but opposite flow of saline water from coasts back inland, each balanced by the relative hydraulic head. Local recharge zones exist around low hills and rises on the plains, which become saline near the foot of these hills, after passing through saline deposits, or forcing saltier watertables to the surface.

Some deep aquifers are located across the site, with recharge from the sandstone and shale hills and rises, and subcrops, particularly on the Coastal Erosional Plain areas. A shallow saline watertable is located at ~3m depth in the dry season, and up to ground level in the wet season across the Estuarine-Deltaic and Coastal Plains, fed by tidal waters and surface rainfall.

Almost the entire Project area (with the exception of minor service corridor areas) is located in an area mapped as containing saline groundwater.

5.2.6.2. Groundwater Dependent Ecosystems

Soils on the coastal erosional plains are sandy and permeable, receiving large amounts of freshwater recharge during the annual wet season. The resulting high head of pressure keeps groundwater in the vicinity of these elevated landforms fresh, with freshwater fronts in similar systems in the Keep River plain area

found up to one kilometre from the edge of these outcropping sandstone plains. However, these systems can (and generally do) abut the relatively impermeable black soils on the estuarine-deltaic plains. This higher groundwater head can force more saline waters to express at the foot of these hills, as the saline water table is elevated or fresh waters pass through more saline deposits.

As such, species regularly found in lower positions on the fringe of the coastal erosional plain (where it meets the estuarine-deltaic plain and where groundwater is known to move laterally towards the estuarine-deltaic plain) may have a facultative dependence on groundwater (i.e. they make use of, but do not rely upon, groundwater). Other areas where facultative dependence on groundwater may occur include perennial springs on the margins of the ranges and flood out plain, and fringing forest/woodland communities along creeks and downstream of Forsyth Dam. Given that the project will have very minor impacts upon groundwater, no impacts that will affect the ability of these communities to use of groundwater are expected.

A number of springs are also known to occur at the foot of the Legume ranges (for example, Alligator Springs, located in the upper Alligator Creek catchment), where recharge from fractured rock aquifers discharges into creeks. One such spring was observed outside Legume Station, approximately five kilometres south west of Linden's bore, where it waters a sometimes lush fringing open forest community.

5.2.6.3. Environmental Values

The key environmental values for groundwater are:

- the ability of groundwater resources as a water supply for pastoral operations, in the locations, depths and at the quality currently found at the site
- the ability of ecosystems dependent on groundwater to continue to be functionally and ecologically sustainable

5.2.6.4. Potential Impacts

Potential impacts to groundwater are expected to be minimal, but could include:

- Impacts to productive aquifers due to lowering of groundwater, where excavation in borrow pits or other excavations extends below groundwater levels
- Direct contamination of groundwaters, from general spills and leaks, and leakage of saline and nutrient rich waters from farm dams and other infrastructure
- Contamination of groundwater from wastewater irrigation areas
- Changes to hydrology, affecting recharge zones and therefore groundwater recharge
- Interactions with the shallow saline water table on the estuarine-deltaic and coastal plains, with impacts possible to Project infrastructure, and to shallow groundwater (refer contamination above).

5.2.7. Terrestrial Vegetation and Flora

5.2.7.1. Threatened Species and Ecological Communities

A search of the Commonwealth Protected Matters database did not predict the presence of any threatened ecological communities, and nor were any identified during field surveys. A search of the Commonwealth Protected Matters database and the online NT Maps database found three flora species of conservation significance predicted to occur on the site, all of which are listed as vulnerable:

- Craven's native hibiscus (Commonwealth and NT)
- *Platysace saxatilis* (NT)
- *Zeuxine oblonga* (NT)

However all three are considered unlikely to be on the Project site, due to their highly restricted and localised ranges and rarity, the lack of suitable habitat, and the fact that no individuals were found during field investigations.

In addition, two species listed as 'near threatened' under the TWPC Act were recorded in Legume Station during the surveys:

- Fine-leaved Kimberley fan palm (*Livistona lorophylla*)
- *Turraea pubescens*.

Both of these are near threatened due to the threat from inappropriate fire regimes, which may interfere with recruitment and kill adults if fires occur too often (more than every 5 years for *Livistona lorophylla*).

Livistona lorophylla was found to occur in the Legume Ranges and low ranges near the Marralam community. *Turraea pubescens* was recorded from a small residual on the estuarine-deltaic plain outside of the Project footprint where it was an uncommon element of the vine thicket community. Neither species will be directly affected by Project works. It is therefore the fire regime on the site that presents any risk of impacts to these species.

A further four species listed as 'data deficient' under the Territory Parks and Wildlife Conservation Act (TWPC Act) were recorded in Legume Station during the surveys:

- *Eleocharis acutangula* - a sedge recorded from Legume Station in Melaleuca low woodland on the flood-out plain, in the vicinity of the proposed Legume Access road
- *Ptilotus capitatus* - a woody herb recorded within Legume Station from Darwin stringybark/Darwin woollybutt woodland on the coastal erosional plain
- *Spermacoce gibba* - a herb found within Legume Station in Darwin stringybark/Darwin woollybutt open forest on the coastal erosional plain
- *Triodia triticoides* - a 'spinifex' hummock grass recorded from the ranges open woodland vegetation community on sandstone of the Legume formation, where it was moderately common

Species listed as data deficient are those whose conservation status cannot be accurately categorised from available information. All of the above species, other than *Triodia triticoides*, were located in habitats that will be impacted by clearing for the Legume Access road. These species are relatively widespread in other Australian states, and *E. acutangula* is considered likely to be more widespread within the NT than current records indicate. None of these three data deficient species were widespread within Legume Station, all of them being represented by a few records each. Given all were recorded from habitats that are well represented within Legume Station and within the bioregion and NT generally, impacts on these species from clearing for the Project are expected to be minor.

5.2.7.2. Other species of note or indigenous cultural significance

One species identified in past surveys of the region was identified on the site as being rare, of conservation significance, or otherwise noteworthy - *Brachychiton tuberculatus*. This is a relatively common species on the coastal erosional plain within Legume Station, however, it has a restricted distribution primarily clustered on the lower Ord River valley.

Two other species of note were recorded on the site:

- Giant spear grass (*Heteropogon triticeus*) – a least concern species which is at its most westerly distribution in Legume Station, was recorded from ranges open woodland.
- *Acacia praelongata*, an NT endemic (also least concern), was recorded from two small populations on low residuals on the coastal erosional plain, approximately two kilometres north-west of Linden's bore.

The distribution of this species is centred on Darwin and the Litchfield National Park with one previous record from the Victoria-Bonaparte bioregion.

As advised by the Northern Land Council, plant species identified as being used by the Jaminjung, Ngaliwurr and Nungali people are considered to constitute flora species of indigenous cultural significance. A total of 98 flora species of cultural significance to indigenous people in the region were recorded within Legume Station. Of these:

- 65 species are associated with food, including flora species closely associated with fauna utilised for food, and plants that indicate the changing of seasons or seasonal availability of resources
- 47 species have material cultural significance (e.g., as a source of glue/resin, fibre, soap, insect repellent etc.)
- 42 species are utilised for weapons or have a technological use, including musical instruments, pipes, fish poison, shields, spears etc.
- 21 are utilised as source of medicine.

5.2.7.3. Local Vegetation Communities

Clearing of less than 5% of a vegetation communities extent at the local scale is considered to have a minor to negligible impact on that community overall. Only three of the 16 vegetation communities mapped within the Project footprint will require clearing of more than 5 % of the extent at the local scale (i.e. within Legume Station):

- Wild plum low open woodland (9%)
- Northern rice grass (*Xerochloa imberbis*) grassland (8%) and
- Canegrass (*Ophiuros exaltatus*) grassland (6%).

Wild plum low open woodland is primarily located on the estuarine-deltaic plain in one large patch dominated by one species, wild plum, and is unique within the Project area, and may be a rarely occurring community. However it is not protected, and does not contain threatened species or their habitats, or any species that are otherwise noteworthy. Other wild plum areas exist on the site, though lacking the large mature trees.

The clearing of northern rice grass and canegrass grasslands for the Project will have a minor impact on vegetation community diversity at the local level, as large areas of this community will still be retained (92% of rice grass and 94% of canegrass grasslands in the Project area, assuring they will still be well represented at the local scale).

5.2.7.4. Vegetation Loss at the Bioregional and NT scale

Two vegetation units are impacted by the Project where clearing will comprise >1% of the total unit/class area in the bioregion, namely:

- *Xerochloa* (ricegrass) grassland (unit 104) – clearing will remove 2,920 ha, which equates to 4% of its bioregional extent and 3% of its NT-wide extent, and
- Mixed closed-grassland/sedgeland (seasonal floodplain) (unit 54) – clearing will remove 186 ha, which equates to 4% of its bioregional occurrence and 0.02% of its NT-wide extent.

For the purpose of assessing impact for the Project, clearing impacts of one percent or less at a bioregional and NT-wide scale have been assessed as negligible.

As such, the impact of the proposed clearing of northern rice grass grassland at a bioregional and NT-wide scale will be minor, since ~96% of the total extent at the bioregional level and ~97% at the NT level will

remain, ensuring it continues to maintain its representation at these scales. Similarly, the retention of 96% of the bioregional extent and over 99% of the NT-wide extent of mixed closed-grassland/sedgeland indicates that clearing impacts on this vegetation unit will be minor at the bioregional scale and negligible at the NT-wide scale.

5.2.7.5. Environmental values

Given that threatened ecological communities and Protected Plants have not been found, and are unlikely to be present, the key environmental values in relation to terrestrial flora are therefore:

- Vegetation community diversity, at a local, bioregional or NT-wide scale
- Flora species diversity, primarily at a local scale
- Habitat for flora and fauna
- Land / soil stability (potentially degraded after clearing).

5.2.7.6. Potential Impacts

The key potential impacts are:

- Reductions in vegetation community and flora species diversity, at a local, bioregional or NT-wide scale, through additional or unintentional clearing or damage to flora outside clearing limits
- Loss of habitat for flora and fauna (impacts to fauna are discussed in Section 5.2.8)
- Land degradation from acid sulfate soils, upslope land clearing or runoff leading to vegetation die-back
- Decreased volume of surface water released from the dam in the late dry season which may affect floodplain vegetation communities
- Impacts to groundwater dependent flora and communities (though this is considered unlikely without changes to groundwater hydrology, also considered unlikely)
- Removal of woody or deep rooted vegetation resulting in the rising of the water table, and surface soil salinity, although again impacts from this source are considered unlikely.
- Dust deposition on vegetation and communities (considered minor given existing dust impacts at the site)
- risks to near threatened species under NT legislation (Fine-leafed Kimberley fan palm (*Livistona lorophylla*) and *Turraea pubescens*) from changes to fire regimes that do not take into account the needs of these species
- impacts to data deficient species, which due to this factor the local and bioregional impacts are not well defined
- Introduced flora and weeds from vehicles, machinery, personnel, resulting in a negative change to community diversity

5.2.8. Terrestrial Fauna and Avifauna

5.2.8.1. Legume Coastal Floodplain Site of Conservation Significance

The Legume coastal floodplain has been identified by the Northern Territory Government as a site of conservation significance because it supports internationally and nationally significant numbers of some waterbird species and exceeds internationally significant thresholds for some shorebird species. This was confirmed based on dry and wet season surveys for the Project.

An extensive terrestrial fauna and avifauna field survey program was implemented over a 12 month period between May 2015 and May 2016. The survey program involved more than 130 survey person days and was implemented by a team of eight highly experienced biologists. The surveys focussed on waterbirds and

shorebirds of both estuarine and freshwater habitats, and on the identification of records and habitat for listed threatened and migratory species under the EPBC Act and the TPWC Act. Understanding how waterbird usage changes over time, in response to changes in freshwater resources, was a particular focus of the survey effort.

The results of the assessment concluded that the construction and operation of the Project, when undertaken in accordance with the mitigation measures outlined in the EIS, will not result in a significant impact to nationally important aggregations of waterbirds, or other listed threatened and migratory species under the EPBC Act and TPWC Act.

5.2.8.2. Waterbirds and shorebirds

The surveys identified a variety of habitats across of the site of importance to waterbirds. Osmans Lake and the lower parts of Alligator Creek were found to support the highest values for waterbirds during the dry season and transition periods. In the wet season, consistent with much of northern Australia, wetland habitat was widespread and the coastal plain supported a range of wetland types, water depths and vegetation characteristics. The estuarine wetlands (Alligator Creek, Bob's Creek and Forsyth Creek) were found to not support a high species richness or abundance of waterbirds and there were no significant or notable congregations of birds (at roost) at these locations. Turtle Point was found to support nationally important habitat for migratory shorebirds, and in comparison to the other estuarine sites on Legume Station, provides important habitat for a variety of migratory shorebird species.

Freshwater wetland species considered to be present in significant numbers were magpie goose, plumed whistling-duck, radjah shelduck, green pygmy-goose, wandering whistling-duck, pied heron, marsh sandpiper, red-necked stint, sharp-tailed sandpiper, curlew sandpiper, little curlew, black-tailed godwit and common greenshank. Estuarine wetland species considered to be present in significant numbers at Turtle Point only were the greater sand plover, lesser sand plover, black-tailed godwit, bar-tailed godwit, whimbrel, eastern curlew, terek sandpiper, grey-tailed tattler, ruddy turnstone, red-necked stint and curlew sandpiper. Importantly, the survey results showed that the lowest density of waterbirds, and lowest waterbird species richness, was generally associated with the northern-most survey transects, where the majority of clearing is proposed to occur for the construction of the farms.

5.2.8.3. Non-waterbird species

The surveys identified 10 threatened species listed under the EPBC Act and/or the TPWC Act that are known to occur on the site (bare-rumped sheath-tailed bat, lesser sand plover, greater sand plover, bar-tailed godwit, eastern curlew, great knot, red knot, curlew sandpiper, Gouldian finch and grey falcon), one that is likely to occur (Australian painted snipe), six that may possibly occur (northern quoll, Mertens' water monitor, Mitchell's water monitor, yellow-spotted monitor, red goshawk and water mouse), three that are unlikely to occur (pale field-rat, vrd blacksoil ctenotus and masked owl (nth)) and six that are highly unlikely to occur (partridge pigeon, purple-crowned fairy-wren (western), brush-tailed rabbit-rat, plains death adder, northern crested shrike-tit and night parrot). Field surveys also identified 40 listed migratory species under the EPBC Act that are known to occur on site and one that is considered likely to occur.

5.2.8.4. Environmental Values

The Environmental Values for the site can be summarised as:

- Vegetation community diversity, at a local, bioregional or NT-wide scale
- Flora and fauna species diversity, particularly threatened or near threatened species.
- Important wetland habitat, particularly associated with the Alligator Creek wetlands and Osman's Lake wetlands (though the latter will not be affected by the Project)

- Nationally and internationally significant, listed threatened and near threatened, and listed migratory species.

5.2.8.5. Potential Impacts

The potential impacts of the Project in regard to impacts to nationally important aggregations of waterbirds, and listed threatened and migratory species were identified, these were:

- vegetation clearance leading to habitat loss or mortality
- changes in floodplain hydrology leading to changes in wetland fauna habitat characteristics
- changes in receiving environment water quality, due to increases in nutrient content and total suspended solids, leading to changes in estuarine shorebird habitat
- disturbance associated with noise and visual stimulation
- disturbance due to bird predation management strategies
- degradation of habitat value or mortality due to introduced species

5.2.9. Introduced and Pest Species

5.2.9.1. Weeds

One Class A declared weed was detected in Legume Station – gamba grass (*Andropogon gayanus*). Two individuals of this species were found in one location, in a fenced enclosure for a pump at the Linden's bore yards. It is not accessible to stock and it does not appear to be spreading. Two other Class A weeds have been identified as potentially occurring on the site, though neither were recorded during the field survey, namely:

- chinee apple (*Ziziphus mauritiana*), and
- Mimosa (*Mimosa pigra*).

The following plants designated as Class B weeds under the Northern Territory Weeds Management Act 2001 were observed during the vegetation and flora surveys:

- Neem (*Azadirachta indica*)
- Caltrope
- Flannel weed (*Sida cordifolia*)
- Olive hymenachne
- Hyptis
- Parkinsonia
- Sicklepod
- Spinyhead sida

Caltropis procera is also common but it is only declared in Northern Territory where it occurs south of 16°30' S (Legume is 15°23' S).

In the Northern Territory, all Class A and B weeds are also Class C weeds. No additional Class C weeds were observed.

The majority of these weeds are spread primarily by grazing animals. The proliferation of these weeds is then encouraged by the preferential grazing of palatable species, which reduces competition for the non-palatable weed and allows it to proliferate. The two exceptions are neem, whose seeds are spread by birds and bats, and olive hymenachne, which is spread by water and animals.

Of those weeds found in Legume Station, the species of most concern from an ecological viewpoint (in terms of damage being done currently) are parkinsonia and hyptis. Parkinsonia is prevalent in patches on the

estuarine-deltaic plain within the grassland mosaic, and unless actively managed in future it could continue to spread, with the potential to significantly change the structure of the grasslands. Hyptis is a particular issue in sclerophyll woodland, where it is generally found in the more accessible areas near dams, stock yards, and roads. Here, it often dominates the ground layer, partially or completely replacing native grasses and herbaceous species. Hyptis has no grazing value and so as grazing continues and palatable species are suppressed, hyptis increases.

5.2.9.2. Pest and Introduced Species

Grazing of the wetlands and floodplains of Legume Station by cattle has also been undertaken for many decades. Of the other species, the fauna survey program provided evidence of five pest animals:

- cane toad (*Rhinella marina*) - this represents arguably the greatest potential threat, however it appears to be well established, at least in parts of the site. Anecdotal observations indicate that toads are of lower abundance (and in parts, absent) in the woodlands within the southern part of the site
- feral pig (*Sus scrofa*) - uncommon to rare on the site
- feral cat (*Felis catus*) - present but apparently not prevalent
- feral dog (*Canis familiaris*) - present but apparently not prevalent
- house mouse (*Mus musculus*) - may be uncommon on the site, although an ongoing baiting program is in place at the homestead complex for mouse control.
- In addition, three native species considered to be pests are present on the Project site - agile wallaby (*Macropus agilis*), red-tailed black-cockatoo (*Calyptrorhynchus banksii macrorhynchus*), and sulphur-crested cockatoo (*Cacatua galerita*).

Pest animal species are not expected to gain a significant benefit from either the construction or operational phase of the development.

5.2.9.3. Environmental Values

The key environmental values relate to those of the existing ecosystems, primarily terrestrial ecosystems, namely:

- Vegetation community diversity, at a local, bioregional or NT-wide scale
- Flora species diversity, primarily at a local scale

5.2.9.4. Potential Impacts

The potential impacts of introduced and pest species include:

- Weed spread may result in reduction in the quality of residual grazing land, and consequent economic consequence to current, and potential future grazing potential on the site
- Weeds, introduced and pest species (flora and fauna) may cause changes in natural systems diversity and community structure. Introduced flora may potentially out compete species and communities, and introduced fauna may outcompete and over predate on native fauna (particularly protected or important)

5.2.10. Aquatic Ecosystems

5.2.10.1. Estuarine and Marine Ecology

There are extensive areas of mangroves and saltmarsh/saltflats in the surrounding estuaries, which provide habitat for a variety of both avian and aquatic species, including species that are commercially and recreationally important, species that are of conservation significance, and species of cultural significance.

In the wet season, water from the catchment is flushed into the estuarine receiving environment from high flows created by heavy rainfall. This catchment run-off transports freshwater, sediment loads and detritus that have built up during the dry season. Within the freshwater and sediments, nutrients are transported and deposited further downstream. Despite nutrient availability, high turbidity limits primary production.

In the dry season, currents driven by stronger offshore winds suspend the sediment, increasing turbidity and limiting primary production even further.

Desktop investigations and field sampling found that:

- There are no seagrass or large macroalgal beds in the surrounding estuaries, likely due to the chronic turbidity and extreme tidal range.
- Coral has not been recorded in the vicinity and primary productivity of phytoplankton is limited, both due to the high turbidity.
- Benthic macroinvertebrate communities have relatively low abundance and diversity, and are dominated by polychaetes and crustaceans, with few filter feeders. These communities are limited by high turbidity, high sediment mobility, and long exposure periods
- *Avicennia marina* var. *eucalyptifolia* was the dominant mangrove species at most survey sites and was present at all sites, and mangrove communities were found to be in good health, indicating unimpacted communities
- Several commercial and recreational fisheries operate in the region, targeting prawns, mud crabs, barramundi, threadfin salmon and a variety of other estuarine and pelagic species. Seafood from the Territory is marketed as being from a pristine environment, and from heavily regulated fisheries.
- There are 15 aquatic species listed as threatened under the EPBC Act and/or the TPWC Act in the region. Of these, nine - northern river shark, spear-tooth shark, dwarf sawfish, green sawfish, freshwater sawfish, green turtle, hawksbill turtle, olive ridley turtle and flatback turtle were considered to have high or moderate likelihood of occurring in the estuarine environment surrounding the Project.
- The desktop assessment identified 18 aquatic species listed as migratory under the EPBC Act within the region. Of these, eight - green turtle, hawksbill turtle, olive ridley turtle, flatback turtle, estuarine crocodile, dugong, Australian snubfin dolphin and Australian humpback dolphin were considered to have high or moderate likelihood of occurring in the estuarine environment surrounding the Project.

The key risks to these species are related to entrainment or impingement in the intake structure, water quality changes due to site discharges, particularly the main controlled releases from the EPZ, escape of prawns and prawn diseases into wild stocks, noise and light impacts, and boat impacts. However, the results of the impact assessment found that these risks are unlikely to cause a significant impact to any threatened or migratory species.

5.2.10.2. Freshwater Ecosystems

The freshwater aquatic habitats of Legume Station include freshwater creeks, Osmans Lake, ephemeral wetlands, spring-fed waterholes and man-made dams. Forsyth Creek and Alligator Creek catchments are the two major waterway catchments of the site, and both have been substantially modified over time as part of the pastoral operations. This appears to have resulted in the aquatic habitat of these systems being generally low to moderate.

Osmans Lake is the largest natural wetland feature on Legume Station, with the riparian vegetation highly disturbed due to grazing. However, the Project will not result in any direct or indirect impacts on Osmans Lake given it is outside of any impacted catchments. The aquatic habitat value of ephemeral wetlands was found to be of low value, limited in structure to aquatic plants and detritus. Waterholes and springs provide

some refuge areas for fauna in an otherwise seasonally dry environment. Aquatic habitat within Forsyth Creek Dam was minimal and limited to aquatic plants, detritus and rock faces, with some trailing root vegetation depending on water levels.

Water quality in the creeks on Legume Station was relatively poor and characterised by low dissolved oxygen, high turbidity and high nutrients in the dry and pre-wet seasons. Cattle on the property contribute to poorer water quality through the input of excess nutrients and disturbing the in-stream bed sediments. Sediments were predominantly fine, and the concentration of most metals and metalloids were low. The abundance and diversity of freshwater macroinvertebrate communities across sampled sites were relatively low, and typical of disturbed ephemeral waterbodies with relatively fine sediment. There is little structure, such as in-stream or riparian vegetation, to provide varied habitat for macroinvertebrates.

All aquatic flora species recorded on the site are commonly occurring aquatic plants, many of which are typical of disturbed ecosystems (e.g. cumbungi and azolla). No listed threatened species or declared pest aquatic plants species were recorded during field surveys, nor are any expected to occur.

The fish communities in the water bodies on Legume Station are likely to have been impacted both by the installation of roads, bunds and artificial dams that prohibit fish passage and by clearing and cattle grazing. The removal of trailing roots, overhanging vegetation, shading of the waterways and the lack of large woody debris has reduced habitat availability. Despite these conditions, there are considered likely to be diverse fish communities in the water bodies on the station, and water bodies such as Alligator Creek, Forsyth Creek Dam and Osmans Lake are likely to provide refugial habitat in the dry season for a variety of species. No threatened fish species were recorded during field surveys. All species recorded are relatively common in northern Australia and appeared to be healthy, with no lesions, abrasions or parasites.




To date, there have been no records of any freshwater turtle species on Legume Station; however, surveys in the area are likely to be minimal. No freshwater turtles were caught or observed on Legume Station during the field surveys for the Project. While turtles, and in particular the northern long necked turtle, are likely to occur on site, water bodies on Legume Station are unlikely to provide substantial significant habitat. In-stream habitat (i.e. woody debris and trailing tree roots) is limited and would provide little protection from predators (i.e. crocodiles) and potential breeding areas are likely to be disturbed by cattle.

Freshwater and estuarine crocodiles are known to occur on Legume Station, they are considered common and locally abundant, and have been recorded throughout the Victoria and Keep River catchments, and are unlikely to be significantly impacted by the Project.

Finally, no threatened aquatic flora species, ecological communities or aquatic fauna species, listed under the EPBC Act or TPWC Act, are present within the Project Area and therefore will not be impacted by the Project.


5.2.10.3. Environmental Values

in relation to estuarine, marine and freshwater aquatic ecosystems, the primary environmental value is the protection of these aquatic Ecosystems. This includes protection and maintenance of:

-  community and species diversity
-  threatened and near threatened species, and
-  aquatic habitat.

5.2.10.4. Potential Impacts

The potential impacts to estuarine and marine ecologies have been identified as:

-  Direct disturbance of habitat for aquatic flora and fauna from vegetation clearing and earthworks

- Changes to floodplain hydrology as a result of changes to the terrain and blocking of flood waters (although these will be engineered away), and the cessation of dry season flows from Forsyth Creek
- The creation of waterway barriers in freshwater waterways
- Entrainment or impingement of aquatic fauna at the seawater intake pump station on Forsyth Creek.
- Changes in water quality resulting from:
 - vegetation clearing and earthworks
 - discharge of waste water from the grow-out facility
 - Spills of hydrocarbons or other contaminants, including oxygen reducing substances (such as cement) and treated or untreated effluent wastewater directly to waterways
- Proliferation of pest plants, more so to freshwaters
- Escape of prawn stock and/or diseases and pathogens from the grow-out facility.
- Disturbance, including physical presence, noise and/or impacts to food chain for estuarine crocodiles
- Increased risk of boat strike, and interruption of movement, for turtles and other large slow moving surface marine creatures, although boat movements are expected to be minimal, particularly for fast moving vessels – limited primarily to environmental monitoring work
- Increase in plastic litter and debris resulting in ingestion and entanglement.
- Loss of access to fishing grounds and/or loss of species of significance to indigenous communities
- Increased site access, increasing habitat disturbance and direct take of aquatic fauna (primarily fish).

5.2.11. Waste Management

5.2.11.1. Existing Site Waste

Past activities on the site include an operating landfill near the Legume homestead, cattle yards and one known cattle dip, all located outside of the Project footprint. Waste infrastructure on the site is limited to the existing landfill, off-site removal of other wastes, and the potential for unexpected findings of residual waste materials during construction, as a result of the long history of pastoral operations on the site.

5.2.11.2. Waste Characterisation

The project will produce a number of different solid and liquid wastes during both construction and operations. The key waste types and the potential quantities have been identified and a management strategy to deal with them has been devised (refer Appendix C9).

5.2.11.3. Waste Management Strategy

Waste Minimisation

The overarching strategy to be implemented on the site is one of minimisation, in the following order of preference (with those listed first preferred over each of the following practices): avoid, reduce, reuse, recycle, recover, dispose. The following sections describe how this strategy will be implemented

Waste Infrastructure

A site wide integrated waste management system will be developed on the site, with the key elements to be initiated as soon as practicable during construction. Until all elements are installed and operational, construction waste will be dealt with by nominated waste storage locations on-site, prior to removal off-site to licensed landfills or recycling / reprocessing facilities.

The overall waste strategy involves the following key infrastructure:

- Transfer of general, recyclable and other non-listed and non-hazardous wastes to a Waste Transfer Facility at the Accommodation Village, or temporary storage at farm services and Central Facilities prior to transfer to this Waste Transfer Facility
- Transfer of listed and hazardous wastes to a Hazardous Waste Facility located at the Central Facilities, before removal off-site by licenced transporters to licenced facilities for reuse, recycling, recovery or disposal
- Drainage of washwaters and rainfall from putrescible bin storage areas into the wastewater treatment plants, via appropriate trash rack screens and sumps in the floor of these areas
- Disposal of general and inert waste at an on-site landfill.

Solid Waste Management

Solid wastes will be managed as part of the waste infrastructure described above, and management will include the identification of waste types, quantification of waste tonnage and volumes, and both on and off-site measures for recycling, recovery or disposal.

Wastewater Management

Wastewater on the site will comprise:

- Non-sewage wastewater:
 - Waste oils and oil/fuel contaminated water from oil-water separators, from refuelling areas, workshops and vehicle wash down
 - Waste liquid chemicals or water/chemical mixes, from laboratories, workshops and vehicle wash down
- Sewage wastewater: from the Accommodation Village, Central Facilities and farm services.

Sewage wastewater will be treated in package wastewater treatment plants on-site, and irrigated in designed land irrigation areas. Non-sewage wastewater will be either treated in the on-site wastewater treatment plants, or removed to the hazardous waste facility for later removal from the site.

5.2.11.4. Environmental Values

The environmental values in relation to waste are:

- The quality of air, land and water environments
- The quality and aesthetic value of the environment, including social and culturally significant sites and landscapes.

5.2.11.5. Potential Impacts

The potential impacts of inappropriate waste management can range from nuisance impacts from noise, odour and dust, through to land and water contamination, attraction and breeding of pests, and human health impacts due to landfill gas asphyxiation or explosion.

Inappropriate handling and storage of waste can result in a range of impacts, including:

- Release of dust and odour, causing nuisance impacts to nearby sensitive receptors, primarily the construction camp and work areas
- Breeding of vermin, with impacts to the natural environment, and nuisance impacts to site workers (flies, rats)
- Contamination of groundwater from inappropriately stored or disposed waste, particularly putrescible and/or chemical (oil, fuel, other chemicals) waste.

5.2.12. Air Quality

Air quality in the Project Area is strongly influenced by the predominating wet and dry seasons. The dry season is characterised by moderate temperatures, low humidity and dry conditions, with strong winds from the east and south-east. Conversely, the wet season is characterised by high temperatures and humidity, with predominant winds coming from the north and north-west. Tropical cyclones, thunderstorms and monsoon rains are common during the wet season.

Based on the available air quality data for a representative site near Darwin (the closest such site), in general air quality can be said to be excellent in the wet season and poor during the dry season. The Northern Territory Ambient Air Quality Monitoring Report produced by the NT EPA states that the primary air pollutant in the Darwin region are particulates generated by bushfires and fuel reduction burns. It is expected that this would also be the case in Project Area due to the large areas of vegetation surrounding the site.

Other existing sources of air pollutants which may potentially affect the air quality of the Project Area include:

- sea-salt as an aerosol from the surrounding coastal environment
- dust from land clearing activities.

The primary emissions generated during the construction of the Project will be dust, through mechanical disturbance from vehicles and equipment, and wind erosion of exposed, disturbed soil surfaces.

Emissions from the operation of the Project will result primarily from the operation of the power station located at the central facilities. The power station will consist of 12 CAT3516C diesel generators, operating concurrently. The capacity of thermal engines is expected to be 17.5 megawatts (MW).

5.2.12.1. Sewage Treatment Plant Odour

Odorous emissions could also occur from sewage treatment plants, though generally only when the plants are not operating efficiently, as long as a suitable off-set distance is applied. The Recommended Separation Distances for Industrial Residual Air Emissions (EPA Victoria, 2013) recommends a separation distance based on the equivalent population, with results shown in Table 1, for 'mechanical/biological wastewater treatment plants'.

TABLE 1 RECOMMENDED PRELIMINARY SEPARATION DISTANCES - SEWAGE TREATMENT PLANTS

Location	Flow (L/day)	EP	Separation Distance (m)
Accommodation Village	122 kL/day	610	~100
Central Facilities	Average 2.5 kL/day	12.5	~30
Farm Services	Average 3.6kL/day	18	~30

These offset distances will be applied, unless more detailed analysis shows a lower distance can be managed without impacts.

5.2.12.2. Environmental Values

As the Project Area is remote, the only potentially sensitive receptors in relation to air quality are the Legume Station homestead and the proposed accommodation village. The Legume Station homestead is located over 15 km from the grow-out centre. The accommodation village which will be constructed as part of the Project will be located approximately 18 km from the grow-out centre.

5.2.12.3. Potential Impacts to Environmental Values

The only potential impacts on air quality are from dust emissions, most notably PM10 during construction and emissions from the power station during the operation of the Project, and odour emissions from the pond waste stockpiles and wastewater treatment plants during operation.

As Legume Station is remote, the only potentially sensitive receptors to these emissions are the Legume Station homestead and the proposed accommodation village. Given the distance between the Project and the Legume Station Homestead and the proposed accommodation village there will be no impact on air quality or odour at either of these potentially sensitive receptors.

5.2.13. Climate Change Assessment

The assessment of climate change impacts to the Project involved:

- The calculation of GHG emissions for the Project based on the methodology outlined in the National Greenhouse Accounts Factors
- a desktop review of relevant literature on potential climate change impacts to the Project
- the development of numerical models including hydrodynamic, wave and transport models to enable the simulation of the tides, waves, and extreme events on physical processes.

5.2.13.1. Potential Impacts

GHG emissions

- The Project's estimated average annual GHG emissions (72,075 t CO₂-e) equate to approximately 0.01% and 0.58% of total 2014 emissions for Australia and the Northern Territory, respectively. The annual emissions exceed the 25 kt threshold listed in the Commonwealth National Greenhouse and Energy Reporting Act 2007 (NGER) Act.

Climate Change Assessment

The key threats to the Project from climate change are sea level rise and increases in tropical cyclone intensity and frequency. These climate change impacts are likely to result in:

- shoreline recession
- increase in storm tide elevations
- higher maximum wind speeds generating larger waves and associated wave set-up on the coastline
- higher maximum wind speeds and lower central pressures generating larger storm surges.

The Project components at risk from climate change impacts include the intake and discharge infrastructure and the land based facilities situated on the estuarine-deltaic plain (i.e. the farms and channels).

5.2.14. Noise and Vibration

Noise levels at the Legume Station homestead were found to be typical of a rural environment with negligible levels of transport noise, but higher background noise levels recorded during the day and evening periods. The noise levels at the proposed grow-out farms were representative of an extremely quiet area with little or no artificial sources of noise, but higher background noise levels during the evening period attributed to insect noise.

Areas close to station access tracks currently experience higher levels of noise due to vehicle traffic than at the proposed grow-out farms.

5.2.14.1. Environmental Values

As the Project Area is remote, the only potentially sensitive receptors in relation to air quality are the Legume Station homestead and the proposed accommodation village. The Legume Station homestead is located over 15 km from the grow-out centre. The accommodation village which will be constructed as part of the Project will be located approximately 18 km from the grow-out centre.

5.2.14.2. Potential Impacts

As Legume Station is remote, the only potentially sensitive receptors to noise generated by the construction and operation of the Project are the Legume Station homestead and the proposed accommodation village.

Based on the results of the modelling, noise levels at the Legume Station homestead will be well below the noise criteria during both the construction and operational phases of the Project.

Construction noise criteria will be exceeded at the accommodation village during the construction of the accommodation camp itself and nearby infrastructure (i.e. roads and the central facilities area). As the majority of the inhabitants of the accommodation village will be part of the construction workforce, any noise impacts will be expected by those affected and will occur during working hours. Noise levels at the accommodation village during operations will be well below the operational noise criteria.

5.3. SOCIO-ECONOMIC CONTEXT

5.3.1. Socio-economic

The Project area is remote with the nearest population centre being the town of Kununurra in Western Australia, approximately 106 km to the south-west. The closest population centre to the project in the Northern Territory is Timber Creek, approximately 135 km to the south-east.

The town of Kununurra is located in the Shire of Wyndham – East Kimberly and is the major commercial centre for the region. The town was created in the early 1960s to service the development of the Ord River Irrigation Scheme and has experienced steady population growth since its establishment.

The Shire of Wyndham – East Kimberly has an estimated permanent population of approximately 8,500 people. The majority of the population is based in the towns of Kununurra and Wyndham with the remaining inhabitants scattered through several Aboriginal communities, pastoral stations and mining camps. The population of the shire can increase by over 25% with the arrival of tourists during the dry season.

Aboriginal people comprise of about 35% of the total population of the area. The traditional owners of the project area have been identified and consultation is underway to ensure the traditional uses and activities of the area are taken into consideration.

Dominant industries in the region are agriculture including pastoral industries and irrigated agricultural operations, mining, tourism and fishing. The labour force participation rate in the region is 67%, which is similar to Australia as a whole (65%). Unemployment however is much higher within the Aboriginal population (8%) than non-Aboriginal people (4%).

The Project will create significant local employment with over 100 staff and contractors employed at Legume and additional workforce required in the vicinity of Kununurra during Stage 1. The intention is to maximise local and indigenous employment within the Project.

5.3.1.1. Social and Community values

Social and Community values relevant to the Project include:

- Indigenous employment and business opportunities within the region
- Local employment and business opportunities within the region
- Recreational fishing and tourism and
- Community safety.

5.3.1.2. Potential Impacts

During construction, potential negative social impacts may arise, including:

- Negative community relations, due to insufficient communication and community involvement on the progress of the Project
- Failure to meet Indigenous and general local community employment and business expectations
- Restriction of community access to fishing, camping and other recreational and tourism activities
- Damage to locally significant areas, particularly in relation to fishing areas, and other areas that have been commonly accessed or can be seen by the public
- Inadequate attention to community safety, particularly in relation to product transport on public roads.

5.3.2. Historic and Cultural Heritage

No non- indigenous heritage sites are listed on the Commonwealth Heritage Database or on the NT Heritage Register as occurring on Legune. However, a number of sacred sites protected under the Aboriginal Sacred Sites Act (NT) have been registered and recorded on Legune. The NT archaeological database also lists ten Aboriginal archaeological sites and artefacts on Legune, though these were identified as a result of two surveys only in the south-west corner of the property. Large areas of Legune have not been subjected to archaeological survey and as such the NT archaeological database may not record all Aboriginal sites and artefacts present in the area.

Some of the project infrastructure including roads, quarries and accommodation village will be situated on the Cockatoo land system, which has a very high likelihood of archaeological sites. These are most likely to be located on sandstone outcrops and may include rock art and artefact scatters.

However, the majority of the project footprint is located on the Legune and Carpentaria land systems, comprised of tidal mudflats and seasonally inundated coastal floodplains with poorly drained clayey soils. These land systems are considered unlikely to host Aboriginal archaeological sites, although shell middens and mounds are possible around the margins of these areas.

More broadly, the site selection for the Project has taken into consideration potential impacts to these sites, and the majority of the Project has been located on land which has low archaeological potential and impacts on known heritage sites will be avoided and/or minimised where possible.

The area of proposed works on Legune Station has had Native Title Determination and has negotiated an Indigenous Land Use Agreement (ILUA) with Traditional Owners. Discussions with the broader indigenous community are ongoing, encompassing opportunities the Project will bring. The Project has also been issued with an Authority Certificate under the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT). The Authority Certificate covers all proposed ground disturbing works and consultation will continue to be undertaken with the Traditional Aboriginal Owners to ensure any impacts to cultural heritage from the development of the project are avoided and/or minimised.

5.3.2.1. Cultural values

The Cultural heritage values requiring protection as part of the Project works include:

- Indigenous objects, sites or places of cultural heritage value, including important songlines

- Non-indigenous historically important sites and objects that may be discovered during site investigations or construction
- Land access by local indigenous people for fishing, hunting and for cultural reasons.

5.3.2.2. Potential Impacts

The potential impacts to cultural heritage values mainly occur due to the removal and/or damage of cultural items or sites, associated with ground disturbing activities conducted during the construction phase. This may occur to known objects or sites, or to chance finds discovered during construction works.

Construction (and operation) also has the potential to limit important site access by Traditional Owner / local indigenous persons, particularly for fishing and hunting activities, or accessing culturally important sites. The degree of impact in this regard (as well as mitigation) will depend on ongoing discussions and negotiations with local indigenous people.

5.3.3. Traffic and Transport

The Project is located approximately 100 km north of Kununurra. Road access is via a single route made up of the Legume Access Road, Cave Springs Road and Moonamang Road. From Moonamang Road, heavy vehicles and trucks heading to the Processing Plant for the Project and/or the Victoria Highway will bypass Kununurra via Stock Route Road, Research Station Road and Ivanhoe Road. Light vehicle traffic heading to Kununurra and/or Victoria Highway will use the Weaber Plain Road.

5.3.3.1. Potential Impacts

Traffic generation estimates have been made for the construction and operational phases of the Project. The forecast total generation of 30 vehicles per day and 42 vehicles per day during construction and operation, respectively, will not have a significant impact on the road network.

5.3.4. Amenity

The focus of the amenity assessment was on visual amenity and the potential impacts of increased access.

The visibility of these Project components was considered and assessed from potentially sensitive viewpoints which included key vantage points, publically accessible areas and/or areas of significance.

5.3.4.1. Potential Impacts

Visual

Given the remote location of the Project on private property, the only potentially sensitive viewpoints from which the Project may be visible will be the estuarine environment and the residual outcrops and ranges to the south of Legume Station. The Project will not have a significant impact on the visual amenity of the area from these viewpoints given:

- Views of the Project from the estuarine environment will be limited to the intake and outfall structures. These views will be limited to parts of Forsyth and Alligator Creeks that are within the immediate vicinity of the structures. Mangroves along the banks of Forsyth and Alligator Creeks will help screen the intake and outfall structures and reduce the level of visual impact.
- The grow-out farms and intake and outfall structures will not be visible from the ranges and residual outcrops in the south of Legume Station given the intervening distance and the low profile of the bund walls.
- The accommodation village and central facilities will not be visible from the ranges and residual outcrops as the buildings will be lowset and screened by the surrounding bushland.

Access

The amenity of the area may be impacted by increased the numbers of recreational visitors to the area resulting from the upgrade of part of Moonamang Road, the Cave Springs Road and the Legume Access Road.

6. ENVIRONMENTAL MANAGEMENT

6.1. ENVIRONMENTAL MANAGEMENT STRATEGIES

Environmental management strategies have been prepared based on the environmental risks identified in the EIS, Volume 1, Chapter 9 - Risk Assessment, and potential impacts, mitigation measures and monitoring identified in the EIS, Volumes 2 - Environmental Assessment and 3 - Social, Economic and Cultural Assessment. These environmental management strategies consolidate and summarise the commitments made as part of the EIS, and will be used to develop site specific management procedures after approval of the Project.

Table 2 shows the potentially impacting aspects of the Project and the relevant environmental management strategy to manage each. Construction and operational impacts are grouped together and management strategies are contained in Appendix C. During operations, all construction type works (earthworks, excavation, etc.) will continue to operate under construction phase controls where relevant.

The strategies are as follows:

- C1 - Erosion and Sediment Control
- C2 - Land and Soils Management
- C3 - Acid Sulfate Soil Management
- C4 - Vegetation Management
- C5 - Weeds and Pests
- C6 - Fauna Management
- C7 - Surface Water Management
- C8 - Groundwater Management
- C9 - Waste Management
- C10 - Air and Noise Management
- C11 - Effluent Management
- C12 - Hazardous Materials Management
- C13 - Bushfire Management
- C14 - Traffic Management
- C15 - Social Impact Management
- C16 - Cultural Heritage Management

The Biosecurity Plan will be developed during the detailed design, and is further discussed in the EIS, Volume 5, Appendix 16 - Biosecurity Assessment.

TABLE 2 ENVIRONMENTAL MANAGEMENT STRATEGIES

Potential Impact/Effect	Environmental Management Strategies
Geology, Geomorphology and Soils	
Earthworks and traffic disturbance	C1 - Erosion and Sediment Control C14 - Traffic Management
Soil erosion	C1 - Erosion and Sediment Control
Disturbance and oxidation of acid sulfate soils	C3 - Acid Sulfate Soil Management
Soil contamination from leaks and spills, excessive treated (or poorly treated) wastewater application	C2 - Land and Soils Management C12 - Hazardous Materials Management C11 - Effluent Management Spill Management (Appendix E, Contingency Management)
Salinity and sodicity	C2 - Land and Soils Management C11 - Effluent Management
Geotechnical issues and stability	C2 - Land and Soils Management Addressed in design, Volume 1, Chapter 3 of EIS
Sterilisation of potential economic mineral resources.	Addressed in design, Volume 1, Chapter 3 of EIS and explored in Volume 2, Chapter 1 - Geology, Geomorphology and Soils
Hydrology	
Physical changes to hydrodynamics at Forsyth Creek inlet	C7 - Surface Water Management
Physical changes to hydrodynamics at Alligator Creek discharge point	C7 - Surface Water Management
Erosion and coastal landform and bathymetry changes at the proposed intake and discharge points	C7 - Surface Water Management
Direct impacts from the Project altering floodplain hydrology, and providing barriers to fish movement.	C7 - Surface Water Management Addressed in design, Volume 1, Chapter 3 of EIS
Potential loss or damage to ephemeral wetlands	C1 - Erosion and Sediment Control C7 - Surface Water Management Addressed in design, Volume 1, Chapter 3 of EIS
Lack of releases from Forsyth Dam, leading to changes to hydrology	C7 - Surface Water Management
Surface water and sediment quality	
Changes to estuarine water quality due to discharges into Alligator Creek	C7 - Surface Water Management
Erosion and sedimentation of waterways	C1 - Erosion and Sediment Control
Leaching of oxidising acid sulfate soils into freshwaters	Acid Sulfate Soil Management

Potential Impact/Effect	Environmental Management Strategies
Leaks and spills into fresh, estuarine and marine waters	C1 - Erosion and Sediment Control C7 - Surface Water Management C12 - Hazardous Materials Management Spill Management (Appendix E, Contingency Management)
Groundwater	
Impacts to productive aquifers due to lowering of groundwater	C8 - Groundwater Management
Spills and leaks leading to direct contamination of groundwaters	C8 - Groundwater Management C12 - Hazardous Materials Management Spill Management (Appendix E, Contingency Management)
Contamination of groundwater from wastewater irrigation areas	C8 - Groundwater Management C11 - Effluent Management
Changes to hydrology, affecting recharge zones and therefore groundwater recharge	C8 - Groundwater Management C7 -Surface Water Management
Impacts from and to shallow saline groundwater on Estuarine-Deltaic Plain	C8 - Groundwater Management
Terrestrial Vegetation and Flora	
Reductions in vegetation community and flora species number and diversity through additional or unintentional clearing or damage to flora outside clearing limits	C4 - Vegetation Management
Land degradation from acid sulfate soils, upslope land clearing or runoff leading to vegetation die-back	C1 - Erosion and Sediment Control C3 - Acid Sulfate Soil Management
Decreased volume of surface water released from the dam in the late dry season which may affect floodplain vegetation communities	C7 - Surface Water Management
Impacts to groundwater dependent flora and communities	C8 - Groundwater Management
Removal of woody or deep rooted vegetation resulting in the rising of the water table, and surface soil salinity.	C4 - Vegetation Management C8 - Groundwater Management
Dust deposition on vegetation and communities	C1 - Erosion and Sediment Control
Bushfire Risk if elevated due to Project works	C13 - Bushfire Management
Introduced flora and weeds resulting in a negative change to community diversity	C5 - Weeds and Pests
Terrestrial Fauna and Avifauna	
Vegetation clearance leading to habitat loss or mortality	C4 - Vegetation Management C6 - Fauna Management

Potential Impact/Effect	Environmental Management Strategies
Changes in floodplain hydrology leading to changes in wetland fauna habitat characteristics	C6 - Fauna Management C7 - Surface Water Management
Changes in receiving environment water quality, due to increases in nutrient content and total suspended solids, leading to changes in estuarine shorebird habitat	C7 - Surface Water Management C6 - Fauna Management
Disturbance associated with noise and visual stimulation	C6 - Fauna Management C10 - Air and Noise Management
Disturbance due to bird predation management strategies	C6 - Fauna Management
Degradation of habitat value or mortality due to introduced species	C5 - Weeds and Pests
Introduced and Pest Species	
Introduced flora and weeds resulting in a negative change to community diversity, impacts to pastoral operations	C5 - Weeds and Pests
Establishment or spread of pest fauna, particularly cane toads, impacting on existing flora and fauna values, particularly threatened and near threatened species	C5 - Weeds and Pests
Aquatic Ecosystems	
Direct disturbance of habitat from vegetation clearing and earthworks	C4 - Vegetation Management C6 - Fauna Management
Changes to floodplain hydrology from changes to flood patterns, and the cessation of dry season flows from Forsyth Creek, and the creation of waterway barriers in freshwater waterways	C7 - Surface Water Management C6 - Fauna Management
Entrainment or impingement of aquatic fauna at the seawater intake pump station on Forsyth Creek	C7 - Surface Water Management C6 - Fauna Management
Changes in water quality from vegetation clearing and earthworks; discharge of grow-out facility wastewater; spills, leaks or waste/litter movement off-site; or discharges of treated or untreated effluent wastewater directly to waterways	C7 - Surface Water Management C12 - Hazardous Materials Management Spill Management (Appendix E, Contingency Management) C11 - Effluent Management
Proliferation of pest aquatic plants	C5 - Weeds and Pests
Escape of prawn stock and/or diseases and pathogens from the grow-out facility	Biosecurity Plan
Noise and light disturbance	C10 - Air and Noise Management C6 - Fauna Management Design as outlined in the EIS, Volume 1, Chapter 3 - Project Description
Loss of access to fishing grounds and/or loss of species of significance to indigenous communities	C6 - Fauna Management C16 - Cultural Heritage Management

Potential Impact/Effect	Environmental Management Strategies
Increased site access, increasing habitat disturbance and direct take of aquatic fauna (primarily fish).	C6 - Fauna Management C15 - Social Impact Management
Waste Management	
Nuisance impacts from noise, odour and dust, land and water contamination, attraction and breeding of pests, and human health impacts due to landfill gas asphyxiation or explosion.	C9 - Waste Management C1 - Erosion and Sediment Control C7 - Surface Water Management C8 - Groundwater Management C8 - Air and Noise Management C12 - Hazardous Materials Management Spill Management (Appendix E, Contingency Management)
Air & Noise	
Excessive dust and noise emissions from construction	C10 - Air and Noise Management C1 - Erosion and Sediment Control
Excessive noise and air quality impacts from operations	C10 - Air and Noise Management
Excessive odour from pond operations	C10 - Air and Noise Management
Excessive odour from sewage treatment plants	C10 - Air and Noise Management C11 - Effluent Management
Climate Change Assessment	
Excessive generation of greenhouse gases from the Project	Ecologically Sustainable Development, outlined in the EIS, Volume 1, Chapter 7 C10 - Air and Noise Management
Sea level rise and increases in tropical cyclone intensity and frequency	This has been incorporated into design elements, outlined in the EIS, Volume 1, Chapter 3 and discussed in Volume 2, Chapter 11
Socio-economic	
Negative community relations	C15 - Social Impact Management
Failure to meet Indigenous and general local community employment and business expectations	C15 - Social Impact Management Discussed in the EIS, Volume 1, Chapter 3 and Volume 3, Chapter 1
Restriction of community access to fishing, camping and other recreational and tourism activities	C15 - Social Impact Management
Damage to locally significant areas, particularly in relation to fishing areas, and other areas that have been commonly accessed or can be seen by the public	C15 - Social Impact Management

Potential Impact/Effect	Environmental Management Strategies
Inadequate attention to community safety, particularly in relation to product transport on public roads	C15 - Social Impact Management C14 - Traffic Management
Historic and Cultural Heritage	
Removal and/or damage of cultural items or sites, associated with ground disturbing activities	C16 - Cultural Heritage Management Unexpected Findings Protocol (Appendix E, Contingency Management)
Limiting important site access by Traditional Owner / local indigenous persons, particularly for fishing and hunting activities, or accessing culturally important sites	C16 - Cultural Heritage Management
Traffic and Transport	
Risks associated with traffic accidents, road kill, etc.	C14 - Traffic Management
Amenity	
Increased the numbers of recreational visitors to the area resulting from the upgrade of part of Moonamang Road, the Cave Springs Road and the Legume Access Road	C15 - Social Impact Management C14 - Traffic Management

6.2. MONITORING AND REVIEW

A monitoring and inspection program has been developed to measure the performance of the works in relation to this EMP, described in each management strategy above. A monitoring and review checklist is included in Appendix D, which includes monitoring required to meet the reporting requirements for EMS level monitoring and review, and site level monitoring and review requirements, as well as reporting requirements relevant to each.

This EMP is to be updated as required to ensure that it complies with relevant statutory requirements (including notably all approval, licence and permit conditions) and its stated objectives, with the strategies able to suitably manage potential environmental risks. Should any changes occur, such as to the Project, legislative requirements, approvals or site conditions, a review should be conducted of the suitability of the EMP to continue to meet its objectives.

6.3. CONTINGENCY PLANS

Appendix E contains a contingency response plan that shall be carried out in the event of unexpected incidents or occurrences on the site (e.g. chemical or fuel spills). It is intended as a guide only, and actual responses must be tailored to the incident and situation.

A detailed site disaster management plan is to be prepared and utilised where appropriate, overriding this contingency plan where required.

Health and Safety concerns will always take precedence when managing an incident. If a situation is not safe, personnel will not enter the area. Emergency response is to be undertaken in accordance with a site OH&S Management Plan (refer to the EIS, Volume 3, Chapter 3 - Human Health and Safety for more information). Environmental Emergencies not identified within the contingency plans are to be dealt with as soon as practical to avoid or minimise environmental harm.

7. REFERENCES

ASC (2014). ASC Shrimp Standard Version 1.0. Technical Advisory Group of the Aquaculture Stewardship Council, March 2014.

IECA (2008). Best Practice Erosion and Sediment Control 2008. International Erosion Control Association. <http://www.austieca.com.au/>

DLRM (2016). Soil management, erosion and sediment control information. Department of Land and Resource Management. Accessed 12 September 2016 at <https://nt.gov.au/environment/soil-land-vegetation/soil-management-erosion-sediment-control>

DNREAS (2010) Land Clearing Guidelines. Technical Report No. 20 / 2009D, Department of Natural Resources, Environment, The Arts and Sport, Northern Territory.

Donovan (2003). Environmental Code of Practice for Australian Prawn Farmers. Australian Prawn Farmers Association

DPI&F (2006). Australian Prawn Farming Manual: Health management for profit. Queensland Department of Primary Industries and Fisheries

APPENDIX A ORGANISATIONAL CHART

[To be developed following engagement of management and construction teams]

APPENDIX B EMP IMPLEMENTATION

PROJECT SEA DRAGON OBJECTIVES AND TARGETS

Objectives	Targets	Key Performance Indicators																					
O1. Develop a long term sustainable aquaculture project	<p>T1.1 Conduct periodic reviews of sustainability and identify opportunities for improvement</p> <p>T1.2 Targets for resource and energy usage set and reviewed periodically</p>	<p>Food Conversion Ratio (%)</p> <p>Supply chain resource usage (mass, volume)</p> <p>Waste volumes and destination (recycled, landfill)</p> <p>Net energy usage (kJ)</p> <p>Net CO_{2,equiv.} emitted (kg)</p>																					
O2. Undertake and complete works in compliance with statutory environmental requirements	T2.1 Zero statutory infringements	<p># of infringements</p> <p># of non-compliances identified in audits and reviews</p>																					
O3. Minimise pollution and the potential for environmental harm or nuisance on the natural, social and cultural environments	<p>T3.1.1 Comply with the following discharge criteria:</p> <table border="1"> <thead> <tr> <th>Element</th><th colspan="2">Criteria</th></tr> <tr> <th></th><th>Mean</th><th>Max</th></tr> </thead> <tbody> <tr> <td>Flow (kL/day)*</td><td colspan="2">Release Point D1: Average <420</td></tr> <tr> <td>Total Nitrogen as N</td><td>≤0.8</td><td>≤3.0</td></tr> <tr> <td>Total Phosphorous as P</td><td>≤0.1</td><td>≤0.3</td></tr> <tr> <td>Total Suspended Solids (mg/L)</td><td>≤20</td><td>≤100</td></tr> <tr> <td>Chlorophyll a (µg/L)</td><td>≤20</td><td>≤100</td></tr> </tbody> </table> <p>Visual: No floating debris, oil, grease, petroleum hydrocarbon sheen, scum, litter or other objectionable matter.</p> <p>Odour: Shall not cause or generate odours which would adversely affect the use of surrounding waters</p> <p>T3.1.2 EIMP program shows no significant impact on receiving waters</p>	Element	Criteria			Mean	Max	Flow (kL/day)*	Release Point D1: Average <420		Total Nitrogen as N	≤0.8	≤3.0	Total Phosphorous as P	≤0.1	≤0.3	Total Suspended Solids (mg/L)	≤20	≤100	Chlorophyll a (µg/L)	≤20	≤100	<p># of non-compliances</p> <p># of complaints</p> <p># of incidents</p> <p># of significant incidents identified through EIMP program</p> <p># areas where pond sludge placed outside of identified conditioning areas</p> <p>Maps showing location and extent where available – e.g. weeds, vegetation</p>
Element	Criteria																						
	Mean	Max																					
Flow (kL/day)*	Release Point D1: Average <420																						
Total Nitrogen as N	≤0.8	≤3.0																					
Total Phosphorous as P	≤0.1	≤0.3																					
Total Suspended Solids (mg/L)	≤20	≤100																					
Chlorophyll a (µg/L)	≤20	≤100																					

Objectives	Targets	Key Performance Indicators
	<p>T3.2 No significant releases of chemicals, spills, unplanned or unauthorised releases off-site</p> <p>T3.3 No Complaints</p> <p>T3.4 No damage to vegetation outside of approved clearing areas</p> <p>T3.5 No harmful incidents involving wildlife</p> <p>T3.6 No increase in weed or pest presence on Project sites</p> <p>T3.7 No physical disturbance to sites of cultural significance</p> <p>T3.8 Monitor all non-compliances until closed out if required</p>	
O4. Develop an effective workplace culture built on continuous improvement, teamwork and a commitment to sustainability, quality and profitability	<p>T4.1 Incidents/complaints addressed in the required timeframes</p> <p>T4.2 Zero incidents, zero complaints</p> <p>T4.3 Training needs identified and training conducted within required timeframes</p>	<p># incidents/complaints</p> <p>% of training and awareness programs completed to schedule</p>
O5. Maintain positive communications with key stakeholders	<p>T5.1 Meet all government reporting requirements</p> <p>T5.2 Local communities provided with information relevant to their needs</p>	<p>% of reports submitted to schedule</p> <p># of complaints</p> <p># of negative media reports</p> <p># of stakeholder meetings per year</p>
O6. Maximise local recruitment and training and local businesses participation, and enable indigenous training, employment and advancement opportunities in the project	<p>T6.1 Targets for local workforce and for indigenous employment set and reviewed periodically</p> <p>T6.2 Maximise local domiciling of workforce</p> <p>T6.3 Implement indigenous employment, training and advancement program within the organisation</p>	<p>% of workforce that is local</p> <p>% of workforce that is indigenous</p> <p>% of workforce domiciled locally</p> <p>% of supply from local sources</p>

Objectives	Targets	Key Performance Indicators
	T6.4 Maximise opportunities for local sourcing	
O7. Complete all review, monitoring and inspections required	T7.1 Review, monitoring and inspections undertaken at: <ul style="list-style-type: none"> ■ The frequency required ■ Covering the sites required, and ■ Including the parameters or scope required. 	# not completed to schedule
O8. Address any non-compliances, complaints and incidents in a reasonable and timely manner	T8.1 Monitor all non-compliances until closed out T8.2 Address all actions within the stipulated time	% of actions not completed within the stipulated time Average delay time

Project Sea Dragon - Legune Station Grow Out Facility - Stage 1 Legislation and Approvals Register

Jurisdiction	Section	Name	Administered by*	Short Description	Relevance
Approvals, Permits and Licences					
Commonwealth	01 Approvals	Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Approval	DoE	EPBC 2015/7527 Approved 10 May 2017 relating to: - Listed threatened species and communities - Listed migratory species	Approved with conditions
Northern Territory	01 Approvals	Aquaculture Licence under Fisheries Act	DPI&F	An aquaculture licence is required to operate the facility	Not approved - required prior to operations commencing
Northern Territory	01 Approvals	Approval under the Environmental Assessment Act	NT EPA	Assessment Report 80 issued 15 March 2017	Issued with recommendations
Northern Territory	01 Approvals	Waste discharge licence under Water Act	DENR	WDL239 Approved for commencement 29 September 2017	Approved with conditions
Northern Territory	01 Approvals	Vegetation clearing permit under Pastoral Land Act	Pastoral Land Board	Permit PLC17-2 Approved on 22 November 2017.	Approved with conditions, for an area of approximately 3686 ha within NT Portion 798
Northern Territory	01 Approvals	Indigenous Land Use Agreement	Cwth, NLC, Native Title Claimant Group	ILUA negotiated and signed	Required to perform works on the site
Northern Territory	01 Approvals	AAPA Certificate	AAPA	Approved	Required to perform works on the site
Northern Territory	01 Approvals	Surface Water Extraction Licence under the Water Act	DENR	Licence No. 8111000 Commencement 7 March 2018; Expiry date 6 March 2028	Required to extract water from Forsyth Creek for operations (i.e. seawater intake). Require renewal with application required at least 1 month prior to the expiry date (i.e. by Friday 4 February 2028)
Northern Territory	01 Approvals	Non-Pastoral Use Permit under the Pastoral Land Act		Permit NPU17/2, approved 3 November 2017	Approved with conditions
Northern Territory	01 Approvals	Environment protection approvals and licences under the Waste Management and Pollution Control Act		Approval and licence required for the proposed landfill and farm services area (an exemption under the Act has been provided by NT EPA in regards to pond sludge and related materials - ref: NTEPA2018/0049~0013, 29 June 2018)	To be obtained
Legislation and Statutory Instruments					
Commonwealth	02 Legislation and Statutory Instruments	Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	DoE	The Commonwealth's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the Act as matters of national environmental significance (MNES). The nine MNES are: - world heritage properties - national heritage places - wetlands of international importance (often called 'Ramsar' wetlands) - nationally threatened species and ecological communities - migratory species - Commonwealth marine areas - the Great Barrier Reef Marine Park - nuclear actions (including uranium mining) - a water resource, in relation to coal seam gas development and large coal mining development.	The project has been determined to be a controlled action as a result of: - listed threatened species and communities (section 18 and 18A) - listed migratory species (sections 20 and 20A). The Project therefore requires assessment and approval under the EPBC Act. The Project is being assessed under the environmental assessment bilateral agreement between the Commonwealth and the NT government. Consideration may need to be made for The Joseph Bonaparte Gulf marine reserve ~25km seawards from Turtle Point, in relation to shipping and waste discharge.

Jurisdiction	Section	Name	Administered by*	Short Description	Relevance
Commonwealth	02 Legislation and Statutory Instruments	National Greenhouse and Energy Reporting Act 2007	Australian Government - Clean Energy Regulator	A mandatory reporting system for corporate greenhouse gas emissions and energy production and consumption, with the first reporting period having commenced on 1 July 2008. Key features are: - Reporting of greenhouse gas emissions, energy consumption and production by large corporations. - Public disclosure of corporate level greenhouse gas emissions and energy information. - Consistent and comparable data available for decision making, in particular, the development of the Carbon Pollution Reduction Scheme	Currently, the National Greenhouse and Energy Reporting Scheme applies to facilities that emit 25 kilotonnes (kt) or more of carbon dioxide equivalent (CO ₂ -e) or produce or consume 100 terajoules (TJ) or more of energy or corporations that emit 50 kt or more of CO ₂ -e or produce or consume 200 TJ or more of energy. Should the project facilities trigger these thresholds, Seafarms will report all energy use and greenhouse gas emissions under the National Greenhouse and Energy Reporting Scheme.
Commonwealth	02 Legislation and Statutory Instruments	Native Title Act 1993	Commonwealth, Northern Land Council	Provides for the recognition and protection of the traditional rights and interests of Aboriginal and Torres Strait Islander people to land and water and contains processes for effecting native title claims. The Native Title Act sets out the processes by which native title rights are established, protected and compensation determined, in addition to facilitating Indigenous Land Use Agreements (ILUA) between native title parties and other interest holders	Native title exists in parts of NT Portions 798 and 3222 of Legune Station (Determination Name: Simon v Northern Territory of Australia, 31 May 2011). The Native Title Claimant Group comprises members of the Gajerrong-Wadanybang group, Gajerrong-Gurrbijim group and Gajerrong-Djarradjarany group. The native title determination gives the Native Title Claimant Group rights to fish, hunt, conduct ceremonies and travel over the land. Refer to agreements below.
Commonwealth	02 Legislation and Statutory Instruments	Protection of Movable Cultural Heritage Act 1986		Movable cultural heritage includes objects that people create or collect, known as cultural property and can be artistic, technological, historical or natural in origin. There are strict guidelines on conditions for the export from Australia of objects considered to be of cultural heritage, with some prohibited. Any project that may involve the removal of cultural property will need to determine an object's eligibility and then obtain a permit.	Should significant aboriginal cultural heritage items be discovered, these will not be disturbed and the finding reported to the appropriate authorities and/or managed under the Cultural Heritage Management Plan. No export will be undertaken.
Northern Territory	02 Legislation and Statutory Instruments	Aboriginal Land Act 1978	DLPE	An Act to provide for access to Aboriginal land, certain roads bordered by Aboriginal land and the seas adjacent to Aboriginal land. A permit is required to undertake certain activities on Aboriginal land in the Darwin-Daly-Wagait, West Arnhem, East Arnhem, Katherine, Victoria River District, Ngukurr or Borroloola-Barkly regions of the NT. This includes entering Aboriginal land for any purpose, entering and visiting a community or travelling through Aboriginal land. A permit is not required to travel on a public road through Aboriginal Land.	Legune is within the Victoria River District, and consultation is underway in regards to native title land use agreements (ILUAs) and a Cultural Heritage Management Plan is to be prepared.
Northern Territory	02 Legislation and Statutory Instruments	Agricultural And Veterinary Chemicals (Control Of Use) Act	DPI&F	Regulates the use of the agvet product after retail sale. The Department controls how agvet chemical products are used in the NT including the manufacture, sale and use of fertilisers and stock foods, to manage land and agricultural produce contaminated by chemicals, and for related purposes.	A licence may be required to use certain agricultural and veterinary chemicals within the NT, including the use of chemicals added to stockfeed and for ground and aerial application of pesticides.

Jurisdiction	Section	Name	Administered by*	Short Description	Relevance
Northern Territory	02 Legislation and Statutory Instruments	Biological Resources Act 2006	DPI&F	Provides for and regulates bioprospecting in the NT and for related purposes. A permit is required which authorises the observation, collection, surveillance or monitoring of wildlife in the wild for research purposes. A deed of agreement under the Act may also be required if the activity has a commercial purpose.	While not relevant for the project at this stage, a permit may be required for the taking of prawn broodstock from the wild for commercial breeding purposes if taken from NT waters (rather than interstate as in the current operation). If this becomes the case, a permit application to assess the activities needs to be submitted, to determine if it would be considered bioprospecting. If so, then a benefits sharing arrangement will be entered into. Other written permissions and approvals/agreements will be required with this permit application.
Northern Territory	02 Legislation and Statutory Instruments	Bushfires Act 1980	Bushfires NT, a branch of DLRM	Relates to the prevention and suppression of bushfires. Bushfires NT's primary roles are to administer the provisions set out in the Bushfires Act and support landholders in fire mitigation and management. The Bushfires Act stresses the need for individual landholders, be they public or private, to have fire management plans in place to prevent and manage large and intense fires.	A Bushfire Management Plan will be developed which will detail measures to prevent and manage bushfires in and surrounding the Project Area. A review is currently being undertaken of the Bushfires Act to assess the effectiveness of the Act and to provide advice on changes that could lead to improved bushfire management in the Northern Territory. Any changes made will be taken into consideration and incorporated into the Bushfire Management Plan.
Northern Territory	02 Legislation and Statutory Instruments	Dangerous Goods Act 1998		The Act regulates how dangerous goods are stored, handled and transported, although most hazardous chemicals are regulated under the Work Health and Safety (National Uniform Legislation) Act (refer below) other than explosives and LP Gases.	No explosives would be used, but requirements may relate to LP Gas use on the site, if
Northern Territory	02 Legislation and Statutory Instruments	Environmental Assessment Act 1982 and Administrative Procedures	NTEPA	Establish the framework for the assessment of potential or anticipated environmental impacts of development	The NT EPA concluded the Project EIS process recommending approval with recommended requirements (Assessment Report 80).
Northern Territory	02 Legislation and Statutory Instruments	Fisheries Act	DPI&F	Provides for the regulation, conservation and management of fisheries and fishery resources so as to maintain their sustainable utilisation, as well as regulating the sale and processing of fish and aquatic life. An aquaculture licence is required under the Act for the breeding or farming of fish or aquatic life for sale.	An aquaculture licence will be required to operate the grow-out facility on Legune Station.
Northern Territory	02 Legislation and Statutory Instruments	Food Act 2005	DoH		All food preparation at construction and accommodation camps will be required to conform to this Act, and food safety standards. Registration of a food business (including accommodation camp food preparation area) is required. Treated drinking water is also required, subjected to an annual test for microbiological parameters, and a 5-yearly test for chemical parameters. Water quality testing results are required to be provided with food business registration and renewal.
Northern Territory	02 Legislation and Statutory Instruments	Heritage Act		Provides a system for the identification, assessment, protection and conservation of the NT's natural and cultural heritage. The Act affords protection for two classes of cultural heritage: - all places and objects formally assessed and added to the NT Heritage Register and - all Aboriginal and Macassan archaeological sites and/or objects. Approval must be sought under the Heritage Act to carry work on, disturb or salvage heritage places or objects declared or protected under the Act.	No places or objects listed under the Heritage Act have been identified within the immediate Project area. The Cultural Heritage Management Plan for the Project will contain procedures in the event that a place or object protected under the Heritage Act is identified

Jurisdiction	Section	Name	Administered by*	Short Description	Relevance
Northern Territory	02 Legislation and Statutory Instruments	Marine Act	DoT	Approval is required to erect structures below the high water mark or attach structures to the sea floor (jetty, wharf, pontoon or mooring) in NT waters. Approval may be subject to conditions.	Approval under the Marine Act is likely to apply to the construction of the intake and discharge pipeline which will be constructed below the high water mark on Forsyth Creek.
Northern Territory	02 Legislation and Statutory Instruments	Marine Pollution Act	DLPE	The Act (and Regulations) regulate water pollution at sea in order to protect the marine and coastal environment by minimising intentional and negligent discharges of ship-sourced pollutants into coastal waters, and for related purposes. They apply to all vessels in NT Waters, generally 3 nautical miles to seaward of the low water mark. Under the Act, all reportable incidents must be notified to the Marine Safety Branch. Section 50 of the Act defines a reportable incident as: - a discharge or probable discharge from a ship of oil or noxious liquid substance, or - jettisoning from a ship a harmful substance that is carried in packaged form.	Should PSD operate a vessel in NT waters, the proposed vessel operators must comply with the requirements of the Act and associated regulations.
Northern Territory	02 Legislation and Statutory Instruments	Northern Territory Aboriginal Sacred Sites Act 1989	AAPA	Provides for the location, recognition, description and protection of sites sacred under Aboriginal tradition. All sacred sites are protected under the Act (even those which have not been registered) and it is an offence to enter or carry out work on a sacred site without an authority certificate issued by the AAPA. The authority certificate sets out conditions for any works undertaken on or near sacred sites.	A number of sacred sites are located in proximity to the Project. Consultation with AAPA and the Traditional Owners is currently being undertaken by Seafarms and an application for an authority certificate for the Project has been lodged. In addition, a Cultural Heritage Management Plan will be developed for the Project and will contain procedures and protocols for the management of sacred sites in and surrounding the Project area.
Northern Territory	02 Legislation and Statutory Instruments	Pastoral Lands Act 1992	Pastoral Land Board	Provides for the administration, management and conservation of pastoral land and establishes the Pastoral Land Board - the statutory authority charged with the administration of pastoral leases in accordance with the Act. The Pastoral Land Board has a range of responsibilities and is the consent authority for non-pastoral uses of pastoral land and the clearing of native vegetation on pastoral land. Under the Act, pastoral leases are intended primarily for pastoral purposes. An application can be made, however, for non-pastoral use permit to use parts of the lease for other activities to improve the economic viability of the pastoral operations. Formal approval is also required from the Pastoral Land Board before undertaking clearing on a pastoral lease.	Legune Station on which the project is located is a pastoral lease and is therefore governed by the Act. An application will be required for a non-pastoral use permit which will allow the use of part of the Legune Station pastoral lease for a non-pastoral purpose (i.e. aquaculture). An application to clear vegetation for the project is required, undertaken in accordance with the Northern Territory Planning Scheme Land Clearing Guidelines which have been adopted by the Pastoral Land Board for land clearing on pastoral leases. This has been approved and a Vegetation Clearing permit issued.
Northern Territory	02 Legislation and Statutory Instruments	Planning Act 2005	DIPL	An Act to provide for appropriate and orderly planning and control of the use and development of land, and for related purposes. It establishes the Northern Territory Planning Scheme and provides for a development approval process. Some of the relevant aspects of the Act include: - Native vegetation clearing on freehold, crown and Aboriginal land tenures in excess of 1ha requires a development approval under the Act - Subdivision of pastoral leases for non-pastoral uses requires a change of tenure - A development approval is required for the construction of facilities and infrastructure for zoned land	The Legune Grow-out Facility does not propose subdivision of pastoral land as part of Stage 1 activities (to be managed under the Pastoral Lands Act). As such and since Legune is located on unzoned land, no development approval is required.

Jurisdiction	Section	Name	Administered by*	Short Description	Relevance
Northern Territory	02 Legislation and Statutory Instruments	Public and Environmental Health Act and Regulations	DoH	Creates a framework for the regulation of particular activities to protect public health in the NT	Accommodation facilities including food preparation facilities and portable water sources for the Project will be required to comply with the Act. A waste water works design approval will also be required for the disposal of waste water from the accommodation village, for < 8000L/day capacity. An on-site wastewater system with a capacity up to 8000 equivalent persons (EP) requires product approval under the Regulations to be able to be sold and installed in the NT.
Northern Territory	02 Legislation and Statutory Instruments	Soil Conservation and Land Utilisation Act 1969	DLRM	An Act to make provision for the prevention of soil erosion and for the conservation and reclamation of soil	Project activities must comply with this legislation to manage erosion on construction sites
Northern Territory	02 Legislation and Statutory Instruments	Territory Parks and Wildlife Conservation Act 1976		Lists those species of plants and animals that are protected within the Northern Territory. Under the TPWC Act, permits are required to take or interfere with protected plants or animals. The TPWC Act may apply if protected flora or fauna are encountered during the Project's life	Permits and approvals for removal of protected plants and animals may be required under the Act
Northern Territory	02 Legislation and Statutory Instruments	Transport of Dangerous Goods by Road and Rail (National Uniform Legislation)	NT WorkSafe	Regulates the transport of dangerous goods by road or rail, and for related purposes, requiring: - A Dangerous Goods Driver Licence for anyone intending to drive a vehicle carrying bulk dangerous goods with the capacity of more than 500L or 500kg goods in a single receptacle - Class 1 - Explosive; Class 2-9 (excluding class 1 and 7) with optional Class 5 Security Sensitive Ammonium Nitrate (SSAN). - A vehicle licence to transport Dangerous Goods.	The Act must be complied with for the movement of dangerous goods in the NT on PSD as well as public property.
Northern Territory	02 Legislation and Statutory Instruments	Waste Management And Pollution Control Act 1998	NTEPA	The purpose of the Act is to protect the environment through the encouragement of effective waste management and pollution prevention and control practices. It facilitates the implementation of national environment protection measures made under the National Environment Protection Council (Northern Territory) Act 1999, and incorporates environmental compliance plans and audits. Environmental protection approvals and licences are required under the Act for activities listed in schedule 2 of the associated with: - the disposal of waste by burial - the collection, transportation, storage, recycling, treatment of disposal of listed waste - the processing of hydrocarbons so as to produce, store or dispatch liquefied natural gas or methanol. Environment protection approvals are granted for works associated with the construction phase and environment protection licences are granted for the operational phase of projects. The Act also establishes a process for notifying the NT EPA about incidents causing, or threatening to cause pollution.	Environment protection approvals will be required for the construction phase of the development, and an environment protection licence for the operational phase. Waste management controls and response procedures for potential environmental incidents will be developed for the Project in the Environmental Management Plans.

Jurisdiction	Section	Name	Administered by*	Short Description	Relevance
Northern Territory	02 Legislation and Statutory Instruments	Water Act 1992	DENR	Provides for the investigation, allocation, use, control, protection and management of NT's surface water and groundwater resources. The regulatory functions of the Water Act cover: - the discharge of waste to water - the extraction of water from surface water sources - the drilling and abstraction of groundwater from bores - construction or alteration works undertaken within a waterway (i.e. dam construction and/or roadworks).	A number of licences and/or permits will be required under the Act, including: - a permit to construct or alter works (Dam construction/interference with a Waterway and roadworks) - a surface water extraction licence to extract and use saline water from Forsyth Creek and fresh water from Forsyth Creek Dam – the existing dam extraction licence will be sufficient for Stage 1, and a transfer will be required to Seafarms - waste discharge licence to discharge waste water from the grow-out facility into Alligator Creek. As no groundwater is proposed to be used for the Project, no groundwater extraction licence is required under the Act.
Northern Territory	02 Legislation and Statutory Instruments	Water Supply and Sewerage Services Act	DoH	Provides for the protection of the NT's water supply system or any water source from which water is drawn for human consumption. Any abstraction or diversion of water from the NT supply system must not be undertaken unless authorised by the appropriate authorities: - Department of Treasury and Finance for the Water Supply and Sewerage Services Act (provisions about economic regulation) - Minister for Essential Services for the Water Supply and Sewerage Services Act (provisions about supply and service provision under licence) - Department of Health for the Water Supply and Sewerage Services Act (provisions about water quality standards).	The provision of water for human consumption, whether sourced from surface or ground water, must comply with the water quality standards set out in the Act. A Waste water works design approval may also be required.
Northern Territory	02 Legislation and Statutory Instruments	Weeds Management Act 2001	DLRM	An Act to protect the Territory's economy, community, industry and environment from the adverse impact of weeds. Owners and occupiers of land are responsible for weed management and have a general duty to control weeds. Persons must dispose of potential weeds only on their own land or at a designated weed disposal area. Under Section 32 of the Act, a person must not move or drive an animal or vehicle that contains a declared weed on a public road or from the person's land to another person's land unless the animal or vehicle has been cleaned in accordance with a declared weed management plan.	PSD will have a responsibility for the management and control of weeds on the properties it manages.
Northern Territory	02 Legislation and Statutory Instruments	Work Health and Safety (National Uniform Legislation) Act	NT Worksafe	The Act and associated regulations aim to promote health and safety in the workplace, including the storage, handling and notification related to hazardous chemicals, including maintenance of a hazardous chemical register	A Health and Safety Plan will be developed for the Project to comply with the Act. Storage and handling of hazardous chemicals must comply with the requirements of the Act.
Agreements					
Legune Station	03 Agreements	Legune Station - three year access and option agreement	Owners of Legune Station & Seafarms	Allows Seafarms to: Secure the land tenure for aquaculture and obtain all of the relevant environmental approvals and all licences required for the development and operation of the Project. Access Legune Station for the purpose of carrying out studies, tests and assessments for the environmental approvals and licences and for the completion of a bankable feasibility study for the Project. Purchase Legune Station at a predetermined price at any time during the three year term of the access and option agreement.	

Jurisdiction	Section	Name	Administered by*	Short Description	Relevance
Legune Station	03 Agreements	ILUA – Native Title Claimant Group comprising members of the Gajerrong-Wadanybang group, Gajerrong-Gurrbijim group and Gajerrong-Djarradjarany group	Seafarms & the Native Title Claimant Group	ILUA agreed and in place for the site and Project.	
Relevant Standards					
National	04 Relevant Standards	AS 1940—Storage and handling of Flammable & Combustible Liquids		Relates to minor storage on a site	
National	04 Relevant Standards	AS/NZS 1547 - On-site domestic wastewater management		Relates to on-site sewerage management on a site, of a small typically domestic sized nature	
Relevant Guideines					
Northern Territory	05 Guildelines	Northern Territory Environmental Protection Authority Guidelines	NT EPA	NT EPA have developed a series of draft and current guidelines related to the Environmental Assessment Act and Waste Management and Pollution Control Act. The NT EPA guidelines are policy documents that describe the minimum expectations of the NT EPA in relation to a particular matter. Potentially relevant guidelines include: - Guidelines for the Preparation of an Economic and Social Impact Assessment - Guidelines for Assessment of Impacts on Terrestrial Biodiversity - Guidelines on Conceptual Site Models - Guidelines on Mixing Zones - Guidelines on Environmental Offsets and Associated Approval Conditions - Draft Guideline for the Preparation of an Environmental Management Plan - Noise Guidelines for Development Sites in the Northern Territory	
Northern Territory	05 Guildelines	Northern Territory Department of Land Resource Management Guidelines	DLRM	Standardised methodologies for surveying vertebrate fauna and flora in the NT, including: - Guidelines and Field Methodology for Vegetation Survey and Mapping (Brocklehurst et. al. 2007) - Guidelines for Surveying Terrestrial Vertebrate Fauna in the Northern Territory	
Northern Territory	05 Guildelines	Guidelines for Preventing Mosquito Breeding Sites Associated with Aquaculture Developments in the NT	Department of Health		
Northern Territory	05 Guildelines	Guidelines for Preventing Mosquito Breeding Associated with Construction Practice near Tidal Areas in the NT	Department of Health		
	05 Guildelines	Australian Drinking Water Guidelines		Primary guideline related to achieving safe and compliant drinking water supplies in Australia	
	05 Guildelines	Public and Environmental Health Guidelines for Public Accommodation			Related to camp accommodation
Northern Territory	05 Guildelines	Guidelines for Wastewater Works Design Approval of Recycled Water Systems	Department of Health		On-site wastewater treatement and disposal scheme

Jurisdiction	Section	Name	Administered by*	Short Description	Relevance
Northern Territory	05 Guidelines	Soil management, erosion and sediment control information	DLRM	The Department of Land Resource Management provides facts sheets on its website for guidance on works and rehabilitation measures to manage soil and erosion: https://nt.gov.au/environment/soil-land-vegetation/soil-management-erosion-sediment-control	Construction phase erosion and sediment control
Northern Territory	05 Guidelines	Waste Management Guidelines for Small Communities in the Northern Territory	NTEPA	The information included in this document is focused on improving the delivery of waste management services of communities with less than 1,000 people. For populations greater than 1,000, the 'Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory' guideline is relevant. http://www.lgaut.asn.au/policy-programs/sustainability-environment/waste-management-in-remote-regional-indigenous-communities	Relevant to the design, construction and maintenance of the proposed landfill on the site
Northern Territory	05 Guidelines	Northern Territory Pastoral Land Clearing Guidelines	Pastoral Land Board	Clearing on pastoral land. This guideline outlines when a permit is required and what the application process is. https://nt.gov.au/property/land-clearing/apply-to-clear-pastoral-land	Relevant to the Legune Station site
Northern Territory	05 Guidelines	Land Clearing Guidelines	DNREAS	Freehold landholders wanting to clear more than a total of one hectare of native vegetation, including existing cleared land on their property, must lodge a development application and receive a permit before clearing, under the NT Planning Scheme, as outlined in this guideline.	Vegetation clearing at Legune Station not under the NT Planning Scheme, so only as reference document. See Northern Territory Pastoral Land Clearing Guidelines instead.
National	05 Guidelines	Best Practice Erosion and Sediment Control 2008	IECA	Erosion and Sediment Control for Construction Sites http://www.austieca.com.au/	Referred to by the NT Government for ESC on Construction Sites
Northern Territory	05 Guidelines	Erosion and Sediment Control for Rural Development and Clearing	DLRM	Model Erosion and Sediment Control Plans https://nt.gov.au/environment/soil-land-vegetation/erosion-and-sediment-control-for-rural-development-and-clearing	
Northern Territory	05 Guidelines	Erosion and Sediment Control for Rural Development and Clearing	DLRM	Model Erosion and Sediment Control Plans https://nt.gov.au/environment/soil-land-vegetation/erosion-and-sediment-control-for-rural-development-and-clearing	
Northern Territory	05 Guidelines	Draft Guidelines for Wastewater Works Design Approval of Recycled Water Systems	DoH	Applies to the development of an on-site facility with a minimum capacity of 8,000L/day. For <8000L/day refer to Code of Practice for Small On-Site Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent http://www.health.nt.gov.au/library/scripts/objectifyMedia.aspx?file=pdf/35/63.pdf&siteID=1&str_title=Guidelines%20for%20Wastewater%20Works%20Design%20Approval%20of%20Recycled%20Water%20Systems.pdf	
Northern Territory	05 Guidelines	Code of Practice for Small On-Site Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent	Territory Health Services	Applies to any on-site wastewater system or part thereof (including land-based disposal or reuse of recycled water) with a maximum daily flow of 8000 litres. For >8000L, refer to Draft Guidelines for Wastewater Works Design Approval of Recycled Water Systems. http://www.health.nt.gov.au/environmental_health/wastewater_management/index.aspx	
Northern Territory	05 Guidelines	Guidelines for Land Capability Assessment for On-site Wastewater Management	DoH	http://www.health.nt.gov.au/environmental_health/wastewater_management/index.aspx	
National	05 Guidelines	Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)	NRMMC, EPHC, AHMC	National guidelines for reuse of recycled water, upon which the NT Draft Guidelines for Wastewater Works Design Approval of Recycled Water Systems is based. http://www.ephc.gov.au/sites/default/files/WQ_AGWR_GL_Managing_Health_Environmental_Risks_Phase1_Final_200611.pdf	

Jurisdiction	Section	Name	Administered by*	Short Description	Relevance
National	05 Guidelines	Environmental Code of Practice for Australian Prawn Farmers		Donovan, 2003	

* Definitions are as follows:

AAPA NT Aboriginal Areas Protection Authority

DIPL NT Department of Infrastructure, Planning and Logistics

DLPE NT Department of Lands, Planning & Environment

DLPE NT Department of Lands, Planning & Environment

DLPE NT Department of Lands, Planning and the Environment

DLRM NT Department of Land Resource Management

DNREAS Department of Natural Resources, Environment, the Arts and Sports

DoE Commonwealth Department of the Environment

DoH NT Department of Health

DoT NT Department of Transport

DPI&F NT Department of Primary Industries and Fisheries

NLC Northern Land Council

NRMMC, EPHC, AHMC Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, Australian Health Ministers Conference

NT EPA NT Environment Protection Authority

PWC NT Parks and Wildlife Commission

PROJECT SEA DRAGON INCIDENT / COMPLAINT / IMPROVEMENT REGISTER

Record of all incidents, near misses and complaints

Date of incident / complaint	Brief Description	Form No.	Raised by	Actions Required	Assigned to	Assigned Close out date	Close out Date	Remarks / Improvement Opportunities
01/05/16	Near miss – spillage of waste oil from waste oil storage bund due to bund failure. Cleanup contained spill	NC001	Joe Bloggs	Repair Bund Wall [also consider EMS or EMP revisions]	Jane Doe	15/05/16	14/05/16	Waste storage tank bund repaired



**PROJECT SEA DRAGON
STAGE 1 LEGUNE GROW-OUT FACILITY
DRAFT ENVIRONMENTAL IMPACT STATEMENT**

**VOLUME 1 - PROJECT OVERVIEW
CHAPTER 8 - RISK ASSESSMENT**

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1 INTRODUCTION

1.1 TERMS OF REFERENCE ADRESSED IN THIS CHAPTER

This chapter provides a description of the risk assessment undertaken for the identification, analysis and mitigation of project environmental risks associated with the Stage 1 Legume Grow-out Facility (the Project or Project Area). The risk assessment provides a framework for identifying components of the Project with the potential for greater environmental risk, and highlights areas of focus for environmental impact assessment and project specific control measures to minimise the likelihood and consequence of these identified risks.

Table 1 summarises the requirements from the Terms of Reference for the Preparation of an Environmental Impact Statement (ToR) for the Project and where they have been addressed in this chapter.

TABLE 1 TERMS OF REFERENCE

Terms of Reference		Sections
4	Risk Assessment	
	<p>The Environmental Impact Statement (EIS) should be undertaken with specific emphasis on the identification, analysis and mitigation of potential impacts through a whole-of-project risk assessment. Through this process, the EIS will:</p> <ul style="list-style-type: none"> ■ identify and discuss the full range of risks presented by the Project ■ identify relevant potential direct and indirect impacts ■ quantify and rank risks so that the reasons for proposed management responses are clear ■ identify levels of uncertainty about estimates of risk and the effectiveness of risk controls in mitigating risk ■ explicitly identify those members of the community expected to accept residual risks and their consequences, providing better understanding of equity issues ■ demonstrate that the Project represents best practicable technology. 	This chapter and the Socio-economic chapter (Volume 3, Chapter 1)

1.2 RISK ASSESSMENT SCOPE

The scope of this risk assessment was confined to the potential impacts and consequences to environmental and cultural heritage values from the construction and operation of the Project. Impacts to cultural heritage have only been considered in the context of risk of direct impacts to physical sites. Indirect impacts to cultural values such as decreased amenity and changes to access will be dealt with through the Indigenous Land Use Agreement (ILUA) process.

The impacts to the Project from climate change are described in Volume 2, Chapter 12. These impacts were assessed using a risk assessment approach, which is described in detail in Volume 5, Appendix 8. As these risks relate to the impact on the Project itself they are not dealt with in the scope of this risk assessment.

A separate risk assessment was undertaken for the socio-economic risks and is presented in the Socio-economic Chapter (Volume 3, Chapter 1). This allowed for the methodical consideration of the potential social and economic impacts of the Project, many of which are relatively distinct from the potential environmental impacts.

2 METHODS

The methodology employed was a standard semi-quantitative risk assessment consistent with AS/NZS ISO 31000:2009 'Risk Management – Principles and Guidelines'. The risk assessment process is shown in Figure 1 and described in more detail in Sections 2.1 to 2.5.

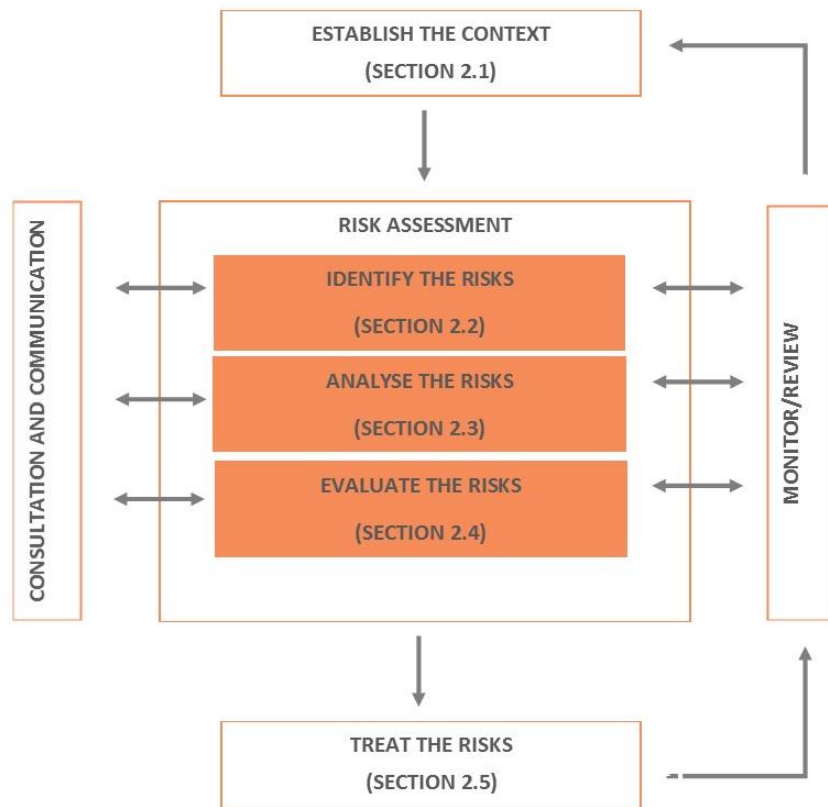


FIGURE 1 RISK ASSESSMENT PROCESS

2.1 CONTEXT ESTABLISHMENT

The first step in the risk assessment process involved establishing the context of the environmental risks. The context of the environmental risks was determined by the environmental setting of the Project and the Project design. A detailed description of the environment in which the Project is located is provided in Volume 2 and Volume 3 of the EIS, and has been informed by numerous technical studies which are included in Volume 5. A description of the construction and operational methods is provided in the Project Description chapter (Volume 1, Chapter 3).

2.2 RISK IDENTIFICATION

The next step in the risk assessment process involved the identification of potential environmental risks associated with the Project. A risk assessment workshop was held with the Project environmental and engineering teams and technical specialists involved in the preparation of the EIS to identify and discuss the full range of environmental risks associated with the Project.

The risk identification process involved the identification of risks on environmental values arising from Project. For the purposes of this risk assessment, the environmental values were referred to as 'consequence aspects' and broadly categorised as:

- general ecological values
- threatened and migratory species
- historic and cultural heritage
- amenity
- land
- marine and estuarine waters
- freshwater streams, rivers and wetlands
- groundwater
- air quality
- human health and safety
- traffic and transport

Risks were systematically identified taking into consideration the full range of Project activities during each phase of the Project (i.e. construction and operations) in relation the consequence aspects listed above.

2.3 RISK ANALYSIS

Once all the potential risks had been identified, initial risk ratings were assessed by assigning a level of consequence in accordance with consequence criteria for the Project (Table 2) and a level of likelihood in accordance with likelihood descriptors (Table 3). The initial risk rating considered the consequence and likelihood of the event occurring without any control measures in place. Following risk treatment (i.e. the implementation of control strategies - Section 2.5) the consequence and likelihood of the event occurring was reassessed.

Consequence criteria (Table 3) were developed for each of the consequence aspects list in Section 2.2 and ranged on a scale of magnitude from 'very low' to 'very high'. Magnitude was considered as a function of the size of the impact, the spatial area affected and expected recovery time.

The level of likelihoods (Table 3) were determined based upon the probability of occurrence, within the context of reasonable timeframes and frequencies given the nature of the anticipated Project life. For many of the risks identified, the conditional probability of the risk occurring was taken into account. The conditional probability is the probability of an event given another event has already occurred. For example, when assessing the likelihood of the intake of water from Forsyth Creek resulting in the mortality of a threatened species (e.g. sawfish), the probability of a. the sawfish being present within Forsyth Creek, b. the sawfish being present within Forsyth Creek at the time the intake pump is operating and c. the sawfish swimming into the zone in which the velocity of the intake exceeds the sawfish's swimming ability, was taken in account when determining the likelihood of this risk occurring.

TABLE 2 CONSEQUENCE SCALE

Consequence aspect	Consequences				
	Very Low	Low	Moderate	High	Very High
General Ecological Values	Insignificant or imperceptible effects.	Minor local resource and/or habitat modification and/or local short-term decrease in abundance of some species with no lasting effect on local population.	Moderate local resource and/or habitat modification and/or local long-term decrease in abundance of some species resulting in some permanent change to community structure.	Moderate resource and/or habitat modification and/or regional decrease in abundance of some species resulting in some changes to community structure.	Substantial regional resource and/or habitat modification and/or loss of numerous species resulting in the dominance of only a few species.
Threatened and Migratory Species	Minor local habitat modification and/or lifecycle disruption for a listed species No discernible decrease in size of populations of conservation significant fauna species.	Moderate local habitat modification and/or lifecycle disruption for a listed species. Minor local decrease in size of populations of species of conservation significance.	Substantial local habitat modification and/or lifecycle disruption for a listed species. Moderate lasting decrease in size of populations of conservation significant species.	Moderate widespread habitat modification and/or lifecycle disruption for a listed species. Substantial local decrease in size of populations of conservation significant species.	Substantial widespread habitat modification and/or lifecycle disruption for a listed species. Moderate or substantial widespread decrease in size of populations of conservation significant species.
Historic and Cultural Heritage	Insignificant impact to site or item of cultural significance.	Reparable minor impact to site or item of cultural significance.	Reparable major damage to site or item of cultural significance.	Irreparable minor damage to site or item of cultural significance.	Irreparable major damage to sites of cultural significance or sacred value.

Consequence aspect	Consequences				
	Very Low	Low	Moderate	High	Very High
Amenity	<p>Visual: Changes to landscape as a result of the Project are barely noticeable from key vantage points, publicly accessible areas and areas of significance.</p> <p>Noise: Negligible noise level increase at closest affected receiver</p>	<p>Visual: Changes to landscape as a result of the Project are visible only from nearby key vantage points, publicly accessible areas and areas of significance, and only occupy a small proportion of the viewshed.</p> <p>Noise: Marginal noise level increase at closest affected receiver</p>	<p>Visual: Changes to landscape as a result of the Project are visible from most key vantage points, publicly accessible areas and areas of significance, and only occupy a small proportion of the viewshed.</p> <p>Noise: Moderate noise level increase at closest affected receiver</p>	<p>Visual: Changes to landscape as a result of the Project are visible, occupy a large proportion of the viewshed and may intrude upon the visual amenity of key vantage points, publicly accessible areas and areas of significance across a variety of landscape.</p> <p>Noise: Appreciable noise level increase at closest affected receiver.</p>	<p>Visual: Changes to landscape as a result of the Project are clearly visible, numerous, continuous and widespread and are likely to be viewed from a number of key vantage points, publicly accessible areas and areas of significance across the landscape.</p> <p>Noise: Significant noise level increase at closest affected receiver.</p>
Land	<p>Impacts are localised and confined to near surface soils and are short-term. Easily rectified with no long term impacts.</p>	<p>Localised and medium-term reversible impact. May take up to 1 year to remediate.</p>	<p>Major localised impact or widespread lower impact. Remediation may take months to years.</p>	<p>Impact most likely affecting large areas and/or deep soil profiles leaving long term residual damage. Requires long-term recovery. May take years for full remediation to a point suitable for beneficial uses commensurate with current land uses.</p>	<p>Impact most likely affecting large areas and/or deep soil profiles leaving major residual damage. Requires long-term recovery. May take decades to achieve full remediation to a point suitable for beneficial uses commensurate with current land uses.</p>

Consequence aspect	Consequences				
	Very Low	Low	Moderate	High	Very High
Marine and Estuarine Waters	<p>Quality: Minimal near source (at point of discharge) eutrophication, or other water quality change with no significant loss of quality.</p> <p>Quantity: Short term minor change in quantity.</p> <p>Seabed changes: Insignificant change in bathymetry as a direct result of project activities.</p>	<p>Quality: Local short-term eutrophication or other water quality change above approved Water Quality Objectives.</p> <p>Quantity: Long term minor change in quantity.</p> <p>Seabed changes: Near-source and minor changes in bathymetry as a result of project activities.</p>	<p>Quality: Local long-term eutrophication or other water quality change above approved Water Quality Objectives.</p> <p>Short term local changes to water quality as a result of discharge or spillage of chemical or toxicants.</p> <p>Quantity: Moderate change in quantity.</p> <p>Seabed changes: Local and minor changes in bathymetry as a result of project activities.</p>	<p>Quality: Widespread long-term eutrophication or other water quality change above approved Water Quality Objectives.</p> <p>Short term widespread changes to water quality as a result of discharge or spillage of chemical or toxicants</p> <p>Quantity: Short term major or long term moderate changes in quantity.</p> <p>Seabed changes: Local and substantial changes in bathymetry as a result of project activities.</p>	<p>Quality: Long term widespread changes to water quality as a result of discharge or spillage of chemical or toxicants</p> <p>Quantity: Long term major changes in quantity.</p> <p>Seabed changes: Widespread and substantial changes in bathymetry as a result of project activities.</p>

Consequence aspect	Consequences				
	Very Low	Low	Moderate	High	Very High
Freshwater streams, rivers and wetlands	<p>Quality: Minimal contamination or change with no significant loss of quality.</p> <p>Quantity: Short term minor change in quantity.</p> <p>Hydrology: Insignificant alteration of existing hydrology.</p>	<p>Quality: Localised minor short term reduction in water quality. Local contamination or change that can be immediately remediated.</p> <p>Quantity: Long term minor change in quantity.</p> <p>Hydrology: Localised minor changes to existing hydrology.</p>	<p>Quality: Localised, minor long term; or widespread, minor short term; reduction in water quality. Remediation may take weeks.</p> <p>Quantity: Moderate change in quantity.</p> <p>Hydrology: Localised major or widespread minor changes to existing hydrology.</p>	<p>Quality: Localised, major long term; or widespread, major short term; reduction in water quality. Remediation may take months.</p> <p>Quantity: Short term major or long term moderate changes in quantity.</p> <p>Hydrology: Widespread major changes to existing hydrology.</p>	<p>Quality: Widespread major long term reduction in water quality. Remediation may take years.</p> <p>Quantity: Long term major changes in quantity.</p> <p>Hydrology: Major changes to existing hydrology on a catchment level.</p>

Consequence aspect	Consequences				
	Very Low	Low	Moderate	High	Very High
Groundwater	<p>Quality: Impacts are localised and confined to near source and are short-term. Easily rectified with no long term impacts.</p> <p>No impact on beneficial uses or ecological values.</p> <p>Drawdown: Insignificant effect.</p>	<p>Quality: Localised and medium-term, low level reversible impact. May take up to 1 year to remediate.</p> <p>No impact on beneficial uses or ecological values.</p> <p>Drawdown: Near-source minor change in recharge patterns within sub-catchments.</p>	<p>Quality: Major localised impact or widespread lower impact.</p> <p>Remediation may take months to years.</p> <p>No impact on beneficial uses or ecological values.</p> <p>Drawdown: Near-source major change in recharge patterns within sub-catchments.</p>	<p>Quality: Large volumes of or deep-seated contaminants requiring long-term recovery. May take years for full remediation.</p> <p>Drawdown: Local major changes in recharge patterns within sub-catchments.</p>	<p>Quality: Large volumes of or deep-seated contaminants requiring long-term recovery. May take decades for full remediation.</p> <p>Drawdown: Widespread major changes in recharge patterns.</p>
Air Quality	No measurable air quality impacts or exceedance of air quality standards	Near source, short-term, and approaching exceedance of air quality standards	Near source, minor, long-term, or widespread minor short term or minor exceedance of air quality standards	Widespread, major, short-term exceedance of air quality standards	Regional long term change in air quality or exceedance of air quality standards
Human Health and Safety	Low level short term subjective inconvenience or symptoms. Typically first aid and no medical treatment.	Reversible / minor injuries requiring medical treatment, but does not lead to restricted duties. Typically a medical treatment.	Reversible injury or moderate irreversible damage or impairment to one or more persons. Typically a lost time injury.	Single fatality and/or severe irreversible damage or severe impairment to one or more persons.	Multiple fatalities or permanent damage to multiple people.

TABLE 3 LIKELIHOOD CLASSIFICATION

	Likelihood				
	Rare	Unlikely	Possible	Likely	Almost Certain
Frequency Interval (multiple events)	1/100 years	1/10 – 1/100 years	1/year – 1/10 years	2/years – 1/year	>2/year
Probability (single events)	<0.1%	0.1%-1%	1%-10%	10%-25%	>25%

2.4 RISK EVALUATION

Once the consequence criteria and level of likelihood had been assigned to each identified risk, the overall risk level was evaluated by using the risk matrix provided in Table 4.

TABLE 4 RISK ASSESSMENT CLASSIFICATION MATRIX

Likelihood	Consequences				
	1 – Very Low	2 – Low	3 – Moderate	4 – High	5 – Very High
5 – Almost Certain	Medium	Medium	High	Extreme	Extreme
4 – Likely	Medium	Medium	Medium	High	Extreme
3 – Possible	Low	Medium	Medium	Medium	High
2 – Unlikely	Very Low	Low	Medium	Medium	Medium
1 – Rare	Very Low	Low	Low	Medium	Medium

A brief description of each overall possible risk classification is provided below.

Extreme

A ranking of very high represents an unacceptable risk, which is usually critical in nature in terms of consequences (e.g. extensive and long term environmental damage) and is considered possible to almost certain to occur. Such risks significantly exceed the risk acceptance threshold and require comprehensive control measures, and additional urgent and immediate attention towards the identification and implementation of measures necessary to reduce the level of risk.

High

High risks typically relate to significant to critical consequences (e.g. a major amount of environmental damage) that are rated as possible to almost certain to occur. These are also likely to exceed the risk acceptance threshold, and although proactive control measures are usually planned or implemented, a very close monitoring regime and additional actions towards achieving further risk reduction is required.

Medium

As suggested by the classification, medium level risks span a group of risk combinations varying from relatively low consequence / high likelihood to mid-level consequence / likelihood to relatively high consequence / low likelihood scenarios. These risks are likely to require active monitoring as they are effectively positioned on the risk acceptance threshold.

Low

Low risks are below the risk acceptance threshold and although they may require additional monitoring in certain cases, are not considered to require active management. In general such risks represent relatively low likelihood, and low to mid-level consequence scenarios.

Very Low

Very Low risks are below the risk acceptance threshold and would, at the most, require additional monitoring and in many cases would not require active management. These risks can include unlikely to rare events with minor consequences, and in essence relate to situations around very low probabilities of relatively minor impacts occurring.

2.5 RISK TREATMENT

Control measures were developed to further reduce the risk. The risk was then reassessed using the processes outlined in Sections 2.3 and 2.4 to confirm the effectiveness of these control measures. This second rating is known as the residual risk rating and was used as the final risk rating.

The control measures have been used in the development of the Environmental Management Plan (Volume 4, Chapter 3) and will be implemented in the construction and operation of the Project.

3 RISK REGISTER

A risk register was established to document the findings of the risk assessment process. The risk register contains details of the source of impact, the potential consequences and control measures that will be implemented as part of the Project.

The risk register for Project construction is presented in Table 5, while the risk register for operations is presented in Table 6. The two tables combined constitute the risk register for the Project.

TABLE 5 CONSTRUCTION RISK REGISTER

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Site establishment, vegetation clearing and earthworks.	General Ecological Values	Clearing of vegetation results in the change or loss of habitat/biodiversity values for terrestrial flora and fauna.	5	2	M	<ul style="list-style-type: none"> Undertake pre-clearance surveys to confirm the presence or absence threatened fauna species. Utilise spotter catchers to conduct pre-clearance assessments and attend clearing as required. 	5	2	M	<ul style="list-style-type: none"> As detailed in the Terrestrial Flora chapter (Volume 2, Chapter 5), the dominant community is northern rice grass (<i>Xerochloa imberbis</i>) grassland which comprises 47% of the clearing footprint. This community is widespread and common and the clearing represents 8% of the area of northern rice grass grassland on Legume Station.
		Clearing of vegetation results in the mortality or injury of flora species.	5	2	M	<ul style="list-style-type: none"> Minimise vegetation clearance to the smallest extent possible. Clearly mark out limits of clearing and individuals to retain. Avoid land clearing during the wet season. Adhere to buffer widths recommended by the NT Land Clearing Guidelines where possible, with regard to riparian vegetation in drainage lines. 	5	2	M	
		Clearing of vegetation and/or earthworks results in the mortality or injury of terrestrial fauna or avifauna species.	5	2	M	<ul style="list-style-type: none"> Install structures that would capture sediment downstream of development. Stage clearing of vegetation to minimise areas of bare ground and clear land only as required and in accordance with the erosion and sediment control plan. 	5	1	M	<ul style="list-style-type: none"> Areas to be cleared are largely depauperate of native fauna, having been heavily modified as a result of grazing practices. Furthermore, construction will be undertaken in the dry season when avifauna are largely absent from these areas.
	Threatened and Migratory Species	Clearing of vegetation results in the change or loss of habitat/biodiversity values for threatened and migratory species.	5	2	M	<ul style="list-style-type: none"> Clearing to be undertaken sequentially to encourage fauna to disperse. Rehabilitate/stabilise cleared land as soon as possible after works have been completed. 	5	1	M	<ul style="list-style-type: none"> As detailed in the Terrestrial Fauna and Avifauna chapter (Volume 2, Chapter 6), the area to be cleared for the grow-out ponds is not important dry season habitat for threatened and migratory avifauna. Wet season habitat for these species is widespread. Clearing for the accommodation village central facilities and service corridors (i.e. roads) comprises of less than 1% of habitat within the surrounding area for the bare-rumped sheath-tail bat and this habitat contains significantly less roosting resources for this species than surrounding non-impacted woodland. No habitat for other non-avian threatened species to be cleared.
						<ul style="list-style-type: none"> Develop and implement vegetation clearing sub-plans which include areas not to be cleared (no-go areas) and make all workers aware of them through environmental management plan and site work briefings. Development and implement fauna management plan including procedures for managing vegetation clearing operations and any direct fauna impacts (injuries, entrapments etc). Controlled burns and/or vegetation mulched for re-use where practicable, no disposal of cleared vegetation into waterways or wetlands. No laydown areas or material storage in wetland areas. Where practicable, temporary fencing to exclude fauna from vegetation clearing areas. 				

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
		Clearing of vegetation results in the mortality or injury of threatened flora species.	1	3	L	<ul style="list-style-type: none">Apply buffers and visual screens between construction areas and migratory and waterbird habitat at the Alligator Creek road crossing.Retain screening vegetation to waterbird habitat areas as long as possible during construction.	1	2	L	<ul style="list-style-type: none">As detailed in the Terrestrial Flora chapter (Volume 2, Chapter 5), no threatened flora species were recorded during the flora and vegetation surveys and none are predicted to occur.
		Clearing of vegetation and/or earthworks results in the mortality or injury of threatened or migratory terrestrial fauna or avifauna species.	2	3	M	<ul style="list-style-type: none">Soil management procedures to target specific areas subject to salinity, sodicity and enhanced erosion including mitigation, soil amelioration and rehabilitation as required.Strict controls for waterway crossing works including erosion and sediment controls, defined trafficable areas etc.	2	2	L	<ul style="list-style-type: none">As detailed in the Terrestrial Fauna and Avifauna chapter (Volume 2, Chapter 6), migratory birds unlikely to be affected as clearing will only occur in dry season when there is no migratory bird habitat in the majority of the areas to be cleared. Special care will be taken around Alligator Creek.Clearing for the accommodation village central facilities and service corridors (i.e. roads) comprises of less than 1% of habitat within the surrounding area for the bare-rumped sheath-tail bat and this habitat contains significantly less roosting resources for this species than surrounding non-impacted woodland.
	Historic and Cultural Heritage	Damage to or destruction of sacred sites or heritage items during vegetation clearing and/or earthworks.	3	5	H	<ul style="list-style-type: none">Undertake pre-clearance surveys to confirm the presence or absence cultural heritage sites and/or objects.Minimise vegetation clearance to the smallest extent possible.	2	5	M	<ul style="list-style-type: none">Low likelihood of unknown sites due to extensive surveys and consultation undertaken during ILUA process.
		Indirect impacts from site establishment, vegetation clearing and earthworks (e.g. sedimentation and pollution) results in impacts to cultural sites.	2	4	M	<ul style="list-style-type: none">Clearly mark out limits of clearing.Install structures that would capture sediment downstream of development.Develop and implement vegetation clearing sub-plans which include areas not to be cleared (no-go areas) and make all workers aware of them through environmental management plan and site work briefings.Controlled burns and/or vegetation mulched for re-use where practicable, no disposal of cleared vegetation into waterways or wetlands.	1	4	M	<ul style="list-style-type: none">Measures to mitigate potential damage to culturally significant sites will be detailed in the Heritage Management Plan in consultation with Traditional Owners.






Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
	Freshwater Streams, Rivers and Wetlands	Clearing of vegetation near waterways and wetlands leads to bank destabilisation, direct damage, or release of sediments and/or organic matter to waterways which impacts on water quality.	3	3	M	<div><div></div> Minimise vegetation clearance to the smallest extent possible.</div> <div><div></div> Clearly mark out limits of clearing and individuals to retain.</div> <div><div></div> Avoid land clearing during the wet season.</div> <div><div></div> Adhere to buffer widths recommended by the NT Land Clearing Guidelines where possible, with regard to riparian vegetation in drainage lines.</div> <td>2</td> <td>2</td> <td>L</td> <td><div><div></div> Limited works near waterways and wetlands.</div><div><div></div> Erosion and sediment controls will be put in place.</div></td>	2	2	L	<div><div></div> Limited works near waterways and wetlands.</div> <div><div></div> Erosion and sediment controls will be put in place.</div>
		Site establishment and construction of farms results in the loss of ephemeral wetlands.	5	2	M	<div><div></div> Install structures that would capture sediment downstream of development.</div> <div><div></div> Stage clearing of vegetation to minimise areas of bare ground and clear land only as required and in accordance with the erosion and sediment control plan.</div> <td>5</td> <td>2</td> <td>M</td> <td><div><div></div> Considering much of the Legune floodplain becomes one major water body for months at a time during the wet season, the relatively small loss of ephemeral wetlands it is not likely to have a measurable ecological impact beyond the Project footprint.</div></td>	5	2	M	<div><div></div> Considering much of the Legune floodplain becomes one major water body for months at a time during the wet season, the relatively small loss of ephemeral wetlands it is not likely to have a measurable ecological impact beyond the Project footprint.</div>
	Marine and Estuarine Waters	Clearing of mangroves leading to bank destabilisation, increased erosion and runoff resulting in release of sediments and/or organic matter to waterways impacting water quality.	3	2	M	<div><div></div> Rehabilitate/stabilise cleared land as soon as possible after works have been completed.</div> <div><div></div> Develop and implement vegetation clearing sub-plans which include areas not to be cleared (no-go areas) and make all workers aware of them through environmental management plan and site work briefings.</div> <div><div></div> Controlled burns and/or vegetation mulched for re-use where practicable, no disposal of cleared vegetation into waterways or wetlands.</div> <div><div></div> No laydown areas or material storage in wetland areas.</div> <div><div></div> Soil management procedures to target specific areas subject to salinity, sodicity and enhanced erosion including mitigation, soil amelioration and rehabilitation as required.</div> <div><div></div> Strict controls for waterway crossing works including erosion and sediment controls, defined trafficable areas etc.</div>	2	1	VL	<div><div></div> Small area of mangroves to be cleared at the intake site only.</div> <div><div></div> Erosion and sediment controls will be put in place.</div> <div><div></div> As detailed in the Marine and Estuarine Water chapter (Volume 2, Chapter 2), the existing estuarine environment is extremely turbid and dynamic.</div>
Land	Clearing of vegetation and/or earthworks leads to increased erosion and loss of topsoil affecting future land productivity.	4	3	M	<div><div></div> Minimise vegetation clearance to the smallest extent possible.</div> <div><div></div> Clearly mark out limits of clearing and individuals to retain.</div> <div><div></div> Avoid land clearing during the wet season.</div> <div><div></div> Install structures that would capture sediment downstream of development.</div> <td>4</td> <td>2</td> <td>M</td> <td><div><div></div> Topsoil will be used in development of pond and channel walls or stockpiled and stabilised for future use.</div><div><div></div> Erosion and sediment controls will be put in place.</div></td>	4	2	M	<div><div></div> Topsoil will be used in development of pond and channel walls or stockpiled and stabilised for future use.</div> <div><div></div> Erosion and sediment controls will be put in place.</div>	
	Clearing of vegetation and/or earthworks leads to increased salinity.	1	3	L	<div><div></div> Stage clearing of vegetation to minimise areas of bare ground and clear land only as required and in accordance with the erosion and sediment control plan.</div> <div><div></div> Rehabilitate/stabilise cleared land as soon as possible after works have been completed.</div>	1	3	L	<div><div></div> Increased salinity due to the removal of vegetation is considered unlikely due to depth of groundwater table and lack of deep rooted woody vegetation. Incidences of sodic soils come from active seawater influence rather than dryland salinity.</div>	

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
		Clearing and/or working of sodic soils leads to enhanced erosion and soil degradation.	2	3	M	<ul style="list-style-type: none"> Develop and implement vegetation clearing sub-plans which include areas not to be cleared (no-go areas) and make all workers aware of them through environmental management plan and site work briefings. Controlled burns and/or vegetation mulched for re-use where practicable, no disposal of cleared vegetation into waterways or wetlands. An unexpected findings protocol will be implemented including stop work, containment and remediation actions. Soil management procedures to target specific areas subject to salinity, sodicity and enhanced erosion including mitigation, soil amelioration and rehabilitation as required. Rehabilitation and decommissioning plan will be developed. 	2	2	L	<ul style="list-style-type: none"> As detailed in the Geology, Geomorphology and Soils chapter (Volume 2, Chapter 1), sodic soils have been identified on site. This is from active seawater influence rather than problematic dryland sodic soils. Typically only the surface soils are sodic and no change in saline/freshwater regime anticipated outside of grow-out pond areas.
		Encountering contaminated sites (e.g. cattle dips and landfills) during vegetation clearing or earthworks requiring clean up or remediation to make safe.	2	3	M	<ul style="list-style-type: none"> Rehabilitation and decommissioning plan will be developed. 	2	2	L	<ul style="list-style-type: none"> Contaminated land assessment did not identify any contaminated sites within the Project footprint.
Introduction or spread of weeds/pest animals during construction activities (e.g. site establishment, earthworks, movement of heavy machinery).	General Ecological Values	The introduction or spread of weeds/pest animals results in the change or loss of habitat/biodiversity values for terrestrial flora and fauna.	4	4	H	<ul style="list-style-type: none"> Weed Management Plan will be implemented, including pre-construction mapping and regular weed inspections. A Fauna Management Plan will be prepared which will include pest animal eradication and management strategies for construction. 	2	2	L	<ul style="list-style-type: none"> With mitigation measures in place it is unlikely that any weeds/pest animals will be introduced or spread as a result of Project construction.
	Threatened and Migratory Species	The introduction or spread of weeds/pest animals results in the change or loss of habitat/biodiversity values for threatened flora and threatened and migratory fauna.	4	4	H	<ul style="list-style-type: none"> Environmental inductions for workforce to include identification of problem weeds. Vehicle and equipment wash-down procedures on-site. Store weed impacted topsoils separately and do not spread around the site. Implement weed control notification and location recording for weed identified on site. Weed control monitoring and management practices. Ensure fire management plan applies to construction and takes into consideration weed impacts following burn offs. Manage landfill and putrescible waste to control feral and pest animal ingress. 	2	2	L	

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Burning to clear vegetation	Air Quality	Air emissions from burning of vegetation results in reduced air quality at sensitive receptors.	1	3	L		1	3	L	As detailed in the Air Quality chapter (Volume 2, Chapter 10) there are no nearby sensitive receptors that would be impacted by air emissions from the Project.
	General Ecological Values	Burning extends beyond vegetation clearing zone resulting in the loss of habitat/biodiversity values.	4	3	M	<div>Implement fire management plan to incorporate controlled burns, firebreaks and health and safety protocols including emergency response procedures and personal protective equipment (PPE).</div> <div>Controlled burns will only take place under supervision of appropriately trained personnel.</div>	2	2	M	Through implementation of a fire management plan there will be measures in place to limit the extent of and respond to fire should it extend beyond vegetation clearing zone.
	Threatened and Migratory Species	Burning results in the mortality or injury of threatened flora species.	1	3	L	Utilise spotter catchers to conduct pre-burning assessments and attend clearing as required.	1	3	L	As detailed in the Terrestrial Flora chapter (Volume 2, Chapter 5), no threatened flora species were recorded during the flora and vegetation surveys and none are predicted to occur.
		Burning results in the mortality or injury of threatened or migratory terrestrial fauna or avifauna species.	1	3	L		1	3	L	<div>As detailed in the Terrestrial Fauna and Avifauna chapter (Volume 2, Chapter 6), area to be burnt for the grow-out ponds is not important dry season habitat for threatened and migratory avifauna.</div> <div>Vegetation at the accommodation village, central facilities and service corridors (i.e. roads) will be cleared and therefore is dealt with in the vegetation clearing section of this risk assessment.</div>
	Human Health and Safety	Burning results in injuries or death from smoke inhalation or fire.	3	5	H	<div>Burning to clear vegetation will only take place under supervision of appropriately trained personnel and in accordance with the fire management plan, health and safety protocol including emergency response procedures and PPE.</div> <div>Firebreaks will be established around areas to be burnt.</div>	1	5	M	Burning to clear vegetation will only be undertaken once to facilitate establishment of the grow-out ponds.

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Noise generation and vibration impacts from site establishment, vegetation clearing, earthworks and the movement of heavy machinery.	General Ecological Values	Increased noise levels results in the disturbance of terrestrial fauna and avifauna.	5	1	M	<ul style="list-style-type: none"> Apply noise barriers between construction areas and migratory and waterbird habitat at the Alligator Creek road crossing. Retain screening vegetation to waterbird habitat areas as long as possible during construction. All engine covers will be kept closed while equipment is operating. The height at which material is dropped into or out of trucks will be minimised as far as possible. Vehicles should be kept properly serviced and fitted with appropriate mufflers. The use of exhaust brakes will be minimised, where practicable. Machines found to produce excessive noise compared to industry best practice will be removed from the site or stood down until repairs or modifications can be made. All equipment will be selected to minimise noise emissions. Equipment will be fitted with appropriate silencers and be in good working order. Machines found to produce excessive noise compared to normal industry expectations will be removed from the site or stood down until repairs or modifications can be made. 	4	1	M	<ul style="list-style-type: none"> As detailed in the Terrestrial Fauna and Avifauna chapter (Volume 2, Chapter 6), noise reduces to below 65 decibels within 100 m of the construction footprint. Noise under 65 decibels is unlikely to cause birds to move away from the site, hence the potential for significant impact is very low. Project construction will occur in the dry season and during this time there is less likely to be threatened and migratory species present. The vast majority of the construction footprint is well removed from areas that are likely to be habitat for threatened and migratory species in the dry season. Mitigation measures are proposed to limit the potential impact from the relatively small amount of works at Alligator Creek for the construction of the Central Services Road.
	Threatened and Migratory Species	Increased noise levels results in the disturbance of threatened and migratory fauna and avifauna.	3	1	L		2	1	VL	
	Amenity	Increased noise levels at sensitive receptors.	1	1	VL	<ul style="list-style-type: none"> The above mitigation measures which are proposed to limit increased noise levels on fauna will also generally reduce noise levels for humans in the vicinity (note that this will be construction personnel only who will have an expectation of noise levels during construction and will be wear appropriate PPE if required). 	1	1	VL	<ul style="list-style-type: none"> As detailed in the Noise and Vibration chapter (Volume 2, Chapter 12), there are no nearby sensitive receptors that would be impacted by noise emissions from the Project.
Noise and vibration during construction of seawater intake pump.	Threatened and Migratory Species	Noise and vibration, particularly during piling operations, results in disturbance to threatened and migratory estuarine megafauna, and terrestrial avifauna.	3	1	L	<ul style="list-style-type: none"> Where possible, a ‘soft-start’ for all pile-driving, slowly increasing intensity of the driving hammer power Routine maintenance and inspection of all noise-generating equipment to ensure noise is kept to a minimum Not leaving noise-generating equipment on standby or running mode If, after works have commenced, marine fauna (large fish, schools of fish, marine mammals and turtles) are observed within 100 m of the noise emitting source, then pile-driving ceases until the animal has passed. 	2	1	VL	<ul style="list-style-type: none"> Short duration of impact. Impact restricted to the seawater intake location. Any threatened and migratory species in the vicinity of the seawater intake pump station may temporarily vacate or avoid the area following the commencement of piling works - soft start would allow them to vacate while impact still minimal. Threatened and migratory species expected to resume normal behavioural patterns following the cessation of the piling works.

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Generation and dispersion of dust emissions from site establishment, vegetation clearing, earthworks.	Air Quality	Dust emissions result in a reduction of air quality at potentially sensitive receptors.	2	2	L	<ul style="list-style-type: none">Watering of unsealed road and construction surfaces to reduce dust emissions.Speed limits will be enforced for all vehicles on unsealed roads.Vegetation clearing will be limited and exposed areas revegetated, where possible.Apply buffers between construction areas and migratory and waterbird habitat at the Alligator Creek road crossing.Retain screening vegetation to waterbird habitat areas as long as possible during construction.Stabilise stockpile surfaces if inactive for extended periods.Weather reports will be checked daily to enable action to be taken immediately if conditions change.A site ‘shut down and cover up’ policy will be implemented during periods of extreme weather conditions.Implement erosion and sediment control plans specific to the site.Personnel to wear personal protection equipment appropriate to the task.	1	1	VL	<ul style="list-style-type: none">No nearby sensitive receptors.
	General Ecological Values	Dust emissions result in increased levels of dust deposition on surrounding flora resulting in smothering of vegetation and habitat degradation.	5	1	M		5	1	M	<ul style="list-style-type: none">Vegetation on-site habituated to already dusty environment.Given the significant rainfall events expected on an annual basis, impacts from dust will be short term and minor at most.
	Threatened and Migratory Species		1	1	VL		1	1	VL	<ul style="list-style-type: none">As detailed in the Terrestrial Fauna and Avifauna chapter (Volume 2, Chapter 6), no threatened or migratory species expected in the majority of the clearing footprint (i.e. grow-out ponds) during construction.Note that flora and fauna at Alligator Creek habituated to already dusty environment due to adjacent road.
	Freshwater Streams, Rivers and Wetlands	Dust emissions result in increased levels of dust deposition which leads to changes in water quality.	2	2	L		2	1	VL	<ul style="list-style-type: none">Freshwater environments on-site habituated to already dusty environment.Given the significant rainfall events expected on an annual basis, impacts from dust will be short term and minor at most.The vast majority of the construction footprint is well removed from freshwater environments (construction in the dry season).
	Historic and Cultural Heritage	Dust impacts on sites of cultural significance.	3	2	M		2	1	VL	<ul style="list-style-type: none">Dusty conditions already exist on the Project site.Given the significant rainfall events expected on an annual basis, impacts from dust will be short term and minor at most.

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Drawdown of groundwater from excavation and borrow pits.	Groundwater	Groundwater drawdown impacts on groundwater levels.	2	2	L	 A site wide groundwater monitoring program will be initiated to monitor groundwater levels in productive (and saline) aquifers and provide early warning of potential impacts from the Project. This will include monitoring for loss of aquifer level.	2	1	VL	 Shallow saline water table on the estuarine-deltaic plain at ~3m below ground level in the dry season.  Grow-out ponds comprise the majority of the Project footprint. Ponds will formed by excavating a thin layer (nominally 300 mm) to form bund walls and therefore will be unlikely to intersect groundwater.  There is some potential for some smaller Project elements to intersect the shallow groundwater on the estuarine-deltaic plain however this resource is not generally useable, other than in some local recharge areas associated with low hills and rises on the plains.  Aquifers and bores in proximity to the Forsyth Dam borrow pits and the Central Facilities and Accommodation Village borrow pits are identified at or below 22.5m below ground level, and excavations are not proposed to that depth in these areas and hence these aquifers are unlikely to be impacted.
Disturbance of acid sulfate soils (ASS) during earthworks.	Freshwater Streams, Rivers and Wetlands	Disturbance of ASS results in the generation of acid leachate which acidifies runoff and leads to changes in water quality in freshwater streams, rivers and wetlands.	2	2	L		2	1	L	
	Marine and Estuarine Waters	Disturbance of ASS results in the generation of acid leachate which acidifies runoff and leads to changes in water quality in Marine and Estuarine Waters.	3	2	M		2	1	L	
	Groundwater	Disturbance of ASS results in the generation of acid leachate which acidifies groundwater and leads to changes in water quality.	3	2	M		2	1	L	
	Land	Disturbance of ASS leads to acidification of soils and/or continued leachate generation.	3	2	M		2	1	L	

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Spills or leaks of contaminants such as fuel, oils, chemicals or liquid waste.	Land	Spills of contaminants result in contamination of soils.	3	4	M	<ul style="list-style-type: none">Fuel, oil, chemical and liquid waste to be stored in bunded and appropriately contained areas.Fuel and chemical transfer points to be bunded.Spill kits and spill management controls utilised at all storage and transfer points.All waste disposed appropriately offsite or disposed of in the onsite landfill.Training and incident/notification procedures to be adopted.An unexpected findings protocol will be implemented including stop work, containment and remediation actions.	2	2	L	<ul style="list-style-type: none">With mitigation and management measures in place spills are unlikely and procedures are in place to rectify them immediately.
	Freshwater Streams, Rivers and Wetlands	Contaminants enter surrounding waterways and lead to changes in water quality in freshwater streams, rivers and wetlands.	3	3	M		2	2	L	<ul style="list-style-type: none">Minimal construction work will be undertaken near freshwater environments.With mitigation and management measures in place spills are unlikely and procedures are in place to rectify them immediately.
	Marine and Estuarine Waters	Contaminants enter surrounding waterways and lead to changes in water quality in Marine and Estuarine Waters.	3	3	M		2	2	L	<ul style="list-style-type: none">Minimal construction work will be undertaken near marine and estuarine environments.With mitigation and management measures in place spills are unlikely and procedures are in place to rectify them immediately.
	Groundwater	Contaminants enter groundwater and lead to changes in water quality.	3	3	M		2	1	VL	<ul style="list-style-type: none">With mitigation and management measures in place spills are unlikely and procedures are in place to rectify them immediately.
	Historic and Cultural Heritage	Contamination results in damage to a site or item of cultural significance.	3	3	M		2	2	L	<ul style="list-style-type: none">With mitigation and management measures in place spills are unlikely and procedures are in place to rectify them immediately.
Landscape changes from the construction of the Project.	Amenity	Changes to the landscape impact on the visual amenity of the area.	2	2	L	<ul style="list-style-type: none">Project footprint has been designed to avoid cultural sites.Decommissioning and rehabilitation plan to be adopted.Non-pastoral use agreement will allow for continuation of pastoral activities on the site.	2	2	L	<ul style="list-style-type: none">As detailed in the Amenity chapter (Volume 3, Chapter 5), Project is remote and unable to be seen from potentially sensitive receptors.Landscape use is changing from one beneficial use to another (i.e. grazing to aquaculture).
	Land	Changes in the landscape impacts on land use.	5	2	M		5	2	M	

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Increased number of unauthorised visitors to Legune Station following the construction of all-weather access road.	Amenity	Increased numbers of visitors results in disturbance of the natural environment (e.g. through the dumping of rubbish or overfishing) which impacts on the amenity of the area.	3	2	M	<ul style="list-style-type: none">A gate will be installed at the entrance to the Legune Access Road.Signage to discourage off-road access from possible vantage off road.Surveillance for trespassers.Access to Legune Station will only be permitted to authorised personnel.	2	2	L	
	Threatened and Migratory Species	Increased numbers of visitors leads to disturbance of the natural environment (e.g. through the dumping of rubbish or overfishing) which results in a loss or change of habitat/biodiversity values or the mortality or injury of threatened or migratory species.	3	2	L		2	2	L	
	Human Health and Safety	Unauthorised visitors interact or interfere with the Project.	3	4	M		2	4	M	<ul style="list-style-type: none">Positive community support for the Project and unlikely to be the target of negative interference that could cause human health and safety issues.
Traffic movements	Human Health and Safety	Increased traffic movements lead to an increase in vehicle incidents.	3	5	H	<ul style="list-style-type: none">The upgrading of part of Moonamang Road, the Cave Springs Road by the WA and NT governments respectively and the Legune Access Road as part of the Project will ensure that the entire route from Legune Station to Kununurra is of an appropriate standard and capacity to accommodate the needs of the Project.Vehicles to adhere to site speed limits and road rules.Personnel operating vehicles must not be under the influence of alcohol or other drugs.Personnel will be appropriately licenced.Vehicle inspection checks and services required to be undertaken at regular (appropriate) intervals.All Project personnel to complete a site and safety induction prior to commencement of work.Establish, implement and monitor a Driver Safety and Fatigue Management Policy for all employees and contractors.	2	5	M	<ul style="list-style-type: none">As described in the Traffic and Transport chapter (Volume 3, Chapter 4), the projected change in traffic movements as a result of the construction of the Project is negligible and will be within the normal day-to-day variation in traffic volumes.
	Air Quality	Increased traffic results in increased dust emissions from unsealed roads.	3	2	M	<ul style="list-style-type: none">Unsealed roads will be watered to reduce dust emissions.	2	1	VL	
	Land	Increased traffic results in soil compaction, rutting and soil erosion outside of designated traffic areas.	3	1	L	<ul style="list-style-type: none">Vehicles to stay on defined ingress and egress points.Vehicles to adhere to site speed limits and road rules.	2	1	VL	

Source of Impact	Consequence Aspect	Risk	Initial Risk Rating			Control Strategies	Residual Risk Rating			Evaluation Rationale
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
	General Ecological Values	Increased traffic results in the mortality or injury of terrestrial fauna or avifauna species.	5	1	M	<div><div></div> Roads will be clearly signposted and designed to minimise potential for roadkill.</div> <div><div></div> A fauna management plan will be developed and implemented and will include procedures for managing traffic incidents involving fauna.</div>	4	1	M	<div><div></div> Legume Station supports a very high density of agile wallabies, which are listed by the Department of Land Resource Management (DLRM) as one of the native pest species for the area. Because they are in such large numbers they are currently subject to mortality as a result of pastoral operations. As such it is likely incidents will occur during construction.</div> <div><div></div> Will not constitute a significant impact to the population given the very high density at which they occur on the site.</div>
	Threatened and Migratory Species	Increased traffic results in the mortality or injury of threatened or migratory terrestrial fauna or avifauna species.	2	2	L		2	2	L	<div><div></div> The majority of threatened and migratory species known to be present on site are avian and unlikely to inhabit road verges.</div>

TABLE 6 OPERATIONAL RISKS













Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Intake of seawater from Forsyth Creek.	Marine and Estuarine Waters	Intake structure alters dynamics of Forsyth Creek changing scour and erosion rates.	4	3	M	<div><div></div> Design of the intake minimises impacts to current speeds and direction by using pile structures to access to centre of Forsyth Creek, as opposed to more solid structures.</div> <div><div></div> Monitoring bank erosion and scour rates around piles and instigate rectification works if negative changes are observed.</div>	3	2	M	<div><div></div> Bathymetry of the marine and estuarine environment is naturally extremely dynamic.</div> <div><div></div> Design minimises risks of scour and erosion to as low as practicable.</div>
		Intake of water results in a change in the tidal prism of Forsyth Creek which affects tidal water levels or currents.	5	2	M		5	2	M	<div><div></div> As detailed in the Marine and Estuarine Water chapter (Volume 2, Chapter 2), the peak rate of extraction represents small percentage of the tidal prism in Forsyth Creek (less than 0.5% during a spring tide and 1.5% during a neap tide).</div> <div><div></div> No follow on consequences for marine fauna or water quality.</div>
	General Ecological Values	Entrainment or impingement in intake structures results in mortality or injury of aquatic fauna.	5	2	M	<div><div></div> The area of potential influence in the vicinity of the four bell-mouth intakes is small and represents a very small area of potential impact relative to Forsyth Creek.</div>	4	1	M	<div><div></div> As detailed in the Marine and Estuarine Ecology chapter (Volume 2, Chapter 7), current velocities in Forsyth Creek are high and therefore resident and transient fish in this area are likely to be able to negotiate these currents.</div>
	Threatened and Migratory Species	Entrainment or impingement of threatened and migratory aquatic fauna in intake structures.	3	2	M	<div><div></div> The intake is positioned approximately 9 m from the creek bed which will avoid bottom dwelling species.</div> <div><div></div> The intake bell-mouth will be fitted with a 100 mm aperture mesh grille, to exclude all but the small debris and aquatic fauna.</div> <div><div></div> Water will only be drawn from the mid and high tides daily, which allows a 12 hour period each day of no operation.</div> <div><div></div> The bell-mouth design will have a target velocity of <0.4 m/s within 1.0 m radius of the bell-mouth. This target velocity accords with the published data that most fish can swim against a current of 0.4 m/sec.</div> <div><div></div> And the 0.1 m/sec velocity is 1.25 m from the bell-mouth. Published data indicates that all fish can swim against currents of 0.1 m/s.</div>	2	2	L	<div><div></div> Juveniles of the threatened species considered possible to occur are relatively large (e.g. sawfish pups > 65 cm and river shark > 50 cm) and therefore they are likely to have a relatively strong swimming ability.</div> <div><div></div> Flatback turtle hatchlings (approximately 6 cm at emergence) can have a swimming speed of >1 m/s.</div> <div><div></div> Adults of the threatened species likely to occur are large and are considered likely to be able to swim away. In any event, the 100 mm aperture mesh grille will exclude any adult threatened species from being entrained.</div>

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Discharge of waste water into Alligator Creek.	Marine and Estuarine Waters	High levels of nutrients in discharge water results in a change in water quality above interim site specific water quality trigger values.	5	3	H	<div><div>Choice of Project location:</div><div><div>Macrotidal receiving environment increases dilution and flushing.</div><div>Largest privately owned dam ensures adequate supply of freshwater which maximises ability to recirculate and therefore minimises discharge.</div></div><div><div>Project design:</div><div><div>Use of freshwater minimises amount of seawater flow-through and therefore discharge.</div><div>Maximum water re-use through Internal Farm Recycling Ponds.</div><div>Environmental Protection Zone (EPZ) designed to slow water flow and 'polish' discharge water.</div><div>Potential for EPZ to be naturally colonised by vegetation to allow for nutrient uptake.</div><div>Weirs within the Main Discharge channel (MDC) and EPZ allow for controlled timing, rate and dispersion of discharge.</div><div>Farm ponds and IFRP will settle out the bulk of organic material before the EPZ.</div><div>A 100 m wide channel has been designed through the centre of the EPZ to keep water moving so it will be unlikely to go stagnant or develop excessive algal blooms (typically observed in still waters).</div><div>Location of discharge into Alligator Creek as opposed to a smaller tidal creek with smaller flushing ability and tidal prism.</div></div><div><div>Project operation:</div><div><div>Release of discharge on ebb tide to ensure minimum residency time and scour in Alligator Creek.</div><div>No use of antibiotics.</div><div>Maximum feed conversion via feed formulation and pond management strategies.</div><div>Aerators create pond spoil mound in the middle which is removed at end of harvest (i.e. is not discharged).</div><div>Aerators also reduce biochemical oxygen demand.</div><div>Annual drainage of ponds and removal of pond waste from the pond floor.</div></div></div></div></div>	5	1	M	<div><div>As detailed in the Marine and Estuarine Water chapter (Volume 2, Chapter 2), there will be no exceedances of interim water quality guidelines outside of the mixing zone.</div><div>The mixing zone at the discharge point (i.e. where the interim site specific water quality trigger values are exceeded) is approximately 200 m either side of the discharge infrastructure.</div></div>

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
		Discharge water results in scour and/or changes to the bathymetry of Alligator Creek.	3	2	M	All of the above control strategies will apply, in addition to: <ul style="list-style-type: none">Rock armouring of discharge point control bank erosion.Peak ebb and flood tides in Alligator Creek are higher than the discharge current speeds, hence discharge is likely to have minimal impact on bathymetric and sediment transport processes in comparison to the natural tidal currents.	2	1	VL	<ul style="list-style-type: none">Bathymetry of the marine and estuarine environment is naturally extremely dynamic.
		Discharge of water results in a change in the tidal prism of Alligator Creek which affects tidal water levels or currents.	5	2	M		5	2	M	<ul style="list-style-type: none">As detailed in the Marine and Estuarine Water Quality chapter (Volume 2, Chapter 2), the average daily discharge rate of 420 ML represents small percentage of the tidal prism (less than 0.5% during a spring tide and 1.9% during a neap tide).No follow on consequences for marine fauna or water quality.
	General Ecological Values	High level of nutrients in discharge water results in changes in water quality which in turn causes a change or loss of habitat/biodiversity values for flora and fauna.	5	3	M	All of the above control strategies for the discharge of water into Alligator Creek will apply.	5	3	M	<ul style="list-style-type: none">As detailed in the Terrestrial Fauna and Avifauna chapter (Volume 2, Chapter 6), there is a low abundance and diversity of shorebirds. This is thought to be a consequence of the low abundance and diversity of benthic infauna in the estuarine environment.Higher value habitats for threatened and migratory species include Turtle Point and Osmans Lake which will not be impacted by the discharge.The Marine and Estuarine Water modelling (Volume 2, Chapter 2) shows that there will be no exceedances of interim water quality guidelines outside of the mixing zone.The ranking of medium post implementation of control strategies is arrived because there is likely to be long term changes. It should be noted however that the mitigation measures provide for a reduction in the size of the mixing zone and therefore area of

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
										impact for benthic infauna.
	Threatened and Migratory Species	High level of nutrients in waste water results in changes in water quality which in turn causes a change or loss of habitat/biodiversity values for threatened and migratory aquatic and avifauna fauna.	3	2	M	All of the above control strategies for the discharge of water into Alligator Creek will apply.	1	2	VL	<div><div></div><div>The receiving environment in Alligator Creek has been identified as being of low importance for threatened and migratory avifauna. This is thought to be a consequence of the low abundance and diversity of benthic infauna in the estuarine environment surrounding the Project Area.</div></div> <div><div></div><div>Higher value habitats for threatened and migratory avifauna include Turtle Point and Osmans Lake which will not be impacted by the discharge.</div></div> <div><div></div><div>Effects of discharge are confined to Alligator Creek and in particular the mixing zone which extends approximately 200 m either side of the discharge infrastructure.</div></div> <div><div></div><div>The threatened marine species likely to present are wide ranging and this area does not represent critical habitat. Furthermore the discharge itself is unlikely to constitute a significant impact to these species.</div></div> <div><div></div><div>The potential impact area represents a relatively small proportion of available habitat. There are extensive areas of similar habitat in the region.</div></div> <div><div></div><div>Regardless, the discharge itself is considered unlikely to have an impact on individual species if they are to pass through the mixing zone.</div></div>
Uncontrolled discharges or leaks from grow-out ponds and channels.	Groundwater	Uncontrolled discharges or leaks lead to changes in groundwater quality.	2	3	M		2	3	M	<div><div></div><div>Soils used to construct farm ponds and channels have low permeability.</div></div> <div><div></div><div>Groundwater in the area of the grow-out ponds is saline and is not used by any other beneficial user (i.e. for human consumption or stock).</div></div>

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
	Marine and Estuarine Waters	Uncontrolled discharges (e.g. through the overtopping of farm ponds and channels) lead to changes in estuarine and intertidal water quality.	2	1	VL	<p>☑ The Project has been designed so that:</p> <ul style="list-style-type: none"> ☑ In storm events less than a 50 year average reoccurrence interval (ARI) events, flows are captured by a system of swales adjacent to the farm bunds and transported to the main discharge channel (MDC) for planned release to the environment. ☑ In extreme rainfall events (> 50 year ARI), uncontrolled releases of water will enter the bio-security zones between farm 1 and farm 2. The excess water will then be channelled along the biosecurity zone and discharged to the tidal floodplain through a culvert under the MDC. 	1	1	VL	<p>☑ The inundation extent is limited and depths are shallow. Much of the water released is ponded on the upper tidal floodplain with little interaction with the tidal creeks. This inundation extent is considered insignificant when compared to the likely flooding conditions during a rainfall event that would cause this degree of overtopping.</p>
	Freshwater Streams, Rivers and Wetlands	Uncontrolled discharges (e.g. through the overtopping of farm ponds and channels) lead to changes in water quality in freshwater streams, rivers and wetlands.	2	2	L		1	2	VL	
Escape of prawn stock from grow-out facility.	General Ecological Values	The escape of prawn stock from the grow-out farms leads to changes in aquatic ecology.	2	2	L	<p>☑ All pond outlets will be screened with a mesh of a suitable size to prevent prawns escaping.</p> <p>☑ A cage screened with a mesh of a suitable size will be inserted inside the monk (the outlet structure) during harvesting.</p> <p>☑ A bird predation management strategy will be implemented to prevent birds predating on prawns and potentially removing prawns from the grow-out ponds.</p> <p>☑ The grow-out facility will be stocked with post-larvae that are bred from Specific Pathogen Free (SPF) prawn stock.</p> <p>☑ A biosecurity plan has been developed for the Project and will operate across the entire grow-out facility to prevent the introduction and spread of diseases through pathways such as staff and equipment movements.</p> <p>☑ In addition to the biosecurity plan, a health monitoring and surveillance program will be implemented to identify any disease outbreaks.</p> <p>☑ If a disease is identified, immediate steps will be taken to contain the disease to the pond(s) in which it has been identified.</p>	1	1	VL	<p>☑ The grow-out facility will be stocked with black tiger prawns (<i>Penaeus monodon</i>) which are native to the Joseph Bonaparte Gulf. The founder stock which will be used to establish the breeding program for the Project will be sourced from wild populations of black tiger prawns from the waters around the Northern Territory and Western Australia.</p>
Use of helicopters and/or drones for bird predation management.	General Ecological Values	The use of helicopters and/or drones to manage bird predation negatively impacts on non-predatory bird species (i.e. those birds that do not feed on prawns).	3	2	M	<p>☑ Experimental trials will be undertaken during the 2018/2019 wet season to assess responses of non-predatory birds. A primary objective of this work will be to investigate practical flight protocols for future operations.</p> <p>☑ Protocols are likely to include:</p> <ul style="list-style-type: none"> ☑ Low altitude helicopter movements (i.e. <450m above ground level) will be restricted to airspace above the farm footprint. ☑ When transiting between farms, constrain routes to airspace above the Project footprint. 	2	1	VL	<p>☑ Non-predatory birds are unlikely to be affected by the use of helicopters and drones as they are unlikely to be attracted to the grow-out farms.</p>
	Threatened and Migratory Species	The use of helicopters and/or drones to manage bird predation negatively impacts on non-predatory threatened and migratory birds (i.e. those birds that do not feed on prawns).	3	2	M		2	1	VL	

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
	Threatened and Migratory Species	The use of helicopters and/or drones to manage bird predation negatively impacts on predatory threatened and migratory birds.	3	2	M	 When transiting from the farm complex to other parts of the site, or off-site, maintain an altitude of >450m above ground level and restrict movement to airspace above the Project footprint (e.g. infrastructure corridor).	2	2	L	 The likelihood of negative impacts is reduced through the implementation of control strategies.
	Human Health and Safety	Accident involving a helicopter results in serious injury or death.	3	5	H	 When transiting between farms or from the farm complex to other parts of the site, or off-site, operate flights procedures which minimise the incidence and duration of rotor blade slap noise.  The operation of helicopters/drones for the Project will comply with the relevant Civil Aviation Authority of Australia (CASA) regulations.	2	5	M	
Spills of contaminants such as fuel and/or chemicals.	Land	Spills of contaminants result in contamination of soils.	3	4	M	 Fuel, oil, chemical and liquid waste to be stored in bunded and appropriately contained areas.  Fuel and chemical transfer points to be bunded.  Spill kits and spill management controls utilised at all storage and transfer points.  All waste disposed appropriately offsite or disposed of in the onsite landfill.  Training and incident/notification procedures to be adopted.	2	2	L	 With mitigation and management measures in place spills are unlikely and procedures are in place to rectify them immediately.
	Freshwater Streams, Rivers and Wetlands	Contaminants enter surrounding freshwater waterways and lead to changes in water quality in freshwater streams, rivers and wetlands.	3	3	M		2	2	L	
	Marine and Estuarine Waters	Contaminants enter surrounding freshwater waterways and lead to changes in water quality in Marine and Estuarine Waters.	3	3	M		2	2	L	
	Groundwater	Contaminants enter groundwater and lead to changes in water quality.	3	3	M		2	1	VL	
	Historic and Cultural Heritage	Contamination results in damage to a site or item of cultural significance.	3	3	M		2	2	L	
Release of waste water from waste water treatment plant (WWTP)	Land	Soil contamination resulting from inappropriate disposal of waste water.	3	2	M	 The Wastewater Treatment Plant (WWTP) will be sized appropriate to the load, suitable to the soil types and climate.  The WWTP will be designed with alarms and other safeguards to avoid overflow.  A Wastewater Works Design Approval will be obtained and the WWTP will be managed in accordance with state and national codes and guidelines, including the Guidelines for Wastewater Works Design Approval of Recycled Water Systems.	1	1	VL	 With mitigation and management measures in place the impacts from the WWTP are considered to be very low.
	Freshwater Streams, Rivers and Wetlands	Inappropriate disposal of waste water results in a change in water quality of freshwater streams, rivers and wetlands.	3	2	M		1	1	VL	
	General Ecological Values	Inappropriate disposal of waste water results in a change in freshwater quality which in turn causes a change or loss of habitat/biodiversity values for flora and fauna.	2	2	L		1	1	VL	

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
	Threatened and Migratory Species	Inappropriate disposal of waste water results in a change in freshwater quality which in turn causes a change or loss of habitat/biodiversity values for threatened and migratory flora and fauna.	1	1	VL		1	1	VL	<div><div></div> With mitigation and management measures in place the impacts from the WWTP are considered to be very low.</div> <div><div></div> There are no known threatened or migratory aquatic species within the freshwater environments of Legune Station.</div>
Modification of surface water flows from the modification of existing infrastructure, including bunds and embankments, and development of Project infrastructure including ponds, channels and roads.	Freshwater Streams, Rivers and Wetlands	Modification of surface water flows results in altered hydrology of freshwater streams, rivers and wetlands.	4	3	M	<div><div></div> To the greatest extent practical, direct impacts on water bodies and major drainage lines have been avoided.</div> <div><div></div> Strategic placement of culverts around grow-out farms and channels, access and service roads to allow for surface water flows.</div> <div><div></div></div>	2	2	L	<div><div></div> As detailed in the Freshwater chapter (Volume 2, Chapter 3), the floodplain hydrological conditions have already been substantially modified over time by the instatement of various bunds, embankments to support roads and the establishment of ponded pastures.</div>
	General Ecological Values	Modification of surface water flows results in a change or a loss of habitat/biodiversity values for flora and fauna.	3	3	M	<div><div></div> To the greatest extent practical, direct impacts on water bodies and major drainage lines have been avoided.</div> <div><div></div> Impacts of waterway barriers will be minimised by appropriately placed and designed culverts and channel works on infrastructure that reduce upstream ponding and flow conveyance, and the inclusion of drainage infrastructure to ensure connectivity.</div>	2	2	L	
	Threatened and Migratory Species	Modification of surface water flows results in a change or a loss of habitat/biodiversity values for threatened and migratory species.	3	3	M	<div><div></div></div>	2	2	L	
	Historic and Cultural Heritage	Modification of surface water flows results in an impact on a cultural site.	3	3	M	<div><div></div> To the greatest extent practical, direct impacts on water bodies and major drainage lines have been avoided.</div> <div><div></div> Strategic placement of culverts around grow-out farms and channels, access and service roads to allow for surface water flows.</div>	2	2	L	
Cessation of annual releases of dam water to create ponded pastures	Freshwater Streams, Rivers and Wetlands	The cessation of the annual releases of dam water reduces the extent of freshwater streams, rivers and wetlands in the dry season.	5	2	M		5	2	M	<div><div></div> Based on the analysis detailed in the Freshwater chapter (Volume 2, Chapter 3), the effect of ceasing water flows from the annual release of Forsyth</div>

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
during the dry season.	General Ecological Values	The cessation of the annual releases of dam water results in a change or loss of habitat/biodiversity values for flora and fauna in the dry season.	4	2	M		4	2	M	<p>Dam in the dry season is a short term decrease in the extent of surface water for 4 to 8 weeks.</p> <p>Water will persist in the upstream sections of Alligator Creek in the dry season. This would be similar to natural conditions prior to the construction of Forsyth Creek Dam.</p> <p>Bird species whose abundance was seen to increase with the inundation are known to move annually in response to the availability water.</p>
	Threatened and Migratory Species	The cessation of the annual releases of dam water results in a change or loss of habitat/biodiversity values for threatened and migratory species in the dry season.	4	1	M		4	1	M	
Contact with crocodiles	Human Health and Safety	Contact with crocodiles results in injury or death.	3	4	M	<ul style="list-style-type: none">All personnel will be made aware of the dangers of crocodiles in the Project Area.Appropriate signage will be installed around the Project Area to remind personnel of the potential presence of crocodiles.All sightings of crocodiles in and around the Project Area will be immediately reported to the farm manager.Access will be restricted to any area that is known to be inhabited by a crocodile until the crocodile has been moved on or relocated from the area.Personnel will be required to observe waterbodies and surrounding areas for crocodiles prior to working near the water's edge.Vegetation surrounding waterbodies will be maintained in as low in height as practical to enable easy observation of the area.Any work required to be undertaken on water (e.g. boat activities) will always be conducted by multi-person work crews with one person acting as an observer at all times.When a crocodile has taken up residence within the Project Area, the NT Parks and Wildlife Commission or other such authority will be notified and a request to trap and relocate the crocodile will be submitted.Only trained, competent and authorised persons will attempt to move, relocate, capture or otherwise handle a crocodile.	2	4	M	
Meteorological Events	Human Health and Safety	Injuries or fatalities of personnel as a result of a cyclone.	3	5	H	<ul style="list-style-type: none">All buildings will be designed to withstand a Category C cyclone wind loading (i.e. wind speeds of up to 252 km/hour).The central mess area (located in the central facilities area) will be designated as the emergency response centre where all personnel will	3	2	M	

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
						<p>assemble in the event of a cyclone warning being issued for the site.</p> <ul style="list-style-type: none">■ The central mess area will be appropriately provisioned with emergency equipment and supplies (e.g. potable water, torches and batteries, first aid kit, radio and communication devices, tarps, ropes and non-perishable foodstuffs).■ Generators and emergency response plant and equipment (e.g. chainsaw, tractor, front-end loader etc.) will be kept onsite and in serviceable condition.■ Fuel stores sufficient for one week's operation of generators and emergency response plant and equipment will be kept on site.■ All personnel will be adequately briefed and practiced in what to do in the event of a cyclone or severe storm.■ A register of all personnel and next of kin contact details will be established and maintained.■ A climate change plan will be developed.				
		Injuries or fatalities of personnel as a result of bushfires.	3	4	M	<ul style="list-style-type: none">■ A bushfire management plan will be developed for the Project in consultation with the relevant authorities and Traditional Owners.■ All buildings will be constructed in accordance with Australian Standard (AS) 3959-2009 - Construction of Buildings in Bushfire-prone Areas.■ Firebreaks up to 30 m wide will be established and maintained around the central facilities and accommodation village.■ A fire truck equipped with the appropriate firefighting equipment will be stationed at the central facilities.■ All personnel will be adequately briefed and practiced in what to do in the event of a bushfire.	3	2	M	
		Dehydration and heat stroke from extreme temperatures.	3	4	M	<ul style="list-style-type: none">■ All personnel working outdoors will be required to wear long sleeved shirts and hats to help reduce sun exposure.■ Sunscreen will also be made available to all personnel.■ All personnel will be made aware during induction training of the signs and symptoms of overexposure to heat and its effects, including dehydration.■ Drinking water will be made readily available onsite.	3	2	M	
Operation of boats	General Ecological Values	Mortality or injury of aquatic fauna from boat strike.	3	1	L	<ul style="list-style-type: none">■ Boat crew to maintain a look out for aquatic fauna during all operations.■ If a boat approaches aquatic fauna (or vice versa), the vessel will take all care to avoid collisions, including stopping, slowing down and/or steering away.	2	1	VL	■ Boats will only be used during the construction of the seawater intake pump and then intermittently during operations (e.g. for water quality
	Threatened	Mortality or injury of threatened or	3	1	L		2	1	VL	

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
	and Migratory Species	migratory aquatic fauna from boat strike.								sampling).
	Human Health and Safety	Injuries or fatalities of personnel resulting from the operation of boats.	3	4	M	<ul style="list-style-type: none">Personnel responsible for the operation of the boats will hold appropriate licences.All personnel on the boat must be fit for work and not under the influence of alcohol or other drug.Any boat activities will always be conducted by multi-person work crews with one person acting as an observer at all times.Boat ramps will be constructed where required to assist in the launching or retrieval of boats from the water.All boats will be adequately sized and equipped with life vests, first aid kit, emergency position indicating radio beacon (EPIRB), fire extinguisher and emergency provisions (e.g. water, food and insect repellent).All personnel on the boat are to wear life vests at all times.All boats are to be fitted with a working means of communication (e.g. a two way radio and/or satellite phone).Tides and weather conditions will be consulted and a journey management plan prepared prior to operating a boat in the waterways surrounding the Project site.	2	3	M	
Traffic movements	General Ecological Values	Increased traffic movements as a result of the Project results in the mortality or injury of terrestrial fauna or avifauna.	5	1	M	<ul style="list-style-type: none">Roads will be clearly signposted and designed to minimise potential for roadkill.A fauna management plan will be developed and implemented and will include procedures for managing traffic incidents involving fauna.	4	1	M	<ul style="list-style-type: none">Legume Station supports a very high density of agile wallabies, which are listed by DLRM as one of the native pest species for the area. Because they are in such large numbers they are currently subject to mortality as a result of pastoral operations. As such it is likely incidents will occur during operations.Will not constitute a significant impact to the population given the very high density at which they occur on the site.
	Threatened and Migratory Species	Increased traffic movements as a result of the Project results in the mortality or injury of threatened or migratory terrestrial fauna or avifauna species.	2	2	L		2	2	L	<ul style="list-style-type: none">The majority of threatened and migratory species known to be present on site are avian and unlikely to inhabit road verges.

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
	Human Health and Safety	Increased traffic movements lead to an increase in vehicle incidents.	3	5	HI	<ul style="list-style-type: none"> The upgrading of part of Moonamang Road, the Cave Springs Road by the WA and NT governments respectively and the Legume Access Road as part of the Project will ensure that the entire route from Legume Station to Kununurra is of an appropriate standard and capacity to accommodate the needs of the Project. Vehicles to adhere to site speed limits and road rules. Personnel operating vehicles must not be under the influence of alcohol or other drugs. Personnel will be appropriately licenced. Vehicle inspection checks and services required to be undertaken at regular (appropriate) intervals. All Project personnel to complete a site and safety induction prior to commencement of work. Establish, implement and monitor a Driver Safety and Fatigue Management Policy for all employees and contractors. 	2	5	M	<ul style="list-style-type: none"> As described in the Traffic and Transport chapter (Volume 3, Chapter 4), the projected change in traffic movements as a result of the operation of the Project is negligible and will be within the normal day-to-day variation in traffic volumes.
Power generation	Air Quality	Emissions from power station impact on air quality at sensitive receptors.	2	1	VL	<ul style="list-style-type: none"> The Project was designed to ensure the power station was located away from any sensitive receptors. 	2	1	VL	<ul style="list-style-type: none"> As detailed in the Air Quality chapter (Volume 2, Chapter 10) there are no nearby sensitive receptors that would be impacted by air emissions from the Project.
Noise generated during operations (e.g. operation of pumps, traffic movements etc)	Amenity	Increased noise levels at sensitive receptors.	2	1	VL	<ul style="list-style-type: none"> All equipment will be selected to minimise noise emissions. Equipment will be fitted with appropriate silencers and be in good working order. All engine covers will be kept closed while equipment is operating. The height at which material is dropped into or out of trucks will be minimised as far as possible. 	2	1	VL	<ul style="list-style-type: none"> As detailed in the Noise and Vibration chapter (Volume 2, Chapter 12), there are no nearby sensitive receptors that would be impacted by noise emissions from the Project.
	Threatened and Migratory Species	Increased noise levels results in the disturbance of threatened and migratory fauna and avifauna.	2	1	VL	<ul style="list-style-type: none"> Vehicles should be kept properly serviced and fitted with appropriate mufflers. The use of exhaust brakes will be minimised, where practicable. Machines found to produce excessive noise compared to industry best practice will be removed from the site or stood down until repairs or modifications can be made. To reduce the annoyance associated with reversing alarms, broadband reversing alarms (audible movement alarms) will be used for site equipment. 	2	1	VL	<ul style="list-style-type: none"> Operational noise will be consistent year-round, but typically peak at 55 dB(A), which is in the realms of normal ambient noise. Operational noises will be longer term, but are modelled to be quieter (<55 dB), more regular, predictable, and more localised than construction operations noise.

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
Biting Insects	Human Health and Safety	The Project results in the creation of areas of mosquito breeding habitat which results in the transmission of diseases or nuisance problems.	3	3	M	<ul style="list-style-type: none">■ The slope of the embankments for the farm ponds, settlement ponds, main feeder canal and main discharge channel will be no flatter than 1V:3H.■ Ponds will be aerated when in use.■ The farm pond floors will be contoured to allow the ponds to completely drain and dry out when not in use.■ Culverts and spoon drains will be installed to drain the areas in between the farms and prevent the inadvertent ponding of water in these areas.■ Culverts will be installed where required along the central service road and Legume Access Road to allow the natural flow of water and prevent the shallow impoundment of water.■ Where possible, borrow pits will be rehabilitated to be free draining when no longer required.■ Any equipment such as tanks, drums, buckets, machinery items and other receptacles sourced from North Queensland will be inspected for water ponding or evidence of previous water ponding (water stains) to prevent the potential introduction of the dengue mosquito, Aedes aegypti, from North Queensland as larvae or desiccation resistant eggs.■ Personnel wear light coloured, long sleeved shirts and mosquito repellent.■ Installation of low intensity yellow lighting in outside areas, where possible, to minimise attracting insects.■ The Project Area will be kept as clean as possible with artificial receptacles stored undercover away from rain where possible or stored in a manner that prevents the ponding of water and creation of mosquito breeding habitat.	2	3	M	<ul style="list-style-type: none">■ Legume Station already contains extensive areas of mosquito breeding habitat.■ The accommodation camp and central facilities where the majority of Project personnel will work and live has been sited away (approximately 20 km to the south) from the grow-out centre.
Introduction or spread of weeds/pest animals during	General Ecological Values	The introduction or spread of weeds/pest animals results in the change or loss of habitat/biodiversity values for terrestrial flora and fauna.	4	4	H	<ul style="list-style-type: none">■ Weed Management Plan will be implemented including regular weed inspections.■ A Fauna Management Plan will be prepared which will include pest animal	2	2	L	<ul style="list-style-type: none">■ With mitigation measures in place it is unlikely that any weeds/pest animals will be introduced or spread as a result of Project operations.

Risk			Initial Risk			Control Strategies	Residual Risk			Evaluation Rationale
Source of Impact	Consequence Aspect	Consequence	Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
operations.	Threatened and Migratory Species	The introduction or spread of weeds/pest animals results in the change or loss of habitat/biodiversity values for threatened flora and threatened and migratory fauna.	4	4	H	<div>eradication and management strategies for operations.</div> <div>Environmental inductions for workforce to include identification of problem weeds.</div> <div>Vehicle and equipment wash-down procedures on-site.</div> <div>Implement weed control notification and location recording for weed identified on site.</div> <div>Weed control monitoring and management practices.</div> <div>Ensure fire management plan applies to construction and takes into consideration weed impacts following burn offs.</div> <div>Manage landfill and putrescible waste to control feral and pest animal ingress.</div>	2	2	L	

4 RISK ASSESSMENT RESULTS

The environmental risk assessment identified 51 construction related risks and 49 operational risks.

The majority of residual risks identified and assessed for construction had a low risk rating (23 - Figure 1). For operations, there were similar numbers of risks that had a medium risk rating (19) as very low risk ratings (17) (Figure 3).

There were no risks identified and assessed during construction or operations that had an extreme risk rating. Five construction related risks and six operational risks were initially rated as high. These risks were associated with:

- Risks to general ecological values and threatened and migratory species as a result of the introduction and/or spread of weeds and pest animals during construction and operations.
- Risks to cultural heritage sites during construction works.
- Risks to marine and estuarine water quality as a result of the discharge into Alligator Creek.
- Risks to human health and safety as a result of vehicle incidents and meteorological events (i.e. cyclones and bushfires).

Through the application of controls measures however, these risks were able to be reduced. As such there are no residual risks with a high risk rating.

The risk profile for each consequence aspect across the construction and operational phases of the Project are presented in Table 7 and Table 8. This shows that the highest number of risks for both construction and operational phases are associated with threatened and migratory species. The majority of these risks to threatened and migratory species, however, are rated low or very low.

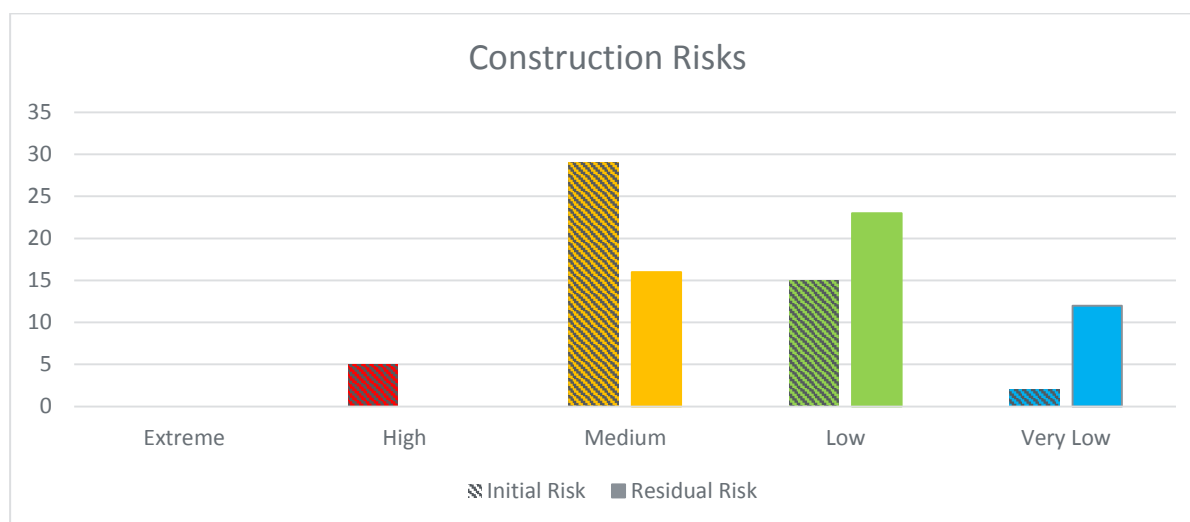


FIGURE 2 CONSTRUCTION RISK RATINGS

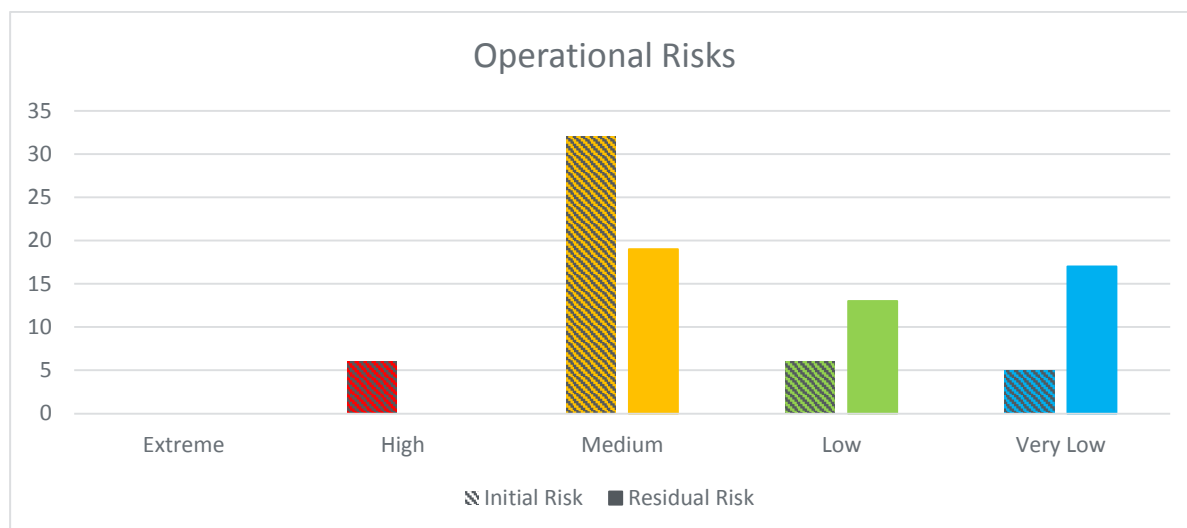


FIGURE 3 OPERATIONAL RISK RATINGS

TABLE 7 SUMMARY OF RESIDUAL RISK RATING BY CONSEQUENCE ASPECT - CONSTRUCTION

Consequence Aspect	Risk Rating					
	Extreme	High	Medium	Low	Very Low	Total
General Ecological Values	0	0	7	1	0	8
Threatened and Migratory Species	0	0	1	7	3	11
Historic and Cultural Heritage	0	0	2	1	1	4
Amenity	0	0	0	2	1	3
Land	0	0	2	5	1	8
Marine and Estuarine Waters	0	0	0	2	1	3
Freshwater Streams, Rivers and Wetlands	0	0	1	3	1	5
Groundwater	0	0	0	1	2	3
Air Quality	0	0	0	1	2	3
Human Health and Safety	0	0	3	0	0	3

TABLE 8 SUMMARY OF RESIDUAL RISK RATING BY CONSEQUENCE ASPECT - OPERATIONS

Consequence Aspect	Risk Rating					
	Extreme	High	Medium	Low	Very Low	Total
General Ecological Values	0	0	4	2	4	10
Threatened and Migratory Species	0	0	1	5	5	11
Historic and Cultural Heritage	0	0	0	2	0	2
Amenity	0	0	0	0	1	1
Land	0	0	0	1	1	2
Marine and Estuarine Waters	0	0	4	1	2	7
Freshwater Streams, Rivers and Wetlands	0	0	1	2	2	5
Groundwater	0	0	1	0	1	2
Air Quality	0	0	0	0	1	1
Human Health and Safety	0	0	8	0	0	8

5 MITIGATION AND MONITORING

There were no risks identified and assessed during construction or operations that had an extreme or high risk rating. All residual risks were either rated medium, low or very low. These risks are considered able to be successfully managed and mitigated through inclusion of the identified control measures into the Environmental Management Plan (EMP) procedures and relevant management plans (Volume 4, Chapter 3).

Ongoing monitoring and management will be undertaken to test the effectiveness of the nominated controls, audit their implementation and identify other measures or different approaches that may be required to achieve and maintain acceptable risk levels. Measures to do so are outlined in the EMP for the Project.

6 CONCLUSION

A risk based approach was adopted to identify and assess potential environmental impacts associated with the Project. The methodology employed was a standard semi-quantitative risk assessment consistent with AS/NZS ISO 31000:2009 'Risk Management – Principles and Guidelines'.

Initial risk ratings were assessed for each risk identified taking into account the consequence and likelihood of the risk occurring without any control measures in place. Control strategies were then identified for each risk, and the risk rating reassessed. All risks identified during the risk assessment process are considered to be able to be successfully managed and mitigated through the implementation of control strategies, and there are no residual risks that have an extreme or high risk rating.

The control measures identified in the risk assessment process have been used in the development of the Environmental Management Plan (Volume 4, Chapter 3) and will be implemented in the construction and operation of the Project.

APPENDIX C ENVIRONMENTAL MANAGEMENT STRATEGIES

C1

Erosion and Sediment Control Strategy

Rev. D

TABLE C1.1 - EROSION AND SEDIMENT CONTROL STRATEGY

Element	Detail		
Applicable site activities Site establishment Vegetation clearing and earthworks Site stabilisation and rehabilitation			
	Aim Ensure that land, soil and water resources are protected both now and in the future, such that the ecological health and land uses, and the health, welfare and amenity of people are maintained		
	Objectives	Targets	Key Performance Criteria
	Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
Minimise erosion and sediment loss by minimising vegetation clearing, stabilising exposed surfaces as soon as possible, and capturing eroded sediments	No evidence of erosion or sediment loss from the site, due to site construction activities	Number of erosion and sediment control failures Area cleared, damaged or deteriorating outside of areas on vegetation clearing plans	
Responsibility	Construction: Construction Manager Operations: Site Manager		
Actions / Mitigation Measures	Preparation of Plans Detailed ESCP plans outlined below are to be prepared and certified by a person certified as a Certified Professional in Erosion and Sediment Control (CPESC) with the International Erosion Control Association (IECA). These are to be reviewed by another person certified as a CPESC by IECA to provide written confirmation of compliance with the IECA (2008) guidelines. The identity of these persons to be provided to the Pastoral Land Board prior to commencing the works. Construction <u>Erosion and Sediment Control Approach</u> The overall approach will focus on three main areas of control: <ul style="list-style-type: none">Access and Traffic Controls - to minimise the impact of traffic on site soils, particularly where fragile, and manage movement of soil and weeds on and off-site through targeted entry and exit points from the siteDrainage Controls - management of runoff volumes and velocity, to control erosion through concentrated flows forming rills and gully erosion, including diversion of clean upslope watersErosion Controls - minimising and protecting exposed surfaces to reduce erosion through raindrop impact and surface water flows, using vegetative or other ground coversSediment Controls - trapping and settling / retaining sediments that have become mobile, before movement off-site Prior to site works starting, detailed ESCPs will be prepared for all areas of ground disturbance. These are to detail the measures to be utilised, their locations, and any details required for their installation and maintenance. These will include: <ul style="list-style-type: none">an overview and key map of the entire development site, and specific maps for particular areaslocation, area and boundaries of vegetation clearing and other disturbance areas on the site, and no go areas on the site (no clearing, or no access or both)the location of any significant features, waterways and natural drainage featuresnatural contours and identification of any high risk erosion areas		

Element	Detail
	<ul style="list-style-type: none"> erosion and sediment controls, including type, location and any other particulars required <p>Erosion and Sediment Controls to be used on the site are provided in Table C1.2. Generally:</p> <ul style="list-style-type: none"> the location of laydown areas, exit and entry points to the site, and trafficable areas of the site will be defined prior to works starting The ingress to and egress from the site will be confined to a minimum number of stabilised access points required for the works Divert clean water around disturbance areas where possible, or provide least resistance and controlled drainage through disturbance areas Form contour banks, ditches or similar across cleared slopes to direct run-off towards surrounding vegetation or sediment dams, and away from waterways Unstable exposed surfaces, particularly batter slopes must be stabilised by sufficient surface roughening and topsoil application followed by vegetation (locally native vegetation preferred), or alternatively by utilising jute mesh, rip-rap or similar. This to be initiated as soon as practicable following final forming of the surface <p><u>Site Establishment</u></p> <p>Ground-truth the location of material stockpiles and erosion and sediment controls shown in the above detailed site plans and adjust if necessary. Nominate areas for parking, storage of materials, areas to avoid disturbing, and other similar matters.</p> <p>All erosion and sediment controls to be installed and operated according to concepts in IECA (2008) and DNREAS (2010), and this management strategy</p> <p>Site works will not start until the erosion and sediment control works outlined herein are installed and functional</p> <p>All weather access roads will be constructed before the start of the wet season for key access areas required during wetter periods</p> <p><u>Vegetation Clearing and Earthworks, General Construction</u></p> <p>Vegetation clearing, earth works and stockpiles of soil are minimise where possible</p> <p>Progressively stabilise exposed areas as works progress - areas that are cleared for construction, but not required to be cleared for operations should be rehabilitated as soon as practical. Utilise native vegetation where possible</p> <p>Protect stockpiles from erosion, particularly topsoils to be used for rehabilitation</p> <p><u>In-stream Works and Waterway Crossings</u></p> <p>Access tracks/roads through waterways will be undertaken in the dry season (both clearing and construction)</p> <p>Where the works cross flowing waters (or waters that may flow during the works), controls will be installed to avoid erosion and blocking streamflow, which may include:</p> <ul style="list-style-type: none"> Dam and pump systems – bund upstream and pump waters past the works (a second downstream or semicircular bund encompassing works may be needed). More suitable to smaller stream systems where works are of short duration only. A fish screen will be required for the pump inlet. Dam and divert systems –similar to the above, except that flows are safely passed from upstream to downstream in a diversion system, comprising an earthen channel, or pipe. Temporary watercourse diversions –divert watercourse around a worksite through temporary drainage structures, allowing works within the main channel prior to reinstatement Stabilised outflow structures or flow spreaders to avoid downstream erosion Installation of sediment fencing on the edges of the construction zone, and silt curtains in standing downstream waters where there is a risk of sediment movement into these waters <p><u>Dewatering</u></p> <p>Dewatering of temporary waterway crossing controls (see above) and excavation works may be required. These to be managed as follows:</p>

Element	Detail
	<ul style="list-style-type: none"> Where practicable, decant surface clean waters first. If clean, discharge to the environment, preferably over vegetated areas. Where not clean, dewater to sediment retention structure Pump remaining waters to sediment retention structure Stabilise entry to the retention structure to avoid erosion, allow sediment to settle out, and test prior to release to the environment Where possible, reuse waters on-site (e.g. for dust suppression) <p>Operation</p> <p>Adopt the construction phase controls for construction, earthworks and similar activities</p> <p>Otherwise, mitigation and monitoring during the operational phase will involve inspection and maintaining existing structures from erosion, instability / cracking.</p> <p>Continued erosion control and rehabilitation will be required after each wet season, including topping up and reshaping works. Topsoils may be replaced with stabilised pond spoil (mixed with coarser sandier materials where required) to reform topsoil where required for vegetation growth.</p> <p>Training and Awareness</p> <p>Adopt the training and awareness, communication and incident management controls outlined in the PSD Environmental Management System</p>
Monitoring	<p>Construction</p> <p>Monitoring will include:</p> <ul style="list-style-type: none"> Regular (weekly) site inspections to ensure erosion and sediment controls are in place, and to identify any rectification works required Site inspections to be undertaken also after any rain event to check for integrity and maintenance requirements for erosion and sediment controls, and other site features Check any stream diversion structures for trapped fish or other aquatic wildlife An incident-complaint register including for all spills and leaks, reviewed regularly, to keep track of and where required improve spill management on the site <p>CPESC Audits and Review</p> <p>The second review CPESC identified in 'Actions / Mitigation Measures' above shall monitor the implementation of the certified ESCPs, no later than 1 day following implementation of post-clearing site stabilization measures and as often as identified in the certified ESCPs.</p> <p>Operation</p> <p>Regular visual monitoring of the site will be conducted, with potential issues identified and entered into the corrective action system for rectification.</p>
Reporting	<p>The CPESC certified plans and written confirmation from the second review CPESC are to be provided to the Pastoral Land Board prior to works commencing on-site</p> <p>The second CPESC is to provide confirmation to the Pastoral Land Board of compliance with the detailed ESCPs within 7 days of each inspection</p> <p>Visual site inspections will be recorded in the Site Manager's logbook, or the site visual inspection form in Appendix F (or similar)</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p> <p>All monitoring results (soil, water quality, etc.) will be retained, with an annual monitoring review conducted and report prepared for reporting to the Seafarms environmental management team</p> <p>Audit reports will be prepared and maintained, with copies to the Seafarms management team</p>
Corrective Actions	<p>Corrective Action Triggers will include:</p> <ul style="list-style-type: none"> Sediment loss from the site, including turbid waters or plumes in receiving waters or drainage lines (due to construction works) Damaged or failing erosion and sediment controls, including breaches in drainage controls, sediment fences or sediment ponds

Element	Detail
	<ul style="list-style-type: none"> Excessive sediment build-up in sediment ponds or other structures (including sediment fences, drains) Evidence of loss of litter and other contaminants from the site <p>Corrective Actions:</p> <ul style="list-style-type: none"> Repair erosion and sediment controls, stabilise exposed surfaces and reinstate drainage or other controls Drain and dig out accumulated sediment in sediment controls, and dispose of material in an area that will not re-erode and move off-site Undertake general site housekeeping to tidy up loose rubbish, ineffective stockpile controls, etc. Review the Erosion and Sediment Control Plans
References <p>IECA (2008). <i>Best Practice Erosion and Sediment Control 2008</i>. International Erosion Control Association. http://www.austieca.com.au/</p> <p>IECA (2008b). <i>Best Practice Erosion and Sediment Control 2008, Volume 4 - Design Fact Sheets and Volume 6 - Standard Drawings</i>. http://www.austieca.com.au/publications/best-practice-erosion-and-sediment-control-bpesc-document</p> <p>DLRM (2016). <i>Soil management, erosion and sediment control information</i>. Department of Land and Resource Management. Accessed 12 September 2016 at https://nt.gov.au/environment/soil-land-vegetation/soil-management-erosion-sediment-control</p> <p>DNREAS (2010) <i>Land Clearing Guidelines</i>. Technical Report No. 20 / 2009D, Department of Natural Resources, Environment, The Arts and Sport, Northern Territory.</p> <p>Leersnyder, H., Bunting, K., Parsonson, M., and Stewart, C. (2016). <i>Erosion and sediment control guide for land disturbing activities in the Auckland region</i>. Auckland Council Guideline Document GD2016/005. Prepared by Beca Ltd and SouthernSkies Environmental for Auckland Council.</p>	

TABLE C1.2 - EROSION AND SEDIMENT CONTROLS TO BE USED ON-SITE

Aspect	Control ¹
Access and Traffic	<p>Stabilised site access and egress points - define access points to the site, and stabilise to avoid movement of soil / weeds on or off-site</p> <p>Traffic control plan - define trafficable and no-go areas on the site</p> <p>All weather access tracks, and road/track drainage</p>
Drainage Controls	<p>Diversion Banks - locate upslope of construction areas, stockpiles and hazardous material storage locations</p> <p>Open Drains - to control drainage paths and directions on the site</p> <p>Contouring - use on long overland flow paths on slopes to avoid rill and gully erosion</p> <p>Check Dams - install in drainage channels to slow runoff velocity in drains to minimise erosion</p> <p>Controlled Discharge - stabilised discharge points, energy dissipater or flow spreaders to avoid erosion in discharge points</p>
Erosion Controls	<p>Surface Roughening - short term surface control</p> <p>Revegetation - longer term stabilisation</p> <p>Synthetic materials, relatively small high risk areas (e.g. jute mesh)</p> <p>Drainage protection – geofabric, jute mesh, HDPE liner, rock armouring to protect against high velocity erosive flows</p>
Sediment Controls	<p>Sediment fences - to guide runoff into other control structures, and to hold water and allow sediment to drop out. Suitable for small areas, or at the foot of stockpiles</p> <p>Sediment ponds and basins located to capture sediment runoff and settle out sediments</p> <p>Vegetated areas to slow flows and capture sediment (not suitable for high value conservation species/areas)</p>

Aspect	Control ¹
Works near or in Waterways	<p>Dam and pump: In-stream dam bunds, sump / pump inlet control, fish screens, pump and pipeline, stabilised outflow or flow spreader</p> <p>Dam and divert: In-stream dam bunds, diversion channel or pipe(s), stabilised outflow or flow spreader</p> <p>Temporary waterway diversion: stabilised diversion channel, lined with geotextile cloth, HDPE liner or similar; non-erodible dam in upstream and downstream ends of existing channel (sandbags, sheet piles, lined earthen banks, etc.); controlled inlet and outlet points; rehabilitation of in-stream morphology</p> <p>Coffer dam diversions: non-erodible dam structure (sand bags, sheet piles, lined earthen banks)</p> <p>Dewatering: all of the above structures may require dewatering (see below)</p>
Dewatering	<p>Pump and sump system, including surface decant where clean surface waters can be removed first</p> <p>Sediment retention structure – skip bin or tank, sediment fencing, earth bunded area for small works, sediment ponds for larger works</p> <p>Energy dissipation, flow spreaders etc. for inflow to above structures (where required to control erosion)</p>

Table notes:

1 refer to IECA (2008) Design Fact Sheets (Volume 4) and Standard Drawings (Volume 6); DLRM (2016) Technical Notes; Leersnyder et al (2016) guideline and example design drawings

C2

Land and Soils Strategy

Rev. D

TABLE C2.1 - LAND AND SOILS STRATEGY

Element	Detail	
Applicable site activities	<p>Site establishment</p> <p>Vegetation clearing and earthworks</p> <p>Site stabilisation and rehabilitation</p> <p>Operations, particularly for saline ponds and channels, and in relation to leaks and spills</p>	
Aim	<p>Ensure that land and soil resources are protected both now and in the future, such that the ecological health and land uses, and the health, welfare and amenity of people are maintained</p>	
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	<p>No statutory infringements</p> <p>No breaches of licence/approval conditions</p>	<p>Number of infringements</p> <p>Number of breaches</p>
Protection of non-impacted site soils and land systems (i.e. outside of the project footprint) to enable stable, self-regulating soil-vegetation environments (management of cover, fertility and contamination)	<p>No damage to vegetation outside of areas identified on vegetation clearing plans</p> <p>Monitoring of vegetation abundance and health over time shows no impacts to vegetation outside of areas identified on vegetation clearing plans</p> <p>No traffic outside of defined roadways</p>	<p>Comply with Vegetation Management Plan</p> <p>Area disturbed by traffic outside of defined Project footprint</p>
Avoid soil contamination	<p>No significant releases of chemicals, spills</p> <p>All unexpected findings notified, works stopped and addressed prior to works proceeding</p> <p>(refer to Effluent Management Strategy in relation to wastewater)</p>	<p>Number of incidents involving leaks, spills or soil contamination</p> <p>Number of contamination incidents reported, and number not addressed as required and in the timeframes outlined</p>
Appropriate engineering design to ensure long term stability and integrity of worked landforms and infrastructure	<p>Engineering design by registered professional engineer, following advice of registered professional geotechnical engineer</p>	<p>Number of defects, failures</p>
Post-closure plans for rehabilitating site soils to allow beneficial post-closure land use (pastoral uses)	<p>Post closure plans prepared and available</p> <p>Rehabilitation methods determined to be suitable, acceptable and achievable</p>	<p>Refer to Decommissioning and Rehabilitation Management Strategy</p>
Responsibility	<p>Construction: Construction Manager</p> <p>Operation: Site Manager</p>	
Actions / Mitigation Measures	<p>Decommissioning and Rehabilitation Plan</p> <p>Update and further develop the decommissioning and rehabilitation plan following pre-construction soil monitoring (refer below). To be completed within one year of commencement of works.</p> <p>Construction</p> <p><u>Topsoils</u></p> <p>Topsoils where encountered will be stockpiled for later use (top dressing or stored for rehabilitation works). Topsoil stockpiles are to be a maximum of 2m high, protected from erosion through erosion controls identified in <i>C1 - Erosion and Sediment Control Strategy</i>.</p> <p>In locations with very thin to non-existent topsoils, the above will be impractical and topsoils for rehabilitation constructed through amelioration of existing soils as required (refer to the draft EIS, Volume 1, Chapter 3, Section 11).</p>	

Element	Detail
	<p><u>Soil Contamination</u></p> <p>Implement the Hazardous Materials Management and Waste Management Strategies, and Spill Response in the Contingency Management Strategy (Appendix E).</p> <p><u>Geotechnical</u></p> <p>Engineering design, and construction techniques will be adopted to overcome identified constraints for the site and Project infrastructure, as outlined in the design (Volume 1, Chapter 3) and based on geotechnical advice.</p> <p><u>Soil Dispersion and Sodicty</u></p> <p>The risk of dispersion will be managed by adopting a suitable level of compaction, and using gypsum ameliorant, internal batter liners or filters internally within embankments (sandy gravel materials, geofabrics such as Bidim or equivalent).</p> <p>Close attention will be paid to pipes and culverts through embankment walls, including seepage control measures, filters, backfill to limit the risk of dispersion and erosion due to seepage along these pipes.</p> <p>Operation</p> <p>Adopt the construction phase controls for construction, earthworks and similar activities.</p> <p>Otherwise, mitigation and monitoring during the operational phase will involve monitoring and maintaining existing structures from erosion, instability / cracking, and avoidance of soil contamination or structural decline.</p> <p>Continued erosion control and rehabilitation including topping up and reshaping works after each wet season. Topsoils may be replaced with stabilised pond spoil (mixed with coarser sandier materials where required) to reform topsoil where required for vegetation growth.</p> <p>Liaison with the owner of the Manbarrum Zinc-Silver Project will occur to ensure that, should that project proceed, the two projects can coexist cooperatively.</p> <p>Training and Awareness</p> <p>Adopt the training and awareness, communication and incident management controls outlined in the PSD Environmental Management System</p>
Monitoring	<p>Pre-Construction</p> <p>Representative sampling of soil profiles for fertility characterisation, salinity and sodicity will be undertaken prior to earthworks commencing for the purpose of characterising soils for impact assessment during operations, and rehabilitation post-closure (should this be required).</p> <p>A pre-construction site reconnaissance inspection will be undertaken for all construction areas. This will include identifying:</p> <ul style="list-style-type: none"> ■ Unstable, shallow or otherwise problematic soils, or evidence of soil contamination ■ Drainage lines and watercourses, and other prominent site features ■ Excavation test pits or bores (after vegetation clearing) to the depth of excavation + 0.5m to confirm soil depths and types to be encountered. Number of pits based on uniformity of the land type, and type of works to be conducted, and at the discretion of the construction manager (inadequate survey will cause delay to construction works rather than potential for environmental harm) <p>Construction</p> <p>Monitoring will include:</p> <ul style="list-style-type: none"> ■ Regular (weekly) site inspections to identify any signs of land or soil deterioration or contamination, and any rectification works required ■ An incident-complaint register including for all spills and leaks, reviewed regularly, to keep track of and where required improve spill management on the site ■ Regular tank integrity testing for all large fuel, oil, chemical and waste storages. ■ Ongoing geotechnical inspection of works to confirm the subgrade conditions and construction quality against design, and the requirements for subgrade or other amelioration ■ Implementation of the Unexpected Findings Protocol provided in the Contingency Management Strategy (Appendix E). <p>Operation</p>

Element	Detail
	<ul style="list-style-type: none"> Regular visual monitoring of the site will be conducted, with potential issues identified and entered into the corrective action system for rectification. Ongoing groundwater monitoring will be undertaken to test for leaks from ponds and channels, and annual inspections / audits of dam and channel walls will be conducted to ensure ongoing integrity and stability.
Reporting	<p>Visual site inspections will be recorded in the Site Manager's logbook, or the site visual inspection form in Appendix F (or similar)</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p> <p>All records of tank integrity testing, soil or other testwork, waste removal, etc. will be retained</p> <p>A report will be prepared confirming that the project infrastructure has been built to an appropriate engineering standard and soil testing was conducted in accordance with relevant Australian Standards on completion of construction. Preliminary versions of this report will be prepared on a quarterly basis throughout construction.</p> <p>All monitoring results (soil, water quality, etc.) will be retained, with an annual monitoring review conducted and report prepared for reporting to the Seafarms environmental management team</p> <p>Audit reports will be prepared and maintained, with copies to Seafarms management team</p>
Corrective Actions	<p>Corrective Action Triggers will include:</p> <ul style="list-style-type: none"> An Unexpected Finding of contamination or other soil issue during construction (typically vegetation clearing / earthworks) Evidence of structural failure, erosion (particularly tunnel erosion) Dispersing soils, evidenced by excessively cloudy runoff or ponding waters, surface crusting and waterlogging (beyond what is currently found on the site) Spills or leaks of potential contaminants <p>Corrective Actions:</p> <ul style="list-style-type: none"> Stop works and implement the Unexpected Findings Protocol provided in the Contingency Management Strategy (Appendix E) Implement the Spill Management process within the Contingency Management Strategy (Appendix E) Instigate repair works, which may require harvest and draining of a pond in worst case situations Investigate the source of any pollution or dispersive soil runoff, ameliorate surface soils by application of ameliorant (e.g. gypsum), surface planting, stabilisation and/or compaction. Review the land and soils management strategy
References <p>ANZECC & ARMCANZ (2000). <i>Australian and New Zealand Guidelines for fresh and marine water quality, The guidelines – Volume 1 – Chapter 4 Primary Industries</i> [sodicity and salinity]</p> <p>DERM (2011). <i>Salinity Management Handbook</i>. Queensland Department of Environment and Resource Management, Second Edition</p> <p>NT Government (2016). <i>Managing Pastoral Land</i>. https://nt.gov.au/industry/agriculture/farm-management/managing-pastoral-land</p> <p>NT EPA (2016). <i>Assessment for Site Contamination</i>. https://ntepa.nt.gov.au/waste-pollution/contaminated-land</p>	

C3

Acid Sulfate Soil Management Strategy

Rev. D

TABLE C3.1 - ACID SULFATE SOIL MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities Site Establishment (minor) Earthworks, particularly channel construction		
Aim Ensure excavation works involving acid sulfate soils are appropriately managed to minimise the risks of environmental pollution and that land and soil, surface and groundwater resources are protected both now and in the future, such that the ecological health and land uses, and the health, welfare and amenity of people are maintained		
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
No oxidation of acid sulfate soils on the site as a result of site activities	Excavation below 2m depth or 2.5m AHD (whichever is the highest absolute elevation) on Estuarine-Deltaic and Coastal Plains includes additional ASS testing or re-internment (within 12 hours) Identified ASS are avoided, contained or adequately neutralised	Number of exceedances of water quality results for pH in leachate, runoff and receiving waters Number of laboratory neutralisation results showing net acidity remaining after treatment
Responsibility	Construction: Construction Manager Operations: Site Manager	
Actions / Mitigation Measures	Construction No excavation below 2m depth or 2.5m AHD (whichever is the lesser) without testing for ASS (refer Monitoring - pre-construction below). Alternatively, where ASS are likely to be encountered and the total quantity for a location is <100m ³ , the material can instead be re-buried within 12 hours, and below the layer where they were excavated (without mixing of layers), without pre-testing. The material should be limed at a nominal rate of 240 kg CaCO ₃ / m ³ soil to be disturbed (as per Dear <i>et al</i> , 2014). Manage acid sulfate soils as follows: <ol style="list-style-type: none">1. Acid sulfate soils are to be avoided, and groundwater level not lowered in their vicinity, OR2. The neutralising capacity of any exposed acid sulfate soil (after treatment) must exceed the existing plus potential acidity of the soil, with a Factor of Safety of 1.5, AND3. Acid Neutralising Capacity, whether naturally available or added, must be sufficiently fine to counteract oxidation and acid generation, as outlined in Dear et al (2014) Any placement of ASS is to be in a place such that future exposure of the material to oxidising conditions is prevented, unless the material is validated as having been neutralised Where ASS neutralisation treatment is required: <ol style="list-style-type: none">1. A laboratory test of the material is to be conducted in accordance with the Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines (Dear <i>et al</i>, 2014)2. An assessment of the bulk density of the soil will be required to determine the rate of lime addition required in kg CaCO₃/m³ of soil (from kg CaCO₃/t soil)3. A subsequent determination of the liming rate per m² to allow determination of lime addition required in kg CaCO3/m²(or other measure such as acre or hectare as appropriate)4. Spreading of lime (preferably fine agricultural lime – ‘aglime’) at a rate exceeding that identified above per tonne soil to be disturbed or removed and ploughing or ripping of spread lime into soil ensuring that lime is distributed throughout the topsoil layer. This management is valid for shallow excavations / stripping affecting at most the top 700mm	

Element	Detail
	<p>only (without intercepting groundwater and with a 500mm safety factor to the limit of investigation).</p> <p>A factor shall be applied to the liming rate depending on the equivalent CaCO_3 of the neutralising agent used. This shall be applied by calculating $100 / \% \text{CaCO}_3$ equivalent and multiplying this factor by the liming rate / tonne of soil (or m^3 of soil) to achieve the required rate in CaCO_3.</p>
Monitoring	<p>Pre-Construction</p> <p>Pre-construction monitoring will be conducted for all areas of excavation below 2m depth or 2.5m AHD (whichever is the highest absolute elevation) on Estuarine-Deltaic and Coastal Plains. This will involve testing to the depth of disturbance + 0.5m in accordance with Dear <i>et al</i> (2014) (field and oxidised pH at 0.25m intervals, chromium reducible sulfur suite analysis at 0.5m intervals).</p> <p>Alternatively, soils that can be reinterred within 12 hours and where the volume at the location is $<100\text{m}^3$ will be recorded (these will be reinterred with a nominal liming rate applied)(see above).</p> <p>Construction</p> <p>Implement pre-construction monitoring where excavation depths exceed the threshold depths above, or where blue/grey estuarine soils are encountered during the works.</p> <p>Testing of receiving and ground waters in accordance with Surface Water and Groundwater Management Strategies for pH to provide warning of possible acidic leachate</p> <p>Identified ASS to be tested before and after any liming / neutralisation treatment, such that no net acidity remains and no chance of oxidation can occur in-situ.</p>
Reporting	<p>All test results shall be retained on-site and electronically by PSD</p> <p>In particular, a tracking system is to be implemented in the form of an ASS register as follows:</p> <ul style="list-style-type: none"> ■ All areas of potential ASS presence to be recorded in the register ■ All of these areas to be subjected to testing (other than reinternment areas), and the key results recorded in the register with full results linked to from the register. Key results are total sulfur acidity (S%), Acid Neutralising Capacity (ANC) and fineness factor, net acidity (S%) liming rate ($\text{kg CaCO}_3 / \text{t soil}$) ■ Time from exposure to reinternment or treatment recorded as start date time, or if addressed on the same day, just the date of exposure and treatment/reinternment ■ Post treatment key results and link to full results recorded in the register. The key results will be Acid Neutralising Capacity (ANC) fineness factor, liming rate, net acidity post treatment ■ The location of all ASS – where they were excavated from, where treated, and where disposed to will be recorded. <p>This register will be recorded electronically and easily accessible from the site. A hardcopy version may also be made available, and/or used for primary data collection prior to transfer to the electronic version</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> ■ Excavation below 2m depth or 2.5m AHD (whichever is the highest absolute elevation) on Estuarine-Deltaic and Coastal Plains ■ Excavation uncovers blue/grey estuarine deposits ■ Water sampling (surface/groundwater) indicates a drop in pH ■ Runoff waters exhibit iron staining, or pools and receiving waters are excessively clear (indicative of low pH) ■ Identified sites on the register (refer to Reporting above) have not been sampled, treated or reinterred (or entry was not marked in the register) <p>Corrective Actions:</p>

Element	Detail
	<ul style="list-style-type: none"> Implement testing regime, or record reinterment plan in the register (and implement the reinterment plan) Implement monitoring and sampling as soon as possible to identify the source of any oxidising PASS material Determine if register was not properly filled out. If data is not available, instigate testing as soon as possible to determine if acid sulfate soils were disturbed, and whether ASS are present, and/or the net acidity (accounting for ANC fineness factor) is suitable to avoid oxidation
References <p>Ahern, C.R., Ahern, M.R. and Powell, B. (1998) Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998. QASSIT, Department of Natural Resources, Resource Sciences Centre, Indooroopilly.</p> <p>Dear S.E., Ahern C.R., O'Brien L.E., Dobos S.K., McElnea A.E., Moore N.G. and Watling K.M. (2014). Soil Management Guidelines in Queensland Acid Sulfate Soil Technical Manual (QASSIT), Department of Science, Information Technology, Innovation and the Arts, Queensland Government, June 2014.</p> <p>DLRM (2016). Soil management, erosion and sediment control information. Department of Land and Resource Management. Accessed 12 September 2016 at https://nt.gov.au/environment/soil-land-vegetation/soil-management-erosion-sediment-control</p>	

C4

Vegetation Management Strategy

Rev. E

TABLE C4.1 - VEGETATION MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities		
Site Establishment		
Vegetation Clearing and Earthworks		
Site stabilisation and rehabilitation works		
Aim		
To maintain the conservation status, abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts on the Project area and on adjacent areas that may be impacted.		
To minimise the risk of Significant Impacts to threatened species and communities, and migratory species listed under the EPBC Act, and species listed under the TPWC Act.		
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
Minimise the area of clearing to the minimum necessary for the construction and operation of the Project	No damage to vegetation outside of areas identified on vegetation clearing plans	As-cleared area and location of clearing compared to vegetation clearing plans
Maintain the health of flora and vegetation communities not directly impacted by vegetation clearing	No deterioration in flora and vegetation community health in areas of retained vegetation Clearing or damage to rare or important flora, vegetation communities and wetland areas is avoided or minimised	Degree of changes to vegetation abundance and health in areas outside of vegetation clearing plan areas Number and/or area of rare or important flora and vegetation communities cleared/damaged
Responsibility	Construction: Construction Manager Operations: Site Manager	
Actions / Mitigation Measures	Pre-construction A pre-construction survey will be conducted as outlined in Monitoring below, the results of which are to be included with vegetation clearing approvals (or the results otherwise advised) to the NT government / Pastoral Land Board Based on detailed design and vegetation clearing approvals, site specific Vegetation Clearing Plans will be developed, with the extent of clearing and 'no go' areas clearly defined Boundaries of clearing and 'no go' areas will be clearly pegged/flagged on the ground prior to clearing starting. Training for all personnel will include information on identifying these marked areas Vegetation Clearing Vegetation clearing will only commence after receipt of vegetation clearing approvals for the site. A detailed plan showing approved vegetation clearing areas is to be prepared prior to any works on the site, and the boundaries of 'no-go' areas drawn on construction plans, and marked out in the field (where required to avoid impacts). Vegetation clearing will be minimised where possible, particularly for: <ul style="list-style-type: none">■ wild plum low open woodland on the estuarine-deltaic plain■ ephemeral wetland and northern ricegrass grassland■ Other permanent wetland or waterway areas, including riparian vegetation No lay down areas or materials storage will be located within wetland areas or areas of retained vegetation	

Element	Detail
	<p>Vegetation clearing and earthworks will be conducted during the dry season, with areas stabilised as much as practicable prior to wet season rains.</p> <p>Clearing activities must avoid damage to the roots, trunks and canopy of adjacent retained vegetation.</p> <p>Cleared vegetation will be pushed into a series of windrows within the disturbed area and either chipped for reuse in rehabilitation areas or burnt. Burning will only occur after receipt of a Permit to Burn. This will include notification of the date, time and location of the controlled burn to relevant parties, including Air North, NT Bushfire Council, traditional owners, and the Legume Station Pastoral Lease Manager.</p> <p>Topsoil Management</p> <p>Where topsoil is not utilised in earthworks, it should be dispersed onto prepared landscaping and revegetation areas immediately to minimise deterioration of soils.</p> <p>Where topsoil is to be stockpiled:</p> <ul style="list-style-type: none"> Stockpiles should have a maximum height of 2m; Stockpiles should be revegetated to prevent soil erosion and weed invasion and to maintain soil microbes; and Stockpiles should be located well away from works areas, access paths and overland flow paths. <p>Topsoil should be dispersed onto landscaping and revegetation areas, evenly spread and ripped to bind soil layers and avoid compaction.</p> <p>Implement the Weeds and Pests Strategy</p> <p>Fire Regimes</p> <p>The Bushfire Management Plan to be prepared for the site will take into account recommended fire regimes for the near threatened species, <i>Turraea pubescens</i> and <i>Livistona lorophylla</i></p> <p>Operation</p> <p>Maintain rehabilitated areas of the site, with endemic species where possible</p>
Monitoring	<p>Pre-construction survey</p> <ul style="list-style-type: none"> A pre-construction survey will be conducted of clearing areas + 100m outside of these areas for the identified data deficient flora species <i>Ptilotus capitatus</i>, <i>Spermacoce gibba</i> and <i>Eleocharis acutangula</i> within the Darwin stringybark/Darwin woollybutt woodland on the coastal erosional plain, and Melaleuca low woodland and flood-out plain wetland on the flood plain. This to be in a suitable season (i.e. April-May). Further survey effort will be required where data deficient or other conservation significant species are detected, to identify the population characteristics and risks from the proposed clearing These surveys are to identify the entire local population within the clearing area (+100 m buffer), including quantifying, mapped and clearly marking populations on the ground The results of the above survey will be collated into a Significant Flora Species Survey report, and lodged with vegetation clearing approvals for subsequent clearing in these areas (or where no data deficient/conservation significant species are found, the results are accepted by the NT government / Pastoral Land Board as being acceptable to clear) <p>Vegetation Clearing</p> <p>Regular inspections will be undertaken of cleared area extents to ensure retained vegetation is not being directly or indirectly impacted by construction activities</p> <p>Weekly monitoring shall be conducted of retained vegetation to detect any damage or decline in the health and condition of retained vegetation within the construction site and adjacent sites</p> <p>Weed mapping will be completed as identified in the Weeds and Pests Strategy</p> <p>All topsoil will be tracked unless used locally in the course of cut to fill earthworks, to ensure that the source and fate of all topsoils across the site are known – where topsoil is removed from weed infested areas, this will not be spread across the site, to limit spread of weed seeds.</p>

Element	Detail
Reporting	<p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p> <p>Any clearing of vegetation outside approved clearing areas shall be reported to the approving authority (Pastoral Land Board)</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> ■ Clearing has occurred outside of the approved and marked clearing areas ■ Vegetation die-back or deterioration is found in areas outside of the clearing footprint ■ Fire regimes are changed on the site to that occurring pre-construction ■ Changes to threatened or near threatened species list at the Commonwealth, Northern Territory or local level ■ Finds of significant species on the site (not previously identified) ■ Poor vegetation health in rehabilitation / replanted areas <p>Corrective Actions:</p> <ul style="list-style-type: none"> ■ Notify the approving authority of clearing outside approved boundaries (Pastoral Land Board) ■ Rectify training, ground truth marking, reinstate controls, review vegetation clearing plans and this Vegetation Management Strategy ■ Investigate the potential cause of vegetation die-back and rectify. This may be related to a number of causes including but not limited to soil related (fertility, salinity/sodicity, acid sulfate soils, loss of topsoil); surface water runoff (toxicants, salinity, waterlogging, or lack of water through changed runoff paths) ■ Review site operations and Vegetation Management Strategy to determine whether changes can be made to lessen or avoid impacts to significant species
References	<p>PLB (2010). Northern Territory Pastoral Land Clearing Guidelines 2010. Northern Territory Government, Pastoral Land Board.</p> <p>DNREAS (2010) Land Clearing Guidelines, Department of Natural Resources, Environment, The Arts and Sport, Darwin. Northern Territory.</p>

C5

Weed and Pests Strategy

Rev. G

TABLE C5.1 - WEED AND PESTS STRATEGY

Element	Detail	
Applicable site activities Construction activities, particularly: <ul style="list-style-type: none">transport of equipment, vehicles and materials to siteclearing, stockpiling and movement of topsoil on the site, particularly from where weed species were present Operational phase of the Project, for natural or other (grazing, vehicles, etc.) spread and movement of weeds on the site Waste handling including on-site landfill, changes to landuse and management (relating to pest fauna species)		
Aim To maintain the conservation status, abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts on the Project area and on adjacent areas that may be impacted. To minimise the risk to pastoral operations (concurrent and potential future) as a result of the spread of weeds and pests		
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
Eliminate / avoid presence of Class A declared weeds on the site Minimise weed and pest introduction or spread on the site Avoid the creation of favourable environments for new or to sustain existing populations of invasive pests	No Class A weeds present on the site. No increase in the distribution and number of weed and pest species on the site No new weed or pest species identified on the site	Number of each weed and pest species identified on the site Location and distribution of each weed and pest species identified on the site
Responsibility	Construction: Construction Manager Operations: Site Manager	
Actions / Mitigation Measures	Weed Management Plan A weed management plan (WMP) is to be developed prior to the commencement of works. The WMP will be prepared in consultation with the Weed Management Branch from Department of Environment and Natural Resources (DENR) and will be developed to the satisfaction of the Pastoral Land Board and in compliance with relevant statutory requirements and approval conditions. The WMP is required to address (but is not limited to): <ul style="list-style-type: none">any obligations outlined in relevant Statutory Weed Management Plansweed classes and required actionsresults and requirements of weed surveysweed management and monitoring measures, including weed washdown requirements, topsoil management,monitoring, reporting and notification requirements, including maintenance of weed map and/or register, andtraining requirements. Weeds are to be controlled as per the requirements of the approved WMP. Pest Control Implement an ongoing baiting program for feral dogs and pigs. Any application of 1080 poison must be authorised via a 1080 Pest Animal Management Authorisation and accompanying Permit to Take Protected Wildlife. Implement an on-going, rodent baiting program around built facilities.	

Element	Detail
	<p>Minimise available food sources for pest animals around buildings and within the Central Facilities and Village.</p> <p>All putrescible rubbish will be collected in covered bins and frequently transferred to landfill.</p>
Monitoring	<p>Pre-Construction</p> <p>Comply with re-construction monitoring requirements in the Weed Management Plan.</p> <p>Construction and Operation</p> <p>Comply with construction and operational monitoring requirements in the Weed Management Plan.</p>
Reporting	<p>Comply with reporting requirements in the Weed Management Plan.</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up.</p> <p>Updates to this strategy, particularly in developing the weed management plan for implementation, will be undertaken with consultation with the Weed Management Branch of the Department of Environment and Natural Resources.</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> ■ Presence of Class A, B or C weeds ■ Spread of existing weeds or pests, or introduction of new pests or weeds to the site ■ Plant or equipment being brought to the site shows signs of carrying weed seeds ■ Plant or equipment being brought to the site has not weed wash certificate ■ Plant or equipment leaving site shows signs of weeds or weed seed presence <p>Corrective Actions:</p> <ul style="list-style-type: none"> ■ Initiate control measures as outlined in the WMP ■ Initiate control measures to stop the spread and where practicable eradicate pests on the site
<p>References</p> <p><u>Weeds</u></p> <p>DLRM (2014). Northern Territory Weed Management Handbook. Weed Management Branch, Northern Territory Department of Land Resource Management.</p> <p>NT Government (2016). Weed Management Plans - https://nt.gov.au/environment/weeds/weeds-and-the-law</p> <p>Statutory weed management plans and other guidance material that may be available, including:</p> <ul style="list-style-type: none"> ■ Weed Management Plan for Gamba Grass (<i>Andropogon gayanus</i>). https://nt.gov.au/environment/weeds/list-of-declared-weeds-in-the-nt/gamba-grass ■ Weed Management Plan for Mimosa (<i>Mimosa pigra</i>). https://nt.gov.au/environment/weeds/list-of-declared-weeds-in-the-nt/mimosa ■ Weed Management Plan for Neem (<i>Azadirachta indica</i>). https://www.nt.gov.au/environment/weeds/list-of-declared-weeds-in-the-nt/neem ■ <i>Preventing Weed Spread is Everybody's Business</i>. https://landresources.nt.gov.au/rangelands/publications/weed-management-publications <p><u>Pest Fauna</u></p> <p>DLRM (2015) Guidelines for the management of the pest animals of Legume. A report extract from Crowley, G.M. and Hill, B. M. (eds.) (2011) Management Practices for Wildlife Conservation in the Northern Territory. Version 1.</p> <p>NT Government (2016) Controlling wild dogs and pest animals with 1080 poison. Last updated 19 April 2016. Available from: https://nt.gov.au/industry/agriculture/farm-management/controlling-pest-animals-wild-dogs-with-1080-poison</p>	

C6

Fauna Management Strategy

Rev. D

TABLE C6.1 - FAUNA MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities		
Site Establishment		
Vegetation Clearing and Earthworks, Construction		
Operation		
Aim		
To maintain the conservation status, abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts on the Project area and on adjacent areas that may be impacted.		
To minimise the risk of Significant Impacts to threatened species and communities, and migratory species listed under the EPBC Act, and species listed under the TPWC Act.		
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
Minimise the impacts of clearing and construction on fauna	Comply with the Vegetation Management Strategy	Number of breaches against Vegetation Management Strategy
Minimise impacts of operations on fauna	No harmful incidents involving wildlife No barriers to fish passage erected in waterways	Number of fauna incidents
Responsibility	Construction: Construction Manager Operations: Site Manager	
Actions / Mitigation Measures	Waterbird Monitoring Program Implement the Waterbird Monitoring and Impact Mitigation Program (WBMIMP) prior to the alteration of flows from Forsyth Creek Dam. Fauna Management Plan Implement the Fauna Management Plan, which should cover the below as a minimum. Pre-Clearing Pre-clearance surveys will be undertaken in areas identified as potential habitat for threatened species, prior to commencement of clearing. In areas where there is the presence of habitat features for threatened species, an experienced fauna spotter-catcher will be engaged to accompany clearing crews, who will check these features prior to clearing. The spotter-catcher will be required to hold a Permit to Take or Interfere with Wildlife. Vegetation Clearing Comply with the Vegetation Management Strategy, in particular to minimising vegetation clearing, and clearing only within the approved bounds In addition: <ul style="list-style-type: none">■ Undertake vegetation clearing sequentially so as to encourage fauna to disperse towards adjacent habitats that will remain intact■ The spotter-catcher is to be in attendance during clearing of known threatened species habitat to implement fauna relocation and protocols for injured wildlife. The fauna spotter-catcher will provide site specific fauna management protocols suitable for use on the site■ Where possible, retain large trees with hollows and hollow logs on the ground to provide nesting opportunities for native species.■ Where practical, temporary fencing will be erected around excavations to exclude mobile animals from vegetation clearing areas.	

Element	Detail
	<ul style="list-style-type: none"> Work areas will be checked before work commences each day for fauna that may have become trapped. If any pits/trenches are to remain open after daily site works have been completed and are not in fenced areas, they will be securely covered by an impenetrable barrier, if possible, or fauna ramps (e.g. log ramps or wooden planks) will be put in place to provide a potential means of escape for trapped fauna. Site inductions are to include education regarding the local fauna of the site and protocols to be undertaken if fauna are encountered. <p>Piling Operations</p> <p>Undertake pre-startup observations for marine turtles to the limit of the piling observation zone for at least 30 min before commencement.</p> <p>Undertake ongoing monitoring within 600m of the pile hammer ('piling observation zone') for the presence of turtles. If marine turtles are sighted within 500m of the pile hammer (the 'exclusion zone') cease piling activities within 2 minutes or as soon as safely possible. Recommence once marine turtles exit the exclusion zone, or at least 30 minutes have passed without another sighting.</p> <p>Piling activities must be initiated with 'soft fairy taps' and then build up to full operating force (if no marine turtles have been sighted as above). The first five impacts from the piling operation must be at no more than 50% of full hammer weight (e.g. a hammer with an adjustable stroke height of 1.2m should drop a height of 0.6m at least 5 times during a 'soft start' procedure), to encourage animals to move away from subsequent blows.</p> <p>Traffic</p> <p>Vehicles will be required to stay on pre-determined routes and must comply with speed limits. Speed limits will be clearly signposted so as to minimise the potential for road kill. This will also apply to vessels operating on fresh and estuarine/marine waters.</p> <p>Where there is a fauna-vehicle interaction which results in a mortality, the animal will be relocated to the edge of the road immediately, and subsequently removed as quickly as practicable to reduce potential for scavengers to be subsequently struck.</p> <p>Boats will generally not be used on the site. In the rare circumstances they are, the key control will be speed reduction in areas where strike is a potential issue for marine megafauna, including turtles, dolphins, dugong and crocodiles. In the very unlikely event of an impact, contact the Marine Wildwatch hotline to determine the next steps.</p> <p>Hydrology and Aquatic Ecology</p> <p>Comply with the Surface Water Management Strategy, in particular to avoid changes to floodplain hydrology, and estuarine hydrology in receiving waters.</p> <p>Comply with the Erosion and Sediment Control Strategy to protect water quality during construction, and the Surface Water and Hazardous Materials Management Strategies during operation. Implement the Effluent Management Strategy on-site.</p> <p>Waterway Barriers</p> <p>Comply with the Erosion and Sediment Control Strategy for In-stream Works and Waterway Crossings during construction.</p> <p>For the operational stage, all waterway crossings are to contain suitable flood and low flow passage to avoid creating barriers to fish passage.</p> <p>Impingement and Entrainment of Aquatic Fauna at Intake Structure</p> <p>To protect listed threatened and migratory sawfish and river shark species, fit the intake with a 100mm (maximum) aperture and operate with a maximum 0.4m/s velocity at the mesh point.</p> <p>Noise Disturbance</p> <p>Comply with the Noise Management Strategy. In addition:</p> <ul style="list-style-type: none"> Temporary noise barriers will be installed where construction works are within 100m of the main crossing of Alligator Creek, should impacts be shown to occur from initial avifauna monitoring in this location (refer Monitoring below). <p>Visual Disturbance</p> <p>Implement the following measures where construction works are within 150 m of either Forsyth Creek or Alligator Creek:</p> <ul style="list-style-type: none"> Maximise the retention of existing woody vegetation (natural screening)

Element	Detail
	<ul style="list-style-type: none"> ■ Develop construction schedules which minimise the period required to complete works ■ Design and implement temporary measures for visual buffer/screening between works areas and adjacent intertidal feeding habitat. ■ Investigate the viability of establishing a band of trees and shrubs along either side of the Alligator Creek infrastructure corridor extending up to 150 m either side of the crossing point to provide for permanent screening of movement activity within this part of the transport corridor. <p>Lighting</p> <p>Restrict artificial lighting where light pollution might affect nesting flat back turtles and hatchlings by using lights of a wavelength to which flatback turtle hatchlings are not sensitive; ensuring lighting is directed away from Turtle Point and reflective materials; mounting lights as low as practicable; and using timer and motion sensors to run off lights when not in use.</p> <p>Bird Predation Management Strategies</p> <p>Should the use of helicopters be adopted as part of the WBMIMP for bird predation management:</p> <ul style="list-style-type: none"> ■ Restrict low altitude helicopter movements (i.e. <450m AGL) to airspace above the farm footprint ■ When transiting between farms, constrain routes to airspace above the Project footprint. ■ When transiting from the farm complex to other parts of the site, or off-site, maintain an altitude of >450m AGL and restrict movement to airspace above the Project footprint (e.g. infrastructure corridor). ■ When transiting between farms or from the farm complex to other parts of the site, or off-site, operate flights procedures which minimise the incidence and duration of rotor blade slap noise. <p>Increased site access leading to increased take of important species</p> <p>Increased site access will be mitigated via the installation of gates on the access road and signs to discourage off road access. In addition, educational materials shall be provided to employees regarding the protected status of sawfish and river shark species, and signage shall be installed next to Alligator Creek and Keep River waterways that promote the protected status of sawfish and river shark species and include identification guides, safe release guidelines and encourage recreational fishers to report any interactions with these species.</p>
Monitoring	<p>Waterbird Monitoring Program</p> <p>Develop, refine and finalise the WBMIMP prior to the alteration of flows from Forsyth Creek Dam, as determined by the Scientific Advisory Group, based on the waterbird monitoring framework included in the Project Sea Dragon Stage 1 Legume Grow-out Facility, Supplementary Environmental Impact Statement, Appendix A.</p> <p>Implement the WBMIMP.</p> <p>Construction</p> <p>Implement Vegetation Management Strategy and Weeds and Pests Strategy monitoring, particularly in relation to inspection of clearing limits and potential damage to retained vegetation, and presence of weeds and pests on the site</p> <p>Pre-clearance surveys by a qualified and experienced spotter-catcher will be undertaken in areas identified as potential habitat for threatened species, prior to commencement of clearing.</p> <p>Monitor all work areas before work commences each day for fauna that may have become trapped.</p> <p>Monitoring of avifauna will be undertaken during initial construction works within 100m of the main crossing of Alligator Creek. Monitoring will record avifauna responses to determine whether noise barriers are required.</p> <p>Operation</p> <p>A series of experimental trials will be undertaken during the wet season to assess responses of waterbirds to bird predation mitigation strategies within wetland habitat adjacent to the farms. A primary objective of this work will be to investigate practical flight protocols for future operations.</p>

Element	Detail
	<p>Regular inspections of the intake structure, the intake channel and settlement ponds will be undertaken for signs of fauna being drawn into the system. In particular, the presence of threatened or near threatened species is to be noted and actions taken to return these to the wild.</p> <p>Increased Site Access</p> <p>Implement monitoring to detect changes in use of the site by employees or the community, and apply rectification measures where required, in accordance with the Cultural Heritage and Social Impact Management Strategies</p>
Reporting	Record all incidents and complaints related to fauna on the incident-complaint form in Appendix F (or similar) and enter into the incident-complaint register for rectification and follow up
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> ■ Clearing outside of approved areas or clearing without spotter-catcher where spotter-catcher was required (refer above) ■ Flooding changes due to the works, or blockages to waterways ■ Aquatic fauna found trapped or entrained in the intake structure, channel or settlement pond ■ Noise or light disturbance occurs in proximity to turtle nesting sites, due to the Project ■ Boat strike or other injury to marine megafauna <p>Corrective Actions:</p> <ul style="list-style-type: none"> ■ Engage spotter catcher to inspect site as soon as possible to identify any injured fauna or fauna in distress to relocate or manage ■ Implement drainage controls and construct or rectify fish passages ■ Remove fauna from intake structures and return to the wild, although only if safe to do so ■ Alter lighting and restrict noisy activities (refer Noise Management Strategy) to avoid impacts to nesting sites ■ If marine fauna are injured, contact the Marine Wildwatch hotline to determine the most appropriate actions. Do not approach crocodiles or enter the water where crocodiles are present without expert advice and assistance ■ Address complaints through the Cultural Heritage and Social Impact Management Strategies
<p>References</p> <p>ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy</p> <p>EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Policy 3.21)</p>	

C7

Surface Water Management Strategy

Rev. F

TABLE C7.1 - SURFACE WATER MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities Intake of seawater from Forsyth Creek Management of waters within farms Earthworks and effects on floodplain hydrology Discharge of water from farms through the EPZ and to Alligator Creek Activities with the potential for spills, leaks or other discharges to surface waters		
Aim Ensure surface waters, including estuarine and marine waters, wetlands and floodplains, are protected both now and in the future, such that the ecological health, and the health, welfare and amenity of people are maintained. Ensure a safe and sustainable fresh and saltwater supply for the Project.		
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
Protection of marine, estuarine, freshwater and floodplain aquatic ecosystems	Design and Development Minimise changes between pre- and post-development floodplain hydrology Construction and Operation As per Water Quality Monitoring and Management Program (WQMMP).	Number of incidents or breaches of the Management Strategies Hydrology, bathymetry, bank erosion changes compared to reference sites Number of flood incidents from altered hydrology Number of complaints Refer to WQMMP
Maintenance of the cultural and spiritual values of marine, estuarine, freshwater and floodplain waters, including ecosystems and biota		
Protection of human consumers, primarily for fish species, crabs, etc.		
Protection of water supplies (general water uses, stock drinking water) for existing and future pastoral uses	Existing water supplies are not impacted where possible (i.e. outside of Project footprint) - no negative changes to existing beneficial uses of surface waters where possible Develop a Post-Closure plan to ensure suitable water supplies to support an agreed level of pastoral operations	Number of exceedances of supply criteria - stock watering, drinking water (Table C7.3)
Maintenance of existing public recreation and aesthetics, in relation to hydrology, water quality and fisheries resources	No complaints No unauthorised access	Number of complaints Number of incidents related to site access
Suitable freshwater supply to support the Project, primarily related to the Forsyth Dam supply	Potable water supplies are all treated prior to use on-site Potable water supplies are reliable with a supply volume sufficient for site operations	Number of freshwater exceedances (potable quality, Table C7.3; farm supply, as required by operations)
Minimise waste of seawater and freshwater used on the site	Minimise water leakage and evaporation as much as practicable	Volume of water extracted (fresh and saline) vs volume discharged.
Responsibility	Construction: Construction Manager Operations: Site Manager	

Element	Detail
Actions / Mitigation Measures	<p>Implement the WQMMP.</p> <p>In addition:</p> <ul style="list-style-type: none"> ■ Avoid construction in freshwater water bodies and major drainage lines to the greatest extent practical. Where not avoidable determine whether fish passage is required, and design crossings and culverts to allow for fish passage. ■ No seawater extraction other than via the licensed intake infrastructure point. ■ Fit the intake with a 100mm (maximum) aperture and operate with a maximum 0.4m/s velocity at the mesh point. ■ Ensure mesh screens of suitable size are maintained over all pond outlets and inside monks during harvesting to prevent prawns from escaping to the external environment ■ Manage the EPZ to minimize infiltration, maximise removal of nutrients and suspended solids, avoid stratification, maintain water quality, increase mixing and dispersion in receiving waters and avoid visual discharge plumes as much as practicable. ■ Maintain armouring and scour protection as required to minimize erosion and scour as a result of the Project – this to include the rock blanket at the base of the discharge weir on Alligator Creek. ■ To the extent practicable and achievable, reduce herd sizes to reduce cumulative water quality impacts where a potential water quality improvement can be identified.
Monitoring	<p>Implement WQMMP. In addition:</p> <ul style="list-style-type: none"> ■ Visual monitoring to include pegging of banks to provide a baseline for further erosion and scour monitoring and protection works, particularly at the inlet and outlet. ■ Regular site inspections along with erosion and sediment control inspections to include rock armoring, scour and erosion protection associated with banks and structures. ■ Routine visual monitoring and inspections of the intake and outlet structures and banks for signs of erosion, fouling, injury to marine organisms, etc. ■ Undertake an annual check of water lost via leakage and evaporation, by comparing intake volumes (fresh and seawaters) with discharge volumes. Undertake ongoing improvement program to minimize water loss as much as practicable. ■ Undertake monitoring as outlined in Table C7.2. ■ The parameters and sites monitored will be reviewed after 2 years of operation, and a revised monitoring plan prepared if required.
Reporting	<p>Implement the WQMMP</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p>
Corrective Actions	Refer to the WQMMP
References WQMMP - Seafarms / CO2 (2018). Draft Water Quality Monitoring and Management Plan. Seafarms Ltd and CO2 Australia Pty Ltd. Ref: EN-01-MP-EM4201.	

TABLE C7.2 MONITORING SITES (LOCATIONS IN TABLE C7.3)

Site	Description	Parameters and Frequency
Freshwaters		
F01	Alligator Creek upstream of tidal influence, important for waterbirds	2 times per year: late dry season and late wet season for first two years. Ongoing requirement to be assessed based on this data.
F02	Ephemeral wetland	
F03	Turkey's nest dam	

Site	Description	Parameters and Frequency
F14	Forsyth Creek, upstream of direct tidal influence, used by waterbirds	Physical and chemical stressors (nitrogen and phosphorous speciation, turbidity, pH, dissolved oxygen, conductivity) Chlorophyll a Recoverable hydrocarbons, and Pesticides.
F17	Alligator Creek, upstream site that is important to waterbirds	
F18	Forsyth Creek Dam. Water from the Dam is released in the late wet season.	
Estuarine and Marine Waters – refer to WQMMP		

TABLE C7.3 MONITORING SITE LOCATIONS (MONITORING REQUIREMENTS TABLE C7.2)

Site	Latitude	Longitude
Freshwater (refer to Figure C7.1 for a map showing locations)		
F01	-15.1706	129.3435
F02	-15.0822	129.3931
F03	-15.0824	129.3918
F14	-15.0746	129.4193
F17	-15.2066	129.3845
F18	-15.2197	129.4614
Estuarine and Marine – refer to WQMMP		



FIGURE C7.2 FRESHWATER MONITORING LOCATIONS

C8

Groundwater Management Strategy

Rev. E

TABLE C8.1 - GROUNDWATER MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities	<p>Construction activities which intersect groundwater</p> <p>Activities with the potential to cause spills and leaks</p> <p>Operation of the site, particularly the saline farm ponds</p>	
Aim	<p>Ensure groundwater resources are protected both now and in the future, such that the ecological health and land uses, and the health, welfare and amenity of people are maintained</p>	
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	<p>No statutory infringements</p> <p>No breaches of licence/approval conditions</p>	<p>Number of infringements</p> <p>Number of breaches</p>
Avoid groundwater contamination, maintain the quality of groundwater used for water supply	<p>No leaks or spills</p> <p>No negative change in the quality (chemistry) of a groundwater resource due to project operations</p> <p>Existing bore beneficial uses retained</p> <p>Implement Effluent Management Strategy</p>	<p>Number of incidents</p> <p>Number of exceedances of beneficial use criteria Table C8.2)</p> <p>Compliance with Effluent Management Strategy</p>
Avoid oxidation of acid sulfate soils and generation of acidic leachate resulting from these soils	Implement Acid Sulfate Soil Management Strategy	Compliance with Acid Sulfate Soil Management Strategy
Ensure the protection and resilience of groundwater dependent ecosystems (GDEs)	<p>No change in seasonal groundwater level in the vicinity of GDEs due to project operations</p> <p>No negative change in the quality (chemistry) of groundwater in the vicinity of GDEs due to project operations</p>	<p>Degree of change in groundwater level, flow in GDE</p> <p>Degree of change in groundwater quality in GDE</p>
Responsibility	<p>Construction: Construction Manager</p> <p>Operations: Site Manager</p>	
Actions / Mitigation Measures	<p>Implement Hazardous Materials, Waste, Acid Sulfate Soil and Effluent Management Strategies</p> <p>Manage excavation depths in borrow pits and monitor groundwater levels to avoid lowering groundwater and damaging productive aquifers / bores</p> <p>Ensure that stormwater diversions and flood management does not change the flow into and out of groundwater recharge zones - pre and post construction flooding levels to be as similar as practicable, using culverts and floodways to avoid excess ponding and allow for continuity of flow.</p> <p>Avoid impacting or drawing from pastoral use bores and borefield areas (freshwater supply will be from Forsyth Creek Dam via the Freshwater Channel)</p> <p>Implement procedures for rapid response to identified large pond and channel leaks. These will include:</p> <ul style="list-style-type: none"> ■ Early detection of leaks through groundwater monitoring of tracers and/or fingerprinting of waters (anion/cation mixes, etc.) ■ Integrity testing of areas with the potential to leak ■ Rectification of leaks, by in-situ repair works, with emptying of the pond in extreme situations 	

Element	Detail
Monitoring	<p>The monitoring program outlined in Table C8.3 will be undertaken for the Project. Monitoring will involve:</p> <ul style="list-style-type: none"> ■ A baseline monitoring round of all monitoring bores for the stated parameters, repeated each quarter for 2 years or until operations begins ■ Continued monitoring of groundwater bores on a 6-monthly basis for the first 2 years of operations, and annually thereafter. ■ Logged water level will be collected and analysed monthly for the first 2 years in the vicinity of the farm ponds, particularly the piezometers installed around the farm area. Additional water level loggers will be installed in any productive bores in proximity to ponds and channels, and areas of excavation (i.e. borrow pits). ■ Groundwater quality will be sampled in the farm area for in-situ parameters (pH, electrical conductivity) and for a suite of anions and cations, to allow identification of leaks (by matching groundwater changes to the 'fingerprint' from pond/channel water if possible). ■ Productive bores will be monitored to ensure their existing beneficial uses are not impacted, by comparison with the criteria in Table C8.2. ■ Visual monitoring of Groundwater Dependent Ecosystems as part of vegetation monitoring program (refer Vegetation Management Strategy). <p>Monitoring bores are shown in Figure C8.1.</p>
Reporting	<p>A review of monitoring results and findings will be conducted annually, and a summary report prepared. This will be provided to the Seafarms Environmental Management team, and to authorised NT Government and officers on request.</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> ■ Bore monitoring results show elevation in salinity in proximity to grow-out ponds and channels, while reference / background sites do not ■ Potentially impacted productive bore levels dropping while reference bores are not ■ Other contamination detected in groundwater aquifers, particularly associated with effluent irrigation areas (nutrients, BOD, E.Coli), pond or channel areas (nutrient impacts) or large leaks or spills (various) <p>Corrective Actions:</p> <ul style="list-style-type: none"> ■ Identify the source of leaks, spills or contamination by: <ul style="list-style-type: none"> ■ Undertaking a review/inspection of the site and incident-complaints register for recent events that may explain the findings ■ Performing a water balance on potential sources of leaks ■ Comparing the water quality fingerprint (anions, cations), and/or ■ Applying a non-toxic tracer compound ■ Rectify leaks as soon as practicable once identified. ■ Cease works which are drawing from productive bores (dewatering in borrow pits, or drainage from borrow pit walls most likely, but very unlikely to occur) ■ Engage a suitably qualified and experienced hydrogeologist to assess the site and provide amelioration measures for contaminated aquifers (such as pump and treat, cutoff trenches, etc.)
References <p>NT Government (2016). Groundwater. https://nt.gov.au/environment/water/groundwater</p> <p>NT Government (2016). Water data portal. https://nt.gov.au/environment/water/water-data-portal</p> <p>Tickell, S.J. (2013). Groundwater of the Northern Territory, 1:2,000,000 scale map. Department of Land Resource Management, Northern Territory.</p> <p>Tickell, S., (2008), Explanatory notes to the Groundwater Map of the Northern Territory.</p> <p>Northern Territory Government Department of Natural Resources the Environment The Arts and Sport,</p>	

Element	Detail
Technical Report No. 12/2008D	
Tickell, S.J. and Rajaratnam, L.R. (1995). Water Resources Survey of the Western Victoria River District, Legume Station. Power and Water Authority, Water Resources Division. Report 31/1995D, June 1995	

TABLE C8.2 - WATER SUPPLY CRITERIA

Water Supply Type	Reference
Potable Water	Latest edition of the Australian Drinking Water Guidelines
Stock Water	ANZECC & ARMCANZ (2000) Guidelines for Fresh and Marine Water Quality
Other (other agricultural types, industrial, etc.)	

TABLE C8.3 GROUNDWATER MONITORING PROGRAM

ID	Easting	Northing	Total Depth (mbgl)	Slotted Range (mbgl)	Aspect	Monitoring
Piezo 1	541643	8338152	3.0	1.5 to 3.0	Farms (Piezos 3 and 5 will be within ponds during operation, and will no longer be monitored)	Logged water level Water chemistry
Piezo 2	542258	8342899	2.81	1.31 to 2.81		
Piezo 3	540822	8341687	3.0	1.5 to 3.0		
Piezo 4	537957	8340712	3.0	1.5 to 3.0		
Piezo 5	539683	8337478	3.2	1.7-3.2		
RN027014	542131.5	8331961	20	nd	Water level associated with Forsyth Dam Borrow Pits	Water level (preferably logged, but not necessary) Water chemistry
RN005135	539131.5	8335161	39.6	nd		
RN038543	538158	8333350	24	Aquifer 9 -24m		
RN027012	547831.5	8316211	60	nd		
RN029730	549031.5	8316411	38.6	22.6 – 34.6		
RN005484	548731.5	8316561	22.3	nd	Water level associated with Central Facilities Borrow Pits. Select the one most promising bore of these three	Water level (preferably logged, but not necessary)
RN005180	549837.5	8317497	36.6	nd		
RN005133	549231.5	8319261	50	nd		
RN004118	548431.5	8318261	120.4	nd		
RN025202	536565.5	8314901	36	28 - 33		
RN005313	536566.5	8314936	28	nd	Central Facilities Land Application area, up and down gradient (for groundwater flow)	Water level Water chemistry, nutrients, E.coli, BOD
RN029936	536566.5	8314961	24.48	nd		
New Bore 1	TBD	TBD		Shallow, deep nested	Central Facilities Land Application area, up and down gradient (for groundwater flow)	Water level Water chemistry, nutrients, E.coli, BOD
New Bore 2	TBD	TBD		Shallow, deep nested		

ID	Easting	Northing	Total Depth (mbgl)	Slotted Range (mbgl)	Aspect	Monitoring
New Bore 3	TBD	TBD		Shallow, deep nested	Accommodation Village Land	Water level
New Bore 4	TBD	TBD		Shallow, deep nested	Application area, up and down gradient (for groundwater flow)	Water chemistry, nutrients, E.coli, BOD
New Bore 5	TBD	TBD		Shallow, deep nested	Farm Services Land Application area, up and down gradient (for groundwater flow)	Water level
New Bore 6	TBD	TBD		Shallow, deep nested		Water chemistry, nutrients, E.coli, BOD
Reference / background Sites	TBD	TBD	Sufficient reference and unimpacted sites to allow comparison of results from the above for (primarily) salinity and groundwater level impacts. These will show similar historical results to monitored bores, and/or be in similar hydrogeological locations, but their aquifers isolated from Project impacts, or up-gradient from the Project (to detect changes with distance).			



C9

Waste Management Strategy

Rev. E

TABLE C9.1 - WASTE MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities		
All construction and operational activities generating, managing or interacting with waste.		
Excludes discharges through the EPZ into Alligator Creek of farm water (refer Surface Water Management Strategy)		
Aim		
Ensure wastes generated by the Project, both solid and liquid, are appropriately managed in accordance with the waste management hierarchy to minimise the risks of environmental pollution and public health nuisances.		
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
Protection of environmental ecosystems, quality and amenity	No leaks or spills No uncontrolled waste on the site All putrescible waste removed within 7 days either to landfill or for soil / waste conditioning on or off-site No hazardous or potentially contaminating wastes, including waste drums or containers, are stored outside of nominated areas Hazardous wastes removed from site or fully contained under cover and above flood levels before the wet season	Number of incidents Number of breaches in site visual inspections Post-storm site condition assessment failures
Minimisation of Waste disposed to on or off-site landfill	Waste targets met. 100% of recyclables are recycled No circumstances of inappropriate waste segregation	Assessment against waste targets Number of non-compliances
Waste Hierarchy		
<u>Avoid and Reduce (1, 2)</u>		
This element involves effective choices and management in procurement and site practices, to limit the amount of waste actually generated.		
<u>Reuse and Recycle (3, 4)</u>		
Reuse and recycling are the next best waste management options, avoiding disposal by maintaining the material in a productive state. The preferred approach is reuse of materials without further processing, being lower energy and material intensive, followed by recycling, where materials may be turned into other materials, potentially with different uses.		
<u>Recover (5)</u>		
Recovery refers to recovery of energy or other materials from a waste stream prior to it going to disposal, or rectifying a waste so that it doesn't ultimately require disposal, such as on-site soil conditioning.		
<u>Dispose (6)</u>		
Disposal is the least preferred option, and the waste management system will seek to minimise as much as practicable disposal of waste, either in the on-site landfill, or off-site landfill sites, by using the above more preferred approaches.		
Responsibility	Construction: Construction Manager Operations: Site Manager	
Actions / Mitigation Measures	General All permanent and temporary storage facilities are to be designed and operated according to appropriate Australian Standards or guidelines. Store hazardous materials in accordance with the Hazardous Materials Management Strategy Maintain products and dispose of all wastes in accordance with their MSDS	

Element	Detail
	<p>Implement the waste hierarchy above to preference practices at the top of the hierarchy (avoid, reduce, reuse) below those lower down (recycle, recover, dispose). This to include:</p> <ul style="list-style-type: none"> Use care in ordering of products and materials to minimise waste Provide segregation of wastes at source where practicable Ensure bins containing putrescible waste are fitted with lids and closed at all times Look for opportunities to reduce, reuse or recycle materials on site. <p>Dispose of wastes as described in Table C9.2.</p> <p>Update Table C9.2 as required to ensure it remains current, and includes all waste streams.</p> <p>Locate waste storage and collection areas away from overland flow paths and direct stormwater away from these areas.</p> <p>Listed Waste (defined in Schedule 2 of the <i>Waste Management and Pollution Control (Administration) Regulations</i> (NT)), shall be collected and removed from the site by a licensed contractor, to a site licensed to accept the waste, or shall otherwise be managed as conditioned under approvals, permits or licences for the site.</p> <p>All litter and waste materials to be stored or transported from the site shall be covered to prevent spillage or loss of materials.</p> <p>Construction</p> <p>Temporary waste collection facilities will be provided, and waste streams sorted as much as practicable at source prior to removal from site.</p> <p>Waste will be regularly removed from site by appropriately licensed contractors, to appropriately licensed facilities. Putrescible waste will be removed at least weekly.</p> <p>Waste separation facilities (including recycling facilities) shall be provided in an area accessible to collection vehicles.</p> <p>Implement the operational waste controls as soon as practicable during construction.</p> <p>Operation</p> <p>Implement the waste strategy described in this EMP, including:</p> <ul style="list-style-type: none"> Waste receptacles located at source, including at source sorting into general waste, recyclables, and listed wastes Transfer of general, recyclable and other non-listed and non-hazardous wastes to a Waste Transfer Facility at the Accommodation Village, or temporary storage at farm services and Central Facilities prior to transfer to this Waste Transfer Facility Transfer of listed and hazardous wastes to a Hazardous Waste Facility located at the Central Facilities, before removal off-site (by licensed transporters to licensed facilities) Drain washwaters and rainfall from bulk putrescible bin storage areas into the sewer system via appropriate trash rack screens and sumps in the floor of these areas, or otherwise treat prior to drainage to stormwater system Disposal of general and inert waste at an on-site landfill. <p>Interstate Transfer</p> <p>Transfer of waste interstate will require a number of authorisations from relevant authorities, either by Seafarms or the transport company. All authorisations are to be in place and a copy maintained on-site for any interstate transfer.</p>
Monitoring	<p>General</p> <p>The waste inventory outlined in this EMP will be updated and maintained during construction and operational phases to record all waste types, quantities produced, and management measures used for each.</p> <p>An annual review will be conducted, and will identify opportunities (and constraints) for continued waste minimisation and optimisation.</p> <p>Landfill Monitoring Program</p> <p>The landfill will be subjected to a monitoring program including:</p> <ul style="list-style-type: none"> Regular visual inspections of the site for signs of the loss of waste materials from the site, erosion, odour, dust, and pest animals and weeds

Element	Detail
	<ul style="list-style-type: none"> Groundwater bores around the perimeter of the landfill, to provide early warning of any potential leaching or loss of leachate from the landfill into groundwater. Bores will be located up and down gradient of the landfill Routine landfill survey to determine the existing utilised and remaining capacity within the engineered landfill.
Reporting	<p>The waste produced on the site and the ultimate end-point will be recorded and summarised annually, to determine opportunities for waste minimisation.</p> <p>Transfer of wastes from the site will be recorded, either by the retention of a receipt from waste transporters, or in the case of listed wastes by recording the type of waste, quantity removed, transporter, destination, and treatment/disposal method (if known) in a register, along with the receipt from the transporter.</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> Inappropriate disposal of wastes, either into the environment, or disposal of wastes that can practicably be recycled Uncontrolled waste disposal Listed wastes removed from the site without appropriate waste tracking, and/or by an unlicensed person, and/or to an unlicensed site <p>Corrective Actions:</p> <ul style="list-style-type: none"> Implement this waste management strategy where site procedures are non-compliant. Review and revise this strategy if required Clean up and appropriately dispose of any waste as needed Ensure only licensed waste transporters are utilised to transport listed wastes.
<p>References</p> <p>LGANT (2010) Waste Management Guidelines for Small Communities in the Northern Territory. Effective from Local Government Association of the Northern Territory, 1 January 2010</p> <p>NT EPA (2013) Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites In the Northern Territory. Northern Territory Environmental Protection Authority, January 2013</p> <p>NT EPA (2015) Waste Management Strategy for the Northern Territory 2015 - 2022. Northern Territory Environmental Protection Authority, July 2015</p> <p>NT EPA (2013). Guideline for Disposal of Waste by Incineration. Version 2.0, Northern Territory Environment Protection Authority, November 2013</p> <p>NT EPA (2016). Listed Waste Company Summary https://ntepa.nt.gov.au/_data/assets/excel_doc/0006/285720/listed_waste_company_summary.xlsx</p> <p>National Environment Protection Measures (NEPM).</p> <p><u>Interstate Transfers:</u></p> <p>NEPM Movement of Controlled Waste between States and Territories (1998)</p> <p>Western Australian Environmental Protection (Controlled Waste) Regulations 2004, which requires a controlled waste tracking form and Consignment Authorisation (CA) from the Department of Environment Regulation, along with a Waste Transport Certificate (WTC) from the Northern Territory.</p> <p>Queensland Environmental Protection Regulation 2008, which requires a WTC from the Northern Territory and CA from the Department of Environment and Heritage Protection</p>	

TABLE C9.2 - SUMMARY OF WASTE MANAGEMENT APPROACH FOR WASTE STREAMS

Waste Source	Waste Classification	Management Strategy
Construction		
Vegetation Clearing	Green Waste	Minimise vegetation clearing areas (1, 2); burning of grassland areas avoiding generation of waste for disposal (1, 2); mulching of woody vegetation for reuse in revegetation, soil stabilisation and rehabilitation (3), or burnt on-site (6)
Excavated Soils	Inert Waste	Waste soils will be minimised by adopting a cut/fill balance (1); any topsoils remaining will be stockpiled for reuse on-site in revegetation, soil stabilisation and rehabilitation (3)
Concrete, rock, inert C&D waste	Inert Waste	Procurement and concrete batching to be managed to reduce material wastage (1, 2); material to be reused as fill (structural or otherwise), or scour protection (3); excess material to be disposed to landfill (6)
Steel, metal waste, offcuts	Recyclables	Waste metal bins to be provided at relevant locations across the site, primarily workshops and maintenance areas. Recycling bins will also be provided next to all general waste receptacles to allow for sorting at source. All recyclable wastes removed to the Waste Transfer Facility for ultimate removal off-site to the receiving station at Kununurra for recycling (4)
Asbestos Containing Materials (ACM) (unexpected findings)	Listed Waste	If found, the site will be isolated and a site investigation will be initiated and site stabilisation and/or cleanup initiated. ACM will generally be double wrapped and removed by licenced operators to a licenced facility for disposal by burial (6)
Construction and Operation		
Batteries	Listed Waste	Vehicle batteries will be removed to the Central Facilities and stored in a bunded area within the Central Hazardous Waste Facility, before removal off-site by a licenced transporter to a licenced facility for recycling (4) and material recovery (5)
Tyres	Listed Waste	Tyres will be stored on the site in small quantities, and sent off-site prior to representing a fire hazard for re-treading (3) or recycling (4) where possible, or disposal (6). Removal will be by a licenced transporter to a licenced facility, to the receiving station at Kununurra.
Used oil/fuel filters, waste oil, oil-water mixtures, oily rags, absorbent and oil spill cleanup products (spent)	Listed waste	<p>Liquid waste of this type will be stored at various locations across the site (at source), in waste oil drums, oil-water separators, and similar, and either:</p> <ul style="list-style-type: none"> ■ Removed periodically to the Central Hazardous Waste Facility, for later removal off-site by a licenced transporter, or ■ Removed periodically from each source by a licenced transporter. <p>Solid material such as oily rags, oil filters and spent absorbent will be stored in drums under cover until removal to the Central Hazardous Waste Facility, for later removal from the site by a licenced transporter.</p> <p>Material removed from the site will be processed to recycle (4) or recover (5) oils for reuse, with residual material, including solids, disposed to licenced landfill facilities (6).</p>
Empty chemical and hazardous materials drums and containers	Potentially Listed Waste if containing the	Waste containers will be stored within bunded areas, in the temporary hazardous waste storage areas across the site, or inside the Hazardous Waste Facility. Alternatively, containers

Waste Source	Waste Classification	Management Strategy
	residue of a Listed Waste	double rinsed with fresh or salt water may be stored as non-hazardous materials (not in bunded or roofed areas) prior to removal off-site.
Oil contaminated soil	Listed Waste	This is expected to be very minimal. Where it is quite small, this can be removed with spent absorbent material as described in the above row for disposal off-site to a licenced facility (6). If larger quantities are involved, on-site soil conditioning will be used where practicable, involving laying out, turning and fertilisation (potentially with nutrients from pond waste) to allow microbes to break down hydrocarbons in the soil (5). Regular soil testing will be undertaken to determine when the soil can be considered 'clean' for reuse (as fill) back on the site (this is not anticipated to be required, however if it is, an approval from NT EPA would be sought prior to undertaking on the site).
Paints and solvents	Listed Waste	These materials will be stored in sealed drums at source, and regularly removed to the Central Hazardous Waste Facility for later transport off-site by licenced transporter to a licenced facility. Recovery (5) or disposal (6) may then occur off-site.
Plastics (classes)? Such as poly pipe, offcuts,	General Waste	This material, where it cannot be reused on the site (3), will be disposed of to landfill (6) with general waste.
Personal Protective equipment and small items: <ul style="list-style-type: none"> ■ Gloves ■ Hardhats ■ Safety glasses ■ Boots, biosecurity gear ■ Water coolers 	General Waste	This material will likely be in small quantities relative to the general waste stream, and will be disposed of to landfill with general waste (6).
Vehicle washbays - wash waters, first flush runoff	Listed Wastes	Washbays will produce oil-water mixtures, and biocide containing waters for disposal. An oil-water separator will separate oily water from the treatable water that will be pumped to the on-site package wastewater treatment plants (5), with the oil-water residue treated as described below.
Workers on-site, accommodation including: <ul style="list-style-type: none"> ■ putrescible wastes ■ Non-class 1, 2, 5 plastics 	General wastes	This material will be disposed of to the on-site landfill (6).
<ul style="list-style-type: none"> ■ Aluminium and steel cans ■ Class 1, 2, 5 plastics ■ Cardboard ■ Paper 	Recyclable wastes	A separate recycling bin will be provided at source, regularly removed to the Waste Transfer Facility and, where practicable, further sorted (e.g. into cans, recyclable plastics, cardboard). This material will be removed off-site for recycling (4).
Wooden Pallets	Green waste (untreated) Listed waste (treated)	Pallets will be stored at the Waste Transfer Facility. Those that can be re-used will be trucked to the Processing Plant at Kununurra where they will be washed and re-used for product transport or bagged feed.
Sewage effluent	Sewage Effluent	Effluent will be treated by package on-site wastewater treatment plants, and disposed of by land disposal systems. This is nominally number (6) in the hierarchy, although effective treatment and disposal will be much more benign than would be waste disposal to landfill.

Waste Source	Waste Classification	Management Strategy
Sewage Sludge and Grease Trap waste	Listed waste	This material will be stored at and accumulate at various locations across the site (at source), and will be removed periodically from each source by a licensed operator, and transported off-site to a licenced facility for soil conditioning and recovery (5) or disposal (6).
Waste from on-site paramedics, nursing/first aid station	Listed Waste (Clinical waste)	A portion of this material may be clinical waste, requiring off-site disposal to a licenced facility. This may include sharps (stored in a sharps container prior to removal), dressings and pharmaceuticals (typically able to be disposed of to landfill unless in large quantities, unlikely to occur on the Project site)
Operation		
Feed bags	General or Recyclable Waste	Feed bags will generally be a woven polypropylene bulka bag. This will be either reused by filling with sand/cement mix and using as armour for scour protection (3), removed from site for recycling where possible (4), or disposed of to landfill (6). Reduction of this waste stream (1, 2) is achieved through improving the Feed Conversion Ratio in ponds, related to pond management, and will be an ongoing refinement process for economic and environmental reasons.
Waste (spoiled) feed	General Waste, or if in large quantities, Listed Waste	In small quantities, this material might be used as fertiliser to assist with the growth of vegetation (landscape or stabilising vegetation) under cover to avoid attracting pests, or disposed of to landfill with general waste (6). In larger quantities (an unlikely and emergency type situation), this material can be conditioned with farm/settlement pond waste (soil composting). This would be undertaken in windrows adjacent to the landfill site until the material is suitably benign to use as topsoil dressing or fertiliser on the site (5)
Channel and settling ponds silt and sediments	Inert Waste	This material can be stockpiled for reuse on-site in revegetation, soil stabilisation and rehabilitation (3), including in soil improvement for higher organic load material such as farm pond spoil, and in soil conditioning or windrowing activities
Pond sludge / waste, including organic material from prawn farming	Listed Waste	This material is initially anoxic, but upon drying and stabilisation is an inert waste, although high in nutrients. The material is likely to be useful for topdressing berms and embankments for re-vegetation, and may represent a useful and valuable resource (3). It may also be mixed with other organic wastes to improve soil conditioning if undertaken on the site (5). Where not able to be used on the site, the material will be stockpiled and compacted into a low stable landform (6).
Dead prawns	Listed Waste	This waste will generally be of small quantities and will be incorporated into the organic material at the bottom of the ponds. Where major quantities arise as part of a notifiable disease outbreak, this will be handled by the official regulatory process, involving development of a plan by the Department of Fisheries and the proponent, covering shutdown of parts or all of the Grow-out Centre, agreed treatment and disposal of prawns. Disposal would be via a method guaranteed to avoid spread of disease / prawn remains, odour, etc.
Laboratory waste	Listed Waste General Waste	General waste will be disposed of to landfill (6). Clinical waste would be expected to be minimal (if any), and if required will be appropriately packaged, stored within the hazardous waste

Waste Source	Waste Classification	Management Strategy
		facility, and transported off-site by licenced transporter to a licenced site for disposal (6).

Table notes: (1) Avoid; (2) reduce; (3) reuse; (4) recycle; (5) recover; (6) dispose

C10

Air and Noise Management Strategy

Rev. D

TABLE C10.1 - AIR AND NOISE MANAGEMENT STRATEGY

Element	Detail																											
Applicable site activities Primarily construction, particularly intake pile driving operations, earthmoving machinery, dust generation from vegetation clearing and earthworks Operational phase power generation																												
Aim Protect the health, welfare and amenity of people due to noise and air quality impacts.																												
Objectives		Targets		Key Performance Criteria																								
Undertake and complete works in compliance with statutory environmental requirements		No statutory infringements No breaches of licence/approval conditions		Number of infringements Number of breaches																								
No dust, odour or air quality impacts to sensitive receptors on the site (refer Table C10.2 and Figure C10.1)		No complaints Air quality at sensitive receptors does not exceed the following due to the Project: <div><div>50 µg/m2 for PM10 (24h averaging period)</div><div>30 µg/m2 for PM10 (annual averaging period)</div><div>2 g/m2/month (annual averaging period)</div><div>246 µm/m3 for NO2 (hourly averaging period)</div><div>7 odour units, Legune Station homestead</div><div>4 odour units, Accommodation Village</div></div>		Number of complaints Number of exceedances																								
No noise impacts to sensitive receptors		No complaints Noise levels at sensitive receptors does not exceed the following due to the Project: Construction <table><tr><td>7 am to 7 pm (Mon - Sat)</td><td>Background + 5dB</td></tr><tr><td>9 am to 6 pm (Sun or public holiday)</td><td>Background + 5dB</td></tr><tr><td><div>Legune Station</div></td><td>58dB</td></tr><tr><td><div>Accommodation Village</div></td><td>51dB</td></tr></table> Operation <table><tr><td>Time Period</td><td>Amenity Criteria (dBA)</td><td>Intrusive Criteria (dBA)</td><td>Project Specific Criteria (dBA)</td></tr><tr><td>Day</td><td>50</td><td>43</td><td>43</td></tr><tr><td>Evening</td><td>45</td><td>43</td><td>43</td></tr><tr><td>Night</td><td>40</td><td>41</td><td>41</td></tr></table>		7 am to 7 pm (Mon - Sat)	Background + 5dB	9 am to 6 pm (Sun or public holiday)	Background + 5dB	<div>Legune Station</div>	58dB	<div>Accommodation Village</div>	51dB	Time Period	Amenity Criteria (dBA)	Intrusive Criteria (dBA)	Project Specific Criteria (dBA)	Day	50	43	43	Evening	45	43	43	Night	40	41	41	
7 am to 7 pm (Mon - Sat)	Background + 5dB																											
9 am to 6 pm (Sun or public holiday)	Background + 5dB																											
<div>Legune Station</div>	58dB																											
<div>Accommodation Village</div>	51dB																											
Time Period	Amenity Criteria (dBA)	Intrusive Criteria (dBA)	Project Specific Criteria (dBA)																									
Day	50	43	43																									
Evening	45	43	43																									
Night	40	41	41																									
Responsibility		Construction: Construction Manager Operations: Site Manager																										

Element	Detail
Actions / Mitigation Measures	<p>Dust</p> <p>Water will be applied periodically to unsealed road and construction area surfaces used for mobile plant and vehicle traffic.</p> <p>Speed limits will be enforced for all vehicles on unsealed roads.</p> <p>Vegetation clearing will be limited and exposed areas revegetated, where possible.</p> <p>Construction water will be pumped close to earthworks, to minimise traffic and long road hauls.</p> <p>Temporary camps and construction laydown areas will be located as close to earthworks as practicable.</p> <p>Weather reports will be checked daily to enable action to be taken immediately if conditions change.</p> <p>Control measures will be implemented in a way that also controls for dust while the site is unattended, e.g. at night or on weekends.</p> <p>A site 'shut down and cover up' policy will be implemented during periods of extreme weather conditions.</p> <p>Additional dust control methods that can be employed where required to control impacts include:</p> <ul style="list-style-type: none"> ■ Physical barriers around dust generating activities (dust fences) ■ Dust suppressants on stockpiles or berms / slopes <p>Odour</p> <p>Sediments that are likely to be odorous will not be disturbed when wind direction and speed are likely disperse the odour toward any sensitive receptors (i.e. not on poor dispersion light wind days).</p> <p>On-site sewage treatment plants will be operated efficiently so as to minimise or eliminate odour (well run plants typically do not produce excessive odour). Implement the Effluent Management Strategy.</p> <p>Noise</p> <p>Undertake works with the potential to affect noise sensitive areas only between the hours of:</p> <ul style="list-style-type: none"> ■ 7 am to 7 pm Monday to Saturday ■ 9 am to 6 pm Sunday or Public Holidays <p>All equipment will be selected to minimise noise emissions</p> <p>Equipment will be fitted with appropriate silencers and be in good working order</p> <p>All engine covers will be kept closed while equipment is operating</p> <p>The height at which material is dropped into or out of trucks will be minimised as far as practicable</p> <p>Vehicles should be kept properly serviced and fitted with appropriate mufflers. The use of exhaust brakes will be minimised, where practicable</p> <p>Machines found to produce excessive noise compared to industry best practice will be removed from the site or stood down until repairs or modifications can be made.</p> <p>To reduce the annoyance associated with reversing alarms, broadband reversing alarms (audible movement alarms) will be used for site equipment where working near sensitive areas.</p>
Monitoring	<p>As part of regular site inspections (weekly during construction and operation), observations will be made of dust, odour, air quality and noise from site works. Any unacceptable noise will be recorded in the Site Manager's logbook, or the site visual inspection form in Appendix F (or similar) for follow up and rectification.</p> <p>Monitoring will be conducted at sensitive receptors where a complaint (non-vexatious) has been made, where evidence is required against air quality criteria, with the monitoring selected as follows:</p> <ul style="list-style-type: none"> ■ Dust: PM10 and dust deposition ■ Odour: H2S monitoring as an indicator, or odour unit sampling if required ■ Noise: According to AS 1055.1 - 3: Acoustics

Element	Detail
Reporting	<p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up.</p> <p>Any monitoring results will be retained and summarised into annual monitoring / environmental performance reporting.</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> Noise, dust or odour complaint Observed excessive noise, dust or odour emissions Odours in proximity to sewage treatment plants <p>Corrective Actions:</p> <ul style="list-style-type: none"> Respond to the complaint on the same day if possible and determine the time, location and possible source Rectify any problems identified if practicable, and if non-vexatious, consider monitoring to determine whether air or noise quality criteria are being exceeded. Follow up on complaints after rectification works to determine if they have been successful For sewage treatment plants, inspect the plant, and determine if system needs maintenance, such as sludge pumping or other works to ensure efficient operation. Additional odour control systems may be required to be retrofit.
<p>References</p> <p>NT EPA (2014) Noise Guidelines for Development Sites in the Northern Territory. Northern Territory Environment Protection Authority, May 2014</p> <p>New South Wales (NSW) Industrial Noise Policy</p> <p>DEC (2005). The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales. NSW Department of Environment and Conservation</p> <p>EPA Victoria (2013) Recommended Separation Distances for Industrial Residual Air Emissions. EPA Victoria, Publication Number 1518, March 2013.</p> <p>AS 1055.1-1997: Acoustics – Description and measurement of environmental noise, Part 1 General procedures</p> <p>AS 1055.2-1997 Acoustics – Description and measurement of environmental noise, Part 2 Application to specific situations</p> <p>AS 1055.3-1997 Acoustics – Description and measurement of environmental noise, Part 3 Acquisition of data pertinent to land use</p>	

TABLE C10.2 SENSITIVE RECEPTORS

Sensitive Receptor (see Figure C10.1)	Distance from Project	Potentially impacting activities
Legume Station homestead	15 km from the grow-out centre	Landfill, borrow pit, Forsyth Dam are the closest, though all too far away to have any impact)
Proposed Accommodation Village	18 km from the grow-out centre	Accommodation Village works, Central Facilities works, traffic

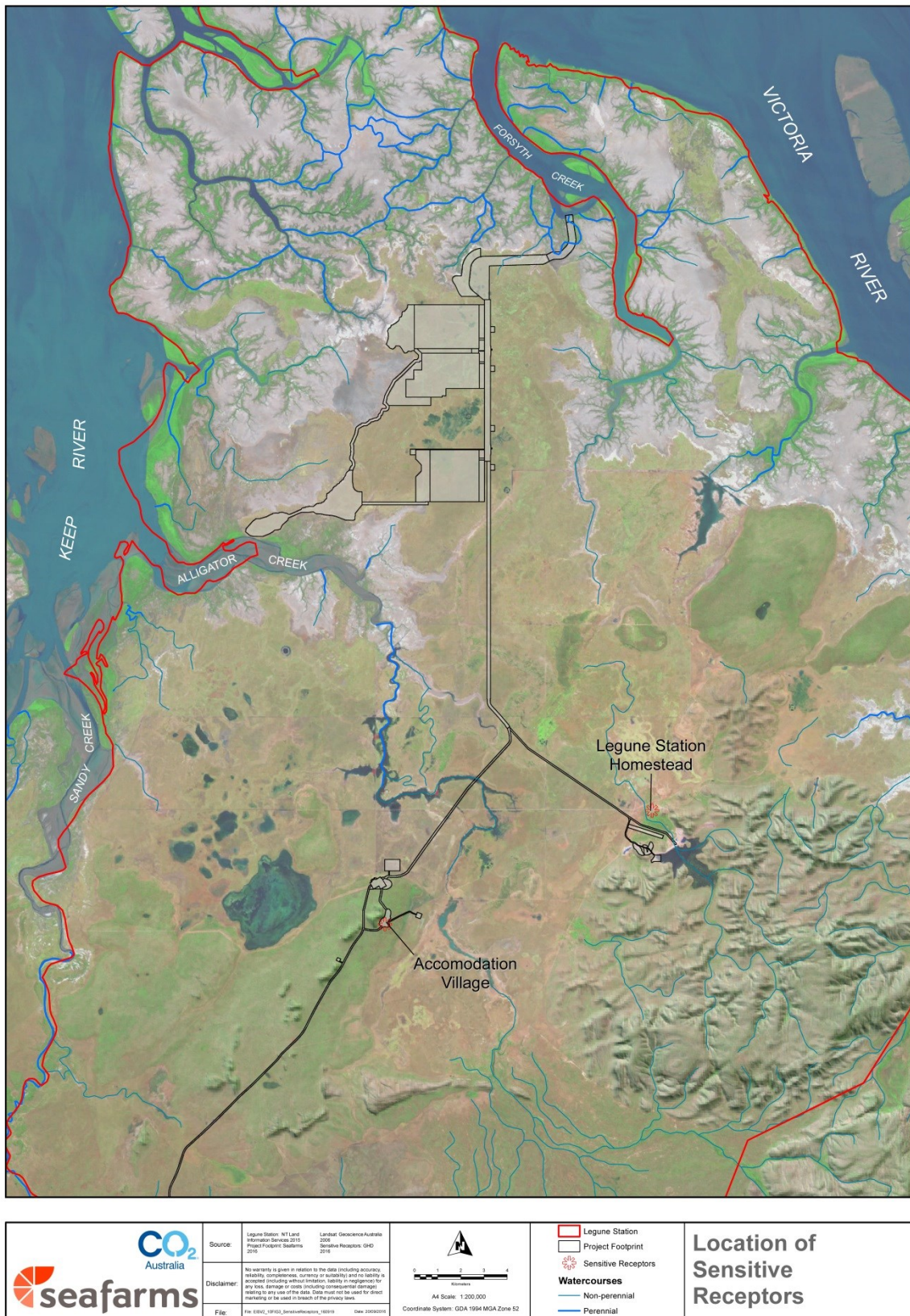


FIGURE C10.1 SENSITIVE RECEPTORS

C11

Effluent Management Strategy

Rev. E

TABLE C11.1 - EFFLUENT MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities		
Construction and Operation activities producing sewage effluent		
Aim		
Ensure sewage effluent generated by the Project is appropriately managed, treated and disposed so as to minimise the risks of environmental pollution, human health impacts, and public health nuisances.		
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
Protection of environmental ecosystems, quality and amenity	Efficient and safe operation of sewage treatment plants No overflows Effluent quality meets reuse criteria (refer Table C11.2)	Compliance with Hazardous Materials Management Strategy
Sustainable long term irrigation schemes operated at the site	No deterioration of groundwater due to irrigation scheme No deterioration of soil quality or structure, due to irrigation scheme No damage to flora or vegetation communities due to irrigation scheme	Degree of change to groundwater quality in proximity to irrigation areas, particularly for salinity, nutrients, pathogens (E.Coli indicator) Degree of changes to soil quality, particularly for salinity, nutrients, heavy metals, pathogens (E.Coli indicator) Changes to irrigation area vegetation health
Responsibility	Construction: Construction Manager Operations: Site Manager In both cases, appoint a Wastewater Officer with responsibility for managing and maintaining (directly or by subcontract) the sewerage treatment schemes	
Actions / Mitigation Measures	Source Control Only effluent suitable for treatment in the sewage treatment plant to drain into the sewer. Quality dependant on STP type and manufacturers / suppliers recommendations Provide warning signs in kitchens, toilets, etc. warning of what not to flush to avoid overloading or destabilising the treatment plants. Treatment Plant and Irrigation Area Wastewater treatment plants and Land Application Areas will be sized appropriate to the hydraulic load and the soils to avoid overwatering, by: <ul style="list-style-type: none">■ matching hydraulic load to the hydraulic capacity of the soils■ matching nutrient application rates to the nutrient assimilation capacity of the soil/vegetation system, and■ managing salinity buildup, by using a salt leaching fraction (if required). Flow meters will be installed to measure the daily amount of irrigation water applied to each separate irrigation area, recorded on a daily basis to ensure that the scheduled volume of recycled water is not exceeded. Adopt suitable buffers between irrigation areas and sensitive receptors, as outlined in DoH (2014). Adopt a default buffer of 100m for the Accommodation Village treatment plant, and 50m for other plants to sensitive receptors. Review buffer distances at detailed design to ensure no odour nuisance will occur.	

Element	Detail
	<p>Erect appropriate signage indicating that recycled water is not suitable for drinking at every outlet from the treated effluent distribution system. Signs shall be easily visible and maintained regularly. Signage shall also be provided and maintained at the irrigation area informing of the use of treated effluent for land irrigation</p> <p>Piping and fittings shall be installed and colour coded in accordance with AS/NZS 1547:2012 On-site domestic wastewater management, AS 3500 National Plumbing and Drainage Code, and AS 1345-1995 Identification of the contents of pipes.</p> <p>Any fittings/valves accessible by public must be appropriately secured to restrict access</p> <p>Alarms and Contingency</p> <p>An alarm system shall be installed on the treatment plant to warn of system malfunctions, high level alerts and potential overflows before they occur (strobe light or similar). Telemetry linked into the Project control system is recommended.</p> <p>All pump stations to be similarly alarmed.</p> <p>Maintenance</p> <p>Do not drive or park vehicles, or build structures or create shade on land application areas.</p> <p>Maintain diversion bunding to keep overland flow water from running across land application areas.</p> <p>Regularly mow and remove excess grass from land application areas. Do not allow trees or large vegetation to grow in this area where roots may disrupt subsurface drip irrigation systems.</p> <p>Ensure system is maintained in accordance with manufacturer's instructions, including routine flushing of irrigation pipework, and cleaning of filters</p>
Monitoring	<p>Systems are to be routinely visually inspected to ensure they are not overflowing and irrigation areas are not being overloaded, that no excessive odours are being generated, and that treatment plants are operating efficiently and effectively.</p> <p>Implement groundwater monitoring program in relation to land application areas</p> <p>Regular visual monitoring of land irrigation areas for signs of:</p> <ul style="list-style-type: none"> ■ Soggy ground with or without ponding evident on the land application area ■ Patchy vegetation growth (or limited growth) indicating blockages or preferential flow pathways to deeper soils ■ Drains and toilets running slowly, which may indicate a blockage in the pipework or treatment system ■ Excessive effluent odour (both land application and sewage treatment systems) which may indicate the system is not performing adequately. <p>One baseline and thereafter 2 yearly soil monitoring in disposal areas, to include monitoring for nutrients, major anions and cations, pH, salinity, and heavy metals.</p> <p>Weekly sampling of water quality, and monthly E.coli. After 2 years, if levels are stable, reduce to quarterly sampling.</p>
Reporting	<p>All monitoring results are to be maintained on-site, and inspected by a person with sufficient knowledge of on-site sewerage treatment plants</p> <p>Compile all results into an annual monitoring report for internal dissemination, and provision to authorised government officers, on request</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> ■ Excessive odour generated from the treatment plant (whether complaints are received or not) ■ High level alarm is triggered ■ Water quality exceedances ■ Evidence of decline of irrigation area soils <p>Corrective Actions:</p>

Element	Detail
	<ul style="list-style-type: none"> Inspect and undertake repair or maintenance of treatment plant Check for blockages or pump failures. If required, pump out to temporary holding tank before reintroduction back to plant at a later time, or organise for a licenced contractor to pump out system and remove off-site Investigate source of issue with plant, and undertake repair or mitigation. If necessary, additional plant or equipment may be required Where irrigation soils are showing signs of decline, improve water quality from the plant (better process control, additional equipment), reduce irrigation rates, or allow irrigation area to rest (irrigate alternative location).
References DoH (2014). Draft Guidelines for Wastewater Works Design Approval of Recycled Water Systems. Northern Territory Department of Health, 9 July 2014.	

TABLE C11.2 RECYCLED WATER CRITERIA

Recycled Water Class	End Uses	Treated water quality criteria
Class C (DoH, 2014)	Irrigation	Conductivity: <1,600 μ S/cm BOD5: <20 mg/L Total Suspended Solids: 30 mg/L pH: 6.0 - 8.5 E.Coli < 1,000 cfu/100 mL Nutrients: Limits as determined by nutrient balance modelling, during detailed design of irrigation fields

C12

Hazardous Materials Management Strategy

Rev. F

TABLE C12.1 - HAZARDOUS MATERIALS MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities		
All activities involving storage of hazardous chemicals, substances or waste. May include storage, handling or transport of:		
<div><div></div>fuels in minor quantities and in bulk tanks</div> <div><div></div>hydrogen peroxide in bulk tanks (up to 10,000L)</div> <div><div></div>pesticides and herbicides (minor quantities)</div> <div><div></div>Waste oils/water, hydrocarbons/water mixtures, emulsions</div> <div><div></div>Lead Acid Batteries, Paints and solvents</div> <div><div></div>Grease Trap waste and Sewage sludge</div> <div><div></div>Clinical and laboratory waste</div> <div><div></div>Wastes of any of the above.</div>		
Storage will generally involve minor storage quantities across the site, other than some bulk stores at the farms/farm services, and a central chemical storage facility at the Central Facilities		
Aim		
Ensure hazardous substances are appropriately managed to minimise the risks of environmental pollution and that land and soil, surface and groundwater resources are protected both now and in the future, such that the ecological health and land uses, and the health, welfare and amenity of people are maintained		
Hazardous Substances		
Hazardous goods are substances that have the potential to cause harm to people, property and the environment. This includes:		
<div><div></div>dangerous goods, classified as having the potential to cause immediate harm to people, property or the environment due to their explosive, corrosive, toxic, oxidising or flammable nature.</div> <div><div></div>Chemicals if they are listed on the national Hazardous Substances Information System and are above the concentration level which is harmful to human health.</div>		
This management strategy covers both hazardous chemicals and dangerous goods, all of which are termed here hazardous substances, whether products to be used, or wastes to be stored and disposed.		
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
No release of hazardous substances causing or having the potential to cause environmental harm or impacts to human health and wellbeing	No releases of hazardous substances outside of containment areas or off-site All rags, absorbents, soils, or containers containing hazardous substances contained on the site Removal of waste or surplus hazardous substances from site by licenced transporters to licenced sites	Number of incidents Number of failures recorded in site inspections Waste Tracking documentation - number of failures to track and breaches of requirements
Responsibility	Construction: Construction Manager Operations: Site Manager	
Actions / Mitigation Measures	Compliance with relevant statutory requirements Comply with the requirements of the Work Health and Safety (National Uniform) Act (NT) and Regulation (WH&S Act, WH&S Regulation) particularly in regards to hazardous chemicals. This includes: <div><div></div>Maintenance of a hazardous chemical register</div> <div><div></div>Notification to NT Worksafe and provision of manifest where hazardous chemicals in excess of the manifest quantity in Schedule 11 of the WH&S Regulation are stored on-site</div>	

Element	Detail
	<p>Notification to NT Worksafe where hazardous chemicals exceed the threshold quantity detailed in Schedule 15 of the WHS Regulations by 10%. A licence may also be required.</p> <p>General</p> <p>All staff to be trained in the safe handling, storage, use and disposal of hazardous substances and chemicals</p> <p>All plant, containers or other equipment used for the storage, handling, or transporting of dangerous or hazardous goods to be maintained in a safe condition</p> <p>Disposal of potentially hazardous substances or chemicals to be undertaken in accordance with the requirements in the SDS. This includes any spill absorbent material, rags, containers, soil, etc. contaminated with the material</p> <p>All hazardous materials shall be stored and handled in accordance with the requirements of the SDS</p> <p>All substance containers to be correctly labelled</p> <p>Site storage and containment requirements</p> <p>Store dangerous goods and hazardous materials and wastes (including material which could cause environmental harm) in designated storage areas to appropriate Australian Standards (refer end of table for examples). These require as a minimum:</p> <p><u>Construction</u></p> <ul style="list-style-type: none"> internally bunded fuel tanks, with spill kits on hand. Permanent installations will be externally bunded around fuel dispensing areas. Chemicals and other hazardous substances to be stored in temporary (or permanent once built) hazardous storage facilities <p><u>Operation</u></p> <ul style="list-style-type: none"> an impermeable base (concrete typically) bunding so that the total bunded storage meets the bunding requirements of relevant Australian Standards (see references below for some examples) roofed, or provision to remove or treat all stormwater as contaminated water through oil water separators sumps and pipework to allow the area inside the bund to be completely drained no breaks through the bund - all pipes to go over the bund wall, trafficable sections to go over the height of any bund specific storage containers or sections for specific items, ensuring separation of incompatible chemicals (refer to SDS, AS1940, etc.) a detailed site plan to be prepared for each storage location to include layout plan, location of spill kit, emergency exit, any emergency/contingency measures (emergency stops etc.), location of PPE, and location and direction of any overflow discharges (if they were to occur) and receiving environment for these discharges SDS for all substances stored at the storage location to be included with the above plan <p>Fuel transfer and refuelling operations</p> <p><u>Construction</u></p> <ul style="list-style-type: none"> Adopt operational controls when they have been constructed Small or day tanks to be double lined and/or stored in suitable containers to mitigate the risks of spills or leaks Store all other quantities and bulk hazardous substances within suitably bunded areas Spill control equipment is to be deployed prior to the transfer of fuel or oil within 30m of a drainage line or the pond, and refuelling is to be attended at all times <p><u>Operation</u></p> <p>All bulk transfer and regular re-topping or refuelling points to be bunded to contain the largest likely spill</p> <p>Refuelling locations to also contain:</p> <ul style="list-style-type: none"> automatic wet weather diversion, to capture all flows while refuelling, plus the first flush (typically 15mm) after refuelling stops, triggered by the refuelling hose

Element	Detail
	<ul style="list-style-type: none"> ■ emergency stops in prominent locations to close off all valves and pipes to tanks ■ auto shut off valves <p>Fuel will be stored within impermeable and bunded areas (and double skinned storage tanks where required), with refuelling areas being either a built for purpose bunded, concreted refuelling area (larger central storage), or smaller bunded refuelling location (permanent or temporary).</p> <p>Chemicals and waste chemicals, fuel and oil, oil-water mixtures, and waste drums or containers, will be stored within designated roofed and bunded chemical and waste storage facilities.</p> <p>Spill Response</p> <p>Ensure spill response equipment of a suitable type and capacity is located on-site at easily accessible locations. These are to include material for spill clean-up within waterways where waterways could be affected</p> <p>Spills of hazardous materials must not be hosed. Dry cleanup procedures shall be employed as appropriate to the substance</p> <p>Spill Response Procedures are located in the Contingency Management Strategy (Appendix E)</p> <p>Health and Safety</p> <p>Comply with the site Health and Safety Plan. In particular, ensure that workers and others are not exposed to risks to health or safety arising from the Project, based on risk assessment and management of risks.</p>
Monitoring	<p>Weekly visual inspections shall be conducted of refuelling/servicing areas and hazardous material containment areas to detect leakages or spills</p> <p>Inspect spill kits monthly and following each use of a spill kit to ensure they are appropriately stocked</p> <p>Monthly inspections of containment bunds to ensure bund integrity, and rectify any issues found</p> <p>Annual tank integrity testing for all bulk hazardous or dangerous goods storage tanks</p>
Reporting	<p>Details of all regulated waste transfers onto and off the site are to be recorded, including the date, quantity, type, name of transporter, source and intended treatment or disposal destination.</p> <p>Records are to be maintained of the quantity of waste material removed from the site, and chemicals stored on the site that are dangerous goods, hazardous materials, or those with the potential to cause environmental harm</p> <p>All chemicals or potentially hazardous substances (products or waste) stored on the site to be subject to a risk assessment to identify the level of risk, and thereafter appropriate controls if required (e.g. using ChemaAlert or similar). Any new chemicals purchased for use to be subject to this risk assessment prior to use</p> <p>Implement a chemical storage register, to identify types and quantities of chemicals, storage details and location on site, etc. The above risk assessment is to be included with or form part of the register.</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> ■ Hazardous substance located outside of containment facility ■ Leaks or spills of any substance (hazardous or otherwise, assuming at first it is hazardous) ■ Structures found to be in need of repair, or potential for spill, leak or breach of containment identified <p>Corrective Actions:</p> <ul style="list-style-type: none"> ■ Initiate spill response (refer Spill Response in the Contingency Management Strategy (Appendix E)) ■ Rectify leaks, defects or potential for leaks or spills, ensuring first it is safe to do so, and appropriate personnel and PPE are utilised

Element	Detail
References	
	Work Health and Safety (National Uniform Legislation) Act (NT)
	Work Health and Safety (National Uniform Legislation) Regulation (NT)
	AS 1940 The storage and handling of flammable and combustible liquids
	AS 3780 The storage and handling of corrosive substances
	AS 4326 The storage and handling of oxidizing agents
	AS 3961 Liquefied natural gas—Storage and handling
	AS 4332 The storage and handling of gases in cylinders
	AS/NZS 1596 The storage and handling of LP Gas
	AS/NZS 3833 - The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers
	National Standard for the Storage and Handling of Workplace Dangerous Goods. http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/ns200103storageandhandling
	Australian Dangerous Goods Code. http://www.ntc.gov.au/heavy-vehicles/safety/australian-dangerous-goods-code/
	Hazardous Substances Information System (HSIS). http://hsis.safeworkaustralia.gov.au/
	NT Work Safe (2016). Dangerous Goods Laws. http://www.worksafe.nt.gov.au/LawsAndCompliance/Pages/Dangerous-Goods-Laws.aspx

C13

Bushfire Management Strategy

Rev. E

TABLE C13.1 - BUSHFIRE MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities		
Construction and Operation, Land management		
Aim		
To minimise the risk of adverse impact from bushfire on life, property and the environment.		
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
Reduce the number of human-induced bushfire ignitions that cause loss of life and/or property and the environment	No human-induced bushfire ignitions that cause loss of life, and/or damage to property and the environment	Number of human-induced bushfire ignitions that cause loss of life, and/or damage to property and the environment
Manage fuel loads to reduce the rate of spread and intensity of bushfires, while minimising environmental/ecological impacts.	Maintain fuel management zones including low fuel loads in asset protection zones (e.g. assets, fire access trails and property boundary) Maintain adequate separation distances between hazardous vegetation and Class 1-3 and 10a buildings in accordance with AS 3959-2009 – <i>Construction of buildings in bushfire-prone areas</i> (Standards Australia 2009). Manage fuel loads taking into consideration ecological impacts on listed species known to be fire-sensitive.	Measured fuel loads within identified fuel management zones, including asset protection zones Number of confirmed losses of listed fire-sensitive species attributable to fuel management activities
Reduce the community's vulnerability to bushfires by improving its preparedness	Prepare, maintain and review detailed Bushfire Management Plan	Availability and familiarity of Bushfire Management Plan to all employees and contractors Review of Bushfire Management Plan annually and after every bushfire event
Responsibility	Construction: Construction Manager Operations: Site Manager	
Actions / Mitigation Measures	A detailed Bushfire Management Plan for the site will be prepared in consultation with Bushfires NT. This will include preparation of risk-based maps to prioritise and evaluate fuel management zones and mitigation activities, including those within asset protection zones. Burning of cleared vegetation, if required, will be undertaken in consultation with Bushfire NT with approval under the Bushfires Management Act (NT).	
Monitoring	All staff and contractors will be briefed about the impacts of bushfires and burning in asset protection zones and other sensitive areas. Fire-fighting equipment will be made available during construction and operation to prevent fires spreading, with all vehicles to be fitted with fire extinguishers The site manager will be responsible for liaison with the local authorities (e.g. Bushfires NT, Northern Territory Bushfires Council) on severe bushfire hazard days Site inspections will be undertaken of fuel management zones. This will include annual assessment of fuel loads prior to the fire season, especially within asset protection zones. The confirmed location of fire-sensitive species will be identified on fuel management maps in order to minimise impacts (or loss) of fuel management activities on those species.	

Element	Detail
Reporting	<p>A report will be prepared following all bushfires on the property, including details of location, source and management actions (if any).</p> <p>Annual reports will be prepared outlining implementation of the bushfire management activities identified in the Bushfire Management Plan.</p> <p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> ■ Bushfire deemed to have ignited as a result of human action ■ Bushfire encroaching into asset protection zones ■ Elevated fuel loads within asset protection zones ■ Confirmed losses of fire-sensitive species as a result of fuel management activities <p>Corrective Actions:</p> <ul style="list-style-type: none"> ■ Review Bushfire Management Plan to ensure no breaches of management strategies including monitoring of fuel loads ■ Ensure Bushfire Management Plan is made available and familiar to all employees and contractors ■ Survey and identify location of fire-sensitive species within fuel management zones
<p>References</p> <p>AS 3959-2009 <i>Construction of buildings in bushfire-prone areas.</i></p>	

C14

Traffic Management Strategy

Rev. D

TABLE C14.1 - TRAFFIC MANAGEMENT STRATEGY

Element	Detail
Applicable site activities	Construction and Operation, vehicles on public roads, and on-site roads
Aim	To minimise risks of accidents on-site and off-site, and reduce the impacts of traffic on site receptors (environmental and social). To minimise impacts and maintain productive use of site and off-site roads
Objectives	Targets Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions Number of infringements Number of breaches
Minimise impacts from traffic on and off-site	No complaints No accidents on-site No increase in accidents off-site Number of complaints Number of accidents on-site (by severity) and off-site involving site vehicles or staff
Responsibility	Construction: Construction Manager Operations: Site Manager
Actions / Mitigation Measures	Reduce total vehicle travel where practicable, by developing logistics to reduce overall travel distance / time on-site, and for workers travelling to and from the site Implement fatigue management procedures, to include driving time (as part of the Health and Safety Plan) Monitor site roads for signs of failure and undertake pre-emptive repair works to avoid accidents or delays Observations from drivers recorded and communicated to NT government on the state of external roads. Liaison to be undertaken to maintain trafficability on these roads Implement speed limits on site to: <ul style="list-style-type: none"> Reduce dust generation Reduce the potential for fauna injury or death, and consequent vehicle damage and human injury (or death) Ensure safe vehicle operation on the site.
Monitoring	All accidents and near misses on-site to be recorded in the incidents-complaints register. All off-site accidents involving Project drivers, employees and/or vehicles to be recorded in the incidents-complaints register. Encourage reporting of near misses. Monitor road pavement condition on-site, and undertake visual observations of external haulage routes
Reporting	Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up In the case of a vehicle accident, an incident form will be required under the site Health and Safety Plan. Undertake an investigation to determine whether future accidents of this type can be reasonably avoided, and implement measures to do so.

C15

Social Impact Management Strategy

Rev. E

TABLE C15.1 - SOCIAL IMPACT MANAGEMENT STRATEGY

Element	Detail	
Applicable site activities	Construction and Operation	
Aim	The overall aim is to monitor and manage the intended and unintended social and economic consequences, both positive and negative, of the Project.	
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements	No statutory infringements No breaches of licence/approval conditions	Number of infringements Number of breaches
Minimise negative social impacts on the surrounding area during construction	No road traffic incidents resulting in injury to employees, contractors or the public No complaints	Compliance with Traffic Management Strategy Number of Complaints
Maximise local opportunities, particularly with regards to employment, up-skilling and business opportunities	Minimum local and indigenous employment targets No complaints No workforce disputes	Review employment data against annual workforce targets Number of complaints or disputes
Maintain positive community and workforce relations	No complaints Recreational fishery access maintained where possible without jeopardising community safety, company operations, security or biosecurity	Number of complaints
Responsibility	Construction: Construction Manager Operations: Site Manager	
Actions / Mitigation Measures	<p>Establish and work towards achieving targets for Indigenous employment, training and skills development</p> <p>Establish Indigenous Employment, Training and Business Policy.</p> <p>Establish targets for contracting and sub-contracting of Indigenous businesses.</p> <p>Open and use an Industry Capability Network.</p> <p>Establish Project Sea Dragon Local Community Reference Group (PSDLCRG) for annual review of Project Sea Dragon social impacts and progress against targets and management actions. The suggested membership for the group is as follows:</p> <ul style="list-style-type: none"> ■ 2 x Traditional Owners ■ 1 x Shire of Wyndham-East Kimberley (SWEK) ■ 1 x Victoria Daly Regional Council (VDRC) ■ 1 x Kununurra Chamber of Commerce and Industry (KCCI) ■ 2 x General community ■ 1 x NT Government ■ 1 x WA Government ■ 1 x Project Sea Dragon. <p>Establish the following policies and targets:</p> <ul style="list-style-type: none"> ■ Community Grievance Policy incorporating public complaints register ■ Local Employment Policy and targets ■ Local Content Policy and targets. 	

Element	Detail
	<ul style="list-style-type: none"> traineeships, apprenticeships and other employee development opportunities. Recreational Fishing Management Plan balancing public access with biosecurity and other farm management concerns Driver Safety and Fatigue Management Policy for employees and contractors. OHS policies as required under law Implement the Traffic Management Strategy
Monitoring	<p>The monitoring associated with the social and community aspects of the Project will involve:</p> <ul style="list-style-type: none"> Project Sea Dragon Local Community Reference Group (PSDLCRG) annual review of social impacts and progress against targets and management actions Internal social impact reviews Maintenance and follow up on complaints register, and annual review
Reporting	<p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up</p> <p>Provide an annual summary report of community and workforce relations, complaints and any incidents.</p>

C16

Cultural Heritage Strategy

Rev. E

TABLE C16.1 - CULTURAL HERITAGE STRATEGY

Element		Detail
Applicable site activities		Construction, particularly excavation, vegetation clearing and road construction. Operation, associated with sacred sites and possible unexpected finds.
Aim		To identify and protect items or places which have historic and/or cultural heritage values, and to minimise impacts on cultural heritage values, places and practices.
Objectives	Targets	Key Performance Criteria
Undertake and complete works in compliance with statutory environmental requirements.	No statutory infringements. No breaches of licence/approval conditions.	Number of infringements. Number of breaches.
No damage or disturbance to objects or sites of cultural significance.	No physical disturbance or damage to significant cultural heritage sites and objects.	Number of unauthorized incursions into Sacred Site areas.
Maintain Access to sites of cultural significance.	Compliance with Schedule 2 of the Indigenous Land Use Agreement - Project Sea Dragon. No unauthorized incursions into Sacred Site areas. Minimise disruption to site access for Native title Holders in line with the negotiated ILUA. Traditional Owners have access to the Project area to monitor progress and impacts upon cultural heritage where necessary, and monitoring indicates no unacceptable impacts. No complaints.	Number of Seafarms personnel receiving Cultural Awareness training. Number of complaints.
Responsibility	Construction: Construction Manager Operations: Site Manager	
Actions / Mitigation Measures	<p>Significant up-front risk mitigation has been actioned via agreements reached with Native Title parties and Certificates issued by AAPA. Detailed heritage surveys have been undertaken by AAPA, the NLC and Traditional Owners (custodians under the Sacred Sites Act and Native Title Holders under the Native Title Act). The heritage and Sacred Site Surveys have resulted in intensive and extensive mapping of sites and the issuance of an Authority Certificate C2017/92. Sacred site information and other information is held in confidence by AAPA. An Indigenous Land Use Agreement has been developed and signed by Seafarms, the NLC, the Top-End Prescribed Body Corporate and the Northern Territory Government. This ILUA contains a confidential binding Cultural Management Strategy at Schedule 2 of the ILUA.</p> <p>Specific risk mitigation in place includes:</p> <ul style="list-style-type: none"> ■ All contractors and employees are to be provided with induction materials including maps that clearly specify areas within which entry and activity must be confined. This is to be endorsed by AAPA and Native Title Holders. ■ All Seafarms personnel will be required to undergo Cultural Awareness training. ■ No entry to Sacred Site Areas unless accompanied by a Cultural Heritage Monitor and: <ul style="list-style-type: none"> (a) In accordance with Sacred Site Clearance Certificate (b) In accordance with an Authority Certificate (c) With the prior written consent of the Land Council. ■ Unexpected findings: Should Seafarms have any knowledge of or identify any archaeological or historical site or object or and Sacred Site or Sacred Object not 	

Element	Detail
	<p>previously identified or advised to Seafarms, Seafarms will notify the Aboriginal Areas Protection Authority, the Project Committee, Land Council and the Top End PBC.</p> <p>Immediate on-ground actions are detailed in the “Unexpected Findings Protocol in the Contingency Management Strategy (Appendix E) for cultural heritage finds (indigenous and non-indigenous).</p>
Monitoring	<p>Compliance with the Cultural Heritage Management Strategy occurs through the ILUA Project committee comprising:</p> <ul style="list-style-type: none"> ■ Seafarms (2 representatives) ■ NLC (2 representatives) ■ Native Title Holders (4 representatives and 2 observers). <p>The Project Committee meets a minimum of twice per year. The ILUA Project Committee is required to facilitate the requirements of the Cultural Heritage Management Strategy.</p> <p>On-ground monitoring will occur through presence of a Cultural Heritage monitor whose appointment is moderated through the ILUA Project Committee.</p> <p>Complaints and any other issues raised in relation to cultural heritage issues will be recorded on the incidents-complaints form and entered into the incidents-complaints register.</p>
Reporting	<p>Any non-conformance, incident or potential incident will be recorded on the incident-complaint form in Appendix F (or similar) and entered into the incident-complaint register for rectification and follow up.</p> <p>Seafarms Aboriginal Liaison Officer will report to the ILUA Parties via the Project Sea Dragon ILUA Project Committee and to AAPA (as required).</p> <p>Provide an annual summary report of cultural heritage interactions, relations, finds, and sites. A register of heritage information will be maintained in confidence by AAPA, with , to be updated with any new finds, and any changes to sites or artefacts.</p>
Corrective Actions	<p>Correction Action Triggers:</p> <ul style="list-style-type: none"> ■ Cultural heritage artefact or site found during construction works ■ Complaint received regarding cultural heritage values or access. <p>Corrective Actions:</p> <ul style="list-style-type: none"> ■ Implement the Unexpected Findings Protocol in the Contingency Management Strategy (Appendix E). Record the location of the find on the heritage register ■ Immediately contact the NLC, Top End Prescribed Boy Corporate, Proeject Committee and AAPA ■ If required seek amendment of Authority Certificate from AAPA ■ Reporting and resolution of any matters through ILUA Project Committee.
References	<p>ICOMOS (2000). The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance. The Australian National Committee of International Council on Monuments and Sites. Available at: http://australia.icomos.org/publications/charters/</p>

APPENDIX D MONITORING AND REVIEW REGISTER

PROJECT SEA DRAGON MONITORING, REVIEW AND REPORTING REGISTER

Description	Details	Responsible Persons	Frequency	Reporting
Audits, reviews, statutory reporting				
EMP Audit / Review	Internal review of EMP to include: <ul style="list-style-type: none"> performance against objectives and targets, including from individual sites review of new or updated legislation and standards Documents and Records 	Environmental Manager	Annual	Report in PSD annual internal report. Store written results of audit in records system.
	Review of relevant parts of EMP on any changes to Project, operations, potential impacts, etc.	Environmental Manager	On changes to Project, operations, potential impacts	Refer to <i>Document Control; Project reports and Licences</i> below Conduct training on updates as required
Project Audit/review	Internal audit of Project to include: <ul style="list-style-type: none"> Performance against objectives and targets General site walkover and assessment of issues and opportunities Compliance with conditions of approval and licencing / permits Assessment of social impacts 	Environmental Manager	Annual	Report in PSD annual internal report. Store written results of audit in records system
	Independent third party audit (as above).		5-years after	Report to NT EPA and DPIR

Description	Details	Responsible Persons	Frequency	Reporting
			commencement OR on direction of the Minister (Cwth)	When directed by Minister, report submitted to Minister.
Energy Audits	Annual accounting of energy use against energy and energy intensity targets. Review annual accounts and identify opportunities for improvement	Site Manager	Annual 5-yearly	Include in site internal annual reports
Waste and Recycling Audits	Annual accounting of waste production against waste and recycling targets Review annual accounts and identify opportunities for improvement	Site Manager	Annual 2-yearly	Include in site internal annual reports
Social – Community Reference Group	Project Sea Dragon Local Community Reference Group (PSDLCRG) review of social impacts and progress against targets and management actions	Project Manager PSDLCRG	Annual	Include in site internal annual reports Public reporting as per PSDLCRG requirements
Training Needs Analysis	Annual review of personnel and training needs, training conducted. Conducted at corporate level and site specific	Environmental Manager Site Manager	Ongoing Annual review	Ongoing as needed Included as part of annual audits / reviews
Document Control	Document register to be updated for all new documents and revisions of existing documents.	Environmental Manager Site Manager	Ongoing Annual review	Included as part of annual audits / reviews

Description	Details	Responsible Persons	Frequency	Reporting
	Annual review / audits to include review of available documentation, ensuring new documents or revisions are captured, and available documents (print and electronic copies) are up to date.	Document Author(s)		
Project reports and Licences	<p>Responsible Person: Environmental Manager</p> <p>Publish and maintain updated versions of the following on the Project website:</p> <ul style="list-style-type: none"> ■ Environmental Management Plan and subplans ■ Compliance reports (with approval conditions and EMP and subplans) ■ WQMMP, WBMIMP ■ WDL licence <p>Maintain the following on the site in hardcopy format:</p> <ul style="list-style-type: none"> ■ WDL Licence <p>Provide the following:</p> <ul style="list-style-type: none"> ■ NT DENR: WQMMP, Emergency Response Plan, EMP once completed and in 2020 Annual Return; Annual returns, annual monitoring reports ■ Cwth DoE: WQMMP and WBMIMP for approval, annual compliance report ■ NT Pastoral Land Board: CPESC certified plans and written confirmation from the second review CPESC <p>Changes to reports:</p> <ul style="list-style-type: none"> ■ Cwth DoE: WQMMP, WBMIMP: <ul style="list-style-type: none"> ■ where amendments are not likely to have a new or increased impact notify at least 4 weeks prior to implementation ■ where amendments may have a new or increased impact approval required prior to implementation 			

Description	Details	Responsible Persons	Frequency	Reporting
Provision of information to Agencies	<p>Advise the Commonwealth Department of Environment in writing of the date of commencement</p> <p>Notify NT DENR when discharges commence and when discharges cease. Provide monitoring data relating to the discharge.</p> <p>Advise the NT EPA, NT DENR and any other responsible agency if the Project is altered such that the environmental significance of the Project may have changed.</p> <p>Reports, monitoring data, etc. required under a licence, permit or condition</p>	<p>Environmental Manager</p> <p>Site Manager</p>	<p>Within 30 days of commencement</p> <p>As soon as practicable after</p> <p>Prior to implementing the change</p> <p>Within 10 days of request</p>	<p>Advice provided to Department in writing</p>
Annual Reporting	<p>Annual return for WDL</p> <p>Cwth Compliance Report - addressing compliance with Cwth Approval.</p> <p>Monitoring Report for previous 12 months</p>	<p>Environmental Manager</p> <p>Site Manager</p>	<p>Annually ≤20 business days of anniversary date (by 26-Oct)</p> <p>Annually ≤3 months of anniversary date (by 10-Aug)</p> <p>Annually ≤10 days of anniversary date (by 12-Oct)</p>	<p>Submit to administering authority</p> <p>Publish report on website, provide evidence of publishing and non-conformance to the Cwth</p> <p>Provide to administering authority</p>

Description	Details	Responsible Persons	Frequency	Reporting
Project signage	Install signage (in English) in a prominent location at each public entrance to the premises that includes the WDL licence number and 24 hour emergency contact details.	Project / Site Manager	20 days prior to commencement	Record photographic evidence of installation and retain in record system
Pre-Construction				
Pre-construction soil sampling and characterisation	Representative sampling of soil profiles for fertility characterisation, salinity and sodicity	Project Manager	Prior to construction	Maintained in site records Map of results prepared
Pre-construction site reconnaissance inspection	For all construction areas to identify: Unstable, shallow or otherwise problematic soils, or evidence of soil contamination Drainage lines and watercourses, and other prominent site features Excavation test pits or bores (after vegetation clearing) to the depth of excavation + 0.5m to confirm soil depths and types to be encountered.	Project Manager	Prior to construction	Maintained in site records Map of results prepared
Pre-construction Acid Sulfate Soils (ASS) assessment	Pre-construction monitoring for ASS presence and management requirements for all construction areas with potential to intersect ASS, in accordance with Qld ASS guidelines, as varied by C3 Acid Sulfate Soil Management Strategy.	Project Manager	Prior to construction commencing	Maintained in site records Map of results prepared

Description	Details	Responsible Persons	Frequency	Reporting
	Involve testing to the depth of disturbance + 0.5m in accordance with Dear et al (2014) (field and oxidised pH at 0.25m intervals, chromium reducible sulfur suite analysis at 0.5m intervals).			
Pre-construction vegetation survey	To be conducted of clearing areas + 100m outside of these areas for the identified data deficient flora species <i>Ptilotus capitatus</i> , <i>Spermacoce gibba</i> and <i>Eleocharis acutangula</i> within the Darwin stringybark/Darwin woollybutt woodland on the coastal erosional plain, and Melaleuca low woodland and flood-out plain wetland on the flood plain.	Project Manager	Prior to construction commencing	Results collated into a Significant Flora Species Survey report
Pre-construction Weed survey	Conducted within the Project footprint + 200m buffer to determine the location and extent of weeds	Project Manager	Prior to construction commencing	Data used to prepare a spatial map of weeds and pests presence on the site, and a register of pertinent information in relation to weed and pest distribution, numbers and control requirements Include results in annual monitoring report
Implement Water Quality Monitoring Program	Implement the program outlined in the Water Quality Management and Management Plan (WQMMP)	Project Manager	Prior to construction commencing	Maintain records Reporting requirements outlined in WQMMP

Description	Details	Responsible Persons	Frequency	Reporting
Pre-clearance surveys	Identify areas where pre-clearance surveys required prior to clearing commencing	Project Manager	Prior to clearing	Prepare map of identified areas and maintain. Provide to Construction Manager
Baseline groundwater monitoring	<p>Sample bores identified in C8 Groundwater Management Strategy as follows:</p> <ul style="list-style-type: none"> Install loggers to record groundwater level Test on-site for pH, electrical conductivity Further tests for anions and cations of both groundwater and pond waters, to 'fingerprint' match the two waters to indicate potential leaks and impacts Monitor productive bores for parameters suitable to confirm their existing beneficial use Conduct visual monitoring during each round of Groundwater dependent ecosystems where accessible for signs of injury or decline 	Project Manager	Quarterly for 2 years or until operations begin	Include results in annual monitoring report
Construction Phase				
Immediately prior to clearing	Pre-clearance surveys by a qualified and experienced spotter-catcher in areas identified as potential habitat for threatened species	Construction Manager	Prior to clearing in any potential habitat areas	Retain written reports from spotter catcher

Description	Details	Responsible Persons	Frequency	Reporting
Site Inspections	<p>Inspections of site controls and for any rectification requirements, signs of spills, leaks or other potential pollution issues, dust, odour, air quality and noise from site works</p> <p>Check diversion structures and other areas for trapped or injured wildlife or fish. Monitor all work areas before work commences each day for fauna that may have become trapped</p> <p>Cleared area extents to ensure retained vegetation not impacted, or for damage or decline in retained vegetation</p>	Construction Manager	Weekly and after any rain event	<p>Results recorded in site manager's logbook</p> <p>Any issues recorded in incident-complaint form and register and actions assigned</p>
Erosion and Sediment Control Audits	Audits of the implementation of Erosion and Sediment Controls based on the certified ESCPs	<p>Construction Manager</p> <p>CPESC engaged to review and certify ESCPs</p>	<p>As identified in ESCPs</p> <p>Reporting ≤7 days after each inspection</p>	<p>Provide confirmation to the Pastoral Land Board of compliance with the detailed ESCPs after each inspection.</p> <p>Any issues recorded in incident-complaint form and register and actions assigned</p>
Tank integrity testing	Regular tank integrity testing for all large fuel, oil, chemical and waste storages	Construction Manager	As needed during construction	Maintained in site records

Description	Details	Responsible Persons	Frequency	Reporting
Geotechnical inspection of works	As required for structural elements – to confirm subgrade conditions and construction quality and requirements	Construction Manager	As needed during construction	Maintained in site records
Implement Unexpected Findings Protocol	Unexpected Findings Protocol requires observation and diligence to identify potential heritage items, contamination, etc. during construction	Construction Manager	At all times	Any unexpected finding to be recorded in incident-complaint form and register and actions assigned
Acid Sulfate Soils (ASS)	Test and manage in accordance with C3 Acid Sulfate Soil Management Strategy. Identified ASS to be tested before and after any liming / neutralisation treatment, such that no net acidity remains and no chance of oxidation can occur in-situ	Construction Manager	As required – all ASS	Maintain ASS register to record: <ul style="list-style-type: none"> Location of all ASS testing and identified ASS Results from all testing including location Location of all ASS material before and after any movement, details of treatment including source, time of exposure, treatment results and destination for each batch
Topsoil tracking	All topsoil will be tracked unless used locally in the course of cut to fill earthworks, to ensure that the source and fate of all topsoils across the site are known – where topsoil is removed from weed infested areas, this will	Construction Manager	As required – all topsoil movement	Register of topsoil movement – source, quantity, movement location

Description	Details	Responsible Persons	Frequency	Reporting
	not be spread across the site, to limit spread of weed seeds			
Weed monitoring	Monitoring of high priority areas identified on the weeds and pests mapping Monitoring of other areas within the construction footprint for presence of weeds	Construction Manager	As identified from initial weed survey	Update weeds and pests plan and register Notify the Weed Management Branch of the NT DLRM of presence of any new Class A – C weed
Bird Predation Monitoring	A series of experimental trials during the 2018/2019 wet season to assess responses of waterbirds to bird predation mitigation strategies within wetland habitat adjacent to the farms.	Project Manager	Prior to operations commencing	Maintain records
Implement Water Quality Monitoring Program	Implement the program outlined in the Water Quality Management and Management Plan (WQMMP)	Project Manager	During construction	Maintain records Reporting requirements outlined in WQMMP
Bank stabilisation and scour monitoring	Install pegs on banks in proximity to infrastructure to provide a baseline for further erosion and scour monitoring and protection works, particularly at the inlet and outlet. Monitor bank location during works.	Construction Manager	At start of construction Weekly	Results recorded in site manager's logbook
Waste monitoring	Update the waste inventory contained in C9 Waste Management Strategy to record all	Construction Manager	As required – all waste	Maintain records Update Waste Inventory

Description	Details	Responsible Persons	Frequency	Reporting
	<p>waste types, quantities produced, and management measures used for each</p> <p>Record details of all listed wastes removed from the site, including the type of waste, quantity removed, transporter, destination, and treatment/disposal method (if known)</p>			
Dust, odour and noise	<p>Monitoring will be conducted at sensitive receptors where a complaint (non-vexatious) has been made, where evidence is required against air quality criteria, with the monitoring selected as follows:</p> <ul style="list-style-type: none"> ■ Dust: PM10 and dust deposition ■ Odour: H2S monitoring as an indicator, or odour unit sampling if required ■ Noise: According to AS 1055.1 - 3: Acoustics 	Construction Manager	If required	Maintain records
On-site effluent treatment systems and disposal areas	<p>Baseline soil monitoring in any new disposal areas (prior to operation of plant), to include monitoring for nutrients, major anions and cations, pH, salinity, and heavy metals.</p> <p>Monitoring of any operating plant / disposal systems in accordance with operational phase requirements.</p>	Project Manager	Once prior to operation of plant	Retain soil monitoring data for comparison with post-operation data
Fuel, waste/chemical storages	Visual inspections of refuelling/servicing areas and hazardous material containment areas to detect leakages or spills	Construction Manager	Weekly	<p>Retain records</p> <p>Any issues recorded in incident-complaint form and</p>

Description	Details	Responsible Persons	Frequency	Reporting
	<p>Inspect spill kits to ensure they are appropriately stocked</p> <p>Inspections of containment bunds to ensure bund integrity, and rectify any issues found</p> <p>Tank integrity testing for all bulk hazardous or dangerous goods storage tanks</p>		<p>Monthly and following each use of a spill kit</p> <p>Weekly</p> <p>Annual</p>	register and actions assigned
Bushfire	See operational phase			
Traffic	Monitor and record any traffic incidents	Construction Manager	At all times	All accidents and near misses on-site and all accidents off-site involving Project drivers, employees and/or vehicles to be recorded in the incidents-complaints register. Encourage reporting of near misses.
Cultural heritage	Visual inspection of exclusion zones around cultural heritage sites to confirm no impacts from site works	Construction Manager	<p>Weekly where works in proximity to sites</p> <p>Quarterly otherwise</p>	Update Cultural heritage register if required.
Operational Phase				
Site Inspections	Visual inspections of the site for signs of erosion, scour, weeds, pests, leaks and spills,	Site Manager	Weekly of high traffic areas	Results recorded in site manager's logbook

Description	Details	Responsible Persons	Frequency	Reporting
	<p>dust, odour, air quality and noise from site works – any indication of potential or actual pollution or environmental harm. Potential issues identified and entered into the corrective action system for rectification</p> <p>Inspections of the intake structure, the intake channel and settlement ponds will be undertaken for signs of fauna being drawn into the system.</p> <p>Routine visual monitoring and inspections of the intake and outlet structures and banks for signs of erosion, fouling, injury to marine organisms, etc.</p>		<p>Monthly otherwise</p> <p>On each visit to these structures, or weekly otherwise</p>	Any issues recorded in incident-complaint form and register and actions assigned
Waterway use by employees and community	Implement monitoring to detect changes in use of the site by employees or the community, and apply rectification measures where required, in accordance with the Cultural Heritage and Social Impact Management Strategies	Site Manager	As required	Results recorded in site manager's logbook
Implement Waterbird Monitoring Program	Implement the program outlined in the Waterbird Management and Impact Monitoring Program (WBMIMP)	Site Manager	During operations	<p>Maintain records</p> <p>Reporting requirements outlined in WBMIMP</p>
Implement Water Quality Monitoring Program	Implement the program outlined in the Water Quality Management and Management Plan (WQMMP)	Site Manager	During operations	<p>Maintain records</p> <p>Reporting requirements outlined in WQMMP</p>

Description	Details	Responsible Persons	Frequency	Reporting
Freshwater monitoring	<p>Sample sites identified in C7 Surface Water Management Strategy for the following parameters:</p> <ul style="list-style-type: none"> Physical and chemical stressors (nitrogen and phosphorous speciation, turbidity, pH, dissolved oxygen, conductivity) Chlorophyll a Recoverable hydrocarbons, and Pesticides 	Site Manager	2 times per year: late dry season and late wet season for first two years. Ongoing requirement to be assessed based on this data	<p>Include results in annual monitoring report</p> <p>Any issues recorded in incident-complaint form and register and actions assigned</p>
Groundwater monitoring	<p>Sample bores identified in C8 Groundwater Management Strategy as follows:</p> <ul style="list-style-type: none"> Continue to obtain data from groundwater level loggers Test on-site for pH, electrical conductivity Further tests for anions and cations of both groundwater and pond waters, to 'fingerprint' match the two waters to indicate potential leaks and impacts Monitor productive bores for parameters suitable to confirm their existing beneficial use <p>Conduct visual monitoring during each round of Groundwater dependent ecosystems where accessible for signs of injury or decline</p>	Site Manager	6-monthly for first 2 years, annually thereafter	<p>Include results in annual monitoring report</p> <p>Any issues recorded in incident-complaint form and register and actions assigned</p>

Description	Details	Responsible Persons	Frequency	Reporting
Waste monitoring	<p>Update the waste inventory contained in C9 Waste Management Strategy to record all waste types, quantities produced, and management measures used for each</p> <p>Record details of all listed wastes removed from the site, including the type of waste, quantity removed, transporter, destination, and treatment/disposal method (if known)</p>	Site Manager	As required – all waste	<p>Maintain records</p> <p>Update Waste Inventory</p> <p>Record movement of all wastes, particularly listed wastes, off-site</p> <p>Include results in annual monitoring report</p>
Landfill monitoring	<p>Visual inspections of the site for signs of the loss of waste materials from the site, erosion, odour, dust, and pest animals and weeds</p> <p>Groundwater bores around the perimeter of the landfill to provide early warning of any potential leaching or loss of leachate from the landfill into groundwater (located up and down gradient of the landfill)</p> <p>Routine landfill survey to determine the existing utilised and remaining capacity within the engineered landfill.</p>	Site Manager	<p>Daily</p> <p>Quarterly for first 2 years, 6 monthly after</p> <p>As required</p>	<p>Record in site manager's logbook</p> <p>Quarterly review and reporting and Include in annual monitoring reports</p> <p>Any issues recorded in incident-complaint form and register and actions assigned</p>
Dust, odour and noise	<p>Monitoring will be conducted at sensitive receptors where a complaint (non-vexatious) has been made, where evidence is required against air quality criteria, with the monitoring selected as follows:</p> <p> Dust: PM10 and dust deposition</p>	Site Manager	If required	<p>Include results in annual monitoring report</p> <p>Any issues recorded in incident-complaint form and register and actions assigned</p>

Ref: EN-01-RG-EM1101, Revision: B, 17-May-2018
Print Date: 24-May-2018 | *Note: printed copies are uncontrolled*

Description	Details	Responsible Persons	Frequency	Reporting
			reduce to quarterly	
Fuel, waste/chemical storages	<p>Visual inspections of refuelling/servicing areas and hazardous material containment areas to detect leakages or spills</p> <p>Inspect spill kits to ensure they are appropriately stocked</p> <p>Inspections of containment bunds to ensure bund integrity, and rectify any issues found</p> <p>Tank integrity testing for all bulk hazardous or dangerous goods storage tanks</p>	Site Manager	<p>Weekly</p> <p>Monthly and following each use of a spill kit</p> <p>Monthly</p> <p>Annual</p>	<p>Retain records</p> <p>Any issues recorded in incident-complaint form and register and actions assigned</p>
Bushfire	<p>Site inspections will be undertaken of fuel management zones to include assessment of fuel loads prior to the fire season, especially within asset protection zones</p>		Annually prior to the fire season	<p>Prepare report following all bushfires on the property including details of location, source and management actions (if any).</p> <p>Prepare annual report outlining implementation of the bushfire management activities.</p>
Traffic	<p>Monitor road pavement condition on-site, and undertake visual observations of external haulage routes</p> <p>Monitor and record any traffic incidents</p>	Site Manager	At all times	<p>All accidents and near misses on-site and all accidents off-site involving Project drivers, employees</p>

Description	Details	Responsible Persons	Frequency	Reporting
			During each trip (by site manager or delegated staff)	<p>and/or vehicles to be recorded in the incidents-complaints register. Encourage reporting of near misses.</p> <p>Road pavement conditions to be recorded in site manager's logbook, and Any issues recorded in incident-complaint form and register and actions assigned</p>

APPENDIX E

ENVIRONMENTAL CONTINGENCY PLAN

E1

Contingency Response

Rev. E

E1.1 Purpose and Scope

This draft contingency strategy aims to outline a basic set of actions to follow when responding to an incident to ensure the correct containment, cleanup and reporting is undertaken for incidents occurring on-site.

E1.2 Health and Safety

Health and Safety concerns will always take precedence when managing an incident. If a situation is not safe, personnel will not enter the area unless they are:

- Properly fitted with Personal Protective Equipment (PPE) and trained in its use;
- Sufficiently experienced to deal with the situation; and
- Acting under an approved Safety Management Plan or Procedure.

The site health and safety management procedures will take precedence in the case where danger to human health and safety exists.

E1.3 Assessment of Importance of Incident – Environmental

The general category of incident should be rapidly assessed to determine the correct course of action. The categories are outlined below.

- High Impact - applies to any one or more of the following:
 - ▲ where there is an immediate threat to human life and property
 - ▲ where the incident could be associated with significant harm to native fauna and flora
 - ▲ creates an immediate observable harm to environmental receptors
 - ▲ where it occurs in water catchments for supply of the Project or other site (or off-site) uses, or
 - ▲ where the incident has the potential to seriously contaminate soil or water resources.
- Moderate Impact - applies to any one or more of the following:
 - ▲ where there is significant (but not immediate) threat to human life and property
 - ▲ where the incident may result in chronic or long-term harm to native fauna and flora, or
 - ▲ may have a long term (but not immediate) observable impact on environmental receptors.
- Low Impact - applies to any one or a combination of the following:
 - ▲ where there is no perceived threat to human life or property
 - ▲ where the incident is outside sensitive environments
 - ▲ where the incident poses no immediate or long term threat to environmental receptors.

E1.4 Incident Response – Environmental Aspects only

Table E1.1 below shows the minimum responses to be undertaken based on a rapid assessment of the category of incident as above.

TABLE E1.1 INCIDENT RESPONSE – MINIMUM RESPONSE RECOMMENDED

Impact class	Clean up	Initial Notification*	Written notification	Review EMP / Site procedures	Environmental monitoring
High	Immediate	ASAP	Within 14 days	Yes	Yes
Moderate	Immediate	24 hours	Within 14 days	Yes	Decide on effectiveness of clean-up
Low	Within 4 hours	None	None	No	No

* Regardless of the above, any exceedance of specific discharge conditions, or any potential or actual environmental harm or pollution, must be notified to the administering authority as soon as possible or at most 24 hours after the event.

Generally, the control methods should follow the Control, then contain, then cleanup hierarchy of approaches, whereby the source of the spill is (safely) controlled, the spill itself contained so as to minimise or avoid its movement into the environment, and cleanup undertaken.

E1.5 Notification

The Site Manager or the delegated site environmental manager/officer must be notified of all incidents as soon as practicable. Following this, relevant Government authorities must be notified of any incident with actual or potential significant off-site impacts on people or the biophysical environment as soon as practicable for high impact events and within a maximum of 48 hours after the event for moderate impact events (“initial notification”).

Regardless of the above, any exceedance of specific discharge conditions, or any potential or actual environmental harm or pollution, must be notified to the administering authority as soon as possible or at most 24 hours after the event.

Following initial notification, written details (“written report”) of the incident must be submitted to the relevant Government authorities within 14 days of the date on which the incident occurred, to include the following information:

- the location and time of the event
- the time site staff and the Site Manager became aware of the event
- the suspected cause and a description of the resulting effects of the event
- actions taken to mitigate any environmental harm or nuisance caused by the event, and
- proposed actions to prevent a recurrence of the event.

E1.6 Training

Training of staff will include spill response specific to the types of spills that may occur - oil and liquid waste spills, larger spills to land and to water, including use of absorbents, floating booms and skimmers, and notification procedures.

E1.7 Wet Season and Extreme Weather

Prior to the start of the wet season, the site will be prepared by ensuring all waste materials, receptacles and storages are properly contained and stable, and will be able to withstand wet season rainfall without leaching or other loss of contaminants. A site audit will be conducted prior to each wet season with the results provided internally in written form.

A similar process will occur prior to forecast storms or other extreme weather events, whereby all wastes are contained and restrained so as to avoid loss of materials during the event. The landfill will have the day's cover applied and compacted, if sufficient time allows (for safety), with any loose materials secured.

E1.8 Records

All incidents shall be recorded on the incident / complaints or similar and maintained as a register of incidents on the site.

E1.9 Review

This contingency plan is to be reviewed and updated prior to works starting on the site, and periodically thereafter, at a minimum annually.

TABLE E1.2 - CONTINGENCY RESPONSE

Element	Detail
Receipt of Complaint	<p>Record details of the complaint in the incidents-complaints register</p> <p>Investigate and determine whether the complaint is vexatious or not</p> <p>Further investigate the cause and possible rectification for non-vexatious complaints</p>
Spill or leak	<p>Define the spills severity by type and scale of the incident (major, moderate, minor) (Table E1.1)</p> <p>Adopt the following spill response process:</p> <ul style="list-style-type: none"> ■ Assess: determine if the spill can be safely controlled, or if other or external help is required (if so seek this help as soon as safely possible) ■ Control: if safe to do so, stop the spill, for example by turning off supply, righting barrels, etc. ■ Contain: apply containment measures, such as spill booms, absorbent material, or by scooping small spills by shovel, etc. ■ Cleanup: clean up the spill by sweeping, shovelling, scooping or otherwise cleaning up the spill. Dry methods are preferred over washing ■ Notify: the spill will be recorded and appropriate persons notified ■ Review: an incident will be logged, and opportunities for improvement identified where practicable.
Unexpected Findings (contamination, archaeology, heritage)	<p>Implement the Unexpected Findings Protocol (UFP) as follows:</p> <p>Contaminated Soil</p> <ul style="list-style-type: none"> ■ If contaminated or potentially contaminated material is found, actions should include, but not be limited to, the following: <ul style="list-style-type: none"> ▲ immediately stop work in the area of concern ▲ contact the Site Manager or their designated authority ▲ erect temporary barricading to prevent access, and warning signs as required ▲ provide cover or suitable suppressant if odorous ▲ provide erosion and sediment control measures as required, and ▲ contact appropriate organisations to provide specialist advice/support. <p>Heritage Finds (indigenous and non-indigenous)</p> <ul style="list-style-type: none"> ■ If any cultural heritage items are found, a similar process will occur as for contaminated soil, and in line with the ILUA and other heritage agreements: <ul style="list-style-type: none"> ▲ immediately stop work in the area of concern ▲ contact the Site Manager or their designated authority ▲ erect temporary barricading to prevent access, and warning signs as required ▲ If the find relates to indigenous heritage:

Element	Detail
	<ul style="list-style-type: none"> ✦ advise the Aboriginal Liaison Officer ✦ immediately notify the Aboriginal Areas Protection Authority, the Project Committee, Land Council and the Top End PBC ✦ If the find relates to non-indigenous heritage: <ul style="list-style-type: none"> ✦ Contact the Heritage Branch of the Department of Tourism and Culture ✦ Set up a temporary exclusion zone and develop a strategy for protection and custody of the find. Works may not recommence in the exclusion zone until a strategy is agreed for protection and custody of the find. <p>The UFP should be integrated with a site specific emergency response plan. If the unexpected findings present an immediate hazard, then the emergency response plan should take precedence over the UFP</p>
Other contingencies	Refer to the relevant Management Strategy, or the site Health and Safety Plan

APPENDIX F ENVIRONMENTAL FORMS

PROJECT SEA DRAGON RESPONSIBILITY AND TRAINING NEEDS ANALYSIS FORM

For persons identified within the EMS, identify responsibilities, determine their competency, identify training needs, and plan for training. *Examples given in red*

Role / Position Title/Position no.	Name	Responsibilities	Qualifications/ competency	Training needs	Planned dates	Training details
<i>Chief Operating Officer</i>		<i>Participate in Management review Set Policy Review Objective & Targets Resource allocation</i>		<i>EMS awareness (in house)</i>		
<i>General Manager – Health, Safety and Environment</i>		<i>Over-all responsibility for system implementation Participate in Management review Monitoring and measurement of environmental performance Corporate level training</i>		<i>EMS awareness (in house)</i>		
<i>Internal Auditor</i>		<i>Develop internal audit program Conduct internal audits</i>	<i>Certified (RABQSA) lead auditor</i>			
<i>Site Managers</i>		<i>Site management, comply with EMS and site specific plans where relevant</i>		<i>EMS awareness (in house)</i>		
<i>Site Environmental Role - Site Manager, or delegate</i>		<i>Implement EMS on site Develop and update site specific plans Training of new staff, environmental performance of the</i>				

Project Sea Dragon

Role / Position Title/Position no.	Name	Responsibilities	Qualifications/ competency	Training needs	Planned dates	Training details
		site				
General Staff		Awareness of EMS and environmental policy Spill and contingency response	N/A	EMS awareness (in house) Spill response training (2 yearly)		

NC-

Form EN-FO-EM0801

Incident / Complaint / Improvement

Date:

Name:

(Person filling out form)

☐ Incident☐ Complaint☐ Improvement

Nature of Incident / Complaint (tick one):

☐ water☐ air☐ land☐ other

Details

Name and Address of person or company complaining / reporting incident (or anonymous)

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Phone:

If company, person lodging complaint / notification:

Time of Incident / Complaint:

Nature of Contact (phone, letter, personal, email, etc.):

Location of Incident:

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Description

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Actions Taken

Date Acted On

Signed

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