



# **Shamrock Station Irrigation Project**

## **Operational Environmental Management Plan**

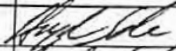

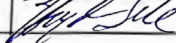
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Argyle Cattle Company Pty Ltd

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- Appendix 3 Introduced animal monitoring and control program
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## 1 CONTEXT, SCOPE AND RATIONALE

This environmental management plan (EMP) describes the environmental management measures to be implemented by Argyle Cattle Company (ACC) during operation of the Shamrock Station Irrigation Project (the Project) so that impacts on the environment are acceptable.

The EMP has been prepared to satisfy condition 6-1 and 6-2 of Ministerial Statement 1086 (see section 1.3). The EMP has also taken into consideration comments raised by the Commonwealth Department of the Environment and Energy (DoEE, now Department of Agriculture, Water and the Environment, DAWE) during the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) assessment of the Project (EPBC Ref: 2017/8004) in relation to Bilby (*Macrotis lagotis*) as a Matter of National Environmental Significance.

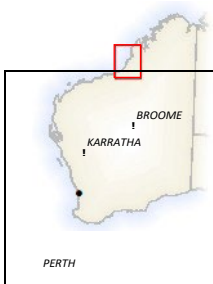
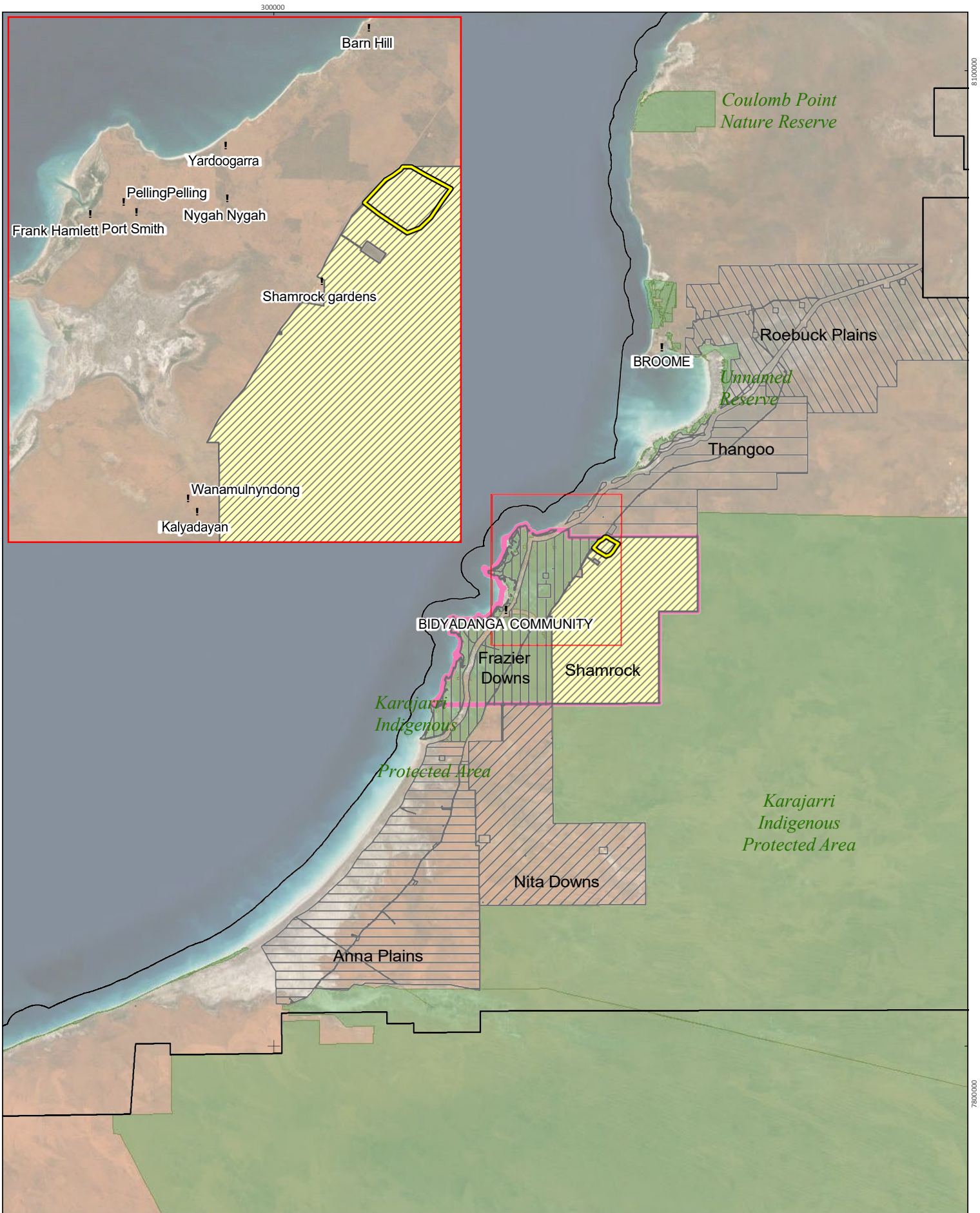
### 1.1 PROPOSAL

The Project is situated within Shamrock Station Pastoral lease on the Great Northern Highway in the locality of La Grange, Western Australia. It is located 64 km south of Broome or approximately 130 km by road (Figure 1-1).

The Project entails the production of irrigated fodder with circular irrigation pivots that will be used to produce irrigated fodder for Shamrock Station, principally as a Rhodes Grass stand and graze operation. Supplementary crops of oats and forage sorghum or maize may also be grown depending on seasonal conditions and livestock demand. Hay may also be produced depending on seasonal conditions and demand, which will be used within the aggregation of Kimberley stations owned by Consolidated Australian Pastoral Holdings Pty Ltd (CAPH), of which ACC is a subsidiary company.

The Project involves the construction of approximately 12 centre-pivot irrigation areas and surrounding vegetation buffers, 12 groundwater abstraction bores, 17 monitoring bores (11 already established), one surface water monitoring site, access tracks and supporting infrastructure. Water supply to the pivots will be sourced from the Broome Sandstone Aquifer.

The site layout will be confined to the development envelope shown in Figure 1-2. An indicative site layout is provided in Figure 1-2; final site layout will be influenced by pivot design and surface hydrology but will be confined to the indicative work area as far as practicable to minimise disturbance to significant flora records and fauna habitat (Figure 1-2).

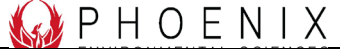


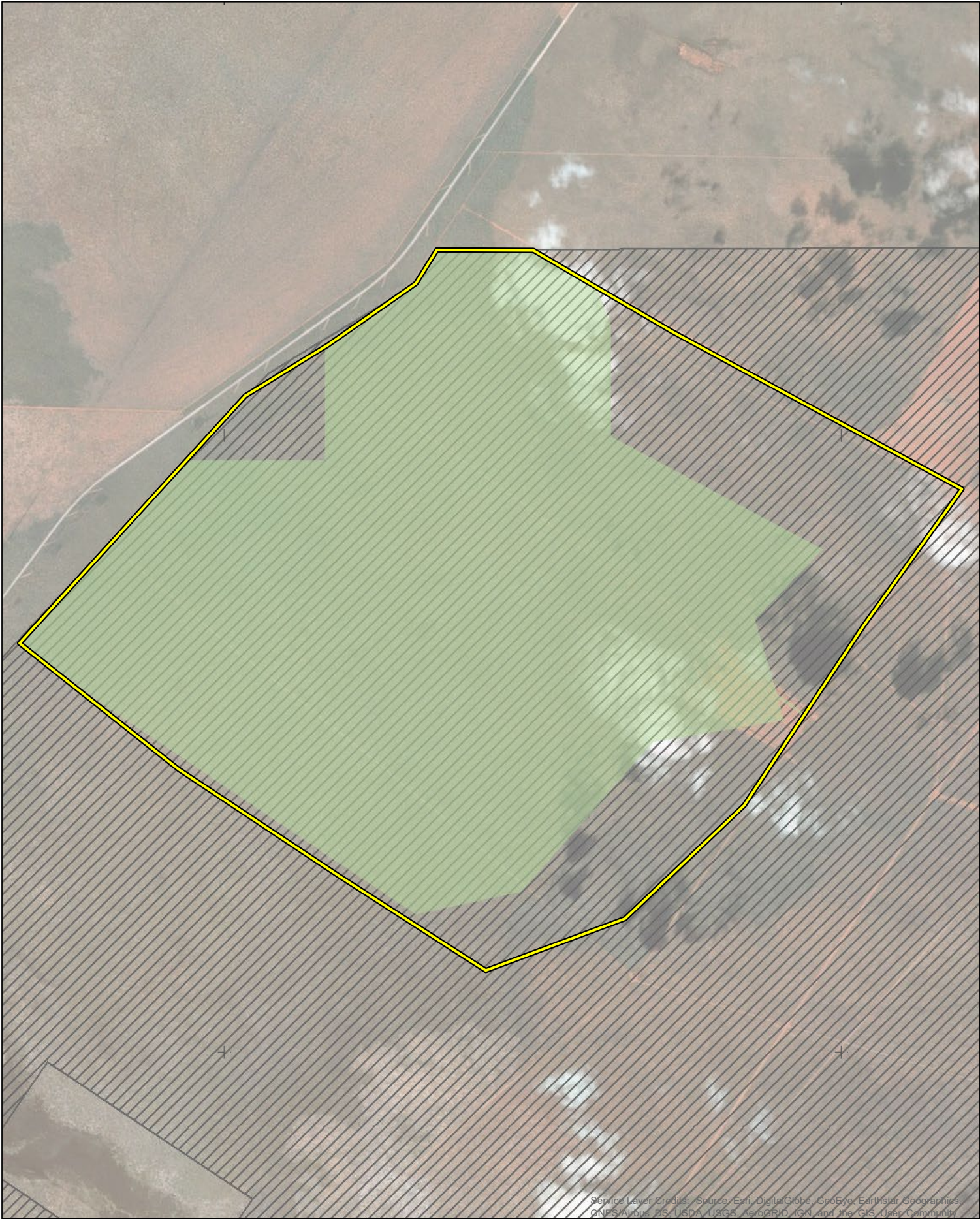
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- Development envelope
- Shire of Broome LGA boundary
- Shamrock station boundary
- La Grange locality boundary
- Australian Protected Areas Database (CAPAD)

**Figure 1-1**  
**Location of the Shamrock Station Irrigation Project**

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- Development envelope
- Indicative work area
- Shamrock station boundary

**Figure 1-2**  
**Development envelope and indicative work area**



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## 1.2 KEY ENVIRONMENTAL FACTORS

The key environmental factors relevant to the Project and activities that may affect the factors are described in Table 1-1.

**Table 1-1 Key environmental factors and Project activities that may affect each factor**

Key environmental factor	Flora and vegetation
Proposal activities that may affect factor	<ul style="list-style-type: none"> <li>• Direct clearing of up to 650 ha of remnant vegetation – loss of vegetation and priority flora</li> <li>• Intensive grazing of cattle in up to 550 ha of vegetation buffers – degradation of vegetation and priority flora</li> <li>• Use of introduced crop species – risk of spread to adjacent remnant vegetation</li> <li>• Irrigation and changes to surface drainage – potential damage to nearby Priority flora populations</li> </ul>
Environmental values that may be affected	<ul style="list-style-type: none"> <li>• Priority flora</li> <li>• Vegetation in excellent condition</li> </ul>
Ecosystem health condition	The development envelope: <ul style="list-style-type: none"> <li>• has been subject to disturbance from cattle grazing</li> <li>• contains existing tracks and other disturbed areas</li> <li>• contains relatively intact vegetation rated in excellent condition</li> <li>• was subject to a wildfire in 2016 which damaged much of the vegetation</li> <li>• is not known to contain any weed species</li> </ul>
Existing and/or potential uses	<ul style="list-style-type: none"> <li>• Pastoral grazing</li> </ul>
Key environmental factor	Terrestrial fauna
Proposal activities that may affect factor	<ul style="list-style-type: none"> <li>• Clearing of up to 650 ha of remnant vegetation – loss terrestrial fauna habitat</li> <li>• Intensive grazing of cattle in up to 550 ha of vegetation buffers – degradation of fauna habitat</li> <li>• Crop establishment and irrigation – potential increase in competitive herbivores</li> <li>• Machinery/vehicle use – risk of fauna mortality</li> </ul>
Environmental values that may be affected	<ul style="list-style-type: none"> <li>• Terrestrial fauna habitat</li> <li>• Greater Bilby</li> </ul> Potential impacts to the Greater Bilby include: <ul style="list-style-type: none"> <li>• Loss of Bilby individuals during clearing. Bilby live and reproduce in burrows and are therefore vulnerable to mortality if active burrows are located in clearing areas</li> <li>• An increase in the abundance of competitive herbivores (e.g. wallabies and rabbits) due to increased food availability may lead to degradation of Greater Bilby habitat and increase the competition for resources.</li> <li>• An increase in the numbers of prey species may, in turn, increase the abundance of introduced predators, which may increase predation threat to Greater Bilby.</li> </ul>
Ecosystem health condition	The development envelope: <ul style="list-style-type: none"> <li>• has been subject to disturbance from cattle grazing</li> </ul>

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	<ul style="list-style-type: none"> <li>contains existing tracks and other disturbed areas</li> <li>contains relatively intact fauna habitat</li> <li>was of variable quality for Greater Bilby</li> <li>was subject to a wildfire in 2016 which damaged much of the vegetation</li> </ul>
Existing and/or potential uses	<ul style="list-style-type: none"> <li>Pastoral grazing</li> <li>Habitat for native fauna</li> </ul>
<b>Key environmental factor</b>	<b>Hydrological processes and inland waters environmental quality</b>
Proposal activities that may affect factor	<ul style="list-style-type: none"> <li>Groundwater abstraction – potential impact on Broome Sandstone aquifer, Injudinah Swamp, other users</li> <li>Nutrient and chemical use – potential decline in groundwater quality</li> </ul>
Environmental values that may be affected	<ul style="list-style-type: none"> <li>Groundwater quality of Broome Sandstone aquifer</li> <li>Broome Sandstone aquifer hydrological regime and location of saltwater interface</li> <li>Groundwater dependent vegetation (offsite – Injudinah Swamp)</li> </ul>
Ecosystem health condition	<ul style="list-style-type: none"> <li>Groundwater from the Broome Sandstone aquifer generally has a NA-CL dominated composition (IGS 2017). Groundwater in the aquifer is generally fresh but there are several areas where it is more saline, such as coastal areas towards the Mandorah Marsh wetland system (Paul <i>et al.</i> 2013).</li> <li>Groundwater salinity underlying the development envelope ranges from 90 – 940 mg/L TDS (or 16 – 171 mS/m) (IGS 2017).</li> <li>One bore sampled in the development envelope recorded a boron concentration elevated above the long-term trigger level (0.5 mg/L) and five bores recorded elevated iron concentrations exceeding the long-term trigger level (0.2 mg/L).</li> <li>All samples from the Broome Sandstone aquifer within the development envelope are slightly enriched with NA, CA and HCO<sub>3</sub> relative to marine aerosols, possibly due to calcite weathering (IGS 2017).</li> <li>The toe of the saltwater interface of the Broome Sandstone aquifer is located approximately 10 km west of the development envelope</li> </ul> <p>Injudinah Swamp:</p> <ul style="list-style-type: none"> <li>contains groundwater dependent vegetation (tree species <i>Sesbania formosa</i> and <i>Melaleuca cajuputi</i> subsp. <i>cajuputi</i>)</li> <li>has been subject to disturbance from cattle grazing</li> </ul>
Existing and/or potential uses	<ul style="list-style-type: none"> <li>Other groundwater users in vicinity</li> <li>Groundwater dependent ecosystems</li> </ul>

### 1.3 CONDITION REQUIREMENTS

Relevant condition requirements of Ministerial Statement 1086 to this EMP and the section of the EMP that addresses each are outlined in Table 1-2.

**Table 1-2 Condition requirements of Ministerial Statement 1086 relevant to EMP**

Condition	EMP section
6-1 Prior to the commencement of ground disturbing activities or as otherwise agreed in writing by the CEO, the proponent shall prepare and submit an Operational Environmental Management Plan to the CEO, to demonstrate that the following environmental objectives will be met: <ol style="list-style-type: none"> <li>(1) Avoid, where possible, and minimise impacts to the Greater Bilby within the development envelope as defined in Figure 2 of Schedule 1.</li> <li>(2) Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause long term impacts to the environmental values of the Injudinah Swamp and on the hydrological regime and water quality of the Broome Sandstone Aquifer.</li> <li>(3) Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause significant change in the location of the saltwater interface due to the abstraction of water for the proposal.</li> <li>(4) Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause long term impacts on Aboriginal heritage values.</li> </ol>	This EMP
6-2 The Operational Environmental Management Plan shall:	
(1) specify the environmental objectives to be achieved, as specified in condition 6-1	Section 2
(2) specify risk-based management actions that will be implemented to demonstrate compliance with the environmental objectives specified in 6-1. Failure to implement one or more of the management actions represents non-compliance with these conditions	Section 2
(3) specify measurable management target(s) to determine the effectiveness of the risk-based management actions	Section 2
(4) specify monitoring to measure the effectiveness of management actions against management targets, including but not limited to, parameters to be measured, baseline data, monitoring locations, and frequency and timing of monitoring	Section 2 Appendix 1 Appendix 3
(5) specify a process for revision of management actions and changes to proposal activities, in the event that the management targets are not achieved. The process shall include an investigation to determine the cause of the management target(s) being exceeded	Section 3
(6) provide the format and timing to demonstrate that condition 6-1 have been met for the reporting period in the Compliance Assessment Report required by condition 4-6 including, but not limited to: <ol style="list-style-type: none"> <li>a. verification of the implementation of management actions; and</li> <li>b. reporting on the effectiveness of management actions against management target(s).</li> </ol>	Section 2

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6-3	<p>After receiving notice in writing from the CEO that the Operational Environmental Management Plan satisfies the requirements of condition 6-2 for condition 6-1, the proponent shall:</p> <ol style="list-style-type: none"> <li>(1) implement the provisions of the Operational Environmental Management Plan; and</li> <li>(2) continue to implement the Operational Environmental Management Plan until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives specified in condition 6-1 have been met.</li> </ol>	This EMP
6-4	<p>In the event that monitoring, tests, surveys or investigations indicate exceedance of management target(s) specified in the Operational Environmental Management Plan, the proponent shall:</p> <ol style="list-style-type: none"> <li>(1) report the exceedance in writing to the CEO within twenty-one (21) days of the exceedance being identified;</li> <li>(2) investigate to determine the cause of the management targets being exceeded;</li> <li>(3) provide a report to the CEO within 90 days of the exceedance being reported as required by condition 6-4(1). The report shall include: <ol style="list-style-type: none"> <li>a. cause of management targets being exceeded;</li> <li>b. the findings of the investigation required by conditions 6-4(2);</li> <li>c. details of revised and/or additional management actions to be implemented to prevent exceedance of the management target(s); and</li> <li>d. relevant changes to proposal activities.</li> </ol> </li> </ol>	Section 4
6-5	<p>In the event that monitoring, tests, surveys or investigations indicate that one or more management actions specified in the Operational Environmental Management Plan have not been implemented, the proponent shall:</p> <ol style="list-style-type: none"> <li>(1) report the failure to implement management action/s in writing to the CEO within seven (7) days of identification;</li> <li>(2) investigate to determine the cause of the management action(s) not being implemented;</li> <li>(3) investigate to provide information for the CEO to determine potential environmental harm or alteration of the environment that occurred due to the failure to implement management actions</li> <li>(4) provide a report to the CEO within twenty-one (21) days of the reporting required by condition 6-5(1). The report shall include: <ol style="list-style-type: none"> <li>a. cause for failure to implement management actions</li> <li>b. the findings of the investigation required by conditions 6-5(2) and (3);</li> <li>c. relevant changes to proposal activities; and</li> <li>d. measures to prevent, control or abate the environmental harm which may have occurred.</li> </ol> </li> </ol>	Section 4
6-6	<p>The proponent:</p> <ol style="list-style-type: none"> <li>(1) may review and revise the Operational Environmental Management Plan, or</li> <li>(2) shall review and revise the Operational Environmental Management Plan as and when directed by the CEO.</li> </ol>	Section 3
6-7	<p>The proponent shall implement the latest revision of the Operational Environmental Management Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 6-2.</p>	This EMP

## 1.4 RATIONALE AND APPROACH

### 1.4.1 Survey and study findings

#### 1.4.1.1 Flora and vegetation

A single season detailed flora and vegetation survey was undertaken within and in the vicinity of the development envelope in April–May 2017 (Phoenix 2017). A subsequent targeted flora survey was conducted for the Priority flora *Polymeria* sp. Broome and the Threatened species *Seringia exastia* in November 2017 (Phoenix 2018a, b).

Key environmental values identified were:

- A total of 114 species and subspecies representing 32 families and 78 genera were recorded in the detailed survey.
- Six vegetation types were recorded in the study area of which five are present in the development envelope. The majority of the development envelope (91%) is represented by a woodland of *Corymbia hamersleyana* and *C. zygophylla* over tall shrubland dominated by *Acacia eriopoda* over tussock grassland dominated by *Triodia schinzii*. The remainder was mapped as four shrublands, all dominated by *Acacia eriopoda* with mixed species mid to low shrublands over mixed tussock grasslands.
- The vegetation in the development envelope is generally representative of the broad Pindan vegetation association 699, *Acacia* thicket with scattered low trees over spinifex *Acacia eriopoda*, *Corymbia dichromophloia*, *Triodia pungens*, *T. bitextura* – covering the majority of the study area which is extensively represented in the correspondingly Pindanland subregion.
- Condition of vegetation within the majority of the development envelope was rated as excellent according to the condition scale of Trudgen (1988, in EPA 2016b)
- No threatened ecological communities (TECs) or priority ecological communities (PECs) are present in the development envelope.
- No flora species listed as Threatened under the *Wildlife Conservation Act 1950* (WC Act) or EPBC Act were recorded.
- Four Priority Flora species were recorded in the study area: *Tephrosia andrewii* (P3), *Polymeria* sp. Broome (P3), *Triodia caelestialis* (P3), *Bonamia oblongifolia* (P3).
- No introduced flora species were recorded in the surveys.

#### ***Tephrosia andrewii***

*Tephrosia andrewii* is a perennial shrub to 0.8 m with orange flowers in April and October and fruits April and August (Figure 1-3). Over 370 plants were recorded in the study area from 18 locations ranging from 1 to >100 individuals (Figure 1-7). Two large populations of 100+ plants were recorded; both locations are outside the development envelope (Figure 1-7). The location of populations to be protected is provided in Appendix 2.



Figure 1-3 *Tephrosia andrewii*

***Polymeria* sp. Broome**

*Polymeria* sp. Broome is a prostrate herb 10 cm high x 30 cm wide, trailing herb with greyish green leaves and mauve flowers (Figure 1-4). *P.* sp. Broome was collected from seven locations in the study area (Figure 1-7). Six of the seven locations are within the development envelope. A large number of plants was recorded at five of the locations in the targeted survey with each of population extending hundreds of metres along wandering transects. This species appears to be a post-fire ephemeral as all populations occurred in areas burnt since the initial detailed survey and plants could not be relocated at one previous record which had not been burnt.



Figure 1-4 *Polymeria* sp. Broome

***Triodia caelestialis***

*Triodia caelestialis* perennial bunchgrass forming compact tussocks 40 cm tall x 60 cm wide (Figure 1-5). *Triodia caelestialis* was recorded from 16 locations, with numbers ranging from 1 to 25 plants (Figure 1-7). Two records are outside the development envelope, four records are within the development envelope but outside the indicative work area, ten records are within the indicative work area.



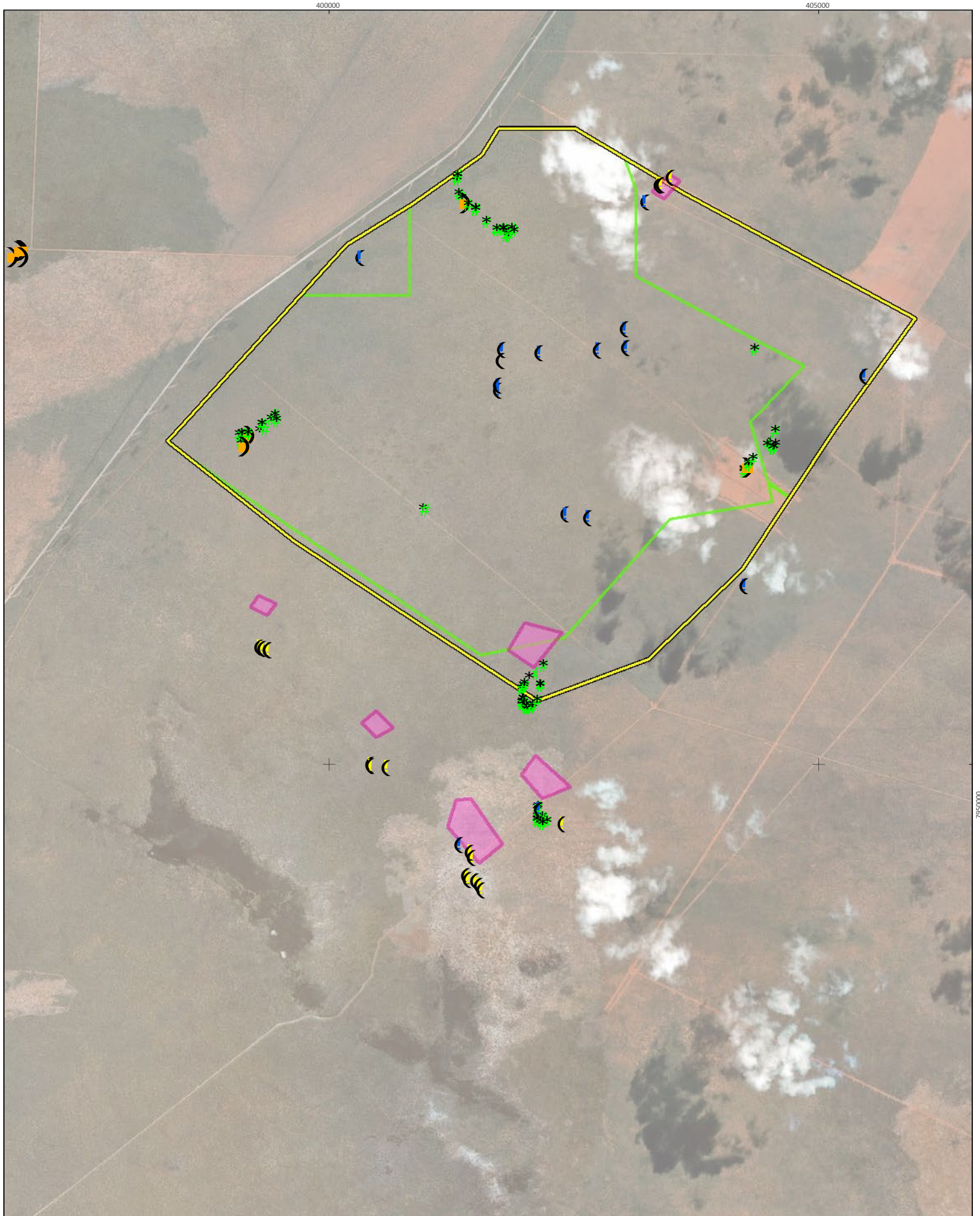
Figure 1-5 *Triodia caelestialis*

***Bonamia oblongifolia***

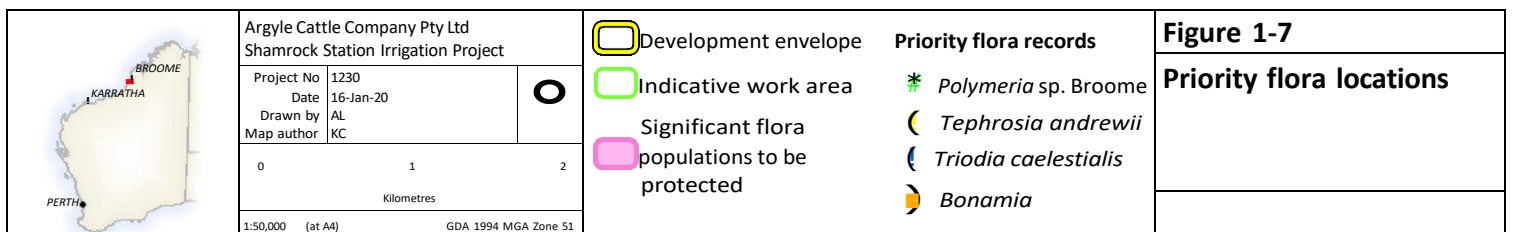
*Bonamia oblongifolia* is a perennial herb or shrub with mauve flowers (Figure 1-6). *B. oblongifolia* was recorded from three locations in the development envelope (Figure 1-7).



Figure 1-6 *Bonamia oblongifolia*



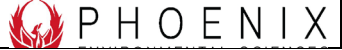
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### 1.4.1.2 Terrestrial fauna

A baseline terrestrial fauna assessment was conducted within and in the vicinity of the development envelope in April–May 2017 (Phoenix 2017) which identified:

- the study area contains one broad fauna habitat type; tall shrubland thicket with scattered eucalypt trees, with variable density of understorey; this habitat is widely represented in the Pindanland subregion
- part of the study area was considered suitable for the Greater Bilby (*Macrotis lagotis*), which is listed as Vulnerable under the EPBC Act and *Biodiversity Conservation Act 2016* (BC Act), in particular along the eastern edge and northern part of the study area, mostly outside the development envelope, where understorey was less dense than the remainder of shrubland and some open areas were present (Figure 1-8). The denser areas of shrubland thicket elsewhere in the study area were mostly not considered optimal for Greater Bilby movement and occurrence.
- evidence of Bilby presence was recorded at five locations in the study area, north and south of the development envelope (Figure 1-8).
- based on the fauna habitat present within the development envelope, eight additional conservation significant species are considered to have potential to occur as occasional visitors only.

In July 2017, a wildfire burnt through part of the development envelope which dramatically reduced vegetation cover (Figure 1-8). Habitat suitability for Bilby is likely to change over time as the burnt areas recover.

A regional La Grange Bilby survey undertaken by the Department of Biodiversity, Conservation and Attractions (DBCA 2018a) recorded evidence of Bilby presence throughout the La Grange region, including at five records at scattered locations on Shamrock Station, one close to the development envelope (Figure 1-9). Habitat suitability modelling conducted as part of the DBCA study indicated suitable habitat for the species is present across La Grange but with several broad categories of higher habitat suitability, specifically:

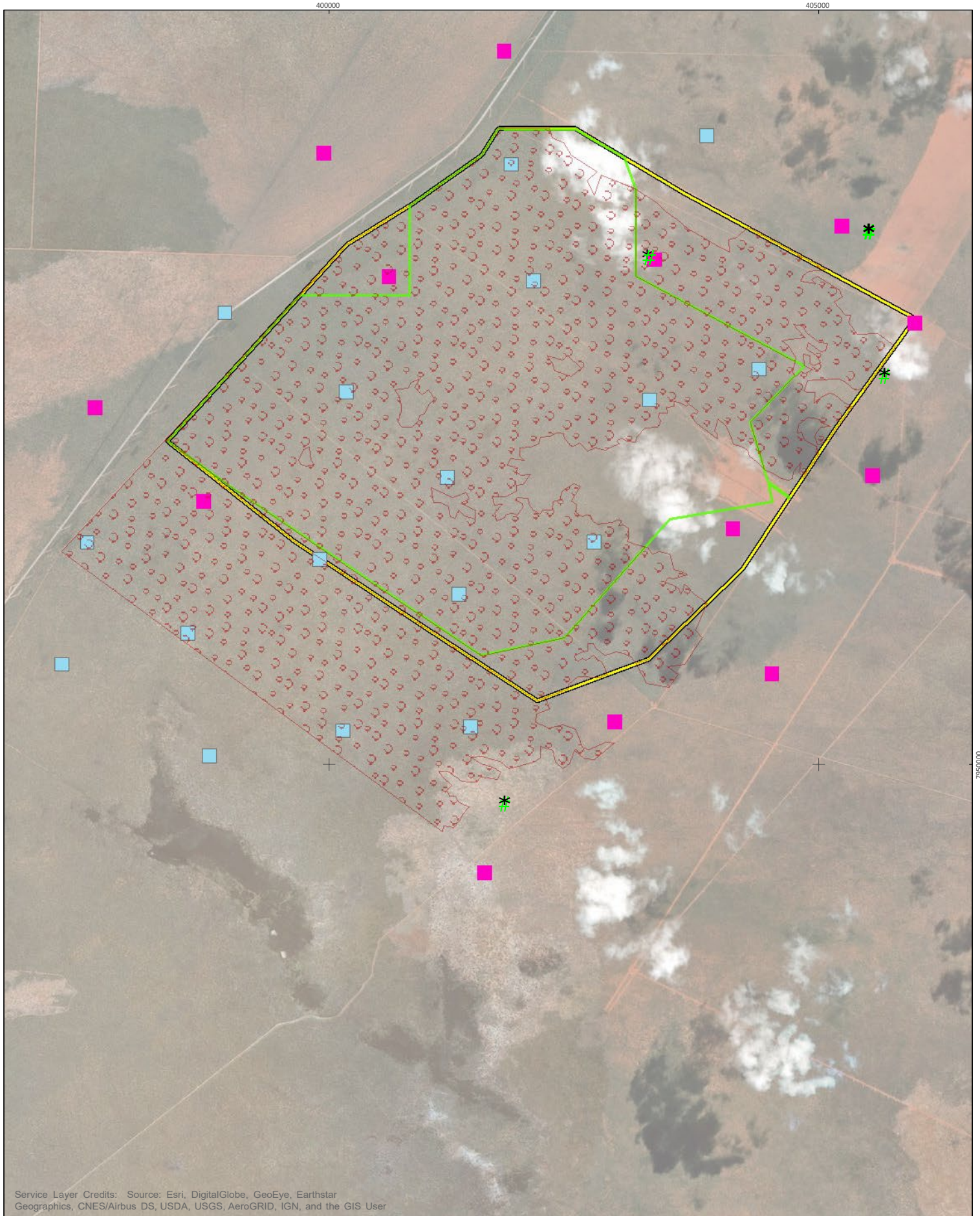
1. a thin coastal strip particularly along Eighty Mile Beach
2. a broad mid-coastal strip further inland running parallel to the coast
3. areas surrounding Mandora Marsh / Walyarta
4. areas inland to the south-west which span extensive sand dunes of the northern Great Sandy Desert.

The second category intersects the very western part of Shamrock Station (Figure 1-10).

**Table 1-3 Conservation significant terrestrial fauna species potentially occurring in the development envelope**

Species	EPBC Act status	WA status	Summary
Fork-tailed Swift ( <i>Apus pacificus</i> )	Migratory	Schedule (Migratory) <sup>1</sup> 5	Occasional foraging visitor
Cattle Egret ( <i>Ardea ibis</i> )	Migratory	Schedule (Migratory) <sup>1</sup> 5	Occasional visits to small dam at eastern edge of study area
Eastern Great Egret ( <i>Ardea modesta</i> )	Migratory	Schedule (Migratory) <sup>1</sup> 5	Occasional visits to small dam at eastern edge of study area
Grey Falcon ( <i>Falco hypoleucos</i> )		Schedule (Vulnerable) <sup>1</sup> 3	Occasional foraging visitor
Peregrine Falcon ( <i>Falco peregrinus</i> )		Schedule 7 (Other specially protected fauna) <sup>1</sup>	Occasional foraging visitor
Princess Parrot ( <i>Polytelis alexandrae</i> )	Vulnerable	Priority 4 <sup>2</sup>	Occasional foraging visitor after rainfall
Greater Bilby ( <i>Macrotis lagotis</i> )	Vulnerable	Schedule (Vulnerable) 3	Occurrence likely to be influenced by regrowth in vegetation following fire
Spectacled Hare Wallaby ( <i>Lagorchestes conspicillatus nudicluniatus</i> )		Priority 3 <sup>2</sup>	Occasional foraging visitor
Short-tailed Mouse ( <i>Leggadina lakedownensis</i> )		Priority 4 <sup>2</sup>	Occurrence and abundance likely to be influenced by rainfall

<sup>1</sup>Under the BC Act. <sup>2</sup>DBCA listing.



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- Development envelope
  - Indicative work area
  - Burnt areas (July 2017 burn)
  - Bilby, *Macrotis lagotis*, Foraging evidence - digging
- Suitability of habitat for Bilby (plots)**
- High
  - Low

**Figure 1-8**  
**Bilby records and habitat**



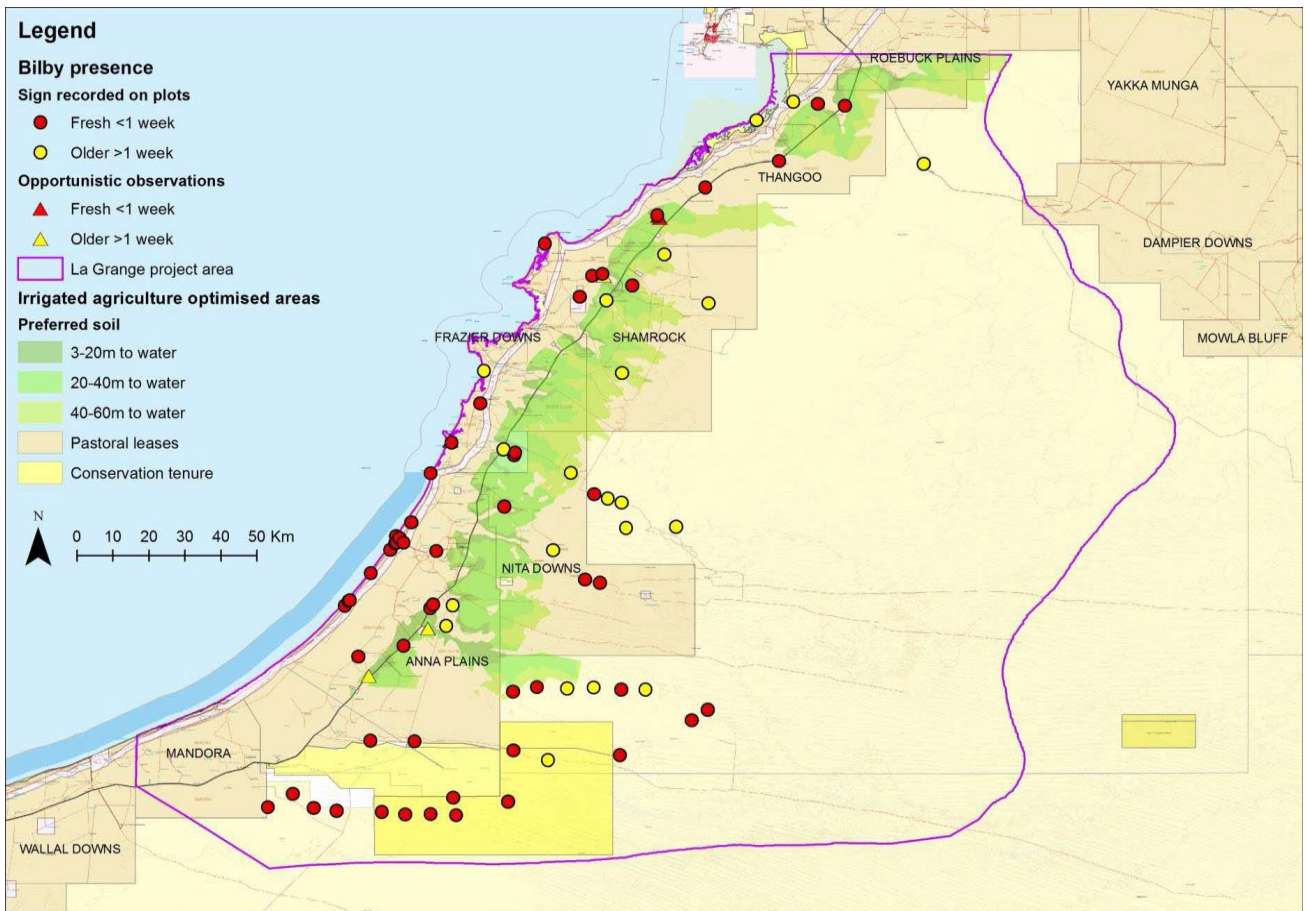
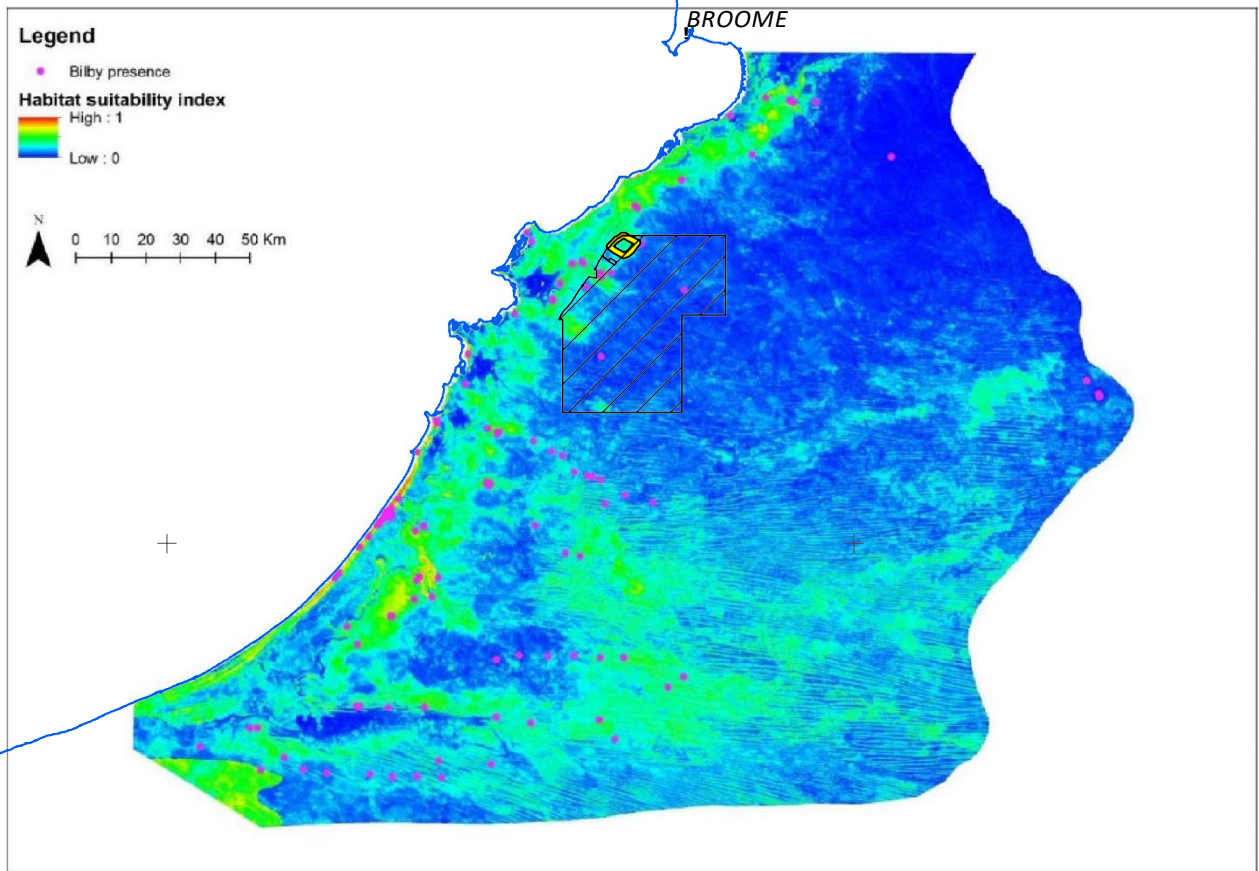


Figure 1-9 Locations of Bilby records from the La Grange regional Bilby survey (figure from DBCA 2018a)



Argyle Cattle Company Pty Ltd Shamrock Station Irrigation Project		Development envelope Shamrock station Coastline
Project No	1230	
Date	16-Jan-20	
Drawn by	AL	
Map author	KC	
1:2,200,000(at A4)		GCS WGS 1984

**Figure 1-10**  
 Shamrock Station in relation to modelled habitat suitability for Bilbies in the La Grange region (figure from DBCA 2018)



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### 1.4.1.3 Hydrological processes and inland waters environmental quality

With respect to hydrological processes, environmental values are either in-situ (i.e. water dependent wetlands or groundwater ecosystems) or extractive (i.e. consumptive use for public water supply, agriculture and industry) (EPA 2016a).

A H3 hydrogeological assessment was conducted in 2017 to support the water licence application for the Project (IGS 2017). The assessment modelled the hydrological changes in the Broome Sandstone Aquifer based on an abstraction rate of approximately 9.5 GL/year within the potential impact zone, including predicted drawdown at Injudinah Swamp and locations of other groundwater users; and predicted movement of the saltwater interface.

#### In-situ environmental values

Injudinah Swamp, located approximately 10 km south-west of the development envelope, is the closest potential groundwater dependent ecosystem (GDE) and the only one identified within the potential zone of impact from the Project (IGS 2017). It represents a wetland situated along the contact zone of the Pindan woodlands and the tidal marshes of La Grange Bay. The wetland is maintained by seepage of freshwater from regional aquifers interfacing with the muds of the tidal zone (V & C Semeniuk Research Group 2000).

Two potentially groundwater dependent PECs are within approximately 10–15 km south-west of the development envelope, both associated with Injudinah Swamp (), “Kimberley Vegetation Association 37” (Priority 3) and “Roebuck Land System” (Priority 3) (DBCA 2017). Both systems feature teatree (*Melaleuca* sp.) thickets that may be susceptible to changes in groundwater levels.

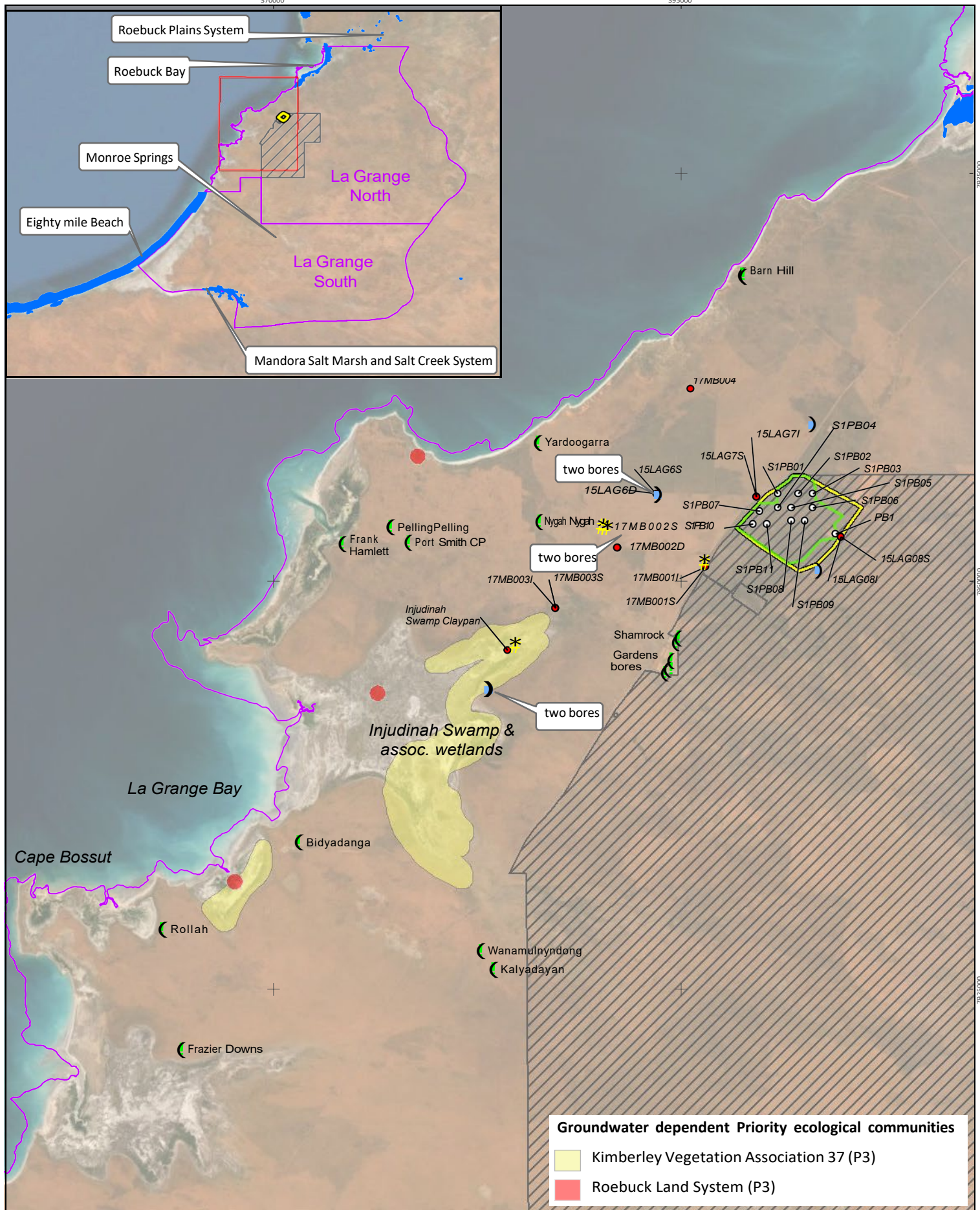
At the ocean interface, a saltwater toe penetrates the base of Broome Sandstone aquifer due to the higher density of saltwater (Figure 1-11). This toe interface occurs approximately between 3.5–4.2 km from the coast at the closest point to the Project (IGS 2017).

#### Extractive values

Twelve existing groundwater users were identified in the La Grange area that may be of relevance for the Project (Figure 1-11). The nine closest were subject to hydrological modelling to assess the potential impact by groundwater abstraction for the Proposal (~9.5 GL/annum; Table 1-4).

**Table 1-4 Existing groundwater users in the vicinity of the development envelope (IGS 2017)**

User	Licensed volume/year	Average use
Shamrock Gardens	2.5 GL	ca. 620–720 ML/year (total of four bores)
Ryall Pty Ltd (Port Smith CP)	19 ML	
Janice Bell (Barn Hill)	40 ML	
Frank Hamlett	10 ML	
Nygah Nygah (aboriginal settlement)		Pop. 4 (two houses)
Yardoogarra (aboriginal settlement)		Seasonal site (one house)
Pelling Pelling and Kalyadayan (aboriginal settlements)		Unknown (not necessarily permanent)
Wanamulnydong (aboriginal settlements)		Pop. 20 (five houses)



Argyle Cattle Company Pty Ltd Shamrock Station Irrigation Project	
Project No	1230
Date	16-Jan-20
Drawn by	AL
Map author	KC
1:300,000 (at A4) GDA 1994 MGA Zone 51	

- Development envelope
- Indicative work area
- Shamrock station
- La Grange groundwater area
- Significant wetlands
- Existing water users
- Proposed monitoring bore locations (existing)
- Proposed new bores
- Monitoring bore
- Production bore

**Figure 1-11**  
**Water values and groundwater monitoring bores**



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## 1.4.2 Key assumptions and uncertainties

Several assumptions were made in the groundwater modelling for the H3 hydrogeological assessment, including:

- modelling was based on theoretical crop water requirements for Rhodes Grass grown under historical climate conditions (Bidyandanga Bureau of Meteorology station) and assumed 80% irrigation efficiency based on discussions with DAFWA.
- modelling was based on use of continuous pumping rates across all production bores and using potential locations for 17 production bores; running alternative pumping schedules or different bore locations would have immeasurable impact on the predictions made in the assessment because the distance from receptors is large compared with the size of the footprint.

DBCA data for the PEC boundaries at Injudinah Swamp was assumed to be accurate.

## 1.4.3 Management approach

The management approach in this EMP is based on relevant government policy and review of current leading practice for managing similar issues within the Kimberley region. Importantly, the EMP takes an adaptive management approach as baseline and monitoring data will continue to be collected, building on the existing environmental datasets for the Project and this data will inform management requirements.

Monitoring data will be collected from a series of onsite and regional sites. The two-tiered groundwater monitoring plan is designed to provide for early warning and response indicators.

## 1.4.4 Rationale for choice of provisions

### 1.4.4.1 Flora and vegetation

There are no conditioned environmental objectives for flora and vegetation. Provisions for flora and vegetation are based on proponent commitments.

### 1.4.4.2 Terrestrial fauna

The following activities have been identified as having potential to increase the existing introduced animal pressure on Bilby:

- Vegetation clearing will remove potential Greater Bilby habitat.
- Vegetation clearing may attract predators to the area.
- Irrigated cropping may result in an increase in the abundance of competitive herbivores (wallabies, rabbits) due to increased food availability which may lead to degradation of Greater Bilby habitat and increase the competition for resources.
- An increase in the numbers of prey species may, in turn, increase the abundance of introduced predators (cats, foxes), which may increase predation threat to Bilby.

Accordingly, a key provision of this EMP relates to the monitoring and control of introduced animal species, specifically feral cats, foxes and rabbits.

Feral cats are established in the Kimberley (DSEWPac 2011a) and the regional La Grange Bilby survey by DBCA (2018a) recorded evidence of extensive feral cat presence in the La Grange region, including Shamrock Station. The difficulty in undertaking effective feral cat monitoring and control is well known. Shooting cats and trapping with leg-hold traps are both effective management techniques but both require substantial time and labour (Fisher *et al.* 2015). Aerial broadcast of sausage baits containing the toxin 1080 (sodium fluoroacetate)

is currently the most cost-efficient management tool for reducing feral cat numbers (Doherty & Algar 2015) and the only tool which is effective over large areas (Comer *et al.* 2018).

Leg-hold trapping can provide an effective complement to aerial baiting, in particular targeting large male cats which may disproportionately impact mammal prey (>1 kg) and are difficult to remove using baits (Moseby *et al.* 2015). Leg-hold trapping is not currently permitted as a management technique for feral cats in Western Australia except via a research permit from DBCA.

A variety of research and development projects are underway to improve both monitoring and control methods for feral cats. For example, motion camera trapping is increasingly being used to monitor feral cat abundance. While difficulties in using this technique have been noted in some environments (Stokeld *et al.* 2015), other programs have specifically used camera trapping to evaluate the efficacy of feral cat control programs (Comer *et al.* 2018; Doherty & Algar 2015; Robley *et al.* 2010). A novel camera trap design, the Felixer grooming trap, is being trialled at several locations with, to date, high success for cats (Read *et al.* 2019). This trap detects target species (cats and foxes) and ejects a dose of poison onto the fur which is in turn ingested. The cost per unit for this trap however is very high and approval of its use outside of research contexts is uncertain.

The development envelope is at the northern extent of European red fox distribution in Western Australia (PestSmart 2011). The DBCA La Grange survey (DBCA 2018a) confirmed foxes are present in the region, mainly closer to the coast (west of the Great Northern Highway), but with occasional records further inland. Evidence of fox presence was recorded sparsely on Shamrock Station in the DBCA survey.

Following desktop review and consultation with experts, it is considered that rabbits are unlikely to move into and persist in the La Grange region. The species is not prevalent in the Kimberley (EPA & DEC 2007) most likely due to climatic factors because the rabbit is a Mediterranean species. DSEWPaC (2011b) shows a satellite population in the southern Kimberley to the east of Shamrock Station; however, this is based on 2008 mapping for the National Land and Water Resource Audit and there is no current data to substantiate this satellite population. Rabbit Scan (PestSmart 2018) shows some penetration into the south eastern Kimberley, although no sightings are recorded in this area on the mapping tool. There are no records of rabbits in the Kimberley on NatureMap except for one old record for Koolan Island (DBCA 2018c). Rabbit Scan shows their distribution along the coast extending to Port Hedland, roughly 400 km south of the project area. The Department of Primary Industries and Regional Development (pers. comm. Richard Watkins, Manager, Pest and Disease Information Service) has also advised that rabbits are unlikely to move into the region.

Wild dog control is already undertaken on Shamrock Station as part of a regional control program. Therefore, wild dogs are not proposed to be included in this EMP. Control measures within this EMP will supplement the existing wild dog control program.

Taking the above considerations into account, the introduced animal monitoring and control provisions are based on the following approach:

1. undertaking initial risk mitigation to Bilbies through implementation of an initial feral cat and fox trapping survey
2. determining baseline activity or abundance of each introduced animal species (feral cats, foxes and rabbits) in the control area
3. if absent, continuing surveillance to detect movement of species into the control area
4. if present, undertaking control actions and monitoring abundance levels in the control area
5. review and update to the introduced animal monitoring and control program to allow for an adaptive management approach, for example, incorporation of more effective control methods for the target species as they become available.

Commitments in the Section 38 referral were to undertake introduced animal control in the vicinity of the project area if an increase in abundance was detected. However, to address concerns of the DoEE raised during the EPBC Act assessment of the Project regarding potential effects of introduced animals on Bilby, the

following changes are proposed and represent the environmental offset for the Project under the EPBC Act assessment (EPBC Ref: 2017/8004):

- a. If after a minimum of four consecutive years, feral cats (*Felis catus*) and foxes (*Vulpes vulpes*) have been demonstrated to be absent from the control area, surveillance monitoring capable of detecting if any individual of these species has returned to the control area, must be conducted at least once every two years: and
- b. If subsequently, surveillance monitoring (as required under condition 3a) detects feral cats (*Felis catus*) and / or foxes (*Vulpes vulpes*) within the control area, annual control and monitoring measures, undertaken in accordance with the program methods, must be resumed for at least 20 years or until both feral species have again been demonstrated to be absent for a minimum of four consecutive years.

The control area has been expanded significantly to cover approximately 40% of Shamrock Station (71,500 ha; Appendix 3). This area covers the DBCA (2018a) modelled areas of higher value habitat value within Shamrock Station (Figure 1-10) and is roughly 28 times the size of the development envelope.

Further to this, ACC recognises that an even wider landscape scale approach to controlling feral cat and fox populations in the La Grange region is going to be more effective than site specific efforts. To this end, ACC will investigate opportunities to expand the program through collaboration with other introduced animal control initiatives in the region. For example, the regional wild dog control program could potentially be expanded to target feral cats and foxes in addition to wild dogs through bait substitution.

Monitoring and control methods have been developed with input from Dr. David Algar, Principal Research Scientist (DBCA). Determining accurate abundance measures of multiple introduced animal species can be extremely costly and difficult, particularly in vegetation typical of the Shamrock Station (dense Pindan vegetation). The proposed monitoring approach utilises track counts which are considered to produce reliable indices of abundance for cats and foxes that may be used to detect changes in populations (Mitchell & Balogh 2007a, b). Track counts are also considered to be useful for rabbits where vegetation or terrain make other counting methods (e.g. spotlighting, warren counts) difficult (Mitchell & Balogh 2007c). Monitoring methods are adapted from Read and Eldridge (2010) and based on a similar program being conducted at Matua (ex-Lorna Glen Station, now managed for conservation) (Algar *et al.* 2013) but scaled in proportion to the control area.

### 1.4.4.3 Hydrological processes and inland waters environmental quality

A comprehensive framework for monitoring and management of groundwater abstraction is outlined in the Detailed Water Resource Operating Strategy (DWROS) for the Project, under water licence GWL203109(1). The DWROS defines key issues that are to be managed in relation to groundwater abstraction, the management objectives related to each key issue and detailed monitoring program (refer to Appendix 1). Management triggers, as described in the DWROS Monitoring and Management Plan (Appendix 1) will be adopted following an assessment of natural variation during the first year of operation to establish a reliable baseline.

The DWROS has been prepared in accordance with Department of Water and Environment Regulation (DWER) Operational Policy 5.08: *Use of operating strategies in the water licencing process* (DoW 2011). Accordingly, overarching management-based provisions for hydrological processes and inland waters environmental quality are provided in this EMP, based on the management framework of the DWROS, while the detailed trigger values and responses will be specified in the DWROS.

As the project will be subject to staged development, installation and operation of the monitoring bore network will also be phased in commensurate with project staging (Table 1-5).

**Table 1-5 Staging of bore construction**

Sub-stage	No. production bores	Locations	Monitoring
1A	1 - 4	PB1, S1PB001, S1PB02, S1PB03	all existing monitoring bores
1B	5 - 8	S1PB04, S1PB05, S1PB06, S1PB09	as above + MB001S/MB001I + 17MB003S/MB003I + MB004
1C	9 - 12	S1PB07, S1PB08, S1PB10, S1PB11	as above + “Injudinah Swamp Claypan”

## 2 EMP PROVISIONS

This section of the EMP describes the provisions that will be implemented to manage impacts to the key environmental factors (Table 2-1).

**Table 2-1 Flora and vegetation provisions to meet legal requirements of Condition 6 of Ministerial Statement 1086**

<b>EPA factor</b>	Flora and vegetation			
<b>EPA objective</b>	To protect flora and vegetation so that biological diversity and ecological integrity are maintained			
<b>Outcome</b>	There are no outcome conditions in MS 1086 specifically for flora and vegetation.			
<b>Project specific objectives</b>	<ul style="list-style-type: none"> <li>– To minimise impacts to Priority flora within the development envelope as far as practicable</li> <li>– To avoid impacts on native vegetation and Priority flora outside the development envelope</li> </ul>			
<b>Key environmental values</b>	Priority flora; vegetation in excellent condition			
<b>Key impacts and risks</b>	Spread of introduced cropping species to adjacent remnant vegetation, degradation of adjacent remnant vegetation and Priority flora populations			
<b>Management-based provisions</b>				
<b>ID</b>	<b>Management actions</b>	<b>Management targets</b>	<b>Monitoring</b>	<b>Reporting</b>
	<b>Condition 6-2 (2)</b>	<b>Condition 6-2 (3)</b>	<b>Condition 6-2 (4)</b>	<b>Condition 6-4, 6-5</b>
FV1	Demarcate and provide GPS co-ordinates of the development envelope and areas to be cleared to the clearing contractor prior to clearing  Demarcate and provide GPS co-ordinates of Priority Flora populations to be protected (Appendix 2) to the clearing contractor prior to clearing	No clearing of vegetation to occur outside the development envelope  Clearing of native vegetation within the development envelope will not exceed 650 ha  Retain six populations of significant flora: <i>Tephrosia andrewii</i> population 1-4, <i>Polymeria</i> sp. Broome population 1-2 (as referred to in Appendix 2)	Weekly inspection along clearing boundaries during clearing to confirm that there is no exceedance of the identified targets	Written correspondence to DWER if management target not met and/or failure to implement management action  Annual Compliance Assessment Report (CAR)
FV2	Demarcate and establish 100-200 metre square fenced vegetation buffers around each pivot	Establishment of fenced vegetation buffers will not exceed 550 ha	Weekly inspection of buffer boundaries and extent during construction to confirm that there is no exceedance of the identified target	Written correspondence to DWER if management target not met and/or failure to implement management action  Annual CAR
FV3	Undertake monitoring of crop and weed species outside of irrigation areas to detect spread into adjacent native vegetation  If monitoring identifies outbreaks of crop species, undertake weed control with a DBCA/DPIRD approved herbicide	Spread of Rhodes Grass, other irrigation crops or weeds into remnant vegetation is limited to isolated occurrences of non-vigorous plants, no more than 300 m from pivots	Annual wet/post-wet season weed monitoring along buffer boundaries and within adjacent native vegetation	Monitoring records  Written correspondence to DWER if management target not met and/or failure to implement management action  Annual CAR

**Table 2-2 Terrestrial fauna provisions to meet legal requirements of Condition 6 of Ministerial Statement 1086**

<b>EPA Factor</b>	Terrestrial fauna			
<b>EPA objective</b>	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained			
<b>Project specific objective</b>	Condition 6-1 (1) Avoid, where possible, and minimise impacts to the Bilby within the development envelope as defined in Figure 2 of Schedule 1			
<b>Key environmental values</b>	Bilby			
<b>Key impacts and risks</b>	Loss of Bilby habitat, loss of individuals during clearing, habitat degradation and increased competition from other herbivores, increase in feral predators			
<b>Management-based provisions</b>				
<b>ID</b>	<b>Management actions</b>	<b>Management targets</b>	<b>Monitoring</b>	<b>Reporting</b>
	<b>Condition 6-2 (2)</b>	<b>Condition 6-2 (3)</b>	<b>Condition 6-2 (4)</b>	<b>Condition 6-4, 6-5</b>
TF1	<p>Minimise clearing of Bilby habitat as far as practicable and avoid clearing of high value habitat</p> <p>Demarcate and provide GPS co-ordinates of the development envelope and areas to be cleared to the clearing contractor prior to clearing</p>	<p>No clearing of Bilby habitat to occur outside the development envelope</p> <p>No clearing within 100 m of Bilby plots rated as high value habitat</p>	<p>Weekly inspection along clearing boundaries during clearing to confirm that there is no exceedance of the identified targets</p>	<p>Written correspondence to DWER if management target not met and/or failure to implement management action</p> <p>Annual CAR</p>
TF2	<p>Undertake a pre-clearance survey for Bilby using an experienced fauna specialist in accordance with DBCA’s Guideline for the survey and relocation of Bilby in Western Australia (DBCA 2018b)</p> <ul style="list-style-type: none"> <li>- Undertake searches for Bilby burrows and signs</li> <li>- If potentially occupied burrows are identified, monitor burrows to determine occupancy. Undertake displacement at any burrows determined to be occupied</li> <li>- If unoccupied burrows are identified, fill in to prevent potential for use prior to clearing</li> <li>- If displacement is unsuccessful, undertake capture and relocate Bilby individuals to suitable habitat on Shamrock Station outside the development envelope</li> </ul>	<p>No Bilby mortality or active burrow destruction during clearing</p>	<p>Visual observations for Bilby burrows and Bilby signs during pre-clearance survey</p> <p>Pre-clearance survey within two weeks prior to clearing</p> <p>Motion camera trapping for up to three nights at suspected occupied burrows</p>	<p>Written correspondence to DWER if management target not met and/or failure to implement management action.</p> <p>Annual CAR</p>

ID	Management actions	Management targets	Monitoring	Reporting
	<b>Condition 6-2 (2)</b>	<b>Condition 6-2 (3)</b>	<b>Condition 6-2 (4)</b>	<b>Condition 6-4, 6-5</b>
TF3	If recent Bilby activity is identified in the clearing area, engage a fauna spotter to traverse the project area ahead of clearing machinery during clearing. The fauna spotter will have appropriate training in fauna handling techniques and hold a permit to relocate fauna in accordance with the <i>Biodiversity Conservation Regulations 2018</i>	No Bilby mortality or active burrow destruction during clearing	Fauna clearance survey	Contractor records Written correspondence to DWER if management target not met and/or failure to implement management action Annual CAR
TF4	Undertake an initial feral cat and fox trapping survey within the control area (see Appendix 3) to mitigate risk to Bilbies and inform future feral cat and fox control  Undertake annual monitoring of feral cats, foxes and rabbits within the control area (see Appendix 3) to assess presence and abundance/activity level of each species  Undertake feral cat and fox control within the control area  Undertake rabbit control within the control area if monitoring detects presence	Demonstrated decrease in introduced predators (feral cats, or foxes) in the control area compared with the baseline  No introduction of rabbits to the control area as a result of the Project	Annual monitoring and control program  Monitoring and control methods as outlined in Appendix 3	Annual monitoring reports. Written correspondence to DWER if management target not met and/or failure to implement management action Annual CAR

**Table 2-3 Hydrological processes and inland waters environmental quality provisions to meet legal requirements of Condition 6 of Ministerial Statement 1086**

<b>EPA Factor</b>		Hydrological processes and inland waters environmental quality		
<b>EPA objective</b>		To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected To maintain the quality of groundwater and surface water so that environmental values are protected		
<b>Project specific objective</b>		Condition 6-1 (2) Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause long term impacts to the environmental values of the Injudinah Swamp and on the hydrological regime and water quality of the Broome Sandstone Aquifer. Condition 6-1 (3) Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause significant change in the location of the saltwater interface due to the abstraction of water for the proposal.		
<b>Key environmental values</b>		Injudinah Swamp and associated PECs and wetlands, Broome Sandstone Aquifer and saltwater interface		
<b>Key impacts and risks</b>		Impacts to groundwater dependent communities/vegetation/wetlands as a result of groundwater abstraction; changes to water quality due to abstraction and/or fertiliser application		
<b>Management-based provisions</b>				
ID	Management actions	Management targets <sup>1</sup>	Monitoring <sup>2</sup>	Reporting
	<b>Condition 6-2 (2)</b>	<b>Condition 6-2 (3)</b>	<b>Condition 6-2 (4)</b>	<b>Condition 6-4, 6-5</b>
HP1	Manage abstraction so that groundwater allocation is not exceeded	No exceedance of annual licensed groundwater allocation	Monthly flowmeter readings and volume calculations at all operating production bores, any new/replacement production bores	Annual groundwater monitoring report to DWER Written correspondence to DWER if management target not met and/or failure to implement management action Annual CAR
HP2	Manage abstraction so that groundwater use does not impact GDEs (Injudinah Swamp)	Groundwater drawdown to be within acceptable limits so as not to impact ecological function of identified GDEs (Injudinah Swamp)	Quarterly monitoring of groundwater levels at monitoring bore 17MB003S&I (Stage 1B) (Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct) Quarterly monitoring of surface water levels at Injudinah Swamp Claypan (Stage 1C) (Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct) Hourly pressure transducer, electrical conductivity and pH monitoring at Injudinah Swamp Claypan (Stage 1C) (ongoing)	Annual groundwater monitoring report to DWER Vegetation monitoring report Written correspondence to DWER if management target not met and/or failure to implement management action Annual CAR



ID	Management actions	Management targets <sup>1</sup>	Monitoring <sup>2</sup>	Reporting
	Condition 6-2 (2)	Condition 6-2 (3)	Condition 6-2 (4)	Condition 6-4, 6-5
HP2 cont.			<p>Quarterly (for first year) comprehensive water quality analysis of surface water quality and Injudinah Swamp Claypan (Stage 1C) (Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct)</p> <p>Vegetation monitoring of established transects (potential impact and control sites) at Injudinah Swamp, bi-annually if water level triggered, end of dry season and during irrigation season (e.g. July)</p>	
HP3	Manage fertiliser application and abstraction so that groundwater quality is not impacted	Maintain groundwater quality and salinity	<p>Annual comprehensive water quality analysis of pumped groundwater sampled from</p> <ul style="list-style-type: none"> <li>- production bores - which production bores to be annually sampled will be agreed upon once bores have been constructed - at a minimum all westernmost pivots must be sampled</li> <li>- monitoring bores 15LAG8S&amp;I, 15LAG7S&amp;I, 17MB002S (Stage 1A) and 17MB001S&amp;I (Stage 1B) (Sept/Oct)</li> </ul> <p>Field pH measured quarterly in monitoring bores for the first year of operation 17MB002S, 15LAG7S&amp;I and 15LAG8S&amp;I (Stage 1A), 17MB001S&amp;I and 7MB003S&amp;I (Stage 1B)</p>	<p>Annual groundwater monitoring report to DWER</p> <p>Written correspondence to DWER if management target not met and/or failure to implement management action</p> <p>Annual CAR</p>
HP4	Manage abstraction so that saline wedge movement does not impact GDEs (Injudinah Swamp) and other users' water supply	Movement of saltwater interface to remain within predicted range	<p>Monitoring of electrical conductivity</p> <ul style="list-style-type: none"> <li>- all operating production bores monthly</li> <li>- logged data in 15LAG8S&amp;I, 15LAG7S (Stage 1A), 17MB001S, 17MB001I (Stage 1B) and 17MB003S, 17MB003I (Stage 1C)</li> </ul> <p>Quarterly monitoring of water level in monitoring bores 17MB002D, 17MB004 and 15LAG06D</p>	<p>Annual groundwater monitoring report to DWER</p> <p>Written correspondence to DWER if management target not met and/or failure to implement management action</p> <p>Annual CAR</p>

<sup>1</sup>Level 1 and 2 trigger values and responses are outlined in the DWROS (Appendix 1).

<sup>2</sup>All monitoring measures are in accordance with the DWROS. Any update to the monitoring and management plans in the DWROS will require review and update to the EMP provisions. Bore sampling is subject to land access permission.

### 3 ADAPTIVE MANAGEMENT AND REVIEW OF THE EMP

ACC will implement adaptive management practices based on learnings gained from the implementation of management actions and monitoring. This will include:

- annual review of monitoring data and information gathered over the review period
- annual evaluation against management targets
- review of management actions as the Project progresses and new management measures and technologies become available that may be more effective.

The EMP will be reviewed annually and updated based on review outcomes, for example, if monitoring indicates that management targets are not being achieved, or not likely to be achieved, and /or new information becomes available that may improve the efficiency and/or effectiveness of the management actions.

Early response indicators and actions (Level 1 triggers and responses) have been established for managing groundwater abstraction as part of the Project; these are outlined in the DWROS (refer to Appendix 1).

### 4 COMPLIANCE REPORTING

ACC is required to report against its compliance with this EMP in an annual Compliance Assessment Report, prepared in accordance condition 4-6 and 6-3 of Ministerial Statement 1086. The Compliance Assessment Report is required to be submitted to DWER by 19 February each year in accordance with the approved Compliance Assessment Plan for the Project (Appendix 4).

An Index of Biodiversity Surveys for Assessment (IBSA) data package will be submitted with all biological monitoring reports.

In accordance with condition 6-4 of Ministerial Statement 1086:

- written notification is to be provided to the CEO of DWER within twenty-one (21) days of any exceedance of management targets in this EMP being identified
- an investigation report is to be provided to the CEO of DWER within 90 days of any exceedance being reported.

In accordance with condition 6-5 of Ministerial Statement 1086:

- written notification is to be provided to the CEO of DWER within seven (7) days of any failure to implement management action/s being identified by monitoring, tests, surveys or investigations
- an investigation report is to be provided to the CEO of DWER within 21 days of any failure to implement management action/s being identified.

### 5 STAKEHOLDER CONSULTATION

ACC has undertaken consultation with DoEE and DBCA for input to this EMP. Further consultation with both agencies will be undertaken as required during implementation and review of the EMP.

## REFERENCES

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## **APPENDICES**

### **Appendix 1 Detailed Water Resource Operating Strategy**



A report prepared for Argyle Cattle Company Pty Ltd

A subsidiary of Consolidated Australian Pastoral Holdings Pty Ltd

REVISED FINAL VERSION

16 July 2019

**Name of water licence applicant/licensee:** Consolidated Australian Pastoral Holdings Pty Ltd

**Name of development project or purpose:** Shamrock Station Irrigation Project - Stage 1

**Legal description and address of land where (a) water is taken, and (b) water is used (if different)**

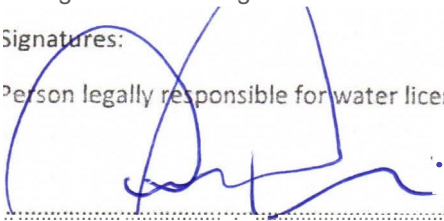
(a) Shamrock Station, Lot 590, Great Northern Highway, La Grange WA

(b) As Above

I understand that the commitments given in the attached operating strategy will be a condition of an associated water licence if approved and that a breach of a commitment or any licence condition may be an infringement of the rights in Water and Irrigation Act 1914":

Signatures:

Person legally responsible for water licence:



Date... J... 1... {i

Printed name: Dale Champion



Approved by Department of Water and Environmental Regulation (delegated authority)

Date... 1 ]/Z..

Printed name: ..C.rIf..Y. /lu.<.Ql:!!?.ef..7.L..

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## Preface

Consolidated Australian Pastoral Holdings (CAPH) purchased an aggregation of stations in the Kimberley region of Western Australia in November 2016. This acquisition was based on the promotion of the La Grange area, located south of Broome, and the possibilities of developing a value-added supply chain through one of the stations, being “Shamrock Station”, which overlies the Broome Sandstone aquifer. This aquifer represents a groundwater resource that is being actively promoted as an agricultural development area in the La Grange area.

The project aligns closely with the Australian Government’s White Paper “Our North, Our Future: White Paper on Developing Northern Australia” (the White Paper), which specifically mentions the West Kimberley (which La Grange area is a part of) as a focus area for development, and the Western Australian Government’s Water for Food programme with La Grange identified as a Kimberley Water for Food Precinct. This is recognised in the Kimberley Development Commission’s Regional Investment Blueprint for the Kimberley (2036 and Beyond).

Argyle Cattle Company Pty Ltd (ACC) a subsidiary of CAPH proposes to develop Irrigation Project on Shamrock Station. The project is based on a staged approach with the first stage modelled for an abstraction of 9.5 GL based on development of approximately 12 x 40 ha pivots.

The fodder produced will be used to enhance the capacity of ACC’s aggregation of stations to maximise weight gain for livestock exported from the region, increase flexibility of operation and ensure security of both fodder and livestock supply through seasonal variations.

On 5 December 2016, Consolidated Australian Pastoral Holdings Pty Ltd (CAPH) applied to the WA Government Department of Water and Environmental Regulation (DWER) for a groundwater extraction licence under the under the *Rights in Water and Irrigation Act 1914* (RIWI Act) of 22 GL, which fits within the allocation limit for the La Grange North subarea set out in the La Grange groundwater allocation plan. DWER subsequently requested that ACC provide additional information in the form of a detailed H3 Hydrogeological Assessment report (IGS, 2017) and a Detailed Water Resources Operating Strategy. This report (the DWROS) constitutes the latter.

The H3 hydrogeological assessment demonstrated, using best available science, that Stage 1 of the Shamrock Station Irrigation Project (the Stage 1 Project) could sustainably extract 9.5 GL/annum from the Broome Sandstone aquifer to support the proposed 12 production bores each capable supplying a centre pivot of area approximately 40 hectares. The location of the Stage 1 Project is on the northern boundary of the station immediately east of the Great Northern Highway (Figure 1).

Both CAPH and ACC are aware this project falls under the RIWI Act and will ensure all staff working within the operation are aware of all water licence obligations and management plans associated with the project development and operations.

Water licences relevant to this DWROS are:

- Licence (insert number when issued): Licence to take water
- Licence (insert number when issued): Licence to construct or alter well.

## 1 Administrative requirements

This section outlines the administrative arrangements necessary to ensure the DWROS is adhered to.

### 1.1. Existing water licences relevant to strategy

There are no other relevant water licences issued that are relevant to this DWROS.

### 1.2. Requirement for DWROS

In accordance with DWER Operational Policy 5.08: *Use of operating strategies in the water licencing process* (DoW 2011), a detailed operating strategy is required under a range of circumstances, including when the water licence meets a combined threshold for several categories. Specifically, a detailed operating strategy is required when the cumulative number of points assigned to the categories (i) volume of water to be taken, (ii) level of allocation, (iii) potential for impacts on other users and (iv) potential for impacts on ecosystems and (v) existing salinity, yield greater than 12 points (Table 1, Section 3.5 of the policy).

The Stage 1 Project achieves a score of more than 12 points for the following three reasons:

- a. Volume of sustainable abstraction has been calculated at greater than 5 GL/annum.
- b. Potential for impacts to existing groundwater users is likely albeit low in magnitude. Shamrock Gardens is the nearest existing licensed user located approximately 6 km south south-west of the proposed Stage 1 development area. Nygah Nygah community is the nearest unlicensed user located approximately 11 km to the west.
- c. Potential for impacts to ecosystems is possible. Injudinah Swamp is a groundwater dependent ecosystem (GDE) listed as a wetland of State significance in the La Grange Groundwater Allocation Plan; it is located approximately 15 km south-west of the proposed Stage 1 development area.

### 1.3. Staging of development

The 22 GL/annum development is scheduled to be staged over a 3-year period, with Stage 1 usage calculated at 9.467 GL/annum as indicated in the H3 Hydrogeological Assessment report developed for Stage 1.

Annual volumes for Stages 2 and 3 will be determined by further hydrogeological modelling; however, each are estimated to be 6 GL/annum.

If hydrogeological modelling proves that either future stage can handle more than the other or either can handle the remainder of the allocation without environmental impacts, then future applications will be lodged accordingly.

### 1.4. Summary of hydrogeological investigations

A H3 Hydrogeological Assessment (H3 report) has been developed for the Stage 1 Project (IGS 2017).

The aquifer of interest for the proposed Shamrock Station development is the unconfined Broome Sandstone. This is the uppermost major aquifer in the La Grange Groundwater Sub-Area and forms part of the Canning Basin. Groundwater flows from east to west in the Broome Sandstone aquifer, towards the coast, and groundwater depth is <1 m to around 158 m.

The H3 report synthesised a variety of recent hydrogeological data collected during the DAFWA Royalties for Regions (*La Grange Agriculture Opportunities*) project, and then used that data in groundwater models to establish how many centre-pivot irrigators could be confidently installed and operated without causing deleterious impacts to existing users and known sites of ecological/cultural importance. Key datasets used in the H3 Hydrogeological Assessment included:

## Detailed Water Resource Operating Strategy: Shamrock Station Irrigation Project – Stage 1 Development

- baseline water quality
- airborne electromagnetics (AEM)
- drilling and downhole geophysical records
- aquifer pumping test analysis
- groundwater level monitoring and depth to water mapping (following previously sporadic monitoring of the groundwater levels, routine monitoring of has occurred since 2013)
- Hydrochemistry and environmental tracers to support groundwater recharge and flow analysis.

The H3 report details the development of a suite of complimentary analytical and numerical groundwater models that address a range of objectives and provide added confidence to model outcomes.

For more detailed description of hydrogeological conditions related to the Stage 1 Project, refer to the H3 report (IGS 2017).

### 1.5. Water resource management area

The Stage 1 Project falls within the area covered by the La Grange Groundwater Allocation Plan (DoW 2009a). The Stage 1 Project comes under the La Grange North Sub-Area of this plan.

Specific water resource management issues identified under the La Grange Groundwater Allocation Plan include:

- impact on other users including community supplies
- impact on GDEs or cultural sites
- impact on the salt water interface
- the allocation limit for the La Grange North Sub-Area is 35 GL/annum. The Stage 1 Project has calculated 9.467 GL/annum can be sustainably extracted from the Broome Sandstone aquifer. This volume, in addition to existing allocations, will instigate a management trigger in the La Grange Groundwater Allocation Plan, with the following response:
  - DWER to assess the need for a regional monitoring program, and
  - DWER to consult with stakeholders to evaluate if further work needs to be undertaken to improve knowledge of in-situ water dependant values.

### 1.6. Person/position responsible for implementing operating strategy

Name: Cameron McDonald

Position: Project Manager, Australian Standard Agriculture

Address: PO Box 216, Brighton SA. 5048

Email: [cameron@aus-standard.com](mailto:cameron@aus-standard.com)

Mob: 0455 477 655

1.7. Reporting dates

Water use year monitoring and DWROS compliance reporting will be negotiated at licence issue but will likely be 28 February each year for consistency with most other irrigators in the region, also reflecting the irrigation season.

1.8. Review date

Major review of this DWROS is required on July 2029 (assumes water licence is granted July 2019 and water licence period is 10 years).

## 2 Water source description

Groundwater used for irrigation, stock and domestic supply in the La Grange region is mostly sourced from the Broome Sandstone aquifer. The Broome Sandstone is a regionally extensive, generally unconfined aquifer forming part of the Canning Basin. The Cretaceous Broome Sandstone sits unconformably above the upper Jurassic Jarlemai Siltstone. The Jarlemai Siltstone forms an aquitard confining the Jurassic Wallal Sandstone aquifer and effectively separates the two aquifer systems. Groundwater salinity is generally fresh inland grading to saline towards the coast where the aquifer salinity is controlled by the salt water interface.

Groundwater abstraction for Shamrock Station Irrigation Project – Stage 1 will occur from existing production bore PB1 and up to 11 new production bores. The exact number and distribution of new production bores is to be determined in consultation with the irrigation engineer, however groundwater modelling undertaken for the H3 report has indicated an optimum number of 12 production bores including PB1.

### 2.1. Groundwater

A description of production and monitoring bore details is provided in Table 1. It should be noted that:

- a. Bore locations provided for new production bores are estimated as the final number and distribution of production bores are to be determined in consultation with the irrigation engineer. The design of bore distribution will also be constrained by drawdown impacts on the agreed sensitive receptors and cross-boundary impact (i.e., beyond the boundary of Shamrock Station).
- b. Bore locations provided for new monitoring bores are estimated with final site selection contingent on clearances and approvals.

Details on the purpose of each monitoring bore are outlined in the Shamrock Station Irrigation Project Stage 1 Monitoring and Management Response Plan (Monitoring and Management Plan) at Attachment 1.

### 2.2. Water distribution network

As previously mentioned, final design is yet to be determined and will be based on final allocation, environmental buffer zones, cultural areas of interest, surface water hydrology and, where possible, fit within the approved development envelope.

A separate stock water system will supply each pivot with stock water, through a network of pipes, tanks and troughs.

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Table 1 Production bore and monitoring bore details

Bore Name (production or monitoring)	Location coordinates (Zone 51)		Aquifer name	Elevation (m AHD)	Depth (m bgl)	Screened interval (m bgl)	Construction details (bore logs to be provided to the department)	Depth of monitoring (pressure / salinity logger) (m bgl)	Comment
	Northing	Easting							
PRODUCTION BORES									
1. PB1	7952893	404449	Broome Sandstone	TBA	153	95-153	0-95 m, 250 mm (ID) PVC casing 95-153 m, 250 mm (ID) slotted PVC 0.5mm 75-153 m, gravel pack 0-75 m, cement grout	N/A	
2. S1PB01	7955350	400900	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
3. S1PB02	7955350	402160	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
4. S1PB03	7955350	403050	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
5. S1PB04	7954500	400900	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
6. S1PB05	7954500	401725	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
7. S1PB06	7954500	403050	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
8. S1PB07	7954300	399800	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
9. S1PB08	7953700	401725	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
10. S1PB09	7953700	402550	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
11. S1PB10	7953500	399375	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
12. S1PB11	7953500	400225	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	N/A	
MONITORING BORES									
1. 17MB001S	7950880	396485	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	TBA	Pressure /salinity logger. Sampling depth to be located within the screened/slotted interval.
2. 17MB001I	7950855	396470	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	TBA	Pressure /salinity logger. Sampling depth to be located within the screened/slotted interval.
3. 15LAG08S	7952722	404769	Broome Sandstone	55.82	47.59	44.59- 47.59	PVC – Class 18	46	Currently installed with DWER pressure logger. To be replaced with a pressure/salinity logger when it fails, located at a depth of 46 m bgl.
4. 15LAG08I	7952719	404773	Broome Sandstone	55.90	102	96-102	PVC – Class 18	98	Currently installed with DWER pressure logger. To be replaced with a pressure/salinity logger when it fails, located at a depth of 98 m bgl.
5. 17MB002S	7952050	391070	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	TBA	Pressure logger only. Sampling depth to be located nominally 5 – 10 m below the water level
6. 17MB002D	7952050	391050	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	TBA	Pressure logger only. Sampling depth to be located nominally 5 – 10 m below the water level
7. 17MB003S	7948350	387300	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	TBA	Pressure /salinity logger. Sampling depth to be located within the screened/slotted interval.
8. 17MB003I	7948350	387280	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	TBA	Pressure /salinity logger. Sampling depth to be located within the screened/slotted interval.

Detailed Water Resource Operating Strategy: Shamrock Station Irrigation Project – Stage 1 Development

Bore Name (production monitoring) or	Location coordinates (Zone 51)		Aquifer name	Elevation (m AHD)	Depth (m bgl)	Screened interval (m bgl)	Construction details (bore logs to be provided to the department)	Depth of monitoring (pressure / salinity logger) (m bgl)	Comment
	Northing	Easting							
9. 17MB004	7961790	395540	Broome Sandstone	TBA	TBA	TBA	TBA, not yet constructed	TBA	Pressure logger only. Sampling depth to be located nominally 5 – 10 m below the water level
10. 15LAG6S	7955345	393478	Broome Sandstone	29.796	40.5	36.94- 39.94	PVC – Class 18	38	Currently installed with DWER pressure logger. To be replaced with a pressure logger when it fails. Sampling depth to be located nominally 5 – 10 m below the water level
11. 15LAG6D	7955354	393486	Broome Sandstone	29.804	216	198-210	PVC - Class 18		Pressure logger only. Maintained by DWER.
12. 15LAG7S	7955172	399587	Broome Sandstone	34.97	31.73	28.73- 31.73	PCV – Class 18	30	Currently installed with DWER pressure logger. To be replaced with a pressure/salinity logger when it fails, located at a depth of 30 m bgl.
13. 15LAG7I	7955169	399584	Broome Sandstone	34.994	71.36	65.36- 71.36	PVC – Class 18	68	Currently installed with DWER pressure logger. To be replaced with a pressure/salinity logger when it fails, located at a depth of 68 m bgl.
14. Injudinah Swamp Claypan	7945750	384350	Surface water	TBA	TBA	TBA	TBA, not yet constructed	TBA	Pressure /salinity logger. Sampling depth to be determined following construction.



### 3 Identifying and managing impacts

The key issues that must be closely managed for the Stage 1 Project are:

1. over abstraction
2. drawdown impacts on other users
3. drawdown impacts on groundwater dependent ecosystems
4. groundwater salinity including movement of the salt water interface
5. changes to water quality due to abstraction and/or use.

The Monitoring and Management Plan (Attachment 1) details:

- management objectives related to each key issue
- a monitoring program that will provide baseline and ongoing water level and quality data against which early warning and immediate management intervention triggers will ensure compliance with the management objectives
- a two-tiered response plan stipulating actions if either an early warning or immediate management intervention trigger are exceeded for each management objective.

## 4 Operating rules

The operating rules for the proposed groundwater production bores for the Stage 1 Project are specified in Table 2. Pending the final design, 12 production bores are anticipated to be drilled and constructed in a staged approach over the next 1-3 years (including one existing bore - PB01, see Figure 1 in Section 8). Annual abstraction from any one of the 12 production bores is anticipated to be approximately 1/12<sup>th</sup> of the total licenced volume. Accordingly, the volume of cumulative abstraction during the bore construction phase will gradually increase up to the total licenced volume (9.467 GL/annum) as each production bore / pivot is commissioned. Pumping will occur predominantly throughout the dry season months from April to November, with an annual demand of up to approximately 20 ML/Ha/year. The staged bore construction phase will provide an opportunity to establish a water level and water quality baseline at dedicated monitoring bores as any drawdown impacts during construction/commissioning are likely to be very localised.

Groundwater modelling as described in the H3 report identified a low risk of drawdown impacts to Injudinah Swamp and the saltwater interface. To minimise potential impacts, the use of moisture meters will reduce the risk of overwatering and monitoring bores will provide baseline and ongoing water level and water quality data against which early warning and immediate management intervention triggers will ensure compliance with the management objectives. Extensive details on both the monitoring requirements and management responses are provided in Attachments 1A and 1B respectively.

**Table 2 Operating rules for production bores**

Bore name	Installed pumping capacity*	Indicative annual abstraction per bore	Operating protocols	Bore abstraction strategy
<b>EXISTING BORE</b>				
1. PB1	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
<b>PROPOSED BORES</b>				
2. S1PB01	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
3. S1PB02	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
4. S1PB03	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
5. S1PB04	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
6. S1PB05	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
7. S1PB06	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
8. S1PB07	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
9. S1PB08	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
10. S1PB09	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
11. S1PB10	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations
12. S1PB11	70-90 L/sec	791,666 kL	Principal	Seasonal variations, crop use will determine monthly variations

\* final pump capacity will be informed by aquifer pumping test results.

## 5 Monitoring and reporting

The Monitoring and Management Plans (Attachment 1) have been developed in close consultation with DWER.

### 5.1. Purpose

Argyle Cattle Company (ACC) recognise the importance of establishing and maintaining a comprehensive groundwater-monitoring program. Meaningful data collected from production bores and monitoring bores not only provides evidence that development is occurring within predicted levels of impact, but also provides business confidence that the resource is capable of sustaining development over the long-term.

Specifically, the purpose of the monitoring program is to:

- record the volumes of groundwater abstracted and characterise any spatial or seasonal abstraction trends
- identify and quantify any drawdown impacts from abstraction
- identify and quantify any groundwater quality changes due to abstraction and irrigation.

The general approach will involve manual measurements on production bores and both automated and manual measurements on monitoring bores. The Stage 1 monitoring network will include all production bores; coupled with six existing bores, seven new dedicated monitoring bores and one surface water monitoring station as outlined in the Monitoring Plan (Attachment 1A).

### Commitments

- The licensee will carry out and report to the department on the monitoring program outlined in sections 5.2 – 5.6.
- An annual water monitoring summary will be prepared at the end of each water use year in accordance with DWER Operational Policy 5.12 *Hydrogeological reporting associated with a groundwater well licence* (DoW 2009a, 2012).

## 5.2. Sub-stages of Development

Stage 1 itself will be developed over a number of years; therefore, installation and operation of the Stage 1 monitoring bore network will also be staged commensurate with expansion of the irrigation footprint. Table 3 outlines the various sub-stages of development and monitoring as Stage 1 expands in a south-westerly direction. These sub-stages are also distinguished via highlighted text in the Monitoring Plan (Attachment 1A).

**Table 3 Sub-staging of production bores, irrigation development and monitoring**

Sub-stage	No. production bores	Locations	Monitoring
1A	1 - 4	PB1, S1PB001, S1PB02, S1PB03	all existing monitoring bores listed in Attachment 1A
1B	5 - 8	S1PB04, S1PB05, S1PB06, S1PB09	as above + 17MB001S/MB001I + 17MB003S/MB003I + MB004
1C	9 - 12	S1PB07, S1PB08, S1PB10, S1PB11	as above + “Injudinah Swamp Claypan”

DWER requires installation of 17MB003S/17MB003I at commencement of sub-stage 1B or earlier if water level or water quality impacts greater than those predicted through the H3 assessment are observed at existing bores 15LAG06S/15LAG06D as determined by the Department’s regional hydrogeologist.

It is understood that DWER and DPIRD are currently planning the drilling and construction of several deep Salt Water Interface Monitoring (SWIM) bores to the west of the Great Northern Highway in LaGrange. Accordingly, ACC will use any suitable SWIM bores established by WA Government and commence monitoring of MB002S/MB002I (or nearest available site) as soon as these bores have been installed by DPIRD/DWER. In the event that DWER do not establish a SWIM site at MB004, ACC will commit to installing MB004 at sub- stage 1B provided that Thangoo Station grants permission for ACC to (i) drill and construct a bore, and (ii) access the site for monitoring purposes on a regular and ongoing basis.

Likewise, ACC’s commitment to install and monitor the MB003S/MB003I bores and the “Injudinah Swamp Claypan” site on Frazier Downs Station is conditional on Karajarri traditional owners granting permission for these activities.

If permission from third party land owners is not granted, then alternative monitoring arrangements will need to be developed and agreed between ACC and DWER for inclusion in a revised Operating Strategy. Such arrangements may include WA Government using its powers to install and access the required infrastructure, or moving the monitoring bore sites to more accessible sites such as road reserves etc.

### 5.3. Water use measurement

The make and model of the water meters for production bores is yet to be determined; however, will be a certified water meter that meets Australian Standards. Frequency of recording will be monthly (Table ).

*This section will be updated once water meter details are available.*

**Table 4 Water meter details for production bores**

<b>Draw point (production bore number)</b>	<b>Description of meter installed (make, serial no. installation date)</b>	<b>Meter maintenance/ Calibration schedule</b>	<b>Frequency of recording data (e.g. same day every month)</b>
1. PB1	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
2. S1PB01	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
3. S1PB02	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
4. S1PB03	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
5. S1PB04	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
6. S1PB05	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
7. S1PB06	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
8. S1PB07	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
9. S1PB08	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
10. S1PB09	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
11. S1PB10	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly
12. S1PB11	Make & model TBC however will be a certified water meter that meets with Australian Standards	determined by make/model and Australian standards.	Monthly

## Commitments

- Install a meter on each water draw-point through which water is taken under the licence
- When installing meters ensure compliance with the *Rights in Water and Irrigation (Approved Meters) Order 2009*;

and for each meter installed

- maintain the meter in good condition and ensure that it is operating within a range of plus or minus 5% of the quantity of water that passes through it when tested in field conditions
- notify DWER within 7 days of detecting a malfunction of the meter
- record the meter reading at the end of each month and provide a copy of the meter readings to DWER within 30 days of the water year (see water year condition on licence)
- submit meter reads to DWER via the online system called Water Online
- within 30 days of the installation of meters, submit to DWER the information listed in section 41C(2) of the Rights in Water and Irrigation Amendment Regulations 2018

### 5.4. Water level monitoring

Refer to Table 1 for the location of existing and proposed new monitoring bores and the Monitoring and Management Plan (Attachment 1) for details regarding the frequency of water level monitoring.

### 5.5. Water quality monitoring

Refer to Table 1 for the location of existing and proposed new monitoring bores and the Monitoring and Management Plan (Attachment 1) for details regarding the frequency of water quality monitoring. Comprehensive chemistry analysis will be carried out in accordance with Appendix C4, Operational policy 5.12 (DoW 2009c).

### 5.6. Environmental monitoring

Vegetation health monitoring is to be conducted at Injudinah Swamp if water level triggers are exceeded. The purpose of the monitoring is to determine if the exceedance of water level triggers has impacted the health of groundwater dependent vegetation.

Two baseline vegetation health monitoring transects have been established in groundwater dependent vegetation at Injudinah Swamp, one 'impact' site located at the northern end of the swamp, closest to the Project, and one control site located near 15LAG09S&I (Phoenix 2018).

Meandering transects were installed at both the control and impact site, with 30 individuals each of phreatophytic tree species *Sesbania formosa* and *Melaleuca cajuputi* subsp. *cajuputi* selected for health monitoring and permanently tagged. The health of the tree was recorded utilising the scale of Casson *et al.* (2009), as well as the three-part assessment scale of Department of Water (2017) to provide equivalent data for vegetation health transects monitored by DWER. At either end of each transect, 20 x 20 m plots were installed and a health rating, count of canopy species present and visual estimate of canopy foliage cover recorded. Depth to groundwater was measured at three points along each transect. Refer to '*Injudinah Swamp baseline vegetation assessment and installation of vegetation health monitoring transects for the Shamrock Station Irrigation Project*' (Attachment 2).

Where future vegetation monitoring is triggered, methods will entail re-assessment of each transect and plot in accordance with the methods listed above and comparison of results between sampling events. All other

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observable disturbances (e.g. fire, storm damage, grazing, weed infestation) will be noted and considered in relation to the potential cause of any identified decline in vegetation health.

### Commitments

- Baseline vegetation condition established prior to Stage 1 abstraction commencing.
- Bi-annual (end of dry season and during irrigation season, e.g., July) for early detection where groundwater level trigger exceeded.

## 6 Environmental impact management

The Stage 1 Project was referred to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986* (EP Act) on 21 September 2017 and subsequently assessed by EPA at the level of Assessment on Referral Information. The EPA released its report in May 2018 (Report 1615) recommending approval for the Stage 1 Project. Ministerial approval was subsequently granted on 19 November 2018 (Statement No. 1086) subject to the implementation of a number of conditions.

Of relevance to this DWROS, this includes the requirement to develop and implement an Operational Environmental Management Plan (EMP) that demonstrates the following environmental objectives will be met:

- Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause long term impacts on the values of Injudinah Swamp and on the hydrological regime and water quality of the Broome Sandstone Aquifer.
- Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause significant change in the location of the saltwater interface due to the abstraction of water for the proposal.

The EMP will reflect and be consistent with the monitoring and management commitments specified in this DWROS.

The Stage 1 Project was referred to the Australian Government Minister for the Environment and Energy under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 7 August 2017 (EPBC 2017/8004). The Project was deemed a controlled action on 2 February 2018 due to potential impacts on matters of national environmental significance (MNES). Level of assessment was set at Assessment on Preliminary Documentation on 13 June 2018. Of relevance to this DWROS, the Commonwealth Department of the Environment and Energy (DoEE) had concern for potential impacts from groundwater abstraction on Roebuck Bay RAMSAR site, West Kimberley National Heritage area and migratory species.

The EPBC Act assessment is still underway; however, extensive consultation has been undertaken between DoEE, ACC, DWER to incorporate DoEE's requirements into the monitoring and management response plans in this DWROS to ensure groundwater abstraction for the Stage 1 Project does not have a significant impact on any MNES.

Adaptive management is a systematic process for improvement and is critical to leading – practice water management. Adaptive management works by evaluating how effective a process or strategy is in meeting a defined objective. Monitoring data submitted in annual reports will be reviewed and evaluated against management objectives, and recommendations made to modify monitoring and management plans will be provided with the reports. Proposed changes to the operating strategy and related water management objectives and outcomes are reviewed and approved by DWER.

The annual monitoring report will contain a section with any recommended changes to the monitoring program for the department's consideration. Changes to conditions/commitments in an operating strategy can be approved by an addendum to the operating strategy (see Appendix C of Operational policy 5.08). A Groundwater Monitoring review will be due in 12 months' time and baseline monitoring data will advise the setting of management trigger levels discussed in the management response plan, Attachment 1.

### Commitments

- The licensee will carry out and report to the department on the following management program:
  - Attachment 1B: Shamrock Station Irrigation Project Stage 1 Management Response Plan



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- A triennial water monitoring review will be prepared in accordance with DWER Operational Policy 5.12 and due 3 months following the end of the water year, beginning in 2020 and every 3 years after. A water monitoring summary will not be due in this year.

### 6.1. Environmental values

Injudinah Swamp, a groundwater dependant ecosystem (GDE) listed in the La Grange Groundwater Allocation Plan as a wetland of State significance, is located approximately 15 km south-west of the proposed Stage 1 development area.

Potential impacts include:

- reduction in groundwater level of the shallow water table
- reduction in ecosystem health associated with reduced groundwater input to the GDE.

The Monitoring and Management Plan (Attachment 1) details early warning and immediate management intervention triggers and associated operational responses to ensure minimal impact to the ecological health of Injudinah Swamp.

The management response plan states that trigger levels will be set in consultation with DWER following one year of continuous baseline monitoring to assess natural variation. Trigger level is to be set 0.25m below the long-term dry season average minimum groundwater level at each bore. The long-term dry season average minimum is calculated from annual minimum groundwater levels recorded at the end of each dry season.

### 6.2. Existing users

Shamrock Gardens is located approximately 6 km south south-west of the proposed Stage 1 development area with the nearest community, Nygah Nygah, located approximately 11 km to the west. Potential impacts to the existing users include:

- reduction in ability to abstract groundwater
- increased salinity.

The Monitoring and Management Plan (Attachment 1) provides details of existing and new proposed monitoring bores, including 17MB001S/I, 15LAG07S/1, 15LAG06S/D and 17MB002S/D, which will be monitored between the irrigation development and neighbouring existing users to provide early warning of drawdown and water quality impacts. The plan states that trigger levels will be set in consultation with DWER following one year of continuous baseline monitoring to assess natural variation.

### 6.3. Surface water

No surface water will be taken for the Stage 1 Project, therefore there will be no impacts to environmental values associated with surface water systems. As per the management response plan, surface water levels at PEC will not be set before a reliable baseline is acquired. External variables including climatic conditions and water consumption by stock may preclude adoption of surface water levels as triggers for management action.

### 6.4. Social values

Groundwater is being used for this development and it is acknowledged that groundwater dependent ecosystems in the La Grange area (e.g., Injudinah Swamp) have social and recreational and cultural values that will be explicitly protected through the Monitoring and Management Plan (Attachment 1). Traditional owners of the land are responsible for the co-management of the Injudinah Swamp and maintaining good relationships via regular communication will ensure access to monitoring sites and compliance with this operating strategy.

## 6.5. Groundwater quality and the salt water interface

As stated in section 3, there is a risk that groundwater abstraction in this location may have a very minor influence on the position of the coastal saline wedge. Little is understood about the relationship between fresh groundwater expression offshore and sea grass beds in this location. A change in the salinity of the groundwater has the risk of impacting GDE and other groundwater users and will be managed by monitoring and setting water quality trigger levels. The management response plan sets trigger levels to detect change in groundwater salinity to ensure the saltwater interface remains within the predicted range and this should be evaluated continuously as more data becomes available.

The take of groundwater for this project will enable the irrigation of crops and this activity has associated potential impacts to the groundwater resource. Fertiliser application will be managed so as to not contaminate the groundwater and cause unacceptable change in water quality. Best practice recommended fertiliser application rates will be applied to this project, crops will not be over irrigated, and a nutrient irrigation management plan will be developed. Monitoring bores will be sampled to detect any potential adverse water quality impacts.

## 7 Contingency program

Contingency planning is a component of good business practice. For developments with a water use licence, contingency planning is important to prepare for change in water use operations to prevent a breach of a water licence condition or commitment. Not all components of contingency programs will involve a breach of a water licence condition. For example, the issue of a water licence does not guarantee a reliable water supply. Argyle Cattle Company has therefore planned for circumstances when there may be a shortfall in water supply due to either natural or mechanical reasons (e.g. bores fail to deliver required volume, or a drought occurs).

With seasonal groundwater level and salinity response not well known, the Monitoring and Management Plan (Attachment 1) has been designed to safeguard the groundwater resource, environment and existing users via a network of dedicated early warning monitoring bores. This data will provide temporal groundwater level and salinity data across Shamrock Station and in the adjacent coastal area. Although routine groundwater level monitoring at three to six monthly intervals has occurred in the La Grange area over the past four to five years, including on Shamrock Station, Frazier Downs, Shamrock Gardens and from Main Roads WA bores along the Great Northern Highway, the magnitude of groundwater level change in response to seasonal conditions is relatively unknown. Further analysis of seasonal response is required to accurately assess seasonal baseline condition.

Similarly, baseline salinity condition in response to seasonal stresses imposed by pumping is unknown. Groundwater salinity status on Shamrock Station was established in 2013 during a water quality survey of the La Grange area (refer to Section 4 of the H3 report); however, no temporal groundwater salinity data has been routinely recorded.

Management triggers, as described in the Monitoring and Management Plan (Attachment 1), will be adopted following an assessment of natural variation during the first year of operation to establish a reliable baseline.

The assessment of management trigger levels will be undertaken across the water use year to avoid misinterpretation of seasonal variation throughout each year. This relies on establishing a meaningful long-term baseline for both groundwater level and salinity.

### 7.1. Management response

The Monitoring and Management Plan (Attachment 1) provides details of Level 1 and Level 2 management responses to early warning Level 1 triggers and intervention Level 2 triggers.

Level 1 responses may include:

- Reassessment of drawdown predictions
- Review of climatic influences
- Repeat measurement
- Review of seasonal EC trends
- Internal investigations
- Development of an abstraction plan
- Development of a water quality plan
- Annual vegetation condition monitoring.

A Level 2 response may include:

- Ceased abstraction (Abstraction greater than the annual water entitlement)
- Management actions stipulated in the abstraction plan developed following a Level 1 response
- Management actions stipulated in the water quality plan developed following a Level 1 response
- Vegetation condition and stress assessment.

Establishing baseline water level and water quality data prior to full abstraction of the licenced volume sets a benchmark against which appropriate trigger levels can be determined. If an early warning Level 1 trigger is exceeded, the Level 1 response provides scope for additional/repeat measurements, investigations and assessment and development of abstraction or water quality plans. Therefore, it is anticipated that all management actions will be effective in limiting detrimental impacts due to the scientific rigour applied in developing the abstraction/water quality plans.

## 7.2. Non-compliance

Contingency responses for non-compliance of water licence terms and conditions are outlined in Table 5.

**Table 5 Contingency responses for non-compliance**

<b>Non-compliance Issue</b>	<b>Contingency Program</b>	<b>Comment</b>
Water meter breaks down	Monitor meter through technology where possible on a daily basis and visual inspections on a weekly basis. Spare meters will be held onsite	Technology will be used where possible to signal if/when any component of the pumping system is malfunctioning
Over abstraction	Monthly flowmeter readings and volume calculations	Refer attachment 1B for level 2 response.

### 7.3. Limited water supply

Contingency responses for limited water supply are outlined in Table .

*Contingency responses are to be identified after test drilling occurs and better understanding of water depth and flow at each site is determined.*

**Table 6 Contingency responses for limited water supply**

<b>Reason for limited water supply</b>	<b>Contingency Program</b>	<b>Comment</b>
Water level in bore drops below total depth of bore	Utilise other production bore(s) whilst remedy is being organised	Possible in the event of successive poor wet seasons limiting aquifer recharge/recovery; also, potential if bore silting or clogging (biofouling) occurs

### 7.4. Flooding

Investigations have not been undertaken to determine flood risk, but this is considered to be low due to the proposed development area’s position within the catchment area.

### 7.5. Unexpected aquifer response

Refer to the Monitoring and Management Plan Attachment 1 and Section 7.1.

### 7.6. Unexpected water quality trends

Refer to the Monitoring and Management Plan Attachment 1 and Section 7.1.

### 7.7. Unexpected environmental impacts

Refer to the Monitoring and Management Plan Attachment 1 and Section 7.1.

## 8 Associated maps

The location of the Stage 1 Project and proposed bore network relative to Injudinah Swamp, existing users and groundwater depth is shown in Figure 1.

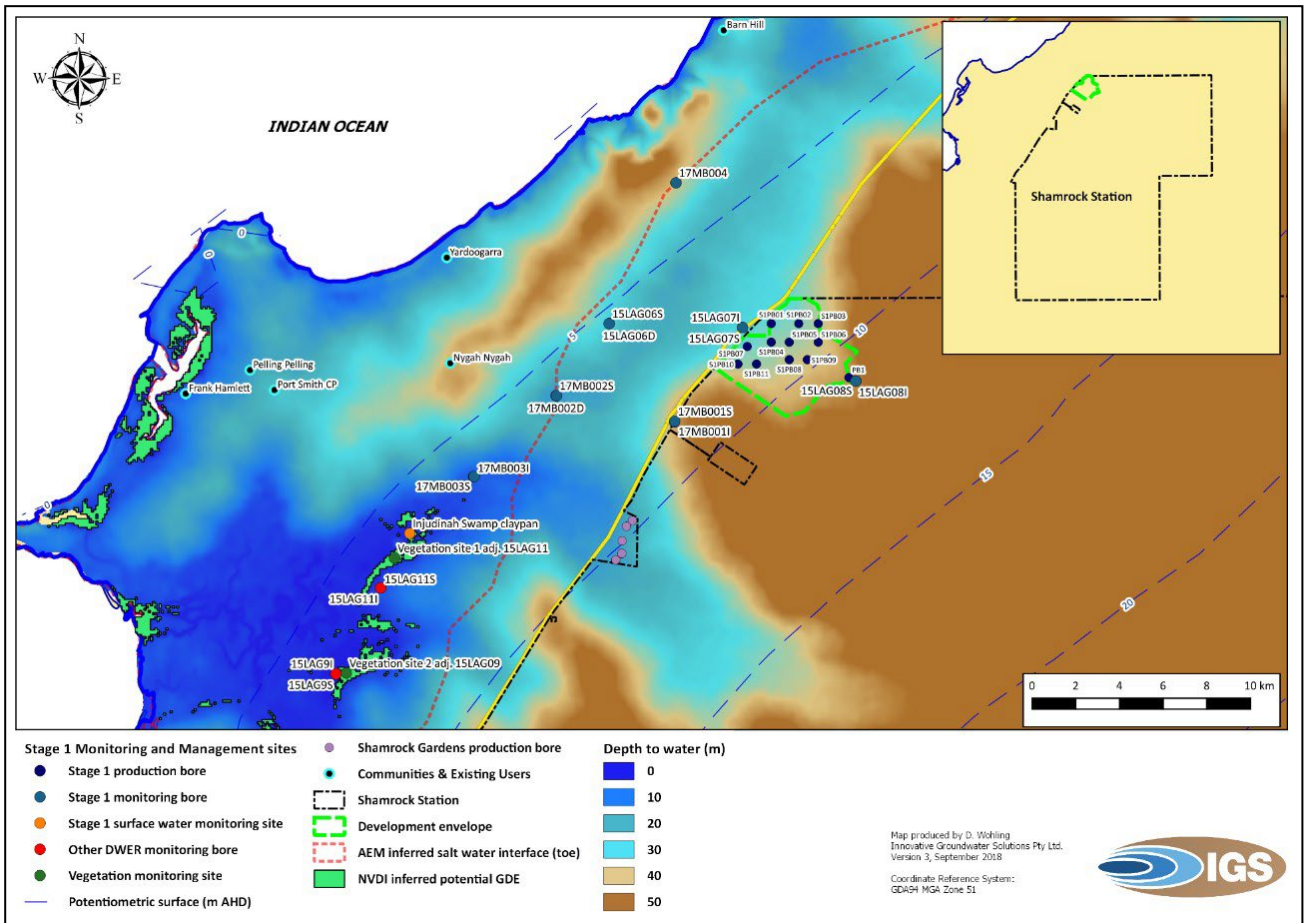


Figure 1 Shamrock Station – Stage 1 development envelope, proposed bore locations, water values and existing users

## 9 Water use efficiency

In accordance with DWER's Operational Policy 1.02 *Policy on water conservation/efficiency plans: Achieving water use efficiency gains through water licensing* (DoW 2009b), water licensees must take appropriate measures to ensure water is used effectively and efficiently.

The use of centre pivots enables the precise management of water application to be applied in an efficient manner. Run-off from this system is minimal as the water is distributed at the rate required for optimum plant production by considering soil moisture requirements, evaporation and transpiration rates.

Technology will be utilised where possible in the Stage 1 Project to monitor and control water application frequency and volume. The project will adapt to best practice learnings from the industry that is developing in the region.

The irrigation schedule will be modified according to data generated from regular monitoring of crop water usage and soil moisture status with irrigation volumes calculated according to plant requirements and soil moisture content for each individual pivot.

The aims of this system are to optimise plant uptake and minimise waste. This is achieved by:

- Weekly field inspections and monitoring.
- Basing irrigation duration on a Crop Factor as a percentage of daily evaporation (refined by crop type and condition categorisation by actual soil moisture response).
- Regular monitoring of soil moisture in the top 150 cm of the profile with the use of moisture probes.
- Measuring pasture production, utilising where possible an irrigation program for precision application, programmed according to local temperature, rainfall and plant needs.
- The water frequency, rates and watering days will be matched to the evaporation rates, soil moisture reserves and plant health needs.
- Watering cycles will be varied based on both weather conditions and the growth requirements of the pastures and crops.
- Application rates will be adjusted by monitoring of root zone moisture, which will reflect the evapotranspiration rate and therefore plant requirements.
- The daily irrigation program will be altered to allow for climatic changes that occur throughout the year. Bureau of Meteorology forecasts and weather will be used to assist in determining irrigation requirements in conjunction with the growth stage of the pastures and crops.
- Irrigation will cease in the event of any surface run-off occurring or rainfall events that are expected to result in surface run-off occurring. This will minimise both run off and nutrient loss through leaching.
- Further potential for improved water efficiency may be gained from implementation of best practice farming approaches to minimise soil disturbance and associated increases in evaporation, for example, by operating with minimum tillage for ongoing improvement of organic matter and soil structure.

## 10 Summary of Commitments

1. The licensee will carry out and report to the department on the following:
  - Attachment 1A: Shamrock Station Irrigation Project Stage 1 Monitoring Plan, and
  - Attachment 1B: Shamrock Station Irrigation Project Stage 1 Management Response Plan
2. Install a meter on each water draw-point through which water is taken under the licence
  - a. When installing meters ensure compliance with the *Rights in Water and Irrigation (Approved Meters) Order 2009*; and for each meter installed
  - b. maintain the meter in good condition and ensure that it is operating within a range of plus or minus 5% of the quantity of water that passes through it when tested in field conditions
  - c. notify DWER within 7 days of detecting a malfunction of the meter
  - d. record the meter reading at the end of each month and provide a copy of the meter readings to DWER within 30 days of the water year (see water year condition on licence)
  - e. submit meter reads to DWER via the online system called Water Online
  - f. within 30 days of the installation of meters, submit to DWER the information listed in section 41C(2) of the Rights in Water and Irrigation Amendment Regulations 2018
3. Baseline vegetation condition established prior to Stage 1 abstraction commencing.
4. Bi-annual vegetation monitoring (end of dry season and during irrigation season, e.g., July) for early detection where groundwater level trigger exceeded.
5. An annual water monitoring summary will be prepared at the end of each subsequent water use year in accordance with DWER Operational Policy 5.12 *Hydrogeological reporting associated with a groundwater well licence* (DoW 2009a, 2012).
6. A triennial water monitoring review will be prepared in accordance with DWER Operational Policy 5.12 and due 3 months following the end of the water year, beginning in March 2022 and every 3 years after. A water monitoring summary will not be due in these years.



## 11 References

Relevant documents to this DWROS include:

- DoW. 2009a. *La Grange Groundwater Allocation Plan. Water resource allocation and planning series. Report no. 25.* Department of Water, Perth, WA. Available at: <http://www.water.wa.gov.au/planning-for-the-future/allocation-plans/north-west-region-allocation-plan/la-grange-groundwater-allocation-plan>
- DoW. 2009b. *Operational policy no. 1.02 – Policy on water conservation/efficiency plans: Achieving water use efficiency gains through water licensing. September 2009.* Department of Water, Perth.
- DoW. 2009c. *Operational policy no. 5.12- Hydrogeological reporting associated with a groundwater well licence.* Department of Water, Perth.
- DoW. 2011. *Operational Policy 5.08: Use of operating strategies in the water licencing process June 2011.* Department of Water, Perth.
- DoW. 2012. *La Grange groundwater allocation plan: Evaluation statement 2011–2012.* Department of Water, Perth, WA. Available at: <http://www.water.wa.gov.au/planning-for-the-future/allocation-plans/north-west-region-allocation-plan/la-grange-groundwater-allocation-plan>
- IGS. 2017. *Shamrock Station irrigation development. Stage 1 hydrogeological assessment.* Innovative Groundwater Solutions, Middleton, SA. Unpublished report prepared for Argyle Cattle Company Pty Ltd.
- Phoenix. 2018. *Injudinah Swamp baseline vegetation assessment and installation of vegetation health monitoring transects for the Shamrock Station Irrigation Project.* Phoenix Environmental Sciences Pty Ltd, Balcatta, WA. Unpublished report prepared for Argyle Cattle Company.

Attachment 1 Shamrock Station Irrigation Project Stage 1 Monitoring and Management Response Plans.

ATTACHMENT 1A: Shamrock Station Irrigation Project Stage 1 Monitoring Plan. Highlighted text refers to sub-stages of development: Stage 1A, Stage 1B and Stage 1C (refer Table 3). Asterisks denote monitoring to commence once these Salt Water Interface Monitoring (SWIM) bores have been installed by WA Government.

Category	Parameters	Monitoring Site	Frequency	Time	Comment
Baseline groundwater quality	pH, conductivity (compensated to 25 °C), TDS, Alkalinity (as CaCO <sub>3</sub> ), Na, Ca, K, Mg, Carbonate, Bicarbonate, Chloride, Sulphate, Nitrate, Total Nitrogen Oxides (or Nitrite), Ammonia, Total Kjeldahl Nitrogen, Nitrogen, Phosphate, Total Phosphorus, Aluminium, Bromide, Boron, Cadmium, Chromium, Copper, Fluoride, Iron, Lead, Molybdenum, Nickel, Silicon, Strontium, Zinc	New production and monitoring bores	Once-off	After bore construction	Pumped sample not airlift sample  Depth of sampling point must be reported
Climate	Rainfall	Bureau of Meteorology Bidyadanga	daily	9 am	Data downloaded for annual reporting purposes
Water Use	Flowmeter reading	Production bores Any new / replacement production bores	monthly	As close as practicable to the end of the month	
Barometric pressure	Pressure (pressure transducer logged data)	On-site monitoring bore 15LAG08S On-site monitoring bore MB17001S	hourly	Ongoing	Used to correct pressure readings collected by pressure transducers recording changes in groundwater level
Groundwater pressure	Pressure (pressure transducer logged data) – on-site monitoring bores	17MB001S, 17MB001I 15LAG08S, 15LAG08I	hourly	Ongoing	EC also logged at these sites (see below) 15LAG08SI pressure logger provided by DWER but to be replaced by ACC when it fails. Depth of sampling point to be located within the screened/slotted interval of the bore (Table 1).
	Pressure (pressure transducer logged data) – regional monitoring bores	15LAG6S, 15LAG6D 15LAG7S, 15LAG7I 17MB002S*, 17MB002D* 17MB003S, 17MB003I 17MB004*	hourly	Ongoing	Subject to land access permission 15LAG6D pressure logger provided and maintained by DWER EC also logged at some of these sites (see below) 15LAG07SI pressure logger provided by DWER but to be replaced by ACC when it fails. Depth of sampling point to be located within the screened/slotted interval of the bore (Table 1).
Groundwater levels	Depth to water – on-site monitoring bores	17MB001S, 17MB001I 15LAG08S, 15LAG08I	quarterly	Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct	
	Depth to water – regional monitoring bores	15LAG6S, 15LAG6D 15LAG7S, 15LAG7I 17MB002S*, 17MB002D* 17MB003S, 17MB003I 17MB004*	quarterly	Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct	Subject to land access permission
Groundwater quality	Field electrical conductivity and pH	All operating production bores	monthly	As close as practicable to the end of the month. Measurements taken using a hand-held pH & electrical conductivity meter	

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Category	Parameters	Monitoring Site	Frequency	Time	Comment
	Electrical conductivity (logged data)	17MB001S, 17MB001I 15LAG08S, 15LAG08I	hourly		Depth of sampling point to be located within the screened/slotted interval of the bore (refer to Table 1).
		17MB003S, 17MB003I 15LAG7S, 15LAG7I			Subject to land access permission Depth of sampling point to be located within the screened/slotted interval of the bore (Table 1).
	Field electrical conductivity and pH	17MB001S, 17MB001I 15LAG8S, 15LAG8I	Quarterly for the first year	Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct	Subject to land access permission
		15LAG7S, 15LAG7I 17MB002S* 17MB003S, 17MB003I			
	Field electrical conductivity (profiling)	15LAG06D 17MB002D* 17MB004*	annual	ongoing	Subject to land access permission 17MB004 included at request of DoEE Down-hole profiling using EC sonde in the two new, fully-penetrating bores. Options for 15LAG06D include sonde in the slotted interval, deep EC logger, or induction logging.
	Total Nitrogen	17MB003S, 17MB003I 17MB002S* 15LAG7S, 15LAG7I	Quarterly for the first year	Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct	Subject to land access permission
pH, conductivity (compensated to 25 °C), TDS, Alkalinity (as CaCO <sub>3</sub> ), Na, Ca, K, Mg, Carbonate, Bicarbonate, Chloride, Sulphate, Nitrate, Total Nitrogen Oxides (or Nitrite), Ammonia, Total Kjeldahl Nitrogen, Nitrogen, Phosphate, Total Phosphorus, Aluminium, Bromide, Boron, Cadmium, Chromium, Copper, Fluoride, Iron, Lead, Molybdenum, Nickel, Silicon, Strontium, Zinc	Production bores 17MB001S, 17MB001I 15LAG08S, 15LAG8I	annual	Sep/Oct	Which production bores to be annually sampled will be agreed upon once bores have been constructed - at a minimum all western-most pivots must be sampled	
	17MB002S* 15LAG7S, 15LAG7I		Sep/Oct	Subject to land access permission	
Surface water levels	Pressure (pressure transducer logged data)	Injudinah Swamp Claypan	hourly	Ongoing	Subject to land access permission
	Depth of water (manual using staff gauge)		quarterly	Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct	
Surface water quality	electrical conductivity and pH (logged data)	Injudinah Swamp Claypan	hourly	Ongoing	Subject to land access permission
	Field electrical conductivity and pH,		Quarterly for the first year	Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct	
	pH, conductivity (compensated to 25 °C), TDS, Alkalinity (as CaCO <sub>3</sub> ), Na, Ca, K, Mg, Carbonate, Bicarbonate, Chloride, Sulphate, Nitrate, Total Nitrogen Oxides (or Nitrite), Ammonia, Total Kjeldahl Nitrogen, Nitrogen, Phosphate, Total Phosphorus, Aluminium, Bromide, Boron, Cadmium, Chromium, Copper, Fluoride, Iron, Lead, Molybdenum, Nickel, Silicon, Strontium, Zinc		Quarterly for the first year	Dec/Jan, Mar/Apr, Jun/Jul, Sep/Oct	

Detailed Water Resource Operating Strategy: Shamrock Station Irrigation Project – Stage 1 Development

Category	Parameters	Monitoring Site	Frequency	Time	Comment
Vegetation monitoring	Vegetation condition	Transects of potential groundwater dependent vegetation at <ul style="list-style-type: none"> <li>• closest potential groundwater-dependent vegetation within PEC to project;</li> <li>• near Injudinah Swamp Claypan surface water monitoring site; and</li> <li>• control (non-impact site)</li> </ul>	Baseline & Annual if water level trigger exceeded	Baseline to be established prior to Stage 1 abstraction commencing i.e., end of dry season. Bi-annual (end of dry season and during irrigation season, e.g., July) for early detection where groundwater level trigger exceeded	

**ATTACHMENT 1B: Shamrock Station Irrigation Project Stage 1 Management Response Plan**

“Level 1 trigger” is to provide early warning that impacts may exceed the predicted conditions, and thus investigation of causal factors is warranted. This in-turn may lead to mitigation measures being implemented.

“Level 2 trigger” is a threshold beyond which the impacts are unacceptable and immediate management intervention is required to mitigate against any adverse impacts occurring to existing users or the environment.

Issue	Management Objectives	Measurement	Trigger Description	Level 1 Trigger value	Level 2 Trigger value	Level 1 response	Level 2 response	Comment
Over abstraction	Do not exceed the licensed groundwater allocation	Monthly flowmeter readings and volume calculations	Change in horticultural operations	Greater than expected cumulative groundwater use in the year	AWE	Manage abstraction so that AWE is not exceeded.  Advise DWER of possible breach of licence conditions.  Keep record of correspondence	Cease abstraction until new water year	Exceedance of the AWE is noncompliance to licence conditions
Drawdown impacts on other users	Do not affect neighbor’s ability to abstract groundwater	Groundwater levels at monitoring bores: 17MB001S&I 17MB002S&D 17MB004 15LAG06S&D	water levels lower than predicted	Adopted trigger level to be set following a minimum of one year continuous baseline monitoring to assess natural variation	Adopted trigger level to be set following a minimum of one year continuous baseline monitoring to assess natural variation	Reassessment of drawdown predictions.  Advise DWER of any revised predictions.  If required by DWER, develop a revised abstraction plan for approval by DWER	Invoke management actions stipulated in revised abstraction plan	Need to establish predicted drawdown at 5 years and 10 years at monitoring sites once their final locations have been established.
Drawdown impacts on GDEs	Drawdowns to be within acceptable limits so as not to impact ecological function of identified GDEs	Groundwater levels at new monitoring bore 17MB003S	water levels lower than acceptable	Adopted trigger level to be set following baseline monitoring to assess natural variation. Trigger level to be set 0.25 m below the long-term dry season average minimum groundwater level at each bore. The long-term dry season average minimum is calculated from annual minimum groundwater levels recorded at the end of each dry season	Adopted trigger level to be established once EWRs for the wetland have been established by DWER	Reassessment of drawdowns prediction.  Review data against climate factors to determine cause of trigger exceedance Commence annual vegetation monitoring and report to DWER on vegetation condition	Conduct additional vegetation condition and stress assessment (predawn pressure test) at transects near 15LAG11 and replacement for 15LAG09 If vegetation is stressed either: <ul style="list-style-type: none"> <li>consider the need to apply to DWER for a vegetation clearing permit,</li> <li>reduce, move or cease abstraction until water levels recover</li> </ul> If vegetation is not stressed <ul style="list-style-type: none"> <li>Rerun model to develop revised drawdown at GDEs, and</li> <li>Reassess risk of impacts at GDEs and revise triggers if appropriate</li> </ul>	Need to establish baseline at 17MB003S and 15LAG09I before triggers can be set

Detailed Water Resource Operating Strategy: Shamrock Station Irrigation Project – Stage 1 Development

Issue	Management Objectives	Measurement	Trigger Description	Level 1 Trigger value	Level 2 Trigger value	Level 1 response	Level 2 response	Comment
		Surface water levels at monitoring sites located at PEC Spring		No trigger level to be adopted before reliable baseline is acquired. External variables including climatic conditions and water consumption by stock preclude adoption of surface water levels as trigger for management action	No trigger level to be adopted before reliable baseline is acquired. External variables including climatic conditions and water consumption by stock preclude adoption of surface water levels as trigger for management action			Need to establish baseline at Spring before triggers can be set. A trigger can only be set if long-term baseline data from surface water monitoring can be directly related to shallow water table monitoring, in order to properly characterise the nature of surface water-groundwater connectivity.
Groundwater salinity	Maintain groundwater quality	Electrical conductivity in groundwater from: <ul style="list-style-type: none"> <li>operating production bores</li> <li>monitoring bores 17MB001S&amp;I 17MB003S&amp;I 15LAG7S&amp;I</li> </ul>	Field electrical conductivity exceeds acceptable value	Values exceed baseline by 15% or 200 $\mu\text{S}/\text{cm}$ (whichever is greater). NB. Baseline value will likely be based on 80 <sup>th</sup> percentile of measured historical data.	Values exceed baseline by 25% or 350 $\mu\text{S}/\text{cm}$ (whichever is greater). NB. Baseline value will likely be based on 80 <sup>th</sup> percentile of measured historical data.	Repeat quarterly measurement.	Repeat quarterly measurement.  If the repeat measurement is greater than Level 2 Trigger value, then report exceedance to DWER within 10 working days	Need to establish baseline at 17MB001S&I, 17MB003S&I, and 15LAG7S&I before triggers can be set. In particular, the baseline for 17MB003S needs to account for seasonal and inter-annual wetting and drying cycles and their impact on EC and/or chemistry
						Review of EC data to assess seasonal fluctuations and increasing trend.  Initiate internal investigation regarding causes for increases in salinity.  Report findings in Annual monitoring report.  If required by DWER, develop water quality management plan for approval by DWER	Invoke management actions stipulated in water quality management plan	Water quality management plan will outline actions to which the licensee commits. The WQM may include a change in: <ul style="list-style-type: none"> <li>types of fertilisers used,</li> <li>fertiliser application rates,</li> <li>methods of fertiliser application</li> <li>irrigation practices</li> <li>monitoring regime (locations, frequency and parameters)</li> </ul>
	Ensure saline wedge movement does not impact GDEs, and other users' water supply	Electrical conductivity and water level in groundwater from monitoring bores: 17MB002D, 17MB004 and 15LAG06D	Movement of saltwater interface to remain within predicted range	Values exceed baseline by 15%. NB. Baseline EC profile will likely be based on 80 <sup>th</sup> percentile of measured historical data.	Values exceed baseline by 25%. NB. Baseline EC profile will likely be based on 80 <sup>th</sup> percentile of measured historical data.	Review of EC data to assess seasonal fluctuations and increasing trend.  Initiate internal investigation regarding causes for increases in salinity.  Report findings in Annual monitoring report.	Invoke management actions stipulated in revised abstraction plan	Need to establish baseline for all bores and compare with model predicted drawdown before triggers can be set

Detailed Water Resource Operating Strategy: Shamrock Station Irrigation Project – Stage 1 Development

Issue	Management Objectives	Measurement	Trigger Description	Level 1 Trigger value	Level 2 Trigger value	Level 1 response	Level 2 response	Comment
						If required by DWER, develop a revised abstraction plan for approval by DWER		
Changes to water quality due to abstraction and/or fertiliser application	Maintain groundwater quality	Annual comprehensive water quality analysis of pumped groundwater sampled from: <ul style="list-style-type: none"> <li>production bores</li> <li>monitoring bores 17MB001S&amp;I 15LAG7S&amp;I</li> </ul>	TN TP pH EC – see groundwater salinity issue	Adopted trigger levels for nutrients and pH to be set following a minimum one year of continuous baseline monitoring to assess natural variation.  If water level triggers are exceeded at 17MB003S then quarterly EC and pH will be collected.	Adopted trigger levels for nutrients and pH to be set following a minimum one year of continuous baseline monitoring to assess natural variation.	Repeat sampling if analysis results deemed spurious.  Review of data to assess seasonal fluctuations and trends.  Initiate internal investigation regarding causes for exceedances.  Report findings in Annual monitoring report  If required by DWER, develop water quality management plan for approval by DWER	Invoke management actions stipulated in water quality management plan	Depth of sampling point in bores must be consistent and stipulated in Operating Strategy  Need to establish baseline nutrients and pH before triggers can be set
		Field pH measured quarterly	pH EC – see groundwater salinity issue	No trigger level to be set until baseline established, however routine measurements at following sites should be evaluated and explored if pH drops below 6.0 <ul style="list-style-type: none"> <li>17MB001S&amp;I 17MB002S&amp;D 17MB003S&amp;I 15LAG06S 15LAG7S&amp;I</li> </ul>	Successive quarterly pH measurements not to be lower than 6.0 pH at 15LAG07S&I, 17MB001S&I, 17MB002S, MB003S&I and production bores	Repeat sampling.  Review of data to assess seasonal fluctuations and trends.  Initiate internal investigation regarding causes for exceedances.  If required by DWER, develop water quality management plan for approval by DWER	Invoke management actions stipulated in water quality management plan	Depth of sampling point must be consistent and stipulated in Operating Strategy

Attachment 2 Injudinah Swamp baseline vegetation monitoring report





# PHOENIX

ENVIRONMENTAL SCIENCES

Injudinah Swamp baseline vegetation assessment and  
installation of vegetation health monitoring transects for the  
Shamrock Station Irrigation Project

Prepared for Argyle Cattle Company Pty Ltd

October 2018

Final Report



Injudinah Swamp baseline vegetation assessment and installation of vegetation health monitoring transects for the Shamrock Station Irrigation Project.

Draft Report

Authors: Grant Wells

Reviewer: Karen Crews

Date: 15 October 2018

Submitted to: Cameron McDonald

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K. Crews	Final, submitted to client	0	15/10/2018

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## EXECUTIVE SUMMARY

Argyle Cattle Company Pty Ltd (ACC) is seeking approval to develop the Shamrock Station Irrigation Project (the Project) on Shamrock Station, located 64 km south of Broome, Western Australia.

Groundwater modelling indicates minimal impact is predicted at a groundwater dependent ecosystem, Injudinah Swamp, located ~10 km south-west of the Project; however, monitoring is required to confirm accuracy of predicted changes and ensure no adverse impacts occur to the wetland.

Injudinah Swamp is a suite of wetlands developed as a chain along the contact of the Pindan sand plain and the coastal mud deposits. Two potentially groundwater dependent Priority Ecological Communities (PECs) are located within the swamp. The seepage areas are typically vegetated by *Melaleuca* thickets with *Sesbania Formosa* (Dragon trees) and *Typha domingensis* (Bulrush) around lakes. In the event, that groundwater monitoring trigger values are exceeded, vegetation monitoring is to be conducted at Injudinah Swamp.

In November 2017, the Department of Water and Environmental Regulation (DWER) undertook baseline vegetation monitoring at Injudinah Swamp to inform their review of the La Grange Groundwater Allocation Plan. During the field survey, DWER identified potential monitoring locations for the vegetation health monitoring program for the Project, including a potential impact site and a control site.

Phoenix Environmental Sciences Pty Ltd (Phoenix) subsequently undertook a baseline vegetation health assessment at Injudinah Swamp for the vegetation health monitoring program. The scope of work was as follows:

- conduct a baseline vegetation survey of Injudinah Swamp in the vicinity of the vegetation health monitoring bore transects at Injudinah Swamp and within the area delineated as the Kimberley Vegetation Association 37 PEC
- select suitable monitoring species and install transects to monitor vegetation health at Injudinah Swamp
- collect baseline vegetation health data
- establish depth to groundwater.

The field survey was conducted 25-27 November 2017. Baseline vegetation survey quadrats, monitoring transects and plots were installed and depth to groundwater measured at the two locations identified by DWER.

Two baseline vegetation quadrats (2,500 m<sup>2</sup>) were surveyed to provide a detailed description of the vegetation type at each monitoring site.

Monitoring transects were installed in vegetation dominated by the phreatophytic tree species *Sesbania formosa* and *Melaleuca cajuputi* subsp. *cajuputi*. Along the length of the transect 30 individuals of both *Sesbania formosa* and *Melaleuca cajuputi* subsp. *cajuputi* were selected for health monitoring. A health score and canopy condition rating were recorded for each tree.

At either end of each transect 20 x 20 m plots were installed within which a health rating for each of the three canopy levels, upper, mid and lower was recorded, a visual estimate of the foliage cover of each canopy level and the number of species present in each canopy level.

At three points along the transect, depth to groundwater underlying the vegetation was measured utilising a hand-auger to drill into the ground until water was reached.

Vegetation at both sites was dominated by *Sesbania formosa*, *Melaleuca cajuputi* subsp. *cajuputi* and *Acacia ampliceps*. The structure of the vegetation differed slightly comprising a mid open forest of *Sesbania formosa* and *Melaleuca cajuputi* subsp. *cajuputi* over open tall *Acacia ampliceps* shrubland over low *Cynodon dactylon* grassland at the control transect. At the impact assessment transect, the vegetation comprised a mid *Sesbania formosa* woodland over a tall *Melaleuca cajuputi* subsp. *cajuputi* and *Acacia ampliceps* shrubland.

Tree health and canopy condition differed between the *Sesbania formosa* and *Melaleuca cajuputi* subsp. *cajuputi* at each site and there were intraspecific differences between monitoring sites. A recent fire at the control transect resulted in poorer vegetation health and canopy condition scores for *Melaleuca cajuputi* subsp. *cajuputi* trees in comparison to the impact assessment site. In contrast, tree health and canopy condition of *Sesbania formosa* trees at the impact assessment site were poorer than those recorded at the control site.

Depth to groundwater varied along each transect but was well within the root zone of both tree species at each site.

Future vegetation health assessments should:

- focus on species specific comparisons between transects as the baseline plant health ratings differ between the different species
- ensure any other observable disturbances, e.g. fire, storm damage, grazing, weed infestation, are noted and considered in relation to the cause of any identified decline in vegetation health
- consider that differences in plant health between transects were evident from the baseline surveys.

Continuance of the measurement of depth to groundwater at the monitoring sites is recommended in addition to the broader groundwater monitoring program to facilitate determining if any identified decline in vegetation health has occurred in association with an increase in depth to groundwater.

## 1. INTRODUCTION

Argyle Cattle Company Pty Ltd (ACC) is seeking approval to develop the Shamrock Station Irrigation Project (the Project) on Shamrock Station, located approximately 64 km south of Broome, Western Australia (Figure 1-1). The proposal includes the development of up to twelve 40 ha irrigation pivots, access tracks and water infrastructure for groundwater abstraction. The area will be used to produce irrigated fodder for station use that will be grazed and possibly baled as required.

The Project is located within the vicinity of groundwater dependent ecosystems (GDEs), the closest being Injudinah Swamp, approximately 10 km to the south-west (Figure 1-1). Groundwater modelling indicates minimal impact is predicted at Injudinah Swamp from groundwater abstraction (IGS 2017); however, monitoring is required to confirm accuracy of predicted changes and ensure no adverse impacts occur to the wetland. A groundwater monitoring program is to be implemented across a suite of production bores, onsite monitoring bores and regional monitoring bores, including a monitoring point at Injudinah Swamp as it is the nearest potential GDE and the only one identified within the potential zone of impact from the Project (Figure 1-1).

Injudinah Swamp is a suite of wetlands developed as a chain along the contact of the Pindan sand plain and the coastal mud deposits (Phoenix 2017). The flow of freshwater from groundwater aquifers that would normally discharge to the coast is perturbed and retarded by coastally deposited muds resulting in seepage zones, springs and lakes. The seepage areas are typically vegetated by *Melaleuca* thickets with *Sesbania Formosa* (Dragon trees) and *Typha domingensis* (Bulrush) around lakes.

Two potentially groundwater dependent Priority Ecological Communities (PECs) are located within the swamp according to the Department of Biodiversity, Conservation and Attractions (DBCA). The closest to the Project is the Priority 3 “Kimberley Vegetation Association 37” (Phoenix 2017) (Figure 1-1).

In the event, that groundwater monitoring trigger values are exceeded, vegetation monitoring is to be conducted at Injudinah Swamp (Phoenix 2017). In November 2017, the Department of Water and Environmental Regulation (DWER) undertook baseline vegetation monitoring at Injudinah Swamp to inform their review of the La Grange Groundwater Allocation Plan. During the field survey DWER identified potential monitoring locations for the Project vegetation health monitoring program, including a potential impact site and a control site (Michelle Antao pers. comm. to Dr Grant Wells, Shamrock/DWER meeting, 23 November 2017) (Figure 1-1). In the interest of sharing data, agreement was made to install monitoring transects and undertake baseline vegetation surveys to inform the Project vegetation health monitoring program at the two locations identified by DWER.

### 1.1 PROJECT SCOPE

The proposed scope of works for the baseline vegetation health assessment was as follows:

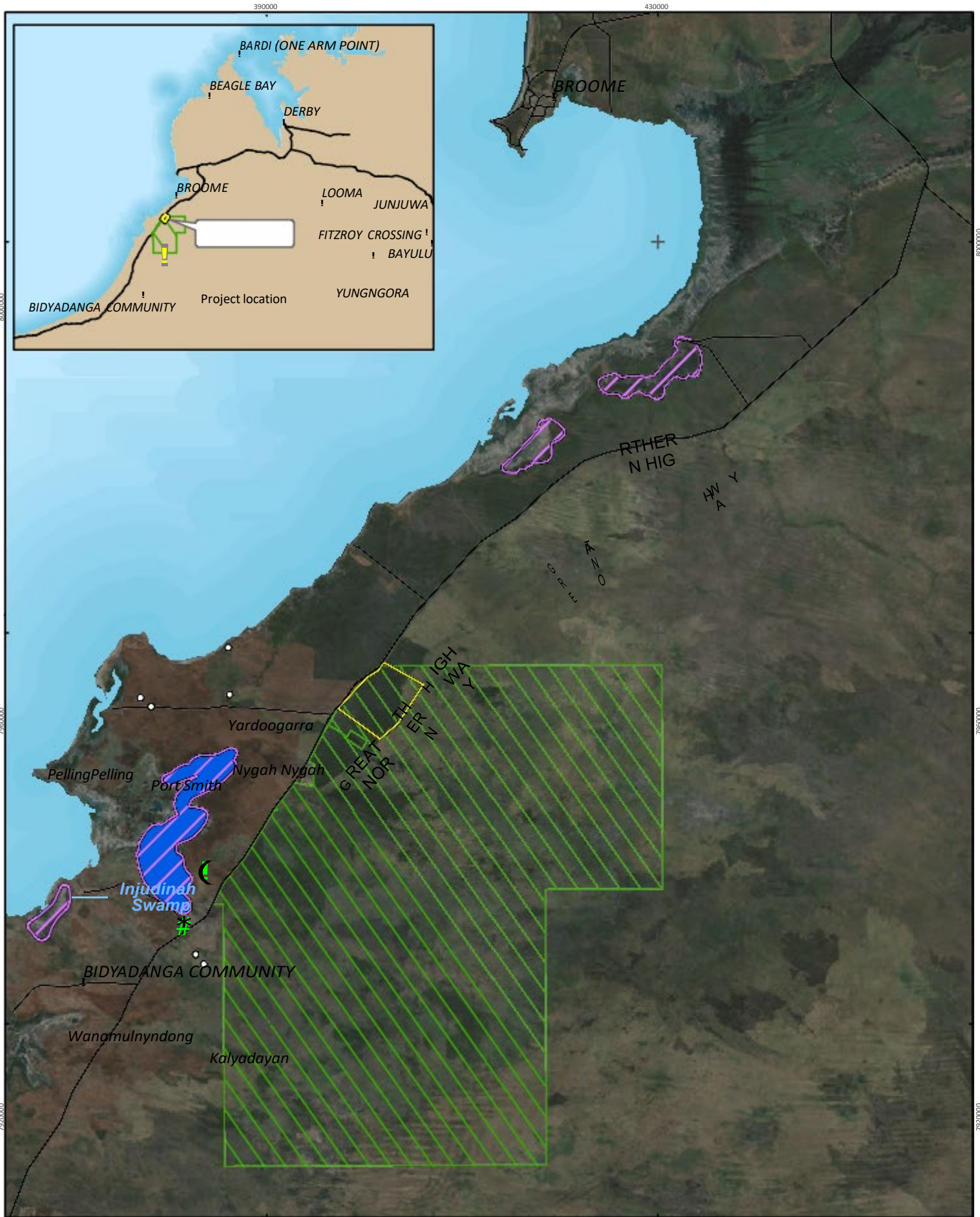
- conduct a baseline vegetation survey of Injudinah Swamp in the vicinity of the vegetation health monitoring bore transects at the swamp and within the area delineated as the Kimberley Vegetation Association 37 PEC
- select suitable monitoring species and install transects to monitor vegetation health at the control site (Injudinah Swamp) and the impact site
- collect baseline vegetation health data
- establish depth to groundwater.

## **1.2 DELIVERABLES**

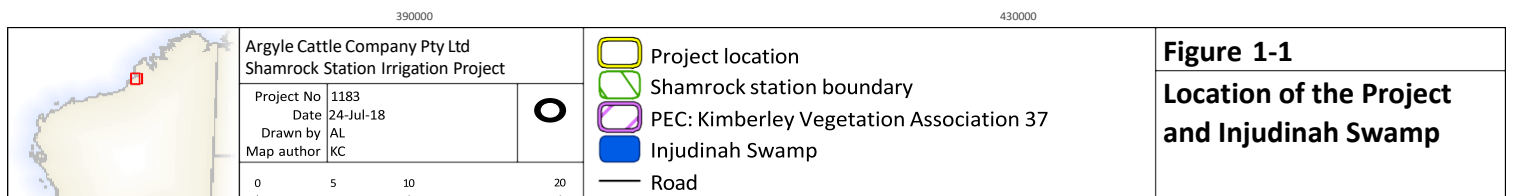
This report represents part of the deliverables for the baseline assessment and comprises a complete technical report containing:

- survey methods
- survey limitations
- analysis of quadrat data identifying similarity of species composition between Injudinah Swamp monitoring sites
- mapping of transect, quadrat and individual plant (selected monitoring species) locations
- baseline vegetation health data
- recommendations for future health assessments.





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## 2. METHODS

The field survey was conducted by Dr Grant Wells and Alice Watt from 25-27 November 2017. Baseline vegetation survey quadrats, monitoring transects and plots were installed at the two locations identified by DWER (Figure 2-1; Figure 2-2). The depth to groundwater was measured at three points located at random along the monitoring transect.

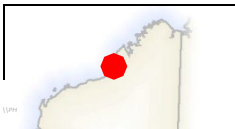
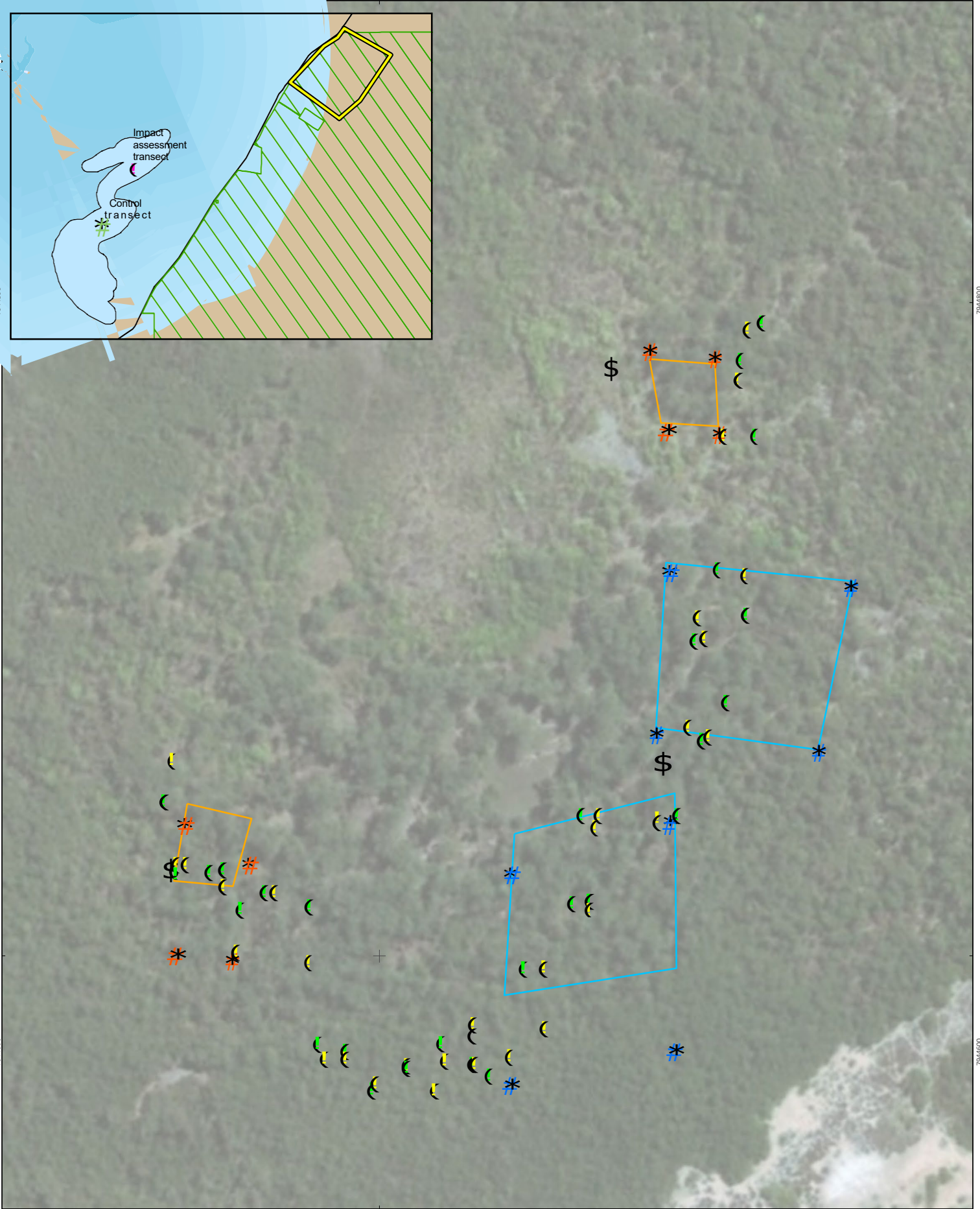
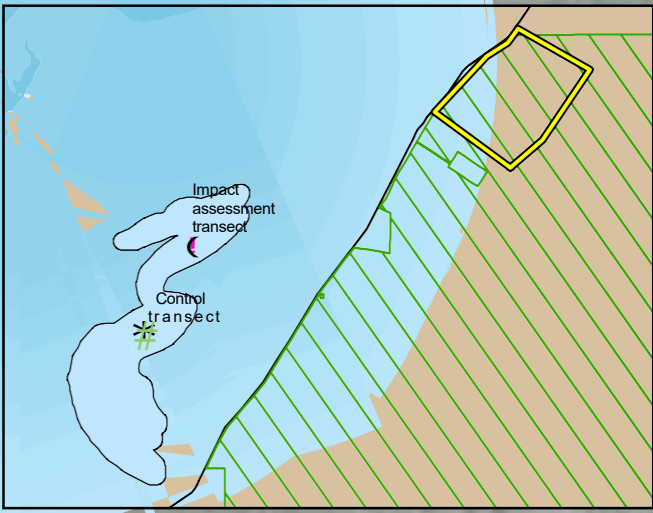
### 2.1 BASELINE VEGETATION SURVEY

Two baseline vegetation quadrats were surveyed to provide a detailed description of the vegetation type at each monitoring site (Figure 2-1; Figure 2-2). Vegetation sampling sites for the Dampierland bioregion consist of quadrats of 50 m x 50 m (2,500 m<sup>2</sup>) dimension (EPA 2016). The quadrats were permanently marked with steel fence droppers and co-ordinates of each corner were recorded on a hand-held Garmin GPS. The following information was recorded for each site (Appendix 1):


- location – the geographic coordinates of all four corners of each quadrat in WGS84 projection
- size and shape of the quadrat
- description of vegetation – dominant growth form, height, cover and species for the three traditional strata (upper, mid and ground) compatible with NVIS Level V (ESCAVI 2003) in accordance with EPA (2016)
- habitat – a brief description of landform and habitat
- geology – a broad description of surface soil type and rock type
- disturbance history – a description of any observed disturbance including an estimate of time since last fire, weed invasions, soil disturbance, human activity and fauna activity
- vegetation condition – based on the condition scale for the Northern botanical province (EPA 2016)
- height and percentage foliage cover (PFC) – a visual estimate of cover at all sites of total vegetation, shrubs and trees >2 m tall, shrubs <2 m, grasses and herbs, as well as canopy cover of each species within quadrats
- photograph – a colour photograph of the vegetation within each quadrat in a south-easterly direction from the north-west corner of the quadrat
- flora species list – a list including the name of every species present within the quadrat; to ensure accurate taxonomic identification of flora species present within the study area, collections were made of each species and each collection was pressed and documented for identification using the WA Herbarium resources.

The vegetation descriptions from the quadrats were grouped according to similarity of community structure (i.e. canopy levels), species composition and combination of species and the prevalent community structure (i.e. woodland, shrubland, etc.) based on statistical analysis.

A cluster analysis was conducted based on species presence/absence in each quadrat to classify grouping of the floristic composition of vegetation to define vegetation types. The fusion strategy for the site classification was flexible UPGMA with a beta value of -0.1 and Bray Curtis association measure in the software package PATN (Belbin 2003). The Bray and Curtis association measure is recommended in PATN to use in the field of ecology for presence / absence (1 / 0) where there are many more '0's than '1's". Generated Dissimilarity Matrix range in value is from '0', implying that the pair of rows or columns are identical, to '1' meaning that the pairs of rows or columns have nothing in common. Similarity below 0.5 represents high similarity and above 0.65 a weak similarity.



Argyle Cattle Company Pty Ltd  
 Shamrock Station Irrigation Project  
 Project No | 1183

 Project location

**Figure 2-1**  
 Location of baseline vegetation

PERTH	Date	10/15/2018		
	Drawn by	AL		
	Map author	KC		
	0	12.5	25	50
	Meters			
	1:1,500	(at A4)	GDA 1994 MGA Zone 51	

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Shamrock station boundary

Vegetation description quadrats

Vegetation health plots

Groundwater points

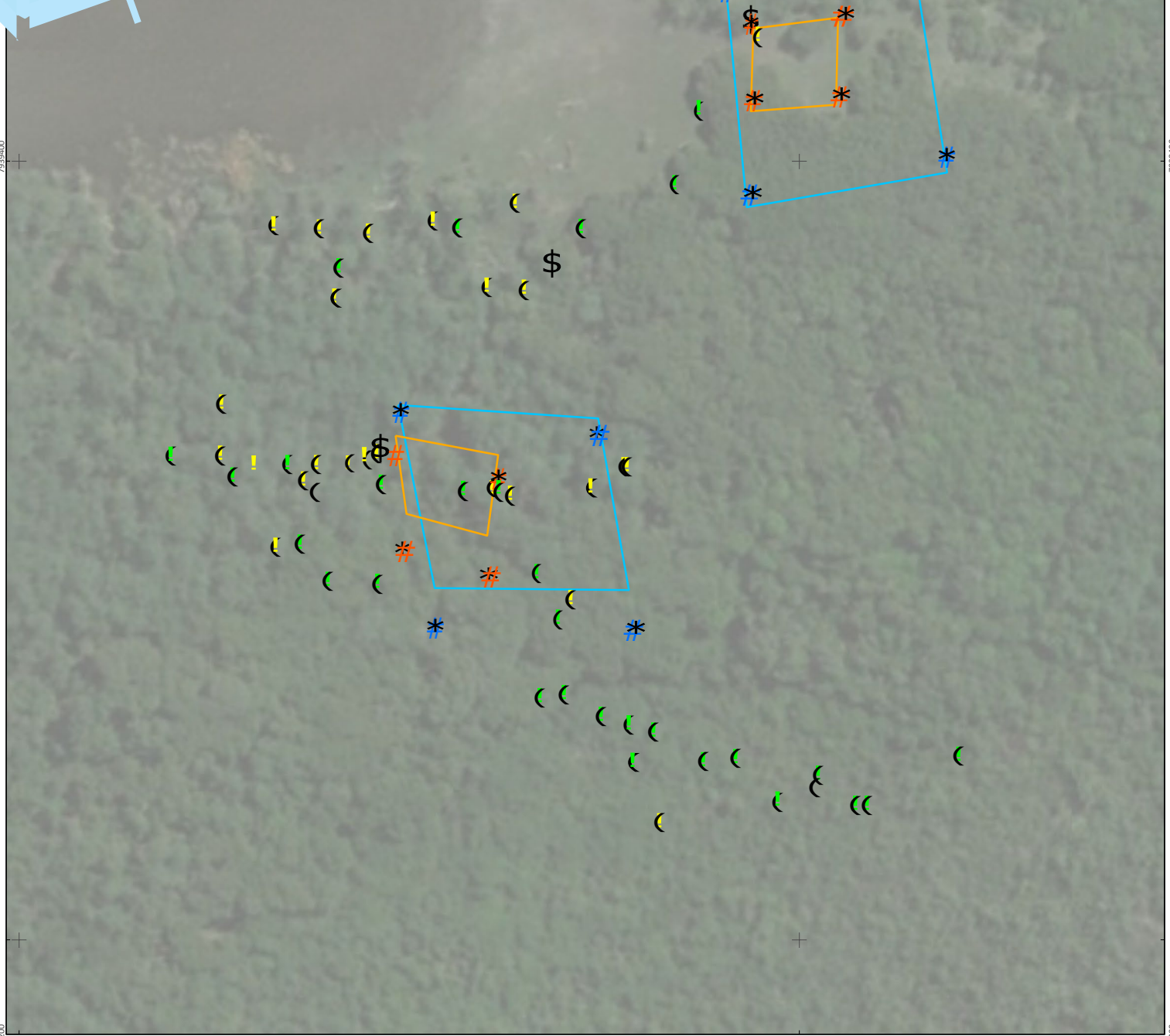
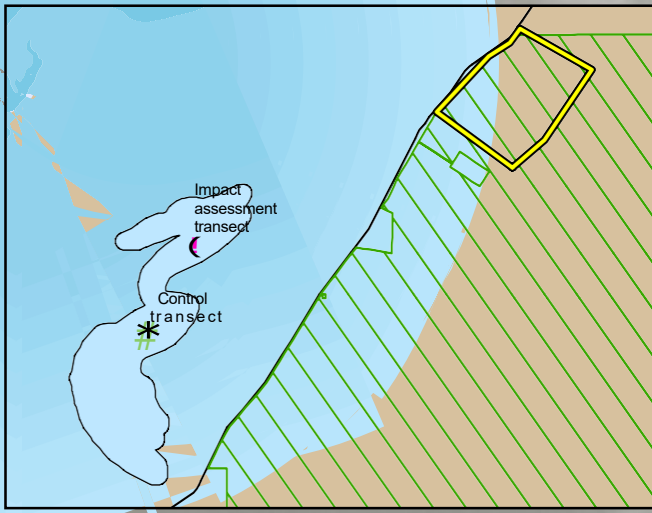
*Melaleuca*

*Sesbania*

**quadrats, vegetation monitoring transects and vegetation health plots at the impact assessment site**



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Argyle Cattle Company Pty Ltd Shamrock Station Irrigation Project	
Project No	1183
Date	10/15/2018
Drawn by	AL
Map author	KC

- Project location
- Shamrock station boundary
- Vegetation description quadrats
- Vegetation health plots

**Figure 2-2**  
**Location of baseline vegetation quadrats, vegetation monitoring transects and vegetation health**

PERTH	0	12.5	25	50
	Meters			
1:1,500 (at A4) GDA 1994 MGA Zone 51				

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- \$ Groundwater points
- Individual trees
  -  Melaleuca
  -  Sesbania

**plots at the control site**



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ENVIRONMENTAL SCIENCES

## 2.2 VEGETATION HEALTH MONITORING TRANSECTS AND PLOTS

### 2.2.1 Transects

Monitoring transects were installed in vegetation dominated by the identified phreatophytic tree species *Sesbania formosa* and *Melaleuca cajuputi* subsp. *cajuputi*. The length and direction of each transect was dictated by the distribution of these species. Meandering transects were installed across the broadest length possible in the selected vegetation type.

Along the length of the transect, individual plants were selected for health monitoring. A total of 30 individuals of both *Sesbania formosa* and *Melaleuca cajuputi* subsp. *cajuputi* were spaced as evenly as possible along the length of the transect (Figure 2-1; Figure 2-2). Each tree was tagged with a metal tag bearing a unique code, flagged with flagging tape and a GPS location recorded.

The health of the tree was recorded utilising the scale of Casson *et al.* (2009) (Table 2-1). In addition, canopy condition was recorded using the three-part assessment scale of (Department of Water 2017) (Figure 2-3) to provide equivalent data for vegetation health transects monitored by DWER. Canopy condition was assessed utilising crown density, proportion of dead branches and epicormic growth scores. These scores are totalled to give a condition assessment score for each tree. This method results in a score of between 3 and 23, with higher scores indicating healthier individuals. Trees recorded as dead are allocated a zero value.

**Table 2-1 Plant health scale (Casson *et al.* 2009)**

Health rating	Description
0	Healthy, no dead leaves
1	Occasional dead leaves
2	Epicormic shoots (therefore stressed)
3	Tips of branches stressed or dying
4	Entire or whole branches dying or dead (NB some lower branches excluded from this assessment)
5	More than half tree dead
6	Tree dead



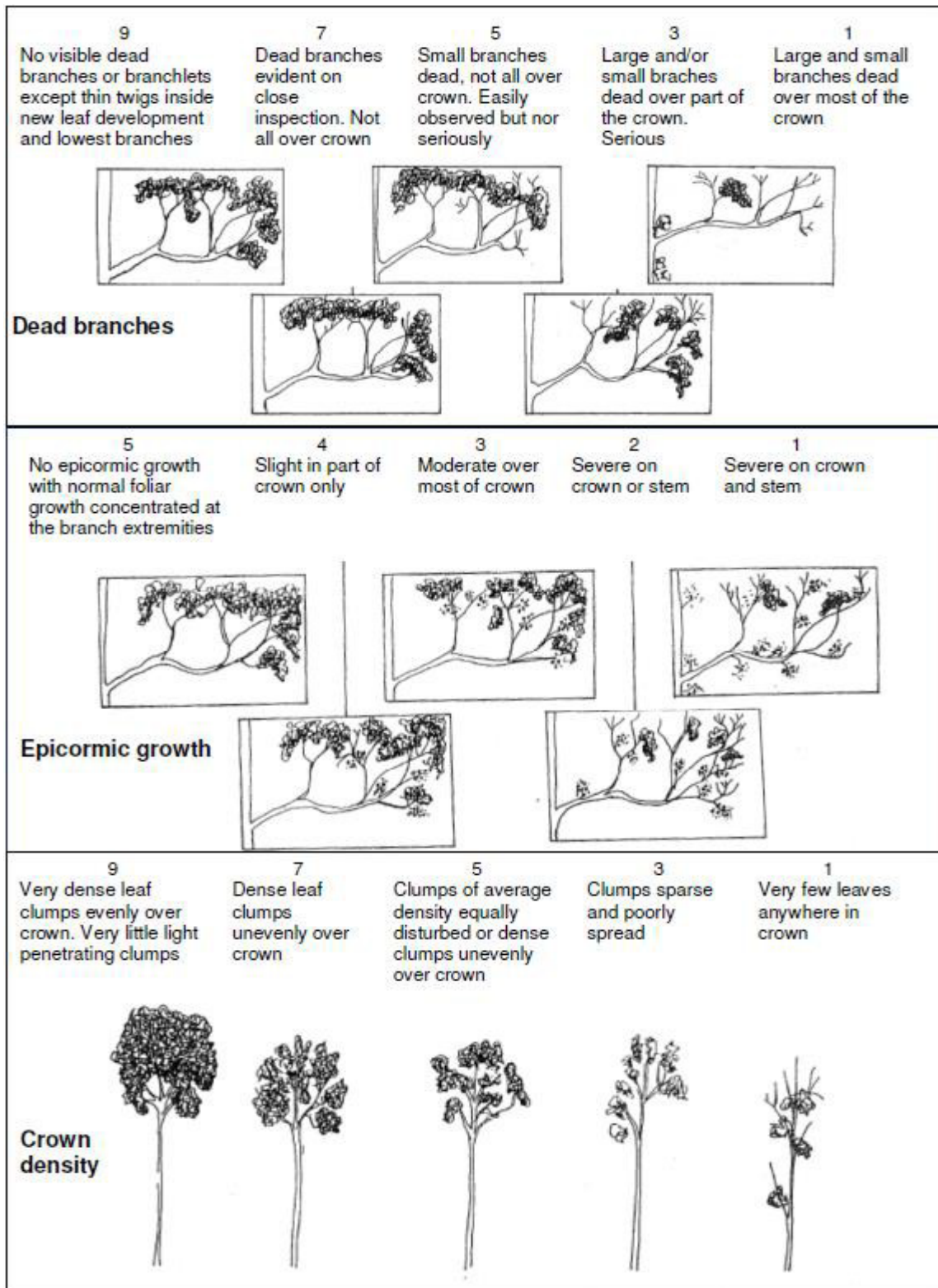


Figure 2-3 Canopy condition – 3 point scale (Department of Water 2017)

## 2.2.2 Plots

At either end of the transect 20 x 20 m plots (Figure 2-1; Figure 2-2) were installed with each corner marked with metal fence droppers. Plots were positioned in a north-south, east-west orientation, with the coordinates of each corner recorded in GDA94 datum, using a handheld GPS.

The following attributes were recorded at each quadrat:

- date, site number and photo (from the NW corner, orientated SE)
- a health rating (Table 2-2) for each of the three canopy levels, upper, mid and lower
- the number of species present in each canopy level
- a visual estimate of the foliage cover of each canopy level.

**Table 2-2 Vegetation health scale (Casson *et al.* 2009)**

Health rating	Description
0	Healthy no signs of stress
1	Some early signs of stress, a few individuals, likely one species
2	Signs of stress in several individuals, one or more species
3	Signs of stress in many individuals, several species
4	Advanced decline and/or death of many individuals and several or most species

## 2.2.3 Depth to groundwater

Depth to groundwater underlying the vegetation was measured at three points along both the meandering transect (Figure 2-1; Figure 2-2). A hand-auger was used to drill into the ground until water was reached and this depth was recorded using a tape measure. A second depth to the water level was recorded after 30 minutes had passed to allow the water level to settle.

## 2.3 WEATHER

The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and historic climate data is located at Bidadanga (no. 003030, Latitude:-18.68°S Longitude: 121.78°E) approximately 13 km west of the study area. Bidadanga records the highest maximum mean monthly temperature in April (35.7°C), the lowest minimum mean (14.1°C) in July (BoM 2017; Figure 2-4). The average annual rainfall is 517 mm with January, February and March recording the highest monthly averages (131.3 mm, 136.9 mm and 95.5 mm respectively).

Daily mean temperatures and rainfall for Bidadanga in the 12 months preceding the survey (November 2016–October 2017) were variable to annual long-term averages (Figure 2-4). Mean maximum temperatures were approximately average to slightly above average while mean minimum temperatures were mostly equal to average. Rainfall was highly variable against long term annual averages with total annual rainfall (770 mm) far higher than the average annual rainfall (517 mm). This was due to the large rainfall event experienced in December with 412.4 mm rainfall in total over the month compared to the average of just 59.7 mm (Figure 2-4). With the exception of October 2018

(the month immediately prior to the survey in November) which had above average rainfall, the preceding five months were completely dry.

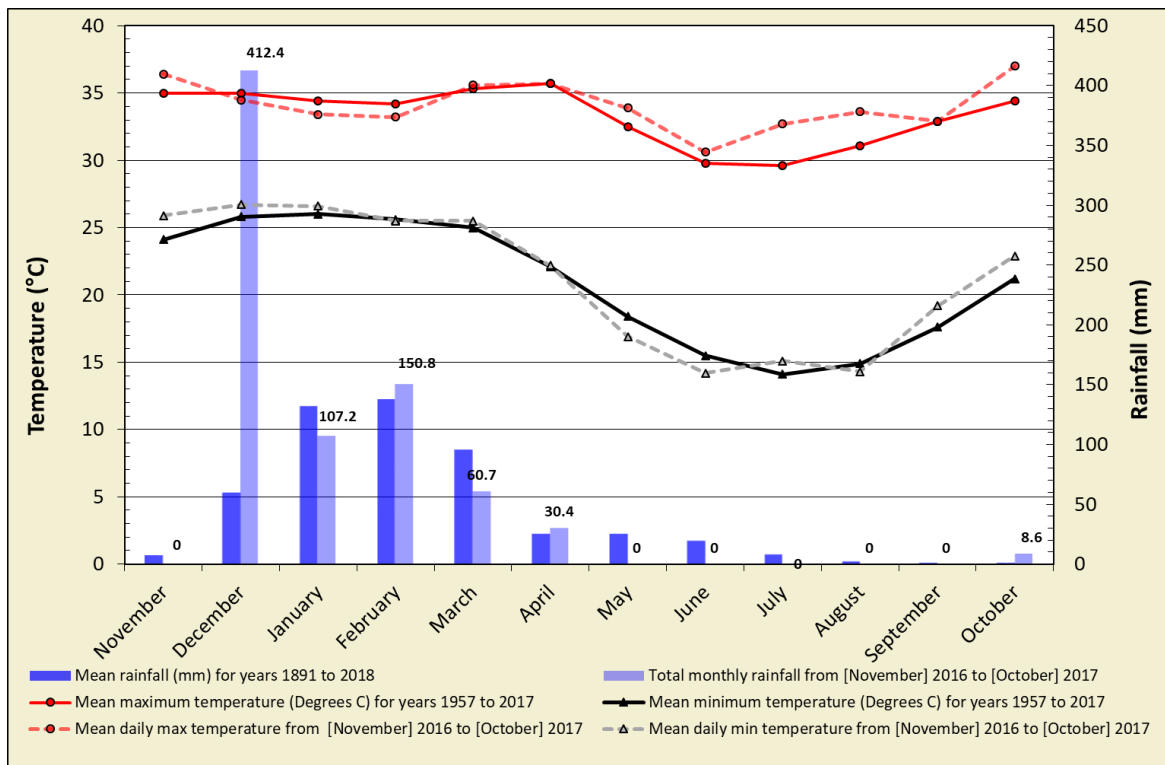


Figure 2-4 Annual climate and weather data for Bidyadanga (no. 003030) (BoM 2017) and mean monthly data for the 12 months preceding the field survey

### 3. RESULTS

#### 3.1 BASELINE VEGETATION SURVEY

The results of the PATN analysis grouped the quadrats at each monitoring site (Figure 3-1); however, the dissimilarity values (Table 3-1) identify a high level of similarity between the two monitoring sites. The similarity of the vegetation is also apparent in site photographs (Figure 3-2; Appendix 1).

Vegetation at both sites was dominated by *Sesbania formosa*, *Melaleuca cajuputi* subsp. *cajuputi* and *Acacia ampliceps*. The structure of the vegetation differed slightly comprising a mid open forest of *Sesbania formosa* and *Melaleuca cajuputi* subsp. *cajuputi* over open tall *Acacia ampliceps* shrubland over low *Cynodon dactylon* grassland at the control transect. At the impact assessment transect, the vegetation comprised a mid *Sesbania formosa* woodland over a tall *Melaleuca cajuputi* subsp. *cajuputi* and *Acacia ampliceps* shrubland.

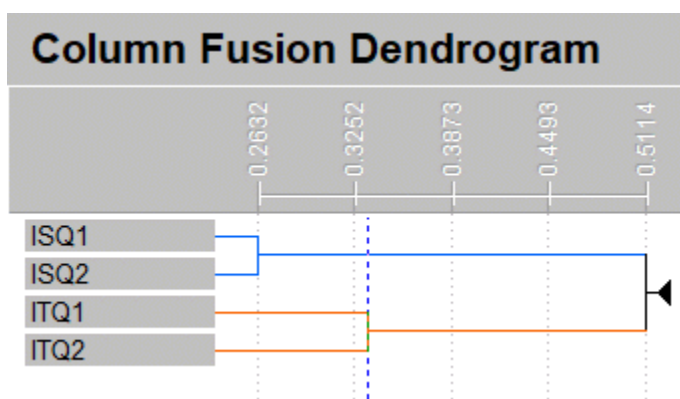


Figure 3-1 PATN analysis of quadrats

Table 3-1 Dissimilarity matrix values

	ISQ1	ISQ2	ITQ1
ISQ2	0.2632		
ITQ1	0.4737	0.4444	
ITQ2	0.4545	0.5238	0.3333



**Figure 3-2**      **Quadrat photos from (top) impact monitoring site and (bottom) control monitoring site**

## 3.2 VEGETATION HEALTH

### 3.2.1 Tree health

The health score value of all *Melaleuca cajuputi* subsp. *cajuputi* trees at the impact assessment transect (Figure 3-3) except for one individual was 0, with the remaining individual assigned a health score of 1 (0 = Healthy, no dead leaves, 1=occasional dead leaves). In contrast, only ten trees at the control transect were rated at 0, 11 at 1, six at 3, two at 4 and one at 5 (3=Tips of branches stressed or dying, 4=Entire or whole branches dying or dead, 5 = more than half the tree dead). There was evidence of recent fire on some of the *Melaleuca* trees at the control transect which had impacted tree health ratings.

In comparison to the adjacent *Melaleuca cajuputi* subsp. *cajuputi* trees, the *Sesbania formosa* trees had much greater variation in health scores at the impact assessment transect (Figure 3-4), with nine trees with a health score of 0, seven 1, ten 3 and four 4. A greater number of *Sesbania formosa* trees at the control transect (16) had a 0 health rating, five 1, seven 3 and two 4.

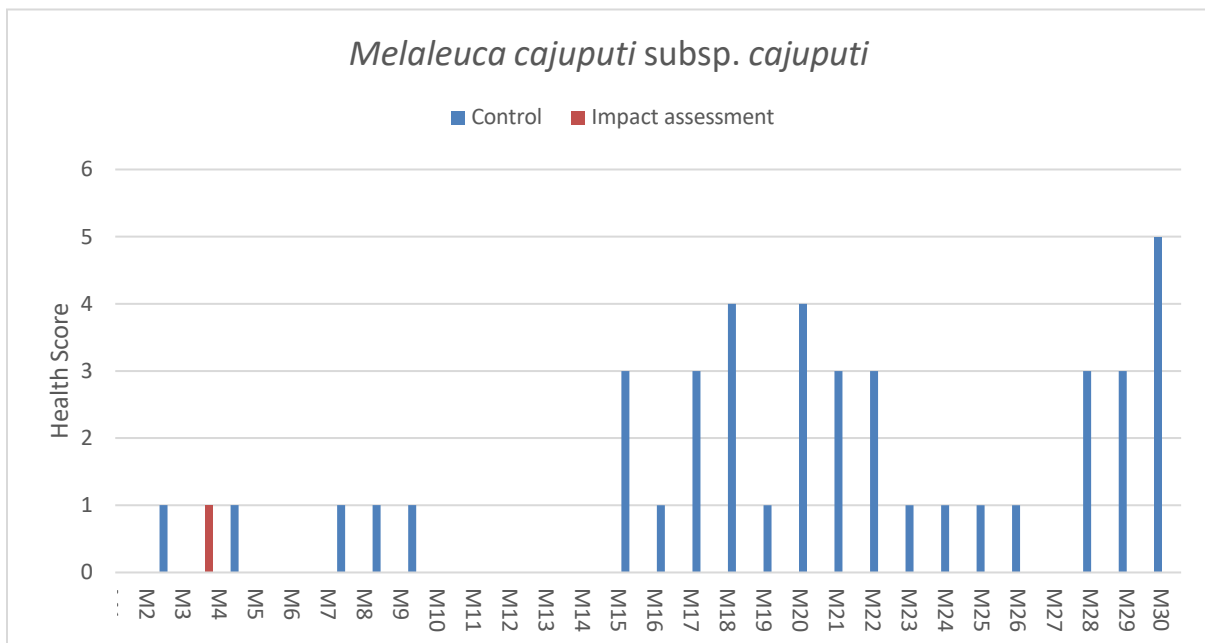


Figure 3-3 Tree health scores for *Melaleuca cajuputi* subsp. *cajuputi*

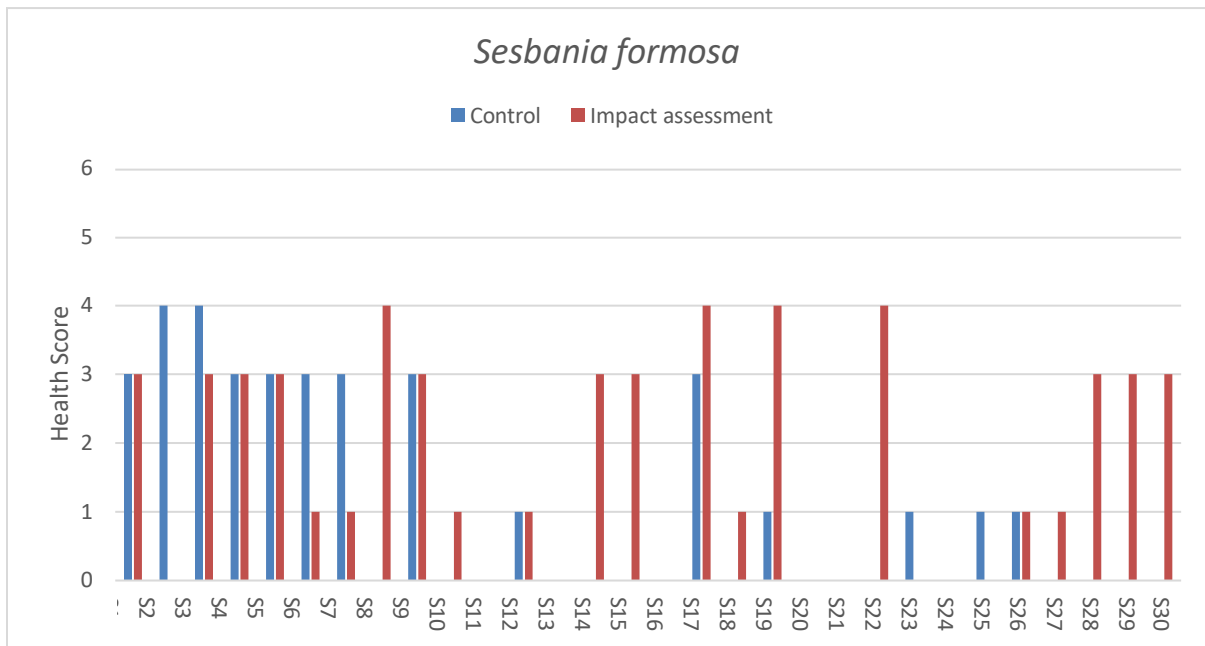


Figure 3-4 Tree health scores for *Sesbania formosa*

### 3.2.2 Canopy condition

The canopy condition of all *Melaleuca cajuputi* subsp. *cajuputi* trees at the impact assessment transect (Figure 3-5), except for one individual, received the maximum score of 23, the remaining individual was scored 21. In contrast, only one third (10) of *Melaleuca cajuputi* subsp. *cajuputi* trees at the control transect had the maximum 23 rating.

Just over half (16) of the *Sesbania formosa* trees at the control transect scored a maximum value of 23 for canopy condition (Figure 3-6). At the impact assessment transect just one third (10) plants obtained the maximum score.

Typically, the score for the number of dead branches present on the tree was the main cause of differences in canopy condition values, frequently with an associated decrease in crown density score.

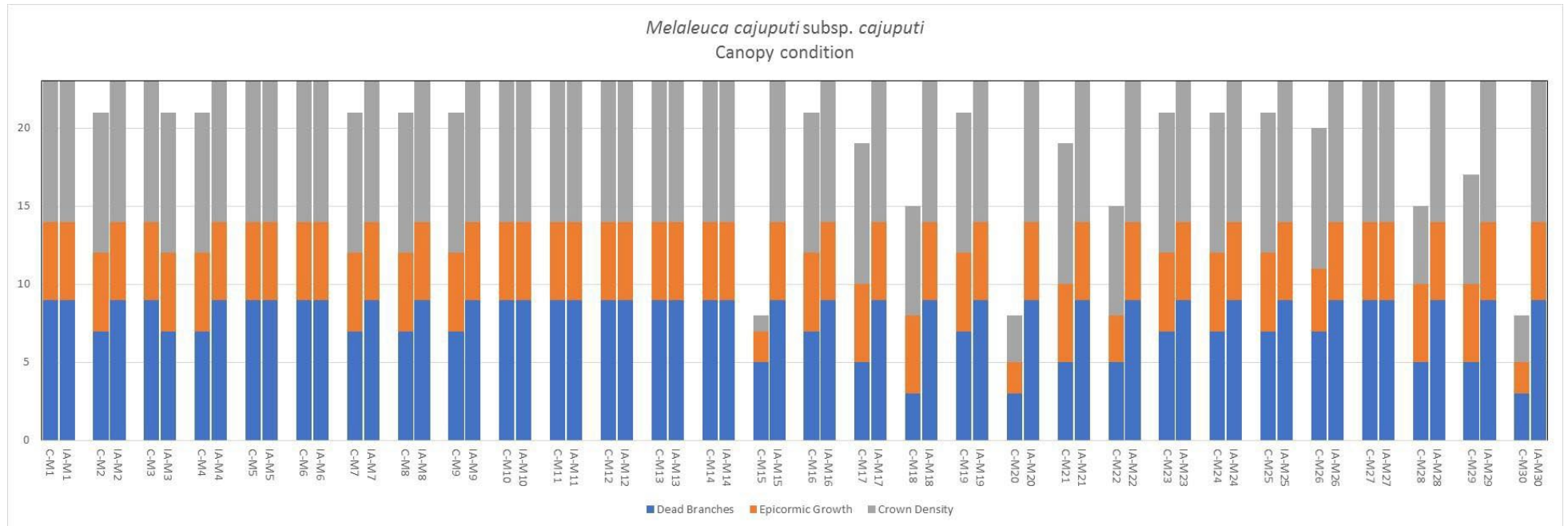


Figure 3-5 Canopy condition scores for *Melaleuca cajuputi* subsp. *cajuputi* trees



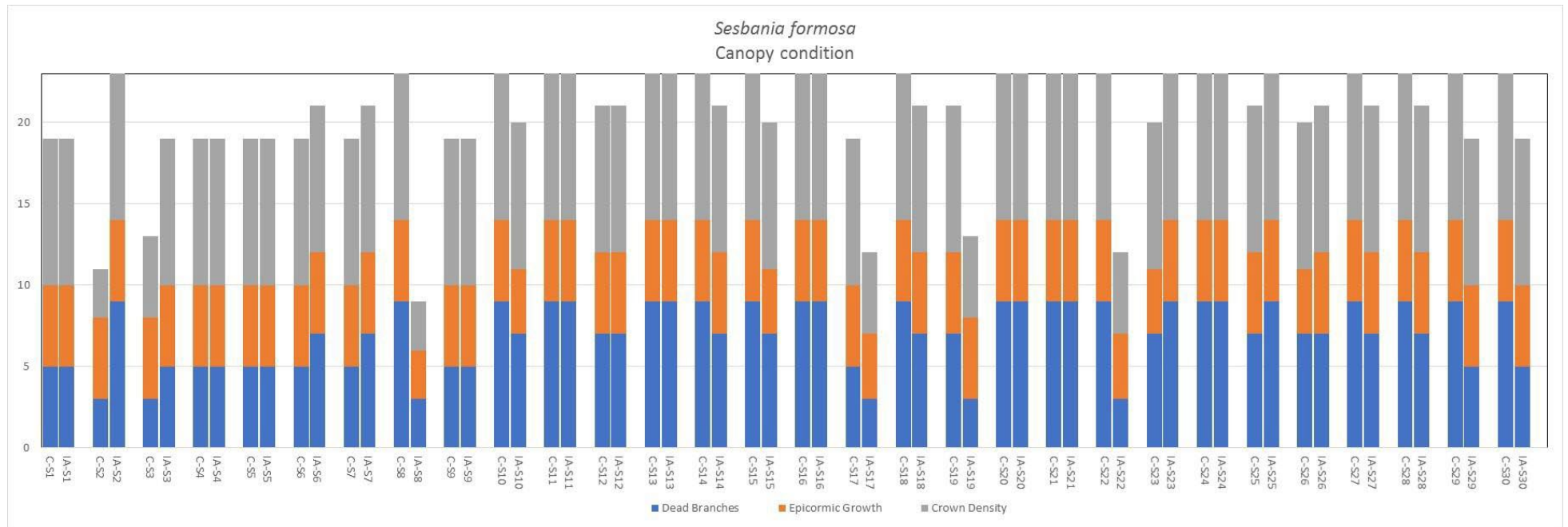


Figure 3-6 Canopy condition scores for *Sesbania formosa* trees

### 3.2.3 Vegetation health plots

In general, the different canopies present in the monitoring plots were healthy (Table 3-2) attaining ratings of either 0 (healthy no signs of stress) or 1 (some early signs of stress, a few individuals, likely one species). Despite dry conditions for most of the six months prior to the survey, the vegetation remained lush and green including the grasses and sedges in the lower canopy (Figure 3-7).

The upper canopy in one plot at each monitoring location was rated at 1 due to some branch death on the *Sesbania formosa* trees. Some plant death in the lower canopy at plot 2 at the impact assessment transect due to dry conditions and grazing by cattle resulted in a health rating of 1.

**Table 3-2 Vegetation health plot data**

Canopy level	Health rating	Foliage cover	Species
<b>ITQ1</b>			
Upper	0	40	<i>Sesbania formosa</i>
Mid	0	50	<i>Melaleuca cajuputi subsp. cajuputi</i> and <i>Acacia ampliceps</i>
Lower	0	3	<i>Sesbania formosa</i> seedlings, <i>Cynodon dactylon</i> , <i>Fimbristylis caespitosa</i> and <i>Fimbristylis cymosa</i>
<b>ITQ2</b>			
Upper	1	60	<i>Sesbania formosa</i>
Mid	0	20	<i>Melaleuca cajuputi subsp. cajuputi</i> and <i>Acacia ampliceps</i>
Lower	1	10	<i>Cynodon dactylon</i> , <i>Fimbristylis caespitosa</i> and <i>Fimbristylis cymosa</i>
<b>CTQ1</b>			
Upper	0	40	<i>Sesbania formosa</i> and <i>Melaleuca cajuputi subsp. cajuputi</i>
Lower	0	75	<i>Cynodon dactylon</i> , <i>Solanum nigrum</i> and <i>Phyla nodiflora</i> var. <i>nodiflora</i>
<b>CTQ2</b>			
Upper	1	65	<i>Sesbania formosa</i> and <i>Melaleuca cajuputi subsp. cajuputi</i>
Mid	0	15	<i>Acacia ampliceps</i> and <i>Melaleuca cajuputi subsp. cajuputi</i>
Lower	0	75	<i>Sesbania formosa</i> seedlings, <i>Cynodon dactylon</i> , <i>Fimbristylis caespitosa</i> and <i>Phyla nodiflora</i> var. <i>nodiflora</i>



Figure 3-7 Photographs of vegetation health plots (top) impact site, (bottom) control site (Injudinah Swamp)

### 3.2.4 Depth to groundwater

The depth to groundwater varied across each of the transects (Table 3-3) but was certainly within the root zone of *Sesbania formosa* and *Melaleuca cajuputi subsp. cajuputi*. Some trees at the control transect were partially surrounded by surface water, there was no surface water at the impact assessment transect at the time of the survey.

**Table 3-3** Depth to groundwater at the impact assessment and control transects

Sample point code	Initial depth to groundwater (cm)	Final depth to groundwater (cm)
ITGW1	76	74
ITGW2	101	101
ITGW3	116	116
CTGW1	101	94.5
CTGW2	42	30
CTGW3	14	12

## 4. DISCUSSION

The high similarity in species composition between the monitoring sites indicates that the control transect at Injudinah Swamp is located in the same vegetation type as the impact assessment transect and therefore represents a suitable control site to gauge any perceived impacts from groundwater abstraction.

A recent fire at the control transect has resulted in poorer health ratings for the *Melaleuca cajuputi* subsp. *cajuputi* trees at this site in comparison to the trees of the same species at the impact assessment transect. In contrast, a greater number of *Sesbania formosa* trees attained a better health rating at the control site in comparison to trees of the same species at the impact assessment transect. A notable number of *Sesbania formosa* trees had at least one or numerous dead branches at both monitoring transects which appear to have died following storm damage as branches were broken.

It is notable from the flora survey quadrats and vegetation health plot assessments that the lower canopy level at both transects is dominated by introduced species, principally the introduced grass \**Cynodon dactylon*. This canopy level is also subject to disturbance from cattle in the form of trampling and grazing.

From these baseline observations, it is evident that any future health assessments should:

- focus on species specific comparisons between transects as the baseline plant health ratings differ between the different species
- ensure any other observable disturbances, e.g. fire, storm damage, grazing, weed infestation, are noted and considered in relation to the cause of any identified decline in vegetation health
- consider that differences in plant health between transects were evident from the baseline surveys.

Continuance of the measurement of depth to groundwater is recommended at the monitoring sites in addition to the broader groundwater monitoring program, to supplement the vegetation health measures. This would facilitate determining if any identified decline in vegetation health has occurred in association with an increase in depth to groundwater.

## 5. REFERENCES

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- Phoenix. 2017. *Shamrock Station Irrigation Project Referral under Section 38 of the Environmental Protection Act 1986*. Phoenix Environmental Sciences, Balcatta, WA. Unpublished report prepared for Argyle Cattle Company Pty Ltd.

**Appendix 1    Site descriptions**

Site details			
<b>Site:</b>	ISQ1	<b>Type:</b>	Quadrat (50 m x 50 m)
<b>Date(s):</b>	27 November 2017	<b>Permanent:</b>	Yes
<b>Observer(s):</b>	Grant Wells	<b>Position:</b>	-18.63372, 121.876474 (North-west)
Vegetation		Physical features	
<b>Total vegetation cover (%):</b>	80	<b>Topography:</b>	seasonally wet area
<b>Tree/shrub cover &gt;2 m (%):</b>	70	<b>Soil colour:</b>	black,
<b>Shrub cover &lt;2 m (%):</b>	25	<b>Soil:</b>	sandy clay,
<b>Grass cover (%):</b>	10	<b>Rock type:</b>	none
<b>Herb cover (%):</b>	15	<b>Fire age:</b>	1 – 5 years
<b>Vegetation condition:</b>	Good, EPA (2016)	<b>Disturbance</b>	grazing – high, livestock tracks, weed infestation,
<b>Land system:</b>	Roebuck System		
<b>Vegetation description and type:</b>	Mid <i>Sesbania formosa</i> and <i>Melaleuca cajuputi</i> subsp. <i>cajuputi</i> open forest over tall open <i>Acacia ampliceps</i> shrubland over low <i>Cynodon dactylon</i> grassland.		



Species	Cover (%)	Height (m)	Weed	Conservation status
<i>Melaleuca cajuputi</i> subsp. <i>cajuputi</i>	40.0	20.00		
<i>Sesbania formosa</i>	30.0	25.00		
<i>Phyla nodiflora</i> var. <i>nodiflora</i>	15.0	00.20	*	
<i>Acacia ampliceps</i>	10.0	04.00		
<i>Cynodon dactylon</i>	10.0	00.20	*	
<i>Cassytha filiformis</i>	01.0	04.00		
<i>Typha domingensis</i>	00.1	01.50		
<i>Fimbristylis caespitosa</i>	00.1	00.50		
<i>Timonius timon</i>	00.1	00.40		
<i>Cenchrus clandestinus</i>	00.1	00.15	*	



Site details			
<b>Site:</b>	ISQ2	<b>Type:</b>	Quadrat (50 m x 50 m)
<b>Date(s):</b>	27 November 2017	<b>Permanent:</b>	Yes
<b>Observer(s):</b>	Grant Wells	<b>Position:</b>	-18.632733, 121.877487 (North-west)
Vegetation		Physical features	
<b>Total vegetation cover (%):</b>	95	<b>Topography:</b>	seasonally wet area
<b>Tree/shrub cover &gt;2 m (%):</b>	40	<b>Soil colour:</b>	grey, black,
<b>Shrub cover &lt;2 m (%):</b>	1	<b>Soil:</b>	sandy clay, clay,
<b>Grass cover (%):</b>	85	<b>Rock type:</b>	none
<b>Herb cover (%):</b>	30	<b>Fire age:</b>	1 – 5 years
<b>Vegetation condition:</b>	Good, EPA (2016)	<b>Disturbance</b>	grazing – high, livestock tracks, weed infestation,
<b>Land system:</b>	Roebuck System		

**Vegetation description and type:** Mid *Sesbania formosa*, *Melaleuca cajuputi* subsp. *cajuputi* and *Melaleuca alsophila* open forest over low closed *Cynodon dactylon* grassland and low *Phyla nodiflora* var. *nodiflora* forbland.



Species	Cover (%)	Height (m)	Weed	Conservation status
<i>Cynodon dactylon</i>	85.0	00.20	*	
<i>Melaleuca cajuputi</i> subsp. <i>cajuputi</i>	35.0	10.00		
<i>Phyla nodiflora</i> var. <i>nodiflora</i>	30.0	00.25	*	
<i>Sesbania formosa</i>	05.0	11.00		
<i>Melaleuca alsophila</i>	01.0	10.00		
<i>Acacia ampliceps</i>	01.0	01.50		
<i>Cassytha filiformis</i>	00.5	02.00		
<i>Typha domingensis</i>	00.1	00.80		
<i>Solanum nigrum</i>	00.1	00.40	*	

Site details			
<b>Site:</b>	ITQ1	<b>Type:</b>	Quadrat (50 m x 50 m)
<b>Date(s):</b>	25 November 2017	<b>Permanent:</b>	Yes
<b>Observer(s):</b>	Grant Wells	<b>Position:</b>	-18.585765, 121.897527 (North-west)
Vegetation		Physical features	
<b>Total vegetation cover (%):</b>	75	<b>Topography:</b>	seasonally wet area
<b>Tree/shrub cover &gt;2 m (%):</b>	75	<b>Soil colour:</b>	grey,
<b>Shrub cover &lt;2 m (%):</b>	0	<b>Soil:</b>	sandy clay, clay,
<b>Grass cover (%):</b>	25	<b>Rock type:</b>	none
<b>Herb cover (%):</b>	1	<b>Fire age:</b>	not evident
<b>Vegetation condition:</b>	Good, EPA (2016)	<b>Disturbance</b>	grazing – high, livestock tracks, weed infestation,
<b>Land system:</b>	Roebuck System		
<b>Vegetation description and type:</b>	Mid <i>Sesbania formosa</i> woodland over tall <i>Melaleuca cajuputi</i> subsp. <i>cajuputi</i> and <i>Acacia ampliceps</i> shrubland over low open <i>Cynodon dactylon</i> grassland.		



Species	Cover (%)	Height (m)	Weed	Conservation status
<i>Acacia ampliceps</i>	30.0	04.00		
<i>Sesbania formosa</i>	25.0	12.00		
<i>Melaleuca cajuputi</i> subsp. <i>cajuputi</i>	25.0	05.00		
<i>Cynodon dactylon</i>	25.0	00.03	*	
<i>Gymnanthera oblonga</i>	01.0	04.00		
<i>Solanum nigrum</i>	01.0	00.60	*	
<i>Fimbristylis caespitosa</i>	00.1	00.50		
<i>Solanum diversiflorum</i>	00.1	00.30		
<i>Fimbristylis cymosa</i>	00.1	00.15		

Site details			
<b>Site:</b>	ITQ2	<b>Type:</b>	Quadrat (50 m x 50 m)
<b>Date(s):</b>	25 November 2017	<b>Permanent:</b>	Yes
<b>Observer(s):</b>	Grant Wells	<b>Position:</b>	-18.585105, 121.897638 (North-west)
Vegetation		Physical features	
<b>Total vegetation cover (%):</b>	75	<b>Topography:</b>	plain
<b>Tree/shrub cover &gt;2 m (%):</b>	70	<b>Soil colour:</b>	brown,
<b>Shrub cover &lt;2 m (%):</b>	0.1	<b>Soil:</b>	clay,
<b>Grass cover (%):</b>	40	<b>Rock type:</b>	none
<b>Herb cover (%):</b>	0.1	<b>Fire age:</b>	not evident
<b>Vegetation condition:</b>	Good, EPA (2016)	<b>Disturbance</b>	grazing – medium, livestock tracks, weed infestation,
<b>Land system:</b>	Roebuck System		
<b>Vegetation description and type:</b>	Mid <i>Sesbania formosa</i> woodland over tall <i>Melaleuca cajuputi</i> subsp. <i>cajuputi</i> and <i>Acacia ampliceps</i> shrubland over low open <i>Cynodon dactylon</i> grassland.		



Species	Cover (%)	Height (m)	Weed	Conservation status
<i>Acacia ampliceps</i>	40.0	04.00		
<i>Cynodon dactylon</i>	40.0	00.40	*	
<i>Melaleuca cajuputi</i> subsp. <i>cajuputi</i>	25.0	05.00		
<i>Sesbania formosa</i>	10.0	12.00		
<i>Cassytha filiformis</i>	01.0	04.00		
<i>Gymnanthera oblonga</i>	01.0	04.00		
<i>Cynanchum carnosum</i>	00.1	02.00		
<i>Abutilon indicum</i> var. <i>australiense</i>	00.1	01.00		
Malvaceae sp.	00.1	01.00		
<i>Fimbristylis caespitosa</i>	00.1	00.70		
<i>Schoenoplectus subulatus</i>	00.1	00.60		
<i>Fimbristylis cymosa</i>	00.1	00.15		

## **Appendix 2 Priority flora populations to be protected**

## Priority flora populations to be protected

Population	Latitude	Longitude
<i>Tephrosia andrewsii</i> 1	122.086649	-18.484448
<i>Tephrosia andrewsii</i> 1	122.085658	-18.483843
<i>Tephrosia andrewsii</i> 1	122.083986	-18.485449
<i>Tephrosia andrewsii</i> 1	122.085141	-18.486151
<i>Polymeria</i> sp. 'Broome' 1	122.075036	-18.526152
<i>Polymeria</i> sp. 'Broome' 1	122.071435	-18.525217
<i>Polymeria</i> sp. 'Broome' 1	122.069803	-18.527719
<i>Polymeria</i> sp. 'Broome' 1	122.072312	-18.529365
<i>Polymeria</i> sp. 'Broome' 2	122.072444	-18.53742
<i>Polymeria</i> sp. 'Broome' 2	122.074762	-18.540043
<i>Polymeria</i> sp. 'Broome' 2	122.073031	-18.541413
<i>Polymeria</i> sp. 'Broome' 2	122.071011	-18.539183
<i>Tephrosia andrewsii</i> 2	122.066167	-18.541393
<i>Tephrosia andrewsii</i> 2	122.069172	-18.545615
<i>Tephrosia andrewsii</i> 2	122.066926	-18.547371
<i>Tephrosia andrewsii</i> 2	122.063883	-18.544008
<i>Tephrosia andrewsii</i> 3	122.056995	-18.535719
<i>Tephrosia andrewsii</i> 3	122.058659	-18.534856
<i>Tephrosia andrewsii</i> 3	122.057073	-18.533241
<i>Tephrosia andrewsii</i> 3	122.055555	-18.534367
<i>Tephrosia andrewsii</i> 4	122.046534	-18.524357
<i>Tephrosia andrewsii</i> 4	122.047356	-18.523331
<i>Tephrosia andrewsii</i> 4	122.045671	-18.522548
<i>Tephrosia andrewsii</i> 4	122.044919	-18.523589

## **Appendix 3 Introduced animal monitoring and control program**

## Introduced animal monitoring and control program

### Rationale

Irrigation and crop production for the Shamrock Station Irrigation Project may attract herbivores (e.g. rabbits, wallabies or other prey animals) due to increased food availability which may lead to degradation of habitat and decrease Bilby access to food resources and burrow sites. Increased water availability and prey abundance may lead to increased abundance of introduced predators (foxes or cats).

Both feral cats and foxes are a threat to the Greater Bilby; however, their relative effect is not consistent throughout the Bilby's distribution. The Development Envelope is located within the distribution of the northern range of the species and it is thought that feral cat predation is a major factor in driving Bilby decline in the northern range (Bradley *et al.* 2015). Foxes are more abundant, and therefore a more significant threat in the southern Bilby populations; however, foxes expanding into Greater Bilby habitat may increase mortality through predation (Bradley *et al.* 2015).

Both foxes and feral cats were recorded in the La Grange area by the La Grange Greater Bilby Survey (DBCA 2018a). Feral cats were recorded extensively throughout all areas surveyed, including Shamrock Station, while foxes were predominantly recorded closer to the coast, with only a few records on Shamrock Station in the eastern and southern parts.

Rabbits are not known to be present in the La Grange region and considered unlikely to move into and persist there. However, monitoring is required to ensure that rabbits do not establish in the area due to project operations.

The control and monitoring protocols outlined in this program have been developed in consultation with Dr. David Algar, Principal Research Scientist, Department of Biodiversity and Attractions (DBCA) to ensure that proposed management actions reflect current standards in introduced animal control for conservation of native wildlife.

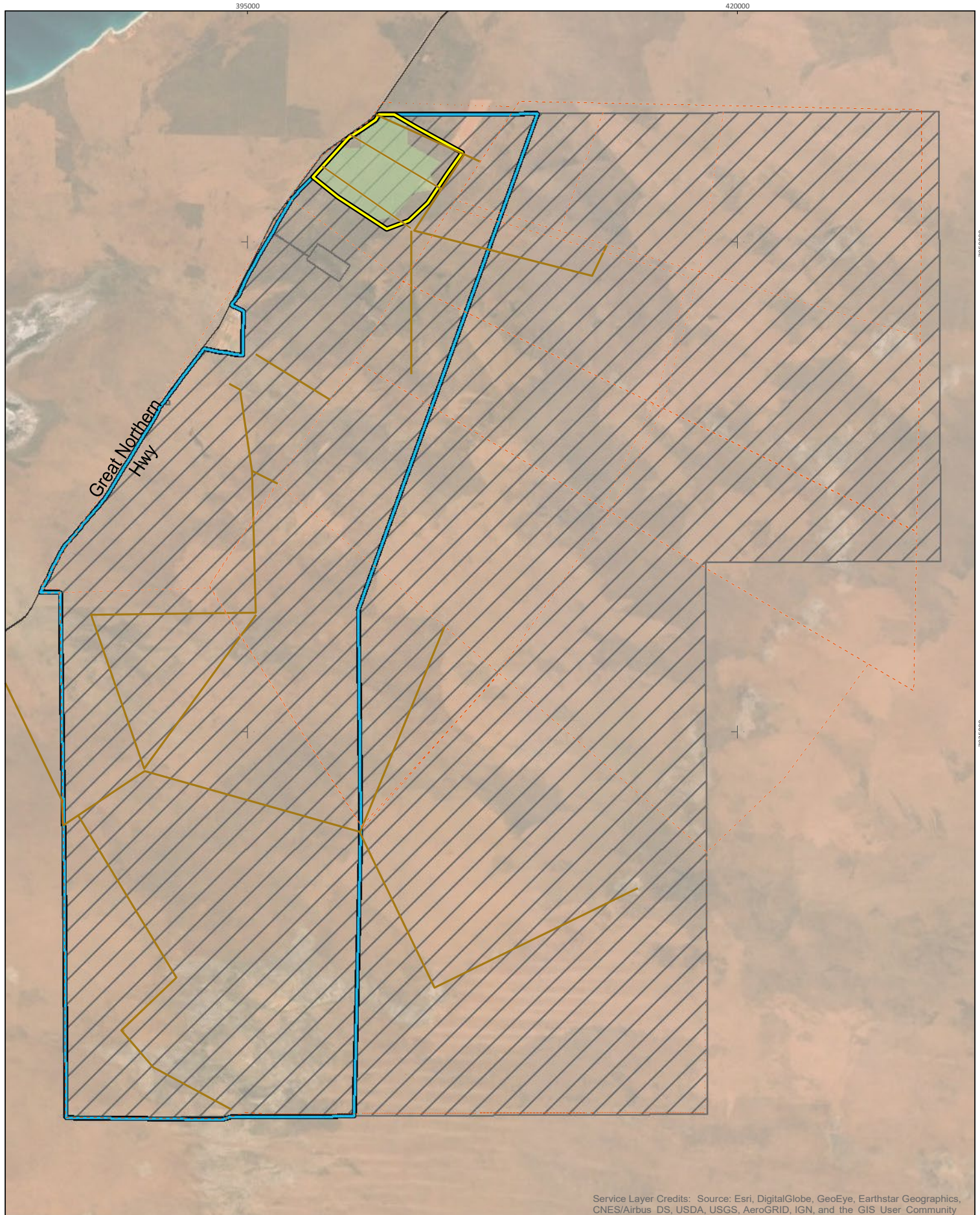
### Management targets

Demonstrated decrease in introduced predators (feral cats, foxes) in the control area compared with the baseline.

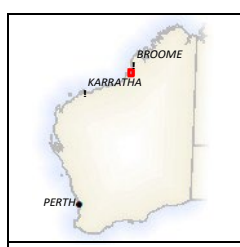
No introduction of rabbits to the control area as a result of the Project.

### Control area

The control area is shown in Figure 1 and is approximately 71,500 ha.



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Argyle Cattle Company Pty Ltd Shamrock Station Irrigation Project		
Project No	1230	
Date	16-Jan-20	
Drawn by	AL	
Map author	KC	
1:250,000 (at A4)		GDA 1994 MGA Zone 51

- Project area
- Indicative work area
- Shamrock station boundary
- Control area
- Tracks
- Fencing

**Figure 1**

**Control area for introduced animal monitoring and control program**

**PHOENIX**  
ENVIRONMENTAL SCIENCES



## Initial trapping survey

Prior to commencement of development activities, an initial round of leg-hold trapping for feral cats and foxes will be implemented within the control area. Trapping will simultaneously serve to mitigate risk to Bilbies by reducing the abundance of feral cats and foxes in the control area and inform future cat and fox control via aerial baiting. To ensure humane outcomes, trapping will be conducted in conjunction with DBCA staff and fauna professionals experienced in leg-hold trapping of cats and foxes for research and wildlife conservation. Leg-hold traps (Victor 'Softcatch') will be placed at approximately 0.5 km intervals along established tracks and preferentially positioned in locations where feral cats and foxes are more likely to be encountered (intersections, drainages and high-quality habitat) or where signs of feral cat and fox activity (scats, tracks, etc.) are observed.

All pest species captured during trapping will be humanely euthanised using a .22 calibre rifle by appropriately licensed staff. Age, sex, reproductive status and weight of all captured feral cats and foxes will be recorded. These metrics will provide a better understanding of population structure ahead of subsequent baiting. Prior knowledge of age and sex structure as well as breeding phenology will be useful because aerial baiting is hypothesized to be more effective on young cats and pregnant females than on adult males and removal of large adult males from an area may increase subsequent baiting efficacy (Lohr & Algar In review). The data provided by leg-hold trapping will allow more targeted timing of subsequent baiting attempts to maximise efficacy at reducing cat numbers. Additionally, large male cats which are difficult to remove using aerial baiting may disproportionately impact mammal prey >1 kg, including bilbies (Moseby *et al.* 2015).

Stomach contents of all cats euthanised during the trapping program, as well as all cat scats opportunistically collected during trapping, will be analysed to determine the species and relative abundance of prey items including Bilbies which have previously been detected in cat stomachs (Moseby *et al.* 2015).

## Monitoring

### Track activity index

Monitoring of introduced animal presence and abundance/activity level will be based on track counts. Methods are adapted from Read and Eldridge (2010) and Algar *et al.* (2013) with emphasis on cat detection.

Monitoring transects are to be established along unsealed tracks in the control area. Up to five transects of approximately 10 km each will be established on roads with suitably sandy substrate across the control area (Algar *et al.* 2013), with approximately 5 km spacing between transects.

The start and end of each transect is to be permanently demarcated using fence droppers (or similar). Transects are to be cleared/prepared by towing a drag behind a vehicle prior to counts. Counts are to be conducted on the morning following clearing of tracks (allowing for capture of overnight activity) by trained observers driving all-terrain vehicles at 10 to 15 km per hour (Algar *et al.* 2013).

All tracks are to be recorded and identified to species. Counts of track abundance will be recorded for each species. Counts of presence/absence per transect will be recorded for rabbits if track abundance counts are not possible. Data collection template example provided in Attachment 1.

Avoid disturbing tracks between clearing and each subsequent count. Avoid establishing tracks in overhanging foliage, because dripping dew may affect the clarity of footprints.

Baseline survey and subsequent monitoring rounds to be conducted yearly in mid-August, when baiting is most likely to occur. Transects established during baseline survey are to be re-sampled in subsequent monitoring events immediately prior to baiting and 24 days after baiting (if baiting occurs) to evaluate control efficacy.

### Control

Introduced animal control methods will be determined in consultation with Dr David Algar (Principal Research Scientist, DBCA) and the DBCA Broome office.

The key target species for the program are cats and foxes. The primary method of control for these species will be baiting. Baiting will be undertaken annually unless pre-control monitoring detects no evidence of feral cat or fox presence in the control area after two consecutive years. If after two consecutive years, no presence of feral cat or fox is detected in the control area, control measures will be directed elsewhere on Shamrock Station, and/or possibly on adjacent stations, subject to consultation with DBCA. In this event, monitoring will continue within the control area until four consecutive years of no feral cat or fox detections have occurred.

Other methods to be undertaken will be dependent on the presence of target species and input from DBCA but may include:

- shooting
- trapping
- targeted camera trap poisoning (Felixer grooming trap).

Introduced animal control is to be undertaken following monitoring rounds in mid-August. Taking an adaptive management approach, additional control measures, such as trapping and shooting, will be implemented if baiting alone does not reduce the cat activity index below baseline track counts.

Proposed methods are as follows:

**Baiting:** Aerial application of Eradicat® 1080 baits will be used as the primary control method for cats and foxes. This method is recognised as the most effective method for controlling feral cats (Comer *et al.* 2018). Baiting will be undertaken at the end of the dry season when food is at a minimum and animals are foraging for food. Timing would potentially vary dependent on weather conditions, but baiting would likely need to occur in mid-August (pers. comm. Dr. David Algar, Principal Research Scientist, DBCA, 8 May 2019). Baits will be applied at a rate of 50 per square kilometre across the control area. Aerial bait deployment will be undertaken by helicopter.

Alternatively, cat control could be achieved by replacing the dried meat bait currently used on Shamrock Station during ongoing feral dog baiting operations with Eradicat® baits. Eradicat baits also effectively control foxes and wild dogs (Doherty & Algar 2015). Predation by both of these species is “considered to be a major threat to the Greater Bilby” (Pavey 2006). Most current research does not suggest that increasing dingo density is an effective method for reducing the impacts of cats on native wildlife (Allen *et al.* 2015). Simultaneous control of cats, foxes, and dingoes is more likely than single-species control to achieve better conservation outcomes for bilbies.

- **Trapping:** If the activity index of introduced predators is not sufficiently reduced after baiting, leg-hold traps (Victor ‘Softcatch’) could be deployed along tracks in the project area, where target species are identified and remain operational for up to two weeks. Research permits would be required for cat trapping and would necessitate collaboration with external university or DBCA researchers. All feral cats captured will be humanely euthanized using a .22 calibre rifle. This technique could be employed in lieu of annual baiting on the advice of DBCA staff if warranted by reduced efficacy of baiting in the previous year.
- **Shooting:** Shooting may be undertaken if insufficient cat control is achieved through baiting alone. Spotlighting or thermal scopes to be used for detection. Targeted shooting may be required if the tracks observed indicate that baiting is not sufficiently removing large cats. Larger male cats are more likely than other cats to prey on larger native fauna including bilbies (Moseby *et al.* 2015) and targeting these individuals may produce a disproportionately larger conservation benefit.
- **Diet analysis:** Stomach contents of target animals euthanized during shooting or trapping will be analysed to determine what prey species have been consumed. Feral cat diet has not been studied in the western Kimberley region (Doherty *et al.* 2015). Gathering data on the diet of feral cats will inform both management at the site and broader ongoing research into feral cat control.

- **Felixer grooming traps:** due to the high cost of purchasing these traps, use of this technology may be undertaken on a pilot scale in conjunction with other control methods identified above if financial support is available from relevant state/federal government departments.

All introduced animal control events are to be recorded, including details of the number, sex, and weight, of each animal species trapped/shot and euthanized.

All captured introduced animals will be euthanized, stomachs removed for analysis and carcasses buried in appropriate pits on Shamrock Station.

#### **Timeframe for implementation**

The proposed timeframe for control and monitoring of introduced species in the control area is whichever comes first of:

- 20 years, or
- until feral cats and foxes are eliminated from the control area, demonstrated through annual monitoring to have been absent for a period of four consecutive years.

#### **Licencing and codes of practice**

A DPIRD Animal Ethics Committee permit is required for leg hold trapping of cats and foxes for the purpose of informing future management via aerial baiting. This permit will be obtained prior to commencement of trapping.

The registration of Eradicat in Western Australia (WA) restricts its use to fauna conservation programs on lands managed by or in agreement with DBCA. Applications to use Eradicat in WA are to be made to DBCA's Feral Cat Technical Committee via email [feralcatetechnicalcommittee@dbca.wa.gov.au](mailto:feralcatetechnicalcommittee@dbca.wa.gov.au)

A valid 1080 baiting application, risk assessment and approval will need to be in place prior to baiting as required under the Code of Practice for the Safe Use and Management of Registered Pesticides containing 1080, PAPP and Strychnine for vertebrate pest management in Western Australia (April 2018).

Introduced animal control will be conducted in accordance with codes of practice for the humane control of feral cats, foxes, wild dogs and rabbits (Sharp 2012; Sharp & Saunders 2012a, b).

Use of 1080 baits will be undertaken according to the Code of practice for the safe use and management of registered pesticides containing 1080, PAPP and strychnine (DoH *et al.* 2018).

#### **Reporting**

The persons undertaking the introduced animal control program will provide a succinct written report at the conclusion of each control round.

#### **Adaptive management**

The results of introduced animal monitoring and control will be reviewed annually. Where required, modifications to the program will be implemented to achieve the management targets.

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## **Appendix 4 Compliance Assessment Plan**

SHAMROCK STATION IRRIGATION PROJECT  
COMPLIANCE ASSESSMENT PLAN  
MINISTERIAL STATEMENT: 1086



Prepared for Argyle Cattle Company Pty Ltd  
A subsidiary of Consolidated Australian Pastoral Holdings Pty Ltd  
REPORT VERSION 1 **FINAL**  
6 February 2019

**Shamrock Station Irrigation Project – Compliance Assessment Plan (MS 1086)**  
**Argyle Cattle Company Pty Ltd**

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**Document history**

<b>Author</b>	<b>Recipient</b>	<b>Organisation</b>	<b>Version number</b>	<b>Date</b>
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## 1. Introduction

### 1.1. Background

Argyle Cattle Company Pty Ltd (ACC) proposes to develop the Shamrock Station Irrigation Project (the Project; Figure 1) is a pivot irrigation project for the production of irrigated pasture and fodder to support intensive cattle grazing. The Project is situated within the Shamrock Pastoral Station on the Great Northern Highway in the locality of La Grange, within the Shire of Broome. The Project is located 64 kilometres (km) south of Broome and approximately 130 km by road (Figure 1).

The Project was approved by the Minister for Environment under the *Environmental Protection Act 1986* (EP Act) on 19 November 2018, with the release of Ministerial Statement 1086 (Statement 1086) establishing conditions for the Project implementation.

Statement 1086 includes seven conditions with a total of 20 sub-conditions. Schedule 1 of Statement 1086 also includes a description and figures regarding the location and authorised extent of physical and operational elements of the Project, with which the proponent must comply.

Key components of the Project as outlined in Statement 1086, Schedule 1 are as follows:

- Clearing of up to 650 ha by mechanical clearing for pivots, access tracks and irrigation infrastructure.
- Installation of 11-12 groundwater abstraction bores and 4 monitoring bores.
- Construction of 12-13 circular irrigation pivots of up to 42.5 ha each.
- Construction of supporting infrastructure, including solar/diesel hybrid pumps.
- Establishing and maintaining a 50-100 metre square fenced vegetation round each pivot, up to 550 ha in total.
- Soil preparation, fertiliser application and seeding of fodder crop such as Rhodes grass, oats and sorghum within pivots.
- Abstraction of up to 9.5 GL of groundwater annually from the Broome Sandstone Aquifer to supply the irrigation system.
- “Stand and graze” operations within the pivot areas, entailing onsite rotational stocking of cattle from Shamrock Station and other stations owned by ACC.
- Baling of surplus fodder for internal use on ACC stations.

### 1.2. Scope and purpose

This Compliance Assessment Plan (CAP) has been prepared to meet conditions 4-1 and 4-2 of Statement 1086 as outlined below.

#### **4 Compliance reporting**

4-1 *The proponent shall prepare, and maintain a Compliance Assessment Plan which is submitted to the CEO at least six (6) months prior to the first Compliance Assessment Report, whichever is sooner.*

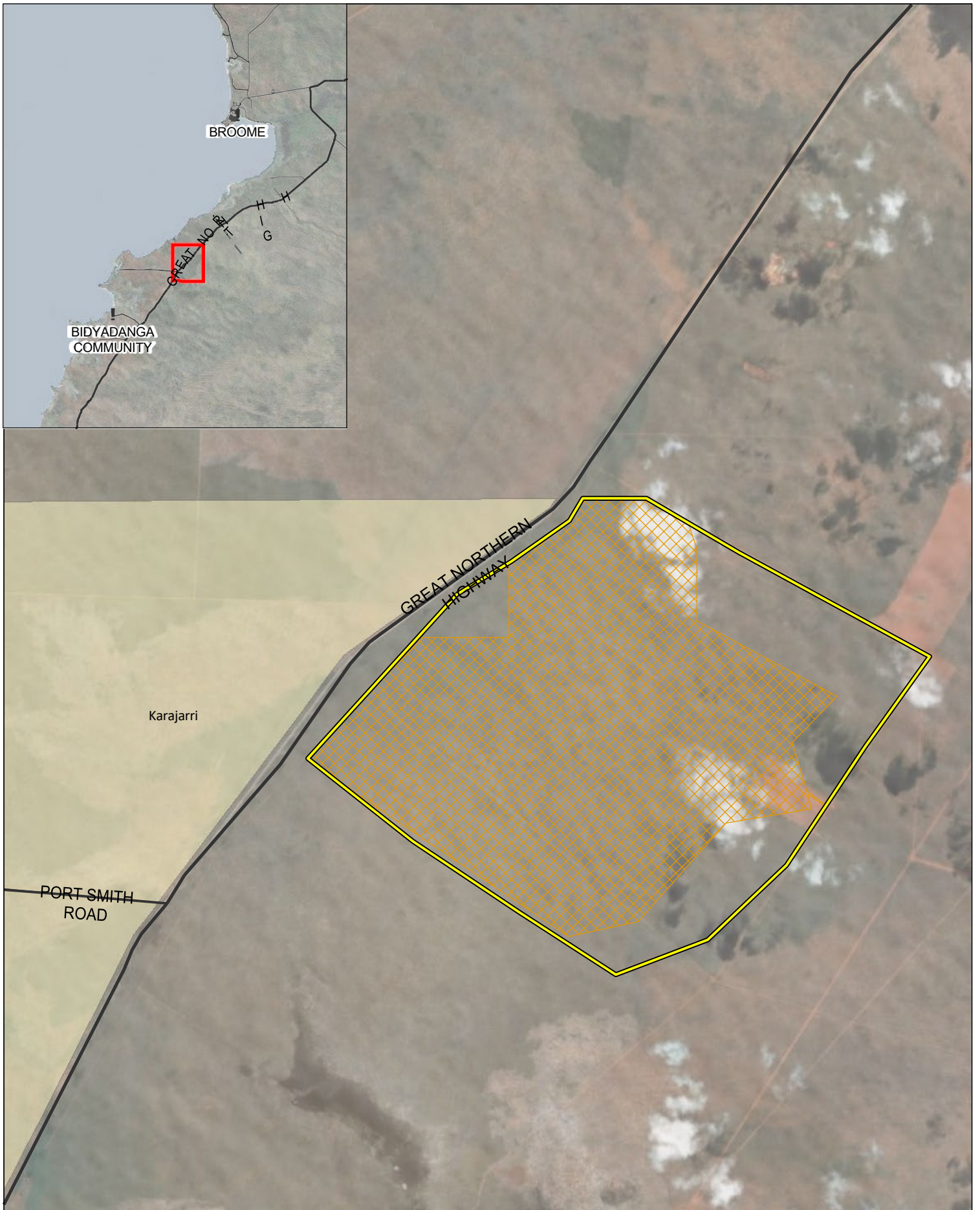
4-2 *The Compliance Assessment Plan shall indicate:*


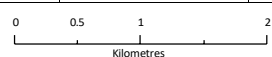
*(1) the frequency of compliance reporting;*




- (2) the approach and timing of compliance assessments;*
- (3) the retention of compliance assessments;*
- (4) the method of reporting of potential non-compliances and corrective actions taken;*
- (5) the table of contents of Compliance Assessment Reports; and*
- (6) public availability of Compliance Assessment Reports.*

This CAP has been prepared in accordance with:

- *Post Assessment Guideline for Preparing an Audit Table, Post Assessment Guideline No. 1 (OEPA 2012d)*
- *Post Assessment Guideline for Preparing a Compliance Assessment Plan, Post Assessment Guideline No. 2 (OEPA 2012b)*
- *Post Assessment Guideline for Making Information Publicly Available, Post Assessment Guideline No. 4 (OEPA 2012a).*



Argyle Cattle Company Pty Ltd Shamrock Station Irrigation Project		
Project No	1230	
Date	15-Jan-19	
Drawn by	JH	
Map author	KC	
		
1:60,000 (at A4) GDA 1994 MGA Zone 51		

-  Development envelope
-  Indicative Footprint
-  Australian Protected Areas (CAPAD 2016)

**Figure 1**  
**Project location and development envelope**

All information within this map is current as of 15-Jan-19. This product is subject to COPYRIGHT and is property of Phoenix Environmental Sciences (Phoenix). While Phoenix has taken care to ensure the accuracy of this product, Phoenix make no representations or warranties about its accuracy, completeness or suitability for any particular purpose.

## 2. Compliance Assessment Plan

### 2.1. Approach and timing of compliance assessments

#### Approach

Information used in annual compliance assessments will be collected by suitably qualified auditors.

Compliance assessments will be reported in Compliance Assessment Reports (CARs), required by condition 4-6 of Statement 1086.

Assessments will be based on sampling of evidence where appropriate. ACC will be responsible for ensuring documentary evidence is provided to the auditors in either hard or electronic formats and for maintaining records of all evidence used to inform the assessment.

#### Timing

ACC will assess its compliance with Statement 1086 annually in accordance with condition 4-6 of Statement 1086.

Statement 1086 was issued on 19 November 2018, with the first CAR to be submitted to the CEO of the Department of Water and Environmental Regulation (DWER) by 18 February 2020, 15 months from the date of issue of the statement and addressing the 12-month period from the date of issue of the statement (19 November 2018 to 18 November 2019).

Subsequent annual CARs will address each compliance period from 19 November to 18 November and be submitted to the CEO of DWER by the 18 February after each compliance period.

### 2.2. Retention of compliance assessments

ACC will retain all CARs and relevant records for the life of the Project and a minimum of seven years following the end of the life of the Project.

The life of the proposal is considered to continue until all implementation conditions of the Project have been met and all decommissioning and/or closure has been completed (OEPA 2012b).

The Project is intended to operate over the long-term, with no decommissioning or closure anticipated.

In accordance with OEPA (2012b), ACC has considered the circumstances that constitute termination of the life of the Project in recognition that groundwater monitoring and management will continue indefinitely under the groundwater licence. ACC proposes the termination date be set at:

- 2027, subject to demonstration of compliance with the environmental objectives of the Operational Environmental Management Plan (EMP); or
- in the event of unforeseen closure of the Project, 12 months following ceasing of groundwater pumping,

whichever comes first.

In the case of the former, all documentation will be retained by ACC until 2033.

### 2.3. Reporting of non-compliance, potential non-compliance and corrective actions

In accordance with condition 4-5 of Statement 1086, ACC will advise the CEO of DWER of any potential non-compliance within seven days of the non-compliance being known via the following means:

- immediate phone call and follow up letter for serious non-compliances
- by email for administrative non-compliances.

Written reports will address the information required in Section 3 of the EPA's Post Assessment Form 2 for Statement of Compliance (available at <http://www.epa.wa.gov.au/post-assessment-forms>), as amended from time to time.

Non-compliances and potential non-compliances will also be reported in the annual CAR for the relevant compliance period in accordance with Section 3 of Post Assessment Form 2 for Statement of Compliance.

#### 2.4. Public availability of reports

ACC will ensure this CAP and all CARs are made publicly available to stakeholders, including members of the public, upon request within seven days of receiving any request.

In accordance with condition 5-1, and subject to condition 5-2 of Statement 1086, ACC will make publicly available all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products) relevant to the assessment of the Project and implementation of Statement 1086.

In accordance with condition 5-2, ACC may request approval from the CEO of DWER to not make data publicly available that contains particulars of a secret formula or process, or confidential commercially sensitive information.

#### 2.5. Audit table

An audit table has been prepared for Ministerial Statement 1086 (Table 2-1). The audit table was partially prepared by the Department of Water and Environmental Regulation (DWER) and provided to ACC on 6 December 2018. ACC has prepared the audit table in accordance with Post Assessment Guideline for Preparing an Audit Table (OEPA 2012d).

The audit table contains each condition separated into audit elements for auditing purposes, and includes the following attributes (OEPA 2012d):

- Audit code: Alphanumeric code given to each implementation condition, procedure or commitment (that is, audit element).
- Subject: The environmental subject/issue.
- Requirement: Copy of the wording of the relevant implementation condition, procedure or commitment.
- How: The way the requirement must be undertaken as outlined in the Statement. Where the Statement is not prescriptive, the proponent should indicate how it intends to achieve the requirement.
- Evidence: Information or data required to be collected to verify compliance as outlined in the Statement. Where the Statement is not prescriptive, the proponent should indicate how it intends to achieve the requirement (e.g. report/letter/site inspection requirements).
- Phase: Project phase applicable to the audit element.
- Timeframe: Specific timing and/or location.
- Status: Compliance status, populated for CARs.

- Further information: Additional comments to support compliance findings, where required.

The audit table is a summary and timetable of conditions and commitments applying to the Project. Refer to Statement 1086 for full detail/precise wording of individual elements.

#### Project phases

Project phases applicable to the audit table are as follows (OEPA 2012d):

- Pre-Construction – No ground disturbance has commenced. Plans may be in development or approvals are being sought prior to ground disturbance.
- Construction – Ground disturbance may have commenced, no waste emission from operations has commenced, limited waste emissions may have occurred during 'commissioning' under a works approval issued under the EP Act; Project has substantially commenced
- Operation – The following may have occurred or may be occurring: ground disturbance; operations are producing waste emissions; 'commissioning' under a licence issued under the EP Act; development of a site; remediation activity prior to development of site; mining activity; subdivision of site.
- The following may occur during this phase: ground disturbance for rehabilitation purposes; post-remediation; post-reclamation; development following remediation where the main objective of the proposal was remediation; decommissioning.
- Decommissioning – The following may occur during this phase: ground disturbance for rehabilitation purposes; post-remediation; post-reclamation; development following remediation where the main objective of the Project was remediation; decommissioning.
- Overall – Used where an audit element applies during multiple phases of the Project.

#### Records

When implementing a requirement listed in Table 2-1, records that verify the timing and extent of implementation will be collected and retained to demonstrate compliance with the approvals. These records may include:

- CARs
- consultant reports, monitoring data and analyses
- photographs illustrating that the action has been completed
- invoices from contractors for completion of a requirement.

#### Status

The 'status' column of Table 2-1 will be populated for inclusion in CARs using the following terms in accordance with (OEPA 2012d):

- Compliant (C) – Implementation of the Project has been carried out in accordance with the requirements of the audit element.
- Completed (CLD) – A requirement with a finite period of application has been satisfactorily completed.
- Not Required at this stage (NR) – The requirements of the audit element were not triggered during the reporting period.

- Potentially Non-compliant (PNC) – Possible or likely failure to meet the requirements of the audit element.
- Non-compliant (NC) – Implementation of the proposal has not been carried out in accordance with the requirements of the audit element.
- In process (IP) – Where an audit element requires a management or monitoring plan be submitted to the OEPA or another government agency for approval, that submission has been made and no further information or changes have been requested by the OEPA or the other government agency and assessment by the OEPA or other government agency for approval is still pending.

Additional terms for use by DWER auditors only:

- Not Audited (NA)
- Verification Required (VR).



**Shamrock Station Irrigation Project – Compliance Assessment Plan (MS 1086)**  
**Argyle Cattle Company Pty Ltd**

Table 2-1 Ministerial Statement 1086 audit table

Audit Code <sup>1</sup>	Subject	Requirement <sup>2</sup>	How <sup>2</sup>	Evidence	Phase	Timeframe	Status	Further Information
1086:M1.1	Proposal Implementation	When implementing the proposal, the proponent shall not exceed the authorised extent of the proposal as defined in Table 2 of Schedule 1, unless amendments to the proposal and the authorised extent of the proposal have been approved under the EP Act.	Implement proposal as described in Schedule 1.	Annual CAR.	Overall	Ongoing		
1086:M2.1	Contact Details	The proponent shall notify the CEO of any change of its name, physical address or postal address for the serving of notices or other correspondence within twenty-eight (28) days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.	Submit written notification to the CEO.	Written notification to the CEO.	Overall	Ongoing		
1086:M3.1	Time Limit for Substantial Commencement	The proposal must be substantially commenced within five (5) years from the date of this Statement.	Commence substantial implementation of the proposal by 19 November 2023.	Written notification to the CEO.	Construction	By 19 November 2023		
1086:M3.2	Time Limit for Substantial Commencement	The proponent must provide to the CEO documentary evidence demonstrating that it has complied with condition 3-1 no later than thirty (30) days after expiration of five (5) years from the date of this Statement.	Provide written evidence of substantial commencement of proposal implementation on or before 19 December 2023.	Written notification to the CEO.	Construction	By 19 December 2023		
1086:M4.1	Compliance Reporting	The proponent shall prepare, and maintain a Compliance Assessment Plan which is submitted to the CEO at least six (6) months prior to the first Compliance Assessment Report required by condition 4-6, or prior to implementation of the proposal, whichever is sooner.	Prepare a CAP and submit to the CEO for approval.	CAP. CEO approval of CAP.	Pre-construction	By 19 August 2019 or prior to implementation of the proposal, whichever is sooner.		
1086:M4.2	Compliance Reporting	The Compliance Assessment Plan shall indicate: (1) the frequency of compliance reporting; (2) the approach and timing of compliance assessments; (3) the retention of compliance assessments; (4) the method of reporting of potential non-compliances and corrective actions taken; (5) the table of contents of Compliance Assessment Reports; and (6) public availability of Compliance Assessment Reports.	Prepare and submit to the CEO a CAP addressing all requirements.	CAP. CEO approval of CAP.	Overall	Ongoing		
1086:M4.3	Compliance Reporting	After receiving notice in writing from the CEO that the Compliance Assessment Plan satisfies the requirements of condition 4-2 the proponent shall assess compliance with conditions in accordance with the Compliance Assessment Plan required by condition 4-1.	Undertake annual compliance assessments in accordance with the approved CAP.	Annual CAR.	Overall	After receiving notice in writing from the CEO that the CAP satisfies the requirements of condition 4-2.		
1086:M4.4	Compliance Reporting	The proponent shall retain reports of all compliance assessments described in the Compliance Assessment Plan required by condition 4-1 and shall make those reports available when requested by the CEO.	Retain annual CARs in accordance with the approved CAP. Make CARs available to CEO on request.	Annual CAR.	Overall	Ongoing		
1086:M4.5	Compliance Reporting	The proponent shall advise the CEO of any potential non-compliance within seven (7) days of that non-compliance being known.	Provide written correspondence to CEO within 7 days of any potential non-compliance.	Correspondence to CEO advising of potential non-compliance. Annual CAR.	Overall	Ongoing		
1086:M4.6	Compliance Reporting	The proponent shall submit to the CEO the first Compliance Assessment Report fifteen (15) months from the date of issue of this Statement addressing the twelve (12) month period from the date of issue of this Statement and then annually from the date of submission of the first Compliance Assessment Report, or as otherwise agreed in writing by the CEO. The Compliance Assessment Report shall: (1) be endorsed by the proponent's Chief Executive Officer or a person delegated to sign on the Chief Executive Officer's behalf; (2) include a statement as to whether the	Submit Annual CARs addressing all requirements annually to DWER.	Annual CAR. Transmittal documentation of CAR.	Overall	By 19 February 2020 and then annually on this date thereafter.		

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Audit Code <sup>1</sup>	Subject	Requirement <sup>2</sup>	How <sup>2</sup>	Evidence	Phase	Timeframe	Status	Further Information
		proponent has complied with the conditions; (3) identify all potential non-compliances and describe corrective and preventative actions taken; (4) be made publicly available in accordance with the approved Compliance Assessment Plan; and (5) indicate any proposed changes to the Compliance Assessment Plan required by condition 4-1.						
1086:M5.1	Public Availability of Data	Subject to condition 5-2, within a reasonable time period approved by the CEO of the issue of this Statement and for the remainder of the life of the proposal the proponent shall make publicly available, in a manner approved by the CEO, all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps)) relevant to the assessment of this proposal and implementation of this Statement.	Make data relevant to the assessment of this proposal and implementation of this statement publicly available as per <i>Post Assessment Guidance for Making information publicly available</i> (OEPA 2012a).	Transmittal documentation of request for data. Website link (if posted on a website)	Overall	Ongoing		
1086:M5.2	Public Availability of Data	If any data referred to in condition 5-1 contains particulars of: (1) a secret formula or process; or (2) confidential commercially sensitive information; the proponent may submit a request for approval from the CEO to not make these data publicly available. In making such a request the proponent shall provide the CEO with an explanation and reasons why the data should not be made publicly available.	Provide the CEO with an explanation and reasons why data should not be made publicly available.	Correspondence to the CEO of the OEPA requesting approval to not make data publicly available, if applicable.	Overall	Ongoing		
1086:M6.1	Operational Environmental Management Plan	Prior to the commencement of ground-disturbing activities or as otherwise agreed in writing by the CEO, the proponent shall prepare and submit an Operational Environmental Management Plan to the CEO, to demonstrate that the following environmental objectives will be met: (1) Avoid, where possible, and minimise impacts to the Greater Bilby within the development envelope as defined in Figure 2 of Schedule 1. (2) Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause long term impacts to the environmental values of the Injudinah Swamp and on the hydrological regime and water quality of the Broome Sandstone Aquifer. (3) Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause significant change in the location of the saltwater interface due to the abstraction of water for the proposal. (4) Avoid, where possible, and minimise direct and indirect impacts so that the proposal does not cause long term impacts on Aboriginal heritage values.	Prepare an Operational EMP which is to be approved by the CEO.	Operational EMP. Approval notice from the CEO.	Pre-construction	Prior to the commencement of ground-disturbing activities or as otherwise agreed in writing by the CEO		
1086:M6.2	Operational Environmental Management Plan	The Operational Environmental Management Plan shall: (1) specify the environmental objectives to be achieved, as specified in condition 6-1; (2) specify risk-based management actions that will be implemented to demonstrate compliance with the environmental objectives specified in condition 6-1. Failure to implement one or more of the management actions represents non-compliance with these conditions; (3) specify measurable management target(s) to determine the effectiveness of the risk-based management actions; (4) specify monitoring to measure the effectiveness of management actions against management targets, including but not limited to, parameters to be measured, baseline data, monitoring locations, and frequency and timing of monitoring; (5) specify a process for revision of management actions and changes to proposal activities, in the event that the management targets are not achieved. The process shall include an investigation to determine the cause of the management target(s) being exceeded; (6) provide the format and timing to demonstrate that condition 6-1 have been met for the reporting period in the Compliance Assessment Report required by condition 4-6 including, but not limited to: (a) verification of the implementation of management	Address all requirements in the Operational EMP.	Operational EMP. Approval notice from the CEO.	Overall	Ongoing		

**Shamrock Station Irrigation Project – Compliance Assessment Plan (MS 1086)**  
**Argyle Cattle Company Pty Ltd**

Audit Code <sup>1</sup>	Subject	Requirement <sup>2</sup>	How <sup>2</sup>	Evidence	Phase	Timeframe	Status	Further Information
		actions; and (b) reporting on the effectiveness of management actions against management target(s).						
1086:M6.3	Operational Environmental Management Plan	After receiving notice in writing from the CEO that the Operational Environmental Management Plan satisfies the requirements of condition 6-2 for condition 6-1, the proponent shall: (1) implement the provisions of the Operational Environmental Management Plan; and (2) continue to implement the Operational Environmental Management Plan until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives specified in condition 6-1 have been met.	Implement the approved Operational EMP.	Annual CAR.	Overall	Ongoing until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives specified in condition 6-1 have been met.		
1086:M6.4	Operational Environmental Management Plan	In the event that monitoring, tests, surveys or investigations indicate exceedance of management target(s) specified in the Operational Environmental Management Plan, the proponent shall: (1) report the exceedance in writing to the CEO within twenty-one (21) days of the exceedance being identified; (2) investigate to determine the cause of the management targets being exceeded; (3) provide a report to the CEO within ninety (90) days of the exceedance being reported as required by condition 6-4(1). The report shall include: (a) cause of management targets being exceeded; (b) the findings of the investigation required by condition 6-4(2); (c) details of revised and/or additional management actions to be implemented to prevent exceedance of the management target(s); and (d) relevant changes to proposal activities.	Notify the CEO within 21 days of any exceedance of management targets being identified. Investigate cause of any exceedance. Provide a written report to the CEO within 90 days of any exceedance being reported.	Written notification to the CEO. Investigation report.	Overall	Report exceedance within 21 days of the exceedance being identified to CEO, provide a report within 90 days to the CEO		
1086:M6.5	Operational Environmental Management Plan	In the event that monitoring, tests, surveys or investigations indicate that one or more management actions specified in the Operational Environmental Management Plan have not been implemented, the proponent shall: (1) report the failure to implement management action/s in writing to the CEO within seven (7) days of identification; (2) investigate to determine the cause of the management action/s not being implemented; (3) investigate to provide information for the CEO to determine potential environmental harm or alteration of the environment that occurred due to the failure to implement management actions; (4) provide a report to the CEO within twenty-one (21) days of the reporting required by condition 6-5(1). The report shall include: (a) cause for failure to implement management actions; (b) the findings of the investigation required by conditions 6-5(2) and (3); (c) relevant changes to proposal activities; and (d) measures to prevent, control or abate the environmental harm which may have occurred.	Notify the CEO within 7 days of any failure to implement management action/s identified by monitoring, tests, surveys or investigations. Investigate cause of management action/s not being implemented. Provide a written report to the CEO within 21 days on any failure to implement management action/s.	Written notification to the CEO. Investigation report.	Overall	Ongoing		
1086:M6.6	Operational Environmental Management Plan	The proponent: (1) may review and revise the Operational Environmental Management Plan, or (2) shall review and revise the Operational Environmental Management Plan as and when directed by the CEO.	Review and revise the Operational EMP to the requirements of the CEO.	Revised Operational EMP. Approval notice from the CEO.	Overall	Ongoing		
1086:M6.7	Operational Environmental Management Plan	The proponent shall implement the latest revision of the Operational Environmental Management Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 6-2.	Implement the approved revisions of the Operational EMP.	Annual CAR.	Overall	Ongoing		
1086:M7.1	Aboriginal Heritage	Prior to the commencement of ground-disturbing activities, the proponent shall consult with the Karajarri Native Title Claim group and ensure that the proponent complies with its obligations under the <i>Aboriginal Heritage Act 1972</i> .	Consult with the Karajarri Native Title Claim group and ensure compliance of the proposal with the <i>Aboriginal Heritage Act 1972</i>	Aboriginal heritage report. Annual CAR.	Pre-construction	Prior to the commencement of ground-disturbing activities		

<sup>1</sup> M = Minister's condition; P = Proponent's commitment.

<sup>2</sup> CEO = CEO of DWER.

## 2.6. CAR table of contents

The table of contents for the CARs is detailed in Table 2-2 in accordance with *Post Assessment Guideline for Preparing a Compliance Assessment Report* (OEPA 2012c). Annual CARs are to be prepared in accordance with the guideline.

Table 2-2 *Table of contents for CARs*

Heading	Description
Endorsement	Endorsement of CAR by ACC's Chief Executive Officer or a person delegated to sign on the Chief Executive Officer's behalf.
Introduction	Brief details about the Project, including: <ul style="list-style-type: none"> <li>• statement number</li> <li>• reporting period</li> <li>• project background</li> <li>• proponent details.</li> </ul>
Current status	Summary of implementation status of the Project, specifically milestones/achievements in reporting period.
Statement of Compliance	Statement of whether ACC has complied with the conditions of Statement 1086 over the reporting period, prepared in accordance with the EPA's Post Assessment Form for a Statement of Compliance. Reference to Ministerial Statement audit table and operational EMP audit table. Identification of all non-compliances and corrective and preventative actions taken.
Details of declared compliance status	Details of the declared compliance status of each implementation condition, including: <ul style="list-style-type: none"> <li>• demonstrating that each declaration of compliance status is accurate</li> <li>• providing details of what criteria were to be met, whether they were met and sufficient information/documentation to support/verify conclusions.</li> </ul>
Proposed changes to CAP	Identification of any proposed changes to the CAP.
Tables	<ul style="list-style-type: none"> <li>• Ministerial Statement audit table in accordance with Table 2-1 of this CAP.</li> <li>• operational EMP audit table.</li> </ul>
Appendices	Supporting/verifying information/documentation

## 3. References

- OEPA. 2012a. *Post Assessment Guideline for Making Information Publicly Available, Post Assessment Guideline No. 4*. Office of the Environmental Protection Authority, Perth, WA.
- OEPA. 2012b. *Post Assessment Guideline for Preparing a Compliance Assessment Plan, Post Assessment Guideline No. 2*. Office of the Environmental Protection Authority, Perth, WA.
- OEPA. 2012c. *Post Assessment Guideline for Preparing a Compliance Assessment Report, Post Assessment Guideline No. 3*. Office of the Environmental Protection Authority, Perth, WA.
- OEPA. 2012d. *Post Assessment Guideline for Preparing an Audit Table, Post Assessment Guideline No. 1*. Office of the Environmental Protection Authority, Perth, WA.