

# EPBC 2021/9133 Offset Area Revegetation and Rehabilitation Management Plan



# Document Control

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## Revision History

Version	Description	Date
1.0	Draft	15 November 2024
2.0	Final	02 December 2024

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# Executive Summary

Townsville City Council has committed to the revegetation and rehabilitation of the Haughton Pipeline Stage 2 project Offset Area, located to the south of Townsville within the Lake Ross Storage Area, 2.7km south-east of Lake Ross. Revegetation and rehabilitation efforts will be undertaken generally in accordance with this Revegetation and Rehabilitation Management Plan, and any future revisions, over the life of the Haughton Pipeline Stage 2 project *Environment Protection and Biodiversity Conservation Act 1999* approval (EPBC ref 2021/9133), and as part of the implementation of the Offset Area Management Plan (GHD, 2023).

There are three regional ecosystems mapped to occur on site including 11.3.12, 11.3.25b and 11.3.35 that occur in remnant, re-growth and non-remnant conditions. Based on these condition states, the Offset Area Management Zone prioritised three different management actions for each state of the regional ecosystems, aligning with key habitat improvement measures for each of the three Matters of National Environmental Significance, which include the Southern Black-throated Finch, Bare-rumped Sheath-tail Bat and Koala. One management action is the *natural regeneration of native grasses*, which is prioritised for the entire Offset Area as an effort to improve habitat for the Southern Black-throated finch. A second measure involves *natural regeneration and rehabilitation of woodland vegetation*, which aligns largely with the re-growth regional ecosystems on site and is aimed at improving habitats for all three Matters of National Environmental Significance. The third action is *active planting and rehabilitation of woodland vegetation*, which aligns with the non-remnant vegetation on site, aimed at increasing canopy and sub-canopy species to offer nesting, roosting and foraging opportunities for the three Matters of National Environmental Significance. The expected increase in habitat from these three key management actions is captured in the ecological outcomes and completion criteria, detailed in Table ES 1.1 and Table 7.5, respectively, of the Offset Area Management Plan.

This plan has been developed with the aim of increasing key habitat quality and area for the three Matters of National Environmental Significance, delivered through both rehabilitation and revegetation measures. Several seeding and planting methodologies have been provided to allow flexibility according to each location on site, and revisions of selected methodologies, if monitoring identifies any revegetation failures. Rehabilitation efforts are integrated with other Offset Area Management Plan actions such as weed management and prescribed burns.

Section 4 of this plan details a schedule for review as well as annual monitoring reporting, which aligns with the requirements of the Offset Area Management Plan, as well as being in line with the Commonwealth Approval (EPBC ref 2021/9133).



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## Acronyms/ Abbreviations

Term	Meaning
BMP	EPBC 2021/9133 Offset Area Bushfire Management Plan
BRSB	Bare-rumped Sheath-tail Bat
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
HPS2	Haughton Pipeline Stage 2
LRSA	Lake Ross Storage Area
MNES	Matters of National Environmental Significance
OAMP	Offset Area Management Plan
Offset Area	HPS2 Offset Area
PAMP	EPBC 2021/9133 Offset Area Pest Animal Management Plan
RRMP	EPBC 2021/9133 Offset Area Revegetation and Rehabilitation Management Plan
SBTF	Southern Black-throated Finch
TCC	Townsville City Council
WMP	EPBC 2021/9133 Offset Area Weed Management Plan
RE	Regional Ecosystem

# 1. Introduction

## 1.1. Purpose and Objectives

The purpose of this Revegetation and Rehabilitation Management Plan (Plan) is to inform the required revegetation and regeneration actions under management action 2 for the Haughton Pipeline Stage 2 Offset Area (Offset Area) Offset Area Management Plan (OAMP). Revegetation and rehabilitation management is a key measure for meeting the ecological outcomes and completion criteria under the OAMP. The OAMP is conditioned and monitored for implementation under the Haughton Pipeline Stage 2 (HPS2) Project *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval (2021/9133). This requirement is included under Condition 7 and Condition 9 of the HPS2 EPBC Act Approval as follows:

*Condition 7: To compensate for residual significant impacts to protected matters, up to the limits specified in Condition 2, the approval holder must commence implementing the Offset Area Management Plan (OAMP) prior to the commencement of the action and continue to implement it for the remainder of the life of the approval. The approval holder must notify the department in writing of the date of commencing the OAMP implementation within 20 business days of the date of commencing OAMP implementation.*

*Condition 9 (excerpt): Within 60 business days following each 5-year anniversary of the date of commencing OAMP implementation, until the expiry of this approval, the approval holder must submit to the department and publish on the website for the remainder of the period of the approval, an OAMP Report which assesses progress towards achieving and maintaining each of the completion criteria. Once the completion criteria are achieved, the approval holder must ensure the completion criteria for the offset area are maintained for the remainder of the life of the approval.*

The objectives of this Plan are to achieve the ecological outcomes and meet the completion criteria relevant to revegetation and rehabilitation requirements under the OAMP, which are detailed in **Table 1**. The ecological outcomes can be found in the Executive Summary of the OAMP, with the performance indicators detailed in Section 7.3 of the OAMP.

**Table 1: Plan Objectives Relevant to OAMP**

OAMP Reference	Objectives relevant to this Plan
Table ES 1.1: Ecological Outcomes for the relevant Matters of National Environmental Significance (MNES)	Bare-rumped Sheathtail Bat ( <i>Saccolaimus saccolaimus</i> ): Increase the area of habitat for the Bare-rumped Sheathtail Bat (BRSB) by 315.76ha, within 20 years, via planting non-remnant areas with roost trees ( <i>E. platyphylla</i> ) and allowing regrowth areas to naturally regenerate.
	Southern Black-throated Finch ( <i>Poephila cincta cincta</i> ): Increase the area of potential habitat for the Southern Black-throated Finch (SBTF) by 352.52ha, within 20 years, via re-establishing native food grasses in key areas (i.e., within 400m of waterbodies) and planting non-remnant areas with native tubestock.
	Koala ( <i>Phascolarctos cinereus</i> ): Increase the area of habitat for the Koala by 315.76ha within 20 years via planting non-remnant areas with locally important koala food trees and allowing regrowth areas to naturally regenerate.
Table 7.5: Interim milestones, completion criteria and corrective actions	Performance indicators <ul style="list-style-type: none"><li>Year 1: At least 90 percent survival of planted tubestock is observed. At least 70 percent germination of seeds is observed. Natural regeneration of key flora species from all vegetation strata is observed in regrowth areas.</li></ul>

OAMP Reference	Objectives relevant to this Plan
	<ul style="list-style-type: none"> <li>Year 5: Regeneration and establishment of native plant communities is recorded. No notable areas of dieback are recorded. Net increase in canopy cover is recorded. Increase in habitat scores is recorded as per 5-year milestones in Table 7.6 (of the OAMP). Net increase in canopy and shrub species diversity is recorded. Net increase in cover and density of target native grasses is recorded.</li> <li>Year 10: Net increase in canopy cover is maintained. Recruitment and regeneration of native plants is maintained. Increase in habitat scores is recorded as per 10-year milestones in Table 7.6 (of the OAMP). Net increase in canopy and shrub species diversity is maintained. Net increase in cover and density of target native grasses is maintained.</li> <li>Year 15: Net increase in canopy cover is maintained. Recruitment and regeneration of native plants is maintained. Increase in habitat scores is recorded as per 15-year milestones in Table 7.6 (of the OAMP). Maintain the net increase in canopy and shrub species diversity. Net increase in cover and density of target native grasses is maintained.</li> <li>Completion criteria: Restore RE vegetation across non-remnant and regrowth areas to achieve floristics comparable to that of the relevant RE benchmarks. Achieve required point increase in habitat condition scores. Species richness of canopy layer meets or exceeds RE benchmark. Diversity and cover of native grasses is comparable to that of the relevant RE benchmarks.</li> <li>Corrective actions: Review potential reasons, such as seasonal or climatic conditions or surveying variation, and/or undertake additional management (e.g., watering, active planting of tubestock and/or seeding). Active planting of tubestock. Seeding with SBTf food species.</li> </ul>

## 1.2. Aims of this Plan

This Plan targets habitat improvement in three key zones across the Offset Area, which align with the OAMP target revegetation and rehabilitation management areas displayed in Figure 7-1 of the OAMP (**Appendix A**). These zones are defined as follows:

- Green Zone:** Aligns with the *Natural Regeneration of Native Grasses* areas (**Appendix A**). The green zone encompasses the entire 625ha Offset Area (**Figure 1, Appendix B**). To ensure minimum total habitat increase targets are achieved for all three MNES as detailed in **Table 2**, both rehabilitation and revegetation (i.e. active planting and/or seeding) will be required to supplement the natural regeneration/rehabilitation efforts.
- Yellow Zone:** Aligns with the *Natural Regeneration and Rehabilitation of Woodland Vegetation* areas (**Appendix A**). The yellow zone is mapped across approximately 81ha of the Offset Area (**Figure 2, Appendix B**). Efforts in this zone will largely consist of rehabilitation, however, revegetation may be undertaken if identified as required by 5-yearly habitat compliance monitoring.
- Red Zone:** Aligns with the *Active Planting and Rehabilitation of Woodland Vegetation* areas (**Appendix A**). The red zone is mapped across approximately 191ha of the Offset Area (**Figure 3, Appendix B**). Revegetation via planting and/or seeding is the main methodology to be undertaken in this zone to ensure an increase in nesting, roosting and foraging habitat for the three MNES.

The Plan aims to increase the available habitat for all three MNES. **Table 2** details the minimum areas of habitat increase required in each zone to achieve the desired ecological outcomes for the three MNES.



**Table 2: Minimum Habitat Increase Targets for Each MNES per Zone**

Total Habitat Increase for MNES Ecological Outcomes (ha)	Minimum Habitat Increase Targets per Zone (ha)
BRSB: 315.76 (non-remnant and re-growth areas)	Red Zone: 191ha
	Yellow Zone: 81ha
	Green Zone (Targeting non-remnant and re-growth RE areas): 44ha*
SBTF: 352.52 (all areas)	Red Zone: 191ha
	Yellow Zone: 81ha
	Green Zone: 81ha*
Koala: 315.76 (non-remnant and re-growth areas)	Red Zone: 191ha
	Yellow Zone: 81ha
	Green Zone (Targeting non-remnant and re-growth RE areas): 44ha*

\*Green zone area calculations are the difference of the total MNES habitat increase target and the combined yellow and red zone targets. Habitat improvement in the green zone must not overlap red and yellow zones to ensure total habitat increase targets are met.

The minimum habitat increase targets have been further disseminated in **Table 3** to align with the 5-yearly milestones. At each 5-year milestone, revegetation and rehabilitation efforts will be assessed in line with **Table 3** goals to determine if they are on trajectory to meet the required outcomes, with corrective actions triggered if habitat increases are not on trajectory to being achieved.

**Table 3: MNES Habitat Increase Goals at 5-yearly Milestones**

Zones	MNES	Minimum Habitat Increase Goals at each 5-year Milestone (ha)			
		Year 5	Year 10	Year 15	Year 20
Green	BRSB and Koala	11	11	11	11
	SBTF	20.25	20.25	20.25	20.25
Yellow	BRSB, SBTF and Koala	20.25	20.25	20.25	20.25
Red	BRSB, SBTF and Koala	48	48	48	48

## 2. Offset Area Conditions

### 2.1. Habitat

There are three Regional Ecosystems (RE) that are mapped to occur in the Offset Area and were verified in varying condition states during the original Bio Condition surveys undertaken for the OAMP. These are presented in **Table 4** and displayed in Figure 2-2 of the OAMP (**Appendix A**). **Table 4** illustrates the status of each RE, as well as their value for the target MNES on site.

**Table 4: Regional Ecosystems Mapped for the Offset Area**

Regional Ecosystem	Description	Status in Offset Area	Area (ha)	Habitat value for MNES
11.3.12	<i>Melaleuca viridiflora</i> woodland to open woodland, occasionally with <i>M. aregentea</i> and <i>M. dealbata</i> . Occasional midstratum of <i>Grevillea pteridifolia</i> and <i>Acacia leptocarpa</i> . Ground layer of perennial native grasses.	Remnant	37.03	Current preferred for SBTF
		Re-growth	17	Marginal and future for SBTF
		Non-remnant	19.76	
11.3.25b	<i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i> , <i>Nauclea orientalis</i> open forest. A range of other canopy or sub-canopy species including <i>Pandanus tectorius</i> , <i>Livistona</i> spp., <i>Eucalyptus tereticornis</i> , <i>Corymbia tessellaris</i> , <i>Millettia pinnata</i> , <i>Casuarina cunninghamiana</i> , <i>Livistona decora</i> , <i>Lophostemon suaveolens</i> or <i>L. grandifolius</i> . Ground layer of tall native grasses.	Remnant	28.38	Current preferred for SBTF, BRSB and Koala
		Non-remnant	21.48	Marginal and future for SBTF, BRSB and Koala
11.3.35	<i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> woodland, occasionally with <i>Corymbia tessellaris</i> . A secondary tree layer commonly occurs of <i>Planchonia careya</i> , <i>Pandanus spiralis</i> , <i>Melaleuca viridiflora</i> or <i>M. nervosa</i> , and <i>Petalostigma pubescens</i> . The ground layer is usually tussock native grasses together with forbs.	Remnant	207.65	Current preferred for SBTF, BRSB and Koala
		Re-growth	110.4	Marginal and future for SBTF, BRSB and Koala
		Non-remnant	183.88	

### 2.2. Previous Land Management

Sustained cattle grazing has caused a reduction in the abundance of native perennial and annual grasses and a relatively high abundance of exotic plant species in the LRSA (OAMP, 2023). The Offset Area also maintains a high occurrence of pest animal species, including the Feral Pig, which significantly impact habitats via degradation of waterbodies, spread of weeds and large-scale ground disturbance when foraging.

A weed survey conducted in 2024 (Kleinfelder, 2024) identified two high threat weed species in large areas including Chinese Apple (*Ziziphus mauritiana*), occurring in varying densities across approximately 571.02ha of the approximately 625ha Offset Area, followed by Rubber vine (*Cryptostegia grandiflora*) occurring across 186ha. These species are both listed under the *Biosecurity Act 2014* as Restricted species. A further six listed Restricted weed species were identified in varying densities across the Offset Area, with four listed as Weeds of National Significance. The survey included transects measuring weed density and richness at 30 locations across the Offset Area, these transects identified high densities of non-listed, introduced flora species, known to have an impact on SBTF habitat, in the groundcover across the site. Invasive groundcover species occurring in moderate to high densities across 10 to 20 locations in the Offset Area included Shrubby Stylo (*Stylosanthes scabra*), Round-leaf Cassia (*Chamaecrista rotundifolia*) and Horehound (*Mesosphaerum* (syn. *Hyptis*) *suaveolens*). A large percentage of the Offset Area currently exists as invasive plant monocultures due to long-term historical grazing and land modification, and as such it is likely a lot of the native seedbank from the pre-clear RE's has been lost.

The Offset Area has not been subject to any set prescribed burn schedule, with controlled burning not occurring since 2016 as noted in the BMP.

Annual land management efforts can be significantly delayed by the north Queensland wet season, which typically occurs from November to March. The Offset Area is located on the Ross Dam foreshore which limits accessibility across the majority of the site, due to large areas of standing water or poor access road conditions once water has retreated, extending access issues beyond the end of the typical wet season.

## 3. Methodologies

### 3.1. Revegetation

Several of the revegetation methodologies detailed in Section 3.1.1 generally align with Department of Transport and Main Roads Technical Specification for Landscape and Revegetation Works (MRTS16) (DTMR, 2017) which is at the time of writing publicly available here: [Category 3 - Roadworks, Drainage, Culverts and Geotechnical \(Department of Transport and Main Roads\)](#). These methodologies provide optionality and adaptive management for revegetation across the Offset Area, to account for various limitations of the Offset Area including seed stock resourcing, water availability and previous land management.

All seeding and planting options have not included the addition of fertilisers. As stated in Section 2.2, historical grazing and land modification has likely replaced the native seedbank with the invasive plants, as evidenced by the extensive monocultures of mature weeds occurring in the Offset Area. The addition of any fertiliser, and therefore extractable nutrients, is likely to provide unfavourable conditions for competition with exotic pasture and herbs as most native species prefer low extractable nutrient levels whilst invasive plants thrive on the presence of high extractable nutrients (Wijesuriya, W.S, 1999).

#### 3.1.1. Seeding Methodologies

##### Direct Seeding

Direct seeding involves sowing seed directly into the ground and can be undertaken by hand or with a machine. This methodology is most suitable for smaller areas where ground disturbance has already occurred and is the best option for areas that cannot be accessed by large machinery for seeding. This methodology is suitable for grass, shrub and canopy species and involves the following steps:

1. Burning or slashing of the groundcover and ripping the ground surface, to nominally 150mm depth unless severe ground compaction has occurred.
2. Sowing of seeds either by hand or machine (e.g., Belly Spreader, which can be mounted on personnel or a side-by-side for efficient sowing), parallel to natural land contours.
3. Re-burying of seed with ripped topsoil to 100mm. Installation of mulch over topsoil if available.
4. Installation watering until topsoil layer is moist.

When undertaken by hand, seed application rates for this methodology will be at the practitioner's discretion, based on seed availability and surface preparation required. Shrub and canopy species' seeds are nominally sowed between 5m and 10m apart. If completed using a machine, the seed application rates in **Table 6** and **Table 7** can be used with addition of a bulking agent such as gravel or lime.

##### Broadcast Seeding

Broadcast seeding is the most cost and time effective option, which involves spreading seeds over a large area mechanically. This methodology is suitable for grass, shrub and canopy species and can implement the application rates detailed in **Table 6** and **Table 7**. This strategy is most suitable for areas that have had ground disturbance as it negates the requirement for surface ripping. The following steps are undertaken:

1. Preferred seed mix and a bulking agent, such as dry sand, sawdust or agricultural lime are combined and spread out over a set area (based on seed application rates) of bare soil.

2. The topsoil area is then lightly worked by hand (e.g., Raking) or with a machine (e.g., Chain-dragging or diamond harrow) to cover seeds with topsoil layer.
3. Undertake initial watering until topsoil layer is moist.

## Standard Hydromulch

Application of a standard hydromulch, whilst effective for covering large areas in shorter timeframes, is the more expensive option. Standard hydromulch is sprayed out from a specialised truck, in which all materials that form the hydromulch are added to a large tank pre-filled with water that is agitated to combine the materials before application. This methodology is also suitable for grass, shrub and canopy species and can implement the application rates detailed in **Table 6** and **Table 7**. This strategy is suitable for large areas that have had ground disturbance as it negates the requirement for surface ripping. The following steps are undertaken:

1. Water is applied to topsoil/ground surface to moisten, which encourages adhesion of the hydromulch.
2. Materials including seeds, binders (optional, but recommended if applying in dry season) and mulch/fibre at a rate of 4000kg/ha total are combined with water in the truck. Combining materials for application must be sequenced as follows:
  - a. The first application consists of a slurry of water, 1000kg/ha of fibre/mulch, binder and 90% of the selected seed mix.
  - b. The second application utilises water, the remaining fibre/mulch, binder and 10% of the seed mix.
3. Each application is sprayed in a dispersed pattern from opposing directions to achieve a complete and uniform coverage. Once applied there should be no bare ground visible.

It is important that hydromulch is not installed before any forecasted rain, nor is it watered the day of installation if binder is included as the binder must set.

## Flora Species for Revegetation

Species utilised in revegetation will be opportunistically harvested from the Offset Area where available and sourced through TCC's selected nursery. The species to be utilised in revegetation are included, but not limited to, the species in **Table 5**, which align with the RE's occurring on site (**Table 4**) and in the wider LRSA, as well as other locally important flora species for the three MNES.

**Table 5: Flora Species to be used in Revegetation**

Canopy and Sub-canopy	Groundcover
<i>Corymbia tesseralis</i> and <i>Corymbia clarksoniana</i> (other local <i>Corymbia</i> spp).	<i>Themeda triandra</i>
<i>Eucalyptus platyphylla</i> , <i>Eucalyptus tereticornis</i> and <i>Eucalyptus camaldulensis</i> (other local <i>Eucalyptus</i> spp).	<i>Dichanthium sericeum</i>
<i>Melaleuca viridiflora</i> , <i>Melaleuca leucadendra</i> and <i>Melaleuca nervosa</i> (other local <i>Melaleuca</i> spp.)	<i>Alloteropsis semialata</i>
<i>Pandanus tectorius</i> and <i>Pandanus spiralis</i>	<i>Eragrostis sororia</i> and <i>Eragrostis elongata</i>
<i>Lophostemon suaveolens</i> and <i>Lophostemon grandiflorus</i>	<i>Setaria surgeons</i>
<i>Planchonia careya</i>	<i>Panicum</i> spp. (native)
<i>Petalostigma pubescens</i>	<i>Chrysopogon fallax</i>
<i>Acacia leptocarpa</i> (other local <i>Acacia</i> spp.)	<i>Ischaemum australe</i>
<i>Millettia pinatta</i>	<i>Hetropogon</i> spp. (native)

## Seed Mix Application Rates

**Table 6** and **Table 7** below provide seed mix application rates, per hectare, for grasses and woodland communities, as well as preferred times of the year for application. The composition and rates will be subject to change based on native seed sourcing and availability. The cover crop species will be sterile.

An additional measure aiding in germination success is coating of the seeds. Coating seeds is done as a measure to protect seeds against diseases and predation by insects, whilst also acting to delay germination without leading to the loss in seed viability, which is of particular importance when seeding in the dry season. Coating is recommended for 50% the native seeds only per application and it is a recommendation only, as coated native seeds are not readily available and some species are unsuitable for coating.

**Table 6: Grass Seed Mix Application Rates**

Time of Year	Description	Total Application Rate (kg/ha)
All Year	Mix of Three (two if three cannot be obtained) Native Perennial Species	15 (dependent on seed availability) (50% coated if available)
<b>Cover Crop Species</b>		
April to October	50% Annual Rye and 50% Annual Millet	10-20
November to March	100% Annual Millet	

**Table 7: Woodland Seed Mix Application Rates**

Time of Year	Description	Total Application Rate (kg/ha)
<b>Native Woodland Species</b>		
All Year	Mix of Three Native Tree Species	2 (dependent on seed availability)
	Mix of Three Native Shrub Species	1 (dependent on seed availability)
<b>Perennial Grass Species</b>		
All Year	Mix of Three (two if three cannot be obtained) Native Perennial Species	15 (dependent on seed availability) (50% coated if available)
<b>Cover Crop Species</b>		
April to October	50% Annual Rye and 50% Annual Millet	10-20
November to March	100% Annual Millet	

## Seed Supply Specifications

Any seeding methodologies that are outsourced will require a Seed Supply Proposal from the selected contractor. A certificate for each species will be requested, as part of the Seed Supply Proposal and should include the following:

- species of the seed
- purity percentage
- germination/viability percentage, and
- pre-treatments or coatings that have been applied to the seed.



Minimum seed application rates in **Table 6** and **Table 7** are based on a seed purity of 95% and germination/viability of 80% as required by MRTS16 (DTMR, 2017). Where purity and germination/viability test certificates indicate seeds are outside these parameters, TCC will ensure the application rate of the species is adjusted to meet the minimum requirements. Where purity and germination/viability are low, an alternate supply or substitution of species with higher purity and germination/viability will be considered. Grass seed purity and germination/viability certificates shall be no older than 6 months old. Tree and shrub seed purity and germination/viability certificates shall be no older than 1 year old.

### 3.1.2. Planting Methodologies

#### Tubestock: Shrub and Canopy Species

Tubestock planting is to involve germinating select shrub and canopy species in a nursery for planting in designated areas. Seedlings are grown to suitable ages, determined by location and ground condition areas of planting, with the typical growth stage reached at a minimum of 6-months (forestry tube size of approximately 140mm) before planting.

Areas of 'deep stem' planting involves growing the select species in the nursery until a minimum of 12-months of age, to allow for a more established deeper root system when planting. This age and planting technique is utilised typically for bank stabilisation of waterways and has a combined advantage of being somewhat resistant to predation from native herbivores due to the trunk being hardy.

For tubestock planting in the Offset Area, the following steps will be undertaken:

1. Planting site is prepared through either removal or control of weeds (both groundcover and shrubby weeds). Planting hole is dug slightly deeper and twice as wide as the planting container size (depth: 140mm for forestry tube, 600-1000mm for deeper stem planting).
2. The soil in the Offset Area has regular fluvial deposits and sandy soils and as such would not benefit from pre-drenching the planting hole, however, where heavier clay soil is encountered, fill the hole with water and allow to soak into surrounding soil.
3. Dunk potted plant in water and allow to soak (until bubbles stop).
4. Pre-mix dug soil with water crystals in bottom of hole at a rate of approximately 0.5g per litre of soil.
5. Invert plant container and tap to loosen plant, ensure damage to roots is minimal.
6. Place plant in hole, replace with dug soil and firm around the plant. Create a shallow saucer around plant stem to capture surface water run-off.
7. Mulch around hole, avoiding plant stem, to aid in water retention.
8. Water all plants with approximately 5L.

#### Tubestock: Groundcover Species

Ground cover species can be planted via tubestock, and this has been previously trialled by TCC. The trial conducted by TCC involved the harvesting of native grass seed and propagating the grasses in the TCC nursery. Germinated grasses were then planted at the trial site at Oak Valley Nature Reserve (approximately 10km north of Offset Area), in 2021, where the grass seeds were harvested from. This trial noted success in the grasses recruiting at the trial site, however, a lack of weed management has impacted full recruitment of the planted native grasses at this location (pers. comms. Angela Wicks TCC Senior Environmental Officer).

This methodology is an option for various areas of the Offset Area, where seeding options do not result in successful germination of native seeds. This option will be of benefit in areas where the ground has been disturbed and cleared of weeds, in particular where regeneration of native grasses is a priority or native groundcover seeding is being outcompeted by exotic grasses. Tubestock planting of grasses would generally involve:

1. Propagating in trays in a nursery before separating into tubestock to harden.
2. Planting at a rate of approximately 5-10 grass tubes per square meter.
3. Initial watering of the plot.

### 3.1.3. Site Preparation, Maintenance and Monitoring

#### Site Preparation

As detailed in Section 2.2, the Offset Area has a high volume of weeds encompassing the mid-canopy and ground layers. For these areas active revegetation is going to be most advantageous for areas that have been cleared of invasive plants over a multi-year program, to ensure the seedbank has also been treated to a manageable level. As per the weed management plan (Kleinfelder, 2024), areas of dense woody weeds will be subject to mechanical clearing involving the removal of trees at the base, where practicable, to avoid significant ground disturbance. In all other areas where the shrubby weed densities are lower, weed densities are being managed by herbicide or prescribed burns. Employment of these management methodologies works in tandem with revegetation of the native species, consistent with the Offset Area pre-clear RE's, as the lack of ground disturbance is favourable for assisted and natural recruitment. Disturbing the soil releases extractable nutrients such as nitrogen (N), Potassium (K) and Phosphorus (P), which encourage recruitment of invasive species that favour the highly fertile and available nutrients (Wijesuriya, W.S, 1999). In areas where exotic flora species are less dominant, preparation is to be managed differently. Prior to planting, a prescribed burn or slashing may be required at the location to reduce the groundcover. No ground disturbance will occur at designated tubestock planting sites, where practicable.

To reduce damage or predation by native or introduced fauna species, fauna exclusion or deterrent devices will be utilised such as mesh fencing or a scare gun. Where the areas are only being planted with tubestock, tree guards will be an alternative option to protect the trees.

#### Maintenance

Follow up weed control and fauna exclusion devices will be undertaken, where required, during each monitoring event.

Watering will be undertaken fortnightly after initial planting until forecasted rain events. Where practicable, revegetation will be undertaken prior to the wet season to limit watering, however, the recommended fortnightly watering may be required ongoing due to the unpredictability of commencement of the wet season. Watering should also be undertaken as required, for up to 12 months, as indicated by regular monitoring.

#### Monitoring

TCC will develop and implement an internal schedule identifying locations to be actively revegetated that aligns with weed management (as per the priority zoning detailed in EPBC 2021/9133 Weed Management Plan), availability of native seed stock (noting various native grasses can have dormancy periods of more than 12-months) and the prescribed burn scheduling detailed in the BMP.

This schedule will factor in the below monitoring commitments (**Table 8**), as detailed in Table 7.7 of the OAMP, to be undertaken following commencement of revegetation efforts. Prior to revegetation, georeferenced photographs will be taken of sites for a comparison of the baseline condition against future monitoring. Where locations coincide with BioCondition monitoring points from the baseline survey undertaken to inform the OAMP, the historical baseline photo monitoring will also be used in comparison. Monitoring events will assess plant health and mortality.

**Table 8: Revegetation Monitoring**

Year	Frequency
1	Weekly during first 3 months
	Quarterly for remaining 9 months
2	6-monthly
3	6-monthly

During monitoring events, where plant health is reported to be declining and/or there are high mortality rates, the corrective actions detailed in **Table 9** will be implemented to ensure 5-yearly performance objectives are being met.

**Table 9: Corrective Actions**

Risks	Mitigation	Timeframe
Insufficient water can lead to the plants failing to survive at both the nursery and planting site.	Controlled watering during dry periods.	Additional watering will be determined by the nursery representative or land manager to ensure the survival and establishment of the plants.
Over-watering can lead to root rot and loss of planted seedlings, particularly for native dryland species.	Monitoring watering to ensure plants are not being overwatered.	Additional watering only undertaken if in prolonged dry periods.
Weed incursions into seeding/planting area may outcompete planted seedlings or create additional fuel load leading to uncontrolled hot fires.	Targeted control of weeds on-site including slashing or mowing. Weed hygiene practiced for all activities on site from commencement of site preparation.	Until end of 3-year monitoring period for select location, as detailed in Table 7.
Damage to plants from livestock or fauna tramping or eating plants.	Fencing will be installed around the active revegetation site to ensure livestock and fauna are excluded.	Until end of 3-year monitoring period for select location, as detailed in Table 7. This timeframe allows planted tubestock to have grown to heights that are less likely to be predated due to hardy trunks.
Attack of plants from pest.	During monitoring events, data will be recorded for each plant on signs of attack from potential pest invertebrates. Option is to remove the leaves or branch material with the signs of attack or treat with insecticide as per the rate recommended for the product.	Until end of 3-year monitoring period for select location, as detailed in Table 7.
Ongoing decline in plant health or failure to strike for seeding areas in mechanically cleared areas where the ground has been extensively disturbed.	TCC will explore soil investigations to understand and analyse the soil composition, in particular the concentration of extractable N, P and K. Amelioration of soils to reduce any N, P and K in high concentrations through potential addition of a carbon source. Other factors will be considered when testing and ameliorating including pH.	At 5-yearly milestone monitoring events.

## 3.2. Rehabilitation

Rehabilitation efforts on site will be integrated with other environmental management and their associated plans on site, including the BMP, PAMP and WMP. Largely, the Offset Area is predicted to naturally regenerate where it is assisted by extensive weed and pest control efforts undertaken as part of the WMP and PAMP. Weed management will avoid disturbing the ground where practicable, in particular along banks of waterways. Retaining root systems along waterway banks will stabilise the ground and reduce sedimentation of the waterways, particularly where groundcover is able to re-establish with the newly opened canopy.

Weed management in the Offset Area will also be facilitated by regular controlled burning as per the BMP scheduling. Due to the historical modification and grazing, dominant native groundcover emergence and recruitment after prescribed burns is unlikely unless burns are regularly scheduled and undertaken. Studies of controlled burns in grassland areas indicate it is likely that introduced groundcover will flourish after the initial years of consistent controlled burning, before their seedbank is eventually depleted, allowing natives to begin more successfully recruiting the areas (Wijesuriya, W.S, 1999). Based on this, controlled burning of areas in the Offset Area that are prioritised for natural regeneration/rehabilitation, will be monitored following the burns with data captured on the species that germinate and establish themselves in the burnt areas. Where burnt areas coincide with weed plot locations detailed in the WMP, monitoring will form part of the weed transect surveys for efficiency of effort and reporting. Areas containing infestations of weeds that are promoted by fire, such as Grader Grass, will not be burnt and instead managed as per the WMP.

Removal of errant cattle is an ongoing management measure for the Offset Area, which will assist in natural rehabilitation by reducing pressure, weed seed spread and degradation of waterbodies and soils.

## 3.3. Targeted Zone Revegetation and Rehabilitation

Planting rates (stems per hectare) in any of the three zones will be guided by the corresponding RE mapped for the planting location, as detailed in **Table 10**. The rates have been provided by a review of the REs occurring on site and the Bio Condition benchmarks, where available for the RE.

**Table 10: Planting Rates for each Offset Area RE**

	RE 11.3.35	RE 11.3.12	RE 11.3.25b
Planting Rate	<ul style="list-style-type: none"><li>50 canopy/sub-canopy stems per hectare.</li></ul>	<ul style="list-style-type: none"><li>60 canopy/sub-canopy stems per hectare</li></ul>	<ul style="list-style-type: none"><li>60 canopy/sub-canopy stems per hectare</li></ul>

### 3.3.1. Green Zone

**Figure 1** illustrates the green zone on site dedicated to natural regeneration of native grasses, encompassing the entire Offset Area.

#### Rehabilitation

Rehabilitation efforts in this zone are through weed and fire management as discussed in Section 3.2.

Regular mosaic burning in the Offset Area will, over time, encourage natural regeneration of the native grass species occurring on site. Monitoring will be conducted, as described in Section 3.2, to review the groundcover species that re-establish and dominate following a controlled burn. At Year 5, results of the post-burn monitoring will be reviewed to assess if additional efforts to assist in regeneration of the native grasses, such as seeding, are required.

Management of shrubby weeds will reduce competition and encourage recruitment of the native shrub and canopy species in this zone. Removal of cattle from the Offset Area will also prevent a vector of weed seed spread across the site.

## **Revegetation**

An eastern portion of the Offset Area with extensive Chinese Apple infestation has been mechanically cleared in the first 12-months following commencement of the OAMP implementation, resulting in significant ground disturbance. This area will be subject to seeding and/or planting as detailed in Section 3, as the native seedbank will have been depleted and unable to rapidly naturally regenerate. Seeding and/or planting will be undertaken initially in trial plots, with sizing to be confirmed based on seed stock availability and fencing requirements, to monitor the success of the revegetation methodologies in this location. The plots will be subject to the monitoring schedule in **Table 8** and corrective actions detailed in **Table 9**.

In conjunction with Management Action 4 of the OAMP, involving installation of a permanent water source, seeding of native grasses will be trialled surrounding the water source. This trial site will be subject to site preparation, maintenance and monitoring detailed in Section 3.1.3, with the aim of establishing foraging grasses for the SBTf adjacent to a water source, followed by recruitment into surrounding areas.

### **3.3.2. Yellow Zone**

**Figure 2** illustrates several isolated areas of the yellow zone in the eastern and western parts of the Offset Area, dedicated to natural regeneration and rehabilitation of woodland vegetation. These areas are associated with mapped areas of regrowth REs and are somewhat associated with waterbodies on site.

## **Rehabilitation**

Rehabilitation efforts in this zone are through weed and fire management as discussed in Section 3.2.

Regular mosaic burning in the Offset Area will promote recruitment of canopy and sub-canopy species through suppression of groundcover and germinating fire-obligate species.

Management of shrubby weeds will reduce competition and encourage recruitment of the native canopy and sub-canopy species in this zone. Management of shrubby weeds along waterbody banks will retain root systems to ensure ongoing bank stabilisation. Removal of cattle from the Offset Area will also prevent a vector of weed seed spread across the site.

## **Revegetation**

As detailed in Section 1.2, this zone may require some supplementation to the rehabilitation efforts with revegetation, as identified through the 5-yearly habitat condition compliance assessments.

A suggested revegetation methodology is through 'deep stem' planting, discussed in Section 3.1.2, which involves propagating select canopy and sub-canopy species in a nursery until 12-months of age in order to develop a more established root system. Planting holes are excavated deeper than forestry tube size, approximately half a metre to a metre deep, which provides a measure of longevity due to the more stable root system and height of the plant. This planting is suggested along waterbody banks, particularly where shrubby weeds have been removed at the base, to both outcompete recruitment of invasives and further stabilise the banks.

### **3.3.3. Red Zone**

**Figure 3** aligns with non-remnant RE's in the Offset Area and is prioritised for active planting and rehabilitation of woodland vegetation. A large portion of the red zone coincides with areas of dense Chinese Apple monocultures.



## Rehabilitation

Rehabilitation in this zone will largely consist of extensive weed management, which is required to occur before any active revegetation. These areas are also mapped along waterway lines and as such will ensure root systems of removed shrubby weeds are retained to keep banks intact.

Regular mosaic burning in the Offset Area will promote recruitment of canopy and sub-canopy species through suppression of groundcover and germination of fire-obligate species.

Removal of cattle will ensure waterway banks and beds are not continually heavily degraded and weed seed spread is minimised.

## Revegetation

This zone is prioritised for active revegetation with the aim to increase canopy and sub-canopy species for MNES nesting, roosting and foraging, whilst also assisting regeneration of native groundcover associated with the RE. Planting and/or seeding will be undertaken annually, aligning with areas that have been successfully managed for shrubby weeds and that are not scheduled for controlled burning in the subsequent 12-24 months. Annual planting and/or seeding will be planned based on seed stock availability and planned to achieve minimum area targets detailed in **Table 3** at each 5-year interval.

# 4. Monitoring, Review and Reporting

## 4.1. Plan Review

This plan will be scheduled for review at the milestones detailed in **Table 11**, to assess performance against the objectives outlined in **Table 1** of this plan and performance indicators detailed in Table 7.5 of the OAMP. The objectives are also subject to compliance auditing and review against Conditions 7 to 11 under the *Environmental Offset Requirements* in the HPS2 Project EPBC Approval (ref 2021/9133).

**Table 11: Management Plan Review**

Timing	Approval Requirement	Management Plan Review Trigger
Year 3	Condition 8 of the HPS2 Project EPBC Approval (ref 2021/9133) requires a report to be produced and provided to the department within 20 business days of the 3-year anniversary of the date of implementing the OAMP (17 July 2026) detailing: <ul style="list-style-type: none"><li>A detailed description of survey method, timing and effort undertaken to detect the SBTF in the Offset Area,</li><li>An assessment of likelihood of SBTF being present in the Offset Area, including analysis of probable cause(s) for failure to detect species, and</li><li>Additional action approval holder to undertake to increase likelihood of detecting SBTF in Offset Area.</li></ul>	In Section 7.6.1 of the OAMP, a commitment to the review of the OAMP is made and scheduled to occur following the reporting event required by Condition 8 of the EPBC Approval.  This review will include the review of the implementation and success of this plan.
Year 5, 10 and 15	Condition 9 of the HPS2 Project EPBC Approval (ref 2021/9133) requires a report to be produced and provided to the department within 60 business days of each 5-year anniversary of the date of implementing the OAMP, assessing progress towards achieving and maintaining the completion criteria. The report must also detail if the SBTF have not been detected in the Offset Area in 5 years. Details to be included are: <ul style="list-style-type: none"><li>Detail performance achieved against all interim performance indicators in the period since approval decision with more detail in respect of the period since the previous OAMP report.</li></ul>	The corrective actions for increasing habitat detailed in Table 7.5 of the OAMP and Condition 9 of the HPS2 project EPBC Approval trigger a review of this plan, which will be undertaken at each 5-year anniversary of the

	<ul style="list-style-type: none"> <li>Describe results and effectiveness of all management actions implemented during period subject of current OAMP report,</li> <li>Include monitoring results including all confirmed sightings of protected matters, and</li> <li>Detail any interim performance indicators not met and describe all corrective actions taken and evaluate their effectiveness.</li> </ul>	implementation of the OAMP.
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## 4.2. Monitoring and Reporting

Monitoring will be triggered on commencement of revegetation efforts in the Offset Area, assessing health and mortality of plants at each event as per the program in **Table 8**. If any corrective actions are triggered (**Table 9**), these will be reported within the monitoring report.

A monitoring report will be produced annually for the monitoring conducted in the 12-month period. The monitoring report shall include:

- A summary of areas that were subject to revegetation efforts including location details, area of revegetation (hectares), revegetation methodology and species used.
- A summary of site preparation and maintenance undertaken in the 12-month period for each area of revegetation.
- Data on plant health and mortality captured during monitoring events, as well as any corrective actions triggered.

Monitoring reports will be provided as part of the annual compliance reporting for the HPS2 Project EPBC Approval.

## 5. References

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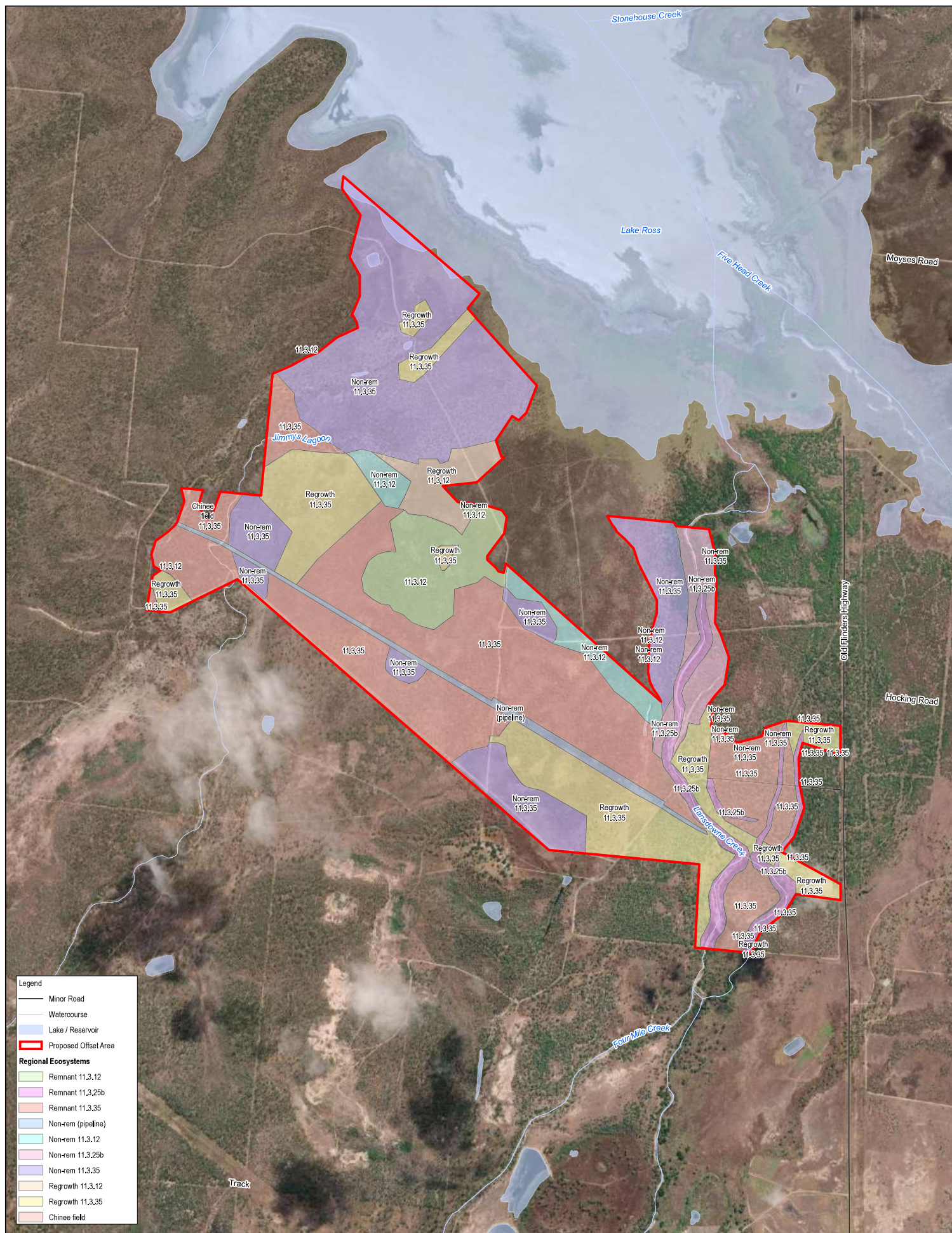
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# Appendix A: OAMP Figures





Based on or contains data provided by the State of QLD 2021.  
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Paper Size ISO A3  
0 250 500  
Meters  
Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



Townsville City Council  
Haughton Pipeline Stage 2 -  
Offset Area Management Plan

Field verified Regional Ecosystems  
within the proposed offset area

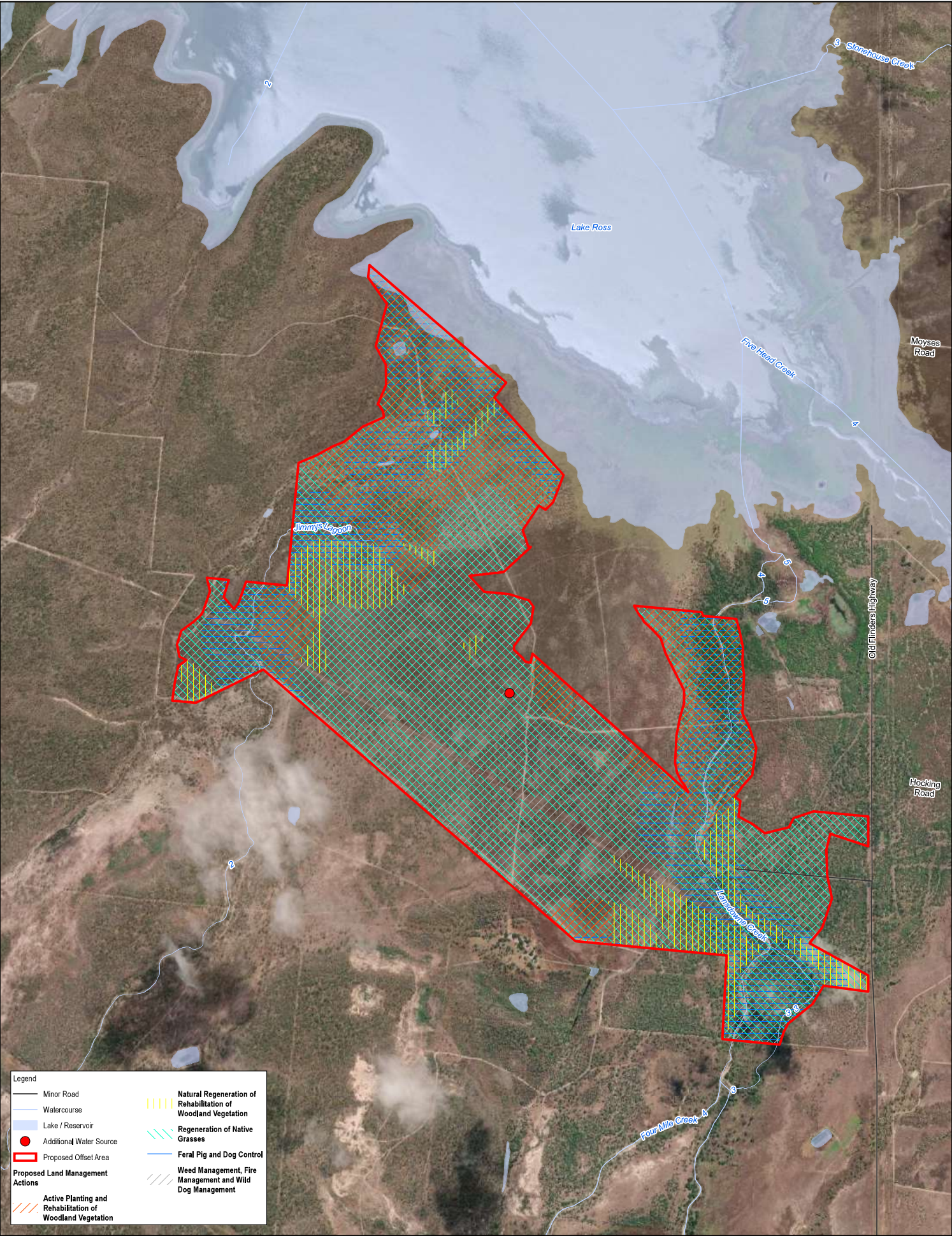
Project No. 12537606  
Revision No. 1  
Date 10/26/2022

FIGURE 2-2

\\ghd\ghd\AU\Townsville\Projects\4212537606\GIS\Maps\APR\12537606\12537606\_Ecology.aprx 12537606\_CMP\_V01\_RegionalEcosystems\_Rev1  
Print date: 27 Oct 2022 - 12:26

Data source: DoR, Roads, Railway, Watercourses (2021); GHD: Site Layout, Regional Ecosystems v12 with Field-verified Edits (2022); World Imagery, Mapbox, Created by: ghfcd





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Paper Size ISO A3  
0 250 500  
Meters  
Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



Townsville City Council  
Haughton Pipeline Stage 2 -  
Offset Area Management Plan  
**Preliminary indicative map of  
proposed land management  
actions within the offset area**

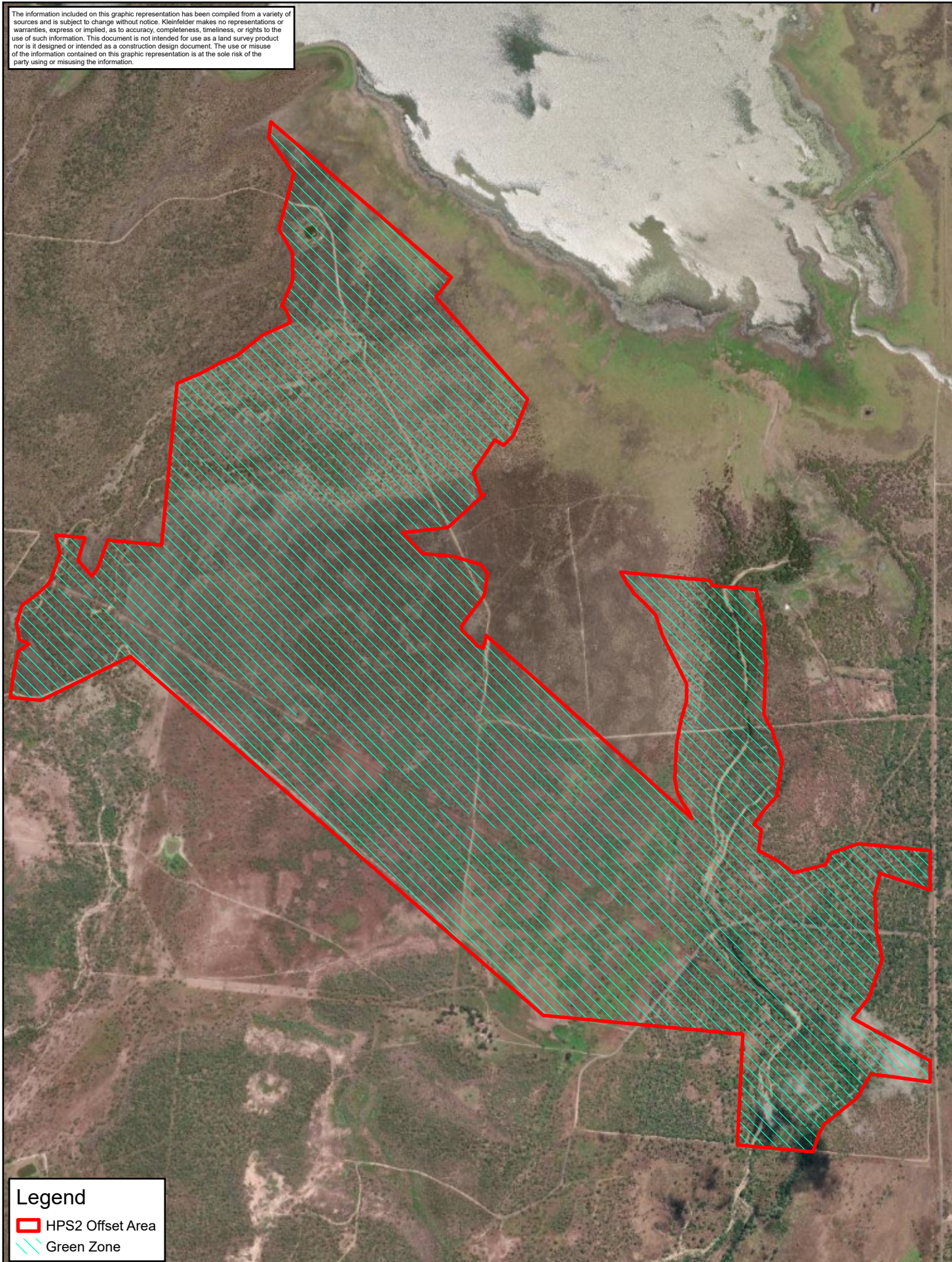
Project No. 12537606  
Revision No. 2  
Date 10/26/2022

**FIGURE 7-1**



# Appendix B: Plan Figures

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## Legend

- ▬ HPS2 Offset Area
- ▬ Green Zone

0 110 220 440 660 880 1,100  
Scale @ A4 1:22,000 Metres

GDA 1994 MGA Zone 55



PROJECT REFERENCE: 24005427

DATE DRAWN: 12/11/2024 Version 1

DRAWN BY: RHourigan

DATA SOURCE:  
Esri - 2024

## NATURAL REGENERATION OF NATIVE GRASSES

TOWNSVILLE CITY COUNCIL  
HAUGHTON PIPELINE STAGE 2  
WEED MANAGEMENT PLAN  
PIPELINE ALIGNMENT

FIGURE:

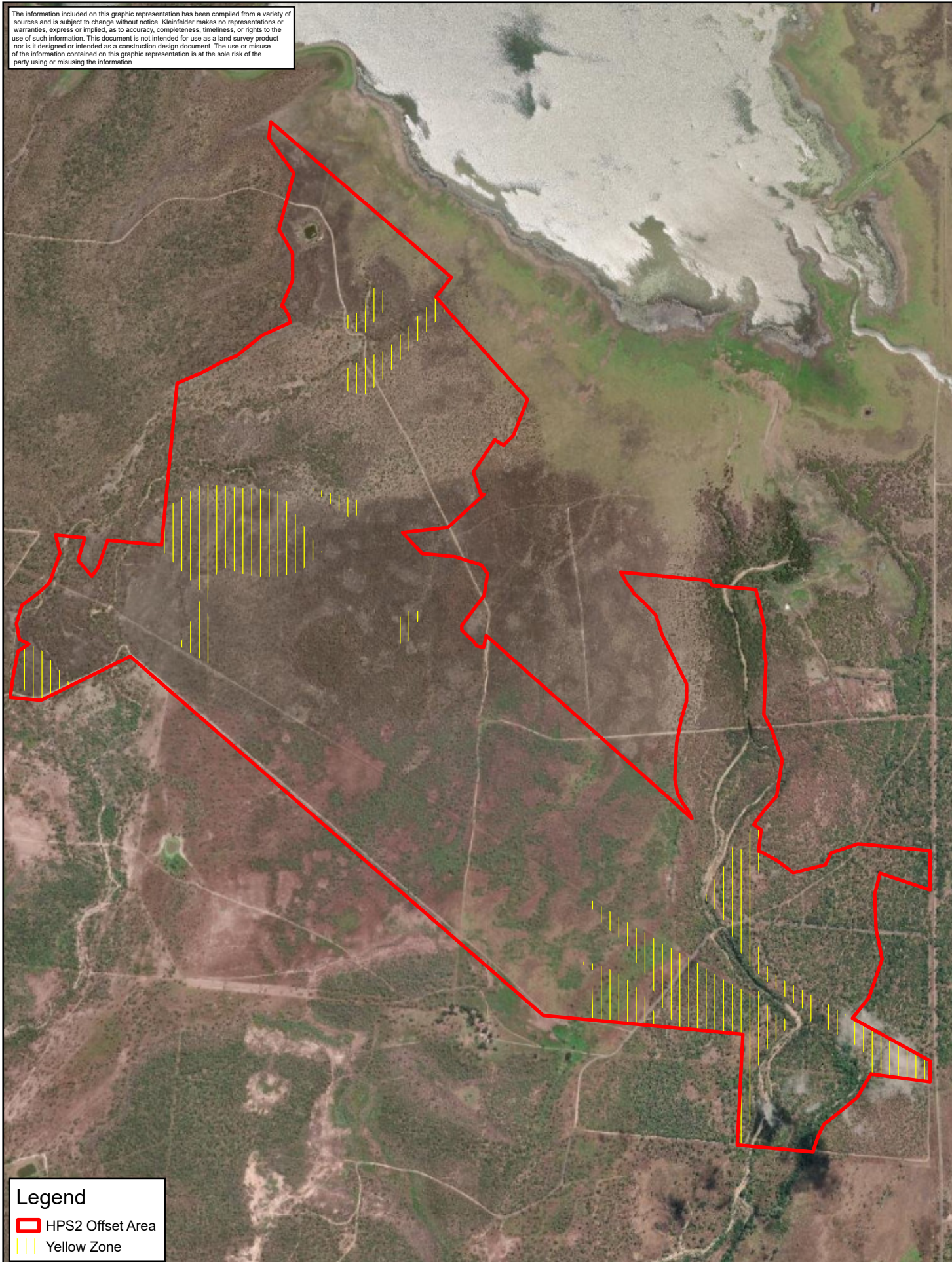
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### Legend

- ▬ HPS2 Offset Area
- ▬▬▬ Yellow Zone

0 110 220 440 660 880 1,100  
Scale @ A4 1:22,000 Metres  
GDA 1994 MGA Zone 55



PROJECT REFERENCE: 24005427

DATE DRAWN: 12/11/2024 Version 1

DRAWN BY: RHourigan

DATA SOURCE:  
Esri - 2024

### NATURAL REGENERATION AND REHABILITATION OF WOODLAND VEGETATION

TOWNSVILLE CITY COUNCIL  
HAUGHTON PIPELINE STAGE 2  
WEED MANAGEMENT PLAN  
PIPELINE ALIGNMENT

FIGURE:

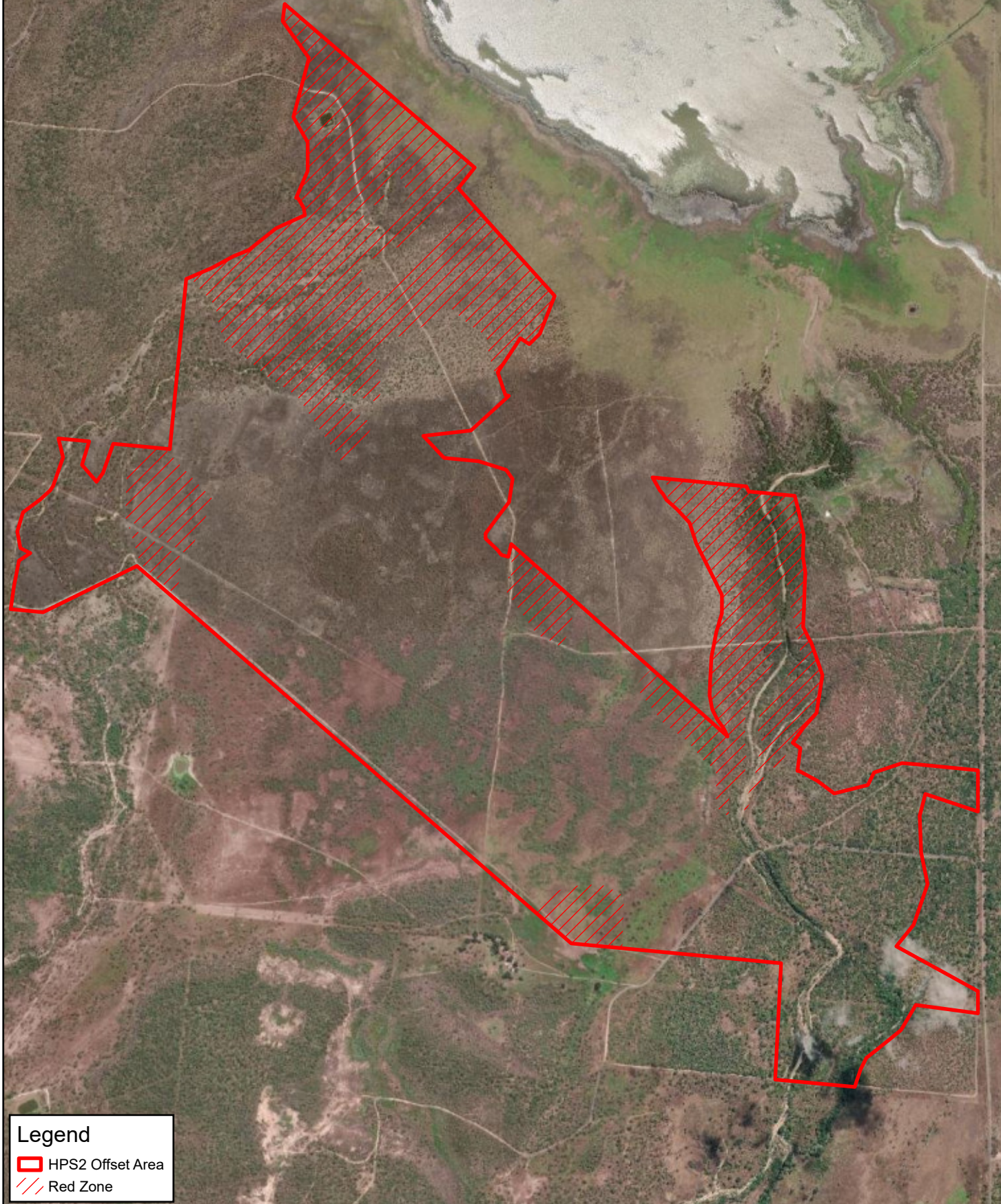
**2**



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**Legend**

HPS2 Offset Area

Red Zone

0 110 220 440 660 880 1,100

Scale @ A4 1:22,000 Metres

GDA 1994 MGA Zone 55

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**ACTIVE PLANTING AND  
REHABILITATION OF WOODLAND  
VEGETATION**

TOWNSVILLE CITY COUNCIL  
HAUGHTON PIPELINE STAGE 2  
WEED MANAGEMENT PLAN  
PIPELINE ALIGNMENT

FIGURE:

**3**

