Edna May Operations Offset Rehabilitation Plan

2020-2022

Document Control Table

Version	Date	Description of changes
1.0	June 2019	Issued. Submitted with Greenfinch Clearing Permit Approval document
2.0	October 2019	Amended to address comments from DMIRS & DotEE during Greenfinch clearing permit approval phase. Incorporated recommended changes to completion criteria.
3.0	15/11/2021	Updated shape of 75ha Offset Revegetation area. Added Version document control table. Minor formatting to match Ramelius Corporate Styles

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1. INTRODUCTION

The Edna May Gold Mine is located within the Merredin Subregion of the Avon Wheatbelt Bioregion, which has been subject to extensive clearing for agriculture and grazed by stock. Remnant Eucalypt woodland vegetation within the region is protected under Commonwealth legislation as a Threatened Ecological Community (TEC) known as the 'Eucalypt woodlands of the Western Australian Wheatbelt'. Red morrel (*Eucalyptus longicornis*) Woodland is the most common of the vegetation communities and representative of the TEC.

This Rehabilitation Plan for the Edna May Operations (EMO) Offset area has been developed to enable EMO to continue the high standard of annual woodland rehabilitation activities on ex-farmland that commenced in 2015. The purposes of the Rehabilitation Plan are to:

- ensure that annual planning and budgeting of ex-farmland rehabilitation continues to be integrated into the mine planning and operational activities;
- provide technical information and procedures on the rehabilitation of ex-farmland;
- demonstrate to Government regulators that EMO follows a well-understood process based on monitoring results from trials and research that maximises the success rate of woodland rehabilitation.

A map of the annual rehabilitation undertaken on ex-farmland owned by EMO is shown in Figure 1. The map highlights the 75ha area, revegetated in 2020 & 2021, that has been chosen and nominated as a suitable and effective offset for the Clearing Permit application (the Greenfinch Project). The main goals and merits of rehabilitating this section of ex-farmland include:

- maintaining the linkage between the eastern and western natural vegetation blocks of the Westonia Common and to avoid fragmentation; and
- maintaining and improving the biological diversity and ecological integrity of flora and vegetation protected under the EPBC Act (namely, *Eremophila resinosa* and the TEC woodland).

The rehabilitation proposal will increase the overall percentage of lost habitat from the Greenfinch Project by revegetating this area (75 ha) with TEC woodland species and widen the existing vegetation habitat linkages. The biodiversity offset of the 75 ha area will be protected by means of a conservation covenant (subject to the granting of any required government consents). Although not coloured, the 15 ha area in the north-east corner of the tenement of Figure 1 is sparse and degraded natural vegetation that will be supplemented with further plantings of TEC species also as part of the proposed Greenfinch project Offset proposal.

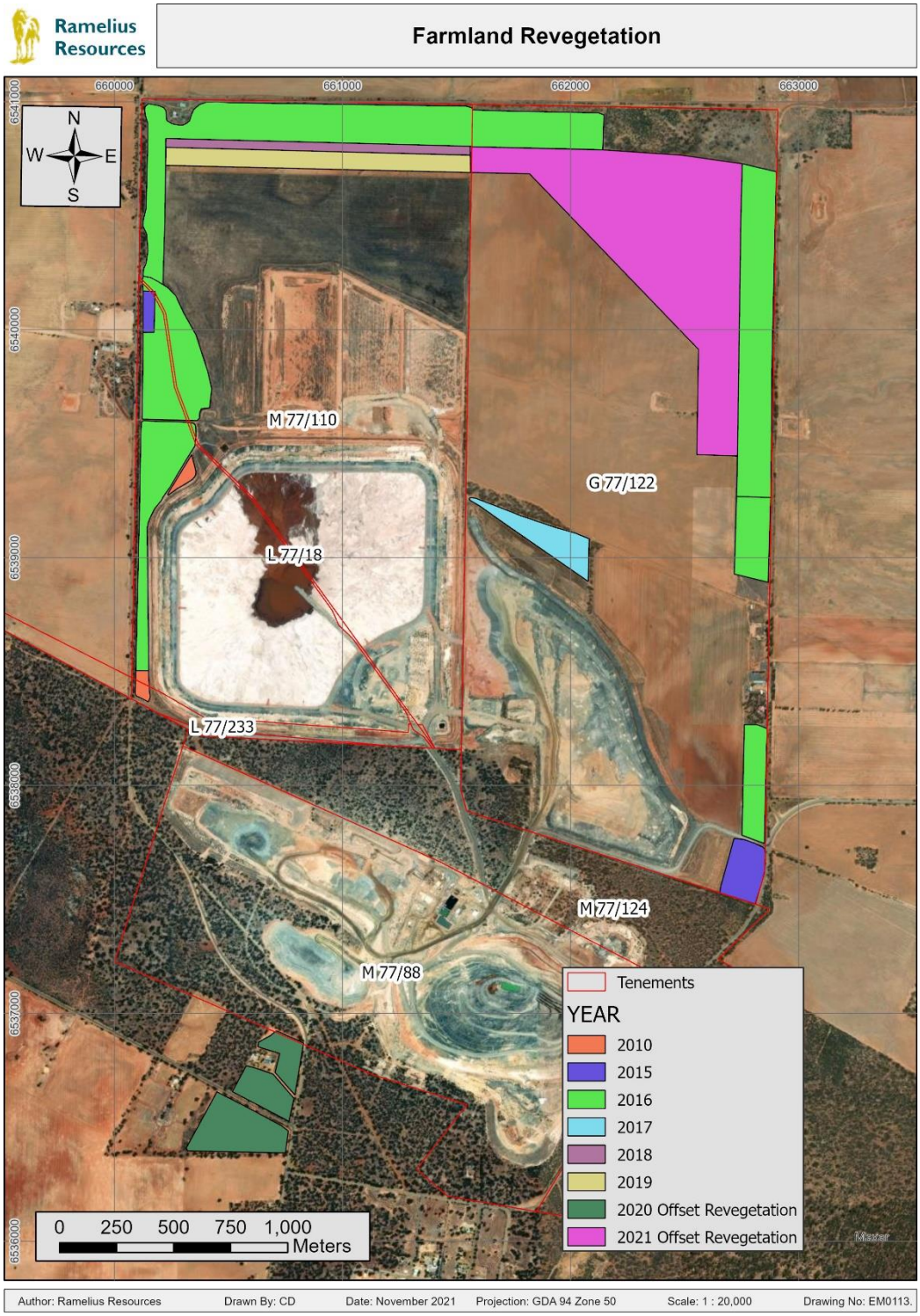

Figure 1: History and Extent of Ex-farmland Rehabilitation to Woodland

2. STATUTORY GUIDANCE

EMO operates within a region of the Western Australian wheatbelt which contains remnant vegetation in close proximity to the mine and infrastructure. Mine development often requires clearing of this vegetation under an approved Clearing Permit. The clearing of native vegetation in Western Australia is regulated under Part V Division 2 of the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations). A clearing permit may be granted subject to conditions that the Western Australian Department of Water and Environmental Regulation's (DWER) Chief Executive Officer (CEO) considers necessary or convenient for mitigating environmental harm or offsetting the loss of cleared vegetation (section 51H). Such conditions may include requirements relating to the revegetation of an area (whether onsite or offsite). This includes the preparation of a revegetation plan for the establishment and maintenance of vegetation on land (other than land cleared under the permit to offset the loss of the cleared vegetation).

EMO has successfully complied with several historical clearing permits in the development of its operations as well as meeting commitments and obligations of conditions imposed. EMO currently manages authorised clearing activities under CPS8550/2.

In conjunction with meeting statutory commitments on rehabilitation of mining disturbance areas, EMO also undertakes voluntary offsite revegetation of the company-owned freehold ex-farmland. This practice is also typically conditioned as part of an approved environmental offset requirement for clearing permit applications when clearing results in a significant residual environmental impact.

This Plan has been developed in accordance with the Western Australian Department of Water and Environmental Regulation's "*A Guide to Preparing Revegetation Plans for Clearing Permits under Part V of the Environmental Protection Act 1986*" (DWER, 2018). The elements of the revegetation practices follow the Environmental Protection Authority's (EPA) "*Guidance Statement No. 6 – Rehabilitation of Terrestrial Ecosystems"* (EPA, 2006) and provides for effective objectives for rehabilitation and revegetation undertaken at EMO.

3. BACKGROUND INFORMATION

3.1 SOILS

3.1.1 Natural Woodland Soils

With the aim of restoring woodland on ex-farmland as the rehabilitation offset goal, it is vital to initially understand the differences in soil profiles between the two land use types. Several detailed baseline soil surveys have been undertaken at EMO as part of previous project approvals documentation. In particular, the "*Greenfinch Baseline Soil Assessment and Mine Waste Review*" undertaken by MWH in June 2016 describes the natural woodland soils as being grouped into three soil associations, namely 'clay', 'gravelly, mottled clay' and 'fractured rock hardpan'. The profiles within these soil associations were typically characterised by:

- Topsoil - a thin layer (depth 0 to 0.1 m) of brown topsoil with few coarse fragments and moderate amounts of organic material; overlying
- gravel or clayey subsoils - from approximately 0.1 to 0.7 m depth (depending on soil association); in turn overlying
- clay hardpans - occurring at depths greater than approximately 0.7 m (on average).

A summary of the physical and chemical characteristics of the surface soils are detailed in Table 1.

Table 1: Soils of the Natural Woodland Vegetation

Natural Soil Depth	Description and Characteristics
0.0 m - 0.2 m Topsoils	• typically classed as 'clay loams'; • generally contained a low percentage of coarse material; • predominantly weakly-aggregated in structure; • exhibited partial clay dispersion upon severe disturbance; • not prone to hardsetting; • 'moderate' drainage class; • 'moderate' to 'high' water holding capacity; • moderately alkaline pH; • slightly saline; • typically moderate in organic carbon and moderate in plant-available nutrient concentration; • non-sodic; and • typically below the limit of reporting (LOR) for the majority of metals tested, with some samples • reporting concentrations of total Cr and Ni above the respective Ecological Investigation Levels (EILs).

Natural Soil Depth	Description and Characteristics
0.2 m - 0.8 m Clay and/or gravel subsoils	• typically classed as 'clay loams' or 'light / medium clays'; • generally contained a moderate percentage of coarse material (>2mm); • predominantly single-grained to weakly-aggregated in structure; • exhibited minimal clay dispersion upon severe disturbance; • generally not prone to hardsetting; • generally 'moderate' drainage class; • 'low' to 'moderate' water holding capacity; • strongly alkaline pH; • moderately to extremely saline; • typically moderate in organic carbon and moderate in plant-available nutrients; • non-sodic; and • typically below the limit of reporting (LOR) for the majority of metals tested, with some samples reporting concentrations of total Ni above the respective Ecological Investigation Level (EIL).
0.6+ m Clay hardpan	• typically classed as 'light clays' or 'medium clays'; • generally contained a moderate percentage of coarse material; • predominantly single-grained to massive in structure; • exhibited some clay dispersion upon severe disturbance; • slightly prone to hardsetting; • generally 'moderately slow' drainage class; • 'moderate' water holding capacity; • strongly alkaline pH; • moderately to extremely saline; • typically low in organic carbon and moderate in plant-available nutrients; • non-sodic; and • typically below the limit of reporting (LOR) for the majority of metals tested, with some samples • reporting concentrations of total Ni above the respective EIL.
0.6+ m Fractured rock hardpan	• classed as 'loamy sand'; • contained a high percentage of coarse material; • predominantly single-grained in structure; • exhibited some clay dispersion upon severe disturbance; • not prone to hardsetting;

Natural Soil Depth	Description and Characteristics
	• 'moderate' drainage class; • strongly alkaline pH; • moderately to extremely saline; • typically low in organic carbon and moderate in plant-available nutrients; • sodic; and • below the limit of reporting (LOR) for the majority of the metals tested.

The soils support the target woodland vegetation community of Red morrel (Tall *Eucalyptus longicornis* (Red Morrel)) overstorey with a sparse shrub understorey.

3.1.2 Ex-farmland Soils

A wide variety of soils are present in the district, with distribution broadly related to position in the landscape and underlying geology. Apart from a few soil groups developed on weathering granite or mafic rocks, all the other soils have formed from the weathering products of ancient deep lateritic soil profiles. The various landforms and associated soils now present have formed after dissection of the lateritic surface, and subsequent deposition of the weathered and eroded materials. The degree of dissection is the main factor which has influenced the nature and distribution of soils within the district. The gently undulating plateau areas of the farmland surrounding EMO have mainly lateritic podzolic soils, yellow earthy sands and siliceous sands often containing lateritic gravels.

The agricultural soil profile of these gently undulating plateau areas where TEC corridor planting is underway since 2015 is sandy clay loam over sandy clay at 10 cm depth. Calcium carbonate is present between 50 and 75 cm, and the soil overlies acid material (below 130 cm) derived from the lower part of a laterite profile. The surface soil reaction is slightly acidic, the subsoil is strongly alkaline. The truncated laterite reaction is moderately acidic. The soil occurs on the upper broad valley flats adjacent to the sloping land. Prior to agricultural use, the native vegetation on these soils was likely a mixed woodland of *Eucalyptus salmonophloia* (salmon gum) and *E. salubris* (gimlet). Where gimlet was dominant, the soil is usually heavier. The soils have favourable attributes including nutrient status with low phosphorus which is ideal for woodland revegetation. Soil water storage is good but soil workability is limited because of deterioration of soil structure.

The agricultural soil profile of the proposed Offset area of ex-farmland opposite the proposed Greenfinch project consists of surface horizons of loam gradually increasing in texture with depth to light medium clay. The soils contain finely divided calcium carbonate throughout the profile. The soils are highly alkaline throughout the profile. Large amounts of finely divided calcium carbonate (approximately 10%) are present in the top 0.5 m of soil. This soil type frequently has large quantities of calcareous nodules present in the profile and is comprised of wind-blown material. Prior to agricultural use, the native vegetation was a woodland was most likely dominated by *Eucalyptus longicornis* (red morrel) and *E. gracilis* (yorrel). The soils have favourable attributes including reasonably

good nutrient status, particularly for potassium. Soil workability is good under favourable moisture conditions. The soil's limitations include a fine textured surface soils vulnerable to wind erosion and a saline subsoil. Soil water storage is limited by the osmotic effects of high concentrations of soluble salts in the soil solution (Stoneman and National Soil Conservation Program (Australia), 1992).

3.2 VEGETATION

3.2.1 Natural Woodland Vegetation

Multiple reconnaissance flora and vegetation surveys of native vegetation surrounding the Edna May Gold Mine have been conducted, including surveys by MWH (2014), Phoenix Environmental Services (2016; 2017) and Botanica Consulting (2018). From these surveys, a total of four broad natural vegetation communities within one landform type are present in the area surrounding the Edna May Gold Mine (Table 2):

- *Eucalyptus longicornis* Woodland
- *Eucalyptus salubris* Woodland
- *Eucalyptus corrugata* Mallee Woodland
- Mix woodland mallee of *Melaleuca/ Acacia* Scrub

Up to 21 Families, 34 Genera and 72 Taxa have been identified.

Table 2: Natural vegetation types surrounding the EMO

Landform	Major Vegetation Group	Vegetation Type
Clay-loam Plain	Eucalypt Woodland (MVG 5)	Mixed woodland of *Eucalyptus longicornis* over isolated tall *Melaleuca pauperiflora* subsp. *fastigiata* shrubs and low open chenopod shrubland of *Atriplex* spp. and open low forbland of *Sclerolaena diacantha* on clay-loam plain
	Eucalypt Woodland (MVG 5)	Mixed woodland of *Eucalyptus salubris* of open mixed shrubland of *Santalum acuminatum* and open low shrubland of *Acacia hemiteles* / *Grevillea acuaria* on clay-loam plain
	Mallee Woodland and Shrublands (MVG 14)	Tall mallee woodland of *Eucalyptus corrugata* of sparse shrubland of *Senna artemisoides* and low forbland of *Sclerolaena diacantha* on clay-loam plain
	Regrowth, Modified Native Vegetation (MVG 29)	Mid woodland/ mallee woodland of mixed Eucalypts over open chenopod shrubland of *Atriplex* spp./ *Maireana* spp. on clay-loam plain

A recent survey and report (Reconnaissance Flora and Vegetation Survey Greenfinch Project, Botanica 2018) identified *Eucalyptus longicornis* (Red morrel) Woodland as being the most common of the vegetation communities and representative of the TEC. Gimlet woodland (*Eucalyptus salubris*) is also representative of TEC. Red morrel / Gimlet woodland is the target vegetation community for the Offset rehabilitation farmland areas.

3.2.2 Ex-farmland Vegetation

The Shire of Westonia within which the EMO is located is predominantly a broadacre wheat and sheep farming shire. The mine itself is surrounded by open farmland with some large tracks of remnant woodland. Given appropriate fertiliser and rotation practices, wheat, barley and peas are the most commonly planted crops. Where the farm soils are saline or alkaline, cereals have limited productivity and is often replaced by barley and oats, being more adapted and tolerant to these conditions. Pastures consist of legume medics (Cyprus barrel medic and burr clovers - Serena, Circle Valley, Santiago) because of the alkaline conditions and are most suited to this soil.

Apart from the sown crops on the surrounding farmland, the balance of flora species is introduced. The BioBlitz conducted in 2007 recorded 22 introduced flora species as occurring in the Common (McLellan, 2008). When combined with previous flora surveys undertaken by Curtin University, a total of 30 introduced flora species have been recorded in the locality. A report produced by EcoLogical Australia (2016) for the Shire of Westonia titled "Westonia Common Conservation Management Plan 2016 – 2021" also documented a comprehensive list of weed species in the Westonia area.

Table 3 lists the introduced weed species from the report by McLellan (2008) and from a search of the Department of Parks and Wildlife (Parks and Wildlife) NatureMap database (Parks and Wildlife 2007 - 2015) based on a 10 km buffer of the Common.

Table 3: Introduced weed species listed as occurring in the Common and within 10 km radius of the Common

Scientific name	Common name	Scientific name	Common name
Aira caryophyllea?	Silvery Hairgrass	*Asphodelus fistulosus*	Onion Weed
Arctotheca calendula	Capeweed	*Avena barbata*	Bearded Oats
Avena fatua	Wild Oats	*Bromus rubens*	Red Brome Grass
Brassica tournefortii	Mediterranean Turnip	*Carrichtera annua*	Ward's Weed
Carthamus lanatus	Saffron Thistle	*Centaurea melitensis*	Maltese Cockspur
Centaurea calcitrapa	Start Thistle	*Chondrilla juncea*	Skeleton Weed
Cleretum papulosum		*Erodium aureum*	Corkscrew
Cynodon dactylon	Couch Grass	*Erodium botrys*	Corkscrew
Erodium cicutarium	Common Storksbill	*Hordeum* sp. *leporinum?*	Barley Grass
Hordeum glaucum	Northern Barley Grass	*Hypochaeris* sp. *radicata / glabra?*	Smooth Cat's Ear; Flatweed
Lepidium africanum	Rubble Peppercress	*Mesembryanthemum* sp. *crystallinum / nodiflorum?*	Common or Slender Iceplant

Scientific name	Common name	Scientific name	Common name
Medicago minima	Small Burr Medic / Goldfields Medic	*Monoculus monstrosus*	Stinking Roger
Opuntia stricta	Prickly Pear	*Raphanus raphanistrum*	Wild radish
Pentaschistis airoides	False Hairgrass	*Rostraria pumila*	
Schismus barbatus	Kelch Grass	*Sisymbrium runcinatum*	
Sisymbrium irio	London Rocket	*Trifolium glomeratum*	Cluster/Ball Clover
Ursinia anthemoides	Ursinia	*Zaluzianskya divaricate*	Spreading Night Phlox
Vulpia sp. *myuros?*	Silver Grass; Rat's Tail Fescue		

3.3 REFERENCE SITE (ANALOGUE) FLORISTIC DATA

A survey and report undertaken by Botanica (2018) aimed to define suitable vegetation monitoring of analogue sites for the Edna May Gold Mine, with specific reference to returning ex-farmland back to native woodland. Methods of recording data from established quadrats largely followed those outlined in CSIRO's Australian Soil and Land Survey Field Handbook (McDonald *et al*., 1998) with recordings made of the following data:

- Identification of dominant taxa from the upper, middle and lower stratum (including growth form, height and crown cover);
- Identification of all vascular plants within the quadrat (species diversity);
- Count of all vascular plants recorded in the quadrat (plant density);
- Landform element (morphological type position and element type);
- Level of site disturbance;
- Presence coarse fragments on the surface;
- Presence of rock outcrops (type and abundance);
- Soil types (colour, profile, field texture and surface type);
- vegetation structure recorded using McDonald *et al*., (1998) methodology (scoring three layers for dominance, growth form, height and estimated cover); and
- Vegetation Condition Rating (adapted from Keighery 1994 and Trudgen 1988).

Species diversity across the six established woodland analogue sites ranged from six to 10 species per 20 m x 20 m quadrat with a mean diversity of seven. Dominant species across the analogue sites included *Eucalyptus longicornis*, *Melaleuca pauperiflora* subsp. *fastigiata, Atriplex stipitata* and *Sclerolaena parvifolia*.

Plant density ranged from 1450 to 7075 plants per hectare with a mean density of 3829 plants per hectare. Vegetation cover ranged from 60% to 90% with a mean vegetation cover of 78% recorded across the six analogue sites.

3.4 REVEGETATION COMMITMENTS AND COMPLETION CRITERIA

3.4.1 Revegetation Commitments as they relate to Mine Closure Planning

The principal closure objective for the whole of the Project is to ensure that the disturbed areas are left safe, stable and non-polluting/non-contaminating, and capable of sustaining the agreed post-mining land use without unacceptable liability to the state. EMO has committed to re-instate the land to a self-sustaining natural ecosystem and minimise impacts of permanent post-mining features comprising of pits, abandonment bunds, an IWL and WRL's.

Rehabilitation and closure will aim to satisfy all requirements in tenement conditions, Mining Proposal commitments and licence conditions encompassing all relevant legal requirements/regulations to return land as close as possible to existing surrounding land to reflect fauna habitats using local provenance species to reflect the surrounding Westonia Common. In particular, EMO had made a Mining Proposal commitment to revegetate an area of farmland to the west of the tailings storage facility (TSF) and evaporation ponds. EMO extended this revegetation programme to encompass the perimeter of the company-owned farmland north of the mine to provide a link between the existing patches of remnant vegetation, allowing for native fauna to move freely between vegetated areas in search of resources such as food, water and habitat. The corridor will also assist in reducing wind erosion and groundwater recharge which can lead to soil salinity.

3.4.2 Revegetation Commitments as they relate to Environmental Offsets Policies

The Western Australian Government's Environmental Offsets Policy seeks to protect and conserve environmental and biodiversity values for present and future generations. With respect to revegetation, an environmental offset is an offsite action to address significant residual environmental impacts of a development or activity. The category of environmental offset relevant to the Greenfinch proposal, as agreed with DMIRS, is "Direct Offset". The proposed Direct Offset includes actions designed to provide for on-ground improvement, rehabilitation and conservation of habitat. Specifically, the agreed Direct Offset includes a combination of restoration, revegetation and rehabilitation of natural areas and ex-farmland areas outside the Greenfinch project area.

Under the WA Environmental Offsets Guideline (2014), on-ground management will include revegetation (re-establishment of native vegetation in degraded areas – agricultural land) and rehabilitation (repair of ecosystem processes and, *e.g.*, management of weeds, disease or feral animals *etc*. of degraded woodland). The objective of on-ground management actions is tangible improvement to environmental values in the offset area.

In addition, the Commonwealth Department of the Environment and Energy's (DotEE) environmental offsets policy has five key aims, to:

- ensure the efficient, effective, timely, transparent, proportionate, scientifically robust and reasonable use of offsets under the Environment Protection and Biodiversity Conservation Act (EPBC Act)
- provide proponents, the community and other stakeholders with greater certainty and guidance on how offsets are determined and when they may be considered under the EPBC Act
- deliver improved environmental outcomes by consistently applying the policy
- outline the appropriate nature and scale of offsets and how they are determined
- provide guidance on acceptable delivery mechanisms for offsets.

The overarching offset principles that are applied in determining the suitability of offsets are to:

- deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action
- be built around direct offsets but may include other compensatory measures
- be in proportion to the level of statutory protection that applies to the protected matter
- be of a size and scale proportionate to the residual impacts on the protected matter
- effectively account for and manage the risks of the offset not succeeding
- be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programmes (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)
- be efficient, effective, timely, transparent, scientifically robust and reasonable
- have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

EMO is committed to meeting the requirements of both the State and Commonwealth Department's Policies through the effective implementation of the proposed offsets as they relate to permits, approvals and rehabilitation of disturbed areas back to TEC woodland. Specifically, EMO propose to commence its rehabilitation of 75 ha of ex-farmland back to TEC Woodland in 2020.

3.4.3 Completion Criteria

Based on the reference sites (analogues) floristic data in Section 3.3, completion criteria for flora/vegetation established on rehabilitated ex-farmland are described in Table 4. Performance indicators to measure the flora/vegetation completion criteria based on the current analogue monitoring results are summarised in Table 5.

Table 4: Completion Criteria Flora/Vegetation

Aspect	Closure Objectives	Closure Indicators	Completion Criteria	Management/ Measurement Approach
Flora/ Vegetation	Revegetation of disturbed areas are the best achievable with available rehabilitation resources and are rehabilitated using local provenance species to reflect the surrounding Westonia Common	Vegetation comprised of local provenance species in a self-sustaining and resilient community comparative to natural landscape	Vegetation cover (total percentage cover of live native vegetation) and species density (total no. perennial plants) levels ≥50% of the mean value from the analogue sites in the target ecosystem[1]. Species diversity (total no. perennial species) levels ≥50% of the mean value from the analogue sites in the target ecosystem	Landscape/Vegetation monitoring on rehabilitated landforms and target ecosystems in Spring to measure biodiversity. Reporting of monitoring results annually in AER
		Weed species not impacting upon the recruitment and growth of indigenous flora	Percentage cover of weeds of National Significance (listed by DotEE) or Declared Plants (listed by DPIRD) on rehabilitated landforms no greater than 0%[2].	Weed monitoring during landscape/ vegetation monitoring and/ or WRL assessments. Management of weeds as per Weed Management Plan

Table 5: Completion Criteria Targets/ Performance Indicators

Completion Criteria	Completion Criteria Target	Performance Indicator
Species Diversity (400 m²)	>80% of the analogue mean	≥ six species
Plant Density (plants/ha)	50% of the analogue mean	≥1915 plants/ha
Vegetation Cover (%)	50% of the analogue mean	≥39%
Weeds of National Environmental Significance (%)	<0%	<15%
Declared Plants (%)	<0%	<15%

[1] Completion criteria based on the minimum biodiversity and landscape function (critical threshold as described by Tongway & Hindley (2003) based on three successive years of monitoring data) at which a landform is self-sustaining (Beyond the critical threshold, the ecosystem becomes increasingly more self-sustaining and able to survive stress and disturbance, both natural and human induced the ecosystem becomes increasingly more self-sustaining and able to survive stress and disturbance, both natural and human induced (Tongway, & Hindley 2003). Will be compared against analogue site/s to ensure target biodiversity values are representative of the natural environment and consistent with the Westonia Common. Rehabilitation will be conducted using best practices for the site and will aim to achieve higher values than the minimum targets/ threshold specified.

[2] Completion criteria targets for weed coverage better than those that are based on published literature which suggests that weed cover (non-naturalised weeds) exceeding 40% impedes native vegetation growth. The target has been set at lower threshold to ensure weeds identified/ managed before native vegetation impacts occur.

3.5 SITE PREPARATION

Prior to planned revegetation of the EMO farmland, the selected area is pre-treated with selected herbicides to reduced competition and water use. In addition, the farmland areas undergo a 1080 rabbit baiting campaign to reduce the number of rabbits that would feed on the seedlings.

Once the weeds are controlled on the ex-farmland, further site preparation depends on seasonal conditions and how the seedlings are going to be planted, mechanically or by hand. At EMO, direct seeding has been undertaken using a special Commercial Native Vegetation Seeder (CommVeg) which is an innovative direct seeding machine to improve the efficiency of native seed sowing whilst reducing costs of revegetation. The CommVeg seeder completes site preparation requirements as it runs over the ground by scalping and ripping the soils as part of the seed sowing process all in a one-pass operation.

Planting of tubestock seedlings depends on the soil type to be planted into and the size of the area to be revegetated. Large areas with good soil structure employ the use of a Chatsfield tree planter which also prepares the site by ripping and scalping the soil and delivers the seedlings all in a one-pass operation. In fragile, smaller (<30 ha) discrete areas of revegetation seedlings are hand planted using a potti-putki into rows pre-prepared by the CommVeg seeder.

A trial is being considered for part of the 75 ha ex-farmland offset area. The proposed trial will consider having the cleared vegetation/ tree trash being removed from the Greenfinch project footprint and directly trucked to the prepared offset area, windrowed in 10 m wide strips, machine-crushed and spread. These tree trash strips will be alternated with 10 m wide direct seeding and tubestock planted strips. Not only will the tree trash provide fauna habit, it is anticipated that the fresh tree trash will contribute valuable TEC Red morrel Woodland seedbank to the area. Germinants will be monitored and compared to directly seeded plots.

4. VEGETATION ESTABLISHMENT

4.1 SPECIES SELECTION

4.1.1 Observations

Multiple reconnaissance flora and vegetation surveys of native vegetation surrounding the Edna May Gold Mine have been conducted, including surveys conducted by MWH (2014), Phoenix Environmental Services (2016; 2017) and Botanica Consulting (2018). From these surveys, a total of five natural vegetation communities are present in the area surrounding the Edna May Gold Mine:

- *Eucalyptus corrugata* Mallee Woodland
- *Eucalyptus longicornis* Woodland
- *Eucalyptus loxophleba* Mallee Woodland
- *Eucalyptus salubris* Woodland
- *Melaleuca/ Acacia* Scrub

Eucalyptus longicornis Woodland is the most common of the vegetation communities and representative of the TEC. *Eucalyptus salubris* Woodland is also representative of TEC. Therefore these vegetation communities are the target of rehabilitation plans for the ex-farmland areas.

In order to replicate the target natural woodland vegetation as close as possible, baseline studies completed for the woodland groups were categorised using the Native Vegetation Information System (NVIS) Major Vegetation Group categories (DotEE, 2018). Data have been collected on the dominant taxa from the upper, middle and lower stratum (including growth form, height and crown cover) of this woodland, including species diversity, plant density and vegetation structure using McDonald *et al*. (1998) methodology.

4.1.2 Species Seeded and Planted

The species that are planted are all endemic to the local area and included both trees and understorey species. EMO uses both seed and seedlings for the rehabilitation areas to achieve a better biodiversity outcome as some species are more suitable to be grown from seed sown directly into the ground (*e.g*., *Acacia* spp.) where as some of the finer seeded species have more success being planted from seedlings (*Eucalyptus* spp.). The number of plants required per ha and the number of each species planted (the planting ratio) have been determined by results of baseline studies, historical field trials and experience of the rehabilitation practitioners undertaking the work (Table 6).

Table 6: Examples of Species Seeded and Planted

Seedlings		Seeds	
Eucalyptus	*longicornis*	*Acacia*	*acuminata* (narrow)
	salmonophloia		*aestivalis*
	salubris		*colletoides*
	yilgarnensis		*coolgardiensis*
Melaleuca	*pauperiflora* ssp *fastigata*		*erinacea*
	eleuterostachya		*jennerae*
	atroviridis		*hemiteles*
	hamata		*lasiocalyx*
	uncinata		*merralli*
	lanceolata		*microbotrya*
	lateriflora		*murrayana*
	radula		*enervia* ssp. *enervia*
Acacia	*acuminata* (typical)		*yorkrakinensis* ssp *acrita*
	acuminata (narrow)	*Allocasuarina*	*acutivalvis*
	colletoides		*campestris*
	hemiteles	*Calothamnus*	*gilesii*
	tetragonophylla	*Eucalyptus*	*salubris*
Allocasuarina	*campestris*		*yilgarnensis*
Pittosporum	*angustifolium*	*Eremophila*	*resinosa*
Hakea	*preissii*		*scoparia*
	recurva		*serrulata*
Calothamnus	*gilesii*	*Hakea*	*francissiana*
			minyma
			preissii
			recurva
			scopari
		Melaleuca	*pauperiflora* ssp. *fastigata*
		Pittosporum	*angustifolium*

Seedlings		Seeds	
		Scaevola	*spinescens*
		Senna	*artem.* ssp. *filifolia*
		Solanumn	*orbiculatum*
		Templetonia	*sulcata*

4.2 DIRECT SEEDING

Western Australian (local if possible) commercial seed collectors and suppliers are used to provide the annual local provenance seed order to EMO. Reliable local seed pickers and suppliers include:

- Nindethana Seed Service (08 9844 3533, seed@nindethana.net.au)
- Red Dirt Seeds (0427 985 322, jack@reddirtseeds.com.au)
- Seed Shed (08 9732 1152, enquiry@seedshed.com.au)
- Jim's Seeds, Weeds and Trees (08 9093 0024, admin@jimseeds.com.au)

Seed of the Declared Rare Flora *Eremophila resinosa* are also collected by EMO site environmental practitioners from the local natural and translocated populations under a DBCA Permit to Take licence. EMO uses a Commercial Native Vegetation Seeder (CommVeg Seeder) developed by Dr Geoff Woodall (Figure 2). In a single pass operation, the CommVeg seeder scalping blade produces a flat-bottomed scalp which is followed by a shallow rip (0.3 m) with a spring tyne followed by paired tillage disks and then the passage of the floating seeder arm which flattens the ripped and tilled soil then forms a seeding trench at a pre-set depth, then places seed before closing the trench and pressing the soil. This method of rip, scalp and direct seed in a one-pass operation has been successful at both EMO and other areas of WA for the direct sowing of native plants in agricultural landscapes. The CommVeg Seeder is towed behind a tractor with all machinery subject to hygiene measures prior to arrival on-site to prevent the spread of weeds.

Figure 2: Picture of CommVeg Seeder being towed behind tractor

Direct seeding generally takes place in May-June but exact timing is wholly dependent upon seasonal conditions. At EMO the CommVeg Seeder has seeded a mix of 30 different native plant species at one time. A slow release fertiliser (Osmocote exact mini) is also added to the direct seeding mix to aid in the initial establishment of the seedlings. Based on experimental trials and monitoring data to-date, the optimum delivery rate is set at 600-800 g/ha to achieve and overall target of 730 stems/ha once established.

4.3 TUBESTOCK PLANTING

Collected and purchased seed is supplied to a local Tammin-based business; Chatfield's Tree Nursery (0427 371 075, info@chatfields.com.au) who germinate the seed and establish the seedlings as tubestock for EMO. Chatfield Tree Nursery is accredited with the Nursery and Garden Industry in WA (NGIWA) for the propagation and provision of the best quality seedlings with best practise. Planting of the tubestock is undertaken by hand using a potti-putki or with a mechanical Chatfield Tree Planter towed behind a tractor (Figure 3). The Chatfield Tree Planter has been successfully used onsite as well as other areas of WA for the planting of native plant tubestock in agricultural landscapes. All equipment is subject to hygiene measures prior to arrival on-site to prevent the spread of weeds.

Figure 3: Picture of Chatfield Tree Planter towed behind a tractor

Tubestock planting at EMO is best commenced as soon as reliable winter growing season rain arrives but exact timing is wholly dependent upon seasonal conditions. Taking delivery of established tubestock earlier in the planting season is also contingent on placing the seedling order, at the latest, by mid-October of the previous year. The aim is plant at a density of 1200 stems/ha. Supplementary planting can also be undertaken in later years by hand planting using a potti-putki planting tool.

5. REVEGETATION MONITORING AND MAINTENANCE

5.1.1 Annual Monitoring Programme

EMO monitors all rehabilitated areas on an annual basis, normally during Spring (September-November). As with all established ex-farmland and mining waste landform rehabilitation areas, proposed ex-farmland to be rehabilitated as part of planned Offsets programme will be monitored with the same methodology of a combination of randomised transects and quadrats established within the prepared areas and comparisons made with equivalent transects and quadrats in natural Eucalypt TEC Woodland analogue sites.

Permanent vegetation monitoring sites (20 m X 20 m quadrats) are established. Methods of recording data from these quadrats largely follow those outlined in the CSIRO's Australian Soil and Land Survey Field Handbook (McDonald *et al*., 1998). The Native Vegetation Information System (NVIS) Major Vegetation Groups are referred to for vegetation group categories (DotEE, 2018). Initially, identification of dominant taxa from the upper, middle and lower stratum (including growth form, height and crown cover are compiled, along with the count and identification of all vascular plants within the quadrat (species density and species diversity respectively). Once the rehabilitation sites become advanced, vegetation structure is recorded using McDonald *et al*. (1998) methodology (scoring three layers for dominance, growth form, height and estimated cover).

The data collected are graphically compared to reference site data from and the status of the rehabilitation will be assessed in accordance to the methodology and agreed completion criteria. A report is prepared annually (submitted by December 30 of each calendar year) describing the status of the rehabilitation.

Photo points have also been established and are monitored on a twice-yearly basis by EMO environmental staff.

5.1.2 Weed Control

The ex-farmland to be rehabilitated has historically been utilised for cropping (wheat, barley, canola) and pasture for sheep grazing. The site features a number of agricultural weeds given that has been the previous land use for a significant period of time. Of the comprehensive list of weed species listed in

Table 3, some of the more prevalent and common agricultural weeds which are present on the site and need to be controlled include:

- Matricaria (*Oncosiphon suffruticosum*);
- Roly Poly (*Salsola australis*);
- Marshmallow (*Malva parviflora*);
- Annual rye grass (*Lolium rigidum*);
- Sowthistle (*Sonchus oleraceus*);
- Burr Medic (*Medicago polymorpha*); and

- Windmill grass (*Chloris truncata*).

Skeleton weed (*Chondrilla juncea*) occurs in the district and has been detected previously on the farm. However, surveillance activities and chemical control has successfully limited the weed and an ongoing programme continues to monitor for this weed and results are reported to DPIRD in February of each year.

Weed control is a key site preparation activity. Weed control of identified revegetation areas should commence as early as possible and target grasses and broadleaf weeds. Spraying generally commences a year prior to planting and seeding providing the area isn't being cropped. A spray during winter and early spring in the year prior is sometimes followed by another application in late summer if there has been sufficient rainfall for a germination. A follow-up weed spraying campaign is completed again in March / April, and then once more immediately prior to direct seeding, however again it is entirely rainfall-dependent.

Weed spraying in the year prior to seeding and planting generally consists of applying a non-selective chemical and applied by a tractor-mounted or towed agricultural boom spray. Weed applications are intended to preserve soil moisture and reduce competition between plants. Broadacre spraying of the site will take place on an as-needed basis post-planting and seeding and most successfully applied after the first rainfall event (>5mm).

5.1.3 Pest Control

Vertebrate pests can be an issue in the area and rabbit control activities are implemented as part of an ongoing site vertebrate pest control programme which includes trapping and 1080 baiting. Kangaroos do graze in the area however their numbers aren't anticipated to be a significant threat to the revegetation efforts.

EMO monitors for insect activity particularly in the year immediately after direct seeding. The insecticide application takes place post-seeding using 100 g/L bifenthrin at the label rate in conjunction with the herbicide spraying.

If climatic conditions are suitable locusts are also monitored as they present a threat to the revegetation programme. When the risk exists, an insecticide application of Fipronil at the label rate is undertaken during the appropriate life cycle stage.

5.2 SCHEDULE AND BUDGET

A schedule of action and budget is developed each year for the rehabilitation activities planned for the following year. This Rehabilitation Plan is reviewed and updated each year with the current year's details and expenditure included. The planned rehabilitation activities and budget for the proposed rehabilitation programmes are summarised in Table 7.

Table 7: Schedule of Planned Rehabilitation Actions and Budgets – 2018-2022; updated November 2021

Stage	Actions	Timing	Responsibility	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 5 2022	Budget ($)
Completion Criteria	Reference Site survey	August 2018	Botanical Consultant	X					Completed
	Develop Completion Criteria	October 2018	RMS Group Environment Manager	X					Completed
Offset Plan Approval	DMIRS and DBCA to approval proposal	September 2019	DMIRS and DBCA		X				Completed
Site Preparation	Ex-farmland soil survey	Autumn 2020	Soil Consultant			X			Completed
	Weed Control	February, April, July, September 2020, February 2021	EMO Environmental Advisor			X	X		Completed
Vegetation Establishment	Submit seedling order to Chatsfield Nursery	October 2020	EMO Environmental Advisor			X			Completed
	Source seed	Autumn, Spring 2020	EMO Environmental Advisor			X			Completed
	Direct seeding and seedling planting	May-July 2021	Rehabilitation Consultant				X		Completed
Monitoring	Vegetation monitoring against completion criteria	October	Botanical Consultant				X	X	$15,000-$20,000 / year
Maintenance and Contingency	Weed control	Ongoing post seeding and planting	EMO Environmental Advisor				X	X	$20,000-$30,000 /year

Stage	Actions	Timing	Responsibility	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 5 2022	Budget ($)
	Remedial (in-fill) planting if required	June – July 2022	EMO Environmental Advisor				X	X	$0.50/seedling
Reporting	Revegetation Plan for following period	June	EMO Environmental Advisor, RMS Group Environment Manager			X	X	X	-
	Annual Progress Report	December	Consultant			X	X	X	$15,000-$20,000 each year

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