



# Native Vegetation Clearance

## Maralinga Site Remediation – Debris Pits

### Data Report

Clearance under Section 28 of the Native Vegetation Act 1991

7 January 2024

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# Document Specification

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**Document #:** ES1123-06

**Citation:** Succession Ecology (2023). Native Vegetation Clearance Maralinga Site Remediation (Debris Pits) Data Report. Succession Ecology report ES1123-06 prepared for Department of Industry, Science, and Resources (DISR).

## DOCUMENT HISTORY

Version	Issue Date	Prepared By	Reviewed By	Status
1	16/03/2023	[REDACTED]	[REDACTED]	V1 Draft
2	08/11/2023	[REDACTED]	[REDACTED]	V2 Draft
3	23/11/2023	[REDACTED]	[REDACTED]	V3 Draft
4	15/12/2023	[REDACTED]	[REDACTED]	FINAL
5	07/01/2024	[REDACTED]	[REDACTED]	FINAL with edits to SEB reduction

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# Acknowledgement of Country

Succession Ecology acknowledges and pays respect to the past, present and future Traditional Custodians and Elders of this nation and the continuation of cultural, spiritual, and educational practices of Aboriginal and Torres Strait Islander peoples.

# Glossary

AoLA	Atlas of Living Australia
BAM	Bushland Assessment Method
BDBSA	Biological Database of South Australia (maintained by DEW)
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DEW	Department of Environment and Water (South Australia)
DISR	Department of Industry, Science, and Resources
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
ha	Hectare
IBRA	Interim Biogeographical Regionalisation of Australia
MNES	Matters of National Environmental Significance
NVC	Native Vegetation Council
PMST	Protected Matters Tool
RAM	Rangelands Assessment Methodology
SEB	Significant Environmental Benefits
TEC	Threatened Ecological Community
VA	Vegetation Association

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# 1. Application information

## 1.1 Application details

<b>Applicant:</b>	Department of Industry, Science, and Resources (DISR)		
<b>Key contact:</b>	<div style="background-color: black; width: 100px; height: 15px; margin-bottom: 5px;"></div> Phone: <div style="background-color: black; width: 100px; height: 15px; display: inline-block;"></div> , email: <div style="background-color: black; width: 100px; height: 15px; display: inline-block;"></div> <a href="mailto: @industry.gov.au">@industry.gov.au</a>		
<b>Landowner:</b>	Maralinga Tjarutja		
<b>Site Address:</b>	Second Avenue, Maralinga Tjarutja Lands (and surrounds)		
<b>Local Government Area:</b>	Maralinga Tjarutja	<b>Hundred:</b>	NA
<b>Title ID:</b>	CT 6048/873 CT/4393/157 CT/4393/157 CR/6142/33	<b>Parcel ID:</b>	H832600 / Sec 400 D31180 Q18 D31180 Q19 F219622 Q54

## 1.2 Summary of proposed clearance

<b>Purpose of clearance</b>	<p>The British Government undertook nuclear weapons testing at Maralinga and Emu Field in the 1950s-1960s. The Australian Government conducted major rehabilitation works at Maralinga between 1995 and 2000. This project predominantly only addressed radiological contamination. The other forms of contamination and/or historic infrastructure present on site also require remediation. The Department of Industry, Science, and Resources (DISR) is proposing to undertake site maintenance works at Maralinga and Emu Field (Maralinga Site Maintenance Project) to:</p> <ul style="list-style-type: none"> <li>Decommission up to 30 abandoned groundwater wells (separate NVC clearance application)</li> <li>Remediate numerous surface debris sites and buried debris pits at Emu Field (separate NVC clearance application).</li> <li>Remediate 138 surface debris or buried debris pits within Maralinga. The waste and contaminated materials from these surface debris sites will be removed using a number of different methodologies, depending on the nature of the material, the location of the pit and the amount of waste to be removed. These methodologies include emu picking of waste materials (does not involve vegetation clearance), surface scraping by hand or plant or excavation to a depth of 1 m. The remediation of the buried debris pits will include exhumation of the pits and the construction of a worker's camp, a debris sorting area and a waste repository (near Maralinga Village) to hold any materials from the debris pits/surface debris sites that cannot be recycled or removed from site (this NVC clearance application). Of the 138 pits to be</li> </ul>
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	<p>remediated, 88 of these require vegetation clearance as part of the remediation methodology.</p> <p>Clearance impacts will include:</p> <ul style="list-style-type: none"> <li>• Impacts on the immediate surrounds of 88 debris pits with most impacts being within 5 m of the pit area (up to 9.8 ha of vegetation). This is largely comprised of highly disturbed and modified vegetation.</li> <li>• Minor impacts on vegetation along tracks that are infrequently used and partially overgrown (with a 2.5 m potential clearance buffer on either side of each track). These dirt tracks are currently accessible by standard 4WD but may need to be widened to allow plant machinery. This may result in up to 5.5 ha of cleared or trimmed vegetation.</li> <li>• Establishment of three groundwater wells at Maralinga, with water to be used as part of asbestos risk mitigation during remediation works. Vegetation clearance will be necessary to establish these, and a 50 m clearance buffer has been applied to prospective groundwater sites (total clearance area of 2.4 ha).</li> <li>• Establishment of a 3.7 ha purpose-built waste repository to be used for disposing of asbestos containing materials and non-recyclable waste. This will be backfilled using geotextiles prior to revegetation.</li> <li>• Establishment of a 2.0 ha debris/waste sorting area.</li> <li>• Establishment of a 0.8 ha workers camp with potential 50 m fire buffer (total clearance area of 2.3 ha) to facilitate remediation activities.</li> </ul> <p>DISR is looking at the most effective low impact strategies for restoring and remediating these pits.</p>
<p><b>Native Vegetation Regulation</b></p>	<p>Section 28 under the <i>Native Vegetation Act 1991</i></p>
<p><b>Description of the vegetation under application</b></p>	<p>Ten vegetation associations were identified across the 63 vegetation assessment sites. In total, 154 native species were recorded during the survey conducted by Succession Ecology in October 2022. Many species were in flower or setting seed at the time of the survey. Eight of the vegetation associations will be impacted during remediation activities of this project. These include:</p> <ul style="list-style-type: none"> <li>• VA1: <i>Acacia aneura</i> shrubland with <i>Senna artemisioides</i> spp. <i>zygophylla</i></li> <li>• VA2: <i>Acacia aneura</i> low open shrubland above <i>Senna</i> and <i>Eremophila</i> species over an understorey of <i>Maireana</i>, <i>Rhagodia</i> and tussock grasses</li> <li>• VA3: Mixed <i>Acacia</i> shrubland with <i>Maireana</i>, <i>Solanum</i>, <i>Sclerolaena</i> and <i>Dodonaea</i> midstorey and <i>Calandrinia</i></li> <li>• VA4: Mallee woodland with midstorey of <i>Acacia</i>, <i>Senna</i>, <i>Eremophila</i> and <i>Dodonaea</i> and understorey of chenopods, <i>Spinifex</i> and other grasses</li> <li>• VA5: <i>Casuarina pauper</i> woodland with midstorey of <i>Acacia</i>, <i>Senna</i>, and <i>Maireana</i>, <i>Solanum</i>, <i>Austrostipa</i> and <i>Enneapogon</i> understorey</li> <li>• VA6: Mixed mallee / <i>Casuarina</i> woodland with a midstorey of <i>Acacia</i>, <i>Senna</i> and <i>Eremophila</i> over chenopods and grasses</li> <li>• VA7: Chenopod shrublands (South) with emergent <i>Eremophila longifolia</i>, <i>Pittosporum angustifolium</i> and <i>Acacia</i> species, over a mix of chenopod and grass species</li> </ul>



	<ul style="list-style-type: none"> <li>VA8: Chenopod shrublands (North) with emergent <i>Acacia</i> and <i>Senna</i> spp.</li> </ul>
<b>Total proposed clearance – area (ha) and number of trees</b>	<p><u>Total</u>: 25.67 hectares</p> <p><u>Individually, for each VA</u>:</p> <p>VA1: 0.59 ha</p> <p>VA2: 1.27 ha</p> <p>VA3: 0.60 ha</p> <p>VA4: 3.00 ha</p> <p>VA5: 12.62 ha</p> <p>VA6: 0.77 ha</p> <p>VA7: 3.66 ha</p> <p>VA8: 3.15 ha</p> <p>Of the total proposed clearance area (25.67 ha), 9.78 ha of vegetation clearance will take place in highly degraded and disturbed/modified landscapes (debris pits).</p>
<b>Level of clearance</b>	<p>Level 4</p> <p>At variance with Principles of Clearance 1(a), 1(b) and 1(c).</p>
<b>Overlay (Planning and Design Code)</b>	N/A– no overlays are available for the project area.
<b>Mitigation hierarchy</b>	<p>The project will remediate previously contaminated sites. While these works cannot be avoided, the methods proposed for implementing them are designed to limit impacts to already impacted spaces such as the cleared space around debris pits and the dirt tracks leading towards debris pits. Native seed will be applied to areas where vegetation has been impacted by the remediation works, to facilitate natural regeneration and promote vegetation recovery (e.g., vegetation clearance to widen access tracks, vegetation clearance for a fire buffer around the workers camp and establish a waste repository). Of the 138 pits to be remediated, 88 require some vegetation clearance to facilitate remediation works and 82 of these include revegetation as a component of their remediation works (revegetation of 25.42 ha).</p>
<b>SEB Offset proposal</b>	A total payment of \$55,906.93, which includes a SEB payment into the fund of \$52,992.34 and an admin fee of \$2,914.59.

# 2. Purpose of clearance

## 2.1 Description

Succession Ecology (SE) was engaged by the Commonwealth Department of Industry, Science and Resources (DISR) to provide baseline ecological assessment of native vegetation to support remediation works in Section 400 of Maralinga in South Australia. The land is owned by the Maralinga Tjarutja traditional owners. The objectives of this assessment are to use a desktop review to identify species and communities listed under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* and the *National Parks and Wildlife Act 1972 (NPW Act)* that may be impacted by the proposed development. In addition, an observation-based field survey will be used to assess the condition of vegetation at the debris sites that may be cleared under the *Native Vegetation Act 1991 (NV Act)*.

## 2.2 Background

The British Government undertook nuclear weapons testing at Maralinga and Emu Field in the 1950s-1960s. The Australian Government conducted major rehabilitation works at Maralinga between 1995 and 2000. While Maralinga and Emu Field were returned to Maralinga Tjarutja traditional owners in 2009 and 1998, respectively, it has become apparent that hazards remain at the site given the 1995-2000 Maralinga Rehabilitation Project predominantly only addressed radiological contamination. The other forms of contamination and/or historic infrastructure present on site also require remediation. The Australian Government is proposing to undertake site maintenance works at Maralinga and Emu Field (Maralinga Site Maintenance Project) to:

- Decommission up to 30 abandoned groundwater wells (separate NVC clearance application)
- Remediate numerous surface debris sites and buried debris pits at Emu Field (separate NVC clearance application).
- Remediate 138 surface debris or buried debris pits within Maralinga. The waste and contaminated materials from these surface debris sites will be removed using a number of different methodologies, depending on the nature of the material, the location of the pit and the amount of waste to be removed. These methodologies include emu picking of waste materials (does not involve vegetation clearance), surface scraping by hand or plant or excavation to a depth of 1 m. The remediation of the buried debris pits will include exhumation of the pits and the construction of one worker's camp, a waste sorting area, and a waste repository, area (near Maralinga Village) to hold any materials from the debris pits/surface debris sites that cannot be recycled or removed from site (this NVC clearance application). Of the 138 debris pits to be remediated, 88 of these will require vegetation clearance to facilitate remediation.

### 2.2.1 Administrative Boundaries

Section 400 (Maralinga) is a 3,000 km<sup>2</sup> parcel of land located about 300 km northwest of Ceduna, South Australia (Figure 1). The project area is located on Maralinga Tjarutja Lands, outside of Local Government Areas. This project falls within two adjacent Interim Biogeographic Regionalisation for Australia (IBRA) regions, Great Victoria Desert and Nullarbor.

### 2.2.2 Local and Regional Land Use

Land uses within Section 400 are tourism, which is focussed on the historical nuclear weapons testing project, and local community use of Maralinga Village. The Oak Valley community is 130 km west of Maralinga. The closest conservation reserves are the Nullarbor Regional Reserve which lies 60 km south of the project area, the Mamungari Conservation Park which lies 125 km to the northwest and the Tallaringa Conservation Park which lies 150 km to the northeast.

### **2.2.3 Native Vegetation Remnancy**

Within the Nullarbor plains sub region of the Nullarbor region 68 % of the remaining vegetation falls within Conservational Parks and Regional Reserves (statistics derived from NatureMaps). The project falls within two subregions of the Great Victoria Desert IBRA region, Maralinga and Yellabinna with vegetation conserved in Conservational Parks and Regional Reserves 38 % and 55 % respectively (NatureMaps).

### **2.2.4 Associated Development**

No known associated developments are proposed for the site.

## **2.3 General location map**

Maralinga is situated about 300 km northwest of Ceduna, South Australia (Figure 1) and is a 215 km<sup>2</sup> area accounting for approximately 7 % of Section 400. The 138 debris sites to be remediated as part of the Maralinga Site Maintenance Project fall within in three main areas within Maralinga, from south to north: Watson, Maralinga Village, and the forward area (Figure 2).

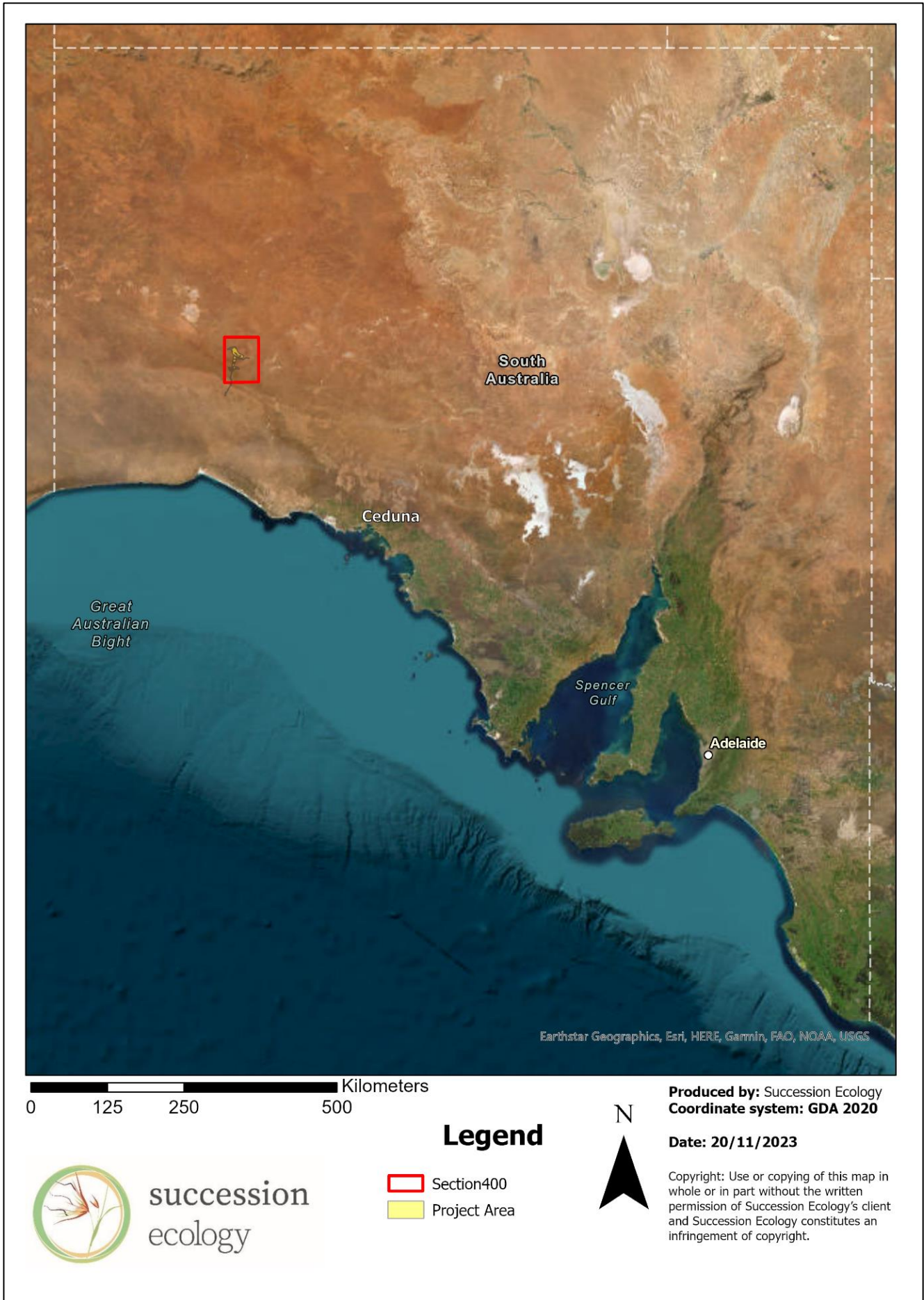


Figure 1: Location of Section 400 and Maralinga Project site within South Australia.

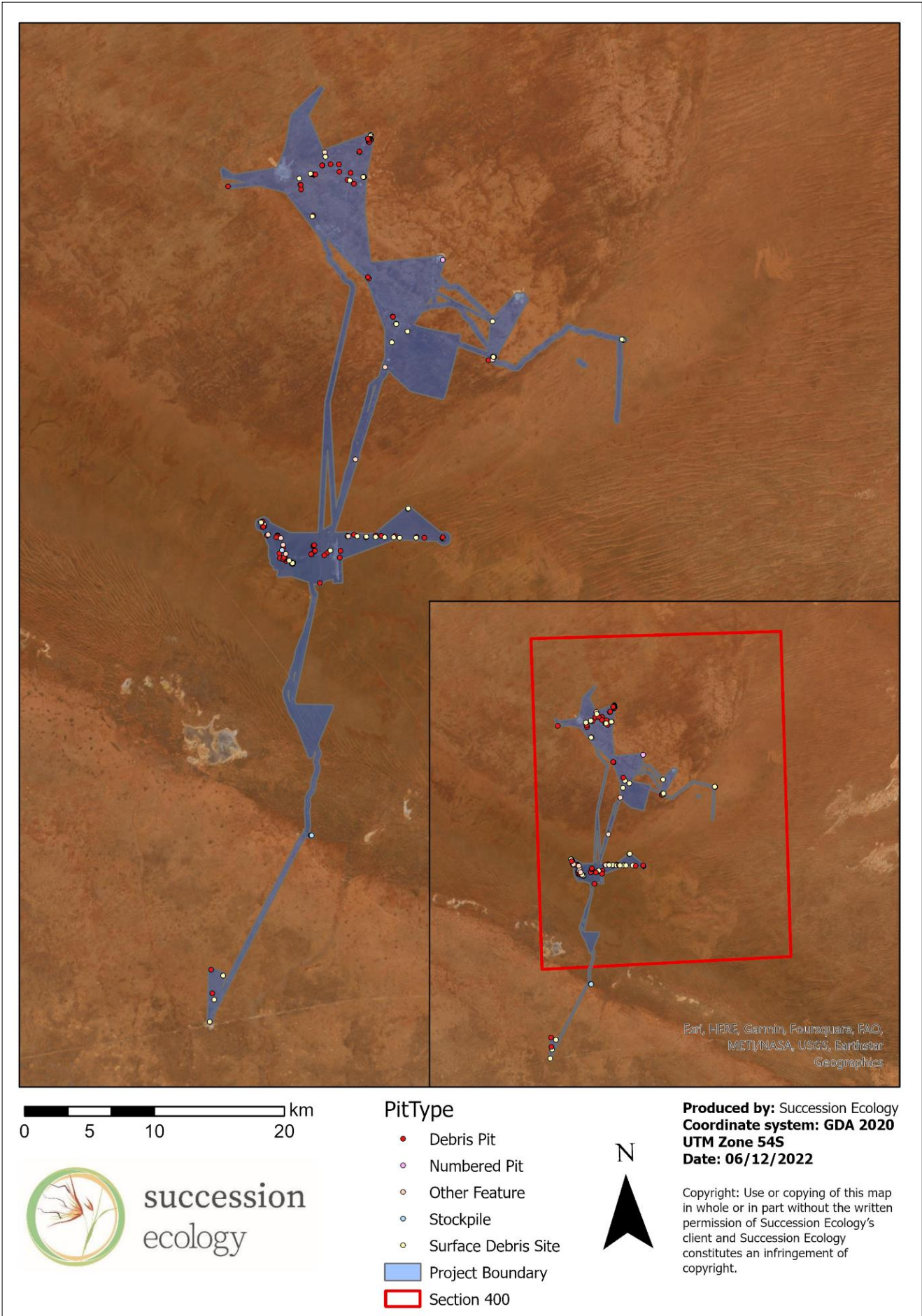


Figure 2: Location of debris sites within the Maralinga Site Maintenance Project boundary and the greater Section 400 boundary.

## 2.4 Details of the proposal

DISR proposes to undertake a series of remediation works including closing ground water wells (a separate application has been already lodged with the NVC), remediation of pits at Emu Field (a separate NVC clearance application) and the debris pit remediation at Maralinga (this project), subject to regulatory approval and Maralinga Tjarutja agreement.

This application is in relation to the remediation of 138 debris pit sites. A debris pit (DP) varies in size with a mounded cap of soil over waste material that had been deposited below. A surface debris site (SDS) is a location where waste is scattered over the ground, either in low piles or in a single layer, often dispersed over a large area of up to 50 m<sup>2</sup>. For the purposes of this report the term 'debris site' is used as a general term for any location where remediation works may require the clearance of, or may impact on, native vegetation and includes debris pits, surface debris sites, 'other sites'. A 3.7-ha debris waste repository is to be established for on-site disposal of asbestos-containing material and non-recyclable, inert waste, along with a 2.0 ha area to be used for debris sorting.

Most of the vegetation present at these debris sites are highly degraded and sit within a modified landscape (Figure 3).



*Figure 3: Images of vegetation at the proposed waste repository (left) and one of the debris pits to be remediated (right).*

Different remediation strategies are proposed in the Remediation Action Plan (RAP; version 07/11/2023), depending on the debris site types and nature of the waste materials present and include:

- Revegetation only (no pit remediation necessary)
- Emu pick of surface waste
- Surface scrape of waste material by hand and subsequent revegetation
- Surface scrape of waste material using plant and subsequent revegetation
- Screening of waste material from stockpiled material
- Excavation of waste soil up to 1 m and subsequent revegetation
- Removal of waste using plant and subsequent revegetation

Other activities will include the construction of a 3.7-ha waste repository, where non-recyclable waste and asbestos containing material will be disposed, and the creation of new tracks. However, the extensive existing road and track network will enable the impacts to native vegetation by machinery during the remediation activities to be generally low. It is expected that these existing tracks may need to be widened to allow large machinery and vehicles to access the debris sites.

New tracks will be created where necessary, proposed locations are included in the mapping of each vegetation association.

Remediation actions conducted without equipment, such as accessing areas by foot to remove surface materials will have minimal impact to vegetation. These sites are mainly surface debris sites and due to their minimal impact to vegetation have not been included in the calculations for the vegetation clearance for this application.

Additionally, vegetation clearance is also necessary for the establishment of a worker's camp. This will be used as accommodation by contractors conducting remediation works. This camp is expected to be 0.8 ha in size and is located within an area of the Maralinga Village which is already mostly bare of vegetation. Therefore, the 0.8 ha is a conservative

estimate of the clearance required at this location. A 50 m vegetation clearance buffer may also be applied, to ensure that the site meets the bush fire buffer zone required by SA Planning. A maximum of 2.3 ha of vegetation will need to be cleared to facilitate the establishment of the worker's camp. In the event that the 50 m buffer is necessary, revegetation of this buffer area (1.5 ha) will be implemented at the completion of the project.

## 2.5 Approvals required or obtained

Applications will be sought under the follow legislation:

- Section 28 of the Native Vegetation Act 1991
- Planning, Development, and Infrastructure Act 2016

An *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* Self-assessment has been undertaken for the project, in which it was assessed that the project will not result in any significant impacts to Matters of National Environmental Significance, and as such will not require referral under Guidelines 1.1 and Guidelines 1.2 of the *EPBC Act*.

Two additional applications for native vegetation clearance are associated with the Maralinga Site Maintenance Project:

- remediation works including closing ground water wells (already lodged with NVC)
- remediation of pits at Emu Field (still to be lodged)

## 2.6 Native vegetation regulation

The proposed clearance will be assessed under Section 28 of the Native Vegetation Act 1991.

## 2.7 Development Application Information

This project is not currently part of a developmental application (DA), however, will be part of one that DISR is anticipating to lodge in early 2024.

# 3. Method

## 3.1 Flora and Fauna assessment

### 3.1.1 Desktop assessment

A Desktop Assessment was conducted to determine the Threatened Ecological Communities, flora species, and fauna species that potentially occur in the area. Communities and species were evaluated as threatened if they were listed as “Endangered”, “Rare”, or “Vulnerable” under the *NPW Act*, or if they were listed as “Critically Endangered”, “Endangered”, or “Vulnerable” under the *EPBC Act*. Communities and species were evaluated if they had been recorded within 5 km of the project site since 1995 or were considered ‘known’ to occur in the area.

The search tools included:

- Protected Matters Search Tool: to identify Matters of National Environmental Significance under the *EPBC Act*, including nationally threatened species and ecological communities, ‘known’ to occur in the area.
- NatureMaps: to identify threatened flora listed under either the *NPW Act* or *EPBC Act*.
- Atlas of Living Australia (AoLA): to identify threatened flora listed under either the *NPW Act* or *EPBC Act*.
- Appendices in the NVC Bushland and Scattered Tree Assessment Manuals: to determine scattered trees species that provide suitable habitat for threatened fauna and identify threatened ecological communities protected under *NPW Act*.
- DEH (in progress) unpublished and provisional list of Threatened Ecosystems: to identify threatened and rare ecosystems.

A likelihood of occurrence assessment was carried out for both threatened fauna and flora species identified during the Desktop Assessment. The likelihood of these species using the site following the metric described in Table 1.

The distribution of vegetation associations was assessed using satellite imagery and vegetation community data obtained through NatureMaps. All maps were generated using ArcGIS Pro.

Table 1: Criteria for the likelihood of occurrence of species within the survey area.

Likelihood	Criteria
<b>Highly Likely/Known</b>	Recorded in the last 10 years, the species does not have highly specific niche requirements, the habitat is present and falls within the known range of the species distribution or  The species was recorded as part of field surveys.
<b>Likely</b>	Recorded within the previous 20 years, the area falls within the known distribution of the species and the area provides habitat or feeding resources for the species.
<b>Possible</b>	Recorded within the previous 20 years, the area falls inside the known distribution of the species, but the area provides limited habitat or feeding resources for the species.  Recorded within 20–40 years, survey effort is considered adequate, habitat and feeding resources present, and species of similar habitat needs have been recorded in the area.
<b>Unlikely</b>	Recorded within the previous 20 years, but the area provides no habitat or feeding resources for the species, including perching, roosting or nesting opportunities, corridor for movement or shelter.  Recorded within 20–40 years; however, suitable habitat does not occur, and species of similar habitat requirements have not been recorded in the area.  No records despite adequate survey effort.



The native vegetation mapping layer within NatureMaps along with satellite imagery for the project area were used to produce a preliminary map of vegetation associations likely to be present at the site. This preliminary map was adjusted based on field survey outcomes (section 3.1.2) and high-resolution aerial imagery to produce a final map of vegetation associations likely to be impacted by the Maralinga Site Maintenance Project.

### **3.1.2 Field survey**

A field survey was conducted to assess vegetation associations and condition at all the debris sites (including debris pits and surface debris sites) where vegetation clearance may occur during the remediation works. Prior to the survey, Succession Ecology was provided with an ArcGIS geodatabase containing the location of 143 debris sites that may require action. The sites were plotted over the SA Vegetation layer to determine the number of vegetation assessments required. If debris sites were close together, and they fell in the same vegetation association, a representative location was chosen to survey between the debris sites. If the debris sites were predicted to be in different vegetation associations, or were a long distance from each other, separate assessment sites were chosen for each site. Recent assessment indicates that only 138 of these initial 143 pits require remediation. Further, assessments were conducted at two potential locations for a debris containment cell, one near the village and one in the forward area. Subsequently, a decision was made to set up a 3.7 ha waste repository and 2.0 ha debris sorting area near the village.

This approach reduced the number of assessments to be undertaken to 63 with the number of debris sites included in each assessment ranging from one to nine at each location. See Appendix 1 for the number of assessment sites, vegetation association descriptions and debris sites.

Vegetation surveys were conducted on the 17<sup>th</sup> to 22<sup>nd</sup> October 2022 using the Rangelands Assessment Methodology (RAM). The Native Vegetation Council (NVC) Rangelands Assessment Manual was developed in 2017 for the purpose of assessing native vegetation systems in the arid zone of South Australia, specifically in the SA Arid Lands (SAAL) and Alinytjara Wilurara (AW) NRM Board regions. This vegetation assessment method aligns the 'Rangelands Assessment Method' (RAM) developed by Natural Resources South Australian Arid Lands (NR SAAL) for the rapid assessment of pastoral properties in sheep and cattle country but was adapted for native vegetation assessments in arid rangelands throughout South Australia. Targeted habitat assessments conducted at Maralinga included identifying native and non-native species present, photographing the vegetation, and collecting a series of biotic and physical disturbance indicators to support an evaluation of the habitat condition. Field data was entered into NVC RAM Scoresheets which calculate a range of scores that help to describe the vegetation condition and its conservation value.

During the October 2022 RAM site assessments, an opportunistic observation-based survey was conducted to identify any fauna species. Opportunistic observations included incidental records of fauna species observed while conducting the vegetation surveys, or while walking and driving to or from a survey site.

To support the NVC application (Level 4) a comprehensive fauna survey was undertaken by Succession Ecology from April 19<sup>th</sup> to April 28<sup>th</sup>, 2023, in the vegetation associations described in this report. The outcomes of this survey are presented as an attachment to this NVC application (Succession Ecology Maralinga Fauna Survey Report, final version 27/10/2023).

# 4. Assessment outcomes

## 4.1 Vegetation assessment

### 4.1.1 General description of the vegetation, the site and matters of significance.

Vegetation in Section 400 (Maralinga) is generally in very good condition due to lack of grazing and the absence of human access and activity over the last 70 years since the nuclear testing. However, vegetation that was cleared during the development of Maralinga Village and test sites for buildings and roads has recovered at varying rates depending on the level of impacts. Vegetation condition at debris sites varied from very good condition (minimal surface debris) to heavily disturbed (lots of animal and vehicle tracks, and debris present). Overall, the vegetation in the broader area surrounding the debris sites is in good condition with natural regeneration evident.

Matters of significance within the project area were assessed as part of an EPBC Self-assessment, under *Significant Impact Guidelines 1.1* and *1.2*. DISR are currently consulting and collaborating with the Maralinga Tjarutja people to identify and manage areas of cultural and heritage significance within the project area. Culturally sensitive areas will not be subject to remediation actions outlined in the Remediation Action Plan (RAP version dated 07/11/2023).

#### IBRA Regions

This project falls within two adjacent Interim Biogeographic Regionalisation for Australia (IBRA) regions, the Great Victoria Desert, and the Nullarbor (Table 2). These areas are dominated by dune landscapes with shallow depression (Great Victoria Desert) and karst plains (Nullarbor). Soils within the Great Victoria Desert are dominated by Aeolian sands, while soils in the Nullarbor are predominantly calcareous. The climate of the Great Victoria Desert and Nullarbor bioregion is arid with variable and unpredictable rainfall. The average rainfall collection from the Maralinga weather station (018114) is 222 mm (Bureau of Meteorology 2023).

Table 2: IBRA bioregion description (Thackway and Cresswell, 1995).

IBRA region	Great Victoria Desert	Nullarbor
<b>Landform</b>	An extensive dunefield with duricrusted rises and shallow depressions	A covered karst plain of flat-lying limestone with closed depressions, caves, and continuous cliff margin to the south. Traces of surface drainage occasionally form elongated chains of dry lakes
<b>Geology</b>	Aeolian sand, ferricrete, calcrete, silcrete on low rises; sheet sands	Pliocene aeolianites, Ripon Calcrete, Loveday soil in aeolian sand sheets. Dune sand forms a thin veneer infilling sink holes in Nullarbor Limestone
<b>Soil</b>	Red earthy sands, Siliceous sands, red earths on duricrusted rises	Shallow loamy calcareous soils
<b>Vegetation</b>	Acacia Open Woodland	Chenopod Shrub, Samphire Shrub and Forblands
<b>Climate</b>	Semi-arid climate that is too dry to support field crops. Soil moisture tends to be greatest in winter	Semi-arid climate that is too dry to support field crops. Soil moisture tends to be greatest in winter

#### Vegetation Overview

The SA Vegetation layer in NatureMaps assigns the vegetation associations described in Table 3 to the locations of the debris site. This data was useful for the initial survey preparation and planning. Field surveys identified ten vegetation associations within the project boundary, using 63 vegetation assessment sites. Mapping from the SA Vegetation layer was mostly accurate, but some inconsistencies were identified at some locations. For example, at Whitmore Park near Maralinga Village, the vegetation is mapped as *Acacia aneura* complex but is in fact a Mallee woodland. In total, 154 native species were recorded during the surveys, constituting a mix of perennial and annual species (Appendix 2). At

the time of the survey, many species were in flower or setting seed. From the assessment sites a total of ten native vegetation associations (Figure 4) were described. Nine vegetation associations contained sites where remediation activities are going to take place (Table 4). Only the nine vegetation associations relevant to the proposed clearance will be discussed in this report. VA1 is the only vegetation association found within both the Maralinga and Yellabinna subregion. Due to it being on the very edge of the Yellabinna subregion, the landscape vegetation and conservation scores being very close or identical and minimal sites, for the clarity this application it has been scored on the same data sheet and recorded as the one vegetation association in the Maralinga region in the score sheets.

Table 3: Descriptions of the vegetation present at Maralinga as presented in the NatureMaps SA Vegetation layer. GV denotes communities of the Great Victorian Desert, while NB is used for those in the Nullarbor Plain IBRA Region. The +/- symbols are used to indicate species which may or may not be present within this association.

Vegetation Group Code	SA Vegetation description
GV0001	<i>Acacia aneura</i> complex low open woodland over +/- <i>Eremophila latrobei</i> ssp. <i>glabra</i> , +/- <i>Senna artemisioides</i> ssp. <i>petiolaris</i> , +/- <i>Acacia tetragonophylla</i> mid sparse shrubland over <i>Ptilotus</i> sp., <i>Eragrostis eriopoda</i> , <i>Aristida contorta</i> , +/- <i>Monachather paradoxus</i> low sparse forbland
GC0002	<i>Acacia aneura</i> complex low open woodland over <i>Maireana sedifolia</i> , +/- <i>Senna artemisioides</i> ssp., +/- <i>Eremophila latrobei</i> ssp. <i>glabra</i> mid sparse shrubland over +/- <i>Ptilotus obovatus</i> var. <i>obovatus</i> , +/- <i>Aristida contorta</i> low sparse forbland
GV0005	<i>Casuarina pauper</i> , +/- <i>Acacia papyrocarpa</i> low woodland over <i>Senna artemisioides</i> ssp. <i>petiolaris</i> , +/- <i>Senna cardiosperma</i> ssp. <i>gawlerensis</i> mid sparse shrubland over <i>Atriplex vesicaria</i> ssp., +/- <i>Maireana sedifolia</i> , +/- <i>Cratystylis conocephala</i> low open shrubland
GV0006	<i>Casuarina pauper</i> , <i>Alectryon oleifolius</i> ssp. <i>canescens</i> , +/- <i>Acacia aneura</i> complex low woodland over <i>Senna cardiosperma</i> ssp. <i>gawlerensis</i> mid sparse shrubland over <i>Ptilotus obovatus</i> var. <i>obovatus</i> low open shrubland
GV0009	<i>Eucalyptus concinna</i> , +/- <i>Eucalyptus canescens</i> ssp. <i>canescens</i> , +/- <i>Eucalyptus socialis</i> ssp., +/- <i>Eucalyptus eremicola</i> , +/- <i>Acacia aneura</i> complex mid mallee woodland over <i>Senna artemisioides</i> ssp. <i>petiolaris</i> , +/- <i>Eremophila paisleyi</i> ssp. <i>paisleyi</i> mid sparse shrubland over <i>Triodia scariosa</i> , <i>Ptilotus obovatus</i> var. <i>obovatus</i> low hummock grassland
GV0016	emergent +/- <i>Melaleuca nanophylla</i> mid sparse shrubland over <i>Atriplex vesicaria</i> ssp., +/- <i>Hemichroa diandra</i> , +/- <i>Tecticornia</i> sp. low open shrubland
GV0019	emergent +/- <i>Acacia tetragonophylla</i> , +/- <i>Alectryon oleifolius</i> ssp. <i>canescens</i> , +/- <i>Pittosporum angustifolium</i> low open woodland over <i>Salsola tragus</i> , +/- <i>Eriochiton sclerolaenoides</i> , +/- <i>Sclerolaena obliquicuspis</i> , +/- <i>Sclerolaena diacantha</i> , +/- <i>Austrostipa nitida</i> , +/- <i>Enneapogon avenaceus</i> low open shrubland
NB0011	<i>Atriplex vesicaria</i> ssp. low shrubland over +/- <i>Eriochiton sclerolaenoides</i> , +/- <i>Sclerolaena obliquicuspis</i>
NU0012	emergent +/- <i>Atriplex vesicaria</i> ssp., +/- <i>Tecticornia</i> sp. over <i>Austrostipa nitida</i> , <i>Austroanthonia caespitosa</i> , +/- <i>Austrostipa eremophila</i> low tussock grassland
NB0013	emergent +/- <i>Atriplex vesicaria</i> ssp. over <i>Eriochiton sclerolaenoides</i> , +/- <i>Sclerolaena obliquicuspis</i> , +/- <i>Sclerolaena patenticuspis</i> , +/- <i>Enneapogon cylindricus</i> low shrubland

Table 4: Vegetation associations (VA) to be impacted by proposed pit remediation. Vegetation around pits were assessed as part of the October 2022 ground surveys.

Vegetation Association	IBRA Subregion
<b>VA1</b> <i>Acacia aneura</i> shrubland with <i>Senna artemisioides</i> ssp. <i>zygophylla</i>	Maralinga, Yellabinna
<b>VA2</b> <i>Acacia aneura</i> low open shrublands, above <i>Senna</i> and <i>Eremophila</i> species over an understorey of <i>Maireana</i> , <i>Rhagodia</i> and tussock grasses	Maralinga
<b>VA3</b> Mixed <i>Acacia</i> Shrubland, with <i>Maireana</i> , <i>Solanum</i> , <i>Sclerolaena</i> and <i>Dodonaea</i> midstorey and <i>Calandrinia</i>	Nullarbor
<b>VA4</b> Mallee woodland with midstorey of <i>Acacia</i> , <i>Senna</i> , <i>Eremophila</i> and <i>Dodonaea</i> and understorey of chenopods, Spinifex, and grasses	Maralinga
<b>VA5</b> <i>Casuarina pauper</i> woodland with midstorey of <i>Acacia</i> , <i>Eremophila</i> , <i>Senna</i> , and <i>Maireana</i> , <i>Solanum</i> , <i>Austrostipa</i> and <i>Enneapogon</i> understorey	Maralinga
<b>VA6</b> Mixed Mallee/ <i>Casuarina</i> Woodland with a midstorey of <i>Acacia</i> , <i>Senna</i> and <i>Eremophila</i> over chenopods and grasses	Maralinga
<b>VA7</b> Chenopod shrublands (South) with emergent <i>Eremophila longifolia</i> , <i>Pittosporum angustifolium</i> and <i>Acacia</i> species, over a mix of chenopod and grass species	Nullarbor
<b>VA8</b> Chenopod shrubland (North) with emergent <i>Acacia</i> and <i>Senna</i> spp.	Maralinga

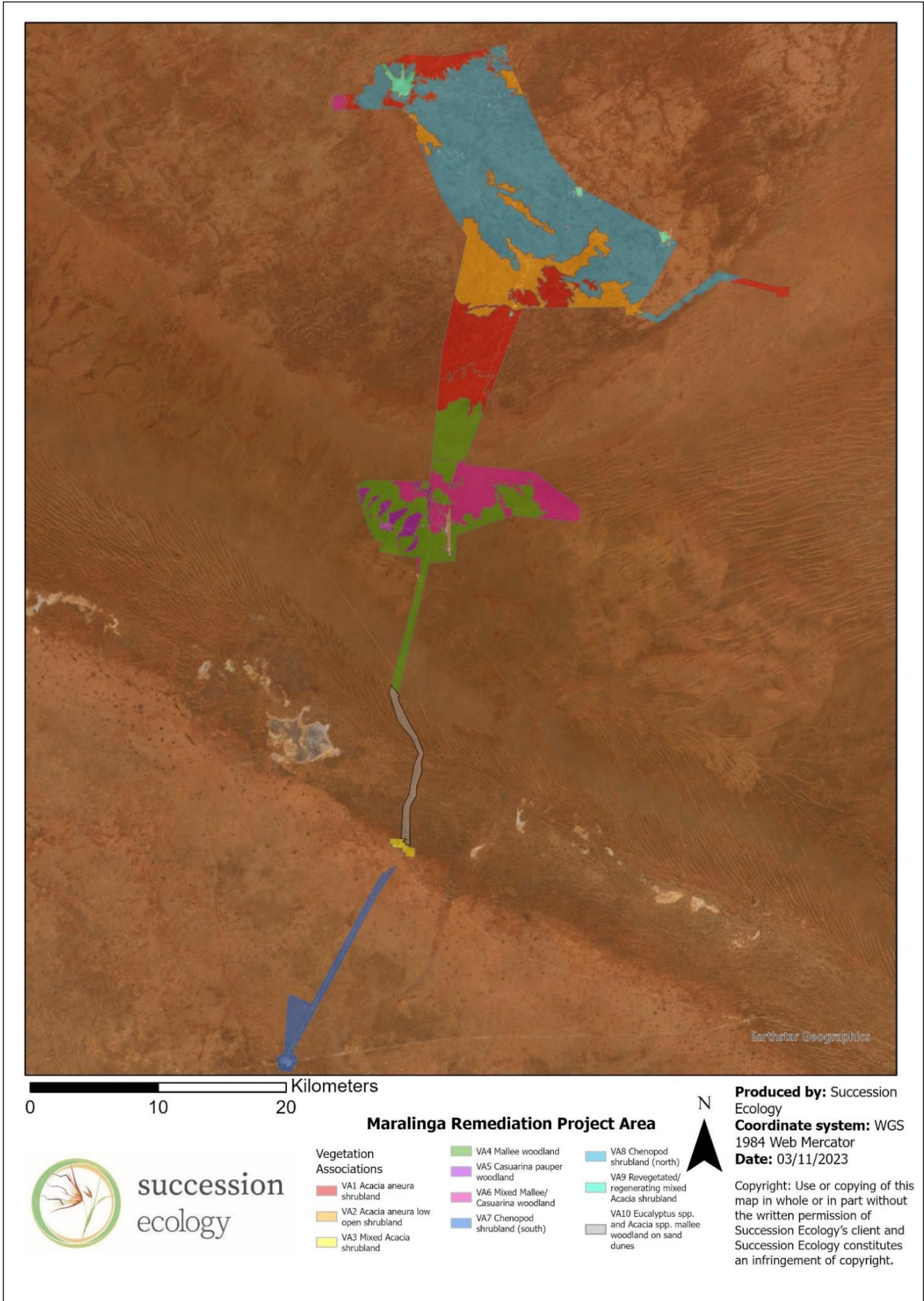


Figure 4: Distribution of Vegetation Associations across the remediation area as mapped and described by Succession Ecology.

### 4.1.2 Details of the vegetation associations and scattered trees proposed to be impacted

Ten vegetation associations were identified in the 63 vegetation assessment sites. Eight of these associations will be impacted by the proposed debris pit remediation works outlined in the Remediation Action Plan (version 07/11/2023) as part of the Maralinga Site Maintenance Project.

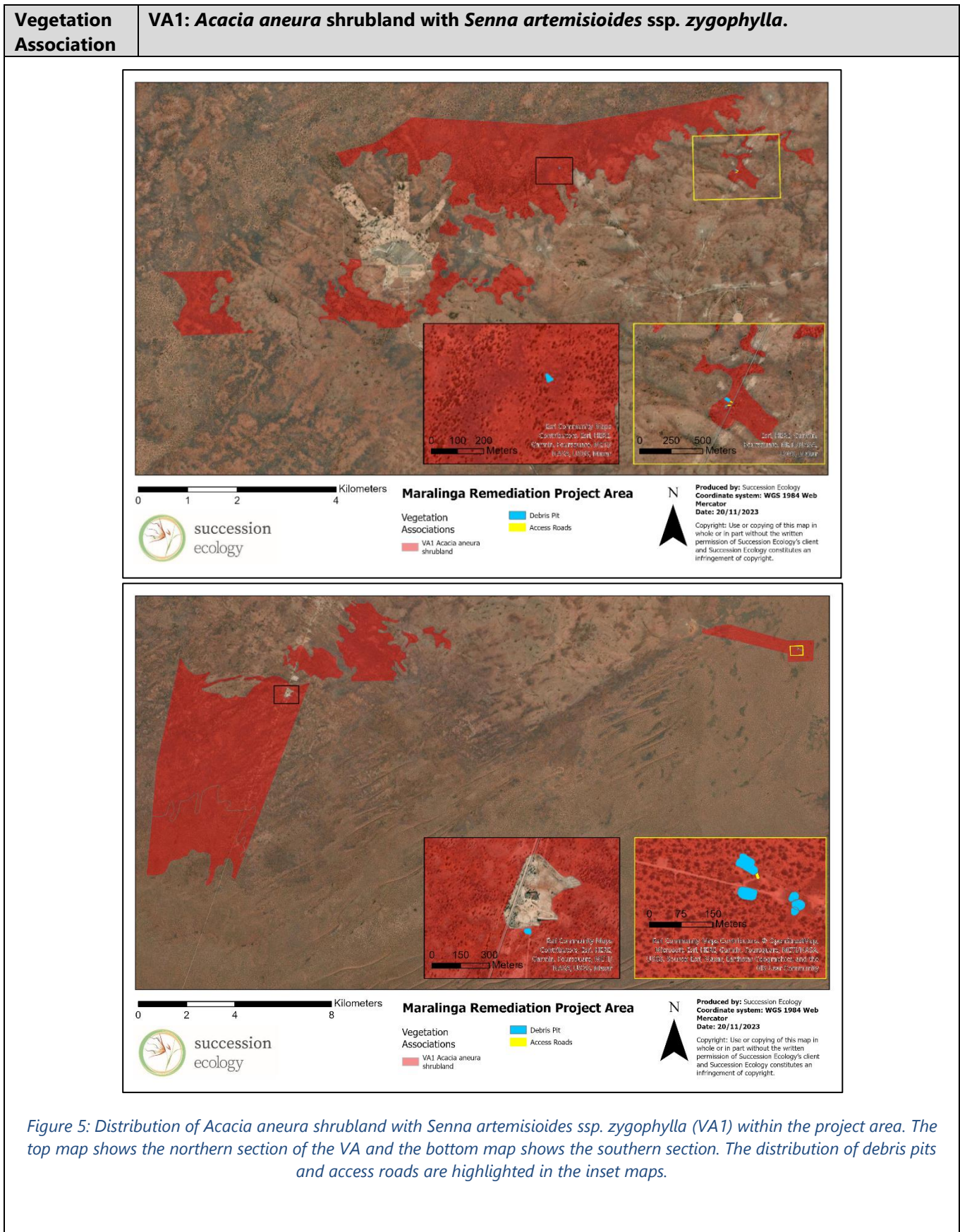



Figure 5: Distribution of *Acacia aneura* shrubland with *Senna artemisioides* ssp. *zygophylla* (VA1) within the project area. The top map shows the northern section of the VA and the bottom map shows the southern section. The distribution of debris pits and access roads are highlighted in the inset maps.

<b>Vegetation Association</b>	<b>VA1: <i>Acacia aneura</i> shrubland with <i>Senna artemisioides</i> ssp. <i>zygophylla</i>.</b>
 <p data-bbox="119 622 1436 689">Figure 6: Representative photographs of <i>Acacia aneura</i> overstorey with chenopod and shrub understorey with varying levels of disturbance (Succession Ecology September 2022).</p>	
<b>General description</b>	<p>Overstorey was dominated by <i>Acacia aneura</i> with multiple age classes represented. A semi-dense midstorey of <i>Senna artemisioides</i> ssp. <i>zygophylla</i> was present, as well as a high diversity of other shrub species such as <i>Acacia burkittii</i>, <i>A. minyura</i>, <i>A. calamifolia</i>, <i>Myoporum platycarpum</i>, <i>Pittosporum angustifolium</i> and <i>Eremophila longifolia</i>. Understorey species included <i>Maireana sedifolia</i>, <i>Ptilotus obovatus</i>, <i>Rhagodia spinescens</i>, <i>Atriplex vesicaria</i> and <i>Enneapogon</i> species. This vegetation type occurred within a landscape that had high levels of historical disturbance but there was little to no invasive weeds present.</p>
<b>Threatened species or community</b>	<p><u>Threatened Ecological Communities</u></p> <p>The Provisional List of Threatened Ecosystems of South Australia lists <i>Acacia aneura</i> Low Woodland on sand plains as being found within the Maralinga IBRA subregion. However, this vegetation association does not fit within that description (DEH in progress).</p> <p><u>Threatened Fauna</u></p> <p>A 50 km radius search identified 13 species protected under federal or state legislation as occurring within the area since 1995. Two species were listed as Vulnerable under the <i>EPBC Act</i>, the Malleefowl and the Southern Whiteface. A further 11 species are listed under the <i>NPW Act</i> two of which are classed as Vulnerable (Little Eagle, Australian Bustard), and eight are classed as Rare (Australasian Darter, Chestnut-backed Quailthrush, White-browed Treecreeper, Black Falcon, Shy Heathwren, Major Mitchell's Cockatoo, Scarlet-chested Parrot, Gilbert's Whistler, Western Black-naped Snake). While Malleefowl are known to occur within the property, the majority of habitat within the clearance footprint does not fall within their preferences, and no signs of activity were observed.</p> <p><u>Threatened Flora</u></p> <p>Eleven flora species were identified in a 50 km search of records since 1995. One EBPC listed species was recorded, the Ooldea Guinea-flower (<i>Hibbertia crispula</i>). A further 10 species listed under the <i>NPW Act</i> were recorded, one <i>Teucrium grandiusculum</i> ssp. <i>pilosum</i> is listed as Endangered, four are classed as Vulnerable (<i>Santalum spicatum</i>, <i>Austrostipa nullanulla</i>, <i>Sarcozona bicarinata</i>, and <i>Sclerolaena symoniana</i>) and five are Rare (<i>Austrostipa tenuifolia</i>, <i>Austrostipa plumigera</i>, <i>Eremophila hillii</i>, <i>Eucalyptus canescens</i> ssp. <i>beadellii</i>, and <i>Gilesia biniflora</i>). None of these species were identified within the clearance footprint for this project by Succession Ecology in October 2022.</p>

<b>Vegetation Association</b>	<b>VA1: <i>Acacia aneura</i> shrubland with <i>Senna artemisioides</i> ssp. <i>zygophylla</i>.</b>				
<b>Landscape context score</b>	1.13	<b>Vegetation Condition Score</b>	60.52	<b>Conservation significance score</b>	1.30
<b>Unit biodiversity Score</b>	88.90	<b>Area (ha)</b>	0.59	<b>Total biodiversity Score</b>	52.01



**Vegetation Association**

**VA2: *Acacia aneura* low open shrublands, above *Senna* and *Eremophila* species over an understorey of *Maireana*, *Rhagodia* and tussock grasses**

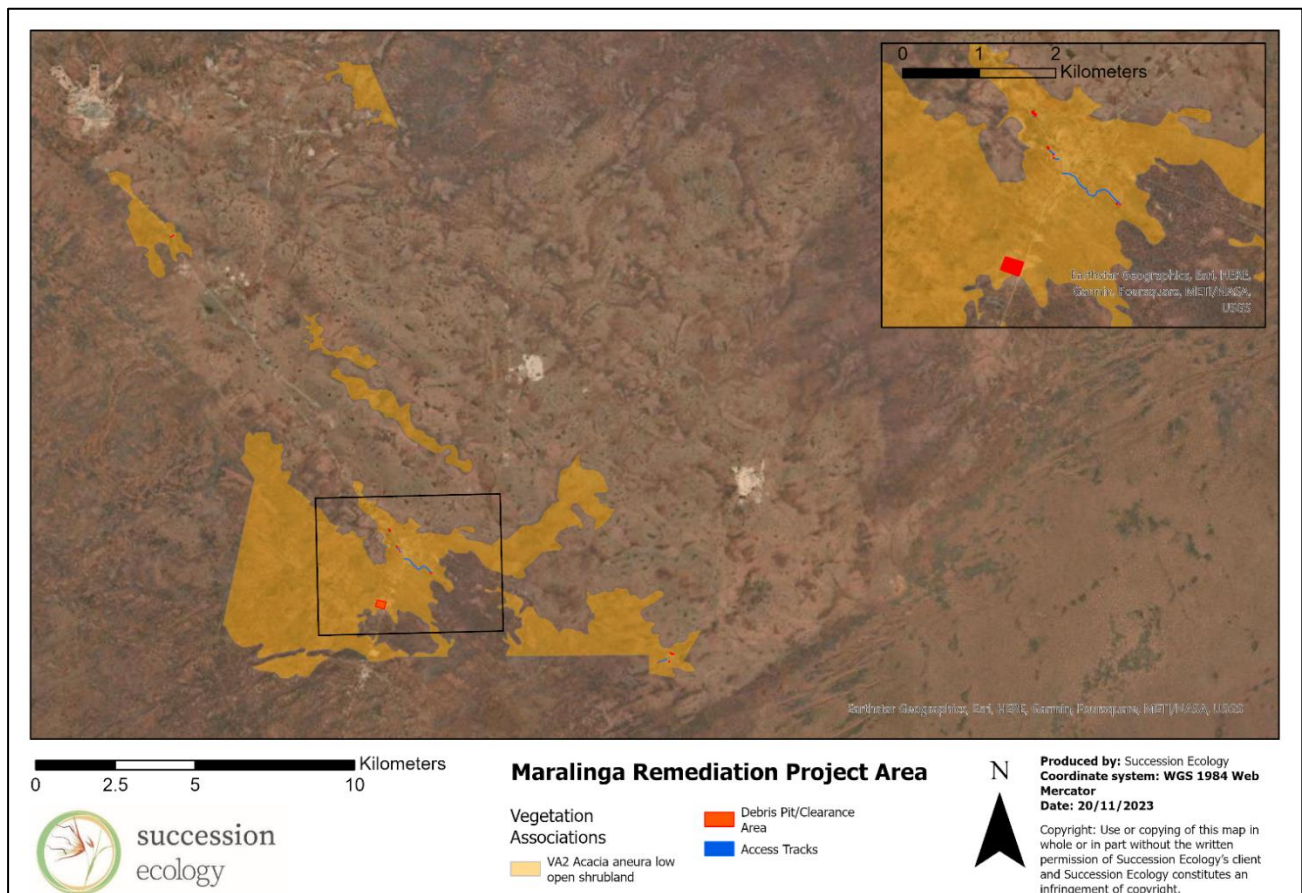


Figure 7: Distribution of *Acacia aneura* low open shrublands (VA2) within the project area. Distribution of debris pits, roads and clearance areas are shown in the inset map.



Figure 8: Representative photographs of an *Acacia aneura* low open shrubland (Succession Ecology September 2022).

<b>Vegetation Association</b>	<b>VA2: <i>Acacia aneura</i> low open shrublands, <i>Acacia</i> species above <i>Senna</i> and <i>Eremophila</i> species over an understorey of <i>Maireana</i>, <i>Rhagodia</i> and tussock grasses</b>
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Figure 9: Examples of disturbance and surface debris within VA2 (Succession Ecology September 2022).

<b>General description</b>	<p><i>Acacia aneura</i> open shrubland is the dominant vegetation association in the forward area beginning approximately halfway between Maralinga Village and Roadside and extending north. The association is characterised by <i>A. aneura</i> and other <i>Acacia</i> species such as <i>A. kempeana</i>, <i>A. minyura</i> and <i>A. tetragonophylla</i>, forming an open overstorey above <i>Senna</i> and <i>Eremophila</i> species with an understorey of chenopods (<i>Maireana</i> and <i>Rhagodia</i> species) and grasses (<i>Aristida</i> and <i>Enneapogon</i> species).</p>
<b>Threatened species or community</b>	<p><u>Threatened Ecological Communities</u> The Provisional List of Threatened Ecosystems of South Australia lists <i>Acacia aneura</i> Low Woodland on sand plains as being found within the Maralinga IBRA subregion. However, this vegetation association does not fit within that description (DEH in progress).</p> <p><u>Threatened Fauna</u> A 50 km radius search identified 13 species protected under federal or state legislation as occurring within the area since 1995. Two species were listed as Vulnerable under the EPBC Act, the Malleefowl and the Southern Whiteface.</p> <p>A further 11 species are listed under the NPW Act two of which are classed as Vulnerable (Little Eagle, Australian Bustard), and eight are classed as Rare (Australasian Darter, Chestnut-backed Quailthrush, White-browed Treecreeper, Black Falcon, Shy Heathwren, Major Mitchell's Cockatoo, Scarlet-chested Parrot, Gilbert's Whistler, Western Black-naped Snake).</p>

<b>Vegetation Association</b>	<b>VA2: <i>Acacia aneura</i> low open shrublands, <i>Acacia</i> species above <i>Senna</i> and <i>Eremophila</i> species over an understorey of <i>Maireana</i>, <i>Rhagodia</i> and tussock grasses</b>				
	<p>While Malleefowl are known to occur within the property, the majority of habitat within the clearance footprint does not fall within their preferences, and no signs of activity were observed.</p> <p><u>Threatened Flora</u>  Eleven flora species were identified in a 50 km search of records since 1995. One EBPC listed species was recorded, the Ooldea Guinea-flower (<i>Hibbertia crispula</i>).</p> <p>A further 10 species listed under the <i>NPW Act</i> were recorded, one <i>Teucrium grandiusculum</i> ssp. <i>pilosum</i> is listed as Endangered, four are classed as Vulnerable (<i>Santalum spicatum</i>, <i>Austrostipa nullanulla</i>, <i>Sarcozona bicarinata</i> and <i>Sclerolaena symoniana</i>) and five are Rare (<i>Austrostipa tenuifolia</i>, <i>Austrostipa plumigera</i>, <i>Eremophila hillii</i>, <i>Eucalyptus canescens</i> ssp. <i>beadellii</i>, and <i>Gilesia biniflora</i>). None of these species were identified within the clearance footprint for this project by Succession Ecology in October 2022.</p>				
<b>Landscape context score</b>	1.13	<b>Vegetation Condition Score</b>	47.90	<b>Conservation significance score</b>	1.30
<b>Unit biodiversity Score</b>	70.37	<b>Area (ha)</b>	1.27	<b>Total biodiversity Score</b>	89.18

**Vegetation Association**

**VA3:** Mixed *Acacia* Shrubland, with *Maireana*, *Solanum*, *Sclerolaena* and *Dodonea* midstorey and *Calandrinia*

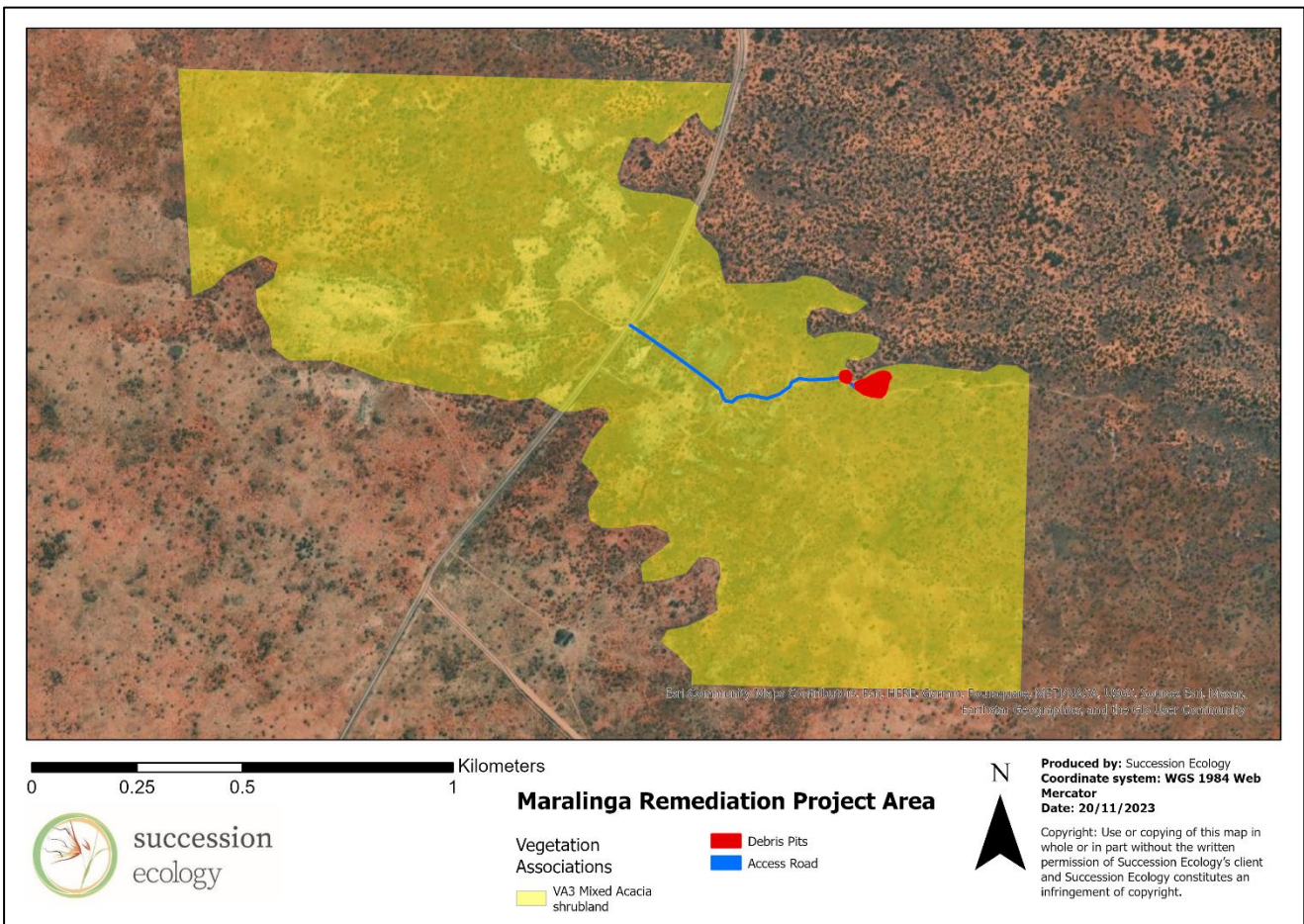


Figure 10: Distribution of Mixed Acacia Shrubland (VA3) within the project area.

<b>Vegetation Association</b>	<b>VA3:</b> Mixed <i>Acacia</i> Shrubland, with <i>Maireana</i> , <i>Solanum</i> , <i>Sclerolaena</i> and <i>Dodonaea</i> midstorey and <i>Calandrinia</i>
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Figure 11: Plant species occurring at DP66 and DP67 including flowering *Calandrinia* (Succession Ecology September 2022).

<b>General description</b>	<p>One vegetation assessment was completed for the debris sites in this vegetation association described as Mixed <i>Acacia</i> Shrublands. The site was located one south of the village near the Ceduna turnoff, on the southern edge of a large dune field that extends 10 km north towards the Oak Valley turnoff. A total of 50 native and three introduced plant species were recorded for this association.</p> <p>The dominant overstorey species were <i>Acacia burkittii</i> and <i>A. kempeana</i>, with a range of mid-storey plants including species from the genera <i>Maireana</i>, <i>Solanum</i> <i>Sclerolaena</i> and <i>Dodonaea</i>. This was the only assessment site where two species of annual wildflowers, <i>Calandrinia eremaea</i> and <i>Calandrinia remota</i> were seen (Figure 11). The <i>Acacia</i> Shrubland association was in good condition with minor signs of physical disturbance, such as erosion from vehicle tracks and old wires running across the site. Signs of rabbits and camels were also recorded. Weeds recorded in this association were Indian Hedge Mustard. At all sites they accounted for less than 5 % of the vegetation cover.</p>
<b>Threatened species or community</b>	<u>Threatened Ecological Communities</u>

<b>Vegetation Association</b>	<b>VA3:</b> Mixed <i>Acacia</i> Shrubland, with <i>Maireana</i> , <i>Solanum</i> , <i>Sclerolaena</i> and <i>Dodonaea</i> midstorey and <i>Calandrinia</i>				
	<p>The Provisional List of Threatened Ecosystems of South Australia lists <i>Acacia aneura</i> Low Woodland on sand plains as being found within the Maralinga IBRA subregion. However, this vegetation association does not fit within that description (DEH in progress).</p> <p><u>Threatened Fauna</u></p> <p>A 50 km radius search identified 13 species protected under federal or state legislation as occurring within the area since 1995. Two species were listed as Vulnerable under the <i>EPBC Act</i>, the Malleefowl and the Southern Whiteface.</p> <p>A further 11 species are listed under the <i>NPW Act</i> two of which are classed as Vulnerable (Little Eagle, Australian Bustard), and eight are classed as Rare (Australasian Darter, Chestnut-backed Quailthrush, White-browed Treecreeper, Black Falcon, Shy Heathwren, Major Mitchell's Cockatoo, Scarlet-chested Parrot, Gilbert's Whistler, Western Black-naped Snake).</p> <p>While Malleefowl are known to occur within the property, the majority of habitat within the clearance footprint does not fall within their preferences, and no signs of activity were observed.</p> <p><u>Threatened Flora</u></p> <p>Eleven flora species were identified in a 50 km search of records since 1995. One EBPC listed species was recorded, the Ooldea Guinea-flower (<i>Hibbertia crispula</i>).</p> <p>A further 10 species listed under the <i>NPW Act</i> were recorded, one <i>Teucrium grandiusculum</i> ssp. <i>pilosum</i> is listed as Endangered, four are classed as Vulnerable (<i>Santalum spicatum</i>, <i>Austrostipa nullanulla</i>, <i>Sarcozona bicarinata</i> and <i>Sclerolaena symoniana</i>) and five are Rare (<i>Austrostipa tenuifolia</i>, <i>Austrostipa plumigera</i>, <i>Eremophila hillii</i>, <i>Eucalyptus canescens</i> ssp. <i>beadellii</i>, and <i>Gilesia biniflora</i>). None of these species were identified within the clearance footprint for this project by Succession Ecology in October 2022.</p>				
<b>Landscape context score</b>	1.13	<b>Vegetation Condition Score</b>	53.47	<b>Conservation significance score</b>	1.30
<b>Unit biodiversity Score</b>	78.55	<b>Area (ha)</b>	0.60	<b>Total biodiversity Score</b>	47.38

<b>Vegetation Association</b>	<b>VA4: Mallee woodland with, midstorey of <i>Acacia</i>, <i>Senna</i>, <i>Eremophila</i> and <i>Dodonaea</i> and understorey of chenopods and grasses</b>
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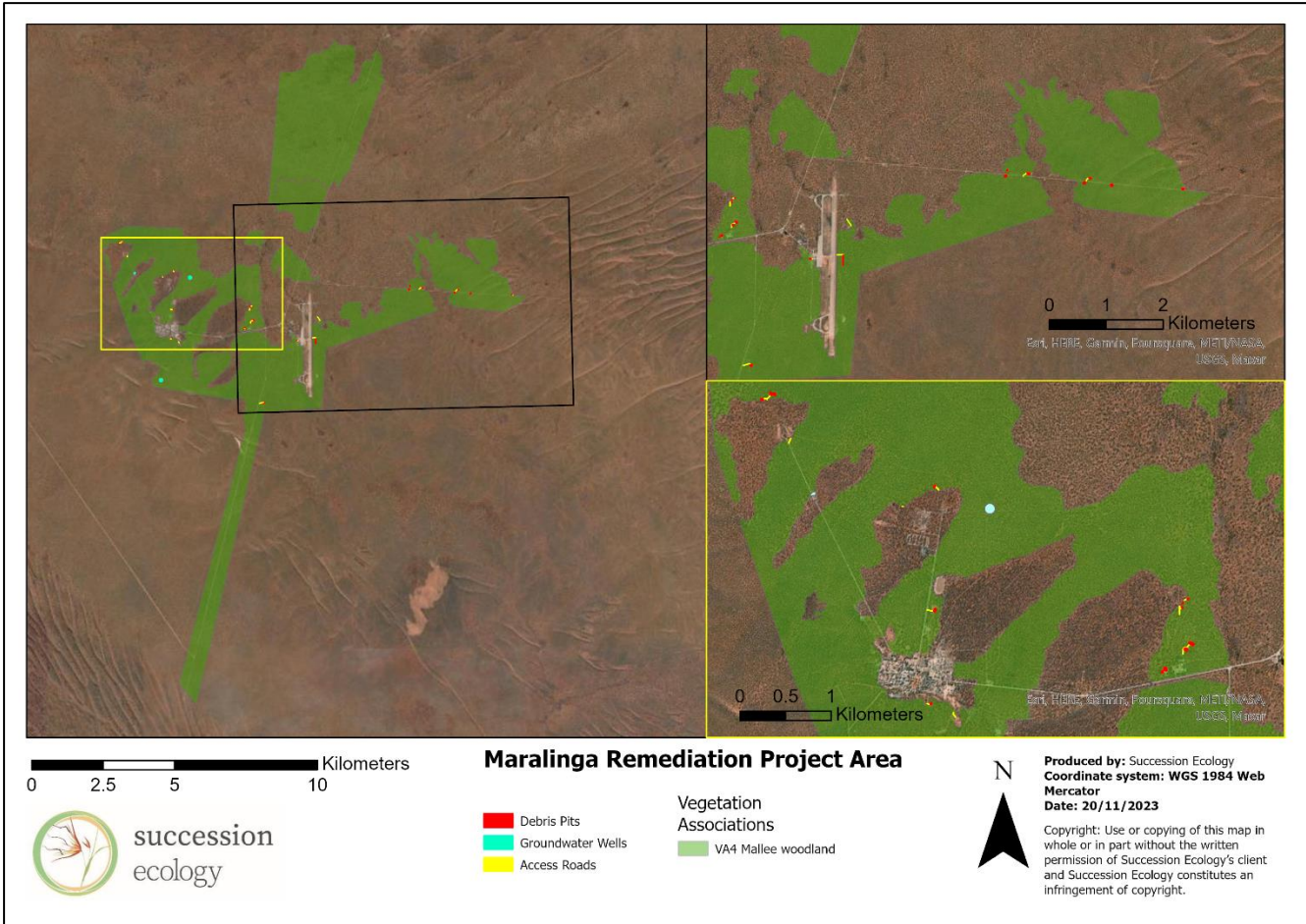


Figure 12: Distribution of Mallee woodland (VA4) within the project area. Location of debris pits, groundwater wells and access roads are indicated in the inset maps.



Figure 13: Examples of the Mallee woodland in VA4 with tussock grasses in the foreground (Succession Ecology September 2022).

<b>General description</b>	Mallee woodlands cover a large extent of both the remediation project boundary and the broader Section 400 parcel (Figure 12). A total of 18 debris sites were assessed in Mallee woodland close to Maralinga Village and along XA Road. There was also an assessment site south of the village (43U). The association encountered was typical open Mallee woodland on red sandy soil with a diverse shrub layer and the understorey dominated by <i>Triodia</i> grasses. It
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<b>Vegetation Association</b>	<b>VA4: Mallee woodland with, midstorey of <i>Acacia</i>, <i>Senna</i>, <i>Eremophila</i> and <i>Dodonea</i> and understorey of chenopods and grasses</b>
	<p>was the most diverse vegetation association with 87 native species recorded across the 18 assessment sites.</p> <p>Multiple mallee species made up the canopy at each assessment site with combinations of 2-3 species from the broader recorded list of eight species including <i>Eucalyptus canescens</i>, <i>E. concinna</i>, <i>E. eremicola</i>, <i>E. gracilis</i>, <i>E. oleosa</i>, <i>E. socialis</i>, <i>E. yumbarrana</i> and <i>E. pimpiniana</i>. The midstorey was represented by <i>Acacia</i>, <i>Senna</i>, <i>Eremophila</i>, and <i>Dodonea</i> species, while the understorey was a mix of chenopods and grasses, notably <i>Maireana</i>, <i>Rhagodia</i>, <i>Triodia</i> and <i>Enneapogon</i> (Figure 13).</p> <p>At surface debris sites the vegetation was largely unimpacted by the piles of rubbish scattered throughout. Regeneration of mid- and understorey species was noted around debris pits where vegetation had previously been cleared, but the Eucalypt canopy species had not grown back. Weeds recorded in the Mallee Woodland association included Ward's Weed (<i>Carrichtera annua</i>), Common Ice Plant (<i>Mesembryanthemum crystallinum</i>), Mustard Weed (<i>Sisymbrium officinale</i>) and Ruby Dock (<i>Rumex vesicarius</i>) which accounted for less than 5% of the vegetation cover.</p>
<b>Threatened species or community</b>	<p><u>Threatened Ecological Communities</u></p> <p>The Provisional List of Threatened Ecosystems of South Australia lists <i>Acacia aneura</i> Low Woodland on sand plains as being found within the Maralinga IBRA subregion. However, this vegetation association does not fit within that description (DEH in progress).</p> <p><u>Threatened Fauna</u></p> <p>A 50 km radius search identified 13 species protected under federal or state legislation as occurring within the area since 1995. Two species were listed as Vulnerable under the <i>EPBC Act</i>, the Malleefowl and the Southern Whiteface.</p> <p>A further 11 species are listed under the <i>NPW Act</i> two of which are classed as Vulnerable (Little Eagle, Australian Bustard), and eight are classed as Rare (Australasian Darter, Chestnut-backed Quailthrush, White-browed Treecreeper, Black Falcon, Shy Heathwren, Major Mitchell's Cockatoo, Scarlet-chested Parrot, Gilbert's Whistler, Western Black-naped Snake).</p> <p>While Malleefowl are known to occur within the property, the majority of habitat within the clearance footprint does not fall within their preferences, and no signs of activity were observed.</p> <p><u>Threatened Flora</u></p> <p>Eleven flora species were identified in a 50 km search of records since 1995. One EBPC listed species was recorded, the Ooldea Guinea-flower (<i>Hibbertia crispula</i>).</p> <p>A further 10 species listed under the <i>NPW Act</i> were recorded, one <i>Teucrium grandiusculum</i> ssp. <i>pilosum</i> is listed as Endangered, four are classed as Vulnerable (<i>Santalum spicatum</i>, <i>Austrostipa nullanulla</i>, <i>Sarcozona bicarinata</i> and <i>Sclerolaena symoniana</i>) and five are Rare (<i>Austrostipa tenuifolia</i>, <i>Austrostipa plumigera</i>, <i>Eremophila hillii</i>, <i>Eucalyptus canescens</i> ssp. <i>beadellii</i>, and <i>Gilesia biniflora</i>). None of these species were identified within the clearance footprint for this project by Succession Ecology in October 2022.</p>



<b>Vegetation Association</b>	<b>VA4: Mallee woodland with, midstorey of <i>Acacia</i>, <i>Senna</i>, <i>Eremophila</i> and <i>Dodonaea</i> and understorey of chenopods and grasses</b>				
<b>Landscape context score</b>	1.13	<b>Vegetation Condition Score</b>	63.83	<b>Conservation significance score</b>	1.30
<b>Unit biodiversity Score</b>	93.77	<b>Area (ha)</b>	3.00	<b>Total biodiversity Score</b>	281.41

<b>Vegetation Association</b>	<b>VA5:</b> <i>Casuarina pauper</i> woodland with midstorey of <i>Acacia</i> , <i>Eremophila</i> , <i>Senna</i> , and <i>Maireana</i> , <i>Solanum</i> , <i>Austrostipa</i> and <i>Enneapogon</i> understorey
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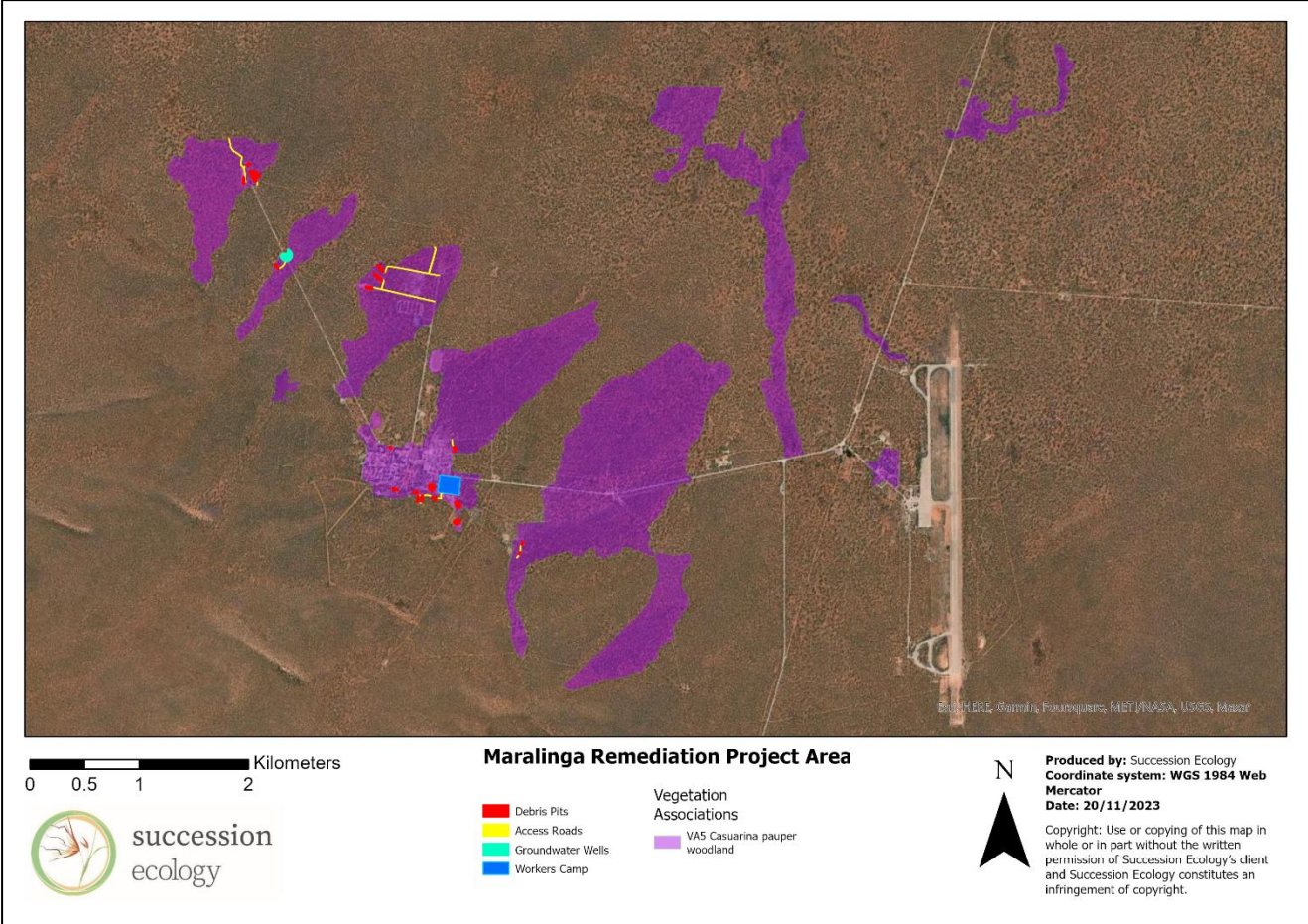


Figure 14: Extent of VA5 *Casuarina pauper* woodland within the project area.



Figure 15: Examples of the vegetation types in *Casuarina pauper* woodland vegetation association (Succession Ecology September 2022).

<b>General description</b>	The <i>Casuarina pauper</i> woodlands were found near the Maralinga Village at five assessment sites. The overstorey in this association is dominated by adult <i>Casuarina pauper</i> tree but also includes <i>Eucalyptus concinna</i> and <i>E. oleosa</i> . The midstorey was a combination of <i>Acacia</i> , <i>Eremophila</i> and <i>Senna</i> species, and the understorey was a mix of <i>Maireana</i> and <i>Solanum</i> species combined with grasses from the <i>Austrostipa</i> and <i>Enneapogon</i> genera (Figure 15).
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<b>Vegetation Association</b>	<b>VA5:</b> <i>Casuarina pauper</i> woodland with midstorey of <i>Acacia</i> , <i>Eremophila</i> , <i>Senna</i> , and <i>Maireana</i> , <i>Solanum</i> , <i>Austrostipa</i> and <i>Enneapogon</i> understorey				
	This vegetation association was in good condition at most assessment sites with all vegetation strata present. More than half of the 62 native species recorded were represented by mixed age classes, implying ongoing regeneration. Palatable shrubs and intact litter mats were dominant under the tall trees and shrubs (>3 m) but there were minor signs of physical disturbance noted at all assessment sites such as high levels of vehicle tracks and soil disturbance in the area. Weeds species noted in the <i>Casuarina pauper</i> vegetation association included Ward's Weed, Mustard Weed, and Common Ice Plant accounting for less than 5 % of the vegetation cover.				
<b>Threatened species or community</b>	<p><u>Threatened Ecological Communities</u> The Provisional List of Threatened Ecosystems of South Australia lists <i>Acacia aneura</i> Low Woodland on sand plains as being found within the Maralinga IBRA subregion. However, this vegetation association does not fit within that description (DEH in progress).</p> <p><u>Threatened Fauna</u> A 50 km radius search identified 13 species protected under federal or state legislation as occurring within the area since 1995. Two species were listed as Vulnerable under the <i>EPBC Act</i>, the Malleefowl and the Southern Whiteface.</p> <p>A further 11 species are listed under the <i>NPW Act</i> two of which are classed as Vulnerable (Little Eagle, Australian Bustard), and eight are classed as Rare (Australasian Darter, Chestnut-backed Quailthrush, White-browed Treecreeper, Black Falcon, Shy Heathwren, Major Mitchell's Cockatoo, Scarlet-chested Parrot, Gilbert's Whistler, Western Black-naped Snake).</p> <p>While Malleefowl are known to occur within the property, the majority of habitat within the clearance footprint does not fall within their preferences, and no signs of activity were observed.</p> <p><u>Threatened Flora</u> Eleven flora species were identified in a 50 km search of records since 1995. One EBPC listed species was recorded, the Ooldea Guinea-flower (<i>Hibbertia crispula</i>). A further 10 species listed under the <i>NPW Act</i> were recorded, one <i>Teucrium grandiusculum</i> ssp. <i>pilosum</i> is listed as Endangered, four are classed as Vulnerable (<i>Santalum spicatum</i>, <i>Austrostipa nullanulla</i>, <i>Sarcozona bicarinata</i> and <i>Sclerolaena symoniana</i>) and five are Rare (<i>Austrostipa tenuifolia</i>, <i>Austrostipa plumigera</i>, <i>Eremophila hillii</i>, <i>Eucalyptus canescens</i> ssp. <i>beadellii</i>, and <i>Gilesia biniflora</i>). None of these species were identified within the clearance footprint for this project by Succession Ecology in October 2022.</p>				
<b>Landscape context score</b>	1.13	<b>Vegetation Condition Score</b>	65.49	<b>Conservation significance score</b>	1.30
<b>Unit biodiversity Score</b>	96.20	<b>Area (ha)</b>	12.62	<b>Total biodiversity Score</b>	1214.23

<b>Vegetation Association</b>	<b>VA6:</b> Mixed Mallee/ <i>Casuarina</i> Woodland with a midstorey of <i>Acacia</i> , <i>Senna</i> and <i>Eremophila</i> over chenopods and grasses
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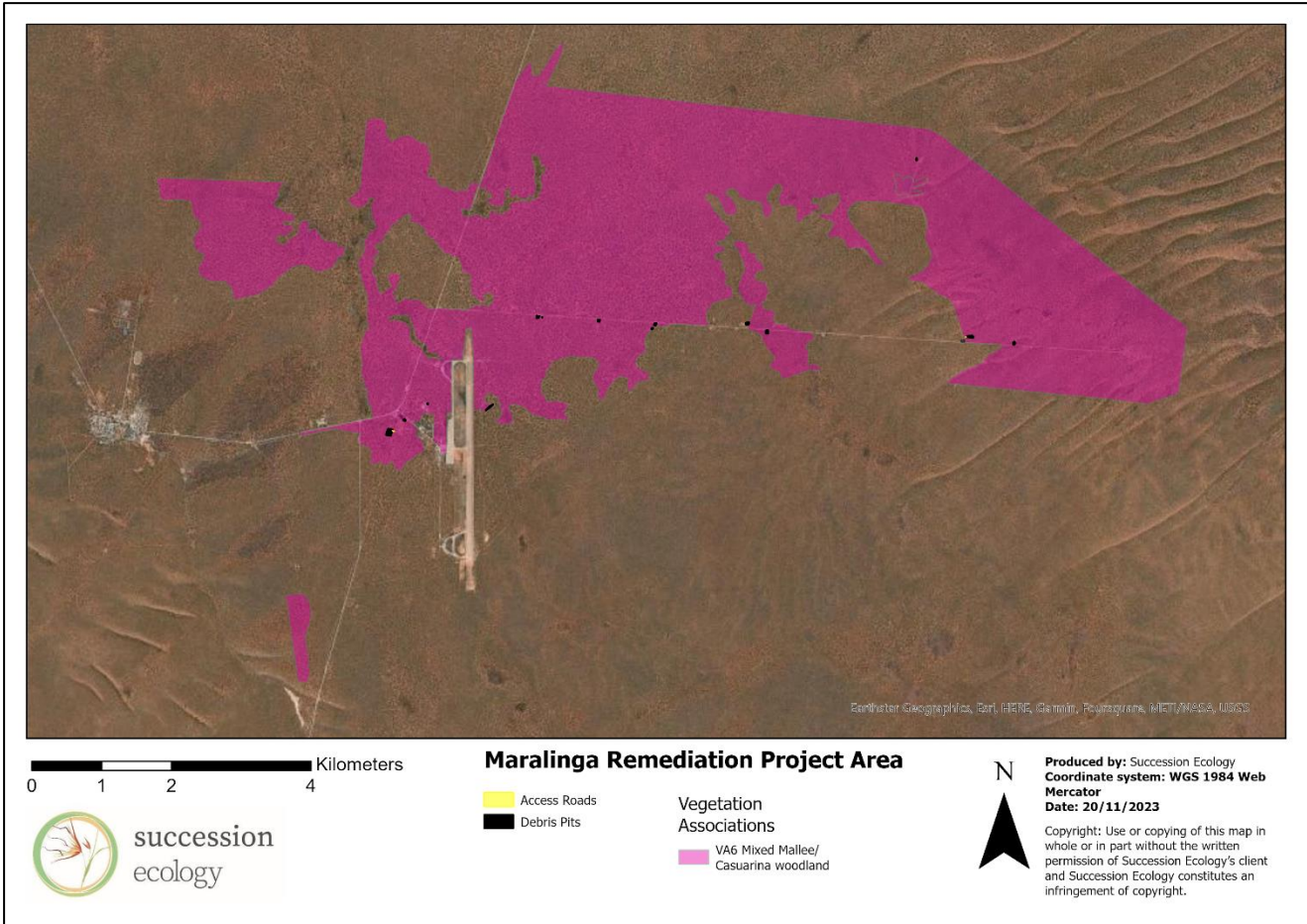


Figure 16: Extent of VA6 Mixed Mallee/*Casuarina* Woodland within the project area.



Figure 17: Example of the vegetation found within the Mixed Mallee/*Casuarina* Woodland (Succession Ecology September 2022).

<b>General description</b>	The mixed Mallee/ <i>Casuarina pauper</i> woodland vegetation association was identified at three assessment sites. The vegetation appeared to be an ecotone between the two other associations and was therefore highly diverse with a total of 56 species recorded. The canopy was dominated by <i>C. pauper</i> and four <i>Eucalyptus</i> species including <i>E. concinna</i> , <i>E. eremicola</i> , <i>E. oleosa</i> and <i>E. vokesensis</i> . The mid- and understorey was represented by species of the genera <i>Acacia</i> , <i>Senna</i> and <i>Eremophila</i> over <i>Maireana</i> , <i>Sclerolaena</i> , <i>Rhagodia</i> and tussock grasses such as <i>Austrostipa</i> and <i>Enneapogon</i> .
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<b>Vegetation Association</b>	<b>VA6:</b> Mixed Mallee/ <i>Casuarina</i> Woodland with a midstory of <i>Acacia</i> , <i>Senna</i> and <i>Eremophila</i> over chenopods and grasses				
	The mixed Mallee/ <i>Casuarina</i> woodland association was in very good condition with all strata present, intact litter mats and palatable species dominant under the canopies. Minor signs of physical disturbance such as animal or vehicle tracks were present. Weeds recorded include Ward's Weed and Common Ice Plant accounting for less than 5 % of the vegetation cover at each site.				
<b>Threatened species or community</b>	<p><u>Threatened Ecological Communities</u> The Provisional List of Threatened Ecosystems of South Australia lists <i>Acacia aneura</i> Low Woodland on sand plains as being found within the Maralinga IBRA subregion. However, this vegetation association does not fit within that description (DEH in progress).</p> <p><u>Threatened Fauna</u> A 50 km radius search identified 13 species protected under federal or state legislation as occurring within the area since 1995. Two species were listed as Vulnerable under the <i>EPBC Act</i>, the Malleefowl and the Southern Whiteface.</p> <p>A further 11 species are listed under the <i>NPW Act</i> two of which are classed as Vulnerable (Little Eagle, Australian Bustard), and eight are classed as Rare (Australasian Darter, Chestnut-backed Quailthrush, White-browed Treecreeper, Black Falcon, Shy Heathwren, Major Mitchell's Cockatoo, Scarlet-chested Parrot, Gilbert's Whistler, Western Black-naped Snake).</p> <p>While Malleefowl are known to occur within the property, the majority of habitat within the clearance footprint does not fall within their preferences, and no signs of activity were observed.</p> <p><u>Threatened Flora</u> Eleven flora species were identified in a 50 km search of records since 1995. One EBPC listed species was recorded, the Ooldea Guinea-flower (<i>Hibbertia crispula</i>).</p> <p>A further 10 species listed under the <i>NPW Act</i> were recorded, one <i>Teucrium grandiusculum</i> ssp. <i>pilosum</i> is listed as Endangered, four are classed as Vulnerable (<i>Santalum spicatum</i>, <i>Austrostipa nullanulla</i>, <i>Sarcozona bicarinata</i> and <i>Sclerolaena symoniana</i>) and five are Rare (<i>Austrostipa tenuifolia</i>, <i>Austrostipa plumigera</i>, <i>Eremophila hillii</i>, <i>Eucalyptus canescens</i> ssp. <i>beadellii</i>, and <i>Gilesia biniflora</i>). None of these species were identified within the clearance footprint for this project by Succession Ecology in October 2022.</p>				
<b>Landscape context score</b>	1.13	<b>Vegetation Condition Score</b>	64.01	<b>Conservation significance score</b>	1.30
<b>Unit biodiversity Score</b>	94.04	<b>Area (ha)</b>	0.77	<b>Total biodiversity Score</b>	72.69

Vegetation Association

VA7: Chenopod shrublands (South) with emergent *Eremophila longifolia*, *Pittosporum angustifolium* and *Acacia* species, over a mix of chenopod and grass species.



0 3 6 Kilometers

### Maralinga Remediation Project Area



succession ecology

Red square: Debris Pits  
Yellow line: Access Roads

Vegetation Associations

Blue square: VA7 Chenopod shrubland (south)



Produced by: Succession Ecology  
Coordinate system: WGS 1984 Web Mercator  
Date: 20/11/2023

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Figure 18: Extent of VA7 Chenopod Shrubland including debris sites.

<b>Vegetation Association</b>	<b>VA7: Chenopod shrublands (South) with emergent <i>Eremophila longifolia</i>, <i>Pittosporum angustifolium</i> and <i>Acacia</i> species, over a mix of chenopod and grass species.</b>
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Figure 19: Examples of the vegetation types in VA7 (Succession Ecology September 2022).

<b>General description</b>	<p>The Chenopod shrubland vegetation association was assessed at debris sites near Watson, the old railway siding, which is 40 km south of Maralinga Village. Five vegetation assessments recorded a total of 39 species. Shrubs and low shrubs were the only vegetation strata present, which is expected for this association. The midstorey was dominated by <i>Eremophila longifolia</i>, <i>Pittosporum angustifolium</i>, <i>Acacia tetragonophylla</i> and <i>A. oswaldii</i>. The understorey was a mix of chenopod species from the genera <i>Maireana</i>, <i>Rhagodia</i>, <i>Atriplex</i> and <i>Sclerolaena</i> with small tussock grasses such as <i>Aristida</i>, <i>Austrostipa</i> and <i>Enneapogon</i> species.</p> <p>The landscape at these sites was very flat and dry and possibly still recovering from years of drought (pers comm. Roger Peterson). The vegetation was low and appeared sparse with minor (&lt;50 %) signs of physical disturbance and moderate invasion of weeds. Ward's Weed, Galenia, Ruby Dock and Sow thistle (<i>Sonchus</i> sp.) accounted for 5 to 50 % of the vegetation cover across the assessment sites.</p>
<b>Threatened species or community</b>	<p><u>Threatened Ecological Communities</u></p> <p>The Provisional List of Threatened Ecosystems of South Australia lists <i>Acacia aneura</i> Low Woodland on sand plains as being found within the Maralinga IBRA subregion. However, this vegetation association does not fit within that description (DEH in progress).</p> <p><u>Threatened Fauna</u></p> <p>A 50 km radius search identified 13 species protected under federal or state legislation as occurring within the area since 1995. Two species were listed as Vulnerable under the EPBC Act, the Malleefowl and the Southern Whiteface.</p> <p>A further 11 species are listed under the NPW Act two of which are classed as Vulnerable (Little Eagle, Australian Bustard), and eight are classed as Rare (Australasian Darter, Chestnut-backed Quailthrush, White-browed Treecreeper, Black Falcon, Shy Heathwren, Major Mitchell's Cockatoo, Scarlet-chested Parrot, Gilbert's Whistler, Western Black-naped Snake).</p> <p>While Malleefowl are known to occur within the property, the majority of habitat within the clearance footprint does not fall within their preferences, and no signs of activity were observed.</p> <p><u>Threatened Flora</u></p> <p>Eleven flora species were identified in a 50 km search of records since 1995. One EBPC listed species was recorded, the Ooldea Guinea-flower (<i>Hibbertia crispula</i>).</p>

<b>Vegetation Association</b>	<b>VA7: Chenopod shrublands (South) with emergent <i>Eremophila longifolia</i>, <i>Pittosporum angustifolium</i> and <i>Acacia</i> species, over a mix of chenopod and grass species.</b>				
	A further 10 species listed under the <i>NPW Act</i> were recorded, one <i>Teucrium grandiusculum</i> ssp. <i>pilosum</i> is listed as Endangered, four are classed as Vulnerable ( <i>Santalum spicatum</i> , <i>Austrostipa nullanulla</i> , <i>Sarcozona bicarinata</i> and <i>Sclerolaena symoniana</i> ) and five are Rare ( <i>Austrostipa tenuifolia</i> , <i>Austrostipa plumigera</i> , <i>Eremophila hillii</i> , <i>Eucalyptus canescens</i> ssp. <i>beadellii</i> , and <i>Gilesia biniflora</i> ). None of these species were identified within the clearance footprint for this project by Succession Ecology in October 2022.				
<b>Landscape context score</b>	1.13	<b>Vegetation Condition Score</b>	52.70	<b>Conservation significance score</b>	1.30
<b>Unit biodiversity Score</b>	77.42	<b>Area (ha)</b>	3.66	<b>Total biodiversity Score</b>	283.31



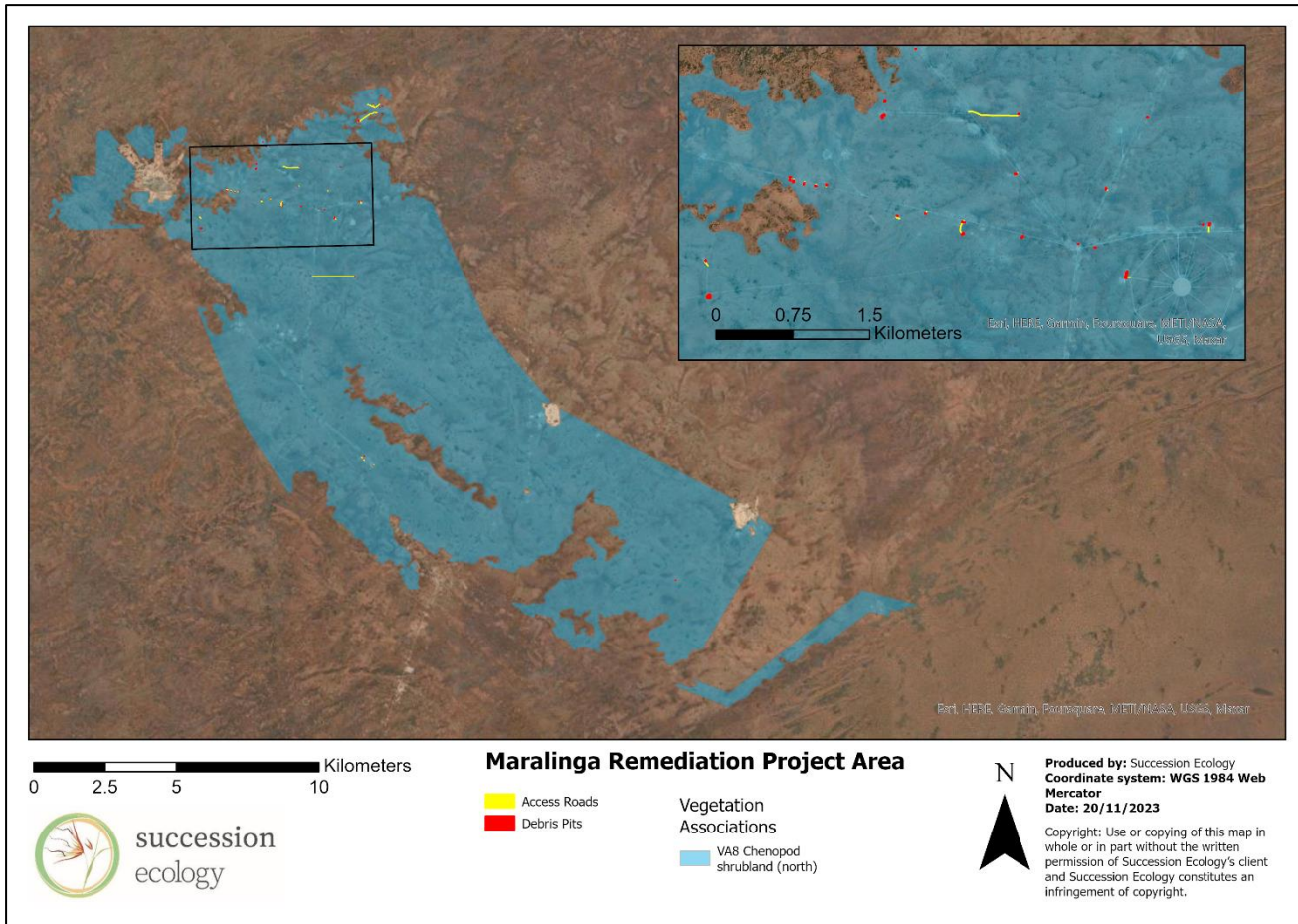


Figure 20: Extent of VA8 Chenopod Shrubland including debris sites. The distribution of debris pits and access roads are highlighted in the inset map.



Figure 21: Examples of the vegetation types in VA8 (Succession Ecology September 2022).

**General description**

The northern chenopod shrublands with emergent *Acacia* species were all located in the forward area north of Maralinga Village. The northern chenopod shrubland vegetation association was more diverse than the southern chenopod shrubland with 47 species recorded across six sites. Strata represented were shrubs and low shrubs (mid- and understorey). The midstorey of larger shrubs included *Acacia aneura*, *A. nyssophylla* and *A. minyura*, along with two *Senna artemisioides* ssp. and *Senna cardiosperma* ssp. *gawlerensis*. Dominant low-growing

<b>Vegetation Association</b>	<b>VA8: Chenopod shrubland with emergent Acacia and Senna spp.</b>				
	<p>shrubs were <i>Maireana georgei</i>, <i>Rhagodia parabolica</i>, <i>Chenopodium desertorum</i>, <i>Atriplex vesicaria</i> and <i>Enchylaena tomentosa</i>.</p> <p>The vegetation was generally in good condition, there was minor to dominant physical disturbance factors such as animal or vehicle tracks recorded across the sites. Weed species accounted for less than 5 % of vegetation cover in this association with only Ward's Weed present.</p>				
<b>Threatened species or community</b>	<p><u>Threatened Ecological Communities</u> The Provisional List of Threatened Ecosystems of South Australia lists <i>Acacia aneura</i> Low Woodland on sand plains as being found within the Maralinga IBRA subregion. However, this vegetation association does not fit within that description (DEH in progress).</p> <p><u>Threatened Fauna</u> A 50 km radius search identified 13 species protected under federal or state legislation as occurring within the area since 1995. Two species were listed as Vulnerable under the <i>EPBC Act</i>, the Malleefowl and the Southern Whiteface.</p> <p>A further 11 species are listed under the <i>NPW Act</i> two of which are classed as Vulnerable (Little Eagle, Australian Bustard), and eight are classed as Rare (Australasian Darter, Chestnut-backed Quailthrush, White-browed Treecreeper, Black Falcon, Shy Heathwren, Major Mitchell's Cockatoo, Scarlet-chested Parrot, Gilbert's Whistler, Western Black-naped Snake).</p> <p>The Southern Whiteface was observed in this vegetation association during Succession Ecology's fauna survey in April 2023.</p> <p>While Malleefowl are known to occur within the property, the majority of habitat within the clearance footprint does not fall within their preferences, and no signs of activity were observed.</p> <p><u>Threatened Flora</u> Eleven flora species were identified in a 50 km search of records since 1995. One EBPC listed species was recorded, the Ooldea Guinea-flower (<i>Hibbertia crispula</i>).</p> <p>A further 10 species listed under the <i>NPW Act</i> were recorded, one <i>Teucrium grandiusculum</i> ssp. <i>pilosum</i> is listed as Endangered, four are classed as Vulnerable (<i>Santalum spicatum</i>, <i>Austrostipa nullanulla</i>, <i>Sarcozona bicarinata</i> and <i>Sclerolaena symoniana</i>) and five are Rare (<i>Austrostipa tenuifolia</i>, <i>Austrostipa plumigera</i>, <i>Eremophila hillii</i>, <i>Eucalyptus canescens</i> ssp. <i>beadellii</i>, and <i>Gilesia biniflora</i>). None of these species were identified within the clearance footprint for this project by Succession Ecology in October 2022.</p>				
<b>Landscape context score</b>	1.13	<b>Vegetation Condition Score</b>	54.74	<b>Conservation significance score</b>	1.30
<b>Unit biodiversity Score</b>	80.41	<b>Area (ha)</b>	3.15	<b>Total biodiversity Score</b>	253.59

## 4.2 Threatened species assessment

### 4.2.1 Threatened ecological communities.

None of the vegetation associations containing debris pits fit under the ecological communities listed as nationally threatened under the *EPBC Act* or within the description of the Provisional List of Threatened Ecosystems of SA under the *NPW Act* (DEH in progress). *Acacia aneura* Low Woodlands on sand dunes are listed as Vulnerable because they are threatened by extensive fires, followed by decreased regeneration due to grazing by introduced herbivores such as rabbits.

### 4.2.2 Threatened fauna

The 50 km radius searches for the ten vegetation associations were conducted at three locations: Watson, Maralinga Village, and the forward area. The Protected Matters search for species listed under the *EPBC Act* found that Malleefowl (*Leipoa ocellata*), or habitat suitable for Malleefowl, was known to occur in the search area. A further search of the Atlas of Living Australia (ALA) found 34 occurrences of Malleefowl records from 2000 to 2022 within the 50 km radius search area.

Table 5: A summary of the fauna species observed on site or recorded within 50km of the application area since 1995.

Species (common name)	NPW Act	EPBC Act	Data source	Date of last record	Species known habitat preferences	Likelihood of use for habitat – Comments
<b>AVES</b>						
<i>Anhinga novaehollandiae</i> (Australasian Darter)	R		2,3	2010	Most often seen inland, around permanent and temporary water bodies at least half a metre deep, but may be seen in calm seas near shore, fishing (iNaturalist 2022).	Possible, previously recorded at Maralinga township dam. No other permanent or semi-permanent water sources within survey area.
<i>Aphelocephala leucopsis</i> (Southern Whiteface)		VU	2,3,6	2010	Prefers Acacia woodlands, particularly those dominated by mulga and drought-resistant chenopod shrub species, including saltbush and bluebush (AoLA, 2023).	Highly likely, suitable habitat present. Observed within project boundary in April 2023.
<i>Ardeotis australis</i> (Australian Bustard)	V		2,3	2011	Dry plains, grasslands and in open woodland, favouring tussock and hummock grasslands (DEWNR 2019).	Highly likely, suitable habitat present. Observed within project boundary in April 2023.
<i>Cinlosoma castanotum</i> (Chestnut-backed Quailthrush)	R		2,3	2010	Semi-arid mallee woodlands with shrubby understorey (DEH 2022a).	Likely, habitat is present within project boundary.

Species (common name)	NPW Act	EPBC Act	Data source	Date of last record	Species known habitat preferences	Likelihood of use for habitat – Comments
<i>Climacteris affinis</i> (White-browed Treecreeper)	R		2,3	2010	Usually inhabit shrublands and woodlands in arid and semi-arid regions. Mostly occur in tall shrubland and low woodland dominated by acacias (DSE 2003).	Likely, habitat is present within project boundary. Observed within project boundary in April 2023.
<i>Falco subniger</i> (Black Falcon)	R		2,3	2004	Nomadic, preferring sparse woodlands, scrubby grasslands and farmlands (Birds SA 2021).	Likely, habitat is present within project boundary.
<i>Hieraetus morphnoides</i> (Little Eagle)	V		2,3	2010	Seen over woodland, forested land and open country. Avoids heavy forest (Birdlife Australia 2021).	Likely, habitat is present within project boundary.
<i>Hylacola cauta cauta</i> (Shy Heathwren)	R		2,3,	2007	Mallee woodlands with dense understorey and heath and shrubs (DEW, 2022).	Likely, habitat is present within project boundary.
<i>Lophochroa leadbeateri mollis</i> (Major Mitchell's Cockatoo)	R		2,3,4,	2010	Wide range of inland habitats near water, feeds on melons and seeds of saltbush, wattles, and cypress pines. Requires hollows for nesting (DCCEEW 2023).	Highly likely, However, limited hollows present. Observed within project boundary in January 2023.
<i>Neophema splendida</i> (Scarlet-chested Parrot)	R		2,3,	2010	Arid, usually waterless habitats preferring Mallee and Mulga habitats (Birdlife Australia, 2019).	Likely, habitat is present within project boundary.
<i>Pachycephala inornata</i> (Gilbert's Whistler)	R		2,3,	2010	Occurs in a range of habitats, all with a dense shrub layer. These include woodlands and mallee shrublands. Also found in association with understorey species of <i>Triodia</i> , <i>Acacia</i> , <i>Hakea</i> , <i>Senna</i> and <i>Dodonaea</i> (DEW, 2022).	Likely, habitat is present within project boundary. Heard within project boundary in April 2023.
<i>Leipoa ocellata</i> (Malleefowl)	V	VU	2,3,5,6	2011	Semi-arid to arid shrublands and woodlands but are found mainly in mallee woodland habitat that has not recently been burnt. (DEW, 2022).	Highly likely, known to be present in locations within the project area within the last 5 years. and close to where remediation works will occur.

Species (common name)	NPW Act	EPBC Act	Data source	Date of last record	Species known habitat preferences	Likelihood of use for habitat – Comments
<b>REPTILIA</b>						
<i>Neelaps bimaculatus</i> (Western Black-naped Snake)	R		2, 3	2004	Mallee woodlands with spinifex understorey on sandy soils (Schembri, 2017).	Possible, habitat is present within the project area.
Source: 1- BDBSA, 2 - AoLA, 3 – NatureMaps, 4 – Observed/recorded in the field, 5 - Protected matters search tool, 6 – others. NPW Act; E= Endangered, V = Vulnerable, R= Rare EPBC Act; Ex = Extinct, CR = Critically endangered, EN = Endangered; VU = Vulnerable						

### 4.2.3 Threatened flora

The threatened flora search found records for twelve species within the 50 km search area that are listed under the *NPW Act* and one species listed under the *EPBC Act*. None of these species were observed during the assessments or more specifically within the clearance footprint.

Table 6: A summary of the flora species observed on site or recorded within 50 km of the application area since 1995.

Species (common name)	STATE RATING	NATIONAL RATING	Data source	Year of last record	Species known habitat preferences	Likelihood of use for habitat – Comments
<i>Austrostipa nullanulla</i> (NC) (Club Spear-grass)	V		3	2005	Occupies gypseous soils on the outskirts of salt lakes across the north of the state. In all cases, gypsum is a major constituent of the soils in the habitat (DEH 2022b).	Unlikely – habitat not present.
<i>Austrostipa plumigera</i> (NA)	R		3	2009	Grows primarily in the desert or dry shrubland biome (Royal Botanic Gardens, 2022).	Likely – records within the last 20 years and non-specific habitat niche.
<i>Austrostipa tenuifolia</i> (Long-awn Spear-grass)	R		3, 2	2004	Found in sandy soils in grassland or grassy woodland associated with Callitris or Allocasuarina (Seeds of SA, 2022).	Likely – records within the last 20 years and habitat present.
<i>Eremophila hillii</i> (Hill's Emubush, Hills Emubush)	R		3, 2	2009	Stony clay (Department of Biodiversity, Conservation and Attractions 1997).	Possible – records within the last 20 years and habitat present. However, this species is inconspicuous, and a thorough survey did not identify it.
<i>Eucalyptus canescens</i> ssp. <i>beadellii</i> (Beadell's Mallee)	R		3	2004	Mallee species occurring in the Great Victoria Desert in South Australia extending into Western Australia near Forrest Lakes. It is seen	Possible – habitat present but outside of known distribution.

Species (common name)	STATE RATING	NATIONAL RATING	Data source	Year of last record	Species known habitat preferences	Likelihood of use for habitat – Comments
					readily in the red sand dune country along the Cook – Vokes Hill Track (Centre for Australian National Biodiversity Research 2020).	
<i>Hibbertia crispula</i> (Ooldea Guinea-flower)	V	VU	5, 2	1997	Ooldea guinea flower is only known from near Ooldea and near Yellabinna Regional Reserve in South Australia and from the Great Victoria Desert in Western Australia (ALA, 2022).	Possible – records within the last 20 years. no specific habitat type is recorded.
<i>Gilesia biniflora</i> (Western Tar-vine)	R		3, 2	2007	Records on Atlas of Living Australia indicate that this species exists in a range of habitats including <i>Acacia</i> open woodlands, <i>Eucalyptus</i> woodlands and chenopod shrublands. (ALA 2023).	Likely – records within the last 20 years and non-specific habitat niche.
<i>Gratwickia monochaeta</i> (NA)	R		3	2005	On various sites but usually in sand (State Herbarium of South Australia 2007a).	Likely – records within the last 20 years and habitat present.
<i>Santalum spicatum</i> (Sandalwood)	V		3, 2	2010	Various arid habitats, across the central region of SA (Seeds of SA, 2021).	Possible – records within the last 20 years and habitat present. However, this species is inconspicuous, and a thorough survey did not identify it.
<i>Sarcozona bicarinata</i> (Ridged Noon-flower)	V		3, 2	2005	Little recorded. Occurs on Yorke and Eyre Peninsulas (Flora of Australia, 2021).	Possible – records within the last 20 years and habitat present. However, this species is inconspicuous, and a thorough survey did not identify it.
<i>Sclerolaena symoniana</i> (Symon's Bindyi)	V		3	2005	Found on sandy margins of salt lakes (State Herbarium of South Australia 2007b).	Unlikely – habitat not present.
<i>Teucrium grandiusculum</i> ssp. <i>pilosum</i> (NA)	E		3	2010	Recorded from surface limestone (State Herbarium of South Australia 2007c).	Unlikely – habitat not present.
Sources 1 - BDBSA, 2 - AoLA, 3 - NatureMaps, 4 - Observed/recorded in the field, 5 - Protected matters search tool, 6 - Other NP&W Act: E - Endangered, V - Vulnerable, R - Rare EPBC Act: Ex - Extinct, CR - Critically endangered, EN - Endangered, VU - Vulnerable						

## 4.3 Presence of Substantially Intact Vegetation

*If the vegetation is considered to represent a substantially intact stratum, the NVC cannot approve clearance, unless for the purpose of harvesting native vegetation (section 27(3)).*

### **4.3.1 Provide information on whether the native vegetation constitutes a continuous intact stratum.**

Vegetation in Section 400 (Maralinga) is generally in very good condition due to lack of grazing and the absence of human access and activity over the last 70 years since the nuclear testing. However, vegetation that was cleared during the development of Maralinga Village and test sites for buildings and roads has recovered at varying rates depending on the level of impacts. While some recovery work was completed 20 years ago, there are still remnants of infrastructure and debris in place.

Vegetation condition within the remediation project sites (debris sites) varies significantly from very good condition (but with surface debris present) to heavily disturbed. For example, animal and vehicle tracks were dominant (>50 %) at most assessment sites in VA1 and VA2. Overall, the vegetation in the broader area surrounding the debris sites is in good condition with natural regeneration evident. However, it could not be considered intact strata due to the tracks and debris present.

### **4.3.2 Provide information on whether the native vegetation has been subject to degradation within the past 20 years.**

No new infrastructure has been built or recent degradation activities have occurred within the last 20 years. Site works from 1995-2000 focused on the remediation of radiologically contaminated materials (predominantly soil) and may have included vegetation clearance to uncover, excavate, move, and bury radiologically contaminated materials. Some of the debris pits were subject to works of the 1995-2000 Maralinga Rehabilitation Project. Due to the restricted access of the area, human disturbance to vegetation is generally low.

## 4.4 Address the Mitigation Hierarchy

*The Native Vegetation Council will consider if the applicant has avoided and minimized the clearance of native vegetation as much as practically possible.*

**a) Avoidance – outline measures taken to avoid clearance of native vegetation.**

Clearance will be avoided where possible by removing debris from pits by emu picking where large machinery is not required and wherever possible to avoid possible damage by vehicles or clearance for vehicular access. Remediation sites (debris pits) will be accessed via existing road and track network wherever possible. The Works contractor will be required to and responsible for minimising clearance. Works are expected to result in lesser clearance than what is being requested in this data report.

**b) Minimisation – if clearance cannot be avoided, outline measures taken to minimize the extent, duration and intensity of impacts of the clearance on biodiversity to the fullest possible extent (whether the impact is direct, indirect or cumulative).**

In the course of remediating 138 sites the native vegetation clearance will be minimised to a total area of 9.78 ha at 88 of those sites (this represents a maximum area of clearance). Clearance will be restricted to no further than 5 m outside of the already degraded areas directly around the debris pits. Light, narrow wheel-base vehicles will be used on existing tracks wherever possible during the remediation works. Where remediation sites (debris pits) cannot be accessed by existing roads/tracks, a preferential use of existing cleared areas or areas with the least vegetation cover will be chosen as access routes. In areas where Emu picking will occur, the creation of pathways through vegetation will be limited and where possible vehicles will not leave existing tracks. Waste repositories and their associated access roads will be established in areas where clearance had already occurred.

**c) Rehabilitation or restoration – outline measures taken to rehabilitate ecosystems that have been degraded, and to restore ecosystems that have been degraded, or destroyed by the impact of clearance that cannot be avoided or further minimized, such as allowing for the re-establishment of the vegetation.**

Following the debris removal works, the revegetation of any cleared areas is to be implemented. This includes at least 82 of the remediated debris pits, the waste repository, the sorting area, the groundwater wells, and the widened access tracks. In total, a maximum of 25.67 ha of native vegetation is expected to be cleared to facilitate remediation works. A total area of 25.42 ha will be revegetated post-remediation using hand-seeding. The main revegetation objectives are to a) stabilise the soil on debris pits and b) establish vegetative cover on the debris pits to establish a biodiverse and resilient habitat. A Revegetation Management Plan has already been developed (final version, 15/12/2023), which includes pre-seeding site preparation methods, the timing and rate of hand-seeding implemented, the types of native species included in the seeding mix, and the post-seeding monitoring requirements. As much as practical, local province seeds will be sourced for the rehabilitation seeding.

**d) Offset – any adverse impact on native vegetation that cannot be avoided or further minimized should be offset by the achievement of a significant environmental benefit that outweighs that impact.**

DISR will contribute an SEB payment into the Native Vegetation Fund to support restoration and conservation works in the region.

*The NVC will only consider an offset once avoidance, minimization and restoration have been documented and fulfilled. The [SEB Policy](#) explains the biodiversity offsetting principles that must be met.*



## 4.5 Principles of clearance (*Schedule 1, Native Vegetation Act 1991*)

If the clearance is seriously at variance with one or more of the principles, the NVC cannot approve clearance, however, the Act provides the NVC with a degree of discretion in certain situations.

Principle of clearance	Considerations
<p><b>Principle 1a - it comprises a high level of diversity of plant species</b></p>	<p><u>Relevant information</u> Vegetation Condition Scores for each VA, followed by the exact number of native and introduced species observed: VA1: 60.52, 72 native, 6 introduced plant species VA2: 47.90, 76 native, 6 introduced plant species VA3: 53.47, 50 native, 3 introduced plant species VA4: 63.83, 87 native, 3 introduced plant species VA5: 65.49, 62 native, 3 introduced plant species VA6: 64.01, 56 native, 2 introduced plant species VA7: 52.70, 39 native, 4 introduced plant species VA8: 54.74, 70 native, 2 introduced plant species</p> <p><u>Assessment against the principles</u> Seriously at Variance - all vegetation associations</p> <p><u>Moderating factors that may be considered by the NVC</u> The proposed area of clearance compared to the area covered by each vegetation association is small. The maximum clearance in most VAs does not exceed 4 ha, except for VA5 (<i>Casuarina</i> woodland) where a maximum clearance of 12.62 ha is expected.</p> <p>It is worth noting that 9.8 ha of clearance to occur at debris pits, plus the 5.7 ha of clearance for the waste repository and sorting areas, and the 2.3 ha for the worker's camp are situated within highly degraded and modified sections of vegetation. The clearance at these sites will in most cases be impacting poor-quality vegetation (see Figure 3).</p>
<p><b>Principle 1b - significance as a habitat for wildlife</b></p>	<p><u>Relevant information</u> Threatened species observed at the site during several surveys conducted by Succession Ecology:</p> <ul style="list-style-type: none"> <li>• <i>Aphelocephala leucopsis</i> (Southern Whiteface)</li> <li>• <i>Ardeotis australis</i> (Australian Bustard)</li> <li>• <i>Climacteris affinis</i> (White-browed Treecreeper)</li> <li>• <i>Lophochroa leadbeateri mollis</i> (Major Mitchell's Cockatoo)</li> <li>• <i>Pachycephala inornata</i> (Gilbert's Whistler)</li> </ul> <p>Threatened species identified in the area since 1995 that are likely to use the area:</p> <ul style="list-style-type: none"> <li>• <i>Cinclosoma castanotum</i> (Chestnut-backed Quailthrush)</li> <li>• <i>Falco subniger</i> (Black Falcon)</li> <li>• <i>Hieraaetus morphnoides</i> (Little Eagle)</li> <li>• <i>Hylacola cauta cauta</i> (Shy Heathwren)</li> <li>• <i>Neophema splendida</i> (Scarlet-chested Parrot)</li> <li>• <i>Leipoa ocellata</i> (Malleefowl)</li> <li>• <i>Neelaps bimaculatus</i> (Western Black-naped Snake)</li> </ul>

Principle of clearance	Considerations
	<p>Threatened Fauna scores:            VA1: 0.1            VA2: 0.1            VA3: 0.1            VA4: 0.1            VA5: 0.1            VA6: 0.1            VA7: 0.1            VA8: 0.1</p> <p>Unit biodiversity scores:            VA1: 88.90            VA2: 70.37            VA3: 78.55            VA4: 93.77            VA5: 96.20            VA6: 94.04            VA7: 77.42            VA8: 80.41</p> <p><u>Assessment against the principles</u>            Seriously at Variance - All vegetation associations</p> <p><u>Moderating factors that may be considered by the NVC</u></p> <p>No threatened species have been detected within the proposed areas of clearance. A number of threatened bird species were observed within the surrounding vegetation during Succession Ecology surveys (e.g., Southern Whiteface and White-browed Treecreeper). However, due to the small-scale clearance at individual impact sites and the highly mobile nature of these animals, they are unlikely to be impacted by the debris sites remediation activities. None of the areas of impact modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline. An EPBC Self-assessment was also conducted by Succession Ecology to determine the impacts on protected matters within the remediation area. Three fauna species were identified as likely to be impacted by the proposed activities: Southern Whiteface, Malleefowl, and the Sandhill Dunnart (<i>Sminthopsis psammophila</i>). Results from this assessment indicate that the current proposal for the Maralinga Site Maintenance Project will not require a Referral under <i>Significant Impact Guidelines 1.1</i> and <i>Significant Impact Guidelines 1.2</i> of the EPBC Act.</p>
<p><b>Principle 1c - plants of a rare, vulnerable or endangered species</b></p>	<p><u>Relevant information</u>            Threatened species identified in the area since 1995 that are possible or likely to use the area:</p> <ul style="list-style-type: none"> <li>• <i>Austrostipa plumigera</i></li> <li>• <i>Austrostipa tenuifolia</i> (Long-awn Spear-grass)</li> <li>• <i>Eremophila hillii</i> (Hill's Emubush)</li> <li>• <i>Eucalyptus canescens</i> ssp. <i>beadellii</i> (Beadell's Mallee)</li> <li>• <i>Hibbertia crispula</i> (Ooldea Guinea-flower)</li> <li>• <i>Santalum spicatum</i> (Sandalwood)</li> <li>• <i>Sarcozona bicarinata</i> (Ridged Noon-flower)</li> <li>• <i>Sclerolaena symoniana</i> (Symon's Bindyi)</li> <li>• <i>Teucrium grandiusculum</i> ssp. <i>pilosum</i></li> </ul>

Principle of clearance	Considerations
	<p>Threatened Flora Score(s)</p> <p>VA1: 0.2 VA2: 0.2 VA3: 0.2 VA4: 0.2 VA5: 0.2 VA6: 0.2 VA7: 0.2 VA8: 0.2</p> <p><u>Assessment against the principles</u> Seriously At Variance - all vegetation associations</p> <p><u>Moderating factors that may be considered by the NVC</u> None of the threatened plant species were detected during the on-ground surveys.</p>
<p><b>Principle 1d - the vegetation comprises the whole or part of a plant community that is Rare, Vulnerable or endangered:</b></p>	<p><u>Relevant information</u> No Threatened Ecological Communities under the <i>EPBC Act</i> were identified in on the site.</p> <p><u>Assessment against the principles</u> Not at variance.</p> <p><u>Moderating factors that may be considered by the NVC</u> NA</p>
<p><b>Principle 1e - it is significant as a remnant of vegetation in an area which has been extensively cleared.</b></p>	<p><u>Relevant information</u> Remnancy: IBRA Association Victoria Desert = 100 % IBRA Subregion Maralinga = 99 %</p> <p>Total Biodiversity Score VA1: 52.01 VA2: 89.18 VA3: 47.38 VA4: 281.41 VA5: 1214.23 VA6: 72.69 VA7: 283.31 VA8: 253.59</p> <p><u>Assessment against the principles</u> At variance – all vegetation associations.</p> <p><u>Moderating factors that may be considered by the NVC</u> This project is not selectively targeting a Vegetation Association or tree species and will not significantly alter the representation of the vegetation types within the region.</p> <p>The vegetation that is to be impacted as part of this project is already within areas that have seen disturbance within the last 70 years. in many cases it is in poorer condition to the vegetation in the surrounding landscape. The IBRA Subregion Maralinga has a remnancy of 99 %, much of which is not significantly degraded.</p>

<b>Principle of clearance</b>	<b>Considerations</b>
<b>Principle 1f - it is growing in, or in association with, a wetland environment.</b>	<u>Relevant information</u> No wetland areas are within the project area.
	<u>Assessment against the principles</u> Not at variance.
	<u>Moderating factors that may be considered by the NVC</u> NA
<b>Principle 1g - it contributes significantly to the amenity of the area in which it is growing or is situated.</b>	<u>Relevant information</u> The vegetation to be cleared does not contribute significantly to the amenity of the area in which it is growing. Maralinga has only recently become accessible to tourists for historical tours of the sites associated with the British Nuclear Test Program, but they currently do not have access to the locations where the clearance is proposed.
	<u>Assessment against the principles</u> N/A
	<u>Moderating factors that may be considered by the NVC</u> The aim of this project is to clear up the waste materials left at the site and assist in the revegetation of impacted sites, increasing the amenities and potential habitat within the area.

*[Principles of Clearance](#) (h-m) will be considered by comments provided by the local NRM Board or relevant Minister. The Data Report should contain information on these principles where relevant and where sufficient information or expertise is available.*

The impact of this clearance is not considered relevant to the Principles of Clearance h-m.

## 4.6 Risk assessment

**Determine the level of risk associated with the application**

<b>Total clearance</b>	No. of trees	NA
	Area (ha)	25.67
	Total biodiversity Score	2,293.8
<b>Seriously at variance with principle 1(b), 1(c) or 1 (d)</b>	1(b) and 1(c)	
<b>Risk assessment outcome</b>	Level 4	

## 4.7 NVC guidelines

**Provide any other information that demonstrates that the clearance complies with any relevant NVC guidelines related to the activity.**

NA

# 5. Clearance summary

## Clearance areas summary table

The following table summarises key aspects of each of the vegetation associations which will be impacted by the remediation works. Vegetation was assessed following the RAM methodology and consequently species diversity was not calculated for each VA. Instead, we have reported vegetation conditions scores within the table.

Block	Site	Vegetation Condition Score	Threatened Ecological community	Threatened plant score	Threatened fauna score	UBS	Area (ha)	Total Biodiversity score	Loss factor	Loadings	Reductions	SEB Points required	SEB payment	Admin Fee
1	VA1	60.52	1	0.2	0.1	88.90	0.59	52.01	1		0.5	27.31	\$1,059.63	\$58.28
1	VA2	47.90	1	0.2	0.1	70.37	1.27	89.18	1		0.5	46.82	\$1,816.85	\$99.93
2	VA3	53.47	1	0.2	0.1	78.55	0.60	47.38	1		0.5	24.87	\$1,633.49	\$89.84
1	VA4	63.83	1	0.2	0.1	93.77	3.00	281.41	1		0.5	147.74	\$6,019.66	\$331.08
1	VA5	65.49	1	0.2	0.1	96.20	12.62	1214.23	1		0.5	637.47	\$25,973.80	\$1,428.56
1	VA6	64.01	1	0.2	0.1	94.04	0.77	72.69	1		0.5	38.16	\$1,555.02	\$85.53
2	VA7	52.70	1	0.2	0.1	77.42	3.66	283.31	1		0.5	148.74	\$9,767.56	\$537.22
1	VA8	54.74	1	0.2	0.1	80.41	3.15	253.59	1		0.5	133.14	\$5,166.33	\$284.15
						<b>679.66</b>	<b>25.67</b>	<b>2,293.80</b>				<b>1,204.25</b>	<b>\$52,992.34</b>	<b>\$2,914.59</b>

## Total summary table

	Total Biodiversity score	Total SEB points required	SEB Payment	Admin Fee	Total Payment
<b>Application</b>	2,293.80	1,204.25	\$52,992.34	\$2,914.59	\$55,906.93

<b>Economies of Scale Factor</b>	VA7 and VA3 - 0.011 All other VAs - 0.065
<b>Rainfall (mm)</b>	VA4, VA5 and VA6 - 210 mm All other VAs - 200 mm

**NOTE:** The minimum payment for this clearance will be \$500.

# 6. Significant Environmental Benefit

A Significant Environmental Benefit (SEB) is required for approval to clear under Division 5 of the *Native Vegetation Regulations 2017*. The NVC must be satisfied that as a result of the loss of vegetation from the clearance that an SEB will result in a positive impact on the environment that is over and above the negative impact of the clearance.

## ACHIEVING AN SEB

Indicate how the SEB will be achieved by ticking the appropriate box and providing the associated information:

- Establish a new SEB Area on land owned by the proponent.
- Use SEB Credit that the proponent has established. Provide the SEB Credit Ref. No. \_\_\_\_\_
- Apply to have SEB Credit assigned from another person or body. The [application form](#) needs to be submitted with this Data Report.
- Apply to have an SEB to be delivered by a Third Party. The [application form](#) needs to be submitted with this Data Report.
- Pay into the Native Vegetation Fund.

## PAYMENT SEB

If a proponent proposes to achieve the SEB by paying into the Native Vegetation Fund, summary information must be provided on the amount required to be paid and the manner of payment:

The proponent chooses to pay the calculated SEB offset amount of \$55,906.93 into the Native Vegetation Fund.

# 7. References

- Bureau of Meteorology (2023) Climate data online  
[http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p\\_nccObsCode=139&p\\_display\\_type=dataFile&p\\_stn\\_num=018114](http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_stn_num=018114).
- Birdlife Australia. 2021. Species Profile: *Hieraetus morphnoides*, Little Eagle.
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- DCCEEW. 2023. Conservation Advice for *Lophochroa leadbeateri leadbeateri* (eastern Major Mitchell's cockatoo).
- DEH. 2022a. Threatened Species Profile: *Cinclosoma castanotum*, Chestnut-backed Quailthrush.
- DEH. 2022b. Species Profile: *Austrostipa nullanulla*, Club Spear-grass.
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<https://florabase.dpaw.wa.gov.au/browse/profile/7220>.
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- DSE. 2003. Species Profile: *Climacteris affinis*, White-browed Treecreeper.
- iNaturalist. 2022. Australasian Darter *Anhinga novaehollandiae*.
- State Herbarium of South Australia. 2007a. Electronic Flora of South Australia species Fact Sheet: *Helichrysum monochaetum*. [http://www.flora.sa.gov.au/cgi-bin/speciesfacts\\_display.cgi?genus=Helichrysum&species=monochaetum](http://www.flora.sa.gov.au/cgi-bin/speciesfacts_display.cgi?genus=Helichrysum&species=monochaetum).
- State Herbarium of South Australia. 2007b. Electronic Flora of South Australia species Fact Sheet: *Sclerolaena symoniana*. [http://www.flora.sa.gov.au/cgi-bin/speciesfacts\\_display.cgi?genus=Sclerolaena&species=symoniana](http://www.flora.sa.gov.au/cgi-bin/speciesfacts_display.cgi?genus=Sclerolaena&species=symoniana).
- State Herbarium of South Australia. 2007c. Electronic Flora of South Australia infraspecific Fact Sheet: *Teucrium grandiusculum* ssp. *pilosum*. [http://www.flora.sa.gov.au/cgi-bin/speciesfacts\\_display.cgi?genus=Teucrium&species=grandiusculum&iname=pilosum](http://www.flora.sa.gov.au/cgi-bin/speciesfacts_display.cgi?genus=Teucrium&species=grandiusculum&iname=pilosum).
- Seeds of SA. (2022). Species Profile: *Austrostipa tenuifolia*.
- Seeds of SA. (2018). Seeds of South Australia - *Hibbertia crispula* (Ooldea Guinea-flower).
- Seeds of SA. (2021). Species Profile: *Santalum spicatum*, Sandalwood
- Flora of Australia. (2021). Species Profile: *Sarcozona bicarinata*, Ridged Noon-flower



# 8. Appendices

## Appendix 1: Vegetation association assessment sites and associated debris sites.

Table 7: Summary of vegetation and debris site assessments conducted within each of the 10 vegetation associations present at Maralinga. The total number of debris sites listed in the table is greater than 138, as some debris pits extended into more than one vegetation association (i.e., was present on the edge of two associations). The size of DP90 is uncertain at this point in time (assessments are still underway and may be presented as a NVC variation at a later stage).

Vegetation Association	No. vegetation assessments	No. plant species	No. debris sites	Debris site IDs
VA1 <i>Acacia aneura</i> shrubland with <i>Senna artemisioides</i> ssp. <i>zygophylla</i> .	2	72 native, 6 introduced plant species	8	01U, DP28, DP29, DP54, DP59, SDS40, SDS41, SDS42
VA2 <i>Acacia aneura</i> low open shrublands, above <i>Senna</i> and <i>Eremophila</i> species over an understorey of <i>Maireana</i> , <i>Rhagodia</i> and tussock grasses	8	76 native, 6 introduced plant species	16	15U, 21U, 23U, 26U, 82Ua, 83U, DP24, DP60, DP64, DP65, OT05, OT10, SDS43, SDS47, SDS48, SDS49
VA3 Mixed <i>Acacia</i> shrubland, with <i>Maireana</i> , <i>Solanum</i> , <i>Sclerolaena</i> and <i>Dodonaea</i> midstorey and <i>Calandrinia</i>	1	50 native, 3 introduced plant species	2	DP66, DP67
VA4 Mallee woodland with midstorey of <i>Acacia</i> , <i>Senna</i> , <i>Eremophila</i> and <i>Dodonaea</i> and understorey of chenopods and grasses	12	87 native, 3 introduced plant species	30	13U, 32U, 33U, 34Ua, 34Ub, 35U, 43U, 44U, 45U, 51U, 60U, 61U, 62U, 64U, 65U, 66U, 86U, DP45, DP47, DP48, DP73, DP78, DP79, DP80, DP92, OT03, SDS25, SDS26, SDS27, SDS28
VA5 <i>Casuarina pauper</i> woodland with midstorey of <i>Acacia</i> , <i>Eremophila</i> , <i>Senna</i> , and <i>Maireana</i> , <i>Solanum</i> , <i>Austrostipa</i> and <i>Enneapogon</i> understorey	7	62 native, 3 introduced plant species	25 + Waste Repository, Waste Sorting Area, Worker's Camp	47U, 48U, 49U, 52U, 54U, 55Ua, 55U, 56U, 57U, 59U, 62U, 63U, 64U, 65U, 66U, 67U, 68U, 69U, DP46, DP61, DP77, DP80, OT08, SP01, SP04, Waste Repository, Waste Sorting Area, Worker's Camp
VA6 Mixed Mallee/ <i>Casuarina</i> Woodland with a midstorey of <i>Acacia</i> , <i>Senna</i> and <i>Eremophila</i> over chenopods and grasses	7	56 native, 2 introduced plant species	18	16U, 29Ua, 29Ub, 32U, 34Ua, 37U, 38U, 41U, 42U, DP43, DP44, DP83, SDS23, SDS24, SDS27, SDS29, SDS30, SDS33

<b>Vegetation Association</b>	<b>No. vegetation assessments</b>	<b>No. plant species</b>	<b>No. debris sites</b>	<b>Debris site IDs</b>
VA7 Chenopod shrublands (South) with emergent <i>Eremophila longifolia</i> , <i>Pittosporum angustifolium</i> and <i>Acacia</i> species, over a mix of chenopod and grass species	3	39 native, 4 introduced plant species	5	DP68, DP69, DP70, DP71, DP76
VA8 Chenopod shrubland (North) with emergent <i>Acacia</i> and <i>Senna</i> spp.	16	70 native, 2 introduced plant species	41	07U, 08Ua, 09U, 10U, 11U, 80U, 81U, DP02, DP25, DP26, DP27, DP31, DP32, DP34, DP35, DP36, DP37, DP38, DP39, DP41, DP42, DP74, DP81, DP82, DP84, DP86, DP87, DP89, DP90, DP91, DP93. DP94, SDS17, SDS18, SDS19, SDS21, SDS22, SDS39, SDS44, SP02, SP03, SP05
VA9 Revegetated/regenerating shrubland with <i>Acacia</i> and <i>Senna</i> midstorey, sometimes <i>C. pauper</i> overstorey and understorey of <i>Solanum</i> , mixed with chenopods and grasses	3	38 native plants	0	
VA10 <i>Eucalyptus</i> spp. and <i>Acacia</i> spp. complex mid-mallee woodland on sand dunes	0	<i>Vegetation surveys not undertaken</i>	0	

## Appendix 2: Vegetation association species list

Table 8: List of native species recorded during Succession Ecology's October 2022 vegetation assessments.

Species name	Common name	VA1	VA2	VA3	VA4	VA5	VA6	VA7	VA8	VA9
<i>Abutilon cryptopetalum</i>	Hill Lantern-bush	x	x						x	
<i>Abutilon halophilum</i>	Plains Lantern-bush			x						
<i>Abutilon otocarpum</i>	Desert Lantern				x					
<i>Abutilon oxycarpum</i>	Horn-fruit Lantern-bush									x
<i>Abutilon sp.</i>				x						
<i>Acacia aneura</i> (includes <i>brachystachya</i> , <i>clelandii</i> )	Mulga	x	x						x	x
<i>Acacia burkittii</i>	Pin-bush Wattle			x	x		x			
<i>Acacia calamifolia</i>	Wallowa									x
<i>Acacia colletioides</i>	Veined Wait-a-while	x	x		x	x	x			
<i>Acacia gilesiana</i>	Gile's Wattle	x	x	x						
<i>Acacia kempeana</i>	Witchetty Bush	x	x	x	x		x		x	x
<i>Acacia ligulata</i>	Dune Wattle				x	x	x			
<i>Acacia minyura</i>	Desert Mulga	x	x		x	x	x		x	x
<i>Acacia nyssophylla</i>	Spine Bush	x	x		x	x	x		x	
<i>Acacia oswaldii</i>	Oswald's Wattle				x	x	x	x		
<i>Acacia prainii</i>	Prain's Wattle				x					
<i>Acacia ramulosa</i>	Horse Mulga	x	x	x	x					x
<i>Acacia tetragonophylla</i>	Dead Finish	x	x	x	x			x	x	x
<i>Aizoon pubescens</i>	Galenia	x	x						x	
<i>Alectryon oleifolius</i> <i>ssp. canescens</i>	Bullock Bush	x	x	x	x	x	x			
<i>Alyogyne pinoniana</i>	Sand Hibiscus				x					
<i>Amphipogon caricinus</i>	Long Grey Beard-grass	x	x							
<i>Amyema preissii</i>	Wire-leaf Mistletoe	x	x		x					x
<i>Aristida contorta</i>	Mulga Grass	x	x					x	x	
<i>Aristida holathera</i>	Kerosene Grass								x	
<i>Atriplex acutibractea</i>	Pointed Saltbush	x	x	x	x	x		x		
<i>Atriplex holocarpa</i>	Pop Saltbush				x					

Species name	Common name	VA1	VA2	VA3	VA4	VA5	VA6	VA7	VA8	VA9
<i>Atriplex vesicaria</i>	Bladder Saltbush	x	x	x	x	x	x	x	x	x
<i>Austrostipa elegantissima</i>	Elegant Spear-grass				x	x				x
<i>Austrostipa sp.</i>		x	x	x	x	x	x	x	x	x
<i>Boerhavia coccinea</i>	Scarlet Spiderling							x		
<i>Brachyscome ciliaris</i>	Fringed Daisy		x						x	
<i>Brachyscome trachycarpa</i>	Inland Daisy			x			x			
<i>Calandrinia eremaea</i>	Small Purslane			x						
<i>Calandrinia remota</i>	Round-leaf Parakeelya			x						
<i>Calotis hispidula</i>	Hairy Burr-daisy			x						
<i>Carrichtera annua</i>	Ward's weed			x						
<i>Casuarina pauper</i>	Black Oak	x	x		x	x	x		x	x
<i>Chenopodium curvispicatum</i>	Cottony Goosefoot		x	x			x		x	
<i>Chenopodium desertorum</i>	Desert Goosefoot	x	x		x	x	x			
<i>Chenopodium gaudichaudianum</i>	Scrambling Goosefoot	x	x		x					
<i>Convolvulus angustissimus</i>	Pink Bindweed							x		
<i>Convolvulus remotus</i>	Grassy Bindweed		x						x	
<i>Cullen pattens</i>	Spreading Scurf-pea							x		
<i>Dissocarpus paradoxus</i>	Cannonball Burr	x	x						x	
<i>Dodonaea lobulata</i>	Lobed-leaf Hop-bush				x	x	x			
<i>Dodonaea microzyga var. microzyga</i>	Brilliant Hop-bush	x	x						x	x
<i>Dodonaea stenozyga</i>	Desert Hop-bush				x					
<i>Dodonaea viscosa ssp. angustissimus</i>	Narrow-leaf Hop-bush			x	x				x	
<i>Einadia nutans ssp. nutans</i>	Nodding Saltbush	x	x	x					x	x
<i>Enchylaena tomentosa</i>	Ruby Saltbush	x	x	x	x	x	x	x	x	x
<i>Enneapogon avenaceus</i>	Oat Nineawn	x	x	x	x	x			x	x
<i>Enneapogon caeruleus</i>	Blue Nineawn									

Species name	Common name	VA1	VA2	VA3	VA4	VA5	VA6	VA7	VA8	VA9
<i>Enneapogon cylindricus</i>	Jointed Nineawn	x	x		x		x		x	x
<i>Enneapogon nigricans</i>		x	x							
<i>Enneapogon polyphyllus</i>	Limestone Bottle-washers	x	x		x			x	x	
<i>Enneapogon sp.</i>				x	x	x		x	x	
<i>Eragrostis eriopoda</i>	Naked Woollybutt	x	x							
<i>Eragrostis dielsii</i>				x						
<i>Eremophila alternifolia</i>	Scented Emubush				x	x	x		x	
<i>Eremophila decipiens</i>	Desert Turkey-bush				x		x			
<i>Eremophila latrobei ssp. glabra</i>	Tar Bush				x	x	x		x	
<i>Eremophila longifolia</i>	Crimson Emubush	x	x					x	x	x
<i>Eremophila paisleyi ssp. paisleyi</i>	Weeping Emubush				x	x				
<i>Eremophila scoparia</i>	Desert Emubush				x					
<i>Eremophila sturtii</i>	Broom Emubush								x	
<i>Eriochiton sclerolaenoides</i>	Woolly-fruit Bluebush	x	x	x	x	x		x	x	x
<i>Erodium aureum</i>		x	x							
<i>Erodium carolinianum</i>	Carolin Haron's Bill	x	x							
<i>Erodium crinitum</i>	Hairy Blue Heron's-bill							x	x	
<i>Erodium cygnorum</i>	Blue Heron's bill									
<i>Erodium sp.</i>				x					x	
<i>Eucalyptus canescens</i>	Oak Valley Mallee				x					
<i>Eucalyptus concinna</i>	Victoria Desert Mallee	x	x		x	x	x			
<i>Eucalyptus eremicola</i>	Vokes Hill Mallee (Nawa)				x		x			
<i>Eucalyptus gracilis</i>	Yorrell				x					
<i>Eucalyptus oleosa</i>	Red Mallee				x	x	x			
<i>Eucalyptus socialis</i>	Beaked Red Mallee				x					
<i>Eucalyptus vokesensis</i>	Vokes Hill Mallee						x			
<i>Eucalyptus yumbarrana</i>	Yumbarra Mallee				x					
<i>Eucalyptus pimpiniana</i>	Pimpin Mallee				x					

Species name	Common name	VA1	VA2	VA3	VA4	VA5	VA6	VA7	VA8	VA9
<i>Euphorbia drummondii</i>	Caustic Weed				x			x	x	
<i>Euphorbia tannensis</i>	Bottle Tree Caustic				x				x	
<i>Goodenia pinnatifida</i>	Scrambled Eggs			x						
<i>Grammosolen truncatus</i>	Shrubby Ray-flower	x	x							
<i>Grevillea huegelii</i>	Comb Grevillia				x	x	x			
<i>Hibiscus krichauffianus</i>	Velvet-leaf Hibiscus	x	x		x	x			x	
<i>Leiocarpa leptolepis</i>	Pale Plover-daisy							x		
<i>Leucochrysum fitzgibbonii</i>		x	x	x						
<i>Lepidium leptopetalum</i>	Shrubby Peppergrass					x				
<i>Lepidium oxytrichum</i>	Green Peppergrass	x	x					x	x	x
<i>Lepidium sp.</i>	Peppergrass			x						
<i>Lotus cruensis</i>	Red Bird's-foot Trefoil							x		
<i>Lycium australe</i>	Australian Boxthorn					x	x	x		
<i>Maireana georgei</i>	Satiny Bluebush	x	x	x	x	x	x	x	x	x
<i>Maireana radiata</i>	Grey Bluebush				x	x	x			
<i>Maireana sedifolia</i>	Bluebush	x	x	x	x	x	x		x	x
<i>Maireana trichoptera</i>	Spike Bluebush	x	x	x	x	x	x		x	x
<i>Maireana turbinata</i>	Satiny Bluebush				x	x		x	x	
<i>Malva weinmanniana</i>	Inland Austral Hollyhock							x		
<i>Marsdenia australis</i>	Bush Banana				x	x	x			
<i>Minuria leptophylla</i>	Minnie Daisy	x	x	x	x	x	x		x	x
<i>Minuria sp.</i>									x	
<i>Myoporum platycarpum</i>	False Sandalwood		x		x	x	x		x	
<i>Olearia muelleri</i>	Mueller's Daisy-bush				x	x	x			
<i>Oxalis perennans</i>	Native Oxalis							x		
<i>Ozothamnus decurrens</i>	Ridged Bush-everlasting	x	x	x	x	x	x	x		
<i>Pimelea microcephala ssp. microcephala</i>	Shrubby Riceflower				x	x	x			
<i>Pittosporum angustifolium</i>	Native Apricot	x	x			x	x	x	x	

Species name	Common name	VA1	VA2	VA3	VA4	VA5	VA6	VA7	VA8	VA9
<i>Portulaca oleracea</i>	Munyeroo							x	x	
<i>Ptilotus exaltus</i>	Regal Fox-tail				x	x	x			
<i>Ptilotus obovatus</i>	Silver Mulla Mulla	x	x	x	x	x	x		x	x
<i>Ptilotus sp.</i>				x						
<i>Rhagodia candolleana</i>	Sea-berry Saltbush				x	x	x			
<i>Rhagodia crassifolia</i>	Fleshy Saltbush				x					
<i>Rhagodia parabolica</i>	Mealy Saltbush	x	x	x	x	x			x	
<i>Rhagodia preissii ssp. preissii</i>	Mallee Saltbush	x	x							
<i>Rhagodia spinescens</i>	Thorny Saltbush						x	x		
<i>Rytidosperma sp.</i>						x				
<i>Rytidosperma setaceum</i>	Bristly Wallaby-grass							x	x	
<i>Salsola australis</i>	Tumbleweed	x	x	x	x	x		x	x	x
<i>Santalum acuminatum</i>	Quandong	x	x		x	x				
<i>Scaevola spinescens</i>	Spiny Fanflower				x	x	x		x	
<i>Sclerolaena diacantha</i>	Spear-fruit Copperburr			x			x			
<i>Sclerolaena obliquicuspis</i>	Grey Bindyi	x	x	x	x	x	x	x	x	x
<i>Sclerolaena parviflora</i>	Horned Bindyi				x					
<i>Sclerolaena patenticuspis</i>	Limestone Copperburr	x	x						x	
<i>Sclerolaena uniflora</i>	Mallee Bindyi	x	x	x	x	x	x		x	x
<i>Senna artemisioides ssp. artemisioides</i>	Silver Senna	x	x					x	x	
<i>Senna artemisioides ssp. filifolia</i>	Fine-leaf Desert Senna	x	x			x			x	x
<i>Senna artemisioides ssp. petiolaris</i>	Woody Cassia	x	x		x	x	x		x	x
<i>Senna artemisioides ssp. zygophylla</i>	Twin-leaf Desert Senna	x	x	x	x	x	x		x	
<i>Senna cardiosperma ssp. gawlerensis</i>	Gawler Ranges Senna	x	x		x	x	x		x	x
<i>Senna pleurocarpa var. pleurocarpa</i>	Stripe-pod Senna	x	x							
<i>Sida corrugata</i>		x	x						x	
<i>Sida fibulifera</i>	Pin Sida								x	
<i>Sida intricata</i>	Tangled Sida	x	x					x	x	

Species name	Common name	VA1	VA2	VA3	VA4	VA5	VA6	VA7	VA8	VA9
<i>Sida petrophila</i>	Rock Sida	x	x		x	x	x	x	x	x
<i>Sida spodochroma</i>	Limestone Sida	x	x	x			x		x	x
<i>Solanum coactiliferum</i>	Western Nightshade				x	x				x
<i>Solanum lasiophyllum</i>	Rangki-rangki	x	x	x		x		x	x	x
<i>Solanum orbiculatum</i>	Tjantu	x	x	x	x	x	x		x	x
<i>Solanum quadriculatum</i>	Tomato Bush	x	x	x	x		x		x	x
<i>Stenopetalum lineare</i>	Narrow Thread-petal	x	x	x	x					
<i>Stenopetalum sphaerocarpum</i>	Pea Thread-petal								x	
<i>Swainsona campestris</i>	Nullarbor Plain Swainson-pea			x						
<i>Swainsona formosa</i>	Sturts Desert-pea							x		
<i>Tetragonia eremaea</i>	Annual Spinach	x	x	x	x	x		x	x	
<i>Trichanthodium skirroporum</i>	Woolly Gnephosis	x	x							
<i>Triodia longiceps</i>	Buck Spinifex				x					
<i>Triodia scariosa</i>	Porcupine Grass	x	x		x	x	x			
<i>Vittadinia cuneata</i>	Fuzzy New Holland Daisy	x	x							
<i>Vittadinia dissecta</i>	Common New Holland Daisy	x	x		x	x		x	x	x
<i>Vittadinia eremaea</i>	Desert New Holland Daisy				x					
<i>Westringia rigida</i>	Stiff Westringia				x	x	x			
<i>Roepera apiculata</i>	Pointed-fruit Twinleaf				x					
<i>Roepera aurantiaca ssp. aurantiaca</i>	Shrubby Twinleaf			x	x		x			
<i>Roepera eremaea</i>	Climbing Twinleaf	x	x		x	x	x		x	
<i>Roepera glauca</i>	Pale Twinleaf			x						
<i>Roepera ovata</i>	Dwarf Twinleaf	x	x			x		x	x	
<b>Grand Total</b>		<b>72</b>	<b>76</b>	<b>50</b>	<b>87</b>	<b>62</b>	<b>56</b>	<b>39</b>	<b>70</b>	<b>38</b>



### Appendix 3: Photos of debris sites and the surrounding area



Figure 22: Waste repository location showing the disturbed and modified condition of this area (supplied by DISR).



Figure 23: Examples of highly disturbed and modified condition of debris pits (supplied by DISR).



Figure 24: Most debris pits are accessible by existing roads as the one above (supplied by DISR).

# 9 Attachments

- 1:** Rangelands scoresheets associated with the proposed clearance
- 2:** Site maps as shape files
- 3:** Maralinga Fauna Survey Report (version 27/10/2023)
- 4:** Restoration Management Plan (version 15/12/2023)



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