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Appendix S – Weed Management Plan

Weed Management Plan

2017

Environment, Safety & People

Environment

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1 INTRODUCTION

McArthur River Mine (MRM) is located approximately 45 km south-west of the township of Borroloola and 740 km south-east of Darwin, in the Gulf Region of the Northern Territory (NT).

The mine site is contained within mineral leases (MLN1121, MLN1122, MLN1123, MLN1124 and MLN1125), located on the McArthur River Station Pastoral Lease. Also contained on McArthur River Station Pastoral Lease are the mineral leases AN455, AN366 and the minor mineral lease MLN582.

The Bing Bong facility is situated on MLN1126, located on the Bing Bong Pastoral Lease. Adjacent to the Bing Bong Mineral Lease is the Bing Bong dredge spoil emplacement area, located on the non-pastoral land use approval NP033.

As a land manager, MRM is obligated under Part 3 Division 1(9) of the *Weeds Management Act* 2013 to manage NT declared noxious weeds. Similarly, to coordinate such activities land managers are to prepare a Weed Management Pan (WMP) in accordance with Part 3 Division 2 (10) of the *Weeds Management Act* 2013.

1.1 Purpose of Plan

This WMP has been prepared to guide the management of weeds on MRM mining lease areas.

1.1.1 Weed Management Objectives

MRM has developed seven (7) objectives to maximise the effectiveness of weed management within the MRM site:

- MRM will manage weeds on site in accordance with the *Weeds Management Act* 2013;
- MRM will liaise with relevant government departments to develop integrated management practices and procedures including; the Weeds Management Branch, NT and Parks and Wildlife Commission;
- MRM will employ an integrated weed management strategy to implement the WMP;
- MRM will maintain a continued workforce education and awareness program including; instructing personnel to check vehicles, and include presentations to permanent and contract staff and visitors during inductions;
- MRM will continue to ensure any equipment or machinery entering the site from interstate or other sectors of the Northern Territory undergo necessary quarantine measures and these goods only leave site after a 'Clean to leave site' form has been approved and signed off;
- Production of a WMP that will identify the targeted weed species, and management strategies and practices to prevent and control weeds; and
- The WMP will be reviewed every three years, to ensure weed management practices and strategies are effective and up-to-date.

1.1.2 Legislation and Other Obligations

1.1.2.1 Weeds Management Act 2013

The Northern Territory currently operates under the *Weeds Management Act 2013* (hereafter referred to as 'the Act') where the purpose of the Act is:

- To prevent the spread of weeds in, into and out of the Territory and to ensure that the management of weeds is an integral component of land management in accordance with the Northern Territory Weeds Management Strategy 1996 – 2005 or any other strategy adopted to control weeds in the Territory;
- To ensure there is community consultation in the creation of weed management plans; and
- To ensure that there is community responsibility in implementing weed management plans.

Noxious weeds are declared under Part 2, Section 7 (4) of the Act and categorised into three classes being:

- Class A Noxious weeds - to be eradicated;
- Class B Noxious weeds - growth and spread to be controlled; and
- Class C Noxious weeds - not to be introduced into the NT.

Under the Act, all Class A and Class B Noxious weeds under the Act are also categorised as Class C Noxious weeds.

The Act specifies 140 noxious species (as at 27th October 2016) and aims to protect the Territory's economy, amenity and environment values from the adverse impacts of weeds. A complete list of Class A, B and C Noxious weeds for the MRM management area are provided as **Appendix A**.

1.1.2.2 Mining Management Act 2013

Under the *Mining Management Act 2001*, MRM is committed to submitting an annual Mining Management Plan (MMP). The MMP is a key operational document and supports the authorisation of the mineral leases on which MRM operates. The MMP aims to satisfy all legislative requirements and provides a valuable reporting and operational planning tool for the project, outlining the actions, programs and responsibilities necessary to achieve a life-of-mine commitment to health, safety, environment and community.

1.1.2.3 Katherine Regional Weed Management Plan 2015 – 2020

The Katherine Regional Weed Management Plan covers an area of approximately 386,350 square kilometres of the Northern Territory, encompassing the MRM leases and Bing Bong loading facility.

The Plan forms part of a strategic approach to reducing the impact of the region's priority weeds by the Northern Territory Government, the Department of Environment and Natural Resources Weed Management Branch and key stakeholders.

Under the regional weed management plan, weed species that require priority management attention within the region are identified. Of this list 6 priority weeds are known to occur on the MRM lease areas and Bing Bong loading facility, including:

- Parkinsonia;
- Chinese Apple;
- Bellyache Bush;
- Neem;
- Snake Weed; and
- Devils Claw.

This weed Management Plan has been developed using information provided:

- In the regional weed management plan and the species specific weed management plans where available
- Within the Northern Territory Government's Preventing Weed Spread is Everybody's Business (2015)
- As part of the Northern Territory Government's Statutory Weed Management Plan for Bellyache Bush

Two weeds recorded at McArthur River Mine, Parkinsonia (*Parkinsonia aculeata*) and Bellyache Bush (*Jatropha gossypiifolia*), are recognised Weeds of National Significance (WoNS). Further details on these exotic species are provided in **Section 4: Weed Species Profile.**

1.1.2.4 Statutory Weed Management Plan for Belly Ache Bush (*Jatropha gossypiifolia*) 2013

This Weed Management Plan forms part of a strategic approach to bellyache bush (Jatropha gossypiifolia) management in the Northern Territory (NT), with the overall aim being to mitigate the damage caused by bellyache bush in relation to production, environmental and cultural values and prevent possible health implications associated with its spread.

This plan establishes the objectives and outcomes to be achieved by land managers and the minimum actions to be taken to achieve these outcomes.

MRM are required under this Statutory Weed Management Plan to actively identify and eradicate all bellyache bush infestations and prevent new infestations. To achieve this, the following must be undertaken:

1. Inspect the lease areas (including any previously treated areas) to identify any bellyache bush plants/infestations. This will be completed annually in October (refer to Table 3 below) prior to flowering and seeding after the onset of the wet season;

2. Design and implement an eradication program using the control methods detailed in the Statutory Weed Management Plan

3. Regularly monitor and survey land to identify new or re-establishing bellyache bush infestations;

4. Design and implement a weed spread prevention program, which will ensure that no new bellyache bush infestations establish as a result of seed or spread;

5. Notify the Weed Management Branch of the presence of bellyache bush when it is identified in areas which it has not been found previously;

6. Monitor the results of bellyache bush management.

As required by the Statutory Weed Management Plan, MRM has established buffer zones to prevent the spread of Bellyache Bush. The buffer zone surrounds the active mine leases which is inspected weekly by appropriately trained environment personnel.

1.1.3 Weed Management at MRM

Historically, the management of weeds on the MRM lease has proved difficult due to a number of issues including:

- The extent of the McArthur River catchment;
- The relatively small area MRM has influence over;
- The limited control of upstream factors; and
- Site access due to wet-season conditions such as high rainfall and flooding.

MRM will continue to work in consultation with the Gulf Region Landcare Group and the Weeds Management Branch of the Northern Territory Government to develop an integrated Weed Management Strategy at catchment scale for priority weed species.

2 INTERGRATED WEED MANAGEMENT

2.1 Overview

The MRM mining leases span approximately 11,000 hectares with a number of weeds species in this area. As every weed species is different, an integrated strategy is to be implemented to control the spread and minimise the extent of weeds with the lease area.

Weeds present on the MRM lease historically are a result of disturbances generated by pastoral and mining activities and therefore requires regional cooperation between MRM and pastoral leaseholders, local councils, Traditional Owners (TOs), and State and Federal Government agencies.

This document sets performance targets for the management of weeds at MRM. It is structured to allow for continuous improvement and updating as issues arise and new management practices are identified.

MRM will continue to work in consultation with the Gulf Region Landcare Group and the Weeds Management Branch of the Northern Territory Government to develop an integrated Weed Management Strategy at catchment scale for priority weed species.

MRM aims through this WMP to produce an integrated weed management program to include the following key aspects:

- Weed Hygiene;
- Biological control;
- Chemical control;
- Mechanical and manual control;
- Fire regimes;
- Quarantine and employee awareness; and
- Establishment of a seasonal weed management program.

2.1.1 Weed Hygiene

Hygiene practices within the MRM management areas are an important factor in the control and containment of exotic plant species. Additionally, the identification and monitoring of potential high Weed Risk areas within and adjacent to the MRM lease sites will play important role in the implementation of the WMP. Weed Risk areas currently under inspection and review are shown below in **Figure 1** and **Figure 2** below.

Actions pertaining the management and containment of weed seeds and propagules are provided as **Table 1.**

TABLE 1 : WEED HYGIENE OBJECTIVES AND OUTCOMES

Objective	Outcome
Recognise and Monitor High Weed Risk regions with the MRM management areas	All potential and recognised High Weed Risk areas mapped within and adjacent to MRM managed areas
	An MRM Environmental Officer will conduct visual inspections of disturbance areas and Weed Risk areas within the MRM lease sites in order to monitor for the presence of weeds. Where possible, the inspections will be conducted in the weeks following rainfall events in order to increase the likelihood for weed species observations.
	An MRM Environmental Officer will document weed locations and treatment activities in the MRM environmental management database.
	Deliver training to key personnel in operations and the environment team for identification of weeds
Weed and soil hygiene protocols adhered to by all staff and contractors	All vehicles leaving the MRM Site are required to go through a mandatory wheel wash (which does not drain into a waterway) before leaving site as part of general environmental management. This practice minimises the potential for vegetative material and weed seeds to be transported on the vehicles off site.
	Clean to leave site forms must be completed as per the MRM Clean Vehicle and Equipment Procedure (GEN-ENV-PRO-6040-0005) which ensures all vehicles/ machinery/ goods/ equipment leaving site are free of weeds prior to departing MRM, assisting in preventing the spread of weed species from MRM to other locations.
Permit to Clear procedures adequately minimise weed spread and the introduction of new weeds	Weed control is undertaken as part of the Permit to Clear Procedure to prevent the spread of weeds. Prior to the approval of land clearing, the environment team inspects the area and undertakes weed control as necessary.
	Where land clearing is undertaken in a location with seeding weeds, cleared vegetation and topsoil is stockpiled separately. Weed control and monitoring is undertaken over a period of 5 years before either use in rehabilitation activities or relocation to the permanent stockpiles.
	The Permit to Clear Procedure aims to minimise the amount of land cleared at MRM.
Visual inspections of plant/light vehicles undertaken by staff and contractors	Vehicles or machinery working or passing through known weed infested areas on site must undertake visual checks of equipment and clothing when leaving the area to ensure vegetative material and seeds are not transported off-site.
Monitoring of purchased seed, plant material or any other construction materials (sand, rock, gravel or fill) for rehabilitation projects	Regular monitoring of nursery and rehabilitation sites by Environmental Officer for potential weeds seeds and plant material in purchased products. Any new weed species will be identified and the appropriate management strategies employed.

Objective	Outcome
	Rehabilitation areas, both permanent and temporary will be planned to minimise weed growth. Rehabilitation areas are inspected annually for new weed infestations. Isolated plants will be eradicated.

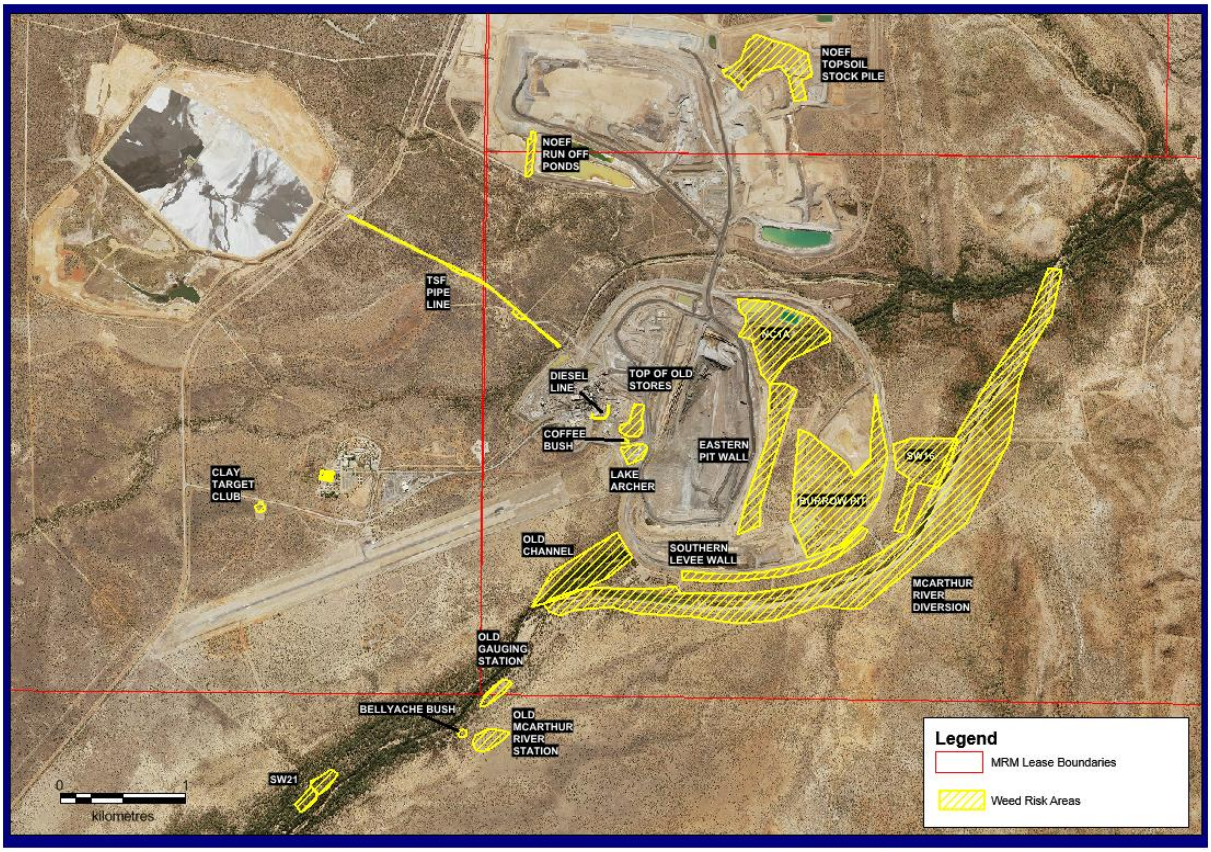


FIGURE 1: MRM WEED RISK AREAS

FIGURE 2: BING BONG WEED RISK AREAS

2.1.2 Biological Control

Biological control utilises NT Government approved species-specific living agents to weaken and/or reduce a pest's reproductive capabilities, thus a reducing seed set.

Within the MRM management area, biological control agents have a tendency for seasonal effectiveness as a result distinct climatic separations between the wet and dry seasons. Agent population reduction in the dry season, caused when the targets vigour has reduced as a result of decreased water availability.

Alist of biological control agents that have been released in the Northern Territory for weeds relevant to the MRM management area is provided in **Table 2.**

Historically biological control agents have been trialled only for control of Parkinsonia at the Bing Bong Dredge Spoil. Further investigation will be undertaken into use of biological controls for Devil's Claw and Noogoora Burr during 2017.

TABLE 2 : RELEVANT MRM BIOLOGICAL AGENTS (ADAPTED FROM NT WEED CONTTROL HANDBOOK, 2015)

Botanical name	Common name	Agent	Type	Part of Plant Targeted
Jatropha gossypiifolia	Bellyache bush	*Agonosoma trilineatum**	Bug	fruit
Parkinsonia aculeata	Parkinsonia	*Eueupethicia cisplatensis*	Moth	leaves
		Penthobruchus germaini	Beetle	seed
Xanthium strumarium	Noogoora Burr	*Epiblema strenuana*	Moth	stems
		Puccinia xanthii	Fungus	leaves

2.1.3 Chemical Control

Chemicals such as herbicides, when used as a of an integrated weed control program, are highly effective.

Herbicides can be applied at the base of the plants (soil application), on the bark (basal barking), directly on the leaves (foliar spraying), stem injection/frilling/drilling or by use of the cut and paint method. Herbicide use decreases weed population size immediately as well as significantly reducing seed output in the area. The application of herbicides over large areas at MRM is most efficient and cost effective using a weed spray unit mounted on a utility vehicle combined with aerial application via helicopter mounted boom sprayer.

Exotic species within the MRM management area can be treated throughout the year, where the optimal times for a successful kill rate is following the first major rain event of the wet season when target species have responded to the high humidity and rainfall, and the end of the wet season.

If possible, weeds should be sprayed when the target is actively growing and/or flowering to reduce further seed set. Optimal times for uptake of foliar herbicide by plants are the early morning and late afternoon, when the evapotranspiration rate is low and the stomata (gas-exchange pores) on the leaves are active and open.

A complete weed species list treatment table for the MRM area is provided as **Appendix B**.

A summary of weed control techniques are provided as **Appendix D.**

2.1.4 Mechanical and Manual Control

Mechanical weed control incorporates methods that impede or reduce the growth and the target species ability to flower and produce seed.

Whilst simple in its implementation, the timing of the treatment is imperative to its successful application. Several variables are to be considered if a mechanical option for weed control is used:

- The target species must be easily assessable, especially if using large plant or equipment;
- Activity is to occur during a flowering or prior to a seeding event; and
- All vehicles used in the weed control activity is undergo onsite wash down when leaving the area at the end of the shift.

Manual weed control hand-pulling is an extremely effective method of removing isolated weeds (from a predominately native understory) and is often used during either the final stages of a weed eradication program or to eradicate small isolated weed incursions.

2.1.5 Fire Regimes

Controlled burns occur regularly as a part of MRM's Fire Management Plan.

As a weed management tool, fire can be applied over large areas removing large areas of weed biomass and depending on the weed species, fire can reduce the weed seed bank in the soil. Unfortunately, the technique is limited in its effectiveness against a range of target species such as Parkinsonia where heat searing of stems can inhibit the uptake of chemicals during basal bark application (NRETAS, pers. com).

FIGURE 3: AN AREA OF LAND BURNED AS PART OF WEED MANAGEMENT

2.1.6 Property Weed Treatment Schedule

The below weed treatment schedule has been developed with information provided by the NT Government's Weed Management Branch website.

As indicated in the schedule, an annual inspection will be undertaken by the Senior Environmental Advisor – Rehabilitation of known infestation areas, high risk areas in addition to a general mine lease overview inspection. The information gathered in this will be used to further refine the target areas for each year of weed control.

TABLE 3: MONTHLY WEED TREATMENT SCHEDULE - CLASS A & CLASS B WEEDS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Azadirachta indica Neem										Inspection		
Hyptis suaveolens Hyptis										Inspection		
Jatropha gossypiifolia Bellyache Bush	Foliar Spray									Inspection		
	Basal bark & Cur Stump											
Martynia annua Devil's Claw										Inspection		
Parkinsonia aculeata Parkinsonia										Inspection		
Xanthium strumarium Noogoora Burr										Inspection		
Aerva javanica Saddle Bag Weed										Inspection		
Miscellaneous grasses and vines										Inspection		

3 MONITORING AND PERFORMANCE CRITERIA

The objective of monitoring and reporting is to record changes to the vegetation as a result of the weed management works. To successfully manage both noxious and environmental weeds within the MRM management area, a MRM Environmental Officer must actively survey all known weed populations and regions deemed as Weed Risk and Non Weed Risk areas.

3.1.1 Data Collection

As an integral part of the weed management process is highlighting all known weed populations including their distribution across the landscape and the densities in which they occur.

A procedure to collate weed data is provided as **Table 4** and **Table 5** below.

TABLE 4: WEED DATA COLLECTION (ADAPTED FROM THE NORTHERN TERRITORY WEED DATA COLLECTION MANUAL, 2015).

Steps	Tasks
Identify, record the specimen and location	• Confirm identification of the weed. If more than one weed species is present then repeat the process with separate records for each species.
	• If unsure, take a sample and photos. If possible collect/photograph flowers, leaves and fruit. Press and dry specimens in newspaper to maintain is integrity for later identification. Record it as "Unknown weed"
	• Remember to record the GPS location (ideally) from the centre of the population or created polygon
Assessing the size and density of the infestation	• Can be achieved by using either a hardcopy map and/or GPS via the creation of a polygon. Take in all of the recorded individual weeds with the area.
	• Assess an approx. projected canopy area that is cover covered by weed/s. Assign a score from 2 to 5 based on the percentages provided in **Table 5.**
	• There can be multiple densities with each allocated area, so don't be afraid to 'mix it up' to provide a better picture of the recorded population.

TABLE 5 WEED DENSITY CATEGORIES (NORTHERN TERRITORY WEED DATA COLLECTION MANUAL, 2015)

Density categories	Descriptions
1	Absent, no weeds of this species in this area.
2	< 1%, Very few, not many weeds e.g.: single plant, perhaps with seedlings
3	1 -10%, More than one or two isolated plants but not a lot e.g.: a few small plants.
4	11-50%, A lot, up to half the area covered e.g.: a tree, dense patches of weeds.
5	> 50%, Dominant cover is weed, more than half covered e.g.: thickets, monocultures

Weed mapping and data collection is an ongoing process and is undertaken annually as described in **Table 4** above. It is only through constant vigilance that integrated weed control will be successful.

Following the annual inspection, the weed treatment schedule will be reviewed to ensure that all weed risk areas are captured in the schedule.

3.1.2 Monitoring Reports

Reporting will be required at the completion of each seasonal control and weed mapping programs and included in the annual Operational Performance Review and/or the Mining Management Plan.

Reports are to contain:

- Works carried out, including weed species targeted and their location;
- An approximation of the time spent on each task;
- Any observations, such as the occurrence of new weed species;
- A description of any problems encountered and how they were overcome;
- A summary of how the site specific objectives have been met (or not);
- Herbicide and other chemicals used including quantity, dilution rate and other relevant information;
- Other weed control mechanisms (e.g. mechanical control) used during the period;
- Climatic conditions which influenced weed germination;
- Performances criteria and success; and
- Maps of weed distribution and density.

3.1.3 Performance Criteria

The performance criteria are outlined in **Table 6** and are to be achieved at the end of each reporting period.

TABLE 6 : MRM WEED MANAGEMENT PERFORMANCE CRITERIA

Performance Criteria	Outcome
All known noxious weed populations mapped and densities recorded within and adjacent to the MRM management area	Updated species specific maps produced indicating a reduction in weeds and highlight any new noxious weeds or incursions
All Weed Risk areas mapped and surveyed quarterly (pending seasonal constraints)	Weed Risk areas mapped and densities of exotic species noted
Areas outside of the non-Weed Risk areas surveyed annually to monitor for isolated weed incursion	Non Weed Risk areas mapped and densities of exotic species noted
Noxious weeds and WONS controlled as per legal control requirements under NT Weed Management Act 2001	A reduction in 10% of Noxious weed populations within the MRM management area per year. Eradication of each weed species is achieved when no individual plants are observed during the annual weed inspection for 5 continuous years.
All monitoring and reporting activities completed as per the WMP	Supporting documentation produced for MRM Environmental compliance reports
Eradication of Bellyache Bush and Devils Claw	All known infestations are eradicated and no individual plants are observed during the annual weed inspection for 5 continuous years.

4 WEED SPECIES PROFILES

A Summary of the control techniques for the key weed species with MRM lease area is provided as **Appendix B Weed Treatment Table.**

4.1 Saddlebag Weed (*Aerva javanica)*

4.1.1 Description

Not Listed – Environmental Weed

Saddle bag weed is a long-lived small woody shrub that grows between 30cm to 100cm tall. Its stems and leaves, particularly their undersides, are densely covered in whitish woolly hairs and numerous whitish flowers are borne in elongated clusters at the tips of the branches.

This species reproduces by seed, which are only produced on female plants. The small fruit are probably dispersed by animals and wind. They may also be spread by vehicles and in soil, as infestations often first appear along roadsides and near mine sites.

This species is widely naturalised in the drier regions of northern Australia. It is most common and widespread in the northern and north-western parts of Western Australia. In the Northern Territory it is relatively common in north-western areas and is also scattered throughout the remainder of the territory.

FIGURE 4: AERVA JAVANICA FORM

FIGURE 5: AERVA JAVANICA FLOWER

4.1.2 Location

Saddlebag weed has spread through disturbed areas of the MRM lease over the past five years. They are particularly populous around the administration buildings, airport and metallurgy areas.

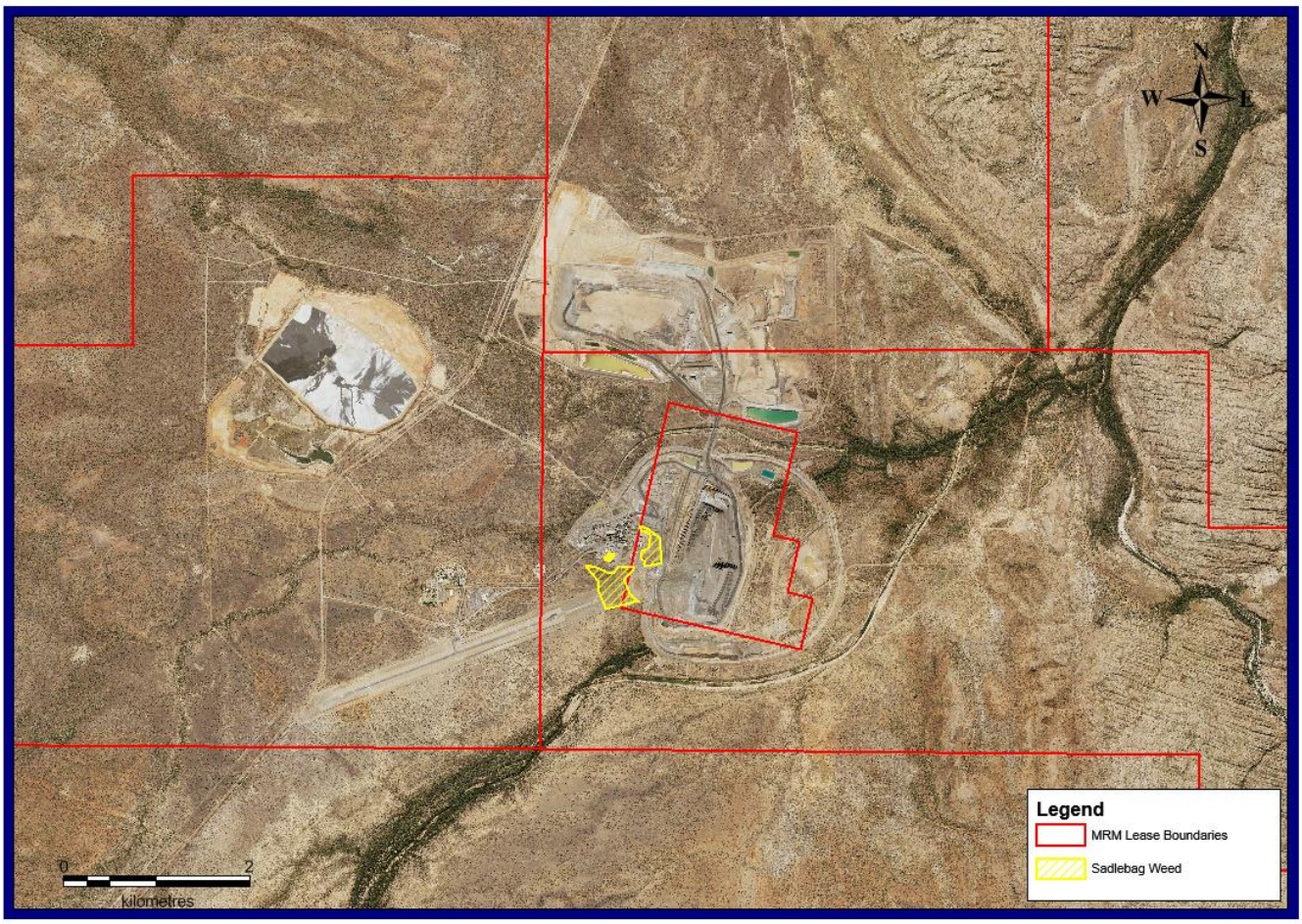


FIGURE 6: LOCATION OF KNOWN INFESTATIONS OF SADLEBAG WEED

4.2 Neem Tree (*Azadirachta indica*)

4.2.1 Description

Class B Weed

Neem are fast growing evergreen trees to 24m with reddish brown flaking bark. Pinnate leaves grow to around 40cm in length, with opposite leaflets to 8cm. Flowers are small, white and mildly fragrant in borne in axillary panicles. Fruit is an olive-like drupe to around 3cm.

Neem trees prefer to grow along drainage lines however their extensive root system provides them with a level of drought resistance, while their water tolerance means they are also able to live in wet areas.

FIGURE 7: AZADIRACHTA INDICA FORM AND FOLIAGE

FIGURE 8: AZADIRACHTA INDICA FRUIT AND FOILAGE

4.2.2 Location

Neem tree populations are widespread throughout the riparian areas of northern Australia and were previously present at the Bing Bong Loading Facility as indicated in **Figure 9** below. Annual weed management activities in the Bing Bong area have resulted in a significant reduction in the population size, with no individual plants recorded in 2017.

FIGURE 9: LOCATION OF PREVIOUSLY KNOWN INFESTATIONS NEEM TREE - BING BONG FACILITY

4.3 Hyptis (*Hyptis suaveolens*)

4.3.1 Description

Class B Weed

Hyptis is an annual or perennial upright branched plant with a characteristic aromatic mint smell, generally growing 1 to 1.5 metres high but at times reaches 2 metres. Stems are square with opposite leaves which are broader at the base than at the tip, varying from 2.5 to 7 cm long and 1 to 5 cm wide, with serrated margins. Small lavender blue flowers occur in clusters in the leaf axils. Seeds are dark brown to black in colour, shield shaped, 3.5 to 4 mm long and 2.5 to 3 mm wide (Miller and Schultz 2002).

Hyptis will grow on most soil types, except those that become waterlogged, and favours disturbed areas such as roadsides and overgrazed areas around cattle yards. It is resistant to fire (Miller and Schultz 2002).

FIGURE 10: HYPTIS LEAF AND FLOWER

FIGURE 11: HYPTIS LEAVES AND ARRANGEMENT

4.3.2 Location

Hyptis is widespread within the Northern Territory and is found in the Darwin, Katherine, Gulf and Victoria River Districts.

Within the MRM leases, Hyptis is present along riparian corridors, including the McArthur River and Barney Creek Diversions.

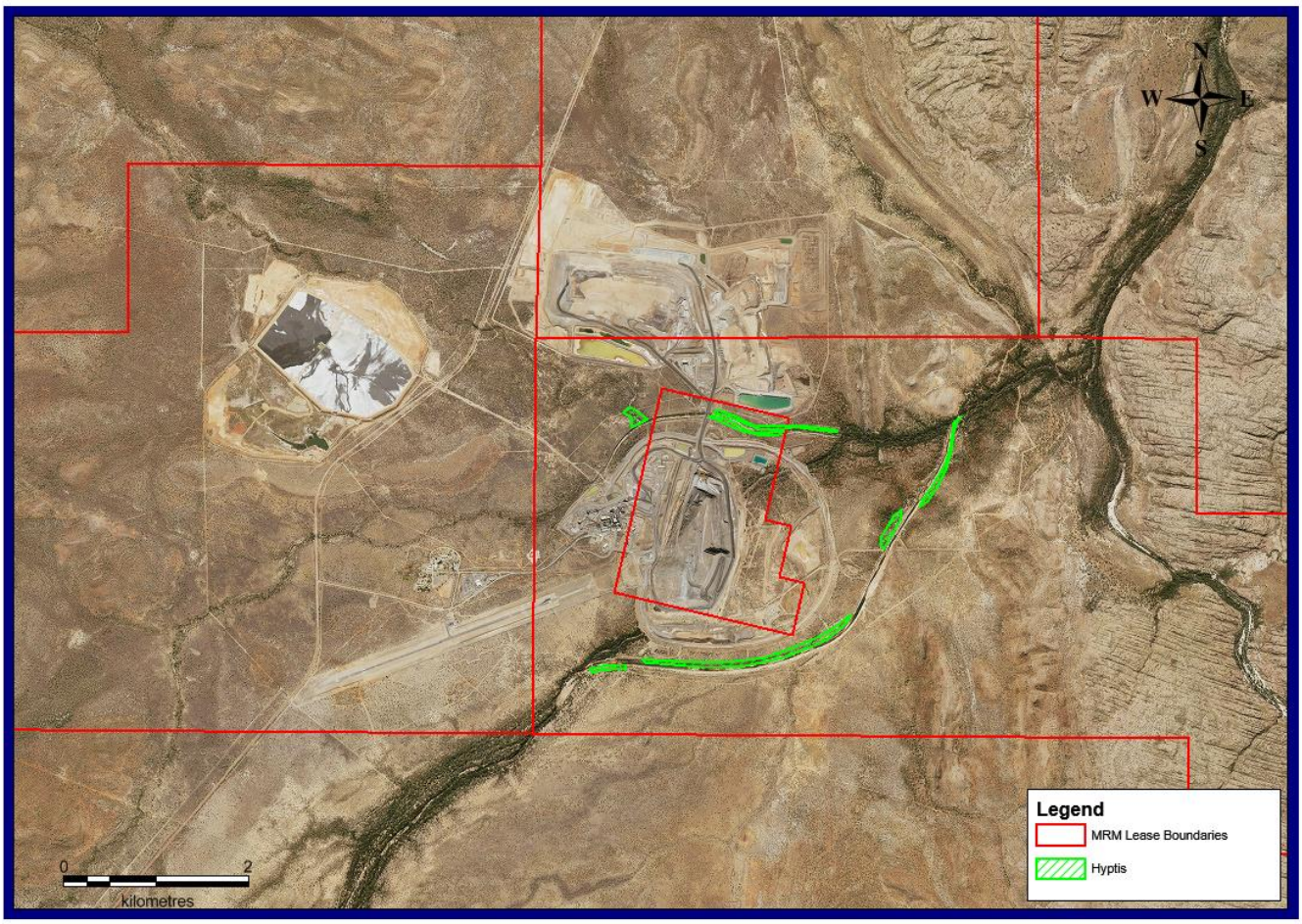


FIGURE 12: LOCATION OF KNOWN HYPTIS INFESTATION

4.4 Bellyache Bush (*Jatropha gossypiifolia*)

4.4.1 Description

Class A Weed

Native to tropical America, Bellyache bush is an erect, woody, perennial shrub which grows to a height of 2.5 to 3 m. It has thick sappy stems, leaves with three to five deep lobes, and small red and yellow flowers. The leaves of some plants have a purple colouration while others are glossy green. Stems, leaf stalks and leaf margins are covered with coarse, gland tipped, sticky, brown hairs (Pitt 1999).

During February to June small red and yellow flowers appear. The fruit capsules are large and contain three seeds which are toxic. The seedpods float when green, and explosively open when mature (Pitt 1999), throwing seeds up to 3m away.

FIGURE 14 BELLYACHE BUSH FOILAGE (SOURCE: QLD GOVERNEMNT)

FIGURE 13: BELLYACHE BUSH FLOWERS (SOURCE: QLD GOVERNEMNT)

4.4.2 Location

In the Northern Territory, Bellyache bush has established on grazing lands and along waterways in the Darwin, Katherine and Gulf regions (Pitt 1999).

The only known population of Bellyache bush is around the old homestead.

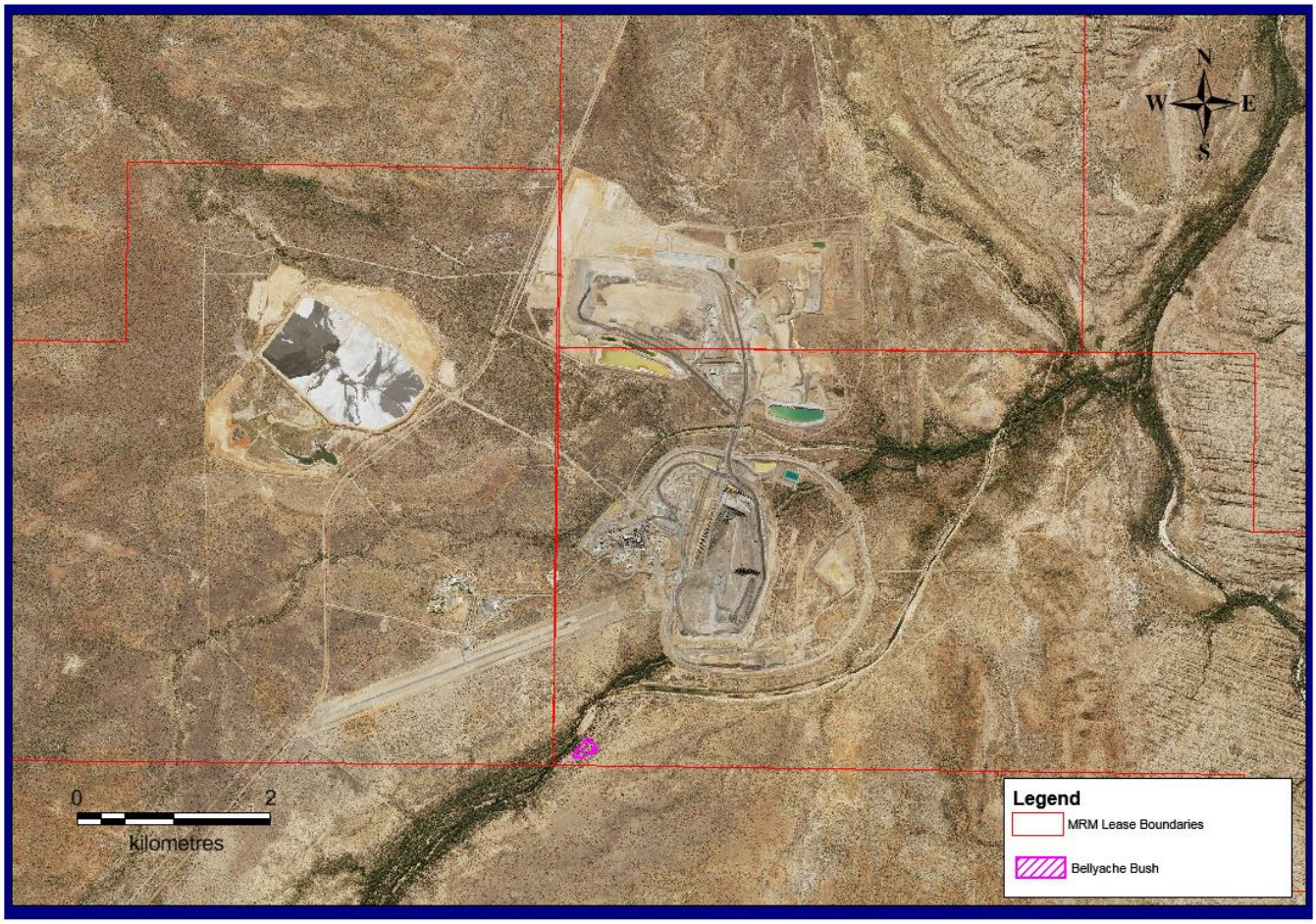


FIGURE 15: LOCATION OF KNOWN INFESTATIONS BELLYACHE

4.5 Coffee Bush (*Leucaena leucocephala*)

4.5.1 Description

Not Listed – Environmental Weed

Small tree to 10 meters tall, low branching when shrubby with brown-greyish bark and bi-pinnate leaves and leaflets to 16 mm. Flowers are whitish, cream or pale yellow flowers are borne in dense rounded clusters (1-3 cm across). Seed pods are elongated and flattened (8-18 cm long and 2 cm wide) turn brown or reddish-brown as they mature.

Coffee Bush is not a declared weed in the Northern Territory, but given its prolific seeding rate and propensity to form dense thickets, it is considered an environmental weed for MRM.

FIGURE 16: COFFEE BUSH BUDS AND FLOWERS

FIGURE 17: COFFEE BUSH FORM AND PODS

4.5.2 Location

This species is widely naturalised and relatively common in the coastal and sub-coastal districts of northern and eastern Australia. It is most common in south-eastern, central and northern Queensland and in the northern parts of the Northern Territory.

At MRM this weed is isolated to one known infestation located adjacent to the power station.

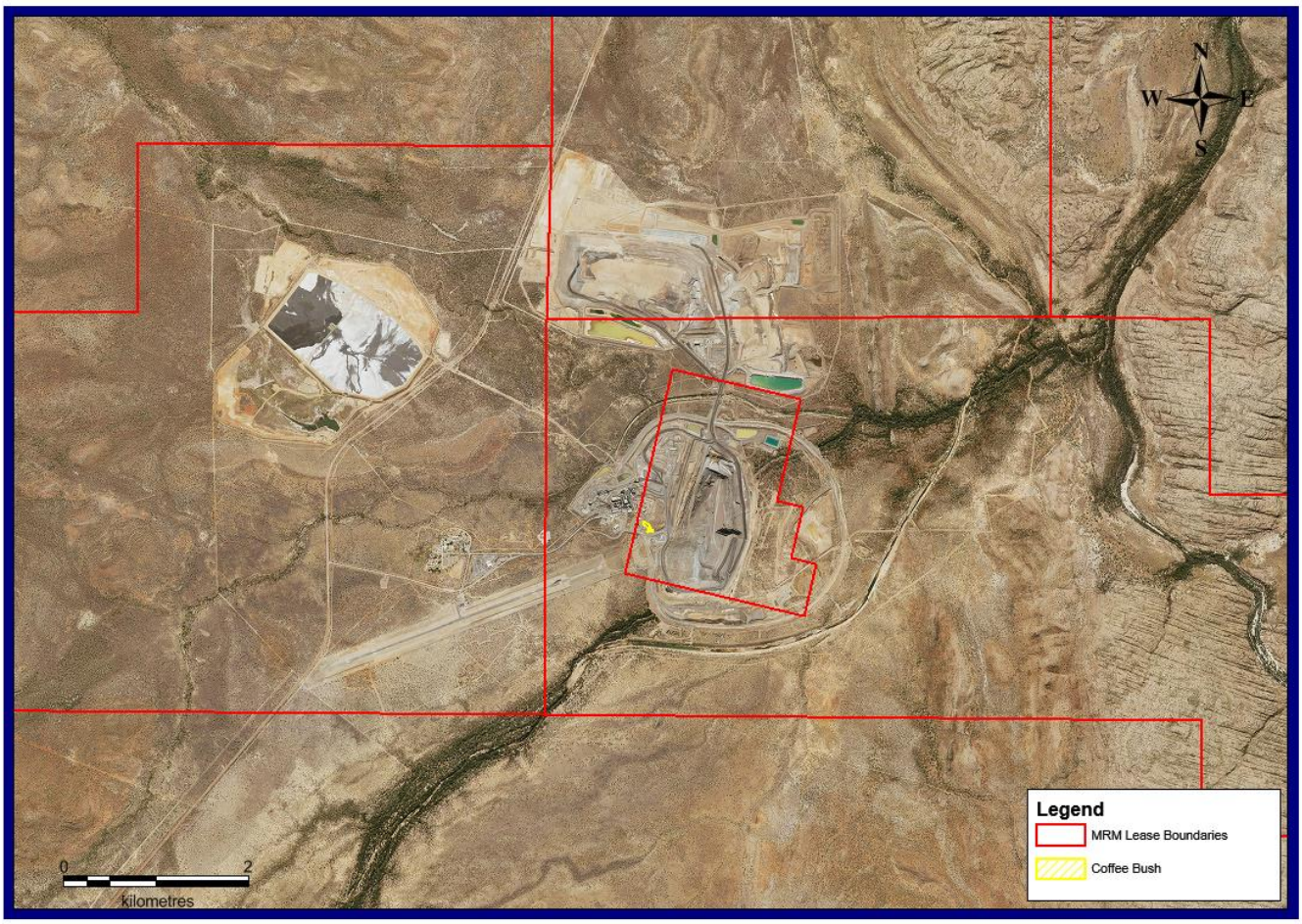


FIGURE 18: LOCATION OF KNOWN INFESTATIONS OF COFFEE BUSH

4.6 Devils Claw (*Martynia annua*)

4.6.1 Description

Class A Weed

Originally from Central America, Devil's claw is an annual plant that germinates during the wet season and grows rapidly to a height of 1.5 to 2 metres. It has large pumpkin-like leaves about 12.5 cm wide. A sticky exudate from the stems and leaves can be felt when the plant is handled. The large, five lobed, bell-shaped flowers are mauve in colour and about 5 cm long (Pitt 1998a).

The seed capsules are initially green with an outer covering of fleshy skin and a curved beak which split when mature, to expose the characteristic "claws". The mature capsule is very hard, grey to black in colour and 3 to 4 cm long. In addition to the claws, there are shorter spines in a groove along the axis of the capsule, which aid in attaching to objects. Each capsule contains two dark seeds that remain inside until germination takes place (Pitt 1998a).

FIGURE 19: DEVILS CLAW FLOWER

FIGURE 20: DEVILS CLAW LEAVES

4.6.2 Location

Devil's claw populations within the NT are confined to the Pine Creek, Katherine and Victoria River Districts (Pitt 1998a). At MRM 189Ha of Devils Claw infestation exists along the McArthur River floodplain area.

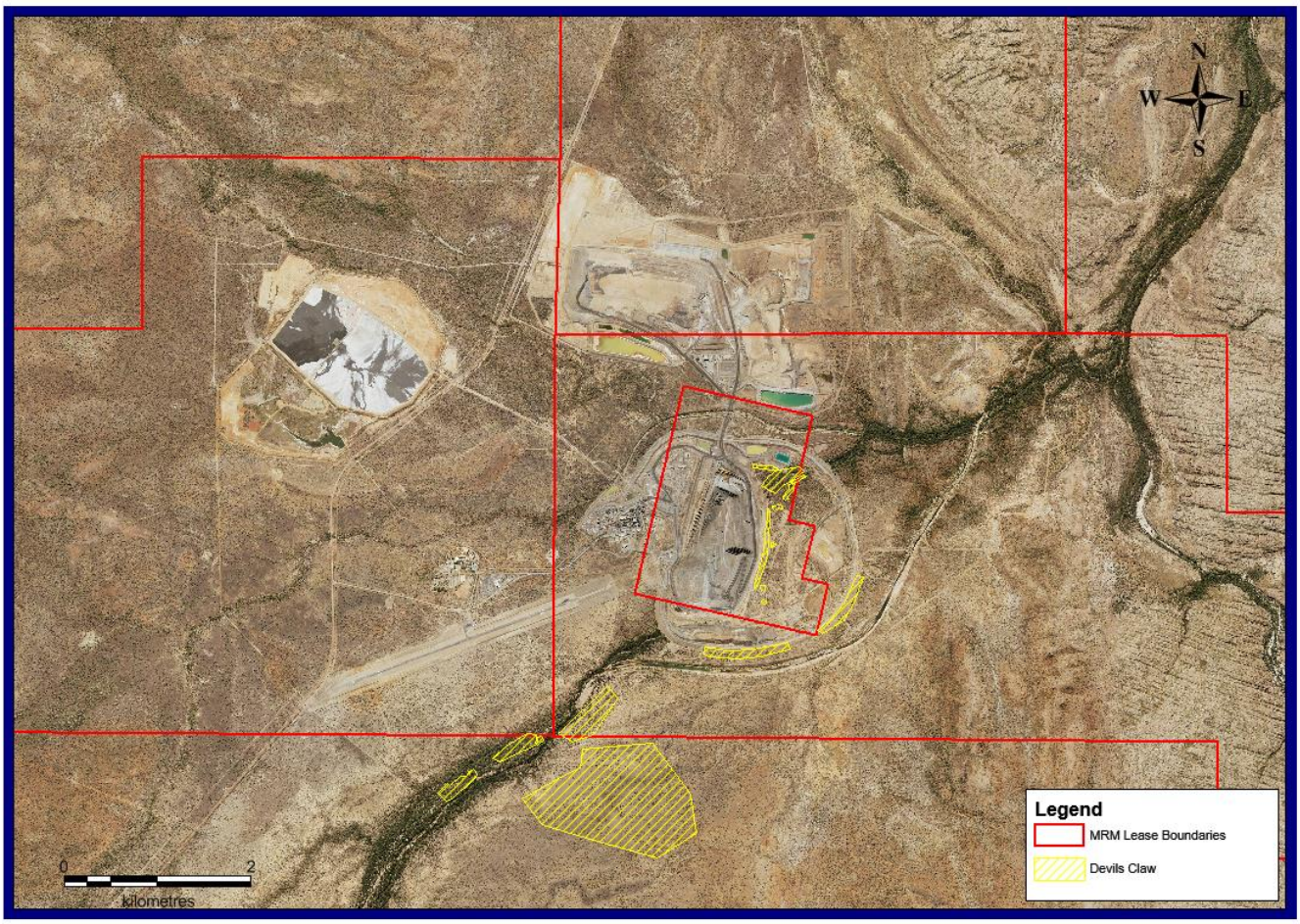


FIGURE 21: DEVIL'S CLAW LOCATIONS

4.6.3 Additional Control Measures

MRM are committed to achieving complete eradication of Devil's Claw on all lease areas and working with McArthur River Station to undertake weed management on a regional level.

Aerial spraying of remote infestations has been undertaken to supplement on ground actions, focussing on the Old McArthur River Homestead area as shown below in **Figure 24** below. This program has been very successful, with no Devils Claw being found at this location during 2017.

Monitoring of this area will continue for a minimum of 5 years as part of the weed management inspection schedule.

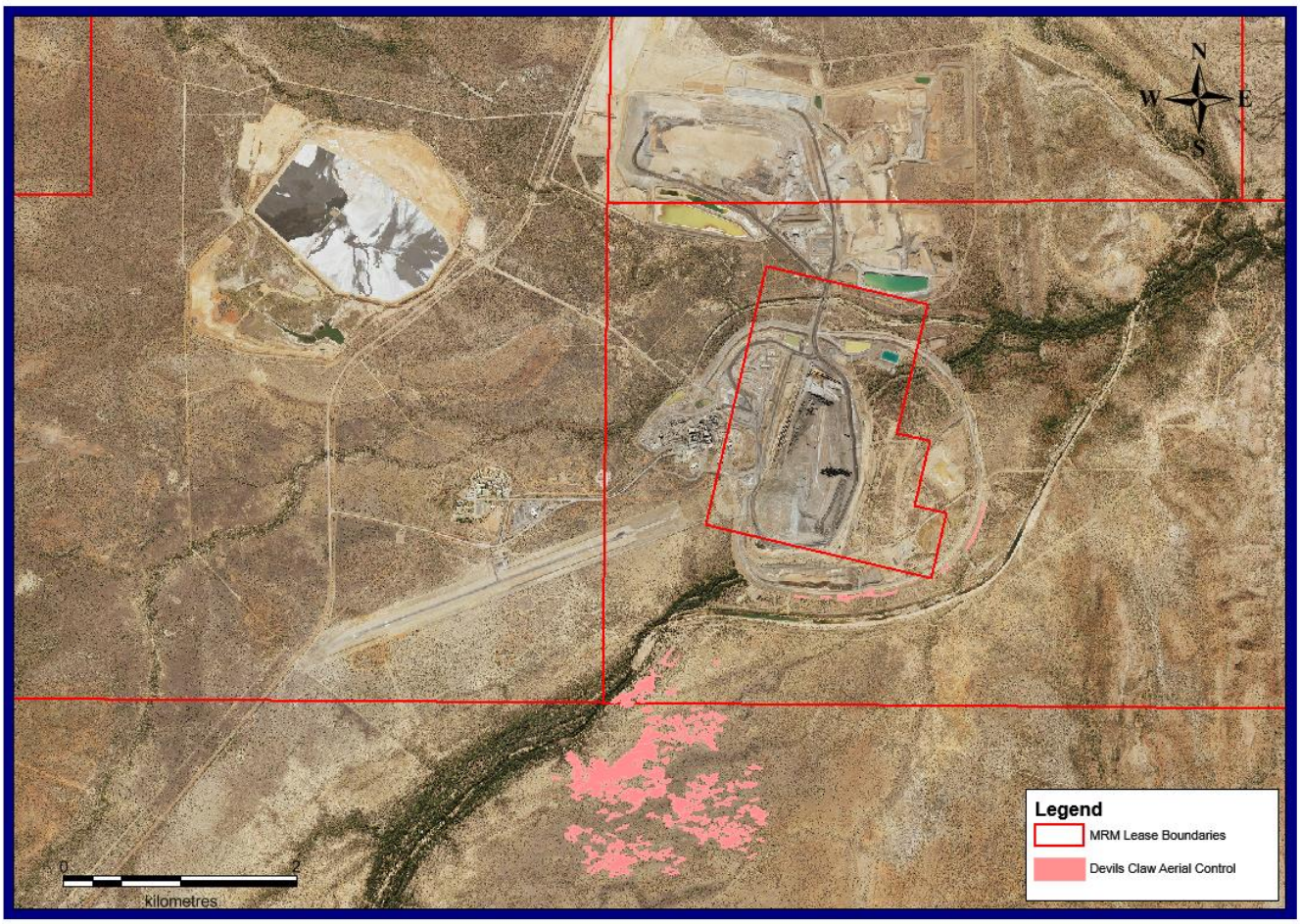


FIGURE 22: LOCATION OF AERIAL SPRAYING OF DEVILS CLAW

4.7 Parkinsonia (*Parkinsonia aculeata*)

4.7.1 Description

Class B Weed

Parkinsonia (Parkinsonia aculeata) is a thorny shrub or small tree to 6m, predominantly found in moist soil, that can form dense thickets. Leaves consist of very thin flattened rachises up to 30 cm long with tiny oblong leaflets in two rows along their length (van Rangelrooy and Flanagan 1999) with sharp thorns 7 to 12 mm long at the leaf nodes.

Flowers are yellow except for one petal, which is either completely orange or has orange spots. There are eight to 12 flowers on each inflorescence. The leathery seed pods are 5 to 11 cm long, each containing two to four seeds and light brown when mature.

FIGURE 23: PARKINSONIA FORM

FIGURE 24: PARKINSONIA FLOWER AND LEAF

4.7.2 Location

Parkinsonia is well adapted to the arid areas on the Barkly Tableland and Gulf. Parkinsonia is present within the MRM lease and at Bing Bong Loading Facility.

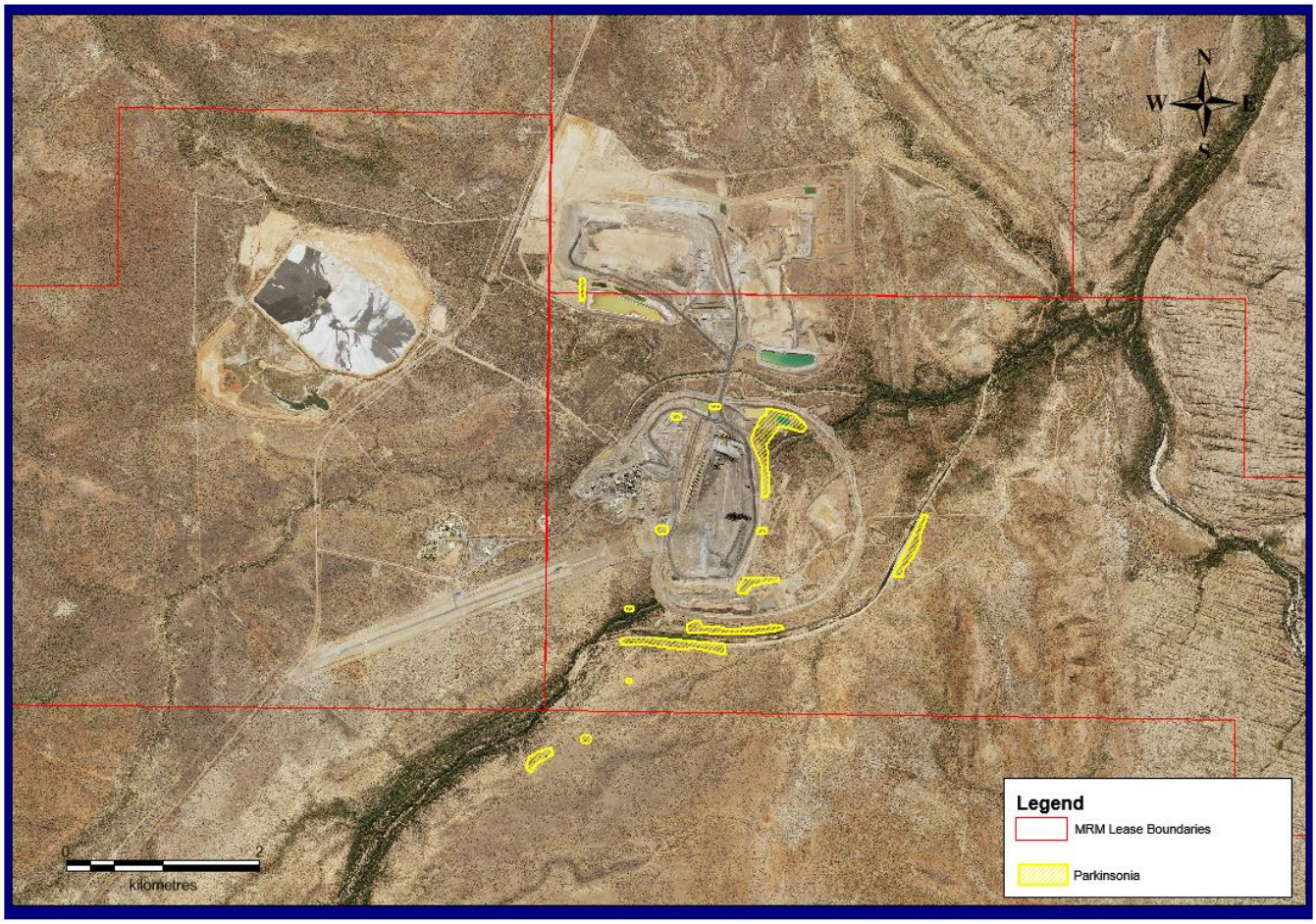


FIGURE 25: PARKINSONIA LOCATIONS WITH MRM LEASE

FIGURE 26: PARKINSONIA LOCATIONS WITH MRM LEASE, BING BONG

4.8 Spinyhead Sida (*Sida acuta*)

4.8.1 Description

Class B Weed

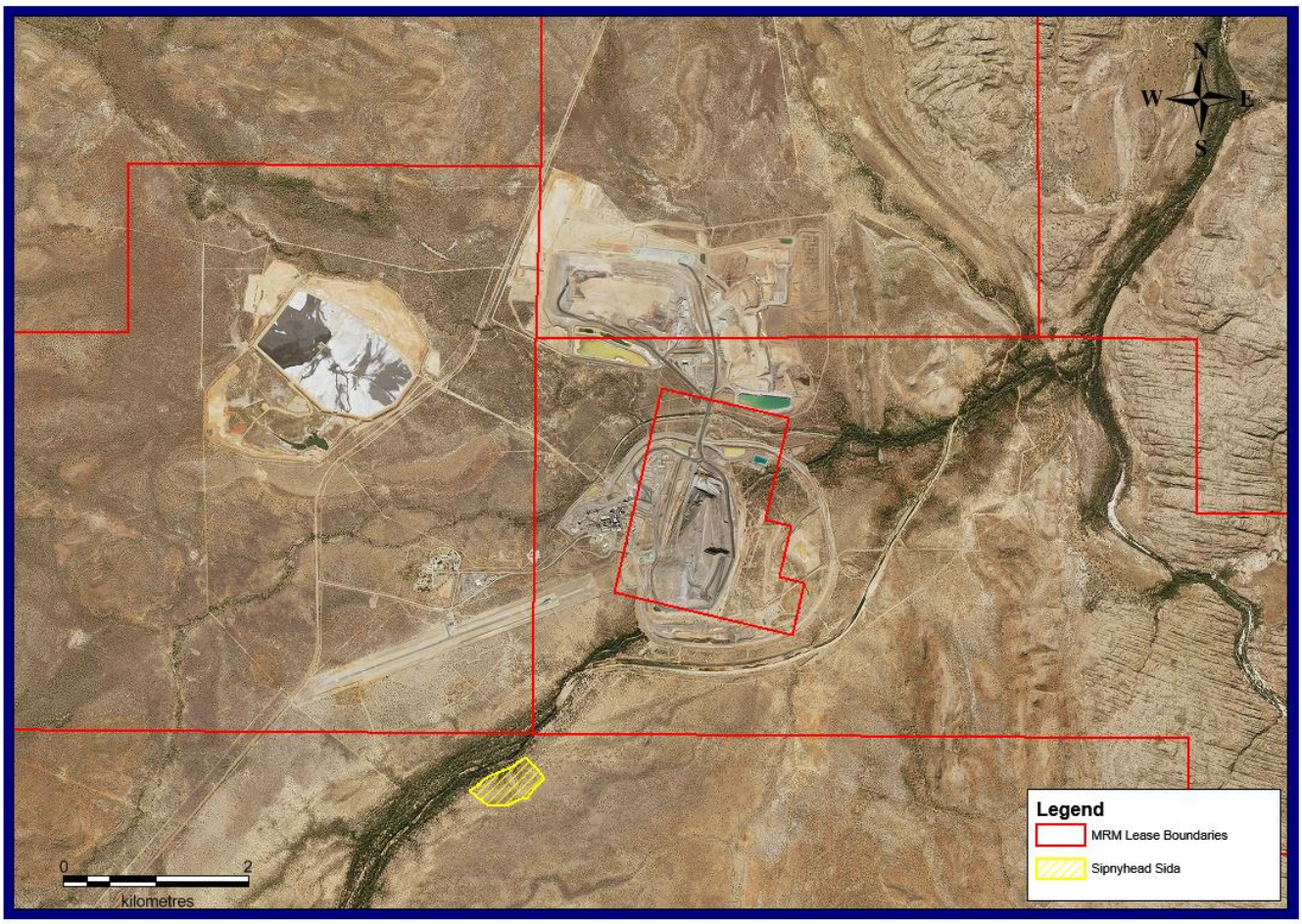
Spinyhead Sida is an erect annual or perennial shrub, usually growing to a height of about 1 metre. The stems are woody, branching several times, and there is a well-developed tap root. The leaves are lance-shaped (tapered at both ends) with serrated margins. The flowers are yellow, usually solitary or growing in pairs in the leaf axils. Seed capsules divide into five to eight portions, each of which has two sharp points approximately 1.5 mm long at one end (Pitt 2002a).

FIGURE 28 : SPINYHEAD SIDA LEAF (SOURCE: ENCYCLOPEDIA OF LIFE IMAGES PHOTO BY J TANN)

FIGURE 27 : SPINYHEAD SIDA FLOWER (SOURCE: ENCYCLOPEDIA OF LIFE IMAGES PHOTO BY J TANN)

4.8.2 Location

The only known location of Spinyhead sida within the MRM lease boundaries is at the old homestead.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S
Legend
MRM Lease Boundaries
Sipnyhead Sida
0
2
kilometres

4.9 Snakeweed (*Stachtarpheta spp*)

4.9.1 Description

Class B Weed

Snakeweeds are clumping perennial shrubs that grow up to 2 m high from woody root-stock. The stems are tough and widely branched, with opposite, lance shaped leaves up to 10 cm long attached by short stalks (Smith 1997).

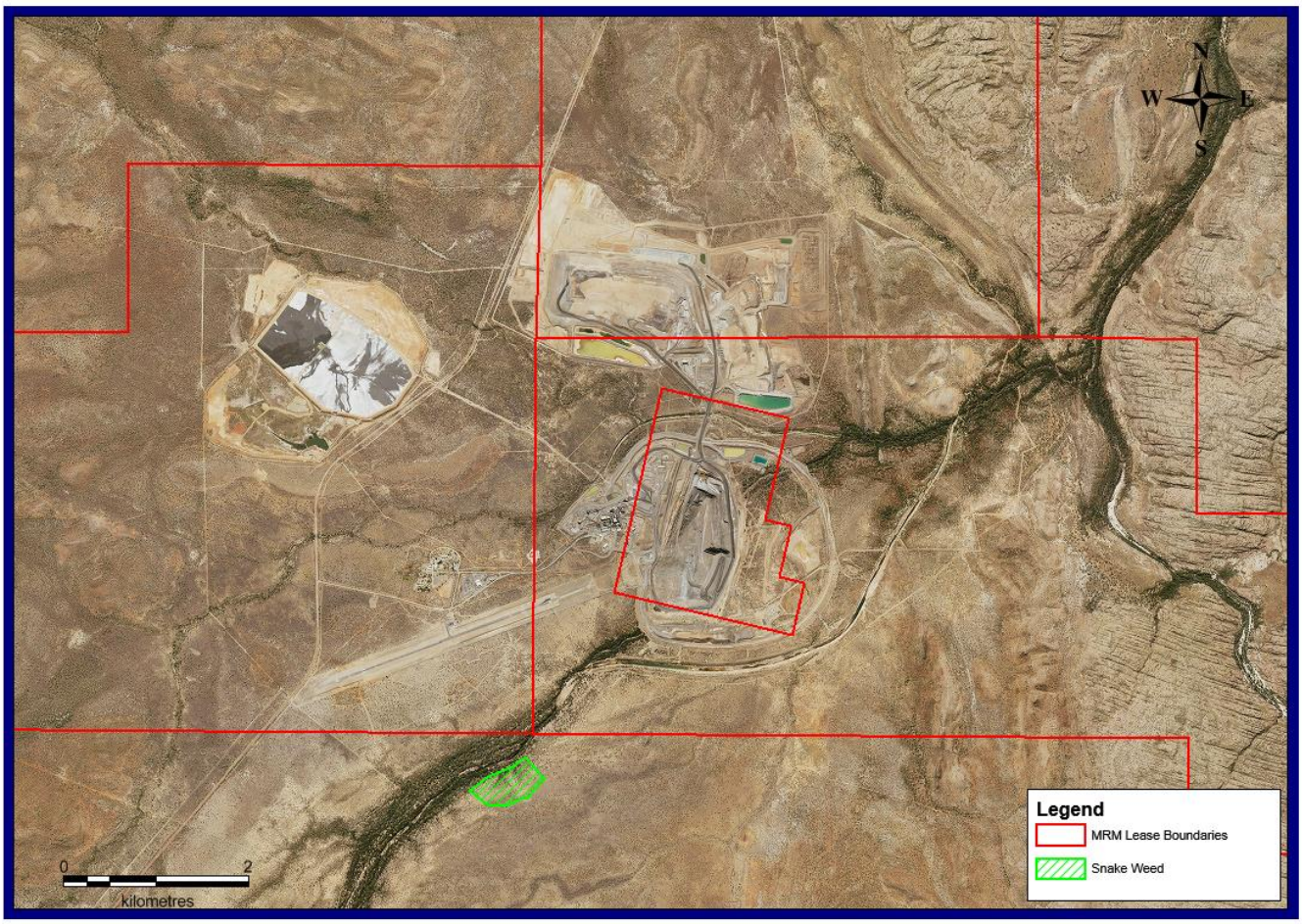
Snakeweed flowers are formed along stiff spikes, up to 50 cm long and 0.5 cm wide. The flowers bloom in rotation from the bottom of the spike upwards and wilt soon after being picked. Flower colour varies with the species and may be white to pale blue, light blue, dark blue to purple or pink. A pointed bract protects the point where the flower joins the spike. After flowering the spikes dry off and the seeds develop beneath the 'scales'. The seeds are dark brown to black and 4 to 6 mm long (Smith 1997).

FIGURE 29: FIGURE 23: SNAKEWEED LEAF (SOURCE: QLD GOVERNEMNT)

FIGURE 30: SNAKEWEED FLOWER AND STEM (SOURCE: QLD GOVERNEMNT)

4.9.2 Location

In the Northern Territory, Snakeweed is found along waterways across the Top End and Gulf regions. Currently within the MRM lease, Snakeweed only occurs at the old homestead.


N
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Legend
MRM Lease Boundaries
Snake Weed
0
2
kilometres

4.10 Noogoora Burr (*Xanthium occidentale*)

4.10.1 Description

Class B Weed

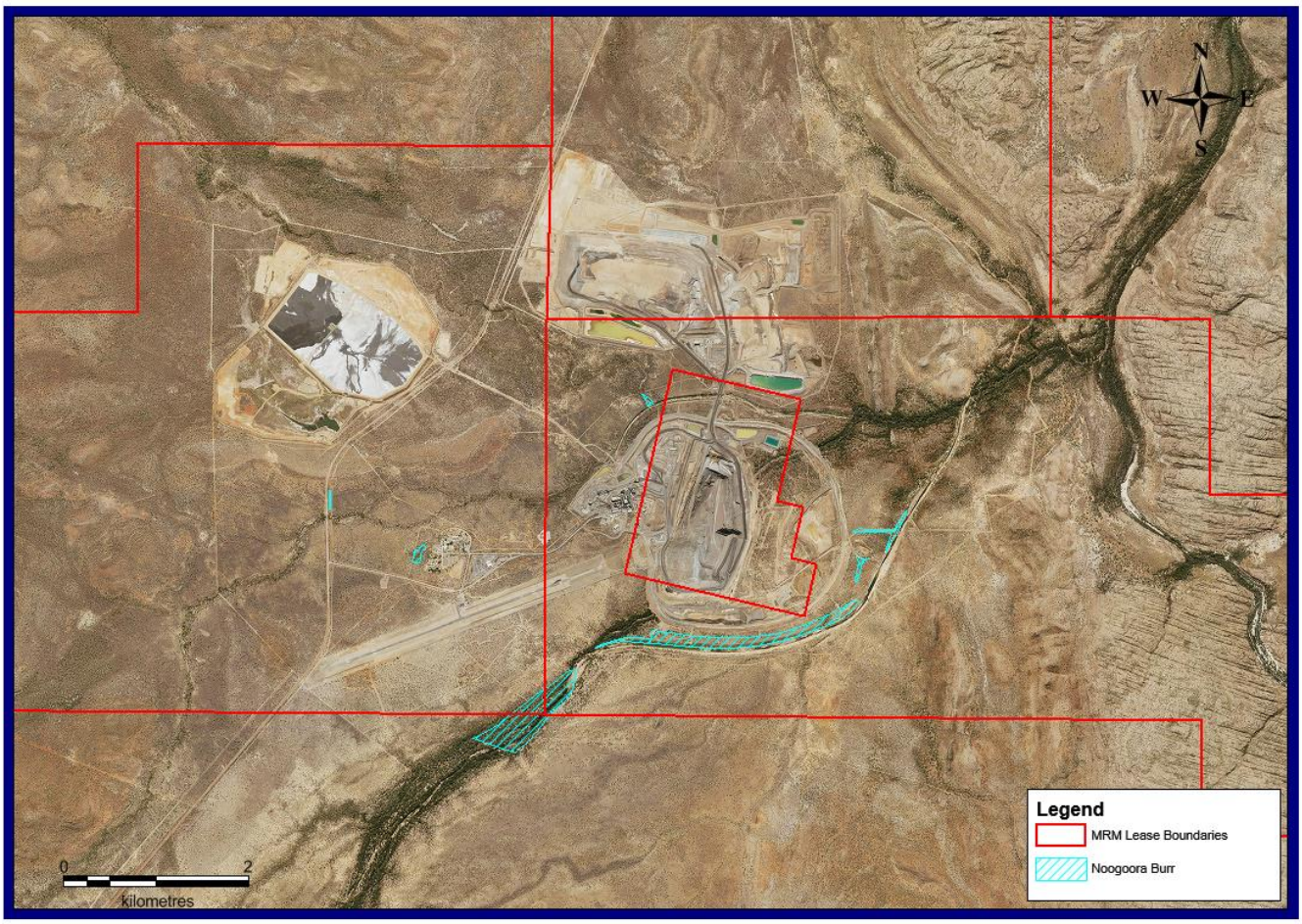
Noogoora burr is a sparingly branched annual plant to 2m. The stems and leaves have a rough texture. The leaves are dark green, alternate, and 10 to 15 cm in diameter with three to five irregular toothed lobes. Female flowers grow in leaf axils and produce clusters of burrs with hooked spines. Each burr turns brown when mature and contains two oblong seeds. One of these seeds will germinate in the first season, while the germination of the second seed will not occur until conditions are suitable.

FIGURE 31: NOOGOORA BURR LEAF (SOURCE: QLD GOVERNEMNT)

FIGURE 32: NOOGOORA BURR FRUIT (SOURCE: QLD GOVERNEMNT)

4.10.2 Location

In the Northern Territory, Noogoora burr is now established on several of the major river systems, including the Calvert, Daly, Mainoru, McArthur, Victoria and West Baines. Noogoora burr on the MRM leases was previously concentrated along the banks of the McArthur River and associated floodplain areas, but it is now establishing away from waterways and has been found in the MRM camp area.


N
W
E
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Legend
MRM Lease Boundaries
Noogoora Burr
0
2
kilometres

4.11 Chinese Apple (*Ziziphus mauritania*)

4.11.1Description

Class A Weed

Chinee Apple is a large shrub or small spreading tree to 12m (Pitt 1998b). Branches grow densely in zigzag patterns with a leaf and a sharp straight or slightly curved thorn at each angle (Pitt 1998b). The leaves are alternate, to 4cm long, with a toothed margin, glossy green above and light brown below. Clusters of small greenish-yellow flowers form in the leaf axils prior to the development yellow or reddish brown fruit (Pitt 1998b).

FIGURE 33: CHINESE APPLE

FIGURE 34: CHINESE APPLE FLOWERS

4.11.2 Location

With only one small population occurring near the Bing Bong Port facility, the 2013 control program was undertaken to remove, cut and paint all plants. No further treatments have been necessary; however the area continues to be monitored. No Chinese Apple was found on either Bing Bong Loading Facility or McArthur River Mine during 2012 – 2017, but the mine remains vigilant to ensure reinfestation does not occur.

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Pitt, J. L. (1998b) Chinee Apple (*Ziziphus mauritiana*), Agnote No. F40, Weeds Branch NRETA. Darwin, Australia

Pitt, J. L. (1999) Bellyache Bush (*Jatropha gossypiifolia*), Agnote No. F22, Weeds Branch NRETA. Darwin, Australia

Pitt, J. L. (2002a) Spinyhead Sida (*Sida acuta*), Agnote No. F44, Weeds Branch NRETA. Darwin, Australia

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van Rangelrooy, D. S. and Flanagan, G. J (1999) Parkinsonia (*Parkinsonia aculeate*) Agnote No. F3. Weeds Branch NRETA. Darwin, Australia

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APPENDIX A NOXIOUS WEEDS LIST

All Class A and B weeds are also considered to be Class C weeds.

Botanical name	Common Name	Area restriction	Class	WONS
Acanthospermum hispidum	Star burr		B	
Acroptilon repens	Creeping knapweed		C	
Ageratina riparia	Mistflower		C	
Alternanthera philoxeroides	Alligator weed		A	
Alternanthera pungens	Khaki weed		B	
Amaranthus dubius	Chinese spinach		C	
Ambrosia artemisiifolia	Annual ragweed		C	
Ambrosia psilostachya	Perennial ragweed		C	
Andropogon gayanus	Gamba grass	Outside B zone	A	Y
Andropogon gayanus	Gamba grass	Inside B zone	B	Y
Annona glabra	Pond apple	Outside B Zone	A	Y
Anredera cordifolia	Madeira vine		C	
Argemone ochroleuca	Mexican poppy		B	
Asparagus aethiopicus	Ground asparagus		C	
Asparagus africanus	Climbing asparagus		C	
Asparagus asparagoides	Bridal creeper		C	
Asparagus declinatus	Bridal veil		C	
Asparagus plumosus	Climbing asparagus Fern		C	
Asparagus scandens	Asparagus fern		C	
Asphodelus fistulosus	Onion weed	Outside B zone	A	
Austrocylindropuntia spp.	Opuntioid cacti		A	
Austroeupatorium inulaefolium	Austroeupatorium		C	
Azadirachta indica	Neem		B	
Baccharis halimifolia	Groundsel bush		C	
Barleria prionitis	Baleria		A	
Boerhavia erecta	Erect spiderling		C	
Brachiaria paspaloides	Common signal grass		C	
Cabomba spp.	Cabomba		A	Y
Calotropis procera	Rubber bush	South of 16°30' S	B	
Carthamus lanatus	Saffron thistle		B	
Cenchrus echinatus	Mossman River grass		B	
Cenchrus polystachios	Mission grass (perennial)		B	
Cenchrus setaceus	Fountain grass		B	
Chromolaena odorata	Siam weed		C	

Chrysanthemoides monilifera	Bitou bush, boneseed		A	
Clidemia hirta	Koster's curse		C	
Coix aquatica	Job's tears		C	
Croton hirtus	Hairy croton		C	
Cryptostegia spp.	Rubber vines		A	Y
Cylindropuntia spp.	Opuntioid cacti, rope cacti		A	
Cytisus scoparius	Scotch broom		C	
Dalbergia sissoo	Dalbergia	North of 18° S	A	
Datura ferox	Longspine thornapple		A	
Datura spp.	Thornapples		C	
Digitaria fuscescens	Common crabgrass		C	
Digitaria insularis	Sourgrass		C	
Diodia sarmentosa	Tropical buttonweed		C	
Dolichandra unguis-cati	Cat's claw creeper		A	Y
Echinochloa glabrescens	Barnyard grass		C	
Echinochloa stagnina	Burgu millet		C	
Echium plantagineum	Paterson's curse		A	
Egeria densa	Dense waterweed		C	
Eichhornia crassipes	Water hyacinth		A	Y
Elodea canadensis	Canadian pondweed		C	
Emex australis	Spiny emex		B	
*Equisetum spp***	Horsetails		C	
Eriocaulon truncatum	Short pipewort		C	
Eriocereus martinii	Harrisia cactus		C	
Eriochloa polystachya	Carib grass		C	
Fimbristylis umbellaris	Globular fimbristylis		C	
Genista linifolia	Flax-leaved broom		C	
Genista monspessulana	Montpellier broom		C	
Hybanthus attenuatus	Western greenviolet		C	
Hymenachne amplexicaulis	Olive hymenachne		B	Y
Hyparrhenia rufa	Thatch grass		A	
Hyptis brevipes	Lesser roundweed		C	
Hyptis capitata	Knob weed		B	
Hyptis suaveolens	Hyptis		B	
Ischaemum timorense	Centipede grass		C	
Jatropha curcas	Physic nut		A	
Jatropha gossypiifolia	Bellyache bush	Outside B zone	A	Y
Jatropha gossypiifolia	Bellyache bush	Inside B zone	B	Y
*Kochia scoparia****	Burning bush		C	
Lagarosiphon major	Lagarosiphon		C	
Lantana camara	Common lantana		B	Y
Lantana montevidensis	Creeping lantana		B	Y
Leonotis nepetifolia	Lion's tail		B	
Leptochloa chinensis	Red sprangletop		C	
Leptochloa panicea	Sprangletop		C	

Limnocharis flava	Yellow burrhead		C	
Lycium ferocissimum	African boxthorn		A	
Martynia annua	Devil's claw		A	
Miconia spp.	Velvet tree		C	
Mikania cordata	Heartleaf hempvine		C	
Mikania micrantha	mile-a-minute		C	
Mimosa invisa	Giant sensitive plant		C	
Mimosa pigra	Mimosa	Outside B zone	A	Y
Mimosa pigra	Mimosa	Inside B zone	B	Y
Mimosa pudica	Common sensitive plant		B	
Myriophyllum aquaticum	Parrot's feather		A	
Myriophyllum spicatum	Eurasian watermilfoil		C	
Nassella neesiana	Chilean needle grass		A	
Nassella tenuissima	Mexican feather grass		A	
Nassella trichotoma	Serrated tussock		A	
Neptunia oleraceae	Water mimosa		A	
Neptunia plena	Water mimosa		A	
Opuntia spp.	Prickly pears		A	Y
*Orobanche sp.***	Broomrapes		C	
Paederia foetida	Lesser Malayan stinkwort		C	
Parkinsonia aculeata	Parkinsonia		B	Y
Parthenium hysterophorus	Parthenium weed		A	Y
Pereskia aculeata	Leaf cactus		A	
Piper aduncum	Spiked pepper		C	
Pistia stratiotes	Water lettuce		B	
Prosopis spp.	Mesquite		A	Y
Rhodomyrtus tomentosa	Downy rose myrtle		C	
Ricinus communis	Castor oil plant		B	
Rotala indica	Indian toothcup		C	
Rubus fruticose agg.	Blackberry		A	
Sacciolepis interrupta	Cupscale grass		C	
Sagittaria platyphylla	Sagittaria		A	Y
*Salix spp**	Willow		A	
Salvinia cucullata	Salvinia		C	
Salvinia molesta	Salvinia		B	Y
Salvinia natans	Salvinia		C	
Schinus terebinthifolius	Brazilian pepper	North of 18° S	A	
Schinus terebinthifolius	Brazilian pepper	South of 18° S	B	
Schoenoplectus juncoides	Rock bulrush		C	
Scirpus maritimus	Sea clubrush		C	
Senecio madagascariensis	Fireweed		C	
Senegalia catechu	Cutch tree		A	
Senna alata	Candle bush		B	
Senna obtusifolia	Sicklepod		B	
Senna occidentalis	Coffee senna		B	

Sida acuta	Spinyhead sida		B	
Sida cordifolia	Flannel weed		B	
Sida rhombifolia	Paddy's lucerne		B	
Solanum elaeagnifolium	Silver leaf nightshade		C	
Sorghum halepense	Johnson grass		C	
Spermacoce mauritiana	Pacific false buttonweed		C	
Stachytarpheta spp.	Snake weeds		B	
*Striga spp.******	Witchweeds		C	
Tamarix aphylla	Athel pine	Outside B zone	A	Y
Tamarix aphylla	Athel pine	Inside B zone	B	Y
Themeda quadrivalvis	Grader grass		B	Y
Trapa spp.	Floating water chestnuts		C	
Tribulus cistoides	Caltrop		B	
Tribulus terrestris	Caltrop		B	
Ulex europaeus	Gorse		A	
Vachellia nilotica	Prickly acacia		A	Y
Xanthium spinosum	Xanthium spinosum		B	
Xanthium spp.	Burrs		C	
Xanthium strumarium	Noogoora burr		B	
Ziziphus mauritiana	Chinee apple		A	

* Except *S. babylonica* (weeping willow), *S. X calodendron* (pussy willow) & *S. X reichardtiji* (sterile pussy willow).

** All including *E. ramosissimum*.

*** All subspp. Except *subsp. trichophylla*.

****All except *O .minor and O. cernua var. australiana*.

***** All non-indigenous, including *S. angustifolia and S. asiatica*.

APPENDIX B WEED SPECIES LIST AND TREATMENT TABLE

Family	Botanical name	Common name	Legal Status	Primary treatment	Timing	Ongoing management
ASTERACEAE	*Xanthium strumarium*	Noogoora Burr	Class B and C	**Seedling and adults :** Foliar spray using a Glyphosate 360 g/L product at a dilution rate of 15 mL / 1L	When actively growing (Dec-April)	Spot spray regrowth and seedlings. Hand removal smaller specimens as required.
EUPHORBIACEAE	*Jatropha gossypiifolia*	Bellyache bush	Class B and C	**Seedling's :** Foliar spray using a Fluroxypyr 200 g/L product at a dilution rate of 500 mL / 100 L Or Metsulfuron-methyl 600 g/kg product at a dilution rate of 10 g / 100 L.	When actively growing (Dec- April)	Slashing prior to flowering/seeding will reduce spread. Spot spray seedlings combined with hand removal.
				Adults : Cut stump or basal bark treatment using Fluroxypyr 200 g/L based product Or Foliare spray with Metsulfuron-methyl 600 g/kg based product at a dilution rate of 10 g / 100 L.		
				Seedling and adults: Controlled fires can kill seedlings, and hand held burners aimed for at least 10 seconds around the base of each plant can kill mature plants		
FABACEAE	*Leucaena leucocephala*	Coffee bush		**Seedlings :** basal bark treatment using a Fluroxypyr 333 g/L product at a dilution rate of 1.8 L / 100 L (diesel) for plants < 15cm stem diameter, 45cm tall	When actively growing (Dec- May)	Spot spray regrowth and seedlings. Hand removal smaller specimens as required.
				Adult: Cut stump > 15 cm stem diameter using either Fluroxypyr 333 g/L product at a dilution rate of 1.8 L / 100 L (diesel) Or Glyphosate at a dilution ratio 1:1 of water		
	Parkinsonia aculeata	Parkinsonia	Class B and C	**Seedling and adults :** Apply basal bark to plants < 5 cm stem diameter at		Blade-ploughing, stick-raking,

Family	Botanical name	Common name	Legal Status	Primary treatment	Timing	Ongoing management
				a dilution rate of 1 L / 60 L (diesel) Or application of their cut stump method for plants for stems > 5 cm stem diameter	Can be targeted all year, for best results March - May	bulldozing and chaining can be effective means of control
				Adult : basal bark treatment using a Fluroxypyr 333 g/L product at a dilution rate of 900 mL / 100 L (diesel) for plants < 10cm stem diameter, 45cm tall Or apply the cut stump method at a dilution rate of 900 mL / 100 L (diesel) for plants > 10cm stem diameter		
LAMIACEAE	*Hyptis suaveolens*	Hyptis	Class B and C	**Seedling and adults :** Foliar spray using a Glyphosate 360 g/L product at dilution rate of 15 mL / 1L	When actively growing (Dec - Mar)	
MARTYNIACEAE	*Martynia annua*	Devil's claw	Class A and C	**Seedling or adults :** Foliar spray using Glyphosate 360 g/L product at dilution rate of 10 mL / 1L	When actively growing (Nov - April)	Small seedlings may be removed by hand, larger plants can be slashed as a means for control
MELIACEAE	*Azadirachta indica*	Neem Tree	Class B and C	**Seedlings :** Foliar spray using a Fluroxypyr 333 g/L product at a dilution rate of 1.8 L / 100 L (diesel) for plants for plants < 15cm stem diameter, 45cm tall	Can be targeted all year, for best results March - May	Monitor for seedlings. Spot spray/ hand remove as required.
				Adult: Cut stump > 15 cm stem diameter using either Fluroxypyr 333 g/L product at a dilution rate of 1.8 L / 100 L (diesel)		
RHAMNACEAE	*Ziziphus mauritiana*	Chinese Apple	Class A and C	**Seedling** : basal bark treatment using a Fluroxypyr 333 g/L product at a dilution rate of 1.8 L / 100 L (diesel) for plants < 15cm stem diameter, 45cm tall	March - May	Spot spray regrowth and seedlings. Hand removal smaller specimens as required.
				Adults : Cut stump treatment using a Fluroxypyr 333 g/L product at a		

Family	Botanical name	Common name	Legal Status	Primary treatment	Timing	Ongoing management
				dilution rate of 1.8 L / 100 L (diesel) for plants > 15 cm stem diameter		
VERBENACEAE	*Stachytarpheta spp*	Snakeweed	Class B and C	**Seedling and adults :** Foliar spray using a Fluroxypyr 333 g/L product at a dilution rate of 450 mL / 100 L. Wetting agent	Dec - March	

APPENDIX C WEED CONTROL TECHNIQUES

Cut and Paint

The cut and paint method is suitable for the control of woody weeds, large herbaceous weeds and vines/climbers (Figure 4). It is commonly used when the biomass is to be removed from the site following the primary weed control. It is most suitable for plants with a small diameter at the base and a single stem or trunk. Where plants have a larger diameter at the base or multiple stems, the drill and fill method may be more efficient.

The plant should be cut as close to the base as possible, below any branches, and the cut should be horizontal. The remaining stump should not exceed 10mm in height. The tools required to make the cut may be a handsaw, secateurs or chainsaw. Any dirt on the stump needs to be removed and the herbicide needs to be directly applied to the stump using a dabber bottle. Some plant species re-sprout after this treatment and follow up work may be required to kill the plant effectively. A non-selective herbicide should be used for the cut and paint method. A non-selective herbicide formulated for use around waters (e.g. RoundUp© Biactive™) is required when working near waterways or sensitive areas.

Stem Scrape

The stem scrape method is used to control vines or woody shrubs and herbaceous weed species.

The stem scrape method involves using a sharp knife to scrape back the top layer of bark from the shrub or vine 20-30cm long. An appropriately mixed herbicide needs to be applied immediately (within 30 seconds) using a dabber bottle. The root system of the plant should not be disturbed until the plant has died as this may reduce the effectiveness of the herbicide. Skirting method may be used in conjunction with stem scrape. This method is especially important to remove large infestations of vines within the canopy layer. Skirting involves cutting the vines within the canopy at chest height. This will allow an increase in the amount of light and resources to the canopy trees through the reduction of plants biomass.

Spot Spraying Grasses and Other Weeds

The most important issue to consider when controlling grasses is to understand their active growing period. Some species are only actively growing in late winter - spring, while other species are actively growing in spring – summer.

The spraying of grasses needs to be undertaken while they are actively growing, but before their flowering season to prevent seed set. Grasses may be slashed using a brush cutter before they are sprayed to remove any dead foliage and to promote the growth of new foliage. The grasses should be sprayed, using a knap-sack sprayer, once new growth has sprouted ensuring herbicide mix is sprayed carefully to prevent off target damage from occurring.

If adjacent to aquatic environments, a non-selective herbicide suitable for use near waterways (e.g. RoundUp© Biactive™) should be used. However, in circumstances away from aquatic environments the use of grass selective herbicides may be suitable to be used (i.e. Fusillade©). The use of a grass selective herbicide will prevent off target damage to broad leaf species. Spray drift should be kept at a minimal and correct handling and application must be followed to ensure non-target impacts on native species. Spot spraying should not be applied close to natural water ways such as the McArthur River, Barney Creek or Surprise Creek.

Spot spraying is also suitable for small patches of emerging saplings. Intensive spraying is usually done during primary weed control and is usually reduced during consecutive weed control.

Hand Removal / Manual Removal

The hand removal or pulling of weeds is suitable for many species of weeds as long as they have a shallow root system. This includes woody weeds, grasses and herbaceous species. It is useful for follow up work on woody

weeds to control seedlings. The hand pulling of weeds involves pulling the plant as close to the base as possible and ensuring the entire tap root is pulled out of the soil. This usually results in soil disturbance and the soil should be replaced and compressed to prevent further weed invasion.

Some weeds require additional effort to ensure the entire regenerative parts are removed; this may require the use of a hand mattock, knife or trowel. Crowning involves using a knife to cut the roots around the crown of the plant.

Management of Weed Waste

All fruiting parts and tubers should be carried off site and composted at the MRM registered green waste disposal facility. Unless otherwise specified, non-fruiting organic waste may remain in-situ. When leaving debris in situ it should be 'rafted'; dead wood should be laid on the ground first then stacked with the cut, living material on top. This keeps the live tips off the ground, preventing them from re-sprouting. Black plastic sheets can be used to accelerate the compositing process.

Herbicide Application

The use of herbicide to control weeds should be carefully considered. Herbicide use should assess potential long-term impacts of the technique including whether the proposed works actually address the source of the weed infestation. However, herbicide application forms an important and useful component of an integrated weed management approach and can be the most appropriate method to control some weed species.

Herbicide use should occur during the active growing season for plants to encourage the chemical uptake into the plant. The selection of herbicides should also consider the type of weed and the location. Where non-selective herbicides are required for use, glyphosate is the most suitable. If herbicides are required to be used near waterways, a glyphosate-based herbicide formulated for use near waterways will be used (e.g. RoundUp© Biactive™).

Broad-leaf selective herbicide may be used as per the Northern Territory Weed Management Handbook (NT Government 2015). However, this type of herbicide is extremely toxic to aquatic life and must not be used in, or adjacent to, waterways. Registration and records must be kept in accordance with the Agricultural and Veterinary Chemicals (Control of Use) Act and Regulations

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