



Weed Control 2022

Higginsville and surrounding areas



Prepared by
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Environmental solutions for

MINING

OIL & GAS

CONSTRUCTION

1.0 INTRODUCTION

Ecotec (WA) Pty Ltd (Ecotec) was engaged by Avoca Mining Pty Ltd, a subsidiary of Karora Resources Ltd, to undertake weed control at the company's Higginsville mine site and surrounding operations.

The intent of this work was to spray identified weeds with suitable herbicide while recording the main locations of infestation using a handheld GPS.

The work was undertaken between 6 and 9 September 2022.

2.0 METHOD

The previous weed mapping (2021) was used to target known weed locations. At the main Higginsville site, the target areas included the camp, the waste water treatment plant, the power station and laydown, the perimeter of the TSF and the haul road south of the TSF for approximately 1.4 km. The areas were inspected on foot, weed locations recorded and herbicide applied. The Chalice site, which was inaccessible due to rain in 2021, was also inspected, mapped and sprayed this year.

Mapping was undertaken using a hand-held GPS unit. Each weed location was marked using codes for the species (Table 2.1) and weed density (Table 2.2).

Table 2.1: Weed species codes.

Code	Scientific name	Common name
Af	<i>Asphodelus fistulosus</i>	Onion weed
Cm	<i>Centaurea melitensis</i>	Maltese cockspur
Mn	<i>Mesembryanthemum nodiflorum</i>	Slender ice plant
La	<i>Lysimachia arvensis</i>	Pimpernel
Rv	<i>Rumex vesicarius</i>	Ruby dock
Sa	<i>Sonchus asper</i>	Prickly sowthistle
Si	<i>Sisymbrium irio</i>	London rocket
Sn	<i>Solanum nigrum</i>	Blackberry nightshade
So	<i>Sonchus oleraceus</i>	Common sow thistle
Sv	<i>Salvia verbenaca</i>	Wild sage

Table 2.2: Weed density scale

Code	Number of individuals
1	<10
2	11-50
3	51-100
4	101-500
5	>500
6	>1000

Weeds were sprayed with herbicide using a back pack sprayer as they were identified. The herbicide mix used has been found to be very effective against a broad range of weed species and comprised:

- Apparent Concussion 540 K (Glyphosate 540 g/L) - a Group M non-selective herbicide
- Kamba M (340 g/L MCPA, 80 g/L DICAMBA) - a Group I broadleaf selective herbicide
- Simazine 900 (900g/kg Simazine) - a Group C pre-emergent herbicide for residual control of weed species
- Pulse Penetrant - a wetter/spreader/penetrant for improved penetration of herbicides
- marking dye

3.0 RESULTS AND DISCUSSION

Ten introduced weed species were identified around the main Higginsville site during the 2022 effort. Five weed species were identified at the Chalice site. The weed species identified are listed in Table 2.1.

Overall, the Higginsville operations are not badly infested with weed species. The weed species that are present across the Higginsville Gold Operations are common throughout the Goldfields Region and are generally spread via wind, surface water movement and livestock. Ruby dock (*Rumex vesicarius*) is the only species considered to be problematic due to its invasive capability in disturbed areas. It is unlikely that ruby dock will be completely eradicated from the site due to the long dormancy of seed (+10 years). Continued regular weed spraying will keep it under control.

Table 3.1 provides the quantities of herbicide used for the weed control work. Figure 3.1 shows the locations where spraying was undertaken.

Table 3.1: Quantities of herbicide used.

Herbicide	Quantity used
Glyphosate	1.2 litres
Kamba	0.15 litre
Simazine	0.5 kg
Pulse	0.4 litre
Marker dye	1 litre

Centaurea melitensis (Maltese cockspur) and *Sonchus oleraceus* (common sow thistle) were the most abundant weed species across the sites. These species are locally prolific in disturbed areas, typically in areas where surface water collects such as road verges, topsoil stockpiles and depressions in rehabilitated areas, but they do not compete well with native species and are generally not invasive. These two weed species were most common around the village, the exploration core yard and the power station. *Sonchus asper* (prickly sowthistle) was recorded in a few locations across the project area.

Rumex vesicarius (ruby dock) was found mainly along the north-western side of the tailings storage facility (TSF). It was also found in relatively low numbers at the Chalice site. Once established, ruby dock is difficult to control and can suppress establishment of native species. Simazine, a pre-emergent residual herbicide, was included in the mix again this year and has been very successful at reducing ruby dock abundance at other sites. There has been a decrease in the number of ruby dock plants present compared to 2021. It is recommended that the areas where ruby dock was located are inspected regularly over spring and summer, particularly in the weeks following rainfall. Plants should be sprayed with herbicide or manually removed prior to setting seed.

Asphodelus fistulosus (onion weed) was again found along the eastern perimeter of the TSF. It is a short-lived perennial species and moderately invasive in disturbed areas. The plants leave sub-surface bulbs from which new plants emerge. Simazine, which persists in the surface soil for around 12 months, along with glyphosate should assist in reducing the

abundance of this species. The affected areas will be inspected again in 2023 and an alternate herbicide such as Metsulfuron will be tried if the herbicides used this year have not been successful.

Mesembryanthemum nodiflorum (slender ice plant) was found in high numbers in very localised patches, predominately around the village in 2021. This species is quite water dependent and not invasive. It is typically short lived however seeds prolifically and will return in abundance under the right conditions.

Lysimachia arvensis (pimpernel) was found in low numbers across the site. It can be common throughout undisturbed vegetation following sufficient rainfall but is not invasive.

Salvia verbenaca (wild sage) was found to the south of the TSF in an area of rehabilitation. While it can be locally abundant it is not an invasive species and generally remains fairly localised.

Carrichtera annua (Ward's weed) is found across the site. It is very common in disturbed areas throughout the Goldfields Region and is extremely difficult to eradicate. While it can be locally abundant, Ward's weed is short lived and does not outcompete native species. Ecotec does not consider it worthwhile targeting this species unless it is with other weeds of greater concern.

Figure 3.1 and Figure 3.2 provide the location of weed species recorded during the 2022 effort. The symbols are sized to provide a representation of the relative abundance of the dominant weed species encountered at each location. The GPS data can be provided if required.

It is recommended that inspection and spraying is continued as a minimum at annual intervals to ensure ruby dock in particular is kept under control. While Maltese cockspur, onion weed and the sowthistles are unlikely to ever be eradicated from the site, regular and continued treatment will reduce their abundance.

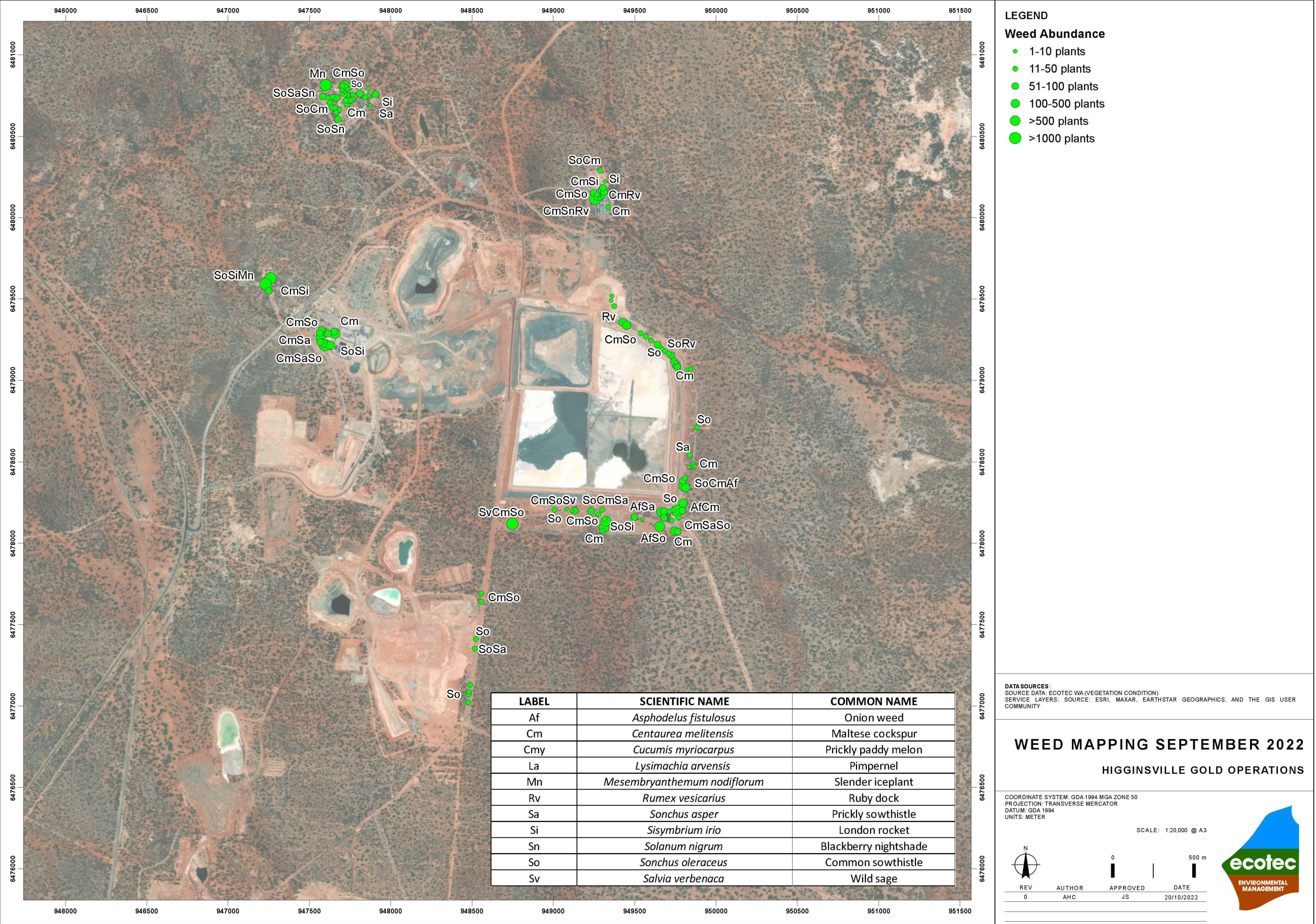


Figure 3.1: Weed locations September 2022 – main Higginsville operations.

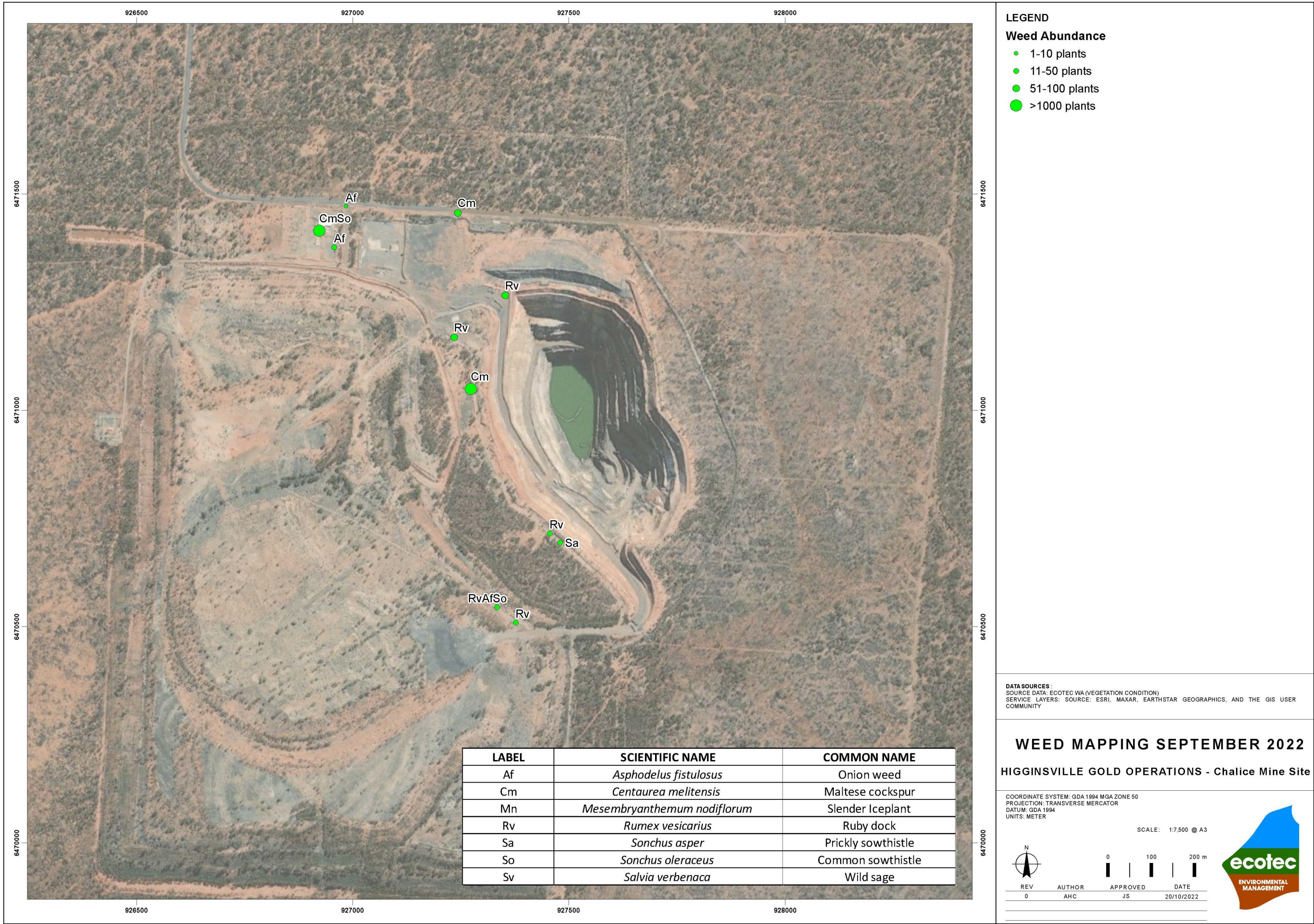


Figure 3.2: Weed locations September 2022 – Chalice mine site.