

Weed Management Plan

Ginninderry Conservation Corridor



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Contents

1. Introduction	4
1.1. Weed survey	6
1.2. Weed inventory	6
1.3. Weed monitoring and surveillance.....	7
1.4. Current weed management program.....	7
2. Weed management methods	10
2.1. Chemical methods	10
2.2. Fire	10
2.3. Physical or mechanical removal.....	10
2.4. Grazing	11
2.5. Biological control	11
2.6. Hygiene	12
3. Weed profiles and management plans.....	12
3.1. African Lovegrass (<i>Eragrostis curvula</i>) - ALG	13
3.2. Bathurst-burr (<i>Xanthium spinosum</i>)	15
3.3. Blackberry (<i>Rubus fruticosus</i>).....	17
3.4. Sweet Briar Rose (<i>Rosa rubiginosa</i>)	20
3.5. Firethorns (<i>Pyracantha</i> spp.)	22
3.6. Hawthorn (<i>Crataegus monogyna</i>)	24
3.7. Great Mullein (<i>Verbascum thapsus</i>)	26
3.8. Paterson’s Curse (<i>Echium plantagineum</i>).....	28
3.9. Saffron Thistle (<i>Carthamus lanatus</i>)	30
3.10. Serrated Tussock (<i>Nassella trichotoma</i>)	32
3.11. St John’s Wort (<i>Hypericum perforatum</i>) - SJW	34
3.12. Willows (<i>Salix</i> spp.)	36
3.13. Weed Infestation Risk Levels	38
3.14. Table 1: Weed Control Calendar (modified from Molonglo Catchment Group, undated)...	41
4. References:	42

List of Abbreviations

Abbreviation	Definition
ACT	Australian Capital Territory
ALG	African Lovegrass (<i>Eragrostis curvula</i>)
BGW or Box-Gum Woodland	White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland
DoEE	Department of the Environment and Energy (now Department of Agriculture, Water and the Environment)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cwth)
EPSDD	Environment, Planning and Sustainable Development Directorate (formerly the Environment and Planning Directorate)
GCC	Ginninderry Conservation Corridor
GAAG	Ginninderry Aboriginal Advisory Group
GCT	Ginninderry Conservation Trust
GCCMP	Ginninderry Conservation Corridor Management Plan 2018-2023
NSW	New South Wales
NTG or Natural Temperate Grassland	Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT
RFS	Rural Fire Services
PCS	ACT Parks and Conservation Service
PTWL	Pink-Tailed Worm Lizard (<i>Aprasia parapulchella</i>)
SJW	St John’s Wort (<i>Hypericum perforatum</i>)
WMP	Weed Management Plan

1. Introduction

This weed management plan (WMP) will guide the treatment of weeds and provide a best practice approach to weed management. The WMP has drawn heavily on existing information from the Weed Management Plan for Proposed Riverview Development West Belconnen (Butler, 2014), [Environment, Planning and Sustainable Development Directorate \(EPSDD\) Invasive Plants Plan 2020-25](#) and other Government information. The WMP will primarily be a spatial plan that is dynamic and easily reviewed for reporting purposes. The WMP gives priority to controlling the most invasive weeds where there are significant infestations, where there is potential for increased weed spread and where weed species pose a high risk to areas of high conservation value such as Pink-tailed Worm Lizard habitat. Weed priorities will change year to year or season to season given climate conditions and other influencing factors.

The current area of the Conservation Corridor is 240 ha within the ACT. The total Corridor area as defined by *Figure 1*. incorporates the eastern part of the former Woodstock Nature Reserve. It incorporates approximately 1.5 km of Murrumbidgee River frontage. A surveillance program will be enacted to enable the swift detection of any new incursions of weeds.

This WMP is an adaptive management plan, which;

- Identifies species that impede conservation goals;
- Considers priorities based on potential impacts on native flora and fauna; and
- Includes weed management plans for key species.

The control methods recommended in the Weed Management Plan are consistent with the requirements of the Pest Plants and Animals Act 2005, the ACT Weeds Strategy and noxious weed control requirements in the ACT and in NSW under the Noxious Weeds Act 1993.

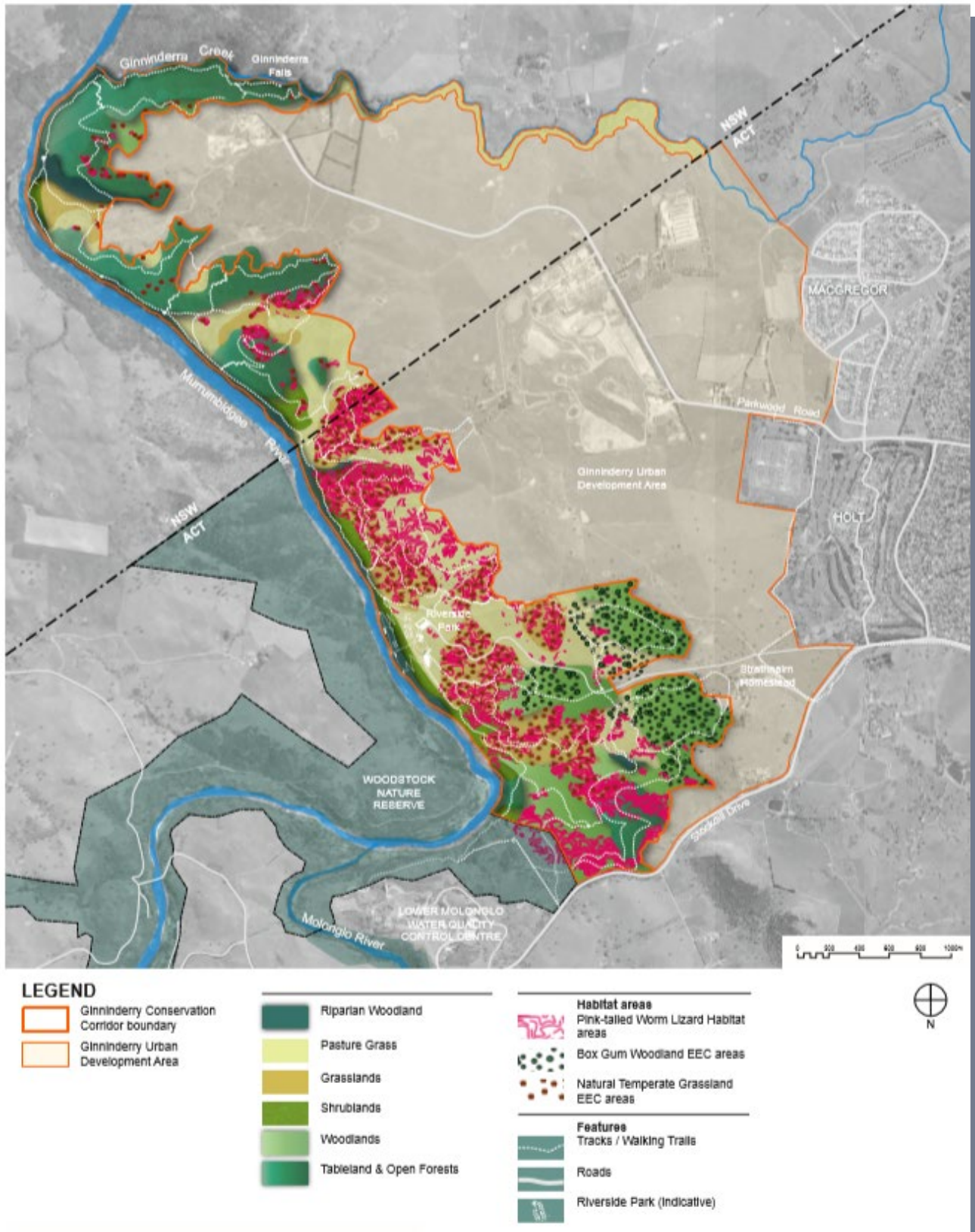


Figure 1: Map of the Ginninderry Conservation Corridor and ecological values (TRC Tourism Ltd (September 2018). Ginninderry Conservation Corridor 2018-2023 Management Plan)

1.1. Weed survey

An ongoing weed mapping survey is being conducted by walking the Conservation Corridor and mapping the locations of the weeds using Survey 123 (ArcGIS). Ongoing surveying will inform management actions and provide data on what weed management has been completed, when it needs to be reviewed and to help detect new incursions. Most species are scattered and widespread, so the general areas of occurrence were mapped. An approximation of the density of the infestation was undertaken using the mapping software and the management action required was recorded. Included in this report is a section on the status of each weed species and details the method used to control it.

1.2. Weed inventory

There are many exotic species throughout the Conservation Corridor. Most of the species recorded are well established and abundant in areas that have been intensively disturbed, for example, old stock camps where nutrient levels are unnaturally high. It would be unrealistic and impractical to aim for eradication of all non-native species. A more considered approach is required. For this reason, the following table only records the significant weeds of the study area that need to be addressed.

Species	Common Name	Comments
<i>Eragrostis curvula</i>	African Lovegrass	Widespread throughout the Corridor. High to moderate densities. Some occurrences in high quality grasslands.
<i>Xanthium spinosum</i>	Bathurst Burr	Scattered through the Corridor. Plants found along fence-lines or near gates where cattle gather.
<i>Rubus fruticosus</i> (sp. agg.)	Blackberry	Widespread throughout the Corridor with high densities along the stream systems and drainage-lines. Previous management of Blackberry is evident, with resprouting occurring with most plants. Seedling plants are present.
<i>Rosa rubiginosa</i>	Briar Rose	Scattered throughout the Corridor. Previous signs of management evident with resprouting occurring with some plants. Not prolific, but some new scattered seedlings observed.
<i>Pyracantha</i> spp.	Firethorns	Scattered throughout the Corridor with high densities along stream systems and drainage-lines.
<i>Crataegus monogyna</i>	Hawthorn	Scattered throughout the Corridor with high densities along stream systems and drainage-lines.

<i>Verbascum thapsus</i>	Mullein	Scattered throughout the corridor with some areas of high density. The species occurs in high quality areas.
<i>Echium plantagineum</i>	Paterson's Curse	Widespread through the Corridor, with large densities in the Box-Gum Woodland and on slopes near Stockdill Drive and in the Cypress-pine (<i>Callitris endlicheri</i>) forest.
<i>Carthamus lanatus</i>	Saffron Thistle	Widespread throughout the Corridor, with high densities in most parts of the Corridor.
<i>Nassella trichotoma</i>	Serrated Tussock	Scattered individuals. Management has been undertaken to control spread.
<i>Hypericum perforatum</i>	St John's Wort	Moderate density to scattered occurrences over a wide area of the Corridor.
<i>Salix</i> spp.	Willows	Scattered along drainage-lines, streams and along the Murrumbidgee River's banks and in the river. Evidence of new recruitment present.

1.3. Weed monitoring and surveillance

Although the WMP focuses on key invasive species throughout the Corridor the Trust is actively surveying other incursions to help with early detection and management. Through the use of Survey 123 (ArcGIS), new incursions are being mapped and monitored. The data collected through Survey 123 includes standard monitoring methods, i.e., mapping, photo points and observational data to support the photo points. Invasive species lists including the preliminary advisory list of invasive plants for the ACT (Sharp & PCS, undated) and [weed risk management assessments](#) (Downey, 2020) are being used to inform on-ground staff about invasive plants of concern. Any new plants that cannot be identified by on-ground staff are mapped in Survey 123 and a photograph is uploaded to Canberra Nature Map. Local residents and volunteers also contribute to the monitoring of weeds using the Canberra Nature Map application. Post-weed-control monitoring will be undertaken to reduce the risk of the incursion recolonising. Monitoring of recovery of native species will also be conducted to show the response of native plant species in areas that have received weed control. The use of the Floristic Value Score (Rehwinkel, 2015) method in selected sites, by applying a 20 m x 20 m plot prior to control and then a year or two after control will enable responses (i.e., a desired increase or undesired decrease in the plot's FVS) to be accurately assessed.

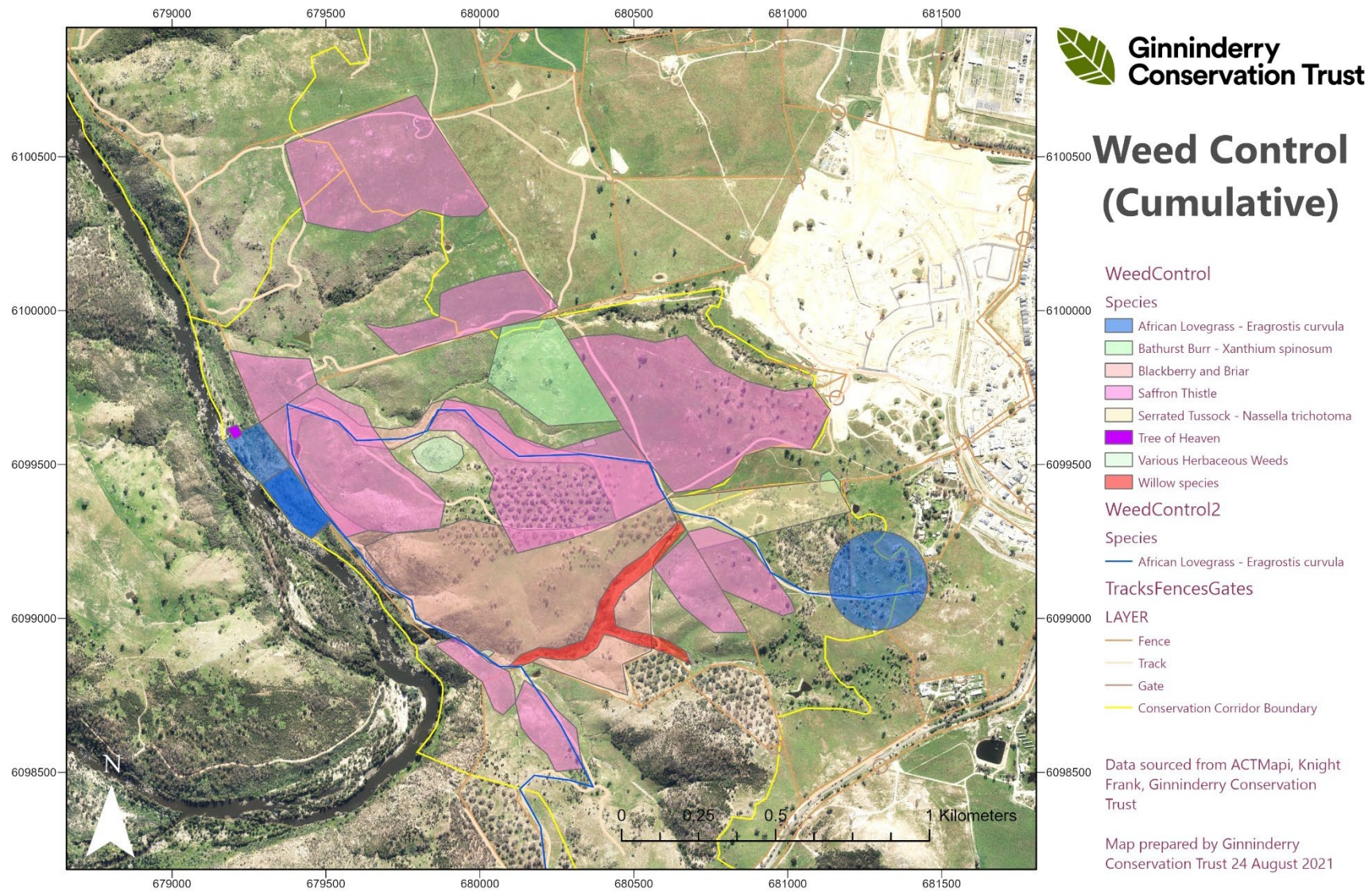
1.4. Current weed management program

Since the Trust's establishment, weed management has been undertaken to control priority weeds. Grazing has been used as a key management tool and cattle have been strategically moved throughout the Corridor to target weedy areas. A grazing trial was undertaken along a section of Murrumbidgee Corridor to control African Lovegrass (*Eragrostis curvula*), followed by spot-spraying and planting of 750 *Poa*, *Casuarina* and *Acacia* plants to strategically shade out ALG-growth and other weed recruitment following their initial knock-down.

Weed management to-date includes:

- Manual removal and spraying of Bathurst Burr;
- Manual removal of Mullein in high quality areas;
- Removal of Tree-of-Heaven (*Ailanthus altissima*) on the riparian zone;
- Weed control on the scrape and sow site;
- Slashing of 32 hectares to control Saffron Thistle; and
- Spraying of Blackberry across sections of the Corridor.
- Spraying ALG along tracks
- Grazing and spraying a section of the Murrumbidgee River

Map of weed management program undertaken to-date (2020 - 2021):



2. Weed management methods

2.1. Chemical methods

The application of herbicides can be used in a variety of ways i.e., broadacre boom-spraying, focused spot-spraying, cut-and-dab and stem injection. Herbicides are to be used during the recommended seasons or growing stages of specific species to be effective. Herbicides are effective for controlling targeted weed infestations by means of working from the perimeters to the core infestations (Butler, 2014). Use of herbicides can be a costly option but is highly effective in the right situations. Herbicides can be impractical where the landscape is inaccessible or where the total area of infestation is too large to achieve appropriate herbicide coverage. This is the case for some areas of the GCC.

Boom-spraying should not be undertaken in grasslands with high diversity, as herbicides that affect herbaceous weeds will also kill native broad-leaved forbs.

It is important to consider alternating the use of chemicals when undertaking continued, year-on-year treatment of specific weeds to ensure that chemical-resistance does not develop in the targeted weeds.

2.2. Fire

Fire can be useful in some circumstances in the promotion of native species (where plants or their propagules are present), but equally, can promote some weed species in situations where they can recruit faster than the desired species (Butler, 2014). Cultural burning (or cool burning) is the traditional Aboriginal practice of reducing biomass loads and assisting native species growth. Cultural burning may have the effect of controlling weed infestations. The practice involves lighting cool-burning fires in small areas, while traversing sites on foot and under appropriate weather conditions. Cultural burns are closely monitored to ensure that only the understorey vegetation is burnt. Cultural burning practices not only clear areas of land, they also provide opportunities for fauna to move out of the way. This technique also does not destroy vital microbes in the soil (Prober et al., 2013). This technique also has the capacity to stimulate germination of certain native species that have a buried seed store, by breaking dormancy of the seeds, either from the effects of the heat or smoke. Cultural burns would be effective in many areas of the GCC, where biomass is dense and there is limited native recruitment. It is recommended that herbicide is used as a follow up treatment, post burning. Any fire used on the site should be in accordance with legislation and environmental considerations being taken into account.

2.3. Physical or mechanical removal

This can include the use of mechanised slashing to prevent seed-set or removal of weeds by other machinery. These methods can be useful as an initial management tool to stop seed-set prior to more permanent management arrangements (Butler, 2014). Physical removal of individual weeds by hand-pulling or with hand-tools is only feasible with small infestations or where the weeds are distributed between sensitive indigenous species. This is the case in some areas of the GCC, where small low densities of invasive weeds are found scattered through

areas of high quality. Physical methods are also most appropriate for low-density stands of woody weeds, using the cut-and-dab technique, i.e., cutting the stems of the tree or shrub near the ground level, and immediately painting the remaining cut surface with herbicide.

*Note that prior to removal of woody weeds, particularly those that occur in dense stands, that are likely to be used as nesting or sheltering habitat or food resources for small passerines should be preceded by prior planting of replacement habitat in the form of suitable indigenous species appropriate to the community. For example, use of dense-foliaged or prickly *Acacia* spp. or dense plantings of Sweet Bursaria, *Bursaria spinosa* or cassinas, *Cassinia* spp., is recommended. The replacement plantings should be allowed to attain a suitable size and density to provide alternative habitat prior to removal of the woody weeds. Alternatively, the dead material resulting from sprayed woody material could be left on site while alternative habitat is establishing, with the dead material providing nesting habitat and shelter in the interim.

2.4. Grazing

Strategic grazing has been the main weed control method used in the Corridor to-date. Strategic grazing includes moving stock through the paddocks to graze down weeds before seed set, reduce biomass and crash graze areas that will receive chemical treatment. Stock will be prohibited from high quality native grasslands to reduce the spread of seeds. Alternatively, grazing stock could be held in temporary electric fenced enclosures for a period prior to letting them onto such sites, to enable them to empty out any seeds of weeds that they may be carrying, prior to allowing them on to sensitive areas. Grazing will be avoided, i.e., to allow for strategic rest periods, when native forbs and grasses are in establishment phases, or when they are actively growing prior to flowering, during their flowering season and while seeding (Biodiversity Conservation Trust, 2018). Grazing needs to be managed carefully to prevent overgrazing of grasslands, as exposing bare soil will provide sites for invasive exotic species to establish new infestations.

2.5. Biological control

Biological control is the use of legislatively approved predators and pathogens to reduce and control weed populations. It is an economical method of weed-control if bio-agents are available and can be established in the required area (Butler, 2014). Biocontrol will not eradicate invasive species. However, this technique will help reduce the level of weeds which can then be controlled using other methods. Inundative biological control uses plant pathogens such as fungi, including rusts to control a weed-incursions. Inundative control is generally species-specific and has a short active period. Classical biological control uses the release of insects, rusts and mites into the target weed incursion (NSW Department of Primary Industries, 2018).

Biological control is practical and effective for:

- Inaccessible areas such as heavily wooded, rocky and steep locations;
- Sensitive aquatic areas where biocontrol is the only option; and
- Situations where chemical control may be inefficient or expensive.

2.6. Hygiene

One of the first and most feasible ways of preventing weed-spread is taking actions to clean machinery, vehicles and footwear, and limiting stock-access in clean areas (Butler, 2014). Realistically, these hygiene measures are often seen to be impractical and inconvenient to be implemented regularly. The Trust may consider construction of a washdown facility specifically for the purpose of cleaning down the machinery that is being used to slash areas of heavy infestations of weeds.

Should large infestations of seeding exotic grasses occur and they are targeted for slashing, then the slasher should be thoroughly cleaned in a washdown facility, constructed in an area situated away from sensitive sites. Machinery could then be effectively washed prior to its use on areas that are free from specific weeds. This is particularly appropriate when dealing with seeding African Lovegrass.

The use of temporary electric fencing to clean out stock prior to their use to strategically graze sensitive grasslands has been mentioned above.

3. Weed profiles and management plans

The following management plans address Weeds of National Significance (WONS) and weeds that are dominant within the Conservation Corridor.

3.1. African Lovegrass (*Eragrostis curvula*) - ALG



Figure 2: ALG habit (WA, 2016)



Figure 3: Mature ALG seed head (WA, 2016)

African Lovegrass (ALG) is commonly present within the GCC. The complete eradication of large infestations of ALG is not feasible. The best that might be achieved is containment and a reduction in overall densities through a combination of control methods.

Growing information:

- ALG grows between September and May;
- New seedlings appear between October and March;
- Flowering occurs between September and December, or even later in favourable seasons; and
- Seeding occurs from January – March, or even later in favourable seasons.

Prevention of spread:

- Clean vehicles that have passed through infested areas;
- Do not take contaminated vehicles through areas of high-quality native vegetation;
- Limit animal movement from infested areas into clean areas;
- Slash or spray tracks;
- Revegetate areas that have been sprayed-out to create competitive cover; and
- Continue the grazing regime before seeding occurs. Seeds are present on the plants from mid-summer to autumn, or even later in favourable seasons.

Control methods

Manual removal: Physical removal is only feasible if there are small isolated infestations of ALG. If undertaking chipping, all parts of the plants, especially the flowering stems, should be bagged and destroyed appropriately (WA, 2011).

Chemicals: Spot-spraying should be undertaken from September to March when the plants are growing or when new seedlings appear.

The most effective herbicide to kill ALG is flupropanate (e.g., Taskforce®). Flupropanate is slow acting and has a residual effect. Although effective at any time of the year, it is best to spot-spray in spring and summer, and to avoiding spraying in winter (NSW Department of Primary Industries, 2018b). It can take up to 18 months to kill the plants. Check the chemical factsheet for the withholding period, to ensure cattle do not become ill.

Glyphosate will also kill African Lovegrass. Apply to actively growing plants in spring and summer. Use glyphosate to kill any regrowth (NSW Department of Primary Industries, 2018b)

Fire: The use of fire is recommended in conjunction with chemical spraying. Burning of ALG can be undertaken in winter and should be followed up with chemical control when regrowth appears. The burnt area should be reseeded with native species (either grasses and forbs or trees and shrubs, according to the appropriate community) to create competition.

Grazing: Controlled rotational grazing should be undertaken from September to May when the plants are young and green. If any grazing should be planned, stock should be held for up to 14 days on clean improved pasture areas to enable them to empty out if there is a risk that they may have been on pastures containing ALG. This will assist in preventing dispersal of African Lovegrass seeds. A follow-up is required between spring and autumn using other control methods.

Revegetation: Any removal of ALG over large areas requires revegetation program over such areas to avoid ALG recruiting in the bare areas that remain.



Figure 4: Approximate distribution of ALG in the GCC (February 2021)

3.2. Bathurst-burr (*Xanthium spinosum*)



Figure 5: Bathurst-burr habit (BCC, n.d)



Figure 6: Young burrs, which contain the seeds (BCC, n.d)

Bathurst-burr is dispersed in isolated patches throughout the Corridor, particularly along fence-lines and farm gates where cattle have gathered. Overall numbers of these plants can be controlled with a combination of control methods.

Growing information:

- Bathurst Burr is an annual plant that grows between late November to March;
- The plants flower between January and March and produce up to 150 burrs per plant; and
- High risk areas for new infestations include flood-prone areas, fence lines and near gates.

Prevention of spread:

- Clean vehicles that have passed through infested areas;
- Do not take contaminated vehicles through areas of high-quality native vegetation;
- Limit animal movement from infested areas into clean areas;
- Revegetate areas that have been sprayed-out to create competitive cover; and;
- Remove infestations as they occur.

Control methods

Manual removal: Chipping or hand-hoeing is only reasonable for small areas, individual plants or isolated populations. This can be done as an effective follow-up control method.

Chemicals: Spot-spraying is most effectively applied to young plants and should be undertaken before any burrs form from February onwards. Older plants may require repeat applications (NSW Department of Primary Industries, 2014). Bathurst-burr is susceptible to a range of foliar and residual herbicides. From early summer, or before the plant flowers, 2,4-D ester or 2,4-D amine herbicides should be used. When the plants are actively growing, Glyphosate, Grazon™ DS, or Picloram + 2,4-D amine are recommended (NSW Department of Primary Industries, 2014). A list of herbicides can be found [here](#). Once removed, establishing competitive healthy cover will help prevent the plants re-establishing.

Grazing: Livestock do not tend to eat the adult plants. Seedlings of Bathurst-burrs are toxic to livestock and death may result from animals that are feeding on them.



Figure 7: Approximate distribution of Bathurst-burr in the GCC (June 2021)

3.3. Blackberry (*Rubus fruticosus*)



Figure 8: A Blackberry on a drainage line, showing its habitat
GCC



Figure 9: A Blackberry with new growth at GCC

Blackberry is commonly present within the GCC. The complete eradication of large infestations of Blackberry is not feasible. The best that might be achieved is containment and a reduction in overall densities through a combination of control methods. Note that the locally indigenous native Raspberry, *Rubus parvifolius*, occurs alongside infestations of Blackberry in the Corridor. This species is similar to Blackberry, but once identified, is easily distinguished. Those undertaking control of Blackberry should familiarise themselves with the native species to ensure that these plants are not destroyed.

Growing information:

- Blackberry plants have a main vertical root, which grows to a depth up to 4 metres;
- New shoots appear in spring;
- Blackberry seeds germinate mainly between September and November;
- Blackberry does not thrive in heavy shaded sites; and
- There can be up to 13,000 seeds per square metre under a Blackberry bush at the end of a fruiting season.

Prevention of spread:

- Do not allow Blackberries to fruit;
- Do not take vehicles contaminated with Blackberry fruit and vegetative material through areas of high-quality native vegetation;
- Suppress infestations on land adjacent to clean areas; and
- Revegetate areas that have been sprayed-out to create competitive cover (see Section 2.3).

Control Methods

Manual removal: Small Blackberry plants and their root systems should be bagged after removal by digging or chipping. Physical control alone is rarely successful because it is difficult to remove all the roots.

Slashing often spreads Blackberry further by inducing new growth when cut vegetative material is left on site. Such material can develop roots if it comes in contact with moist soil. After slashing, use a follow-up control.

Note on fauna habitat values: As discussed in **Section 2.3 Physical or mechanical removal**, above, woody weeds, particularly where they form dense infestations, may have fauna habitat values (nesting, shelter, food resources). See the recommendations relating to the creation of alternative habitat prior to the removal of dense woody weeds in Section 2.3.

Chemicals: Use of herbicides is the most reliable Blackberry control method and chemical-control can be undertaken between September and April (Agriculture Victoria, 2019). Use herbicides in combination with other control methods. Common application methods include foliar drenching, the cut-and-dab treatment and granular applications. The best time to spray Blackberry is from just prior to the flowering season and then through to autumn (NSW Department of Agriculture, 2019). Young Blackberry plants are readily managed with herbicide and should be treated as soon as they are observed.

Established Blackberry thickets can contain a number of root crowns of varying ages. Large, old crowns are difficult to destroy. When using foliar-absorbent herbicides, ensure the whole thicket is drenched when the plant is actively growing, as this method will be less effective on plants growing under stress under dry conditions or high temperatures. Low temperatures can also limit absorption (NSW Department of Agriculture, 2019a).

After slashing or burning, wait until plants have up to 1 m of regrowth before applying herbicide. Some Blackberry species are more resistant to certain herbicides than others. It is important to identify the specific species of Blackberry before choosing which herbicide is the most effective. The recommended herbicides for Blackberry can be accessed [here](#).

Grazing: Goats can make a start on controlling heavy infestations. Being browsers, goats prefer Blackberry plants over grasses. Cattle will not control Blackberry infestations, but can inhibit the establishment of seedlings.

Fire: Burning does not kill Blackberry plants. However, burning can have the effect to make infestations more accessible for follow-up treatment.



Figure 10: Approximate distribution of Blackberry in the GCC (February 2021)

3.4. Sweet Briar Rose (*Rosa rubiginosa*)



Figure 11: Briar Rose flower and its fruit (a rosehip) (AP, 2021)



Figure 12: Previously managed Briar Rose with resprouting from its base in the GCC

Sweet Briars are scattered throughout the Corridor, with previous signs of management evident. Resprouting is occurring in some of the plants that have received management. The overall numbers of Briar Rose can be controlled with a chemical spraying regime.

Growing information:

- Sweet Briar seeds can remain viable in the soil for up to 4 years;
- Root pieces and disturbed crowns of Sweet Briar can also produce new growth by sprouting at the base of the plant, or from suckers from the roots;
- The extensive roots are at least 1 m long and are usually confined to within the top 30 cm of soil;
- Flowers usually appear in late spring and are pale pink and white; and
- Sweet Briar fruits, the rosehips, appear in autumn.

Prevention of spread:

- Avoid letting the plant fruit; the seeds of Sweet Briar are dispersed by birds after they consume the rosehips;
- Remove small plants immediately; and
- Revegetate areas that have been sprayed-out to create competitive cover (but see Section 2.3).

Control methods

Chemicals: Applying chemicals through foliar spraying is more effective when the plants are actively growing. Chemicals should be thoroughly applied to the whole plant. Generally, this method should be used during late spring to early autumn (NSW Department of Primary Industries, 2017a). The plants should be in full-leaf (i.e., well-prior to leaf fall). For effective results, do not treat infestations during hot, dry summer periods or when the plants are stressed from drought, waterlogging or cold, or when the plants are leafless (i.e., during winter, or after a drought has broken, but the plants have not yet responded).

The cut-and-dab technique is another method of removing Sweet Briars. In cut-and-dab applications it is important to apply the chemical immediately to the cut stem. This technique is appropriate for small infestations in environmentally sensitive locations (NSW Department of Primary Industries, 2017a) and is most suitable for large plants with stems greater than 5 cm in diameter. A list of appropriate herbicides can be accessed [here](#).

Grazing: Sweet Briar is highly palatable to goats, so they can be successful in controlling infestations. Goats will graze both established plants and seedlings, continually defoliating all accessible stems and eventually ringbarking them. This kills established plants and prevents seedlings from establishing. A follow-up application of herbicide may be necessary to kill any resprouting plants.

Mechanical removal: Established plants can be removed by hand grubbing. This is easier and more effective when the ground is wet. The site should be monitored regularly and any regrowth should be treated with repeat cultivations or by spraying with an appropriate herbicide. If this method is used, care should be taken to tamp down the disturbed soil from where the plants were grubbed out, because any patches of disturbed soil are likely to provide ideal recruitment sites for exotic grass weeds and other exotic herbaceous species.

Note on fauna habitat values: As discussed in **Section 2.3 Physical or mechanical removal**, above, woody weeds, particularly where they form dense infestations, may have fauna habitat values (nesting, shelter, food resources). See the recommendations relating to the creation of alternative habitat prior to the removal of dense woody weeds in Section 2.3.



Figure 13: Approximate distribution of Briar Rose in the GCC (February 2021)

3.5. Firethorns (*Pyracantha* spp.)



Figure 14: A previously treated firethorn resprouting



Figure 15: Firethorn leaves and stem

Firethorns are scattered throughout the Corridor, with high densities along stream systems and drainage-lines. The overall numbers of firethorns can be controlled with a cut-and-dab treatment, ideally before the plants go to seed.

Growing information:

- Firethorns produce masses of white flowers in branched clusters during spring and summer; and
- In late summer and autumn, masses of yellow, orange or red berries (according to species) are produced.

Prevention of spread:

- Avoid letting the plant fruit; firethorns are generally spread by birds after consuming berries;
- Remove any small plants immediately; and
- Revegetate areas that have been sprayed-out to create competitive cover (but see Section 2.3).

Control methods

Chemical: The cut-and-dab method can be used on established firethorn plants. They will need to be cut right down to the base of the plant and the cut stumps painted using herbicide. Every exposed woody stump will need to have herbicide applied (NSW Department of Primary Industries, 2018c).

Drilling is also an option. Drill holes 25-30mm deep in the trunk and around 5 cm apart. Drill holes as close to the root zone as possible. Fill the hole immediately with an undiluted glyphosate-based product. Large shrubs will need several holes drilled into each main trunk, or the bark can be chipped around the trunk immediately prior to the application of herbicide.

The recommended herbicides for firethorns are:

- Glyphosate 360 g/L (Roundup®).
- Glyphosate 360 g/L with Metsulfuron-methyl 600 g/kg (various products).

Manual removal: Seedlings can be hand pulled if all the roots can be removed. Removal of flowering or fruiting branches can also be undertaken.

Note on fauna habitat values: As discussed in **Section 2.3 Physical or mechanical removal**, above, woody weeds, particularly where they form dense infestations, may have fauna habitat values (nesting, shelter, food resources). See the recommendations relating to the creation of alternative habitat prior to the removal of dense woody weeds in Section 2.3.

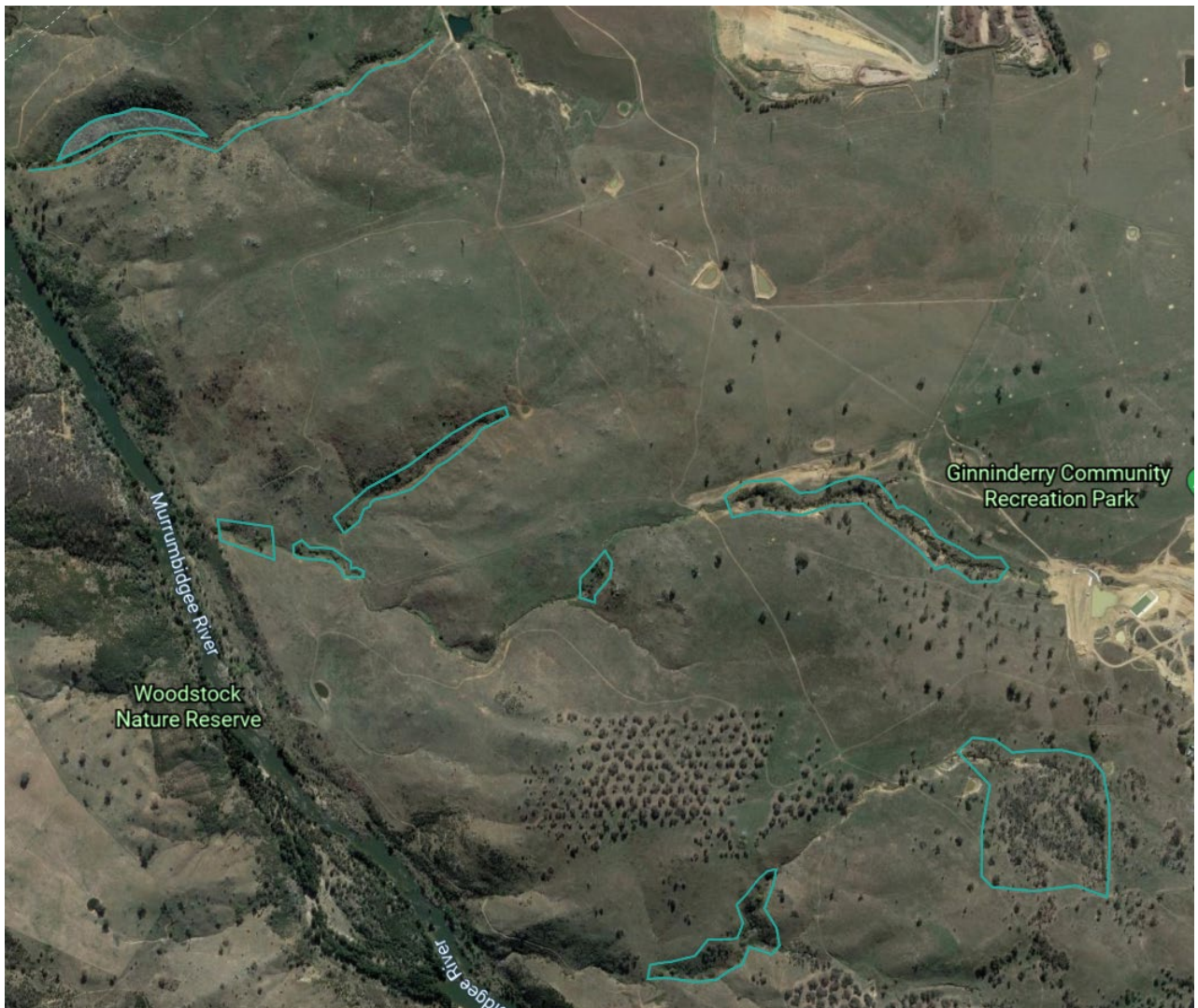


Figure 16: Approximate distribution of firethorns in the GCC (June 2021)

3.6. Hawthorn (*Crataegus monogyna*)



Figure 17: Hawthorn leaves shaped a little like oak leaves



Figure 18: Hawthorn habit (a young tree)

Hawthorns are scattered throughout the Corridor, with high densities along stream systems and drainage-lines. The overall numbers of Hawthorn can be controlled with the cut –and-dab treatment before the plants go to seed.

Growing information:

- Grows 5-10m high;
- Flowers between October and December; and
- Fruits between February and July.

Prevention of spread:

- Avoid letting the plants fruit; Hawthorns are generally spread by birds after consuming the berries;
- Remove small plants immediately; and
- Revegetate areas that have been sprayed-out to create competitive cover (but see Section 2.3).

Control methods

Chemical: The cut-and-dab method can be used on established Hawthorn plants. They will need to be cut right down to the base of the plant and painted using herbicide. Every exposed woody stump will need to have herbicide applied (NSW Department of Primary Industries, 2018d).

Drilling is also an option. Drill holes 25 to 30 mm deep into the trunk and around 5 cm apart. Drill holes as close to the root zone as possible. Fill the hole immediately with an undiluted glyphosate-based product. Large trees will need several holes drilled or the bark can be chipped around the trunk and herbicide applied to the exposed wood.

The recommended herbicides for Hawthorn are:

- Glyphosate 360 g/L (Roundup®).
- Glyphosate 360 g/L with Metsulfuron-methyl 600 g/kg (various products).

Manual removal: Seedlings can be hand pulled if all the roots can be removed. Removal of flowering and fruiting branches can also be undertaken.

Note on fauna habitat values: As discussed in **Section 2.3 Physical or mechanical removal**, above, woody weeds, particularly where they form dense infestations, may have fauna habitat values (nesting, shelter, food resources). See the recommendations relating to the creation of alternative habitat prior to the removal of dense woody weeds in Section 2.3.

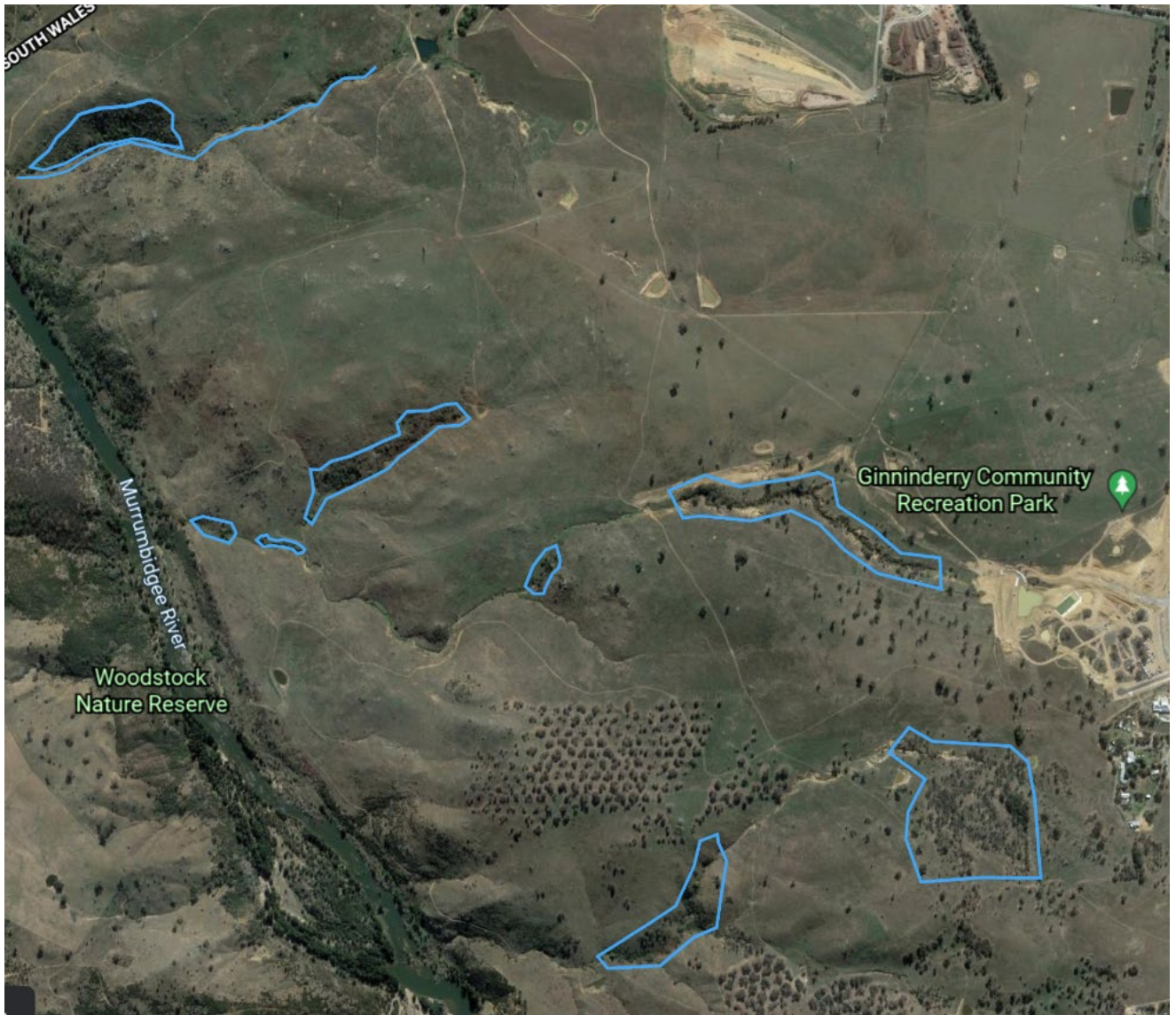


Figure 19: Approximate distribution of Hawthorns in the GCC (June 2021)

3.7. Great Mullein (*Verbascum thapsus*)



Figure 20: Mullein habit (FN,2021)



Figure 21: Mullein flowers (FN, 2021)

Great Mulleins are scattered throughout the Corridor, with high densities present in high quality areas. The overall numbers of Great Mullein can be controlled with regular manual removal. Another species, Twiggly Mullein, *Verbascum virgatus*, a smaller plant, is also likely to be present. It has green, relatively hairless leaves, and similar flower spikes bearing yellow flowers, though on shorter spikes than those of Great Mullein. Control methods for Twiggly Mullein are the same as for the taller species.

Growing information:

- Seeds germinate in autumn and spring, and plants form rosettes of leaves and large taproots during the first summer; and
- During the second spring and summer, plants reach maturity, flower and produce seed.

Spread Prevention:

- Avoid allowing the plants flower and produce seed;
- Suppress infestations on land adjacent to clean areas; and
- Revegetate areas that have been sprayed-out to create competitive cover.

Control methods

Manual removal: Mulleins can be pulled out by hand-tools. Removal of plants should be conducted prior to flowering. Ensure as much of each plant's taproot is removed as possible (WA, 2011).

Chemical: Herbicides (Glyphosate) can be used if applied to the leaves at the rosette stage before flowering.

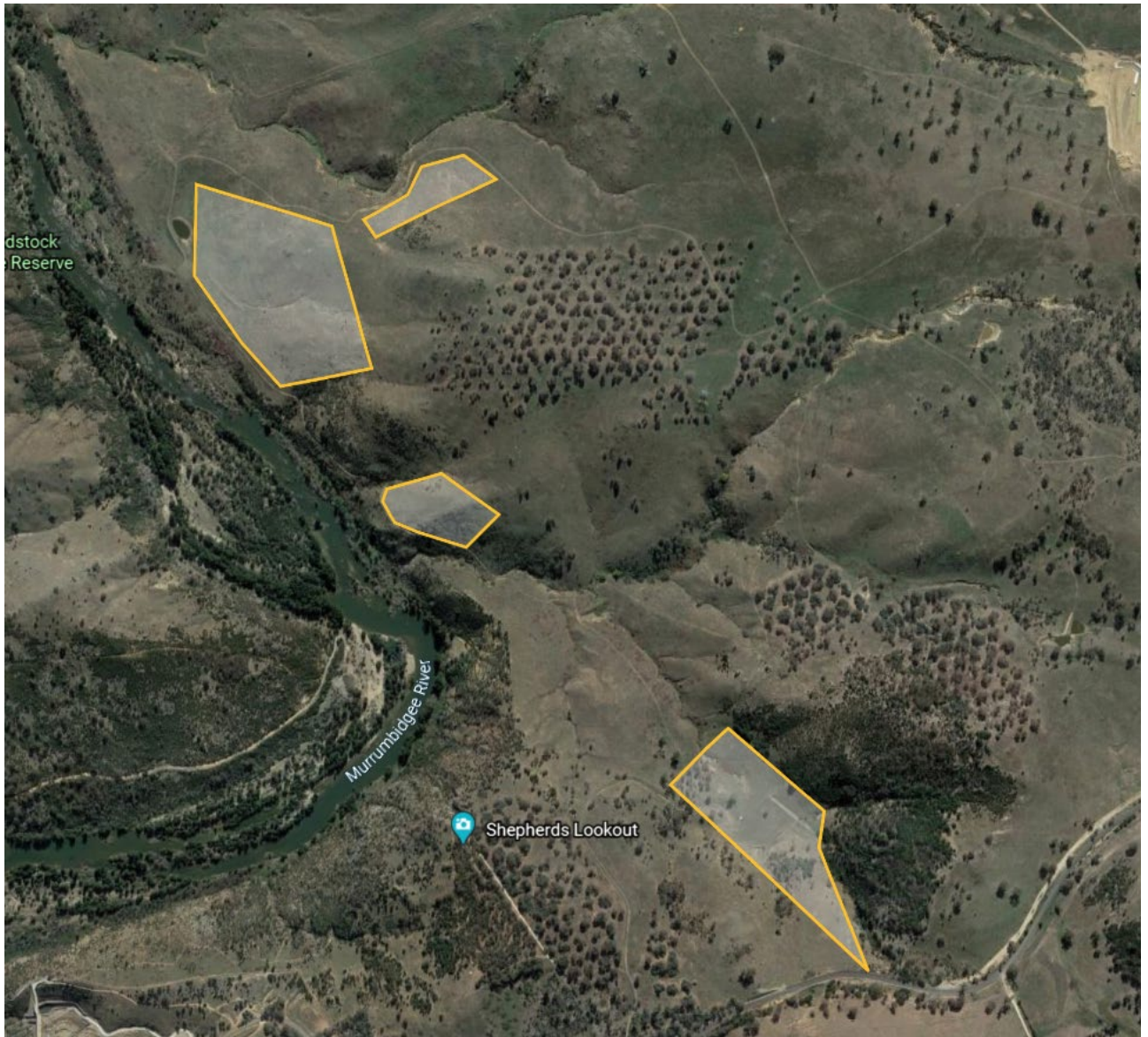


Figure 22: Approximate distribution of Great Mullein in the GCC (February 2021)

3.8. Paterson's Curse (*Echium plantagineum*)



Figure 23: Paterson's Curse habit (WBM, 2015)



Figure 24: Paterson's Curse in flower (WM, n.d)

Paterson's Curse is commonly present within the GCC. The complete eradication of large infestations of the plant is not feasible. The best that might be achieved is containment and a reduction in overall densities through a combination of control methods. As a nitrophile (a plant that responds to increased levels of nitrogen in the soil (Moreau et al., 2013), which is commonly associated with grazed pastures and particularly stock camps), long-term reduction in the soil-nutrient status following the reduction of, or removal of high levels of stock-grazing may ultimately result in reduced presence of this species at GCC.

Growing information:

- Paterson's Curse is an annual or biennial herb;
- Most seed germination occurs between mid-summer and late autumn; and
- Flowers generally appear between September and December.

Prevention of spread:

- Avoid moving stock from infested areas to clean grasslands;
- Clean machinery and vehicles before moving out of infested areas;
- Suppress infestations on land adjacent to clean areas; and
- Avoid allowing the plant go to seed.

Control methods

Manual removal: Paterson's Curse plants can be hand pulled or dug out. This technique is effective for where there are single plants or small patches. Viable seeds are capable of developing on Paterson's Curse plants after they have been pulled, so it is important to remove all plants from site.

Chemical: Herbicides can be useful if applied to the leaves at the rosette stage and before flowering. A list of effective herbicides can be found [here](#) (NSW Department of Primary Industries, 2021).

Biological: There are seven insect species that have been released to attack all of the growing stages of Paterson's Curse plants. More information can be found [here](#).

Slashing: Slashing can be considered as a short-term control method as the plants will quickly regrow. Slashing does not kill the plants, but helps to suppress flowering and weakens the plants as they use up reserves to regrow.

Fire: Burning will kill many seeds of Paterson’s Curse, but it will stimulate others to germinate. Follow-up treatment with cultivation or herbicides may be required.

Grazing: Grazing can be an effective form of control, by weakening the plant and preventing seed-set. Grazing should be undertaken when the plants are young and in the rosette stage (NSW Department of Primary Industries, 2021). Once the plants have flowered, grazing should be stopped.



Figure 25: Approximate distribution of Paterson's curse in the GCC (February 2021)

3.9. Saffron Thistle (*Carthamus lanatus*)



Figure 26: Juvenile Saffron Thistle habit



Figure 27: Saffron Thistle in flower

Saffron thistle is commonly present within the GCC. The complete eradication of large infestations of the plant is not feasible. The best that might be achieved is containment and a reduction in overall densities through a combination of control methods. As a nitrophile (a plant that responds to increased levels of nitrogen in the soil (Moreau et al., 2013), which is commonly associated with grazed pastures and particularly stock camps), long-term reduction in the soil-nutrient status following the reduction of, or removal of high levels of stock-grazing may ultimately result in reduced presence of this species at GCC.

Growing information:

- Saffron Thistle is an annual plant that usually grows to one metre in height;
- It spreads by seed only; and
- Flowers late Spring to Autumn.

Spread Prevention:

- Clean machinery and vehicles before moving out of infested areas;
- Suppress infestations on land adjacent to clean areas; and
- Avoid allowing the plants to flower and go to seed.

Control Methods

Manual removal: Saffron Thistle can be hand-pulled or dug out. This is effective for where there are single plants or small patches. Plants that have been removed need to be disposed of appropriately.

Chemical: Boom-spray application is the most effective method due the density and scale of infestation at GCC. Boom-spraying should be undertaken when the leaves are at the rosette or seedling stage between October and early November (NSW Department of Primary Industries, 2018e).

Boom-spraying should not be undertaken in grasslands with high diversity, as herbicides that affect Saffron Thistles will also kill native broad-leaved forbs.

Spot-spraying can be undertaken if there is a small infestation and is best undertaken when the plant is at the rosette stage. A list of effective herbicides can be found [here](#).

Slashing: Slashing can be considered as a short-term control method as the plants will quickly regrow. Slashing does not kill the plants but it helps suppress flowering and weakens the plants as they use up reserves to regrow.



Figure 28: Approximate distribution of Saffron Thistle in the GCC (February 2021)

3.10. Serrated Tussock (*Nassella trichotoma*)



Figure 29: Serrated tussock habit - taking over paddock (NSW Department of Agriculture, 2019b)



Figure 30: Serrated Tussock with its purple-tinged flowerheads (NSW Department of Agriculture, 2019b)

There are scattered incursions of Serrated Tussock in the GCC. Removal has been undertaken soon after their identification.

Growing information:

- Flowering times can change depending on seasonal conditions.
- Seed heads take about 10 weeks to develop.
- Seeds develop between early and mid-summer.
- Seeds germinate year-round, but most germinate in autumn following rain.
- Some seeds remain viable in the soil for over 3 years.
- Serrated Tussock does not tolerate the heavy shade of tree canopies.

Prevention of spread:

- Avoid moving stock from infested areas to areas that do not support Serrated Tussock;
- Clean machinery and vehicles before moving out of infested areas;
- Suppress infestations on land adjacent to clean areas; and
- Avoid allowing the plants to flower and go to seed.

Control Methods

Manual removal: Manual removal with a mattock can be undertaken in small, isolated patches. Bag and dispose of the pulled-out plants and also dispose of soil attached to roots as it may contain seeds. Tussocks with flowers should be burnt after removal. If removing by hand, tamp down the disturbed soil from where the plants were matted out, because any patches of disturbed soil are likely to provide ideal recruitment sites for exotic grass weeds and other exotic herbaceous species. Replant or sow seeds using indigenous species appropriate to the community where the ground is left exposed bare.

Chemical: Spot-spraying can be undertaken on scattered and small infestations year-round. Glyphosate and Flupropanate herbicides are the most effective and should be applied to plants when they are actively growing in spring (NSW Department of Agriculture, 2019b).

Revegetation: Serrated Tussock does not tolerate heavy shade or competition from other plants. Planting trees with a dense canopy, or native grasses, as appropriate to the site, will help shade out Serrated Tussock and will create competition.



Figure 31: Approximate distribution of Serrated Tussock in the GCC (February 2021)

3.11. St John's Wort (*Hypericum perforatum*) - SJW



Figure 32: Yellow flowers of St John's Wort (NSW Department of Primary Industries, 2018d)



Figure 33: Lateral roots (rhizomatous stems) of St John's Wort, which can resprout by suckering (NSW Department of Primary Industries, 2018d)

St John's Wort (SJW) is commonly found throughout the GCC.

Growing information:

- Seeds are released in autumn and winter. They require mild temperatures and rainfall to develop;
- Seeds can remain viable for 12 years;
- Seedlings appear from autumn to spring; and
- Flowering is present between late October and January.

Prevention of spread:

- Minimise moving stock from infested areas to areas that do not support St John's Wort;
- Quarantine livestock from contaminated areas for five weeks to minimise dispersal of seeds;
- Clean vehicles that have passed through infested areas; and
- Suppress infestations on land adjacent to clean areas.

Control

Physical removal: Physical removal of SJW plants is only feasible in the GCC if isolated or small numbers of plants are noted in areas with low population densities. All parts of the plant, especially the flowers and rhizomatous stems, should be bagged and destroyed appropriately. If physical removal of the plant cannot be done, seed heads can be removed before the seeds drop.

Chemical: Only spray SJW plants when they are actively growing. Seedlings appear between autumn and spring. Flowers appear on mature plants between spring and autumn. Two consecutive years of spraying is often required to kill SJW plants. The deep, extensive root system can survive the first treatment, and the plants can regrow (NSW Department of Primary Industries, 2018d). Spot-spray isolated infestations when SJW plants are flowering (late October to January). It is too late to spray once

the flowers have turned brown. Cover all the foliage with herbicide. A list of herbicides used for SJW can be found [here](#).

Boom-spraying is another option for control. Use boom-sprays between budding of flowers and full flowering (between November to early January). Use selective herbicides if the grassland has a mix of other species. Boom-spraying should not be undertaken in grasslands with high diversity, as herbicides that affect SJW will also kill native broad-leaved forbs.

Slashing: Slashing can be considered as a short-term control method as the plants will quickly regrow. Slashing does not kill the SJW plants, but helps suppress flowering and weakens the plants as they use reserves to regrow.

Biological: The Chrysolina Beetle is an effective form of biocontrol. The larvae and adult insects feed on the leaves of SJW. The larvae feed on winter growth and adults feed on spring-growth (NSW Department of Primary Industries, 2018d). Chrysolina Beetles can form dense populations that will remove all the leaves on SJW plants. This biocontrol is currently being used in the Corridor.

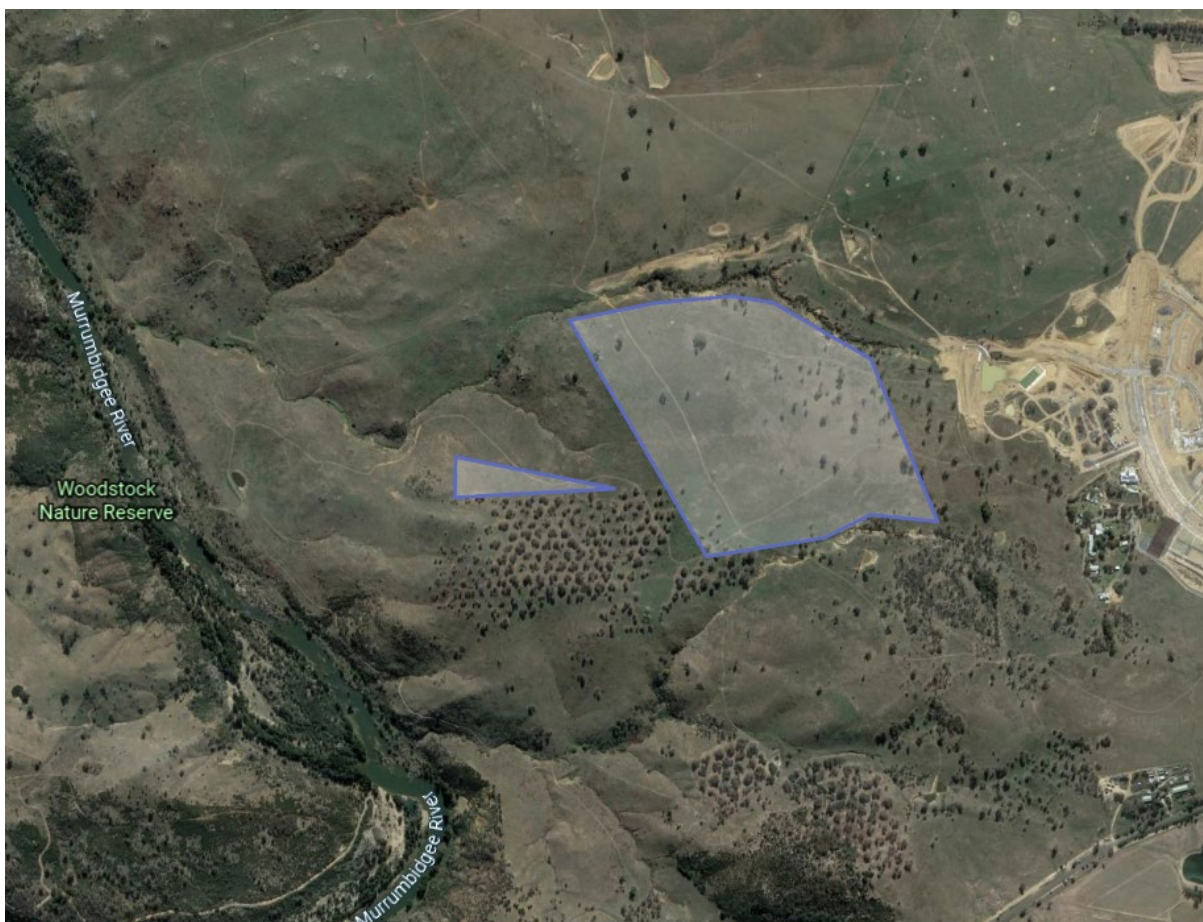


Figure 34: Approximate distribution of St John's Wort in the GCC (February 2021)

3.12. Willows (*Salix* spp.)



Figure 35: A large willow with resprouting growth



Figure 36: A willow growing along the Murrumbidgee River

There are several willow species found in the Corridor, including Grey Sallow (*Salix cinerea*) and Crack Willow (*S. fragilis*). Willows are scattered along the waterways and drainage points. A staged removal ideally should be undertaken from the top of a catchment to reduce recolonisation. This is impossible to achieve along the Murrumbidgee River. However, staged removal is practical in sub-catchments within the GCC. The removal of trees that have no potential to destabilise river- and creek-banks should be undertaken first.

Note that the Weeping Willow, *S. babylonica*, is not strictly considered to be a weed. However, should that species occur in the GCC, then as an alien species, it too could be targeted for control.

Growing information:

- Most willow species spread by fragments of stems or twigs breaking off the parent trees and rooting when they are in contact with moist soil;
- Flowering occurs in spring, with the flowers (catkins) only lasting for 2 or 3 weeks;
- The seeds ripen about 3 or 4 weeks later (in late spring or early summer); and
- Germination occurs rapidly after dispersal, i.e., within 24 hours, and seedlings grow rapidly under favourable conditions.

Spread Prevention:

- Early detection is the most effective way to prevent the spread of new infestations.

Control Methods

Manual removal: Hand pulling of seedlings and rooted branches can be undertaken while the plants are small. Bag and dispose of the pulled-out plants and regularly monitor sites for new growth.

Chemical: Stem-injection is the preferred method for mature plants, as this technique reduces the risk of chemical run-off. Make cuts or drill holes 20 to 30 mm into the sapwood, in a circular pattern around the trunk and near ground-level. The injection points should be single cuts spaced at less than 130 mm intervals, or in holes drilled at 50 to 100 mm intervals, around the circumference of the trunk.

Angle the holes and cuts downwards to minimise herbicide leakage. Herbicide should be immediately injected into each cut or hole at the recommended rate (NSW Department of Primary Industries, 2017b). Leave the tree undisturbed for at least 12 months after application of herbicide to ensure a successful kill.

The cut-and-dab technique is appropriate for smaller trees that can be disposed of safely. Cut as close to the ground as possible and immediately apply herbicide to the cut stump. Remove all material to prevent recolonisation from vegetative material. The cut surface of the removed stem should also be painted with herbicide for safe disposal.

A list of effective herbicides can be found [here](#).

Mechanical removal: For large, dense infestations, the use of a fitted excavator or bulldozer can be used, but only when conditions are dry. Remove all debris from the watercourse to avoid the risk of recolonisation from vegetative material.

Fire: Fire is recommended for the disposal of Crack Willow material that has been cut down. Crack Willow material should be burnt in-situ to avoid the spreading of material that could enable recolonisation (NSW Department of Primary Industries Victorian Department of Primary Industries, 2007). Stack piles tightly outside the flood zones of the river or creeks and allow the piles to dry out for 6 months. Inform the local RFS prior to any proposed burning.



Figure 37: Approximate distribution of willows in the GCC (February 2021)

3.13. Weed Infestation Risk Levels

Priority of control has been determined by the degree of ability for a species to change the conservation values of a site in terms of native plant diversity and richness, including diversity of species, structure and habitat. Weed risk assessment has been informed by the Invasive Plants Program Weed Risk Management Assessments for the Australian Capital Territory (Sharp & PCS, undated) and [30 Post Border Weed Risk Management Assessments for the Australian Capital Territory](#) (Downey, 2020). The Priority Control Action column is to be used to determine the specific priority for the GCC. For example, with ALG the priority would be containment in the heavily infested areas, control on tracks to prevent further spread, and control in areas of high-quality vegetation. Should resources be available to undertake further control through innovative methods, including following grazing or Cultural burning trials, that would be of benefit. However, containment or control, as in the WMP above, are the priorities.

Species	Common Name	Degree of disturbance	Level of invasiveness	Priority control action	Conservation impact
<i>Eragrostis curvula</i>	African Lovegrass	Transformer – a species that transforms a site	Highly invasive	Very high risk. Contain growing infestations and control along tracks and in high quality habitat zones.	Displaces native vegetation and prevents regeneration. Readily forms monocultures in both disturbed and undisturbed sites. Occurs in areas of high conservation value.
<i>Xanthium spinosum</i>	Bathurst-burr	Invasive plant – control dependent on situation	Invasive	Medium to high risk. Contain and control along fence lines and around gates where cattle gather.	Forms infestations more frequently on disturbed sites, with less frequent occurrences in undisturbed sites.
<i>Rubus fruticosus</i> (sp. agg.)	Blackberry	Transformer – a species that transforms a site	Highly invasive	Very high risk. Contain along ridgelines, riversides and drainage-lines.	Displaces native vegetation and prevents natural regeneration. Readily forms monocultures disturbed and undisturbed sites. Harbour for feral pests. Occurs in areas of high conservation value.

<i>Rosa rubiginosa</i>	Sweet Briar	Invasive plant – control dependent on situation	Invasive	Medium to high risk. Contain in isolated patches throughout the Corridor.	Forms infestations more frequently on disturbed sites, with less frequent occurrences in undisturbed sites.
<i>Pyracantha</i> spp.	Firethorns	Invasive plant – control dependent on situation	Moderately invasive	Medium to high risk. Contain and control along drainage-lines and riversides. Control isolated infestations in high quality habitat.	Displaces native vegetation and prevents natural regeneration. Occurs in areas of high conservation value.
<i>Crataegus monogyna</i>	Hawthorn	Invasive plant - control dependent on situation	Moderately invasive	Medium to high risk. Contain and control along drainage line and streams. Control isolated infestations in high quality habitat.	Displaces native vegetation and prevents natural regeneration. Occurs in areas of high conservation value.
<i>Verbascum thapsus</i>	Great Mullein	Invasive plant - control dependent on situation	Invasive	Medium to high risk. Contain and control throughout high quality habitat, in particular PTWL habitat where infestations are growing.	Readily forms infestations in both disturbed and undisturbed sites. Occurs in areas of high conservation value.
<i>Echium plantagineum</i>	Paterson's Curse	Invasive plant - control dependent on situation	Invasive	Medium to high risk. Contain within disturbed pastures and control in high quality habitat.	Potential to displace native vegetation and prevent regeneration. Forms near-monocultures if unmanaged, primarily in disturbed sites. Occurs in in undisturbed sites, for example, in some areas of high conservation value.

<i>Carthamus lanatus</i>	Saffron Thistle	Invasive plant - control dependent on situation	Invasive	Medium to high risk. Contain within disturbed pastures and control in high quality habitat.	Potential to displace native vegetation and prevents regeneration. Forms near-monocultures if unmanaged on both disturbed and undisturbed sites. Occurs in some areas of high conservation value.
<i>Nassella trichotoma</i>	Serrated Tussock	Transformer – a species that transforms a site	Highly invasive	Very high risk. Contain growing infestations	Readily forms monocultures in both disturbed and undisturbed sites. Occurs in areas of high conservation value.
<i>Hypericum perforatum</i>	St John's Wort	Invasive plant - control dependent on situation	Invasive	Medium to high risk. Contain within disturbed pastures and control in high quality habitat.	Potential to displace native vegetation and prevents regeneration. Forms near-monocultures if unmanaged on disturbed and undisturbed sites. Occurs in some areas of high conservation value, mainly in disturbed grassland.
<i>Salix</i> spp.	Willows	Transformer – species that transforms a site	Highly invasive	Very high risk. Contain along and in the river and along streams throughout the Corridor.	Displaces native vegetation and prevents regeneration. Occurs in areas of high conservation value.

3.14. Weed Control Calendar (modified from Molonglo Catchment Group, undated)

	Summer (December to February)								Autumn (March – May)								Winter (June – August)								Spring (September – November)												
	Hand-pull	Dig	Cut (no chemicals)	Graze	Competitive pasture	Cut-and-dab	Drill- and-fill	Spray	Biocontrol	Hand-pull	Dig	Cut (no chemicals)	Graze	Competitive pasture	Cut-and-dab	Drill- and-fill	Spray	Biocontrol	Hand-pull	Dig	Cut (no chemicals)	Graze	Competitive pasture	Cut-and-dab	Drill- and-fill	Spray	Biocontrol										
African Lovegrass																																					
Bathurst-burr																																					
Blackberry																																					
Sweet Briar																																					
Firethorns																																					
Hawthorn																																					
Great Mullein																																					
Paterson’s Curse																																					
Saffron Thistle																																					
Serrated Tussock																																					
St John’s Wort																																					
Willows																																					

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