360 environmental

Railway Dam

Reserve 20939

Management Plan

Prepared for:

Shire of Narrogin

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people • planet • professional

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1 Introduction

360 Environmental Pty Ltd was commissioned by the Shire of Narrogin to develop a Management Plan for the Railway Dam Reserve located south west of the Narrogin town site. The aim of the management plan is to protect as well as enhance the conservation values of the reserve by encouraging sustainable use of the reserve for recreation, education and eco-tourism purposes.

1.1 Background

The Railway Dam was originally constructed in 1912 for the purposes of servicing steam locomotives which required large amounts of water. These steam trains travelled from Beverly to Albany during the early 1900's and used Railway Dam as a re-filling station. Thus the Narrogin town emerged due to the busy train junction and the employment it provided.

After World War II (1940s – 1950s), European immigrants came to Narrogin mainly from Displaced Persons camps in Germany and Italy on the basis that they were to work for the Western Australian Government organisations WA Railways and/or Main Roads (Norwell 2016). The Railway Dam was used as a local water supply for the immigrant camps. After the replacement of steam trains to electric trains, the Railway Dam no longer served a functional purpose. In the 1990s a Jet Boat racing course, Archibald Park, was developed on the Northern side of the dam; however public interest waned and the site was abandoned.

Currently the dam and reserve is used as a picnic spot for locals and tourists.

1.2 Aims and Objectives

The Railway Dam Management Plan (RDMP) has been developed in consultation with the Shire of Narrogin's aims and objectives for the future conservation and management of the reserve.

The objectives of the RDMP are as follows:

- To protect and conserve the native vegetation, flora, fauna and habitats;
- Consolidate work undertaken to date in establishing walking trails and interpretive sites;
- To facilitate, where practical, existing tracks and pathways to be suitable for people with disabilities;
- To rehabilitate areas of erosion located within the reserves and recommended action to prevent future erosion;
- To minimise the impact that reserve users have on the natural environment;

- To minimise weeds, feral animals and the risk of introducing disease to the reserves;
- To minimise the risk of fire damage outside the reserve while maintaining biodiversity; and
- To provide an attractive area in a bushland setting for picnics and passive recreation that highlights local history and preserves environmental values.

2 Site Characteristics

2.1 Site Location

The Railway Dam Reserve is located within the large farming town of Narrogin in the Wheatbelt region of Western Australia. Narrogin is approximately 192 km southeast of Perth on the Great Southern Highway (Figure 1).

Railway Dam Reserve (Reserve 20939) located at Lots 1560, 1133B, 1133 and 1954 corner of Mokine and Federal Streets is zoned "Recreation" under the former Town of Narrogin Town Planning Scheme No 2. The land is vested to the Shire of Narrogin for the purpose of "Parkland and Recreation" and has a total area of approximately 16 hectares.

2.2 Geology and Soils

The very western boundary of the reserve site supports Felsic geological units, whilst the majority of the reserve sites consists of Alluvial geological units (GSWA 2008):

- Felsic Intrusives_74292: Undifferentiated felsic intrusive rocks, including monzogranite, granodiorite, granite, tonalite, quartz monzonite, syenogranite, diorite, monzodiorite, pegmatite. Locally metamorphosed, foliated, gneissic. Local abundant mafic and ultramafic inclusions; and
- Alluvium_38485: Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted.

The soils across the Railway Dam reserve form part of the Narrogin System which can be described as interfluves with significant gradient, aggressively stripped by headward incision, at the headwaters of the Hotham and Blackwood catchments. Numerous dolerite dyke swarms (DAFWA 2012). The soils on the site are red and brown loams, clays and sandy loam duplexes often supporting vegetation including York gums, Jam woodlands with minor wandoo and she-oak (DAFWA 2012).

The bulk of the site is underlain by mafic rocks (gabbro, diorite and mafic gneisses) associated with the Binneringie dyke (large east-west ridge to the north of the dam). Rocks grade to granite in the south west of the site. Soils are predominantly colluvial red-brown loams and loamy duplexes *(D Sawkins 2018, pers. comm. 26 October)*.

2.3 Hydrology

The Railway Dam is located within the Blackwood River basin. Narrogin Brook is located 500 m north east of the reserve site. Currently the Railway Dam is fed by a rainwater-fed catchment which is channelled through various constructed drains leading into the dam (Figure 2).

The groundwater across the reserve has been mapped as having a total dissolved solids (TDS) measure of 14,000 – 35,000 mg/L which is considered to be saline (DoW 2010).

Site observations have indicated that shallow groundwater has created a saline area sparsely covered by introduced Couch Grass (*Cynodon dactylon*) between the weir on the western boundary and the dam inlet that is exposed during most summers.

2.4 Flora and Vegetation

360 Environmental undertook a site assessment of the Railway Dam reserve area to a) determine the current vegetation condition of the site, b) assess the existing facilities onsite and c) to identify areas needing particular prioritization in order to further enhance and conserve the reserve. The vegetation in the reserve has been altered by historical land use and ad-hoc management practices. The land-use of the reserve has been a source of extensive weed infestations, particularly in and around the wetlands, tracks, car park and public access areas. Firebreaks and proximity to the road and unauthorised 4wd and dirt bike access has also contributed to the introduction and spread of weeds and damage to soil structure and vegetation.

2.4.1 Regional Vegetation

The site is within the Katanning Subregion (Avon Wheatbelt) of Interim Biogeographical Regions of Australia (IBRA). Vegetation mapping of WA was completed on a broad scale (1:250,000) by Beard (1972-80). These vegetation units were re-assessed by Shepherd et al. (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units. There is one Beard / Shepherd vegetation unit that intersects the Reserve (DAFWA 2012b). The Shepherd et al. (2001) vegetation association for the site is described below:

- Narrogin_1023: Medium woodland containing York gum, wandoo and salmon gum.

The reserve is within the mapped distribution of the Eucalypt Woodlands of the Western Australia Wheatbelt threatened ecological community (TEC) which is listed as a Critically Endangered under the EPBC Act. The site assessment determined that this TEC was not on the site.

An EPBC PMST database search returned the following threatened species or their habitat may occur within 1 km of the reserve:

- Yornaning Wattle, *Acacia insolita subsp. recurva* (Endangered);
- Wagin Banksia, *Banksia oligantha* (Endangered);
- *Boronia capitata subsp. capitate*, (Endangered);
- Mogumber Bell, Narrogin Bell, *Darwinia carnea* (Endangered);
- Dwarf Bee-orchid, *Diuris micrantha* (Vulnerable); and
- Shy Featherflower, *Verticordia fimbrilepis subsp. fimbrilepis* (Endangered).

The site assessment was not done in spring season and therefore it was not able to be determined whether the above species were present within the reserve.

2.4.2 Flora

A site assessment of the Railway Dam Reserve was undertaken by an experienced 360 Environmental botanist on the 16th of March 2018. A total of 21 taxa (including species, subspecies, varieties and forms) from 17 genera and 8 families were recorded within the site, of these 13 were introduced species. The commonly occurring families were; Poaceae (6 taxa), Myrtaceae (5 taxa) and Asteraceae (3 taxa). The flora inventory is provided Table 1.

The vegetation in the reserve has been altered by historical land use and ad-hoc management practices. The land-use of the reserve has been a source of extensive weed infestations, particularly in and around the wetlands, tracks, carpark and public access areas. Firebreaks and proximity to the road and unauthorised 4wd and dirt bike access has also contributed to the introduction and spread of weeds and damage to soil structure and vegetation (D Sawkins 2018, *pers. comm*. 26 October).

Table 1: Taxa Identified within the Site

FAMILY	TAXA	NOTES
Asteraceae	**Cotula coronopifolia*	
Asteraceae	**Hypochaeris glabra*	
Asteraceae	**Sonchus oleraceus*	
Chenopodiaceae	**Chenopodium album*	
Chenopodiaceae	*Maireana* sp.	
Fabaceae	**Lupinus* sp.	
Fabaceae	*Acacia rostellata*	
Juncaceae	**Juncus acutus*	
Myrtaceae	*Eucalyptus accedens*	
Myrtaceae	*Eucalyptus loxophleba*	
Myrtaceae	*Eucalyptus stoatei*	planted
Myrtaceae	*Eucalyptus rudis*	
Myrtaceae	*Eucalyptus woodwardii*	planted
Pinaceae	**Pinus* sp.	
Poaceae	**Avena barbata*	
Poaceae	**Briza maxima*	
Poaceae	**Cynodon dactylon*	
Poaceae	**Ehrharta calycina*	
Poaceae	**Eragrostis curvula*	
Poaceae	*Themeda triandra*	
Typhaceae	**Typha orientalis*	

**Weed Species*

In addition to 360 Environmental's flora survey, local knowledge gathered from Doug Sawkins indicated that Pre-European vegetation is predominantly York gum (*Eucalyptus*

loxophleba), Jam tree (*Acacia acuminata*) woodland with occasional wandoo (*E. wandoo*). Flooded gum (*E. rudis*) occurred in the original stream channel and now also occurs on the dam walls and upper waterway. Rock Sheoak (*Allocasuarina huegeliana*) occurs on the south-western edge of the dam (D Sawkins 2018, pers. comm. 26 October). Historically, non-endemic Western Australian plant species were planted in the reserve:

- *Eucalyptus stoateii*, *E. torwood*, *Hakea pandanicarpa* ssp. *crassifolia* and *Melaleuca radula* on the southern bank of the main dam;
- A line of *Melaleuca radula* shrubs adjoining Mokine Road in the south-east corner of the reserve;
- Two lines of *Eucalyptus nutans* between the fire access track and an east-west collection drain on the south-western corner; and
- *Eucalyptus camaldulensis*, *Eucalyptus arachnea*, *Eucalyptus* sp. and *Casuarina obesa* in the north-eastern corner of the reserve.

2.4.3 Flora of Conservation Significance

No Threatened species pursuant to the EPBC Act and/or gazetted as DRF pursuant to the WC Act were recorded during the survey. One Priority species, *Eucalyptus stoatei,* was recorded during the survey which is a Priority 4, This specimen is however planted and has a restricted distribution of east and north-east of Ravensthorpe to south of Pyramid Lake. For this reason, its presence within the site does not have any conservation significance. No other Priority species were located at the time of the field survey.

2.4.4 Weeds

A total of 13 introduced species were recorded during the survey (Table 1). None of these species are listed as Declared under the BAM Act or listed as a WONS. Sharp Rush (*Juncus acutus*) identified during the survey species dominates the drainage channels and in the eastern wetland area of the reserve This introduced weed is also widespread in the upper catchment and the surrounding district.

2.4.5 Vegetation

One natural vegetation community was described for the site. The vegetation lacks structure with the dominant feature being the tree canopy of *Eucalyptus loxophleba* and *Eucalyptus accedens* with *Eucalyptus rudis* in the wetter parts of the site. The understorey is nearly devoid of native species and in dominated by grass weed species.

2.5 Fauna

The majority of the site is in a moderately degraded condition and lacking a native understory, the potential for suitable habitat to occur for conservation significant fauna

species is limited. However the reserve is within the Forest Red-tailed and Carnaby's Black Cockatoo distribution range; the flooded gum (*Eucalyptus Rudis*), York gum (*Eucalyptus loxophleba*), salmon gum (*Eucalyptus salmonophloia*) trees record within the reserve can provide potential foraging habitat for the black cockatoo species. No black cockatoo species were recorded or observed during the survey. Railway Dam is an important habitat for local and migratory water birds (D Sawkins 2018, *pers. comm.* 26 October).

During the site assessment, there were signs of two pest fauna species – Fox (*Vulpes vulpes*) and domestic dogs (*Canis lupus*).

There were also signs of kangaroo (*Macropus fuliginosus*) within the reserve as well as a number of bird species:

- Pacific Black duck (*Anas superciliosa*);
- Galah (*Eolophus roseicapillus*);
- Australian Ringneck (*Barnardius zonarius*);
- Common bronzewing (*Phaps chalcoptera*);
- Crow (*Corvus coronoides*);
- Wattle bird (*Anthochaera* sp.);
- Australian Magpie (*Gymnorhina tibicen*); and
- New Holland honeyeater (*Phylidonyris novaehollandiae*).

Local knowledge from site observations indicate that a variety of introduced fauna have been recorded within the reserve, including feral cats, Redfin perch *(Perca fluviatilis), Mosquitofish (Gambusia* spp) and fresh water crayfish (gilgie and yabby). Other fauna that have been observed at the reserve include lizards, frogs, snakes and long necked tortoises. Additional bird species that have been observed in the reserve are included in Appendix 1 (D Sawkins 2018, *pers. comm.* 26 October).

2.6 Heritage

A search of the Department of Planning, Lands and Heritage (DPLH) Aboriginal Heritage Inquiry System did not identify any registered or lodged sites within the Site. The Main Roads Migrant Camp has been registered as a State Register Place (1302); however it is located 100 m to the east of the reserve boundary (east of Mokine Road) (DPLH 2017)

The Locomotive Shed Camps are listed as an Aboriginal Heritage place; this is located approximately 100 m north east of the reserve (DAA 2017).

2.7 Existing Infrastructure

The site assessment determined that the current infrastructure within the reserve includes:

- A small carpark area;
- Historical interpretive signage;
- Railway Immigrant Camp memorial;
- Two picnic benches with non-gas barbeque facilities;
- Signs stating no swimming;
- A bridge across the two dams, a small access bridge off Mokine Rd and a small bridge at Archibald Park;
- A network of historical drains and weirs leading into the dam;
- Archibald Park - a historical jet boat park;
- A geocache;
- Vehicle tracks created by 4WD; and
- Two walking trails created by a community member.

2.7.1 Archibald Park

Archibald Park (a secondary dam/water feature) was constructed in the early 1990s as a jet boat race course in which boats competed in time trial events. Twice a year, water was pumped from Railway Dam into Archibald Park for the events. However the public interest waned after two years and the site has since been abandoned (Sawkins 2017).

There is ephemeral water in the park and islands of York Gum (*Eucalyptus loxophleba*) and bulrushes (*Typha orientalis*) which provide some habitat value to birds and frogs. The informal walls of the park are subject to erosion from inappropriate and unmanaged drainage and creating a hazard to walkers and possibly small fauna (Plates 1 and 2).

There is opportunity to rehabilitate this park to provide a more diverse wetland type habitat. The fencing and pedestrian bridge at Archibald Park are dilapidated and require upgrading (or removal).

Plate 1: Erosion (and fencing) on banks of Archibald Park

Plate 2: Erosion (and bridge) at Archibald Park

2.7.2 Railway Dam Drainage Network

The Railway Dam was built for the purpose of providing a water source for the steam locomotives in the early 1900s. The dam is fed from ephemeral streams within the catchment area. As agriculture became the primary land activity in the region, salinity concerns from the catchment led to the construction of a network of drains which aimed to separate saline water and fresh water inflows to the dam. The drainage system began on Graham Road and worked towards the dam. A weir located at the south western edge of the dam attempts to separate fresh (blue) water or saline (orange) water by

either entering into the dam or bypassing the dam via a diversion drain (Figure 3; Plate 3). It is understood that the Shire recently cleaned out some of these drains from vegetation and debris. There is concern that some incoming water is now being diverted into diversion drains rather than entering Railway Dam.

Plate 3: The historical drainage network installed at Railway Dam Reserve (Sawkins 2017)

According to Doug Sawkins (2018 *pers. comm*. 26 October) other water inflow areas include

- Inflow from Mokine and Gibson roads that gets inundated (blocking the walk trail) and results in an eroded gully contributing to dam siltation;
- Runoff from tracks North West of the reserve, this is currently being diverted by the old railway line and northern bank of Archibald Park, and therefore not entering the dam. The runoff enters Archibald Park via an erosion gully, but could be diverted to Railway dam in the future; and
- Runoff from an eroding firebreak on the west side of a private property (adjoining the reserve) enters the ephemeral wetland on the west of the dam. This could be diverted into Archibald Park.

2.7.3 Walking Trails

Local community members have created two walking trials within the reserve (Plate 4). These walking trails are used by locals and for the purposes of dog walking, cycling, trail biking and 4WD use.

Plate 4: Walking Trails within Railway Dam Reserve (Sawkins 2017)

2.8 Current Uses

Based on site observations, Shire meetings and local community input, the Railway Dam reserve is currently used as a lunchtime picnic spot, dog walking, 4WD driving, dirt bike riding and leisure walks.

These current uses should drive the priorities for the management of the reserve. For example blocking access to 4WD and dirt bikes will assist in combating the erosion control spread of weeds and safety and tranquillity for users. Additionally, enhancing the picnic area and walking trails will assist in increasing the use of the reserve by visitors as well as combating weeds and enhancing native flora species by formalising the walking trails.

3 Local Community Engagement

As part of developing the Railway Dam Reserve Management Plan, the Shire of Narrogin undertook a survey to understand the priorities of the community for the reserve's management. 67 participants responded to the survey questionnaire. The results indicated the top priorities that were 'very important' for the Railway Dam Reserve were as follows:

- Railway Dam should have designated walking trails (including dog walking);
- Weeds should be managed as soon as practical and brought under control with ongoing actions;
- Railway Dam should have more historical/heritage (as well as geological) interpretive signage about the about the history of Narrogin and the dam along the walking trail; and
- Staged erosion control around the Railway Dam and Archibald Park area should be undertaken.

The Shire will take these community preferences into consideration when implementing the management of the reserve and prioritising actions as part of the Railway Dam Reserve Action Plan (Section 5). Additionally, comments and submissions on the draft Railway Dam Reserve Management Plan were received by members of the public, these submissions have been taken into consideration and incorporated throughout the management plan.

4 Railway Dam Management

The maintenance and management of the Railway Dam Reserve has been identified as a priority by the local community and Shire of Narrogin. The section below outlines management measures that could potentially enhance, preserve and maintain the reserve. Table 2 provides a management action plan for the Shire of Narrogin to guide the ongoing process of enhancing and maintaining the reserve.

4.1 Vegetation Management

Existing native vegetation within the Railway Dam Reserve should be retained, preserved and further degradation needs to be prevented. The key steps to achieving this are as follows:

- Prevent 4WD and motorbike access into the reserve;
- Formalise the two walking trails within the reserve and ensure visitors adhere to these tracks only;
- Implement a weed control and monitoring program; and
- Revegetate priority areas (i.e. Archibald Park and picnic area).

4.1.1 Revegetation Strategy

Planting within the Railway Dam Reserve is only proposed within three key areas - Archibald Park, the proposed picnic area and areas surrounding the northern dam (Figure 4). All revegetation areas will be ripped prior to planting. The control of perennial veldt grass, couch grass, bridal creeper and introduced annual grass control is essential for successful revegetation.

Revegetation tubestock shrubs will be planted within the island patches within Archibald Park at a rate of 1 tree species per 10 m^2 (groundcover will be planted at a rate of 1 plant per 5m^2). Within the areas surrounding the dams as well as the picnic area only groundcover species will be planted, groundcover planting will occur at a rate of 1 plant per 5 m^2.

4.1.1.1 Species Selection

Species selected for planting within the Railway Dam Reserve will be selected from the Species List (Table 1). The Species List has been compiled base on the species known to occur within the site or based on surrounding vegetation communities and land systems.

All tubestock will be obtained from nurseries accredited under the Nursery Industry Accreditation Scheme of Australia. Any tubestock that is unable to be supplied in the quantities required may be replaced with another native species.

Local indigenous species, or provenance species, are characterised by the slight variations that occur between plants of the same species from area to area. These variations indicate the species response to the local conditions to which the plants have adapted. Provenant stock ensures plants are better adapted to local conditions, are hardier, more resistant to local pests and diseases and complement other native plants and fauna in the area. Provenance also promotes genetic and ecological sustainability of the local vegetation. All tubestock shall be sourced from local provenance stock as far as it is practicably possible.

4.1.1.2 Planting

Planting of tubestock will be undertaken between May and July after the break of the summer season, when sufficient soil moisture is present to adequately support the establishment of tubestock. Timing of planting should occur just prior to and during expected rain events to maximise soil moisture levels. Tubestock will be hardened, vigorous and free of disease and insect pests at the time of planting and will have adequate and healthy root mass readily evident when removed from the tube, sufficient to hold the potting medium together. Tree guards will be installed around tubestock to prevent animals from grazing new growth.

Small augers and drills will be used to install tubestock and will adhere to the following planting method specifications:

- Individual seedlings will be removed from their container as to minimise damage to leaves, stem and root ball;
- The root ball shall not be exposed or left to dry out and will be planted immediately;
- Fertiliser will be placed at the bottom of the hole and cover with soil to ensure there is no contact between the roots and fertiliser;
- The plant will be placed into the hole and backfilled with soil free from weeds, stones, clods of subsoil and other extraneous matter;
- The soil will be lightly compacted by hand or foot to remove air pockets; and
- Plants will be set plumb and level with the adjacent soil – ensuring no soil is placed against the stem of the root crown.

It will not be necessary to water the plants on planting provided they are well watered before planting and the planting precedes good winter rainfall.

4.2 Fauna Management

The existing flooded gum (*Eucalyptus Rudis*), York gum (*Eucalyptus loxophleba*), salmon gum (*Eucalyptus salmonophloia*) trees recorded within the reserve can provide potential foraging habitat for the Carnaby's and Forest Red-tailed black cockatoo species. These trees will be retained. Planting of these tree species is recommended within Archibald

Park- particularly the flooded gum, since the tree is a riparian species which inhabits riverbanks, seasonal creeks, fringing lakes or swampy areas. *Eucalyptus rudis* is a relatively fast-growing species with potential for remediation of areas affected by moderate levels of salinity and waterlogging which would be ideal for Archibald Park as well as the Railway Dam Reserve as a whole (Marcar & Crawford 2004).

Traffic management within the reserve will assist in the enhancement of natural fauna habitat, particularly in wetland areas.

4.2.1 Introduced Fauna

There was evidence of feral/introduced fauna species (domestic dog and fox) within Railway Reserve. It is recommended that signs are placed to ensure dog owners keep their dogs on a leash and stick to the created walking paths only. It is also recommended to place dog waste bags within the car park area and ensure dog owners dispose of their dog waste appropriately.

It will be difficult to control the introduced foxes in the reserve with 1080 bait as the community use it to walk their dogs. Control methods can include fumigation of dens, den destruction or trapping using soft jawed/cage traps or shooting of foxes. The most effective fox control is achieved during late winter and spring. At this time foxes are less mobile as they are rearing young and food demands are high. At other times there are more young animals to move into vacated territories (DPIRD 2018).

4.3 Weed Management

A site assessment of the Railway Dam Reserve was undertaken in March 2018 and 13 introduced species were identified.

A weed control program is recommended with resources focused towards eradicating the Sharp Rush (*juncus acutus*) species within the drainage channels and in the northern wetland area of the reserve (Figure 5). To facilitate natural regeneration of native species and planted species, weed control will need to be implemented for a minimum of two years. Follow up weed control (including spot spraying and isolated hand removal) should be continued for at least another two years following initial weed control to avoid the re-establishment of weed species. Spraying of firebreaks will be essential, particularly for weed species such as couch grass and perennial veldt grasses.

4.3.1 Methods for Weed Control

Weed control should be undertaken by appropriately trained operators following the correct usage, storage, and handling and safety instructions on the herbicide labels.

Weed control will require a mix of hand-removal, herbicide pasting and targeted spot spraying to minimise impacts on any revegetation (FloraBase 2017). Weed management in open areas can include a more broad-scale herbicide treatment due to the degraded condition of the Railway Dam Reserve.

4.3.2 Herbicide Application

Herbicide application will be undertaken prior to planting. The aim of herbicide application will be to open up areas for planting. Following completion of the works, regular herbicide application will be undertaken to increase chances of seedling survival. Herbicide application will cease immediately under the following weather conditions:

- Wind stronger than 10 km per hour; and
- Heavy rain.

Where necessary, a wetting agent or other adjuvant such as spray oil will be mixed into the herbicide in accordance with the herbicide manufacturer's recommendation.

A non-toxic, water-soluble, biodegradable coloured dye will be added to the herbicide spray mix that will be clearly visible for at least 48 hours after the herbicide application.

The pressure of application will be kept to a level that prevents excessive spray drift, accordingly avoiding damage to surrounding vegetation. Extreme care will be taken during works to avoid off-target damage to trees, shrubs, and other native vegetation. The choice of nozzle should be selected based on the manufacturer's specifications for herbicide use.

4.3.3 Weed Control Procedures and Safety

All persons engaged in spraying herbicides will have a current Pesticide Operator's license in accordance with the *Health Pesticide Regulations 1956*. The following operating procedures and processes will be used while applying herbicide from a motorised pump:

- Ensure weather conditions are suitable for the spray technique, site and chemicals to be used;
- Erect suitable signage at all major entrances and access ways prior to spraying;
- Select the least toxic chemical to perform the work and the most suitable chemical for the weed species to be controlled;
- Use measuring containers for all liquid herbicides and scales for accurately measuring granulated herbicides;
- Ensure the presence/absence of susceptible, non-target species is known prior to commencing work; and
- Ensure the location of target species is understood to reduce the time spent searching and the amount of chemical used pointlessly blanket spraying.

Preventable procedures will be followed to minimise the risk of accidental spills of hydrocarbons or other hazardous material. However, remediation procedures are in place to contain, and if possible, remove the spill from the site.

The main risk associated with the revegetation project is accidental herbicide spill. The procedures to minimise this and any other accidental spill are as follows:

- All chemical containers are to be regularly inspected for leaks to avoid the possibility of environmental or cross contamination. Leaking containers should have their contents transferred to an intact empty container of the same type, or if none is available, a thoroughly rinsed container which is then clearly labelled and used as soon as possible;
- Attapulgite, a shovel and a recovery drum will be present on all vehicles to clean up any spills; and
- A chemical spill must be reported to the Department of Health if it involves more than one Litre (L) of concentrate chemical or 10 L of mix.

4.3.4 Eradicating *Juncus actus* Species

In order to eradicate the large areas of *Juncus actus* in the northern wetland area and drainage channels, the following methods are recommended (DEC 2006):

- Focus on eradicating new populations of the weed first to stop populations spreading (as this is more cost effective);
- Dig out isolated plants within drainage channels in the dry season (ensure plants are taken off site as they could potentially re-root);
- Always bag seed heads, take off site and destroy either by deep burial or burning;
- Spot spray larger areas with glyphosate 360 at a rate of 20 ml:1litre water – plus an addition of a penetrant (e.g. Pulse® at 2 ml/L water;
- Where appropriate, supplement regulator glyphosate with APVMA approved formulations such as Raze® and Roundup Biactive®;
- Arrange follow up spraying to control any missed plants and new seedlings and monitor the area on a regular basis;
- Replant bare areas that have been removed of weeds with native species to prevent the *Juncus* filling in the gaps;
- Control plants upstream as more seed will wash down into the dam and reserve area;
- Burning plants after they have been stressed by herbicide can increase kill rate (however ensure the plants are dead before burning as fire can disperse seeds); and
- A combination of two or more methods might be the best approach for control.

Ensure all equipment is clean before starting works (i.e. free of dirt or weeds and tanks or spray lines must be decontaminated and flushed before use). Ensure herbicides adhere to any regulations or conditions (i.e. approved by Agricultural Pesticides and Veterinary Medicines Authority [APVMA]).

4.4 Dieback Management

During the site assessment, no evidence of dieback was recorded (360 Environmental 2018). However, disease in natural ecosystems of Australia, caused by the introduced plant pathogen *Phytophthora cinnamomi* (Dieback), is listed as a key threatening process under the Commonwealth EPBC Act. Dieback is common throughout south-west Australia. Appropriate soil management for weeds and pathogens is required to prevent the spread of disease and protect the vegetation onsite.

The following management measures will be implemented for dieback prevention and control:

- Any soil, mulch or fill to be imported will be certified as dieback and weed free prior to its delivery to site;
- Bulk earthworks activities will be scheduled for dry soil conditions where possible will reduce the spread of pathogens such as *Phytophthora* dieback;
- Earth moving machinery should be inspected upon arrival to ensure it is free from excessive vegetative matter and soil;
- Topsoil movement between sites will be restricted from sites with significant weeds or pathogens;
- Topsoil from areas of high weed density will be isolated and will remain at the source location; and
- Ensure all tubestock used in revegetation activities are sourced from certified dieback free nurseries.

Phosphite is a chemical that can be used in the management of *Phytophthora* dieback. It is a biodegradable fungicide that protects plants against *Phytophthora cinnamomi*. It can be injected or sprayed and works by boosting the plant's natural defence. Phosphite will be used if required.

4.5 Surface Water Management

The key surface water management priorities identified for the Railway Dam Reserve are as follows:

- Assess the function of the numerous drains associated with the dam and ensure the drain leading into the dam maintains water flow and the drain diverting water is closed off (Plate 3 and Figure 3);
- Assess water source options for the dam and rectify any uncertainties of water catchment and water flow (this may require an external surface water consultant). Currently there is uncertainty regarding the catchment and flow of water into the dam. There are differing opinions that the Foxes Lair flood mitigation drain will provide a significant supplementary water source for the dam since it flows into

Archibald Park (however this drain may flow west of the Park and therefore may not be a sufficient source of water). It also believed that the natural catchment within which the Railway dam is located, may be a better option for capturing water flow into the dam;

- Once the above points are rectified, maintain sufficient water flow (levels) into the Railway Dam;
- Assess surface water drainage across the Railway Dam Reserve to ensure areas prone to inundation are managed via effective drainage control measures (Plate 5);
- Undertake water quality monitoring for salinity purposes;
- Demarcate the high water mark at the dam, and erect signage not to cross this area;
- Prevent access to 4WD and motorbikes to mitigate erosion caused by surface water flows;
- Provide notification to local residents via newsletter or mail out stating that the Reserve is under rehabilitation and 4WD vehicles are prohibited from entering the reserve; and
- Increase ranger presence at reserve.

Plate 5: Areas prone to inundation during wet season (Source: Pomykala 2018)

4.6 Erosion Control

Appropriately managing surface water flow and drainage around and within the reserve is critical to mitigating the erosion control issues on site. The key steps for mitigating erosion control at the reserve are:

- Implementing drainage control measures to address sheet flow (e.g. swales, rock and mesh and diversion drains particularly at Archibald Park);
- Preventing the 4WD access into the reserve (by blocking entries using fencing or bollards);
- Revegetation of the erosion prone areas (i.e. banks of the dams and dam walls);
- Planting of salt tolerant species (e.g. *acacia acuminata*) along the banks of the dam to minimise surface water erosion such as erosion gullies (Plates 6 and 7); and
- Fill and stabilise erosion gullies along dam walls of Archibald Park.

Plate 6: Erosion of banks of Railway Dam

Plate 7: Erosion on banks of Railway Dam

Plate 8: 4WD Access contributing to erosion issues

4.7 Bushfire Management

The Site is mapped as a Bushfire Prone Area (DFES 2017); this could be due to the large adjoining bushland areas to the east and west of the site. There is no bushfire management plan in place for the reserve and no active management is being undertaken. There are fire breaks in place at the reserve (Plate 9), but they do not currently meet the Shire of Narrogin's requirements that fire breaks must be at least 2.5 m wide and 4 m high. Current fire breaks would be sufficient for smaller emergency vehicle access in the event of a fire but would require maintenance to allow for larger emergency vehicle access.

Access for firefighting vehicles is provided on Mokine Road on the eastern boundary of the reserve and Federal Street on the northern boundary as well as Granite Road on the western boundary (Plate 9).

It is recommended that the current fire breaks are assessed and maintained to meet the Shire of Narrogin's requirements (Plate 9). Fire breaks must be in place by the 1 November each year and maintained through to the 1 May the following year (summer bushfire season) (Shire of Narrogin 2018). Consultation with Department of Fire and Emergency Services (DFES) has recommended that the Shire consult with the local DFES Narrogin office to develop a Bushfire Risk Management Plan (BRMP) for the reserve.

Plate 9: Firebreaks within Narrogin Railway Dam Reserve (Source: Shire of Narrogin)

4.8 Facilities and Access Management

The current facilities at Railway Dam have the potential to be enhanced and access to the reserve needs to be managed to prevent further degradation of the site as well as preserve the sites' current values.

4.8.1 Access

In order to mitigate any further environmental degradation to the site, access to 4WDs and motorbikes needs to be prevented.

The following actions are recommended:

- Block off access in the northern most point of the reserve (pedestrians only);
- Block off access in the entrance on Mokine Rd (pedestrians only at access bridge);
- Block off access beyond the designated car park area; and
- Install signage that shows 4WD access is prohibited.

It is recommended that the car park area is increased to allow for more cars to be parked. The car park should also have bollards in place that only allow pedestrians to go beyond the car park area. Methods of blocking off public vehicle access must consider emergency vehicle access in the event of a fire. It is recommended that the access to Mokine Rd, should be blocked off through paddock and key lock on a gate, as not to inhibit safety in the event the emergency vehicles require access due to fire event.

4.8.2 Trail Walks and Push Bike Trails

It is recommended that the walking trails are formalised and that visitors stick to these paths only (this can be done by erecting maps/signage at the car park). The trails could potentially be shared by pedestrians and push bike riders. A dog waste dispenser should also be erected in the car park area to encourage visitors to clean up after their dogs. Additional waste bins should be placed in the car park and along the walking trails.

It is recommended that the derelict footbridge and stairs from Mokine Road to the south-eastern corner of the reserve be removed as they are considered a safety hazard.

4.8.3 Education and Signage

It is recommended to have signage erected of maps of the designated walking trails at the car park area and in various locations along the walking trail. This signage should encourage visitors to stick to the designated paths.

It is also recommended to have educational signage along the path for the purposes of identifying native plant species and native fauna. The historical drainage network at Railway Dam is illustrated on the sign at the cark park entry; however a new sign at the location of the old weir/separator area may be of interest to visitors and pedestrians and to explain the wider function and history of the reserve (Plate 10 and Figure 3).

Signage, to formalise entries into the Railway Dam, need to be upgraded and made obvious for visitors and thereby discouraging entry via blocked off areas.

Plate 10: Map illustrating drainage network at Railway Park (located at car park entry)

5 Railway Dam Reserve Action Plan

An action plan has been developed to guide the future management of the Railway Dam Reserve (Table 2). The action plan provides a step-by-step process using specific timeframes to assist in prioritising management measure at the site.

Table 2: Railway Dam Reserve Action Plan

TIMING	AREA	ACTION	MAINTENANCE AND MONITORING
Year 1	Access	• Prevent all access to 4WDs and dirt bikes around the perimeter of the reserve (using a combination of gates with padlocks, fencing, planting and bollards) • Prevent all vehicle access beyond the car park area (using bollards or fencing) • Put up signage prohibiting 4WD and dirt bikes within the reserve and signage prohibiting vehicles to drive beyond the car park • Send a mail out or article in newspaper notifying residents of the rehabilitation at the reserve and therefore 4WD driving is prohibited • Undertake structural safety assessment of all pedestrian bridges (across two dams, Mokine Rd, Archibald Park) to determine structural integrity and any further actions or refurbishments required	• Monthly inspections of reserve boundary to ensure access is securely blocked for first 6 months and then quarterly inspections • Quarterly inspections of signage for damage or vandalism

Timing	Area	Action	Maintenance and Monitoring
	Leisure	• Formalise the two existing walking trails (Archibald Park Walk and Dam Walk) by installing maps and signage prohibiting visitors to walk off the tracks and educating them of the importance of sticking to tracks (Plate 4) • Provide signage that dogs need to be on a leash and that dog waste must be collected and placed in bins • Develop a design for parking/picnic area • Apply for funding for parking/picnin area/walk trail upgrade and rehabilitation of bare areas • Provide more bins around car park and picnic area and a dog waste bag dispenser	• Monthly inspections of walking trails to ensure pedestrians are adhering to pathways (for first 6 months and then quarterly inspections) • Quarterly maintenance of walking trails and signage • Fortnightly emptying of bins (depending on peak visitor season and volumes of waste being produced)
	Water Management	• Assess the network of drains leading into the dam and ensure water flow into the dam is established (and not being diverted around the dam) • Assess the potential of improving water flow into the dam from natural gravity fed catchments and improve areas prone to inundation during the wet season • Demarcate the high water line at the edge of the dam (represented by line of York Gums) and install signage preventing visitors to go beyond this point • Develop a water management plan which includes water	• Monthly inspections of drains during the wet season to ensure water flow into the dam • Quarterly inspections of signage for damage or vandalism • Seasonal water quality monitoring • Monthly inspections of drainage control measures

Timing	Area	Action	Maintenance and Monitoring
		quality (salinity) monitoring • Install drainage control measures around the Railway Dam and Archibald Park (bank stabilisation, diversion drains, swales, rock battering etc.)	
	Weed Management	• Develop a weed management plan for the reserve and ongoing weed control • Procure weed management chemicals (glyphosate) and equipment – or engage a weed control contractor • Spot spray the *Juncus* species in the drainage areas and upstream areas during the dry season	• Follow up spraying of weeds monthly – and then 6 monthly (or after heavy rains) • Adhere to weed management plan
	Fire Management	• Maintain Fire breaks within the reserve through from the 1 November – 1 May (Bushfire Season)	• Adhere to Shire of Narrogin's fire break requirements • Completion of fire breaks and fuel hazard reduction measures prior to the start of the summer bushfire season (by 1 November each year)
Year 2	Access	• Undertake bridge repair works as per outcomes of structural integrity assessment	• Two-yearly structural assessment of all pedestrian bridges

TIMING	AREA	ACTION	MAINTENANCE AND MONITORING
	Leisure	• Expand car park area to allow more cars to able to park • Install interpretive signage identifying native flora and fauna (e.g. turtles) along the walking paths for visitors • Install interpretive signage at the location of the historical weir/separator drainage area	• Quarterly inspections of signage for damage or vandalism
	Weed Management	• Implement weed control plan for the large *Juncus* infestation in the wetland area in the east of the reserve • Remove pine trees on eastern boundary of reserve, adjacent to Mokine Road	• Undertake follow-up spraying and excavation of weed infested areas • Adhere to weed management plan • Implement monitoring plan to determine effectiveness of weed control
	Rehabilitation	• Procure native plant species seedlings using Table 1 as a reference • Revegetate priority areas as per Figure 4 • Revegetate islands in Archibald Park with York Gum species (Figure 4) • Revegetate dam boundary areas with salt tolerant species • Establish 25 m x 25 m quadrats for monitoring purposes	• If conditions after planting are such that rain is infrequent and plants are looking stressed, watering of planted areas shall be undertaken • Quarterly monitoring of rehabilitation progress at quadrat sites
Year 3	Weed	• Assess the reserve for any new weed infestations and	• Assess the reserve for any new

TIMING	AREA	ACTION	MAINTENANCE AND MONITORING
	Management	control these areas • Undertake follow-up spraying and excavation of weed infested areas	weed infestations and control these areas • Undertake follow-up spraying and excavation of weed infested areas
	Rehabilitation	• Undertake monitoring of revegetation areas and ensure seedlings are successfully establishing	• Quarterly monitoring of rehabilitation progress at quadrat sites

6 Maintenance and Monitoring

Follow-up maintenance immediately after planting is required in most cases of rehabilitation. The following maintenance shall be undertaken no later than six months after planting and should be continued for a minimum of two years following practical completion:

- **Follow up watering**: If conditions after planting are such that rain is infrequent and plants are looking stressed, watering of planted areas shall be undertaken;
- **Weed Control**: Follow up weed control should be undertaken for up to two years. The level of control and timing will be dependent upon the weed species present. A site visit will be conducted with a qualified weed contractor prior to any control programs to determine weed species present, their location, and appropriate control measures; and
- **Infill planting**: Infill planting should be undertaken where mortalities of more than 30% are encountered.

The following maintenance may also be undertaken, where required:

- Tree guard repairs and replacement: Where tree guards have been damaged or removed as a result of vandalism or other causes;
- Rubbish removal; and
- Erosion control.

6.1 Monitoring Methods and Frequency

Monitoring of the rehabilitated areas within the Railway Dam Reserve shall be undertaken every six months by a suitably qualified/experienced contractor for a period of 2 years. Monitoring of the rehabilitated areas shall record the condition of the plants, survival rate of the planted vegetation and individual species, species diversity and an assessment of weed cover. Infill planting should be undertaken where mortalities of more than 30% are encountered.

6.2 Monitoring Reports

Reports regarding the condition and success of rehabilitation (including a description of problems encountered and how they were rectified) shall be developed by the Shire (or contractor if one is engaged). The reports should be completed no later than one month after the monitoring period.

At the completion of the two year (or otherwise agreed) maintenance and monitoring period, a closure report discussing rehabilitation outcomes and an assessment of Shire of Narrogin (if a contractor undertakes the work) ready for handover approval.

6.3 Completion Criteria

Completion criteria have been developed to provide improved management through the monitoring period. Completion criteria are provided in Table 3.

Table 3: Completion Criteria

TYPE	AREA	TARGET
Qualitative	Revegetation and Weed Priority Areas (Figure 4 and 5)	• Vegetation is well-formed and exhibits signs of healthy growth; • 70% of plants are free of disease symptoms (yellowing, wilting etc); • Site must be safe, stable & suitable for agreed use without inputs
Quantitative	Revegetation Priority Area Quadrats	**Year 1:** Plant foliage cover is more than 30% (excluding weeds) **Year 2**: Plant foliage cover is more than 60% (excluding weeds)
	Revegetation Priority Area Quadrats	Vegetation structure consists of 30% overstorey, 70% understory
	Weed Priority Areas	**Year 1:** Weed foliage cover is less than 30% **Year 2**: Weed foliage cover is less than 5%
	Revegetation Priority Areas	At least 6 species per quadrat (excluding weed species)

7 Conclusion and Future Considerations

The Railway Dam Reserve has the potential to become a frequented leisure site for local residents and tourists. By implementing the Railway Dam Reserve management plan, the site will be preserved and further enhanced thus creating a native vegetation escape. Local residents will appreciate the improved picnic areas and benefit from the educational information regarding the history and nature of the Narrogin area.

8 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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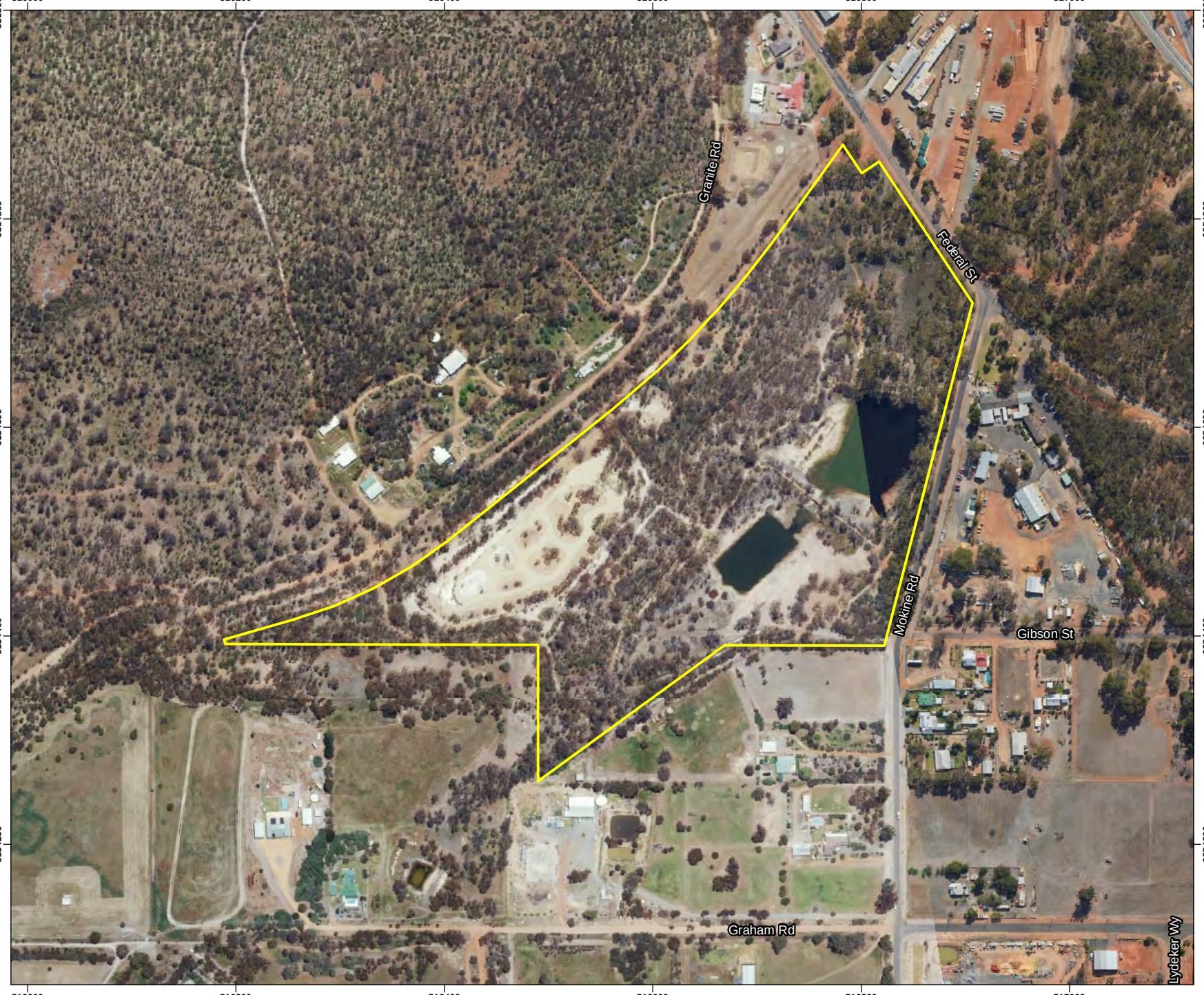
FIGURES



Legend

Site Boundary

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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LOCALITY MAP

PROJECT ID	DATE
2617	2/05/2018

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
SL	HT	FJ	0

Shire of Narrogin
Railway Dam Reserve

Railway Dam Reserve Management Plan

Figure 1 Site Location

K:\Projects\9.0 APP\2617 Narrogin Railway Dam MP\2617 Figure 1 - Site Location.mxd

Legend

- Site Boundary

Hydrography

- Watercourse - minor, non-perennial
- Drain - minor
- Lake - artificial
- Water Reservoir
- Dam Wall
- Earth Dam

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Shire of Narrogin
Railway Dam Reserve

Railway Dam Reserve Management Plan

Figure 2 Hydrology

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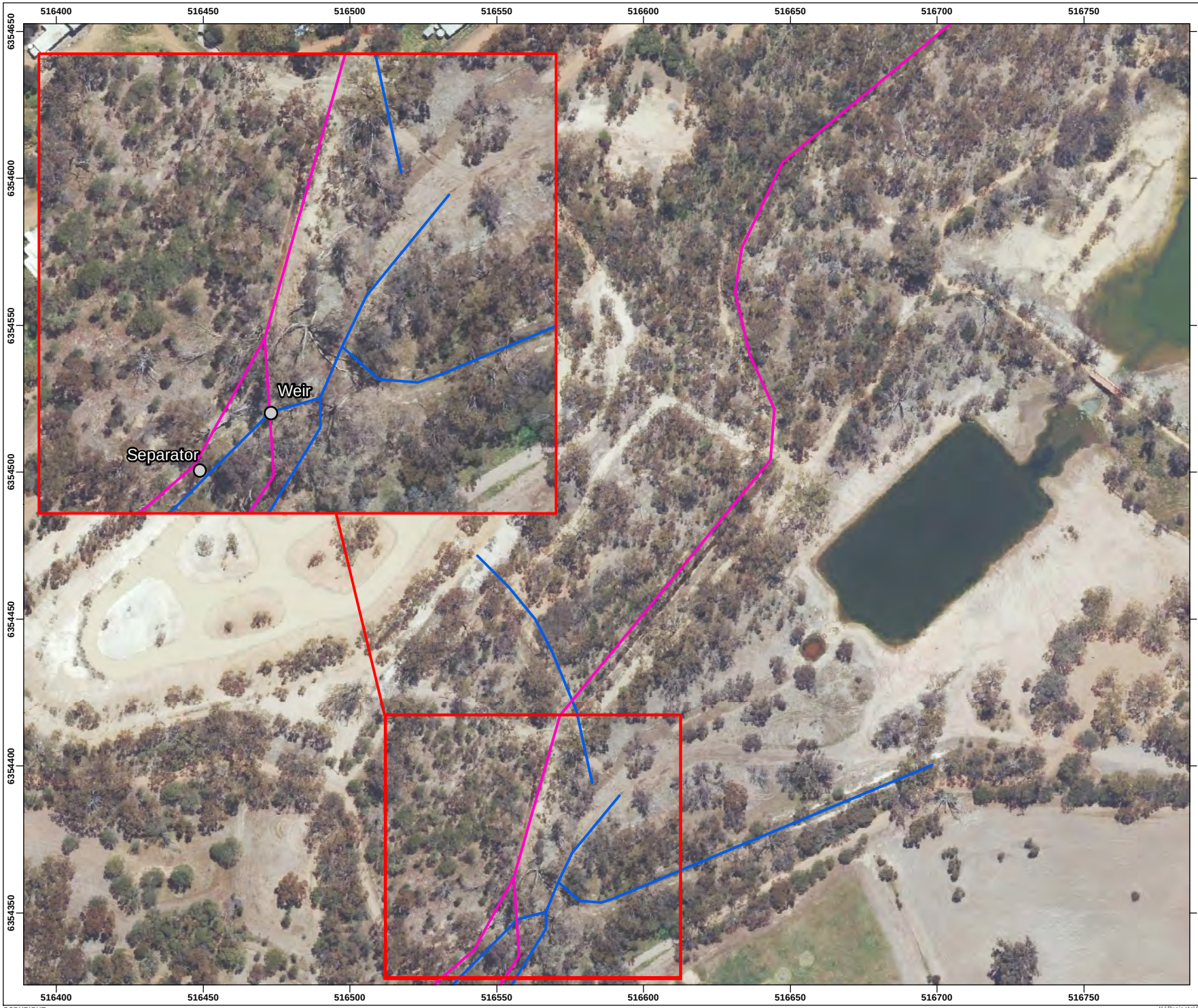

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Drainage System

- Fresh Water
- Saline Water

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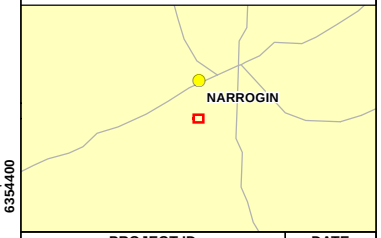

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Shire of Narrogin
Railway Dam Reserve

Railway Dam Reserve Management Plan

Figure 3
Drainage System

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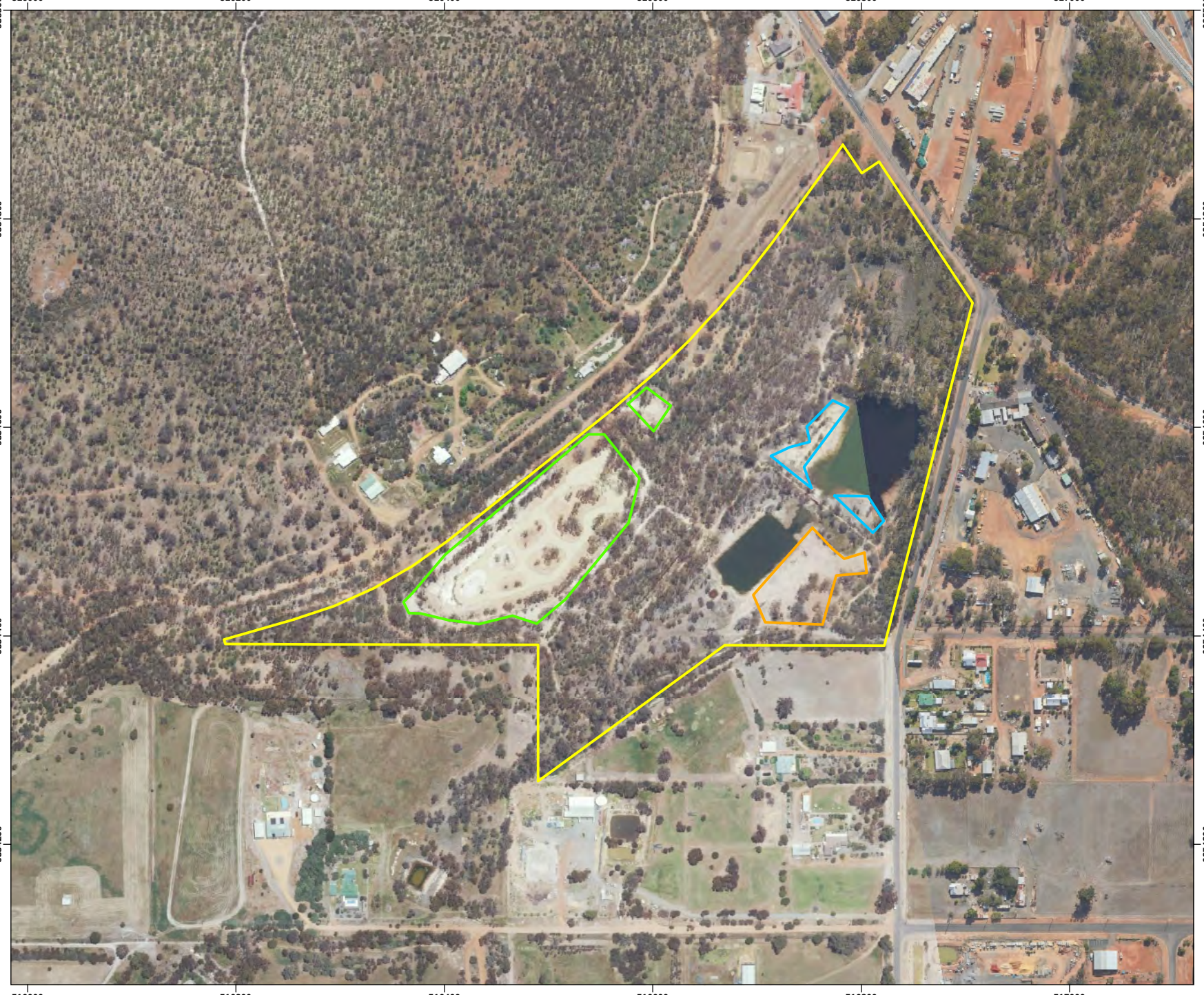

Legend

- Site Boundary

Revegetation Area

- Archibald Park
- Picnic Area
- Dam Area

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Shire of Narrogin
Railway Dam Reserve

Railway Dam Reserve Management Plan

Figure 4
Priority Revegetation Areas

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Legend

- Site Boundary
- Priority Weed Management Areas

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Shire of Narrogin
Railway Dam Reserve

Railway Dam Reserve Management Plan

Figure 5
Weed Priority Areas

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APPENDIX A

Fauna Species List

Bird Species List sited at the Railway Dam Reserve (provided by Doug Sawkins 2018)

Australian Shelduck

Australian Wood Duck

Grey Teal

Australasian Grebe

Little Pied Cormorant

White Necked Heron

Yellow Spoonbill

Australian White Ibis

Pelican

Black Fronted Dotterel

Sacred Kingfisher

Weebill

Western Gerygone

Chestnut Rumped Thornbill

Western Thornbill

Striated Pardalote

Varied Sittella

Black Faced Cuckoo-Shrike

Rufous Whistler

Black Faced Wood Swallow

Grey Fantail

Willy Wagtail

Restless Fly Catcher

Magpie Lark

Jacky Winter

Silvereye

Tree Martin

APPENDIX B

SWOT Alalysis

SWOT Analysis

Strengths

- Close to town.
- Highly valued by residents who regularly use it for picnics, passive recreation and dog walking.
- Popular area for people wishing to enjoy the scenery, either in their car or on foot.
- Bird watching destination that complements Foxes Lair.
- Significant and interesting historical value.
- Two walk trails that are potentially suitable for most people.
- Effectively promoted by Dryandra Country Visitor Centre.

Weaknesses

- Location and terrain attracts 4x4 and off road vehicle vehicles, and makes it susceptible to vandalism.
- Dense layer of weeds under trees.
- Network of eroded tracks that are a safety hazard and attract unwanted vehicles.
- No toilets.
- Existing infrastructure is old and worn.
- Parking area does not separate vehicles from facilities.
- Erosion in the picnic area and walking trails is a danger for the elderly and disabled.
- Inaccurate map of water channels
- Inconsistent monitoring and maintenance.

Opportunities

- To create a valuable ecotourism attraction that will complement Foxes Lair.
- To improve the safety, attractiveness, and amenity of the dam for visitors.
- To reduce fire risk to town.

Threats

- Ongoing damage to the reserve by off-road vehicles to trails, roads, and facilities.
- Litter and vandalism to facilities associated with easy vehicle access to them.
- High fire risk from open fire BBQ facilities and dense annual weed infestation.
- Walker safety hazards due to erosion and deep vehicle ruts in walk trails and parking area.
- Possibly more seasons with low water levels.
- Salinity increase in dam water and western edge of the dam.
- Risk of incidents due to uncontrolled dogs.
- Dam siltation from erosion of dam banks and the catchment.
- Fires from fire in the BBQs in the reserve spreading to adjoining reserves.

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