



# Fifth Creek Survey and Management Plan

Report to the Campbelltown City Council

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## **Acknowledgements**

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**Cover photos** (clockwise from top left): Section 1 where Fifth Creek enters Wadmore Park / Pulyonna Wirra; Section 3 older revegetation; Section 4 old in-stream bed control structure that has been by-passed; Section 5 erosion area, showing typical bed profile of cobblestones in unconsolidated sediment.

All maps are produced by Miles Environmental Pty Ltd

## 1. SUMMARY

This report presents the results of an assessment of the biodiversity and habitat values of Fifth Creek within the Campbelltown City Council boundaries and proposes management recommendations for improving the terrestrial and watercourse habitat and condition and enhancing the amenity values. The creek was surveyed on foot in February 2017.

Within the Campbelltown City Council, Fifth Creek runs through large recreation reserves and wide riparian corridors. While there have been some works in the stream for bridge protection and erosion management, the creek's channel form appears to be largely unmodified. There are remnant River Red Gums along the entire length, and a small number of naturally occurring native groundlayer species. Revegetation with a small number of large shrubs and small tree species was undertaken in all public reserves between ten and twenty years ago, while in the larger reserves, recent revegetation has been undertaken that includes a more diverse range of local native species, particularly groundlayer species. A total of 52 local native species were recorded in this survey.

For the purposes of this report, Fifth Creek is divided into five sections, described in detail and prioritised for management. Management priorities are given at the section scale and prioritised in Table 1, with more detail provided in Section 4.6

**Table 1 Management priorities for Fifth Creek**

| Section | Priority of Section | Management action priority                                                                              |                                                                                                                       |                                                                            |                                                                                                                                                                |
|---------|---------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |                     | Very High                                                                                               | High                                                                                                                  | Medium                                                                     | Low                                                                                                                                                            |
| 1       | High                | Asset protection<br>erosion<br>management<br>works<br><br>Monitor and<br>remove<br>watercourse<br>weeds | Removal of high threat<br>woody weeds (including<br>non-local native<br>species)                                      | Control of moderate<br>threat weeds                                        | Engage with local<br>residents to encourage<br>use of local native<br>species in gardens and<br>discourage planting<br>weedy species<br><br>Install nest boxes |
| 2       | High                |                                                                                                         | Removal of high threat<br>non-woody weeds<br><br>Spot weed around<br>existing revegetation in<br>good condition areas | Erosion management<br>with revegetation and<br>'soft engineering'          |                                                                                                                                                                |
| 3       | Medium              |                                                                                                         |                                                                                                                       | Revegetation of<br>groundlayer species in<br>areas of good weed<br>control |                                                                                                                                                                |
| 4       | High                |                                                                                                         |                                                                                                                       |                                                                            |                                                                                                                                                                |
| 5       | Low                 |                                                                                                         |                                                                                                                       |                                                                            |                                                                                                                                                                |

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## 2. INTRODUCTION

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### 3.1 PROJECT OBJECTIVES

This project was undertaken to:

- Assess the biodiversity and habitat values of Fifth Creek
- Identify major weed issues and options for management, and
- Identify opportunities for strategic revegetation for both erosion control and habitat enhancement.

Ultimately, the aim of this work is to assist the Campbelltown City Council to take a coordinated approach to the management of Fifth Creek to ensure all aspects of management contribute to good environmental outcomes and community expectations. Creek surveys and management plans have been prepared for Fourth and Third Creeks within Campbelltown City Council (Miles 2016, 2017), giving the Council a consistent framework for watercourse management and investment across the Council area.

### 3.2 FIFTH CREEK

Fifth Creek originates in the western Mount Lofty Ranges and traverses the Adelaide Plains for a distance of some 2.2 kilometres before joining the Torrens River. The mid-catchment upstream of the Campbelltown City Council area is within conservation reserves (Black Hill and Morialta) while the upper catchment is comprised of native vegetation, orchards and market gardens.

Fifth Creek enters the Campbelltown City Council area in Black Hill Conservation Park and flows through Council-owned reserve for almost the entire length. The council is committed to continuing improvement of the creek corridor for stormwater management, water quality, visual amenity and accessibility for the community while protecting and enhancing the remnant native vegetation to provide habitat and resources for the local wildlife.

Within the Campbelltown City Council area the native vegetation has been largely cleared except for remnant River Red Gums lining the riparian corridor. A survey of the riparian reserve at St Ignatius School was undertaken in June 1999 and August 2000 and found twelve native species (Brewer 2000; see Appendix 1). Pre-European vegetation of Third Creek would have been River Red Gum (*Eucalyptus camaldulensis* ssp. *camaldulensis*) woodland, with SA Blue Gum (*E. leucoxylon* ssp. *leucoxylon*) woodlands on the adjacent plains. The pre-European vegetation is described in more detail in Brewer (2009) and Kraehenbuel (1996).

Today, the corridor contains many large old River Red Gums as well as younger regenerated trees, a small number of naturally occurring native groundlayer species and areas of understorey revegetation. Fifth Creek has been identified as a corridor for wildlife movement between Morialta Conservation Park and the River Torrens.

The channel bed is lined with sand, gravel and cobblestones, and the adjacent banks are unconsolidated sediments with gravel and cobblestone. It is highly likely that, prior to vegetation clearance and urbanisation, the alignment of the watercourse would have been highly mobile, shifting during high flow events in response to sediment deposition, vegetation growth.



### 3.3 EXISTING PLANS AND STRATEGIES

The Council's Strategic Plan (Campbelltown City Council 2010) is framed around five key themes: quality living, leadership, city planning, environmental responsibility and local economy. Goal 4 is *"An enhanced local environment delivered in partnership with the community"* and relevant to this project is Objective 4.1: *"Valuable recreation and open spaces enhanced through effective planning and management."* Strategies to achieve this objective include

- Conserving and enhancing local biodiversity through formal and informal landscaping and
- Improving and developing local seed banks to maintain biodiversity.

The Council also has obligations to manage stormwater to meet current standards and environmental requirements. The Council's Environmental Management Plan (EMP) was updated in 2016 and, under the theme of connected and healthy landscapes, focusses on connecting open space, conserving biodiversity and protecting local waterways (City of Campbelltown 2016). This watercourse management plan will support the Council to undertake a number of the initiatives identified in the EMP, particularly:

- Identify high priority biodiversity areas and prepare management strategies for protection and enhancement of these areas.
- Undertake erosion, bank stabilisation and revegetation works along creeks within Council's care.
- Integrate creek improvement works with Chain of Trails Master Plan to provide opportunities for conservation options.
- Develop a strategic approach to creek management.
- Identify priority preventative works such as appropriate riparian revegetation.

The Council has recently completed a Chain of Trails Master Plan (COTMP) (Swanbury Penglase 2014) for all creeks in the Campbelltown region, including Fifth Creek. The Master Plan includes a preliminary assessment of biodiversity values and erosion issues and recommendations to conserve and enhance biodiversity and mitigate erosion. The Master Plan sets a framework for developing and improving the trail network through the creek reserves and incorporates sustainable trail development principles (Government of South Australia). The Master Plan also promotes the use of local native species for plantings.

The Adelaide and Mt Lofty Ranges Natural Resources Management Plan (AMLR NRMB 2013) identifies the following targets relevant to the Third Creek Management Plan to be achieved by 2028:

- Target 2: Aquatic ecosystems and groundwater condition is maintained or improved by 2028
- Target 7: Condition and function of ecosystems (terrestrial, riparian) recovered from current levels
- Target 13: Increase participation in natural resources management activities by 20%.

A management plan has been prepared for Wadmore Park / Pulyonna Wirra which is owned by the Campbelltown City Council (Campbelltown City Council 2013). Relevant parts of that plan are incorporated in the recommendations for that part of the creek (see Section 1, page 11).

### 3. WATERCOURSE MANAGEMENT PLAN

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#### 4.1 OVERVIEW

For the purposes of this report, Fifth Creek is divided into five sections (see Map 1) each exhibiting similar features and management issues. However there is variation throughout the entire survey area and therefore each section has been further divided into zones of broad condition categories as follows:

A – Good condition (e.g. remnant canopy, diverse revegetated understorey, few high threat weeds)

B – Moderate condition (e.g. remnant canopy, low diversity revegetated understorey, high threat weeds present in low abundance)

C – Poor condition (e.g. remnant canopy may or may not be present, no other native species, dominated by exotic species)

#### 4.2 MANAGEMENT OBJECTIVES

The objectives for managing Fifth Creek are to:

- *Prevent any further decline in condition of the watercourse and riparian habitats*
- *Restore the condition of the watercourse and riparian habitats*
- *Maintain and enhance the amenity and recreational values of the creek corridor*
- *Coordinate management across Council to achieve multiple objectives.*

#### 4.3 STRATEGIC FRAMEWORK

In order to assist the Council to most effectively allocate funds to manage and restore creek-lines within the study area, each management section has been assigned an overall priority and the management requirements within each section are prioritised.

The overall priority of the subsections for management is derived from a basic assessment of the ecological value of the sections based on:

- Naturalness (channel form, erosion, remnant native overstorey, revegetation, habitats, weed threat)
- Diversity and richness (number of native plant species, range of habitats).

More natural and more diverse sites are considered a higher priority on the basis that less resources are required to maintain these areas and they have more to lose than highly modified and low diversity sites.

Management actions within each section were prioritised based on the following ecological criteria:

**Very high** - short term action required in to mitigate threats

**High** – action required to prevent the condition of the site deteriorating

**Medium** – action required to improve the condition of the site (relatively low level of resources required compared with the benefits)

**Low** – action required to improve the condition of the site (relatively high level of resources required compared with the benefit, or low cost and low level of benefit).



Some actions may be re-prioritised as circumstances change, such as where external funding becomes available for certain types of work or other related measures are being implemented (e.g. as part of the implementation of the Trails Master Plan or erosion control measures).

#### 4.4 SURVEY METHOD

A survey of Fifth Creek was undertaken on the 13<sup>th</sup> of February 2017. Sections of creek line were delineated in the field based on common features occurring throughout a section. For each section the following were recorded:

- Native and introduced vegetation species in the riparian zone and the watercourse
- Condition of riparian and watercourse vegetation (based on abundance and diversity of native species and exotic species)
- Riparian habitat features (hollows, fallen timber, leaf litter, groundcover, shrubs, overstorey and other)
- Watercourse habitat features (deeper pools, logs, rocks, other)
- High threat weeds
- Erosion and Channel modification
- Safety issues
- Other management issues

High threat weeds were mapped in the field using handheld GPS (Garmin GPSMap 62pc).

The following features were subjectively assessed to derive overall priority for each section:

- Remnant Native Vegetation: the proportion of native vegetation covering the site, and the range of native species.
- Weed Risk: the proportion of weed cover, and the risk of those weeds spreading through the site and the wider area (Croft et. al. 2005).
- Revegetation: areas already revegetated were considered to have a higher value for biodiversity and creek health.
- Habitats: areas with a greater range and number of habitats were given a higher value, habitats included large remnant trees with hollows, shrubs, reed beds, permanent pools, large woody debris in pools, open water and submerged aquatic vegetation.
- Channel form: unmodified channel form was given a higher priority than modified channels (e.g. widened).
- Erosion: presence or absence.

Plants are referred to by their common name throughout the report, with a list of scientific names in Appendix 1 where a full list of all plant species observed is given.

The report was prepared in consultation with staff from Campbelltown City Council.





0

400

Meters  
800

Map produced by Miles Environmental Pty Ltd  
March 2017

**Map 1: Fifth Creek management sections**



## 4.5 SURVEY RESULTS

### 4.5.1 Section 1. Wadmore Park / Pulyonna Wirra

Section 1 of Fifth Creek flows through Wadmore Park / Pulyonna Wirra, a Council owned park adjoining Blackhill Conservation Park. The Wadmore Park / Pulyonna Wirra Management Plan includes the following strategies specific to management of the watercourse:

*1.3 Control unwanted pest plants (including non-indigenous native species)*

*4.1 Further improve stormwater runoff in high problem areas*

*5.1 Rehabilitate Fifth Creek to an indigenous stream habitat while improving the physical condition of the channel*

These strategies are consistent with the objectives of this management plan and the management recommendations for this section (see section 4.6) reflect these strategies.

Along this section there are mature River Red Gums and occasional SA Blue Gums, with natural regeneration of the former, mostly in the creek. Local native small tree and shrub species are growing throughout the riparian zone and it is assumed that these have been planted as they all appear to be around the same age (10 to 15 years old) and comprise a similar range of species as have been planted elsewhere. The riparian zone extends into the surrounding terrestrial (dryland) environments.

There are a number of weirs constructed in the creek, most of which appear to have been installed for erosion control but also provide pedestrian access across the creek. There is some minor erosion of the banks and some scouring below concrete weirs. The deepest scour pool is behind the sports clubrooms. The structures appear to be stable currently but may become unstable with further erosion and should be monitored. Rock reinforcements near the Maryvale Road bridge appear to be new and further work may be needed in this area to stabilise the soil and rocks – planting native grasses and sedges with organic weed matting may assist.

There were deeper pools of water below concrete weirs and in naturally low lying areas. There was a small amount of in-stream native vegetation. There is a low abundance of high threat weeds in the site, including on the banks and in the watercourse. However the small number of Weeds of National Significance (WoNS) and declared weeds can spread quickly and are therefore a priority to control. Watercourse weeds include Dense Flat-sedge, Hemlock and one occurrence each of Jointed Rush and Giant Reed.

**Priority: High**



**Map 2: Section 1 weeds and watercourse condition**

## Fifth Creek Management Plan

| Feature                            | Condition                                                                                                                                                                                                                                                                                             |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Native vegetation condition</b> | Good (100%): remnant and regenerating River Red Gums and SA Blue Gums with planted small trees and shrubs and few high threat weeds but lacking native groundlayer species<br>Total native species: 14                                                                                                |
| <b>Watercourse condition</b>       | Good: two native herbs and a native sedge, few watercourse weeds, some deeper pools with water                                                                                                                                                                                                        |
| <b>High threat weeds</b>           | Occasional Fennel, Periwinkle, Hemlock, Castor Oil Plants, Blackberry and Dense Flat-sedge in the creek; isolated Olive, Montpellier Broom and Green Cestrum. One Arum Lily was hand-pulled by the author. Couch, Kikuyu and Nasturtiums on the banks. Swamp Oaks and Peppercorn Trees planted nearby |
| <b>Habitat (terrestrial)</b>       | Large trees with hollows, fallen timber, leaf litter, shrubs                                                                                                                                                                                                                                          |
| <b>Habitat (watercourse)</b>       | Deeper pools, rocks                                                                                                                                                                                                                                                                                   |
| <b>Watercourse erosion</b>         | Some recent bed deepening and widening with scouring around and below existing weirs and structures in the stream, but the level of erosion is generally minor in all areas except behind the sports club rooms where the banks are quite high                                                        |
| <b>Channel modification</b>        | Weir structures in stream. Rock and gravel deposited from the floods has been excavated from the creek just above the Maryvale Road bridge                                                                                                                                                            |
| <b>Other</b>                       | A dead tree above the Maryvale Road bridge may present a risk of falling in future and should be monitored.<br>Water flowing out of the creek bed at the bridge was notably orange in colour.                                                                                                         |



**Figure 1** Water was present in deeper pools, note broken concrete structure on the right creek bank





**Figure 2 The scour pool and some bank erosion behind the sports club rooms**

#### 4.5.2 Section 2. St Ignatius College

Section 2 of Fifth Creek flows through St Ignatius College grounds and a Council-owned reserve. The vegetation of the upper part of Section 2 comprises remnant River Red Gums over Ash trees, Olive trees and exotic lawns (Figure 3). A small number of local native species have been planted into this area. There is some erosion of fill near the carpark. The bank immediately below the Maryvale Road bridge has been reinforced with rock gabion.

The middle part of Section 2 has been revegetated and comprises a good mix of local native species, including groundlayer species (Figure 4). There is regeneration of some planted species, and some of the species may have colonised the site naturally; these are signs that the site is becoming self-supporting and the management of this area should focus on 'bush care' over revegetation.

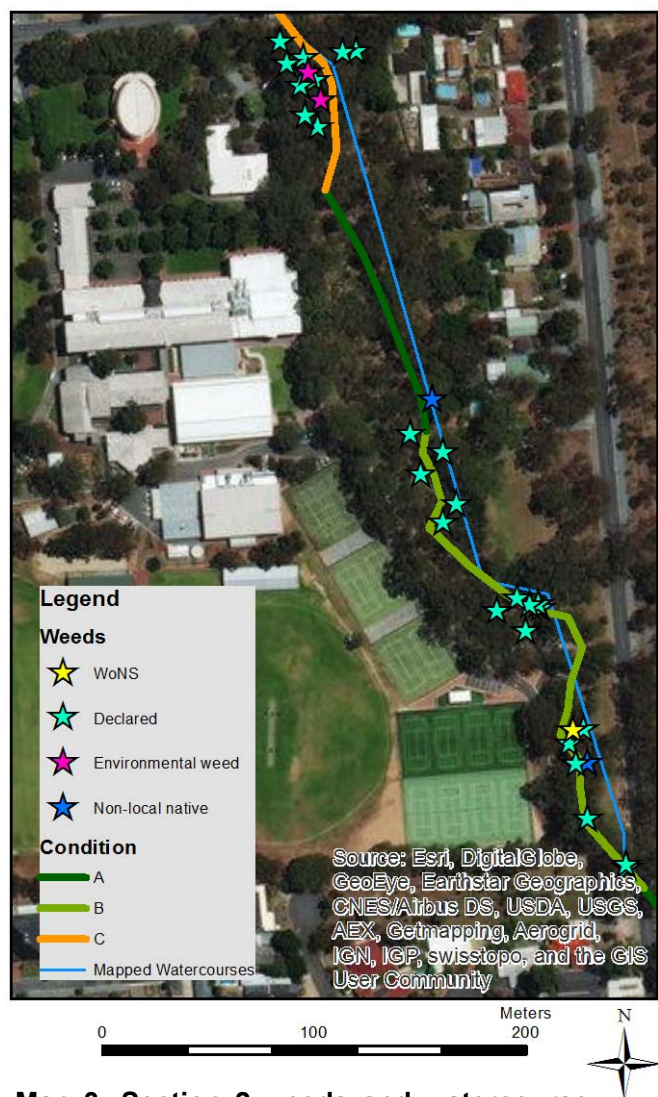
The lower area is overgrown with exotic species, including many declared weeds and 'garden escapees' (Figure 5). The banks in this part are steep and high; while there doesn't appear to be any active erosion in this area currently, any weed control would need to be undertaken using minimal disturbance techniques and in conjunction with bank protection measures (e.g. matting and revegetation) to ensure no erosion does occur.

A survey of the Fifth Creek walking trail in the school grounds was undertaken between 1999 and 2000 and recorded twelve native species. This survey recorded 25 native species

There are some areas of garden encroachment, with exotic fruit trees growing on the edges of the reserves, some of which, whilst not being high threat weeds, can spread over time if not managed.

Removal of the Olive and Ash trees and other high threat weeds in the upstream (medium condition) part of the watercourse is recommended as a priority for Section 2 as it will reduce the weed threat to the adjacent revegetation area and enable the revegetation to be extended into this area, linking with the Wadmore Park / Pulyonna Wirra. Weed control in the lower end should focus firstly on ensuring the weeds do not spread into the revegetation area. Removal of the weeds should be undertaken in the longer term, working from upstream to downstream, to reduce the weed threat to downstream areas.

**Priority: High**



**Map 3: Section 2 weeds and watercourse condition**



| Feature                            | Condition                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Native vegetation condition</b> | <p>Good (25%): Remnant overstorey of River Red Gums with a diverse revegetated understorey and very few weeds.</p> <p>Medium (55%): Remnant overstorey of River Red Gums over large and small Olives and Ash trees in the creek and on the right bank</p> <p>Poor (19%): Dense weeds amongst remnant River Red Gums</p> <p>Total 25 species</p>                                                                                                      |
| <b>Watercourse condition</b>       | Moderate: there are River Red Gums seedlings, Stiff Flat Sedge and Slender Knotweed growing in the watercourse, but exotic trees and shrubs line much of the watercourse. The watercourse itself appears largely unmodified and there was limited erosion.                                                                                                                                                                                           |
| <b>High threat weeds</b>           | Exotic trees: Olives and Ash in the upper and lower ends. Non-local natives: Golden Wreath Wattle, Flinders Ranges Wattle and Sweet Pittosporum. Isolated Montpellier Broom, Italian Buckthorn, Palm Tree and Giant Reed. One patch of Gazania and one of Nasturtium. Periwinkle is only found in the downstream end. Exotic perennial grasses throughout but in low abundance. Exotic climbers English Ivy and Morning Glory in the downstream end. |
| <b>Habitat (terrestrial)</b>       | Large trees with hollows, fallen timber, leaf litter, shrubs, occasional groundcovers and natural regeneration of planted species                                                                                                                                                                                                                                                                                                                    |
| <b>Habitat (watercourse)</b>       | Deeper pools, rocky creek bed                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Watercourse erosion</b>         | Minor scouring and areas of fill on banks have eroded.                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Channel modification</b>        | Channel bank gabion-lined at upstream end near school entrance                                                                                                                                                                                                                                                                                                                                                                                       |



Figure 3 Remnant River Red Gums over Ash and Olive trees





**Figure 4 Revegetation area**



**Figure 5 The downstream end of Section 2 is overgrown with exotic species**



#### 4.5.3 Section 3. Manresa Court to the start of Max Amber Reserve

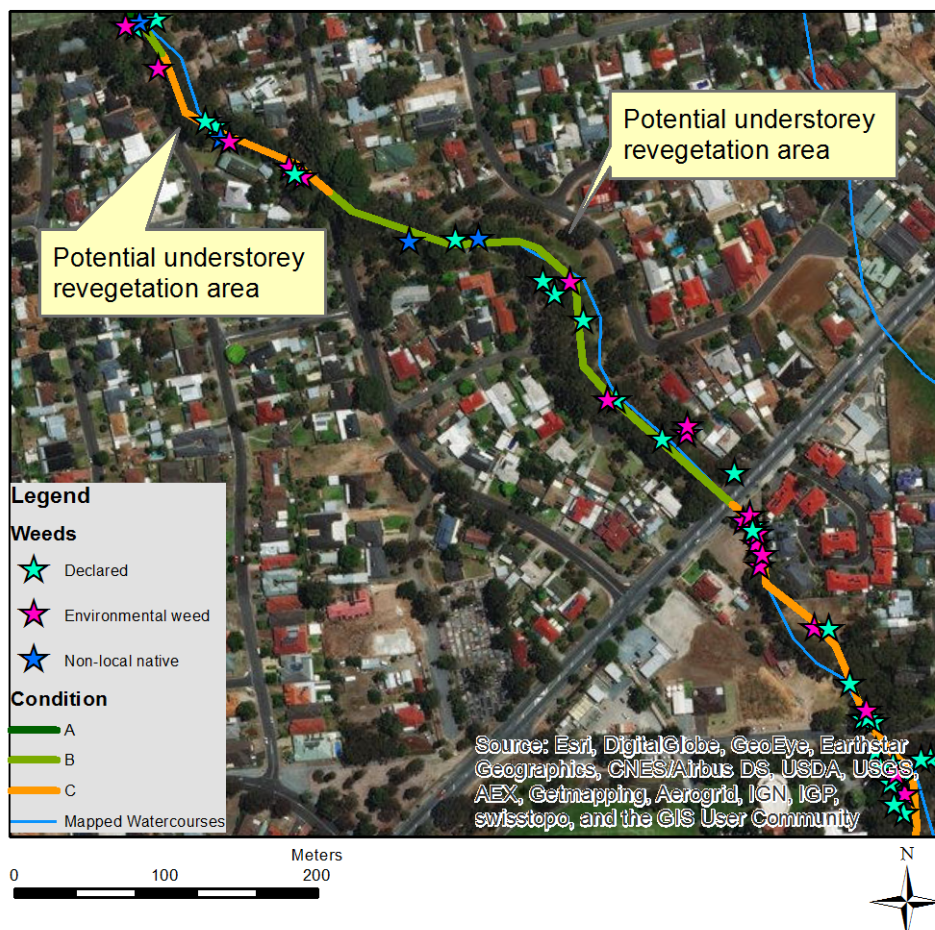
Most of this section was in moderate condition, with a relatively undisturbed creek channel, an overstorey of remnant River Red Gums and scattered plantings of local native shrub and small tree species (Figure 7). There are high threat weeds throughout but rarely in high abundance. There is a wide riparian reserve along most of the length with potential for further revegetation focussing on lower growing species. The Chain of Trails Master Plan (COTMP, Swanbury Penglase 2014) proposes the eastern bank adjacent to Woodlands Road and the banks adjacent to Stoneybrooke Drive as areas for improving biodiversity. These sites have good potential although the latter will require removal of non-local native species. The banks are currently sprayed along most of the length and therefore any revegetation of the banks will require some changes to the current management regime.

In some locations there are residential gardens adjacent to the riparian reserve where weedy species are growing including Palm trees, English Ivy, Periwinkle and Arum Lilies. There does not appear to have been garden-encroachment onto the reserve but these areas should be monitored for spread of the weedy species and property owners encouraged to replace the weedy species with alternatives. There are also a handful of locations where it appears that exotic species have been planted into the reserve and it is recommended to remove these plants.

Between Manresa Court and Gorge Road the creek runs through private property and was only surveyed from the adjacent roads. There are exotic trees and shrubs through this section with an overstorey of River Red Gums (Figure 6). The banks have been sprayed out and are bare and there is some bed erosion.

There is some minor erosion, the most severe of which is upstream of Gorge Road and downstream of Schulze Road (Figure 8).

**Priority: Medium**



**Map 4: Section 3 weeds and watercourse condition**



| Feature                            | Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Native vegetation condition</b> | <p>Moderate condition (53%): this section has been sparsely revegetated with local native species around 10 to 15 years old. There are remnant River Red Gums and a patch of the native groundcover Tom Thumb, which it is assumed is growing naturally. Secondary regeneration of Sticky Hopbush and Broughton Willow was found. High threat weeds are sparse but the section lacks local native groundlayer species.</p> <p>Poor condition (47%): The section downstream of Manresa Court to Gorge Road was dominated by exotic trees and shrubs. The creek downstream of Schulze Road also lacked native vegetation but was less weedy.</p> <p>Total species diversity: 19</p> |
| <b>Watercourse condition</b>       | Moderate to poor: River Red Gum seedlings and occasional Stiff Flat-sedge and Slender Knotweed were growing in the watercourse. Through the middle section (rated moderate condition) the creek form is relatively natural but in the parts rated poor, the creek is incised, weedy and gabion-lined in parts.                                                                                                                                                                                                                                                                                                                                                                    |
| <b>High threat weeds</b>           | High threat weeds are most abundant upstream of Gorge Road, particularly Castor Oil Plant. Non-local natives Golden Wreath Wattle and Swamp Oak are re-growing where they have been cut back, other non-local natives are Flinders Ranges Wattle and Bracelet Honey Myrtle. Few Olives, Ash, Palms, Giant Reed and Italian Buckthorn. Occasional Nasturtiums, Rice Millet and South African Daisy.                                                                                                                                                                                                                                                                                |
| <b>Habitat (terrestrial)</b>       | Large trees (although fewer than upstream areas), some with hollows, leaf litter, large shrubs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Habitat (watercourse)</b>       | Rocky creek bed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Watercourse erosion</b>         | Bed deepening above Gorge Road. Recent bank erosion downstream of the gabions below Schulze Road bridge has exposed buried pipes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Channel modification</b>        | Appears to be unmodified except for some reinforcing of the banks with gabions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

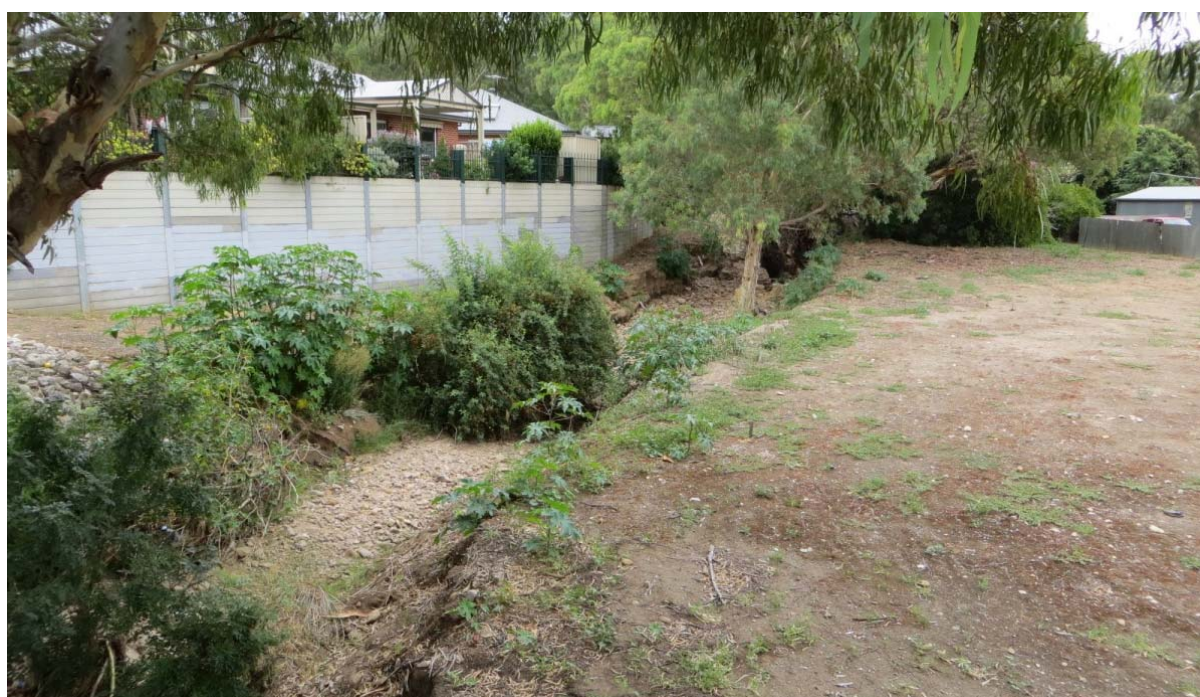


Figure 6 Looking upstream from Gorge Road, note Castor Oil Plants growing on the banks





**Figure 7 Downstream of Gorge Road**



**Figure 8 Erosion downstream of Schulze Road**



#### 4.5.4 Section 4. Max Amber Reserve

Fifth Creek through the Max Amber Reserve is characterised by wide riparian reserves, and a canopy of mature River Red Gums. The creekline has been revegetated to varying extents along the entire length. Recent plantings have focussed on groundlayer and small shrub species which has greatly increased the diversity of species. Two local native planted species were noted as regenerating naturally, but the number of species regenerating may be higher as regeneration is difficult to distinguish from plantings of grasses and groundcovers. The revegetation area on the south western bank between the tennis courts and the creek (Figure 9) is an excellent example of what can be achieved with revegetation and this area is priority to keep weed free and encourage natural regeneration.

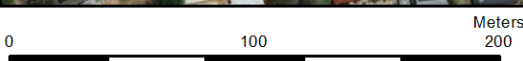
Although there are many River Red Gums, there are few 'large' trees that contain hollows that native birds, possums, bats and lizards would use. The ecological values could be enhanced with the installation of a range of different nest boxes.

Many of the older planting are more 'landscape' type plantings and contain a number of non-locally native species, including species that can become weedy (e.g. Golden Wreath Wattle and Flinders Ranges Wattle). These should be removed, but special care will need to be applied in the removal of the Casuarinas as many of these have already suckered and are growing on the creek banks in areas where there is bank erosion. A weed of concern is the groundcover *Lippia* which occurs in one large patch. Although this is not a declared weed in South Australia it is a declared species in some other states due to it's potential to spread in damp areas and difficulty to control. It has a high potential to spread into other locations and is therefore a priority for removal.

The creek appears to have sustained some erosion damage from the floods last year. This erosion is generally minor except for areas downstream of the floodway, particularly near to the football clubrooms where the banks are close to the building (Figure 10). Engineering advice will be required to determine which areas require works to stabilise them and what should be done,

however the planting of local native sedges, rushes and grasses around any new (and existing) structures will help to stabilise them.

There are existing erosion control structures in the watercourse. Most of these appear to have functioned successfully in the recent floods but some are collapsing and may need to be removed and replaced, according to an engineer's advice. At one location a small erosion control 'fence' has been used to trap rocks against the bank and prevent bank erosion (Figure 11 below). It has functioned effectively but has been partly pushed over and the droppers may pose a safety risk and may need to be replaced.



**Map 5: Section 4 weeds and watercourse condition**

**Priority: High**

| Feature                            | Condition                                                                                                                                                                                                                                                                                                 |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Native vegetation condition</b> | <p>Good condition (39%): Good diversity of local native species planted on the banks and natural River Red Gum canopy.</p> <p>Moderate condition (61%): Canopy of River Red Gums but mostly lacking understorey (except some plantings in the north eastern banks)</p> <p>Total species diversity: 37</p> |
| <b>Watercourse condition</b>       | Good to moderate: two native sedges as well as one herb and River Red Gums, few in-stream weeds. Some erosion.                                                                                                                                                                                            |
| <b>High threat weeds</b>           | One patch of Lippia, one Olive, Ash re-growth. Isolated Dense Flat-sedge and Giant Reed in-stream. Non-local native species planted throughout with many regenerating.                                                                                                                                    |
| <b>Habitat (terrestrial)</b>       | Overstorey but few hollows, leaf litter, groundcovers and shrubs.                                                                                                                                                                                                                                         |
| <b>Habitat (watercourse)</b>       | Rocky creek bed, occasional sedges                                                                                                                                                                                                                                                                        |
| <b>Watercourse erosion</b>         | Scouring around and below structures, bank erosion                                                                                                                                                                                                                                                        |
| <b>Channel modification</b>        | Erosion control works                                                                                                                                                                                                                                                                                     |



**Figure 9 New high diversity understorey plantings amongst older local and non-local revegetation**





**Figure 10 Erosion downstream of the football club rooms, note the Casuarina's suckering on the far bank and revegetation in the background**



**Figure 11 Small scale erosion control fence has successfully trapped rocks but the posts pose a hazard.**



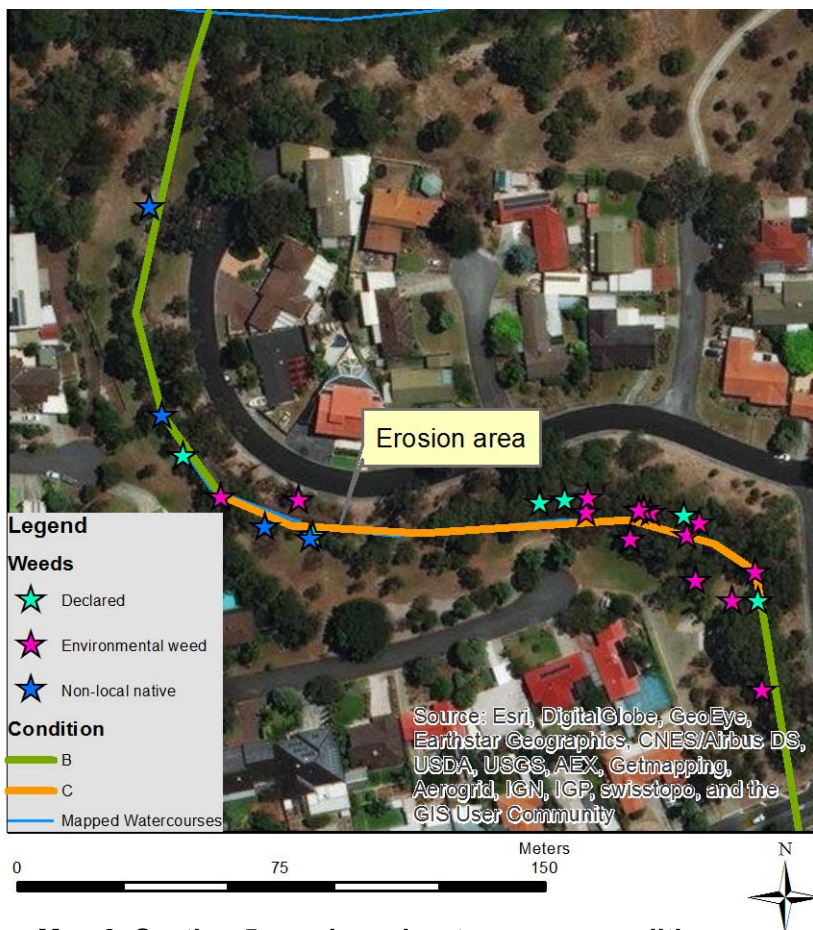
#### 4.5.5 Section 5. George Street to the River Torrens

The most downstream section of Fifth Creek has a sparse canopy of medium-sized River Red Gums but very few large old trees with hollows. There is a moderate diversity of local native species due mainly to some plantings near George Street. There are older plantings of non-local native species, with many *Casuarina*'s that are suckering, and other weedy species that have probably been planted (e.g. Weeping Willows and Palm trees; Figure 12). Castor Oil Plants, Ash seedlings, Giant Reed and Dense Flat-sedge are growing in the watercourse and should be removed.

Through the middle part of this section the bed and banks of the creek has eroded (Figure 13). Erosion in this area was noted in the COTMP and so is not entirely the result of the recent floods however the banks appear to be freshly exposed. This area should be assessed by an engineer. Any measures to treat the erosion should combine measures to control bed deepening as a priority and bank erosion where there is a risk to infrastructure. Planting native sedges, rushes and grasses around structures will help to stabilise them.

The most downstream end of the creek has an overstorey of River Red Gums over exotic grasses with few high threat weeds (Figure 14). This would be a good site for future understorey revegetation.

**Priority: Low**





| Feature                            | Condition                                                                                                                                                                                                                                                            |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Native vegetation condition</b> | <p>Moderate condition (46%): There is a canopy of River Red Gums and moderate level of species diversity at the upper end due to revegetation</p> <p>Poor condition (54%): Remnant River Red gums and many high threat weeds.</p> <p>Total species diversity: 15</p> |
| <b>Watercourse condition</b>       | <p>Moderate to poor: there is relatively wide riparian reserve and some instream vegetation but the creek is eroded in a number of places and lacks native vegetation cover on the banks</p> <p>Watercourse species diversity: 4</p>                                 |
| <b>High threat weeds</b>           | Re-growth of Ash trees, one Weeping Willow, one Ivy; large Palm trees and smaller seedlings, Caster Oil plants and wild Prunus throughout. Non-local native Casuarinas have been planted and are suckering.                                                          |
| <b>Habitat (terrestrial)</b>       | Canopy of River Red Gums but very few large trees with hollows, some leaf litter, sparse shrubs                                                                                                                                                                      |
| <b>Habitat (watercourse)</b>       | Deeper pools with water, rocky creek bed and rock bars                                                                                                                                                                                                               |
| <b>Watercourse erosion</b>         | Bed deepening in the middle section which is contributing to bank erosion                                                                                                                                                                                            |
| <b>Channel modification</b>        | Trash racks installed below the George Street bridge.                                                                                                                                                                                                                |



Figure 12 Weedy bend downstream of the trash racks





**Figure 13 Bed deepening and bank erosion adjacent to Heather Court**



**Figure 14 Upstream of the outflow of Fifth Creek into the River Torrens**



## 4.6 MANAGEMENT PRIORITIES

See Section 4 for methods.

| Priority  | Management Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Section                      |                                    |                                |                              |                            |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------|--------------------------------|------------------------------|----------------------------|
|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                            | 2                                  | 3                              | 4                            | 5                          |
|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Section priority#:           |                                    |                                |                              |                            |
|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | H                            | H                                  | M                              | H                            | L                          |
| Very High | <b>Asset protection erosion management works</b><br>Undertake engineering works to repair and reduce risk to assets and public safety, incorporating revegetation where feasible.                                                                                                                                                                                                                                                                                                                                                        |                              | ✓                                  |                                |                              | ✓                          |
| Very High | <b>Monitor for and remove watercourse weeds</b><br>Remove watercourse weeds with a high potential to spread using minimal disturbance methods to prevent off-target damage to the aquatic environment; work from upstream to downstream; undertake monitoring for and removal of re-growth within twelve months: <ul style="list-style-type: none"><li>• Blackberry</li><li>• Dense Flat-sedge*</li><li>• Desert Ash*</li><li>• Giant Reed*</li><li>• Lippia.</li></ul>                                                                  | ✓<br>✓<br><br>✓<br>✓         | <br>✓<br>✓<br>✓<br>✓               | <br><br>✓<br>✓<br>✓            | <br><br>✓<br>✓<br>✓          | <br>✓<br><br>✓<br>✓        |
| High      | <b>Removal of high threat woody weeds (including non-local natives)</b><br>Control of exotic trees and woody weeds and follow-up every two to four years. Use minimal disturbance techniques such as “cut and swab” for saplings and shrubs, “drill and fill” for larger trees and small seedlings may be hand-pulled: <ul style="list-style-type: none"><li>• Buckthorn</li><li>• Caster Oil Plant*</li><li>• Dog / Briar Rose</li><li>• Golden Wreath Wattle</li><li>• Montpellier Broom</li><li>• Olives**</li><li>• Palm*.</li></ul> | <br><br>✓<br><br>✓<br>✓<br>✓ | <br><br>✓<br>✓<br>✓<br>✓<br>✓<br>✓ | <br>✓<br>✓<br>✓<br>✓<br>✓<br>✓ | <br>✓<br><br>✓<br><br>✓<br>✓ | <br><br><br><br><br>✓<br>✓ |
| High      | <b>Removal of high threat non-woody weeds</b><br>Control of non-woody weeds using minimal disturbance methods including spot spray and grubbing out: <ul style="list-style-type: none"><li>• Arum Lily*,**</li><li>• Fennel</li><li>• Giant Reed*</li><li>• Hemlock*</li><li>• Periwinkle.</li></ul>                                                                                                                                                                                                                                     | ✓<br>✓<br>✓<br>✓<br>✓        | <br><br>✓<br><br>✓                 | <br><br>✓<br><br><br>          | <br><br>✓<br><br>✓<br><br>   | <br><br><br>✓<br><br>      |
| High      | <b>Spot weed around existing revegetation in good condition areas</b><br>Use minimal disturbance techniques (spot spray, hand pull, brush-cutting) to remove grassy and herbaceous weeds around revegetation, particularly native groundcovers, to encourage natural regeneration.                                                                                                                                                                                                                                                       | ✓                            | ✓                                  |                                | ✓                            |                            |

| Priority          | Management Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Section |   |   |   |   |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---|---|---|---|
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1       | 2 | 3 | 4 | 5 |
| Section priority: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | H       | H | M | H | L |
| Medium            | <b>Control of moderate threat weeds:</b> <ul style="list-style-type: none"><li>• Bracelet Honey-myrtle</li><li>• Casuarina / Swamp Oak</li><li>• English Ivy</li><li>• Gazania</li><li>• Green Cestrum</li><li>• Flinders Ranges Wattle</li><li>• Jointed Rush*</li><li>• Nasturtium (in revegetation areas only)</li><li>• Peppercorn tree**</li><li>• Plum (wild)</li><li>• Rice Millet (in revegetation areas only)</li><li>• South African Daisy</li><li>• Weeping Willow.</li></ul> |         |   | ✓ | ✓ | ✓ |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |   |   |   |   |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         | ✓ |   |   | ✓ |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         | ✓ |   |   |   |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ✓       |   |   |   |   |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         | ✓ | ✓ | ✓ |   |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ✓       |   |   |   |   |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         | ✓ | ✓ |   |   |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         | ✓ | ✓ |   |   |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |   | ✓ | ✓ | ✓ |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ✓       | ✓ | ✓ |   | ✓ |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |   | ✓ |   | ✓ |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |   |   |   | ✓ |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |   |   |   | ✓ |
| Medium            | <b>Erosion management with revegetation and ‘soft engineering’</b>                                                                                                                                                                                                                                                                                                                                                                                                                       | ✓       |   |   | ✓ | ✓ |
|                   | Undertake erosion control works to address active erosion at lower risk sites, favouring ‘soft’ engineering options and improving bank protection with native sedges and rushes and focussing on addressing bed deepening.                                                                                                                                                                                                                                                               |         |   |   |   |   |
| Medium            | <b>Revegetation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |   |   |   |   |
|                   | Plant groundlayer species where sufficient weed control has been achieved to improve diversity in good condition areas and expand revegetation into medium condition areas.                                                                                                                                                                                                                                                                                                              | ✓       | ✓ | ✓ | ✓ | ✓ |
| Low               | <b>Residential gardens</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |   |   |   |   |
|                   | Engage with local landholders to encourage incorporation of local native species and removal of weedy species in gardens and on reserves.                                                                                                                                                                                                                                                                                                                                                |         | ✓ | ✓ |   | ✓ |
| Low               | <b>Install artificial habitats</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |   |   |   |   |
|                   | Install nest boxes of various sizes to support a range of hollow-nesting species.                                                                                                                                                                                                                                                                                                                                                                                                        |         |   | ✓ | ✓ | ✓ |

# Section priority: H (high), M (medium), L (low)

\*Indicates weeds growing in the watercourse that require great care to avoid off target damage

\*\*Indicates weeds growing in adjacent gardens/planted in reserves



## 4. MANAGEMENT METHODS

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### 5.1 WEED MANAGEMENT

The length of Fifth Creek within the Campbelltown City Council is at the downstream end of the catchment and within an urban setting where many weedy species are planted in residential gardens. Weed control will be an on-going task and it will be important to focus on maintaining areas that are currently low in weed abundance, focussing on species with potential to expand their distribution and supporting and encouraging community efforts on public and private land.

Isolated occurrences of high threat weeds were mapped as part of the field survey; these include Weeds of National Significance (WoNS), declared weeds under the Natural Resources Management Act (2004) as well as species considered to pose a threat to the watercourse values.

#### 5.1.1 Woody weeds and exotic trees

Council staff currently undertake an annual to biannual program of woody weed control using cut and swab methods to remove instream and bank woody weeds, particularly Desert Ash (Ash) and Olives. This program will need to be on-going as the urban setting of the creek means that weeds are constantly being replaced, however, with regular maintenance, the task is kept to a minimum.

Ash seedlings occurred throughout in low abundance and were not mapped individually. The field survey component also identified a number of non-local native species considered a weed threat that have been planted and are either regenerating or have the potential to do so (Virtue and Melland 2003). These species should also be included in the regular woody weed control program and similar control methods can be used. Large exotic tree species (e.g. Buckthorn, Peppercorn Tree, large Olives) can be removed using drill and fill method and subsequently cut down if they are considered likely to pose a risk.

The control methods (Table 2 Weed control methods) used must be consistent with current best practice (AMLR NRMB 2014, Shepherd 2013) to ensure no off-target damage, including undertaking control work when the watercourse is dry and no rain is expected and only using approved herbicides.

#### 5.1.2 Non-woody weeds

A range of non-woody weeds were also identified in the field survey that should be controlled to reduce the threat of these becoming dominant. Control methods are outlined below based on Robertson (2005), Shepard (2013) and Romanowski (2011). Recommended herbicides and application rates for declared species are given in Shepard (2013). As for woody weeds, control methods must be consistent with current best practice (AMLR NRMB 2014). It should be noted that, as the survey was carried out in summer, some annual weeds and weeds that shoot from bulbs and tubers and then die-back could be present during the winter months.

#### Exotic Sedge (*Cyperus* spp.) identification

The exotic sedge Dense Flat-sedge (*Cyperus congestus*) was found growing in Fifth Creek. Native sedge species, Stiff Flat-sedge (*C. vaginatus*) and Spiny Flat-sedge (*C. gymnocaulos*), were also found. The exotic sedge can be most easily distinguished from the native species by the following features:

- Dense (/Drain) Flat-sedge has leaves of similar length to the stems and is bright green while the two native species have no obvious leaves (they are reduced to short bracts around the base of the stem) and are a darker green colour.

### Herbaceous and grassy weeds

Herbaceous and grassy weed species were recorded throughout most of Fifth Creek, particularly Kikuyu, Nasturtiums and Couch, and their occurrences were not mapped. Attempting to remove these weeds on a broad scale is not recommended as they are already so abundant that effective removal would be difficult to achieve, would leave large areas bare and may result in off-target damage. However, in existing and proposed revegetation areas, herbaceous and grassy weeds should be controlled as part of the revegetation preparation and management. Non-selective herbicides approved for use near a watercourse should be effective, however, non-herbicide methods that could also be effective are steam weeding and flame torch. Experienced contractors should be engaged to trial these non-herbicide methods.

**Table 2 Weed control methods**

| Weed                           | Control methods                                                                                                                                   | Timing                         | Other                                                                                           |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------|
| Arum Lily                      | Grub out small plants before they grow, spot spray or cut and swab                                                                                | Spring                         | Remove while still small                                                                        |
| Dense Flat-sedge, Jointed Rush | Grub out small plants, ensuring all roots are removed or wipe herbicide onto leaves                                                               | Early summer (before seed set) | See below for identification tips. Work from upstream to downstream.                            |
| English Ivy                    | Work inwards from outer edges, grub out or spray                                                                                                  | Spring                         | Herbicide may not be highly effective                                                           |
| Gazania                        | Grub out plants working inwards from the outer edges. Cut and swab main roots                                                                     | Spring to Summer               | Folia application can work, wetter required                                                     |
| Giant Reed                     | Slash and spot spray re-growth                                                                                                                    | Spring to Summer               | Small plants can be grubbed out and removed by hand                                             |
| Lippia                         | Spray soon after rain when plants are actively growing, work from the outside in. Spray or grub out re-growth in the same season. See DPI (2014). | Spring to Summer               | Follow-up required annually, do not revegetated until area has been 'Lippia free' for > 2 years |
| Periwinkle                     | Spray from the outer edges, can be slashed and actively growing re-growth sprayed                                                                 | Winter – spring                | Monitor and control regrowth annually                                                           |
| Rice Millet                    | Apply non-selective herbicide when actively growing                                                                                               | Spring to early Summer         | Slashing and spraying re-growth may be most effective                                           |
| South African Daisy            | Hand pull in Winter before flowering                                                                                                              | Winter to Spring               | Cut and swab can be used for large plants                                                       |

### 5.1.3 Weed sources

Work with Department for Environment, Water and Natural resources to locate and control upstream seed sources for species such as Ash, Giant Reed, Dense Flat-sedgs and Caster Oil Plant in Blackhill Conservation Park. Implement the Wadmore Park/Pulyonna Wirra Management Plan 2013 – 2018 (Campbelltown City Council 2013) which includes strategies for pest plant control including non-local native species.



## 5.2 NATIVE VEGETATION MANAGEMENT

### 5.2.1 Management of existing revegetation

Revegetation with a small number of large shrubs and small tree species has been undertaken in almost all of the riparian reserves between ten and twenty years ago, while in the larger reserves, recent revegetation has been undertaken that includes a more diverse range of local native species, particularly groundlayer species (e.g. Figure 4, Figure 9). Areas that have been rated as being in good condition generally have remnant and regenerating River Red Gums and planted local native shrubs and small trees with groundlayer species (e.g. groundcovers, native grasses, tussocks and herbaceous species). Areas rated as being in medium condition generally have local native trees and large shrubs planted without groundlayer species. Areas without groundlayer will provide habitat and biodiversity benefits without further plantings, however native groundlayer plants provide food and habitat for a greater range of fauna, particularly insects, lizards and ground foraging birds (Munro et al., 2007; Kazemi et al., 2009). Groundlayer species are relatively difficult to establish in existing revegetation where there is competition for soil moisture and light and their establishment requires more complex on-going weed management.

Managing weeds in existing revegetation areas is a priority to ensure that the resources and effort that has gone into these areas to date is not wasted, to encourage natural regeneration and to ensure community support for further revegetation work.

#### Encouraging natural regeneration

Spot spraying and hand-pulling weeds around existing plantings can assist to encourage natural regeneration but requires good plant identification and care to ensure no accidental damage to the revegetation. Brush-cutting annual weeds amongst revegetation can also be used to reduce the weed seed set.

Mulching is a useful method to control weed regeneration in new plantings but generally prevents natural regeneration. Therefore it is recommended that mulching should not continue to be applied once revegetation is well established (i.e. after three years) unless weed control is a priority (i.e. in 'demonstration revegetation' areas).

### 5.2.2 Future revegetation works

As noted above, all areas of Fifth Creek that can be revegetated have been, to varying degrees, and there are no areas where entirely new revegetation is required. However there is scope to expand the areas of understorey plantings into areas where good weed control has been achieved and to continue to increase the diversity of species in recent understorey planting areas. Any new areas of revegetation should have regard to the Trails Master Plan, including the proposed widths and location of trails. Revegetation in public places should also follow CPTED<sup>1</sup> principles, particularly ensuring good sightlines along pathways, with planting mostly lower than 0.6 metres and branches above two metres high.

Local seed sources should be used for propagation and a records system should be developed to document the source of seed used in projects. This will enable revegetation sites to become a source for propagation for future revegetation.

### 5.2.3 Revegetation species list and plant numbers

The following tables are recommended species for plantings (Table 3) and relative numbers of plant life forms per 10 x 10 metres (0.01 hectares) of revegetation area designed to achieve an 'open park' appearance (Table 4).

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<sup>1</sup> Crime Prevention Through Environmental Design

The groundlayer of any area of undisturbed remnant vegetation generally contains the greatest diversity of species but many of these species are difficult to propagate. Some groundlayer species are often accidentally mistaken for weeds by those not familiar in plant identification, which results in them being removed as part of site maintenance. The groundlayer revegetation species are therefore divided into two groups:

- Group A: species that are reasonably hardy and readily identifiable as being planted natives
- Group B: species that are less hardy and more likely to be confused with weeds.

Group B species should only be planted in areas where a high level of weed maintenance by experienced staff, contractors or volunteers can be undertaken. Council staff that are likely to undertake maintenance should be involved in the plantings so that they are aware of what has been planted, and plant identification resources and/or training will assist them to maintain the areas without causing accidental off-target damage. Bamboo stakes placed next to each plant may also assist to identify planted species.

**Table 3 Revegetation species (see Table 4 for plant numbers)**

| Scientific Name                                     | Common Name            | Watercourse | Bank | Large tree | Small tree | Shrub | Groundlayer A | Groundlayer B |
|-----------------------------------------------------|------------------------|-------------|------|------------|------------|-------|---------------|---------------|
| <i>Acacia acinacea</i>                              | Wreath Wattle          |             | ✓    |            |            | ✓     |               |               |
| <i>Acacia melanoxylon</i>                           | Blackwood              |             | ✓    |            | ✓          |       |               |               |
| <i>Acacia pycnantha</i>                             | Golden Wattle          |             | ✓    |            | ✓          |       |               |               |
| <i>Acacia retinodes</i>                             | Wirilda ('hill form')  |             | ✓    |            | ✓          |       |               |               |
| <i>Acaena novae-zelandiae</i>                       | Biddy-biddy            |             | ✓    |            |            |       |               | ✓             |
| <i>Allocasuarina verticillata</i>                   | Drooping Sheoak        |             | ✓    |            | ✓          |       |               |               |
| <i>Arthropodium strictum</i> , <i>A. fimbriatum</i> | Chocolate lilies       |             | ✓    |            |            |       |               | ✓             |
| <i>Atriplex semibaccata</i>                         | Berry Saltbush         |             | ✓    |            |            |       | ✓             |               |
| <i>Austrostipa elegantissima</i>                    | Elegant Spear-grass    |             | ✓    |            |            |       |               | ✓             |
| <i>Austrostipa</i> spp.                             | Spear Grass            |             | ✓    |            |            |       |               | ✓             |
| <i>Banksia marginata</i>                            | Silver Banksia         |             | ✓    |            | ✓          |       |               |               |
| <i>Bulbine bulbosa</i>                              | Bulbine Lily           |             | ✓    |            |            |       |               | ✓             |
| <i>Bursaria spinosa</i> var. <i>spinosa</i>         | Christmas Bush         |             | ✓    |            |            | ✓     |               |               |
| <i>Callistemon sieberi</i>                          | River Bottlebrush      | ✓           |      |            |            | ✓     |               |               |
| <i>Callitris gracilis</i>                           | Native Pine            |             | ✓    |            | ✓          |       |               |               |
| <i>Calocephalus citreus</i>                         | Lemon Beauty-heads     |             | ✓    |            |            |       |               | ✓             |
| <i>Calostemma purpureum</i>                         | Pink Garland Lily      |             | ✓    |            |            |       |               | ✓             |
| <i>Carex tereticaulis</i>                           | Rush Sedge             | ✓           |      |            |            |       | ✓             |               |
| <i>Chloris truncata</i>                             | Windmill Grass         |             | ✓    |            |            |       |               | ✓             |
| <i>Chrysocephalum apiculatum</i>                    | Common Everlasting     |             | ✓    |            |            |       |               | ✓             |
| <i>Clematis microphylla</i>                         | Old Man's Beard        |             | ✓    |            |            |       |               |               |
| <i>Correa glabra</i>                                | Rock Correa            |             | ✓    |            |            | ✓     |               |               |
| <i>Cullen parvifolium</i>                           | Native Scurf-pea       |             | ✓    |            |            | ✓     |               |               |
| <i>Cyperus gymnocaulos</i>                          | Spiny Flat-sedge       | ✓           | ✓    |            |            |       | ✓             |               |
| <i>Cyperus vaginatus</i>                            | Flat-sedge             | ✓           |      |            |            |       | ✓             |               |
| <i>Dianella longifolia</i> var. <i>grandis</i>      | Pale Flax-lily         |             | ✓    |            |            |       |               | ✓             |
| <i>Dianella revoluta</i>                            | Black-anther Flax-lily |             | ✓    |            |            |       | ✓             |               |
| <i>Dodonaea viscosa</i> ssp. <i>spatulata</i>       | Sticky Hop-bush        |             | ✓    |            |            | ✓     |               |               |
| <i>Einadia nutans</i>                               | Climbing Saltbush      |             | ✓    |            |            |       | ✓             |               |
| <i>Enchylaena tomentosa</i>                         | Ruby Saltbush          |             | ✓    |            |            |       | ✓             |               |
| <i>Enneopogon nigricans</i>                         | Blackhead              |             | ✓    |            |            |       | ✓             |               |



# Fifth Creek Management Plan

| Scientific Name                                                                             | Common Name            | Watercourse | Bank | Large tree | Small tree | Shrub | Groundlayer A | Groundlayer B |
|---------------------------------------------------------------------------------------------|------------------------|-------------|------|------------|------------|-------|---------------|---------------|
| <i>Eucalyptus camaldulensis</i> ssp. <i>camaldulensis</i>                                   | River Red Gum          |             | ✓    | ✓          |            |       |               |               |
| <i>Eutaxia microphylla</i>                                                                  | Common Eutaxia         |             | ✓    |            |            |       | ✓             |               |
| <i>Ficinia nodosa</i>                                                                       | Knobby Club-rush       | ✓           | ✓    |            |            |       | ✓             |               |
| <i>Geranium retrorsum</i>                                                                   | Grassland Geranium     |             | ✓    |            |            |       |               | ✓             |
| <i>Goodenia amplexicans</i>                                                                 | Clasping Goodenia      |             | ✓    |            |            |       | ✓             |               |
| <i>Grevillea lavandulacea</i> var. <i>lavandulacea</i>                                      | Lavender Grevillea     |             | ✓    |            |            |       | ✓             |               |
| <i>Hakea rostrata</i>                                                                       | Beaked Hakea           |             | ✓    |            |            | ✓     |               |               |
| <i>Hardenbergia violacea</i>                                                                | Native Lilac           |             | ✓    |            |            | ✓     |               |               |
| <i>Hibbertia exutiacies</i>                                                                 | Prickly Guinea-flower  |             | ✓    |            |            |       | ✓             |               |
| <i>Juncus</i> spp. (e.g <i>J. sarophorus</i> , <i>J. subsecundus</i> , <i>J. pallidus</i> ) | Rushes                 | ✓           | ✓    |            |            |       | ✓             |               |
| <i>Kennedia prostrata</i>                                                                   | Running Post-man       |             | ✓    |            |            |       | ✓             |               |
| <i>Lavatera plebia</i>                                                                      | Native Hollyhock       |             | ✓    |            |            | ✓     |               |               |
| <i>Leptospermum lanigerum</i> *                                                             | Woolly Tea-tree        | ✓           |      |            |            |       |               |               |
| <i>Lomandra multiflora</i> ssp. <i>dura</i>                                                 | Hard Mat-rush          |             | ✓    |            |            |       | ✓             |               |
| <i>Myoporum viscosum</i>                                                                    | Sticky Boobialla       |             | ✓    |            |            | ✓     |               |               |
| <i>Olearia ramulosa</i>                                                                     | Twiggy Daisy-bush      |             | ✓    |            |            | ✓     |               |               |
| <i>Pelargonium australe</i>                                                                 | Australian Pelargonium |             | ✓    |            |            |       |               | ✓             |
| <i>Pittosporum angustifolium</i>                                                            | Native Apricot         |             | ✓    |            | ✓          |       |               |               |
| <i>Poa labillardieri</i>                                                                    | Tussock Grass          | ✓           | ✓    |            |            |       | ✓             |               |
| <i>Rubus parvifolius</i>                                                                    | Native Raspberry       |             | ✓    |            |            |       |               | ✓             |
| <i>Rytidosperma</i> spp.                                                                    | Wallaby Grass          |             | ✓    |            |            |       |               | ✓             |
| <i>Santalum acuminatum</i>                                                                  | Quandong               |             | ✓    |            | ✓          |       |               |               |
| <i>Scaevola albida</i>                                                                      | White Fanflower        |             | ✓    |            |            |       |               | ✓             |
| <i>Senecio phelleus</i>                                                                     | Woodland Groundsel     |             | ✓    |            |            |       |               | ✓             |
| <i>Senecio quadridentatus</i>                                                               | Cotton Groundsel       |             | ✓    |            |            |       |               | ✓             |
| <i>Teucrium racemosum</i>                                                                   | Grey Germander         |             | ✓    |            |            |       | ✓             |               |
| <i>Themeda triandra</i>                                                                     | Kangaroo Grass         |             | ✓    |            |            |       | ✓             |               |
| <i>Vittadinia</i> spp.                                                                      | New Holland Daisy      |             | ✓    |            |            |       |               | ✓             |
| <i>Xanthorrhoea quadrangulata</i>                                                           | Rock Grass-tree        |             | ✓    |            |            | ✓     |               |               |

\*Only plant on the margins of pools

**Table 4 Number of plants per 10 x 10 metres of revegetation**

| Plant life form | Number    |
|-----------------|-----------|
| Large tree*     | 1         |
| Small tree*     | 2         |
| Shrub           | 5         |
| Groundlayer A   | 25 to 100 |
| Groundlayer B   | 50 to 200 |

\*Note that there are very few areas where large and small tree species do not already exist and therefore these plant life forms should only be included where the mature tree species appear very old and there is no natural regeneration or the species listed is not already present. They could also be included in landscaping projects.

### **5.2.3 In-Stream Vegetation**

#### **River Red Gum Regeneration**

River Red Gums seedlings and saplings were observed at some locations of growing in the watercourse. In a 'natural' system this would be considered a positive outcome, however, in the highly urbanised setting of Fifth Creek, where the creek provides an important stormwater transport system, such regeneration may contribute to flooding (by restricting and slowing flow) and erosion (by diverting flow into new flow paths). Therefore the current practice of removing River Red Gums growing in the watercourse can continue except:

- Those growing on the outer bends where they may provide protection of the banks from erosion and
- Potentially in areas where the reserve is wider and there is room for flows to spread out.

Where River Red Gums regenerate on the banks they should be clearly marked (so as not to be mown) and retained.

#### **Revegetation of Sedges and Rushes**

Little instream native vegetation was observed during the field survey, however these types of fast flowing, cobbled watercourses are commonly not densely vegetated. Stiff Flat-sedge and Spiny Flat-sedge was observed growing in the watercourse. Additional sedges and rushes could be planted on the lower banks of the creek in areas with low weed cover.



### 5.3 EROSION MANAGEMENT

Major erosion issues were only recorded at a small number of sites in Fifth Creek. At a limited number of sites it is a very high priority to undertake bank and infrastructure protection and repair works, while there are lower priority issues to be addressed at other locations. The following are some issues to be considered in relation to these works:

- Where large trees are being removed the logs should be utilised in the adjacent riparian reserve, either for habitat (e.g. as natural fallen logs) or natural play areas (e.g. stumps and balance logs)
- Where new gabions are used to protect banks, incorporate methods or structures to prevent channel deepening and undermining of gabions in future flood events
- Rocks naturally deposited in channel will help prevent bed deepening in the future
- Where bank erosion has occurred but no assets are at risk, consider working with the new bank alignment
- Incorporate planting of native sedges, rushes and grasses around structures and infill to trap sediments.

Soft engineering options that could be considered for future erosion management are:

- Not spraying the banks so that grass is retained to protect the soil,
- Establishing local native sedges and rushes (see Table 3) around existing and new instream rock structures to assist in binding the soil and trapping sediments,;
- Planting low growing woody shrubs and sedges and rushes (see Table 3) at the toe of outer bank erosion points to protect the banks and trap debris without obstructing the flow (it is important that only small species are used and this method is only used on outer bends so that flood risk is not exacerbated); this can be done in conjunction with the construction of alignment fences however these would need to be biodegradable and/or strongly constructed to minimise the impact if the fence is damaged in major floods.

Erosion control works may require a Water Affecting Activities permit under the Natural Resources Management Act (2004) and should utilise the AMLR NRMB Best Practice Operating Procedures (AMLR NRMB 2014).

## 5.4 MONITORING RECOMMENDATIONS

There are two types of monitoring that should be undertaken as part of the implementation of this plan. Firstly there is monitoring that informs day to day management activities, this can include monitoring the survival of revegetation, weeds that require control and the success of watercourse erosion control works. The second type of monitoring is evaluating if the objectives outlined in this plan are being achieved.

The first type of monitoring ('action monitoring') should be undertaken at least annually and is probably already undertaken to some extent at least informally by Council staff. This could be formalised to at least a biannual survey of medium and high threat weeds using GPS and plant counts.

The second type of monitoring ('objective monitoring') can be undertaken less frequently (e.g. every five years) and will require more careful planning to ensure progress towards the objectives is evaluated.

Table 5 presents some options for monitoring progress towards the objectives which could be developed into a more formalised monitoring program.

**Table 5 Options for monitoring objectives**

| Objective                                                                            | Method                                                                                      | Performance indicator                                                                                   |
|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| To prevent any further decline in condition of the watercourse and riparian habitats | Re-survey the creek using the method used for this project                                  | No section declines in condition in overall or individual attributes                                    |
|                                                                                      | Bushland Condition Monitoring (Croft et al. 2005) or Bushland Assessment (NVC 2017) methods | No decline in Bushland Condition Monitoring / Bushland Assessment score                                 |
|                                                                                      | Fauna (e.g. birds, macroinvertebrates) monitoring                                           | No decline in fauna diversity                                                                           |
| To restore the condition of the watercourse and riparian habitats                    | Re-survey the creek using the method used for this project                                  | Sections improve in watercourse attribute indicators (e.g. watercourse condition, weed threat, erosion) |
|                                                                                      | Establish BCM sites in each section                                                         | Improved BCM score                                                                                      |
|                                                                                      | Fauna (e.g. birds, macroinvertebrates) monitoring                                           | Improved fauna diversity                                                                                |
| Maintain and enhance the amenity and recreational values of the creek corridor       | Survey adjacent residents                                                                   | Resident satisfaction is maintained or improved                                                         |
|                                                                                      | Survey number of people using                                                               | Number of people using the creek corridor is maintained or improved                                     |
| Coordinated management across Council to achieve multiple objectives.                | Actions are implemented and maintained by staff                                             | Qualitative evaluation                                                                                  |



## 5. CONCLUSIONS

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Of the three creeks in the Campbelltown City Council surveyed by the author, Fifth Creek is considered to be in the best condition. The Creek runs through wide recreation and linear reserves with remnant River Red Gums along the entire length and a small amount of remnant native understorey vegetation. There are extensive areas of revegetation with local native species, with more recent plantings having a high diversity of understorey species.

The Wadmore Park, St Ignatius College and Max Amber Reserve sections are considered the highest priority for management to ensure the gains achieved in these areas are not lost.

There are a small number of areas where erosion from the 2016 floods has placed some assets at risk and these areas are a priority for erosion management. In lower risk areas, soft engineering options that focus on reducing bed deepening and incorporate native species plantings should be implemented.

Weed management is also a high priority; weed control should focus on high threat species, work from up to downstream for watercourse weeds, and work from the least weedy areas first for other weeds. Minimal disturbance techniques are required to prevent off-target damage to native vegetation and the aquatic environment. Careful spot weeding of grassy and herbaceous weeds around existing revegetation will encourage natural regeneration.

Further revegetation should focus on understorey (particularly groundlayer) species to increase the diversity in existing revegetation areas and expand revegetation extent where sufficient weed control has been achieved.

In the longer term, incorporating local native species into public landscaping works and encouraging adjacent property owners to use local native species and not plant weedy species will improved the biodiversity values of the local area and reduce potential weed sources.

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## 7. APPENDIX: PLANT SPECIES OBSERVED

**Table 6 Local native species**

W = watercourse (naturally occurring), P = planted (banks), N = naturally occurring, T = throughout (naturally occurring)

| Species Name                                       | Common Name             | St Ignatius <sup>1</sup> | Section 1 | Section 2 | Section 3 | Section 4 | Section 5 |
|----------------------------------------------------|-------------------------|--------------------------|-----------|-----------|-----------|-----------|-----------|
| <i>Acacia acinacea</i>                             | Round-leaf Wattle       |                          | P         | P         | P         | P         |           |
| <i>Acacia sp. cupularis(?)</i>                     | Wattle (Cup Wattle?)    |                          |           |           |           | P         |           |
| <i>Acacia melanoxylon</i>                          | Blackwood               |                          |           |           | P         | R         |           |
| <i>Acacia myrtifolia</i>                           | Myrtle Wattle           |                          | P         | R         |           |           |           |
| <i>Acacia paradoxa</i>                             | Kangaroo Thorn          |                          | P         | P         | P         | P         |           |
| <i>Acacia provincialis</i>                         | Wirilda                 |                          |           |           | P         | P         |           |
| <i>Acacia pycnantha</i>                            | Golden Wattle           |                          | P         | P         |           | P         |           |
| <i>Acacia retinodes</i>                            | Silver Wattle           |                          |           |           | P         | P         |           |
| <i>Acacia rupicola</i>                             | Rock Wattle             |                          |           | P         | P         |           |           |
| <i>Acacia salicina**</i>                           | Broughton Willow        |                          |           |           | P         | P         | P         |
| <i>Acacia sp.</i>                                  | Wattle                  |                          |           |           |           | P         |           |
| <i>Allocasuarina muelleriana ssp. muelleriana</i>  | Sheoak                  |                          | P         |           |           |           |           |
| <i>Allocasuarina verticillata</i>                  | Drooping Sheoak         |                          | P         | P         | P         | P         | P         |
| <i>Austrostipa elegantissima</i>                   | Elegant Spear-grass     |                          |           |           |           | P         |           |
| <i>Austrostipa sp.</i>                             | Spear-grass             |                          |           |           |           | P         |           |
| <i>Austrostipa sp.</i>                             | Spear-grass             |                          |           |           |           | P         |           |
| <i>Banksia marginata</i>                           | Silver Banksia          |                          |           |           | P         |           |           |
| <i>Bursaria spinosa var. spinosa</i>               | Christmas Bush          |                          | P         | P         | P         |           | P         |
| <i>Callistemon sieberi</i>                         | River Bottlebrush       |                          | P         | P         | P         | P         | p         |
| <i>Callistemon sp. (?rugulosus)</i>                | Bottlebrush             |                          |           |           | P         |           |           |
| <i>Callitris gracilis</i>                          | Southern Cypress-pine   |                          | P         | P         | P         | P         | p         |
| <i>Carex breviculmis</i>                           | Short-stem Sedge        | N                        |           |           |           |           |           |
| <i>Chloris truncata</i>                            | Windmill Grass          | N                        |           | N         |           | P         |           |
| <i>Correa sp. (?reflexa?)</i>                      | Correa                  |                          |           |           |           | P         | P         |
| <i>Cullen parvum</i>                               | Small Scurf-pea         |                          |           |           |           | P         |           |
| <i>Cyperus gymnocaulos</i>                         | Spiny Flat-sedge        |                          |           | P         |           | W         |           |
| <i>Cyperus vaginatus</i>                           | Stiff Flat-sedge        | N                        | W         | W         | W         | W         | W         |
| <i>Dianella revoluta var. revoluta</i>             | Long-stem Flaxlily      |                          |           |           |           |           | P         |
| <i>Dianella sp. (revoluta/brevifolia)</i>          | Flax-lily               |                          |           | P         |           | P         |           |
| <i>Dichondra repens</i>                            | Tom Thumb               |                          |           | N         | N         |           | N         |
| <i>Dodonaea viscosa ssp. spatulata</i>             | Sticky Hopbush          |                          | P         | P         | R         | P         |           |
| <i>Einadia nutans</i>                              | Climbing Saltbush       |                          |           |           |           | P         |           |
| <i>Enchylaena tomentosa</i>                        | Ruby Saltbush           |                          |           |           |           | P         |           |
| <i>Eucalyptus camaldulensis ssp. camaldulensis</i> | River Red Gum           | N                        | T         | T         | T         | T         | T         |
| <i>Eucalyptus leucoxylon ssp.</i>                  |                         |                          |           |           |           | P         |           |
| <i>Eucalyptus leucoxylon ssp. leucoxylon</i>       | SA Blue Gum             | N                        | P         | P         | P         | P         | N         |
| <i>Eucalyptus viminalis ssp. viminalis**</i>       | Rough-barked Manna Gum  |                          |           | P         |           |           |           |
| <i>Geranium retrorsum</i>                          | Grassland Geranium      |                          |           | P         |           |           |           |
| <i>Geranium solanderi</i>                          | Australian Crane's Bill |                          |           |           |           | P         |           |
| <i>Hakea carinata</i>                              | Erect Hakea             |                          | P         | P         |           |           |           |
| <i>Hakea rugosa</i>                                | Dwarf hakea             |                          |           |           |           | P         |           |
| <i>Hardenbergia violacea</i>                       | Native Lilac            |                          |           | P         |           |           | P         |



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| Species Name                                 | Common Name         | St Ignatius <sup>1</sup> | Section 1 | Section 2 | Section 3 | Section 4 | Section 5 |
|----------------------------------------------|---------------------|--------------------------|-----------|-----------|-----------|-----------|-----------|
| <i>Isolepis hookeriana</i>                   | Grassy Club-rush    | N                        |           |           |           |           |           |
| <i>Juncus bufonius</i>                       | Toad rush           | N                        |           |           |           |           |           |
| <i>Juncus usitatus</i>                       | Common Rush         | N                        |           |           |           |           |           |
| <i>Lomandra sororia</i>                      | Sword Mat-rush      | N                        |           |           |           |           |           |
| <i>Lythrum hyssopifolia</i>                  | Lesser loosestrife  |                          | W         |           |           |           | W         |
| <i>Melaleuca brevifolia</i>                  | Mallee Honey-myrtle |                          |           |           |           | P         | P         |
| <i>Myoporum viscosum</i>                     | Sticky Boobialla    |                          |           |           |           | P         |           |
| <i>Olearia ramulosa</i>                      | Twiggy Daisy-bush   |                          |           | P         |           | P         | P         |
| <i>Persicaria decipiens</i>                  | Slender Knotweed    |                          | W         | W         | W         | W         |           |
| <i>Persicaria lapathifolia</i>               | Pale Knotweed       |                          |           |           |           |           | W         |
| <i>Poa labillardieri</i>                     | Tussock Gras        |                          |           |           |           | P         |           |
| <i>Rytidosperma sp.</i>                      | Wattlaby Grass      |                          |           |           |           | P         |           |
| <i>Senecio phelleus</i>                      | Woodland Groundsel  |                          |           | R         |           | R         |           |
| <i>Themeda triandra</i>                      | Kangaroo Grass      | N                        |           |           |           | P         |           |
| <i>Xanthorrhoea quadrangulata</i>            | Grass Tree          |                          | P         | P         |           |           |           |
| <i>Xanthorrhoea semiplana ssp. semiplana</i> | Yacca               |                          |           |           |           | P         |           |
|                                              | Total               | 10                       | 17        | 25        | 19        | 37        | 15        |

<sup>1</sup>St Ignatius School, Fifth Creek Walking Trail, surveyed June 1999 - August 2000

\* indicates South Australian native species that may be outside their natural range

**Table 7 Introduced species**

P = Planted      T = Throughout      W = Watercourse only      Banks = isolated occurrences, mapped

| High threat <sup>2</sup> | WoNS <sup>3</sup> | SA declared <sup>4</sup> | Species Name                                          | Common Name              | Section 1 | Section 2 | Section 3 | Section 4 | Section 5 |
|--------------------------|-------------------|--------------------------|-------------------------------------------------------|--------------------------|-----------|-----------|-----------|-----------|-----------|
|                          |                   |                          |                                                       | Bamboo                   |           |           | R         |           |           |
| *                        |                   |                          | <i>Acacia iteaphylla</i>                              | Flinders Ranges Wattle   |           | P         | R         | P         |           |
| *                        |                   |                          | <i>Acacia saligna</i>                                 | Golden Wreath Wattle     |           | P         | R         | P         |           |
| *                        |                   |                          | <i>Arecaceae sp.</i>                                  | Palm                     |           | R         | O         |           | O         |
| *                        |                   | Cn                       | <i>Arundo donax</i>                                   | Giant Reed               | R         | O         | O         | O         | O         |
|                          |                   |                          | <i>Aster subulatus</i>                                | Wild Aster               |           |           |           |           | O         |
| *                        |                   | C                        | <i>Casuarina sp. (? glauca)</i>                       | (?Swamp) Oak             | R         |           | O         | O         | O         |
|                          |                   |                          | <i>Cestrum paqui</i>                                  | Green Cestrum            | R         |           |           |           |           |
|                          |                   |                          | <i>Conium maculatum</i>                               | Hemlock                  | O         |           |           |           |           |
|                          |                   |                          | <i>Convolvulus arvensis</i>                           | Bindweed                 | R         |           |           |           |           |
|                          |                   |                          | <i>Corymbia maculata</i>                              | Spotted Gum              |           |           |           | P         |           |
|                          |                   |                          | <i>Cynodon dactylon</i>                               | Couch                    | W         | O         | W         | W         | W         |
| *                        |                   |                          | <i>Cyperus congestus</i> (/C. <i>eragrostis</i> )     | Dense / Drain Flat-sedge | O         | O         |           | O         | R         |
| *                        |                   |                          | <i>Cyperus involucratus</i>                           | Umbrella Sedge           |           |           | O         |           |           |
| *                        |                   |                          | <i>Foeniculum vulgare</i>                             | Fennel                   | O         |           |           |           |           |
| *                        |                   | C                        | <i>Fraxinus angustifolia</i> ssp. <i>angustifolia</i> | Desert Ash               |           | W         | W         | W         | W         |
|                          |                   | CE                       | <i>Gazania sp.</i>                                    | Gazania                  |           | P         |           |           |           |
| *                        | *                 | C                        | <i>Genista monspessulana</i>                          | Broom                    | R         | R         |           |           |           |
| *                        |                   |                          | <i>Hedera helix</i>                                   | English Ivy              |           | O         |           |           | R         |
|                          |                   |                          | <i>Juncus articulatus</i>                             | Jointed Rush             | R         |           |           |           |           |
| *                        |                   |                          | <i>Melaleuca armilaris</i>                            | Bracelet Honey-myrtle    |           |           | O         | O         | P         |
| *                        |                   | *                        | <i>Olea europaea</i> ssp. <i>europaea</i>             | Olive                    | R         | W         | O         | O         | O         |
|                          |                   |                          | <i>Pennisetum clandestinum</i>                        | Kikuyu                   | W         | W         | W         | W         | W         |
| *                        |                   |                          | <i>Phyla canescens</i>                                | Lippia                   |           |           |           | P         |           |
| *                        |                   | (C)                      | <i>Pinus sp.</i>                                      | Pine                     |           |           |           |           | R         |
| *                        |                   |                          | <i>Piptatherum miliaceum</i>                          | Rice Millet              | O         | O         | O         |           | O         |
|                          |                   | C                        | <i>Pittosporum undulatum</i>                          | Sweet Pittosporum        |           | O         |           | P         |           |
|                          |                   |                          | <i>Prunus sp.</i>                                     | Plum                     |           | R         | R         | R         | O         |
| *                        |                   | C                        | <i>Rhamnus alaternus</i>                              | Italian Buckthorn        |           | O         | O         | O         |           |
| *                        |                   |                          | <i>Ricinus communis</i>                               | Caster Oil Plant         | O         |           | O         |           | O         |

<sup>2</sup>Mapped weeds<sup>3</sup>WoNS = Weeds of national significance<sup>4</sup>SA Declared = Declared plants in South Australia, Natural Resources Management (NRM) Act 2004, January 2017, C = Control required in part of the State only, Cn = Control not required (but sale prohibited), *Pinus sp.* declared if it is *P. halapensis*

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| High threat <sup>2</sup> | WoNS <sup>3</sup> | SA declared <sup>4</sup> | Species Name                   | Common Name           | Section 1 | Section 2 | Section 3 | Section 4 | Section 5 |
|--------------------------|-------------------|--------------------------|--------------------------------|-----------------------|-----------|-----------|-----------|-----------|-----------|
|                          |                   |                          | <i>Rosa sp.</i>                | Rose (Dog / Briar)    |           | R         | R         |           |           |
| *                        | *                 | C                        | <i>Rubus fruticosus</i>        | Blackberry            | R         |           |           |           |           |
| *                        |                   |                          | <i>Salix babylonica</i>        | Weeping Willow        |           |           |           |           | R         |
| *                        |                   |                          | <i>Schoenus molle</i>          | Peppercorn            | R         |           |           |           |           |
| *                        |                   |                          | <i>Senecio pterophorus</i>     | South African Daisy   |           |           | R         |           | R         |
|                          |                   |                          | <i>Tropaeolum majus</i>        | Nasturtium            |           | R         | R         |           |           |
|                          |                   |                          | Unknown                        | Bippinate leaved tree |           |           |           |           | O         |
| *                        |                   |                          | <i>Vinca major</i>             | Periwinkle            | R         | O         |           |           |           |
| *                        |                   | C                        | <i>Zantedeschia aethiopica</i> | Arum Lily             | R         |           | O         |           |           |