Bushland Management Strategy

Sartor Crescent Reserve, Bossley Park

Report prepared by Narla Environmental Pty Ltd

for

Fairfield City Council

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Narla Environmental Pty Ltd
www.narla.com.au

Report Certification

Works for this report were undertaken by:

Name	Company / Position	Role
Kurtis Lindsay BSc (Hons)	Narla Environmental – Principal Ecologist	Project Management, Document Review
Emily Strautins BSc (Hons)	Narla Environmental – Ecologist	Author, Field Ecologist

As Principal of Narla Environmental Pty Ltd I, Kurtis Lindsay, certify that:

- This report has been prepared in accordance with the brief provided by the client.
- The information presented in this report is a true and accurate record of the study findings in the opinion of the authors.

Kurtis Lindsay
Principal Ecologist and Manager
Narla Environmental Pty ltd
02 9986 1295
0414 314 859
kurtis.lindsay@narla.com.au

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Glossary

Acronym or Term	Definition
BioMetric	Refers to the State Government devised methodology for vegetation assessment
BMS	Bushland Management Strategy
BVT	BioMetric Vegetation Type
EPBC Act	The Environment Protection and Biodiversity Conservation Act 1999
ha	Hectare
km	Kilometres
LGA	Local Government Area
m	Metre
RC	Riparian Corridor
BC Act	Threatened Species Conservation Act 1995
VRZ	Vegetated Riparian Zone

1.Introduction

Narla Environmental Pty Ltd (Narla) was engaged by Fairfield City Council to research and prepare a Bushland Management Strategy (BMS) for Sartor Crescent Reserve, Bossley Park, New South Wales. This report will provide the basis for ongoing management of the natural assets found within the Reserve.

Activities already taking place in the Reserve include contract and volunteer bush regeneration activities (e.g. Bushcare), maintenance of pedestrian thoroughfare, bushfire management and community engagement through educational events.

This report refers to the Sartor Crescent Reserve, as the existing area occupied by 'bushland' (**Figure 1**) ('the subject site'). This excludes the adjoining Coolatai Crescent and Whitlam Avenue Reserves, which are largely cleared of native bushland and managed as open grassland parks. The subject site covers the entire riparian zone associated with Orphan School Creek, and the remaining surrounding bushland. The site is bounded by Belfield Road to the west, Sweethaven Road to the east and moderate density residential housing to the north and south.

In producing this BMS, Narla has drawn information from the following key documents:

- Fairfield City Council (2001) Sartor Crescent Reserve Bossley Park Plan of Management. Including Coolatai Crescent Reserve, Whitlam Avenue Reserve and Britten Place Reserve. Fairfield City Council March 2001
- Fairfield City Council (2012) Fairfield Biodiversity Strategy. Reviewed May 2017
- Sartor Crescent Reserve Volunteer Reports (Mick Gee) 2015 – 2017
- New South Wales National Parks and Wildlife Service (1997) Urban Bushland Biodiversity Survey of Western Sydney. Biodiversity Survey Program.

1.1 Objectives for Management

Sartor Crescent Reserve is currently managed under the Sartor Crescent Reserve Plan of Management (POM) (Fairfield City Council 2001).

The land is categorised under sections 36(4) and (5) of the *Local Government Act 1993* (as amended 1999) as:

- Primary land categorisation: Natural Area - Bushland
- Secondary land categorisations: Natural Area – Watercourse, Park

As detailed in the POM, the following core objectives for managing community land are prescribed by the *Local Government Act 1993* and are relevant to Sartor Crescent Reserve.

36J Core objectives for management of community land categorised as bushland

The core objectives for management of community land categorised as bushland are to:

(a) Ensure the ongoing ecological viability of the land by protecting the ecological biodiversity and habitat values of the land, the flora and fauna (including invertebrates, fungi and micro-organisms) of the land and other ecological values of the land, and

(b) Protect the aesthetic, heritage, recreational, educational and scientific values of the land, and

(c) Promote the management of the land in a manner that protects and enhances the values and quality of the land and facilitates public enjoyment of the land, and to implement

measures directed to minimising or mitigating any disturbance caused by human intrusion, and

(d) Restore degraded bushland, and

(e) Protect existing landforms such as natural drainage lines, watercourses and foreshores, and

(f) Retain bushland in parcels of a size and configuration that will enable the existing plant and animal communities to survive in the long term, and

(g) Protect bushland as a natural stabiliser of the soil surface.

36M Core objectives for management of community land categorised as a watercourse

The core objectives for management of community land categorised as a watercourse are to:

(a) Manage watercourses so as to protect the biodiversity and ecological values of the instream environment, particularly in relation to water quality and water flows, and

(b) Manage watercourses so as to protect the riparian environment, particularly in relation to riparian vegetation and habitats and bank stability, and

(c) Restore degraded watercourses, and

(d) Promote community education, and community access to and use of the watercourse, without compromising the other core objectives of the category.

36E Core objectives for management of community land categorised as a natural area

The core objectives for management of community land categorised as a natural area are to:

(a) Conserve biodiversity and maintain ecosystem function in respect of the land, or the feature or habitat in respect of which the land is categorised as a natural area, and

(b) Maintain the land, or that feature or habitat, in its natural state and setting, and

(c) Provide for the restoration and regeneration of the land, and

(d) Provide for community use of and access to the land in such a manner as will minimise and mitigate any disturbance caused by human intrusion, and

(e) Assist in and facilitate the implementation of any provisions restricting the use and management of the land that are set out in a recovery plan or threat abatement plan prepared under the *Threatened Species Conservation Act 1995* or the *Fisheries Management Act 1994*.

36G Core objectives for management of community land categorised as a park

The core objectives for management of community land categorised as a park are to:

(a) Encourage, promote and facilitate recreational, cultural, social and educational pastimes and activities, and

(b) Provide for passive recreational activities or pastimes and for the casual playing of games, and

(c) Improve the land in such a way as to promote and facilitate its use to achieve the other core objectives for its management.

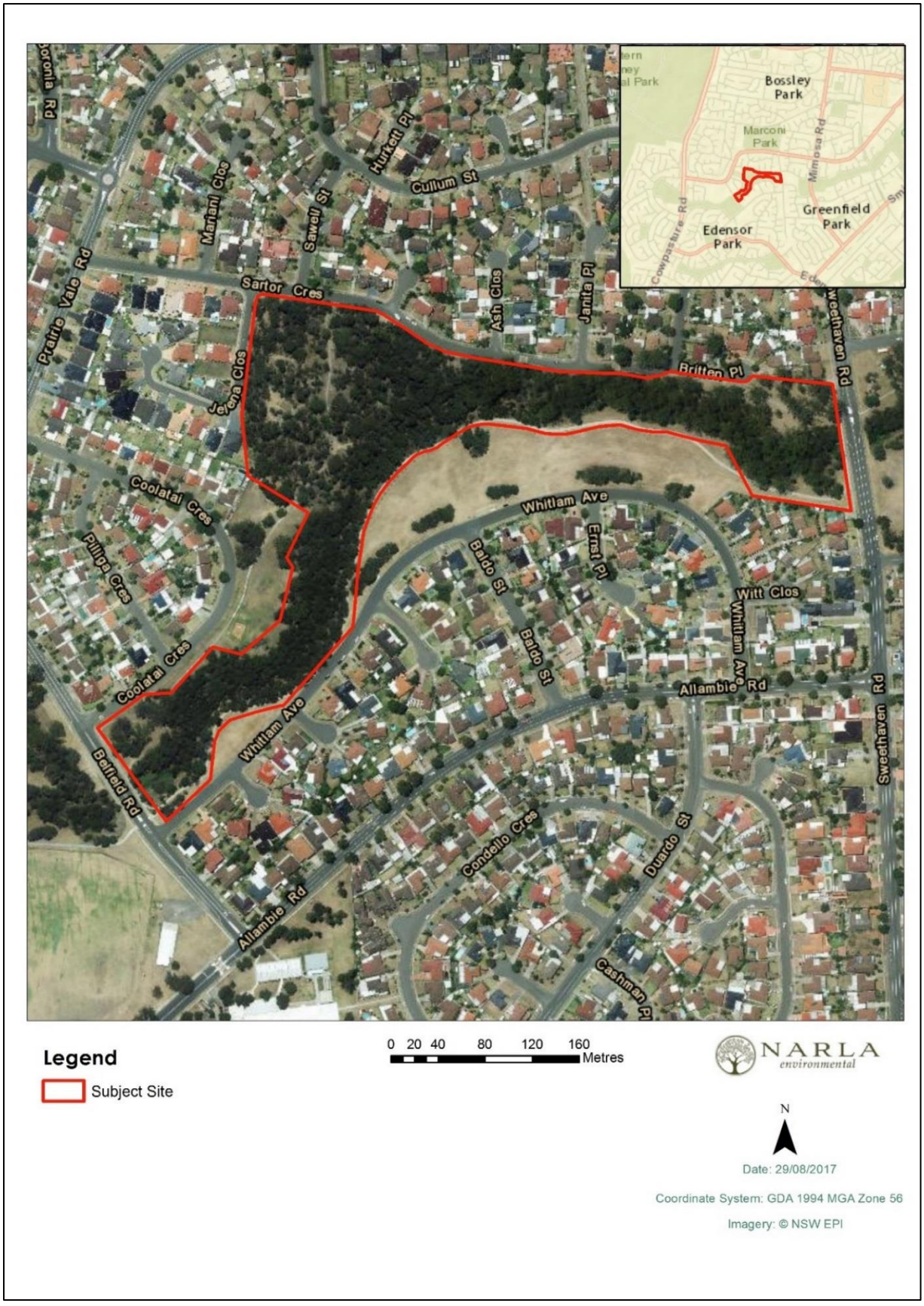

Figure 1. The Subject site- Sartor Crescent Reserve, Bossley Park

2.Site Description

2.1 Site history and current land uses

The subject site is one of a number of remnant bushland sites currently located in the Fairfield LGA (LGA). The land was originally set aside as a detention basin that ultimately was not required (Fairfield City Council 2001).

The subject site forms part of a strip of bushland which adjoins Allambie Road Reserve to the west and Powhatan Street Reserve to the east. This vegetated strip continues along the path of the Orphan School Creek for nearly 4 km before becoming fragmented at Fairfield City Golf Course.

2.2 Local Environmental Plan 2013

2.2.1 **Zoning**

Sartor Crescent Reserve is zoned under the Fairfield Local Environmental Plan (LEP 2013) as E2 – Environmental Conservation. The objectives of this zone are to:

- Protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.
- Prevent development that could destroy, damage or otherwise have an adverse effect on those values.
- Enhance and protect riparian corridors and water quality associated with the waterways of Fairfield.

The site is classified as *Bushland in Urban Areas*, and applicable under State Environmental Planning Policy No. 19. The general aim of this Policy is to protect and preserve bushland within the urban areas referred to in Schedule 1 because of:

(a) Its value to the community as part of the natural heritage,
(b) Its aesthetic value, and
(c) Its value as a recreational, educational and scientific resource.

The specific aims of this policy are to:

(a) Protect the remnants of plant communities which were once characteristic of land now within an urban area,
(b) Retain bushland in parcels of a size and configuration which will enable the existing plant and animal communities to survive in the long term,
(c) Protect rare and endangered flora and fauna species,
(d) Protect habitats for native flora and fauna,
(e) Protect wildlife corridors and vegetation links with other nearby bushland,
(f) Protect bushland as a natural stabiliser of the soil surface,
(g) Protect bushland for its scenic values, and to retain the unique visual identity of the landscape,
(h) Protect significant geological features,
(i) Protect existing landforms, such as natural drainage lines, watercourses and foreshores,
(j) Protect archaeological relics,
(k) Protect the recreational potential of bushland,
(l) Protect the educational potential of bushland,
(m) Maintain bushland in locations which are readily accessible to the community, and

(n) Promote the management of bushland in a manner which protects and enhances the quality of the bushland and facilitates public enjoyment of the bushland compatible with its conservation.

2.2.2 Terrestrial Biodiversity Mapping

Almost the entirety of Sartor Crescent reserve is mapped as *Terrestrial Biodiversity* Land, the objective of which is to maintain terrestrial biodiversity by:

(a) Protecting native fauna and flora, and
(b) Protecting the ecological processes necessary for their continued existence, and
(c) Encouraging the conservation and recovery of native fauna and flora and their habitats.

As Orphan School Creek runs through the reserve, much of it is Riparian Lands, as identified on the Riparian Lands and Watercourses Map. The objective of this clause is to protect and maintain the following:

(a) Water quality within watercourses,
(b) the stability of the bed and banks of watercourses,
(c) Aquatic and riparian habitats,
(d) Ecological processes within watercourses and riparian areas.

2.3 Hydrology

Orphan School Creek runs the length of the Sartor Crescent Reserve. It is a first order stream under the Strahler System. Orphan School Creek is a tributary of Prospect Creek which eventually flows into the Georges River (approx. 10km from the subject site).

The subject site is located within the Georges River Catchment, and is an area where 'waterways are affected by urban development' (DECCW 2006). The impact of development in the past 50 years has resulted in severe degradation of the natural habitat and water quality in creeks across Fairfield.

Orphan School Creek influences the flora and fauna species assemblage found within the subject site through hydrology, geology and microclimate. The riparian corridor acts as a transport route for vegetative propagules, sediment and pollutants. A large proportion of Sartor Crescent Reserve bushland is located within the Vegetated Riparian Zone (VRZ) which is defined as 10 metres to each side of the water course (DPI 2012). The total Riparian Corridor (RC) is measured as 20 metres from the channel width as measured from the top of the highest bank on both sides of the watercourse (DPI 2012).

2.4 Existing Vegetation

Sartor Crescent Reserve represents a rare, moderate-high quality bushland patch in suburbs of the Fairfield LGA. The high floristic diversity of this reserve is unusual for such a narrow and linear reserve that is positioned in an urban setting, and subject to the influences of edge effects, transport of weed propagules, anthropogenic rubbish and human disturbances.

Within the centre and northern regions of the subject site native vegetation is dominant with intact ground, shrub and canopy layers. This has been facilitated through active and on-going bush regeneration efforts. A large proportion of the southern side of Orphan School Creek is dominated by exotic vegetation, despite retaining an entirely native canopy.

Existing vegetation mapping (OEH 2013) (**Figure 2**) indicates that the subject site contains two main vegetation communities. This was confirmed during the field survey by Narla Environmental. The vegetation communities represented in the subject site are '*Cumberland Shale Plains Woodland*' and '*Cumberland Riverflat Forest*' (**Table 1**). Both vegetation communities are listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) as an *Endangered Ecological Community* (EEC) (**Table 1**). Cumberland Shale Plains is also listed as a *Critically Endangered Ecological Community* under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Table 1. Nomenclature of the two vegetation communities present within Sartor Crescent Reserve

Sydney Metropolitan Vegetation Mapping (OEH 2015)	Tozer 2003	BioMetric Vegetation Type (BVT)	Plant Community Type (PCT)	BC Act Listing	EPBC Act Listing
Cumberland Shale Plains Woodland (S_GW03)	Cumberland Shale Plains Woodland	ME020: Cumberland shale plains woodland	849: Grey Box-Forest Red Gum Grassy Woodland on Flats of the Cumberland Plain, Sydney Basin	Cumberland Plain Woodland in the Sydney Basin Bioregion - critically endangered ecological community	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically Endangered)
Cumberland Riverflat Forest (S_F0W06)	Sydney Coastal River Flat Forest, sub-formations: -Alluvial Woodland -Riparian Forest	ME018: Cumberland riverflat forest	835: Forest Red Gum-Rough-barked Apple Grassy Woodland on Alluvial Flats of the Cumberland Plain, Sydney Basin	River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community	Not Listed

2.5 Geology, Topography and Soils

Sartor Crescent Reserve contains a transitional landscape between a low, undulating clay plain and a riparian zone. Elevation varies from 40 – 50 m amsl. The geology is dominated by quaternary alluvium derived from geology of the Wianamatta Group. The soil landscape represented within the reserve is the 'South Creek Soil Landscape' (Chapman and Murphy 1989). This soil landscape comprises the active floodplain of many drainage networks of the Cumberland Plain. This includes the South Creek, Eastern Creek, Ricabys Creek and Prospect Creek systems. The soils of the South Creek soil landscape are often very deep layered sediments over bedrock or relict soils. Where pedogenesis has occurred structured plastic clays (Uf6.13) or structured loams (Um6.1) in and immediately adjacent to drainage lines; red and yellow podzolic soils (Dr5.11, Dy2.41, Dr2.21), terraces with small areas of structured grey clays (Gn4.54), leached clay (Uf4.42) and yellow solodic soils (Dy4.42, Dy5.23). This is a dynamic soil landscape; there are many areas of erosion and deposition. Streambank erosion and sheet erosion of floodplains are common. Sartor Crescent Reserve is a good example of the diversity of soils and landforms that typically occur in the South Creek Soil landscape.

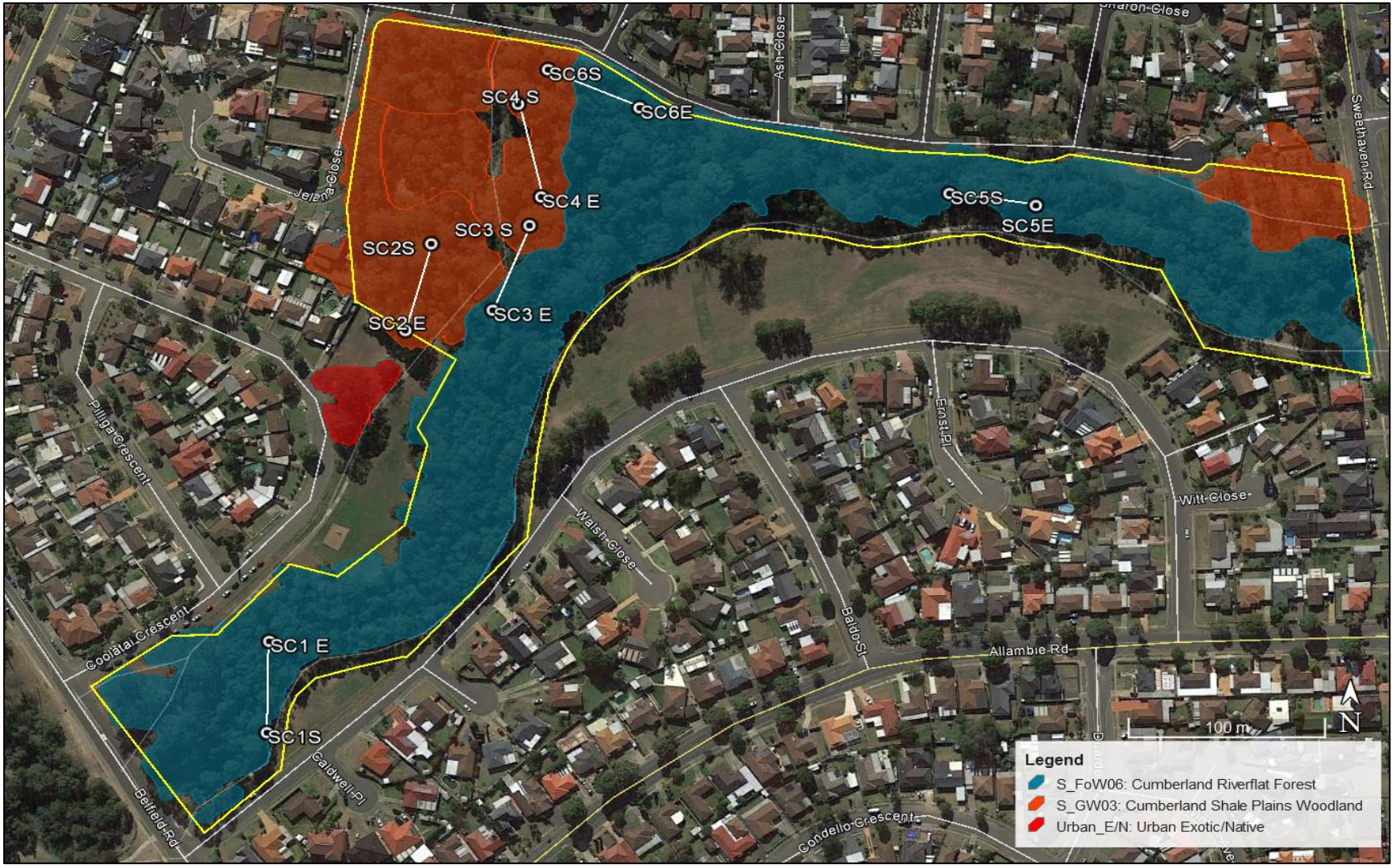

Figure 2. Location of monitoring plots and vegetation community extent within the subject site

3. Methodology

3.1 Desktop Assessment and Literature Review

A thorough literature review of local information relevant to the Fairfield City Council ocal government area was undertaken. Searches utilising NSW Wildlife Atlas (Bionet) and the Commonwealth Protected Matters Search Tool were conducted to identify all current threatened and migratory flora and fauna records within a 10 km² search area centred on the subject site. This data was used to assist in establishing the presence or likelihood of any such ecological values as occurring on or adjacent the subject site, and helped inform our Ecologist on what to look for during the site assessment.

Soil landscape and geological mapping was examined to gain an understanding of the environment on the subject site and assist in determining whether any threatened flora or ecological communities may occur there (Herbert 1983, Chapman & Murphy 1989).

3.2 Ecological Site Assessment

An ecological assessment of the subject site was undertaken by Narla Ecologists Kurtis Lindsay, Emily Strautins, Emily Benn.

3.2.1 Vegetation Survey

A vegetation assessment using the BioMetric survey method (DECCW 2011) was undertaken across the subject site on 16th May 2017.

Six permanent BioMetric Plots were established during the site survey and are to be used consistently to form the basis for ongoing flora monitoring (**Figure 2**). The plots were typical BioMetric Vegetation Plots, as outlined in DECCW (2011). The start and end point of the centre transect of each plot was physically marked with a 45cm star picket with yellow cap, and a GPS point location recorded. Photos of all plots are presented in **Appendix 2**.

Full BioMetric vegetation plot data was recorded at each plot location (DECCW 2011). The transect method described within DECCW (2011) was utilised to estimate/measure cover for all vegetation strata along a 50 m transect. Cover-abundance was estimated for each species (native and exotic) found within the 20m x 20m plot. The Braun-Blanquet cover-abundance scores utilised to make species cover-abundance estimates was as follows:

- 1: <5% - rare/ <3 individuals;
- 2: <5% - uncommon / >3 individuals;
- 3: <5% - common, scattered or locally common;
- 4: <5% - very abundant;
- 5: 5-25%;
- 6: 25-50%;
- 7: 50-75%;
- 8: 75-100%.

3.2.2 **Targeted Threatened Flora Survey**

A targeted survey of threatened flora species across the subject site was undertaken by Emily Benn and Emily Strautins on the 16th May 2017 and again by Emily Benn on 22nd June 2017. This survey followed the 'Random Meander' methodologies of Cropper (1993) and involved Ecologists traversing suitable habitats across the subject site in search of threatened flora species that have been previously recorded or expected to occur in the subject site. Targeted threatened flora searches focused on the following species that had been previously recorded in Sartor Crescent Reserve or the surrounding area:
Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas

- *Acacia pubescens* (Downy Wattle)
- *Pimelea spicata* (Spiked Rice Flower)
- *Cynanchum elegans* (White-flowered Wax Plant)

The whole site was traversed, however increased survey effort was allocated to the north-eastern area of Sartor Crescent Reserve within the area mapped as 'Cumberland Shale Plains Woodland' where historical records of both *Acacia pubescens* and *Marsdenia viridiflora* occurred.

Some areas of the subject site were difficult to survey due to difficulties traversing through thick infestations of Trad (*Tradescantia fluminensis*), on a steep gradient along the entire length of the banks of Orphan School Creek. Such areas were considered to hold low-quality ecological value, and a reduced likelihood of the species occurring within these areas, therefore, given the limited resources available these poorer quality areas were considered a low priority for survey effort in comparison with other areas of the reserve.

3.2.3 **Fauna and Fauna Habitat**

During both site assessments, the Ecologists recorded:

- Opportunistic sightings of any fauna species seen or heard on or within the immediate surrounds of the subject site
- The locations of notable fauna habitat such as important nesting, roosting or foraging microhabitats
- Any habitat trees such as hollow-bearing trees that may be potential habitat for any threatened and regionally significant fauna such as threatened large forest owls, parrots, cockatoos and arboreal mammals.
- The locations of any pest fauna

The Ecologists also assessed the habitat for its suitability to implement fauna and habitat augmentation measures such as nest box installation or tree-hollow excavation, habitat planting or fauna reintroduction.

3.2.1 **Soil Investigation**

Narla Ecologist Emily Benn collected soil samples from within an area of the reserve on the 22nd June 2017. A portion of Sartor Crescent Reserve located near the junction of Jelena Close and Sartor Crescent was bare and devoid of groundcover, shrub and canopy vegetation.

Two soil samples (1 and 2) were collected from within this area at a distance of approximately 10m apart. Within each sample location, two separate samples (a and b) were collected. Collection was undertaken using a plastic hand trowel and plastic garden fork and stored in large plastic zip lock bags. Samples were obtained to a depth of approximately 10-15cm. Soil samples were then sent to Envirolab Services Pty Ltd for laboratory analysis. Refer to **Appendix 3** for reference photos of soil samples in situ.

Figure 3. Locations of soil samples collected for analysis. Soil Sample 1 and 2 indicated by purple polygon. Sample 1 is north and Sample 2 is south.

4. Results and Discussion

4.1 Flora

During the survey period, Narla Environmental recorded 79 native flora species, and 39 exotic flora species across the subject site (Refer to **Appendix 5** and **Appendix 6** for full flora lists).

All BioMetric data was compared with the BioMetric Benchmarks developed for the relevant vegetation community in accordance with the NSW Vegetation Information System (VIS) 2.1. These Benchmarks are provided for comparison with the bench line data collected in May 2017 during preparation of this Management Strategy (**Appendix 1**).

Exotic plant species were highly prevalent across the subject site, particularly along the banks of Orphan School Creek. Large infestations of environmental weeds such as Trad (*Tradescantia fluminensis*) dominated the banks of the creek, and Cobblers Pegs (*Bidens pilosa*) and exotic grasses dominated some areas within the Cumberland Shale Plains Woodland, and the ridgetop along the creek line. Weeds represent an on-going threat to the biodiversity of the Reserve.

4.1.1 Threatened Flora

Sartor Crescent Reserve contains a diverse assemblage of native plant species including locally rare and conservation significant species as recorded by Narla Environmental and previous studies (Total Earth Care 2017; Fairfield City Council 2015;2017). The following species have all been previously recorded within Sartor Crescent Reserve:

- *Marsdenia viridiflora subsp. viridiflora* (Milk Vine) – Endangered Population, BC Act
- *Dichopogon fimbriatus* (Chocolate Lily) – Locally Rare in Fairfield LGA
- *Goodenea hederacea* (Ivy-leaved Goodenea*)* – Locally Rare in Fairfield LGA
- *Acacia pubescens* (Downy Wattle) – Vulnerable, BC Act and EPBC Act

The threatened flora targeted search undertaken by Narla Environmental revealed an abundance of *Marsdenia viridiflora subsp. viridiflora*, which was restricted to the southern extent of the Cumberland Shale Plain Woodland in the subject site. *Marsdenia viridiflora subsp. viridiflora* appeared to occur within two clusters. One cluster occurred within the burnt area on the western side of the central footpath, and the other cluster occurring approximately 10m north on the eastern side of the footpath (**Figure 4**).

No *Dichopogon fimbriatus* (Chocolate Lily), or *Pimelea spicata* (Spiked Rice-flower) were observed within the subject site, despite thorough searches by Narla Ecologists on both the 16th May 2017 and 22nd June 2017. These herbs flower annually, usually after spring rain and therefore were unlikely to have been encountered during the site assessments. It is considered likely that these two species occur in Sartor Crescent Reserve as there is extensive suitable habitat.

No registered records of Downy Wattle have been made in the subject site since 1999 (**Table 2**). It is possible that these individuals have senesced or died. It is also possible that other native vegetation has grown over, or crowded-out these plants. It is likely that this species is still present within the subject site as part of the soil seedbank.

Table 2. Historical records of Downy Wattle (Acacia pubescens) in Sartor Crescent Reserve

Date Collected	Latitude	Longitude	Accuracy	Comments	Institution
9/06/1998	-33.8686	150.879	100 m	Two individuals reported	OEH Wildlife Atlas
23/02/1999	-33.8684	150.879	50 m	Specimen lodged at NSW Herbarium	Royal Botanic Gardens Herbarium Specimen Register

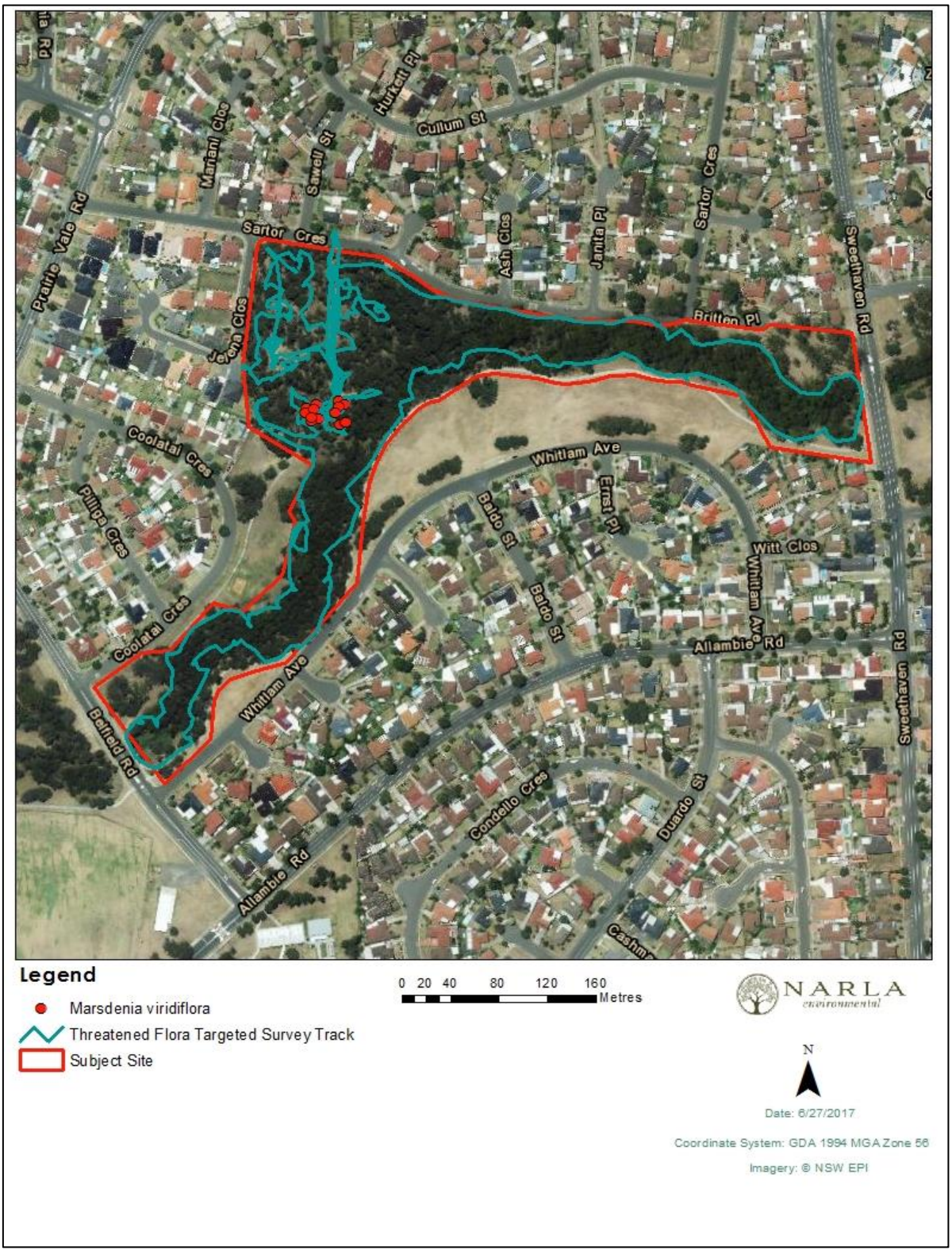

Figure 4. Threatened Flora Targeted Survey Tracks and Records of *Marsdenia viridiflora subsp. viridiflora* within Sartor Crescent Reserve

Plate 1. A healthy, mature specimen of Marsdenia viridiflora var viridiflora photographed within Sartor Crescent Reserve (Narla Environmental 2017)

4.2 Fauna and Habitat

Narla Environmental identified twenty-two fauna species during the site survey on the 16th May 2017 (**Appendix 3**). All native fauna species encountered are 'protected' under the *NSW National Parks and Wildlife Act 1974*, however none of those identified were listed as threatened under either the BC Act or EPBC Act.

Exotic species including Red Fox (*Vulpes vulpes*) and Domestic Cat (*Felis catus)* were both observed during the site survey. It is likely that the presence of these species is contributing to the on-going reduction in both the abundance and diversity of native species inhabiting Sartor Crescent Reserve.

Remnant trees and dense shrubbery across the subject site provide moderate value habitat, including food resources and shelter for fauna. Only a small number of natural tree hollows were identified, one of which was harbouring introduced European Honey Bees (*Apis melifera*) (**Figure 5**).

Coarse woody debris was not common in the reserve; however, this habitat feature was recorded present and will accumulate over time as trees and limbs fall. Woody debris and rotting bark present throughout the subject site provided suitable habitat for the vulnerable Cumberland Land Snail (*Meridolum corneovirens*).

Dense weedy growth along the creek provided shelter for small, locally uncommon, sensitive, shrub-dwelling birds including White-browed Scrubwren (*Sericornis frontalis*) which were observed on the subject site. The presence of abundant Noisy Miner (*Manorina melanocephala*) and other aggressive birds throughout the reserve, particularly the less-densely vegetated areas, indicated the need to retain dense shrubbery as it provides shelter for small, sensitive passerines such as White-browed Scrubwren. Dense weed growth provides similar habitat values to dense native shrubbery. When weeds are removed and not replaced with sufficient, dense native shrubbery small birds are less likely to occupy the habitat as they become increasingly susceptible to predation and harassment from overabundant aggressive bird such as Noisy Miner. For this reason, it is essential to undertake weed removal progressively and promote regeneration of dense, native shrubbery species such as B*reynia oblongifolia, Bursaria spinosa, Acacia spp., Ozothamnus spp.,* and *Dillwynia spp.* in order to replace weedy shrubs removed.

The riparian zone contained ephemeral pools which provide habitat for native freshwater fish including eels (*Anguilla spp*). These pools are also likely to harbour exotic pest fish such as Mosquitofish (*Gambusia holbrooki*). The banks of Orphan School Creek provided suitable habitat for burrowing fauna, including the locally uncommon Spotted Pardalote (*Pardalotus puncatatus*) (small native bird) which may excavate their nests into creek banks. Other fauna that may utilise creek bank habitat include Long-necked Turtle (*Chelodina longicollis*) which may shelter in holes in creek banks, and pests such as Rabbit (*Oryctolagus cunniculus*) and Red Fox.

A key objective of the management of Sartor Crescent Reserve is to enhance the potential habitat available for native fauna.

Figure 5. Significant fauna habitat features recorded in the subject site

4.3 Soil Analysis

Soil analysis was undertaken by EnviroLab Services Pty Ltd in Chatswood, NSW (**Appendix 7**). Analysis of the two samples within Sartor Crescent Reserve provided important data for understanding the constraints that are inhibiting plant growth in the area assessed (**Figure 3**). The three main constraints identified were

- salinity,
- phosphorus and
- sodicity

The pH values of the soil (5 – 7.6) were considered within range for optimal plant growth and unlikely to have had any effect on the native vegetation.

Sample 1 was taken towards the centre of the scalded area, whilst sample 2 was taken towards the perimeter of the scalded area. Sample 1 displayed higher levels of phosphorus and sodicity than sample 2. This indicates that the soil within the centre of the scald patch is the most inhospitable habitat for plant growth.

It is considered likely that the soils in this north-western corner of Sartor Crescent Reserve consist of excavated fill (e.g. subsoil) that has been historically dumped in Sartor Crescent Reserve. Illegal dumping is a recurring issue at Sartor Crescent Reserve and can have significant effects on native flora and vegetation, as evidenced in this part of the subject site.

4.3.1 **Salinity**

Soil salinity is determined by analysing the Electrical Conductivity of a saturated soil Extract (ECe). Analysis revealed both soil samples were slightly to moderately saline. As soil salinity increases, plants find it difficult to extract water from the soil. High levels of salt can create an imbalance of plant nutrients in the soil,

and as some salts are toxic to certain plants, salinity can be a significant factor inhibiting plant growth. (Office of Environment and Heritage 2015).

4.3.2 Phosphorus

Phosphorus has also been identified as a major limiting factor for plant growth in Australian soils typically because phosphorus is limited in Australian soils (Leishman, Hughes and Gore 2004). However, laboratory analysis of the samples collected at Sartor Crescent Reserve revealed extremely high levels of phosphorus in both samples. As mentioned above, this area may have been used as an illegal dumping site, whereby garden waste and fertilisers may have been offloaded into the reserve. The proximity of the scald area to the road (Jelena Close) may indicate a long-term history of runoff from the surrounding houses, which may have increased phosphorus levels to the area. Excessive phosphorus is extremely detrimental to plant growth, and can be retained in the soil for many years, causing inhibition of future growth.

The Colwell extraction method was used to obtain readings of phosphorus from the soil samples. According to the Colwell method, a reading of >55 mg/kg indicates a high phosphorus status (Hazelton and Murphy 2007) (**Figure 6**). Analysis of soil samples 1 and 2 indicated extremely high levels of phosphorus in both samples, with phosphorus levels of 150 and 110 mg/kg respectively.

Phosphorus status at 95% of maximum production		
Low	Medium	High
Critical Colwell soil test P (mg/kg)		
<15	15-20	>20
<20	20-25	>25
<25	25-29	>29
<29	29-34	>34
<34	34-40	>40
>40	40-55	>55

Figure 6. Phosphorus levels according to the Colwell extraction method (based on 0 - 10cm sample)

4.3.3 Sodicity

Sodicity is a term given to the amount of sodium held in a soil. Sodium is a cation (positive ion) that is held loosely on clay particles in soil. It is one of many types of cations that are bound to clay particles. Other types bound to clay particles include calcium, magnesium, potassium and hydrogen. When sodium makes up more than about 5% of all cations bound to clay particles, structural problems begin to occur, and the soil is said to be sodic (McMullen 2000).

High sodicity causes clay to swell excessively when wet. The clay particles move so far apart that they separate (disperse). This weakens the aggregates in the soil, causing structural collapse and closing-off of soil pores. For this reason, water and air movement through sodic soils is severely restricted (McMullen 2000).

In vegetation, sodic layers or horizons in the soil may prevent adequate water penetration when during irrigation, making the water storage low. Additionally, waterlogging is common in sodic soil, since swelling and dispersion closes off pores, reducing the internal drainage of the soil (McMullen 2000). Sodicity of the surface soil is likely to cause dispersion of surface aggregates, resulting in surface crusts. As observed in the subject site.

Soils with an ESP of >6 in Australia are generally classified as being 'sodic' (Sydney Water 2008). Analysis of the soil samples collected at Sartor Crescent Reserve revealed both samples were situated in highly sodic soils, evident by their ESP of 33 and 13 respectively.

5. Management Issues

5.1 Feral Pests

Feral fauna species including the Red Fox were confirmed to be residing in Sartor Crescent Reserve. This was evident by visual observation of the species as well as identification of numerous burrows within the subject site, along the banks of Orphan School Creek which runs through Sartor Crescent Reserve. *Predation by the European Red Fox Vulpes vulpes* is a listed Key Threatening Process (KTP) under the BC Act. Domestic cats were also observed entering the reserve. *Predation by the Feral Cat Felis catus* is listed KTP. Both of these pest mammals hunt and kill small native fauna species and contribute to their decline.

European Honey Bee were recorded occupying one of the few natural tree hollows on the subject site. *Competition from feral honey bees, Apis mellifera L.* is a listed KTP and is a significant issue in small patches of urban habitat such as Sartor Crescent Reserve where there are limited habitat resources for native fauna.

5.2 Illegal Dumping

Illegal dumping is a significant, reoccurring issue at Sartor Crescent Reserve as identified in multiple Bushcare reports and during the surveys undertaken in May and June 2017. Dumping within the creek and its surrounds included food wrappers, bottles, clothing, small household appliances such as kettles and stereos, as well as large whitegoods and shopping trolleys. Illegal dumping can impede bushland management actions as it may act as a continual source of weed propagules and has the ability to crush native regeneration and introduce contaminants which put the environment and public at risk.

Large pieces of anthropogenic waste such as old tyres or sheet metal may provide some shelter habitat for native fauna, such as reptiles, amphibians and Cumberland Land Snail, however natural, coarse woody debris provides superior habitat values.

5.3 Riparian Management Issues

5.3.1 Bank Erosion

Erosion was evident along the entire reach of Orphan School Creek in Sartor Crescent Reserve. The creek displays a steep, incised bed and banks that are continuing to erode through scouring and rilling. The extent of erosion reflects the highly altered local hydrology. Owing to the extensive area of hard surface present in the Orphan School Creek catchment, it is expected that surface runoff accumulates quickly during/post heavy rainfall events and this runoff is considered likely to cause powerful, high-velocity flows along Orphan School Creek. Such occur at considerably higher rates and velocity than what would be expected from a creek located in a less urban setting. Historical clearing of the bushland within and surrounding Orphan School Creek has exacerbated the effects of erosion.

5.3.2 Sedimentation

Sedimentation was evident along most of Orphan School Creek in Sartor Crescent Reserve, particularly in the southern end of the creek. This is a common issue in urban drainage lines and is caused by hard surface runoff and release of loose sediments from exposed soil surfaces such as in construction sites located further up in the creek catchment. Sediment slugs alter the morphology of creeks and impact on the habitat values.

5.3.3 **Pollution**

Orphan School Creek acts as a source of pollutants of both chemicals and litter into Sartor Crescent Reserve, these pollutants are washed into the creek and carried downstream through the reserve. No sediment or water tests were undertaken during the present study; however it is considered likely that it both water and sediment is polluted. While coarse pollution along Orphan School Creek can be reduced through strategically placed and well-managed 'gross pollutant traps', sediment and water pollution is best managed on a catchment-wide level.

5.4 Exotic Weedy Vegetation

No significant infestations of Noxious / Priority Weeds were observed within the subject site however, a large percentage of the Reserve is dominated by environmental weeds. The exotic flora assemblage was dominated by understorey species. Trad (*Tradescantia flumensis*) and Balloon Vine (*Cardiospermum grandiflorum*) and exotic grasses such as Rhodes Grass (*Chloris gayana*). For the full Exotic Flora Species list refer to **Appendix 6**.

Few woody weeds were present at the time of the survey. Work undertaken by a local Bushcare Group which has been working within the Reserve since at least 2015 was evident. Without these on-going works, it is likely that the existing bushland would be considerably poorer, with dense woody weed infestations. African Olive (*Olea europaea subsp. cuspidata*) and Small-leaved Privet (*Ligustrum sinense*) are significant threats to all remaining patches of Cumberland Plain Woodland. Particularly small patches such as the subject site. On-going management is essential to prevent the infestation of these significant woody weeds.

5.5 Fire Management

Sartor Crescent Reserve was not mapped as 'Bushfire Prone Land 'by the New South Wales Rural Fire Service at the time of preparing this assessment. Therefore, the reserve therefore does not currently require bushfire management actions such as Asset Protection Zones (APZ).

Fire can be used as an effective tool to stimulate regeneration within the vegetation communities present on the subject site. A patch within the reserve was illegally burnt during 2015 (*T. Johnson pers. comm June 2017*). The burn resulted in positive natural regeneration, and the germination of a number of native species which occurred less frequently in other parts of the Reserve, including the threatened *Marsdenia viridiflora subsp. viridiflora* and Ivy-leaved Goodenia.

6. Management Recommendations

6.1 Weed Management

The management of weeds must continue across Sartor Crescent Reserve as a priority. Effort should be made to progressively expand the quality of native vegetation patches through gradual replacement of weeds with ecologically-equivalent native plants. This may be achieved through implementation of multiple methods including manual weed removal, strategic ecological burns, supported natural regeneration and possibly planting.

6.1.1 Herbicide Usage

As the subject site contains a creek line the use of herbicide should be minimised, however the use of Glyphosate-based herbicides such as Roundup Biactive can be utilised effectively by trained and experienced personnel including Bushcare and contract bush regenerators.

6.1.2 Progressive Weed Replacement

Effective bushland restoration involves the restoration and enhancement of flora diversity, vegetation structure and habitat for flora and fauna. Weeds impact on floristic diversity and vegetation structure, however, they can provide shelter and foraging resources for native fauna, particularly in the absence of similar habitat features. For this reason, it is important to ensure that all weeds removed are replaced (through regeneration or revegetation) with ecologically-equivalent native flora as quickly as possible. For example, the removal of a prolifically-seeding exotic grass reduces seed availability for fauna such as native finches, therefore such grasses should be replaced with native, seeding-grasses as quickly as possible to restore that habitat value lost. This rule is especially important for weeds that provide shelter or nesting habitat for fauna. Such weeds must only be removed if suitable habitat can be quickly replaced with equivalent native shelter plants.

6.1.3 Bushcare and Equivalent Volunteer Programs

The value of council-funded bushland restoration programs such as Bushcare cannot be understated. The on-going commitment of volunteers to bushland patches such as Sartor Crescent Reserve are reflected by the unusually high quality of the bushland including the high floristic diversity and presence of healthy populations of locally rare and threatened flora.

6.1.4 Professional Bush Regeneration

It is recommended that a professional Bush Regeneration company with skills and expertise in supporting the natural regeneration of Cumberland Plain Woodland is employed to provide on-going support in vegetation management and restoration at Sartor Crescent Reserve. Such Bush Restoration Professionals will work to support the efforts made by volunteers (e.g. Bushcare) and assist in improving the biodiversity, and quality of the bushland and habitat across Sartor Crescent Reserve.

Professional Bush Regenerators can also assist in training and educating local community and volunteers in effective bushland restoration techniques.

6.2 Revegetation

Many areas within the Reserve present opportunities to significantly enhance the area through revegetation. This includes all areas that are currently occupied by cleared lawn areas (**Figure 7**). Expanding existing patches of quality native bushland will improve habitat availability for flora and fauna and enhance the overall coverage of EEC within the Fairfield local government area.

Strategic planting of thorny shrub species such as *Bursaria spinosa*, *Daviesia ulicifolia* or dense rows of *Lomandra longifolia* on the edges of bushland can be undertaken to dissuade people and domestic animals from penetrating into bushland patches (off tracks). This in turn may reduce illegal dumping and trampling of flora and support an increase in native fauna habitat.

Some portions of the subject site support native canopy but limited understorey, it is recommended that supplementary planting of mid and ground strata vegetation is undertaken in these areas (**Figure 7**). Species selection should be based on microclimatic conditions, such as proximity to creekline.

Plantings should consist only of local provenance stock, collected within Sartor Crescent Reserve or elsewhere within Fairfield LGA, such as Western Sydney Parklands.

6.1 Ecological Burning Regimes

Owing to the success of undertaking well-timed ecological burns within Sartor Crescent Reserve, it is recommended that further ecological burning is undertaken in suitable locations in order to promote native flora regeneration and reduce weed growth.

All future ecological burns should be preceded by an 'Ecological Burn Plan' that details the specific to the location proposed for the burn, and the timing the burn is proposed, along with the intention/purpose of the burn and all relevant permits and personnel involved in the process.

It is recommended that prior to any burn taking place, an Ecologist or appropriately trained wildlife handler is commissioned to survey the site of proposed burn for any sensitive or vulnerable flora or fauna. In the event any sensitive fauna is observed (e.g. nesting birds) the burn should be postponed. In the event any less mobile fauna such as Cumberland Plain Land Snails are found, they should be promptly captured and relocated in a suitable location in Sartor Crescent Reserve, outside of the proposed burn site.

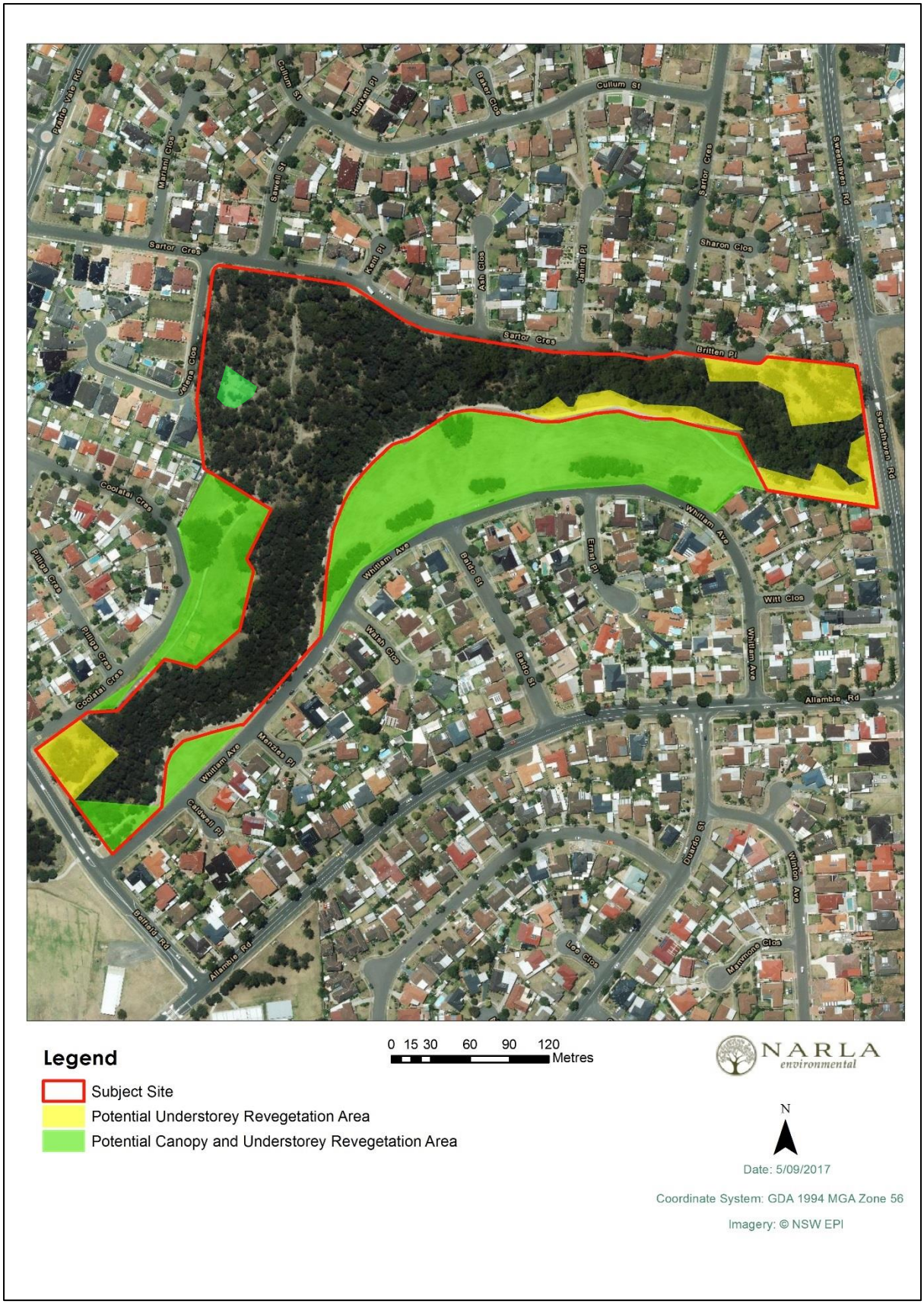

Figure 7. Potential sites for future revegetation works

6.2 Threatened Flora Species Management

6.2.1 Translocation

Fairfield Council may consider the active translocation of threatened flora from elsewhere in the Fairfield LGA into Sartor Crescent Reserve. All translocation efforts must be preceded by appropriate planning and license acquisition from the local authorities. The most effective way to undertake a translocation activity is to prepare a management plan that details the location of source stock, the process for harvesting and preparing the stock for translocation and the location and preparations of the site for translocation. All translocation management plans and measures should be undertaken in line with the "*Guidelines for the Translocation of Threatened Plants in Australia*" (Hogbin *et al.* 2004) as revised.

6.2.2 Downy Wattle (*Acacia pubescens*)

Downy Wattle has not been recorded in Sartor Crescent Reserve since 1999, however, it is likely to exist in the soil seedbank. All areas that are managed of dense weed growth through active weed removal or ecological burning regimes should be promptly surveyed for regenerating Downy Wattle.

If/when any Downy Wattle plants are located, they should be promptly fenced-off and suitable signage should be erected to inform the public and bushland managers of the significance of the threatened species. Active management of the vegetation growing around these plants (i.e. through thinning) and eradication of all proximal weeds (i.e. within 10 metres) should be undertaken by qualified Bushland Restoration professionals in order to assist in the ongoing protection of any plants discovered.

6.2.3 Spiked Rice Flower (*Pimelea spicata*)

Spiked Rice Flower has not been recorded in Sartor Crescent Reserve to date, however, it is likely to exist in the soil seedbank. All areas that are managed of dense weed growth through active weed removal or ecological burning regimes should be promptly surveyed for Spiked Rice Flower during times when the species is known to be flowering locally, as determined through knowledge of the species local ecology.

If/when any Spiked Rice Flower plants are located, they should be promptly fenced-off and suitable signage should be erected to inform the public and bushland managers of the significance of the threatened species. Active management of the vegetation growing around these plants (i.e. through thinning) and eradication of all proximal weeds (i.e. within 10 metres) should be undertaken by qualified Bushland Restoration professionals in order to assist in the ongoing protection of any plants discovered.

6.2.4 Marsdenia viridiflora var. viridiflora

Marsdenia viridiflora var. viridiflora is locally common across a small portion of the centre of Sartor Crescent Reserve. There is potential for the distribution of this plant to be increased across the subject site through active translocation efforts.

Ecological burns undertaken in different parts of Sartor Crescent Reserve may yield regeneration of this Endangered vine.

6.2.5 Hibbertia puberula subsp. glabrescens

Hibbertia puberula subsp. glabrescens is a small, Guineaflower formerly known as 'Hibbertia sp. Bankstown (R.T.Miller & C.P.Gibson s.n. 18/10/06)' it is endemic to New South Wales and is currently known to occur in only one population at Bankstown Airport, in the Bankstown local government area. The species is not known from any conservation reserves. The population comprises fewer than 100 individuals. It is one of the rarest plants in Australia. It is understood to occur on alluvium beneath a canopy of Forest Red Gum (*Eucalyptus tereticornis*) and Rough-barked Apple (*Angophora floribunda*) (NSW Scientific Committee 2011b).

Parts of Sartor Crescent Bushland Reserve may be suitable for the translocation of this rare species. Such translocation could provide an additional insurance population and assist in long term conservation of the species. This opportunity could be explored with the relevant conservation manager at the NSW Office of Environment and Heritage.

6.3 Improving Habitat Connectivity Corridors

The subject site forms part of a habitat corridor centred on Orphan School Creek. The corridor extends from an area located east of the Western Sydney Parklands (west of the subject site) along an easterly trajectory to Fairfield Golf Course in the east (**Figure 8**). The connectivity between the subject site and Western Sydney Parklands is broken by an absence of any native vegetation habitat along parts of Stockdale Crescent and the entirety of Roony Avenue, Abbotsbury (west of the subject site).

It is recommended that complete vegetation/habitat connectivity is restored and enhanced between the subject site and Western Sydney Parklands. This can be achieved by planting a structurally diverse habitat corridor comprised of locally indigenous canopy, midstorey, shrub and groundcover species centred on public (and where possible private) lands that abut Stockdale Crescent and Roony Avenue, Abbotsbury (west of the subject site)

A dense, native shrub layer, and connective native canopy will encourage the movement of small, sensitive, native birds (including important pollinators such as honeyeaters) and sensitive fauna (e.g. Sugar Glider *Petaurus breviceps*) across the landscape and in to reserves including the subject site.

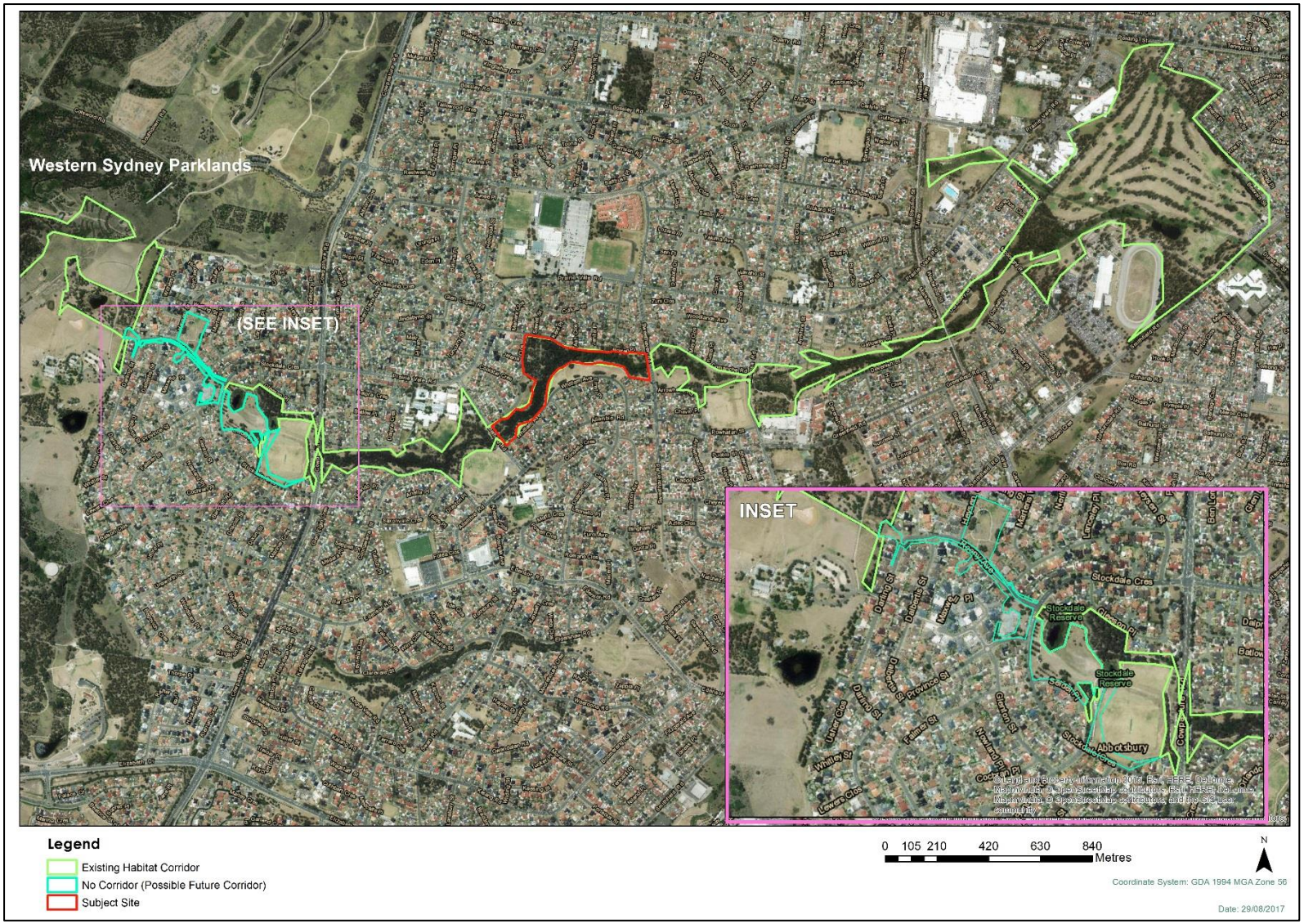

Figure 8. Habitat Connectivity of the Subject Site and Surrounding Landscape

6.4 Native Fauna Habitat Augmentation

Increasing the availability and range of fauna habitat found within Sartor Crescent Reserve will help to enhance local biodiversity. Currently, hollow-dwelling native fauna, such as gliders, possums and owls are rare within the Sartor Crescent Reserve. This is likely to be a result of limited shelter and breeding habitat in the form of a suitable abundance of appropriately sized and positioned tree-hollows.

6.4.1 Nest Boxes and Hollow Augmentation

Owing to the low density of natural tree-hollows across Sartor Crescent Reserve, it is recommended that an appropriate number of artificial hollows are installed to improve the available habitat resources.

Tree hollow augmentation through installation of artificial nestboxes has been proven to provide effective shelter habitat for arboreal mammals in small remnant patches of Cumberland Plain Woodland and Riverflat Forest in Western Sydney (Narla Environmental 2017). A study undertaken by Narla Environmental (2017) revealed one resident arboreal mammal (Sugar Glider, Ring-tailed Possum or Brush-tailed Possum) recorded per 7.5 nest boxes installed (Narla Environmental 2017). In contrast, there was lower rates of nocturnal bird usage (Owlet Nightjar) per 159 nest boxes installed, however this could be related to the types of nestboxes installed or the abundance of competing hollow-dwelling species.

An alternative to installation of artificial nest boxes is the cutting of artificial hollows into standing dead or living trees. This type of activity requires specialised skills and qualifications in tree climbing and chainsaw use. Only skilled and qualified arborists are able to provide such services. This technique can work and should be explored within Sartor Crescent Reserve.

Nest hollow augmentation should be preceded by a 'Nest box Management Plan' produced by an experienced and qualified Ecologist or equivalent experienced and qualified person. The management plan should identify a suite of target fauna species, and the appropriate nest box/hollow design, positioning and density required to maximise suitability for those target fauna species. The plan should also detail a nestboxes monitoring and maintenance regime, along with a procedure for removing unwanted pests including feral European Honey Bees, rats, starlings and Common Myna (*Acridotheres tristis*).

6.4.2 Vertebrate Fauna Reintroduction

Fairfield City Council could explore the suitability of Sartor Crescent Reserve as release site for displaced or rehabilitated fauna (e.g. fauna released from care). This activity hinges on the availability of habitat resources suitable for the species proposed for release (e.g. appropriate types and densities of nest boxes) or suitable landscape connectivity is provided (**section 6.3**). The reintroduction of vertebrate fauna into Sartor Crescent Reserve would be restricted to common, arboreal fauna and this would only be undertaken once suitable shelter habitat is made available and availability of sufficient foraging habitat is determined. Species that could be considered for reintroduction include Sugar Glider, Common Brush-tailed Possum (*Trichosurus vulpecula*), Common Ring-tailed Possum (*Pseudocheirus peregrinus*) and Feather-tailed Glider (*Acrobates pygmaeus*). Such reintroductions should be preceded by a "Reintroduction Plan" produced by an experienced and qualified Ecologist or equivalent experienced and qualified person. Owing to the presence of Fox and Cat and an extensive busy road network surrounding Sartor Crescent Reserve the reintroduction of ground-dwelling fauna such as macropods and native rodents is not recommended to take place in Sartor Crescent Reserve.

6.4.3 Cumberland Land Snail

It is possible that the Cumberland Land Snail occurs in Sartor Crescent Reserve. Well-timed, targeted surveys by experienced and qualified Ecologists should be undertaken to establish the presence, extent and if possible, population density of Cumberland Land Snail. Optimal survey timing is early daylight (two hours either end of sunrise), after rain, during spring and summer. If Cumberland Land Snail is not currently present within the reserve or population density is low, reintroduction of Cumberland Land Snail could be explored. However, owing to the Endangered status of this species, any proposed translocation would only be possible if preceded by a translocation plan that is development with the assistance and approval of the relevant Conservation Officers and licensing personnel of the NSW Office of Environment and Heritage.

6.5 Soil Remediation

The area of contaminated, sodic, bare soil located in the portion of Sartor Crescent Reserve that fronts Jelena Close should be assessed by a landscape remediation expert and an appropriate procedure for site remediation should be implemented. This may include topsoil amelioration or removal and replacement.

6.6 Community Engagement

Landscaping and revegetating a site can indicate to the community that it is valued, monitored and used (EPA 2007). Planting days can also enable further community involvement, and are often found to entice more volunteers in comparison with weeding days. Increasing the number of people involved or increasing the visibility of such projects can build community pride and can lead to changed perceptions and increased community surveillance, which may contribute to reducing antisocial activity (such as dumping) taking place within Sartor Crescent Reserve.

6.6.1 Community Information Events

Fairfield Council may explore the suitability to host educational events such as 'walks and talks' within Sartor Crescent Reserve. Examples of such talks would be lead by local or external experts and could focus on fauna species and habitat, threatened flora, Cumberland Land Snail, ecological communities, aboriginal bush tucker, ecological burning or riparian ecology. Such activities will increase the profile of the reserve and attract community interest and support to its conservation and management.

6.6.2 Informational Signage

Several information signs currently exist within Sartor Crescent Reserve. These signs provide valuable information regarding the conservation and local community values of the Reserve. Such signage should be maintained clear and free of impediments such as overgrown shrubbery, vines or algae. When signs appear to be fading or illegible they should be promptly cleaned or replaced.

Additional signage may be installed to inform visitors of the fauna or threatened species located within Sartor Crescent Reserve. The species identified in this report could form a basis for such signage.

6.7 Feral Fauna Management

In order to gain an understanding of the extent of the feral Red Fox and Cat problem across Sartor Reserve and the adjoining vegetation patches, it is recommended that a "Pest Monitoring Program" is implemented. This may involve the use of well-timed observational surveys and trail cameras.

Successful fox management requires ongoing action, with greatest success found when a regional approach is undertaken (DPI 2015). No single control method will be successful on its own, and when foxes are removed from an area, reinvasion or immigration from existing untreated areas generally occurs within 2 to 6 weeks (DPI 2015). Suitable management techniques which could be applied within Sartor Crescent may include den destruction in combination with baiting and trapping. In the case that these management techniques are adopted they must include appropriate measures to inform local residents who may need to take steps to protect pets, as required in accordance with the Local Land Services Act 2013 (LLS Act). Management of Feral Cats could be undertaken using similar means.

All Feral Honey bee hives located in tree hollows should be removed from Sartor Crescent as quickly as possible to ensure these scarce habitat resources remain available for use by native fauna. The removal of such hives is a requirement under the BC Act and LLS Act as competition for nest hollows by feral bee is a listed KTP. Bee removal can be undertaken by licensed and qualified pest controllers or apiarists.

All rat or feral bird nests present in tree hollows or nest boxes should be removed by appropriately trained tree climbers, pest control experts or ecologists quickly and efficiently to ensure these scarce habitat resources remain available for use by native fauna.

6.8 Maintaining Public Safety

It is important to note the presence of the shared cycle- and walk-way which runs through the subject site. These are heavily used by the public and therefore safe operation during all management activities is crucial. Key elements prior to the onset of any works are:

- Development of a Traffic Management Plan (TMP) to demonstrate how access to the site and walkways will be managed. The TMP will specifically address how plant, labour and materials will cross walkways and be stored on site – without risk to the public. The TMP will also demonstrate how the works will be accessed from the road, and cover traffic and pedestrian activities in this area.
- Any feral fauna control should be undertaken in accordance to DPI Control Orders with measures taken to reduce the potential risk to the public and pets.
- Bush Regeneration Contractors, Educational Personnel, Ecologists or Research Intitutions must be covered by Public Indemnity/ Insurances and be appropriately licensed and qualified to deliver the tasks required.
- Planned ecological burns must only be undertaken under the approval and guidance of the NSW Rural Fire Service.

6.9 Monitoring

An annual ecological monitoring program could be implemented to gauge the success of on-going management of Sartor Crescent Reserve. Monitoring could contain some/all of the following components:

- Survey of the six permanent BioMetric Plots that were established during the May 2017 survey.
- Targeted survey for rare and threatened flora recording all individual occurrences and abundance in a GPS enabled device.
- Fauna survey including diurnal bird, land snail and nocturnal spotlighting/call playback or trail camera components.
- Riparian health and quality monitoring

7. Summary

Sartor Crescent Reserve is a showcase example of how strategically allocated resources can provide an extensive on-going benefit to biodiversity and the local community. The surveys undertaken in deliver of this report revealed Sartor Crescent Reserve holds a higher flora diversity than was expected for its size and urban context. Already some moderate quality bushland is present, and this may easily be expanded with the aid of management. This management should be supported through adaptive methods informed by regular monitoring.

The initial surveys undertaken in preparation of this Management Strategy are a starting point and not intended to contain a complete biodiversity inventory. Over time regular, strategic monitoring will build a more complete understanding of the processes, threats and opportunities present within the Reserve.

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Appendices

Appendix 1 - Summary of augmented BioMetric data and the Benchmarks for both vegetation communities present within Sartor Crescent Reserve.

Appendix 2 - Reference photos taken during the establishment of BioMetric Plots (May 2017)

Appendix 3 - Reference photos of soil samples collected and analysed (June 2017)

Appendix 4 - Fauna species list

Appendix 5 - Native flora species list

Appendix 6 - Exotic flora species list

Appendix 7 – Soil Analysis Results

Appendix 1. Summary of augmented BioMetric data and the Benchmarks for both vegetation communities present within Sartor Crescent Reserve.

Parameter		Biometric Benchmark		BioMetric Plot Identifier					
		BVT: ME018	BVT: ME020	SC1	SC2	SC3	SC4	SC5	SC6
Native plant species richness		31	16	17	35	44	35	11	17
Exotic species richness		0	0	22	11	13	14	17	9
Native over-storey cover	Lower	10	15	44.5	50.5	32	28.5	65	43.5
	Upper	29	44						
Native mid-storey cover	Lower	4	4	6	11.5	2.5	9.5	0	4.5
	Upper	39	34						
Native ground cover (shrubs)	Lower	1	8	0	44	6	62	0	0
	Upper	22	37						
Native ground cover (grasses)	Lower	18	32	2	12	10	88	0	4
	Upper	65	82						
Native ground cover (other)	Lower	13	8	2	22	52	76	2	4
	Upper	48	37						
Exotic Over-storey %		0	0	0	0	0	0	0	0
Exotic Mid-storey %				0	0	0	0	0	0
Exotic Groundcover %				92	4	10	14	82	100
Leaf Litter % Cover		n/a	n/a	96	92	96	100	32	10
Bare Soil % Cover		n/a	n/a	0	8	0	0	0	0
Number of trees with hollows		1	1	0	0	0	0	0	0
Total length of fallen logs (m)		50	30	35	0	0	0	13	6
Regeneration Score		1	1	0.3	0.3	0.3	0.3	0.3	0.3

Key to Colour coding: Those parameters which are within Benchmark (Green), closely above or below benchmark (Orange), substantially outside of the benchmark range (Red)

Appendix 2. Reference photos taken during the establishment of BioMetric Plots (May 2017)

Plot SC1

Plot SC2

Plot SC3

Plot SC4

Plot SC5

Plot SC6

Appendix 3. Reference photos of where soil samples were collected within Sartor Crescent Reserve for analysis (June 2017)

Soil Sample 1a

Soil Sample 1b

Soil Sample 2a

Sample 2b

Appendix 4. Fauna species list (Narla Environmental, June 2017)

Common Name	Species Name
Birds	
Australian Magpie	*Cracticus tibicen*
European Starling*	*Sturnus vulgaris*
Galah	*Eolophus roseicapilla*
Grey Butcherbird	*Cracticus torquatus*
Common Myna*	*Acridotheres tristis*
Laughing Kookaburra	*Dacelo novaeguineae*
Magpie-lark	*Grallina cyanoleuca*
Musk Lorikeet	*Glossopsitta concinna*
Noisy Miner	*Manorina melanocephala*
Pied Currawong	*Strepera graculina*
Rainbow Lorikeet	*Trichoglossus moluccanus*
Red-rumped Parrot	*Psephotus haematonotus*
Silvereye	*Zosterops lateralis*
Spotted Pardalote	*Pardalotus punctatus*
Spotted Turtledove*	*Spilopelia chinensis*
Sulphur Crested Cockatoo	*Cacatua galerita*
White-browed Scrubwren	*Sericornis frontalis*
Yellow-faced Honeyeater	*Caligavis chrysops*
Mammals	
Domestic Cat*	*Felis catus*
European Fox*	*Vulpes vulpes*
Amphibians	
Common Eastern Froglet	*Crinia signifera*
Reptiles	
Common Garden Skink	*Lampropholis delicata*

***Indicates exotic fauna species**

Appendix 5. Native flora species list (Narla Environmental, June 2017)

Species	GF	SC1	SC2	SC3	SC4	SC5	SC6	Observed (outside plots)
Acacia decurrens	S	1	2	4a	2		1	
Acacia parramatttensis	S							*
Aristida vagans	G			4a	5			
Arthopodium milliflorum	H		4a	4a	3			
Bothriochloa macra	G							
Breynia oblongifolia	S	2	3	4a	4b		2	
Brunoniella australis	H	2		2	3			
Brunoniella pumillio	H	1			2			
Bursaria spinosa	S		4b	4a	3	1		
Calotis lappulacea	H			4a				
Casuarina cunninghamiana	T					4a	3	
Casuarina glauca	T	5						
Cheilanthes sieberi	F		3	3	3			
Chloris truncata	G		3	3				
Chloris ventricosa	G			3				
Clematis aristata	V		4a	5	4a	3	4a	
Commelina cyanea	H		3	3	4a	2	3	
Corymbia maculata	T		4a	4a	3	3	2	
Cymbopogon refractus	G							*
Daviesia ulicifolia	S		4a		4a			
Desmodium rhytidophyllum	V		4b					
Desmodium varians	V		4a	4b				
Dianella caerula	H				2			
Dianella longifolia	H		2	3	2			
Dichondra repens	H	3	5	5	5		3	
Dillwynia sieberi	S				2			
Dodonaea viscosa subsp. angustifolia	S			3				
Dodonaea viscosa subsp. cuneata	S	3	2	4a	3			
Einadia hastata	H	3	3	2	2	2		
Einadia nutans	H							*
Entolasia stricta	G				4a			
Eragrostis brownii	G							*
Eremophila debilis	S		4b	4b				
Eucalyptus crebra	T							*
Eucalptus moluccana	T		3	4a				
Eucalyptus tereticornis	T	3			2	3	2	
Euchiton sphaericus	H				2			
Eustrephus latifolius	V	4a	4a	6	4b	3	2	
Exocarpus cupressiformis	S							*
Glycine clandestina	V			4a	4a			

Species	GF	SC1	SC2	SC3	SC4	SC5	SC6	Observed (outside plots)
Glycine microphylla	V			3	4a			
Glycine tabacina	V		4b		4a			
Goodenia hederacea	H		3	3				
Hardenbergia violacea	V			2				
Indigofera australis	S		4a	3			1	
Isolepis fluitans	H	3				3		
Juncus acutus	H	2				2		
Lomandra filiformis	H		3	4a				
Lomandra longifolia	H	3					3	
Lomandra multiflora	H		3		2			
Marsdenia viridiflora subsp. viridiflora	V		3	2				
Melaleuca linariifolia	S						1	
Melaleuca styphelioides	S						3	
Melia azedarach	T						1	
Microlaena stipoides	G	4b	5	7	7		4a	
Notelaea longifolia	S							*
Oplismenus aemulus	G	4a		3		2	4a	
Ottochloa gracillima	G			3				
Opercularia diphylla	H							
Oxalis perennans	H		2	3				
Ozothamnus diosmifolius	S		3		3			
Panicum simile	G		4b	4b				
Paspallum distans	G		5	5	4b			
Persicaria decipens	H	3					1	
Phyllanthus virgatus	H							*
Plantago varia	H			3				
Plectranthus parviflorus	H		4b	5	4a			
Pseuderanthemum variabile	H	2		4a				
Rytidosperma fulvum	G		3	3	3			
Rytidosperma tenuius	G		4a	3	3			
Siegesbeckia orientalis	H				2			
Solanum prinophyllum	H			2				
Sporobolus creber	G			2				
Tetragonia tetragonioides	H							*
Themeda australis	G				2			
Typha australis	H		3					
Vernonia cinerea var. cinerea	H		4b	3	3			
Vittadinia cunatea var. minor	H			3				
Wahlenbergia gracilis	H				3			
Sum	**79**	**17**	**35**	**44**	**35**	**11**	**17**	

Appendix 6. Exotic flora species list (Narla Environmental, June 2017)

Species	GF	Noxious Listing	SC1	SC2	SC3	SC4	SC5	SC6	Observed (outside plots)
Acetosa sagittata	V		2						
Anredera cordifolia	V		2				3		
Araujia sericifera	V		4b		4b		1	2	
Asparagus aethiopicus	H	4			2		2		
Bidens pilosa	H		4a	3	3	3	3	3	
Bidens subalternans	H		3	3					
Brassica sp.	H						3	2	
Cardiospermum grandiflorum	V		3				7		
Cenchrus clandestinus	G			4b					
Chloris gayana	G		3		4a	3			
Conyza sp.	H			3		3			
Crassula multicava	H				4b				
Cynodon dactylon	G				4a	5			
Erharta erecta	G		6	4a	6	4b	6	4b	
Erogrostis curvula	G					3			
Fumaria capereolata	H						3	5	
Gallium sp.	H		3				4a		
Juncus acutus	H		2				2		
Mirabilis jalapa	H		4b				3	2	
Modiola caroliniana	H		2						
Ipomoea indica	V								*
Oxalis corniculata	H					2			
Paspalum dilatatum	G			2	3	4a	2		
Passiflora suberosa	V		2				4a		
Plantago lanceolata	H		2			3	3		
Plectranthus sp.	H								*
Richardia stellaris	H		1						
Rumex obtusifolius	H		2	2				2	
Senecio madagascariensis	H	4		3		3			
Setaria parviflora	G		3		3	4a			
Sida rhombifolia	H		3	3	4a	4a	3		
Solanum americanum	H				2				
Solanum nigrum	H			2					
Solanum pseudocapsicum	H		3		4a		4a		
Sonchus oleraceus	H		2					2	
Tradescantia fluminensis	H		7	4a	4b	4a	7	7	
Tropaeolum majus	H								
Verbena bonariensis	H		3						
Vicia sp.	H					1			
Sum	**39**	**2**	**22**	**11**	**13**	**14**	**17**	**9**	

NARLA

environmental

Eastern Sydney Office
2/26-30 Tepko Road
Terrey Hills
NSW 2084
Ph: 02 9986 1295

Western Sydney Office
7 Twenty-fifth Avenue
West Hoxton
NSW 2171
Ph: 0414314859

Hunter Valley Office
10/103 Glenwood Drive
Thornton
NSW 2322
Ph: 0414314859

www.narla.com.au