City of Stirling

Star Swamp Bushland Reserve

Environmental Management Plan

May 2013

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City of Stirling

Star Swamp Bushland Reserve Environmental Management Plan

May 2013

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Executive Summary

Star Swamp Bushland Reserve is a 95.79 ha A-class reserve located within the City of Stirling suburbs of Watermans Bay and North Beach. The Reserve was gazetted in 1987 due its environmental and conservation values; these include:

- its large area within an urban setting,
- listing on the Heritage Council of Western Australia State Register of Heritage Places due to its landscape values and vegetation communities,
- the presence of Star Swamp, which is listed as a conservation category wetland on the Geomorphic Wetlands of the Swan Coastal Plain Dataset,
- the presence of a priority listed flora along with a number of locally significant species, and
- its listing as Bush Forever Site number 204.

The Reserve includes a 4 ha swamp which is a surface expression of the groundwater, with open water typically present during winter months. In addition to the wetland flora and vegetation, the Reserve also supports the following vegetation types:

- Melaleuca woodland,
- Tuart woodland,
- Banksia woodland,
- *Corymbia calophylla* (Marri) forest,
- *Acacia pulchella* heath,
- *Acacia rostellifera* heath,
- *Banksia prionotes* heath, and
- *Banksia sessilis* heath.

An assessment of vegetation condition across the Reserve using the bushland rating scale attributed to Keighery in the Bush Forever documents (Government of Western Australia, 2000) found that 94% was considered to be in good, very good or excellent condition. The vegetation structure was generally intact; however there were areas that have been impacted by frequent fire and the presence of weeds.

The most significant threatening processes affecting the Reserve include:

- frequency and extent of fires,
- weed invasion,
- the presence of domestic and feral fauna species,
- tree health decline, and
- physical disturbances including trampling and track creation.

The management strategies for Star Swamp Reserve are centralised around continuing to promote its' environmental and conservation values, including:

- expanding the weed mapping carried out by the City to include an indication of species density, and using the information to target weed control activities,
- closing and revegetating tracks created by people taking shortcuts through the bush, and retaining others as sand tracks for bushland appreciation,

- extending the heritage trail in a manner that allows points of interest to be accessed in a round trip,
- updating signage across the site, including information about environmental values and reasons why nominated activities are not allowed,
- designating the Reserve as requiring dogs to be kept on a leash,
- increasing the number of 'poo-pouches' and bins around the Reserve, and
- continuing to remove rubbish and cubbies when they are located within the Reserve.

Recommendations

A number of recommendations have been made in various sections of the Management Plan for consideration by the City of Stirling. For convenience, these are listed under the heading of the section in which they are discussed.

Hydrology

When sampling exercises are carried out, it is recommended that:

- conditions prior to and around the time of sampling are noted, particularly rainfall, approximate temperature and wind, as weather conditions influence the various physical and chemical parameters that will be recorded on a particular day,
- the height and location of monitoring bores is accurately surveyed and collar heights recorded, and
- the security of bores should also be considered, such as through the installation of lockable steel collars.

Drainage

As stormwater can carry sediment and a number of pollutants into water bodies, it is recommended that:

- the use of sediment traps be maintained,
- sumps maintained on a regular basis to allow an appropriate detention time for stormwater inflows, and
- culverts and other stormwater inflow areas are designed and maintained to ensure that erosion is kept to a minimum.

Flora and Vegetation

The flora survey planned by the City of Stirling is supported and recommended by NAC. It is also recommended that further flora surveys are undertaken every five years to provide a comprehensive flora inventory and to identify changes in species composition.

Vegetation Condition

It is recommended that:

- the proposed flora survey proceed in order to bring the knowledge of flora on the site up to date, including any populations of current priority and significant flora, and to identify weed species present,
- vegetation condition be mapped during the flora survey, and repeated every five years to monitor changes over time within the Reserve. Outcomes will assist with identifying areas that will benefit from revegetation, fencing, or some other form of active management, and

- information about the negative impacts of picking wildflowers or damaging native flora species is provided to the community.

Tree Health Decline

It is recommended that the City of Stirling:

- continue to monitor the vigour and health of trees and other flora species within the Reserve, undertaking investigations for *Phytophthora* dieback or other microbiological agents if the extent of decline increases, and
- monitor watertable levels to assess whether or not drawdown may be affecting the health of *Eucalyptus gomphocephala* (Tuart) and *Banksia* species.

Weeds and Other Introduced Flora

It is recommended that:

- the weed mapping currently undertaken by the City of Stirling be updated to accurately reflect the extent of infestations and provide a density rating of weed occurrence, with mapping reviewed every three – five years,
- a formal flora survey of the reserve would aid in identifying weeds species currently present in the reserve,
- formal mapping of the weed species of concern identified from the survey would assist in prioritising weed control measures, highlighting potential problems and provide data on the effectiveness of weed control strategies by monitoring changes over time,
- ongoing targeted weed control is needed to prevent further degradation of the natural areas within the reserve,
- that any olive trees other than the historical remnant tree be removed from within the reserve,
- ongoing liaison and education with local residents with the aim of reducing the potential of new weed infestations from the surrounding area in the future,
- the City of Stirling give consideration to the re-introduction of Bridal Creeper Rust and leaf hoppers to aid in control of the present population of Bridal Creeper (*Asparagus asparagoides*), and
- that the City of Stirling ensure sufficient resources are provided to ensure weeds on road verges surrounding Star Swamp Bushland Reserve are treated on a regular basis.

Mammals

It is recommended that the feasibility of translocating Quenda back into the Reserve if none are present be investigated.

Native Fauna Management Strategies

It is recommended that:

- a current baseline fauna diversity survey be carried out within Star Swamp Bushland Reserve, with survey activities including pitfall trapping, cage and/or Elliot trapping, bird identification, and monitoring of frog calls to identify different species over a number of days, and
- the survey should also target the vegetated areas around the swamp that Quenda are likely to favour.

Feral and Introduced Fauna

It is recommended that the City continue to control the following feral fauna species in accordance with City of Stirling policies, practices and procedures:

- feral Honey Bee,
- European Rabbit, and
- European Fox.

Introduced Avifauna

It is recommended that if numbers of Rainbow Lorikeets (*Trichoglossus haematodus*) and the Eastern Long-billed Corella (*Cacatua tenuirostris*) continue to be problematic that the City of Stirling discuss potential control options with the Department of Environment and Conservation.

Domestic Animals

It is recommended that the City of Stirling

- remove Star Swamp Bushland Reserve from the list of designated dog exercise areas,
- develop and implement an education process to advise of the changes and why they are important,
- when the changes are implemented, that City of Stirling personnel visiting the site reinforce the message through discussion with community members and provision of information, and
- provide information on signs indicating that Star Swamp Bushland Reserve is a cat free zone.

Fire Management

It is recommended that

- the City of Stirling undertake flora surveys in burnt areas after they have recovered sufficiently to determine what impacts are occurring to flora species present, vegetation type and condition,
- undertake surveys of fauna within burnt areas are also recommended at regular intervals to determine impacts and rate of recovery after fire, and
- the City continue to work with land owners and occupiers and provide information about fire management principles, including the need to minimise flammable material in backyard areas, such as wooden gazebos and fences.

Aboriginal Heritage

It is recommended that Aboriginal Heritage continue to be considered in the event major works similar to those that have previously occurred are planned.

Cultural Heritage Trail

It is recommended that the City of Stirling give consideration to extending the heritage trail in a manner that allows all points of interest to be accessed in a single, ‘round trip’.

Access

It is recommended that

- those vehicles entering the Reserve ensure they reattach chains and close gates upon entering so there is no inferred 'invitation' to other vehicles, and
- consideration be given to upgrading chain barriers to gates.

Tracks

It is recommended that:

- informal tracks be reviewed and those that are unnecessary are closed and rehabilitated, and
- a track naming system be developed and implement through the installation of appropriate signage.

Signage

It is recommended that:

- directional signage be installed at locations where there is none and where appropriate, provide information on those where it is absent,
- over time, this form of signage be replaced with ones that highlight the reasons why activities are not allowed, thus informing the community about key environmental and ecological values,
- existing signs are checked regularly for graffiti and vandalism, and cleaned and/or repaired as appropriate in a timely manner,
- in the short term, the City of Stirling consider the signage at Star Swamp Bushland Reserve and decide on a form that is in keeping with the signage style guide that will be implemented when signs are replaced or otherwise upgraded,
- when signs are replaced or otherwise upgraded, they are constructed from materials and in a manner that limits the potential damage associated with the removal of graffiti in particular, along with other forms of vandalism including fire
- directional signage be installed at those locations where it is absent,
- signage is installed at the fork in the track near point 2 to indicate that the heritage trail continues in two directions, and
- signs with maps of the Reserve are installed at more access locations to assist community members and visitors to find their way around more readily, and
- significant features such as Marmion Avenue or North Beach Road are included on directional signage to help visitors to the Reserve navigate.

Dog Walking

It is recommended that:

- information that informs residents of the negative impacts with dog faeces is provided that reinforces the message that owners need to pick up after their dogs,
- the City of Stirling review the locations where 'poo-pouches' are provided, and if necessary, increase the number of locations as well as ensure they are restocked in a timely manner, and
- dogs be confined to a leash whilst within the park boundaries to reduce the chance of injury and disturbance to native species of flora and fauna.

Rubbish

It is recommended that when City of Stirling personnel and, where possible, contractors come across rubbish items they are promptly removed and disposed of in an appropriate manner.

Graffiti Vandalism

It is recommended that graffiti be removed in a timely manner when it is found, recognising that removal of graffiti from trees could be problematic on those with thin bark.

Cubbies

It is recommended that the City of Stirling promptly remove any cubbies found within the Reserve as soon as practicable after they are found, and any disturbance to the soil and vegetation restored where possible to do so.

Picking of Wildflowers

It is recommended that the City of Stirling give consideration to providing information that reinforces the importance of not picking wildflowers through appropriate signage, pamphlets, or other communication means.

Cannabis Growing

In the event cannabis plants are found growing within the Reserve, it is recommended that the plants are either removed or reported to the relevant authorities for their investigation and action if more appropriate to do so.

Friends of Star Swamp Bushland

It is recommended that the Friends of Star Swamp Bushland continue to be involved with management of the Reserve and be consulted when major decisions are planned.

Henderson Environmental Centre

It is recommended that the City of Stirling investigate further complementary uses of the Henderson Environmental Centre, such as:

- having City of Stirling environmental and conservation officers based within the Centre for nominated times or days,
- making the centre available to primary school, high school and tertiary educational institutions for environmental education opportunities,
- making the centre available to research students when carrying out projects that involve some aspect of the Star Swamp Bushland Reserve, such as research into the decline of tree health, assessment of changes in vegetation as a result of fire, or other topic decided in consultation with the City of Stirling,
- opening the Centre to the public at nominated days and times where volunteers or other personnel are on hand to provide information about the Reserve and its history,
- developing and offering environmental training courses to the public, and
- informing providers of environmental training courses and local environmental community groups about the availability of the venue for use.

Acknowledgements

Natural Area Consulting would like to acknowledge the contribution of the following during preparation of the management plan:

- Daniel Rajah, Murray Woods and Jo Taylor from the City of Stirling,
- David Pike and Phylis Robertson from the Friends of Star Swamp Bushland, and
- the City of Stirling Natural Environment Working Group.

1.0 Introduction

Star Swamp Bushland Reserve is located approximately 14 km north north-west of the Perth central business district (CBD) in the suburbs of Watermans Bay and North Beach in the City of Stirling (Figure 1). The Reserve comprises 95.79 ha of natural bushland that contain a number of different vegetation types, along with a seasonal wetland that occupies approximately 4 ha. It is bounded on the east by Marmion Avenue, on the south by North Beach Road, by Beach Road to the north and Hope St to the west (Figure 2). Star Swamp Bushland Reserve was gazetted as an A-class reserve in 1987 (Reserve no. 39962) with a management aim of '...conservation of flora and fauna and passive recreation' (Government Gazette Western Australia, 1987). Accordingly, it is an important natural space that provides:

- habitat for flora and fauna, including Priority and Endangered species,
- an ecological linkage between other reserves,
- stormwater management,
- passive recreational opportunities,
- educational opportunities,
- recognition of heritage values.

The City of Stirling commissioned Natural Area Consulting to update the 1987 Star Swamp Bushland Reserve Management Plan (City of Stirling, 1987), taking into consideration current site conditions, characteristics and management practices, along with City documents such as the *Local Biodiversity Strategy* (City of Stirling, 2010b). As the aim of the environmental management plan is to ensure the protection of the significant environmental and cultural values of Star Swamp Bushland Reserve, this plan will include information and suggested management activities relating to:

- flora, including native and introduced species,
- fauna,
- fire,
- public access,
- recreation,
- heritage, and
- wetland and water management.

1.1 Purpose

The purpose of the Star Swamp Bushland Reserve Environmental Management Plan is to review and document the current site characteristics and conditions within the Star Swamp Bushland Reserve with the aim of guiding ongoing management of the site for the conservation of flora and fauna and to allow appropriate passive recreation and education to occur. The primary aim of the Plan is to retain the Reserve's biodiversity and ecological values. The secondary aim is to promote the social benefits of the Reserve through education and passive recreation usage. A number of processes threaten these values including:

- weeds,
- introduced fauna,
- increased fire frequency,
- altered hydrology,

- rubbish accumulation,
- track formation.

This Management Plan should be read in conjunction with other City of Stirling documents, particularly the Local Biodiversity Strategy (City of Stirling, 2002) and Green Plan 2 (City of Stirling, 2010b). These documents include a description of annual reporting of various performance indicators. The Management Plan will be reviewed at an interval determined by the City of Stirling.

1.2 Community Involvement

In order to ensure that the views of community members and other key stakeholders were taken into consideration, the following activities were undertaken:

- meetings with representatives of the City of Stirling, including the Natural Environment Working Group,
- input from representatives of Friends of Star Swamp Bushland at various meetings,
- meeting with the Department of Environment and Conservation,
- meeting with personnel from Bush Forever Branch of the Department of Planning, and
- input from community members through a public open day held at the Henderson Environmental Centre.

2.0 Management Directions

2.1 Management Aim

The overall management aim for the Star Swamp Bushland Reserve is for the conservation of flora and fauna and allowing appropriate passive recreation. The site is considered to be a regionally significant natural bushland area, having been listed as:

- an 'A'-class reserve in 1987 due to the natural features present at the site, and
- Bush Forever Site 204, which endorses the existing management arrangements (Government of Western Australia, 2000).

It is also important for its heritage values and to the general community for passive recreation.

2.2 Conservation Values

Conservation values present within the Star Swamp Bushland Reserve include:

- it being a large area of intact remnant bushland that provides refuge and protection for flora and fauna,
- listing on the Register of the National Estate in 1983 until the list was closed in 2007 (Department of Sustainability, Environment, Water, Population and Communities, 2012),
- listing by the Heritage Council of Western Australia on the State Register of Heritage Places as Place No. 04507 due to its landscape values with vegetation communities including Paperbark woodland, Tuart woodland, Banksia woodland and open heath, and
- Star Swamp is listed as a conservation category sumpland (unique feature identifier 8181) on the Geomorphic Wetlands of the Swan Coastal Plain Dataset (WA Atlas, 2012).

The Henderson Environmental Centre, located on the southern edge of the Reserve adjacent to the North Beach Primary School, was opened in 2001. It was intended to be a regional facility for the purpose of community education associated with the Reserve (City of Stirling, 2004).

2.3 Location and Tenure

Star Swamp Bushland Reserve is vested for management with the City of Stirling. It is located 14km north west of the Perth central business district (Figure 1). The north-eastern part of the Reserve is in the suburb of Watermans Bay and the south-western part of the Reserve in the suburb of North Beach (Figure 2).

2.4 Management Plan Objective

The objective of the management plan is to provide the framework for the sustainable management and maintenance of the ecological and environmental values at the site to allow the conservation of flora and fauna, in balance with passive recreation and education. The management plan considers:

- the outcomes of site assessments,
- the regional significance of the Reserve,
- the ecological and environmental sustainability of the site,
- integrated catchment management principles,
- balancing conservation needs and passive recreation, and
- community involvement in shared ownership, responsibility and management.

2.5 Scope of Works

The scope of works associated with preparation of the management plan included:

- undertaking literature review and other desktop activities,
- undertaking on site assessments of flora and vegetation, site characteristics, threatening processes and preliminary identification of potential management strategies,
- consultation with City of Stirling, Friends of Star Swamp Bushland, Department of Planning and the Department of Environment and Conservation,
- consultation with community members , and
- preparation of the updated management plan.

2.6 Methodology

In order to determine the most appropriate management options for an area, it is necessary to ascertain the current site conditions and environmental values.

2.6.1 Desktop Assessment Methodology

In order to gain an understanding of the sites specific management issues, relevant data bases and studies were reviewed including:

- Aboriginal heritage considerations (Department of Indigenous Affairs 2012),
- soils and landforms (SLIPs NRM Portal, 2012b),
- local biodiversity (NatureMap, 2012),
- significant fauna, flora, threatened and priority ecological communities (PEC) (Protected Matters Search Tool, 2012 (Cwlth)),
- hydrological information (Perth Groundwater Atlas, 2004),
- fire history (City of Stirling, 2012), and
- data relating to flora, fauna and weeds (City of Stirling, 2012).

2.6.2 Site Assessment Methodology

A site assessment was conducted to ascertain current site conditions and environmental values. A botanist (Jacquie Milner), biologist (Alex Devine) and environmental scientist (Sue Brand) from NAC surveyed the site to assess the following:

- type and density of weeds species present,
- vegetation types and condition,
- flora species present,
- opportunistic observation of fauna species, and
- assessment of facilities and infrastructure including tracks, signage and infrastructure.

The methodology for each activity is summarised in Table 1.

Table 1: Site Assessment Methodology

Activity	Method
Weeds	Weed maps provided by the City of Stirling were formalised into GIS maps using MapInfo.
Flora species	Identification of flora species included review of documents including the 1987 Management Plan, input from the Friends of Star Swamp Bushland and the City of Stirling, and on site observations.
Vegetation condition	Vegetation condition was assessed using the rating scale attributed to Keighery in Bush Forever (Government of Western Australia, 2000) (Appendix 5) and mapped using GPS.
Vegetation type	Vegetation types described in the 1987 management plan were reviewed and then assessed in the field. The extent of the vegetation types were mapped using GPS.
Opportunistic fauna survey	The presence of fauna within the Reserve was assessed opportunistically while conducting field work. Fauna were also identified through the interpretation of diggings, scats and tracks.
Hydrology	An assessment of the hydrology of the Reserve involved visual observation of the site, along with review of known data from other available sources, particularly the Perth Groundwater Atlas (Department of Environment, 2004).
Disturbances	Evidence of disturbances and threatening processes were observed during field work and mapped using GPS. Disturbances noted included feral animals, tracks and wastes.
Signage	The location of current signs were noted during site assessment activities and marked using GPS.
Fire	Information relating to fire history since 1987 was provided by the City of Stirling and formalised into GIS maps using MapInfo. Assessment of tracks that provide access for emergency responders and potential fire management issues occurred during site assessment works.

2.6.3 Site Assessment Limitations

Site assessment and ground-truthing activities occurred during March and April 2012, which means that observations of flora and vegetation, including weeds, are based on those species presenting at that time. Accordingly, those species that flower during spring may have been missed, particularly those herb species and some of the grassy and other weeds that do not grow until that time of year. It should also be noted that a flora survey was not included within the required scope of works.

Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: Nearmap.com
Datum: GDA94

Figure 1: Location of Star Swamp Bushland Reserve

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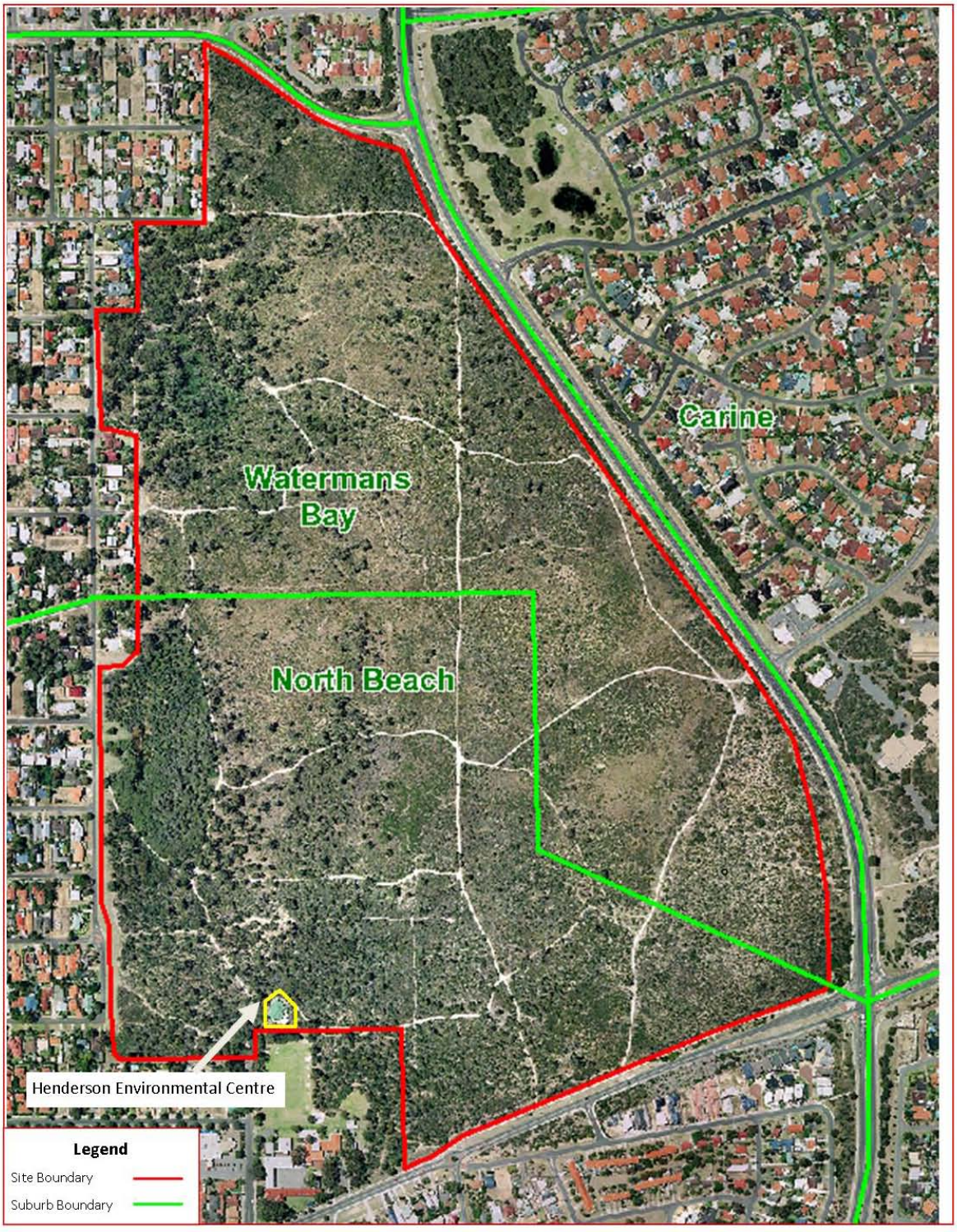
4
kilometres



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Date: May 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

Figure 2: Star Swamp Bushland Reserve

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0 200

metres

3.0 The Natural Environment

3.1 Regional Context

According to the Interim Biogeographical Regionalisation of Australia (IBRA) descriptions, Perth is located within the Swan Coastal Plain region. The Swan Coastal Plain comprises two major divisions, namely Swan Coastal Plain 1 – Dandaragan Plateau and Swan Coastal Plain 2 – Perth Coastal Plain. Star Swamp Bushland Reserve is located within the Perth subregion, which is broadly characterised as including areas of Jarrah and Banksia woodlands on sandy soils in a series of sand dunes, along with wetland areas, often within the interdunal swales (Mitchell, Williams and Desmond, 2002).

3.1.2 Linkages

Bushland areas can be considered to be linked if the bushland is greater than one hectare and there is less than 1000 m distance between areas (City of Stirling, 2010b). Linkages to Star Swamp Bushland Reserve occur to the east, south and west, and include:

- the coastal foreshore reserve approximately 600m to the west,
- Charles Riley Memorial Reserve to the immediate south, which links further south to the northern block of Trigg Bushland Reserve,
- Basalt-Silver-Topaz Reserve to the east and which links to Carine Regional Open Space, and.
- Beach-Marmion Reserve to the north east.

The location of these reserves in relation to Star Swamp Bushland Reserve is shown in Figure 3.

3.2 Climate

The climate experienced in the Perth Metropolitan Region is Mediterranean, with dry, hot summers and cool, wet winters. According to the Bureau of Meteorology (2012):

- average rainfall as measured at the Perth Airport Observatory (site ID 009021) is 728 mm pa, with the majority falling between May and August,
- average maximum temperature ranges from 17.7 ^{0}C in winter to 33.4 ^{0}C in summer, with the highest recorded maximum being 46.7 ^{0}C,
- average minimum temperatures range from 8.2 ^{0}C in winter to 17.6 ^{0}C in summer, with the lowest recorded minimum being -1.3 ^{0}C, and
- the predominant wind directions include morning easterlies and westerly sea breezes during summer months when the risk of fire is greatest, with an average wind speed of 23.8 km/h and gusts of more than 100 km/h, particularly during storm events.

Figure 3: Bushland Linkages to Star Swamp Bushland Reserve

3.3 Geomorphology, Soils and Landforms

The majority of the Reserve lies on the western edge of the Spearwood dune system (Figure 4). These dunes are typified by yellow or brown sands with underlying limestone areas that are sometimes expressed at the surface (Churchward and McArthur, 1980), such as the limestone ridge that is visible at the surface through the centre of the Reserve. Sections of the ridge are populated by *Banksia prionotes* (Acorn Banksia) and *Banksia sessilis* var. *cygnorum* (Parrot Bush), both species that are often associated with limestone close to the surface.

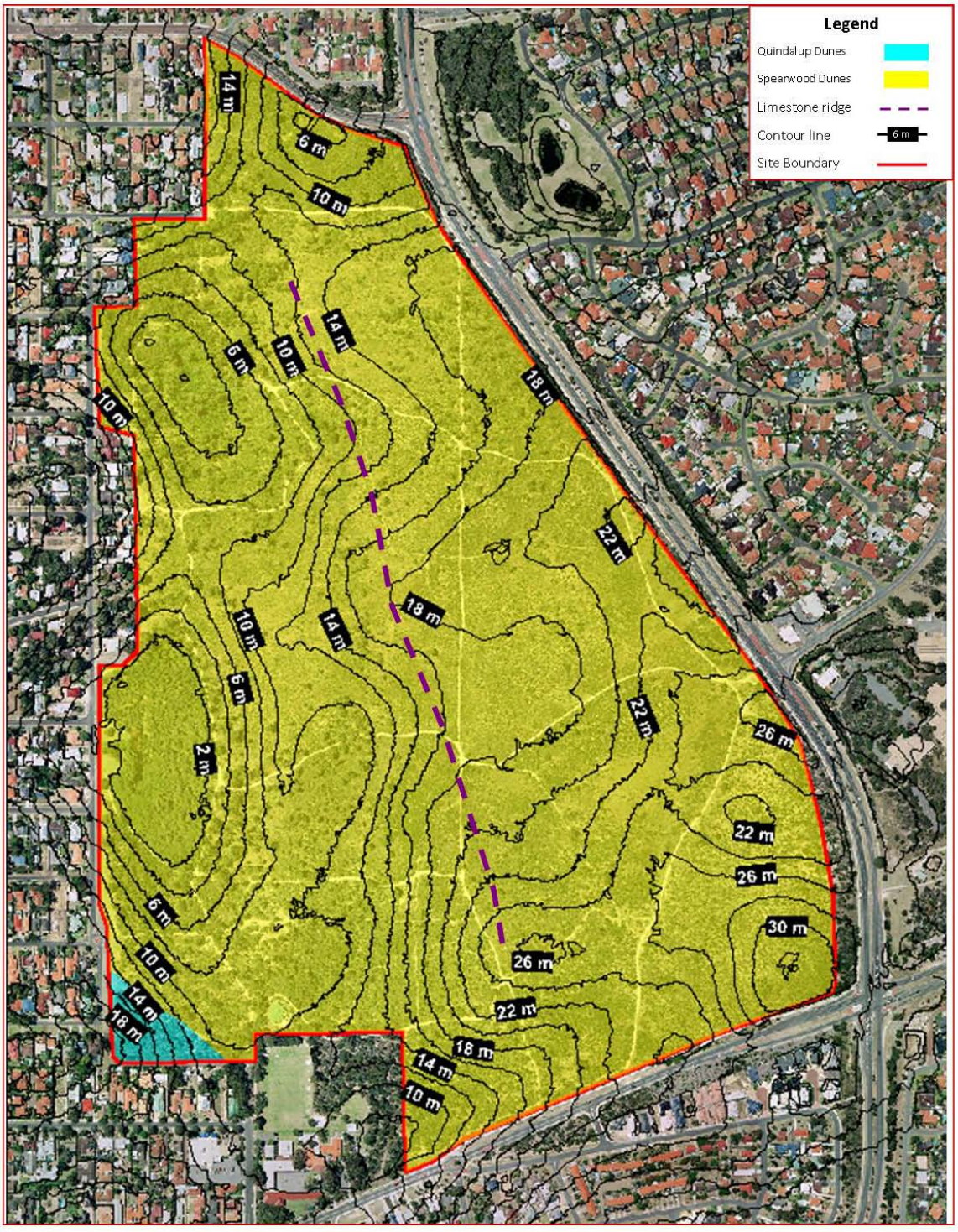
The Slips NRM database shows that there are three main soil types found within the Reserve (Figure 5). There are two wetland basins that are lined with peaty clay along the western side of the Reserve, with Star Swamp occupying the southern basin. The main soil type is the Spearwood yellow-brown sands associated with limestone outcrops. A small section of yellow Spearwood sand protrudes from the south and can also be found in the far north east corner where the Reserve just intersects with a large area of it to the north. Table 2 summarises the description of the soils as given on the SLIPs NRM database. Figure 5 indicates the approximate extent of the soil types and there may be small scale variations within these indicated areas.

Table 2: Soil Types – Star Swamp Bushland Reserve

Map Unit	Name	Description
211Sp_LS1	Spearwood LS1 Phase	Limestone - light, yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin; minor heavy minerals.
211Sp_S7	Spearwood S7 Phase	Sand - pale and olive yellow, medium to coarse-grained, sub-angular to sub-rounded quartz, trace of feldspar, moderately sorted, of residual origin.
211Sp_Cps	Spearwood Cps Phase	Peaty Clay - dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin.

(Source: Department of Agriculture and Food, 2012)

While not recorded on the SLIPs NRM Portal, Churchward and McArthur (1980) indicate that a small section of the Reserve near Star Swamp in the south west occurs on soils associated with the Quindalup dune system portion of the Reserve (Figure 4). Heights range from 1 m above mean sea level (MSL) in the swamp to 30 m on the south eastern side of the Reserve (City of Stirling, 1987).



Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

Figure 4: Geomorphology of Star Swamp Bushland Reserve

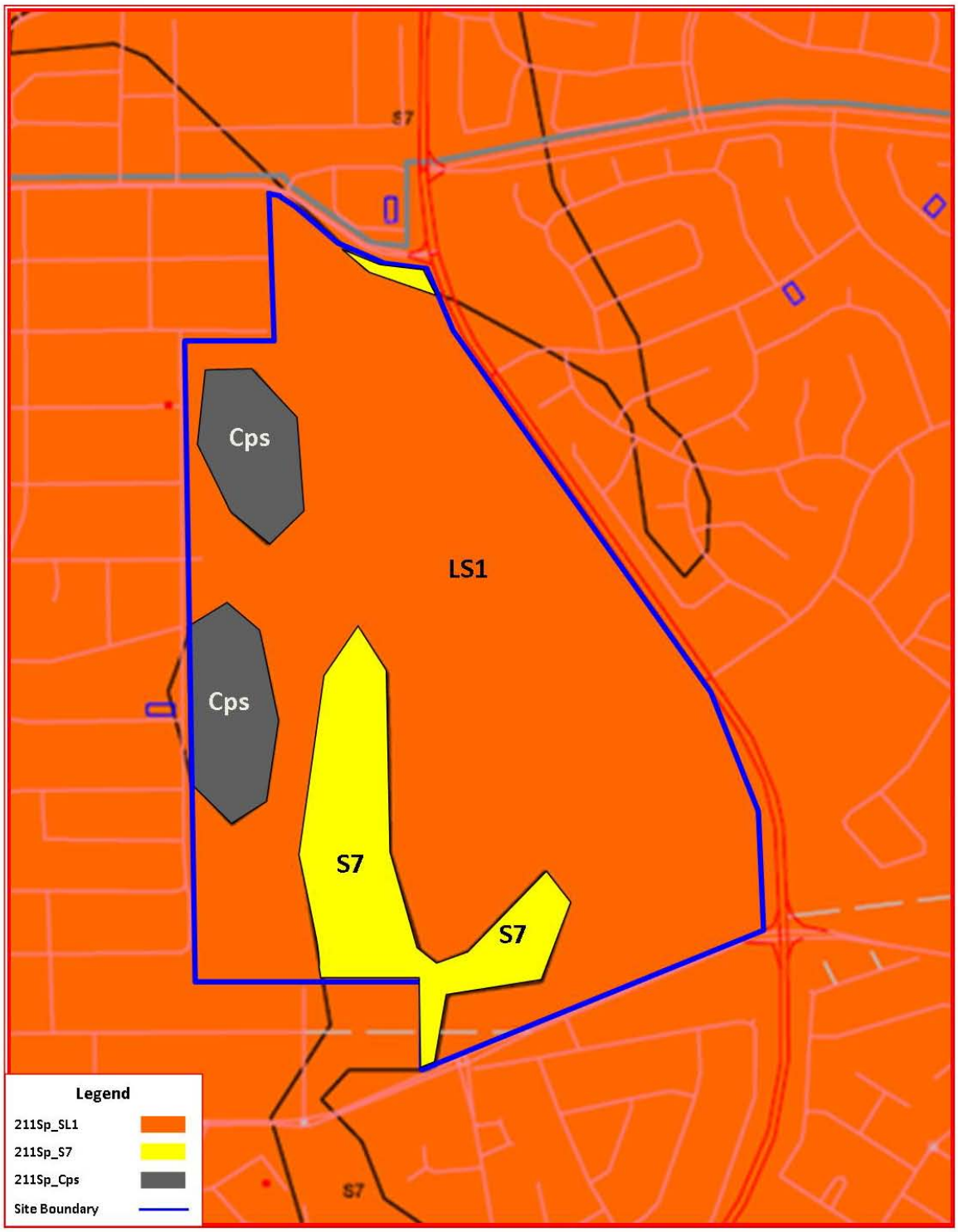


Figure 5: Soils of Star Swamp Bushland Reserve

3.4 Hydrology

Star Swamp is listed on the Geomorphic Wetlands of the Swan Coastal Plain Dataset as a conservation category sumpland (UFI 8181) (WA Atlas, 2012). According to the Water and Rivers Commission (2001), a sumpland is a seasonally inundated basin and those wetlands assigned as conservation category are considered to have a high level of ecological value and function, and are thus deemed to have the highest priority in terms of preservation.

The wetland is a surface expression of the groundwater table and will contain water during winter months when the water table rises to intersect the natural land surface (Figure 6) and dry out when the watertable drops during warmer months. The length of time water remains in the basin depends on the seasonal rise and fall of the watertable, rainfall, groundwater abstraction and stormwater inflow from surrounding urban catchments. Groundwater flow is westerly towards the ocean. Note that it would be beneficial for the City to also consider groundwater at a regional scale.

Figure 6: Star Swamp beginning to fill with early winter rains, June 2012

Information provided by the Water Information Branch at the Department of Water (2012) indicates that while there are a number of groundwater bores within the vicinity of Star Swamp Bushland Reserve, only two have current depth to groundwater information. Data from bore 61611512 within the Reserve boundary is available from 1967 to 2012, and indicates that that depth to groundwater fluctuates on a seasonal basis and ranges from 0.7 – 0.9 m AHD in summer to 1.5 – 1.7 m AHD during winter. Bore 61610007 located in Arnott Street near the Trigg border has data from 1971, and shows depth to the watertable ranging from 0.7 m in summer to 1.3 m in winter. This data suggests that there is some variability with groundwater levels over time with readings similar to those that have occurred in previous times; however the general trend is an increasing depth to the watertable of between 5 – 20 cm (Appendix 10), and this will have implications on groundwater dependent vegetation in the longer term.

A water quality monitoring and sampling program has been implemented by the City of Stirling at Star Swamp, with samples being collected when surface water levels permit. This data assists with identification of impacts and ongoing management of the Swamp. The sampling program includes measurement of the following parameters:

- electrical conductivity (EC),
- pH,
- colour,
- water depth,
- chloride (Cl)
- calcium carbonate ($CaCO_3$)
- total nitrogen (TN),
- nitrate and nitrite (NO_x),
- ammonia (NH_3),
- total phosphorous (TP),
- filterable reactive phosphorous (FRP), and
- a range of metals including arsenic (As), aluminium (Al), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), selenium (Se) and zinc (Zn).

When surface water sampling exercises are carried out, it is recommended that conditions prior to and around the time of sampling are noted, particularly rainfall, approximate temperature and wind, as weather conditions influence the various physical and chemical parameters that will be recorded on a particular day.

Four water monitoring bores were installed in Star Swamp during 2012, and will enhance the data collected by the City in terms of groundwater fluctuations in the medium to longer term. The height and location of these bores should be accurately surveyed, and collar heights recorded. Consideration should also be given to their ongoing security, such as the installation of lockable steel collars

3.4.1 Drainage

There are three main drains that carry water from the surrounding urban areas to the west into Star Swamp or the Reserve, with one being on the west side adjacent to Hope Street near Ada Street, another near Elvire Street and the final drain near the park area to the west of Star Swamp (Figure 7). A fourth drain with a large sump area is located on the north side of the Reserve adjacent to Beach Road that is isolated from the wetland area. Typical impacts associated with drainage activities include the carrying of sediment and other pollutants from within the stormwater catchment into the water body where they can result in poor water quality, increased problems with nuisance aquatic plants and invertebrate species such as midges and mosquitoes, erosion and decreased aesthetics.

Ada St sump, April 19, 2012

Sediment inflow at Ada St sump, June 18 2012

Elvire St drain and sump area

Erosion from water from the Elvire St drain.

Hope St drain and sump

Sediment inflow at Hope St sump

Figure 7: Drains and Associated Sumps Entering Star Swamp

There are also a number of culverts that drain water from roads and surrounding areas, such as the one opposite of where Charles Riley Road joins North Beach Road (Figure 8). During storm events when rainfall is at its heaviest, the amount and velocity of runoff can result in erosion. If outflow pipes allow the water to spread from higher areas down slopes, the extent of erosion can be significant.

Figure 8: Culvert near Charles Riley Road and Associated Erosion

As stormwater can carry sediment and a number of pollutants into water bodies, it is recommended that:

- that sediment traps be regularly maintained,
- sumps are maintained on a regular basis to allow an appropriate detention time for stormwater inflows, and
- culverts and other stormwater inflow areas are designed and maintained to ensure that erosion is kept to a minimum.

3.5 Flora and Vegetation

An assessment of flora and vegetation was carried out using a range of data sources including information provided by the City of Stirling, Friends of Star Swamp Bushland flora list, online databases including NatureMap, FloraBase and the Protected Matters Search Tool (Cwlth), and ground-truthed as far as was possible during site assessment activities. It is understood that a comprehensive flora survey is planned for the Star Swamp Bushland Reserve. This survey is supported and recommended by NAC as it will provide an indication of current species present and assist with managing flora and vegetation in the longer term. It is recommended further flora surveys are undertaken every five years to provide a comprehensive flora inventory and to identify any changes to the species composition.

3.5.1 Flora Species

A total of 209 native flora species from 48 families have been recorded at Star Swamp Bushland Reserve during previous surveys. These include one cycad, 64 monocotyledons and 143 dicotyledons. Three species of native Western Australian flora has been introduced to the Reserve as well as 98 species of weeds. A list of species recorded in Star Swamp Bushland Reserve is provided in Appendix 1, having been compiled from species listed in the 1987 management plan (City of Stirling, 1987) and incidental observations by members of the Friends of Star Swamp Bushland. Where possible, species were confirmed during site assessment activities.

According to Pike (2012, personal communication), there are several species that were once found in the Reserve but are now considered locally extinct, including:

- *Anigozanthos manglesii*,
- *Anthocercis littorea*,

- *Brachyscome iberidifolia*,
- *Cyanicula gemmata*,
- *Pimelea suaveolens*,
- *Potamogeton pectinatus,* and
- *Verticordia densiflora*.

3.5.2 Priority Flora and Other Flora of Significance

Two species of priority flora are found within the park, one of which is *Jacksonia sericea*. This has a Priority 4 rating as it is considered to be endemic to the Perth Metropolitan Area. *Pimelea calcicola*, which has recently been added to the priority flora listing, has a Priority 3 rating. A description of the Conservation Codes of Western Australia is given in Appendix 2.

Significant flora are species listed in Bush Forever (Government of Western Australia, 2000) as being of particular interest as they are either rare, poorly known, restricted in distribution or have some other distinctive feature. Those listed for Star Swamp Bushland Reserve are:

- *Glischrocaryon aureum*,
- *Grevillea preissii*,
- *Jacksonia sericea*,
- *Leschenaultia linarioides*,
- *Melaleuca huegelii*,
- *Pimelea calcicola*.
- *Ricinocarpos glaucus*, and
- *Trymalium ledifolium* var. *ledifolium*,

Pike (2012, personal communication) indicates that there are several significant flora species that were previously listed as being present but are no longer found within the Reserve, including:

- *Astroloma microcalyx*,
- *Conostephium minus*,
- *Trachymene coerulea*,
- *Trichocline spathulata*, and
- *Verticordia densiflora* var. *densiflora* (due to vandalism).

It should be noted, however, that as information improves, changes to what is considered to be a significant species will also change. For example, *Petrophile serruriae* was previously listed as a species of significant flora, however it has been renamed *P. axillaris* and it is no longer considered to be under threat in the region. Similarly, *Melaleuca huegelii*, *Trymalium ledifolium* var. *ledifolium* and the *Grevillea preissii* are species that are common in other locations.

3.5.3 Vegetation Communities

The vegetation communities within Star Swamp Bushland Reserve are part of the Cottesloe Central and South Vegetation Complex on Spearwood Dunes (City of Stirling, 2010b). This is described as a mosaic of *Eucalyptus gomphocephala* woodlands, open forests of *Eucalyptus gomphocephala/Eucalyptus marginata/Corymbia calophylla* and closed heaths on limestone outcrops.

Bush Forever (Government of Western Australia, 2000) documents two Swan Coastal Plain floristic community types (SCP FCT) occurring within the Reserve:

- SCP FCT 24: Northern Spearwood shrublands and woodlands and
- SCP FCT 28 Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands.

The SCP FCT 24 Northern Spearwood shrublands and woodlands are described as:

> Heaths with scattered *Eucalyptus gomphocephala* occurring on deeper soils north from Woodman Point, with most sites occurring on the Cottesloe unit of the Spearwood system. The heathlands in this group typically include *Dryandra sessilis, Calothamnus quadrifidus*, and *Schoenus grandiflorus*, (Department of Environment and Conservation, 2012).

This floristic community type is recognised as being a Priority Three ecological community (Species and Communities Branch, DEC, 2012), which is a poorly known ecological community which is not under immediate threat of destruction or degradation (refer Appendix 3 for a description of the conservation codes).

In previous reports the vegetation communities have been divided into four main types:

- Melaleuca Woodland in the swamp area,
- Tuart Woodland,
- Banksia Woodland, and
- Open Heath.

The Melaleuca Woodland is a distinct area that has not changed in extent over time but interpretation of the dry upland areas has varied between studies, as seen in Figure 18. An on-site review of the current vegetation patterns was undertaken as part of the preparation of this management plan and is presented in Figure 19. This review recognises the stand of *Corymbia calophylla* (Marri) forest in the North West corner of the Reserve and divides the heathland into areas described by their dominant species. Vegetation patterns have changed over the last two decades as a result of frequent fire events and it has been observed that the stands of *Banksia prionotes* have expanded and spread in response to disturbance from fire (Pike, 2012, personal communication). At present large areas are dominated by a heath of *Acacia pulchella*, a fire-stimulated species. A description of each of the vegetation communities is provided below.

Melaleuca Woodland (Mel)

A woodland of *Melaleuca rhaphiophylla* (Paperbark) trees in the wetland area over *Sporobolus virginicus*, *Gahnia trifida, Baumea juncea* and *Logania vaginalis* with *Centella asiatica* in shaded areas (Figure 9).

Figure 9: Melaleuca Woodland

Source: City of Stirling (left), Natural Area Consulting (right)

Tuart Woodland (TW)

An open to very open woodland of *Eucalyptus gomphocephala* (Tuart) with a low woodland of Banksia trees (*B. attenuata, B. menziesii, B. grandis, B. prionotes*), *Allocasuarina fraseriana, Hakea lissocarpha, Hovea trisperma* and *Austrostipa flavescens* (Figure 10).

Figure 10: Tuart Woodland

Banksia woodland (BW)

Low open woodland of Banksia (B*. attenuata, B. menziesii, B. prionotes*) with *Eucalyptus marginata* (Jarrah) and the occasional Tuart tree, over a diverse shrubland of *Xanthorrhoea preissii, Nuytsia floribunda, Allocasuarina humilis, Daviesia triflora, Stirlingia latifolia, Hibbertia hypericoides, Petrophile linearis, Synaphea spinulosa, Bossiaea eriocarpa, Conostylis aculeata*, *Mesomelaena pseudostygia* (Figure 11).

Figure 11: Banksia Woodland

Heath (H)

An open heath with *Xanthorrhoea preissii, Jacksonia sternbergiana, Acacia pulchella, Calothamnus quadrifidus, Melaleuca huegelii, Grevillea vestita, Hakea prostrata, Banksia sessilis, Macrozamia fraseri, Lechenaultia linarioides* and *Conostylis aculeata* (Figure 12).

Figure 12: Heath

Corymbia calophylla (Marri) Forest (Cc)

A forest of *Corymbia calophylla* (Marri) over *Xanthorrhoea preissii* and *Macrozamia fraseri*. Often areas of low diversity due to shading by the Marri trees (Figure 13).

Figure 13: Marri Forest

Acacia pulchella Heath (Ap)

Areas dominated by *Acacia pulchella* with scattered *Xanthorrhoea preissii* and *Jacksonia sternbergiana*, often with a grassy weed layer underneath the Acacia shrubs (Figure 14).

Figure 14: *Acacia Pulchella* Heath (left) and *Acacia pulchella* in Flower (right).
Source: Natural Area Consulting (left), City of Stirling (right).

Acacia rostellifera Heath (Ar)

Areas dominated by *Acacia rostellifera* (Figure 15). In Star Swamp Bushland Reserve the plants are relatively low, from 1 to 2 m. When mature they can form thickets several metres high, depending on their exposure to salt-laden winds. Their dense canopy shades the ground and discourages other plants from growing under them.

Figure 15: *Acacia rostellifera* Heath

Banksia prionotes Heath (Bp)

Areas where *Banksia prionotes* is the dominant plant, although there may be a sparse understorey of grasses (Figure 16). This species of Banksia is killed by fire, which then stimulates seed production and dropping, leading to increased germination opportunities. The regular occurrence of fire in the Reserve has seen this species expand its range within the Reserve in recent decades (Pike, 2012, personal communication). Also found with *Banksia sessilis* heath in Star Swamp Bushland Reserve.

Figure 16: *Banksia prionotes* Heath and *Banksia prionotes* in flower.

Banksia sessilis Heath (Bs)

Areas dominated by *Banksia sessilis*, often associated with limestone at or close to the surface (Figure 17). As they mature they form a mat of dead leaves and spent flowers under the bushes that discourage the presence of other vegetation under their drip line. Other species found in association with *B. sessilis* include *Calothamnus quadrifidus, Melaleuca huegelii, Grevillea preissii, Acacia rostellifera* and *Lomandra maritima.*

Figure 17: *Banksia sessilis* Heath

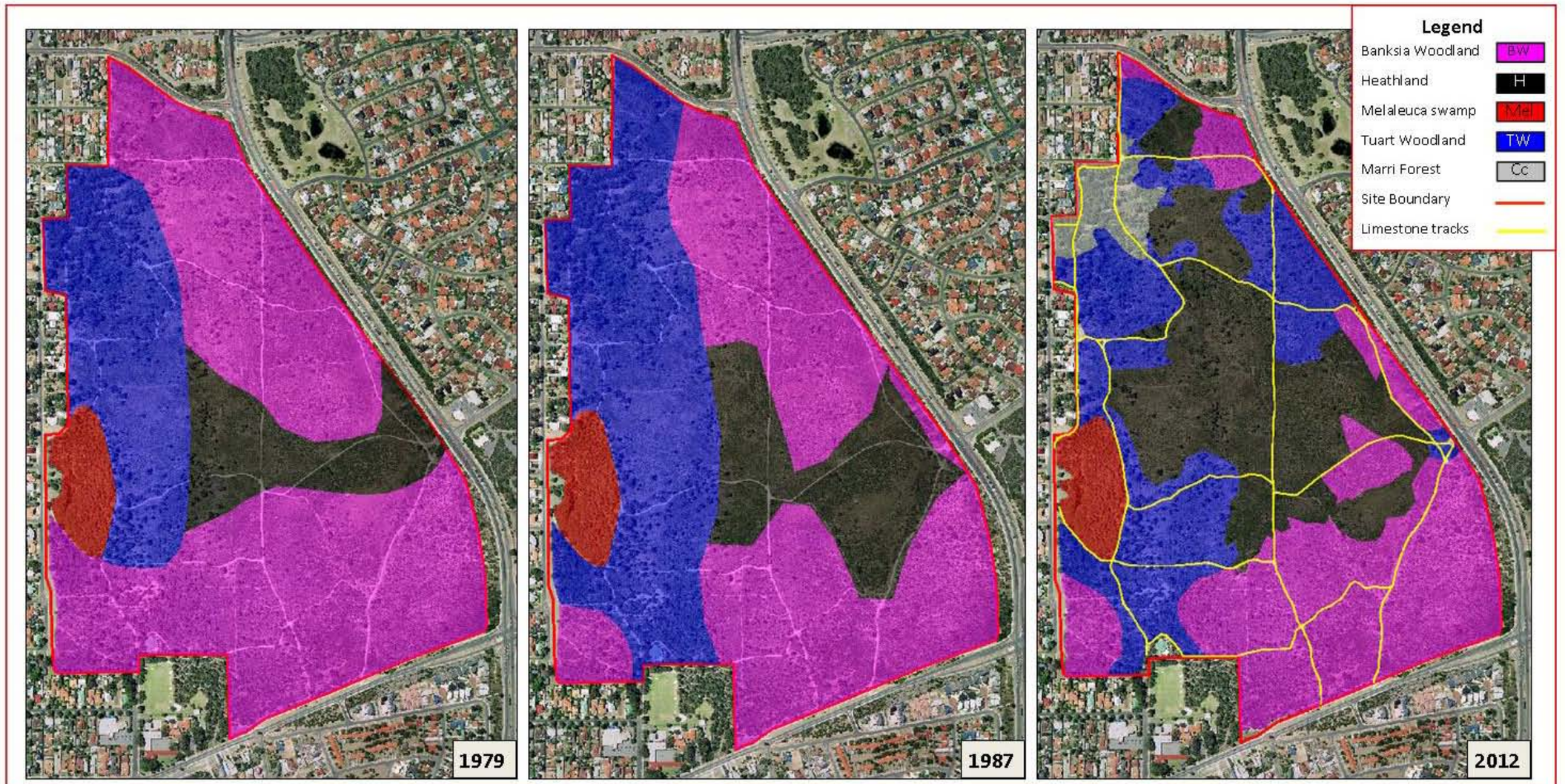


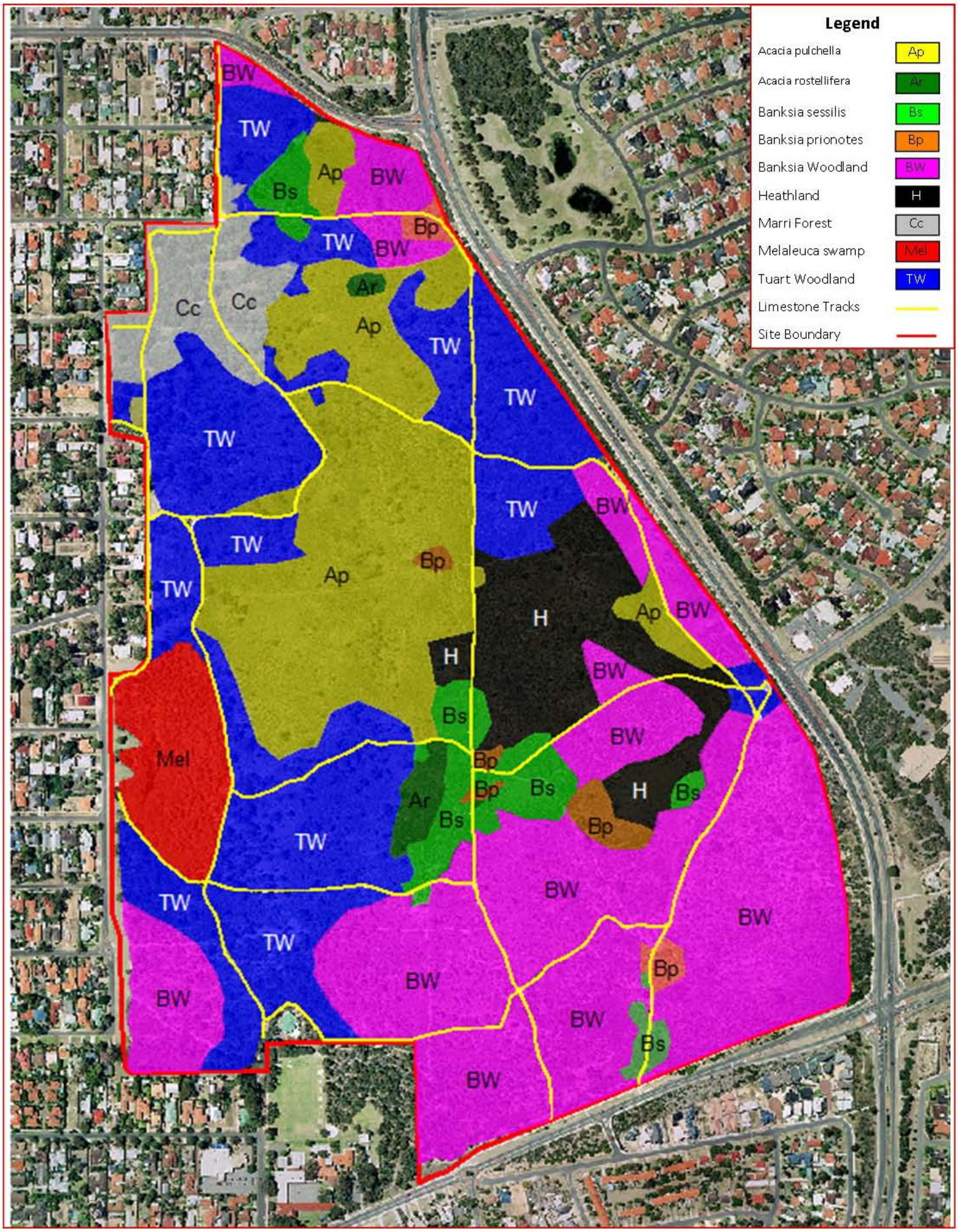
Figure 18:
Vegetation Types
(Historical comparison)

Natural Area Consulting
99C Lord St, Whiteman, WA, 6068
naturalareaconsulting.com.au
08 9209 2767

N

Client: City of Stirling
Created by: JM
Date: June 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

0 300
metres



Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

Figure 19: Vegetation Types (2012)

N

0 200

metres

3.5.4 Vegetation Condition

Vegetation condition was assessed during site visits in March and April 2012 using the vegetation condition rating scale attributed to Keighery (Appendix 5). While this was not the ideal time of year to assess vegetation condition, the major aim was to highlight degraded areas that may require remedial work as well as any excellent areas that should be protected (Figure 20). The area of each category is summarised in Table 3. It is recommended that vegetation condition mapping is undertaken every five years to identify changes over time within the Reserve. Outcomes will assist with identifying areas that will benefit from active management, such as weed control and/or revegetation. Future assessments of condition could include the use of remotely sensed data, such as satellite imagery or multi-spectral analysis to detect signs of stress associated with water stress at an early stage. It is also recommended that information about the negative impacts of picking wildflowers or damaging native flora species is provided to the community.

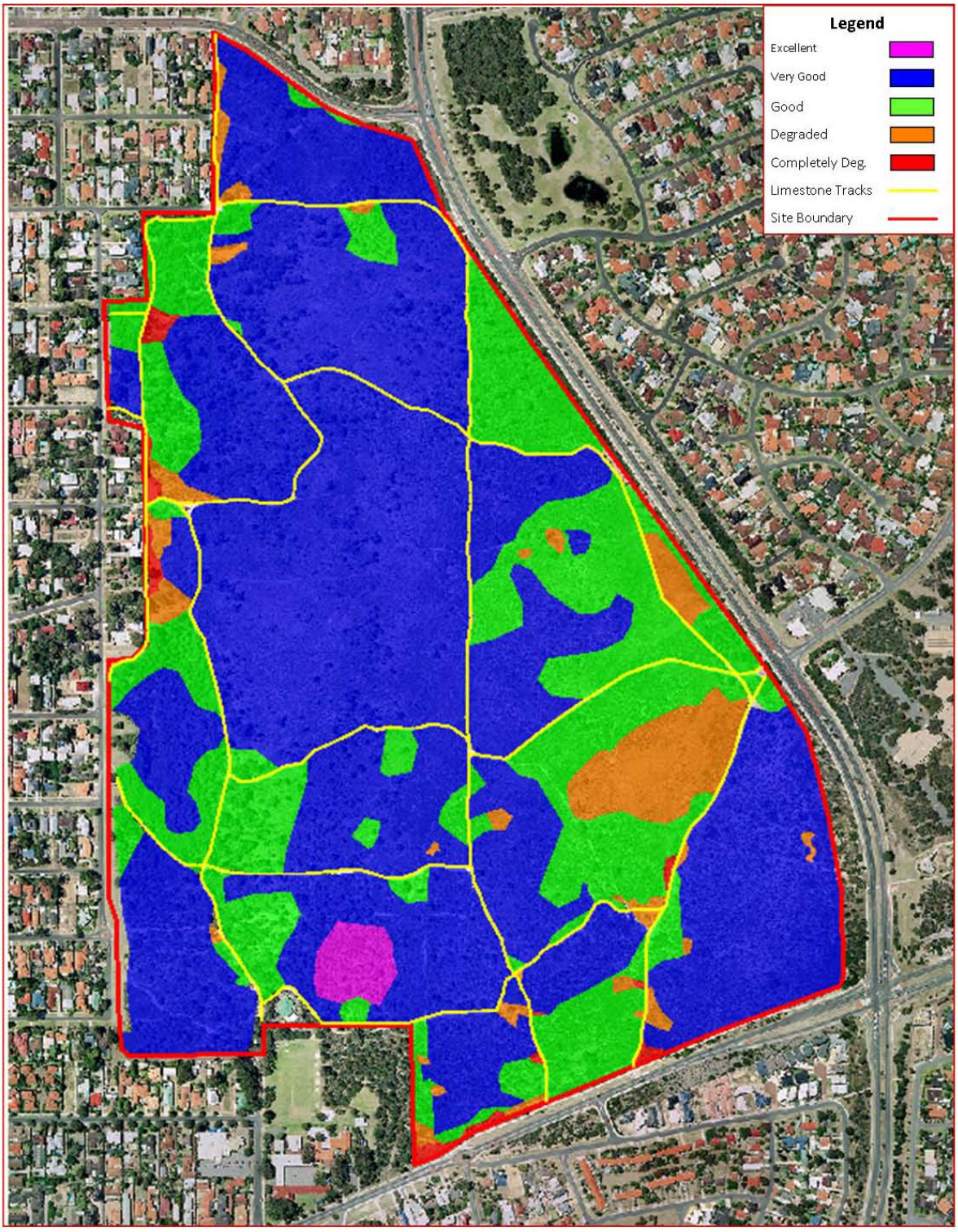
Table 3: Vegetation Condition by Area

	Completely Degraded	Degraded	Good	Very Good	Excellent
Area (ha)	0.7	4.9	23.5	62.5	1.0
% Area	0.8%	5.3%	25.4%	67.5%	1.1%

The majority of the Reserve is in Very Good condition. There is good diversity of species present, despite the presence of major weeds in some areas. The Very Good areas include the Banksia woodland in the south east and south west corners. One section of the Banksia woodland adjacent to the North Beach Primary School was considered to be in Excellent condition.

Some of the areas rated as being in Good condition received this rating based on weed densities. There are infestations of Buffalo Grass (*Stenotaphrum secundum*) on the northern and eastern edges of the swamp where it has formed a thick (0.5 m) layer in places, smothering most native vegetation on the ground. It is recommended that these areas be treated by an appropriate weed control program.

Completely Degraded areas were represented by less than 1% of the total area of the Reserve. Degraded areas persist where there has been disturbance in the past, with a large area on the eastern side of the Reserve remaining in this condition. Also of note on the western side of the Reserve were areas adjacent to the Elvire Street drain and the section to the south of that drain which backs onto a section of housing. It should be noted, however, that degraded areas can assist with appropriate fire management of the site by reducing the presence of trees that could otherwise contribute to damage to nearby property from smoke, embers and flames.



Natural Area CONSULTING

Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

Figure 20: Vegetation Condition

N
0 200
metres

3.5.5 Tree Health Decline

The Tuart (*Eucalyptus gomphocephala*) population in Star Swamp Bushland Reserve has been noted to be in poor health. This was commented on in the 1987 management plan and is evidenced by a loss of vigour and reduction in the crown density. The frequent fires within the Reserve may have contributed to this decline with the trees being under constant stress and unable to recover fully. In order to improve the condition of the trees the occurrence of fire should be restricted where possible; however it should be noted that reducing the frequency of fires will be difficult to achieve.

A small area of dead trees radiating from around the Elvire Street access was observed during a site visit in April 2012. Dead trees including Banksia and Allocasuarina species were also noted adjacent to Ada Street sump (Figure 21). It is recommended that watertable levels are monitored to assess whether or not drawdown may be affecting the health of *Eucalyptus gomphocephala* (Tuart) and *Banksia* species.

An assessment for the presence of Phytophthora dieback in Star Swamp Reserve during 2011 found no evidence of the pathogen, however it was found at Beach Marmion Reserve to the north east during a 2012 survey carried out by Glevan Consulting (Woods, 2012, personal communication). It is recommended that the City of Stirling continue to monitor the vigour and health of trees and other flora species within the Reserve, undertaking investigations for *Phytophthora* dieback or other microbiological agents if the extent of decline increases.

Dead Tuarts, Hope Street March 2010
Source: City of Stirling

Dead Banksias, Elvire Street access, March 2012.
Source: Natural Area Consulting

Dead trees, Ada St sump, 2008
Source: City of Stirling

Example of tree canopy decline
Source: Natural Area Consulting

Figure 21: Examples of tree health decline in Star Swamp Bushland Reserve

3.6 Weeds and Other Introduced Flora

According to the Department of Environment and Conservation (1999), an environmental weed is a plant species that becomes established in an ecosystem and modifies natural processes, usually to the detriment of natural plant forms. All forms of plant life can become a weed if conditions allow, with potential adverse effects from their presence including:

- competition for resources including nutrients, space and water,
- preventing the growth of native species, including understorey species,
- spreading prolific amounts of seed that readily germinate, in contrast to many native species that require mechanical processes such as the presence of smoke or abrasion before they will germinate,
- decreasing the availability of suitable habitat for fauna species, and
- increasing fire fuel loads at a given location.

Weeds are a major threat to the biodiversity of Star Swamp Bushland Reserve and have the potential to diminish the aesthetic values of the site (Figure 22).

Figure 22: Buffalo Grass (*Stenotaphrum secundatum*) smothering the ground on the eastern side of Star Swamp, impacting on biodiversity (left). Dried foliage of Perennial Veldt Grass (*Ehrharta calycina*) creates an increased fire hazard (right).

Table 4: Known weed species of concern in Star Swamp Bushland Reserve

Species Name	Common Name	Mapped[1]
Asparagus asparagoides	Bridal Creeper	Yes
Babiana angustifolia	Baboon Flower	Yes
Brassica species	Wild Turnip, Wild Radish	No
Carpobrotus edulis	Pigface	No
Cenchrus clandestinum	Kikuyu	No
Chamelaucium uncinatum	Geraldton Wax	No
Chasmanthe floribunda	African Cornflag	Yes
Cortaderia selloana	Pampas Grass	No
Cyanella hyacinthoides	Lady's Hand	No
Ehrharta calycina	Perennial Veldt	No
Ehrharta longiflora	Annual Veldt	No
Euphorbia terracina	Geraldton Carnation Weed	Yes
Ferraria crispa	Black Flag	Yes
Freesia leichtlinii x alba	Freesias	Yes
Fumaria capreolata	Fumaria	Yes
Gazania linearis	Gazania	No
Gladiolus caryophyllaceus	Pink Gladiolus	No
Lachenalia reflexa	Yellow Soldiers	Yes
Lupinus cosentinii	Lupins	Yes
Oxalis pes-caprae	Soursob	Yes
Pelargonium capitatum	Pelargonium	No
Pennisetum setaceum	Fountain Grass	No
Schinus terebinthifolia	Japanese Pepper Tree	No
Solanum nigrum	Nightshade	No
Stenotaphrum secundatum	Buffalo Grass	No
Trachyandra divaricata	Trachyandra	No
Tripteris clandestina	Stinking Roger	No
Typha orientalis	Typha	No

1. Mapping was carried out by the City of Stirling during 2011

Surrounding residential areas are a source of weed species. There has been an anecdotal report of a local resident removing Black flag (*Ferraria crispa*) bulbs from the Reserve to propagate in their own garden (City of Stirling, 2012). While this is not an illegal activity as Black Flag is an introduced plant to Western Australia and not considered to be protected flora, it could become a future source of seed for new infestations within the Reserve. Ongoing liaison and education with local residents is recommended to reduce the future potential of new weed infestations from the surrounding area.

Bridal Creeper (*Asparagus asparagoides*), which was observed in the northern end of the swamp as well as being mapped in other areas of the Reserve (Appendix 6), has the potential to result in dense mats that are difficult to remove and which preclude the germination of native species. Bridal Creeper Rust and leaf hoppers were introduced to the Reserve in the past but fire is thought to have wiped both out. It is recommended that the City of Stirling give consideration to the reintroduction

of Bridal Creeper Rust and leaf hoppers to aid in control of the present population of Bridal Creeper, as well as reintroducing them after fire.

A historical remnant olive tree (*Olea europaea*) on the west side of Star Swamp (Figure 24) is a potential source of new olive trees in the Reserve. While not a major weed in Western Australia at present feral olive trees are undesirable in bushland areas. It is recommended that any new olive trees that may have originated from the remnant olive tree be removed when located. As the seed can be eaten by birds and carried some distance from the parent tree so they may appear at any location within the Reserve and not necessarily within the vicinity of the parent tree.

Figure 24: The Remnant Olive Tree on Hope Street

Weeds are also present on road verges surrounding Star Swamp Reserve which could provide a source of seed and continue infestation. Road verges are recognised as places that contribute to the conservation of native flora and fauna, so ongoing weed control in these areas will contribute to effective management of weeds within the Reserve. It is recommended that the City of Stirling ensure sufficient resources are provided to ensure this occurs. The Roadside Conservation Committee has prepared a list of environmental roadside weeds (2012) that can be used to guide weed management in these areas (Appendix 11).

3.6.1 Weed Mapping

In-house assessment of weeds is currently undertaken by the City of Stirling to guide treatment activities. This usually involves identifying the location of significant populations of selected weed species only, not recording their density. Maps for the ten species that were surveyed by the City of Stirling in 2011 are displayed in Appendix 6. Species of concern identified during site assessment activities are provided in Table 4. Weed species currently in the Reserve are included in the Flora species list in Appendix 1. As the Reserve has not had a formal flora survey undertaken in recent years, it is possible that other species of concern may be present.

It is recommended that the weed mapping currently undertaken by the City of Stirling be updated to accurately reflect the extent of infestations and provide a density rating of weed occurrence, with mapping reviewed every five years. The Department of Environment and conservation (DEC) utilises a standard operating procedure for measuring weed density using the following classes (DEC, 2011):

- less than 5%
- 6 – 75%
- 76 – 100%.

A formal flora survey of the Reserve would aid in identifying weeds species currently present in the Reserve. Formal mapping of the weed species of concern identified from the survey would assist in prioritising weed control measures, highlighting potential problems and provide data on the effectiveness of weed control strategies by monitoring changes over time. Ongoing targeted weed control is needed to prevent further degradation of the natural areas within the Reserve.

3.6.2 Weed Treatment Strategy

Weed control is currently undertaken by the City of Stirling personnel and contractors. The Friends of Star Swamp Bushland are also involved in manual weed control involving the hand weeding of Lupins (*Lupinus cosentinii*) (Figure 23) and other weeds in selected areas. Weed control is an ongoing activity and will be carried out in accordance with current City policies, practices and procedures. Specific weed management objectives have been documented in the City's Local Biodiversity Strategy (City of Stirling, 2010b) and Green Plan 2 (City of Stirling, 2002).

Figure 23: Lupins (*Lupinus cosentinii*)
Source: City of Stirling

Weed treatment should consider not only the Star Swamp Reserve but should also address road verges, nature strips and other sources of weed seed/material that may find its way into the Reserve. A holistic approach that considers herbicide use, manual control and biological controls should be considered and implemented as a program on an ongoing basis. The program should also consider the established control methods available from resources such as Bushland Weeds (Brown & Brooks, 2002), Southern Weeds (Moore and Wheeler, 2008), as well as the most up to date

treatments published on FloraBase by the Department of Environment and Conservation (DEC). A cyclical process involving evaluation (mapping), treatment, monitoring of results, and then adjusting the control program as required should be adopted as this process will ensure that resources are assigned to key areas and that timely responses to changing conditions and weed species can be made. Follow up treatments are important to maintain weeds at manageable densities and to reduce the seed bank. The treatment priorities will be set by the City in response to:

- the City of Stirling's Local Biodiversity Strategy (City of Stirling, 2010b)
- Green Plan 2 (City of Stirling, 2002)
- weed mapping outcomes
- focussing efforts on areas of higher bushland condition (Good, Very Good and Excellent).

Herbicide treatments should be undertaken by the City's crews or a licensed subcontractor with suitable bushland experience. Applications are to be undertaken according to license conditions and off label permit instructions as well as complying with any local City of Stirling policies.

3.7 Native Fauna

Star Swamp Bushland Reserve is a significant habitat remnant for native fauna species, many of which are in decline across the Perth metropolitan region. The occurrence of several different habitat types promotes species diversity within the Reserve and provides an important ecological link to other natural areas.

3.7.1 Mammals

The Western Grey Kangaroo (*Macropus fuliginosus*) has been known to use the Reserve in the past and it is suspected that there is one small to medium sized kangaroo currently utilising the south east corner of the Reserve. It has not been sighted recently but numerous scats indicate that it is probably still in residence. While there are kangaroos known to be present in reserves and golf courses to the south east of Star Swamp Bushland Reserve, they are not expected to move in and take up residence in large numbers as there is a lack of their preferred food (soft grasses) within the Reserve. One has been seen in Beach-Marmion Reserve (Woods, 2012, personal communication) which is located across Marmion Avenue at the north east end of Star Swamp, but this is not a regular occurrence.

Historically the Southern Brown Bandicoot or Quenda (*Isoodon obesulus fusciventer*) were present within the area, however it is undetermined if a population is currently located in the Star Swamp Bushland Reserve. Some diggings consistent with Quenda activity were observed around the wetland; however it is unclear if these were made by Quenda. The habitat in the Reserve would be suitable to support Quenda, particularly around the wetland area, so the rarity of this animal most likely relates to predation pressure from introduced carnivores. It is recommended that the feasibility of translocating Quenda back into the Reserve if none are present be investigated. If translocation is considered to be viable, foxes and cats will need to be controlled to maximise the chances of establishing a self sustaining Quenda population.

The Reserve is frequented by insectivorous microbats (*Microchiroptera*) with the numerous tree hollows throughout the Reserve providing habitat for roosting. The most likely species to occur are

the White-striped Mastiff Bat (*Tadarida australis*) and the Gould's Wattled Bat (*Chalinolobus gouldii*).

3.7.2 Birds

Star Swamp Bushland Reserve has a high diversity of birds with several significant species identified by the City of Stirling, along with species that are listed under State and Federal legislation. The site has high numbers of small passerines such as Honeyeaters, Pardalotes, Thornbills and Wrens. The highest diversity of these species was noted in the area identified as having an Excellent vegetation condition (Figure 20). The site has resident populations of the Splendid Fairy Wren (*Malurus splendens*), White-winged Fairy Wren (*Malurus leucopterus*) and Variegated Fairy Wren (*Malurus lamberti*) which are of high priority to the City of Stirling. Other species identified as significant by the City include the

- Black-faced Honeyeater (*Certhionyx niger*),
- Shining Bronze Cuckoo (*Chrysococcyx lucidus*),
- White-necked Heron (*Ardea pacifica*), and
- Barn Owl (*Tyto alba*).

Several priority and specially protected species utilise the bushland as feeding, nesting and roosting habitat. The site is a known feeding site for Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and they have also been observed to use it as a nocturnal roosting site in recent years (Taylor, 2012, personal communication). The Carnaby's Cockatoo is known to feed on the *Banksia* and *Hakea* species found on the site (Figure 25). The Reserve is also used by the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), with this species preferring to feed on the *Corymbia calophylla* (Marri) which occurs in the north west of the site. The Carnaby's Cockatoo is an endangered species listed under the *Wildlife Conservation Act 1950* (WA) and the *Environmental Protection and Biodiversity Conservation Act 1999* (Cwlth). The Forest Red-tailed Black Cockatoo is listed as Vulnerable under the *Wildlife Conservation Act 1950* (WA) and the *Environmental Protection and Biodiversity Conservation Act 1999* (Cwlth). Star Swamp Bushland Reserve is a significant remnant for these iconic cockatoo species promoting their persistence in the Perth metropolitan region.

Figure 25: Carnaby's Black Cockatoos feeding on Parrot Bush (*Banksia sessilis var. cygnorum)*
Source: City of Stirling

The Rainbow Bee-eater (*Merops ornatus*) is a migratory species that utilises the site between late September and early March each year during the summer breeding season. This bird excavates burrows in the sand on the western side of the Reserve for nesting. This is a specially protected species under the Japan Australia Migratory Bird Agreement (JAMBA) (Department of Sustainability, Environment, Water, Population and Communities, 2011).

3.7.3 Reptiles

Star Swamp Bushland Reserve has a high diversity of reptiles with species present including those that are not typically found in close proximity to urbanised areas. These include the Gould's Monitor (*Varanus gouldii*) sighted in the Reserve during 2011 (Taylor, 2012, personal communication) and a Western Blue-tongue Lizard (*Tiliqua occipitalis*) was observed during site assessment activities (Figure 26). The Western Blue-tongue Lizard is uncommon in metropolitan Perth and as such its presence in the Reserve is significant. Lizard species include Geckos, Skinks and Dragons, such as the Western Bearded Dragon (*Pagona minor*). The Long-necked Turtle (*Chelodina oblonga*) is also found within Star Swamp.

Figure 26: Western Bluetongue Lizard (*Tiliqua occipitalis)* and Western Bearded Dragon (*Pagona minor*)
Source: Natural Area Consulting (left) and City of Stirling (right)

Skinks are the most common reptile found in Star Swamp Bushland Reserve , with species including:

- *Cryptoblepharus plagiocephalus* (Figure 27);
- *Ctenotus fallens*;
- *Hemiergis quadrilineata;*
- *Lerista elegans;*
- *Morethia spp.; and*
- *Tiliqua rugosa.*

Figure 27: Fence Skink, (*Cryptoblepharus plagiocephalus*)

The Reserve contains populations of Dugite (*Pseudonaja affinis*) (Figure 28), Jan's Banded Snake (*Simoselaps bertholdi*) and the Western Tiger Snake (*Notechis scutatus*) which are predators of small vertebrate fauna. A NatureMap search (2012) indicated that the Reserve may contain the Black-striped Snake (*Neelaps calonotos*) which is listed as a Priority 3 species (Department of Environment and Conservation, 2012). The presence of the Carpet Python (*Morelia spilota*) was noted in the Bush Forever listing information (Government of Western Australia, 2000).

Figure 28: Dugite (*Pseudonaja affinis*)
Source: City of Stirling

3.7.4 Amphibians

The amphibian species found in Star Swamp Bushland Reserve are generally located in close proximity to the wetland area on the western side of the Reserve. The Moaning Frog (*Heleioporus eyrei*) (Figure 29) is one of the species that has been positively identified by previous surveys (Taylor, 2012, personal communication). Frog species that have recently been identified as being present in the swamp are provided in Appendix 7.

Figure 29: Moaning Frog (*Heleioporus eyrei*)
Source: City of Stirling

3.7.5 Invertebrates

Invertebrates play a critical role in the environment providing important ecological functions including nutrient cycling and providing an important food source for higher order species, particularly birds. Star Swamp Bushland Reserve has a high diversity of invertebrates including several species that are uncommon in urbanised areas including the Blue Banded Bee (*Amegilla cingulata*) (City of Stirling Priority 1), and Jewel Beetles (*Castiarina* sp.). It has also been the location of a rare sighting of the small green cicada *Jassopsaltria rufifacies* and an unnamed species of resin pot bee (*Austrochile* sp), (Figure 30) which was the first recorded presence of this type of bee in south-western Australia (Pike, 2012, personal communication). The presence of these rare and uncommon insects highlights the significance of the Reserve in providing a suitable habitat for these and other invertebrate species within the Perth metropolitan area.

Resin Pot Bees (*Austrochile* sp.)

Jassopsaltria rufifacies

Hasta sp. (female) *Castiarina picta*

Figure 30: Insects Observed in Star Swamp Bushland Reserve
Source: © David Pike

Surveys for the Graceful Sun Moth (*Synemon gratiosa*) have been undertaken in recent years, however it has not been sighted within Star Swamp Bushland Reserve (Pike, 2012, personal communication). It is listed as a priority 4 species under the *Wildlife Conservation Act 1950* (WA) as from November 2012 and 'endangered' under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) in 2009, which provides it with federal protection from significant impacts. The larvae feed on the bases of tussocks of *Lomandra maritima* and *L. hermaphrodita* in the Perth metropolitan region. While its range is now known to be from Binningup in the south to Kalbarri in the north, it is expected that 20% of its habitat will be lost in the next ten years, resulting in a 30 – 40% loss of population (Western Australian Insect Study Society, 2012). Star Swamp Bushland Reserve provides a potential refuge for the Graceful Sun Moth.

3.7.6 Native Fauna Management Strategies

It is recommended that a formal baseline vertebrate fauna diversity survey be carried out within Star Swamp Bushland Reserve to complement the surveys currently being undertaken. Survey activities should involve pitfall trapping, cage and/or Elliot trapping, bird identification, and monitoring of frog calls to identify different species over a number of days. Surveying for the Quenda population should take place in the vegetation surrounding the swamp area.

3.8 Feral and Introduced Fauna

Feral and introduced fauna have the potential to compromise a site's biodiversity through competition for limited resources such as food, nesting hollows or territory and predation of native animals. Several key non-native species that have been identified are the European Rabbit (*Oryctolagus cuniculus*), European Fox (*Vulpes vulpes*), feral Honey Bees (*Apis mellifera*) and several bird species. Management of introduced fauna can be complex due to the highly mobile nature of some species, the inherent difficulty of management and the fact that some species are not viewed as pests by the community.

The following species are recommended for control due to the direct impact they have on the biodiversity of the Reserve and the practicality of their management:

- feral Honey Bee,
- European Rabbit, and
- European Fox.

Control techniques should be in accordance with City of Stirling policies, practices and procedures.

3.8.1 European Rabbit (*Oryctolagus cuniculus*)

Rabbits are known to inhabit the Reserve as evidenced by the presence of scats, diggings and warrens. They impact on the biodiversity of the Reserve through grazing on native plants, spreading and promoting weed growth, competing with native fauna species, compounding erosion and providing a stable food source for introduced carnivores such as the European Red Fox (*Vulpes vulpes*). Various control measures have been applied in recent years to control numbers. Baiting with Pindone® in 2008, 2009, 2010 saw noticeable reductions in rabbit numbers and as a result vegetation cover was observed to increase during the 2010 growing season (City of Stirling, 2012). Pindone® is toxic to Quenda and any baiting programs will need to take this into consideration before being implemented.

Continued control of Rabbit populations within Star Swamp Bushland Reserve is recommended. Control should be in accordance with City of Stirling current practices and procedures.

3.8.2 European Red Fox (*Vulpes vulpes*)

The fox has attributed to the decline of fauna across the Australian continent. While they are rarely sighted in the Star Swamp Bushland Reserve, there appears to be a resident population, with dead foxes being found from time to time. This animal is an adaptable omnivore that preys upon native reptiles, birds and mammals but will also supplement its diet with rubbish and plant material. It is likely that populations of the Quenda (*Isoodon obesulus fusciventer*) and the Brush-tail Possum (*Trichosurus vulpecular*) have declined or are absent due to predation by foxes and other introduced mammals.

The use of 1080 baits to control fox populations in an urbanised setting such as Star Swamp Bushland Reserve poses a number of challenges, particularly the potential for baits to be taken by domestic dogs. The use of soft pad foot clamps and tablets can be used as means of controlling populations whilst minimising impacts to non-target species.

3.8.3 Feral Honey Bee (*Apis mellifera*)

Feral Honey Bees reduce the biodiversity of the site by competing for nesting hollows with native species as well as posing a threat to public safety. A number of feral bee hives are known to currently exist within the Reserve in tree trunks, fallen logs and the stumps of dead *Xanthorrhoea preissii*. The historic Drovers Tree, which is also known as the 'beehive tree' holds the largest population of feral bees on the Reserve, where large wax combs can be seen hanging from high branches (Figure 31).

The presence of hives should be monitored and removed by a suitably qualified and experienced contractor. This should be complemented by an informal monitoring program and advice from on ground crews so bee hives can be identified and dealt with in a timely manner.

Figure 31: Beehive in tree hollow (left) and wax comb on the Drover's Tree (right).

3.8.4 Introduced Avifauna

During the site assessment high numbers of Rainbow Lorikeets (*Trichoglossus haematodus*) (Figure 32) were identified within the Reserve and observed utilising tree hollows. Lorikeets can be aggressive and their presence may restrict the nesting activities of native animals such as the Ringneck Parrot (*Barnardius zonarius*), Australian Shelduck (*Tadorna tadornoides*) and various bat species.

Figure 32: Rainbow Lorikeet (*Trichoglossus haematodus*)
Source: City of Stirling

The Eastern Long-billed Corella (*Cacatua tenuirostris*) is also present at Star Swamp Bushland Reserve. These birds form large flocks, graze on ovals and parkland, compete for nest hollows and can damage native vegetation through chewing the bark from tree trunks.

Laughing Kookaburras (*Dacelo novaeguineae*) use Star Swamp Bushland Reserve as habitat, preying on reptiles and thus having the potential to alter the species composition of lizards, snakes and amphibians. Two introduced doves, namely the Spotted Turtle Dove (*Streptopelia chinensis*) and the

Laughing Turtle Dove (*Streptopelia senegalensis*), are present within the Reserve. These species are cosmopolitan and able to live in urban areas, and only have an indirect impact to the biodiversity of the Reserve, particularly through the spread of weed seeds.

While the Department of Environment and Conservation has carried out some culling of Rainbow Lorikeets and the Eastern Long-billed Corella (Coupar, 2012, personal communication), their large numbers and mobility make them difficult to control at a local level. It is recommended that if numbers of Rainbow Lorikeets (*Trichoglossus haematodus*) and the Eastern Long-billed Corella (*Cacatua tenuirostris*) continue to be problematic that the City of Stirling discuss potential control options with the Department of Environment and Conservation.

3.8.5 Domestic Animals

A common activity is for residents to walk their dogs, often without a leash, within the Reserve, where they have the potential to chase, injure or kill native fauna species, trample herbaceous flora species such as orchids and trigger plants, as well as interfere with the enjoyment of the Reserve by other users. Dog faeces were a common sight during visits to the Reserve where owners had not picked up after their animal, with the waste material detracting from overall aesthetics and having the potential to result in microbiological pollution if it washes into the wetland.

Due to the conservation values present within the Reserve, it is recommended that the City of Stirling designate Star Swamp Bushland Reserve as an area where dogs are only permitted if they are on a leash. It is recognised that this change is unlikely to be viewed favourably by some sectors of the community, so an education process is recommended to provide dog owners with information about the change and why the change is deemed to be important, with a focus on the protection of natural values, as well as providing information about penalties that may be imposed. This could be achieved through advertising the changes in local papers, producing an information brochure with the relevant information and the installation of additional signage within the Reserve. It is also recommended that City personnel visiting the site reinforce the message through talking to residents about the changes and providing them with copies of any information brochure produced when implementing the changes.

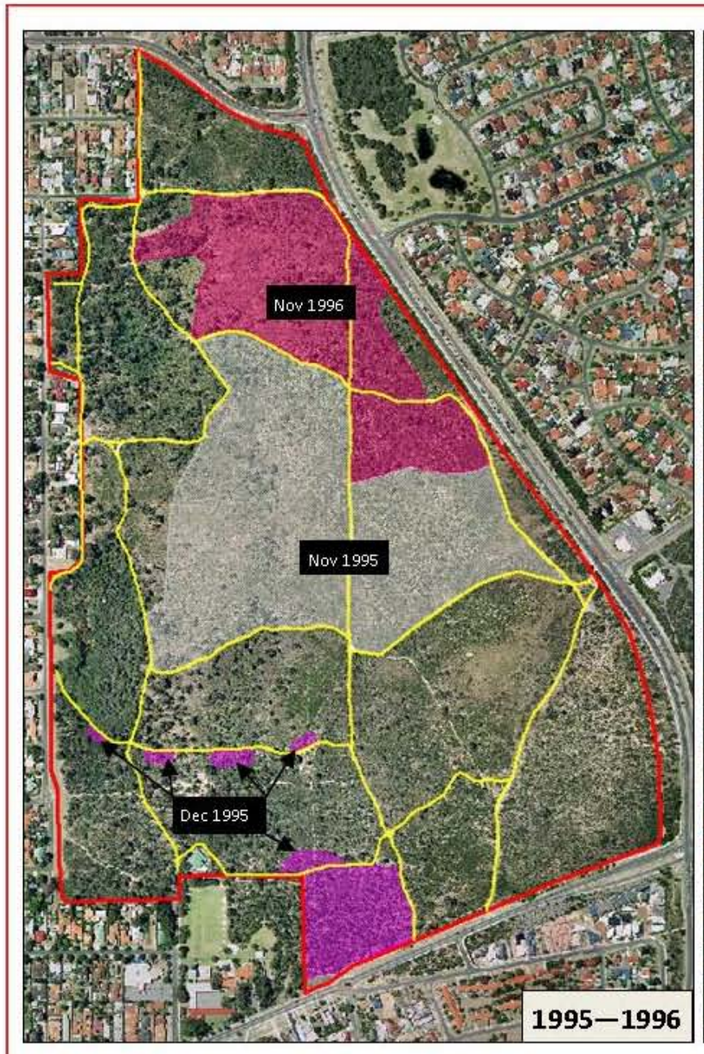
Despite being a designated cat free zone, the Reserve is also likely to be frequented by domestic cats which hunt and often kill native animals, particularly birds, lizards and frogs. It is recommended that the information relating to cats be included on key Reserve signage. In time, the provisions of the *Cat Act 2011* (WA) will allow for cats found in public places or private property to be seized.

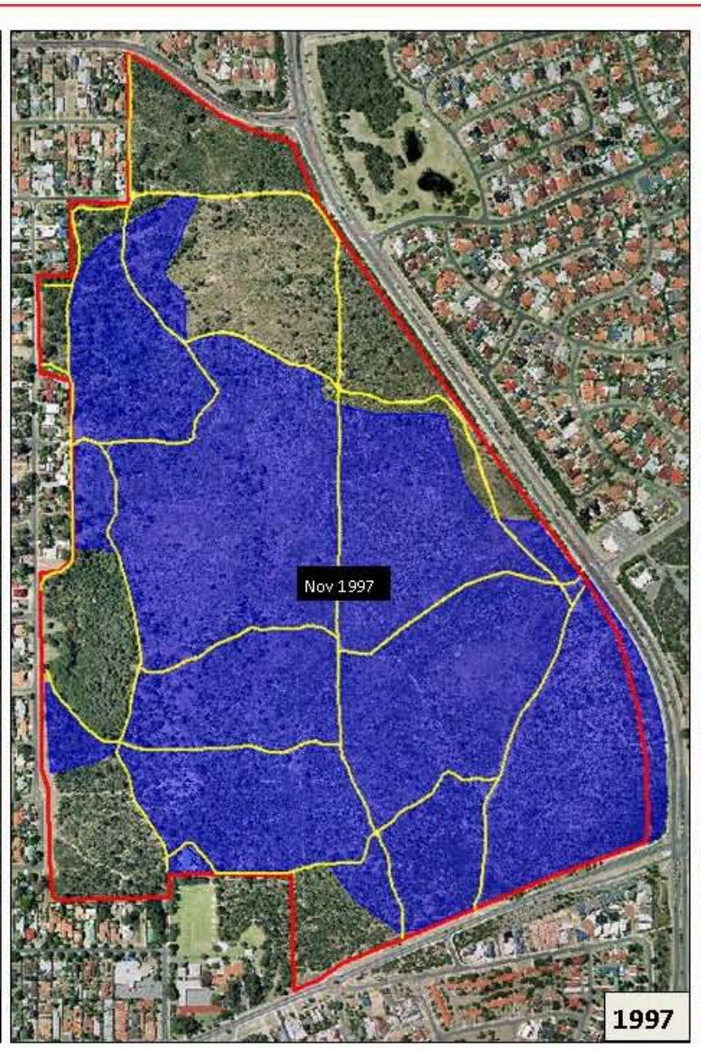
3.9 Fire Management

As a bushland remnant, locations within Star Swamp Bushland Reserve have been burnt in the past. A review of fire history within the 1987 management plan along with data provided by the City of Stirling on fires that have occurred between 1995 and the present indicate that with the exception of a small portion of Star Swamp itself, the entire Reserve has been burnt at one time or another (Figure 33, Appendix 8), and that fires have occurred almost annually since 1995, with some locations being burnt more than once within a few years of each other. While Australian flora has adapted to a fire ecology, frequent fires are known to result in changes to vegetation type and

structure, the loss of fauna and promote the presence of weeds. Despite the negative impacts associated with fire, fire also presents an opportunity to carry out targeted weed control when vegetation is less dense, and when it may be possible to eradicate some species that might otherwise be difficult to control.

It is recommended that the City of Stirling undertake flora surveys in burnt areas after they have recovered sufficiently to determine whether or not impacts are occurring to flora species present, vegetation type and condition, as indicated by baseline survey data. Surveys of fauna within burnt areas are also recommended at regular intervals to determine impacts and rate of recovery after fire. Post fire weed control is also recommended.





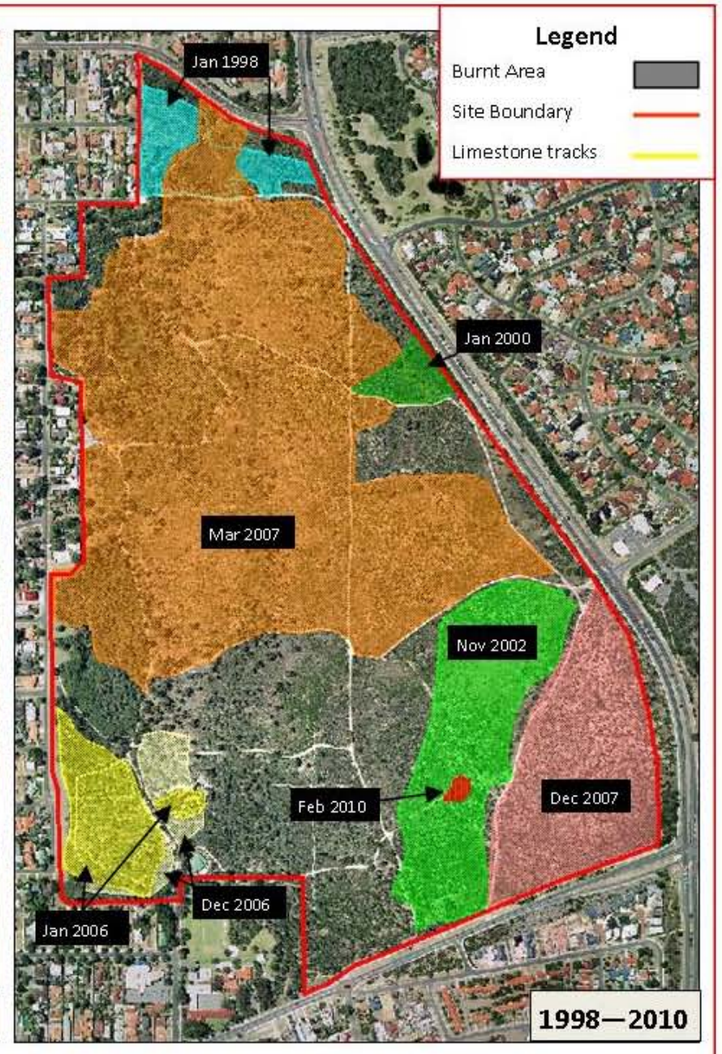


Figure 33:

Fire History

(1995 to 2010)

Natural Area Consulting

99C Lord St, Whiteman, WA, 6068

naturalareaconsulting.com.au

08 9209 2767

N

Client: City of Stirling

Created by: JM

Date: June 2012

Image Source: City of Stirling

Datum: GDA94

Projection: MGA Zone 50

0 300

metres

3.9.1 Other Fire Management Issues

In addition to ecological issues associated with frequent fires, other management issues revolve around the presence of a large bushland remnant within an urban area, and the potential for damage from smoke, embers and flames to infrastructure within the Reserve and housing immediately adjacent to or beyond the Reserve boundary. Access by emergency responders is also an important consideration for management of the site. The Department of Fire and Emergency Services (DFES) produces an Urban Bushland Fire Response Plan for Star Swamp Bushland Reserve which is reviewed annually. All tracks and access points are detailed within this Plan.

Property Damage Potential

The housing along the western side of the Reserve is at the greatest risk of damage from smoke, embers and flames from fires within the bushland area. It is recognised that home owners and occupiers are responsible for ensuring their properties are compliant with City of Stirling fire management policies and annual requirements. However, the City also has a responsibility as the management authority for Star Swamp Bushland Reserve. This responsibility includes implementing appropriate fire management strategies within the Reserve, such as ensuring vegetation within the immediate vicinity of houses is pruned or otherwise maintained to reduce the potential for damage to neighbouring properties, maintaining adequate fire breaks, and ensuring adequate access is available for emergency responders. It is acknowledged that fire can enter Star Swamp Bushland Reserve from neighbouring properties and that neighbouring landowners and managers need to maintain responsibility for fire management on their land.

It is recommended that the City continue to work with land owners and occupiers and provide information about fire management principles, including the need to minimise flammable material in backyard areas, such as wooden gazebos and fences. The Homeowner's Bush Fire Survival Manual (Fire and Emergency Services Authority (FESA), 2008) and the Prepare Act Survive brochure (DFES, 2012) would be a useful resource for those living in close proximity to bushland areas (Figure 34).

Figure 34: Vegetation close to housing in the NW of the Reserve
(Source: Nearmap, 2012)

Access

Access by emergency responders is a key management strategy for the Reserve. The current network of limestone paths provides suitable, trafficable surfaces for light emergency response vehicles, such as a Toyota Landcruiser or similar. There are also sufficient gates that provide access from the road network surrounding the Reserve. The need for further access would need to be balanced with the conservation values of Star Swamp Bushland Reserve and determined in consultation with DFES. Firebreaks should be maintained around the Reserve particularly adjacent to Marmion Avenue which has a high density of grass weeds and dead vegetation. Specifications should be consistent with the City of Stirling firebreak requirements:

- firebreaks must be maintained clear of obstructions
- vegetation must be cut to ground level ensuring stubble and grasses are no more than 25 mm from soil level
- firebreaks must be a minimum of 3 metres in width with no dead ends
- firebreaks must be maintained from November 30 to March 31.

3.10 Natural Environment – Summary of Recommendations

Hydrology

When sampling exercises are carried out, it is recommended that:

- conditions prior to and around the time of sampling are noted, particularly rainfall, approximate temperature and wind, as weather conditions influence the various physical and chemical parameters that will be recorded on a particular day,
- the height and location of monitoring bores is accurately surveyed and collar heights recorded, and
- the security of bores should also be considered, such as through the installation of lockable steel collars.

Drainage

As stormwater can carry sediment and a number of pollutants into water bodies, it is recommended that:

- the use of sediment traps be maintained,
- sumps maintained on a regular basis to allow an appropriate detention time for stormwater inflows, and
- culverts and other stormwater inflow areas are designed and maintained to ensure that erosion is kept to a minimum.

Flora and Vegetation

The flora survey planned by the City of Stirling is supported and recommended by NAC. It is also recommended that further flora surveys are undertaken every five years to provide a comprehensive flora inventory and to identify changes in species composition.

Vegetation Condition

It is recommended that:

- the proposed flora survey proceed in order to bring the knowledge of flora on the site up to date, including any populations of current priority and significant flora, and to identify weed species present,
- vegetation condition be mapped during the flora survey, and repeated every five years to monitor changes over time within the Reserve. Outcomes will assist with identifying areas that will benefit from revegetation, fencing, or some other form of active management, and
- information about the negative impacts of picking wildflowers or damaging native flora species is provided to the community.

Tree Health Decline

It is recommended that the City of Stirling:

- continue to monitor the vigour and health of trees and other flora species within the Reserve, undertaking investigations for *Phytophthora* dieback or other microbiological agents if the extent of decline increases, and

- monitor watertable levels to assess whether or not drawdown may be affecting the health of *Eucalyptus gomphocephala* (Tuart) and *Banksia* species.

Weeds and Other Introduced Flora

It is recommended that:

- the weed mapping currently undertaken by the City of Stirling be updated to accurately reflect the extent of infestations and provide a density rating of weed occurrence, with mapping reviewed every three – five years,
- a formal flora survey of the reserve would aid in identifying weeds species currently present in the reserve,
- formal mapping of the weed species of concern identified from the survey would assist in prioritising weed control measures, highlighting potential problems and provide data on the effectiveness of weed control strategies by monitoring changes over time,
- ongoing targeted weed control is needed to prevent further degradation of the natural areas within the reserve,
- that any olive trees other than the historical remnant tree be removed from within the reserve,
- ongoing liaison and education with local residents with the aim of reducing the potential of new weed infestations from the surrounding area in the future,
- the City of Stirling give consideration to the re-introduction of Bridal Creeper Rust and leaf hoppers to aid in control of the present population of Bridal Creeper (*Asparagus asparagoides*), and
- that the City of Stirling ensure sufficient resources are provided to ensure weeds on road verges surrounding Star Swamp Bushland Reserve are treated on a regular basis.

Mammals

It is recommended that the feasibility of translocating Quenda back into the Reserve if none are present be investigated.

Native Fauna Management Strategies

It is recommended that:

- a current baseline fauna diversity survey be carried out within Star Swamp Bushland Reserve, with survey activities including pitfall trapping, cage and/or Elliot trapping, bird identification, and monitoring of frog calls to identify different species over a number of days, and
- the survey should also target the vegetated areas around the swamp that Quenda are likely to favour.

Feral and Introduced Fauna

It is recommended that the City continue to control the following feral fauna species in accordance with City of Stirling policies, practices and procedures:

- feral Honey Bee,
- European Rabbit, and
- European Fox.

Introduced Avifauna

It is recommended that if numbers of Rainbow Lorikeets (*Trichoglossus haematodus*) and the Eastern Long-billed Corella (*Cacatua tenuirostris*) continue to be problematic that the City of Stirling discuss potential control options with the Department of Environment and Conservation.

Domestic Animals

It is recommended that the City of Stirling

- remove Star Swamp Bushland Reserve from the list of designated dog exercise areas,
- develop and implement an education process to advise of the changes and why they are important,
- when the changes are implemented, that City of Stirling personnel visiting the site reinforce the message through discussion with community members and provision of information, and
- provide information on signs indicating that Star Swamp Bushland Reserve is a cat free zone.

Fire Management

It is recommended that

- the City of Stirling undertake flora surveys in burnt areas after they have recovered sufficiently to determine what impacts are occurring to flora species present, vegetation type and condition,
- undertake surveys of fauna within burnt areas are also recommended at regular intervals to determine impacts and rate of recovery after fire, and
- the City continue to work with land owners and occupiers and provide information about fire management principles, including the need to minimise flammable material in backyard areas, such as wooden gazebos and fences.

4.0 Cultural Heritage

Cultural heritage includes consideration of Aboriginal and non-Aboriginal heritage.

4.1 Aboriginal Heritage

A review of information on the Aboriginal Heritage Inquiry System indicates that there are no known Aboriginal heritage sites within Star Swamp Bushland Reserve (Department of Indigenous Affairs, 2012), Appendix 9). Localised heritage and ethnographic surveys undertaken on behalf of the City of Stirling as a prelude to the development of the Henderson Environmental Centre (south) and drainage works on the western side of the Reserve revealed no indication of Aboriginal presence. No other comprehensive surveys for Aboriginal heritage have been carried out within the Reserve (City of Stirling, 2012, personal communication). It is recommended that Aboriginal Heritage continue to be considered in the event major works similar to those that have previously occurred are planned.

According to the Heritage Council of Western Australia, (1999), there are trees that show signs of scarring, and which have been inferred rather than confirmed as indicating usage by Aboriginal people for making shields and bark dishes. This link is commemorated at point 9 of the Star Swamp Heritage Trail.

4.2 History of Star Swamp since European Settlement

Star Swamp Bushland Reserve and the surrounding areas have a long association with local residents, initially being used for pastoral activities such as grazing and cultivation before eventually being sold for the development of housing. During the 1970's local residents saw the value of the site for conservation and passive recreation, and lobbied for the protection of the more than 90 ha of land that makes up Star Swamp and its associated bushland reserve. The outcome of that process was the gazettal of the Reserve on 03 April 1987 for conservation of flora and fauna and passive recreation and its vesting with the City of Stirling for ongoing management. Table 5summarises various events that have occurred since the first land use.

Table 5: History Timeline of Star Swamp and Surrounding Areas

Timing	Event(s)
Mid 1800's[1,5]	Land set aside as timber reserve for the Midland Railway Company
Mid 1800's – 1900's[5]	Used as a cattle droving way point as it was near the end of the Coastal Stock Route at Fremantle
1860's[5]	Large areas of land settled by pastoralists including Brockman's and Hamersley's
1865[5]	Hamersley's built their house at Mount Flora, north west of Star Swamp
1868[4,5]	First record of name on a tillage lease application by J.H. Okely of Wanneroo
February & November 1869[5]	Okely lease survey by James Cowle

Timing	Event(s)
1872[1]	Pastoral lease granted to Hamersley for Star Swamp watershed
1887[1]	Pastoral lease granted to Hamersley for woodland area to the north of Star Swamp
1870-1915[1,5]	Land to west and south cleared for cultivation, orange and olive groves established, large olive tree on Reserve boundary near Hope Street is the only known remnant of this land use
1890's[5]	Area used for camel quarantine station
Early 1900's[3]	Area to west subdivided for housing
1914[1]	Charles Riley Memorial Reserve just to the east of Star Swamp Bushland Reserve gazetted for recreation
1915[1,5]	Grazing by dairy cattle from Bettles Dairy ended
1919[1,5]	Marl extracted from Star Swamp for sealing new roads
1920's-1940's[1]	Nearby area (now North Beach Primary School) used for disposal of sanitary wastes
1935[1]	Recreation reserve near Ada Street gazetted
1940's[1,3,5]	Australian Army 10th Light Horse division watered horses at the swamp
1953 and 1973[1]	Purchase of older grazing leases by Homeswest (previously known as the State Housing Commission)
1970's[1]	Surrounding area begins to be subdivided for residential housing, large drains and sewers constructed across south west corner, construction of Marmion Ave and Beach Road, community interest in conservation of the site begins to grow
1976[1]	Application to State Housing Commission to rezone the crown land for residential development Initial Request by residents to retain Star Swamp for conservation to Jim Clarko, Member for Karrinyup
30 March 1976[1]	Peter Jones, the Minister for Housing and Minister for Conservation and Environment agreed to the reservation of approximately 4 ha around the swamp
1977[1]	7000 signature petition to Parliament requesting the preservation of the Star Swamp area
20 September 1977[1]	Report by the Environmental Protection Authority recognised the significance of Star Swamp
1983[1]	Australian Heritage Commission placed what is now Star Swamp Bushland Reserve on the Register of the National Estate
1985[1]	State Cabinet decides to commence process to gazette Star Swamp Bushland Reserve as an A-class Reserve Friends of Star Swamp Bushland formed out of the community association that led the process to preserve the swamp for conservation
3 April 1987[1,4]	Star Swamp Bushland Reserve declared an A-Class reserve by the Government of

Timing	Event(s)
	Western Australia, vested with the City of Stirling for management
1988[5]	Heritage trail researched and installed
3 April 2001[2]	Henderson Environmental Centre opened

(Sources: City of Stirling, 1987[1]; City of Stirling, undated[2]; Friends of Star Swamp Bushland, 2012[3]; Government Gazette of Western Australia, 1987[4]; Heritage Council of Western Australia, 1999[5])

Major human disturbances other than fire that have occurred in the area of the Reserve are listed in Table 6 and shown in Figure 35.

Table 6: Historical Disturbance Events within the Reserve Area

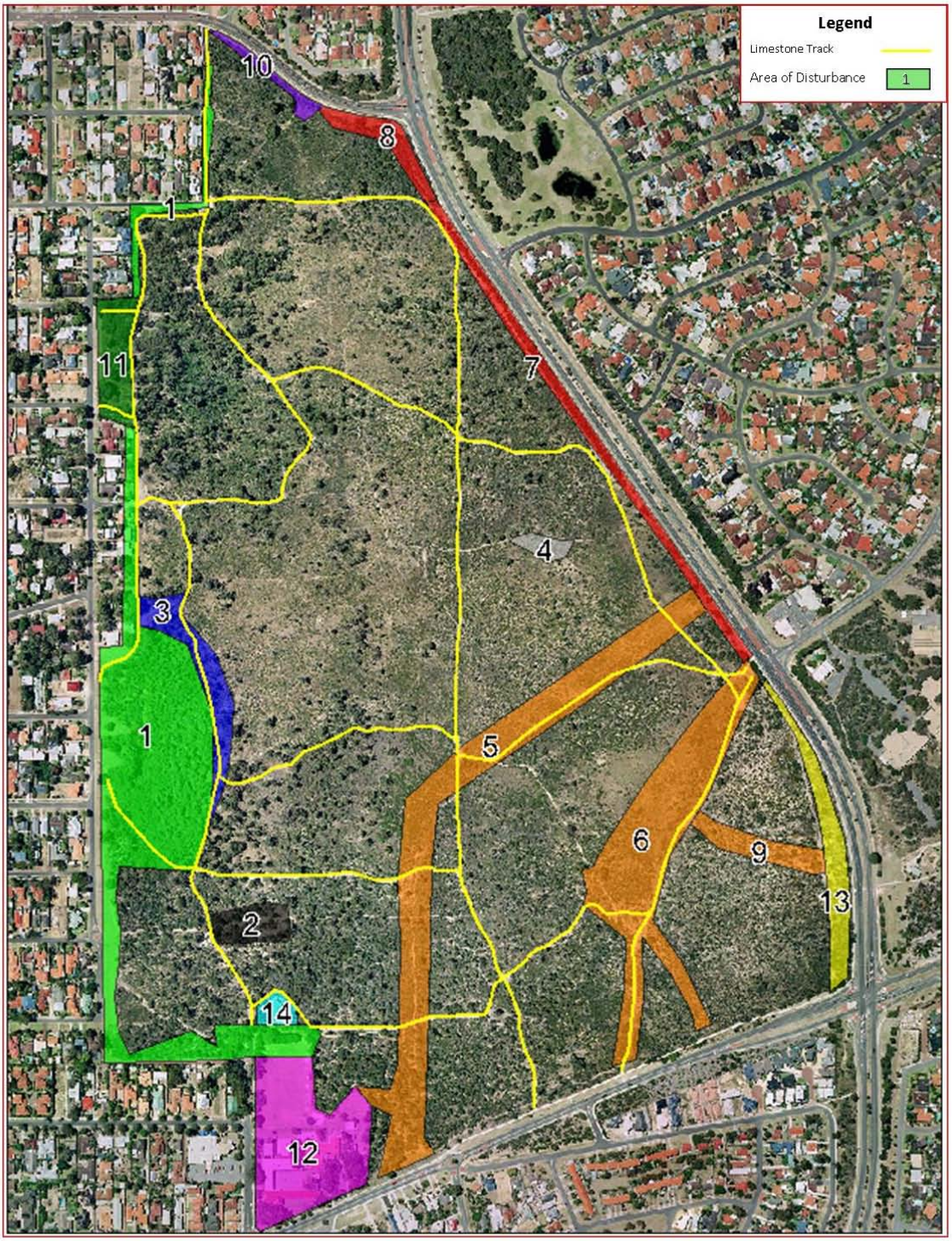
Location	Timing	Event(s)
1	Prior to 1948	Timber cutting, use of swamp as watering place for stock and vegetable cultivation
2	1930's to 1945	Cleared for burying of night soil and other rubbish
3	Prior to 1948	Overgrazing and clearing at swamp
4	1968	Motocross track on previously disturbed site
5	1970	Clearing and excavation for main drain
6	1973	Clearing and excavation for Karrinyup sewer
7	1976	Marmion Avenue extension
8	1977	Marmion Avenue extension and drain excavation
9	1980	Carine sewer extension excavation
10	1981	Beach Road sump
11	1980's	Dumping of garden rubbish
12	1980's	Development to the north of North Beach Primary School
13	1987	Gas pipeline excavation in SE of Reserve
14	2000	Henderson Environmental Centre built

Source: Piggot, 1994

4.2.1. Cultural Heritage Trail

A cultural heritage trail was established in 1988, with ten information signs highlighting historical information and places of significance. It extends for approximately 1.4 km from the southern end of the Reserve near the Henderson Environmental Centre up to Mary Street, with a short side diversion along the western side of Star Swamp (Figure 36).

It is recommended that the City of Stirling give consideration to extending the heritage trail in a manner that allows all points of interest to be accessed in a single, 'round trip'. For example, additional points of interest could include highlighting environmental or conservation values to provide a complete loop between point 4 and point 7.



Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

Figure 35: History of Human Disturbances within Star Swamp Bushland Reserve

(Refer to Table 6 for disturbance type)

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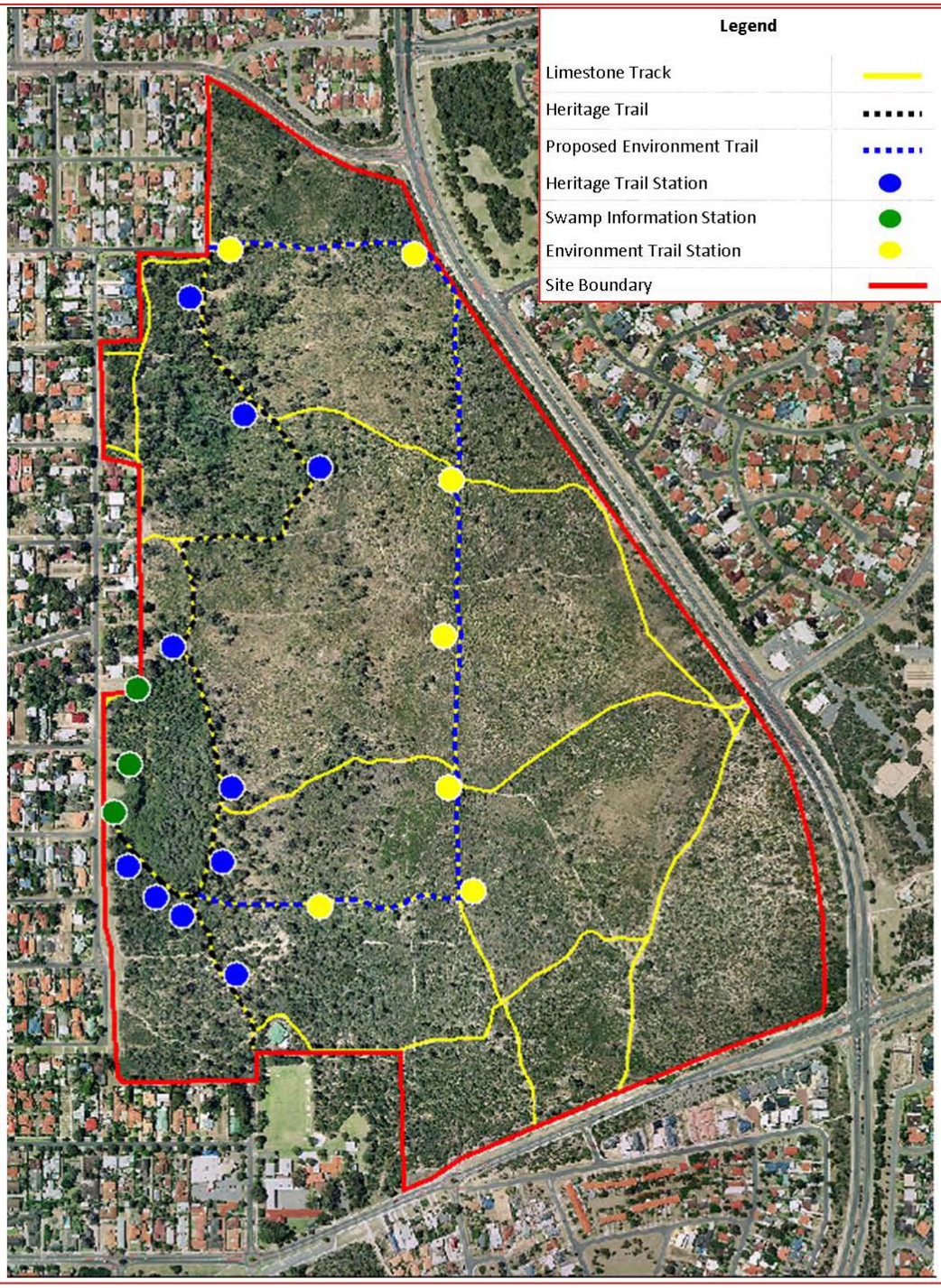
0 200
metres



Natural Area CONSULTING

Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: SLIP NRM
Datum: GDA94
Projection: MGA Zone 50

Figure 36 : Heritage Trail and Proposed Extension and Information Station Locations

N

0 300

metres

4.3 Cultural Heritage Recommendations – Summary

Aboriginal Heritage

It is recommended that Aboriginal Heritage continue to be considered in the event major works similar to those that have previously occurred are planned.

European and Other Heritage

It is recommended that the City of Stirling give consideration to extending the heritage trail in a manner that allows all points of interest to be accessed in a single, 'round trip' (Figure 36).

5.0 Recreation

Star Swamp Bushland Reserve is an important natural area for the local community providing a range of activities that can contribute to a number of social benefits. Some of these activities include:

- exercise (e.g.: walking and jogging)
- relaxation and reflection
- involvement with 'friends' group
- community education
- school physical education
- community engagement.

When Star Swamp Bushland Reserve was vested as an A-Class Reserve in 1987, the management aims were conservation of flora and fauna whilst allowing passive recreation and education. Passive recreation can be described as those activities that result in minimal impact to the environmental and ecological values present within the Reserve, such as walking, exercise consistent with the Reserve zoning, photography, and bird watching. The importance of allowing these rather than active forms of recreation is reaffirmed, with activities confined to designated areas such as within the Henderson Environmental Centre, paths and the grassed area near the wetland.

5.1 Access

There are ten vehicle access points with gates found on all sides of the Reserve, with pedestrian access also available at these locations (Figure 40). A new vehicle gate along Hope Street does not have pedestrian access associated with it. In addition to the vehicle access gates there are five pedestrian only access points to the Reserve on the western side. There is one location in the south east of the Reserve where it is obvious that a number of people are climbing the fence to gain access, and have created a track from that point to one of the limestone tracks Overall, access is considered to be sufficient, with no further pedestrian or vehicle entry points required. It is recommended that those vehicles entering the Reserve ensure they reattach chains and close gates upon entering so there is no inferred 'invitation' to other vehicles. Consideration should also be given to upgrading chain barriers (Figure 37) to a gate.

Figure 37: Typical pedestrian access point next to a vehicle chain gate

5.2 Tracks

Within the Reserve, there is an extensive network of tracks providing access to the interior. Site surveys identified three types of tracks (Figure 38), these being:

- paved limestone tracks that provide pedestrian access throughout the Reserve, and which are also suitable for vehicle movement for maintenance and fire control activities,
- sandy walking tracks that have developed over time; it is recognised that many of these have been created by people taking a 'short-cut' through the bush, thus a number are considered to be informal, established tracks, and
- incipient tracks that show signs of use by people, but which are not readily discernible to the majority as they are often still covered with dead plant material.

Paved, limestone track

Sandy walking track

Incipient track marked with broken *Xanthorrhoea* fronds and flattened dead plant material on the ground

Figure 38: Track types within Star Swamp Bushland Reserve

The extent of tracks within the Reserve has changed over time, with some of the initial sandy tracks being progressively paved with crushed limestone to facilitate vehicle movement for maintenance and fire response activities (Figure 39). The current extent of tracks identified during site assessment activities is shown in Figure 40. It is apparent that over time, the number of sandy and incipient tracks has increased as human population and access has increased (Figure 39).

Some sandy tracks have fallen into disuse as vegetation growth has occurred in those areas while in other locations there are signs that new tracks are being established and that some of the older tracks that have been allowed to overgrow and regenerate are beginning to be reused. At a few tracks in particular, fronds from a Grass Tree (*Xanthorrhoea preissii*) had been broken off and left on the ground as markers along these incipient tracks. According to Pike (2012, personal communication), there is at least one visitor to the site that has been observed walking a large dog through bushland areas rather than keeping to the established pathways who is creating the majority of the incipient tracks, with many other walkers and joggers also choosing to avoid the designated pathways. Other sand track users include mountain and BMX bike riders.

When considering the current extent of track s within the Reserve, it is recommended that some are blocked off and either allowed to regenerate or be rehabilitated to discourage continued use. Examples of closure techniques include installation of woody debris (i.e.: large branches, tree trunks), revegetation, fencing and signage. The nominated revegetation methodology will be in accordance with City of Stirling's current policies, practices and procedures.

When recommending tracks for closure, consideration has been given to whether they are formal or informal, how long they have been used by visitors, and their location. Some of the more established sandy tracks could be retained as bush appreciation trails for pedestrian access only, with no dogs, bicycles or jogging allowed. The use of targeted signage could highlight notable features in the vicinity of those tracks that are designated for bushland appreciation. Figure 41 outlines recommended track closures, indicating those that should be closed as a matter of priority (immediate to short term), others with medium priority (3 – 5 years), and the remainder as a low priority (> 5 years). In making this recommendation it is recognised that the site is a Bush Forever site and that the management purpose is conservation.

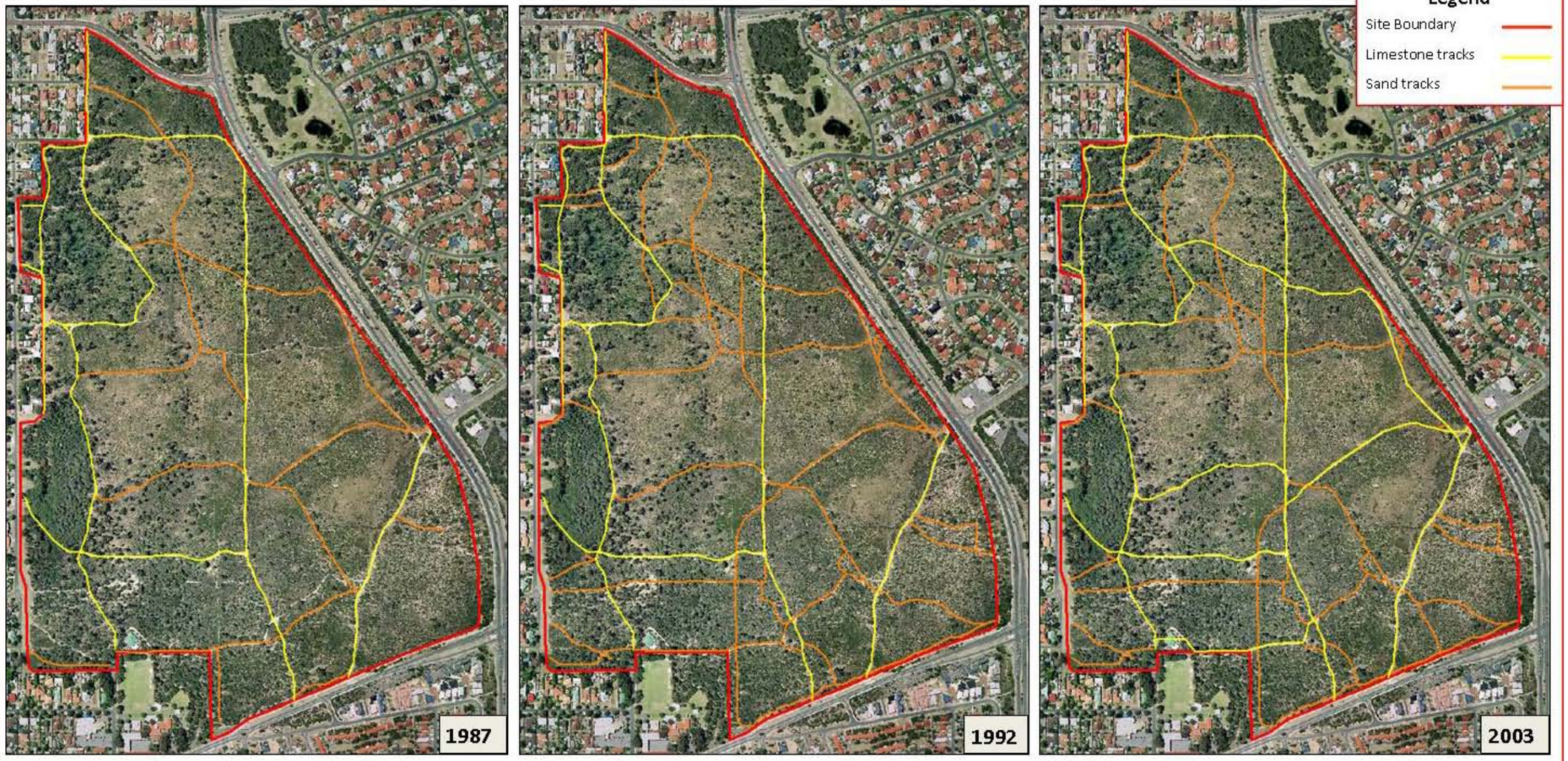


Figure 39:

Changes to tracks (1987 to 2003)

Natural Area Consulting
99C Lord St, Whiteman, WA, 6068
naturalareaconsulting.com.au
08 9209 2767

N

Client: City of Stirling
Created by: JM
Date: June 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

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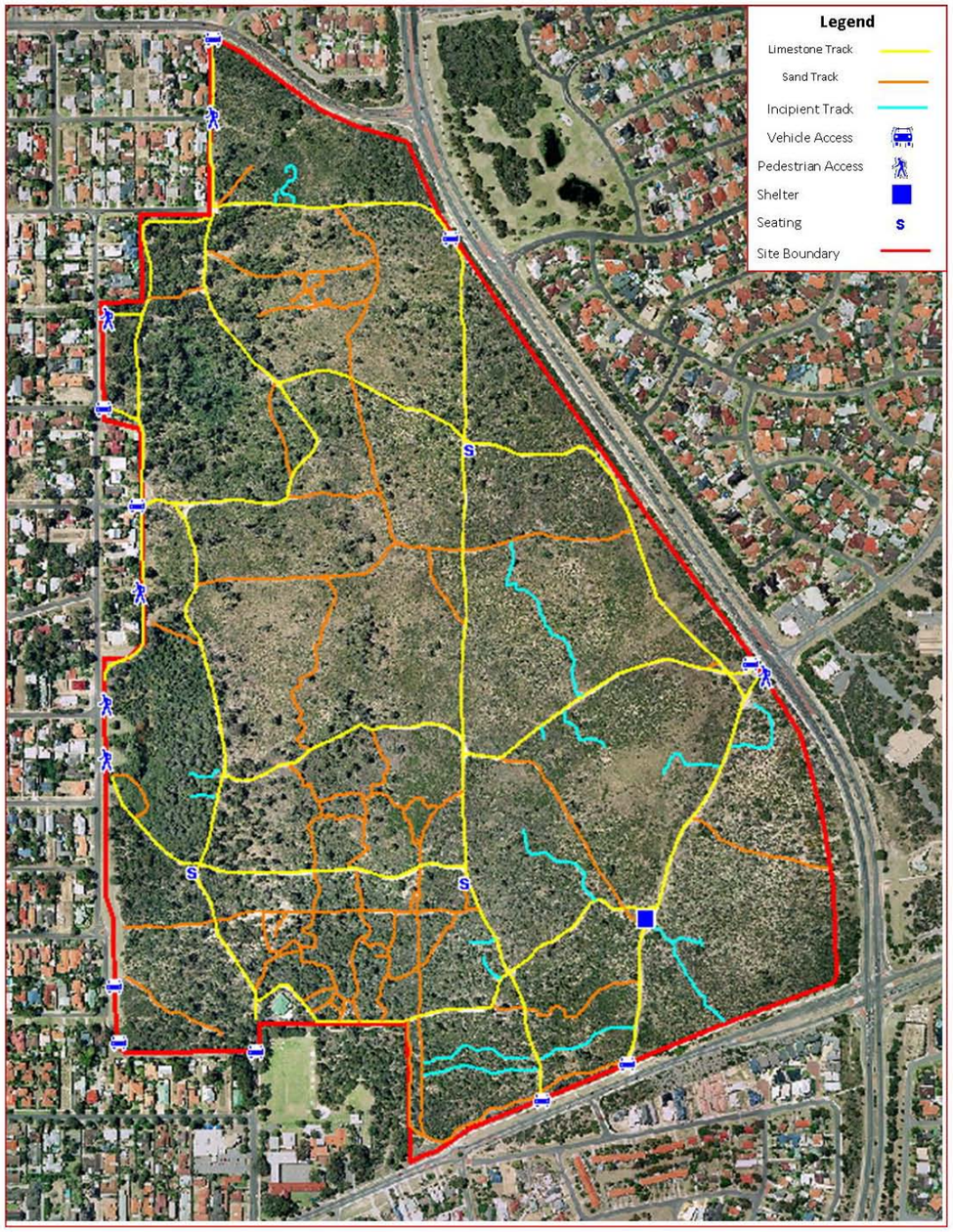

Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

Figure 40: Current tracks and access points

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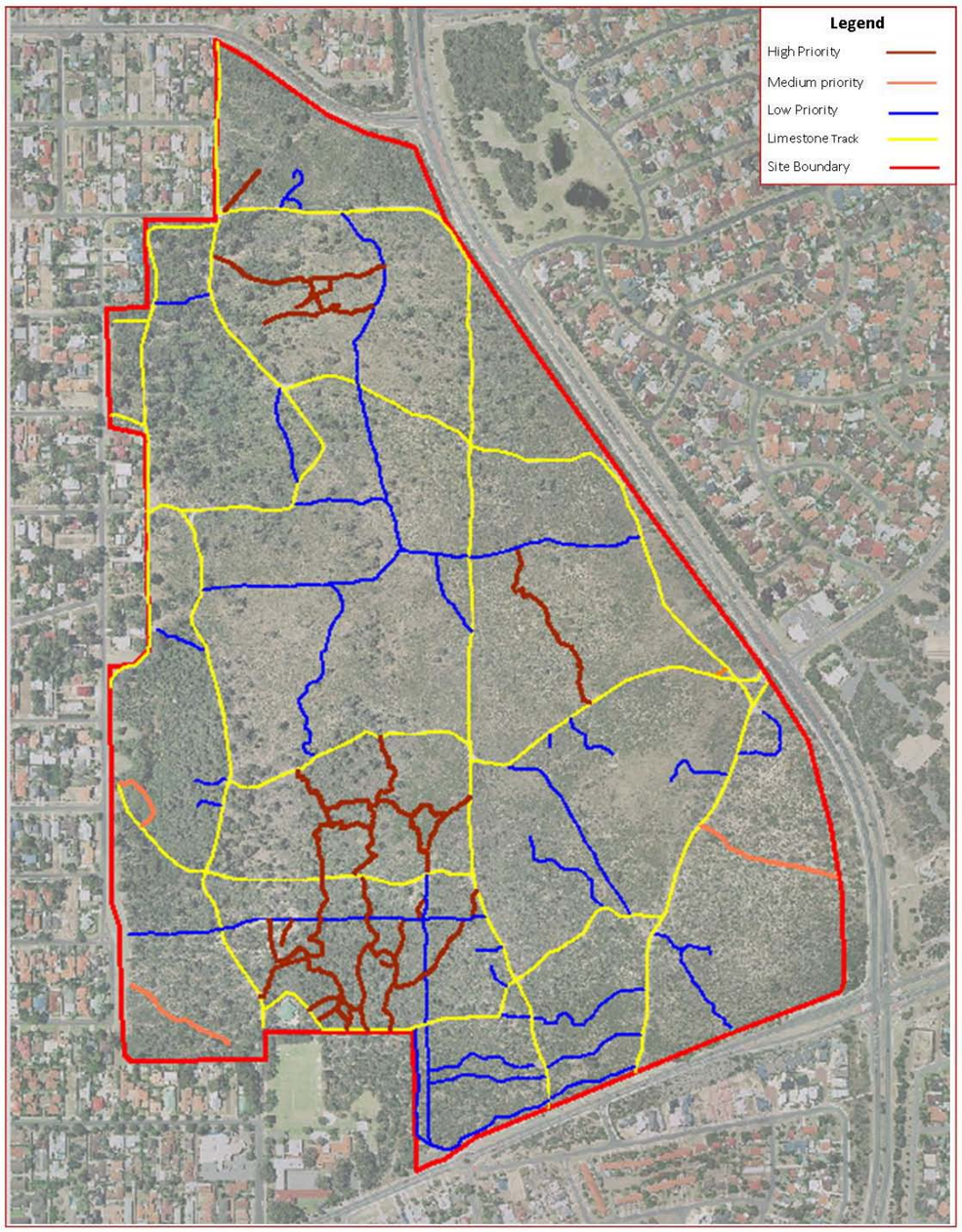
metres



Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

Figure 41: Closure priority for tracks through bushland areas

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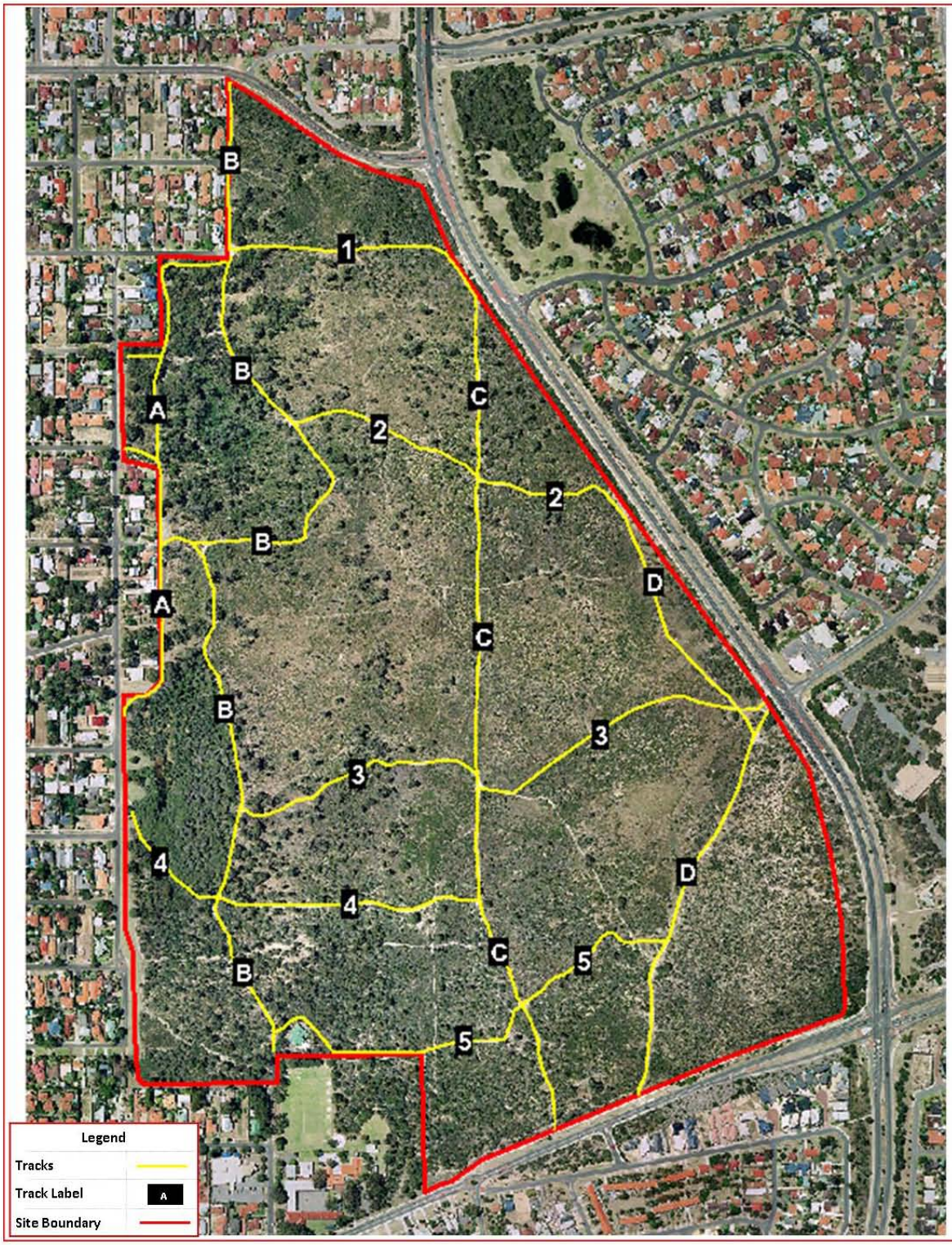
metres



Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: SLIP NRM
Datum: GDA94
Projection: MGA Zone 50

Figure 42: Track Naming System for Star Swamp Bushland Reserve

N
0 300
metres

5.2.1 Track Naming System

Previously the tracks within the Reserve have not been given any names. This has presented some difficulties in describing to visitors where they are and where they need to go to arrive at their desired destination, or to emergency services when directing them to a particular location. Figure 42 presents the preferred naming system for the tracks to aid in direction finding within the Reserve. North-south tracks would be given an alphabetic indicator and east-west tracks a numerical indicator. Consideration can be given to including an indication to major roads or compass bearings at cross points (e.g.: 2W or 2E posted at the intersection of Tracks 2 and C).

5.3 Signage

Signs serve the broad function of imparting key information to the community. Signage within the Star Swamp Bushland Reserve is limited and takes one of three major forms, these being:

- direction and distance indicators,
- heritage trail information points and large information boards, and
- preclusions within the Reserve.

Those signs that are present were installed prior to signage style guidelines being developed by the City of Stirling. Figure 46 shows the location of the different types of signs found within the Reserve.

5.3.1 Directional Signage

Directional signage provides an indication of the direction and distance to the nominated feature. As Figure 46 indicates, not all pathways and junctions within the Reserve have directional signs present; while Figure 43 shows that some signs have information on one side and not the other. Accordingly, it is recommended that directional signage be installed where tracks intersect and that information should be provided on both sides.

Figure 43: Directional signage

5.3.2 Star Swamp Heritage Trail Signage

The Heritage Trail was established in 1988, and includes a series of ten information signs highlighting different aspects of Star Swamp's history (Figure 36). Three major sign boards are located at each of the three ends of the heritage trail that includes a map of the different points of interest and the broader Reserve as well as highlighting background information about the trail (Figure 44).

Figure 44: Heritage Trail signage

5.3.3 'Preclusion' Signage

This form of signage has often been used in reserves and natural areas to inform people of what activities are prohibited, including within Star Swamp Bushland Reserve (Figure 45). While this form of signage can be useful, one of the disadvantages is that they do not provide information about the reasons why the nominated activities are precluded. For this reason, it is recommended that over time, this form of signage be replaced with ones that highlight the reasons why activities are not allowed, thus informing the community about key environmental and ecological values and also enhancing decision making processes. For example, information on the Bush Forever status of the site could be considered.

Old wooden sign facing Marmion Avenue

Sign on Marmion Avenue hidden by *Hakea prostrata* shrub

Figure 45: Preclusion signage

5.3.4 Other Signage Considerations

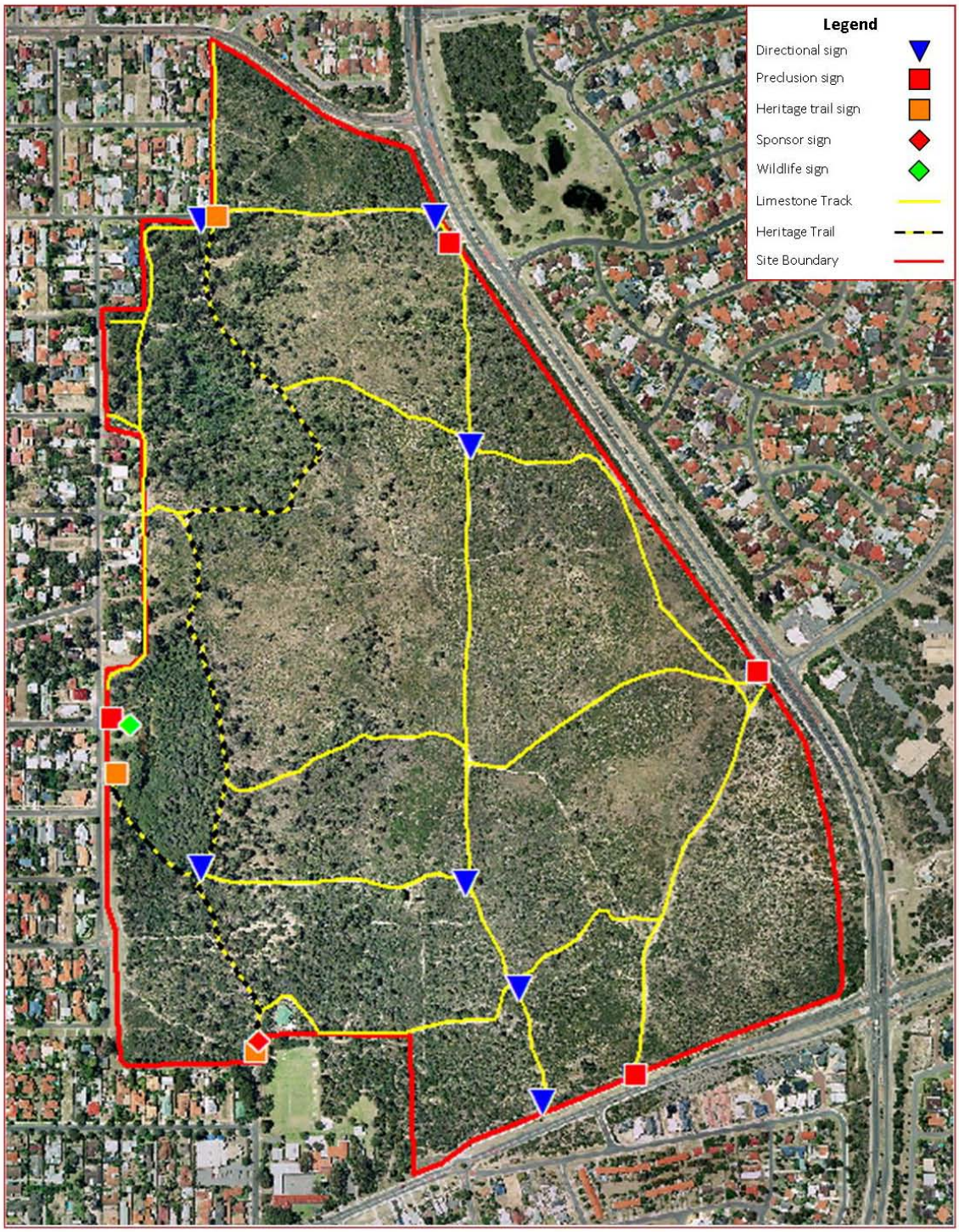
Despite the major purpose of signage being to provide information to the community, there are those who will use them as a target of graffiti and other forms of vandalism. Accordingly, the following are recommended in relation to signage:

- existing signs are checked regularly for graffiti and vandalism, and cleaned and/or repaired as appropriate in a timely manner,
- in the short term, the City of Stirling consider the signage at Star Swamp Bushland Reserve and decide on a form that is in keeping with the signage style guide that will be implemented when signs are replaced or otherwise upgraded, and

- when signs are replaced or otherwise upgraded, they are constructed from materials and in a manner that limits the potential damage associated with the removal of graffiti in particular, along with other forms of vandalism including fire.

It is also recommended that:

- directional signage be installed at those locations where it is absent (refer Figure 46) in the short term,
- signage is installed at the fork in the track near point 2 to indicate that the heritage trail continues in two directions,
- if further points of interest are added to the heritage trail, additional signage may be required,
- signs with maps of the Reserve are installed at more access locations to assist community members and visitors to find their way around more readily,
- significant features such as Marmion Avenue or North Beach Road are included on directional signage to help visitors to the Reserve navigate.



Natural Area CONSULTING

Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

Figure 46: Current Signage Locations

N

0 200

metres

5.4 Human Disturbance Issues

Other than fire, there are a number of management issues related to recreational use that are apparent within the Reserve.

5.4.1 Dog walking

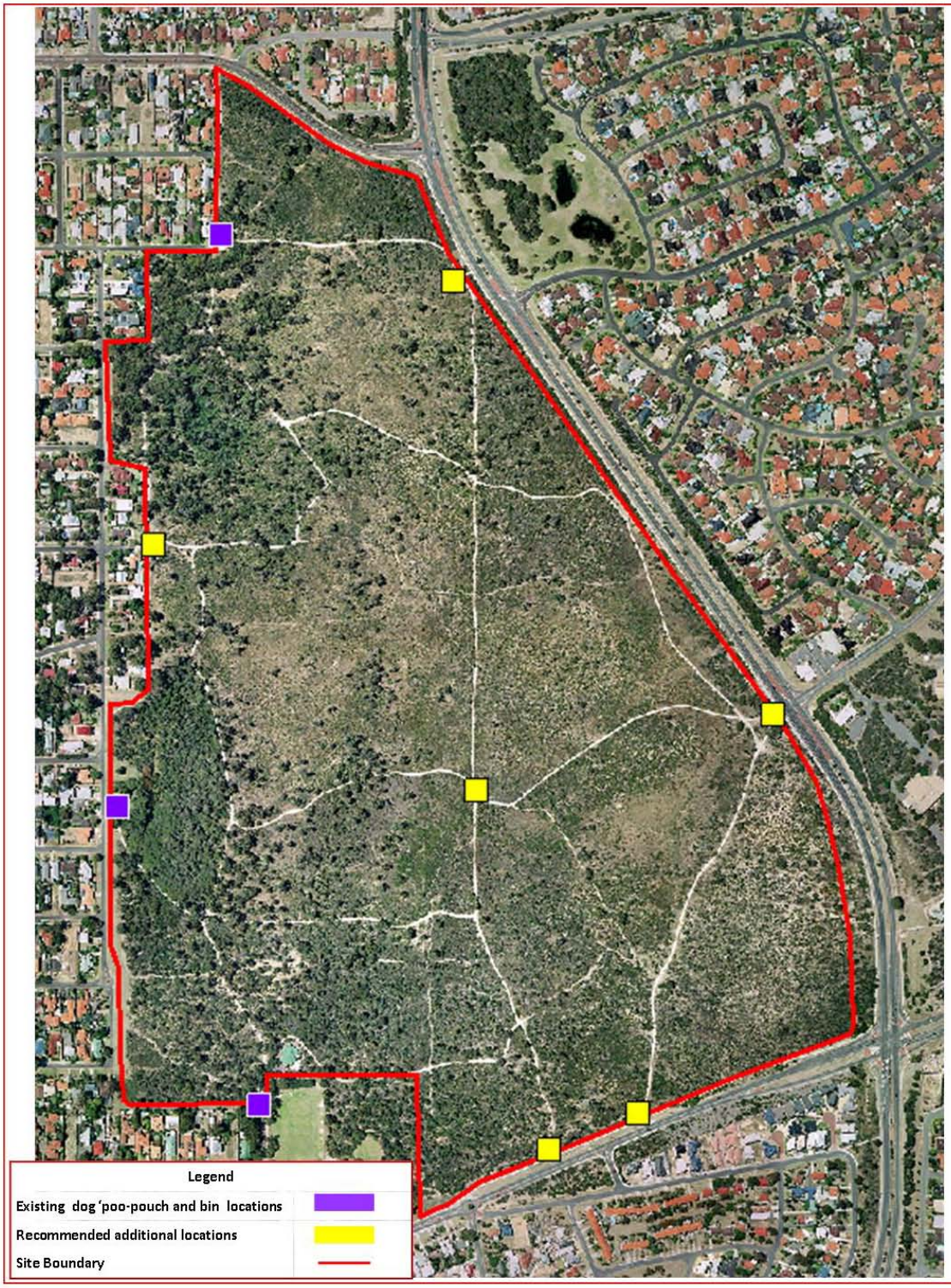
As noted in Section 3.8.5, the Reserve is regularly used by the community to walk their dogs. As a designated dog exercise area, this practice can lead to conflict between dogs and other users, individual animals chasing or attacking birds and other wildlife, or even people. As the City of Stirling has the power to designate which reserves require dogs to be on leash, it is recommended that it does so for Star Swamp Bushland Reserve in recognition of its conservation values.

Despite the provision of 'poo-pouches' at three of the reserve entrances, there are those dog owners that neglect to pick up after their dogs, with faeces often noticeable left lying on and nearby the walk trails. This practice is not only unsightly and reduces visual amenity, it is also unpleasant for those who happen to stand in messes left behind and there is also the potential for the waste material to be washed into the wetland area where it can contribute to nutrient enrichment and microbiological pollution. It is recommended that information about the negative impacts with dog faeces is provided that reinforces the message that owners are required to pick up after their dogs. It is also recommended that the City of Stirling review the locations where 'poo-pouches' are provided, and if necessary, increase the number of locations as well as ensure they are restocked in a timely manner. Recommended locations are provided in Figure 48.

5.4.2 Rubbish

The presence of rubbish has the potential to reduce the visual amenity of the Reserve. While small amounts of rubbish was observed during site assessment activities, it was primarily in locations away from those generally frequented by the community where teenagers are meeting to smoke and drink. Items included aluminium drink cans, cigarette packets and clothes (Figure 48). It is recommended that when City of Stirling personnel and, where possible, contractors come across rubbish items they are promptly removed and disposed of.

Figure 47: Rubbish left in the bush



Natural Area CONSULTING

Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: SLIP NRM
Datum: GDA94
Projection: MGA Zone 50

Figure 48: Bins and Dog 'Poo-Pouch' Current and Recommended Locations Star Swamp Bushland Reserve

N

0 300

metres

5.4.3 Graffiti Vandalism

Site assessment activities indicated that graffiti vandalism is occurring within the Reserve, both in terms of 'tagging' infrastructure such as signs, but also trees (Figure 49). In addition to the recommendations outlined in Section 5.3, it is recommended that graffiti be removed in a timely manner when it is found. However, it needs to be noted that removing graffiti from trees is potentially problematic due to the difficulty of removing the tags without damaging the bark of the trees, especially for Banksias which have a thin bark. Painting over the graffiti in such situations may be an option. For trees with thicker bark the paint can be removed with a wire brush.

Figure 49: 'Tagged' Banksia tree

5.4.4 Cubbies

Cubbies have been constructed within the reserve at various times, with recent examples involving large excavated holes up to two metres deep and the removal of green branches broken off trees to create a lean-to type of structure (Figure 50). As well as disturbing vegetation and/or the soil, they often result in large items of rubbish being brought into the Reserve to aid in their construction as well as being a potential fire hazard when matches, lighters, cigarette butts and similar are disposed of inappropriately. It is recommended that the City of Stirling promptly remove any cubbies found within the Reserve as soon as practicable after they are found, and any disturbance to the soil and vegetation restored where possible to do so.

Figure 50: Examples of cubbies constructed in Star Swamp Bushland Reserve
Sources: City of Stirling (left, right), Natural Area Consulting (centre)

5.4.5 Cars and Motorbikes

Cars and motorbikes have been known to be driven or ridden around the Reserve despite there being fencing and gates in place (Figure 51). In one incident, a car was set on fire after the joy ride, which spread into the surrounding bushland (February 2012) and was fortunately contained before it spread too far (City of Stirling, 2012). It is recommended that access limitations as outline in Section 5.1 are investigated and implemented.

Burnt out car | Trail or motor bike evidence | Mountain or BMX bike evidence

Figure 51: Damage caused by motorised vehicle activity within the Reserve.
Source: City of Stirling (left), Natural Area Consulting (centre and right).

5.4.6 Picking of Wildflowers

As a natural bushland reserve, Star Swamp Bushland Reserve contains a number of native species that are considered attractive and which some members of the community like to pick. According to the City of Stirling (2012) there have been anecdotal reports of people picking wildflowers in the past, but does not appear to be currently happening on a large or noticeable scale. Informative signage and other information sources can be used to reinforce the message of why it is important not to pick wildflowers.

5.4.7 Cannabis Growing

Large areas of bushland can attract cannabis cultivation activity and the Star Swamp Bushland Reserve has been the site of repeated attempts to grow cannabis plants over the last few decades (Pike, 2012, personal communication). Two sites in the northern section of the Reserve where there had been a recent attempt to grow cannabis were found during site visits in March 2012. The attempts did not look to have been successful despite the use of tree guards to protect them from

predation by grazing animals. As this activity was creating new tracks and trampling vegetation in the vicinity of the cannabis plants, it is recommended that any such plantings found in the future are either removed or reported to the relevant authorities for their investigation and action if more appropriate to do so.

5.5 Managing Human Activities – Summary of Recommendations

Access

It is recommended that

- those vehicles entering the Reserve ensure they reattach chains and close gates upon entering so there is no inferred 'invitation' to other vehicles, and
- consideration be given to upgrading chain barriers to gates.

Tracks

It is recommended that:

- informal tracks be reviewed and those that are unnecessary are closed and rehabilitated, and
- a track naming system be developed and implement through the installation of appropriate signage.

Signage

It is recommended that:

- directional signage be installed at locations where there is none and where appropriate, provide information on those where it is absent,
- over time, this form of signage be replaced with ones that highlight the reasons why activities are not allowed, thus informing the community about key environmental and ecological values,
- existing signs are checked regularly for graffiti and vandalism, and cleaned and/or repaired as appropriate in a timely manner,
- in the short term, the City of Stirling consider the signage at Star Swamp Bushland Reserve and decide on a form that is in keeping with the signage style guide that will be implemented when signs are replaced or otherwise upgraded,
- when signs are replaced or otherwise upgraded, they are constructed from materials and in a manner that limits the potential damage associated with the removal of graffiti in particular, along with other forms of vandalism including fire
- directional signage be installed at those locations where it is absent,
- signage is installed at the fork in the track near point 2 to indicate that the heritage trail continues in two directions, and
- signs with maps of the Reserve are installed at more access locations to assist community members and visitors to find their way around more readily, and
- significant features such as Marmion Avenue or North Beach Road are included on directional signage to help visitors to the Reserve navigate.

Dog Walking

It is recommended that:

- information that informs residents of the negative impacts with dog faeces is provided that reinforces the message that owners need to pick up after their dogs,
- the City of Stirling review the locations where 'poo-pouches' are provided, and if necessary, increase the number of locations as well as ensure they are restocked in a timely manner, and
- dogs be confined to a leash whilst within the park boundaries to reduce the chance of injury and disturbance to native species of flora and fauna.

Rubbish

It is recommended that when City of Stirling personnel and, where possible, contractors come across rubbish items they are promptly removed and disposed of in an appropriate manner.

Graffiti Vandalism

It is recommended that graffiti be removed in a timely manner when it is found, recognising that removal of graffiti from trees could be problematic on those with thin bark.

Cubbies

It is recommended that the City of Stirling promptly remove any cubbies found within the Reserve as soon as practicable after they are found, and any disturbance to the soil and vegetation restored where possible to do so.

Picking of Wildflowers

It is recommended that the City of Stirling give consideration to providing information that reinforces the importance of not picking wildflowers through appropriate signage, pamphlets, or other communication means.

Cannabis Growing

In the event cannabis plants are found growing within the Reserve, it is recommended that the plants are either removed or reported to the relevant authorities for their investigation and action if more appropriate to do so.

6.0 Community Involvement and Consultation

There is a long history of community involvement with the ongoing management of Star Swamp Bushland Reserve, which is important to the City of Stirling. Also important is the need to work with neighbours, nearby residents and the Friends of Star Swamp Bushland on issues of potential concern to each other, such as fire preparedness and management.

6.1 Guiding Principles for Working with the Community

The City of Stirling is currently in the process of developing a guide to working with the community that will be applied across all operations, not just those relating to Star Swamp Bushland Reserve. It is expected that the principles outlined in the guide will be applied to Star Swamp Bushland Reserve when it becomes available.

6.2 Community Involvement

As outlined in Section 4.0, the community took the lead role in lobbying for the protection of what is now Star Swamp Bushland Reserve during the 1970's until the decision was made to commence that process of gazetting the site as an A-Class reserve in 1985 and its subsequent gazettal in 1987. The community has continued to be seen as a legitimate partner in the management of the Reserve, with major decisions including community consultation processes, such as those that occurred when drainage improvements off Hope Street and the construction of the Henderson Environmental Centre were planned.

Similarly, the preparation of this management plan has included consultation with the community through an open day held at the Henderson Environmental Centre in July 2012. The open day included representatives from the City of Stirling, Natural Area Consulting, and the Friends of Star Swamp Bushland. Information was made available on the day, along with an invitation to provide comment on the draft management plan. Comments were collated and incorporated into the plan where appropriate to do so. A list of those who provided comments and a summary of their submission are provided in Appendix 12.

6.2.1 Friends of Star Swamp Bushland

The Friends of Star Swamp Bushland formed when the decision was made to commence the gazettal process of the site as an A-Class reserve in 1985. Since then, their interest in the site and its management has continued. Members conduct regular activities that are planned in consultation with the City of Stirling, including nature walks, weeding and rehabilitation. Information about upcoming activities can be found on the Friends of Star Swamp Bushland website: http://www.friendsofstarswamp.org/.

The input from members of the Friends of Star Swamp Bushland during various stages of this management plan is gratefully acknowledged. It is recommended that the Friends of Star Swamp Bushland continue to be involved with management of the Reserve and be consulted when major decisions are planned.

6.3 Henderson Environmental Centre

The Henderson Environmental Centre is located at the Groat Street entrance to the Reserve (Figure 2, 52), and was initiated by a donation from Mrs Emily Joyce Brushfield in 1996, who requested that it be named after her family name of Henderson (City of Stirling, 2010a). One of the main objectives of the centre was for it to be a place for the environmental education of primary school children. It was officially opened for use on 3rd April 2001, and has been used for functions and by community groups and organisations since that time.

The Centre is designed with sustainability in mind that integrates into the surrounding bushland environment. The building contains:

1. large meeting room/auditorium
2. presentation/lobby
3. toilet facilities
4. multiple store rooms
5. small laboratory equipped with basic equipment
6. library room with resources supplied by the regular users of the facility
7. small office and reception area
8. large kitchen area
9. large outdoor gazebo area surrounded by a landscaped native garden.

At present, the centre is utilised on a limited basis by community groups including:

- Friends of Star Swamp Bushland
- Northern Suburbs branch of the Wildflower Society of WA (Inc)
- Art groups
- Animal Ark
- Northern Suburbs branch of the Western Australian Naturalist Club.

Entry to the Centre

Inside the centre

Figure 52: Henderson Environmental Centre

In preparation of this Management Plan and throughout public consultation, it was noted that the centre was not utilised to the extent that it should be and its role in eco-education was not being fully realised. The City of Stirling (personal communication, 2012) considers that the Henderson Environmental Centre is underutilised and requested suggestions of how utilisation can improve,

with a particular emphasis on involvement that supports and promotes conservation and passive recreation within Star Swamp Bushland Reserve.

Natural Area Consulting investigated similar facilities including Piney Lakes Environment Centre (PLEC; City of Melville), Cockburn Wetlands Centre (CWC; City of Cockburn), and Canning River Eco Education Centre (CREEC; City of Canning) focusing on utilisation of the centres in the area of education, as a hire facility, and as possible office space. Although there is a case for the City of Stirling to investigate the options of having a commercial tenant at the site to lease some of the space this has not been discussed in detail; it is thought that this idea would be met with resistance from the current users of the centre as well as not being consistent with the City's charter for the facility. Funding and staffing arrangements for the centres include a mix of grant money, volunteer contributions, or full funding from council; it is believed that those that are staffed by council officers experience higher visitation rates in most cases.

There was consensus that having an enthusiastic professional person that was passionate about the environment and education was imperative to the success of each centre. An individual with exceptional organisational skills, enthusiasm, passion for education and the environment, as well as liaison and marketing skills was required in order for an Environment Centre to succeed. The other imperative was ongoing funding of staff as a basis to run successful programmes; grant money is hard to secure on an annual basis to pay for salaries and the application process is time consuming.

6.3.1 Eco Education

Eco-education was the main driver of usage for the environment centres examined. Both the CREEC and the PLEC have a full time Education Officer, closely liaising with schools to promote the centres as an education resource. The programs had been developed to fit in with the National Curriculum and as result are well supported by attendance from schools. The centres both report 3 -15 excursion groups per week. Critical to the success of these programs is the education officer's ability to engage the schools initially and then continue to sustain interest in the longer term by evolving and changing the subject matter on a regular basis. The CWC is funded by the City of Cockburn and the full time wetland officer dedicates two days per week to presenting workshops and education sessions to students and other interested parties; the officer reported that attendance rates varies with the wet season being busier than others.

Marketing of the environment centres is multi-faceted with one critical aspect being regularly updated informative websites either as a stand-alone entity or as part of the wider Local Government website for their area.

The subject matter and type of presentations for an environment centre should be based on the resources available and these will be unique to each centre and its location. An officer with an education/science background would be best equipped to develop the centre and its presentations. The key to providing a successful display is a mix of traditional interactive materials that can be picked up, touched and observed as well as multi-media digital options. The natural environment and heritage trails at Star Swamp are an ideal basis for engaging young students in the ecological, social and heritage values of the area.

Those centres that had an aspect of Aboriginal history and culture, and indigenous presenters had strong interest from school groups. It is recommended that this is considered when establishing environmental programmes.

6.3.2 Hire facility

Hiring of rooms for meetings and other events is the other main utilisation of the environmental centres which were investigated. Some centres made 5-15 bookings per week. Star Swamp is currently being used in this manner; however promotion of the facility will increase usage and revenue to aid in cost recovery for the running and upkeep on the building. PLEC, CREEC, and CWC had regular users of the rooms and reported that regular users were easier to manage and provided regular hire fees.

6.3.3 Users

At present there are 4 – 5 main users of the Henderson Environmental Centre. Consideration should be given to expanding the users to other compatible groups; seniors groups, mothers groups, scouts and guides, art classes, fitness and recreation groups are just a few that would be compatible with the current set up without much modification.

A lease to a community environment group that has a need for permanent office space but that would be sympathetic to visitation and community use of the centre should also be considered. Rent would need to be at a rate lower than normal commercial rent with the benefit that a tenant would offer site security and rent can be used to defray the running costs of the centre. Natural Resource Management (NRM) groups operate out of various locations and could be a possible tenant at the Henderson Environmental Centre. More research on the funding and the role of NRM's in the community would be required to see if this would be a compatible tenant. Target organisations should be approached to determine if there would be any local interest.

At PLEC, the City of Melville's environment team of 4 people work from an office inside the main building. This arrangement works well for the staff and valuable office space for other employees of larger departments is made available at the main Civic Centre. The Henderson Environmental Centre has suitable parking and office facilities for a small team to work from on a permanent basis and this arrangement could be beneficial for all. An analysis of such an arrangement would need to be undertaken to gain a greater understanding of the benefits and downsides to such an arrangement.

In the past the DEC has had a connection with the HEC and re-establishing this relationship would be beneficial in raising the profile of the centre and aid in the modernisation of resources and materials.

6.4 Community Involvement – Summary of Recommendations

Friends of Star Swamp Bushland

It is recommended that the Friends of Star Swamp Bushland continue to be involved with management of the Reserve and be consulted when major decisions are planned.

Henderson Environmental Centre

It is recommended that the City of Stirling investigate further complementary uses of the Henderson Environmental Centre, such as:

- having City of Stirling environmental/conservation officers or volunteers based within the Centre for nominated times or days so the centre is manned on a full-time basis
- developing eco-education programs, providing interactive displays and promoting these programs and displays
- making the centre available to primary school, high school and tertiary educational institutions for environmental education opportunities
- making the centre available to research students when carrying out projects that involve some aspect of the Star Swamp Bushland Reserve, such as research into the decline of tree health, assessment of changes in vegetation as a result of fire, or other topic decided in consultation with the City of Stirling
- opening the Centre to the public at nominated days and times where volunteers or other personnel are on hand to provide information about the Reserve and its history
- making the centre available to compatible community groups on a regular basis,
- leasing the premises to a commercial tenant
- approaching DEC to be involved with the programs on offer at the centre
- developing and offering environmental training courses to the public
- informing providers of environmental training courses and local environmental community groups about the availability of the venue for use.

7.0 Implementation

In order to assist with ongoing management, a number of recommendations have been made throughout the management plan for consideration and implementation by the City of Stirling. The recommendations have been summarised in Table 7, with suggested implementation priorities, relevant standards and guidelines, and measurement criteria.

Management Category	Objectives	Standard (if applicable)	Management Action	Priority	Measurement Criteria
Water Quality Monitoring (Section 3.4)	▪ Relate water quality data to environmental conditions at the time of sampling	▪ ANZECC Fresh and Marine Water Quality Guidelines (2000)	▪ Record environmental conditions such as rainfall, temperature and wind at the time of sampling	▪ High, ongoing	▪ Preparation of field recording sheets ▪ Recording of data in City database
Stormwater management (Section 3.4.1)	▪ Minimise pollution and sediment from stormwater in Star Swamp and the broader Bushland Reserve	▪ ANZECC Fresh and Marine Water Quality Guidelines (2000)	▪ The use of sediment traps continues and regular maintenance occurs	▪ Short – medium term	▪ Maintenance records are kept
			▪ Maintaining sumps to ensure adequate stormwater detention time	▪ Ongoing	▪ Water quality within sumps and Star Swamp ▪ Maintenance records
			▪ Culverts and stormwater inflow areas are designed and maintained to ensure that erosion is kept to a minimum	▪ As required	▪ Documented design process ▪ Maintenance records ▪ Water quality records
Flora and vegetation	▪ Update information about current flora species present	▪ EPA Guideline Statement 51 – Terrestrial Flora and Vegetation Surveys	▪ Undertake a comprehensive flora and vegetation survey at Star Swamp Bushland Reserve	▪ High priority	▪ Recording of species present ▪ Incorporation of data into City records and documents
Tree health decline (Section 3.5.5)	▪ Minimise the decline of trees and other vegetation with Star Swamp Bushland	▪ Bush Forever and Conservation values	▪ Undertake regular health monitoring of vegetation during regular management and maintenance activities within the Reserve	▪ Ongoing	▪ Vegetation condition assessment comparisons ▪ Variation over time
			▪ Increase the frequency of Dieback evaluation within in the reserve (e.g.: every three years)	▪ High priority	▪ Consultant reports ▪ Comparison with previous outcomes
Weed mapping (Section 3.6)	▪ Enhance weed management activities	▪ DEC Weed Mapping Standard Operating Procedure (DEC, 2011) ▪ Agricultural and Related Resources Protection Act 1976 (WA) ▪ Weeds of National Significance ▪ DEC Weed Prioritisation Process 2010	▪ Include details of weed density ratings when carrying out weed mapping activities	▪ High priority, ongoing	▪ Recording of weed density ratings with other weed mapping activities ▪ Evaluation of weed control activities over time
Weed Management	▪ Control weeds causing damage to bushland	▪ Local Biodiversity Strategy (City of Stirling, 2010b) ▪ Green Plan 2 (City of Stirling, 2002).	▪ Control weed species in accordance with current City of Stirling priorities for the site. Treatment will be assessed and monitored in line with the Local Biodiversity Strategy (City of Stirling, 2010b) and Green Plan 2 (City of Stirling, 2002).	▪ High Priority	▪ Flora survey's ▪ Vegetation condition mapping
Bridal creeper rust and leaf hoppers (Section 3.6)	▪ Utilise available biological controls for Bridal Creeper	▪ Department of Agriculture and Food	▪ Reintroduce the rust and leaf hoppers to areas infested with Bridal Creeper, particularly after fires	▪ As required	▪ Need for alternative weed control methodology over time
Olive tree (Section 3.6)	▪ Other than the historic Olive tree, ensure new trees do not become established within the Reserve	▪ City weed management principles	▪ Remove any young or juvenile olive trees when noted within the Reserve	▪ As required	▪ Number removed

Management Category	Objectives	Standard (if applicable)	Management Action	Priority	Measurement Criteria
Resident liaison (Section 3.6, 3.9.1	▪ Recognise that influences outside the Reserve boundaries can have an impact ▪ Maintain the 'good neighbour' policy	▪ Catchment management principles and practices	▪ Undertake liaison and communication on management issues and practices as required	▪ Ongoing	▪ Record of communications and outcomes
Quenda (Section 3.7.1)	▪ Determine if Quenda are present within the Star Swamp Reserve ▪ If not, consider potential of translocating populations back into the Reserve	▪ EPA Guidance Statement 56 – Terrestrial Fauna Surveys	▪ Undertake a detailed survey, either as part of a comprehensive fauna survey or as a targeted species survey	▪ High priority	▪ Survey report ▪ Outcomes used to update fauna knowledge base ▪ Outcomes used to make decision about translocation potential
Fauna survey (Section 3.7.6)	▪ Update knowledge of fauna species, including Quenda, present within the Reserve	▪ EPA Guidance Statement 56 – Terrestrial Fauna Surveys	▪ Undertake a detailed vertebrate fauna survey within the Reserve to complement other surveys being carried out	▪ High priority	▪ Survey report ▪ Outcomes used to update fauna knowledge base
Introduced fauna (Section 3.8)	▪ Limit the presence of introduced fauna within the Reserve wherever possible	▪ City of Stirling practices and procedures ▪ DEC and/or Department of Agriculture and Food advice and guidelines	▪ Control populations of the feral Honey Bee, European Rabbit and European Fox ▪ If required, consider the control of the Eastern Long-billed Corella and the Rainbow Lorikeet	▪ Ongoing	▪ Records of control activities ▪ observations of conditions within the Reserve that can be linked to feral animal control, such as vegetation improvements with reduced rabbit populations
Domestic Animals (Section 3.8.5, 5.4.1)	▪ Limit impacts associated with the presence of domestic dogs and cats	▪ State and local cat and dog laws, policies and guidelines	▪ Adjust the designation of Star Swamp Bushland Reserve from being a designated dog exercise area to one where they are only permitted if kept on a leash ▪ Undertake an appropriate public awareness campaign to inform and educate local residents about the proposed changes and how they will be managed	▪ High priority	▪ Council decision to change designation ▪ Development of a communication and implementation plan ▪ Monitoring of the implementation process over time
			▪ Provide signage at entrances and other key locations informing residents the Reserve is a designated cat free zone	▪ Medium – high priority	▪ Design and installation of signs
Fire impacts (Section 3.9)	▪ Determine changes to flora and vegetation over time that can be attributed to fire	▪ EPA Guidance Statement 51 – Terrestrial Flora and Vegetation Surveys	▪ Undertake flora surveys at varying times after fire	▪ Ongoing	▪ Survey outcomes such as changes to vegetation species, type and condition within fire affected area over time
Heritage (Section 4)	▪ Ensure cultural and heritage values of the site are recognised, maintained and protected	▪ State heritage guidelines, policies and regulations	▪ Undertake Aboriginal heritage and ethnographic surveys prior to any major works within the Reserve	▪ As required	▪ Survey reports ▪ Consideration of any findings when planning major works
			▪ Extend the heritage trail that allows all points of interest to be accessed in a 'round trip'	▪ Low to medium priority	▪ Inclusion of extra points in trail
Access (Section 5.1)	▪ Ensure appropriate access to and within the Reserve	▪ Good practice	▪ Vehicles entering the Reserve reattach chains or close gates as appropriate	▪ Ongoing	▪ Number of incidences
			▪ Consider installation of gates to replace chain link vehicle barriers	▪ Low priority	▪ Replacement schedule
Tracks (Section 5.2)	▪ Tracks and access ways are sufficient and suitable for their purpose	▪ FESA guidelines and policies	▪ Close off and revegetate designated tracks	▪ Medium – high priority	▪ Closure and rehabilitation activities

Management Category	Objectives	Standard (if applicable)	Management Action	Priority	Measurement Criteria
		▪ Engineering guidelines and requirements	▪ Monitor and manage development of new tracks	▪ Ongoing	▪ Number of new tracks ▪ Rehabilitation requirements
			▪ Implement a track naming system and install suitable signage	▪ High priority	▪ Agreed naming system implemented
Signage (Section 5.3, 5.4.1, 5.4.6)	▪ Signage is appropriate and informative	▪ City signage guidelines and policies	▪ Develop a signage style for Star Swamp that is consistent with the City signage style guide	▪ High priority	▪ Agreed style and implementation
			▪ Include positive, informative messages on signs to highlight the reasons why nominated activities are inappropriate	▪ Medium – high priority, ongoing	▪ Changes in signage over time ▪ Community response and changes in behaviour
			▪ Review directional signage and install and/or maintain as appropriate	▪ High priority, ongoing	▪ Records of number and locations of signs installed
			▪ Signage is installed at the fork in the track near heritage trail point 2	▪ High priority	▪ Installation of sign
			▪ Signage showing layout of the Reserve and its features is installed at key entrances and internal track junctions	▪ High priority	▪ Installation of signs
Rubbish (Section 5.4.2)	▪ Minimise impacts associated with the presence of rubbish	▪ Good practice	▪ Rubbish found during normal maintenance activities is removed and disposed of more appropriately	▪ Ongoing	▪ Work records
Graffiti vandalism (Section 5.4.3)	▪ Aesthetic values of the Reserve are maintained	▪ City policies and procedures	▪ Removal of graffiti from infrastructure as soon as is practicable to do so	▪ Ongoing	▪ Number of new graffiti ‘tags’ ▪ Maintenance records
			▪ Procedures for the removal of graffiti from vegetation are developed and implemented	▪ High priority	
Cubbies (Section 5.4.4)	▪ Degradation associated with cubby construction is repaired as soon as is practicable to do so	▪ City policies and procedures	▪ Cubbies found within the Reserve are dismantled and materials removed ▪ Any clearing or other damage is repaired or restored to its previous condition as appropriate	▪ Ongoing	▪ Number of new cubbies ▪ Maintenance records
Cannabis growing (Section 5.4.7)	▪ Clearing and other impacts are revegetated or managed in an appropriate manner	▪ City policies and procedures	▪ Any cannabis plants are removed ▪ If appropriate, relevant authorities are informed ▪ Any damage associated with the cultivation of the plants are revegetated or allowed to regenerate where appropriate	▪ Ongoing	▪ Number, frequency and locations where cannabis plants are found
Henderson Environmental Centre	▪ Utilise the Henderson Environmental Centre to capacity	▪ Henderson Environmental Centre Business Plan	▪ Consider basing City conservation officers at the centre for nominated times or days	▪ Medium priority	▪ Number and type organisations approached ▪ Changes in utilisation patterns
			▪ Explore and inform schools, tertiary educational institutions and research students about the Centre and its potential complementary uses	▪ High priority	
			▪ Consider employing a Centre Manager or similar (e.g.: someone with an environmental background) with a view to enhancing	▪ Medium priority	

Management Category	Objectives	Standard (if applicable)	Management Action	Priority	Measurement Criteria
			community and public access		
			▪ Inform training providers, particularly environmental trainers, about the availability and features of the Centre	▪ Medium priority	

8.0 Conclusion

The conservation and ecological values of Star Swamp Bushland Reserve are still considered to be significant, with site assessment activities carried out during the management plan review process reconfirming the management aims of flora and fauna conservation balanced with passive recreation and education. It is recognised that ongoing management of the natural and human aspects of the Reserve need to be managed in the longer term to ensure that negative impacts from various threatening processes are kept to a minimum.

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Appendix 1: Flora Species List

* Weed species
\# Introduced native species
(S) Significant flora species
Syn. Synonymous with

Family	Genus and Species	Previous Name	Common Name
	Class CYCADOPSIDA (Cycads)		
ZAMIACEAE	*Macrozamia fraseri*		
	Class PINOPSIDA (Conifers)		
CUPRESSACEAE	*#Callitris preissii*		Rottnest Island Pine
	Class LILIOPSIDA (Monocotyledons)		
AGAVACEAE	**Agave americanum*		Century plant
	**Yucca elata*		Yucca
ALLIACEAE	**Allium triquetrum*		Three-cornered garlic
AMARYLLIDACEAE	**Narcissus* sp.		Daffodil/Jonquil
ASPARAGACEAE	*Acanthocarpus preissii*		
	**Asparagus asparagoides*		Bridal creeper
	Dichopogon capillipes		Chocolate Lily
	Lomandra hermaphrodita		
	Lomandra maritima		
	Lomandra micrantha subsp.		

Family	Genus and Species	Previous Name	Common Name
	micrantha		
	Lomandra preissii		
	Sowerbaea laxiflora		Purple Tassels
ASPARAGACEAE (cont.)	*Thysanotus arenarius*		Fringe Lily
	Thysanotus manglesianus		Fringe Lily
	Thysanotus sparteus		Fringe Lily
	Thysanotus triandrus		Fringe Lily
ASPHODELACEAE	**Asphodelus fistulosus*		Onion weed
	**Trachyandra divaricata*		Trachyandra
CENTROLEPIDACEAE	*Centrolepis aristata*		Pointed Centrolepis
	Centrolepis drummondiana		
COLCHICACEAE	*Burchardia congesta*	syn. *Burchardia umbellata*	Milkmaids
	Wurmbea pygmaea		
CYPERACEAE	*Baumea juncea*		Bare Twig Rush
	Bolboschoenus caldwellii		Marsh Club-rush
	Carex preissii		
	Ficinia nodosa	syn. *Isolepis nodosa, Scirpus nodosa*	Knotted Club Rush
	Gahnia trifida		
	Lepidosperma gladiatum		Sword Sedge
	Lepidosperma gracile		
	Lepidosperma scabrum		
	Lepidosperma tenue		
	Mesomelaena pseudostygia	syn. *Mesomelaena stygia*	Semaphore Sedge
	Schoenoplectus validus		Lake Club Rush

Family	Genus and Species	Previous Name	Common Name
	Schoenus grandiflorus		Large Flowered Bogrush
	Schoenus trachycarpus		Rough Fruited Bogrush
	Schoenus lanatus		Woolly Bogrush
	Tetraria octandra		
DASYPOGONACEAE	*Dasypogon bromeliifolius*		Pineapple Bush
HAEMODORACEAE	*Anigozanthos humilis*		Catspaw
	Anigozanthos manglesii x humilis		Mangles Kangaroo Paw
	Conostylis aculeata		
	Conostylis candicans subsp. *calcicola*		Grey Cottonheads
	Haemodorum paniculatum		Blood Root
	Haemodorum spicatum		Blood Root
HEMEROCALLIDACEAE	*Caesia micrantha*		Pale Grass Lily
	Corynotheca micrantha		Sand Lily
	Dianella revoluta var. *divaricata*		
	Stypandra glauca		Blind Grass
	Tricoryne elatior		Yellow Autumn Lily
HYACINTHACEAE	**Lachenalia reflexa*		Yellow soldiers
IRIDACEAE	**Babiana angustifolia*		Baboon flower
	**Chasmanthe floribunda*		African cornflag
	**Ferraria crispa*		Black flag
	**Freesia leichtlinii x alba*		Freesias
	**Gladiolus angustus*		Long-tubed Painted Lady
	**Gladiolus caryophyllaceus*		Pink gladiolus

Family	Genus and Species	Previous Name	Common Name
	**Moraea flaccida*	*syn. Homeria flaccida*	Cape tulip, One-leaved cape tulip
	Orthrosanthus laxus var. *laxus*		Morning Iris
	Patersonia occidentalis		Purple Flag
	**Romulea rosea* var. *australis*		Guildford grass
	**Sparaxis bulbifera*		Harlequin flower
JUNCACEAE	*Juncus kraussii* subsp. *australiensis*		Sea Rush
JUNCAGINACEAE	*Cycnogeton lineare*	syn. *Triglochin linearis, T. procera*	
	Triglochin striata		
ORCHIDACEAE	*Caladenia arenicola*		Carousel Spider Orchid
	Caladenia flava		Cowslip Orchid
	Caladenia latifolia		Pink Fairy Orchid
	Caladenia longicauda subsp. *calcigena*		White Spider Orchid
	Diuris longifolia		Common Donkey Orchid
	Leptoceras menziesii		Rabbit Orchid
	Microtis media		Mignonette Orchid
	Pheladenia deformis	syn. *Caladenia deformis*, *Cyanicula deformis*	Blue Fairy Orchid
	Prasophyllum giganteum subsp. *giganteum*		Bronze Leek Orchid
	Pterostylis brevisepala		Short-eared Snail Orchid
	Pterostylis recurva		Jug Orchid
	Pterostylis vittata		Banded Greenhood
	Pyrorchis nigricans	syn. *Lyperanthus nigricans*	Red Beak Orchid

Family	Genus and Species	Previous Name	Common Name
	Thelymitra crinita		Blue Lady Orchid
POACEAE	**Aira caryophyllea*		Silvery hair grass
	Austrostipa compressa		
	Austrostipa flavescens		
	Austrostipa variabilis		Spear Grass
	**Avena barbata*		Wild oats
	**Briza maxima*		Blowfly grass
	**Briza minor*		Shivery grass
	**Bromus diandrus*		Great brome
POACEAE (cont.)	**Cortaderia selloana*		Pampas grass
	**Cynodon dactylon*		Couch
	**Ehrharta calycina*		Perennial veldt
	**Ehrharta longiflora*		Annual veldt
	**Eragrostis curvula*		African lovegrass
	**Gastridium phleoides*		Nit grass
	**Hordeum leporinum*		Barley grass
	**Lagurus ovatus*		Hare's Tail grass
	**Pennisetum clandestinum*		Kikuyu
	**Pennisetum setaceum*		Fountain grass
	Sporobolus virginicus		Marine Couch
	**Stenotaphrum secundatum*		Buffalo grass
RESTIONACEAE	*Desmocladus flexuosus*		
TECOPHILAEACEAE	**Cyanella hyacinthoides*		Lady's Hand
TYPHACEAE	**Typha orientalis*		Typha

Family	Genus and Species	Previous Name	Common Name
XANTHORRHOEACEAE	*Xanthorrhoea preissii*		Grass Tree
	Class MAGNOLIOPSIDA (Dicotyledons)		
AIZOACEAE	**Carpobrotus aequilaterus*		Chilean pigface
	**Carpobrotus edulis*		Pigface
	**Galenia pubescens*		
AMARANTHACEAE	*Ptilotus polystachyus* var. *polystachyus*		Prince of Wales Feather
	Ptilotus drummondii var. *drummondii*		Narrow-leaf Mulla Mulla
	Ptilotus manglesii		Pom Poms
AMARANTHACEAE (cont.)	*Ptilotus sericostachyus* subsp. *sericostachyus*		
ANACARDIACEAE	**Schinus terebinthifolia*		Japanese pepper tree
APIACEAE	*Centella asiatica*		
	Daucus glochidiatus		
	Eryngium pinnatifidum		
	**Foeniculum vulgare*		Fennel
	Homalosciadium homalocarpum		
	Trachymene pilosa		Native Parsnip
	Xanthosia huegelii		
APOCYNACEAE	**Hydrocotyle bonariensis*		
ASTERACEAE	*Actites megalocarpus*		Dune Thistle

Family	Genus and Species	Previous Name	Common Name
	**Arctotheca calendula*		Capeweed
	**Aster subulatus*		Brush starwort
	**Conyza bonariensis*		Fleabane
	Craspedia sp.		
	Cotula coronopifolia		Waterbuttons
	**Dittrichia graveolens*		Stinkwort
	**Gazania linearis*		
	**Hedypnois rhagadioloides*		Cretan weed
	**Helichrysum luteoalbum*		Jersey Cudweed
	**Hypochaeris glabra*		Smooth Cat's Ear
	**Hypochaeris radicata*		Flatweed
	Lagenophora huegelii		
	Olearia axillaris		Coastal Daisy Bush
	**Onopordum acaulon*		Stemless thistle
ASTERACEAE (cont.)	*Ozothamnus cordatus*	syn. *Helichrysum cordatum*	Tangle Daisy
	Podolepis gracilis		Slender Podolepis
	Podolepis nutans		Nodding Podolepis
	Podotheca angustifolia		Sticky Long-heads
	Podotheca chrysantha		Yellow Podotheca
	Podotheca gnaphalioides		Golden Long-heads
	Sonchus hydrophilus		Native sowthistle
	**Sonchus oleraceus*		Common sowthistle
	**Tripteris clandestina*	syn. *Osteospermum clandestinum*	Stinking roger
	**Ursinia anthemoides*		
	Waitzia suaveolens		Fragrant Waitzia
BRASSICACEAE	**Heliophila pusilla*		
	**Lobularia maritima*		Sweet alyssum

Family	Genus and Species	Previous Name	Common Name
	**Raphanus raphanistrum*		Wild turnip, wild radish
	**Rorippa nasturtium-aquaticum*		Watercress
	**Sinapis arvensis*		
CAMPANULACEAE	*Lobelia anceps*	syn. *Lobelia alata*	
	Lobelia gibbosa		
	Lobelia tenuior		
	**Wahlenbergia capensis*		Cape Bluebell
	Wahlenbergia preissii		Austral Bluebell
CARYOPHYLLACEAE	**Cerastium glomeratum*		Mouse-eared chickweed
	**Petrorhagia dubia*	syn. *Petrorhagia velutina*	Velvet pink
	**Silene gallica*		French catchfly
	**Spergula arvensis*		Corn spurrey
	**Stellaria media*		Common chickweed
CASUARINACEAE	*Allocasuarina fraseriana*		Sheoak
	Allocasuarina humilis		Dwarf Sheoak
CELASTRACEAE	*Stackhousia monogyna*		
CHENOPODIACEAE	*Rhagodia baccata subsp baccata*		Berry Saltbush
CONVOLVULACEAE	**Ipomoea indica*		Morning glory
CRASSULACEAE	*Crassula colorata*		Dense Stonecrop
	**Crassula glomerata*		

Family	Genus and Species	Previous Name	Common Name
DILLENIACEAE	*Hibbertia hypericoides*		
	Hibbertia racemosa		
	Hibbertia subvaginata		
DROSERACEAE	*Drosera erythrorhiza* subsp *erythrorhiza*		Red Ink Sundew
	Drosera macrantha subsp. *macrantha*		Bridal Rainbow
	Drosera menziesii subsp. *penicillaris*		
ERICACEAE	*Astroloma ciliatum*		
	Astroloma pallidum		Kick Bush
	Conostephium pendulum		Pearl Flower
	Conostephium preissii		
	Cryptandra nutans		
	Leucopogon parviflorus		
	Leucopogon propinquus		
EUPHORBIACEAE	*Adriana quadripartita*		Bitter Bush
	**Euphorbia peplus*		Petty spurge
	**Euphorbia terracina*		Geraldton carnation weed
	Monotaxis grandiflora var. *grandiflora*		
	Phyllanthus calycinus		False Boronia
	Ricinocarpos glaucus		Wedding Bush
	**Ricinus communis*		Castor oil plant
FABACEAE	*Acacia cochlearis*		Rigid Wattle

Family	Genus and Species	Previous Name	Common Name
	Acacia cyclops		Coastal Wattle
	Acacia huegelii		Huegel's Wattle
	Acacia pulchella var. *glaberrima*		Prickly Moses
	Acacia rostellifera		
	Acacia saligna		Orange Wattle
	Acacia stenoptera		Narrow Winged Wattle
	Acacia truncata		
	Acacia willdenowiana		Grass Wattle
	Bossiaea eriocarpa		
	Daviesia divaricata subsp. *divaricata*		
	Daviesia nudiflora subsp. *nudiflora*		
	Daviesia triflora		
	Gastrolobium capitatum	syn. *Nemcia capitata,* *syn. Oxylobium capitatum*	Bacon & Eggs
	Gastrolobium nervosum		
	Gompholobium tomentosum		Hairy Yellow Pea
	Hardenbergia comptoniana		Native Wisteria
	Hovea pungens		Devils Pins
	Hovea trisperma var. *trisperma*		Common Hovea
	Isotropis cuneifolia subsp. *cuneifolia*		Granny's Bonnets
	Jacksonia calcicola		
FABACEAE (cont.)	*Jacksonia furcellata*		Stinkwood
	Jacksonia sericea (P4)		
	Jacksonia sternbergiana		Grey Stinkwood
	Kennedia prostrata		Running Postman
	**Lupinus angustifolius*		Narrowleaf Lupin
	**Lupinus cosentinii*		Sandplain Lupin
	**Medicago sp.*		Medic clover

Family	Genus and Species	Previous Name	Common Name
	**Melilotus indicus*		Hexham scent
	Templetonia retusa		Cockies Tongue
	**Trifolium angustifolium*		Narrow-leaved clover
	**Trifolium fragiferum*		Strawberry clover
	**Vicia sativa*		Common vetch
FUMARIACEAE	**Fumaria capreolata*		Fumaria
GERANIACEAE	**Erodium botrys*		Long storksbill
	**Geranium molle*		Dove's-foot cranesbill
	**Pelargonium capitatum*		Rose pelargonium
GOODENIACEAE	*Dampiera linearis*		
	Lechenaultia linarioides		
	Scaevola anchusifolia		Silky Scaevola
	Scaevola canescens		Grey Scaevola
	#Scaevola crassifolia		
	Scaevola globulifera		
	Scaevola repens var. *angustifolia*		
	Scaevola thesioides subsp. *thesioides*		
GYROSTEMONACEAE	*Tersonia cyathiflora*		Button Creeper
HALORAGACEAE	*Glischrocaryon aureum* var. *aureum*		Popflower
LAMIACEAE	*Hemiandra pungens*		
LAURACEAE	*Cassytha sp*		Dodder Laurel

Family	Genus and Species	Previous Name	Common Name
LOGANIACEAE	*Logania vaginalis*		
LORANTHACEAE	*Nuytsia floribunda*		Australian Christmas Tree
MYRTACEAE	*#Agonis flexuosa*		Peppermint tree
	Baeckea sp. Limestone		
	Calothamnus quadrifidus		One-sided Bottlebrush
	#Chamelaucium uncinatum		
	Corymbia calophylla	syn. *Eucalyptus calophylla*	Marri
	Eucalyptus decipiens		
	Eucalyptus gomphocephala		Tuart
	Eucalyptus marginata subsp. *marginata*		Jarrah
	Eucalyptus todtiana		
	Kunzea glabrescens		Spearwood
	**Leptospermum laevigatum*		Victorian teatree
	Melaleuca huegelii subsp. *huegelii*		Chenille Honeymyrtle
	Melaleuca rhaphiophylla		Swamp paperbark
	Melaleuca systena	syn. *Melaleuca acerosa*	Coastal Honeymyrtle
OLEACEAE	**Olea europaea*		Olive
ONAGRACEAE	**Oenothera drummondii*		Beach evening primrose
OROBANCHACEAE	**Orobanche minor*	syn. *Orobanche australis*	Lesser Broomrape
OXALIDACEAE	**Oxalis corniculata*		Yellow Wood Sorrel

Family	Genus and Species	Previous Name	Common Name
	**Oxalis pes-caprae*		Soursob
	**Oxalis purpurea*		Purple Oxalis
PITTOSPORACEAE	*Billardiera fraseri*		Elegant Pronaya
PLANTAGINACEAE	**Plantago sp.*		
PLUMBAGINACEAE	**Limonium sinuatum*		Perennial Sea Lavender
POLYGALACEAE	*Comesperma calymega*		Blue-spike Milkwort
	Comesperma confertum		
	**Emex australis*		Doublegee
	**Rumex acetosella*		Dock
PORTULACACEAE	*Calandrinia corrigioloides*		Strap Purslane
	Calandrinia granulifera		Pygmy Purslane
	Calandrinia liniflora		Parakeelya
	Calandrinia volubilis		
PRIMULACEAE	**Lysimachia arvensis* var. *arvensis*	syn. *Anagallis arvensis var arvensis*	Scarlet Pimpernel
	**Lysimachia arvensis* var. *caerulea*	syn. *Anagallis arvensis var caerulea*	Blue Pimpernel
	Samolus repens		Creeping Brookweed
PROTEACEAE	*Banksia attenuata*		Slender Banksia
	Banksia dallanneyi var. *dallanneyi*	syn. *Dryandra lindleyana, D. nivea*	Couch Honeypot Dryandra
	Banksia grandis		Bull Banksia
	Banksia menziesii		Menzies Banksia
PROTEACEAE (cont.)	*Banksia prionotes*		Acorn Banksia

Family	Genus and Species	Previous Name	Common Name
	Banksia sessilis var. *cygnorum*	syn. *Dryandra sessilis* var. *cygnorum*	Parrot Bush
	Grevillea crithmifolia		
	Grevillea preissii subsp *preissii*	syn. *Grevillea thelemanniana*	
	Grevillea vestita subsp*. vestita*		
	Hakea lissocarpha		Honey Bush
	Hakea prostrata		Harsh Hakea
	Hakea ruscifolia		Candle Hakea
	Persoonia saccata		Snottygobble
	Petrophile axillaris	syn. *Petrophile serruriae subsp. nova*	
	Petrophile brevifolia		
	Petrophile linearis		Pixie Mops
	Petrophile macrostachya		
	Stirlingia latifolia		Blue Boy
	Synaphea spinulosa subsp. *spinulosa*		
RANUNCULACEAE	*Clematis linearifolia*	syn. *Clematis microphylla*	Small-leafed Clematis
	Clematis pubescens		
	Ranunculus colonorum		Common Buttercup
RHAMNACEAE	*Cryptandra mutila*		
	Spyridium globulosum		Basket Bush
	Stenanthemum notiale subsp. *chamelum*		
	Trymalium ledifolium var. *ledifolium*		
RUBIACEAE	**Coprosma repens*		Mirror plant
	Opercularia vaginata		

Family	Genus and Species	Previous Name	Common Name
RUTACEAE	*Philotheca spicata*		Pepper and Salt
SANTALACEAE	*Exocarpos sparteus*		Broom Ballart
	Santalum acuminatum		Quandong
SCROPHULARIACEAE	**Dischisma arenarium*		
	Eremophila glabra		Tar Bush
	Myoporum caprarioides		Slender Myoporum
	Myoporum tetrandrum		
SOLANACEAE	**Solanum nigrum*		Black Berry Nightshade
	**Solanum linnaeanum*	syn. *Solanum sodomaeum*	Apple of Sodom
	Solanum symonii		
STYLIDACEAE	*Levenhookia stipitata*		Common Stylewort
	Stylidium brunonianum		Pink Fountain Triggerplant
	Stylidium calcaratum		Book Triggerplant
	Stylidium junceum subsp. *junceum*		Reed Triggerplant
	Stylidium repens		Mat Triggerplant
	Stylidium rigidulum		Flagon Triggerplant
	Stylidium schoenoides		Cow Kicks
THYMELAEACEAE	*Pimelea calcicola* (P3)		Limestone Banjine
	Pimelea rosea		Rose Banjine
	Pimelea sulphurea		Yellow Banjine
VERBENACEAE	**Lantana camara*		Lantana

Family	Genus and Species	Previous Name	Common Name
VIOLACEAE	*Hybanthus calycinus*		Native Violet
ZYGOPHYLLACEAE	**Tribulus terrestris*		Caltrop

Appendix 2: Conservation Codes

Western Australia

Conservation Code	Name	Description
T	Threatened	Flora or fauna that is rare or likely to become extinct (Schedule 1 of the *Wildlife Conservation Act* 1950) Taxa that have been adequately searched for and deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X	Presumed Extinct	Flora or fauna that is presumed to be extinct in the wild (Schedule 2 of the *Wildlife Conservation Act* 1950) Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.
IA	International Agreement	Birds protected under international agreement (Schedule 3 of the *Wildlife Conservation Act* 1950) Birds that are subject to an agreement between governments of Australia and other countries relating to the protection of migratory birds and birds in danger of extinction
S	Specially Protected	Other specially protected fauna (Schedule 4 of the *Wildlife Conservation Act* 1950) Fauna that is in need of special protection, otherwise than for the reasons listed in other schedules of the *Wildlife Conservation Act* 1950.
Schedule 1 species that are ranked by the DEC according to their level of threat using IUCN Red List criteria		
CR	Critically endangered	Species considered to be facing an extremely high risk of extinction within the wild
EN	Endangered	Species considered to be facing a very high risk of extinction within the wild
VU	Vulnerable	Species considered to be facing a high risk of

Conservation Code	Name	Description
		extinction in the wild
Taxa that have not been adequately surveyed for listing under Schedule 1 or 2 of the Wildlife Protection Act are added to the Priority Lists under priorities 1, 2 or 3, according to the priority for further survey and evaluation of their conservation status.		
1	Priority One	Poorly known taxa Taxa which are known from one or a few collections or sight records (generally <5), on all lands not managed for conservation, such as road verges, urban areas, farmland, active mineral lease and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2	Priority Two	Poorly known taxa Taxa which are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, such as national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves and similar. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes
3	Priority Three	Poorly known taxa Taxa that are known collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known

Conservation Code	Name	Description
		threatening processes exist that could affect them.
4	Priority Four	Rare or near threatened and other taxa in need of monitoring Rare: Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. Near threatened: Taxa that are considered to have been adequately surveyed and that to not qualify for Conservation Dependent, but that are close to qualifying for vulnerable. Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
5	Priority Five	Conservation Dependent Taxa Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

(Source: Department of Environment and Conservation, 2011)

Commonwealth Conservation Codes

Category	Description
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium term

(Source: Department of Sustainability, Environment, Water, Population and Communities, 2012)

Appendix 3: Definition of Priority Three Ecological Community

From:
Department of Environment and Conservation
December 2010
DEFINITIONS, CATEGORIES AND CRITERIA FOR THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES
http://www.dec.wa.gov.au/content/view/849/2017/
Accessed May 2012

Priority Three: Poorly known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:
(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;
(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.
Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Appendix 4: Bush Forever Vegetation Structural Classes

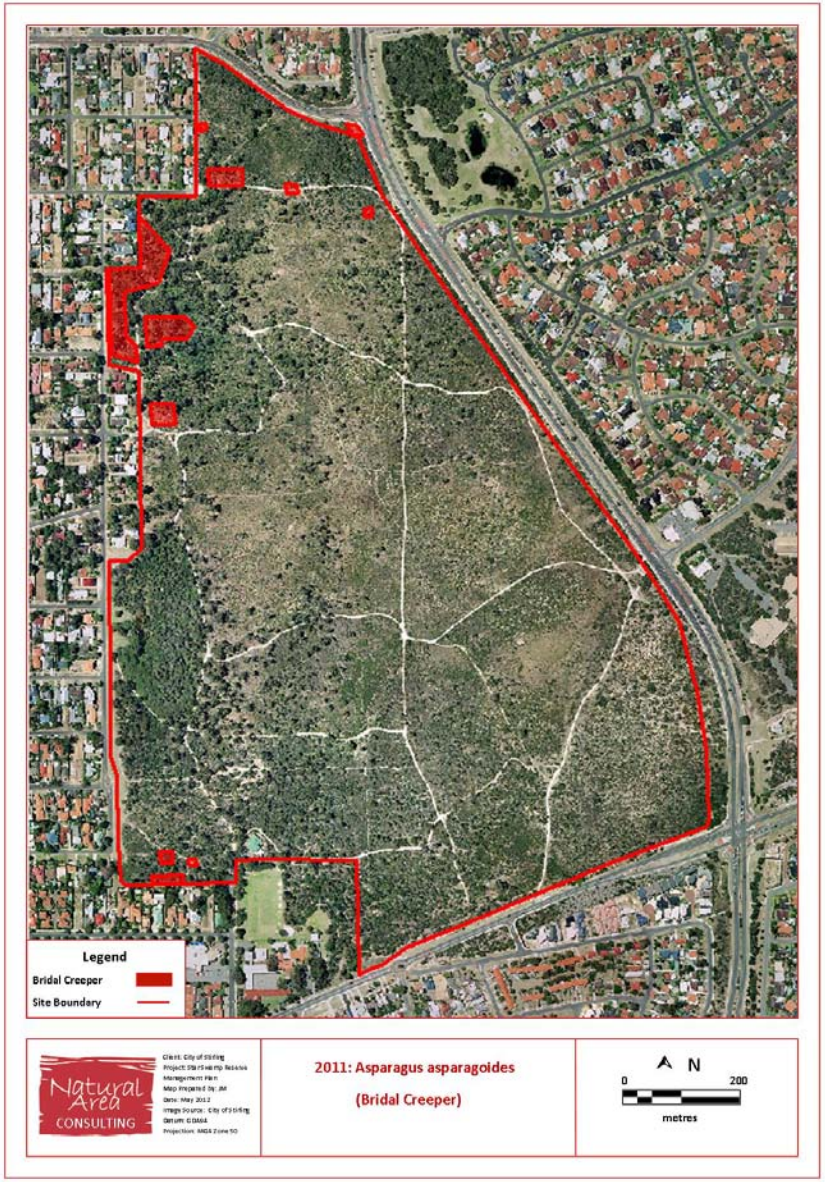
Vegetation Structural Classes				
Life Form/Height Class	**Canopy Percentage Cover**			
	100 – 70%	**70 – 30%**	**30 - 10%**	**10 – 2 %**
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland
Trees 10 – 30 m	Closed forest	Open forest	Woodland	Open woodland
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland
Tree Mallee	Closed tree mallee	Tree mallee	Open tree mallee	Very open tree mallee
Shrub Mallee	Closed shrub mallee	Shrub mallee	Open shrub mallee	Very open shrub mallee
Shrubs over 2 m	Closed tall scrub	Tall open scrub	Tall shrubland	Tall open shrubland
Shrubs 1 – 2 m	Closed heath	Open heath	Shrubland	Open shrubland
Shrubs under 1 m	Closed low heath	Open low heath	Low shrubland	Low open shrubland
Grasses	Closed grassland	Grassland	Open grassland	Very open grassland
Herbs	Closed herbland	Herbland	Open herbland	Very open herbland
Sedges	Closed sedgeland	Sedgeland	Open sedgeland	Very open sedgeland

(Source: Government of Western Australia, 2000)

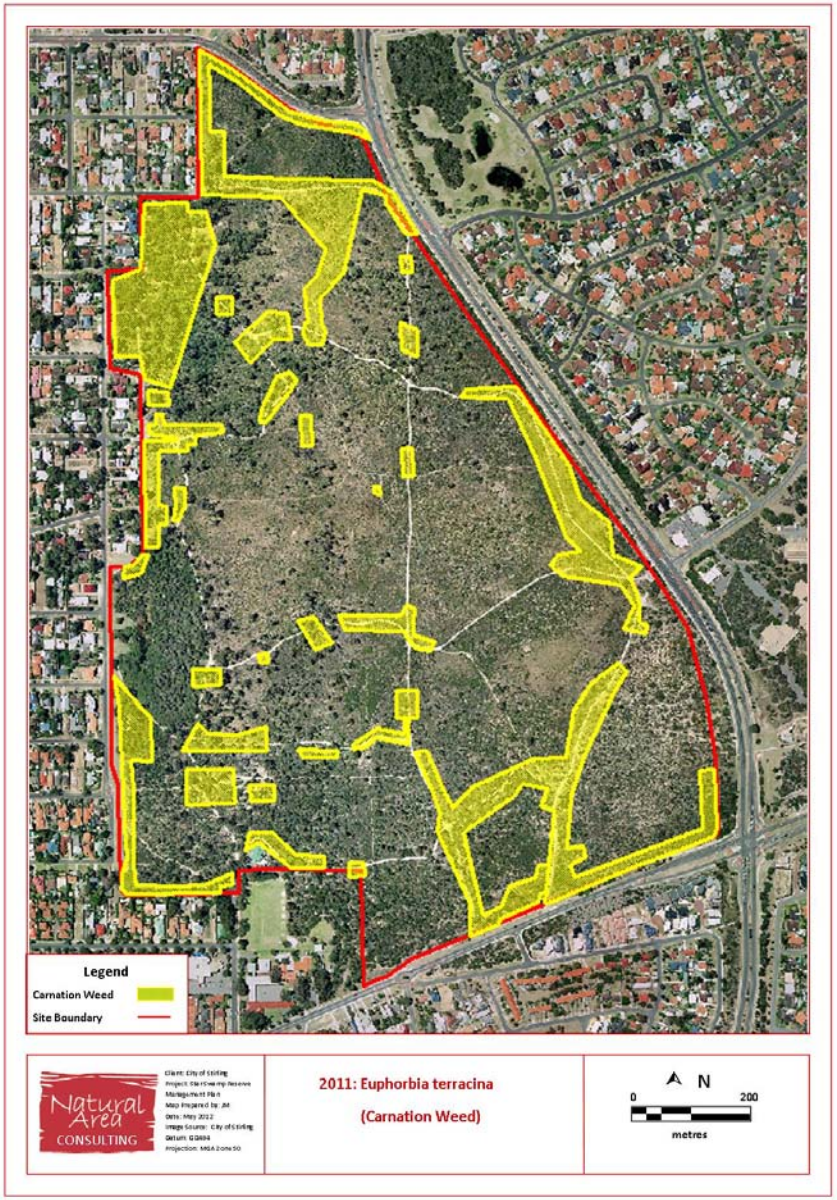
Appendix 5: Vegetation Condition Rating Scale

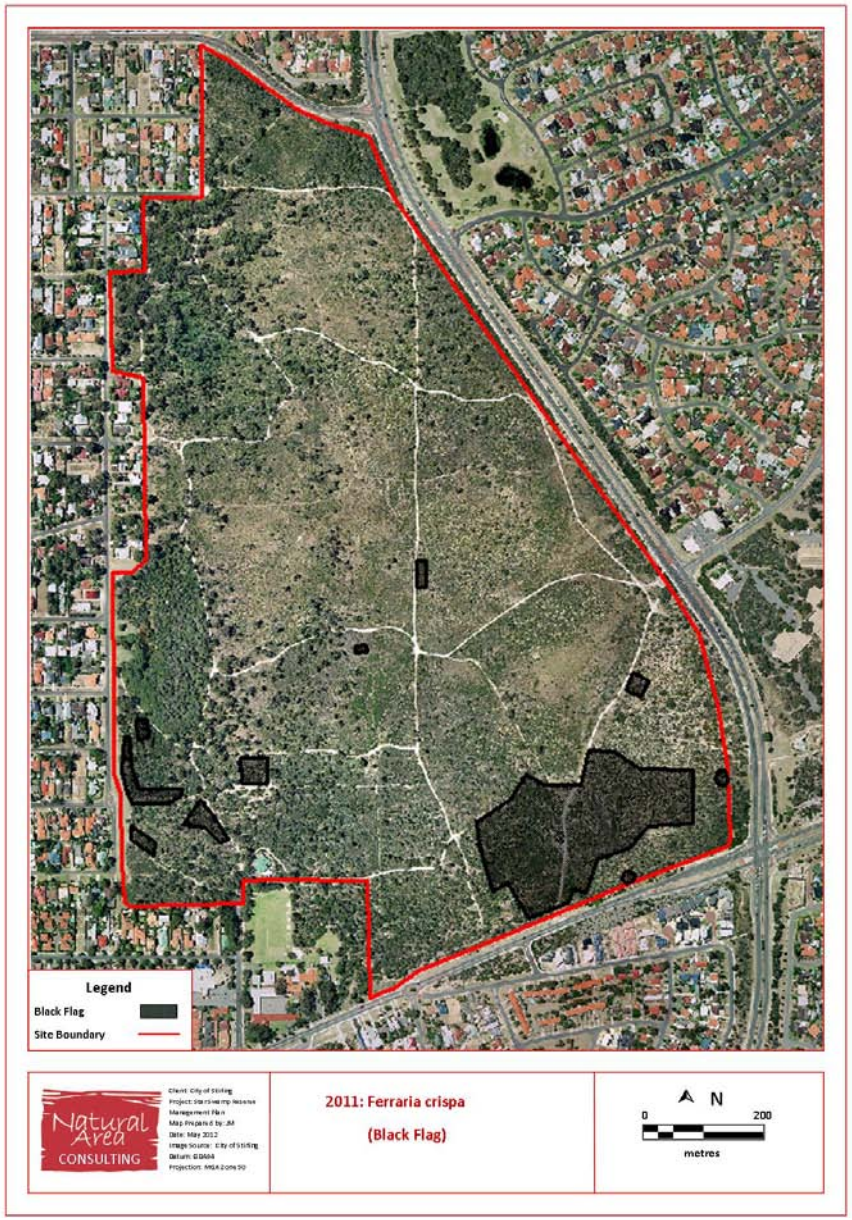
Category	Description
1 Pristine	Pristine or nearly so, no obvious signs of disturbance.
2 Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3 Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4 Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
5 Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
6 Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

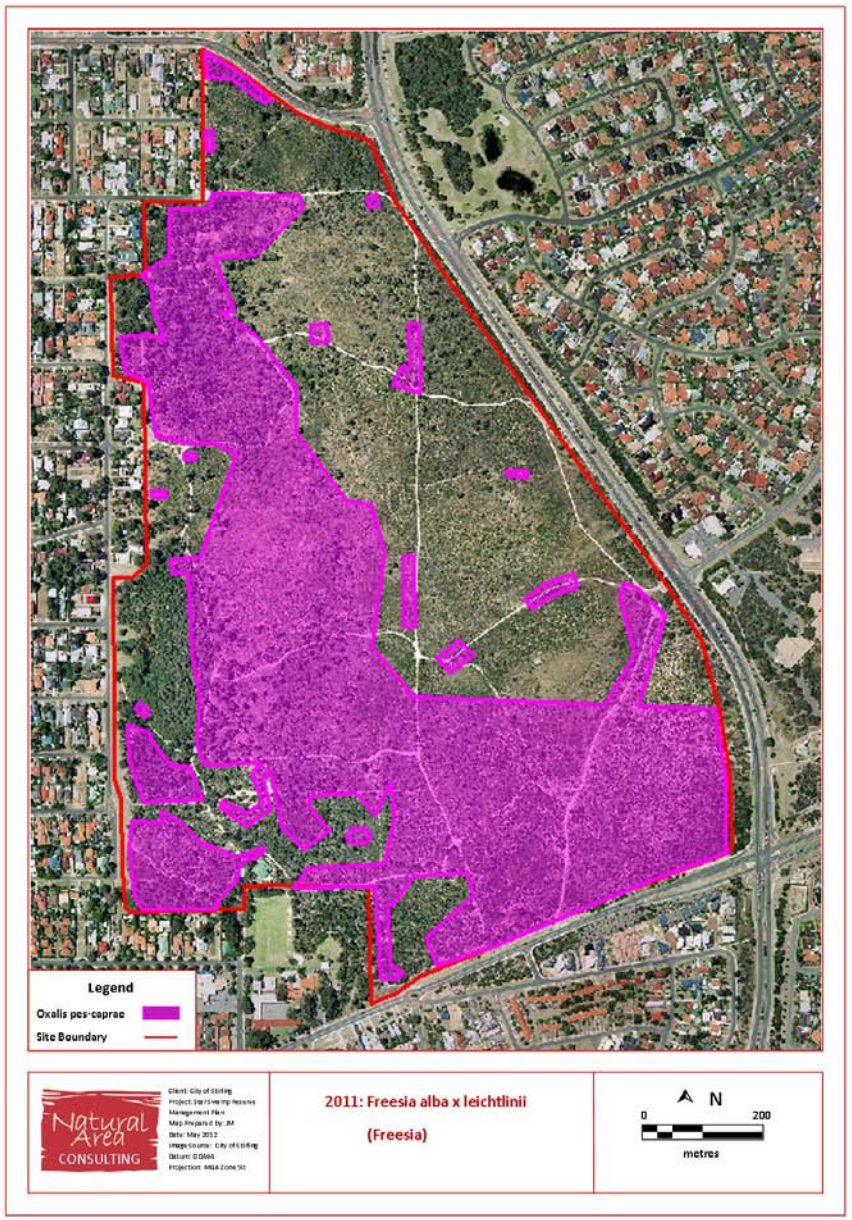
Appendix 6: Weed Maps for 2011

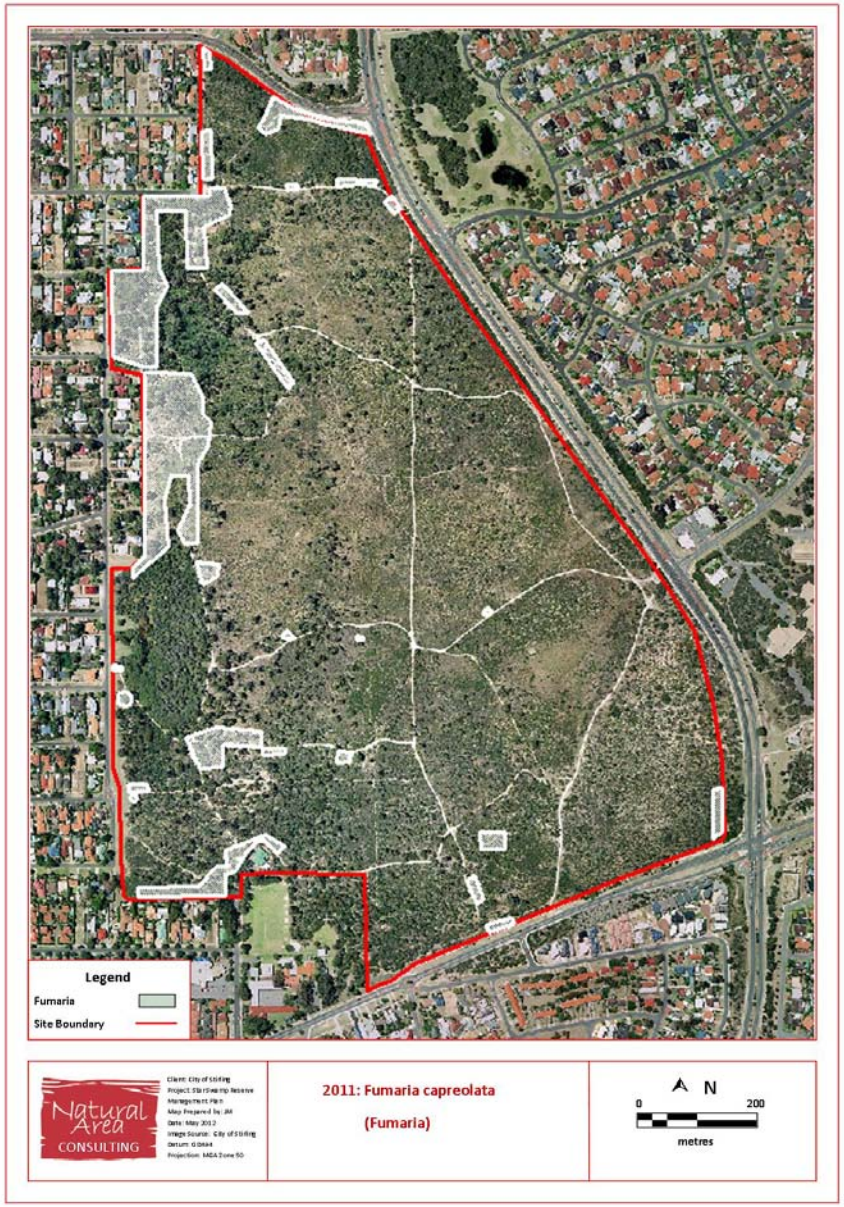


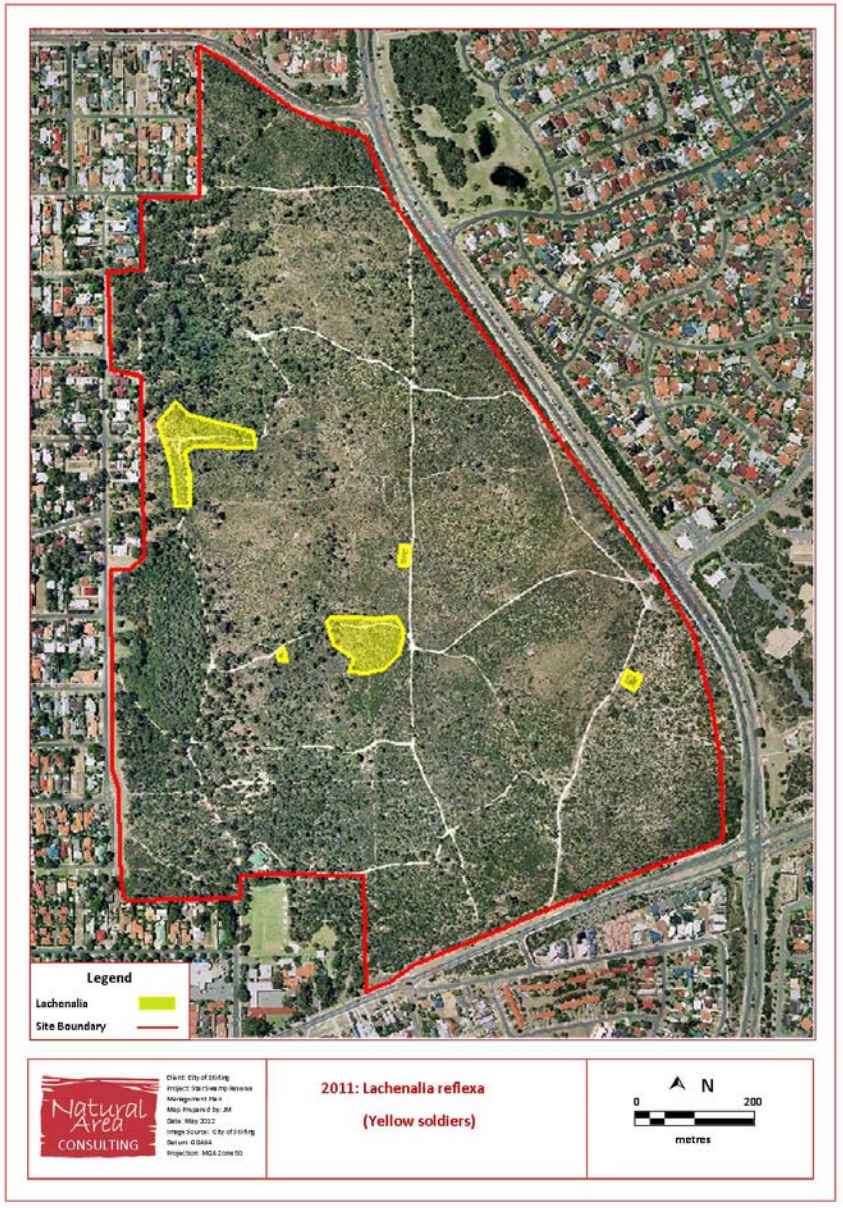

Legend
African Cornflag
Site Boundary
Natural Area CONSULTING
2011: Chasmanthe floribunda
(African Cornflag)
N
0
200
metres

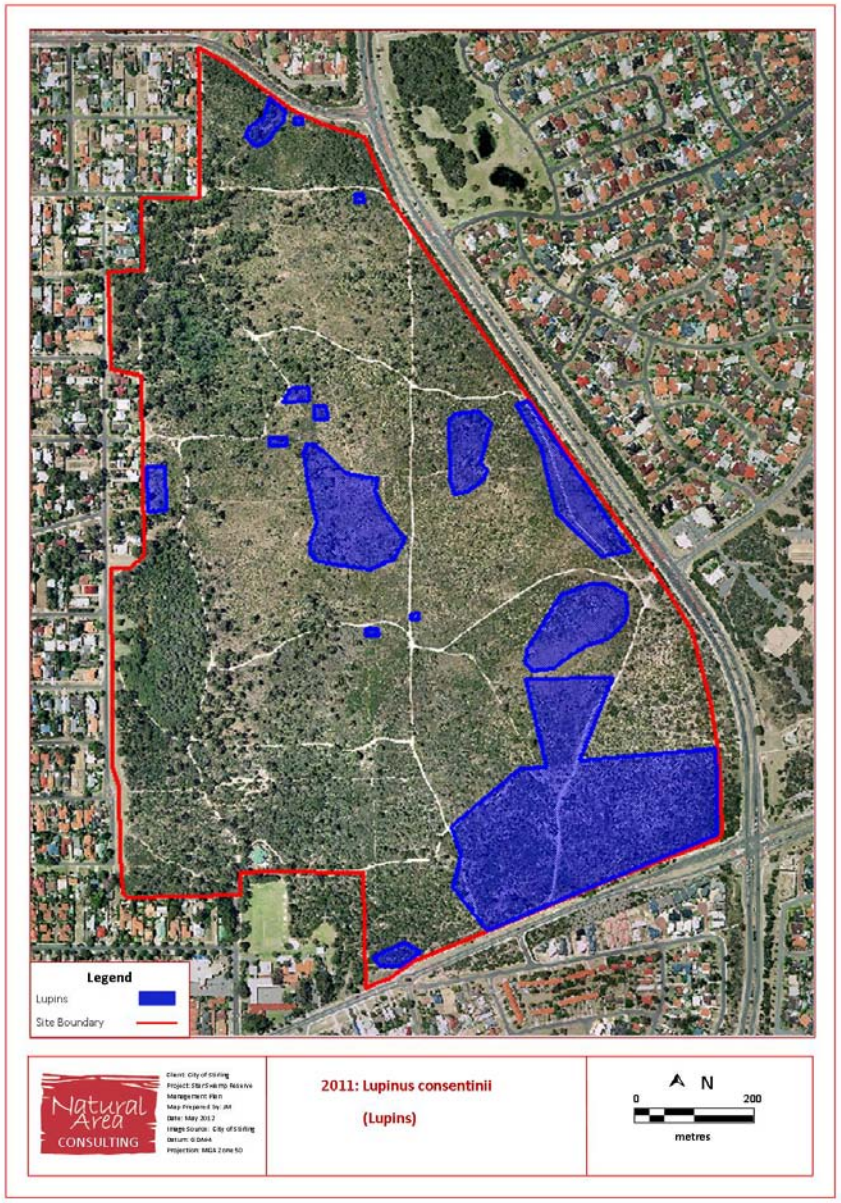

Legend
Carnation Weed
Site Boundary
Natural Area CONSULTING
2011: Euphorbia terracina
(Carnation Weed)
N
0
200
metres

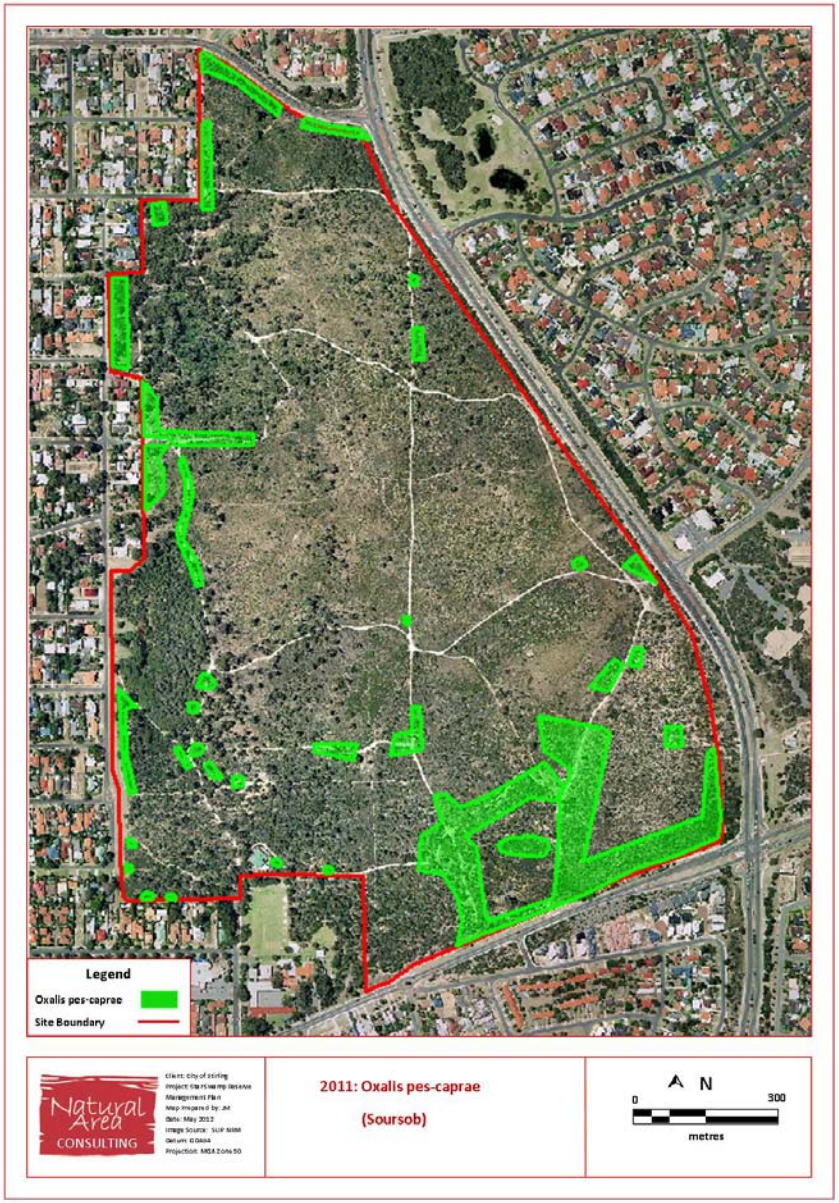

Legend
Black Flag
Site Boundary
Natural Area CONSULTING
2011: Ferraria crispa
(Black Flag)
N
0
200
metres


Legend
Oxalis pes-caprae
Site Boundary
Natural Area CONSULTING
2011: Freesia alba x leichtlinii
(Freesia)
N
0
200
metres


Legend
Fumaria
Site Boundary
Natural Area CONSULTING
2011: Fumaria capreolata
(Fumaria)
N
0
200
metres


Legend
Lachenalia
Site Boundary
Natural Area CONSULTING
2011: Lachenalia reflexa
(Yellow soldiers)
N
0
200
metres


Legend
Lupins
Site Boundary
Natural Area CONSULTING
2011: Lupinus consentinii
(Lupins)
N
0
200
metres


Legend
Oxalis pes-caprae
Site Boundary
Natural Area CONSULTING
2011: Oxalis pes-caprae
(Soursob)
N
0
300
metres

Appendix 7: Vertebrate Fauna species

Species Name	Common Name	Breeding/Nesting site	Conservation Status
Birds			
Acanthiza apicalis	Inland Thornbill	Unknown	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Unknown	
Acanthiza inornata	Western Thornbill	Unknown	
Acanthorhynchus superciliosus	Western Spinebill	Unknown	
Accipiter cirrocephalus	Collared Sparrowhawk	Unknown	
Accipiter fasciatus	Brown Goshawk	Unknown	
Acrocephalus australis	Australian Reed-Warbler	Unknown	
Anas castanea	Chestnut Teal	Unknown	
Anas gracilis	Grey Teal	Unknown	
Anas sp	Domestic Duck	Unknown	
Anas superciliosa	Pacific Black Duck	Yes	Secure
Anhinga novaehollandiae	Australasian Darter	Unknown	Secure
Anthochaera carunculata	Red Wattlebird	Yes	Secure
Anthochaera lunulata	Western Wattlebird	Unknown	
Apus pacificus	Fork-tailed Swift	Unknown	
Ardea alba	Great Egret	Unknown	Secure
Ardea modesta	Eastern Great Egret	Unknown	
Ardea novaehollandiae	White-faced Heron	Unknown	
Ardea pacifica	White-necked Heron	Unknown	CoS Priority 1
Artamus cyanopterus	Dusky Woodswallow	Unknown	
Aythya australis	Hardhead Duck	Unknown	Secure
Barnardius zonarius	Australian Ringneck	Unknown	Secure
Barnardius zonarius semitorquatus	Twenty Eight Parrot	Unknown	Secure
Cacatua pastinator	Western Corella	Unknown	

Species Name	Common Name	Breeding/Nesting site	Conservation Status
Cacatua roseicapilla	Galah	Yes	Secure
Cacatua sanguinea	Little Corella	Unknown	
Cacomantis pallidus	Pallid Cuckoo	Unknown	
Calyptorhynchus banksii naso	Red-tailed Black Cockatoo	Unknown	Threatened
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	Unknown	Endangered
Certhionyx niger	Black-faced Honeyeater	Yes	CoS Priority 1
Chenonetta jubata	Australian Wood Duck	Yes	Secure
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	Unknown	
Chrysococcyx lucidus	Shining Bronze Cuckoo	Unknown	CoS Vulnerable
Colluricincla harmonica	Grey Shrike-thrush	Unknown	
Columba livia	Rock Dove	Unknown	
Coracina novaehollandiae	Black-faced Cuckoo Shrike	Unknown	Secure
Corvus coronoides	Australian Raven	Unknown	Secure
Cracticus torquatus	Grey Butcher Bird	Unknown	Secure
Cygnus atratus	Black Swan	Unknown	
Dacelo novaeguineae	Laughing Kookaburra	Yes	Non-Endemic
Elanus axillaris	Black-shouldered Kite	Unknown	Secure
Falco cenchroides	Nankeen Kestrel	Unknown	Secure
Falco longipennis	Australian Hobby	Unknown	Secure
Falco peregrinus	Peregrine Falcon	Unknown	
Fulica atra	Eurasian Coot	Unknown	
Gallinula tenebrosa	Dusky Moorhen	Unknown	
Gerygone fusca	Western Gerygone	Unknown	
Grallina cyanoleuca	Magpie Lark	Yes	Secure
Gymnorhina tibicen	Australian Magpie	Yes	Secure
Haliastur sphenurus	Whistling Kite	Unknown	
Hieraaetus morphnoides	Little Eagle	Unknown	

Species Name	Common Name	Breeding/Nesting site	Conservation Status
Hirundo neoxena	Welcome Swallow	Unknown	
Hirundo nigricans	Tree Martin	Unknown	
Larus novaehollandiae	Silver Gull	Unknown	
Lichenostomus virescens	Singing Honeyeater	Yes	Secure
Lichmera indistincta	Brown Honeyeater	Yes	Secure
Malacorhynchus membranaceus	Pink-eared Duck	Unknown	
Malurus leucopterus	White-winged Fairy Wren	Yes	
Malurus lamberti	Variegated Fairy Wren	Yes	CoS Priority 1
Malurus splendens	Splendid Blue Fairy Wren	Yes	CoS Priority 1
Merops ornatus	Rainbow Bee-eater	Yes	Specially Protected
Nycticorax caledonicus	Nankeen Night-Heron	Unknown	
Pachycephala pectoralis	Golden Whistler	Unknown	Secure
Pachycephala rufiventris	Rufous Whistler	Yes	Secure
Pardalotus punctatus	Spotted Pardalote	Unknown	
Pardalotus striatus	Striated Pardalote	Yes	Secure
Phalacrocorax fuscescens	Black-faced Cormorant	Unknown	
Phalacrocorax melanoleucos	Little Pied Cormorant	Unknown	
Phylidonyris nigra	White-cheeked Honeyeater	Yes	Secure
Phylidonyris novaehollandiae	New Holland Honeyeater	Yes	Secure
Platalea flavipes	Yellow-billed Spoonbill	Unknown	
Podargus strigoides	Tawny Frogmouth	Yes	Secure
Porphyrio porphyrio	Purple Swamp Hen	Yes	Secure
Purpureicephalus spurius	Red-capped Parrot	Unknown	Secure
Rhipidura fuliginosa preissi	Grey Fantail	Unknown	
Rhipidura leucophrys	Willie Wagtail	Yes	Secure
Sericornis frontalis	White-browed Scrubwren	Unknown	
Smicrornis brevirostris	Weebill	Unknown	Secure

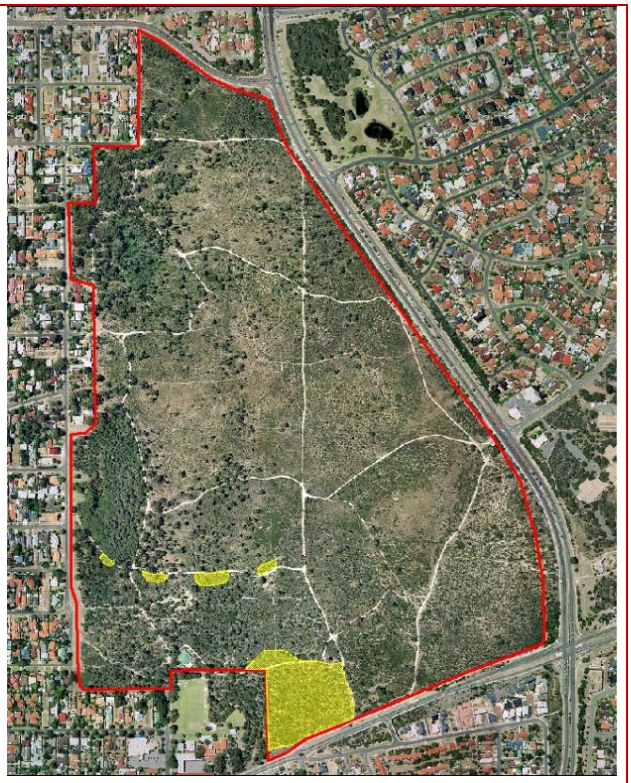
Species Name	Common Name	Breeding/Nesting site	Conservation Status
Sterna hirundo	Common Tern	Unknown	
Streptopelia chinensis	Spotted Turtle-Dove	Unknown	
Streptopelia senegalensis	Laughing Turtle-Dove	Unknown	
Tachybaptus novaehollandiae	Australasian Grebe	Unknown	Secure
Tadorna tadornoides	Australian Shelduck	Unknown	
Threskiornis molucca	Australian White Ibis	Unknown	Secure
Threskiornis spinicollis	Straw-necked Ibis	Unknown	Secure
Turnix varia	Button Quail	Yes	
Tyto alba	Barn Owl	Unknown	CoS Priority 1
Trichoglossus haematodus	Rainbow Lorikeet	Yes	Non-endemic
Todiramphus sanctus	Sacred Kingfisher	Unknown	
Zosterops lateralis	Silver Eye	Yes	Secure
Reptiles & Amphibians			
Crinia insignifera	Sign-bearing Froglet	Yes	
Cryptoblepharus buchananii	Fence skink	Yes	Secure
Heleioporus eyrei	Moaning Frog	Yes	Secure
Litoria adelaidensis	Slender Tree Frog	Yes	
Litoria moorei	Motorbike Frog	Yes	
Lymnodynastes dorsalis	Bullfrog	Yes	
Myobatrachus gouldii	Turtle Frog	Unknown	
Pogona minor	Western Bearded Dragon	Yes	Secure
Pseudonaja affinis	Dugite	Yes	Secure
Simoselaps bertholdi	Jan's Banded Snake	Yes	
Strophurus spinigerus	Yellow-eyed West Coast Spiny-tailed Gecko	Yes	Secure
Tiliqua occipitalis	Western Blue-tongue	Yes	Secure
Tiliqua r rugosa	Western Bobtail Lizard	Yes	Secure
Varanus gouldii	Gould's Sand Monitor	Yes	Secure

Species Name	Common Name	Breeding/Nesting site	Conservation Status
Mammals			
Felis catus	Feral & domestic cat	Yes	Introduced
Isoodon obesulus fusciventer	Southern Brown Bandicoot, Quenda	Unknown	Priority 5
Macropus fuliginosus	Western Grey Kangaroo	Yes	CoS Priority 1
Oryctolagus cuniculus	European Rabbit	Yes	Introduced
Vulpes vulpes	European Red Fox	Yes	Introduced

Sources: Birdlife Australia, 2012; City of Stirling, Friends of Star Swamp Bushland

Appendix 8: Fire History

21 November 1995



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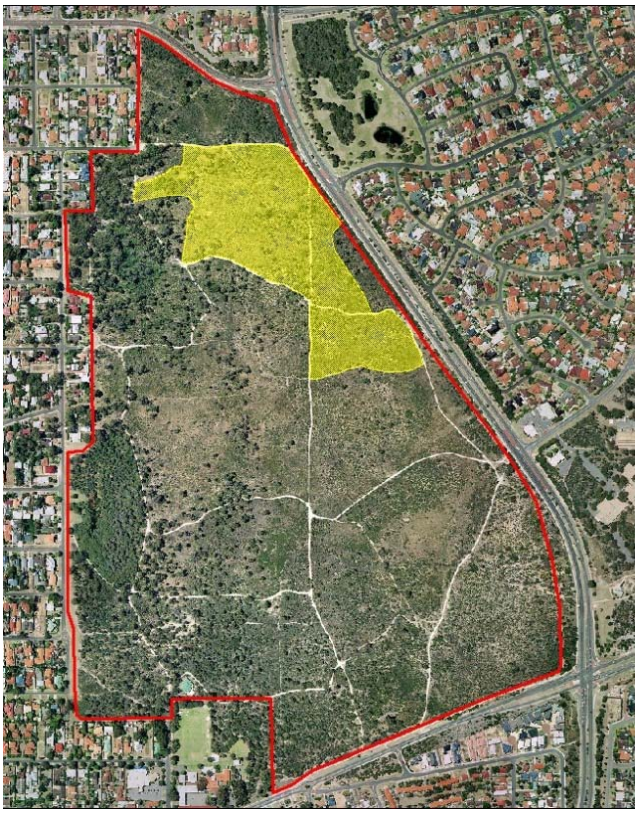

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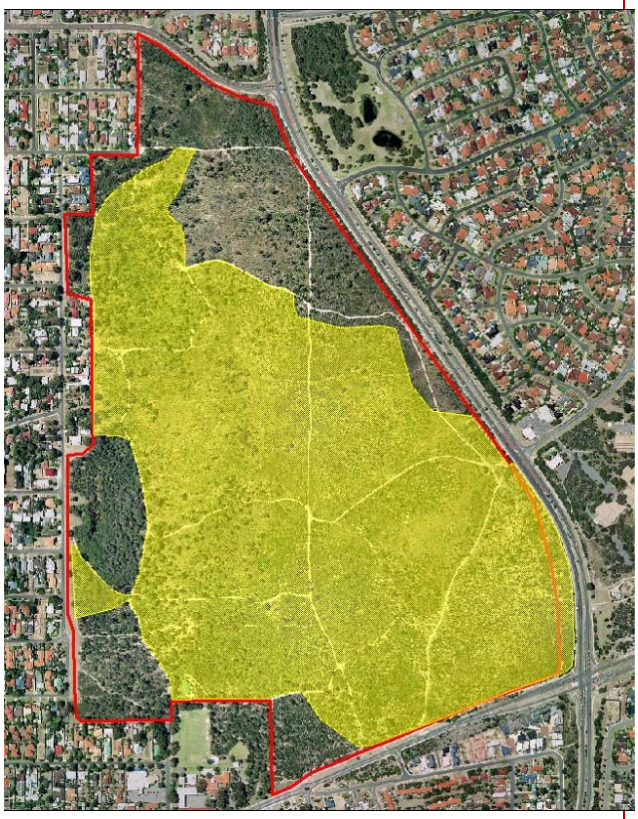
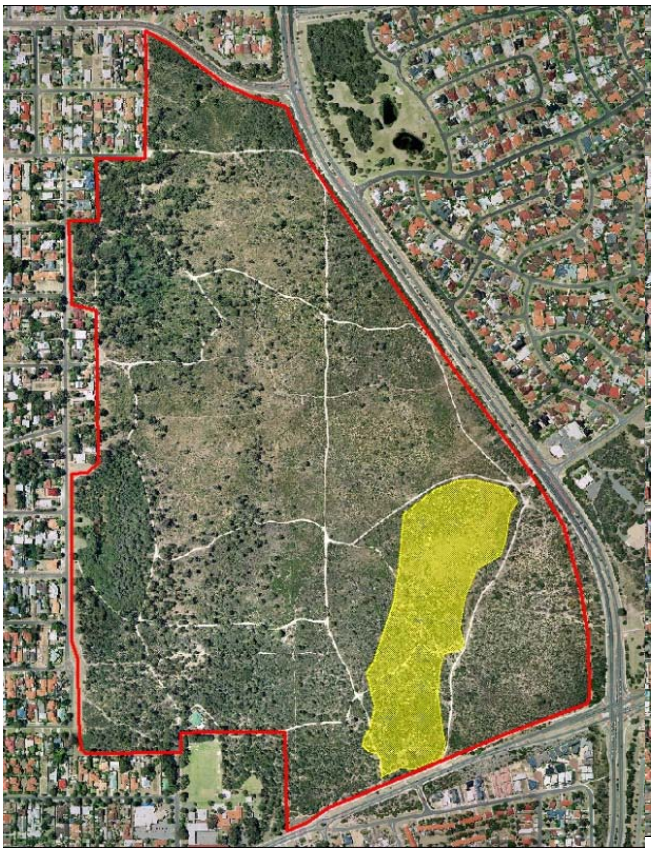


21 Nov 1997

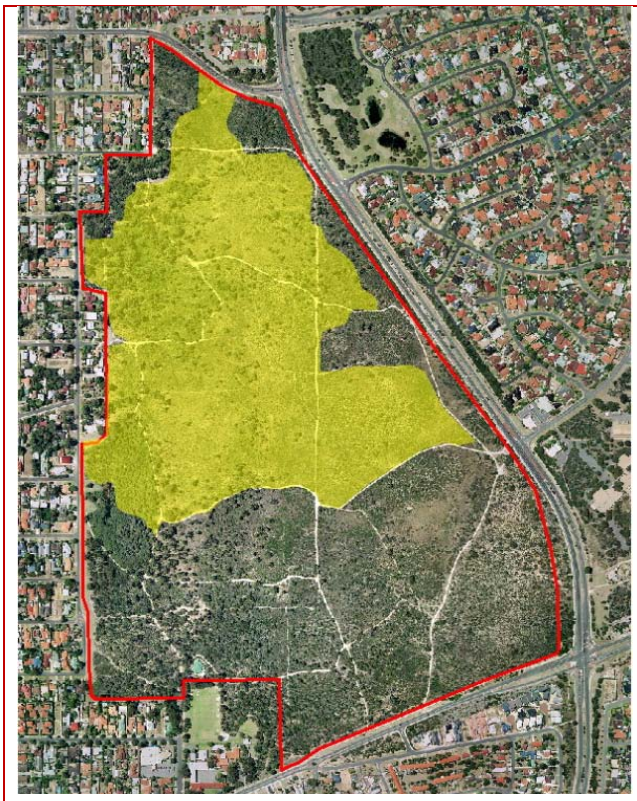
25 January 1998

11 January 2000

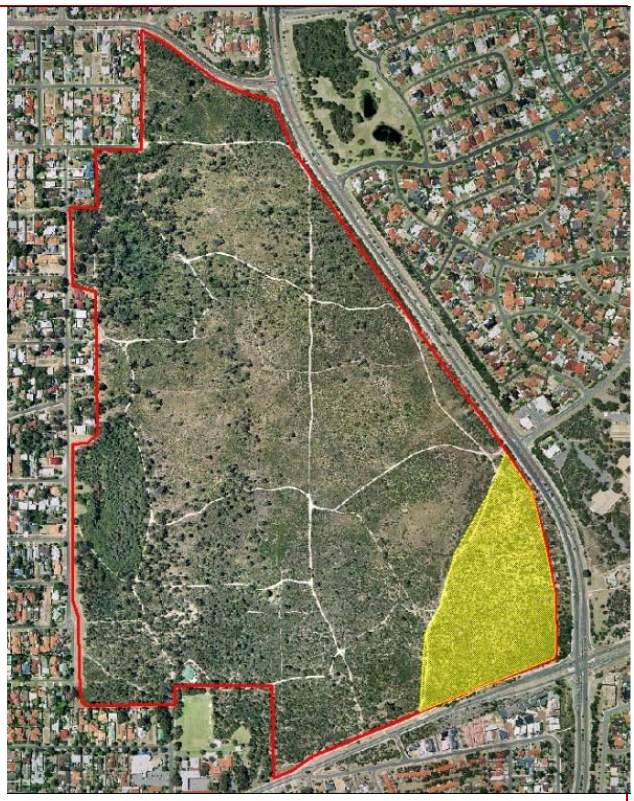


23 November 2002

January 2006

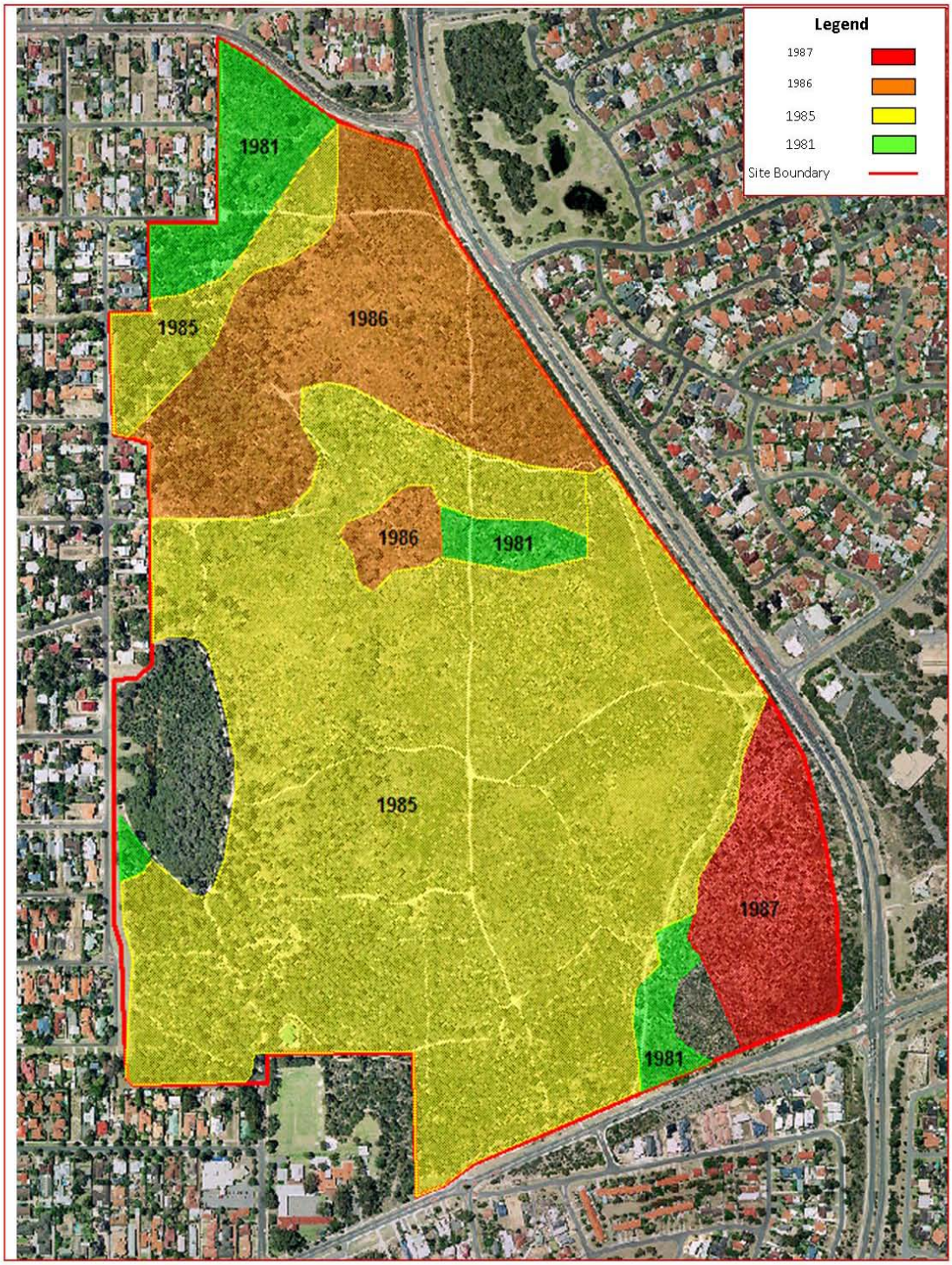


4 March 2007



20 December 2007

February 2010



Client: City of Stirling
Project: Star Swamp Reserve Management Plan
Map Prepared by: JM
Date: May 2012
Image Source: City of Stirling
Datum: GDA94
Projection: MGA Zone 50

Pre-1987 Fire History

N
0 200
Metres

Appendix 9: Aboriginal Heritage Inquiry System Search Outcomes

Government of **Western Australia**
Department of **Indigenous Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Search Criteria

1 sites in a search box. The box is formed by these diagonally opposed corner points:

MGA Zone 50	
Northing	Easting
6474180	382293
6476046	383738

Report created 08 May 2012 10:10:24. Identifier: 916584.

Page 1

Government of **Western Australia**
Department of **Indigenous Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

Legend

Restriction

N	No restriction
M	Male access only
F	Female access

Access

C	Closed
O	Open
V	Vulnerable

Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Status

L - Lodged		ACMC Decision Made
Information lodged, awaiting assessment	→	**R - Registered Site** **I - Insufficient information** **S - Stored Data**

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Sites Shown on Maps

Site boundaries may not appear on maps at low zoom levels

Report created 08 May 2012 10:10:24. Identifier: 916584.
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Government of **Western Australia**
Department of **Indigenous Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

List of Registered Aboriginal Sites with Map

No results

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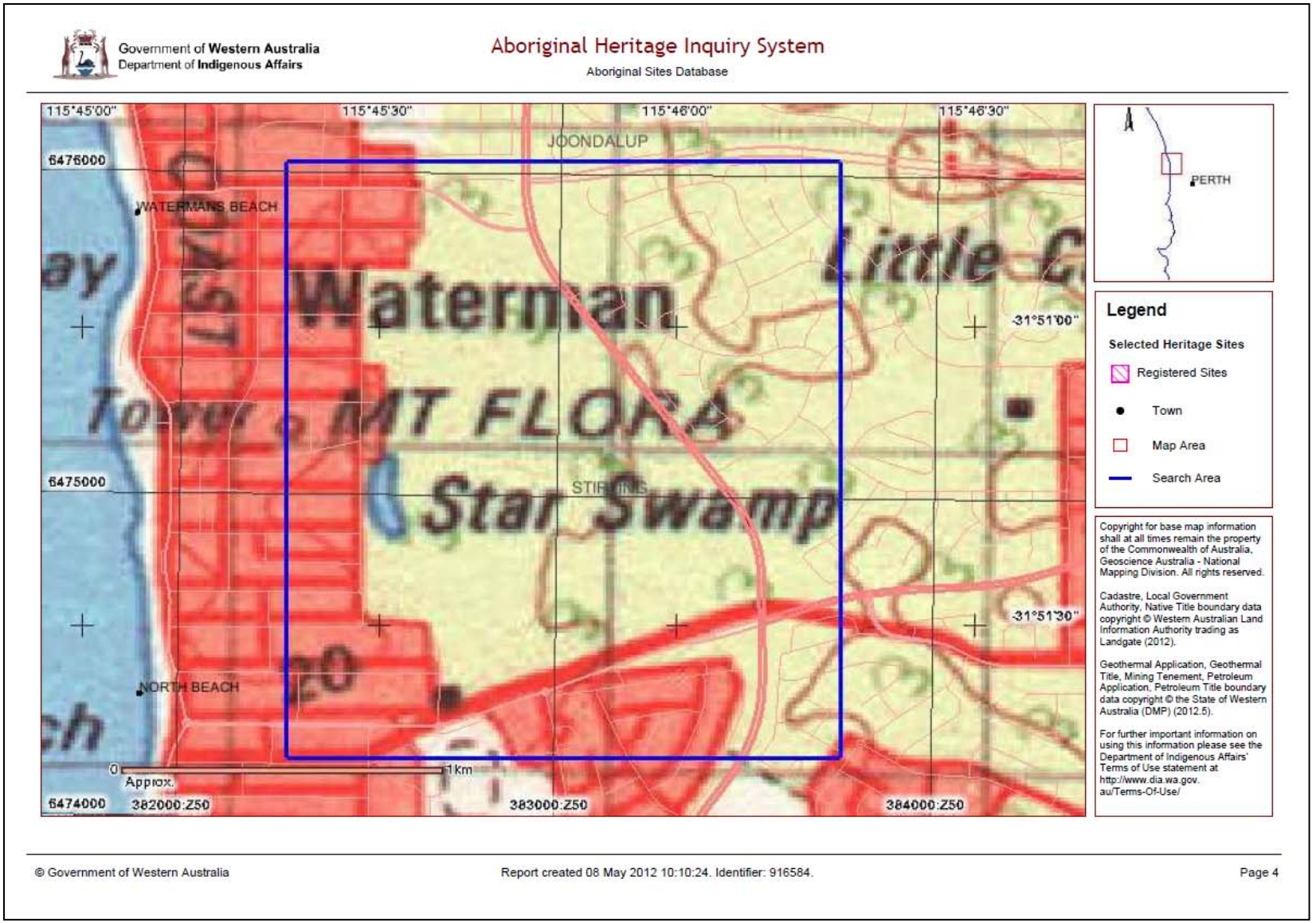
Government of Western Australia
Department of Indigenous Affairs
Aboriginal Heritage Inquiry System
Aboriginal Sites Database
115°45'00"
115°45'30"
115°46'00"
115°46'30"
JOONDALUP
6476000
WATERMANS BEACH
Waterman
MT FLORA
Star Swamp
STIRLING
-31°51'00"
-31°51'30"
6475000
NORTH BEACH
0
1km
Approx.
6474000
382000:Z50
383000:Z50
384000:Z50
PERTH
Legend
Selected Heritage Sites
Registered Sites
Town
Map Area
Search Area
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Government of **Western Australia**
Department of **Indigenous Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

List of 1 Other Heritage Places with Map

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
25379	S	O	N	Star Swamp Reserve	Mythological, Skeletal material/Burial, Historical	Plant Resource, Camp, Hunting Place, Natural Feature, Water Source	*Registered Informant names available from DIA.	382924mE 6475059mN Zone 50 [Reliable]	

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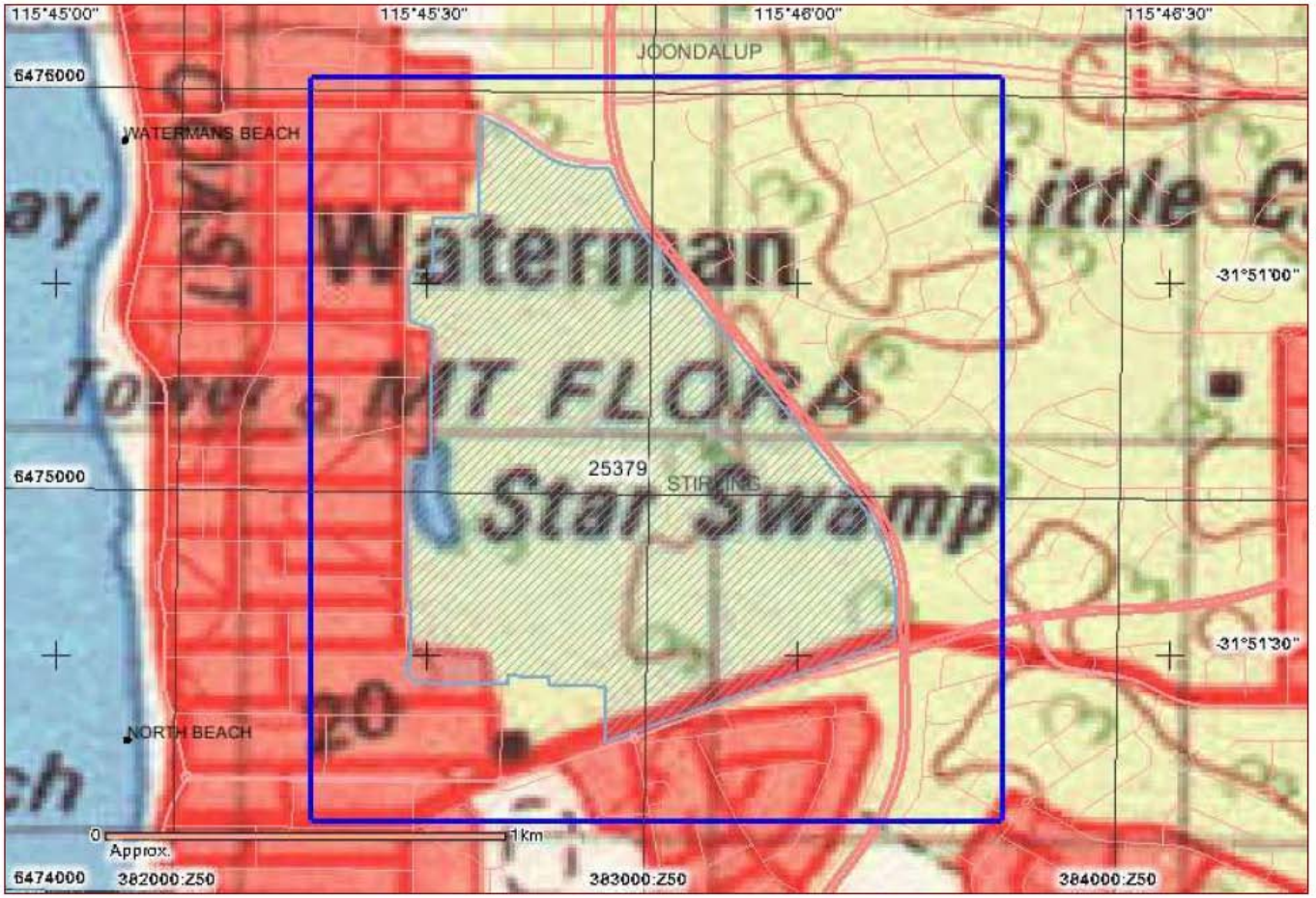
Page 5

Government of Western Australia
Department of Indigenous Affairs

Aboriginal Heritage Inquiry System

Aboriginal Sites Database



Legend

Selected Heritage Sites

Other Heritage Places

Town

Map Area

Search Area

Report created 08 May 2012 10:10:24. Identifier: 916584.

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Government of **Western Australia**
Department of **Indigenous Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Map Showing Registered Aboriginal Sites and Other Heritage Places

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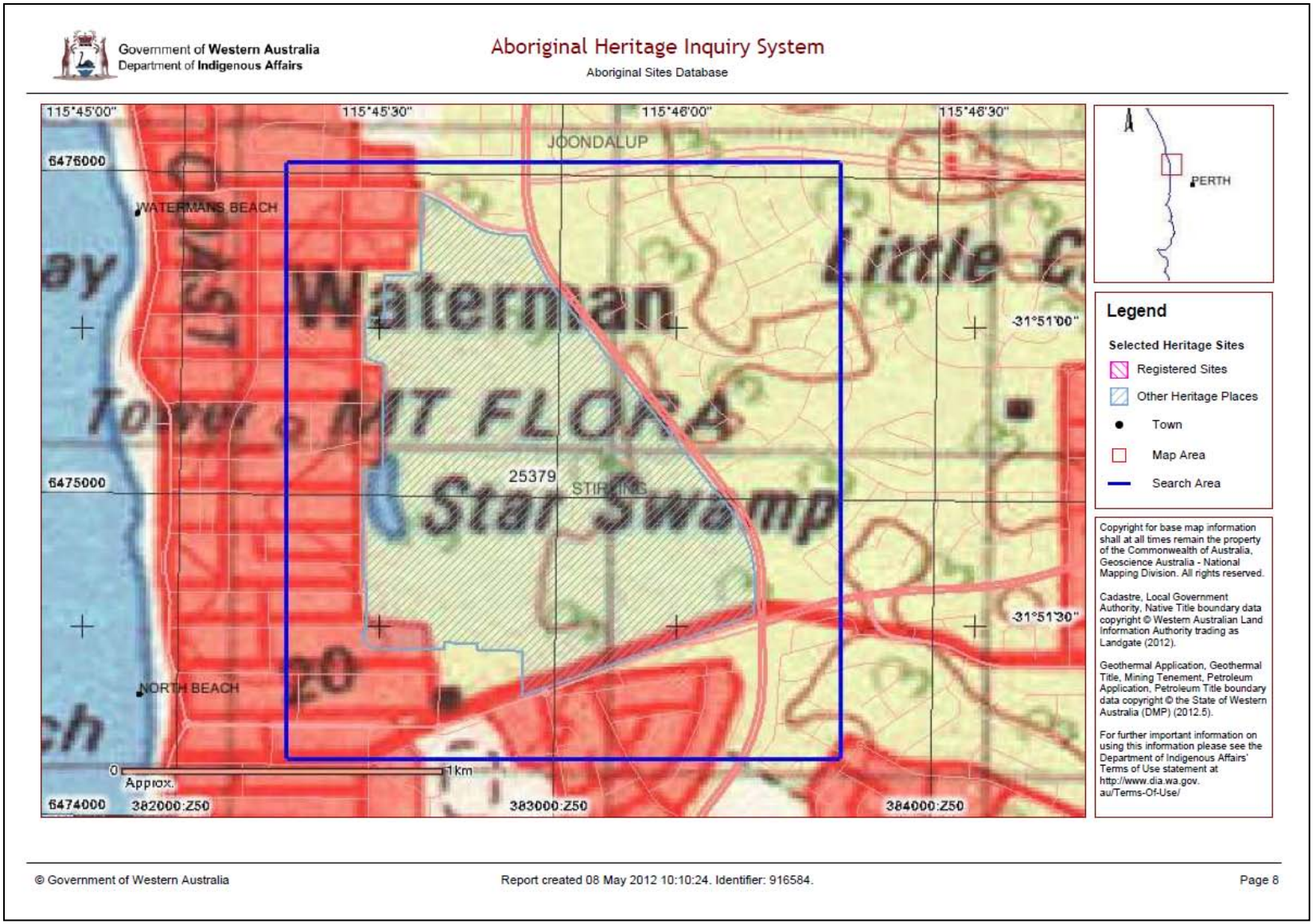
Government of Western Australia
Department of Indigenous Affairs
Aboriginal Heritage Inquiry System
Aboriginal Sites Database
115°45'00"
115°45'30"
115°46'00"
115°46'30"
JOONDALUP
6476000
WATERMANS BEACH
Waterman
Little G
31°51'00"
25379
STIRLING
Star Swamp
6475000
31°51'30"
NORTH BEACH
0
1km
Approx.
6474000
382000:Z50
383000:Z50
384000:Z50
PERTH
Legend
Selected Heritage Sites
Registered Sites
Other Heritage Places
Town
Map Area
Search Area
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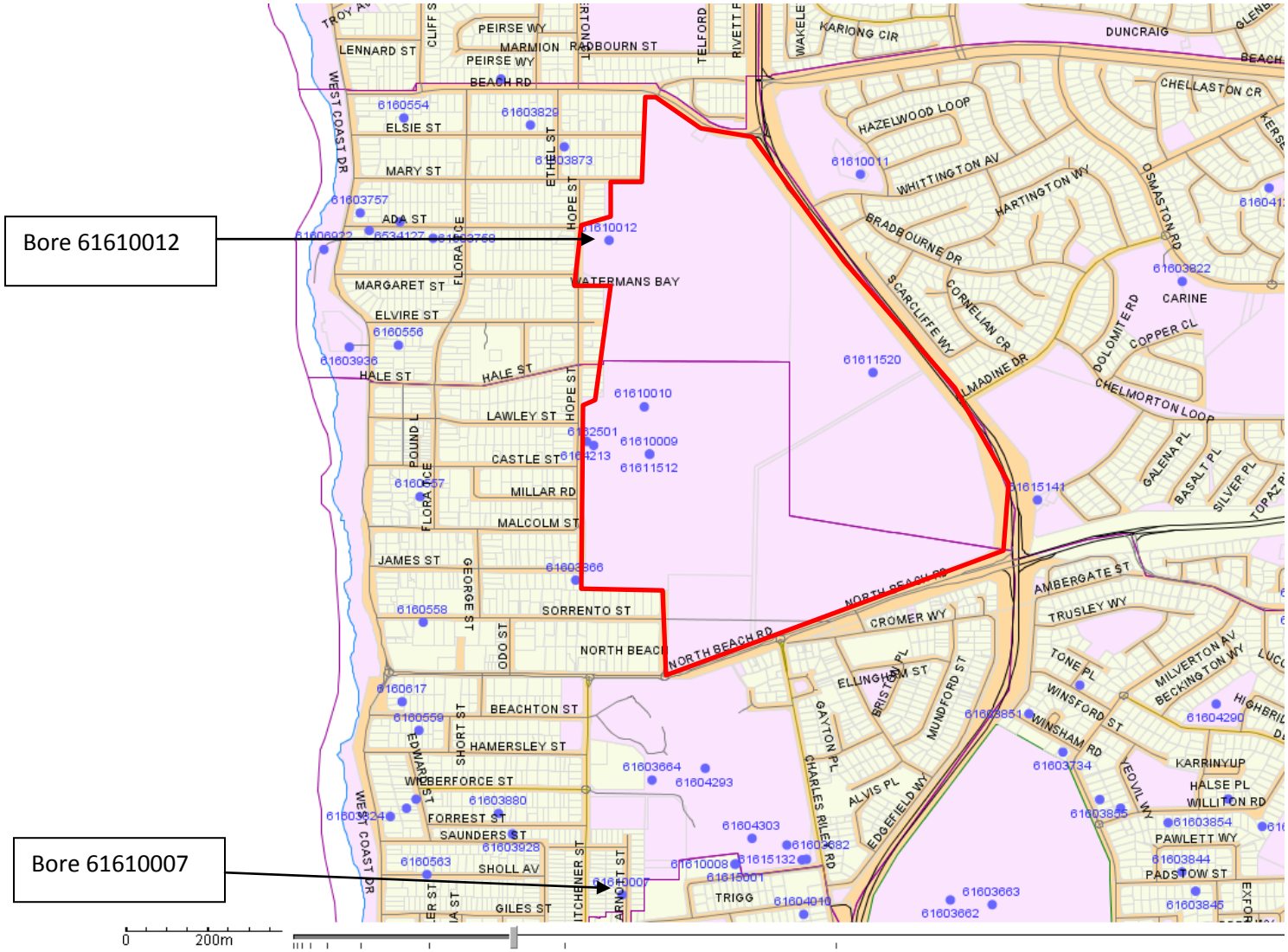
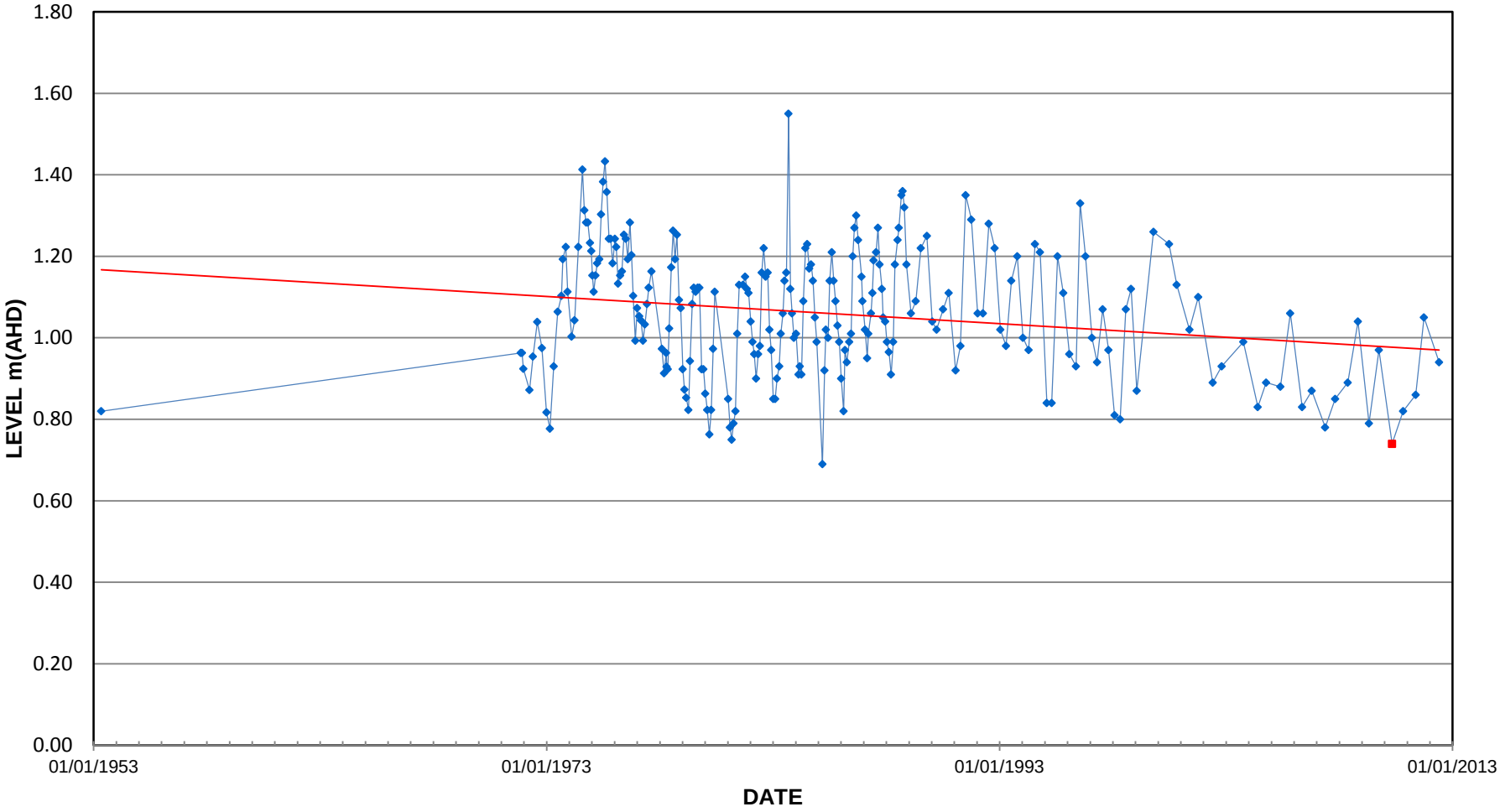
Appendix 10: Department of Water WIN Database Bore Results



Government of Western Australia
Department of Water

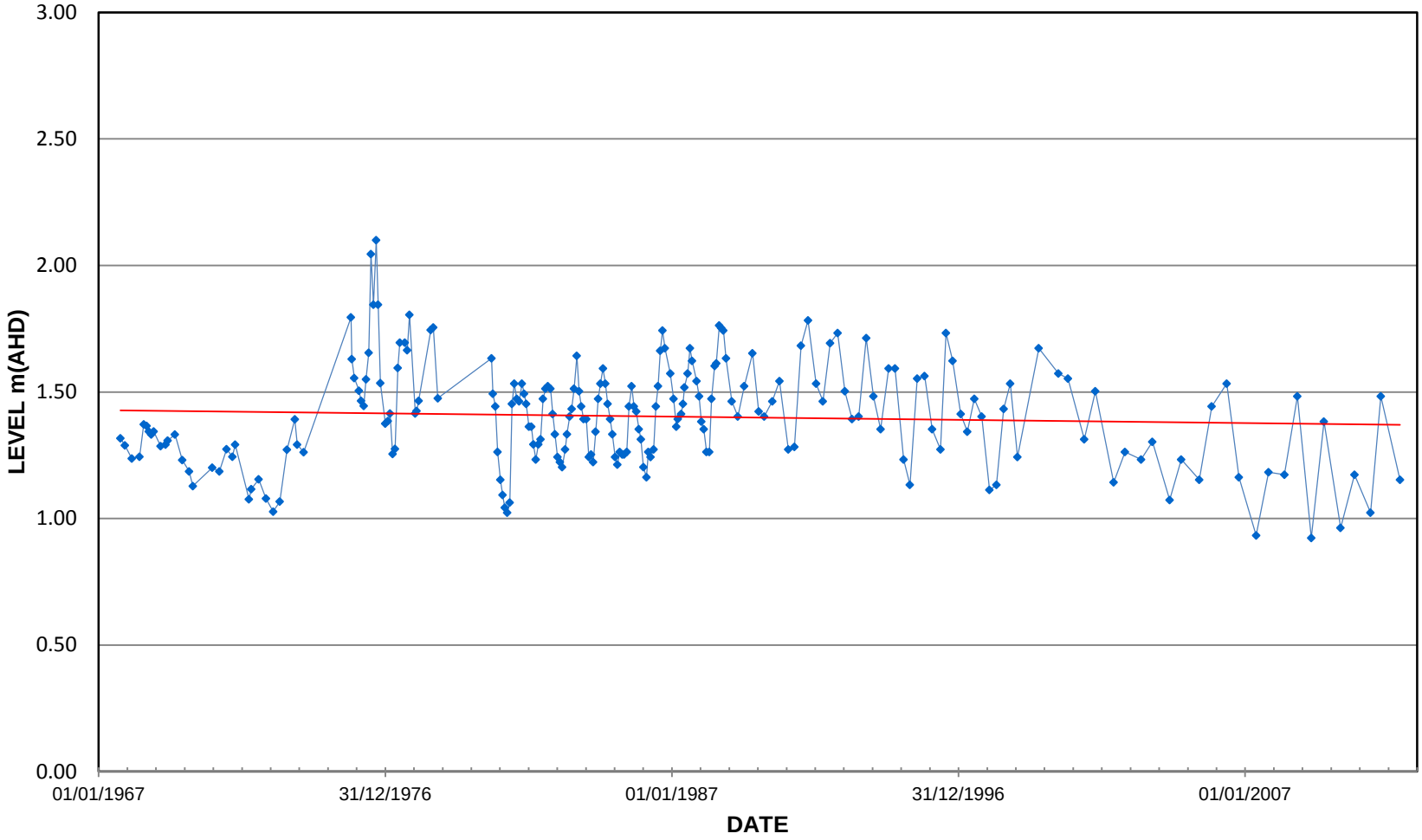
61610007 LAKES AND WETLANDS - BORE 793
Easting = 382601.00 Northing = 6473660.00 Zone = 50 TOC = 4.14mAHD WIN SITE ID = 4349



◆ = Good Record ●= Satisfactory Record ▲= Water Level is Above the Datum ■= Water Level is Below the Reading
Datums: AHD = Australian Height Datum. GL = Ground Level. SLE = Standard Level Elevation . () = none.
References: TOC = Top of case. GL = Ground Level. PM = Permanent Mark. TOVAL = Top of Valve. () = none.

Government of Western Australia
Department of Water

61610012 LAKES AND WETLANDS - BORE 7597
Easting = 382548.00 Northing = 6475522.00 Zone = 50 TOC = 3.193mAHD WIN SITE ID = 4354



◆ = Good Record ●= Satisfactory Record ▲= Water Level is Above the Datum ■= Water Level is Below the Reading
Datums: AHD = Australian Height Datum. GL = Ground Level. SLE = Standard Level Elevation . () = none.
References: TOC = Top of case. GL = Ground Level. PM = Permanent Mark. TOVAL = Top of Valve. () = none.

Appendix 11: Roadside Environmental Weed List

Environmental Roadside Weeds List

Updated and endorsed by the Minister for Environment, August 2012

Trees and Large Shrubs

Acacia baileyana	Cootamundra Wattle
Acacia iteaphylla	Flinders Range Wattle
Acacia longifolia	Sydney Golden Wattle
Acacia podalyriifolia	Mount Morgan Wattle
Acacia pycnantha	Golden Wattle
Chamaecytisus palmensis	Tagasaste
Genista linifolia	Flaxleaf Broom
Genista monspessulana	Montpellier Broom
Gomphocarpus fruticosus	Narrowleaf Cottonbush
Lavandula stoechas	Lavender
Leptospermum laevigatum	Victorian Tea-tree
Lycium ferocissimum	African Boxthorn
Olea europaea	Olive
Parkinsonia aculeata	Parkinsonia
Pinus radiata/pinaster	Pines
Psoralea pinnata	Taylorina
Retama raetam	White Weeping Broom
Rhamnus alaternus	Buckthorn
Ricinus communis	Castor Oil Plant

Small Shrubs and Herbs

Acetosa vesicaria	Ruby Dock
Aerva javanica	Kapok Bush
Arctotheca calendula	Cape Weed
Brassica napus	Canola
Brassica tournefortii	Wild Turnip
Carpobrotus edulis	Pigface
Dittrichia graveolens	Stinkwort
Echium plantagineum	Paterson's Curse
Euphorbia terracina	Geraldton Carnation Weed
Fumaria capreolata	Whiteflower Fumitory
Gazania linearis	Gazania
Lupinus cosentinii	Blue Lupin
Oenothera stricta	Common Evening Primrose
Raphanus raphanistrum	Wild Radish
Tribulus terrestris	Caltrop

Grasses

Arundo donax	Giant Reed
Avena spp.	Wild Oats
Cenchrus ciliaris	Buffel Grass
Ehrharta calycina	Perennial Veldt Grass
Ehrharta longiflora	Annual Veldt Grass
Eragrostis curvula	African Lovegrass
Hyparrhenia hirta	Tambookie Grass
Melinis repens	Natal Redtop
Themeda quadrivalvis	Grader Grass
Pennisetum clandestinum	Kikuyu
Pennisetum setaceum	Fountain Grass
Pennisetum villosum	Feathertop Grass

Creepers

Asparagus aethiopicus	Asparagus Fern
A. asparagoides	Bridal Creeper
A. declinatus	
A. plumosus	Climbing Asparagus Fern
A. scandens	

Bulbus Type Weeds

Babiana angustifolia	Baboon Flower
Ferraria crispa	Black Flag
Freesia alba x *leichtlinii*	Freesia
Gladiolus caryophyllaceus	Wild Gladiolus
Lachenalia spp.	Soldiers
Moraea flaccida	One-leaf Cape Tulip
Watsonia spp.	Watsonia
Zantedeschia aethiopica	Arum Lily

Appendix 12: Audit of Public Submissions

Star Swamp Management Plan - Audit of Public Submissions

No	Name	Subject Matter	Comment Received	City's Response
1	Phylis Robertson	Dog faeces	Dog dung on paths is a public health hazard especially for children and people in wheel chairs.	Noted, no changes to plan; general discussion included in Section 3.8.5
2	Phylis Robertson	Dog walking	Unleashed dogs confronting walkers can be dangerous.	Noted, no changes to plan, general discussion included in Section 3.8.5
3	Phylis Robertson	Walking paths	Widening of paths force people to make 'goat tracks' (FESA issue).	Noted, no changes to plan, tracks discussed in Section 5.2 along with recommendations for those to be closed and revegetated
4	Phylis Robertson	Undergrowth	Clearing undergrowth is a habitat destructor for birds and small animals.	No clearing of native undergrowth is planned; however removal of weeds and litter may be required to assist with minimising fire fuel loads. No changes to plan
5	Phylis Robertson	Naming of tracks	A,B,C, 1,2,3 is a logical way to name tracks, but future consideration should be given to using pioneer names.	It is the City of Stirling policy to not use the names of living people when naming streets, or in this case, tracks within Star Swamp. Accordingly, it is their preference to use the naming system described in the management plan
6	Margarid Hodkinson	Dog walking	I have been walking dogs in the swamp for 25 years (daily). If dogs are 'under control', there should not be a problem. Why target one aspect of society when I have often been threatened by cyclists often travelling too fast or not being aware of other people walking. I would add I never leave the pathways and neither does my dog and always pick up dog poo.	Noted, no changes to plan. The issue of dogs on/off leads has been discussed with City Officers during plan development and will be highlighted to Council when the plan is submitted for their consideration. Unfortunately, domestic animals, including dogs and cats, are not compatible with bushland conservation areas and that the effects are often not immediately noticeable and accumulate over time
7	David Mathias (Vice president F.O.S.S)	Walking paths	When bush tracks cross, i.e.. Track 2 crossing C, this needs identification as N.S.E.W of the other tracks and may well need signage 'To Marmion Ave', 'To North Beach Road' etc. For visitors using the map and walking unguided.	Noted, Section 5.2.1 will be updated to include this recommendation
8	Christine Curry	Dog walking	I agree with dogs on leads, but this will need a major 'awareness' program in order for it to be accepted.	Noted, the need for a program to improve awareness is discussed in Section 3.8.5. No changes to plan
9	Christine Curry	Domestic animals	Cats in adjacent areas will need to be locked in at night, this needs to be an enforced more strongly.	When the final provisions of the Cat Act 2011 come into force during the latter part of 2013, the City of Stirling will have greater legislative rights to enforce cat control measures. Cat Act 2011 referred to in Section 3.8.5 of the plan, and no further changes are required
10	Christine Curry	Resource person	The placement of a teacher/resource person at least 2 days per week at Henderson Centre is an opportunity for the City to develop environmental responsible role.	Potential uses of the Henderson Centre and resources associated with each option are currently being investigated by the City of Stirling
11	Martine Hulsdunk	Education program	I feel that Star Swamp could do with the education program on domestic animals and faeces collection but as we have not long ago won a vote on the continued exercising of dogs off leads I feel it makes this unnecessary.	Refer to comment 6 above on issue of dogs on/off leads.
12	Martine Hulsdunk	Dog walking	I have exercised animals in the swamp six days per week for 24 years and have not seen a large amount of damage or trouble with dogs. Most dogs do not leave the tracks provided as vegetation is too prickly.	Refer to comment 6 above on issue of dogs on/off leads.
13	Jane Coffee	Dog exercise area	I feel the plan is brilliant, but not the removal of the dog exercise area designation. The vast majority of users are responsible dog owners who value the bushland highly.	Refer to comment 6 above on issue of dogs on/off leads.
14	Terry Wilson	Domestic animals	I support the domestic animal recommendations in particular.	Noted - no changes to plan
15	Terry Wilson	Fire management	Fire Management is a little too 'motherhood' The fire hazard from Marmion Ave (current over ground boundary) without management of their fire break.	Plan adjusted to reflect that fire can occur from offsite locations and that other neighbouring landowners/managers need to maintain responsibility for fire management on their land

Star Swamp Management Plan - Audit of Public Submissions

No	Name	Subject Matter	Comment Received	City's Response
16	Terry Wilson	Weeds	Feral weeds are spreading into the reserve.	Section 3.6 acknowledges surrounding properties are a potential source of weeds, as are road verges. No changes to the plan
17	David Manning	Snakes	Tiger snakes are present in the reserve.	Section 3.7.3 will be updated to reflect recent reports of tiger snakes being seen with the reserve
18	David Manning	Domestic cats	Cat control with a cat proof fence.	The implementation of the Cat Act 2011 due to come into effect later in 2013 and provide the City of Stirling with greater powers in relation to cat control, which can be monitored over time. A cat proof fence is an expensive option that is likely to decrease visual amenity, and will be decided on by the City of Stirling; no changes to plan.
19	David Manning	Coffee shop	Coffee shop open in the Henderson Centre.	Refer to comment 10
20	Loretta Van Asselt - Dep't of Planning	Support	Support extending weed mapping, undertaking a baseline vertebrate fauna diversity survey and closing off and revegetating designated tracks	Noted - no changes to plan
21	Lorreta Van Gasselt - Dep't of Planning	Designated dog exercise area	Star Swamp Reserve is within bush forever area 204. The proposed change from a designated dog exercise area to one where they are only permitted if kept on a leash is supported, as this should reduce the potential impact domestic dogs have on the natural environment. For example, information on the Bush Forever status on the site could be considered.	Noted - no changes to plan. Discussion of signage relating to the Bush Forever status of the site is included within the plan in Section 5.3.3
22	Lorreta Van Gasselt - Dep't of Planning	Signage	Also supported is replacing the 'preclusion' signage with ones that highlight reasons why activities are not allowed, informing the community about key environmental and ecological values and the Bush Forever status of the site - example provided.	Noted - no changes to plan
23	Craig Waters FESA	Fire management	Discussion on Homeowners Bush Fire Survival Manual S3.9.1 - recommended that publisher be changed from FESA to DFES, and FESA acronym to DFES on p41	The publisher will not be adjusted to DFES as it did not exist as an organisation at the time the booklet was published; acronym of p 41 has been adjusted to reflect name change
24	Craig Waters FESA	Fire management	Consideration to be given to the purple text to reflect the change to the Department of Fire and Emergency Services: The Department of Fire and Emergency Services (DFES) produces an Urban Bushland Fire Response Plan for Star Swamp Bushland Reserve which is reviewed annually	Information will be included in Section 3.9.1
25	Craig Waters FESA	Fire management	The 'Prepare Act Survive' brochure and 'Homeowners' Bush Fire Survival Manual produced by DFES would be a useful resource for those living in close proximity to bushland areas or visit the DFES website for further information (www.dfes.wa.gov.au) (Figure 34).	Information will be included in Section 3.9.1
26	Craig Waters FESA	Access	Recommended that the following is included in the text: 'All tracks and access points are detailed within the DFES Urban Bushland Fire Response Plan'	Information will be included in Section 3.9.1

Star Swamp Management Plan - Audit of Public Submissions

No	Name	Subject Matter	Comment Received	City's Response
27	Julia Cullity - DEC	Weeds and other introduced flora	This management plan should make some specific recommendations based on the information that is included in Appendix 6	Text in Section 3.6 adjusted to reflect that weed mapping was carried out by the City of Stirling. The recommendation has been made to adjust the method of weed mapping, which will then lead to appropriate management actions by the City of Stirling. It is also needs to be noted that two key documents that the City uses to guide the management of bushland areas and which discuss their approach to the management of a number of issues are the 'Local Biodiversity Strategy 2010' and 'Green Plan 2 - 2002'. These are available on the City website, and include information on surveys including the assessment of weeds, implications for biodiversity, threat management, monitoring and reporting. Due to the dynamic nature of weed control and the changes in infestations, it has been decided not to include specific recommendations and treatment in the management plan.
28	Julia Cullity - DEC	Weeds and other introduced flora	Have the weeds been prioritised for their ecological impact on the natural values of Star Swamp?	No prioritisation of weeds has occurred at present as it is expected this will occur after the planned flora survey is carried out. The City of Stirling will then be in a position to develop and implement appropriate weed control priorities for the reserve. The City of Stirling will be conductiong regular assessments and adjustement to control plans on a regular, ongoing basis.
29	Julia Cullity - DEC	Weeds and other introduced flora	DEC uses different cover classes as a standards <5%, 5-75%, >75%, see http://www.dec.wa.gov.au/management-and-protection/programs/urban-nature/standard-operating-procedures-for-weed-mapping.html	Section 3.6 will be updated to reflect the DEC standard operating procedure for weed mapping
30	Julia Cullity - DEC	Weeds and other introduced flora	It is not clear which weed species should be treated. Please clarify. Are there different priorities for weed treatment - in terms of species or areas? Refer to the weed mapping in Appendix 6 and/or information about the unmapped weeds.	Will adjust Section 3.6 and/or 3.6.1 to indicate that weed treatment will be in accordance with current City of Stirling priorities for the site. The need for weed treatment will be assessed and monitored in line with the City of Stirling 'Local Biodiversity Strategy' and 'Greenplan 2'
31	Julia Cullity - DEC	Feral and introduced fauna	Elaborate on control techniques	As practices and procedures may change as new information becomes available, it is deemed more appropriate to keep this information general - the City procedures can then change without the need to update the managment plan. These will be assessed in line with the City of Stirling 'Local Biodiversity Stratgey' and 'Green Plan 2'.
32	Julia Cullity - DEC	European rabbit	Pindone is toxic to Quenda. This control technique is not recommended if Quenda are found to be present on site or are to be translocated	Section 3.8.1 will be updated to indicate that Pindone is toxic to Quenda and that consideration of their presence will be required prior to use. Note that the plan does not make a recommendation on the use of Pindone, rather it comments on its previous use. Any future control of rabbits will be undertaken in accordance with the City's policies, practices and procedures, including those outlined in the 'Local Biodiversity Strategy' and 'Green Plan 2'
33	Julia Cullity - DEC	European rabbit	Elaborate on rabbit control techniques	Refer to comment 31
34	Julia Cullity - DEC	1995 - 2010 Fire map	labels are difficult to read	Labels have been modified, key maps throughout the plan adjusted to A3

Star Swamp Management Plan - Audit of Public Submissions

No	Name	Subject Matter	Comment Received	City's Response
35	Julia Cullity - DEC	Tracks	All plant materials used for rehabilitation must be sourced from within the reserve	At present, the City of Stirling has a seed collection and plant propagation program which utilises only provenance seed/plants for rehabiltiation activities. However the use material sourced only from within the reserve may not be feasible, with local provenance stock from nearby locations also being suitable for use within the reserve. Section 5.2 updated to indicate that rehabilitation will be in accordance with City of Stirling current policies, practices and procedures
36	Julia Cullity - DEC	Tracks	Will be difficult to enforce sandy tracks for pedestrian access only	Noted - no changes to plan
37	Julia Cullity - DEC	Tracks	Useful to recommend track closure techniques where discussion on track closure occurs	Section 5.2 will be updated to include some examples of closure techniques, and an indication that they will be in accordance with City policy, practices and procedures
38	Julia Cullity - DEC	Figure 40	need to upgrade the map print resolution so the text is legible	Map will be adjusted to A3
39	Julia Cullity - DEC	Track naming system	Strongly disagree. Named tracks should have names - names could be selected to support the cultural and natural heritage interpretation	Refer to comment 5
40	Julia Cullity - DEC	Directional signage	Last sentence - this is unclear. Do you mean signs should be printed on both sides?	Section 5.3.1 will be adjusted to ensure this is clear
41	Julia Cullity - DEC	Flora and Vegetation - implementation	include recommendation for recurrent vegetation condition mapping	recommendations highlighted within the Executive Summary will be included in Section 3.5.4
42	Julia Cullity - DEC	Weed mapping - implementation	DEC weed mapping standards operating procedure	Implementation table in Section 7.0 will be adjusted to include the DEC weed mapping SOP in the 'Standard' column
43	Julia Cullity - DEC	Weed mapping - bridal creeper	Need to address weed management in this table beyond bridal creeper and the olive. Objective would be to minimise threats and maintain or improve vegetation condition. Changes in weed density via weed mapping would be the measurement criteria. Management action would list the species/areas and priorities for treatment.	A general weed management component will be added to the table in Section 7.0. Weed control will be undertaken in accordance with the 'Local Biodiversity Strategy' and 'Greenplan 2'. Specific control methods have not been included as these change over time as do the weed species requiring treament, so their inclusion can restrict the flexibility of future efforts.
44	Dave Bright	Flora survey	It seems quite bizarre having a highly detailed Management Plan but without a spring flora survey and without a dieback assessment having been included as part of it. It's a bit late now but that SHOULD have been included in the original brief! Information from such assessments would SURELY be pertinent (and ESSENTIAL) to certain recommendations in the Plan?	The flora survey was not an essential requirement prior to preparing the management plan because of the significant knowledge level of that currently exists. Its main purpose would be to assist with fine tuning of the plan and the setting of some priorities, such as the treatment of weeds, however that can occur at any stage. No changes to the plan
45	Dave Bright	Flora survey results	Along similar lines, the report states that "a comprehensive flora survey is planned for the Star Swamp Bushland Reserve during spring 2012"! So why then aren't the results included in the Plan when the Plan is dated Nov 2012?	The flora survey was not commissioned by the City of Stirling during 2012, and it is envisaged it will occur during 2013
46	Astron Environmental Services	Weed management	Needs to be some clear direction on what the City would like to achieve for weed management.	A general comment in relation to weed management aims will be included in Section 3.6 recognising that weed control is an ongoing activity and will be carried out in accordance with current City policies, practices and procedures. Specific weed management objectives have been documented in the City's 'Green Plan 2' and the 'Local Biodiversity Strategy' documents, which outline the strategy for the conservation of urban bushland

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47	Astron Environmental Services	Weed management	Site should be broken down into practical management areas, Management can be prioritised against conservation assets, areas of good bushland condition and weeds prioritised for control.	This will be decided by the City of Stirling if required, as there are a number of potential options for the assigning of areas to a particular management area; no changes to the plan
48	Astron Environmental Services	Weed management	Set management objectives at reserve level, spatial management area and species specific level. **Reserve level:** No increase in weed species richness in the Reserve, reduction of total area infested by priority species, increase in areas classified as having excellent bushland condition. **Spatial management area level:** Reduction in weed species richness in high value conservation asset management areas, increased native species richness in high value conservation asset management areas. **Species Specific level:** Reduction in the number of spatial management areas in which identified priority weed species occur, reduction in the abundance and density of identified priority species per spatial management area.	The broad management objective for Star Swamp is to preserve biodiverisity, which is in keeping with its zoning for conservation and education. The aim of the management plan is to guide ongoing managment in the longer term, rather than detail day-to-day activities. The City also has a broader system of monitoring against key performance indicators across all reserves, as described in the 'Local Biodiversity Strategy' and 'Green Plan 2'.
49	Astron Environmental Services	Weed management	Ensure repeat weed treatments are undertaken.	Section 3.6.1 will be updated to acknowledge this
50	Astron Environmental Services	Weed management	Weed control efforts should be directed at high priority areas with good bushland condition with less resources directed at low priority areas.	Section 3.6.1 will be updated to indicate that treatment priorities will be set by the City in response to weed mapping and prioritisation processess, with the aim of improving those areas in good or better condition
51	Ray and Jane Coffey	Dog walking	Star Swamp Reserve should remain a dog exercise area. Less people utilising the park as a dog exercise area will result in less community ownership and care for the bushland. Most dog owners are responsible. Removing Star Swamp as a dog exercise area will not stop those who are irresponsible as they 'flout' regulations.	Refer to comment 6 above on issue of dogs on/off leads.
52	Christopher Nutt	Management Plan not strategic	The document is not a management plan in the 'modern sense'. It represents a vast body of knowledge on the Reserve however, does not lend itself to being used from a strategic point of view.	The aim of the plan is to guide ongoing managment over time rather than detailing prescribed treatments or activities that will occur on a day-to-day basis. The ongoing management of flora, fauna, weeds, and similar, is discusssed in the City's 'Local Biodiversity Strategy' and 'Green Plan 2'. These documents also describe various threats along with monitoring and reporting requirements
53	Christopher Nutt	Management Plan not strategic	Needs clear definitions of Values (social and environmental) and pressures.	An acknowledgement of the importance of environmental (ecological) and other values will be included in the introduction, and will recognise the major aim of the plan is to protect biodiversity within the reserve
54	Christopher Nutt	Management Plan not strategic	Protection and mitigation strategies should be developed and directly related to the values and pressures. The plan also needs to define how it intends to measure if these strategies are working.	Refer to comment 52
55	Christopher Nutt	Management Plan not strategic	Annual reporting should be compulsory and as simplified as practical with a mandatory review built in after a specified period of time.	The City of Stirling currently has an annual reporting system of various performance indicators which the management of Star Swamp, along with all the other reserves the City uses for performance management
56	Christopher Nutt	Management Plan not strategic	Without clear links from the broadest vision for the area through to on ground day-to-day works it is difficult to see how the plan will 'succeed'.	Refer to comment 52
57	Brian Hodkinson	Cycle path hazards	Install passive barrier at the pavement edge at the entrance to the Reserve at Marmion Avenue to avoid walkers and cyclists colliding.	The entrance to the reserve serves a dual function as a firebreak and emergency vehicle access way which would be compromised if a passive barrier is installed - no changes to the plan
58	Brian Hodkinson	Seats	More seats with shelters (or under trees) would be welcome on hot days.	This will be reviewed by the City of Stirling and a decision made as to whether or not they are appropriate. No changes have been made to the plan

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59	Brian Hodkinson	Dog faeces	Proposal of additional dog waste disposal sites are welcome.	Noted - no changes to plan
60	Brian Hodkinson	Dog Walking	Even though I walk my dog in the Reserve dogs should be banned in the interest of preserving the swamp.	Noted - no changes to plan
61	Brian Hodkinson	Feral And introduced fauna	Rainbow Lorikeets and Cats should be culled.	Plan recommends control in accordance with City policy and legislation
62	Carole Wallis	Dog walking	I am dismayed to notice that it is requested that the designated animal exercise area is to be abolished. 95% of dog walkers co-exist well with little or no trouble. I have used this area for the last 25 years and while I realise that an education program on staying on provided tracks is needed and it should not impinge on moste who keep their dogs under control and on the	Refer comment 6 above
63	Carole Wallis	Dog walking	I welcome the provision of more 'poo bins' and an education program on the importance of their use would be beneficial.	Noted - no changes to plan
64	David Pike	Hydrology	Stormwater inflow to the swamp also temporarily raises water level above the surrounding groundwater level.	Section 3.4 will be adjusted to reflect that Star Swamp is a conservation category sumpland, and provide a definition
65	David Pike	Flora survey	A one off spring flora survey will only provide a 'snapshot' of the Reserve at that time. Flora surveys should be an on-going process.	Recommendations will be adjusted to reflect regular surveys, with a suggestion of every 5 years as being a suitable frequency
66	David Pike	Quenda	There seems to be a small population of Quenda. Maybe include a suggestion to relocate Quenda into the Reserve to bring the population back to a sustainable level.	Section 3.7.1 indicates it is unknown whether or not a population of Quenda are present, and includes a recommendation to the City to explore the feasibility of translocating animals back into the reserve. The presence of predators such as foxes and cats will need to controlled to maximise the potential for successful reintroduction.
67	David Pike	Dog walking	I fully support the removal of Star Swamp as a designated dog exercise area.	Noted - no changes to plan
68	David Pike	Fire hazards and planning	The City's Planning Department needs to be flagged when development applications come in for properties adjoining bushland so that they don't approve fire hazards such as Bali style gazebos or pine fencing.	New developments will be picked up under current planning process, including the need for fire management plans that are consistent with WAPC bushfire planning guidelines; however, changes to existing properities will not necessarily be picked up, emphasising the need for ongoing liaison
69	David Pike	Firebreak	Marmion Avenue verge has a high fire fuel load (dead vegetation and dry grasses), so re-provision of the firebreak outside the Star Swamp fence line needs to be looked at fairly soon.	Section 3.9.1 will be updated to include information on maintaining firebreaks around the reserve
70	David Pike	Sand tracks	I agree with the informal sand tracks being closed in a staged process, but some solution needs to be found to stop new tracks from forming.	Section 5.2 will be updated to include some examples of closure techniques, however it is likely that there is no effective solution to preventing new tracks forming
71	David Pike	Dog faeces	Dog owners are required by law to clean up after their dogs and to carry a means of cleaning up after their dog whenever they take their dog off their own property. Unfortunately many people do not consider that this applies to areas of bushland (or school ovals). If a new bin is provided in the middle of the Reserve vandalism and emptying it would appear to be a problem?	Noted, no changes to plan, the City will determine suitable locations of bins , with current suggestion of a bin within the centre of the reserve being discussed with the City prior to its inclusion
72	David Pike	Orchid picking	Last orchid season a women was observed walking out of Star Swamp carrying two hands full of Donkey Orchids, so it is still happening. This is probably the main cause of our disappearing orchid populations. I realise that negative signage is now out of fashion, so maybe this is another issue that needs to be covered by a brochure with rates notices?	Noted, no changes to plan, general discussion included in Section 5.5.5, the City will determine suitable means of public education
73	Bernard Mclean	Section 3.5.5	Do you think it would be possible for the City of Stirling to reduce the frequency of fires? Is that something you can control?	Section 3.5.5 will be reworded as this is something that will be difficult to control

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74	Bernard Mclean	Section 3.4	I note in Section 3.4 that groundwater may have dropped 5 - 20 cm over the years and the consultant noted that this may affect groundwater dependant vegetation. However, the effect of groundwater drawdown on tuarts and banksias is not discussed in this section. It may be worth considering this, in addition to dieback surveys.	Noted, sections 3.5.5 and 3.10.4 will be updated to include the recommendation to consider declines in watertable depth on Tuarts and Banksias
75	Bernard Mclean	Figure 42	Would there be potential to name tracks after people who are historically associated with Star Swamp and those who were responsible for its initial conservation and ongoing management? Provides an opportunity to acknowledge the community and promote the Reserve through media release and function.	Refer comment 5
76	Bernard Mclean	Section 5.4.4	I agree that it's not appropriate to use natural resources to make cubbies and that this practice should be discouraged. The Rio Tinto Naturescape area at Kings Park has an excellent little area where they have created cubbies for the kids at ground level. The City should consider attracting kids to the park by designating an area where you have constructed, safe cubbies with some sort of educational or building component available for users. If one of the objectives of the plan is to attract school groups to the Henderson Environmental Centre, a feature like this may enrich the experience. The fact that they are being built anyway suggests cubbies bring the kids into the Reserve. This could be used as positive leverage to create some nature based activities.	The reserve is zoned for conservationa and education, rather than being a regional park which would include the provision for recreational activities. On this basis, cubbies of any sort are likely to be considered incompatible with the overall management aim. Note that the cubbies discussed in the plan are believed to have been constructed by teenagers and young adults for purposes other than being a fun place to play
77	Emma Friedman	Community use	The report does not include enough information about the social benefits provided by the Reserve.	Noted, Section 5 will be updated to reflect the social importance of the Reserve
78	Emma Friedman	Dog walking	I have never seen an animal chasing the ducks and I consistently hear owners calling dogs onto paths away from the bushland, often from fear of snakes. Dogs typically sniff and run around the immediate pathway.	Refer to comment 6 above on issue of dogs on/off leads.
79	Emma Friedman	Exercise	The Management Plan does not address the use of Star Swamp as an exercise area for people.	Noted, Section 5 will include information on the use of Star Swamp as an exercise area, however it will indicate that exercise activities will be consistent with the reserve being zoned for conservation and education
80	Emma Friedman	Neighbourhood watch	The Management Plan does not address neighbourhood watch. The more people that use the Reserve the safer it is. Too many restrictions will alienate the community from the bushland.	Noted - no changes to plan
81	Kim Friedman	Review	The Management Plan should be time bound (ten years with midterm review).	Noted - the timeframe is yet to be determined by the City of Stirling
82	Kim Friedman	Values	The Management Plan should articulate clearly what we value and what should be protected (ecological and social assets should be listed).	Noted, discussion on the aim of retaining the Reserve's biodiversity and other ecolgoical/environmental values will be provided in Section 1
83	Kim Friedman	Targets	The Management Plan should have targets for these assets and values.	The City of Stirling currently has an annual reporting system of various performance indicators which the management of Star Swamp, along with all the other reserves the City has responsibility for, will contribute to management. These are described in the 'Local Biodiversity Strategy' and 'Green Plan 2' documents that are available on the City's website
84	Kim Friedman	Pressures	The Management Plan should articulate what we believe threatens these assets (pressures).	Noted, section 1 will be updated to reflect this as a lead-in to the rest of the plan, we will also include a discrete section on the Local Biodiversity Plan and Green Plan 2
85	Kim Friedman	Adaptive management and reporting	The Management Plan should promote adaptive management and reporting - the measurement of condition indicators, pressure indicators and our management responses so we can show how Stirling Council staff and the general community what is going right and what is going wrong and what we are doing about it - through time- to get people on-side and assisting us reach conservation objectives.	Refer to comment 83, note that the Local Biodiversity Strategy and Greenplan 2 include information on the approach to monitoring and reporting

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86	Kim Friedman	Management Plan goals	All changes to the current management plan should be linked to the condition goals of our ecological assets and values (not randomly placed in the Management Plan - e.g. weeds removed, dogs walked on leashes and other such random orders).	Refer to comment 83
87	Kim Friedman	Management Plan reporting	The Management Plan should articulate how management performance is going to be reported and assessed e.g. 1) Internally, 2) to an external board and 3)running a mid-term and 10 year review of the Management Plan with an independent oversight.	Noted, Information will be included in Section 1, however the review interval is yet to be determined by the City
88	Denise and John Mulligan	Dogs on leash	We strongly object to the proposal that Star Swamp Bushland Reserve be designated as an area where dogs are only permitted on a leash. This would detract signifcantly from the quality of the exercise possible for ourselves and our dog without necessarily addressing the issues of owners failing to pick up dog faeces and the use of cross-country tracks, both of which can occur whether or not a dog is on a lead.	Refer to comment 6 above on issue of dogs on/off leads.
89	Denise and John Mulligan	Dogs on leash	The danger to local fauna from unrestrained dogs - in all our years of walking our dogs at Star Swamp, we have never seen any evidence of such incidents occurring with the owners present. We would suggest the greater risk is associated with foxes and cats.	Refer to comment 6 above on issue of dogs on/off leads.
90	Denise and John Mulligan	Education program	An education program is supported on the need to pick up after dogs and not using cross-country tracks, as most park users would do whatever it takes to preserve its natural beauty and our ability to enjoy it.	Noted, no changes to plan