

City of Stirling

Star Swamp Bushland Reserve

**Environmental
Management Plan**



November 2012

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City of Stirling

Star Swamp Bushland Reserve Environmental Management Plan

November 2012

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Executive Summary

Star Swamp Bushland Reserve is a 95.79 ha A-class reserve located within the City of Stirling within the suburbs of Watermans Bay and North Beach. The Reserve was gazetted in 1987 due to 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 or better 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

For convenience, recommendations provided in the various sections of the management plan are summarised below.

3.4 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,
- that the outcomes of the sampling program be recorded in a suitable database that will enable trending of data over time, as well as other data analysis activities that may be required.

3.4.1 Drainage

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

- the use of sediment traps be investigated,
- 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.

3.5.4 Vegetation Condition

It is recommended that:

- the proposed flora survey planned for spring 2012 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,
- information about the negative impacts of picking wildflowers or damaging native flora species is provided to the community, and
- the City of Stirling continue to monitor the vigour and health of trees and other flora species within Star Swamp Bushland Reserve, undertaking investigations for *Phytophthora* dieback or other microbiological agents if the extent of decline increases.

3.5.5 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.

3.6 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.

3.7.1 Mammals

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

3.7.6 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.

3.8 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.

3.8.4 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.

3.8.5 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.

3.9 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.

4.1 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.

4.2.1 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'.

5.1 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.

5.2 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.

5.3 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.

5.4.1 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.

5.4.2 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 a more appropriate manner.

5.4.3 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.

5.4.4 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.

5.4.6 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.

5.4.7 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.

6.2.1 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.

6.3 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,

- employing one or more personnel specifically to manage the Centre and be available to the public in a similar manner to other environmental centres within the Perth metropolitan area,
- 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.

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- 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 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).

The City of Stirling commissioned Natural Area Consulting to update the 1987 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.

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
- gain 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 importance 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 the 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 (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

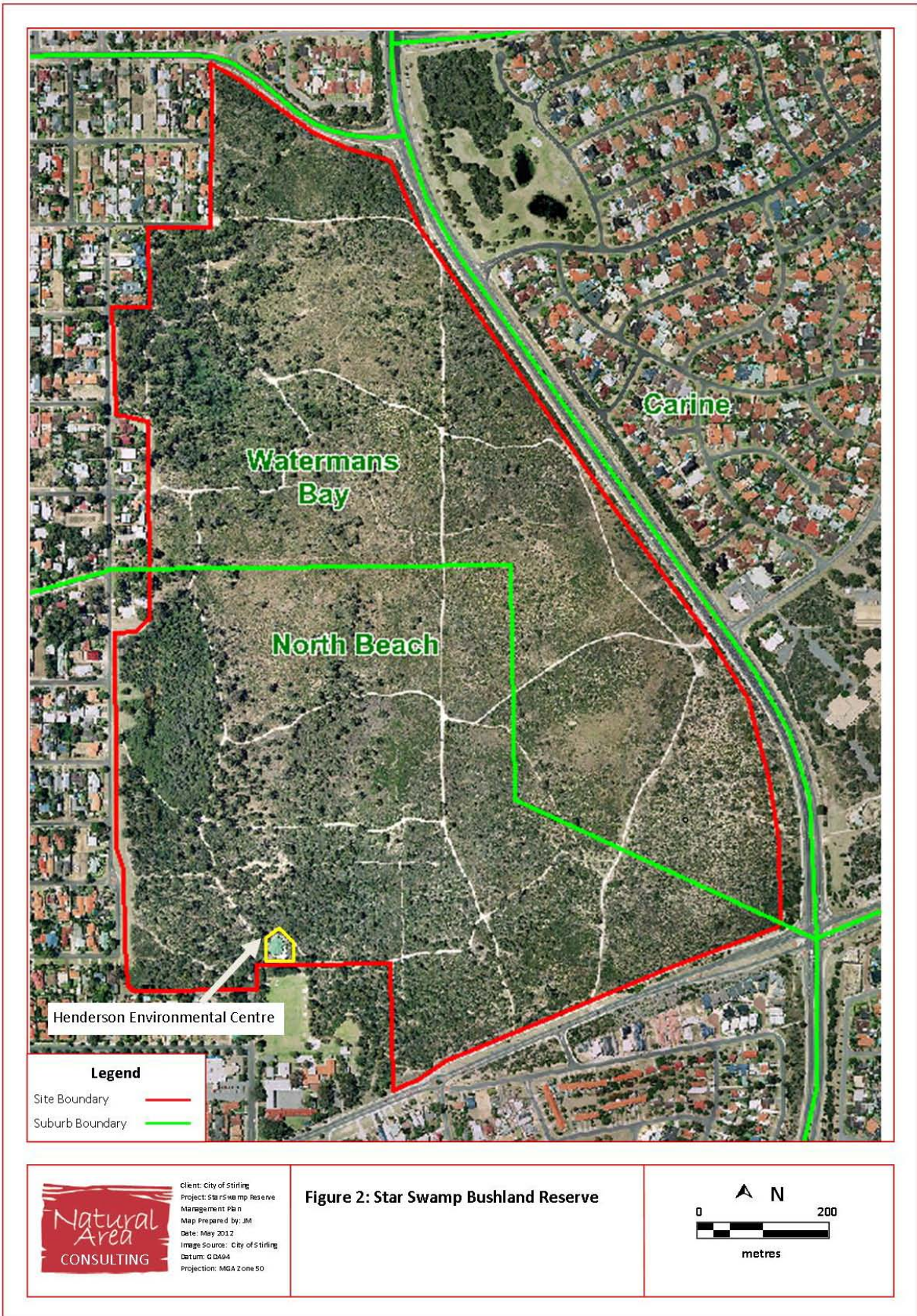
Activity	Method
	available sources, particularly the Perth Groundwater Atlas (Department of Environment, 2004).
Disturbances	Evidence of disturbances and threatening processes were observed during field work and mapped using GPS. Disturbances noted included feral animals, tracks and wastes.
Signage	The 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.

DRAFT





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 °C in winter to 33.4 °C in summer, with the highest recorded maximum being 46.7 °C,
- average minimum temperatures range from 8.2 °C in winter to 17.6 °C in summer, with the lowest recorded minimum being -1.3 °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.



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.

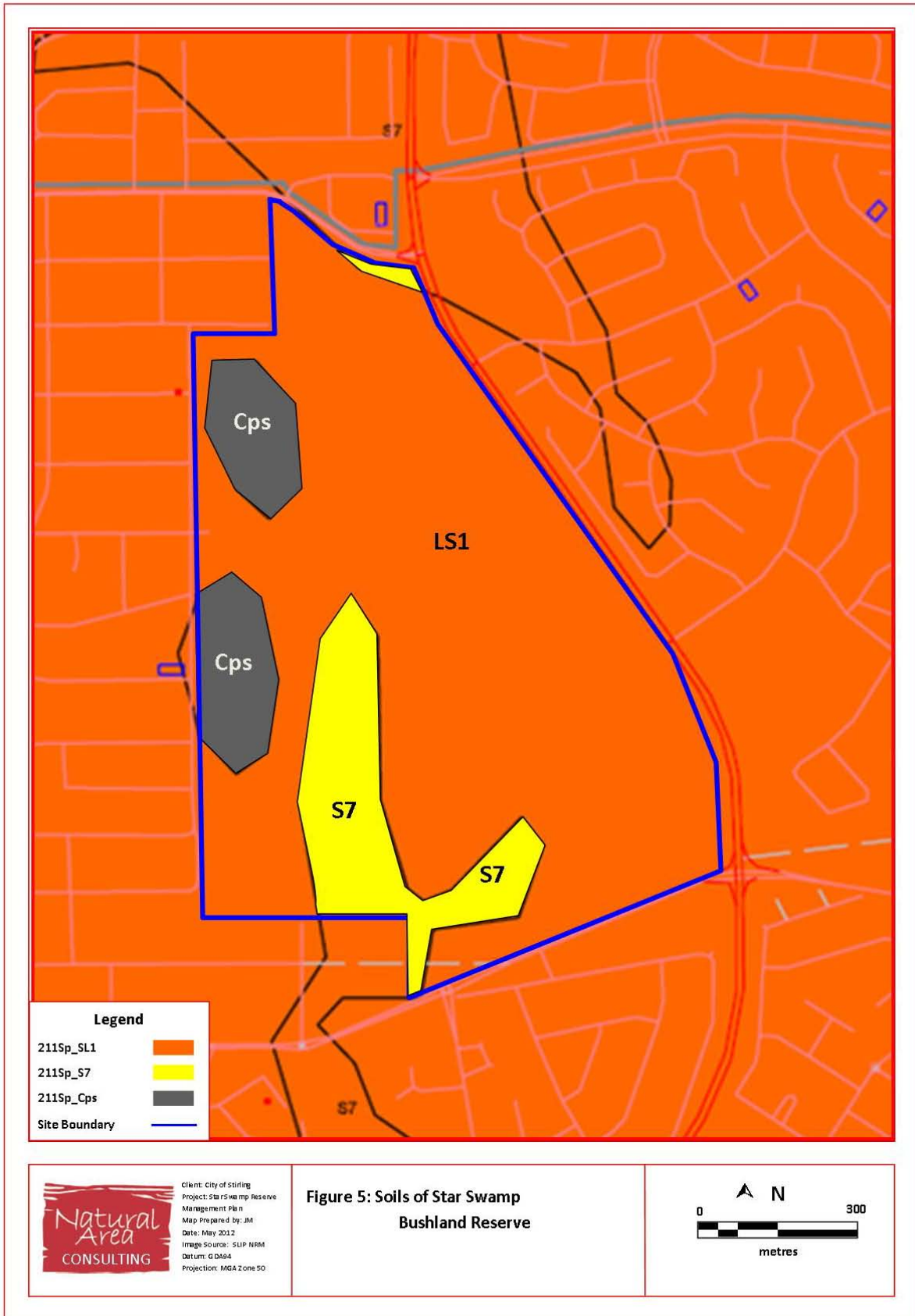
Table 2: Soil Types – Star Swamp Bushland Reserve

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).





3.4 Hydrology

The hydrology of Star Swamp is dominated by the unconfined aquifer known as the Gnangara Mound. 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.

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 a 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.

A water quality monitoring and sampling program has been implemented 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 the following:

- 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 St 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.



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 that occurs 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 during spring 2012. 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.

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 appears 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 (PEC) (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 report 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.

Melaleuca Woodland (Mel)

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



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: 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: 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: 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: 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: *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*. 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. 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.



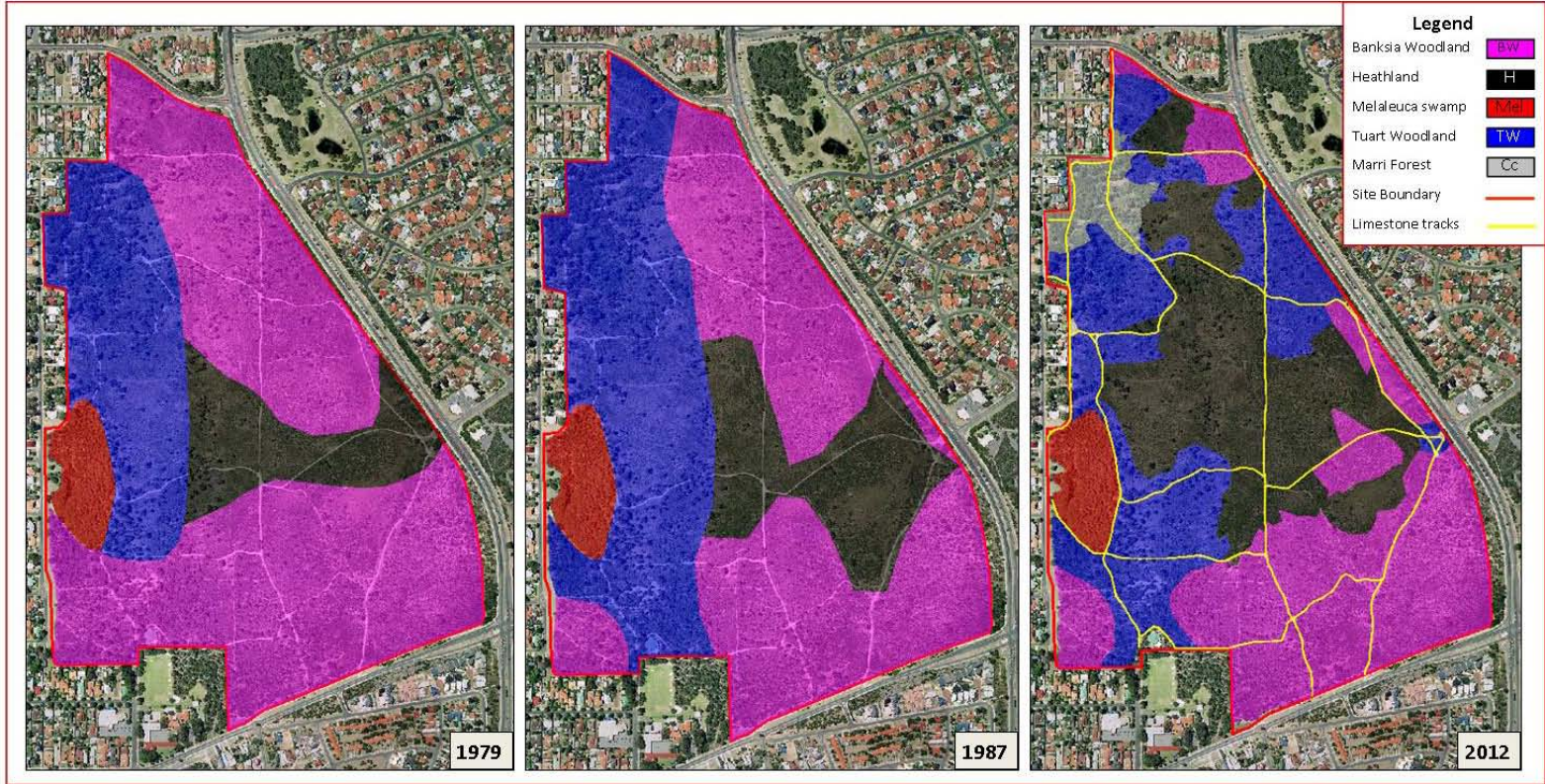
Figure 16: *Banksia prionotes* Heath and *Banksia prionotes* in flower.

***Banksia sessilis* Heath (Bs)**

Areas dominated by *Banksia sessilis*, often associated with limestone at or close to the surface. 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



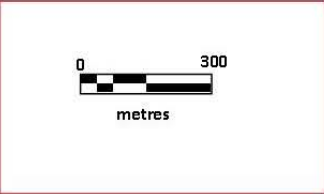
Natural Area CONSULTING

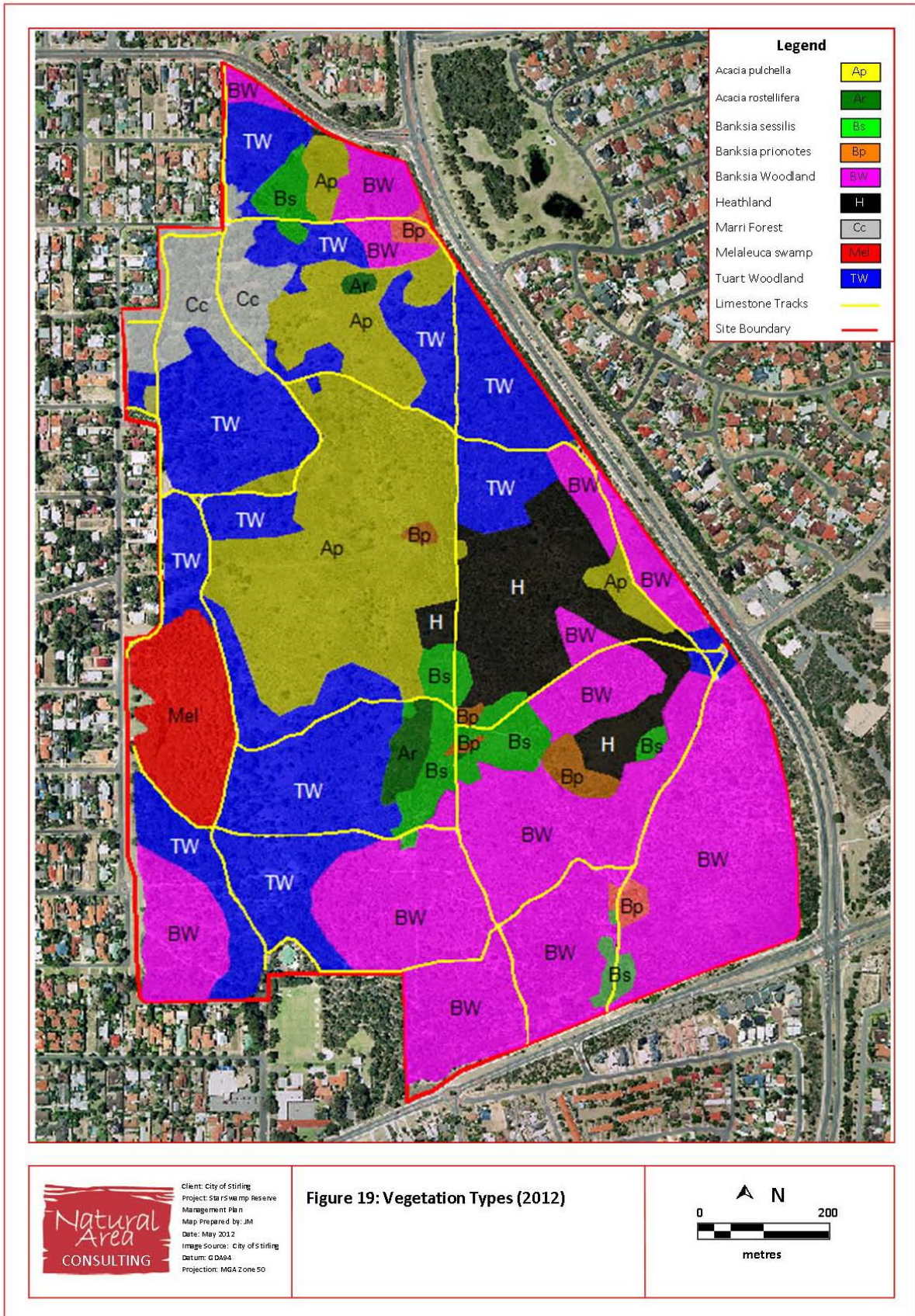
Figure 18:
Vegetation Types
(Historical comparison)

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





3.5.4 Vegetation Condition

The 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 19). The area of each category is summarised in Table 3. 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.

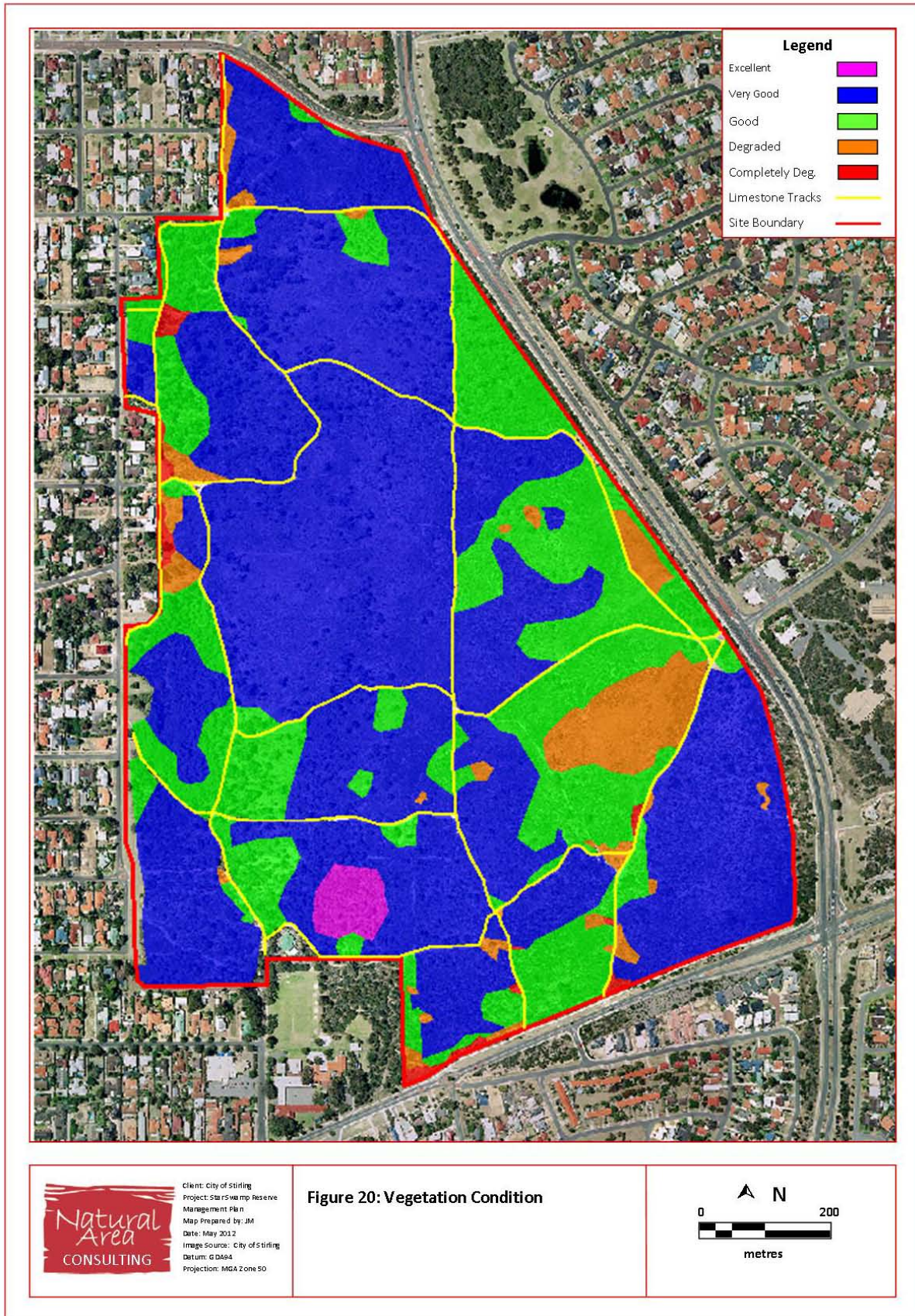
Table 3: Vegetation Condition by Area

	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.

Part of Star Swamp was only rated as Good due to the high level of weeds seen in the area. 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.



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 and reduced to allow trees to recover and mature.

A small area of dead trees radiating from around the Elvire St access was observed during a site visit in April 2012. Dead trees including Banksia and Allocasuarina species were also noted adjacent to Ada St sump (Figure 21).

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 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 St 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, such as 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
- increase fire fuel loads at a given location.

Thus, 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). 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 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.



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
<i>Asparagus asparagoides</i>	Bridal Creeper	Yes
<i>Babiana angustifolia</i>	Baboon Flower	Yes
<i>Brassica species</i>	Wild Turnip, Wild Radish	No
<i>Carpobrotus edulis</i>	Pigface	No
<i>Chamelaucium uncinatum</i>	Geraldton Wax	No
<i>Chasmanthe floribunda</i>	African Cornflag	Yes
<i>Cortaderia selloana</i>	Pampas Grass	No

Species Name	Common Name	Mapped
<i>Cyanella hyacinthoides</i>	Lady's Hand	No
<i>Ehrharta calycina</i>	Perennial Veldt	No
<i>Ehrharta longiflora</i>	Annual Veldt	No
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	Yes
<i>Ferraria crispa</i>	Black Flag	Yes
<i>Freesia leichtlinii x alba</i>	Freesias	Yes
<i>Fumaria capreolata</i>	Fumaria	Yes
<i>Gazania linearis</i>	Gazania	No
<i>Gladiolus caryophyllaceus</i>	Pink Gladiolus	No
<i>Lachenalia reflexa</i>	Yellow Soldiers	Yes
<i>Lupinus cosentinii</i>	Lupins	Yes
<i>Oxalis pes-caprae</i>	Soursob	Yes
<i>Pelargonium capitatum</i>	Pelargonium	No
<i>Pennisetum clandestinum</i>	Kikuyu	No
<i>Pennisetum setaceum</i>	Fountain Grass	No
<i>Schinus terebinthifolia</i>	Japanese Pepper Tree	No
<i>Solanum nigrum</i>	Nightshade	No
<i>Stenotaphrum secundatum</i>	Buffalo Grass	No
<i>Trachyandra divaricata</i>	Trachyandra	No
<i>Tripteris clandestina</i>	Stinking Roger	No
<i>Typha orientalis</i>	Typha	No

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.

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.



Figure 23: Lupins (*Lupinus cosentinii*)

Source: City of Stirling

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. Examples of weed distribution and density rating methods include the following:

- weed distribution is determined according to the amount of weeds in a nominated area, using the following descriptors:
 - Occasional: <5%
 - Common: 5 - 25%
 - Abundant: >25%
- weed density is determined according to the amount of weeds in a nominated area, using the following descriptors:
 - High: 70 – 100%
 - Medium: 30 – 70%
 - Low: 10 – 30%
 - Very low: < 10%

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.

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 in road verges surrounding Star Swamp Reserve, and which could provide a source of seed and thus continuing 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.

3.6.1 Weed Treatment Strategy

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 programme on an ongoing basis. The programme should also consider the established control methods available from resources such as *Bushland Weeds* (Brown & Brooks, 2002), *Southern Weeds* (Moore and Wheeler), 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 programme 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.

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 (*Isodon 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.

The Reserve is frequented by insectivorous microbats (*Microchiroptera*) with the numerous hollows throughout the Reserve providing habitat for roosting. The most likely species to occur are the White-striped Mastiff Bat (*Tadorida australis*) and the Gould's Wattleed 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 Bluetongue Lizard (*Tiliqua occipitalis*) was observed during site assessment activities (Figure 26). This large species of skink 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 (*Pagana minor*). The Long-necked Turtle (*Chelodina oblonga*) is found within Star Swamp.



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

Of these species, the Skinks are the most common, with species are found in Star Swamp Bushland Reserve 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) and Jan's Banded Snake (*Simoselaps bertholdi*) 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). The Western Tiger Snake (*Notechis scutatus*) is no longer found in the Reserve (Pike, 2012, personal communication).



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 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, European Fox, feral Honey Bees 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).

Continued control of Rabbit populations within Star Swamp Bushland Reserve is recommended. Removal 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 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 competition 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 programme 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 around 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.

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.

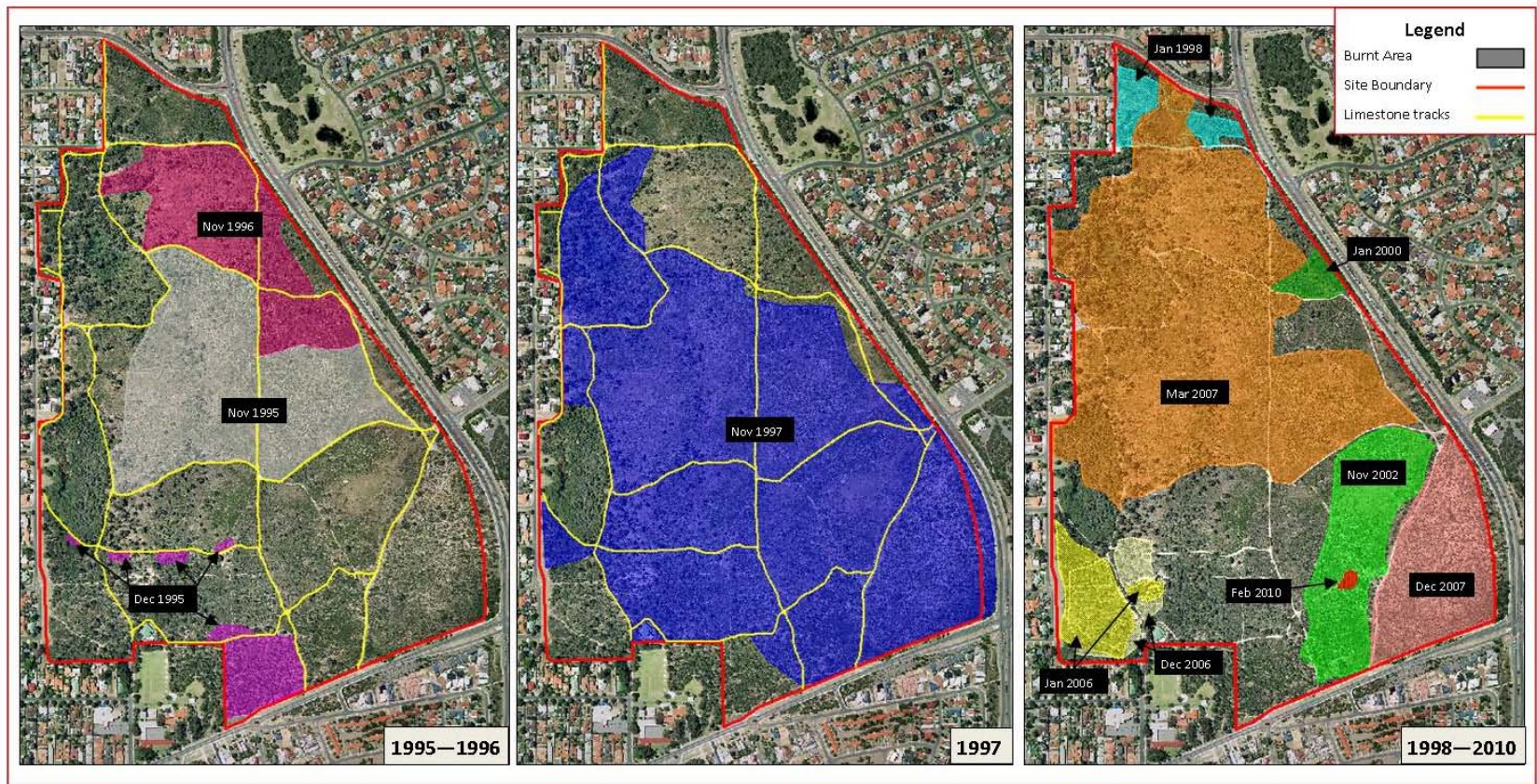
Due to the conservation values present within the Reserve, it is recommended that the City of Stirling designate Star Swamp Bushland Reserve an area where dogs are only permitted if they are on a leash. It is recognised that this change is unlikely to be viewed favourably by some sectors of the community, so an education process is recommended to provide dog owners with information about the change 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 a pamphlet with the relevant information and 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 this information 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, they also represent 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. 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.



	<p>Figure 33: Fire History (1995 to 2010)</p>	<p>Natural Area Consulting 99C Lord St, Whiteman, WA, 6068 naturalareaconsulting.com.au 08 9209 2767</p>	<p>↑ N</p>	<p>Client: City of Stirling Created by: JM Date: June 2012 Image Source: City of Stirling Datum: GDA94 Projection: MGA Zone 50</p>	<p>0 300 metres</p>
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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.

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 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 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) would be a useful resource for those living in close proximity to bushland areas (Figure 34).

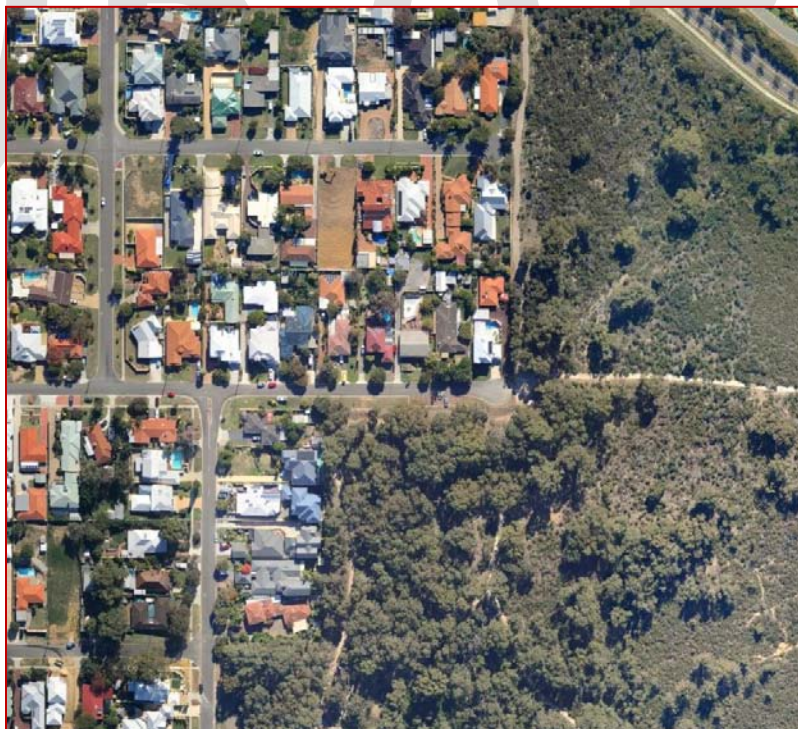


Figure 34: Vegetation Close to Housing in the NW of the Reserve
(Source: Nearthmap, 2012)

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 FESA.

3.10 Natural Environment – Summary of Recommendations

3.10.1 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,
- that the outcomes of the sampling program be recorded in a suitable database that will enable trending of data over time, as well as other data analysis activities that may be required.

3.10.2 Drainage

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

- that sediment traps continue to be used and regularly 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.

3.10.3 Flora

It is recommended that:

- the proposed flora survey planned for spring 2012 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,
- information about the negative impacts of picking wildflowers or damaging native flora species is provided to the community, and
- the City of Stirling continue to monitor the vigour and health of trees and other flora species within Star Swamp Bushland Reserve, undertaking investigations for *Phytophthora* dieback or other microbiological agents if the extent of decline increases.

3.10.4 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.

3.10.5 Weeds

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.

3.10.6 Fauna

It is recommended that:

- a current baseline vertebrate 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,
- the survey should also target the vegetated areas around the swamp that Quenda are likely to favour, and
- if no Quenda are found during surveys, the feasibility of translocating Quenda back into the Reserve should be investigated.

3.10.7 Introduced and Feral 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.

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.

3.10.8 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.

3.10.9 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.

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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). Heritage and ethnographic surveys undertaken by 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 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 5 summarises 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
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 St is the only known remnant of this land use

Timing	Event(s)
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 ended 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 10 th 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 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, 1987¹; City of Stirling, undated²; Friends of Star Swamp Bushland, 2012³; Government Gazette of Western Australia, 1987⁴; Heritage Council of Western Australia, 1999⁵)

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

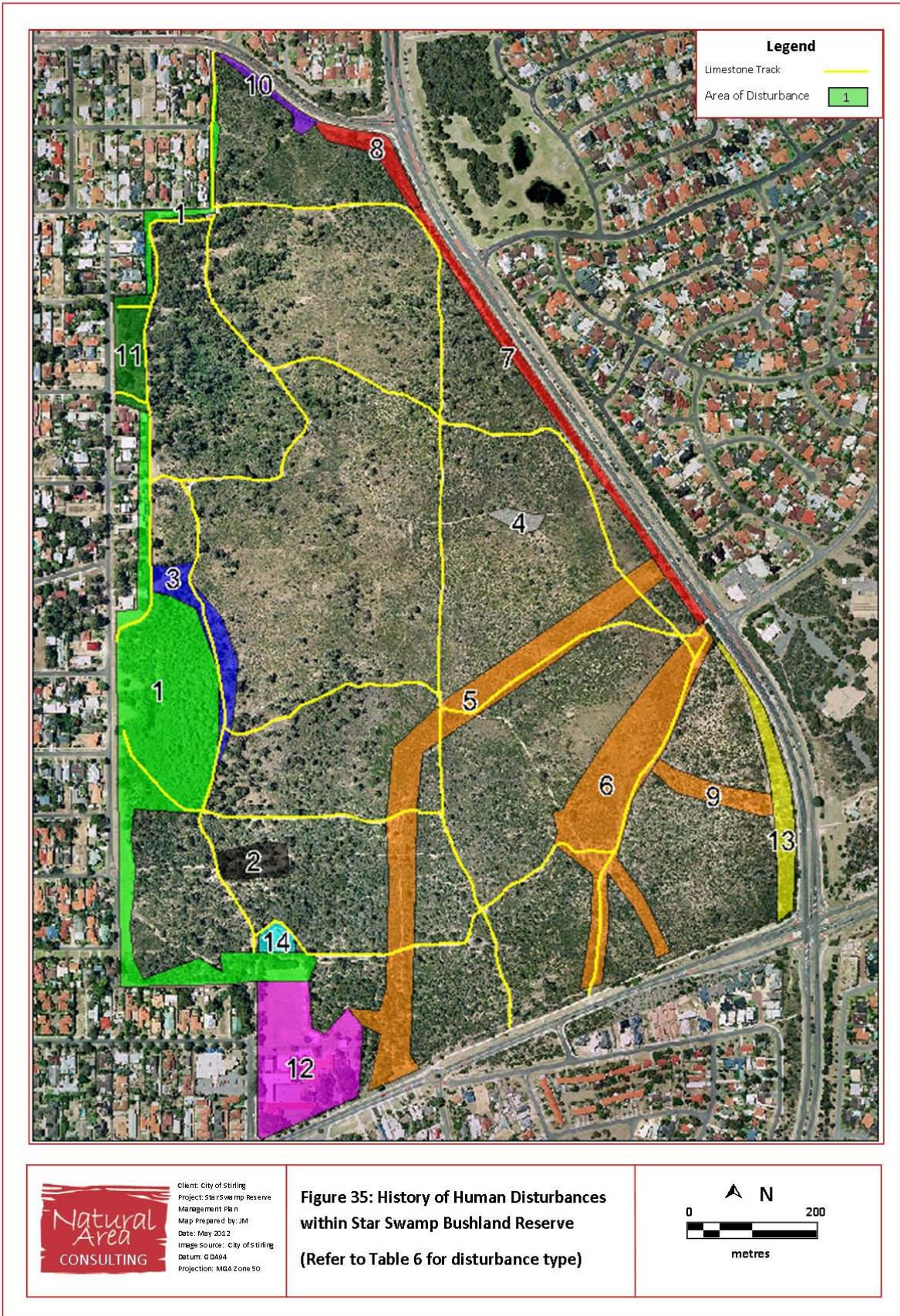
Location	Timing	Event(s)
1	Prior to 1948	Timber cutting, use of swamp as watering place for stock and vegetable cultivation
2	1930's to 1945	Cleared for burying of night soil and other rubbish
3	Prior to 1948	Overgrazing and clearing at swamp
4	1968	Motocross track on previously disturbed site
5	1970	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

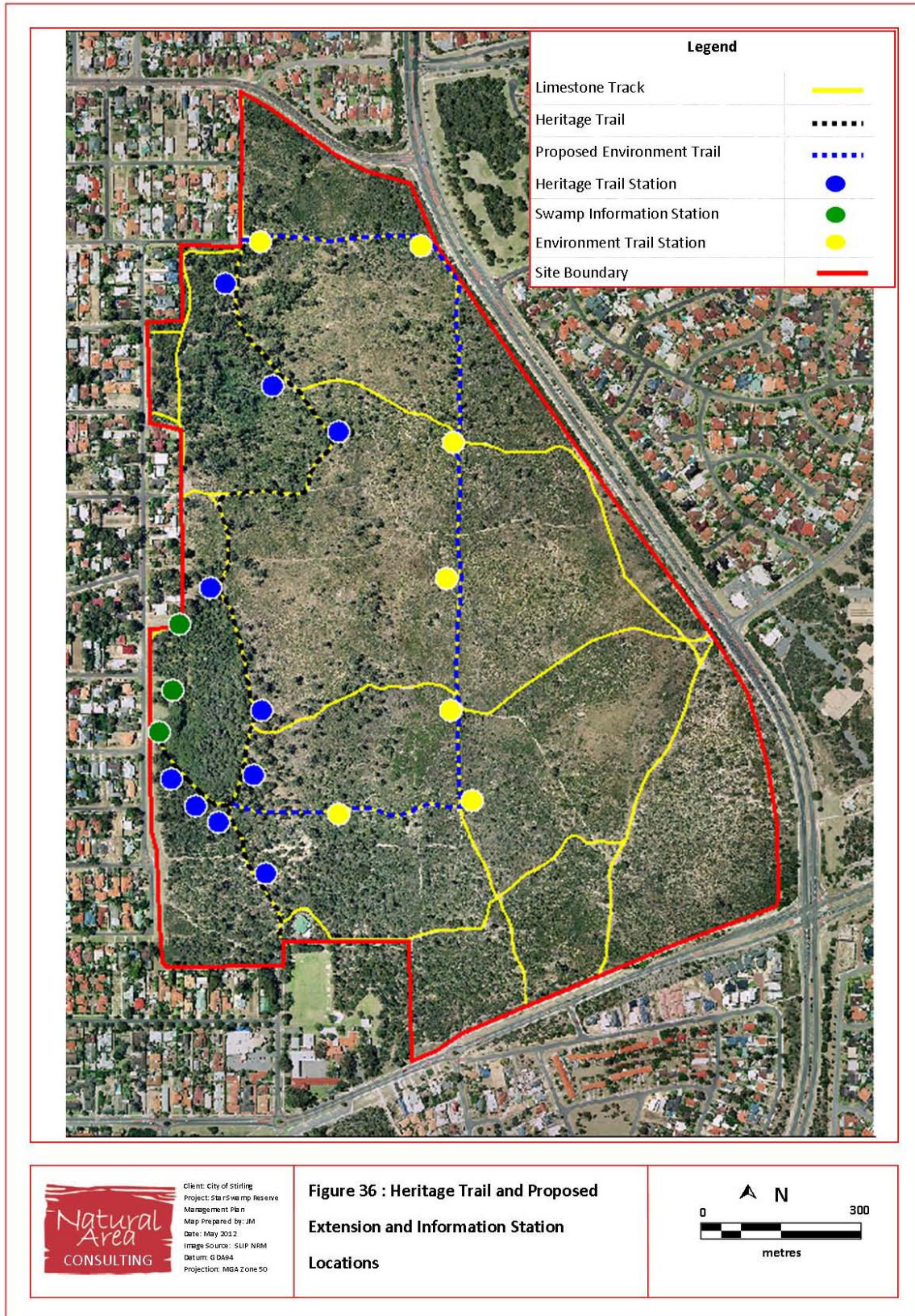
Source: Piggot, 1994

4.2.1. Cultural Heritage Trail

A cultural heritage trail was set up 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 St, 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.





4.3 Cultural Heritage Recommendations – Summary

4.3.1 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.

4.3.2 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).

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5.0 Managing Recreation

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, 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 survey activities 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.

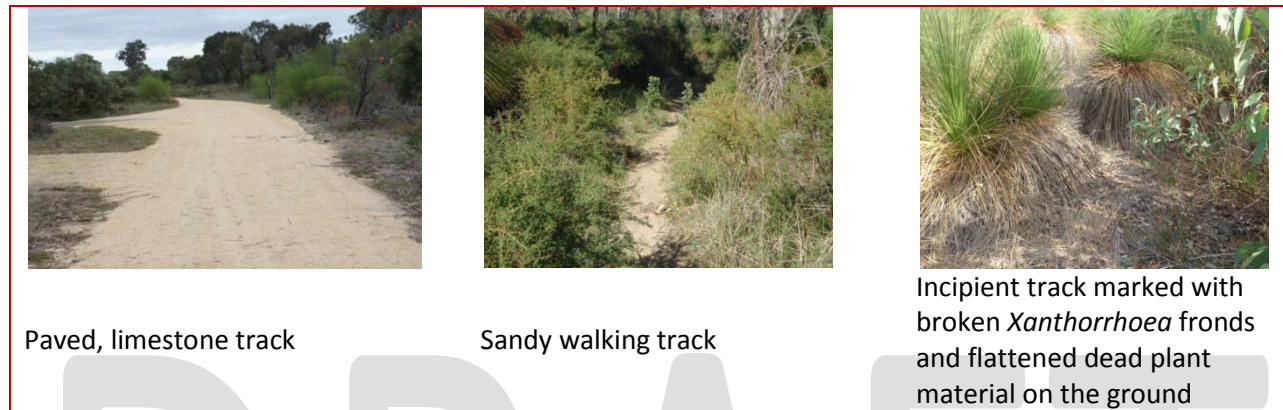
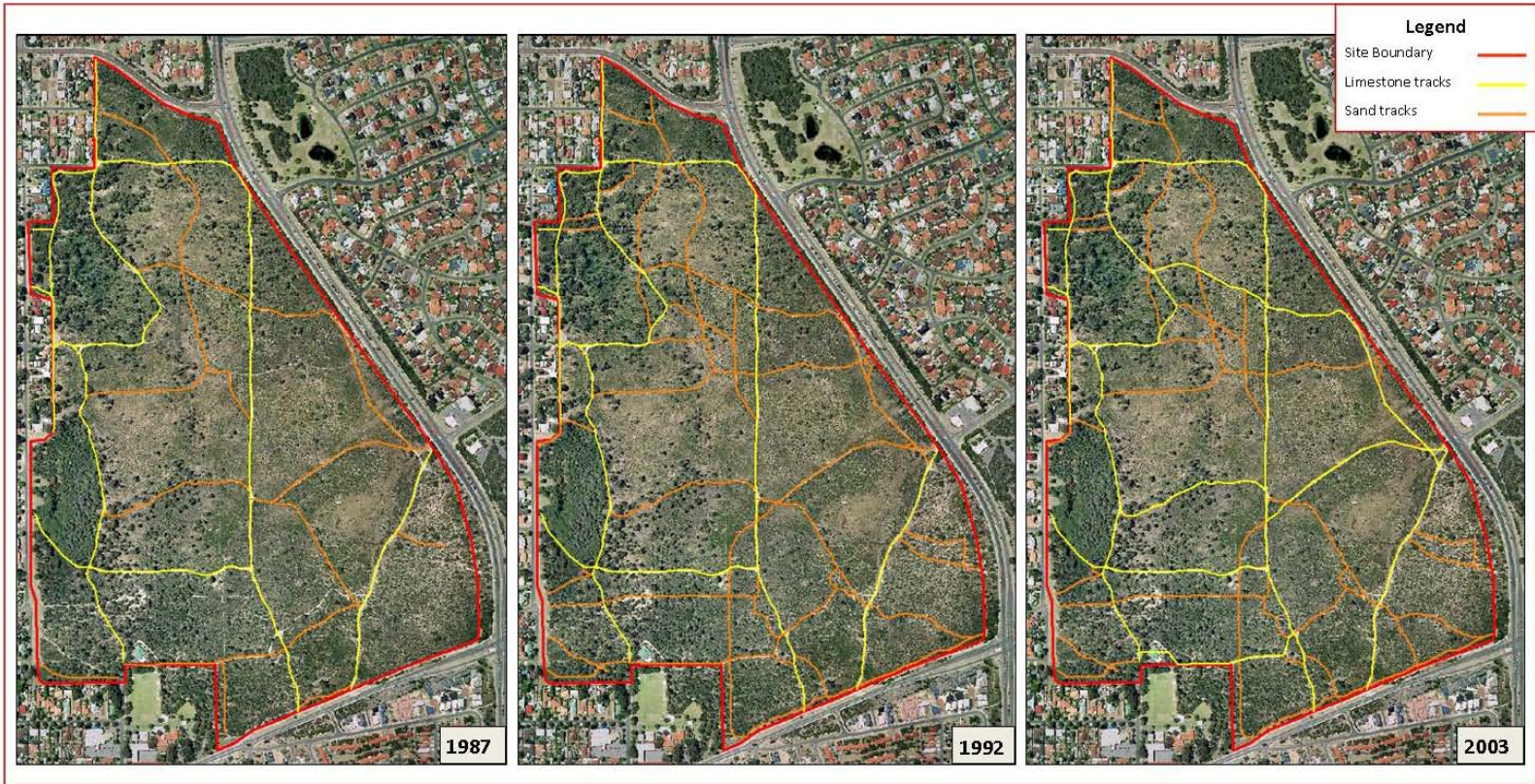


Figure 38: Track Types within Star Swamp Bushland Reserve

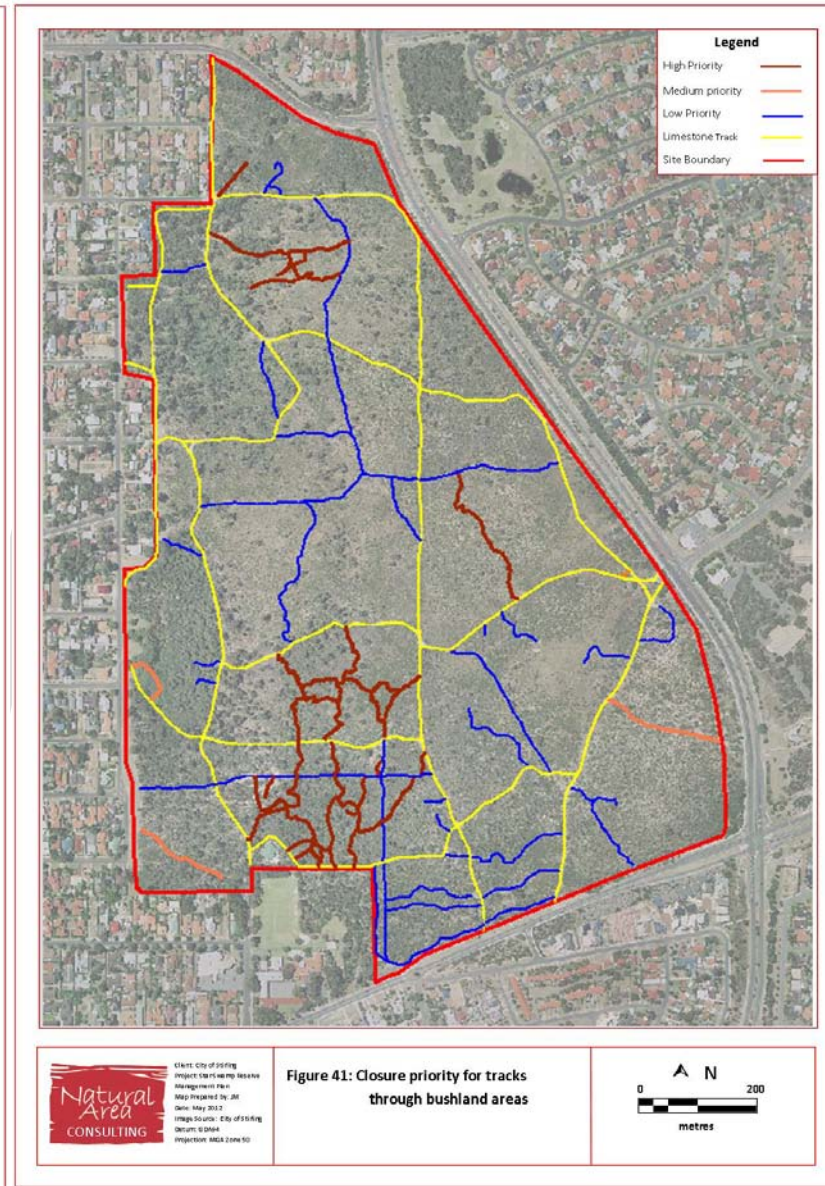
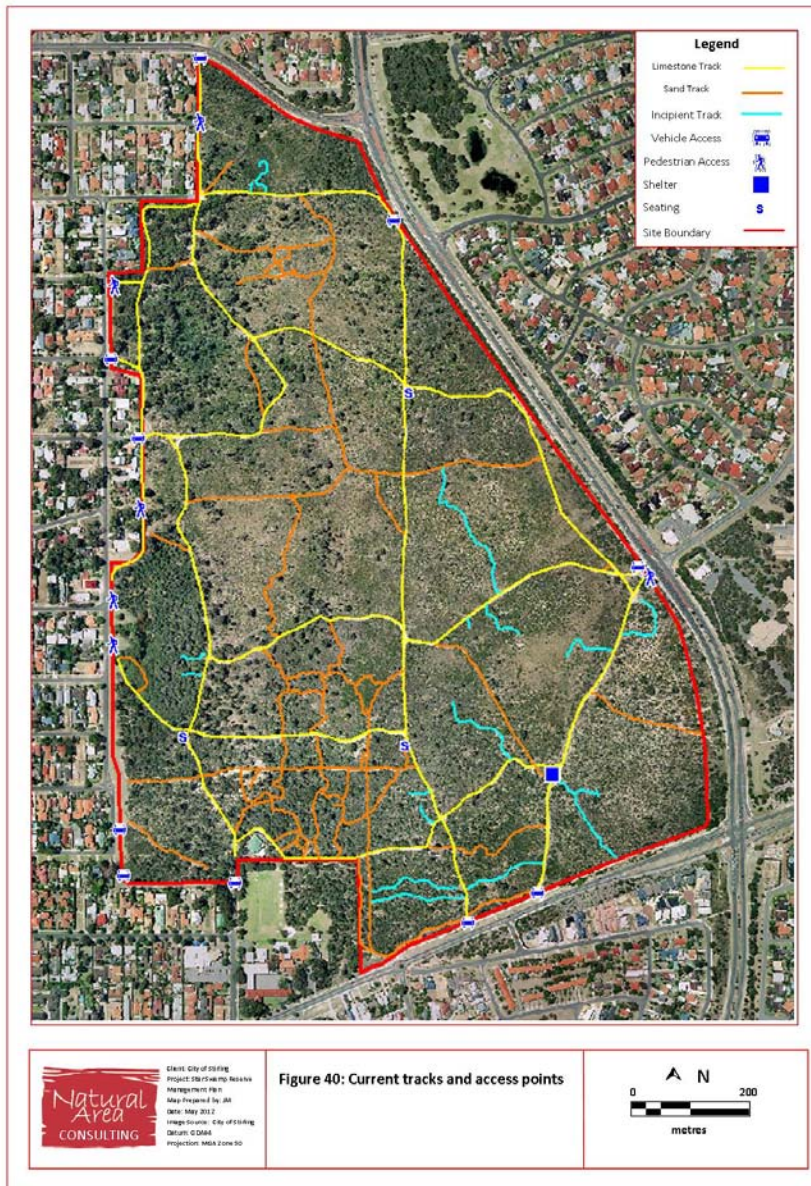
The extent of tracks within the Reserve has changed over time, with some of the initial sandy tracks being progressively paved with crushed limestone to facilitate vehicle movement for maintenance and fire response activities (Figure 39). The current extent of tracks identified during site assessment 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.

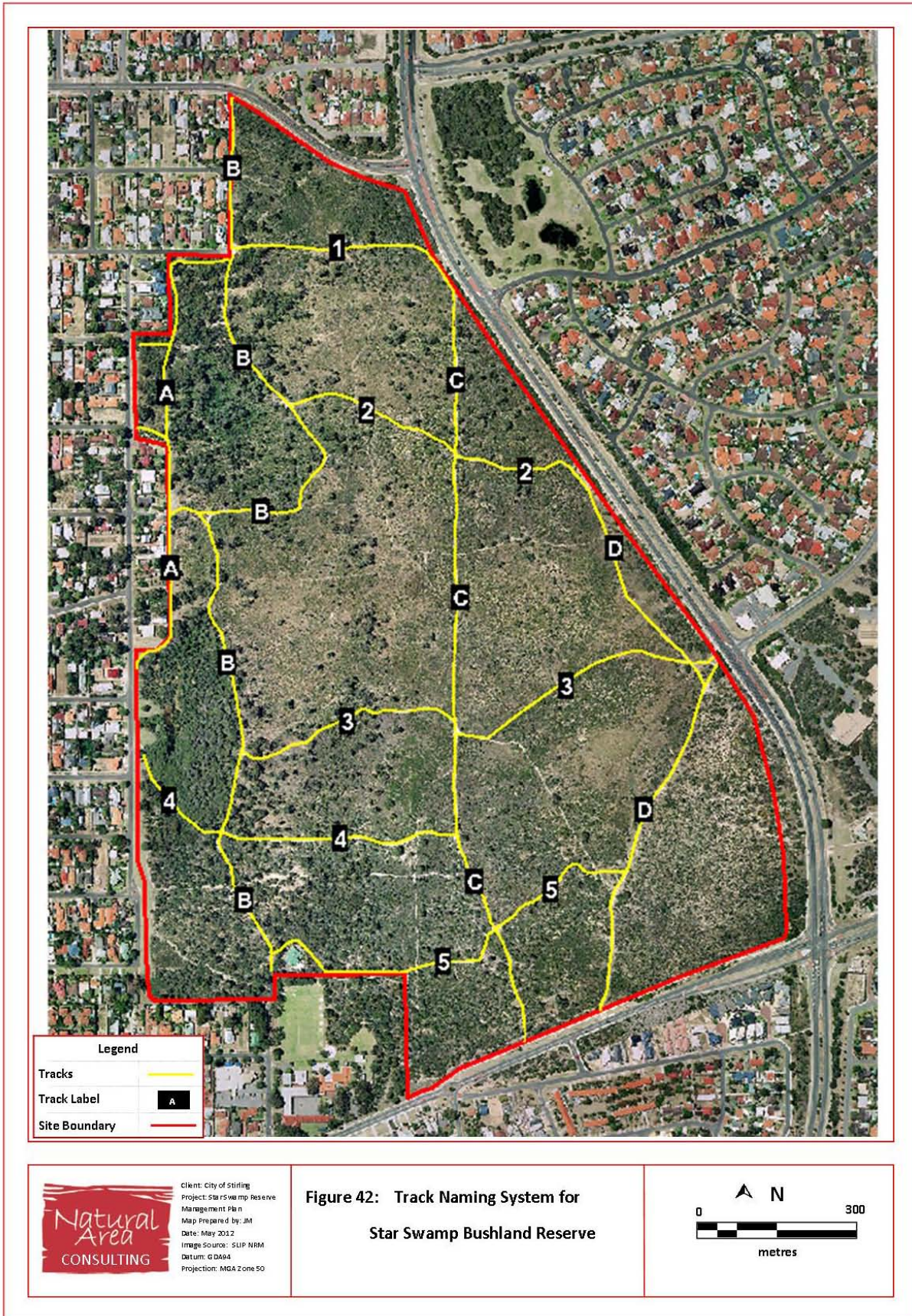
Some sandy tracks have fallen into disuse as vegetation regrew in those areas while in other locations there are signs that new tracks are being established and that some of the older tracks that have been allowed to overgrow and regenerate are beginning to be reused. At a few tracks in particular, fronds 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 signs of sandy track usage include mountain bike users and BMX bikes.

When considering the current extent of tracks within the Reserve, it is recommended that some are blocked off and either allowed to regenerate or rehabilitated to discourage continued use. 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.



	<p>Figure 39: Changes to tracks (1987 to 2003)</p>	<p>Natural Area Consulting 99C Lord St, Whiteman, WA, 6068 naturalareaconsulting.com.au 08 9209 2767</p>		<p>Client: City of Stirling Created by: JM Date: June 2012 Image Source: City of Stirling Datum: GDA94 Projection: MGA Zone 50</p>	
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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.

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 at locations where there is none and where appropriate, provide information on those where it is absent.



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 let people know 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 some form of 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:

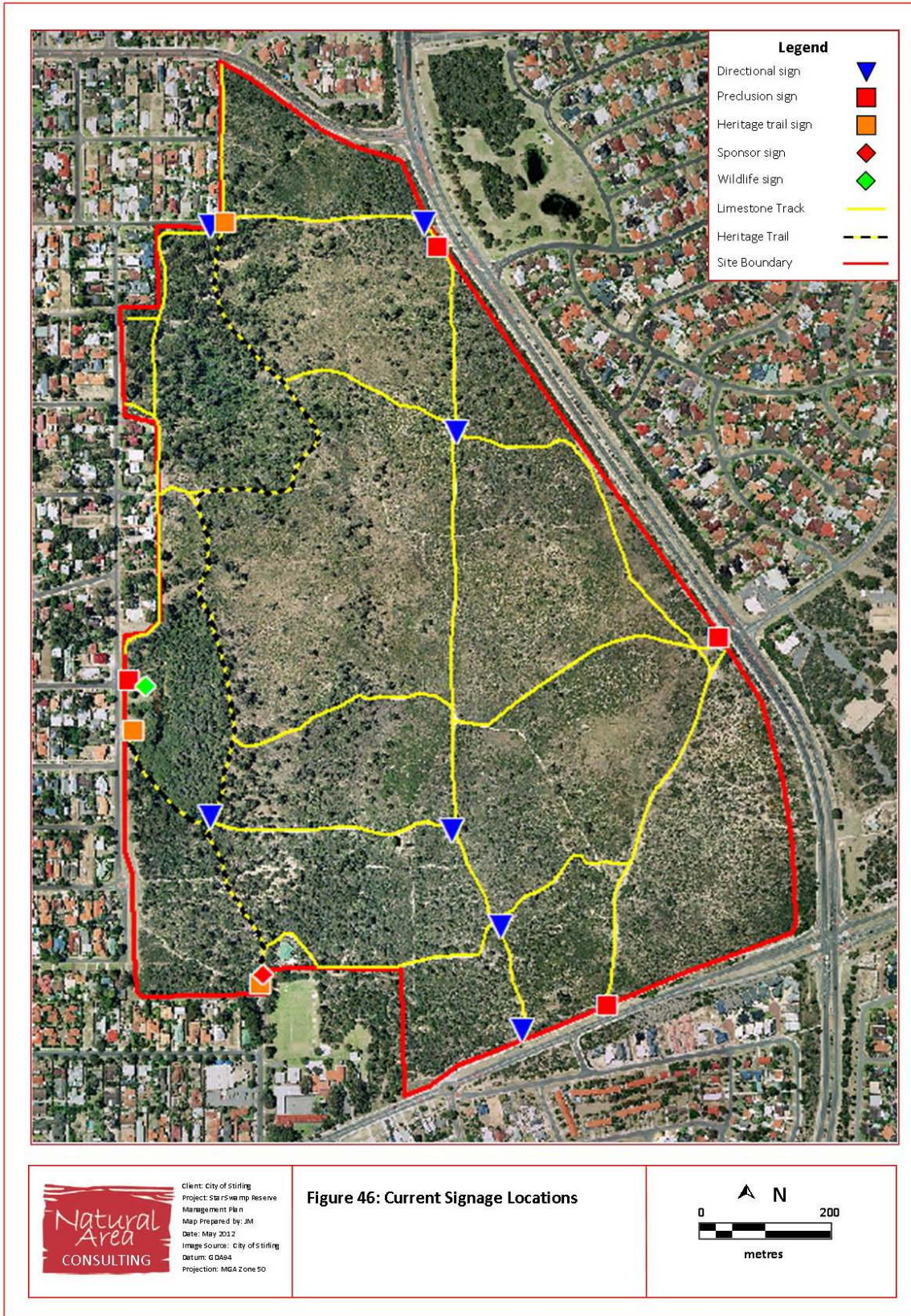
- existing signs are checked regularly for graffiti and vandalism, and cleaned and/or repaired as appropriate in a timely manner,
- in the short term, the City of Stirling consider the signage at Star Swamp Bushland Reserve and decide on a form that is in keeping with the signage style guide that will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

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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 owners, 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.

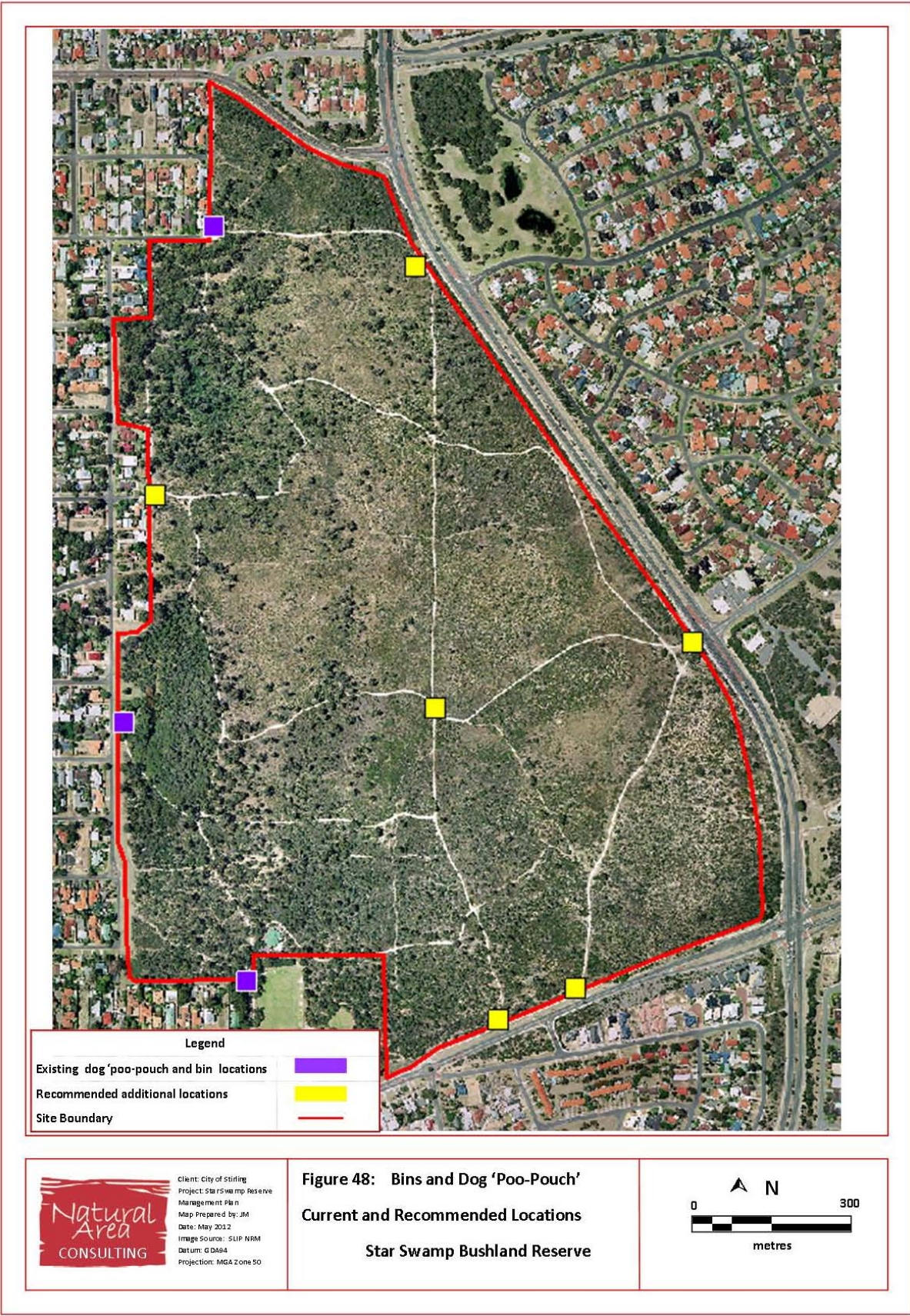
Despite the provision of ‘poo-pouches’ at three of the reserve entrances, there are those dog owners that neglect to pick up after their dogs, with faeces often noticeable left lying on and nearby the walk trails. This practice is not only unsightly and reduces visual amenity, it is also unpleasant for 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 that informs residents of 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.



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: A '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 others 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.

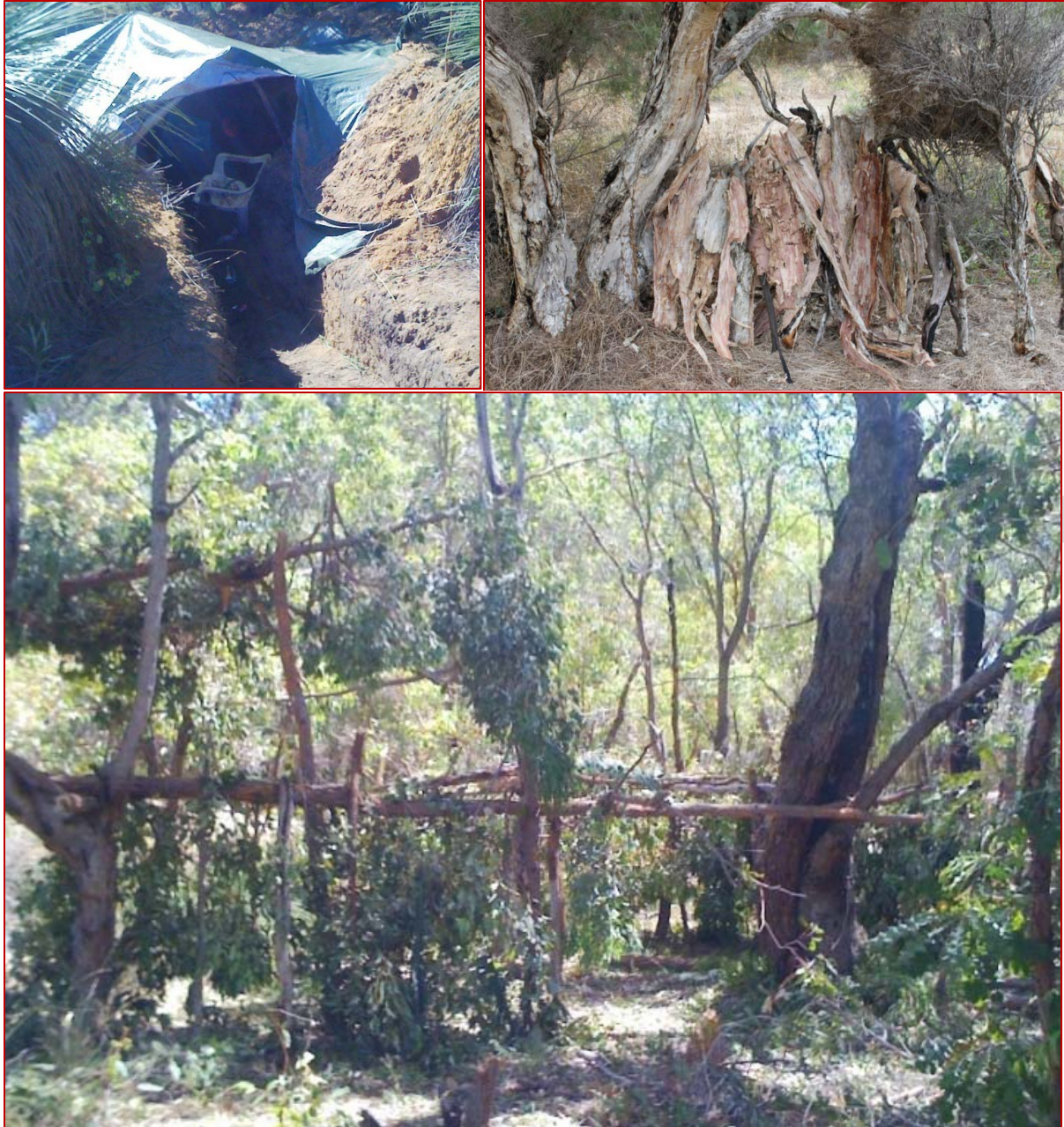


Figure 50: Examples of cubbies constructed in Star Swamp Bushland Reserve
Sources: City of Stirling (upper left, bottom), Natural Area Consulting (upper right)

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.



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, possibly due to the dryness of the soil. 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

5.5.1 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.

5.5.2 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.

5.5.3 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.

5.5.4 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 are required 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.

5.5.5 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 a more appropriate manner.

5.5.3 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.

5.5.4 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.

5.5.5 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.

5.5.6 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.

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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 xxx.

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 to be a place for the environmental education of primary school children. The centre contains a small function room (hall), some smaller meeting rooms and a small laboratory, and some shaded outdoor areas. 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.

At present, the centre is used by on 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, and
- Northern Suburbs branch of the Western Australian Naturalist Club.



Entry to the Centre



Inside the centre

Figure 52: Henderson Environmental Centre

The City of Stirling (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.

Activities that are consistent with those aims include:

- 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,
- employing one or more personnel specifically to manage the Centre and be available to the public in a similar manner to other environmental centres within the Perth metropolitan area,
- 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.

6.4 Community Involvement – Summary of Recommendations

6.4.1 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.

6.4.2 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,
- employing one or more personnel specifically to manage the Centre and be available to the public in a similar manner to other environmental centres within the Perth metropolitan area,
- 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.

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.

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Management Category	Objectives	Standard (if applicable)	Management Action	Priority	Measurement Criteria
Water Quality Monitoring (Section 3.4)	<ul style="list-style-type: none"> Relate water quality data to environmental conditions at the time of sampling 	<ul style="list-style-type: none"> ANZECC Fresh and Marine Water Quality Guidelines (2000) 	<ul style="list-style-type: none"> Record environmental conditions such as rainfall, temperature and wind at the time of sampling 	<ul style="list-style-type: none"> High, ongoing 	<ul style="list-style-type: none"> Preparation of field recording sheets Recording of data in City database
Stormwater management (Section 3.4.1)	<ul style="list-style-type: none"> Minimise pollution and sediment from stormwater in Star Swamp and the broader Bushland Reserve 	<ul style="list-style-type: none"> ANZECC Fresh and Marine Water Quality Guidelines (2000) 	<ul style="list-style-type: none"> The use of sediment traps continues and regular maintenance occurs 	<ul style="list-style-type: none"> Short – medium term 	<ul style="list-style-type: none"> Maintenance records are kept
			<ul style="list-style-type: none"> Maintaining sumps to ensure adequate stormwater detention time 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Water quality within sumps and Star Swamp Maintenance records
			<ul style="list-style-type: none"> Culverts and stormwater inflow areas are designed and maintained to ensure that erosion is kept to a minimum 	<ul style="list-style-type: none"> As required 	<ul style="list-style-type: none"> Documented design process Maintenance records Water quality records
Flora and vegetation	<ul style="list-style-type: none"> Update information about current flora species present 	<ul style="list-style-type: none"> EPA Guideline Statement 51 – Terrestrial Flora and Vegetation Surveys 	<ul style="list-style-type: none"> Undertake a comprehensive flora and vegetation survey at Star Swamp Bushland Reserve 	<ul style="list-style-type: none"> High priority 	<ul style="list-style-type: none"> Recording of species present Incorporation of data into City records and documents
Tree health decline (Section 3.5.5)	<ul style="list-style-type: none"> Minimise the decline of trees and other vegetation with Star Swamp Bushland 	<ul style="list-style-type: none"> Bush Forever and Conservation values 	<ul style="list-style-type: none"> Undertake regular health monitoring of vegetation during regular management and maintenance activities within the Reserve 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Vegetation condition assessment comparisons Variation over time
			<ul style="list-style-type: none"> Increase the frequency of Dieback evaluation within in the reserve (e.g.: every three years) 	<ul style="list-style-type: none"> High priority 	<ul style="list-style-type: none"> Consultant reports Comparison with previous outcomes
Weed mapping (Section 3.6)	<ul style="list-style-type: none"> Enhance weed management activities 	<ul style="list-style-type: none"> Agricultural and Related Resources Protection Act 1976 (WA) Weeds of National Significance DEC Weed Prioritisation Process 2010 	<ul style="list-style-type: none"> Include details of weed density ratings when carrying out weed mapping activities 	<ul style="list-style-type: none"> High priority, ongoing 	<ul style="list-style-type: none"> Recording of weed density ratings with other weed mapping activities Evaluation of weed control activities over time
Bridal creeper rust and leaf hoppers (Section 3.6)	<ul style="list-style-type: none"> Utilise available biological controls for Bridal Creeper 	<ul style="list-style-type: none"> Department of Agriculture and Food 	<ul style="list-style-type: none"> Reintroduce the rust and leaf hoppers to areas infested with Bridal Creeper, particularly after fires 	<ul style="list-style-type: none"> As required 	<ul style="list-style-type: none"> Need for alternative weed control methodology over time
Olive tree (Section 3.6)	<ul style="list-style-type: none"> Other than the historic Olive tree, ensure new trees do not become established within the Reserve 	<ul style="list-style-type: none"> City weed management principles 	<ul style="list-style-type: none"> Remove any young or juvenile olive trees when noted within the Reserve 	<ul style="list-style-type: none"> As required 	<ul style="list-style-type: none"> Number removed
Resident liaison (Section 3.6, 3.9.1)	<ul style="list-style-type: none"> Recognise that influences outside the Reserve boundaries can have an impact Maintain the ‘good neighbour’ policy 	<ul style="list-style-type: none"> Catchment management principles and practices 	<ul style="list-style-type: none"> Undertake liaison and communication on management issues and practices as required 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Record of communications and outcomes
Quenda (Section 3.7.1)	<ul style="list-style-type: none"> Determine if Quenda are present within the Star Swamp Reserve If not, consider potential of translocating populations back into the Reserve 	<ul style="list-style-type: none"> EPA Guidance Statement 56 – Terrestrial Fauna Surveys 	<ul style="list-style-type: none"> Undertake a detailed survey, either as part of a comprehensive fauna survey or as a targeted species survey 	<ul style="list-style-type: none"> High priority 	<ul style="list-style-type: none"> Survey report Outcomes used to update fauna knowledge base Outcomes used to make decision about translocation potential
Fauna survey (Section 3.7.6)	<ul style="list-style-type: none"> Update knowledge of fauna species, including Quenda, present within the Reserve 	<ul style="list-style-type: none"> EPA Guidance Statement 56 – Terrestrial Fauna Surveys 	<ul style="list-style-type: none"> Undertake a detailed vertebrate fauna survey within the Reserve to complement other surveys being carried out 	<ul style="list-style-type: none"> High priority 	<ul style="list-style-type: none"> Survey report Outcomes used to update fauna knowledge base
Introduced fauna (Section 3.8)	<ul style="list-style-type: none"> Limit the presence of introduced fauna within the Reserve wherever possible 	<ul style="list-style-type: none"> City of Stirling practices and procedures DEC and/or Department of Agriculture and Food advice and guidelines 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Records of control activities observations of conditions within the Reserve that can be linked to feral animal control, such as vegetation improvements with

Management Category	Objectives	Standard (if applicable)	Management Action	Priority	Measurement Criteria
Domestic Animals (Section 3.8.5, 5.4.1)	<ul style="list-style-type: none"> Limit impacts associated with the presence of domestic dogs and cats 	<ul style="list-style-type: none"> State and local cat and dog laws, policies and guidelines 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> High priority 	<ul style="list-style-type: none"> reduced rabbit populations Council decision to change designation Development of a communication and implementation plan Monitoring of the implementation process over time
			<ul style="list-style-type: none"> Provide signage at entrances and other key locations informing residents the Reserve is a designated cat free zone 	<ul style="list-style-type: none"> Medium – high priority 	<ul style="list-style-type: none"> Design and installation of signs
Fire impacts (Section 3.9)	<ul style="list-style-type: none"> Determine changes to flora and vegetation over time that can be attributed to fire 	<ul style="list-style-type: none"> EPA Guidance Statement 51 – Terrestrial Flora and Vegetation Surveys 	<ul style="list-style-type: none"> Undertake flora surveys at varying times after fire 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Survey outcomes such as changes to vegetation species, type and condition within fire affected area over time
Heritage (Section 4)	<ul style="list-style-type: none"> Ensure cultural and heritage values of the site are recognised, maintained and protected 	<ul style="list-style-type: none"> State heritage guidelines, policies and regulations 	<ul style="list-style-type: none"> Undertake Aboriginal heritage and ethnographic surveys prior to any major works within the Reserve 	<ul style="list-style-type: none"> As required 	<ul style="list-style-type: none"> Survey reports Consideration of any findings when planning major works
			<ul style="list-style-type: none"> Extend the heritage trail that allows all points of interest to be accessed in a ‘round trip’ 	<ul style="list-style-type: none"> Low to medium priority 	<ul style="list-style-type: none"> Inclusion of extra points in trail
Access (Section 5.1)	<ul style="list-style-type: none"> Ensure appropriate access to and within the Reserve 	<ul style="list-style-type: none"> Good practice 	<ul style="list-style-type: none"> Vehicles entering the Reserve reattach chains or close gates as appropriate 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Number of incidences
			<ul style="list-style-type: none"> Consider installation of gates to replace chain link vehicle barriers 	<ul style="list-style-type: none"> Low priority 	<ul style="list-style-type: none"> Replacement schedule
Tracks (Section 5.2)	<ul style="list-style-type: none"> Tracks and access ways are sufficient and suitable for their purpose 	<ul style="list-style-type: none"> FESA guidelines and policies Engineering guidelines and requirements 	<ul style="list-style-type: none"> Close off and revegetate designated tracks 	<ul style="list-style-type: none"> Medium – high priority 	<ul style="list-style-type: none"> Closure and rehabilitation activities
			<ul style="list-style-type: none"> Monitor and manage development of new tracks 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Number of new tracks Rehabilitation requirements
			<ul style="list-style-type: none"> Implement a track naming system and install suitable signage 	<ul style="list-style-type: none"> High priority 	<ul style="list-style-type: none"> Agreed naming system implemented
Signage (Section 5.3, 5.4.1, 5.4.6)	<ul style="list-style-type: none"> Signage is appropriate and informative 	<ul style="list-style-type: none"> City signage guidelines and policies 	<ul style="list-style-type: none"> Develop a signage style for Star Swamp that is consistent with the City signage style guide 	<ul style="list-style-type: none"> High priority 	<ul style="list-style-type: none"> Agreed style and implementation
			<ul style="list-style-type: none"> Include positive, informative messages on signs to highlight the reasons why nominated activities are inappropriate 	<ul style="list-style-type: none"> Medium – high priority, ongoing 	<ul style="list-style-type: none"> Changes in signage over time Community response and changes in behaviour
			<ul style="list-style-type: none"> Review directional signage and install and/or maintain as appropriate 	<ul style="list-style-type: none"> High priority, ongoing 	<ul style="list-style-type: none"> Records of number and locations of signs installed
			<ul style="list-style-type: none"> Signage is installed at the fork in the track near heritage trail point 2 	<ul style="list-style-type: none"> High priority 	<ul style="list-style-type: none"> Installation of sign
			<ul style="list-style-type: none"> Signage showing layout of the Reserve and its features is installed at key entrances and internal track junctions 	<ul style="list-style-type: none"> High priority 	<ul style="list-style-type: none"> Installation of signs
Rubbish (Section 5.4.2)	<ul style="list-style-type: none"> Minimise impacts associated with the presence of rubbish 	<ul style="list-style-type: none"> Good practice 	<ul style="list-style-type: none"> Rubbish found during normal maintenance activities is removed and disposed of more appropriately 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Work records

Management Category	Objectives	Standard (if applicable)	Management Action	Priority	Measurement Criteria
Graffiti vandalism (Section 5.4.3)	<ul style="list-style-type: none"> Aesthetic values of the Reserve are maintained 	<ul style="list-style-type: none"> City policies and procedures 	<ul style="list-style-type: none"> Removal of graffiti from infrastructure as soon as is practicable to do so Procedures for the removal of graffiti from vegetation are developed and implemented 	<ul style="list-style-type: none"> Ongoing High priority 	<ul style="list-style-type: none"> Number of new graffiti 'tags' Maintenance records
Cubbies (Section 5.4.4)	<ul style="list-style-type: none"> Degradation associated with cubby construction is repaired as soon as is practicable to do so 	<ul style="list-style-type: none"> City policies and procedures 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Number of new cubbies Maintenance records
Cannabis growing (Section 5.4.7)	<ul style="list-style-type: none"> Clearing and other impacts are revegetated or managed in an appropriate manner 	<ul style="list-style-type: none"> City policies and procedures 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Ongoing 	<ul style="list-style-type: none"> Number, frequency and locations where cannabis plants are found
Henderson Environmental Centre	<ul style="list-style-type: none"> Utilise the Henderson Environmental Centre to capacity 	<ul style="list-style-type: none"> Henderson Environmental Centre Business Plan 	<ul style="list-style-type: none"> Consider basing City conservation officers at the centre for nominated times or days Explore and inform schools, tertiary educational institutions and research students about the Centre and its potential complementary uses Consider employing a Centre Manager or similar (e.g.: someone with an environmental background) with a view to enhancing community and public access Inform training providers, particularly environmental trainers, about the availability and features of the Centre 	<ul style="list-style-type: none"> Medium priority High priority Medium priority Medium priority 	<ul style="list-style-type: none"> Number and type organisations approached Changes in utilisation patterns

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	<i>Macrozamia fraseri</i>		
Class PINOPSIDA (Conifers)			
CUPRESSACEAE	# <i>Callitris preissii</i>		Rottnest Island Pine
Class LILIOPSIDA (Monocotyledons)			
AGAVACEAE	* <i>Agave americanum</i> * <i>Yucca elata</i>		Century plant Yucca
ALLIACEAE	* <i>Allium triquetrum</i>		Three-cornered garlic
AMARYLLIDACEAE	* <i>Narcissus</i> sp.		Daffodil/Jonquil
ASPARAGACEAE	<i>Acanthocarpus preissii</i> * <i>Asparagus asparagoides</i> <i>Dichopogon capillipes</i> <i>Lomandra hermaphrodita</i> <i>Lomandra maritima</i> <i>Lomandra micrantha</i> subsp. <i>micrantha</i> <i>Lomandra preissii</i> <i>Sowerbaea laxiflora</i>		Bridal creeper Chocolate Lily Purple Tassels

Family	Genus and Species	Previous Name	Common Name
ASPARAGACEAE (cont.)	<i>Thysanotus arenarius</i>		Fringe Lily
	<i>Thysanotus manglesianus</i>		Fringe Lily
	<i>Thysanotus sparteus</i>		Fringe Lily
	<i>Thysanotus triandrus</i>		Fringe Lily
ASPHODELACEAE	* <i>Asphodelus fistulosus</i>		Onion weed
	* <i>Trachyandra divaricata</i>		Trachyandra
CENTROLEPIDACEAE	<i>Centrolepis aristata</i>		Pointed Centrolepis
	<i>Centrolepis drummondiana</i>		
COLCHICACEAE	<i>Burchardia congesta</i>	syn. <i>Burchardia umbellata</i>	Milkmaids
	<i>Wurmbea pygmaea</i>		
CYPERACEAE	<i>Baumea juncea</i>		Bare Twig Rush
	<i>Bolboschoenus caldwellii</i>		Marsh Club-rush
	<i>Carex preissii</i>		
	<i>Ficinia nodosa</i>	syn. <i>Isolepis nodosa</i> , <i>Scirpus nodosa</i>	Knotted Club Rush
	<i>Gahnia trifida</i>		
	<i>Lepidosperma gladiatum</i>		Sword Sedge
	<i>Lepidosperma gracile</i>		
	<i>Lepidosperma scabrum</i>		
	<i>Lepidosperma tenue</i>		
	<i>Mesomelaena pseudostygia</i>	syn. <i>Mesomelaena stygia</i>	Semaphore Sedge
	<i>Schoenoplectus validus</i>		Lake Club Rush
	<i>Schoenus grandiflorus</i>		Large Flowered Bogrush
	<i>Schoenus trachycarpus</i>		Rough Fruited Bogrush
	<i>Schoenus lanatus</i>		Woolly Bogrush
<i>Tetraria octandra</i>			

Family	Genus and Species	Previous Name	Common Name
DASYPOGONACEAE	<i>Dasyogon bromeliifolius</i>		Pineapple Bush
HAEMODORACEAE	<i>Anigozanthos humilis</i>		Catspaw
	<i>Anigozanthos manglesii x humilis</i>		Mangles Kangaroo Paw
	<i>Conostylis aculeata</i>		
	<i>Conostylis candicans</i> subsp. <i>calcicola</i>		Grey Cottonheads
	<i>Haemodorum paniculatum</i>		Blood Root
	<i>Haemodorum spicatum</i>		Blood Root
HEMEROCALLIDACEAE	<i>Caesia micrantha</i>		Pale Grass Lily
	<i>Corynotheca micrantha</i>		Sand Lily
	<i>Dianella revoluta</i> var. <i>divaricata</i>		
	<i>Stypandra glauca</i>		Blind Grass
	<i>Tricoryne elatior</i>		Yellow Autumn Lily
HYACINTHACEAE	* <i>Lachenalia reflexa</i>		Yellow soldiers
IRIDACEAE	* <i>Babiana angustifolia</i>		Baboon flower
	* <i>Chasmanthe floribunda</i>		African cornflag
	* <i>Ferraria crispa</i>		Black flag
	* <i>Freesia leichtlinii x alba</i>		Freesias
	* <i>Gladiolus angustus</i>		Long-tubed Painted Lady
	* <i>Gladiolus caryophyllaceus</i>		Pink gladiolus
	* <i>Moraea flaccida</i>	<i>syn. Homeria flaccida</i>	Cape tulip, One-leaved cape tulip
	<i>Orthrosanthus laxus</i> var. <i>laxus</i>		Morning Iris
	<i>Patersonia occidentalis</i>		Purple Flag
	* <i>Romulea rosea</i> var. <i>australis</i>		Guildford grass
* <i>Sparaxis bulbifera</i>		Harlequin flower	

Family	Genus and Species	Previous Name	Common Name
POACEAE (cont.)	<i>*Cortaderia selloana</i>		Pampas grass
	<i>*Cynodon dactylon</i>		Couch
	<i>*Ehrharta calycina</i>		Perennial veldt
	<i>*Ehrharta longiflora</i>		Annual veldt
	<i>*Eragrostis curvula</i>		African lovegrass
	<i>*Gastridium phleoides</i>		Nit grass
	<i>*Hordeum leporinum</i>		Barley grass
	<i>*Lagurus ovatus</i>		Hare's Tail grass
	<i>*Pennisetum clandestinum</i>		Kikuyu
	<i>*Pennisetum setaceum</i>		Fountain grass
	<i>Sporobolus virginicus</i>		Marine Couch
	<i>*Stenotaphrum secundatum</i>		Buffalo grass
RESTIONACEAE	<i>Desmocladus flexuosus</i>		
TECOPHILAEACEAE	<i>*Cyanella hyacinthoides</i>		Lady's Hand
TYPHACEAE	<i>*Typha orientalis</i>		Typha
XANTHORRHOEACEAE	<i>Xanthorrhoea preissii</i>		Grass Tree
Class MAGNOLIOPSIDA (Dicotyledons)			
AIZOACEAE	<i>*Carpobrotus aequilaterus</i>		Chilean pigface
	<i>*Carpobrotus edulis</i>		Pigface
	<i>*Galenia pubescens</i>		
AMARANTHACEAE	<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>		Prince of Wales Feather
	<i>Ptilotus drummondii</i> var. <i>drummondii</i>		Narrow-leaf Mulla Mulla
	<i>Ptilotus manglesii</i>		Pom Poms

Family	Genus and Species	Previous Name	Common Name
AMARANTHACEAE (cont.)	<i>Ptilotus sericostachyus</i> subsp. <i>sericostachyus</i>		
ANACARDIACEAE	* <i>Schinus terebinthifolia</i>		Japanese pepper tree
APIACEAE	<i>Centella asiatica</i> <i>Daucus glochidiatus</i> <i>Eryngium pinnatifidum</i> * <i>Foeniculum vulgare</i> <i>Homalosciadium homalocarpum</i> <i>Trachymene pilosa</i> <i>Xanthosia huegelii</i>		Fennel Native Parsnip
APOCYNACEAE	* <i>Hydrocotyle bonariensis</i>		
ASTERACEAE	<i>Actites megalocarpus</i> * <i>Arctotheca calendula</i> * <i>Aster subulatus</i> * <i>Conyza bonariensis</i> <i>Craspedia</i> sp. <i>Cotula coronopifolia</i> * <i>Dittrichia graveolens</i> * <i>Gazania linearis</i> * <i>Hedypnois rhagadioloides</i> * <i>Helichrysum luteoalbum</i> * <i>Hypochaeris glabra</i> * <i>Hypochaeris radicata</i> <i>Lagenophora huegelii</i> <i>Olearia axillaris</i> * <i>Onopordum acaulon</i>		Dune Thistle Capeweed Brush starwort Fleabane Waterbuttons Stinkwort Cretan weed Jersey Cudweed Smooth Cat's Ear Flatweed Coastal Daisy Bush Stemless thistle

Family	Genus and Species	Previous Name	Common Name
CASUARINACEAE	<i>Allocasuarina fraseriana</i> <i>Allocasuarina humilis</i>		Sheoak Dwarf Sheoak
CELASTRACEAE	<i>Stackhousia monogyna</i>		
CHENOPODIACEAE	<i>Rhagodia baccata subsp baccata</i>		Berry Saltbush
CONVOLVULACEAE	* <i>Ipomoea indica</i>		Morning glory
CRASSULACEAE	<i>Crassula colorata</i> * <i>Crassula glomerata</i>		Dense Stonecrop
DILLENIACEAE	<i>Hibbertia hypericoides</i> <i>Hibbertia racemosa</i> <i>Hibbertia subvaginata</i>		
DROSERACEAE	<i>Drosera erythrorhiza</i> subsp <i>erythrorhiza</i> <i>Drosera macrantha</i> subsp. <i>macrantha</i> <i>Drosera menziesii</i> subsp. <i>penicillaris</i>		Red Ink Sundew Bridal Rainbow
ERICACEAE	<i>Astroloma ciliatum</i> <i>Astroloma pallidum</i> <i>Conostephium pendulum</i> <i>Conostephium preissii</i> <i>Cryptandra nutans</i> <i>Leucopogon parviflorus</i> <i>Leucopogon propinquus</i>		Kick Bush Pearl Flower

Family	Genus and Species	Previous Name	Common Name	
EUPHORBIACEAE	<i>Adriana quadripartita</i>		Bitter Bush	
	* <i>Euphorbia peplus</i>		Petty spurge	
	* <i>Euphorbia terracina</i>		Geraldton carnation weed	
	<i>Monotaxis grandiflora</i> var. <i>grandiflora</i>			
	<i>Phyllanthus calycinus</i>		False Boronia	
	<i>Ricinocarpos glaucus</i>		Wedding Bush	
	* <i>Ricinus communis</i>		Castor oil plant	
	FABACEAE	<i>Acacia cochlearis</i>		Rigid Wattle
		<i>Acacia cyclops</i>		Coastal Wattle
		<i>Acacia huegelii</i>		Huegel's Wattle
<i>Acacia pulchella</i> var. <i>glaberrima</i>			Prickly Moses	
<i>Acacia rostelifera</i>				
<i>Acacia saligna</i>			Orange Wattle	
<i>Acacia stenoptera</i>			Narrow Winged Wattle	
<i>Acacia truncata</i>				
<i>Acacia willdenowiana</i>			Grass Wattle	
<i>Bossiaea eriocarpa</i>				
<i>Daviesia divaricata</i> subsp. <i>divaricata</i>				
<i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>				
<i>Daviesia triflora</i>				
<i>Gastrolobium capitatum</i>		syn. <i>Nemcia capitata</i> , syn. <i>Oxylobium capitatum</i>	Bacon & Eggs	
<i>Gastrolobium nervosum</i>				
<i>Gompholobium tomentosum</i>			Hairy Yellow Pea	
<i>Hardenbergia comptoniana</i>			Native Wisteria	
<i>Hovea pungens</i>		Devils Pins		
<i>Hovea trisperma</i> var. <i>trisperma</i>		Common Hovea		
<i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>		Granny's Bonnets		
<i>Jacksonia calcicola</i>				

Family	Genus and Species	Previous Name	Common Name
FABACEAE (cont.)	<i>Jacksonia furcellata</i>		Stinkwood
	<i>Jacksonia sericea</i> (P4)		
	<i>Jacksonia sternbergiana</i>		Grey Stinkwood
	<i>Kennedia prostrata</i>		Running Postman
	* <i>Lupinus angustifolius</i>		Narrowleaf Lupin
	* <i>Lupinus cosentinii</i>		Sandplain Lupin
	* <i>Medicago</i> sp.		Medic clover
	* <i>Melilotus indicus</i>		Hexham scent
	<i>Templetonia retusa</i>		Cockies Tongue
	* <i>Trifolium angustifolium</i>		Narrow-leaved clover
	* <i>Trifolium fragiferum</i>		Strawberry clover
	* <i>Vicia sativa</i>		Common vetch
FUMARIACEAE	* <i>Fumaria capreolata</i>		Fumaria
GERANIACEAE	* <i>Erodium botrys</i>		Long storksbill
	* <i>Geranium molle</i>		Dove's-foot cranesbill
	* <i>Pelargonium capitatum</i>		Rose pelargonium
GOODENIACEAE	<i>Dampiera linearis</i>		
	<i>Lechenaultia linarioides</i>		
	<i>Scaevola anchlussifolia</i>		Silky Scaevola
	<i>Scaevola canescens</i>		Grey Scaevola
	# <i>Scaevola crassifolia</i>		
	<i>Scaevola globulifera</i>		
	<i>Scaevola repens</i> var. <i>angustifolia</i>		
	<i>Scaevola thesioides</i> subsp. <i>thesioides</i>		
GYROSTEMONACEAE	<i>Tersonia cyathiflora</i>		Button Creeper

Family	Genus and Species	Previous Name	Common Name
HALORAGACEAE	<i>Glischrocaryon aureum</i> var. <i>aureum</i>		Popflower
LAMIACEAE	<i>Hemiandra pungens</i>		
LAURACEAE	<i>Cassytha</i> sp		Dodder Laurel
LOGANIACEAE	<i>Logania vaginalis</i>		
LORANTHACEAE	<i>Nuytsia floribunda</i>		Australian Christmas Tree
MYRTACEAE	<i>#Agonis flexuosa</i>		Peppermint tree
	<i>Baeckea</i> sp. <i>Limestone</i>		
	<i>Calothamnus quadrifidus</i>		One-sided Bottlebrush
	<i>#Chamelaucium uncinatum</i>		
	<i>Corymbia calophylla</i>	syn. <i>Eucalyptus calophylla</i>	Marri
	<i>Eucalyptus decipiens</i>		
	<i>Eucalyptus gomphocephala</i>		Tuart
	<i>Eucalyptus marginata</i> subsp. <i>marginata</i>		Jarrah
	<i>Eucalyptus todtiana</i>		
	<i>Kunzea glabrescens</i>		Spearwood
	<i>*Leptospermum laevigatum</i>		Victorian teatree
	<i>Melaleuca huegelii</i> subsp. <i>huegelii</i>		Chenille Honeymyrtle
	<i>Melaleuca rhapsiophylla</i>		Swamp paperbark
	<i>Melaleuca systema</i>	syn. <i>Melaleuca acerosa</i>	Coastal Honeymyrtle
OLEACEAE	<i>*Olea europaea</i>		Olive
ONAGRACEAE	<i>*Oenothera drummondii</i>		Beach evening primrose

Family	Genus and Species	Previous Name	Common Name
OROBANCHACEAE	<i>*Orobanche minor</i>	syn. <i>Orobanche australis</i>	Lesser Broomrape
OXALIDACEAE	<i>*Oxalis corniculata</i> <i>*Oxalis pes-caprae</i> <i>*Oxalis purpurea</i>		Yellow Wood Sorrel Soursob Purple Oxalis
PITTOSPORACEAE	<i>Billardiera fraseri</i>		Elegant Pronaya
PLANTAGINACEAE	<i>*Plantago sp.</i>		
PLUMBAGINACEAE	<i>*Limonium sinuatum</i>		Perennial Sea Lavender
POLYGALACEAE	<i>Comesperma calymega</i> <i>Comesperma confertum</i> <i>*Emex australis</i> <i>*Rumex acetosella</i>		Blue-spike Milkwort Doublegee Dock
PORTULACACEAE	<i>Calandrinia corrigioloides</i> <i>Calandrinia granulifera</i> <i>Calandrinia liniflora</i> <i>Calandrinia volubilis</i>		Strap Purslane Pygmy Purslane Parakeelya
PRIMULACEAE	<i>*Lysimachia arvensis var. arvensis</i> <i>*Lysimachia arvensis var. caerulea</i> <i>Samolus repens</i>	syn. <i>Anagallis arvensis var arvensis</i> syn. <i>Anagallis arvensis var caerulea</i>	Scarlet Pimpernel Blue Pimpernel Creeping Brookweed
PROTEACEAE	<i>Banksia attenuata</i> <i>Banksia dallanneyi var. dallanneyi</i> <i>Banksia grandis</i> <i>Banksia menziesii</i>	syn. <i>Dryandra lindleyana, D. nivea</i>	Slender Banksia Couch Honey-pot Dryandra Bull Banksia Menzies Banksia

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

Family	Genus and Species	Previous Name	Common Name
RUTACEAE	<i>Philotheca spicata</i>		Pepper and Salt
SANTALACEAE	<i>Exocarpos sparteus</i> <i>Santalum acuminatum</i>		Broom Ballart Quandong
SCROPHULARIACEAE	* <i>Dischisma arenarium</i> <i>Eremophila glabra</i> <i>Myoporum caprarioides</i> <i>Myoporum tetrandrum</i>		Tar Bush Slender Myoporum
SOLANACEAE	* <i>Solanum nigrum</i> * <i>Solanum linnaeanum</i> <i>Solanum symonii</i>	syn. <i>Solanum sodomaeum</i>	Black Berry Nightshade Apple of Sodom
STYLIDACEAE	<i>Levenhookia stipitata</i> <i>Stylidium brunonianum</i> <i>Stylidium calcaratum</i> <i>Stylidium junceum</i> subsp. <i>junceum</i> <i>Stylidium repens</i> <i>Stylidium rigidulum</i> <i>Stylidium schoenoides</i>		Common Stylewort Pink Fountain Triggerplant Book Triggerplant Reed Triggerplant Mat Triggerplant Flagon Triggerplant Cow Kicks
THYMELAEACEAE	<i>Pimelea calcicola</i> (P3) <i>Pimelea rosea</i> <i>Pimelea sulphurea</i>		Limestone Banjine Rose Banjine Yellow Banjine
VERBENACEAE	* <i>Lantana camara</i>		Lantana
VIOLACEAE	<i>Hybanthus calycinus</i>		Native Violet
ZYGOPHYLLACEAE	* <i>Tribulus terrestris</i>		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 <i>Wildlife Conservation Act 1950</i>) 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 <i>Wildlife Conservation Act 1950</i>) 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 <i>Wildlife Conservation Act 1950</i>) 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 <i>Wildlife Conservation Act 1950</i>) Fauna that is in need of special protection, otherwise than for the reasons listed in other schedules of the <i>Wildlife Conservation Act 1950</i> .
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 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

Conservation Code	Name	Description
		<p>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.</p>
2	Priority Two	<p>Poorly known taxa</p> <p>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</p>
3	Priority Three	<p>Poorly known taxa</p> <p>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 threatening processes exist that could affect them.</p>
4	Priority Four	<p>Rare or near threatened and other taxa in need of monitoring</p> <p>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.</p>

Conservation Code	Name	Description
		<p>Near threatened: Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for vulnerable.</p> <p>Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
5	Priority Five	<p>Conservation Dependent Taxa</p> <p>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.</p>

(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

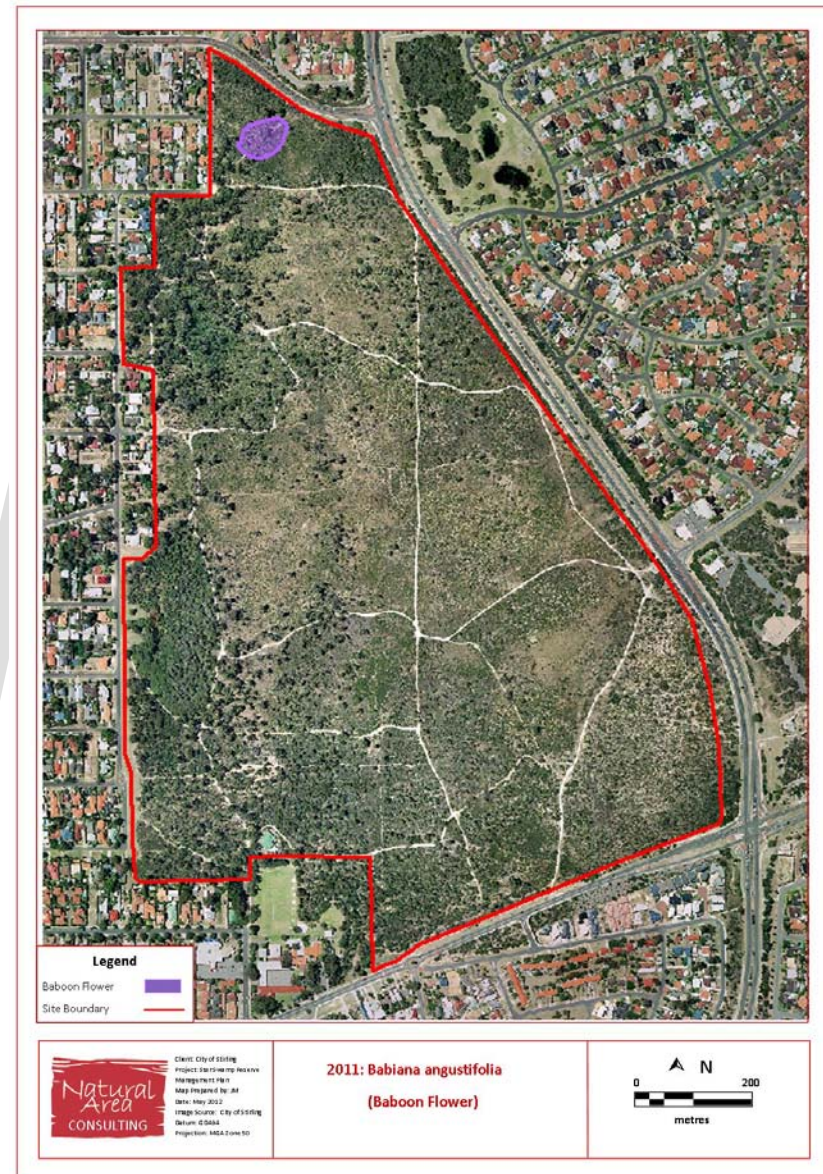
Vegetation Structural Classes				
Life Form/Height Class	Canopy Percentage Cover			
	100 – 70%	70 – 30%	30 - 10%	10 – 2 %
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland
Trees 10 – 30 m	Closed forest	Open forest	Woodland	Open woodland
Trees under 10 m	Low closed forest	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

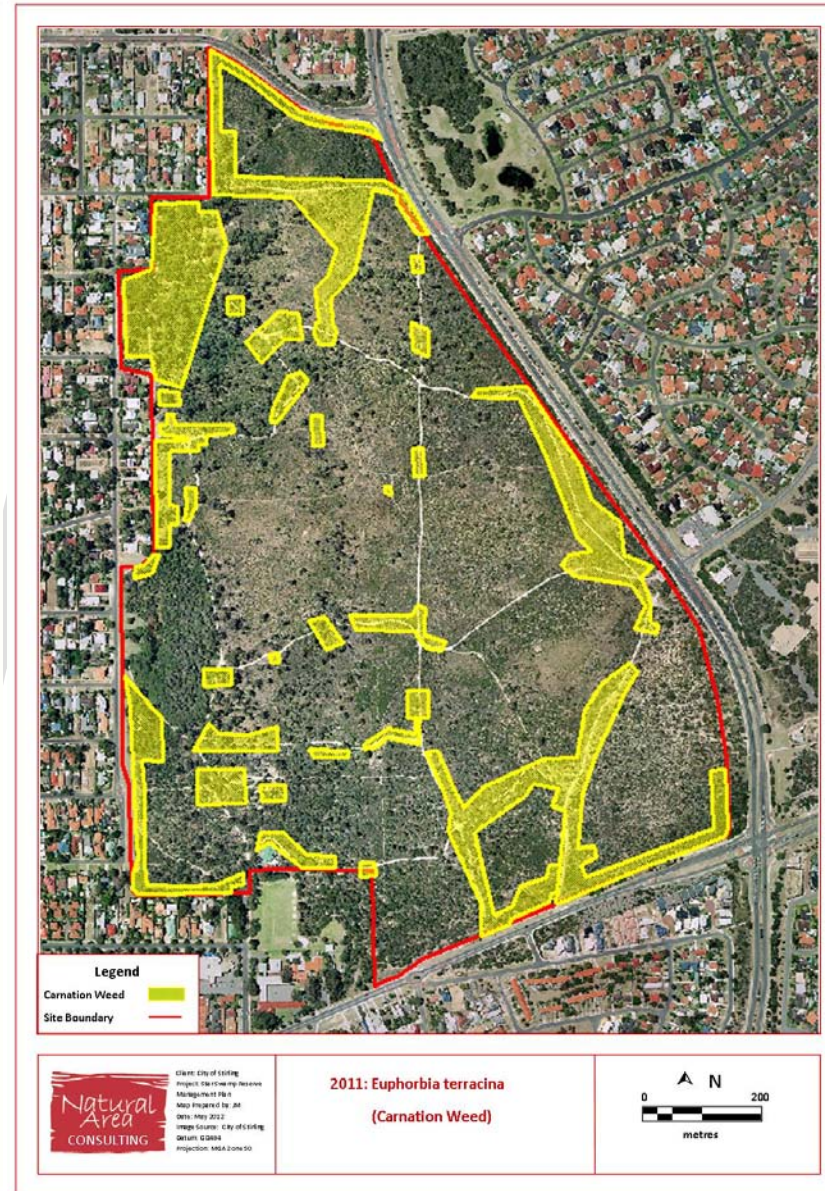
(Source: Government of Western Australia, 2000)

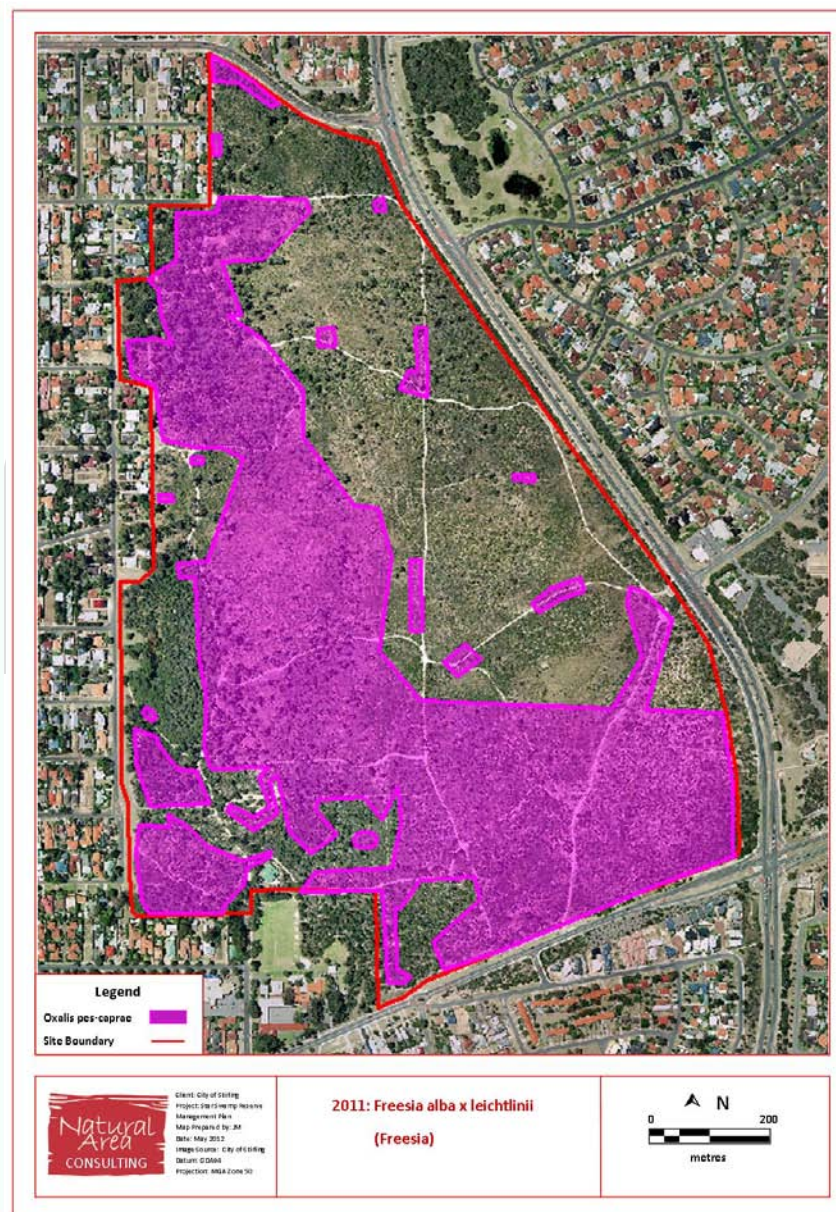
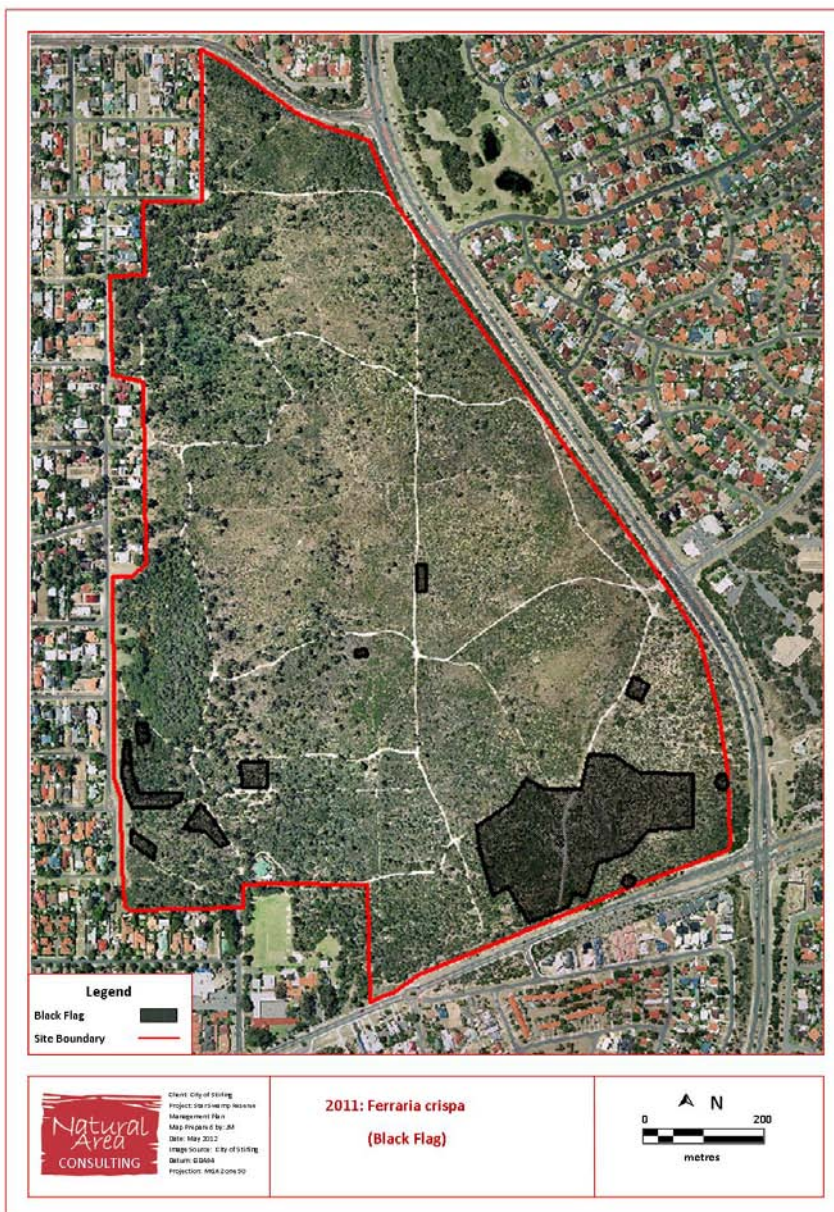
Appendix 5: Vegetation Condition Rating Scale

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.

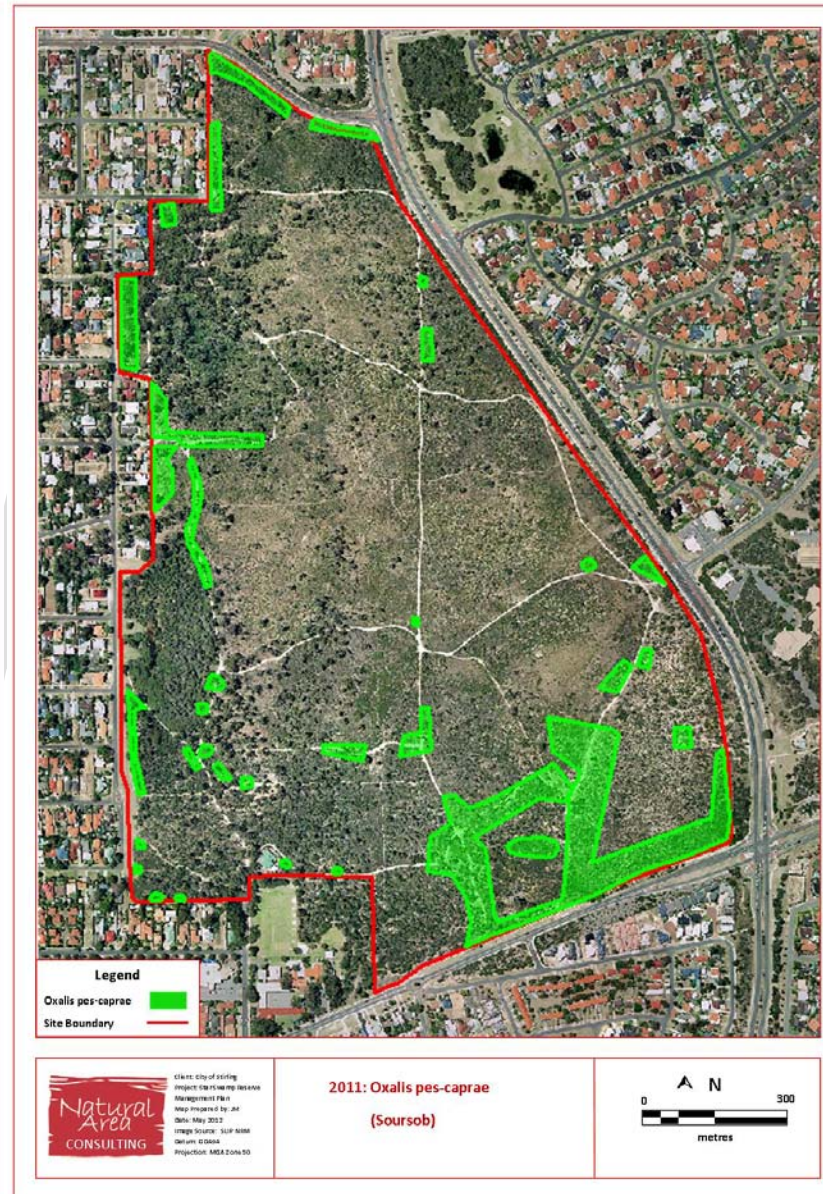
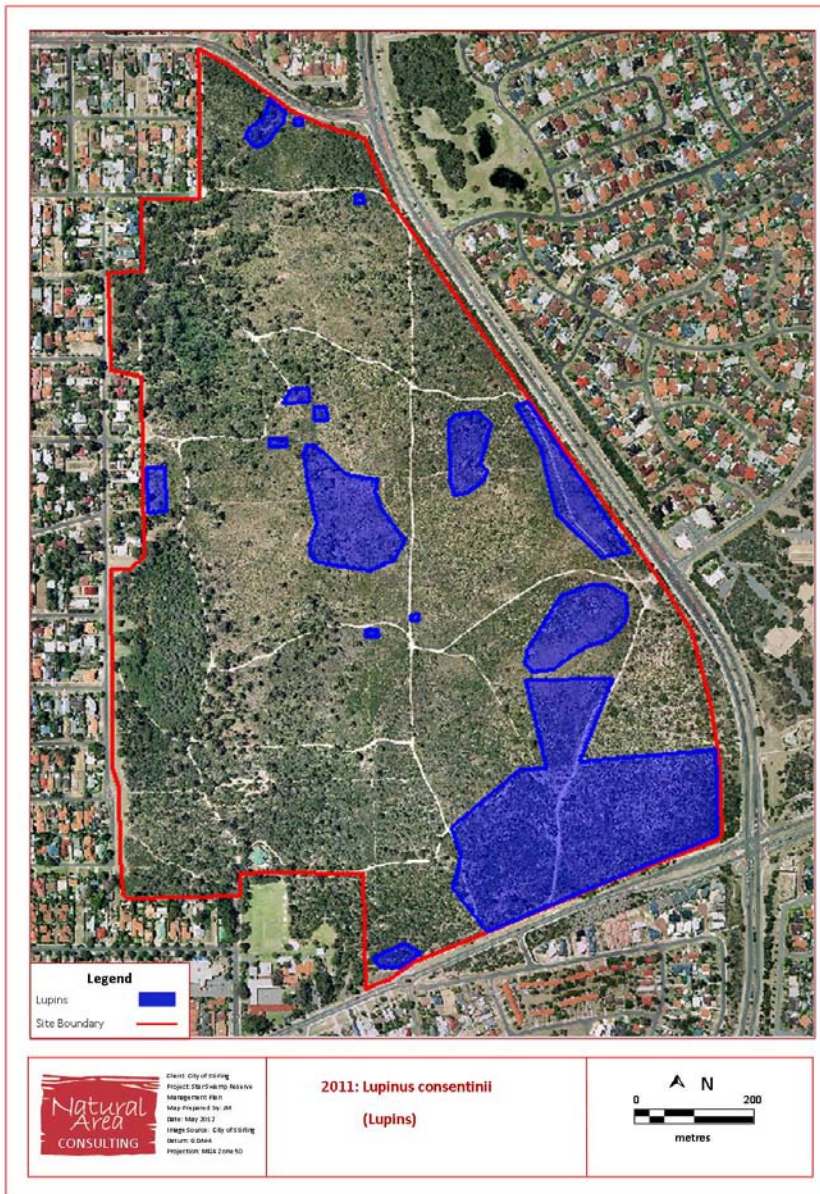
Appendix 6: Weed Maps for 2011











Appendix 7: Vertebrate Fauna species

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

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

Species Name	Common Name	Breeding/Nesting site	Conservation Status
<i>Lichmera indistincta</i>	Brown Honeyeater	Yes	Secure
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck	Unknown	
<i>Malurus leucopterus</i>	White-winged Fairy Wren	Yes	
<i>Malurus lamberti</i>	Variegated Fairy Wren	Yes	CoS Priority 1
<i>Malurus splendens</i>	Splendid Blue Fairy Wren	Yes	CoS Priority 1
<i>Merops ornatus</i>	Rainbow Bee-eater	Yes	Specially Protected
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron	Unknown	
<i>Pachycephala pectoralis</i>	Golden Whistler	Unknown	Secure
<i>Pachycephala rufiventris</i>	Rufous Whistler	Yes	Secure
<i>Pardalotus punctatus</i>	Spotted Pardalote	Unknown	
<i>Pardalotus striatus</i>	Striated Pardalote	Yes	Secure
<i>Phalacrocorax fuscescens</i>	Black-faced Cormorant	Unknown	
<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant	Unknown	
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	Yes	Secure
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	Yes	Secure
<i>Platalea flavipes</i>	Yellow-billed Spoonbill	Unknown	
<i>Podargus strigoides</i>	Tawny Frogmouth	Yes	Secure
<i>Porphyrio porphyrio</i>	Purple Swamp Hen	Yes	Secure
<i>Purpureicephalus spurius</i>	Red-capped Parrot	Unknown	Secure
<i>Rhipidura fuliginosa preissi</i>	Grey Fantail	Unknown	
<i>Rhipidura leucophrys</i>	Willie Wagtail	Yes	Secure
<i>Sericornis frontalis</i>	White-browed Scrubwren	Unknown	
<i>Smicronis brevirostris</i>	Weebill	Unknown	Secure
<i>Sterna hirundo</i>	Common Tern	Unknown	
<i>Streptopelia chinensis</i>	Spotted Turtle-Dove	Unknown	
<i>Streptopelia senegalensis</i>	Laughing Turtle-Dove	Unknown	
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	Unknown	Secure
<i>Tadorna tadornoides</i>	Australian Shelduck	Unknown	
<i>Threskiornis molucca</i>	Australian White Ibis	Unknown	Secure

Species Name	Common Name	Breeding/Nesting site	Conservation Status
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	Unknown	Secure
<i>Turnix varia</i>	Button Quail	Yes	
<i>Tyto alba</i>	Barn Owl	Unknown	CoS Priority 1
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	Yes	Non-endemic
<i>Todiramphus sanctus</i>	Sacred Kingfisher	Unknown	
<i>Zosterops lateralis</i>	Silver Eye	Yes	Secure
Reptiles & Amphibians			
<i>Crinia insignifera</i>	Sign-bearing Froglet	Yes	
<i>Cryptoblepharus buchananii</i>	Fence skink	Yes	Secure
<i>Heleioporus eyrei</i>	Moaning Frog	Yes	Secure
<i>Litoria adelaidensis</i>	Slender Tree Frog	Yes	
<i>Litoria moorei</i>	Motorbike Frog	Yes	
<i>Lymnodynastes dorsalis</i>	Bullfrog	Yes	
<i>Myobatrachus gouldii</i>	Turtle Frog	Unknown	
<i>Pogona minor</i>	Western Bearded Dragon	Yes	Secure
<i>Pseudonaja affinis</i>	Dugite	Yes	Secure
<i>Simoselaps bertholdi</i>	Jan's Banded Snake	Yes	
<i>Strophurus spinigerus</i>	Yellow-eyed West Coast Spiny-tailed Gecko	Yes	Secure
<i>Tiliqua occipitalis</i>	Western Blue-tongue	Yes	Secure
<i>Tiliqua r rugosa</i>	Western Bobtail Lizard	Yes	Secure
<i>Varanus gouldii</i>	Gould's Sand Monitor	Yes	Secure
Mammals			
<i>Felis catus</i>	Feral & domestic cat	Yes	Introduced
<i>Isoodon obesulus fusciventer</i>	Southern Brown Bandicoot, Quenda	Unknown	Priority 5
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	Yes	CoS Priority 1
<i>Oryctolagus cuniculus</i>	European Rabbit	Yes	Introduced
<i>Vulpes vulpes</i>	European Red Fox	Yes	Introduced

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

Appendix 8: Fire History



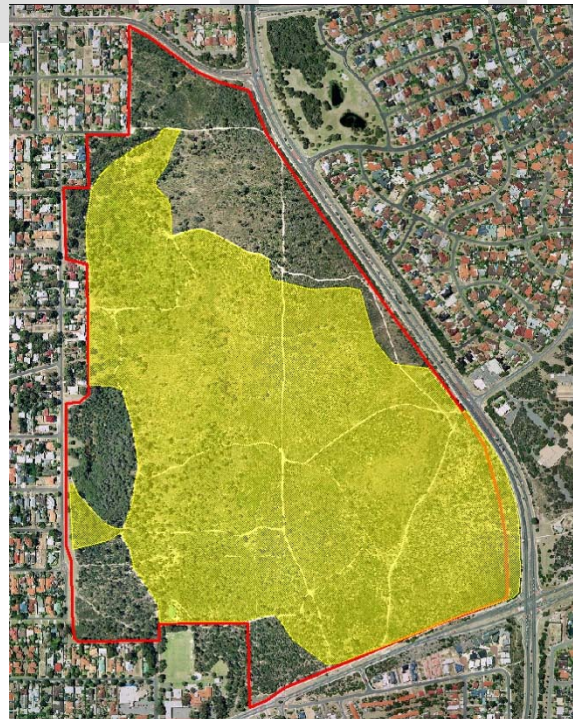
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17 Dec 1995



23 November 1996



21 Nov 1997



25 January 1998



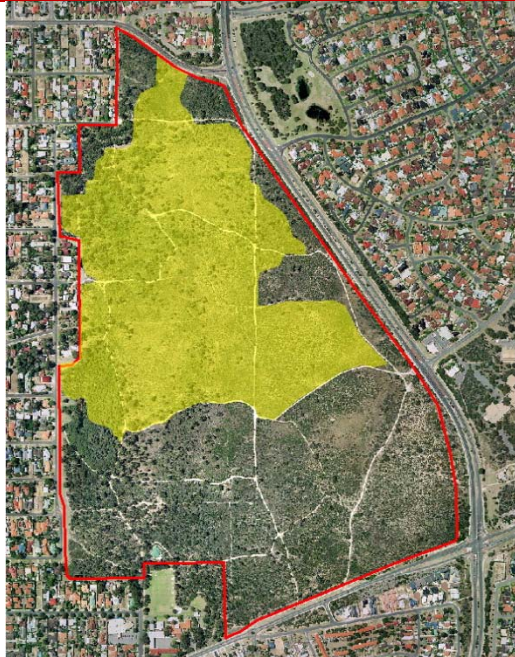
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23 November 2002



January 2006



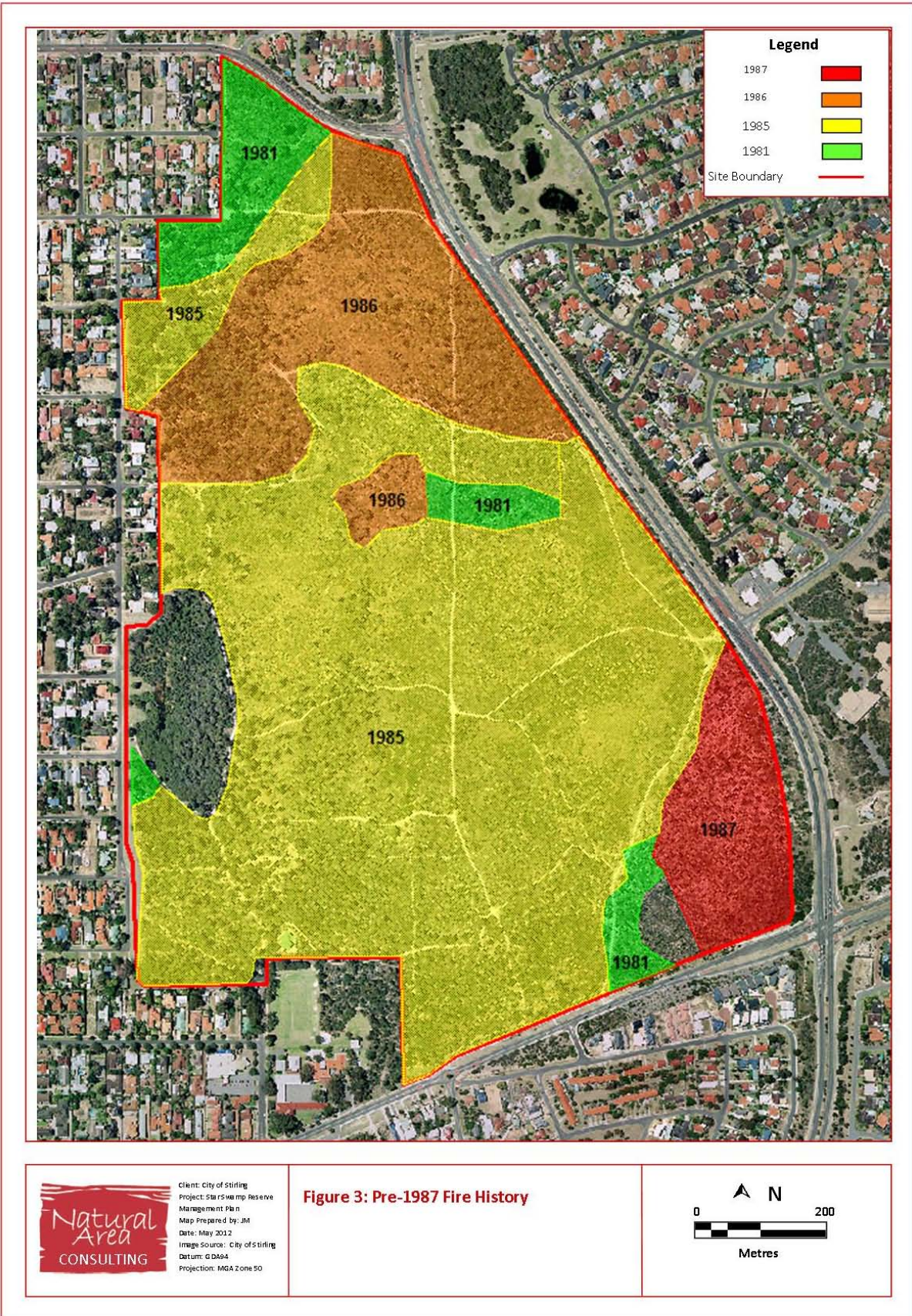
4 March 2007




20 December 2007



February 2010



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

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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

Copyright in the information contained herein is and shall remain the property of the State of Western Australia. All rights reserved. This includes, but is not limited to, information from the Register of Aboriginal Sites established and maintained under the Aboriginal Heritage Act 1972 (AHA).

Legend

Restriction

- N** No restriction
- M** Male access only
- F** Female access

Access

- C** Closed
- O** Open
- V** Vulnerable

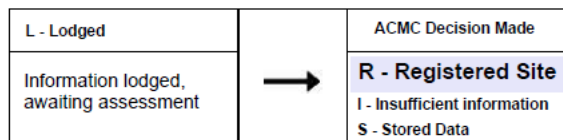
Coordinate Accuracy

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



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



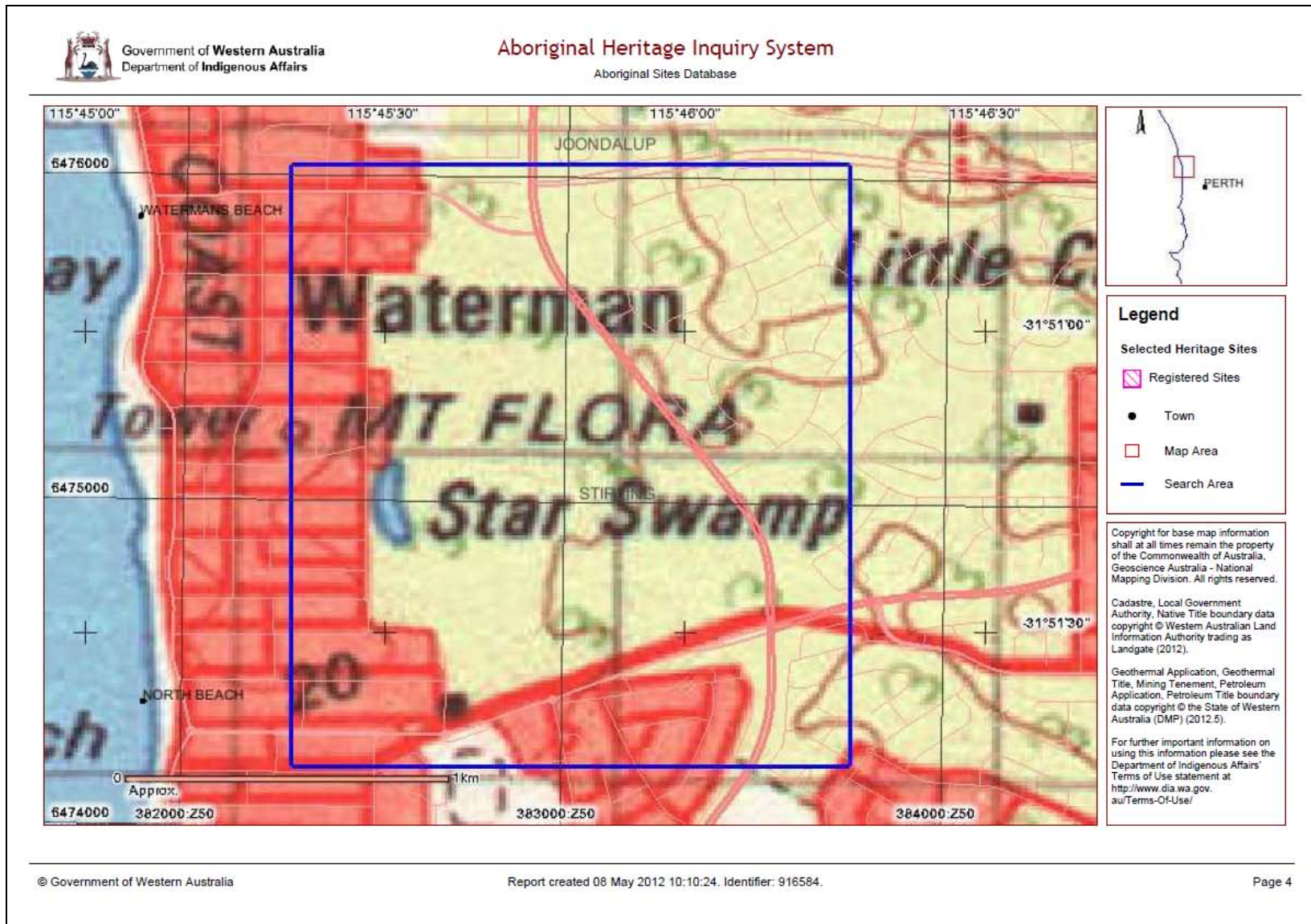
Government of **Western Australia**
Department of **Indigenous Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

List of Registered Aboriginal Sites with Map

No results





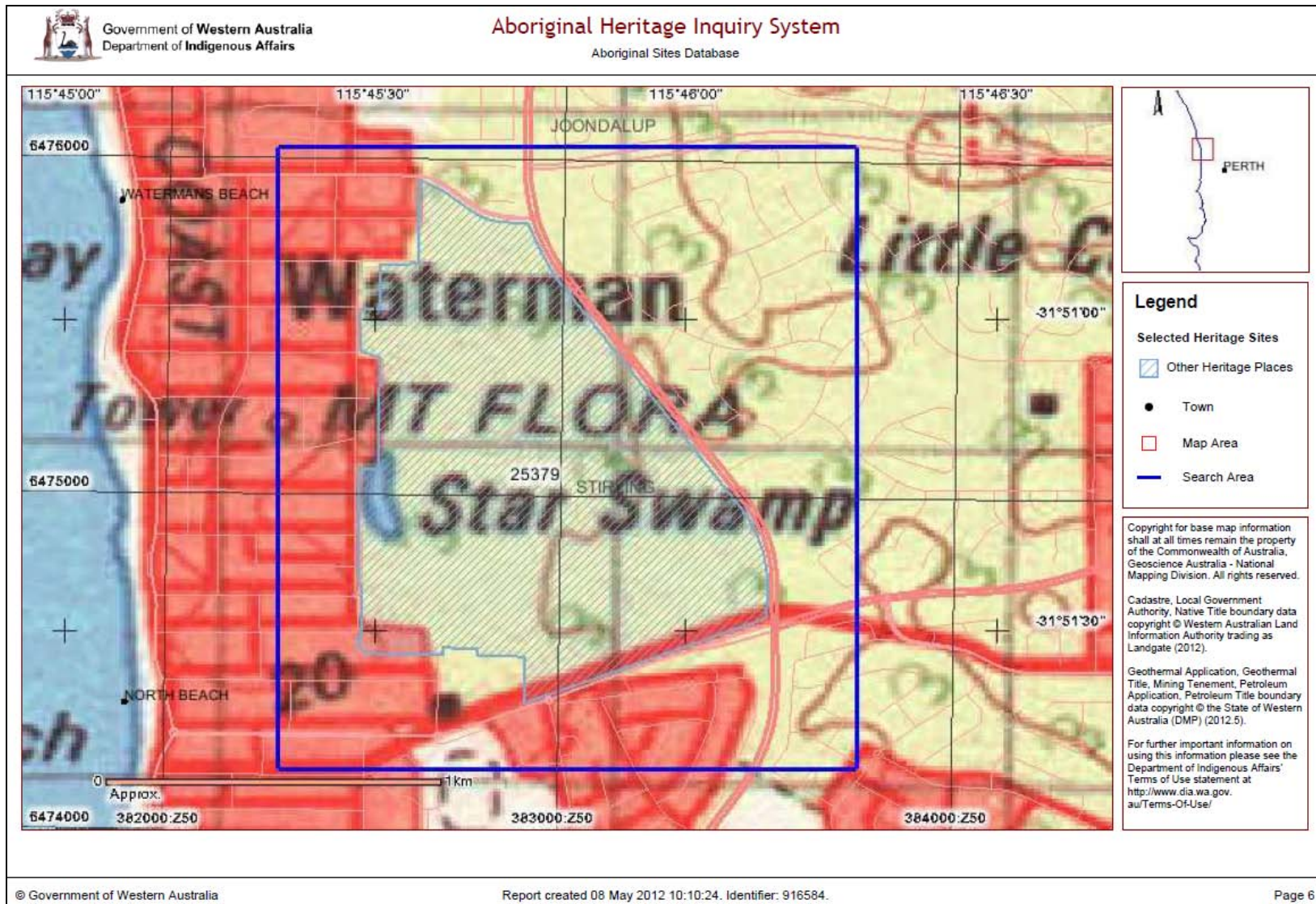
Government of Western Australia
Department of Indigenous Affairs

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]	



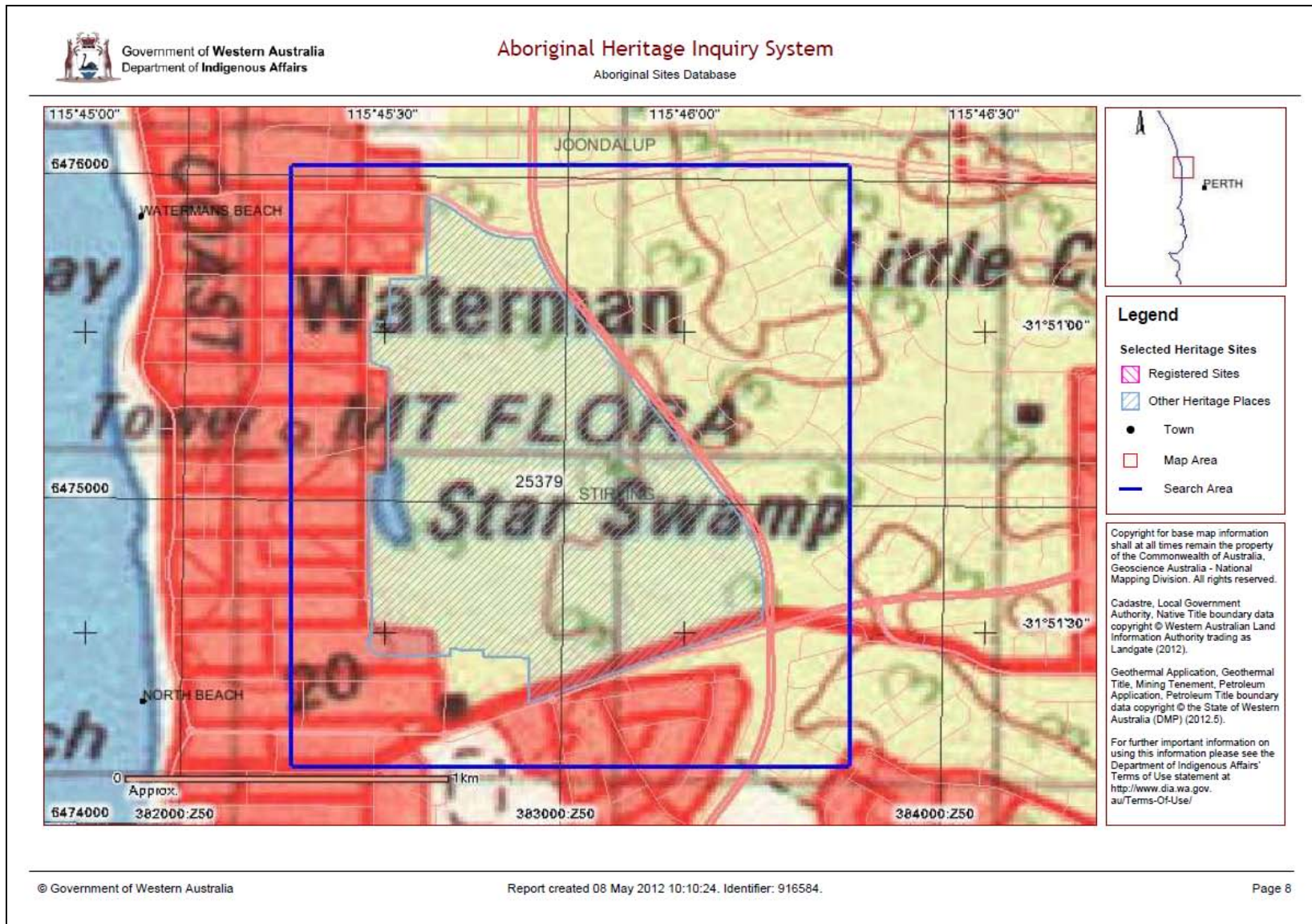


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Department of **Indigenous Affairs**

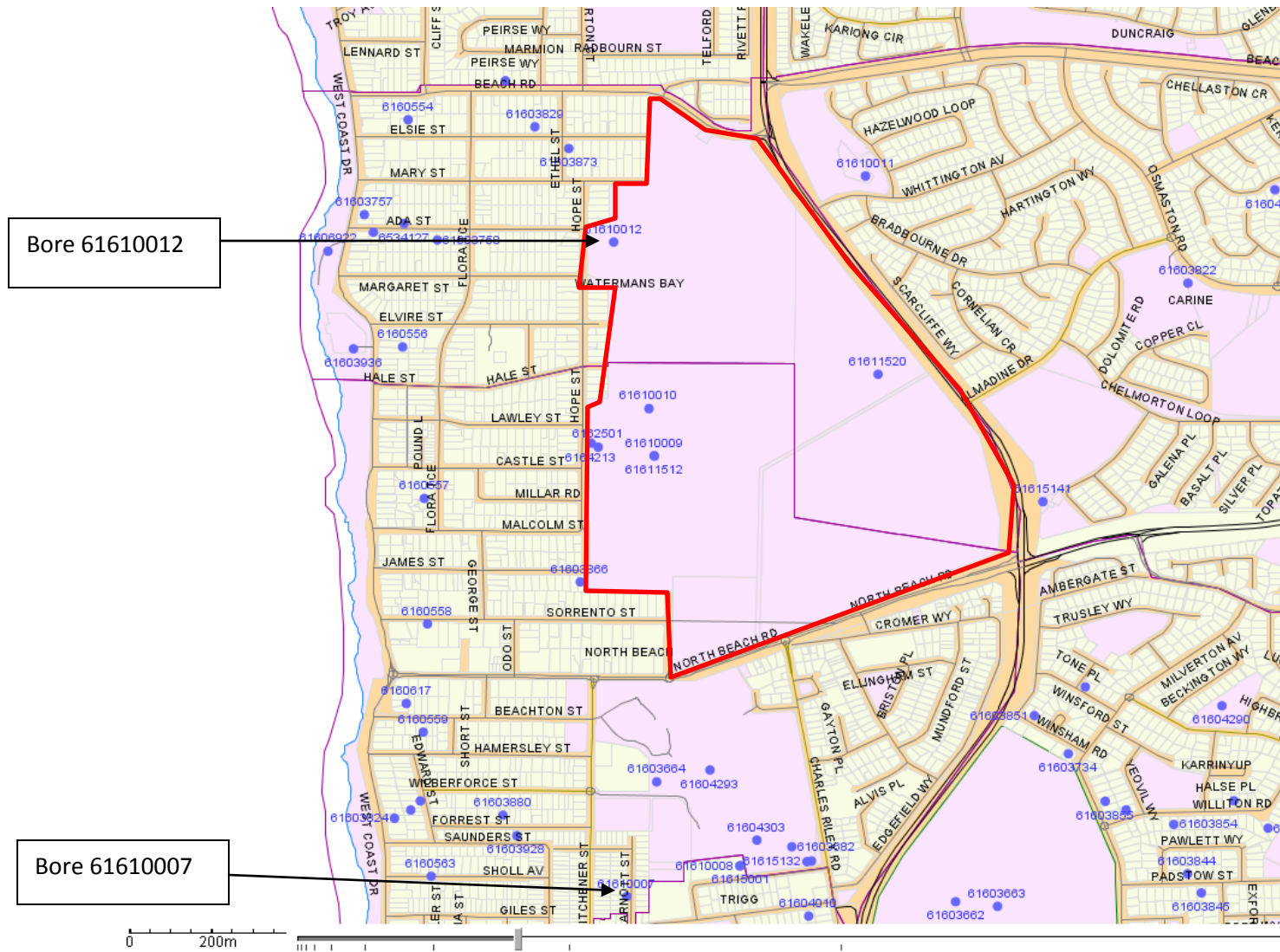
Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Map Showing Registered Aboriginal Sites and Other Heritage Places



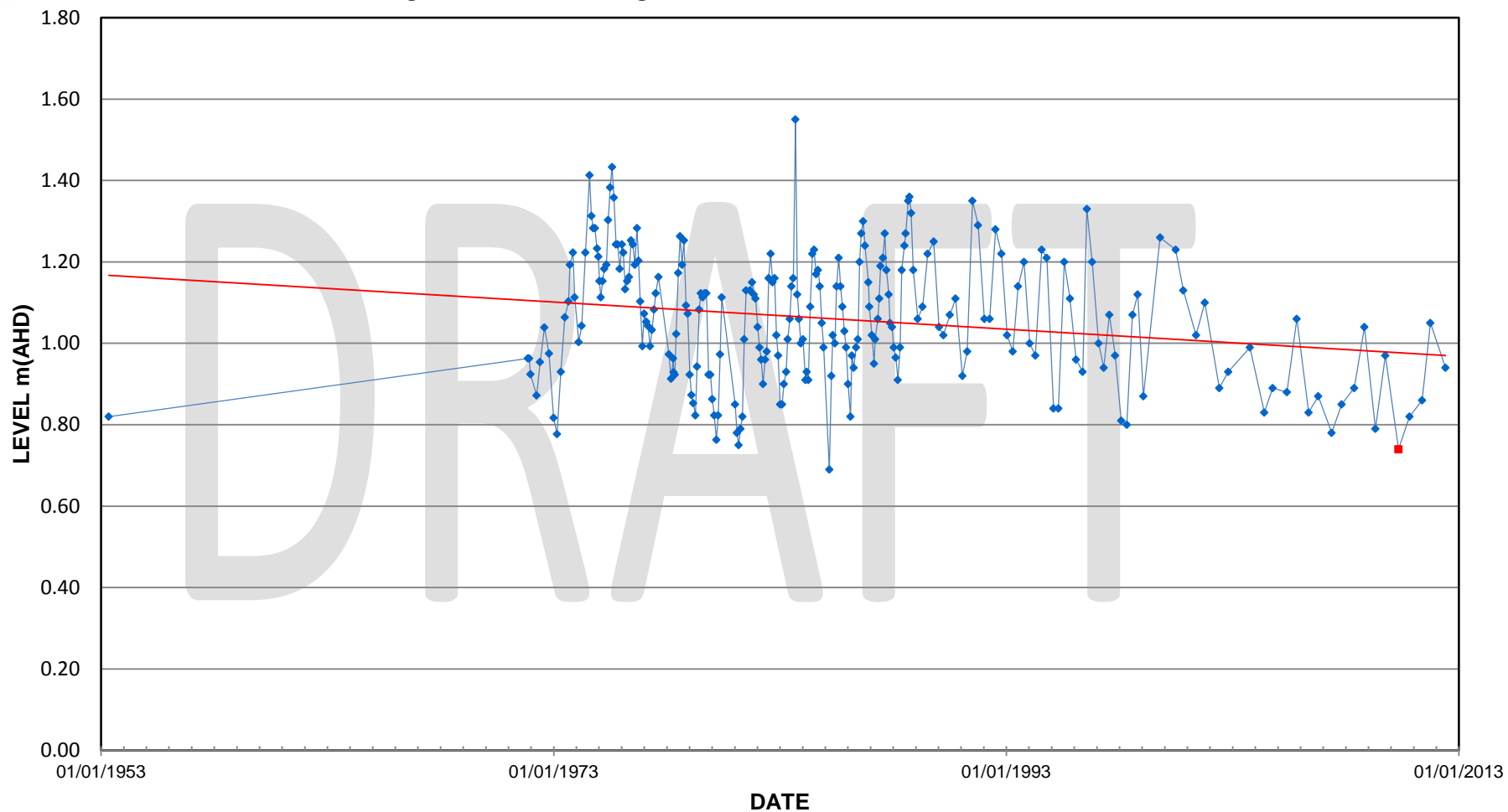
Appendix 10: Department of Water WIN Database Bore Results





Government of Western Australia
Department of Water

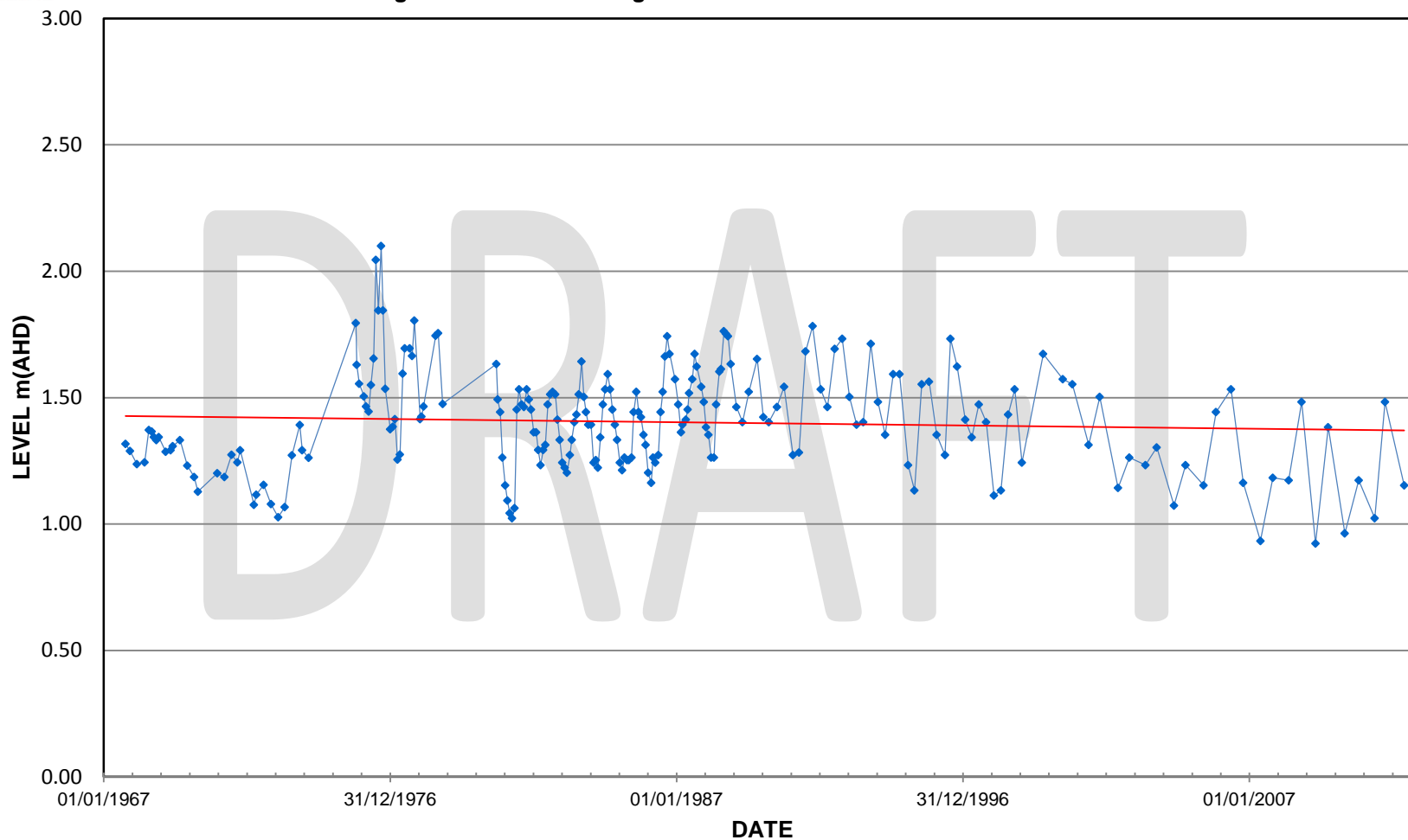
61610007 LAKES AND WETLANDS - BORE 793
Easting = 382601.00 Northing = 6473660.00 Zone = 50 TOC = 4.14m AHD WIN SITE ID = 4349



◆ = 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.



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.