



River Torrens Linear Park Management Plan – Hindmarsh Bridge to the River Mouth

City of West Torrens and City of Charles Sturt





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City of West Torrens and City of Charles Sturt

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- Lisa Will (Sport and Recreation Project Officer, City of Charles Sturt)
- John Voigt (Management Adviser, Property Services, City of West Torrens)
- Lisa Kirwan (Coordinator Horticultural Services, City of West Torrens)
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EXECUTIVE SUMMARY

The City of Charles Sturt and City of West Torrens are adjoining local government areas which have joined in partnership to produce a management plan for the River Torrens Linear Park which is located within their council areas. It is considered that there are significant benefits in the two councils working closely together to appropriately manage this significant asset. Benefits of the two councils working together include cost savings for investigative studies, similar actions have a similar priority regardless of the council area and the users of the park receive a similar quality asset on both sides of the river. It is also likely that funding applications may be more successful through the councils combining and increasing the benefits of undertaking actions within their respective council areas.

The River Torrens Linear Park was developed in the early 1980's and connects the Adelaide Hills to the coast line. The Linear Park is primarily designed as a flood mitigation device but has developed into a significant open space and recreational asset utilised by a broad cross-section of the community. Activities such as walking, cycling and jogging are the dominant activities undertaken along the Linear Park.

The pressures on the River Torrens Linear Park are increasing with an increase in commuter cycle traffic as well as an increase in general users from residential developments in close proximity to the Linear Park. The Linear Park also provides an excellent opportunity to implement a range of environmental initiatives such as water quality improvement, increasing biodiversity and undertaking revegetation. The Cities of Charles Sturt and West Torrens both identified a need for a management plan to ensure that their sections of the River Torrens Linear Park can address the current issues within the project area, cope with the increased demands and remain a significant asset for both councils.

The River Torrens Linear Park Management Plan addresses issues and opportunities along the river corridor from the Port Road Bridge to the Outlet at Henley Beach South. Extensive background research was undertaken for the project as well as a series of field surveys. A character analysis was undertaken to determine the different precincts within the project area and their key attributes.

A number of current issues have been identified as part of the project. These include a lack of biodiversity along the corridor, safety concerns in relation to the path network, locations of significant erosion and significant infestations of declared and environmental weed species. The path network contains sections which are not up to current Australian standards as they are too narrow whilst the conflict between pedestrians and cyclists was the issue that was raised the most during the community consultation which was undertaken.

The information collected has been utilised to create a planning framework which sets the broad guidelines for future activities within the different sections of the project area. A series of specific recommended actions have also been developed to address issues, further investigate opportunities and ensure the River Torrens Linear Park is a significant asset for the community into the future.

The recommended actions are divided into several key categories including general management, biodiversity, infrastructure, water quality, erosion and maintenance. The actions include items such as undertaking revegetation, implementing a structured weed

control program and installing a number of bird and bat boxes. A number of the actions detailed within the infrastructure section are related to public safety and risk management and include items such as path upgrades (e.g. removing blind spots, increasing path width, sealing selected gravel paths). Actions have either been identified at a specific location (e.g. addressing an erosion issue) whilst other actions are more general (e.g. installation of bird and bat boxes) and can be implemented along the entire length of the project area.

Each action has been prioritised with risks, costs and benefits of implementing the action or not implementing the action taken into account. A timeframe has also been determined for each action with some actions required to be undertaken in the short-term whilst other given a longer timeframe.

1. INTRODUCTION

The River Torrens Linear Park is a significant asset within Metropolitan Adelaide as a biological, recreational, educational and open space resource. The River Torrens Linear Park was implemented in the early 1980's and was designed to mitigate flooding events and to provide a continuous park system from the Adelaide Hills to the coast.

The River Torrens is of considerable historical significance and it has influenced development patterns within Adelaide. It has been subject to significant modification over the years with the draining of coastal wetlands, dams within its upper catchment, straightening sections of the river bed, removing the majority of remnant vegetation and using it for disposal of stormwater and industrial wastes.

Numerous studies have been undertaken along the length of the River Torrens Linear Park including user surveys, vegetation surveys, bird surveys and general fauna surveys. Several guidelines have also been prepared for the River Torrens Linear Park in relation to management and maintenance, park furniture and pedestrian and bicycle path standards. The majority of the guidelines are old (>14 years) with some of the guidelines (e.g. Pedestrian and Bicycle Path Standards) aimed at the implementation of the River Torrens Linear Park and the standards required today have been changed and updated.

A River Torrens Linear Park Management Plan was developed for the entire corridor (Gorge Weir to the Gulf St Vincent) in 1993 (Land Systems EBC 1993). This plan was a detailed overview and provides clear directions on the management of the Linear Park from developing maintenance zones to developing standard procedures for the establishment of grassed areas. This plan is now over 14 years old and some aspects are well out of date.

Several editions of a maintenance plan have been developed for the River Torrens Linear Park (1st and 2nd editions) whilst a review of the Maintenance Plan resulted in a change in focus of how the Linear Park was maintained. In 2003, by Pedler and Crompton (2003) reviewed the maintenance plan and focussed on increasing the biodiversity along the Linear Park. The review provided guidelines on management and maintenance based on ecological zones. This document was aimed at utilising local native plant species and planting them into zones which they would have naturally occurred.

The City of West Torrens and City of Charles Sturt do not currently have specific management plans implemented for the ongoing management of the River Torrens Linear Park. Each council is responsible for the ongoing and regular management of the River Torrens Linear Park including:

- Vegetation (grassed areas as well as planted areas)
- Path network
- Signage and park furniture
- Recreation facilities

The responsibility for the detailed management of the waterway, wetlands, water quality and structures within these areas has been the source of ongoing debate. The Adelaide and

Mount Lofty Ranges Natural Resource Management Board and SA Water, in conjunction with each of the councils, are responsible for the appropriate management of the River Torrens. There needs to be an agreement between the different parties to finalise which body is responsible for funding and undertaking the required activities. This would ensure that activities were implemented and the quality of the waterway would improve.

Both the City of West Torrens and City of Charles Sturt consider the River Torrens Linear Park to be a very significant asset within their council areas. The Linear Park is utilised not only by residents and business owners within the two council areas but it is also extensively utilised by people from across the metropolitan area. The Park is used for a variety of activities including social gatherings, recreational activities (passive and active), commuting and environmental activities. The River Torrens Linear Park is a key open space asset within both councils and needs to be enhanced and managed to ensure future requirements are catered for.

The linkage of the River Torrens Linear Park with the surrounding area is a critical component to the usability of the Linear Park. Creating better linkages and further developing the Linear Park for recreational activities is supported by the City of West Torrens Open Space Strategic Plan (URPS 2004). The recommendations from the Open Space Strategic Plan have been taken into consideration when preparing the current management plan.

1.1. Project location

The management plan developed as part of this project covers the section of the River Torrens Linear Park which is located within the City of West Torrens and the City of Charles Sturt. This extends from the Port Road Bridge at Hindmarsh to the outlet into Gulf St Vincent at Henley Beach South. Refer to the Volume I report for a location map.

1.2. Background research

Extensive background research was undertaken as part of the development of the River Torrens Linear Park Management Plan. The background studies included an ecological assessment of the project area, a review of planning requirements and controls and an assessment of infrastructure condition and quality. In addition to this a character precinct site analysis was undertaken and consultation with key stakeholders, adjoining landowners and Linear Park users was undertaken (refer to Section 3.5 for more details on consultation).

The information that was collected has been used as the basis for developing the management recommendations and actions. The background reports are supplied as appendices to this management plan and are regularly referred to throughout this document.

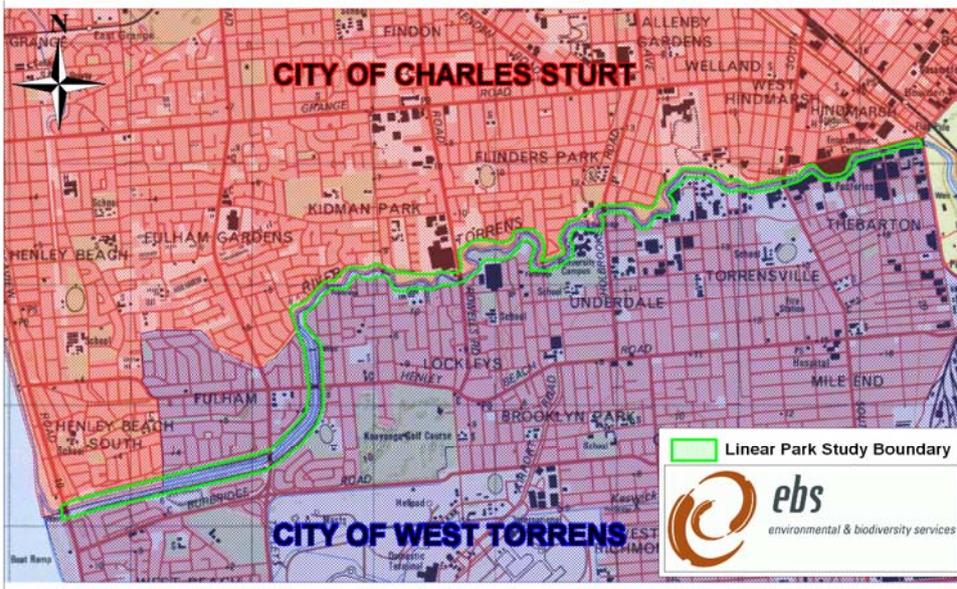


Figure 1. The extent of the River Torrens Linear Park project within the City of West Torrens and City of Charles Sturt council areas.

1.3. Consultation strategy

The consultation undertaken as part of the preparation of the management plan consisted of three main strategies. A workshop was held with key stakeholders, including the Adelaide and Mount Lofty Ranges Natural Resource Management Board, the Office for Recreation and Sport, Planning SA, Bike South and the two relevant councils, to raise current issues in regard to the River Torrens Linear Park. A number of one on one discussions were also undertaken with key stakeholders to further develop issues and possible management actions.

The community consultation was undertaken by sending a questionnaire to residents adjoining onto the Linear Park. The Questionnaire asked residents to comment on a range of issues including safety, biodiversity and recreational use. After the preliminary findings of the project were developed a poster presentation was developed and displayed for two weeks at the Henley Library and the Hamra Centre Library. The poster presentation was advertised at regular intervals along the Linear Park (within the project area) and Linear Park users were invited to view and comment on the plans. A member of the project team was also present at each library for a period of two hours on a Saturday morning to answer queries and discuss the project with the general public. A summary of the main comments is provided in Appendix 1

Addition community awareness of the project has been raised through articles in the local Messenger Newspaper, a small article in The Advertiser and through an interview on ABC Radio.

1.4. Aboriginal Heritage and Significance

The Kurna Aboriginal community have resided on the Adelaide Plains for over 40,000 years (Daniels and Tait 2005). The Adelaide region was a diverse area with an abundance of food resources at different times of the year. It is reported that the Kurna groups would spend the majority of the warmer weather on the coast where fish and other seafood were plentiful and then move into the foothills during the colder wetter months (Twidale *et al* 1976). The River Torrens and associated swamp and wetland areas is considered to be a significant area for the Kurna Aboriginal community. Prior to European settlement, the lower reaches of the River Torrens spread out across the plains to form a range of swamps, wetlands and reedbeds (Kraehenbuehl 1996). An abundance of wildlife and water would have occurred in this area and provided valuable resources to the local Aboriginal groups.

The Kurna community should be included in the planning and design of projects along the River Torrens. This is particularly important for the larger redevelopment projects where there is a prime opportunity to recognise and promote the Kurna culture. The recognition and promotion of the Kurna culture could come in many different forms, however, it is recommended that this be directed by the Kurna community directly to ensure areas respect their traditions and culture.

1.5. Current projects

Several projects are currently underway or about to commence within the project area. The three main projects are the upgrade of the section of Linear Park between Henley Beach Road and Tapleys Hill Road (known as Breakout Creek Stage 2), the upgrade of Linear Park between Holbrooks Road and the Kalbarra St footbridge (associated with the development at Underdale on either side of the river) and the implementation of signage strategy along the entire length of the River Torrens Linear Park (includes areas upstream of the current project location). Each of these projects are discussed briefly below. The current management plan will not address the specific areas covered by each of these projects, however, reference to them where appropriate will be made.

The River Torrens Breakout Creek Stage 2 redevelopment is a large project which is redeveloping the section of the River Torrens between the Henley Beach Road Bridge and the Tapleys Hill Road Bridge. It involves extensive earthworks, building of wetlands and a large amount of revegetation. The project also involves constructing new paths, small boardwalk areas and an underpass on the eastern side of the River Torrens under the Henley Beach Road Bridge. This project will commence construction in late 2007 and be

complete in March / April 2008. Revegetation will occur in 2008 and 2009 with more than 70,000 local native plants utilised in the revegetation.

The redevelopment of another section of the River Torrens Linear Park, within the project area, is also currently being implemented. This redevelopment is associated with the large residential and school development at Underdale which is located between Holbrooks Road and the Kanbara Street Footbridge. This area has sections which are currently very steep, paths that are too narrow and in poor condition and extensive weed infestations. The plans (Appendix 2) for the area show that revegetation will be undertaken, weed management will be implemented, a high quality path network will be implemented on both sides of the River Torrens and additional infrastructure will be built (e.g. BBQ facilities, bench seats).

The Office for Recreation and Sport, the Department for Transport, Energy and Infrastructure and the Local Government Association (SA) have developed a signage plan for the entire River Torrens Linear Park Trail. The signage plan has been developed over several years and has developed a consistent signage strategy for the entire River Torrens Linear Park not just the project area. The strategy involves implementing a hierarchy of signs along the entire route which provide locational, directional, and behavioural information. The main information stations will be spaced approximately 1km apart with additional signs for exits to main road and trail indicators where several trails meet. The Signage Strategy identifies the locations for the different types of signs as well as providing the specifications for the different signs. The strategy also identifies locations where line marking is required to delineate intersections along the path network. Standard line marking requirements and cost estimates are also given as part of the strategy. The strategy also details the removal of numerous different types of existing signs which will not be required after the current strategy is implemented.

1.6. Project aims and objectives

The River Torrens Linear Park Management Plan (Port Road to the Gulf St Vincent) (hereafter referred to as the River Torrens Linear Park Management Plan) project aims to review the existing condition of the Linear Park, provide a framework and clear direction for the future planning and management of the Linear Park and provide management actions to address key issues. The management plan will provide detailed management actions for the next 5 years and general management actions for a 10 year period.

Due to the nature of the River Torrens Linear Park and its wide range of uses, numerous broad issues will be addressed in the management plan. These include:

- Infrastructure
- Erosion
- Biodiversity
- Water Quality
- Safety
- Recreational Use

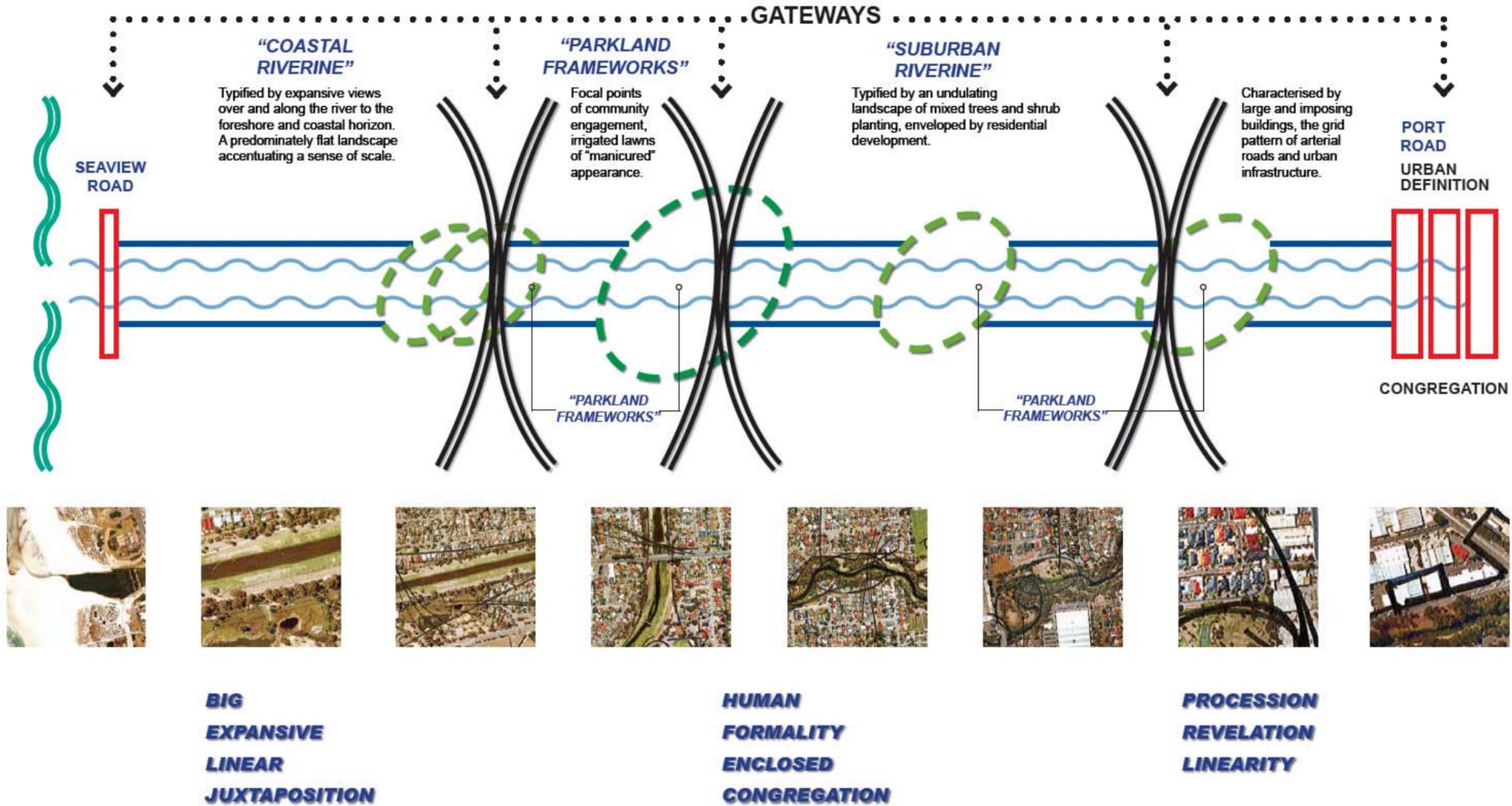
The project also aims to produce a GIS database for each council showing the location of significant trees and infrastructure such as benches, water fountains, playgrounds and toilets. This can then be utilised by council staff as an important management tool for the River Torrens Linear Park corridor.

2. RIVER TORRENS LINEAR PARK CHARACTER ANALYSIS

CHARACTER PRECINCTS : SERIAL VISION JOURNEY

RTLTP - IS SRP

SRP - PART OF RTLTP



CHARACTER VALUES PLAN

DIAGRAM 2.0

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3. RIVER TORRENS LINEAR PARK PLANNING FRAMEWORK

A rigorous site analysis was conducted to identify the landscape values within the broader study area that defines the 'sense of place' of the River Torrens Linear Park.

These values and anecdotes are captured and recorded on the appendix plans and summarized in the character precinct diagram.

Notable observations captured in the Character Values diagram (2.0) include:

The definition of three distinctive types of landscape character precincts; the 'Coastal Riverine', 'Suburban Riverine', and 'Parkland Framework' landscapes. The use, amenity value, and vegetative and habitat qualities were defining considerations between the different precincts.

- **Coastal Riverine** is typified by expansive views over and along the river to the foreshore and coastal horizon. A predominantly flat landscape which accentuates the sense of scale.
- **Parkland Frameworks** are areas which are considered to be focal points of community engagement, including irrigated lawns of "manicured" appearance.
- **Suburban Riverine** is typified by an undulating landscape of mixed trees and shrub plantings, enveloped by residential and light industrial development.
- The strong 'urban definition' of the Linear Park on approaching and at the arrival of Port Road is characterised by large and imposing buildings, the grid pattern of arterial roads and urban infrastructure.
- The differential scale within the character precincts typified by the expansive landscape of the 'Coastal Riverine' precinct and the intimate human scale enclosure of the 'Parkland Framework'.
- The sense and experience of 'journey' along the shared path, directional and functional yet casual and informal. The path leads the traveller through a 'journey' which passes both through and outside the Linear Park.

The qualities and attributes of the character precincts underpin a series of potential land use and management opportunities that define a vision for the management of the River Torrens Linear Park. These opportunities are described in the following Framework Plans (3.1 – 3.8).

Potential opportunities include:

- Development adjacent to the River Torrens Linear Park which encourages public access to the Linear Park whilst promoting and enhancing the Linear Park for all users.
- Continue rehabilitation of Breakout Creek.
- Create a gateway statement from the city within a formal exotic landscape structure.

- Create welcome statements to define entry into different character precincts.
- Create urban plaza areas close to city.
- Establish a series of planning initiatives to better define the interface between Linear Park and the industry land uses.
- Those allotments abutting the Linear Park within the existing industry zone (Policy Area 56) should be amended to incorporate an Interface Policy Area 57 to reflect a land use shift to cleaner and more appropriate industry.
- Consider potential for Lockleys Oval to become a part of Metropolitan Open Space System (MOSS).

Access

- Develop a hierarchy of accessibility with a mixture of commuter paths and shared trails.
- Encourage walking and cycling through the provision of safe, convenient and attractive routes with connections to adjoining streets, paths and open spaces.
- Widen and improve access path to Miranda Avenue, Lockleys.
- Investigate potential for pedestrian / cyclist link along Fulham Park Drive, Lockleys.
- Where the need is identified, gravel paths to be upgraded to sealed surface paths.
- Incorporate a 'trail', at designated locations, to encourage more passive activities.
- Create consistent path surfaces throughout the Linear Park to promote the path hierarchy.
- Investigate a 'ring route' around Lockleys Oval.

Connectivity

- Explore linkages to surrounding street networks.
- Create legible linkages to future urban infill areas and points of interest.
- Reinforce path network and vegetation linkage into Apex Park.
- Create links through to airport.
- Develop pedestrian and cycle linkages to nearby open spaces.
- Define links with other recreational spaces.
- Form linkages along Military Road between Henley High School, Henley Oval and West Lakes.

- Establish and formalize linkages between Kings Reserve, Thebarton Oval and Thebarton Senior College with the former Brickworks Market development site and with the potential urban infill area to the north of Ashwin Parade.
- Investigate future recreation land use opportunities for the University Playing Fields and create links to these (in line with the Adelaide Airport Master Plan).

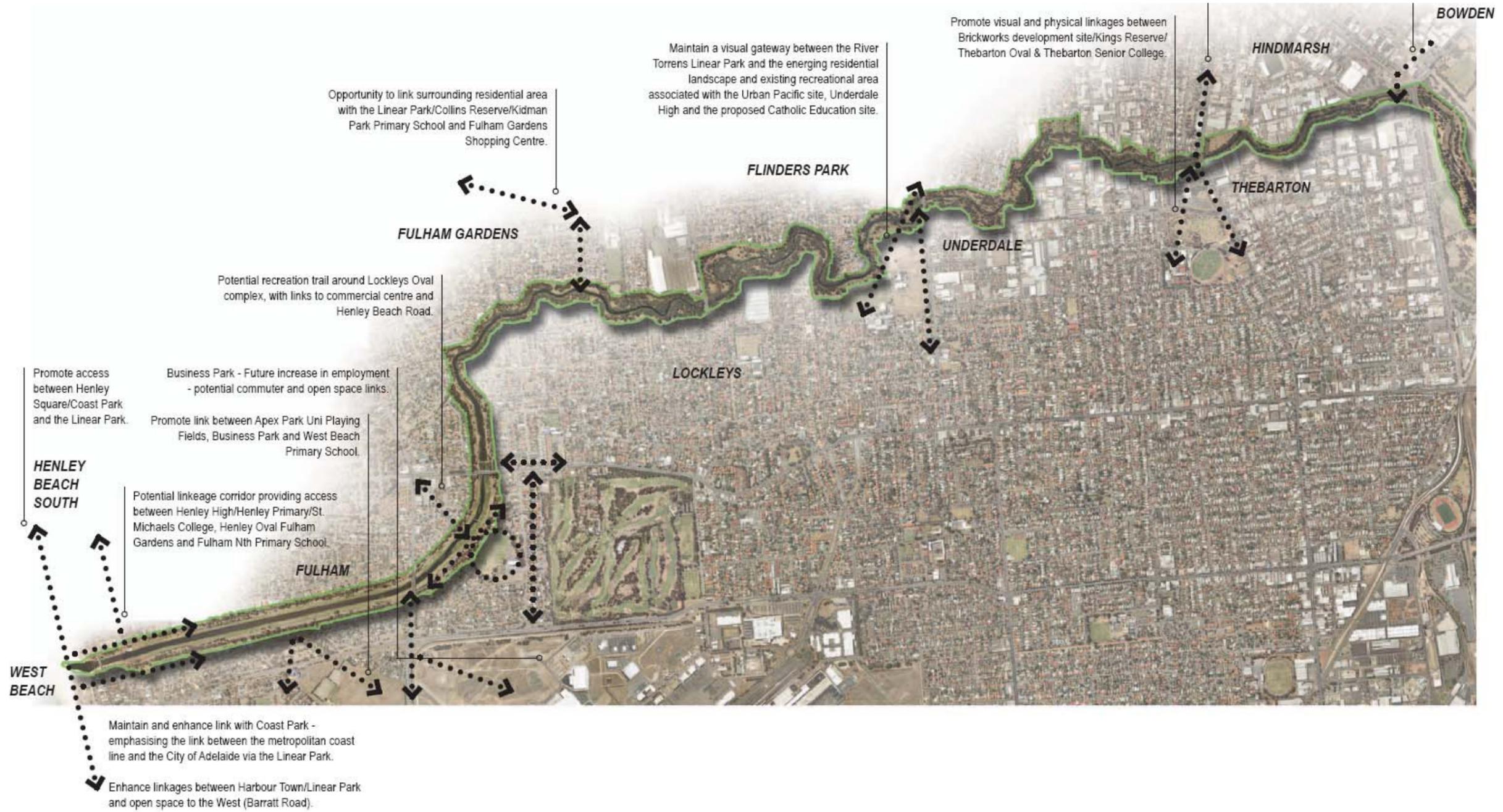
Vegetation

- Revegetate with appropriate coastal plain species.
- Replace non-local species with local indigenous species.
- Create an eco-diversity experience with concentrated plantings of local native species.
- Encourage diversity of habitats along river edge to top of batter.
- Introduce eco-sustainability interpretive corridors.
- Create ephemeral wetland areas and enhance habitat quality through logs, rock piles, bird and bat boxes.
- Encourage a strong focus on habitat awareness and protection.
- Improve biodiversity through revegetation with local coastal dune species, and the re-creation of low dunes integrating into the riverine environment, and the promotion of fauna movement through habitat linkages.
- Increase landscaped buffer area at the interface between industrial land uses and the zone boundaries of the Linear Park zone.
- Use large plantings to frame expansive views to hills.

Recreation

- Promote area as regional open space.
- Create recreational / activity focused nodes.
- Create eco-play space part physical/tactile.
- Create recreation nodes such as exercise stations.

These potential future management opportunities are described in the following Framework Plans (3.1 – 3.8).



REGIONAL CONTEXT PLAN
DIAGRAM 3.1
 H036/09/07 NOT TO SCALE - SCHEMATIC ONLY





This diagram gives direction and guidance to the more specific action plans schedule identified in this report.

The alignments shown for both the commuter link and shared trail are notional only.

Development should ensure that a permeable street and path network is established that encourages walking and cycling through the provision of safe, convenient and attractive routes with connections to adjoining streets, paths and open spaces.

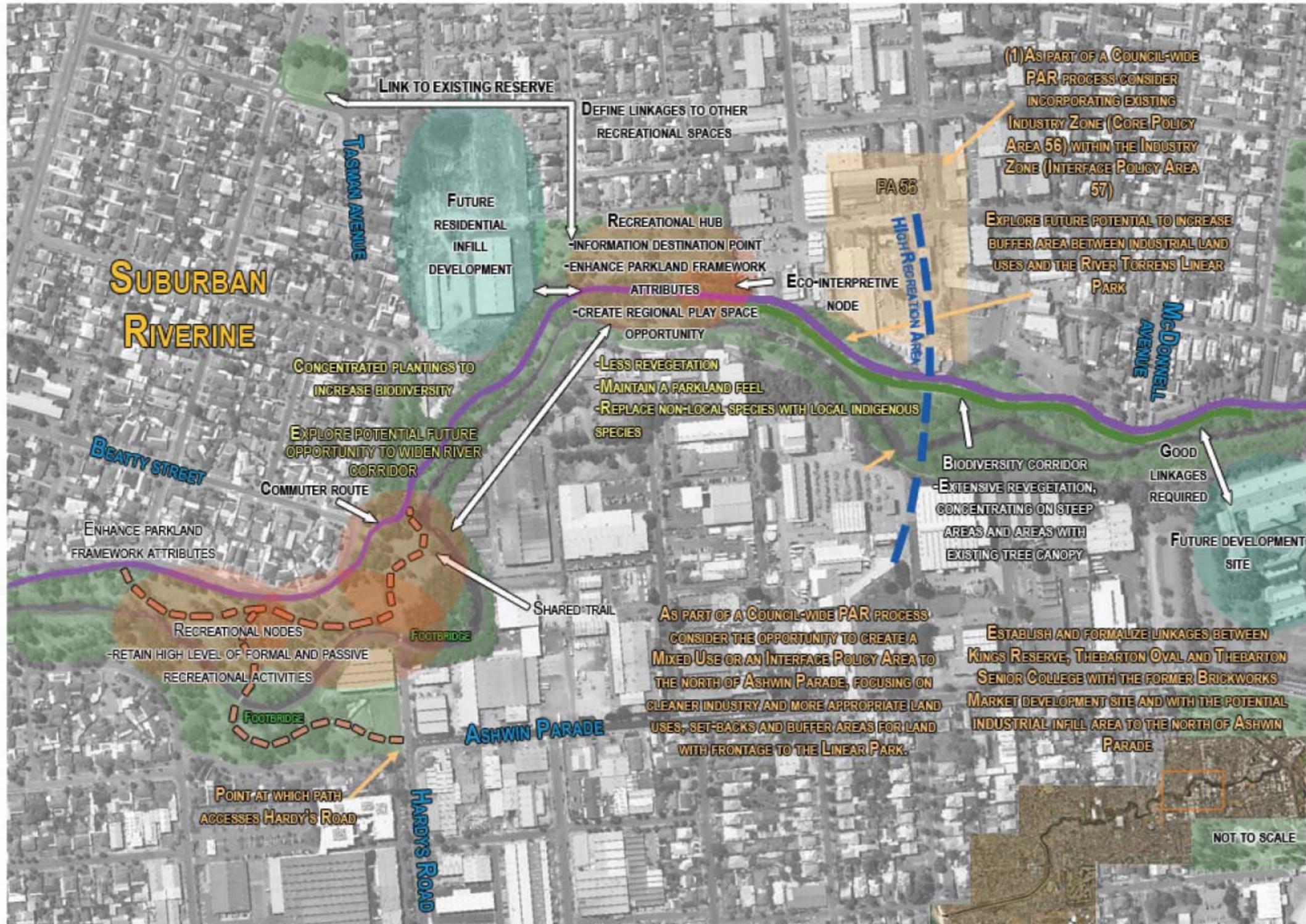
Development should encourage public access to the River Torrens Linear Park and ensure that it is retained and enhanced for cyclists and pedestrians.

FRAMEWORK PLAN
 STRATEGIC FUTURE LAND USE AND MANAGEMENT OPPORTUNITIES
 DIAGRAM 3.2
 H036/09/07 NOT TO SCALE



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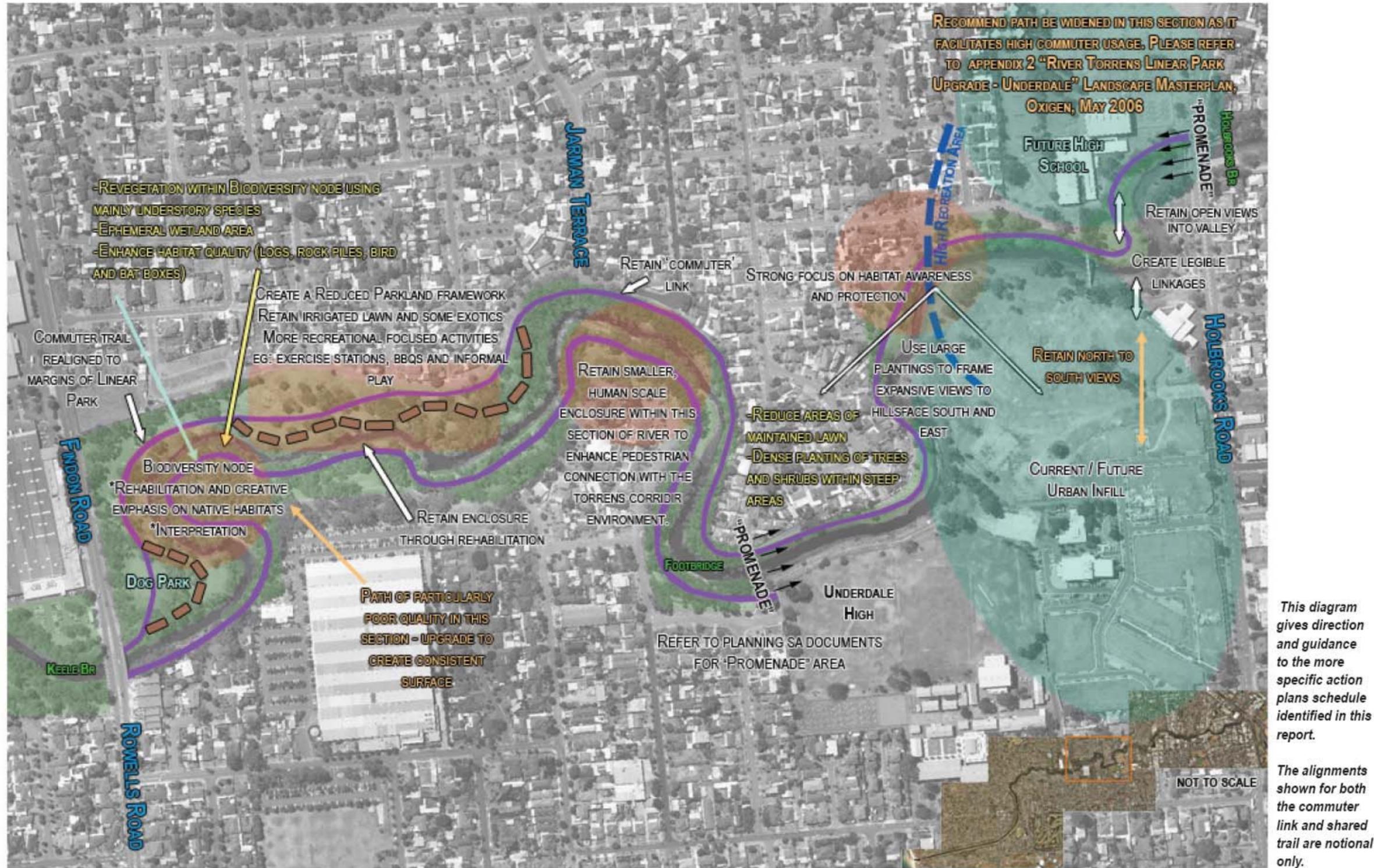


This diagram gives direction and guidance to the more specific action plans schedule identified in this report.

The alignments shown for both the commuter link and shared trail are notional only.

FRAMEWORK PLAN
 STRATEGIC FUTURE LAND USE AND MANAGEMENT OPPORTUNITIES
 DIAGRAM 3.3
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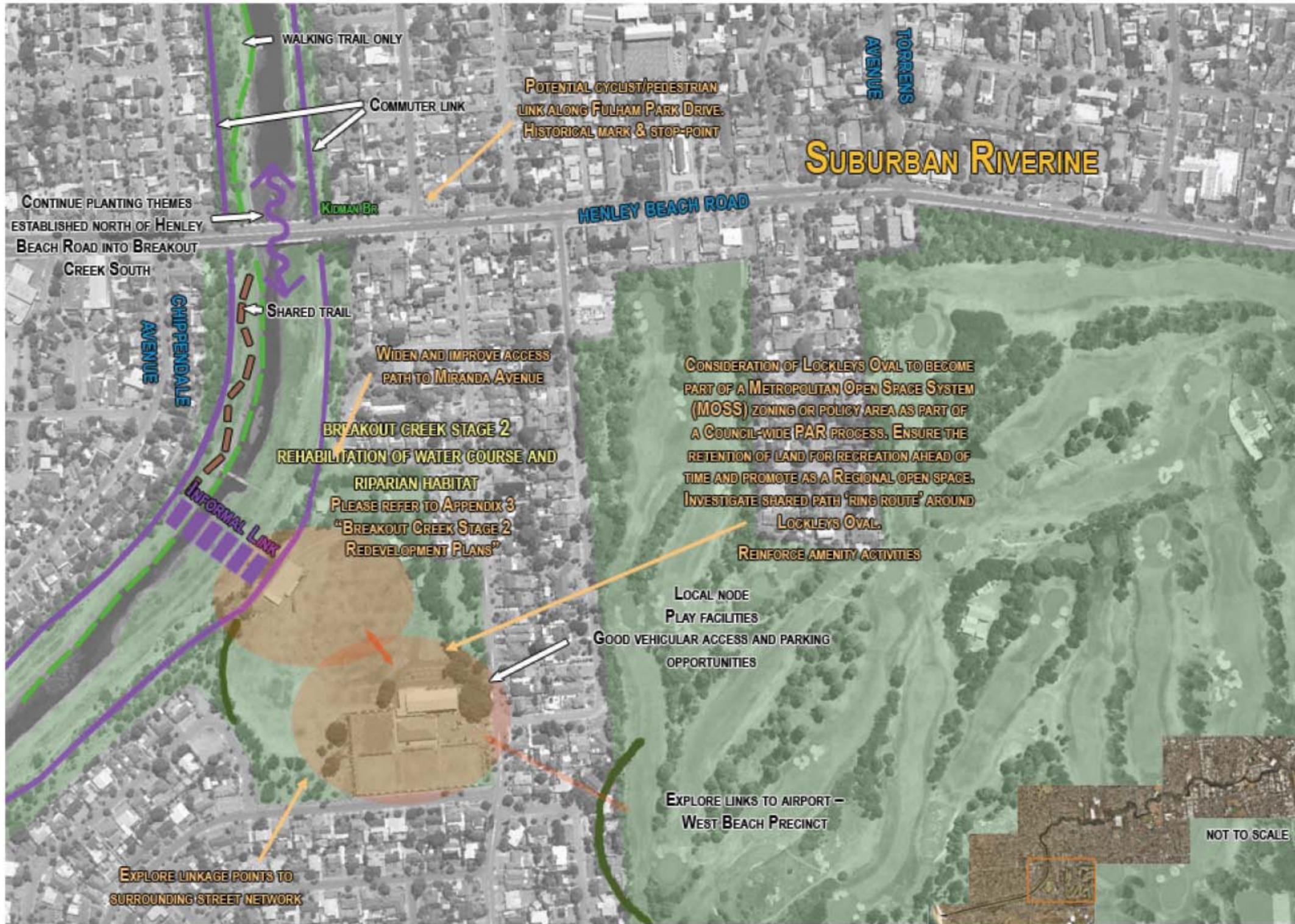


FRAMEWORK PLAN
 STRATEGIC FUTURE LAND USE AND MANAGEMENT OPPORTUNITIES
 DIAGRAM 3.4
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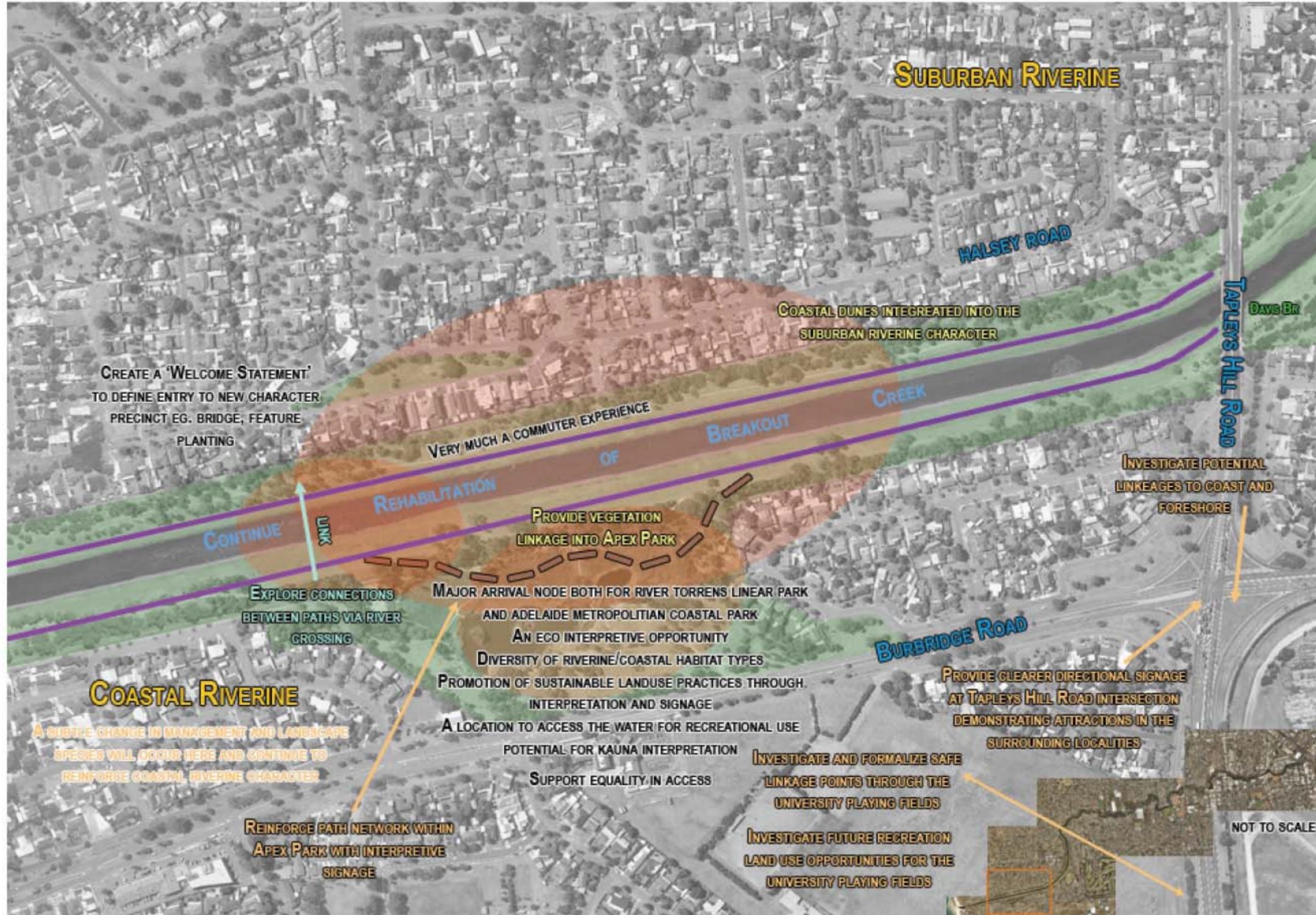


This diagram gives direction and guidance to the more specific action plans schedule identified in this report.

The alignments shown for both the commuter link and shared trail are notional only.

FRAMEWORK PLAN
 STRATEGIC FUTURE LAND USE AND MANAGEMENT OPPORTUNITIES
 DIAGRAM 3.6
 H036/09/07 NOT TO SCALE





This diagram gives direction and guidance to the more specific action plans schedule identified in this report.

The alignments shown for both the commuter link and shared trail are notional only.

FRAMEWORK PLAN
 STRATEGIC FUTURE LAND USE AND MANAGEMENT OPPORTUNITIES
 DIAGRAM 3.7
 H036/09/07 NOT TO SCALE





FRAMEWORK PLAN
 STRATEGIC FUTURE LAND USE AND MANAGEMENT OPPORTUNITIES
 DIAGRAM 3.8
 H036/09/07 NOT TO SCALE



4. BIODIVERSITY

Biodiversity is commonly known as the variety of all forms of life. It relates to plants, animals, micro-organisms, their genetic composition and the ecosystems they form, however most people typically think only of plants and animals. There are many different species recorded within the council area and each one is uniquely connected in some form of relationship with others. Direct impacts upon one species may have a detrimental effect on another. That is why biodiversity conservation needs to be focussed upon conservation of ecosystems, as well as single species.

Healthy ecosystems can perform a number of functions aside from the provision of habitat to plants and animals. These can range from the purification of water, pollination of plants, construction and stability of fertile soils, flood mitigation and breakdown of pollutants in our environment (ANZECC, 2001). Different ecosystems range in diversity and complexity, but all assist in performing these functions to some degree. Evidence of the breakdown of these functions can be seen in the form of erosion, flood damage, weed infestations, disease and population fluctuations of native and feral animals, pollution and fluctuating nutrient levels in water ways.

An area of biodiversity value will generally contain a high diversity of local native plants and animals. In the urban environment, habitat clearance and modification has left few areas which are considered to have a high biodiversity value, particularly along the River Torrens. However, areas can be improved and enhanced to increase the biodiversity value. This can be achieved through revegetation projects which utilise local native plant species planted in the types of habitats they would have originally occurred in. For example, the River Bottlebrush (*Callistemon sieber*) grows naturally along the edges of permanently wet or regularly inundated areas and therefore should be planted back into these areas only. By selecting the right local native plant species for the right area, the survival rates increase, the plants will grow and look better, the biodiversity levels are enhanced and the local fauna species will be encouraged back into an area.

Planting a mix of understorey species (native grasses, lilies, groundcovers), small and large shrubs as well as trees will increase the plant diversity within an area. This will also provide more resources for local fauna species and increase the diversity of species which can utilise an area. If nesting and roosting sites are also included in a revegetation project, some fauna species will be encouraged to utilise the area once the revegetation has been undertaken and won't need to wait for nesting and roosting sites to develop. Fallen logs, large rocks, bird and bat boxes and leaf litter provide excellent refuges for a range of species. These habitat features also increase the number and diversity of insects in an area which in turn provides more food resources for a broader range of fauna species.

Along the River Torrens Linear Park, biodiversity based projects must take into account that the Linear Park is primarily designed as a flood mitigation device and is now a valuable recreational asset. Therefore, the layout and design of biodiversity enhancing projects must take these factors into account so that the flood risks and safety of Linear Park users is not compromised. In some areas, it may result in the biodiversity measures being restricted or modified.

5. SAFETY ISSUES

A number of safety issues have been raised and identified as part of the development of the River Torrens Linear Park Management Plan. These have been identified through the consultation process, background research, discussions with council staff and through the audit of Linear Park which was undertaken.

The key safety concerns include:

- ~ Conflict between pedestrians and cyclists;
- ~ Areas which promote inappropriate behaviour;
- ~ General condition of some infrastructure; and
- ~ Existing condition of sections of the river bank and the stability of associated paths

The conflict between the pedestrians and cyclists utilising the River Torrens Linear Park is an issue that was raised numerous times. The conflict occurs under a number of different circumstances such as when cyclists are unsighted by pedestrians (e.g. blind corners), the pedestrians panic when a cyclist is approaching and is unsure which way to move, cyclists that don't use their bells to notify they are approaching and groups of pedestrians that walk with several people abreast. The cause of the conflict is not exclusively pedestrians or cyclists but a mix of both. The use of signage, line marking and educating user groups will aid in reducing the conflict. However, it is considered that increased commuter traffic along Linear Park is partly to blame for the conflict. This has been addressed in this plan by recommending an investigation into the development of a designated commuter link along Linear Park.

Areas which encourage inappropriate behaviour include poorly lit areas or areas which contain thick shrubby vegetation where people can hide. In some areas along Linear Park this has been addressed by the removal of shrubby vegetation, however, this is often the vegetation layer that offers the most habitat to local fauna species. A strategy of keeping all shrubby vegetation well away from any paths, planting only low growing (<1m high) plants near paths (other than trees) and ensure all of the installed lighting is well maintained will improve safety in the area.

The condition of some of the infrastructure, primarily the path network, has been raised as a safety issue and was recorded as such during the audit of the infrastructure. Long sections of the path network are considered to be narrow with a poor surface quality. Numerous blind spots were identified as well as one section that is unsealed. One section of the path on the City of West Torrens side near Ashwin Parade has been closed due to the erosion of the river bank and subsequent eroding of the path network. This area will require a major reconstruction to rebuild the path and ensure that the river bank is stable.

6. MANAGEMENT ISSUES AND RECOMMENDED ACTIONS

A detailed Action Plan has been produced as part of the project. Diagrams 6.1 to 6.7 provide a visual representation of the recommended actions for the project area. The action ranges from undertaking revegetation to commissioning large studies to develop an entire section of the River Torrens Linear Park.

Timeframes and priorities have been assigned to each of the actions based on several criteria. Priorities have been assigned within each of the management categories (see below for management categories) and therefore the actions have been assessed within a category independently. For example, actions within the Biodiversity category and Infrastructure categories have been prioritised independently of each other.

The main considerations taken into account when determining the priority of actions include:

- ~ Consequences of not undertaking the action (e.g. safety of users)
- ~ The benefits of undertaking the action
- ~ Budget considerations (some actions may require extensive external funding)

Safety considerations were at the forefront of determining the actions which were considered to be high priorities, particularly within the infrastructure category where safety issues are a primary concern. In addition to this, the funding requirements for a particular action also influenced the timeframe component as those expensive actions need to have funding sourced which can be a lengthy process. The definitions utilised for the timeframe are short term (1-3 years), medium term (3-6 years) and long term (6-10 years).

A series of management actions and recommendations have been developed as part of the current project. Actions have been divided into different categories including:

- General Management (where actions are beneficial to a number of categories)
- Revegetation
- Weed Management
- Fauna and Fauna Habitat
- Infrastructure
- Water Quality
- Erosion
- Implementation and Long-term Maintenance

Each management action has been prioritised based on the urgency of the action (particularly from a safety aspect), the funding required for the action (some high cost actions will require substantial funding to be sourced) and the benefits of implementing the action. A timeframe for each action has also been set with short term (1-3 years), medium term (3-6 years) and long term (6-10 years) categories being used. The council area and therefore responsibility has also been recorded to allow each council to determine their requirements

in relation to the actions and associated costs. A broad cost estimate has also been developed for the high priority actions. Some of the actions which require investigations to determine the most suitable treatment have not been costed as different treatments will result in large variations in the cost estimate. General comments have also been made regarding some of the actions.

Some of the actions which have been recommended will require the City of West Torrens and the City of Charles Sturt to work closely together to ensure they are implemented at the same time and undertaken to a similar standard. This will be a critical factor in ensuring the management of the River Torrens Linear Park is similar on both sides of the river corridor. In relation to seeking funding for projects, similar funding priorities will have to be placed on related actions from the two council areas to ensure projects can be undertaken simultaneously. It is advisable for both councils to communicate prior to submitting funding proposals and it may be beneficial to submit joint funding proposals.

The actions that have been developed and recommended within this section are the result of extensive background investigations, community consultation and discussions with council staff and the project team. The background investigations are included in this document as Appendices and are referred to in the document as required.

Appendix 4 details the strategic and statutory urban planning directions for the River Torrens Linear Park Management Plan. These have influenced the recommended actions and have been taken into account when determining what actions can be undertaken in the different locations.

6.1. General Management

The General Management section identifies actions which have a significant benefit to a number of different categories and therefore do not fit within a defined category. There are three actions that are recommended that fall within the General Management category. Two of the actions are related to ensuring current plans at Underdale and Breakout Creek Stage 2 are implemented appropriately and are to the standard required within the Linear Park. The third action relates to the investigation, design and implementation of a redevelopment between the Tapleys Hill Road Bridge to the Gulf St Vincent.

The area of the River Torrens Linear Park from Tapleys Hill Road to Seaview Road currently contains very little native vegetation and is a very straight channel with very few facilities. It has a low visual amenity and is not with the keeping of the River Torrens Linear Park along its entire length. The majority of the area is currently used for horse agistment with horse yard facilities adjacent to the Linear Park on the northern side at Henley South and on the southern side near the Lockleys Oval complex.

The Tapleys Hill Road to Seaview Road section of the River Torrens Linear Park is considered to be a significant stretch of the River Torrens Linear Park and provides excellent opportunities to improve biodiversity, water quality and visual amenity. It is considered to be the remaining corridor link requiring major upgrade from the Hills to the Gulf St Vincent.

The agistment of horses within the section between Tapleys Hill Road and Seaview Road is considered to be a significant issue and one that needs to be addressed. There is strong community support for the horses to remain in this location and there is also support for them to be relocated away from the River Torrens. It is well-known that livestock, including horses, have a significant impact on biodiversity, water quality and soil stability when they have uncontrolled access to waterways. The Lockleys Riding Club spends a lot of time and effort implementing land management practices to reduce the impact of the horses on the river environment. However, allowing the horses to have full access to the waterway will impact on water quality through increased nutrient loads and through soil disturbance from hooves and whilst the current land management practices reduces the impact, the current land management practices can not prevent this occurring. The presence of the horses in the current situation, with full access to the river, will also have a negative impact on any biodiversity improvement projects, such as revegetation, which may be undertaken.

It is recommended that the investigations into the upgrade of the Tapleys Hill Road to Seaview Road section determine the most appropriate outcome for this area. The two options that are available are the removal / relocation of the horses away from river environment and implement a redevelopment similar to Breakout Creek or incorporate horses into any redevelopment but keeping them away from waterways and fencing off any revegetation areas. From a biodiversity, water quality and soil erosion aspect it is preferable to remove / relocate the horses away from the River Torrens Linear Park. The removal / relocation of the horses would also open this area up for recreation purposes for the wider community. If this is not achieved, as a minimum, the horses should be kept at least 10m from either side of the waterway with fenced areas of revegetation between the water and the horses. The number of horses kept within the area may also need to be reduced to reflect the reduction in the available area.

The investigations for the upgrade of the lower section of the Linear Park should ensure that the higher level recommendations and planning framework detailed in the previous sections are incorporated into the design. This will further enhance biodiversity, recreational opportunities and the experience of the user.

The second general management recommendation is the implementation of the plan developed as part of the investigations for the Tapleys Hill Road to Gulf St Vincent section of the Linear Park. This action has a long timeframe due to the likely costs of the project and the need to source a suitable level of funding.

General Management Action Plan

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
General 1	Investigate and development and implementation of an eco-interpretive node with clumps of revegetation using local species and the creation of regional interactive eco-play space	Medium	Medium	Charles Sturt		Focussed on developing play and educational opportunities showcasing the local plants, animals and Aboriginal heritage
General 2	Investigate the development of a recreational node which encourages a range of recreational activities	Medium	Short	Charles Sturt	\$20,000	Provide facilities for a wider range of users as well as increasing the experience of existing users. Encourages a physical activity and a healthy lifestyle.
General 3	Ensure the River Torrens Linear Park Upgrade – Underdale plan is implemented as per specified (Appendix 2)	High	Short	Charles Sturt West Torrens	N/A	Ensure that each of the components, including path width and quality, revegetation and weed control, exceed minimum standards
General 4	Investigate pedestrian and cyclist linkages along Fulham Park Drive	Medium	Short	West Torrens	\$10,000	Develop better connectivity to areas outside of Linear Park.
General 5	Ensure the Breakout Creek Stage 2 development is implemented as per specified (Appendix 3)	High	Short	West Torrens	N/A	Ensure that each of the components, including path width and quality, revegetation and weed control, exceed minimum standards

General Management Action Plan

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
General 6	Investigate, develop concept plans and implement redevelopment of the Tapleys Hill Road to the Gulf St Vincent section of the River Torrens Linear Park	Medium	Investigations – Short Implementation - Long	West Torrens Charles Sturt	\$60,000 \$60,000 (cost estimate for investigations and design only)	A single study, similar redevelopment to Breakout Creek Stages 1 and 2 but with more of a coastal focus. Ensure that the design contains deep pools to improve water quality prior to entering the Gulf. Undertake extensive consultation with the Lockleys Riding Club, AMLR NRM Board and SA Water.
Entire Corridor	Ensure signage strategy is implemented and implement user educational program	High	Short	West Torrens Charles Sturt	\$5,000 \$5,000	Use the implementation of the signage strategy to start an educational program aimed particularly at the cyclists and pedestrians to reduce conflict. Create large temporary signs that detail expectations of all user groups, these could be moved up and down the Linear Park for a set period of time. This could be undertaken in conjunction with the DTEI.

6.2. Biodiversity

The lack of biodiversity within the River Torrens Linear Park is one of the key issues addressed by this management plan. The majority of the corridor is a well maintained parkland environment with scattered trees over mown grass. This does not promote local native flora or fauna species and it is very similar habitat along the entire length of the River Torrens Linear Park.

Appendix 5 details the ecological assessment of the project area with details on the flora and fauna species observed within the area and the species likely to occur within the area. The ecological assessment also provides details on the weed species recorded, erosion issues and information on the significant trees.

Due to the extensive development within the urban area and the massive changes in topography which have occurred over the year, it is not possible to recreate a pre-European environment. However, it is possible to implement a number of actions to improve the level of biodiversity within the area and create more complex habitat. The more complex the habitat is, the greater the number of flora and fauna species which can occupy an area. The following sections detail actions which are aimed at increasing the number of local native flora and fauna species which utilise the River Torrens Linear Park. These actions are not aimed at reducing the functionality of the Linear Park as a flood mitigation device or as an extremely valuable recreational area.

The actions have been grouped into similar actions with Revegetation, Weed Control and Fauna headings utilised.

6.2.1 Revegetation

The diversity of local native plant species and the area which they occupy within the River Torrens Linear Park is considered to be low (Appendix 5). The dominant vegetation within the area is trees over mown grass with the only native vegetation either being scattered trees or confined to the waterway (Appendix 5). To increase the number of species within the area and the area which is occupied by local native species, revegetation should be undertaken.

Revegetation is an extremely important management tool for increasing the diversity of flora and fauna species within a highly degraded environment. The revegetation must be suitably planned with appropriate resources secured for the nominated areas to ensure a high quality project which has ongoing management.

Within the River Torrens Linear Park, the tree canopy layer is generally well developed. A variety of tree species have been planted with some local native species as well as a variety of non-local native and exotic species being planted. There are also scattered remnant trees along the river corridor and whilst the non-local species are not ideal in the area, they do offer habitat and are a good asset for improving the biodiversity of the area.

The majority of the recommended revegetation for the River Torrens Linear Park involves planting understorey species which are low growing (<1m high). This has been recommended for several reasons, low growing plants will not impede the flow of water in the event of a flood and the low growing (<1m) species do not create safety issues which densely planted shrubs may cause. Any shrub species (>1m in height) which are planted within the Linear Park should be located at least 5m from the path network and planted to create an open feel (i.e. >10m apart).

The ecological zones developed by Pedlar and Crompton (2003) should be used as a guide in determining the plant species to be planted in the different areas. The ecological zones have been determined based on the likelihood of inundation and the types of species which would have originally occupied these areas. The understorey species (<1m high) should be planted densely to reduce the available area for weed species to establish. Suitable site preparation is required for all revegetation with at least two weed controls prior to planting. This will reduce the ongoing maintenance required in the revegetated areas. In addition, areas should also be mulched, providing they are at least 2m above the regular water level. An area of 1-2m of mulch should be spread around the edge of each revegetated area. This will act as a boundary to the revegetated area, allow maintenance staff to determine where revegetation areas are and allow mowing / spraying within this area without damaging the revegetation.

Revegetation Action Plan

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Revegetation 1	Revegetate steep banks using dense plantings of shrub and understorey species	Medium	Short	West Torrens Charles Sturt	Year 1 - \$10,000 Year 2 - \$10,000 Year 3 - \$10,000	Access will be an issue Plantings will need to be staged over 5-10 years Costing should be split 50:50 between council areas
Revegetation 2	Revegetate a corridor connecting Linear Park to Kings Park	Medium	Medium	West Torrens	Year 1 - \$8,000 Year 2 - \$2,500 Year 3 - \$2,500	Narrow corridor, limited area but revegetation with local native species should be incorporated into links between the two areas
Revegetation 3	Revegetate with understorey species	Medium	Short	West Torrens Charles Sturt	Year 1 - \$15,000 Year 2 - \$10,000 Year 3 - \$8,000	Low growing species only, keep the open feel, maximise the number of local native species planted Costing should be split 50:50 between council areas
Revegetation 4	Revegetate with understorey species under existing tree canopy and revegetate open areas with trees and understorey species, ensure that open areas are left as picnic locations	High	Short	Charles Sturt	Year 1 - \$18,000 Year 2 - \$10,000 Year 3 - \$8,000	Low growing species only, keep the open feel to the area, the occasional shrub species is ok, trees only in areas where trees currently do not occur
Revegetation 5	Revegetate area with understorey plants only	Medium	Medium	Charles Sturt	Year 1 - \$15,000 Year 2 - \$10,000 Year 3 - \$8,000	Low growing species only, no trees or shrubs

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Revegetation 6	Revegetate with understorey plants, plant lower lying areas with appropriate species	Medium	Medium	West Torrens	Year 1 - \$12,000 Year 2 - \$7,000 Year 3 - \$4,000	Ensure more water tolerant plants are placed within the areas likely to be inundated
Revegetation 7	Undertake revegetation using understorey species to enhance existing Our Patch Site, plant scattered trees and shrubs in the open areas	High	Short	Charles Sturt	Year 1 - \$10,000 Year 2 - \$5,000 Year 3 - \$4000	Consult with Our Patch Officer
Revegetation 8	Revegetate with understorey species only	Low	Medium	West Torrens		
Revegetation 9	Revegetate with understorey species only	Low	Medium	Charles Sturt		
Revegetation 10	Revegetate with understorey species only	Low	Medium	Charles Sturt		
Revegetation 11	Revegetate with understorey species only	Medium	Short	Charles Sturt	Year 1 - \$6,000 Year 2 - \$3,000 Year 3 - \$2,000	
Revegetation 12	Revegetate with understorey species only	Low	Medium	Charles Sturt		
Revegetation 13	Investigate possible corridor linkages from the River Torrens Linear Park to the Our Patch site on Kooyonga Golf Course through Lockleys Oval	Low	Medium	West Torrens		

6.2.2 Weed Management

Weed management with the River Torrens Linear Park will be a long-term ongoing management issue. Table 6.1 details the priority list of species to be controlled within the Linear Park. This list details the environmental and declared weed species which should be controlled and removed within the River Torrens Linear Park. The list of target species must be flexible and updated regularly as new species will appear within the area or new populations or scattered occurrences of species will possibly occur. These may need addressing as a Priority and undertaken regardless of the list in Table 6.1.

The weed control methods that should be utilised are detailed in Appendix 6. The weed control methods used will be determined by the target species, the size of the infestation, the size of the target plants and the proximity of the weeds to waterways. Methods should be employed that will ensure effective control of the target species but will also minimise off-target damage and any impacts on the surrounding environment.

Table 6.1 Priority weed species requiring control within the River Torrens Linear Park

Species name	Common name	Weed status*	Priority
<i>Acacia baileyana</i>	Cootamundra Wattle	E	Medium
<i>Acacia saligna</i>	Golden Wreath Wattle	E	High
<i>Asparagus asparagoides</i>	Bridal Creeper	D	High
<i>Asphodelus fistulosus</i>	Onion Weed	D	High
<i>Conyza bonariensis</i>	Flax-leaf Fleabane	E	Low
<i>Coprosma repens</i>	Mirror bush	E	Medium
<i>Cotoneaster pannosus</i>	Cotoneaster	E	Medium
<i>Cytisus scoparius</i>	English Broom	D	High
<i>Elodea canadensis</i>	Canadian Pondweed	D	High
<i>Emex australis</i>	Three-cornered Jack	D	High
<i>Eurhorbia terracina</i>	False Caper	D	Medium
<i>Foeniculum vulgare</i>	Fennel	E	High
<i>Fraxinus angustifolia</i>	Narrow Leaved Ash	E	High
<i>Galenia secunda</i>	Galenia	E	Low
<i>Lantana camara</i>	Lantana	D	High
<i>Lycium ferocissimum</i>	African Boxthorn	D	High
<i>Olea europaea</i>	Olive	D	High
<i>Opuntia sp.</i>	Prickly Pear	D	High
<i>Oxalis pes-caprae</i>	Soursob	D	Medium
<i>Pennisetum clandestinum</i>	Kikuyu	E	Medium (High in revegetation areas)
<i>Pennisetum villosum</i>	Feathertop	E	High
<i>Pinus radiata</i>	Monterey Pine	E	Medium
<i>Pittosporum undulatum</i>	Sweet Pittosporum	E	High
<i>Ricinus communis</i>	Caster Oil	E	Medium
<i>Rubus fruticosus</i> sp. agg.	Blackberry	D	High
<i>Scirpus molle</i>	Pepper Tree	E	Medium
<i>Senecio mikanoides</i>	Mile a minute	E	High
<i>Senecio pterophorus</i>	South African Daisy	E	High
<i>Solanum nigrum</i>	Black-berry Nightshade	E	Low
<i>Sonchus oleraceus</i>	Common Sow-thistle	E	Low
<i>Tamarix aphylla</i>	Athel pine	D	Medium
<i>Tribulus terrestris</i>	Caltrop	D	High
<i>Watsonia meriana</i> var. <i>bulbillifera</i>	Bulbil Watsonia	D	High

*Weed Status

E = Environmental Weed; D = Declared Weed under the *Natural Resource Management Act 2004*

Weed Action Plan

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Entire corridor	Implement weed control along entire corridor starting at the Port Road end targeting the species listed above	High	Ongoing	West Torrens Charles Sturt	\$25,000 / year \$25,000 / year	

6.2.3 Fauna and Fauna Habitat

The diversity of fauna species, particularly reptiles and mammals, along the River Torrens Linear Park is considered to be very low (Appendix 5). This is an artefact of the high level of disturbance and urbanisation of the area. The lack of native vegetation (natural or revegetated) limits the number of species which may utilise the Linear Park as it does not provide enough resources such as shelter and food.

The dominant fauna species within the River Torrens Linear Park are waterbirds such as Eurasian Coots, Dusky Moorhens, Australian Wood Ducks and Pacific Black Ducks (Appendix 5). These species are generally confined to the waterway or the banks of the River Torrens. Terrestrial bird species which are common along Linear Park include Australian Magpies, Magpie Larks and Noisy Miners. These species are typical species found across metropolitan Adelaide as they have adapted to living within an urban environment and are habitat generalists. The species, such as some insectivorous species, which require a range of habitat structures within an area have generally disappeared from the site.

To recreate suitable fauna habitat and promote the use of the area by a variety of fauna species, the complexity of habitats offered to species needs to increase. This requires revegetation projects to utilise understorey and shrub species in addition to planting just tree species. Native grasses provide valuable food resources to numerous native bird species while the flowers on shrubs and trees provide valuable resources to native honeyeaters. Increasing the complexity of the habitats is also likely to make conditions more favourable for species which are displaced by more aggressive species such as Noisy Miners. It must be noted that planting dense areas of shrub species is a safety issue and should be avoided unless the areas are relatively inaccessible (e.g. on the steep slopes). Shrub species should be planted sparsely and at least 5m from the path network.

In addition to the revegetation other activities can be undertaken which improve and enhance the existing fauna habitat. In a number of instances the limiting factor in an area is the lack of suitable nesting and roosting sites for hollow dependent species. This can be alleviated, to a degree, by installing bird and bat boxes and affixing hollows to trees. The majority of trees within the River Torrens Linear Park are many years away from forming hollows and therefore the installation of boxes and hollows will provide valuable resources to a range of species. All boxes or hollows that are installed should be regularly inspected as it may be introduced species which utilise them. Species such as feral honeybees, should be removed if found using the hollows / boxes. Appendix 7 provides the dimensions of example bird and bat boxes.

Within the revegetation areas, structures such as fallen logs, large rocks and leaf litter should be incorporated. These will provide additional resources to a range of fauna species. It will also provide more habitat for insects which are the food source for a broad range of fauna species, particularly birds. In turn, this is likely to attract either additional species or more individuals to the area.

Native fish have also significantly declined within the River Torrens catchment. Recently the Adelaide and Mount Lofty Ranges Natural Resource Management Board funded a fish

ladder near the mouth of the River Torrens to allow native fish to pass over the weir. As part of future studies it is recommended that investigations into fish ladders and passageways be undertaken. The long term aim of this would be remove all barriers to fish movement up and down the River Torrens. This is likely to increase the number of fish species utilising the River Torrens, particularly when combined with projects such as Breakout Creek Stage 2 and the possible upgrade of the area between Tapleys Hill Road and Seaview Road. Additionally, deeper more permanent pools along the length of the River Torrens would provide valuable habitat for native fish, particularly in dry times. Habitat within the water, such as snags, overhangs and rock piles, can also provide excellent habitat for the native fish species.

Fauna Action Plan

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Entire corridor	Investigate the requirements for implementing fish passage ways / ladders for all fish barriers along the length of the project area	High	Short	West Torrens Charles Sturt	\$4,000 \$4,000	To be undertaken in partnership with the AMLR NRM Board
Entire corridor	Implement numerous bird and bat boxes / hollow logs (attached to trees) along within the project area	High	Short	West Torrens Charles Sturt	\$7,000 \$7,000	Opportunity to get schools involved Guidelines for construction in Appendix 7
Revegetated areas	Improve fauna habitat quality by using fallen logs (including hollows), rocks and leaf litter within the revegetated areas	High	Short	West Torrens Charles Sturt	\$3,000 / year for three years \$3,000 / year for three years	Ensure logs and rocks are secure or outside of the flood zone

6.3 Infrastructure

As part of the investigations for the River Torrens Linear Park Management Plan, an audit of open space and existing recreation and supporting infrastructure and facilities within the study area was undertaken. The results of this have been put into a GIS Database which can be utilized by council staff. The audit included an assessment of the quality of the shared pathway in this area as well as an assessment of other infrastructure such as seats, bins and BBQ areas. The audit is an extensive summary of the facilities that exist within the Linear Park across both of the relevant Council areas and has led to a number of recommendations being made.

All infrastructure has been allocated a corresponding number reference providing an indication to the quality of that infrastructure as follows:

- 4 Good quality
- 3 Requires some repair
- 2 Poor quality
- 1 Requires replacement

The facilities inspected were generally considered to be either of a good standard or requiring some minor repair. It is also considered that there is adequate seating, BBQ areas and drink fountains. It has been highlighted in the community consultation that dog litter bags be placed at more regular intervals within the Linear Park. It was also highlighted that additional toilets be installed, however, there were also concerns in relation to personal safety near these facilities.

To cater for increased recreational demand and usage, the upgrade of the path network is a necessity and a high priority. It should be an aim for the Linear Park that the entire corridor can be traveled on both sides of the River without having to cross a road or utilize the road network in any location. For this to occur, significant investment is required, particularly for the South Road to Port Road section where the Linear Park is narrow and steep. This area will require extensive investigations to determine the feasible location of the path and the possible construction methodologies which could be utilised. Several underpasses have also been highlighted as future actions to allow users to remain on the path network.

There were two issues that dominated the responses from the users of the River Torrens Linear Park. They were the conflict between cyclists and pedestrians and the quality of the path network. Numerous upgrades to the path network have been recommended as part of this plan. This will ensure that the path widths and path surface meet Australian Standards and are consistent with Linear Park. To reduce the conflict between cyclists and pedestrians, it has been recommended that an investigation into a dedicated commuter path be undertaken. Whilst it is likely to be a costly exercise with a variety of issues, having a dedicated commuter path would help to alleviate the majority of conflicts between cyclists and pedestrians as they generally occur when cyclists are traveling at speed and pedestrians are slow to react. The commuter traffic is likely to increase over time due to rising vehicle running costs and the promotion of an active healthy lifestyle.

The sections of the path that are narrow (<3m wide) have been highlighted as well as areas containing significant blind spots and areas where the path is unsealed. All of these activities are considered to be high priorities and occur across both council areas.

To diversify the user groups who utilize the Linear Park on a regular basis, it is recommended that a fitness circuit / designated areas be developed. These areas will also aid in meeting the increase recreational demands on the area. The fitness circuit could involve having designated larger outdoor workout stations or smaller areas at more regular intervals. The development of this concept would require further investigations into the nature and type of fitness stations which should be implemented.

As part of the audit of existing infrastructure, an audit of the safety of the Linear Park in relation to access to the river was undertaken. This was undertaken as a result of recent incidents involving two separate accidents where pushers / strollers rolled into the river. This broad safety survey was undertaken to identify potential locations where further investigations may be required. The result of the survey was that the section of the River Torrens Linear Park from the Port Road Bridge to the River Mouth did not contain any locations where further investigations would be warranted, in relation to the issue described above. Areas adjacent to steep embankments are generally fenced with a pine rail fence and the lower stretches of the area are relatively flat with minor undulations. It is considered that there will always be potential issues with safety around water unless the entire river is fenced which is not practicable or feasible.

Infrastructure Action Plan

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Entire corridor	Investigate the feasibility of developing a commuter link utilising one side of the River Torrens Linear Park Corridor	High	Short	West Torrens Charles Sturt	\$50,000 \$50,000	To reduce the conflict between pedestrian and cyclists
Entire corridor	Improve network and path linkages with surrounding area	Medium	Long	West Torrens Charles Sturt		
Entire corridor	Design and implement a fitness circuit / area at designated locations	High	Short	West Torrens Charles Sturt		
Entire Corridor	Undertake ongoing maintenance of paths to repair general wear and damage to the path network, increase path width to a minimum of 3m	High	Ongoing	West Torrens Charles Sturt		Particularly focussed on small areas where surface is in poor condition, damaged by trees roots etc
Infrastructure 1	Investigate options and design new path from South Road to Port Road including an underpass under South Road on the southern side of Linear Park Construct path from South Road to Port Road	High High	Medium Long	West Torrens Charles Sturt	\$50,000 \$50,000	Aim is to have path network extend on both sides of the River Torrens from Port Road to South Road within the Linear Park with no on-road sections, ensure that it ties in with the KBR 2007 report for the stabilisation and redevelopment plan May require boardwalk type infrastructure to fit it within Linear Park Possible land acquisition, particularly on south side of Linear Park

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Infrastructure 2	Investigate the upgrade of the existing path ensuring that it is a minimum of 3m wide, where possible remove undulations, address blind spots and address significant bank / path stability issues. Remove some of the non-local native vegetation to improve sight distance	High	Short	West Torrens	\$60,000 (investigations only)	May require level of path to be dropped to allow an increase in the width of the path. Stabilisation of path is likely to require full engineering report and may require extensive rock gabions and shaping of bank to be undertaken
Infrastructure 3	Design and Construct underpass on the south side of the River Torrens under Holbrooks Road	Medium	Long	West Torrens		
Infrastructure 4	Fix blind spot and path gradient	High	Short	West Torrens		
Infrastructure 5	Fix blind spot and path width	High	Short	Charles Sturt	High	Lower and widen path, ensure path connects safely with footbridge
Infrastructure 6	Upgrade path, increase width	High	Short	West Torrens		
Infrastructure 7	Upgrade path, increase width and remove blind spots	Medium	Medium	West Torrens		
Infrastructure 8	Design and construct an underpass on the south side of Linear Park under Rowells Road	Medium	Long	West Torrens		
Infrastructure 9	Upgrade path, widen and remove blind spots	High	Short	West Torrens		
Infrastructure 10	Upgrade path to a sealed path with appropriate width	High	Medium	West Torrens		
Infrastructure 11	Improve and widen access to Miranda Avenue Lockleys	Medium	Medium	West Torrens		
Infrastructure 12	Design and construct a pedestrian bridge parallel to the road bridge to move pedestrians away from road way.	Medium	Long	Charles Sturt		Will safely connect the north and south sides of Linear Park for pedestrians.

6.4 Water Quality

A number of factors influence the quality of the water within an urban river system. These include stormwater run-off, industry discharges, water flow rates and the design of the river system (i.e. straight channel vs wetlands or combination of both). The quality of the water in the lower stretches of the River Torrens has not been monitored in detail, however there are a number of factors (including those mentioned above) that would be influencing the water quality in this area.

There are a number of stormwater outlets located within the project area which discharge run off from buildings, streets and footpaths into the River. The increased amount of runoff has led to higher inputs of pathogens, nutrients, toxicants and litter. In turn these inputs can lead to a decline in water quality, algal blooms, sedimentation and a decline in the abundance and diversity of native flora and fauna species, primarily within the aquatic and riparian ecological zones.

In addition to run-off, a lack of water flows can significantly affect water quality. As water flows decrease, the concentration of sediments and toxins in the remaining water increases. High flows are required to occasionally flush the system.

The presence of the horses also affects water quality. This is particularly important as the horses are located in the last section of the River Torrens before it enters Gulf St Vincent. Therefore, there is little opportunity to remove higher nutrient loads and sedimentation from the water prior to going out to sea. The Lockleys Riding Club spend a lot of time collecting manure before it enters the waterway which would significantly reduce the nutrient load entering the water. However, as the horses have full access to the waterway, they possibly defecate in the water as well as their hooves creating sedimentation and increasing turbidity in the water. This is also discussed in Section 6.1 General Management. The recommendation is to preferably remove the horses from the Linear Park and if this can not be achieved, the horses should be prevented from being within 10m of either side of the River.

The recommended water quality monitoring program has six monitoring locations spread throughout the project area. The location of the monitoring points is designed to see what the water quality is likely coming into the project area, what sections of the river are adding to the nutrient and toxin loads and what the water quality is as it leaves the river system. Each site should be monitored every two months.

Justification of the location of the recommended water quality monitoring locations:

1. Western side of Port Road Bridge on the northern bank
Reason
 - This will allow observations on water quality entering the subject area and will provide a baseline and reference point for data collected further downstream
2. Approximately 10 meters west of the South Road Bridge on the northern bank
Reasons
 - Approximately 11 pipes flow into river between Port Road Bridge and Monitoring Location 2

- This number includes 3 large concrete pipes approximately 1 meter in diameter and also a large 3 meter wide drain from the West End Brewery
 - Land use is primarily industrial between Port Road Bridge and Monitoring Location 2
3. Approximately 5 meters east of the weir, which is on the eastern side of Holbrooks Road Bridge
- Reasons*
- Approximately 6 large pipes, ranging in size from approximately 0.7-1.3 meters in diameter, flow into the river between Monitoring Location 2 and the weir east of the Holbrooks Road Bridge
 - Lots of reed and rushes are within this section which may assist in water cleaning processes
 - Residential and industrial areas exist in this section between Monitoring Location 2 and the weir east of Holbrooks Road Bridge
4. The beginning point of Breakout Creek wetlands on either side of the river
- Reasons*
- Will allow water quality to be noted prior to entering the wetlands
 - 5 large drains flow into the river between Monitoring Location 3 and the beginning of Breakout Creek wetlands. One drain is 2.5 x 1.5 meters (largest observed drain) and others are approximately 1.3 meters in diameter
 - Long section between Monitoring Location 3 and the beginning of Breakout Creek wetlands, which is highly vegetated for the majority of it
5. The finishing point of the Breakout Creek wetlands on either side of the river
- Reasons*
- Will allow water quality to be noted after it has passed through wetlands
 - Will provide information on how effective wetlands are at improving water quality
6. Approximately 5 meters east of the weir adjacent to Seaview Road on either side of the river
- Reasons*
- Will provide detail on final quality of water being released into ocean
 - Will allow impact of horse grazing area (from wetlands to ocean) on water quality
 - Several pipes flow into the river between Monitoring Location 5 and the weir adjacent to Seaview Road
 - Residential area

Water samples should be tested for the following:

- Nutrients (phosphorous and nitrogen)
- Dissolved oxygen
- Water temperature
- pH
- Limited metals
- Salinity
- Turbidity
- Water flow

It is suggested that the water quality monitoring sites be set up as Waterwatch sites and that local schools and community groups be encouraged to undertake the monitoring. Waterwatch have been sampling along the River Torrens for a number of years and therefore, they should be contacted in relation to any water sampling. Any new sampling sites should compliment the existing monitoring. The results from the new sampling sites can then be analysed and interpreted. The previous data collected for the river should also be reviewed as it has been collected over a number of years.

The data collected is likely to influence the ongoing management of the waterway. Depending on the specific results, infrastructure such as Gross Pollutant Traps or small detention basin may be installed where pipes flow into the river. Alternatively, it may lead to changes in the management of industrial discharges into the river, particularly in relation to the quantity and quality of the discharges. Over time the monitoring will allow the impact of specific water quality management actions along the River Torrens to be assessed and the success of the different actions can be determined.

The data collected for the water quality monitoring must be analysed and interpreted regularly so that any specific management actions or alterations to the monitoring program can be implemented.

Water Quality Action Plan

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Water1 – Water6	Support existing water monitoring sites within project area and ensure water quality monitoring is undertaken at the nominated locations	High	Short	West Torrens Charles Sturt	\$4,000 / year \$4,000 / year	Possible project several locals schools, community groups and Waterwatch could get involved in. Monitoring should be undertaken every 2 months and should coincide with Waterwatch testing. The Waterwatch program should be reviewed prior to implementing monitoring to ensure sites do not overlap and to ensure the correct methods are being used to collect data.
Entire corridor	Investigate the requirements for Gross Pollutant Traps, siltation traps at inlets / outlets	High	Long	West Torrens Charles Sturt		May require several years of monitoring data prior to implementing (depending on results)
Entire corridor	Investigate feasibility of implementing deep pools to act as siltation traps near stormwater outlets	Medium	Long	West Torrens Charles Sturt		May require several years of monitoring data prior to implementing, would need to develop an ongoing maintenance schedule to ensure ponds are effective over time

6.5 Erosion

Since European settlement, increased erosion within the River Torrens has been the result of river modification and the removal of natural riparian vegetation. Almost all forms of river modification increase the velocity of a stream, thus increasing erosion and removing or altering in-stream habitat (Tait, 2005). When soil is eroded and deposited, the depth of river pools can be significantly decreased as sediment builds up. As the size and depth of river pools decrease, the availability of habitat for aquatic fauna species is also reduced.

The River Torrens Linear Park contains sections where the bank slopes are very steep which make the area prone to erosion. Several locations were identified as containing erosion of concern as well as other areas which will require ongoing monitoring. The bank adjacent to the river on both sides is also of concern as the water has caused the bank to be almost vertical for the majority of the length. This poses as a safety issue for maintenance staff as well as users. The edge of the banks are generally covered with thick Kikuyu and therefore the exact location of the top of the bank is unknown as the thick mat of Kikuyu can prove to be deceptive in relation to the edge.

The majority of erosion within Linear Park is occurring on the edges of the River, predominantly on the outside edges of river bends during periods of increased water flow. Whilst erosion along the banks of the river primarily occurs during flooding events, it does cause a loss of soil, decline in water quality and sedimentation.

Erosion at several locations adjacent to the river has undermined and exposed the roots of several remnant trees such as the River Red Gum (*Eucalyptus camaldulensis*) (see plate 8; Appendix 5). As these erosive processes continue, further exposure of these tree roots will ultimately lead to a further loss of native riparian vegetation.

A stable, non-eroding river bank is characterised by a gradual slope away from the waters edge where vegetation provides bank stabilisation and there are few areas of exposed bare ground. There are numerous sections where the River Torrens is characterised by stable, non-eroding river banks, most of which occur within Breakout Creek Stage 1 and downstream from the Henley Beach Road Bridge. However, there are also many sections where there are very steep embankments adjacent to the river. The majority of these steep embankments occur between the Port Road Bridge and the beginning of Breakout Creek Stage 1. These embankments are generally unstable and due to their steepness, will always have an erosion potential. The embankments are dominated by introduced flora species such as Kikuyu (*Pennisetum clandestinum*) and are often characterised by exposed roots of trees and shrubs, and sections of exposed bare ground (see plate 6; Appendix 5). The extensive weed infestations that are present on these steep embankments are the result of restricted accessibility for maintenance activities. Very little native vegetation and suitable fauna habitat occurs on any of the steep embankments.

Erosion Action Plan

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Erosion 1	Complete design and implement the KBR Plan	High	Short	Charles Sturt	Complete Design - \$50,000 Implement - \$1m	Includes major stabilisation works and redevelopment along Adams Street. Reference is Kellog Brown & Root Pty Ltd (2007), "Adams Street – River Torrens bank Stabilisation".
Erosion 2	Design and implement bank reinstatement	High	Short	West Torrens	\$45,000 (design only)	Likely to require engineering solution such as rock gabions due to location on bend and high velocity water flows experienced Funding should be sought from the AMLR NRM Board to undertake design and implementation of project.
Erosion 3	Undertake revegetation to address sheet erosion	Medium	Medium	Charles Sturt		Could be incorporated into other revegetation projects in the area.
Erosion 4	Undertake revegetation to address sheet erosion	Medium	Medium	Charles Sturt		Could be incorporated into other revegetation projects in the area.
Erosion 5	Design and implement plan to address extensive bank erosion	High	Short	Charles Sturt	\$25,000 (design only)	Likely to require rock gabions or similar to be utilised as well as revegetation on the higher ground
Erosion 6	Undertake revegetation to address sheet erosion	Medium	Medium	Charles Sturt		Could be incorporated into other revegetation projects in the area.
Erosion 7	Undertake revegetation to address bank erosion, may require some earthworks to re-shape bank	Medium	Medium	West Torrens		Could be incorporated into other revegetation projects in the area.

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Erosion 8	Undertake revegetation to address sheet erosion	Medium	Medium	West Torrens		Could be incorporated into other revegetation projects in the area.
Erosion 9	Undertake revegetation to address sheet erosion	Medium	Medium	Charles Sturt		Could be incorporated into other revegetation projects in the area.
Entire Corridor	Minor bank erosion occurs along a large portion of the River, develop and implement a strategy to plant low growing reeds along waters edge to prevent ongoing erosion	High	Ongoing	West Torrens Charles Sturt	\$15,000/yr \$15,000/yr	Will delineate the waters edge for mowing purposes, and prevent the bank from under-cutting and collapsing, establishment costs will be high and some areas may require minor earthworks to reinstate the bank prior to planting

6.6 Implementation and Long-term Maintenance

The River Torrens Linear Park is a significant asset to both the City of West Torrens and the City of Charles Sturt. The implementation of this management plan and the long-term maintenance of the Linear Park are key factors in ensuring the Linear Park remains a high quality area of open space which caters for increasing recreational demands as well as increasing the biodiversity values of the area. The implementation of the Management Plan needs to be the responsibility of a nominated person or team within each council area. This will ensure that the Management Plan is a working document, regularly reviewed and updated. It will also ensure that the high priority actions are addressed, funding sourced if required and implemented.

It is recommended that the number of staff and the level of resources available to those staff are increased to allow a higher level of maintenance of the River Torrens Linear Park. This is particularly relevant as the level of weed control and revegetation has been recommended to be significantly increased. If the councils are to adequately implement and maintain the revegetation areas and undertake the additional weed control, the maintenance of resources need to be increased. Whilst the revegetation areas will decrease the amount of mowing required, the time taken to maintain the revegetation areas to an appropriate level will outweigh any savings on mowing time.

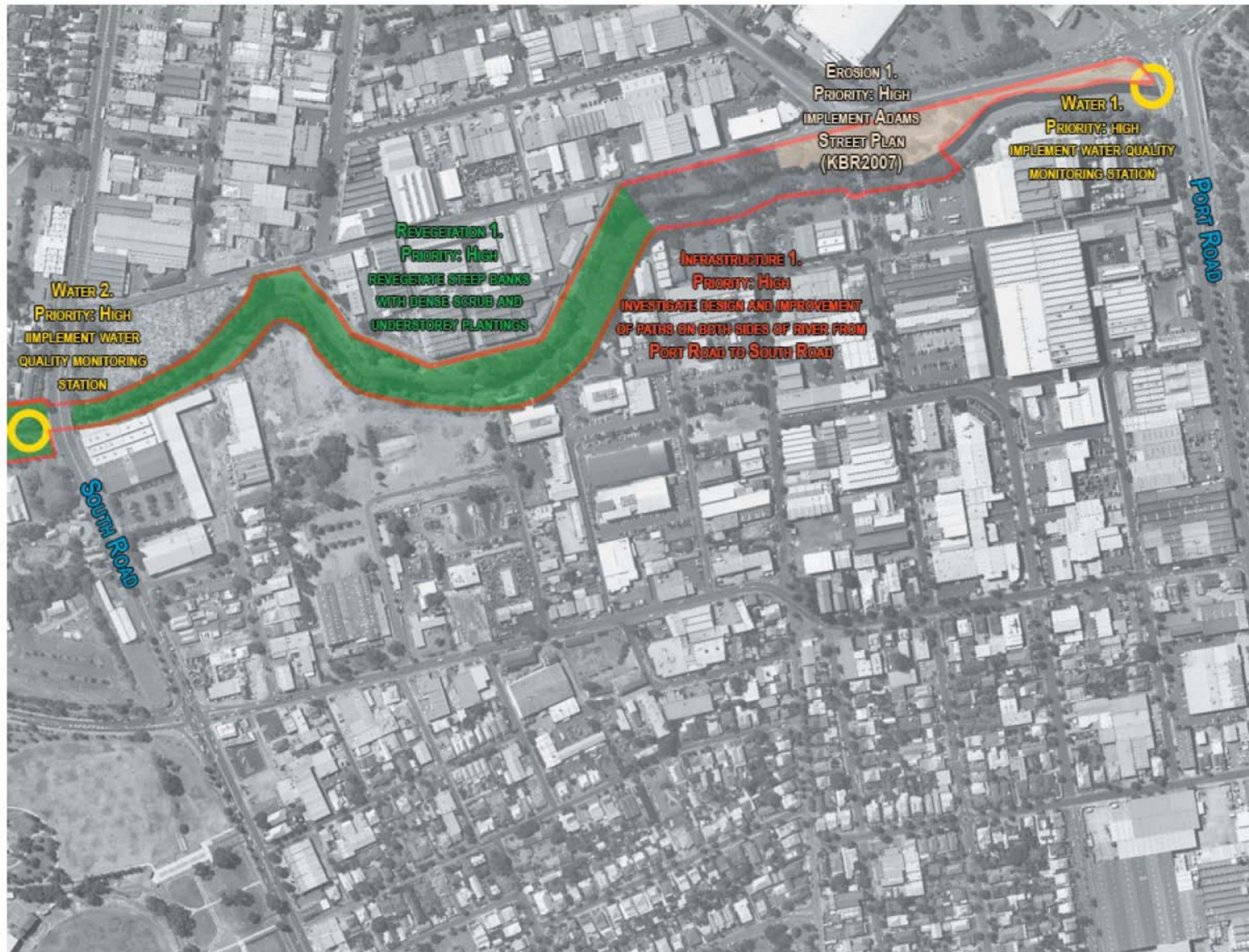
It is also recommended that the council staff undertaking the maintenance of the River Torrens Linear Park either increase their knowledge relating to the local native flora and fauna or any additional staff employed should have a stronger biodiversity background. This will aid in the maintenance of the revegetation areas as staff will recognize the local native species and know to avoid them. It will also aid in the implementation of the Management Plan as staff will have a biodiversity focus and believe in the principles of this Plan.

General maintenance of the infrastructure should also be increased. This is related particularly to the path network where minor issues occur within both council areas. Path lifting due to tree roots or isolated cracking should be fixed on a regular basis. This will decrease the safety issues within the Linear Park as trip hazards will be reduced. These issues are seen as minor and should therefore be rectified as part of the general maintenance of the park.

Vandalism (e.g. breakage of bins, seats, graffiti) is a common occurrence along the Linear Park and regular maintenance to remove graffiti and fix broken infrastructure is required. It appears that this occurs presently and needs to be maintained to ensure that the facilities within the Linear Park are functioning and aesthetically appealing to users of the park.

Implementation and Long-term Maintenance Action Plan

Plan reference	Action	Priority	Timeframe	Council area	Cost estimate	Comments
Entire corridor	Increase number of staff and resources to more adequately maintain Linear Park, particularly the recommended revegetation areas. Increase the biodiversity skills of staff or employ staff with a stronger biodiversity background	High	Ongoing	West Torrens Charles Sturt	\$110,000 / yr \$110,000 / yr	Allows for the employment of two additional staff in each council area, training for existing staff and additional equipment for the increase in staff
Entire corridor	Increase the level of funding to better maintain infrastructure such as the path network, explore possibilities of developing new low maintenance practices	High	Ongoing	West Torrens Charles Sturt	\$30,000 / yr \$30,000 / yr	



ACTIONS AND DIRECTIONS PLAN

DIAGRAM 6.1

H036/09/07 NOT TO SCALE





ACTIONS AND DIRECTIONS PLAN

DIAGRAM 6.2

H036/09/07 NOT TO SCALE



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ACTIONS AND DIRECTIONS PLAN

DIAGRAM 6.3

H036/09/07 NOT TO SCALE



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ACTIONS AND DIRECTIONS PLAN

DIAGRAM 6.4

H036/09/07 NOT TO SCALE



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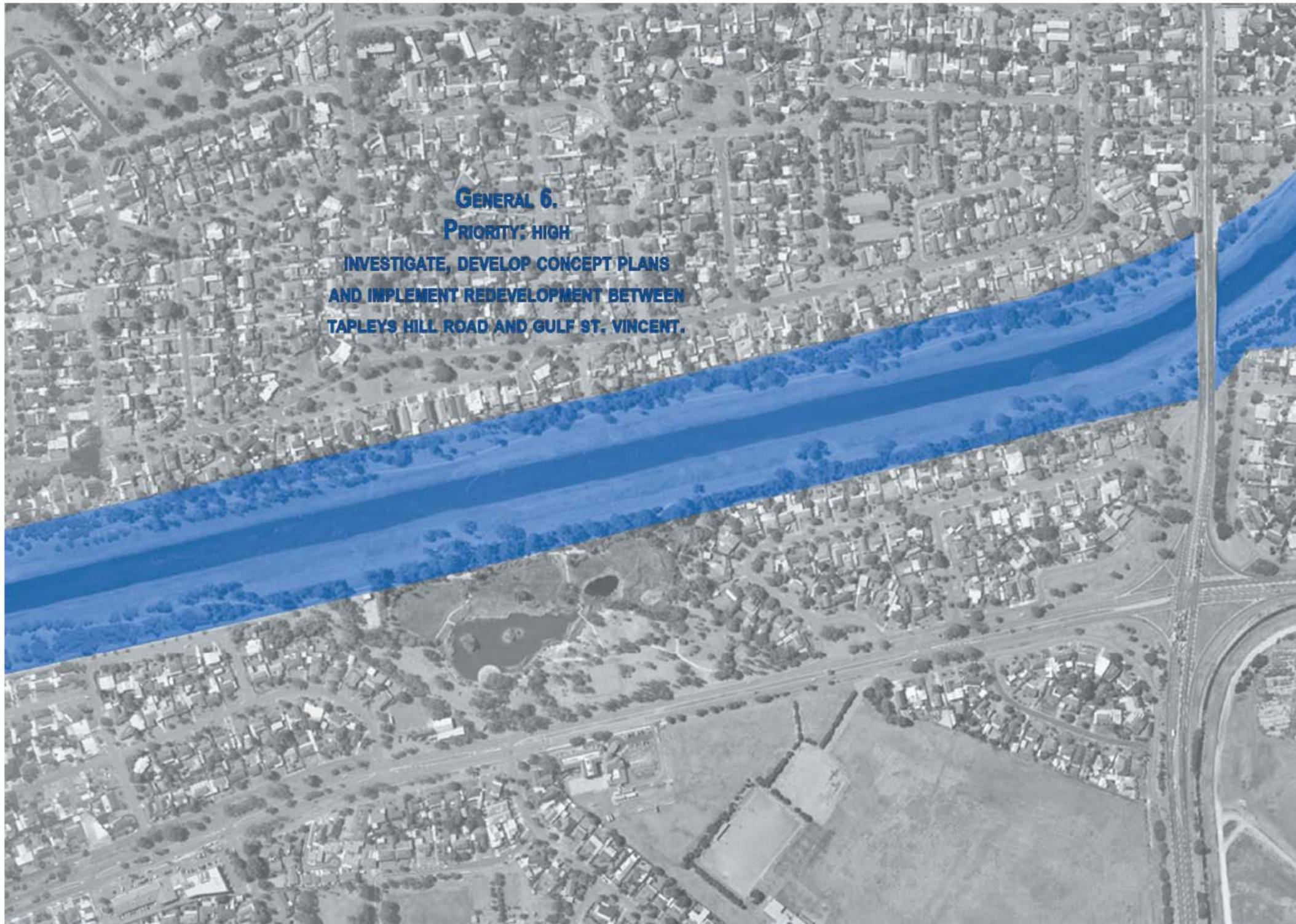


ACTIONS AND DIRECTIONS PLAN
DIAGRAM 6.5
H036/09/07 NOT TO SCALE



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ACTIONS AND DIRECTIONS PLAN
DIAGRAM 6.6
H036/09/07 NOT TO SCALE



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ACTIONS AND DIRECTIONS PLAN

DIAGRAM 6.7

H036/09/07 NOT TO SCALE



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7. FUNDING OPPORTUNITIES

The implementation of the strategies and actions will be reliant to a degree on funding availability from the identified agencies and key stakeholders to the River Torrens Linear Park. The allocation of funding resources in order for the identified strategies to be implemented, should be strategically planned in order to maximise these opportunities. This document is aimed at allowing for a clear focus on the objectives and means to achieving those objectives, potentially allowing for greater facility and service provision.

Outlined below is a range of suggested funding avenues at State and Commonwealth Government level to assist the key stakeholders in generating and attracting financial income to provide the necessary impetus for the key priorities.

Funding Programs

Program	Description
Adelaide and Mount Lofty Ranges Natural Resource Management Board	Project proposals which have a water quality / riparian improvement aspect can be submitted to the AMLR NRM Board for funding. This may include large redevelopment type projects (such as that proposed between Tapleys Hill Road and Seaview Road) or smaller specific projects such as riparian revegetation or weed removal. The AMLR NRM Board should also be submitted proposals for funding for projects which propose to remediate erosion issue associated with the river and riverbanks.
Department for Environment and Heritage	Urban Forest Biodiversity Program: Funding opportunities are available for undertaking revegetation projects. The purpose is to promote urban biodiversity and projects between local government and UFBP have been undertaken previously. Assistance may also be provided through the supply of technical information and suitable plants or seed for a project.
Regional Open Space Enhancement Subsidy (ROSES) Source: Planning SA www.planning.sa.gov.au	Purpose: There are opportunities for Regional Open Space Enhancement Subsidy (ROSES) grants for appropriate identified programs. The ROSES program provides financial assistance to local government for the purchase, development and planning of regional open space. Subsidies are provided for works relating to conservation and recreation on public land. Projects eligible for consideration should be designed to assist in the preservation, enhancement and enjoyment of open space areas containing elements of natural beauty, conservation significance and cultural value.
Tourism Development Fund Source: South Australian Tourism Commission (SATC)	Purpose: The Tourism Development Fund provides for the development of supporting tourism infrastructure including public toilets, paths, walkways, lookouts, information bays, wayside stops, signs, entry statements and regional arrivals. Applications are considered once per year with applications closing at the end of April. The next round of funding applications to be considered will be the 2008-09 round. The South Australian Tourism Commission also considers applications for more major funding (> \$50,000). This does not fall under the Tourism Development Fund, and a meeting can be set-up with SATC to discuss

Program	Description
http://www.tourism.sa.gov.au/industryinfo/default.asp	<p>opportunities for major funding.</p> <p>Funding Availability:</p> <p>The Minor Infrastructure Fund provides \$ for \$ assistance (up to \$50,000 per project)</p> <p>The SATC offers Tourism Development Fund guidelines and hints for funding applications. These can be found at the following web addresses:</p> <p>http://www.tourism.sa.gov.au/industryinfo/documents/TDF%20Guidelines%202007-08.doc (Guidelines)</p> <p>http://www.tourism.sa.gov.au/industryinfo/documents/TDF%20Applications%20-%20handy%20hints.doc (Hints for funding applications)</p>
<p>Community Recreation and Sports Facilities Program</p> <p>Source: www.recSPORT.sa.gov.au/programs</p>	<p>Purpose: To Provide financial support for facility infrastructure that is regionally significant and serves a catchment area that normally is greater than one local government area. At a more local community level grant assistance can also be provided</p> <p>Funding Availability:</p> <ul style="list-style-type: none"> ▪ up to \$300,000 regionally significant infrastructure ▪ up to \$50,000 local community level
<p>Move It! Making Communities Active Program</p> <p>Source: http://www.recSPORT.sa.gov.au/grants-scholarships/move-it-program.html</p>	<p>Purpose: The Move It! Making Communities Active Program provides financial assistance to sport, active recreation and physical activity organisations for projects that target inactive or insufficiently active people in South Australia</p> <p>Funding Availability: An example of a successful applicant for 2006-07 include:</p> <ul style="list-style-type: none"> ▪ Recreation SA Incorporated – Community Fitness Program \$30,000

Program	Description
<p>Active Club Program</p> <p>Source www.recsport.sa.gov.au</p>	<p>Purpose: The Active Club program provides assistance to eligible South Australian sport and/or active recreation organisations to provide quality facilities and deliver competition, and activity experiences in the community.</p> <p>The program has three types of grants, they are:</p> <ol style="list-style-type: none"> 1. Local Initiative 2. Minor Capital Works 3. Youth Encompassing Sport <p>These grants are offered twice per financial year. The objectives of these grants is to assist, not for profit community-based sporting and active recreation organisations to develop and expand the services which they provide, thereby increasing the community's access to quality sport and active recreation activities and facilities. The next round is anticipated to be in September 2007.</p> <p>Funding Availability:</p> <ul style="list-style-type: none"> ▪ Local Initiative Grants – up to \$10,000 ▪ Youth Encompassing Sport Grants – up to \$10,000 ▪ Minor Capital Works Grants – up to \$20,000
<p>Statewide Enhancement Program</p> <p>Source: http://www.recsport.sa.gov.au/grants-scholarships/statewide-enhancement.html</p>	<p>Purpose: The Statewide Enhancement Program is designed to provide assistance to active recreation and sport organisations to enable them to maintain and increase the level of participation of South Australians in physical activity. It also aims to ensure that all South Australians have access to quality programs and services</p> <p>Funding Availability:</p> <p>There are two streams of funding:</p> <ul style="list-style-type: none"> ▪ State Organisations Support Funding (Stream 1) ▪ Sport and Active Recreation Project Funding (Stream 2) <p>An example of a recent grant is:</p> <ul style="list-style-type: none"> ▪ Active Ageing SA Incorporated (2007-08 Grant \$10,000)
<p>Department of</p>	<p>Purpose: To help eligible community based environment and heritage organisations to value, conserve and protect the natural environment and cultural heritage by assisting these organisations with their administrative costs</p>

Program	Description
<p data-bbox="161 266 474 293">Environment and Heritage</p> <p data-bbox="161 327 474 435">Program of Grants to Voluntary Environment and Heritage Organisations</p> <p data-bbox="161 469 250 496">Source:</p> <p data-bbox="161 529 465 579">http://www.deh.gov.au/programs/gveho/index.html</p>	<p data-bbox="497 266 730 293">Funding Availability:</p> <p data-bbox="497 327 913 354">Examples of funding availability include;</p> <ul data-bbox="537 387 1200 469" style="list-style-type: none"><li data-bbox="537 387 1200 414">▪ Native Grass resources Group Inc. (2006-07 Grant \$1,800)<li data-bbox="537 416 1200 443">▪ 'Trees please' (2006-07 Grant \$1,500)<li data-bbox="537 445 1200 469">▪ Community Land Management Inc. (2006-07 Grant \$1,800)

More examples of funding can be found at <http://www.deh.gov.au/programs> and www.grantslink.gov.au

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9. APPENDICES

Appendix 1 – Community Consultation Summary

Methodology

A Questionnaire concerning the biodiversity value, recreation, infrastructure and safety and security of the River Torrens Linear Park was sent out to all residents and landholders within both the City of West Torrens District Council zone and the City of Charles Sturt District Council zone at the commencement of the project. Other members of the public who used Linear Park but who were not necessarily residents of either respecting councils were able to express their opinions on these issues via the District Councils' websites. The responses to the questionnaires were then compiled, analysed and reviewed for use within the development of a 10 year management plan for Linear Park.

The second phase of the community consultation project involved developing a poster showing the key issues and recommendations for the project. The posters were placed in the Hamra Library (City of West Torrens) and the Henley Library (City of Charles Sturt) for a period of two weeks. The poster presentations were advertised through the council websites, through signs placed along the length of the Linear Park within the project area, in the local Messenger Newspaper and through mailing a notice to respondents of the questionnaire. Each library was attended to by the Project Consultant for one three session to allow comments and discussions to occur. A Feedback Form was left next to each poster to allow feedback to be provided.

Results – Stage 1 Consultation

A total of 146 people completed the questionnaire concerning Linear Park (87 from the West Torrens District and 59 from the Charles Sturt District). Many participants had strong views pertaining to certain issues in regards to the park with most of these issues regarding the recklessness of cyclists, the presents of horses, the quality and quantity of infrastructure and unsavoury individuals/groups using the park for inappropriate purposes.

Responses Concerning Biodiversity

The majority (84.74%) of City of Charles Sturt participants considered Linear Park very important to local wildlife. 11.86% of responders believed that Linear Park was important to the wildlife, with only one responder (1.70%) believing that the park has some importance as well as one other responder believing that the park has no importance. Comments to this questions included participants noting that the park was a unique urban environment, that the park provides an important sanctuary and corridor for native fauna and that many fauna species have been observed within the park (in particular many diverse birds species).

The majority of City of West Torrens participants also considered Linear Park very important to local wildlife (81.61%). 10.34% believed it was important and 8.05% saying it had some importance. No participants considered the park un-important to the local wildlife. Comments included again that the park provides sanctuaries and a corridor for fauna and that wildlife numbers have increased since the restoration of wetlands. A responder who answered that the park is only somewhat important to wildlife suggested that there is not much wildlife present.

When Charles Sturt participants were asked "Do you see opportunities within River Torrens Linear Park to increase its biodiversity value and provide more habitat for local wildlife?", the majority answered yes (72.98%) with 16.98% believing there is no opportunity for an increase in biodiversity and 10.16% leaving no answer or being unsure. Comments included that the health of the river needs to be increased (i.e. removal of rubbish and more regular water flow), that exotic fauna and flora need to be controlled (especially pigeons, rats,

foxes and cats), that certain areas need to be set aside for native fauna and that bird/bat boxes should be installed.

An overwhelming majority (88.51%) of West Torrens participants also agreed that there were opportunities to increase the biodiversity of Linear Park with 10.34% stating that there are no opportunities. One participant (1.15%) was unsure. Comments included that strategies need to be scientifically managed, that the horses should be removed, again that feral animals need to be controlled, that some native birds (Sulphur Crested Cockatoos & Noisy Miners) need to be controlled and that more wetland should be restored to make the area as natural as possible. Negative responses expressed towards increased restoration effort included that increased opportunities for native fauna would mean a smaller area for the horses and that there is enough wildlife there already.

The question "Do you think more local native vegetation should be planted within the River Torrens Linear Park?" was answered yes by 83.05% of Charles Sturt participants and 16.94% answering no, one participant was unsure (1.70%). Comments included that revegetation should include more shrubs than trees, that the vegetation planted should be fruit and nectar bearing flora that attracts birds, that planted vegetation needs to be maintained and that dead and exotic vegetation should be removed and replaced. Many people also suggested that any revegetation programme needs to be done appropriately so that it doesn't act as a fire hazard and that vegetation is not so dense that unsavoury people can hide amongst the vegetation.

West Torrens participants were also in favour of more vegetation being planted (85.05%) with 14.95% not in favour. These participants agreed that a revegetation programme should be done in coherence with removal of exotics, that planted vegetation should be maintained and that shrubs that protect birds should be planted as well as hardy perennial vegetation. Another participant wanted a revegetation programme that would not result in a smaller area for the horses. Negative responses were again concerned with safety issues which would result in increasing the vegetation cover and that native trees are dangerous due to branches and debris falling.

Responses Concerning Recreation

93.20% of participants from the Charles Sturt District used Linear Park for recreational purposes. 10.16% did not answer this question with only one person (1.70%) not using the park. Their reasons for this individual answering no being that the grasses are too overgrown to be able to walk on the footpaths. Everyone that used the park used it for walking or/and jogging with 55% used it for cycling. Other recreational activities included feeding the ducks, picnics, BBQs, interacting with the horses, use of the playground relaxing and enjoying the wildlife.

100% of West Torrens participants used the park. 96.55% of responders used the park for walking/jogging while 58.68% also used the park for cycling. Other uses for the park included picnics, BBQ, relaxing, enjoying the wildlife, use of the playground, interacting with the horses and also fishing, meetings and horse riding.

In regards to the question asked "Do you think that there is enough open space with the River Torrens Linear Park?", 84.74% Charles Sturt responders answered yes, 15.25% answered no and 5.10% did not answer or were unsure. Some responders believed that more open space was needed in certain spots while another responder said that more open space may be needed depending on details of the Breakout Creek Stage 2 redevelopment.

The majority of West Torrens participants also believed that there was enough open space within the park (87.35%), 10.35% believed that there wasn't enough space and 2.30% were unsure or didn't answer. Comments included that the removal of horses would open up more space, that more lawn area is needed for ball games and that a skate park is not necessary as it would decrease the amount of open area.

A question concerning if participants believed that the recreational demand on Linear Park will increase during the next 10 years and what can be done to improve the park produced many comments and ideas. Within the Charles Sturt Council, 83.05% of responses believed that the demand would increase with 6.79% believing demand would not increase. 10.16% of responders were unsure or did not answer. Suggestions to improve the park included maintaining and upgrade existing paths and facilities, more seating for the elderly, separate paths for cyclists, footpaths widened to Australian standard of 3 meters, the removal of large and overhanging branches, more facilities (i.e. bins, toilets, picnics, solar lighting and phones) and a higher emphasis on landscape than on recreational use.

West Torrens participants overwhelmingly believed (90.80%) that the recreational demand would increase, 3.45% believed it would not increase and 5.75% of participants were unsure/did not answer. Many people also suggested better maintained and upgraded facilities, more facilities (disabled access, fishing facilities, benches, a kiosk, bins, toilets, drinking fountains, and lighting), widening paths and signage for reckless cyclists. A few people suggested that there should be fewer infrastructures in favour of biodiversity while another suggested no more toilets as they encourage unwanted behaviour and people into the park.

Responses Concerning Infrastructure

When participants were asked if they believed if there were current issues with existing infrastructure, 76.28% of Charles Sturt responders answered yes with 11.86% answering no, an additional 11.86% were unsure or did not answer. Comments regarding this question were mainly in regards to the poor quality of the paths. Many concerns included the path being too narrow, cracks in the surface and general surface quality of the paths. Other concerns were in regards to the hygiene of toilets, the quality of playground equipment and vandalism of infrastructure.

The majority of West Torrens participants (77.01%) also believed that there are current issues surrounding existing infrastructure, 18.39% believed that there wasn't a problem and 4.60% did not answer or were unsure. The issues identified again included the quality of the paths (tree roots under the paths was also an identified issue), maintenance of watering systems, bins cleaned more regularly, lighting maintenance and a speed limit for cyclists.

A question regarding if there is belief in any foreseeable issues with future infrastructure was answered yes by 55.93% of Charles Sturt responders. 25.42% could not see any problem in the future while 18.65% were unsure or did not answer. Comments were also mainly concerned with path quality but also toilets being misplaced and not open 24 hours a day, not enough dog bags available and concerns with the increase in council rates if the amount of infrastructure was increased or upgraded.

Responses from the West Torrens participants were also in agreed that future infrastructure issues may arise with 64.4% saying yes, 26.4% saying no and 9.2% not answering or unsure. Comments included that the bank is not stable and will become worse in the future, unwanted people and activities hanging around toilet facilities, flood mitigation

issues, upgrading the retaining wall, path quality and future infrastructure not effecting the horses within the area.

Responses Concerning Safety and Security

The question "Do you believe there are any specific safety/security aspects that should be considered, and if so, how could they be managed" had a "yes" response from 86.44% of Charles Sturt participants. 8.46% believed there are no safety/security issues within the park while 5.10% did not answer. Suggestions to manage safety/security issues include better lighting facilities, public phones, removal of overhanging branches and bushes from pathway which act as a hazard, separate paths for cyclists, signs for cyclists with speed limit, guards to reduce vandalism, motorized vehicles on the paths and inappropriate behaviour/people and frequent police patrols.

72.45% of West Torrens Council responders believed that there were aspects of safety/security to be considered with 17.25% not seeing any issues and 10.35% not responding or unsure. Suggestions were the same as those from Charles Sturt but also included the implementation of neighbourhood watch programmes.

Commonly raised issues – the quality & width of pathways

The quality & width of pathways within Linear Park was by far the most commented on issue and safety concern expressed throughout the questionnaire. 29.88% (26 participants) of West Torrens and 64.41% (38 participants) of Charles Sturt Council participants commented on the quality of pathways, with many participants commenting on the quality several times. The concerns included the pathways not being the Australian standard width of 3 meters, tree roots lifting up and cracking the path, tree debris (overhanging branches, leaf litter and gum nuts) on the pathways and general poor quality of path surfaces.

Commonly raised issues – Reckless cyclists on pathways within Linear Park

Many participants who completed this questionnaire were concerned with cyclists and motorised bicycles being reckless when considering the safety of others. 37.28% (22 participants) within the Charles Sturt Council and 32.18% (28 participants) with the West Torrens Council expressed opinions on the raising concerns between pedestrians and cyclists using pathways in Linear Park. Many concerns were in regards to cyclists riding too fast along the narrow pathways and not sounding their bell when approaching unaware pedestrians. A few participants knew of incidences where cyclists had knocked over elderly pedestrians. Suggestions to stop reckless cyclists included creating separate pathways for pedestrians and cyclists, speed limits implemented for cyclist with signage, pedestrians encouraged to sound bell when approaching pedestrians, the prohibition of motorised bicycles from pathways, widening of paths to the Australian standard of pathways for cyclists and pedestrians (3 meters) and the creation of speed bumps to slow cyclists down.

Results – Stage 2 Consultation

Numerous people stopped and looked at the poster presentation for the project. Approximately 15 people attended the poster when the project consultant was present at Henley Library and four people attended the poster when the project consultant was present at the Hamra Library. A total of 36 feedback forms were received as a result of the consultation. The results discussed below combine the responses received on the feedback forms as well as the verbal feedback from people attending the posters when the project consultant was present. Many participants had strong views pertaining to certain issues in

regards to the park, however, these views were similar to those aired during the Stage 1 of the consultation.

Responses

The majority of responders to the second stage of consultation are supportive of the project and pleased that the management plan is being produced. The conflict between pedestrians and cyclists was again raised as a major concern with support for the commuter link along the length of Linear Park. It was suggested that this would need extensive consultation and involvement of the community to ensure that it is implemented appropriately. A commuter path would also need to be a separate path so that pedestrians and more passive cycling are still encouraged.

There was overwhelming support for the upgrade and improvement of the path network within the project area. Numerous issues have been raised in relation to the path quality, width and lack of maintenance. This would encourage more people to utilise the Linear Park for recreational activities (e.g. cycling, jogging, walking) and make it a lot safer to do so.

There was mixed support for increasing the level of revegetation within the Linear Park. Some respondents were very supportive of planting patches of thick shrub and understorey vegetation, in particular, to encourage more birds to the area. Other respondents suggested keeping it more open due to the safety issues associated with dense plantings.

The presence of the horses in the lower reaches of the Linear Park gained a mix with some respondents supporting the presence of the horses and suggesting that better facilities be incorporated into Linear Park. Other respondents suggested that the horses need to be removed and the lower sections upgraded to be in keeping with the remainder of Linear Park.

Other feedback received was for more signage (not addressed by this management plan), more facilities such as water fountains, bins and toilets and more cross over points along the Linear Park.

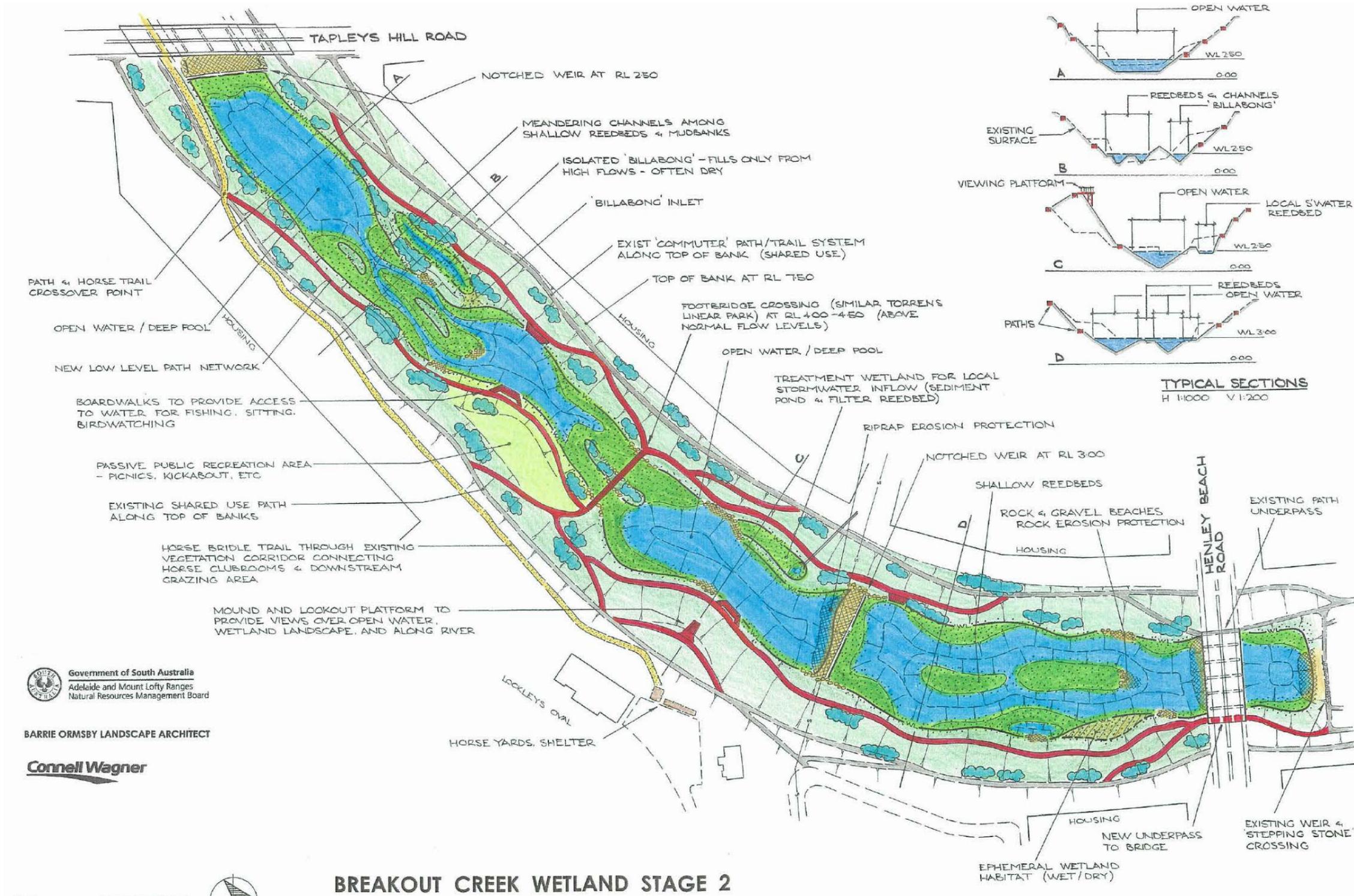
Summary

The feedback received during both stages of consultation has been taken into consideration when preparing the action plan. A number of the suggestions and recommendations from the feedback received have been included as actions. For example the suggestion of a pedestrian bridge adjacent to Seaview Road bridge was suggested by a member of the public during the consultation phase. A number of the issues raised by the users of Linear Park, local residents and the general community are quite complex and will require detailed investigations. These include the suggestion and support for a dedicated commuter path and the redevelopment / upgrade of the section between Tapleys Hill Road and Seaview Road

Appendix 2 – Underdale Redevelopment Plans



Appendix 3 – Breakout Creek Stage 2 Redevelopment Plans



Appendix 4 – Planning Report

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**Strategic and Statutory Planning
Directions
River Torrens Linear Park Management
Plan
City of West Torrens and City of Charles
Sturt**

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Introduction

This document comprises a summary of strategic and statutory urban planning directions for the River Torrens Linear Park Management Plan. The tables within this document expand on comments relating to strategic and statutory planning directions that feature elsewhere in the Management Plan, specifically on the mapping that visually represent the character precincts, opportunities and priorities that for the study area.

Strategic and Statutory Directions - General Issues and Objectives

The table below details general issues and strategic directions from a planning perspective for the Management Plan study area as a whole.

ISSUE	STRATEGIC DIRECTIONS	STAKEHOLDERS / TIMEFRAMES
Better use of Open Space Networks	<p>Better promotion of the existence of open space networks, e.g. the 'whole' of the River Torrens Linear Park and not exclusively the shared path aspect of the park.</p> <p>Encourage and promote a wider variety of recreation / physical activities and opportunities, e.g. exercise / fitness circuits.</p> <p>Plan for the development of multi-use facilities that benefit a wider range of users and that are operationally efficient in terms of maintenance costs.</p>	<p>Local Councils Clubs / Associations</p> <p>5 Years</p>
Risk Management (Administration / Insurance)	Increase awareness in the region associated with risks and identify potential high risk areas for further investigation such as steep gradients and un-fenced areas.	<p>Local Councils Clubs / Associations</p> <p>5 Years</p>
Facilities - cost of maintaining facilities	Allocate funding in accordance with priority actions (short, medium and long term)	<p>Local Councils</p> <p>5 Years 10 Years</p>
<p>Quality of infrastructure</p> <p>(Quality rating "good" overall according to Infrastructure Condition Audit)</p>	Identification of blind spots / expanding focus of the park away from shared path / new recreation opportunities and facility provision are issues requiring attention as part of the <i>5 and 10 year Action Plans</i> .	<p>Local Councils</p> <p>5 Years 10 Years</p>

ISSUE	STRATEGIC DIRECTIONS	STAKEHOLDERS / TIMEFRAMES
Adjacent open space usage and new infrastructure development	<p>Encouraging clubs, Councils, community groups and State Agencies to work co-operatively in relation to:</p> <p>Strategic linkages</p> <ul style="list-style-type: none"> • Linkages to adjoining suburbs and activity centres both major and minor e.g.: <ul style="list-style-type: none"> - <i>Brickworks site</i> - <i>Thebarton Oval / Kings Reserve and Swimming Centre</i> - <i>Urban Pacific / Underdale housing developments / school</i> - <i>Lockleys Oval</i> - <i>University Playing Fields / Apex Park</i> - <i>Henley Square</i> - <i>Schools</i> - <i>West Beach Foreshore Reserve via Coast Park</i> - <i>Glenelg via Coast Park</i> 	<p>Local Councils</p> <p>5 Years 10 Years</p>
Adjacent open space usage and new infrastructure development	<p>Facility developments</p> <ul style="list-style-type: none"> • Exercise / fitness circuits • Facilitate limited number(s) of shops/kiosks/cafés within close proximity of areas that display high visitation and demand/capacity • Continuity of shared path • New / additional routes for shared path in order to reduce 'linear' form of the path in relation to 'cycling speed control' and reduce cyclist/pedestrian conflict • Interpretive signage 	<p>Local Councils</p> <p>5 Years 10 Years</p>

ISSUE	STRATEGIC DIRECTIONS	STAKEHOLDERS / TIMEFRAMES
	<p>Further investigation of Acquisition of land for widening the shared path to meet Australian Standards / further open space provision</p> <p>Funding Opportunities (<i>refer to Funding Opportunities section</i>)</p> <p>Plan Amendment Report (PAR) facilitation and co-ordination to ensure a consistent approach across Council boundaries</p>	
Underutilisation of facilities	<p>Explore potential to increase usage by:</p> <ul style="list-style-type: none"> • Encouraging different and alternative uses within the park • Encouraging use of the park as a whole rather than a focus on the shared path, e.g. by creating additional new routes for walking and recreational cycling only / different recreation activities such as fishing and kayaking • Improving the amenity of the park through re-vegetation recommendations • Facility sharing (particularly in relation to open space adjacent the Linear Park and sporting and community groups) 	<p>Local Councils Local Sporting Clubs Community Groups</p> <p>5 Years 10 Years</p>
Declining physical activity / changing activity patterns	<p>Consider greater flexibility in use and provision of facilities to accommodate increasing trend towards unstructured and more individual forms of recreation activity (e.g. exercise circuits)</p> <p>Addressing issues of pedestrian and cyclist conflict</p> <p>Identify ways of motivating inactive people to participate in a sporting/recreation activity as a means of becoming physically active. Utilise available resources and programs including the <i>beactive</i> campaign</p>	<p>Local Councils Office for Rec & Sport</p> <p>5 Years 10 Years</p>
Access and linkages	<p>Provide equitable access to facilities and Linear Park / shared path itself across all ages by ensuring facilities and infrastructure meet Australian Standards</p>	<p>Local Councils</p> <p>5 Years</p>

ISSUE	STRATEGIC DIRECTIONS	STAKEHOLDERS / TIMEFRAMES
Population	<p>Identify population growth areas (such as Urban Pacific residential development at Underdale) along and adjacent the Linear Park, as well as potential urban consolidation areas e.g. underutilised large industrial areas</p> <p>Assess opportunities and constraints of those nearby sections of the Linear Park and the ability to increase capacity to support increased recreational/commuter usage</p>	<p>Local Councils</p> <p>5 Years 10 Years</p>
Incompatible land uses	<p>Encourage incompatible land uses adjoining the River Torrens Linear Park to relocate over the long-term:</p> <ul style="list-style-type: none"> • Land uses such as heavy industry should be removed over time and land re-zoned to reflect more compatible land uses. Where this is unfeasible significant buffer areas should be established where they do not already exist. • The increasing value of residential properties may over time drive the urban consolidation or residential infill of existing industrial or commercial/bulky goods sites located within close proximity of the River Torrens. 	<p>Local Councils Private land owners</p> <p>5 Years 10 Years</p>
Strategic Planning	<p>Address conflict between pedestrians and cyclists - typically commuter cyclists (identified in consultation process)</p> <p>Take sole focus of the Linear Park away from the shared path by providing alternative recreation and commuting options for cyclists and pedestrians. One such mechanism for achieving this may include:</p> <ul style="list-style-type: none"> • Physical treatments to shared path (e.g. speed control devices, path surfaces, path alignment, separate pedestrian/cyclist paths etc.) <p>Whilst the ability to resource this is a key factor, projects such as this should be supported as part of a wider holistic approach to facility provision i.e. facility planning across Council boundaries/areas and funding through key stakeholders with continued support and involvement from Planning SA, ORS etc.</p>	<p>Local Councils Planning SA Office for Recreation and Sport (ORS) Key Stakeholder Groups</p> <p>10 Years</p>
Long-term approach	<p>Facility provision and strategic long-term projects should not be viewed in isolation rather they must continue to take a holistic approach involving a wide range of stakeholders including PlnSA, ORS and adjoining Councils.</p>	<p>Local Councils Planning SA Office for Recreation and Sport Key Stakeholder Groups</p> <p>5 Years 10 Years</p>

ISSUE	STRATEGIC DIRECTIONS	STAKEHOLDERS / TIMEFRAMES
Regional Approach	<p>Encourage Councils (in this instance CCST and CWT) to develop a co-ordinated approach to funding.</p> <p>Work closely with funding agencies and demonstrate a willingness to design and pursue facility development proposals that will be financially sustainable from an ongoing operational perspective.</p>	<p>Local Councils Stakeholders/Funding Opportunities</p> <p>5 Years 10 Years</p>

Strategic and Statutory Directions - Character Precincts

6.7 Coastal Riverine Precinct

The table below details site analysis, strategic directions, and possible statutory responses to those areas of the River Torrens Linear Park that have been identified as part of the Coastal Riverine Precinct for the purposes of the Management Plan.

Many of the Statutory Responses listed in the tables below have been developed in accordance with Planning SA's Better Development Plan Policies.

COASTAL RIVERINE PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>There is a clear link between the <i>Coast Park</i> and the <i>River Torrens Linear Park</i> that has been established and enhanced through the development of the Seaview Road underpass.</p> <p>This is evident on the southern side of the River, and Coastal Zone Objective 8 promotes further enhancement of this existing gateway to the north (Henley Beach) also.</p> <p><i>(Refer also to Gateways Character Precinct section 3.3)</i></p> <p>Linear nature and dominance of the shared path in this precinct is particularly prevalent. <i>Access and Linkages</i></p>	<p>Promote pedestrian and cyclist links to the <i>Coast Park</i> that connects with the Seaview Road entrance to the River Torrens Linear Park. Further investigate measures to return this section of the River Torrens to a more natural state, i.e. pre 1930</p> <p>Promote linkages which relate to the connectivity between the <i>Coast Park</i>, Henley Square, the West Beach Foreshore and Glenelg.</p> <p>Further investigate the opportunity of alternate pedestrian routes to reduce linearity of the park.</p> <p>Provide equitable access to facilities and Linear Park / shared path itself across all ages by ensuring facilities and infrastructure meet Australian Standards</p> <p>Continue to provide a dedicated commuter link as well as a 'shared trail' that opens up more of the linear park and takes the primary focus of the park away from the existing shared pathway and helps reduce cyclist/pedestrian conflict.</p>	<p>As part of a Council-Wide PAR the following provisions should be considered for the Coastal Zone and the Linear Park (River Torrens) Zone (<i>City of Charles Sturt</i>), to complement the existing Zone provisions.</p> <p><i>Development should provide access, and accommodate multiple route options, for cyclists by enhancing and integrating with:</i></p> <p><i>(a) open space networks, recreation trails, parks, reserves and recreation areas</i></p> <p>Existing Coastal Zone Objective 8 (City of Charles Sturt) promotes the establishment and maintenance of key open space linkages.</p> <p><i>Objective 8: Maintenance of open space links with the various local and regional open space networks and corridors to ensure passive recreational linkages.</i></p> <p>As part of a Council-Wide PAR the following provisions should be considered for the <i>Residential Zone (PA 38 & 39) (City of West Torrens)</i>; & <i>Residential Zone (PA 2 & 3) (City of Charles Sturt)</i></p> <ul style="list-style-type: none"> <i>Development should ensure that public access to the River Torrens Linear Park is retained and enhanced for cyclists and pedestrians.</i> <p>To promote access through the surrounding suburban area</p>	<p>Local Councils Planning SA</p> <p>5 Years</p> <p>Local Councils Planning SA</p> <p>5 Years 10 Years</p>

COASTAL RIVERINE PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p><i>Military Road West Beach and Henley Beach - Alternate commuter/pedestrian paths</i></p> <p><i>Adjacent open space usage and new infrastructure development</i></p> <p>There is a limited amount of significant open space area located adjacent to the Linear Park within the Coastal Riverine Precinct extending from Apex Park to the Coast. This is reflected in the linearity of the shared path in this section of the park.</p> <p>One of the most significant open space areas within the Coastal Riverine Precinct is the Apex Park Wetlands at</p>	<p>Promote linkages between the River Torrens Linear Park and Henley Oval, Henley High School, Henley Primary and West Lakes along Military Road.</p> <p>A small local park exists off Military Road on the southern side of the River and a small pocket of space is utilised for horse training/adjustment off Military Road on the northern side of the River. There is potential to further incorporate a shared path and commuter access link with these spaces.</p> <p>The wetlands also provide a 'gateway' from the surrounding suburban environment to the Linear Park (<i>refer Gateways</i>). Further investigation of recreational land uses on the University Playing Fields to the south of the Apex Park Wetlands should also involve formalising safe linkages between the two open spaces.</p>	<p>and better link the northern and southern sides of the River, the following may be included in the relevant Zone provisions of the CCST and CWT Development Plans;</p> <p>Cycling and Walking</p> <p><i>14 Development should ensure that a permeable street and path network is established that encourages walking and cycling through the provision of safe, convenient and attractive routes with connections to adjoining streets, paths, open spaces, schools, public transport stops and activity centres.</i></p> <p><i>15 Development should provide access, and accommodate multiple route options, for cyclists by enhancing and integrating with open space networks, recreational trails, parks, reserves and recreation areas</i></p> <ul style="list-style-type: none"> • <i>Open space should be designed to incorporate:</i> <ul style="list-style-type: none"> - <i>pedestrian, cycle linkages to other open spaces, centres, schools and public transport nodes</i> - <i>park furniture, shaded areas and resting places to enhance pedestrian comfort</i> - <i>safe crossing points where pedestrian routes intersect the road network</i> - <i>easily identified access points</i> - <i>frontage to abutting public roads to optimise pedestrian access and visibility</i> - <i>re-use of stormwater for irrigation purposes</i> • <i>Provision of safe, pleasant, accessible, integrated and permeable pedestrian and cycling networks</i> <p><i>Investigate future recreation land use opportunities for the University Playing Fields.</i></p> <p><i>Formalise safe and convenient linkage points between the Apex Park and University Playing Fields and through the University Playing Fields to the Reece Jennings Bikeway</i></p>	<p>Local Councils Stakeholders/Funding Opportunities Planning SA</p> <p>5 Years 10 Years</p>

COASTAL RIVERINE PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>West Beach. The wetlands provide for a range of active and recreational land uses, as well as supporting and promoting biodiversity within the region.</p> <p><i>Population</i></p> <p>Due to a range of factors associated with the property market including an increase in land values, the predominantly residential area surrounding the River Torrens within the Coastal Riverine precinct is likely to undergo some degree of urban consolidation during the next 5-10 years.</p>	<p>Address requirement for greater retention, provision and capacity of open space to support a growing population resulting from increasing urban densities in surrounding residential areas</p>	<p><i>along Tapleys Hill Road.</i></p> <p>Open Space provisions should be consistent in both Development Plans and reflect the open space hierarchy as follows;</p> <ul style="list-style-type: none"> • <i>District level parks should be at least 3 hectares in size, and provided within 2 kilometres of all households that they serve</i> • <i>Neighbourhood parks should be at least 0.5 hectares and generally closer to 1 hectare in size, and provided within 500 metres of households that they serve</i> • <i>Local parks should generally be a minimum of 0.2 hectares in size, and should be centrally located within a residential area, close to schools, shops and generally within 300 metres of households that they serve.</i> <p>(City of Charles Sturt have implemented an Open Space Hierarchy into Development Plan provisions)</p>	<p>Local Councils Office for Recreation and Sport Planning SA</p> <p>5 Years 10 Years</p>

6.8 Parkland Frameworks Precinct

The table below details site analysis, strategic directions, and possible statutory responses to those areas of the River Torrens Linear Park that have been identified as part of the Parkland Framework Precinct for the purposes of the Management Plan.

Many of the Statutory Responses listed in the tables below have been developed in accordance with Planning SA's Better Development Plan Policies.

PARKLAND FRAMEWORKS PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>Areas identified as parkland frameworks offer a buffer area between the adjoining suburban or industrial/commercial areas and the River Torrens Linear Park.</p>	<p>Ensure that surrounding incompatible land uses do not encroach on the Linear Park.</p>	<p>As part of a Council-Wide PAR process, the following provisions should be considered for land in zones adjoining the Linear Park (River Torrens) Zone.</p> <ul style="list-style-type: none"> <i>Land bordering watercourses should be reserved for public use</i> <i>Buildings well set back & front onto a road and reserve along a watercourse</i> <p><i>General/Special/Heavy Industry should be encouraged to be removed from allotments immediately adjoining the River Torrens Linear Park.</i></p> <p><i>A Landscaped buffer should be provided between industrial land uses and the River Torrens Linear Park</i></p> <ul style="list-style-type: none"> <i>Development should be designed, constructed and sited to minimise negative impacts of effluent, odour, smoke, fumes, dust or other airborne pollutants</i> 	<p>Local Councils Planning SA</p> <p>5 Years 10 Years</p>
<p><i>Long-term approach</i></p> <p>The retention of parkland areas along and adjacent to the River Torrens will ensure a higher capacity of the Linear Park to support a growing population.</p>	<p>Facility provision and strategic long-term projects should not be viewed in isolation and must involve a holistic approach in cooperation with a wide range of stakeholders including PLNSA, ORS and adjoining Councils.</p> <p>The re-vegetation of some areas of open space should be considered in terms of the entire area and strategically</p>	<p>The 12.5% contribution to Open Space as a result of land division comprising 20+ allotments (associated with Urban Infill sites nearby/adjacent the River Torrens) should be vested to the improvement of the River Torrens Linear Park.</p>	<p>Local Councils Planning SA Office for Recreation and Sport</p> <p>5 Years 10 Years</p>

PARKLAND FRAMEWORKS PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p><i>Regional Approach</i></p>	<p>implemented to accommodate annual costing budgets.</p> <p>Encourage Councils to develop a co-ordinated approach to funding and re-vegetation of Parkland Frameworks.</p> <p>Work closely with funding agencies and demonstrate a willingness to design and pursue facility development proposals that will be financially sustainable from an ongoing operational perspective.</p> <p>Open Space should be developed in accordance with the Open Space Hierarchy</p>	<p>Open Space provisions should be consistent in both Development Plans and reflect the open space hierarchy as follows;</p> <ul style="list-style-type: none"> • <i>District level parks should be at least 3 hectares in size, and provided within 2 kilometres of all households that they serve</i> • <i>Neighbourhood parks should be at least 0.5 hectares and generally closer to 1 hectare in size, and provided within 500 metres of households that they serve</i> • <i>Local parks should generally be a minimum of 0.2 hectares in size, and should be centrally located within a residential area, close to schools, shops and generally within 300 metres of households that they serve.</i> 	<p>Local Councils Planning SA Office for Recreation and Sport 5 Years 10 Years</p>
<p><i>Strategic Planning</i></p> <p>Current zoning includes: Industry Zone (City of West Torrens) Industry Zone (Core PA 56) and Industry Zone (Interface PA 57) (City of Charles Sturt)</p>	<p>Wider holistic approach to facility provision i.e. facility planning and re-vegetation across Council boundaries/areas and funding through key stakeholders with continued support and involvement from Planning SA, ORS etc.</p> <p>Parkland frameworks offer an interface between different land uses such as the Linear Park, Industry and suburban Riverine (as is the case at the Western End of Ashwin Parade, where all three land uses are located in close proximity of each other)</p> <p>The Core Industry Policy Area 56 should not directly interface with the River Torrens Linear Park Zone (City of Charles Sturt, West Hindmarsh Policy Area Map ChSt/43)</p>	<p>The existing landscaping provisions in the Charles Sturt Development Plan provide the following for the Industry Zone Core Policy Area 56;</p> <p>16 <i>On property boundaries facing the River Torrens, substantial landscaped buffers of at least 8 metres of appropriate vegetation should be established to improve the visual amenity of the area.</i></p> <p>The long-term approach involves the removal of incompatible land uses adjoining the River Torrens, if that is not achievable then a substantial increase in buffer areas between incompatible land uses is recommended.</p>	<p>Local Councils Planning SA 10 Years</p>

6.9 Gateways Precinct

The table below details site analysis, strategic directions, and possible statutory responses to those areas of the River Torrens Linear Park that have been identified as part of the Gateways Precinct for the purposes of the Management Plan.

Many of the Statutory Responses listed in the tables below have been developed in accordance with Planning SA's Better Development Plan Policies.

GATEWAYS PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>These areas are high demand/capacity areas of the Linear Park. Major Gateways providing access and links to the surrounding suburban environment include:</p> <p><i>Seaview Road/Coast Park</i></p> <p><i>Lockleys Oval</i></p> <p><i>Apex Park Wetlands</i></p> <p><i>Underdale/Urban Pacific site</i></p> <p><i>Tapleys Hill/Burbridge Road Intersection</i></p>	<p>Linkages to key points along the Linear Park provide for a permeable gateway between the Linear Park and the surrounding area.</p>	<p>The following are two of the key existing Development Plan provisions relating to open space provision, and the relationship between pedestrian and cyclist movement and that open space.</p> <p><i>West Torrens Development Plan</i> Objective 77: <i>An increase in parks and recreation areas, containing facilities appropriate to the localities they serve, and, where possible, linked to cycle routes and linear parks.</i></p> <p><i>City of Charles Sturt Development Plan</i> 258 <i>Development should provide for linked areas of major open space which will provide for a network of parks and pedestrian and cycle ways throughout the Council area.</i></p>	<p>Local Councils Stakeholders/Funding Opportunities 5 Years 10 Years</p>
<p><i>Seaview Road/Coast Park</i> There is a clear link between the <i>Coast Park</i> and the <i>River Torrens Linear Park</i> that has been established and enhanced through the development of the Seaview Road underpass. This is evident on the southern side of the River, and Coastal Zone Objective 8 promotes further enhancement of this existing gateway to the north (Henley Beach) also.</p>	<p><i>Seaview Road</i> – access to Henley Square (Henley Beach) and to the West Beach Foreshore Reserve and Glenelg via the <i>Coast Park</i></p>	<p>Existing Objective 8 within the Coastal Zone (City of Charles Sturt) particularly demonstrates the importance of the linkage of Coast Park to the River Torrens and supports the continued enhancement of the Seaview Road linkage Gateway.</p> <p><i>Objective 8: Maintenance of open space links with the various local and regional open space networks and corridors to ensure passive recreational linkages.</i></p>	<p>Local Councils Planning SA Office for Recreation and Sport 5 Years 10 Years</p>
<p><i>Lockleys Oval</i> <i>Residential Zone (Policy Area 38)</i></p>		<p>Consideration should be given to the Desired Character Statement for the creation of such a policy area and should further detail the vision for the zone and may include the</p>	

GATEWAYS PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>Lockleys Oval is considered to be a Major District Open Space, however the area does draw a wide range of people from different areas and has the potential to become a regional recreation node.</p>	<p>To further link the River Torrens Linear Park with Lockley's Oval and the surrounding suburban area, a recreational trail should be incorporated. Separate access linking both sides of the River Torrens would also provide greater permeability of the surrounding suburban areas and encourage greater use of the Linear Park and of Lockley's Oval.</p> <p>Proposed access would link Residential Zones from both Council areas, and would take place within the Linear Park Zone.</p> <p>Consideration of a Lockley's Oval Policy Area or a MOSS Zone encompassing Lockley's Oval to ensure the retention of land ahead of time and promote this District Level Open Space as a Regional Recreation Hub. A Policy Area may also enable future consolidation of community facilities to further promote the space as a Regional Hub.</p>	<p>following:</p> <ul style="list-style-type: none"> ▪ the role of the zone within the council area ▪ the natural environment including major topographic features <ul style="list-style-type: none"> ▪ activities occurring within the zone—types of land uses, amenity and 'feel' of the area ▪ the physical environment including: <ul style="list-style-type: none"> - built form—design, density, height - urban design issues—vistas, orientation, building edges - major landmarks/key buildings ▪ circulation/movement within the area—pedestrian and vehicular activity, transport nodes ▪ linkages to adjoining areas <p><i>Alternatively</i> the following are recommended to be inserted into Policy Area 38 as part of a PAR process;</p> <p><i>2. Public open space and recreation areas should be of a size, dimension and location that:</i></p> <ul style="list-style-type: none"> (a) <i>facilitate a range of formal and informal recreation activities to meet the needs of the community</i> (b) <i>provide for the movement of pedestrians and cyclists</i> <p><i>As part of a Council-Wide PAR process the Residential Zone Policy Areas 38, 39 and 42 should all have consideration to the following:</i></p> <p><i>Development should ensure that public access to the River Torrens Linear Park is retained and enhanced for cyclists and pedestrians.</i></p>	<p>Local Councils Stakeholders/Funding Opportunities 5 Years 10 Years</p>
<p><i>Apex Park Wetlands (Linear Park River Torrens Zone interfaces with Residential Policy Area 38, Adelaide Airport Zone, City of West Torrens)</i></p> <p>Apex Park Wetlands – provides a visual transition and character shift from the suburban environment to the River Torrens Linear Park.</p>	<p>Maintain this area as an attractive and functional wetland and its importance in providing a Gateway between the suburban environment and the River Torrens Linear Park.</p> <p>The Wetlands provide an attractive area for recognition of the traditional owners and occupiers of the land of the Kaurna people. This could take place in the form of</p>	<p><i>Development should ensure that public access to the River Torrens Linear Park is retained and enhanced for cyclists and pedestrians.</i></p>	<p>Local Councils Stakeholders/Funding Opportunities 5 Years</p>

GATEWAYS PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>The Apex Park provides a range of recreational facilities and an attractive environment that encourages multiple-usage of the area as well as providing a link to the Linear Park.</p> <p>As urban infill development becomes more apparent, the provision of new parks within the established 'built up' area becomes difficult. Therefore the emphasis shifts to the importance of providing functional links to open space areas, as well as the provision of open space within new housing estates.</p> <p><i>Residential Zone Policy Areas 38, 39 and 42 interface directly with the River Torrens Linear Park.</i></p> <p><i>Underdale/Urban Pacific site</i></p>	<p>interpretive signage and other educational material.</p> <p>Maintain a visual gateway between the River Torrens Linear Park and the emerging residential landscape and existing recreational area associated with the Urban Pacific Site, Underdale High and the proposed Catholic Education site.</p> <p>Promote the usage of recreation areas (such as that associated with Underdale High and the proposed Catholic Education site on the former Underdale University Campus site) to incorporate multiple uses at different times of the day, particularly on weekends and outside of school hours.</p> <p>Encourage 'permeability' through emerging residential area by creating pathways and trails that connect open space and the residential landscape with the Linear Park. Create legible linkages between infill sites on the northern and southern sides of the River.</p>	<p>As part of a Council-Wide PAR process the following provisions should be considered for this site:</p> <ul style="list-style-type: none"> • Development located and designed to prevent adverse impact and conflict between land uses. • Development should be designed and sited to minimise negative impact on existing and potential future land uses considered appropriate in the locality. (i.e. Linear Park Reserve) • Land bordering watercourses should be reserved for public use • Buildings well set back & front onto a reserve along a watercourse • Retain open views to the Hills from Open Space associated with Underdale High. <p>The 12.5% contribution to Open Space as a result of land division comprising 20+ allotments (associated with Urban Infill sites nearby/adjacent the River Torrens) should be vested to the improvement of the River Torrens Linear Park.</p>	<p>10 Years</p> <p>Local Councils Stakeholders/Funding Opportunities 5 Years 10 Years</p>

GATEWAYS PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p><i>Underdale/Urban Pacific site Special Uses Zone (City of Charles Sturt)</i></p> <p>The parcel of land located to the north of the Urban Pacific site (within the City of Charles Sturt) associated with the former Underdale Campus is proposed to be developed as a School.</p> <p>Development of this site should establish legible linkages to the surrounding suburban environment including the Urban Pacific Site and the River Torrens Linear Park.</p> <p>Current projects are proposed (Planning SA, Urban Pacific, Catholic Education) for the improvement of the Linear Park along these sections of land.</p> <p>The lack of continuity of the shared pedestrian/cycle path in this section is an issue that should be addressed through these improvement projects.</p> <p><i>Regional Approach</i></p>	<p>Development of this site should establish legible linkages to the surrounding suburban environment including the Urban Pacific Site and the River Torrens Linear Park.</p> <p>Improve continuity in shared pedestrian/cycle path.</p> <p>North to south views should be retained through the site.</p> <p>The recognition and identification of key gateways between the River Torrens Linear Park/open space hierarchy/suburban environment/major & minor activity centres, provides a framework for further investigation into promoting functional linkages between these areas.</p> <p>The co-ordination across Council areas particularly with regard to funding opportunities is essential to achieving functional linkages between the Linear Park, open space, residential areas and activity centres (major and minor).</p>	<p>The existing Special Uses Zone provisions are considered to support the sustainable use and improvement of the River Torrens Linear Park as well as the establishment of development of an institutional (educational) nature.</p> <p>Special Uses Zone (CCST) Principle of Development Control 7 is particularly relevant and relates to the establishment of sound urban design outcomes as well as providing effective pedestrian access/linkages.</p> <p>Adopt the following into the Desired Future Character Statement for the Linear Park River Torrens Zone provisions for all Council areas:</p> <p><i>The policy area is primarily an open space with aesthetic, stormwater management and recreation functions. Development within the policy area is appropriate where it is integral to any of these functions provided any structures are not a dominant feature. The policy area will provide for the establishment and</i></p>	<p>Local Councils Urban Pacific Catholic Education 5 Years 10 Years</p>

GATEWAYS PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>Strategic Planning The Apex Park Wetlands provide a very effective mechanism for achieving taking the sole focus of the Linear Park away from the shared path and providing alternative recreation and commuting options for cyclists and pedestrians..</p> <p>The nature of the trails surrounding the wetlands is such that there is not the same perceived conflict between cyclists and pedestrians and therefore provides a safe and attractive area for a variety of users.</p> <p>Tapleys Hill Road/Burbridge Road Intersection</p>	<p>Further improvement of connectivity between the River Torrens Linear Park and the Apex Park Wetland through greater visual connection, equitable and safe access and some interpretive signage.</p> <p>Continue to provide alternate routes for pedestrians and cyclists to further reduce conflict and will facilitate interesting and diverse routes for recreational and commuter users.</p> <p>Opportunity to further promote regional attractions i.e. River Torrens Linear Park, Harbour Town and Glenelg.</p> <p>Provide clearer signage at the Tapleys Hill Road and Burbridge Road/Sir Donald Bradman Drive intersection demonstrating attractions in the surrounding localities.</p>	<p><i>maintenance of a linear open space and biological corridor based on the existing watercourse channel, associated floodplains and vegetation.</i></p> <p><i>Water quality of the river and the recreational opportunities will be retained and enhanced.</i></p> <p><i>Pedestrian, cycle and recreation facilities, such as drinking fountains and barbecues, should be incorporated into the Linear Park.</i></p> <p>As part of a City wide PAR process consideration should be given to the following provisions in Zones adjoining the River Torrens Linear Park;</p> <p><i>City of West Torrens: Residential Zone (Policy Areas 38, 39 & 42), District Commercial Zone, Industry Zone and Commercial Recreation Zone.</i></p> <p><i>City of Charles Sturt: Residential Zone (Policy Areas 2 & 3), Industry Zone (Policy Areas 56 & 57), Special Use Zone, Mixed Use Zone (Policy Area 53), District Centre Hindmarsh Zone (Policy Area 39 & 41).</i></p> <ul style="list-style-type: none"> <i>Provision of safe, pleasant, accessible, integrated and permeable pedestrian and cycling networks to the River Torrens Linear Park.</i> <p><i>Land uses arranged to support the efficient provision of pedestrian and cycling networks and encourage their use</i></p> <p>The intersection and roads leading to it are located within the <i>Adelaide Airport Zone and Residential Zone (Policy Area 38)</i></p>	<p>Local Councils (<i>consistent across Metropolitan Adelaide</i>) Planning SA 5 Years 10 Years</p> <p>Local Councils Planning SA 5 Years 10 Years</p>

GATEWAYS PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
Existing link providing cycle access between Glenelg and the River Torrens Linear Park			Transport SA Federal Airports Corporation 5 Years

6.10 Suburban Riverine Precinct

The table below details site analysis, strategic directions, and possible statutory responses to those areas of the River Torrens Linear Park that have been identified as part of the Suburban Riverine Precinct for the purposes of the Management Plan.

Many of the Statutory Responses listed in the tables below have been developed in accordance with Planning SA's Better Development Plan Policies.

SUBURBAN RIVERINE PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>The interface between the suburban 'hard' environment and the River Torrens Linear Park should prevent the encroachment of incompatible land uses.</p> <p>Increasing residential land values may lead to the urban consolidation or residential infill of existing industrial sites or commercial/bulky goods sites located within close proximity of the River Torrens.</p>	<p>Incompatible land uses adjoining the River Torrens Linear Park should be encouraged to relocate over the long-term.</p> <p>Reserve land bordering watercourses for public use.</p> <p>Investigate further opportunities to increase set-back/buffer distances between Industrial land uses and the River Torrens Linear Park.</p>	<p>Through a Council-wide PAR process consideration should be given to all general/special/core industrial zoning that immediately abuts the River Torrens Linear Park and the potential to incorporate this land into an interface policy area similar to that which is implemented in the City of West Torrens (i.e. Industry Zone Policy Area 57).</p> <p>Development Plan provisions should address:</p> <ul style="list-style-type: none"> The proper provision of public and community/recreation facilities including the reservation of suitable land in 	<p>Local Councils Planning SA 5 Years 10 Years</p>

SUBURBAN RIVERINE PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
		<p>advance of need.</p> <ul style="list-style-type: none"> Buildings well set back & front onto a road and reserve along a watercourse - Residential Zone (PA 38, 39 & 42 City of West Torrens) & Residential Zone (PA2 & 3 City of Charles Sturt) 	
<p>Industry Zone (Core Policy Area 56) (City of Charles Sturt)</p> <p>Industry Zone (City of West Torrens)</p> <p>The Industry Zone (Core Policy Area 56) directly interfaces with the Linear Park (River Torrens) Zone along several sections of the Linear Park and particularly within the West Hindmarsh and Hindmarsh sections of the River.</p>	<p>Consider Re-locating Special/General Industry away from land adjoining the River Torrens Linear Park</p> <p>Consider incorporating Special/General/Heavy Industry immediately adjoining the Linear Park into an Interface Policy Area (similar to the Industry Zone Interface Policy Area 57 within the City of Charles Sturt), to ensure heavy Industry does not become established on adjoining the Linear Park.</p> <p>Incorporate those areas of the <i>Industry Zone Core Policy Area 56</i> within the City of Charles Sturt that immediately abut the River Torrens Linear Park into <i>Interface Policy Area 57</i>.</p> <p>Incorporate land within the <i>Industry Zone</i> that immediately abuts the River Torrens Linear Park in the City of West Torrens into an <i>Industry Zone Interface Policy Area</i> similar to that of the City of Charles Sturt.</p>	<p>As part of a Council-wide PAR process consideration should be given to the following associated with incompatible land uses surrounding the River Torrens e.g. Heavy Industry.</p> <ul style="list-style-type: none"> Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following: <ul style="list-style-type: none"> the emission of effluent, odour, smoke, fumes dust or other airborne pollutants noise vibration electrical interference light spill glare hours of operation traffic impacts Development should be designed and sited to minimize negative impact on existing and potential future land uses considered appropriate in the locality <p>Consideration should be given to General /Heavy industry land uses to be non-complying on allotments directly adjoining the Zone boundary interface with the Linear Park (River Torrens) Zone or Linear Park (River Torrens/Karrawirra Pari) Zone.</p> <p>As part of a Council-wide PAR process consideration should be given to the creation of a Policy Area (bounded by Ashwin Parade, Hardy's Road and South Road (City of West Torrens).</p>	<p>Local Councils Planning SA 5 Years 10 Years</p>

SUBURBAN RIVERINE PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>Urban Consolidation/Intensification</p> <p>Anecdotal evidence suggests that future urban intensification in and adjacent this precinct will lead to increased pressure on and demand for recreational facilities along the River Torrens.</p> <p>The suburban Riverine Character Precinct contains much of the area that has the potential to be consolidated through a change to development plan policy as well as property market influences.</p> <p>This locality has been identified as a potential area that may have a significant residential and employee population increase through urban infill and establishment of alternative industry.</p>	<p>Create a Mixed Use Policy Area within this locality</p> <p>A longer-term approach would ultimately involve incorporating commercial and residential development with the existing non-intensive 'clean' industry.</p> <p>The opportunity to ultimately support an increase in recreation/open space demand resulting from urban consolidation of this locality should come through the enhancement of the adjoining Parkland Framework attributes.</p> <p>These should include the retention of a high level of formal and passive recreational activities, establishment of a regional play space and time trial/fitness circuit, linked through an interpretive and directional recreational signage corridor.</p> <p>The creation of linkages and development in this locality should consider the relationship of the Linear Park with the former <i>Brickworks Markets</i> development site, located immediately to the west of South Road.</p> <p>Establish and formalise linkages with <i>Kings Reserve</i>, <i>Thebarton Oval</i> and <i>Thebarton Senior College</i> located to the south-east.</p>	<p>This may involve a two-step process which would initially involve the creation of an Industry Interface Policy Area to encourage the removal of any incompatible Industry uses and encourage 'cleaner' industry in this area.</p> <p>Initially an Interface Policy Area should encourage a change to more service related and home Industry (such as that associated with the proposed Thebarton Bio Science Precinct.</p> <p>Consideration should be given to the establishment of an Industry Interface Policy Area should be based on the following principles:</p> <ul style="list-style-type: none"> • Development located and designed to prevent adverse impact and conflict between land uses. • Development should be designed and sited to minimise negative impact on existing and potential future land uses considered appropriate in the locality. <p>The establishment of a Mixed-use policy Area should include the following Principles:</p> <ul style="list-style-type: none"> • A functional and diverse zone accommodating a mix of commercial, community, light industrial, medium density residential, office, and small-scale shop land uses. • Development that minimises any adverse impacts upon the amenity of the locality within the zone. • Development that does not adversely impact on the amenity of adjacent land that is zoned for residential purposes or within the Linear Park (River Torrens) Zone. 	<p>Local Councils Planning SA 5 Years 10 Years</p>

6.11 Urban Definition Precinct

The table below details site analysis, strategic directions, and possible statutory responses to those areas of the River Torrens Linear Park that have been identified as part of the Urban definition Precinct for the purposes of the Management Plan.

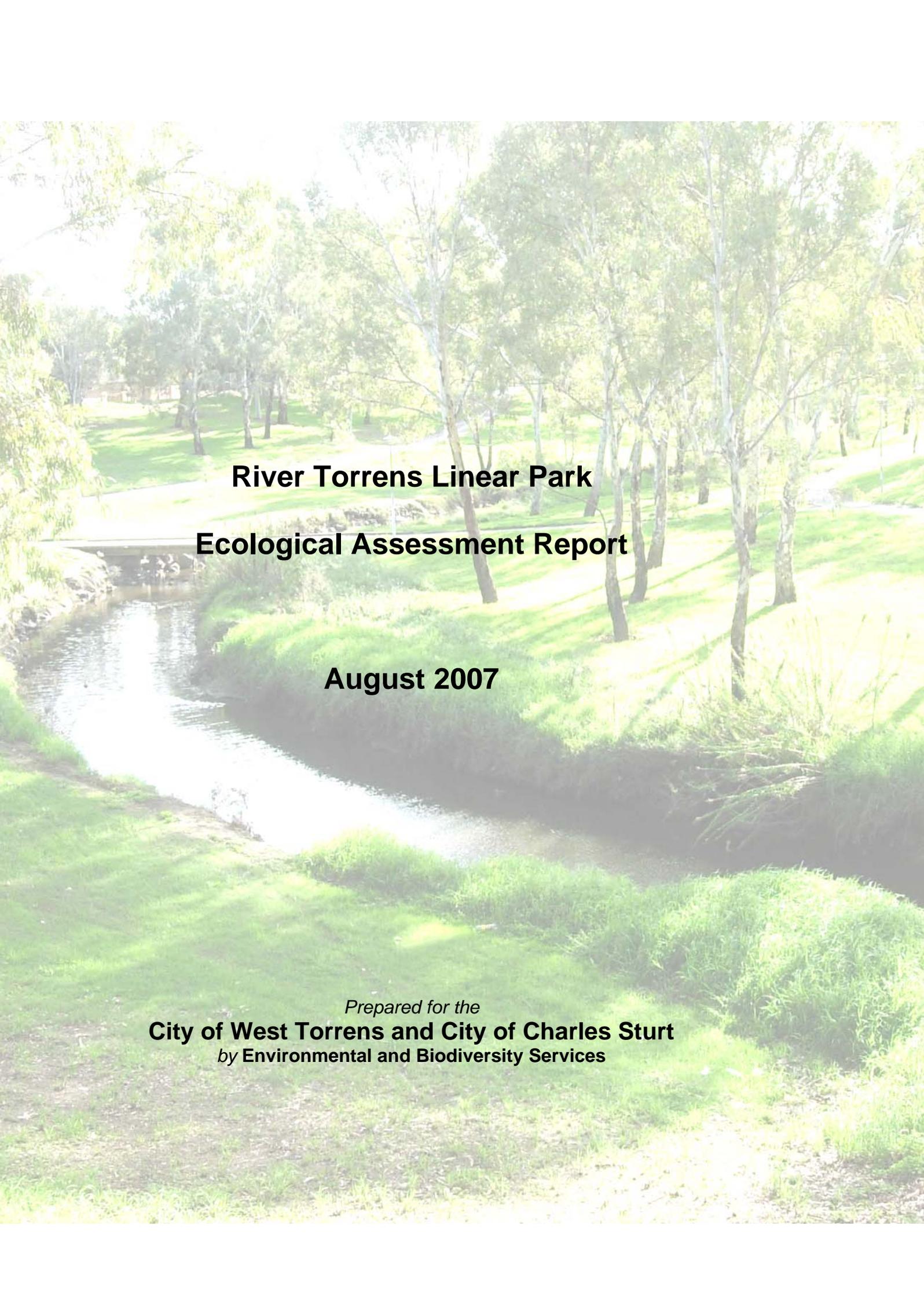
Many of the Statutory Responses listed in the tables below have been developed in accordance with Planning SA's Better Development Plan Policies.

URBAN DEFINITION PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>Currently Industry Zone</p> <p>The River Torrens Linear Park can be viewed as a link between the 'Coastal Riverine' precinct beginning at West Beach and the Urban Definition of the City of Adelaide to the north of Port Road</p>	<p>Connecting the Urban Definition landscape character to the Suburban Riverine landscape through a range of passive and recreational activities may be achieved through a shift in landscape character of the predominantly Industrial area leading to Port Road.</p> <p>Thebarton Bioscience Precinct. (source Bio News). Bio Innovation SA located in-between Adam Street and the River Torrens represents a mechanism to facilitate cleaner industry and further promote mixed use in the urban definition landscape character precinct.</p>	<p>As part of a Council-wide PAR process consideration should be given to a new policy area supporting/facilitating the new Bio-Precinct and University Research Hub (Hindmarsh and Thebarton), addressing the following:</p> <ul style="list-style-type: none"> Industrial development occurring without adverse effects on the health and amenity of land in adjoining zones. i.e. Linear Park (River Torrens) Zone. Encouragement of forms of Industry such as Home Industry, Bioscience and research development and Service Industry. Promote a functional and diverse zone accommodating a mix of commercial, community, light industrial, medium density residential, office, and small-scale shop land uses. 	<p>State & Local Gov Planning SA 5 Years 10 Years</p>
<p>Industry Zone and Residential Policy Areas 38 and 39 (City of West Torrens) -</p> <p>Residential Zone (Mid Suburban PA 2), Residential Zone (Integrated medium density PA 6), Industry Zone (Core PA 56) and Industry Zone (Interface PA 57)</p>	<p>Ideally the Industry Zone (Interface Policy Area 57) should front the Linear Park where Industrial land uses are compatible with the surrounding environment. A shift toward service industry and bulky goods/commercial to replace heavy industry in these areas is considered an appropriate direction for future development.</p>	<p>Consideration should be given to the interface with the River Torrens Linear Park Zone and Policy area 56 (or any other core/heavy industry)</p> <p>An Industry Zone (Interface Policy Area 57) is considered a more appropriate land use, and a shift toward cleaner industry such as of the proposed Bioscience Precinct creates a more environmentally sustainable interface with the River Torrens.</p>	<p>Local Councils Planning SA 5 Years 10 Years</p>
	<p>Establish a continued cyclist/pedestrian pathway in accordance with Australian Standards along this section of the Linear Park.</p>	<p>As part of a Council-Wide PAR process consideration should be given to incorporating those parts of existing <i>Industry Zone Policy Area 56</i> that immediately abut River Street (Hindmarsh) into <i>Industry Zone Interface Policy Area 57</i>.</p>	

URBAN DEFINITION PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>Adam Street <i>Industry Zone (Core Policy Area 56)</i> The <i>Core Industry Policy Area 56</i> directly interfaces with the River Torrens Linear Park along that section of Adam Street from the western edge of the Adelaide Entertainment Centre to the eastern edge of the Cheltenham Cemetery. Particularly, the River Street (Hindmarsh) interface abuts directly with the River Torrens as the shared path along this section is discontinued and the road network is used.</p>	<p>Facilitate investigation into providing increased set-back distances between industrial land uses and the linear park in this locality.</p>	<p>This is not as prevalent of an issue further to the east along Adam Street, where that road separates land uses to the north within the Industry Zone and District Centre Hindmarsh Zone from the Linear Park.</p> <p><i>Existing zone provisions promote development of such an opportunity.</i></p>	<p>Local Councils Planning SA 5 Years 10 Years</p>
<p>District Centre (Hindmarsh) Zone (Entertainment/office/commercial Policy Area 39)</p>	<p>Urban Plaza opportunity, within existing entertainment precinct, which should be of a high amenity reflecting locations of iconic community significance</p> <p>Opportunity to link the surrounding (predominantly Industrial) area with a proposal such as an urban plaza would further revitalise this area as a functional and vibrant area for workers as well as an entertainment and recreation precinct.</p>	<p>As part of a Council-wide PAR process consideration should be given to an Interface or a Technology and Research Policy Area within the existing Industry Zone encompassing those allotments that immediately abut the River Torrens Linear Park.</p>	<p>Local Councils Planning SA</p>
<p>Industry Zone directly Interfacing with the River Torrens Linear Park - <i>City of West Torrens (Industry Zone, located between South Road and Port Road)</i></p> <p>This locality has been the subject of a shift to cleaner and more technology/research based Industry through the creation of the University Research Park/Thebarton Advanced Technology and Bioscience Hub.</p>	<p>Use the PAR process to encourage more sustainable development in close proximity to the River Torrens linear Park. A shift from General Industry to 'cleaner' forms of industry is considered appropriate.</p>	<p>The desired character statement should further detail the vision for the zone. As a guide, imagine the zone into the future and describe the following:</p> <ul style="list-style-type: none"> • the role of the zone within the council area • the natural environment including major topographic features 	<p>Local Councils Planning SA 5 Years 10 Years</p>

URBAN DEFINITION PRECINCT			
ANALYSIS	STRATEGIC DIRECTIONS	STATUTORY RESPONSE	STAKEHOLDERS
<p>The Bioscience Hub has allowed for the establishment lasting partnerships with industry tenants in the locality, and is considered to be a facilitator for alternative forms of Industry that are more environmentally suited to the area.</p>		<ul style="list-style-type: none"> - activities occurring within the zone—types of land uses, amenity and 'feel' of the area - the physical environment including: - built form—design, density, height - urban design issues—vistas, orientation, building edges - major landmarks/key buildings - circulation/movement within the area—pedestrian and vehicular activity, transport nodes - linkages to adjoining areas 	

Appendix 5 – Ecology Report



**River Torrens Linear Park
Ecological Assessment Report**

August 2007

Prepared for the
City of West Torrens and City of Charles Sturt
by Environmental and Biodiversity Services

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1. Introduction

1.1 Background

Biodiversity along the River Torrens and associated floodplains has been significantly altered since European settlement. Grazing, agriculture, horticulture, residential development and industry have all contributed to the decline, removal and fragmentation of native flora and fauna species and the colonisation of introduced species. Consequently, the biodiversity once considered common within the area now bears little or no resemblance to that of the natural environment that existed prior to European settlement. Furthermore, these activities have individually and collectively caused major and irreversible damage to the river including a change to the natural flow, a decline in water quality, and an acceleration of erosion and sedimentation.

Despite the degradation of flora and fauna habitats, the River Torrens Linear Park which is now dominated by planted trees and shrubs over mown grass; does have the capacity to support an increased abundance and diversity of native flora and fauna species. Within a landscape dominated by urban development, Linear Park provides an important corridor for birds and other native fauna species. The future maintenance and enhancement of biodiversity within Linear Park is essential for the protection of native species that currently inhabit the area and to encourage an overall increase in native species abundance and diversity. From a societal perspective (with 92% of Australians living in cities), urban nature plays a critical role in conserving all of Australia's biodiversity because it is the nature that most Australians experience and interact with on a daily basis (McDonnell, 2007). As communities increasingly recognise the value of healthy urban environments, the future management of Linear Park provides the opportunity to protect and enhance biodiversity and improve the overall quality of the River Torrens Linear Park environment.

The following ecological assessment report details the current ecological conditions within a section of the River Torrens Linear Park and identifies the prevailing management issues associated there. By reviewing the current conditions, future works can be focused on the management of issues identified. The removal of native vegetation, lack of faunal habitat, encroachment of introduced species, erosion and poor water quality are the main issues facing biodiversity within Linear Park.

1.2 The study area

The River Torrens Linear Park (referred to as Linear Park hereafter) was surveyed from the Port Road Bridge through to the river mouth at Henley Beach South, a distance of approximately 10 km. The section of Linear Park surveyed passes through two local council zones including the City of West Torrens and the City of Charles Sturt. The study area occurs within a highly urbanised environment predominantly designed for recreation and flood mitigation and is surrounded by residential and commercial development.

1.3 Aims

The aims of this ecological assessment were:

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1. to obtain information on the presence, distribution and function of both native and introduced flora and fauna species within the study area;
2. to determine the level of biodiversity remaining within the study area;
3. to assess the ecological significance of the study area; and
4. to identify threatening processes to the biodiversity within the study area.

2. Methodology

2.1 Taxonomy

Plant taxonomy used in this report follows Jessop and Toelken (1986), which are used in Lang and Kraehenbuehl (2006) and Barker et al (2005). The scientific and common names for fauna species used in this report follow Robinson et al (2000).

2.2 Background research

A review of relevant information relating to fauna and flora species within or near to the study area was undertaken prior to the commencement of the field survey and involved:

- a) a review of existing data and literature relating to biodiversity within the study area and surrounding region;
- b) a review of the current occurrence of both native and introduced fauna and flora species within the study area; and
- c) a review of flora and fauna species likely to have been present within the study area prior to European settlement.

2.3 Field Survey

The study area was surveyed between the 7th and 11th of May 2007 and was carried out in a westerly direction from the Port Road Bridge through to the river mouth at Henley Beach South. The field survey involved recording the condition of vegetation present, assessing fauna habitats within the study area, assessing the ecological and landscape value of the study area, mapping ecological zones and significant trees and identifying the locations of declared and or environmental weeds. The methodologies utilised for mapping ecological zones and significant trees are described in further detail below.

A full and comprehensive fauna survey was not carried out for this project; rather, opportunistic observations of fauna species were recorded whilst undertaking the flora survey. All fauna species observed during the vegetation survey were recorded. A fauna assessment was conducted and involved the identification of important fauna habitat, assessing the quality of fauna habitat present and determining the likely presence of fauna species within the study area.

2.4 Ecological Zones

The study area was divided into five ecological zones based on the topography of the area and the habitat types which are considered likely to have been present prior to European settlement. The ecological zones utilised have been described in detail by Pedlar and Crompton (2003) in their River Torrens Linear Park Biodiversity Protection and Management Review. These zones, which for consistency have been used within this ecological assessment report, are described in Table 1.

Table 1: Description of Ecological Zones

Ecological Zone	Description
Aquatic	The area within the main channel which remains underwater or waterlogged;
Riparian	The area immediately adjacent to the aquatic zone that is influenced by the watercourse and remains moist throughout the year and is subject to seasonal flooding and flooding in storm events;
Outer Riparian	The area adjacent to the riparian zone that benefits from the extra root zone moisture provided by proximity to the watercourse, but does not stay waterlogged for long. This area is flooded less frequently than the riparian zone. It falls within the 1 in 5 year flood zone;
Upper Slopes	These areas are naturally dry areas with limited subsoil moisture and are very infrequently flooded, if ever. Upper slopes are only slightly influenced by the watercourse and are above the 1 in 5 year flood zone;
Steep Slopes	These steep slopes may be steep banks close to the watercourse or constitute the outer edge of the river valley, some distance from the watercourse. They are elevated sites not subject to flooding whose steep slopes and exposure produce a very dry growing environment.

2.5 Significant Trees

The study area is situated within the City of West Torrens and the City of Charles Sturt, both of which are within the zoning where vegetation is subject to the *Development Act 1993*. As a result, any tree (alive or dead) which has a trunk circumference of 2.0m or more at 1.0m above the ground is considered to be significant. In the case where trees have multiple trunks, those trees with trunks that have a total circumference of 2.0m or more and have an average circumference of 625mm or more are also considered to be significant.

The measurable attributes for each scattered trees were recorded onto datasheets during the field survey and detailed tree height and spread, health and condition, landscape value, ecological value and the presence of hollows.

2.6 Survey Limitations

At the time the survey was undertaken all plant species may not have been visibly present and others are unidentifiable to species level due to a lack of distinguishing features. Therefore, some species which may occur within the study area may not have been observed or recorded and others were only identified to the level of genus.

Without undertaking a full and comprehensive fauna survey, it is not possible to detect all terrestrial fauna species that occur within Linear Park. A comprehensive fauna survey would be required to accurately increase the diversity of the fauna species list. In addition to the fauna species recorded during the field survey, background research which identified species that have been previously recorded or are likely to occur within the study area was undertaken in order to compile a list of fauna species that currently occur within Linear Park

3. Pre-settlement Conditions

3.1 Pre-settlement Flora

Due to a limited record of detailed plant communities within and adjacent to the River Torrens prior to European settlement, especially in relation to the swampland area near the river mouth, compilation of likely plant communities and probable species lists for each community have been arranged. According to Kraehenbuehl (1996), the pre-settlement vegetation along the River Torrens between Port Road and the river mouth at Henley Beach South consisted of three broad plant communities. The likely plant communities within the study area as arranged by Kraehenbuehl (1996) are detailed below.

It is considered likely that the study area between Port Road and slightly upstream from Henley Beach Road was dominated by River Red Gum (*Eucalyptus camaldulensis*) and South Australia Blue Gum (*Eucalyptus leucoxylon*) woodland. Dominant shrubs present within this woodland would have included Bursaria (*Bursaria spinosa*) and Golden Wattle (*Acacia pycnantha*). The aquatic and riparian ecological zones would have been covered by Common Reed (*Phragmites australis*) and Narrow-leaf Bulrush (*Typha domingensis*). Other understorey species located along the banks are likely to have included Grey Bindyi (*Sclerolaena diacantha*), Clammy Goosefoot (*Chenopodium pumilio*), Common Vanilla-lily (*Arthropodium strictum*) and Tall Spear-grass (*Austrostipa nodosa*).

It is considered likely that four distinct vegetation communities would have occurred downstream from Henley Beach Road to where the River Torrens would have once terminated into swamp land (east of Seaview Road). These vegetation communities would have been characterised by a diversity of sedge, reed and grass species. The most dominant vegetation community within this area would have included closed sedgeland, referred to as the reedbeds and was dominated by Common reed (*Phragmites australis*), Narrow-leaf Bulrush (*Typha domingensis*) and Pondweed (*Potamogeton* sp.). Adjacent to the edges of the lagoon within the aquatic and riparian ecological zones, reedbeds in conjunction with a closed sedgeland of Rush (*Juncus* sp.), Flat-sedge (*Cyperus* sp.) and Club-rush (*Isolepis* sp.) were dominant. Also, a Club-rush (*Bolboschoenus* sp.) sedgeland and a mixed Tangled Lignum (*Muehlenbeckia florulenta*) low shrubland would have been present within the riparian and outer riparian ecological zones. During the summer months when the swamp land dried up, many herbaceous and grass species such as Yellow Twin-heads (*Eclipta platyglossus*), Annual Cudweed (*Euchiton sphaericum*), Kidney weed (*Dichondra repens*), Blue Devil (*Eryngium rostratum*), Nardoo (*Marsilea drummondii*), Kangaroo grass (*Themeda triandra*), Black-head Grass (*Enneopogon nigricans*) and Bulbine semibarbata (Small leek-lilly) would have grow within this area.

As it remains today, the area around the River Torrens mouth prior to European settlement was a sand dune system and was likely to have been dominated by Coastal Daisy Bush (*Olearia axillaries*) and Sallow Wattle (*Acacia longifolia*) low shrubland and Coast Cushion Bush (*Leucophyta brownii*) low shrubland. The dense nature of these dominant shrublands would have provided excellent sand stabilisation within the dune system. Two minor plant associations including Rolling Spinifex (*Spinifex hirsutus*) open tussock grassland and Coast Sword-sedge (*Lepidosperma gladiatum*) tussock sedgeland, still present in patches along the Adelaide metropolitan coastline would have been present within the dune system. Silver Banksia (*Banksia marginata*) and Southern Cypress Pine (*Callitris gracilis*) open woodland would have been common within the sand dunes system of which a fragmented population still remains at the Grange Golf Course. Other plants which are likely to have been

associated with the sand dune system include; Common everlasting (*Chrysocephalum apiculatum*), Muntries (*Kenzea pomifera*), Coastal Lignum (*Meuhlenbeckia gunnii*), Coast saltbush (*Atriplex cinerea*) and Knobby Club-rush (*Isolepis nodosa*).

3.2 Pre-settlement Fauna

Prior to European settlement, a large number of native fauna species inhabited the area now known as Linear Park. A fauna list compiled from *Adelaide. Nature of a City: The Ecology of a Dynamic City from 1836 to 2036* (edited by Daniels and Tate (2005)) identified that a total of 403 native fauna species would have existed within the Adelaide Metropolitan district prior to European settlement. Of the 403 species listed, it is considered likely that 285 species would have occurred within and around the River Torrens including 6 amphibian species, 185 bird species, 11 fish species, 47 reptile species, 35 mammal species and 1 crustacean. Many fauna species that were once common within the River Torrens area prior to European settlement are now extinct from the Adelaide metropolitan region such as the Western Grey Kangaroo (*Macropus fuliginosus*), Dingo (*Canis lupus dingo*) and Southern Hairy-nosed Wombat (*Lasiornhinus latifrons*). Furthermore several species such as the Azure Kingfisher (*Alcedo azurea*), Spotted-tailed Quoll (*Dasyurus maculatus maculatus*), Platypus (*Ornithorhynchus anatinus*) and the Common Wombat (*Vombatus ursinus*) also once common within the River Torrens area are now extinct from the Adelaide metropolitan region and are listed as threatened within South Australia under the *National Parks and Wildlife Act, 1972*. Habitat fragmentation and degradation, increased predation from introduced species and decline in water quality has led to the local extinction and decline of many native fauna species once common within the River Torrens area.

4. The Existing Linear Park Environment

Biodiversity within the River Torrens Linear Park has been significantly altered since European Settlement. Magavin (2003) states that the River Torrens was used in the years following European settlement as both a source of water and as a sewer. It was the site for garbage dumping and for the mining of sand, gravel and clay. Much of Adelaide's more recent urban sprawl and agricultural production has taken place on the floodplains adjacent to the River Torrens which were previously susceptible to periodic flooding (Tait, 2005). Consequently, the River Torrens corridor has been extensively modified through straightening, enlarging and lining sections of the river channel to increase the flow of water in order to manage flooding events and increased urban runoff. These activities have individually and collectively caused major and irreversible damage to the flora and fauna adjacent to the River Torrens. Furthermore, as the urban environment surrounding the River Torrens has expanded, areas of natural habitat adjacent to the river have disappeared, restricting the dispersal ability of native flora and fauna species. As its name suggests, the linear shape of Linear Park has a high ratio of edge to surrounding area. These edges are more susceptible to a vast array of disturbances including the invasion of introduced fauna and flora species (Bennett et al. 2000). The following sections detail the results from the field survey and background research, summarising the native and introduced fauna and flora species that currently occur within Linear Park. Several key threatening processes to biodiversity within Linear Park are also identified.

4.1 Flora

Flora within the study area has been completely transformed since European settlement. Consequently, the vegetation now bears little or no resemblance to that of the natural environment that existed prior to settlement. This is made evident by the lack of remnant species, the absence of a functioning overstorey, midstorey and understorey layer, the dominance of introduced species and the extensive plantings of introduced and non-local native species.

Overall, Linear Park is maintained as a parkland environment where the vegetation is dominated by planted trees and shrubs (local native, non-local native and introduced species) with scattered remnant trees over mown grass (predominantly Kikuyu (*Pennisetum clandestinum*)). The parkland environment extends through the majority of the study area from the Port Road Bridge down to Stage 1 of the Breakout Creek Wetlands project. Located on the upstream side of Henley Beach Road, Stage 1 of the Breakout Creek Wetlands project has involved the removal of horses, deepening sections of the river to form wetlands, weed control and revegetation. The Breakout Creek Wetlands project is further discussed in Section 5. Towards the Port Road end of the study area, Linear Park is characterised by steep embankments which restrict the accessibility of certain maintenance activities. As a result, this area is typically unmown, dominated by weed species and is more susceptible to erosion.

The section of Linear Park from Henley Beach Road to the river mouth has been constructed so as to form a stormwater outlet as part of the flood mitigation scheme. The vegetation within this section generally comprises open exotic grassland dominated by Kikuyu (*Pennisetum clandestinum*) which extends down to the water edge. Common Reed (*Phragmites australis*) and Narrow-leaf Bulrush (*Typha domingensis*) also occur as patches within the aquatic ecological zone. It is considered that this area is in very poor condition as it has been largely cleared of native vegetation. However, Creeping Monkey Flower (*Mimulus repens*) which has a regional rating of rare within the Southern Lofty Botanical Region does occur within this area, with populations growing amongst thick

Kikuyu. Furthermore, due to the presence of horses, the majority of native species that are able to germinate are grazed out. As a result, this area offers little biodiversity value for native fauna species.

4.1.1 Flora Species

A total of 153 flora species were observed within the study area during the field survey. Of these species, 73 were native and 81 were introduced species. Appendix 1 lists the native flora species observed and Appendix 2 lists the introduced flora species observed within the study area. Of the 73 native species observed, only 18 were remnant species. Furthermore, a total of 32 local native species and 23 non-local native tree and shrub species have been planted within the study area.

The diversity and abundance of remnant species remaining within the Linear Park is extremely low. Table 2 lists the 18 remnant species observed within the study area during the field survey. The majority of remnant vegetation within the study area is limited to scattered overstorey tree species which are located within and adjacent to the river in the aquatic and riparian ecological zones. The River Red Gum (*Eucalyptus camaldulensis*) and Blue Gum (*Eucalyptus leucoxylon*) are the only remnant plant species that commonly occur within Linear Park and are the only remnant plant species that occur outside either of the aquatic or riparian ecological zones. Both of these hollow forming tree species provide excellent habitat for possums, bats, and many bird species within Linear Park. River Red Gum and Blue Gum individuals adjacent to the river have also created habitat for aquatic species as tree limbs and branches have fallen into the water. These large tree species which are an essential part of a healthy river ecosystem also help to stabilise the river bank and provide shade within the aquatic zone. Shade within the aquatic zone limits the rivers exposure to sunlight, reduces water temperatures and helps to prevent algal growth.

The next most dominant remnant species observed within the study area were Common Reed (*Phragmites australis*) and Narrow-leaf Bulrush (*Typha domingensis*). Both of these species thrive within shallow water and have the ability to form dense thickets. At several locations, Common Reed and Narrow-leaf Bulrush form very thick stands along the edges of the main river channel. These stands provide important habitat for a range of shy and cryptic bird species, nesting places for a variety of waterbird species and habitat for other native fauna including amphibians. The dense root structure of these species also helps to control erosion along the banks of the river. Although Common Reed and Narrow-leaf Bulrush are native to the River Torrens, they can be very invasive. At certain locations, the distribution of reeds has increased over the years as a result of altered flows and sedimentation of the river. Although these species provide excellent habitat for several fauna species, they do have the potential, when very thick, to out compete other native species within the aquatic and riparian ecological zone.

Table 2. Remnant flora species observed within the study area

Scientific Name	Common Name	Conservation Rating		
		AUS	SA	SL
<i>Acacia calamifolia</i>	Wallowa			
<i>Acacia pycnantha</i>	Golden Wattle			
<i>Amyema miquelli</i>	Box Mistletoe			
<i>Bolboschoenus caldwellii</i>	Salt Club-rush			
<i>Callistemon sieberi</i>	River Bottlebrush			
<i>Calystegia sepium</i>	Large Bindweed			U
<i>Chenopodium cristatum</i>	Crested Goosefoot			
<i>Cyperus vaginatis</i>	Flat Sedge			
<i>Eucalyptus camaldulensis</i>	River Red Gum			
<i>Eucalyptus leucoxylon</i>	South Australia Blue Gum			

Scientific Name	Common Name	Conservation Rating		
		AUS	SA	SL
<i>Juncus subsecundus</i>	Finger Rush			
<i>Melaleuca halmaturorum</i>	Swamp Paperbark			
<i>Mimulus repens</i>	Creeping Monkey-flower			R
<i>Muehlenbeckia florulenta</i>	Lignum			
<i>Persicaria decipiens</i>	Slender Knotweed			
<i>Phragmites australis</i>	Common Reed			
<i>Schoenoplectus pungens</i>	Spiky Club-rush			U
<i>Typha domingensis</i>	Narrow-leaf Bulrush			

Regions

AUS = Australia, SA = South Australia, SL = Southern Lofty Botanical Region

SL Conservation Ratings (as listed by Lang and Kraehenbuehl 2007)

E = Endangered
 R = Rare
 K = Uncertain – either Threatened or Rare
 Q = Not yet assessed but flagged as being of possible significance
 V = Vulnerable
 T = Threatened
 U = Uncommon

4.1.2 Species of Conservation Significance

Of the 18 remnant species recorded during the vegetation survey, no species of national or state conservation significance were observed; however three species observed have a regional conservation rating within the Southern Lofty Botanical Region (Lang and Kraehenbuehl 2007). These include the regionally rare Creeping Monkey Flower (*Mimulus repens*) and the regionally uncommon Large Bindweed (*Calystegia sepium*) and Spiky Club-rush (*Schoenoplectus pungens*). Each of the regionally rated species were observed within Stage 2 of the Breakout Creek Wetlands project and were found to be growing amongst thick patches of Kikuyu (*Pennisetum clandestinum*). Although these three species were only recorded within Breakout Creek, it is considered likely that they would occur at other locations within the study area.

4.1.3 Introduced Species

The establishment of and continued encroachment of weed species is a major threat to biodiversity within Linear Park, particularly adjacent to the rivers edge. Of the 81 introduced plant species observed within the project area, 14 are listed as declared under the *Natural Resources Management Act 2004* and 18 species are considered to be environmental weeds. One of the declared weed species; Onion Weed (*Asphodelus fistulosus*) is also listed as an environmental weed species. Table 3 lists the declared and environmental weed species observed during the field survey. The majority of the declared and/or environmental weed species were observed to be scattered throughout Linear Park many of which have been planted.

The major species of concern within Linear Park are declared and environmental species including Olive (*Olea europaea*), African Boxthorn (*Lycium ferocissimum*), Blackberry (*Rubus fruticosus* sp. agg.), Bulbil Watsonia (*Watsonia meriana* var. *bulbillifera*), Caster Oil (*Tribulus terrestris*) and Caltrop (*Tribulus terrestris*). Although the densities of these species are not currently high, they have the potential to become widespread throughout Linear Park. Kikuyu (*Pennisetum clandestinum*) is also a species of concern as it is extremely widespread within linear Park, particularly in close proximity to water. Kikuyu is an extremely invasive species and was observed to be encroaching upon several revegetation areas. Kikuyu can have a significant impact on the success of revegetation projects.

One introduced aquatic species, Canadian Pondweed (*Elodea Canadensis*) was observed within the River Torrens at Breakout Creek Stage 2. The declared aquatic herb grows prolifically in summer and dies off in winter.

The species has the ability to quickly spread throughout waterways where it can form dense stands which can restrict the flow of water. Furthermore, Canadian Pondweed competes with native aquatic species for nutrients and has the ability to outgrow many native species.

An additional 49 weed species were recorded within the study area. A complete list of introduced species observed within the study area is included in Appendix 2. The escape of garden and ornamental plants from the boundaries of numerous residential properties into Linear Park was observed during the field survey.

Table 3. Declared and environmental weed species observed within the study area

Scientific Name	Common Name	Status
<i>Acacia baileyana</i>	Cootamundra Wattle	E
<i>Acacia saligna</i>	Golden Wreath Wattle	E
<i>Asparagus asparagoides</i>	Bridal Creeper	D
<i>Asphodelus fistulosus</i>	Onion Weed	E & D
<i>Conyza bonariensis</i>	Flax-leaf Fleabane	E
<i>Coprosma repens</i>	Mirror bush	E
<i>Cotoneaster pannosus</i>	Cotoneaster	E
<i>Cytisus scoparius</i>	English Broom	D
<i>Elodea canadensis</i>	Canadian Pondweed	D
<i>Eurhobia terracina</i>	False Caper	D
<i>Foeniculum vulgare</i>	Fennel	E
<i>Fraxinus angustifolia</i>	Narrow Leaved Ash	E
<i>Galenia secunda</i>	Galenia	E
<i>Lantana camara</i>	Lantana	D
<i>Lycium ferocissimum</i>	African Boxthorn	D
<i>Olea europaea</i>	Olive	D
<i>Opuntia sp.</i>	Prickly Pear	D
<i>Oxalis pes-caprae</i>	Soursob	D
<i>Pennisetum clandestinum</i>	Kikuyu	E
<i>Pennisetum villosum</i>	Feathertop	E
<i>Pinus radiata</i>	Monterey Pine	E
<i>Pittosporum undulatum</i>	Sweet Pittosporum	E
<i>Ricinus communis</i>	Caster Oil	E
<i>Rubus fruticosus sp. agg.</i>	Blackberry	D
<i>Scrinus molle</i>	Pepper Tree	E
<i>Senecio mikanoides</i>	Mile a minute	E
<i>Senecio pterophorus</i>	South African Daisy	E
<i>Solanum nigrum</i>	Black-berry Nightshade	E
<i>Sonchus oleraceus</i>	Common Sow-thistle	E
<i>Tamarix aphylla</i>	Athel pine	D
<i>Tribulus terrestris</i>	Caltrop	D
<i>Watsonia meriana var. bulbillifera</i>	Bulbil Watsonia	D

Status

E = Environmental weed

D = Declared plant under the *Natural Resources Management Act, 2004*

4.1.4 Significant Trees

Within Linear Park, significant trees are protected under the *Development Act 1993* as they assist in biodiversity conservation and contribute to the character and amenity of the area.

A total of 609 significant trees of 39 different species were recorded within the study area during the field survey including local and non-local native species and introduced species. Appendix 3 summarises the different species of significant trees observed within the study area. The most dominant significant trees recorded were remnant species including River Red Gum (*Eucalyptus camaldulensis*), South Australian Blue Gum (*Eucalyptus leucoxylon*) and Mallee Box (*Eucalyptus porosa*) with 253, 62 and 60 individuals observed respectively. The

majority of these species were scattered within Linear Park in the riparian, outer riparian and upper slope ecological zones between Port Road and Henley Beach Road.

4.2 Fauna

Within Adelaide, changes in the distribution and abundance of particular fauna species are the result of habitat reduction and fragmentation, introduced species invasion and changes in external processes affecting the dynamics of vegetation fragments (Turner, 2001). Furthermore, current maintenance activities within Linear Park such as the tidying and clearing of understorey vegetation have prevented the establishment of midstorey and understorey layers. As a result, the availability of a diverse range of habitats has been reduced leading to an increased exposure of fauna to predation, noise, disturbance and competition (Hero et al. 2007).

Despite these changes, Linear Park does provide an important sanctuary and interconnected system through the urban environment for certain native fauna species. Acting as a corridor, Linear Park provides feeding, breeding and refuge areas for many fauna species that would not otherwise survive within a heavily fragmented landscape (Pedler & Crompton, 2003). Many fauna species live permanently within Linear Park; while others pass through briefly, nevertheless each depend upon the vegetated corridor that Linear Park provides. Magavin (2003) describes the River Torrens Linear Park as “Adelaide’s Greenway” linking the Mount Lofty Ranges with the Gulf St Vincent.

The results from the native and introduced fauna species that currently occur within Linear Park suggest that the habitat within Linear Park primarily favors highly mobile fauna species such as birds and bats. Species that require large areas of habitat or specialised types of habitat are not as likely to utilise Linear Park. Garden et al. (2006) highlights that fauna species classed as urban sensitive are unable to persist in urban landscapes, even in remnant patches of native vegetation. These urban sensitive species share characteristics such as limited dispersal ability, inability to persist within the urban environment and narrow or specialised dietary requirements. The low diversity of native fauna species that currently inhabit Linear Park is the result of numerous processes which have taken place over a long period of time, some of which still exist today.

No fauna species of national conservation significance currently occur within the study area. However, one species of state rare conservation significance, Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) is considered likely to occur within Linear Park. Although the species was not observed during the current field survey, background research suggests that the species may occur there as particular remnant trees within Linear Park may provide potentially suitable habitat. All of the remaining species that occur within Linear Park are considered to be common. Fauna species observed during the field survey and those which have been previously recorded or are likely to occur within the study area are listed in Appendix 3. The results from the native and introduced fauna species that currently occur within Linear Park are described below.

4.2.1 Fauna Species

Birds

Currently, a total of 63 bird species, eight of which are introduced, either live permanently within or pass through Linear Park. This is considered to be an under-estimation of the bird species that do utilise the study area; however, detailed bird surveys would be required to accurately determine the full extent of the diversity of bird species. The most common bird species that occur within Linear Park include a variety of Parrots, Waterbirds and Honeyeaters. The introduced bird species are described in further detail in Section 4.2.2.

Of the native species, the Noisy Miner (*Manorina melanocephala*) is the most abundant species within the study area. The Noisy Miner is a bold, curious and aggressive species which can exclude other birds from their territories. French et al. (2006) indicates that the Noisy Miner is a common urban dwelling native species whose interactions with other birds may lead to the decline of smaller bird species.

Appendix 4 summarises the results from the native and introduced bird species that currently occur within Linear Park.

Mammals

In comparison to birds, bats, and reptiles, small and medium sized ground-dwelling mammals have experienced the greatest declines within Linear Park. Ground-dwelling mammals are directly affected by the removal of native vegetation as dense understorey and midstorey vegetative layers provide important nesting and feeding resources and protection from predators.

No mammal species were recorded within the study area during the field survey. However, the results from background research suggest it is likely that a total of 16 mammal species occur within Linear Park including nine native and seven introduced species. With the exception of bats such as the White-striped Freeail Bat (*Tadarida australis*) and Lesser Long-eared Bat (*Nyctophylis geoffryii*), native mammal diversity is considered to be very low. Although no bat species were observed during the current field survey, nor have they been officially recorded previously within the study area, background research suggests that six species are likely to occur there as particular remnant trees within Linear Park may provide potentially suitable habitat. All of the bat species, apart from the Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) which has a state conservation rating of rare, are considered to be common within Linear Park. In addition to the bat species, native mammal diversity is limited to three species including the Common Brushtail Possum (*Trichosurus vulpecula*), Common Ringtail Possum (*Pseudocheirus peregrinus*) and to a lesser extent the Water Rat (*Hydromys chrysogaster*). The introduced mammal species are described in further detail in Section 4.2.2.

With the removal of many large Eucalypt trees from within Linear Park, the Common Brushtail Possum and Common Ringtail Possum have been forced to find shelter and nesting sites in alternative settings and are now often viewed to be pests. Within the urban environment, the Common Brushtail possum is most likely to inhabit buildings and permanent fixtures such as roof cavities, while the Common Ringtail Possum usually seeks shelter amongst dense foliage of trees or shrubs. While populations of the Common Brushtail Possum remain secure within Linear Park and the greater Adelaide region, the Department for Environment and Heritage has identified that due to the removal of preferred habitat across South Australia the species has suffered a decline in abundance and reduction in its natural range. The Department for Environment and Heritage reviewed the status of the Common Brushtail Possum and recommended that the species be listed as rare on the *National Parks and Wildlife Act 1972* Threatened Species Schedules in 2005. The Common Ringtail Possum remains common across its range.

Appendix 4 summarises the results from the native and introduced mammal species that currently occur within Linear Park.

Reptiles

No reptile species were recorded within the study area during the field survey. However, the results from background research suggest that the study area does support habitat for a range of common reptile species. A total of nine native reptile species have been previously recorded within Linear Park including four skink species, two lizard species, two snake species and one species of gecko. These species have the capacity to persist within urban environments as they do not rely solely on the presence of native vegetation. Each of the reptile species that occur within Linear Park are considered to be common. A further two non local native species have been previously recorded within Linear Park including one species of dragon and one species of tortoise. It is considered that both of these species present no serious competition with and predation upon native fauna species within Linear Park. Appendix 4 summarises the results from the native and non local native reptile species that currently occur within Linear Park.

Two snake species have been recorded within the study area including the Eastern Brown Snake (*Pseudonaja textilis*) and Red-bellied Black Snake (*Pseudechis porphyriacus*). These snakes are an essential part of the faunal food chain, both as food for other animals and as predators of small animals such as mice, rats and frogs. Snakes move in search of food, breeding mates and shelter such as under a large log, tree stump, or rock. Often, their preferred habitat is typically associated with vegetated waterways such as the River Torrens. Consequently, the presence of snakes adjacent to the River Torrens is a natural occurrence and should be received.

Amphibians

No amphibian species were recorded within the study area during the field survey. However, the results from background research indicate that a total of five amphibian species have been previously recorded within Linear Park, all of which are native species. These species include the Common Froglet (*Crinia signifera*), Spotted Grass Frog (*Lymnodynastes tasmaniensis*) and Painted Frog (*Neobatrachus pictus*). Each of these frog species are likely to occur in and around shallow pools of water, clumps of sedges and reeds and under rocks and logs adjacent to the river. Appendix 4 summarises the results from the native amphibian species that currently occur within Linear Park.

Aquatic Species

The results from background research suggest that the River Torrens supports a low diversity of native aquatic species, including 6 native species (five fish and one crustacean) and 6 introduced species. The introduced aquatic species, all of which are fish are described in further detail in Section 4.2.2. The installation of instream barriers, reduction in water quality, disappearance and modification of aquatic habitat and colonisation of introduced aquatic species has led to a decline in the diversity and abundance of native aquatic species. Although only one native fish species, Short-headed Lamprey (*Mordacia mordax*) has been recorded within the river, a further four native fish species such as Common Jollytail (*Galaxias maculatus*) and Congolli (*Pseudaphritis urvillii*) are considered likely to occur within the river. Appendix 4 summarises the results from the native and introduced aquatic species that currently occur within Linear Park.

One native crustacean, Yabby (*Cherax destructor*) has been recorded within the River Torrens. The species occurs in a range of aquatic habitats burrowing deep into river banks and within the bed of the river. The Yabby is very hardy species which can tolerate poor water conditions.

4.2.2 Introduced Fauna

The urban environment provides favorable habitat for the establishment of a variety of introduced fauna species (DECC, 2004). Introduced fauna within Linear Park can compete with and prey upon native fauna, damage native vegetation and degrade habitats. The following section details the introduced fauna species that occur within Linear Park.

Birds

Feral bird species compete with native birds for food, shelter, hollows and nesting sites. Some feral bird species are quite aggressive and territorial, sometimes forcing native birds out of an area. Of these 63 bird species that occur within Linear Park, 8 are introduced species including the Rock Dove (*Columba livia*), House Sparrow (*Passer domesticus*), Common Starling (*Sturnus vulgaris*), Spotted Turtle Dove (*Streptopelia chinensis*) and Common Blackbird (*Turdus merula*) which along with the native Noisy Miner (*Manorina melanocephala*) are the most abundant bird species occurring within Linear Park. In general, the presence of highly abundant bird species, such as the introduced species listed and the Noisy Miner, is thought to influence the abundance of many bird species within urban areas (French et al. 2006).

Mammals

Of these 16 mammal species that occur within Linear Park, 7 are introduced species. Each of the introduced mammal species that occur within the study area are considered to be common within Linear Park and common within the majority of urban environments. Two introduced predators, the Domestic and Feral Cat (*Felis catus*) and Fox (*Vulpes vulpes*) occur within Linear Park, both of which prey upon native and introduced fauna species. The Cat and Fox are both adaptable and elusive predators which prey upon birds, reptiles, mammals and amphibians. The predation by cats and foxes within Linear Park threatens the survival of certain native fauna species, particularly bird species. The absence of understorey and midstorey vegetative layers within Linear Park has restricted the ability for native fauna species to stay undercover and protect themselves from potential predators.

The House Mice (*Mus musculus*), Black Rat (*Rattus rattus*) and Brown Rat (*Rattus norvegicus*) also commonly occur within the study area all of which compete with native fauna species for food, shelter and other resources. A number of Horses (*Equus caballus*), are currently kept within the section of the River Torrens Linear Park from the Henley Beach Road Bridge to the Seaview Road Bridge. The keeping of horses within this area is discussed further in Section 4.5.

Introduced Fish

Feral Fish species within the River Torrens have damaged aquatic habitats and led to a decline in the diversity and abundance of native aquatic species. A total of six introduced fish species including the European Carp (*Cyprinus carpio*), Brown Trout (*Salmo trutta*) and Mosquito Fish (*Gambusia holbrooki*) have been recorded within the river. The regulation of the River Torrens has provided relatively stable water levels through the reduction of flooding frequency, volume and duration. These conditions have favoured introduced fish at the expense of native fish species (DEH, 2004). The majority of these introduced fish species are now dominant within the River Torrens and compete aggressively with native species for food and habitat. Furthermore, these introduced fish species have introduced and spread exotic diseases, parasites and pathogens which have the potential to wipe out native fish species (DEH, 2004).

According to DEH (2004), the European Carp has had a significant impact within the aquatic environment as a result of its feeding habits. As the species feeds, it disturbs aquatic and wetland soils which in turn increase turbidity within the water. As a result, these feeding habits impair water quality which in turn affects aquatic flora and fauna species (DEH, 2004). The Eastern Gambusia has also had a damaging impact upon native fish species and other aquatic life by successfully out competing them for mosquitoes.

Feral Honeybees

Although no Feral Honeybees (*Apis mellifera*) or associated nests were recorded during the field survey, populations have been recorded previously within Linear Park. Feral Honeybees are introduced bees which have escaped from hives and subsequently established in the wild, usually within tree hollows. The DECC (2004) recognise that Feral Honeybee populations impact on biodiversity through competition with native fauna species for tree hollows and competition for nectar and pollen which native birds, insects and other animals need to survive. Furthermore, Feral Honeybees are seen to be the main cause in the decline in native bees.

4.2.3 Fauna Habitats

The majority of native fauna species are adapted to particular vegetation layers which contain a high diversity in plant species. The lack of native vegetation and absence of layers including an overstorey, midstorey and understorey layer within Linear Park has reduced the quality and availability fauna habitat. Overall, the habitat that is available is considered to be poor. French et al. (2006) indicates that while data is scarce, it is believed that ground and shrub nesting bird species are less common in suburban areas due to a lack of suitable vegetation cover. Furthermore, fauna habitats in areas adjacent to Linear Park have been removed or fragmented as the urban environment has expanded. Although it is considered that the quality and availability of terrestrial habitat within Linear Park is poor, the habitat that does occur is critical to the survival of numerous native species that remain within the urban environment.

The dominant vegetation type present within Linear Park is comprised of large open areas of mown exotic grass with planted non-local and scattered remnant trees. The structure of this vegetation type which refers to the size, shape and amount of flora species is too open and does not provide suitable resources for numerous native fauna species.

The fringing vegetation adjacent to the river provides the majority of habitat for fauna species, particularly those species that are restricted to aquatic environments. The majority of this habitat is provided by Common Reed (*Phragmites australis*) and Narrow-leaf Bulrush (*Typha domingensis*). This fringing vegetation provides shade which is essential for aquatic species that cannot tolerate high water temperatures or exposure to direct sunlight. Lower water temperatures within the river also help to reduce the risk of algal growth. The removal of woody debris from within the river in order to increase river flow and reduce the impact of flooding has resulted in the loss of habitat for aquatic fauna species. Woody debris within the river provides many functions for aquatic species such as the creation of microclimates within the river, protection of species from strong currents and protection from predators.

McDonnell (2007) highlights that in Australia there is an emphasis on creating tidy lawns and parklands through the removal of dead trees and decomposing plant material. This is evident by the few remaining habitat features within Linear Park such as rocks, logs and leaf litter which provide micro habitats for reptile, invertebrates and amphibian species. Logs, rocks and leaf litter provide shelter, refuge and living space for a variety of small fauna species such as skinks, spiders and a variety of insects. In turn, these species are the food of larger animals and

so these habitat features provide foraging areas for mammals, insectivorous birds and a variety of larger reptiles (Bennett et al. 2000). Many of these larger predators also utilise hollow logs, rocks and dense vegetation as shelter and breeding sites.

Over the summer season the majority of the water in the river is restricted to the deeper pools. The pools provide an essential summer drought refuge for many aquatic fauna species, including waterbirds, water rats, fish, and yabbies, and are integral to the survival of many aquatic animal populations. These river pools which are surrounded by dense fringing vegetation provide very important habitat for many fauna species within Linear Park.

4.2.4 Hollows

Many native fauna species rely on tree hollows for shelter, roosting, breeding and protection. These hollows are formed in mature trees which are at least 60 years of age and also dead trees when fungal, bacterial or insect activity decays the centre of a tree limb (Gibbons & Lindenmayer, 2000). Generally, native fauna species prefer native tree hollows while those hollows that do form within introduced flora species such as Weeping Willow (*Salix babylonica*) and Radiata Pine (*Pinus radiata*) are not usually suitable for native fauna species. The removal of mature remnant tree species within Linear Park has reduced the availability of tree hollows and consequently led to the decline, removal and fragmentation of native fauna species that depend on them. However, some native bird species which do require hollows have adapted to nesting in artificial hollows in buildings as well as in introduced vegetation within the urban environment. During the field survey, only one bird nesting box was observed within Linear Park located towards the Port Road Bridge end of the study area. Furthermore, some introduced fauna species utilise tree hollows which compete with native fauna species for the hollows. As a result of the removal of mature remnant tree and competition with introduced fauna species, the availability of hollows for native fauna has been reduced.

Overall, there are very few remnant trees remaining within the study area that are in excess of 60 years of age. As a result, the majority of remnant trees within Linear Park are those that have re-grown since the area was extensively cleared and are not as yet at the hollow forming age. The remnant trees that do remain within Linear Park lack suitable nesting and roosting places for native fauna species, primarily due to the age and size of these species. The number of hollows available is likely to increase over time; however, this is likely to take many years.

During the field survey, only 17 trees were observed to contain hollows, each of which was a native significant tree. Of the 609 significant trees observed, only 10 living trees were recorded to have tree hollows including nine River Red Gum (*Eucalyptus camaldulensis*) and one Sugar Gum (*Eucalyptus cladocalyx*) species. Furthermore, seven dead *Eucalyptus* sp. significant trees were observed to contain hollows. A greater number of hollows per tree were observed within the dead significant trees compared to the living significant trees. The size of hollows varied considerably between each of the significant trees.

4.3 Erosion

Since European settlement, increased river erosion within the River Torrens has been the result of river modification and the removal of natural riparian vegetation. Almost all forms of river modification increase the velocity of a stream, thus increasing erosion and removing or altering in-stream habitat (Tait, 2005). When soil is eroded and deposited, the depth of river pools can be significantly decreased as sediment builds up. As the size and depth of river pools decrease, the availability of habitat for aquatic fauna species is also reduced.

The majority of erosion within Linear Park is occurring on the edges of the River Torrens, predominantly on the outside edges of river bends during periods of increased water flow. Whilst erosion along the banks of the river primarily occurs during flooding events, it does cause a loss of soil, decline in water quality and sedimentation.

Erosion at several locations adjacent to the river has undermined and exposed the roots of several remnant trees such as the River Red Gum (*Eucalyptus camaldulensis*) (see plate 8; Appendix 4). As these erosive processes continue, further exposure of these tree roots will ultimately lead to a further loss of native riparian vegetation.

A stable, non-eroding river bank is characterised by a gradual slope away from the waters edge where vegetation provides bank stabilisation and there are few areas of exposed bare ground. There are numerous sections where the River Torrens is characterised by stable, non-eroding river banks, most of which occur within Breakout Creek Stage 1 and downstream from the Henley Beach Road Bridge. However, there are also many sections where there are very steep embankments adjacent to the river. The majority of these steep embankments occur between the Port Road Bridge and the beginning of Breakout Creek Stage 1. These embankments are generally unstable and due to their steepness, will always have an erosion potential. The embankments are dominated by introduced flora species such as Kikuyu (*Pennisetum clandestinum*) and are often characterised by exposed roots of trees and shrubs, and sections of exposed bare ground (see plate 6; Appendix 4). The extensive weed infestations that are present on these steep embankments are the result of restricted accessibility for maintenance activities. Very little native vegetation and suitable fauna habitat occurs on any of the steep embankments.

4.4 Water Pollution

The extensive areas of sealed surfaces surrounding the River Torrens including buildings, streets and footpaths have increased the amount of stormwater runoff into the river. The increased amount of runoff has led to higher inputs of pathogens, nutrients, toxicants and litter. In turn these inputs can lead to a decline in water quality, algal blooms, sedimentation and a decline in the abundance and diversity of native flora and fauna species, primarily within the aquatic and riparian ecological zones.

Buckney and King (2000) indicate that the enrichment of nutrients within rivers as a result of runoff is likely to favour flora species that are adapted to higher nutrient levels than are naturally present. As many introduced flora species are adapted to or have the ability to tolerate higher nutrient levels, it is probable that increased nutrient levels within the river have further encouraged the establishment of introduced species such as Kikuyu (*Pennisetum clandestinum*) within the aquatic and riparian ecological zones.

4.5 Horses

The area of Linear Park between Henley Beach Road and Seaview Road is currently used for the adjustment of horses by members of the Lockleys Riding Club. However, the proposed plans for Stage 2 of the Breakout Creek Wetlands Project (discussed in Section 5) include the removal of horses further downstream to an area of Linear Park between Tapleys Hill Road and the river mouth (a stretch of approximately 1.6 kilometers).

The adjustment of horses within Linear Park is a sensitive topic with a lot of community support for their presence, however, community consultation for the current project suggests that there is also support for the horses to be

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removed. Within Linear Park, the impact of horses on biodiversity and water quality is considered to be significant. Although horse manure is cleaned up within the area of adjustment, there are no fences to exclude horses from the river; as a result, manure is directly deposited into the waterway. The biological and chemical properties of horse manure and urine within the river can be detrimental to fish, insects, and other aquatic fauna and flora species.

Furthermore, trampling from the horses physically erodes the river banks and damages the cover of vegetation adjacent to the river. As the river banks are eroded, soil is mobilized and the amount of sedimentation within the river increases. Grazing from the horses also prevents the establishment of native vegetation.

5. Completed and Future Projects

5.1 Breakout Creek Wetlands Project Stage 1 and Stage 2

The completion of Stage 1 of the Breakout Creek Wetlands project has seen the development of a 500 meter stretch of Linear Park upstream from Henley Beach Road into an area that has restored and enhanced native biodiversity. The project, completed in 1999 involved the widening and deepening of parts of the river to form a wetland environment. Introduced flora species were removed from within this area and replaced with local native flora species. The extensive revegetation and exclusion of horses has increased the diversity and abundance of native flora and fauna species, whilst maintaining flood mitigation. The project also involved the creation of a variety of habitats for native fauna species such as birds, reptiles, and amphibians.

The plans for Stage 2 of the Breakout Creek Wetlands Project are designed to replicate and extend the wetland environment created at Stage 1, including the movement of the horse adjustment to an area between Tapleys Hill Road and the river mouth. The future development of Stage 2 occupies a 700 meter stretch of Linear Park between Henley Beach Road and Tapleys Hill Road and is due to be completed by April 2008.

Upon completion the entire length of the Stage 1 and Stage 2 Breakout Creek Wetlands Project will extend continuously for approximately 1.2 kilometers upstream from Tapleys Hill Road.

5.2 Underdale

The existing plans for the River Torrens Linear Park upgrade at Underdale are designed to re-develop an area between Holbrooks Road and Kanbara Street. From a biodiversity perspective, the future development of this area will include river bank rehabilitation, the removal of introduced flora species and extensive revegetation using native species.

6. Summary

The section of Linear Park between the Port Road Bridge and the river mouth is considered to have a low biodiversity level. There is little native vegetation remaining within this section and fauna habitat is generally confined to the rivers edge.

There are many opportunities to improve current management within Linear Park in order to enhance biodiversity and address key threatening processes. Some of the key threats to biodiversity within Linear Park include a lack of native vegetation, lack of fauna habitats, competition from introduced flora and fauna species, predation from introduced fauna species, erosion, and water quality.

It is important that the control of introduced fauna species within Linear Park is taken into consideration for the successful management and enhancement of biodiversity. The control of introduced fauna within Linear Park will help to decrease the predation pressure on native fauna and increase the availability of resources for native fauna species.

Revegetation within Linear Park will also assist in improving the water quality of the river and aquatic environments and help to reduce erosion of the banks of the river.

Due to the surrounding urban environment, there is little opportunity to develop biodiversity corridors from Linear Park, however, it is important to identify existing and future possibilities which may provide a vegetative link for faunal species to traverse to other potential habitats.

A coordinated strategy involving a weed control program within the City of West Torrens and the City of Charles Sturt is essential for the effective control of introduced species within Linear Park. At some locations within Linear Park, where patches of these species are very thick, control of any further spread is important.

Overall, the diversity and abundance of native fauna species within Linear Park depends upon the availability of suitable habitat. Although fauna habitat is currently restricted to the rivers edge, certain sections of Linear Park provide excellent opportunities for habitat creation and enhancement. While the capacity to increase the size of habitats within Linear Park is limited, there are opportunities to increase a variety of habitat characteristics through the design, establishment and management of more functional areas which comprise multiple vegetation layers. Habitats that have greater structural complexity will have the ability to support a greater diversity of fauna species.

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8. Appendices

Appendix 1. Native flora species recorded within the study area during the field survey (includes remnant species, native local planted species and native non-local planted species)

Species Name	Common Name	Status	Conservation Rating
<i>Acacia acinacea</i>	Gold Dust Wattle	P	
<i>Acacia calamifolia</i>	Wallowa	R	
<i>Acacia iteaefolia</i>		P	
<i>Acacia longifolia</i> var. <i>sophorae</i>	Coastal Wattle	P	
<i>Acacia melanoxylon</i>	Blackwood	P	
<i>Acacia paradoxa</i>	Kangaroo Thorn	P	
<i>Acacia pycnantha</i>	Golden Wattle	R	
<i>Acacia salicina</i>	Willow Acacia	P	
<i>Adriana klotzschii</i>	Coast Bitterbush	P	
<i>Allocasuarina verticillata</i>	Drooping Sheoak	P	
<i>Amyema miquelli</i>	Box Mistletoe	R	
<i>Atriplex cinerea</i>	Coast Saltbush	P	
<i>Atriplex semibaccata</i>	Berry Saltbush	P	
<i>Austrodanthonia caespitosa</i>	Common Wallaby-grass	P	
<i>Austrostipa elegantissima</i>	Feather Spear-grass	P	
<i>Austrostipa flavescens</i>	Coast Spear-grass	P	
<i>Austrostipa nodosa</i>	Tall Spear-grass	P	
<i>Bolboschoenus caldwellii</i>	Salt Club-rush	R	
<i>Bursaria spinosa</i>	Christmas Bush	P	
<i>Callistemon rugulosus</i>	Scarlet Bottlebrush	P	
<i>Callistemon sieberi</i>	River Bottlebrush	R	
<i>Callitris gracilis</i>	Native Pine	P	
<i>Calystegia sepium</i>	Large Bindweed	R	U
<i>Carpobrotus rossii</i>	Pigface	P	
<i>Chenopodium cristatum</i>	Crested Goosefoot	R	
<i>Correa reflexa</i>	Correa	P	
<i>Corymbia gummiifera</i>	Red Bloodwood	PN	
<i>Cupressus macrocarpa</i>	Monterey Cypress	PN	
<i>Cyperus vaginatis</i>	Flat Sedge	R	
<i>Dodonaea viscosa</i>	Sticky Hop Bush	P	
<i>Einadia nutans</i>	Climbing Saltbush	P	
<i>Elymus scaber</i>	Native Wheat-grass	P	
<i>Enchylaena tomentosa</i>	Ruby Saltbush	P	
<i>Ennepogon</i> sp.		P	
<i>Eremophila glabra</i>	Tar bush	P	
<i>Eucalyptus camaldulensis</i>	River Red Gum	R	
<i>Eucalyptus citriodora</i>	Lemon Scented Gum	PN	
<i>Eucalyptus cladocalyx</i>	Sugar Gum	PN	
<i>Eucalyptus cypellocarpa</i>	Maountain Gum	PN	
<i>Eucalyptus erythronema</i> var. <i>erythronema</i>	Red-flowered Mallee	PN	
<i>Eucalyptus fibrosa</i> subsp. <i>Fibrosa</i>	Broad-leaved Red Ironbark	PN	
<i>Eucalyptus gracilis</i>	White Mallee	PN	
<i>Eucalyptus grandis</i>	Flooded gum	PN	
<i>Eucalyptus largiflorens</i>	Black Box	PN	
<i>Eucalyptus leucoxylon</i>	South Australia Blue Gum	R	
<i>Eucalyptus maculata</i>	Spotted Gum	PN	
<i>Eucalyptus meqacornuta</i>	Warted yate	PN	
<i>Eucalyptus phenax</i> subsp. <i>phenax</i>	Green dumosa mallee	P	
<i>Eucalyptus porosa</i>	Mallee Box	P	
<i>Eucalyptus salmonophloia</i>	Salmon Gum	PN	
<i>Eucalyptus sideroxylon</i>	Red Ironbark	PN	
<i>Eucalyptus socialis</i>	Red Mallee	P	
<i>Eucalyptus spathulata</i>	Swamp mallet	PN	
<i>Eucalyptus talyuberlup</i>		PN	
<i>Eucalyptus torquata</i>	Coral Gum	PN	
<i>Eucalyptus utilis</i>		PN	

Species Name	Common Name	Status	Conservation Rating
<i>Goodenia albiflora</i>	White Goodenia	P	
<i>Grevillea robusta</i>	Silky Oak	PN	
<i>Hakea laurina</i>	Pincushion Hakea	PN	
<i>Hardenbergia violacea</i>	Native Lilac	P	
<i>Juncus subsecundus</i>	Finger Rush	R	
<i>Leptospermum laevigatum</i>	Coastal Tea Tree	PN	
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush	P	
<i>Melaleuca halmaturorum</i>	Swamp Paperbark	R	
<i>Melaleuca hypericifolia</i>	Hillock Bush	PN	
<i>Melaleuca lanceolata</i>	Dryland TeaTree	P	
<i>Mimulus repens</i>	Creeping Monkey-flower	R	R
<i>Muehlenbeckia florulenta</i>	Lignum	R	
<i>Muehlenbeckia gunnii</i>	Coastal lignum	P	
<i>Myoporum insulare</i>	Native Juniper	P	
<i>Olearia ramulosa</i>	Twiggy Daisy Bush	P	
<i>Persicaria decipiens</i>	Slender Knotweed	R	
<i>Phragmites australis</i>	Common Reed	R	
<i>Potamogeton crispus</i>	Curley Pondweed	PN	
<i>Rhagodia candolleana</i>	Seaberry Saltbush	P	
<i>Rhagodia parabolica</i>	Mealy Saltbush	P	
<i>Schoenoplectus pungens</i>	Spiky Club-rush	R	U
<i>Senna artemisioides</i>	Desert Senna	P	
<i>Typha domingensis</i>	Narrow-leaf Bulrush	R	
<i>Xanthorrhoea semiplana</i>	Yacca	P	

Status

R = Remnant species

P = Native local planted species

PN = Native non-local planted species

Appendix 2. Introduced flora species recorded within the study area during the field survey

Species Name	Common Name	Status
<i>Acacia baileyana</i>	Cootamundra Wattle	E
<i>Acacia saligna</i>	Golden Wreath Wattle	E
<i>Agave americana</i>	Century plant	
<i>Agonis flexuosa</i>	Willow Myrtle	
<i>Aloe sp.</i>	Aloe	
<i>Apium graveolens</i>	Celery	
<i>Asparagus aethiopicus</i>	Asparagus Fern	
<i>Asparagus asparagoides</i>	Bridal Creeper	D
<i>Asparagus plumosus</i>	Climbing Asparagus Fern	
<i>Asphodelus fistulosus</i>	Onion Weed	E & D
<i>Aster subulatus</i>	Wild Aster	
<i>Bougainvillea sp.</i>	Bougainvillea	
<i>Bromus catharticus</i>	Prairie Grass	
<i>Casuarina glauca</i>	Swamp Oak	
<i>Centaurium erythraea</i>	Common Centaury	
<i>Centranthus rubra</i>	Red Valerian	
<i>Chamaecytisus palmensis</i>	Tree Lucerne	
<i>Chenopodium album</i>	Fat Hen	
<i>Conyza bilbaoana</i>	Fleabane	
<i>Conyza bonariensis</i>	Flax-leaf Fleabane	E
<i>Coprosma repens</i>	Mirror bush	E
<i>Cortaderia selloana</i>	Pampas Grass	
<i>Cotoneaster pannosus</i>	Cotoneaster	E
<i>Cotula coronopifolia</i>	Water Buttons	
<i>Cupressus sempervirens</i>	Pencil Pine	
<i>Cyperus eragrostis</i>	Drain Flat-sedge	
<i>Cytisus scoparius</i>	English Broom	D
<i>Elodea canadensis</i>	Canadian Pondweed	D
<i>Euphorbia lathyris</i>	Caper Spurge	
<i>Eurhorbia terracina</i>	False Caper	D
<i>Ficus carica</i>	Fig	
<i>Ficus macrophylla</i>	Mortan Bay Fig	
<i>Foeniculum vulgare</i>	Fennel	E
<i>Fraxinus angustifolia</i>	Narrow Leaved Ash	E
<i>Galenia secunda</i>	Galenia	E
<i>Hedera helix</i>	Ivy	
<i>Iris psedacorus</i>	Yellow Iris	
<i>Juncus acutus</i>	Sharp Rush	
<i>Lagunaria patersonia subsp. Patersonia</i>	Norfolk Island Hibiscus	
<i>Lantana camara</i>	Lantana	D
<i>Lepidium latifolium</i>	Perennial Peppergrass	
<i>Lycium ferocissimum</i>	African Boxthorn	D
<i>Malva nicaeensis</i>	Mallow Of Nice	
<i>Melia azedarach</i>	White cedar	
<i>Melilotus albus</i>	Bokhara Clover	
<i>Nerium oleander</i>	Oleander	
<i>Nicotiana glauca</i>	Tree Tobacco	
<i>Olea europaea</i>	Olive	D
<i>Opuntia sp.</i>	Prickly Pear	D
<i>Oxalis pes-caprae</i>	Soursob	D
<i>Paspalum sp.</i>	Paspalum	
<i>Pennisetum clandestinum</i>	Kikuyu	E
<i>Pennisetum villosum</i>	Feathertop	E
<i>Phoenix canariensis</i>	Canary Island Palm	
<i>Phyla canescens</i>	Lippia	
<i>Phyllostachys aurea</i>	Golden Bamboo	
<i>Pinus radiata</i>	Radiata Pine	E
<i>Pittosporum undulatum</i>	Sweet Pittosporum	E
<i>Plantago major</i>	Greater Plantain	
<i>Populus tremuloides</i>	Poplar	

Species Name	Common Name	Status
<i>Prunus amygdalus</i>	Almond	
<i>Ricinus communis</i>	Caster Oil	E
<i>Rose canina</i>	Dog Rose	
<i>Rubus fruticosus</i> sp. agg.	Blackberry	D
<i>Rumex crispus</i>	Curled Dock	
<i>Rumex pulcher</i> ssp. <i>pulcher</i>	Fiddle Dock	
<i>Salix babylonica</i>	Weeping Willow	
<i>Scninus molle</i>	Pepper Tree	E
<i>Senecio mikanoides</i>	Mile a minute	E
<i>Senecio pterophorus</i>	South African Daisy	E
<i>Sisymbrium erysimoides</i>	Smooth Mustard	
<i>Sisymbrium orientale</i>	Wild Mustard	
<i>Solanum nigrum</i>	Black-berry Nightshade	E
<i>Sonchus oleraceus</i>	Common Sow-thistle	E
<i>Tamarix aphylla</i>	Athel pine	D
<i>Tribulus terrestris</i>	Caltrop	D
<i>Tropaeolum majus</i>	Nasturtium	
<i>Vitis vinifera</i>	Grape Vine	
<i>Washington filifera</i>	Fan Palm	
<i>Watsonia meriana</i> var. <i>bulbillifera</i>	Bulbil Watsonia	D
<i>Xanthium californicum</i>	Californian Burr	

Status

E = Environmental weed

D = Declared plant under the *Natural Resources Management Act, 2004*

Appendix 3. Significant tree species observed within the study area

Species Name	Common Name
<i>Acacia calamifolia</i>	Willow
<i>Acacia salicina</i>	Willow Wattle
* <i>Agonis flexuosa</i>	Willow Myrtle
<i>Allocasuarina verticillata</i>	Drooping Sheoak
<i>Callistemon sieberi</i>	River Bottlebrush
* <i>Casuarina glauca</i>	Grey Bul oak
* <i>Corymbia gummifera</i>	Red Bloodwood
* <i>Cupressus macrocarpa</i>	Monterey Cypress
<i>Eucalyptus camaldulensis</i>	River Red Gum
+ <i>Eucalyptus citriodora</i>	Lemon Scented Gum
+ <i>Eucalyptus cladocalyx</i>	Sugar Gum
+ <i>Eucalyptus erythronema</i> var. <i>erythronema</i>	Red-flowered Mallee
+ <i>Eucalyptus fibrosa</i>	Red Ironbark
+ <i>Eucalyptus gracilis</i>	Yorrell
+ <i>Eucalyptus grandis</i>	Flooded Gum
+ <i>Eucalyptus largiflorens</i>	Black Box
<i>Eucalyptus leucoxylon</i>	South Australian Blue Gum
+ <i>Eucalyptus maculata</i>	Spotted Gum
<i>Eucalyptus phenax</i> ssp. <i>phenax</i>	White Mallee
<i>Eucalyptus porosa</i>	Mallee Box
+ <i>Eucalyptus salmonophloia</i>	Salmon Gum
+ <i>Eucalyptus sideroxylon</i>	Red Ironbark
<i>Eucalyptus socialis</i>	Red Mallee
<i>Eucalyptus</i> sp.	
+ <i>Eucalyptus spathulata</i>	Swamp Mallet
+ <i>Eucalyptus utilis</i>	Coastal Moort
* <i>Ficus macrophylla</i>	Moreton Bay Fig
* <i>Fraxinus angustifolia</i>	Desert Ash
* <i>Grevillea robusta</i>	Silky Oak
* <i>Lagunaria patersonii</i>	Itchy Powder Tree
<i>Melaleuca halmaturorum</i>	Swamp Paper-bark
<i>Melaleuca lanceolata</i>	Dryland Tea-tree
* <i>Melia azedarach</i> var. <i>australasica</i>	White Cedar
* <i>Phoenix dactylifera</i>	Date Palm
* <i>Pinus radiata</i>	Radiata Pine
* <i>Populus tremuloides</i>	Quaking Aspen
* <i>Salix babylonica</i>	Weeping Willow
* <i>Schinus molle</i>	Pepper-tree
* <i>Tamarix aphylla</i>	Athel Pine

+ Denotes non-local native species

* Denotes introduced species

Appendix 4. Native and introduced fauna species that currently occur within the study area (includes species recorded during the current field survey and species previously recorded or likely to occur within the study area)

Class	Species Name	Common Name	Status
Amphibian	<i>Crinia signifera</i>	Common Froglet	R
Amphibian	<i>Limnodynastes dumerili</i>	Southern Banjo Frog	R
Amphibian	<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	R
Amphibian	<i>Litoria ewingi</i>	Brown Tree Frog	R
Amphibian	<i>Neobatrachus pictus</i>	Painted Frog	R
Amphibian	<i>Pseudophryne bibroni</i>	Bibron's Toadlet	L
Aves	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	L
Aves	<i>Accipter cirrhocephalus</i>	Collared Sparrowhawk	L
Aves	<i>Accipter fasciatus</i>	Brown Goshawk	R
Aves	<i>Acrocephalus australis</i>	Clamorous Reed-Warbler	L
Aves	<i>Agapornis reseicollis</i> *	Peach-faced Lovebird	L
Aves	<i>Alauda arvensis</i> *	Eurasian Skylark	L
Aves	<i>Anas castanea</i>	Chestnut Teal	R
Aves	<i>Anas gracilis</i>	Grey Teal	O
Aves	<i>Anas platyrhynchos</i> *	Mallard	R
Aves	<i>Anas superciliosa</i>	Pacific Black Duck	O
Aves	<i>Anhinga melanogaster</i>	Darter	R
Aves	<i>Anthochaera carunculata</i>	Red Wattlebird	O
Aves	<i>Anthochaera chrysoptera</i>	Little Wattlebird	R
Aves	<i>Apus pacificus</i>	Fork-tailed Swift	L
Aves	<i>Aquila audax</i>	Wedge-tailed Eagle	L
Aves	<i>Ardea alba</i>	Great Egret	R
Aves	<i>Ardea pacifia</i>	White-necked Heron	L
Aves	<i>Aythya australis</i>	Hardhead	R
Aves	<i>Barnardius zonarius</i>	Ringneck Parrot (cage escapees)	R
Aves	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	R
Aves	<i>Cacatua roseicapilla</i>	Galah	O
Aves	<i>Cacatua sanguinea</i>	Little Corella	O
Aves	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	L
Aves	<i>Chenonetta jubata</i>	Australian Wood Duck	O
Aves	<i>Chlidonias hybridus</i>	Whiskered Tern	R
Aves	<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo	L
Aves	<i>Cincloramphus cruralis</i>	Brown Songlark	R
Aves	<i>Columba livia</i> *	Rock Dove	O
Aves	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	R
Aves	<i>Corvus mellori</i>	Little Raven	O
Aves	<i>Cuculus pallidus</i>	Pallid Cuckoo	O
Aves	<i>Cygnus atratus</i>	Black Swan	R
Aves	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	R
Aves	<i>Egretta novaehollandiae</i>	White-faced Heron	R
Aves	<i>Elanus axillaris</i>	Black-shouldered Kite	L
Aves	<i>Elseiyornis melanops</i>	Black-fronted Dotterel	L
Aves	<i>Falco cenchroides</i>	Nankeen Kestrel	L
Aves	<i>Falco longipennis</i>	Australian Hobby	L
Aves	<i>Fulica atra</i>	Eurasian Coot	O
Aves	<i>Gallinula tenebrosa</i>	Dusky Moorhen	O
Aves	<i>Gallinula ventralis</i>	Black-tailed native- Hen	R
Aves	<i>Glossopsitta concinna</i>	Musk Lorikeet	O
Aves	<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet	R
Aves	<i>Grallina cyanoleuca</i>	Australian Magpie-lark	O
Aves	<i>Gymnorhina tibicen</i>	Australian Magpie	O
Aves	<i>Himantopus himantopus</i>	Black-winged Stilt	R
Aves	<i>Hirundo neoxena</i>	Welcome Swallow	O
Aves	<i>Hirunda nigrcans</i>	Tree Martin	L
Aves	<i>Larus novaehollandiae</i>	Silver Gull	O
Aves	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	O
Aves	<i>Lichenostomus virescens</i>	Singing Honeyeater	O
Aves	<i>Manorina melanocephala</i>	Noisy Miner	O
Aves	<i>Megalurus gramineus</i>	Little Grassbird	R

Class	Species Name	Common Name	Status
Aves	<i>Melopsittacus undulatus</i>	Budgerigar	L
Aves	<i>Ninox novaeseelandiae</i>	Southern Boobook	L
Aves	<i>Nycticorax caledonicus</i>	Nankeen Night-Heron	R
Aves	<i>Ocyphaps lophotes</i>	Crested Pigeon	O
Aves	<i>Paradalotus striatus</i>	Striated Pardalote	L
Aves	<i>Passer domesticus</i> *	House Sparrow	O
Aves	<i>Pelecanus conspicillatus</i>	Australian Pelican	R
Aves	<i>Petrochelidon ariel</i>	Fairy Martin	R
Aves	<i>Petrochelidon nigricans</i>	Tree Martin	R
Aves	<i>Phalacrocorax carbo</i>	Great Cormorant	R
Aves	<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant	O
Aves	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	R
Aves	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	O
Aves	<i>Platalea regia</i>	Royal Spoonbill	R
Aves	<i>Platycercus elegans</i>	Crimson Rosella	R
Aves	<i>Platycercus eximius</i>	Eastern Rosella	O
Aves	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe	R
Aves	<i>Porphyrio porphyrio</i>	Purple Swampphen	O
Aves	<i>Psephetus haematonotus</i>	Red-rumped Parrot	L
Aves	<i>Psitteuteles versicolor</i>	Varied Lorikeet	L
Aves	<i>Rhipidura leucophrys</i>	Willie Wagtail	O
Aves	<i>Sterna caspia</i>	Caspian Tern	R
Aves	<i>Streptopelia chinensis</i> *	Spotted Turtle-dove	O
Aves	<i>Sturnus vulgaris</i> *	Common Starling	O
Aves	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	R
Aves	<i>Taeniopygia bichenovii</i>	Double-barred Finch	L
Aves	<i>Threskiornis molucca</i>	Sacred Ibis	R
Aves	<i>Todiramphus sanctus</i>	Sacred Kingfisher	L
Aves	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	R
Aves	<i>Turdus merula</i> *	Common Blackbird	O
Aves	<i>Tyto alba</i>	Barn Owl	L
Aves	<i>Vanellus miles</i>	Masked Lapwing	R
Aves	<i>Zosterops lateralis</i>	Silvereye	R
Crustacean	<i>Cherax destructor</i>	Yabby	R
Fishes	<i>Carassius auratus</i> *	Goldfish	R
Fishes	<i>Cyprinus carpio</i> *	European Carp	R
Fishes	<i>Galaxias brevipinnis</i>	Climbing Galaxias	L
Fishes	<i>Galaxias maculatus</i>	Common Jollytail	L
Fishes	<i>Gambusia holbrooki</i> *	Mosquito Fish	R
Fishes	<i>Geotria australis</i>	Pouched Lamprey	L
Fishes	<i>Hypseleotris klunzingeri</i> **	Western Carp Gudgeon	L
Fishes	<i>Onchorhynchus mykiss</i> *	Rainbow Trout	R
Fishes	<i>Perca fluviatilis</i> *	Redfin Perch	R
Fishes	<i>Philypnodon grandiceps</i>	Big-headed Gudgeon	R
Fishes	<i>Pseudaphritis urvillii</i>	Congolli	L
Fishes	<i>Salmo trutta</i> *	Brown trout	R
Fishes	<i>Mordacia mordax</i>	Short-headed Lamprey	R
Fishes	<i>Nematocentris klunzingeri</i> **	Crimson-spotted Rainbow Fish	L
Mammalia	<i>Canis familiaris</i> *	Domestic Dog	R
Mammalia	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	L
Mammalia	<i>Chalinolobus morio</i>	Chocolate Wattled Bat	L
Mammalia	<i>Felis catus</i> *	Feral or Domestic Cat	R
Mammalia	<i>Hydromys chrysogaster</i>	Water Rat	R
Mammalia	<i>Lepus capensis</i> *	Hare	R
Mammalia	<i>Mormopterus planiceps</i>	Southern Free-tail Bat	L
Mammalia	<i>Mus musculus</i> *	House Mouse	R
Mammalia	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	L
Mammalia	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	R
Mammalia	<i>Rattus norvegicus</i> *	Brown Rat	R
Mammalia	<i>Rattus rattus</i> *	Black Rat	R
Mammalia	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail Bat (Rare in SA)	L
Mammalia	<i>Tadarida australis</i>	White-striped Freetail Bat	L
Mammalia	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	R

Class	Species Name	Common Name	Status
Mammalia	<i>Vulpes vulpes</i> *	Fox	R
Reptilia	<i>Chelodina longicollis</i> **	Long-necked tortoises	R
Reptilia	<i>Christinus marmoratus</i>	Marbled Gecko	R
Reptilia	<i>Cryptoblepharus plagiocephalus</i>	Desert Wall Skink	L
Reptilia	<i>Emydura macquarii</i>	Short-necked Tortoise	L
Reptilia	<i>Eulamprus quoyii</i>	Eastern Water Skink	R
Reptilia	<i>Hemiergis decresiensis</i>	Three-toed Earless Skink	R
Reptilia	<i>Hemiergis peronii</i>	Four-toed Earless Skink	I
Reptilia	<i>Lampropholis guichenoti</i>	Garden Skink	R
Reptilia	<i>Menetia greyii</i>	Dwarf Skink	R
Reptilia	<i>Physignathus lesueurii</i> **	Water Dragon	R
Reptilia	<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake	R
Reptilia	<i>Pseudonaja textilis</i>	Eastern Brown Snake	R
Reptilia	<i>Tiliqua rugosa</i>	Sleepy Lizard	R
Reptilia	<i>Tiliqua scincoides</i>	Eastern Blue-tongue Lizard	R

* Denotes introduced species

** Denotes non-local native species

Key:

O = observed during current field survey, L = likely to occur within Linear Park

R = recorded previously within River Torrens Linear Park

Appendix 5. General Photos



Plate 1: Photo displaying a thick patch of Common Reed (*Phragmites australis*) and Narrow-leaf Bulrush (*Typha domingensis*) in the aquatic and riparian ecological zones.



Plate 2: Photo displaying Flat Sedge (*Cyperus vaginatus*) a native aquatic flora species.



Plate 3: Photo displaying a natural hollow in a River Red Gum (*Eucalyptus camaldulensis*) located in the riparian zone of Linear Park.



Plate 4: Photo displaying an artificial hollow that has been installed within Linear Park



Plate 5: Photo displaying bank erosion



Plate 6: Photo displaying a steep unstable embankment and the occurrence of erosion. The photo also displays a thick infestation of Kikuyu (*Pennisetum clandestinum*) adjacent to the river.



Plate 7: Photo displaying erosion where the river bank is being undercut during flooding periods.



Plate 8: Photo displaying erosion which has undermined and exposed the roots of native vegetation.



Plate 9: Photo displaying area of Breakout Creek down stream from Tapleys Hill Road.



Plate 10: Photo displaying a revegetated area adjacent to the River Torrens within Breakout Creek Stage 1.

Appendix 6 - Weed control methods

It is recommended that the following methods should be used as a guide only and that prior to implementing a weed control program, that you seek technical advice and assistance from the relevant Council staff and the Local Authorised Officer (for chemical use). This is particularly important with respect to chemical use in close proximity to waterways.

There are a variety of weed control methods that can be utilised to effectively control different weed species. The method utilised will be dependent on the weed species being targeted, the size of the plant, the size of the infestation, the proximity to a watercourse and the presence / absence of native species. Weed control methods include cutting and swabbing, stump injection, drilling and filling, spot spraying and hand pulling.

Cut and Swab

- ~ Cut off all stems as low as possible using a chainsaw or pruning saw, secateurs or long-handled loppers. The cut must be horizontal so that the herbicide rests on the cut area while being absorbed, rather than running down the side of the stem.
- ~ Liberally swab all cut surfaces immediately with a herbicide mixture. This must be done preferably within 30 seconds, or immediately if possible. The cut surface can not be allowed to dry out, otherwise the herbicide will be much less effective. Use a paintbrush, swabber or squeeze bottle (laboratory) to apply the herbicide mixture. Add a dye to the herbicide mixture that will help indicate where swabbing has already been done.
- ~ Stumps will be left in the ground so as to not disturb the soil and to help retain the soil in place i.e. reduce the likelihood of soil erosion.
- ~ Remove all stems from the stump, so that no active (or green) branches/shoots remain, no matter how small they are.
- ~ The tissues that take up and move the poison are immediately under the bark layer, so concentrate on applying the poison around the outer rim of the stump.
- ~ Follow up work may be required. If the stumps resprout, which can be common with some species, then cut and swab or spray the new regrowth with the herbicide.
- ~ The most effective time of the year to cut and swab plants is when they are actively growing, which varies between species.

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Stump Injection

For large and medium sized trees and shrubs with a large stump or lignotuber the following "Stump Injection" method is recommended. It can be used in conjunction with the cut and swab method to get a higher dose of herbicide into the plant, and to get a more thorough application of herbicide.

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After the plant has been cut and swabbed, make regular extra cuts into the remaining stump and any exposed roots with a hammer and chisel to expose the sapwood. Immediately fill

chisel marks with the herbicide mixture in the squeeze bottle. This provides more surface area for the herbicide to penetrate, and ensures a good dose of herbicide. This method used in conjunction with cut and swab should provide a much better kill rate when compared to the cut and swab method by itself.

Drill and Fill

- ~ Drill a steeply angled hole into the plant's cambium layer (where sap flows just beneath the bark layer) with a cordless drill, using a 10mm drill bit.
- ~ The holes should be as close to the base of the plant as possible, and it is essential for the hole to be steeply angled into the cambium (bark layer) otherwise the herbicide will not be absorbed into the sap flow.
- ~ Immediately after the hole has been drilled, it should be filled with a herbicide mixture. Syringes (without the needle) or squeeze bottles can be used to administer the herbicide into the hole.
- ~ Holes are drilled every 2.5-5cm until the base of the plant has been circled.
- ~ Follow up work may be required. If the plant re-sprouts which can be common with some species, then the process needs to be repeated.

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Spraying and Wick Wipers

- ~ The most effective time of the year to spray is when the plant is actively growing.
- ~ Look for native plants and cover with plastic bags or sheeting while spraying. If there are too many native plants amongst the weeds then this method should not be used.
- ~ Where weeds have narrow vertical leaves, spraying might result in herbicide running off or drifting onto non-target plants. In this situation, wipe on the herbicide mixture with a weed wand, sponge or wick applicator.
- ~ Always read the label on the herbicide container, follow the instructions and wear protective clothing. Dilute the mixture as recommended. Add a dye to the herbicide mixture that will help to indicate where spraying has already been done.
- ~ If spraying near creeks or other water bodies, do not spray herbicide in or near the water, because it can have a negative effect on aquatic fauna such as frogs. It is preferable to use other more accurate methods such as cutting and swabbing along creeklines.
- ~ Surfactants can also be used when spraying plants such as Bridal Creeper which have a waxy leaf surface. A surfactant can be added to the herbicide mix which will increase the uptake of the poison through the waxy leaf surface. Surfactants should not be used on or near plants growing in water as they are suspected of affecting frogs.
- ~ To increase the effectiveness of the herbicide whilst spraying large tussocks of grass, the grass can be slashed and then left to re-grow for several weeks. The regrowth can then be sprayed.

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Hand Pulling

- | ~ Hand pulling of smaller plants is easiest in the wetter months of the year when the soil is soft and the seedlings are much easier to pull out.
- | ~ Seedlings: take hold of the plant at ground level and pull. If you pull at any point higher on the stem it may break and the plant will then require swabbing with herbicide.
- | ~ Small woody plants: Take hold of the stem at ground level and gently rock the plant back and forth until it comes away cleanly.
- | ~ For species that have a bulb (eg watsonia) a screw driver can be used to gently lift the bulb out of the ground.
- | ~ If possible place both feet or fingers on either side of the plant when pulling out. This helps to keep the soil in place and avoids unnecessary disturbance of the soil.

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Following the treatment of all weed species, weed propagules remain in the soil and species will re-sprout or germinate. An essential component of any successful weed control program is follow-up work over a period of years.

Appendix 7 – Bird and Bat Box Guidelines

Diagram _: Approximate Dimensions for a Nest Box Specific to Rosella sp. (Birds Australia, 2000)

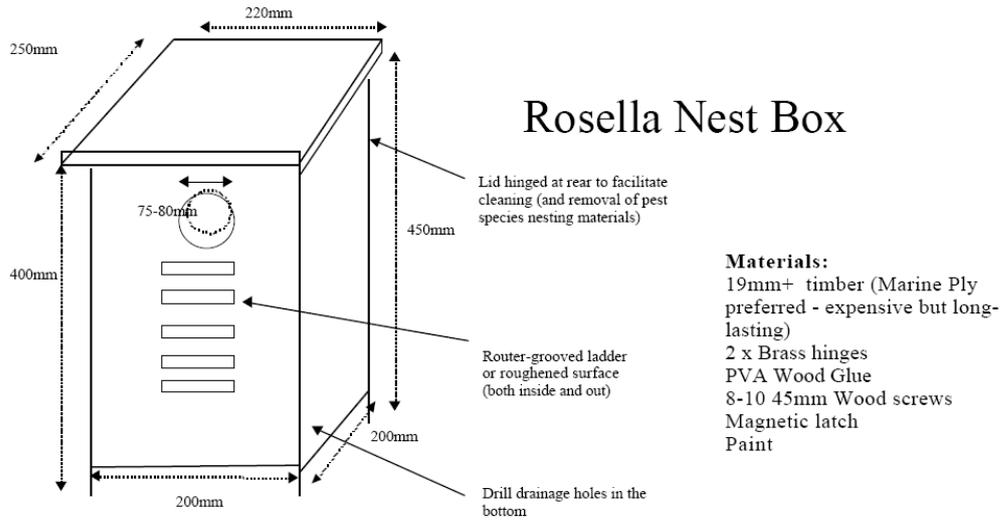


Photo &.....: Photos of installed Possum and Bird boxes, created by Faunature, a South Australian company specialising in Nest Boxes (Faunature, n.d)



Possum Box



Small Parrot Box

**Recommended Nest Box Diameters for some Species within River Torrens
Linear Park (*Birds Australia*, 2002)**

Species	INT. DIAM	DEPTH/ LENGTH	ENT. DIAM	VERT./ HOR.	HEIGHT	SEASON	REF.
Chestnut Teal (<i>Anus castanea</i>)	200-400mm	450-750mm	100-120mm	V	1.5m	Sep-Dec	Adams (1980)
Grey Teal (<i>Anus gracilis</i>)	200-400mm	450-750mm	100-120mm	V	1.5m	All year	Adams (1980)
Sulphur-crested Cockatoo (<i>Cacatua galerita</i>)	-	-	150mm	V	-	Aug - Jan	Trainor (1995)
Galah (<i>Cacatua roseicappilla</i>)	200mm	650mm	120mm	V	6m	Jul-Dec	Adams (1980)
Little Corella (<i>Cacatua sanguinea</i>)	-	-	150mm	-	-	All year	Trainor (1995)
Australian Wood Duck (<i>Chenonetta jubata</i>)	200mm	500mm	120mm	V	-	Sept-Nov	Trainor (1995)
Lorikeet sp. (<i>Glossopsitta</i> sp.)	120mm	600mm	60mm	H	5m	Aug-Jan	Adams (1980)
Crimson Rosella (<i>Platycercus elegans</i>)	150-200mm	350-800mm	75-100mm	V/H	5-6m	Sept-Jan	Adams (1980)
Eastern Rosella (<i>Platycercus eximilus</i>)	135-150mm	350-800mm	75-100mm	V/H	5-6m	Aug-Jan	Adams (1980)
Common Brushtail Possum (<i>Trichosurus vulpecula</i>)	320mm	400mm	120-150mm	V	4-8m	Autumn	MZES (2001)