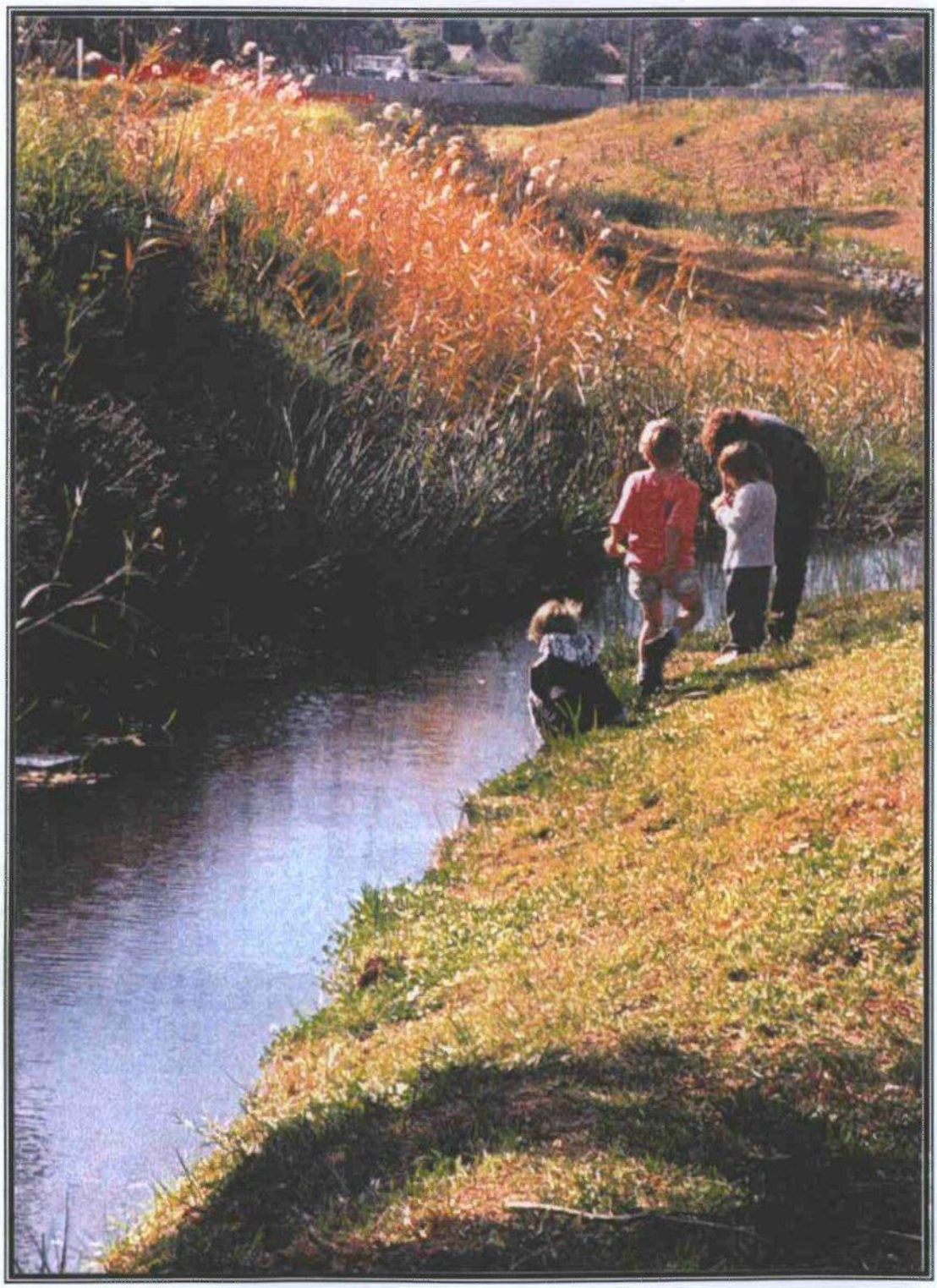
GREYSTANES CREEK RESERVES

PLAN OF MANAGEMENT



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PLAN OF MANAGEMENT

prepared by

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for

BLACKTOWN CITY COUNCIL

HOLROYD CITY COUNCIL

UPPER PARRAMATTA RIVER CATCHMENT TRUST

NOVEMBER 1998

(Approved by HCC – 18/11/98)
(Approved by BCC – 11/11/98)

EXECUTIVE SUMMARY

PURPOSE

This Plan of Management has been funded by the Upper Parramatta River Catchment Trust, Blacktown City Council and Holroyd City Council.

The aim of this study is the preparation of a Management Plan for the Greystanes Creek open space reserves between Fox Hills Golf Course and the Main Western Railway Line and briefly extend the concept to Station Road. The plan will outline future management, access, use and developments within the reserves to enhance their value for recreation, wildlife habitat, nature conservation, water quality improvement, drainage and flood mitigation.

CATEGORY OF LAND

The land is classified as Community Land.

The site comprises the following categories, as outlined by the Department of Local Government:

- Natural area incorporating water course
- General community use
- Park.

STATEMENT OF SIGNIFICANCE

Clearing for residential, agricultural, recreational, flood control activities and stream stabilisation has significantly reduced the ecological values of the site. Nevertheless a high level of degradation does not prevent the area from being highly valued by local residents and providing significant local habitat.

The most significant or unifying element on the site is the creek itself, although it varies greatly in landscape character, habitat values and visual quality.

The fundamental value of the creek as an ecological, recreational and visual resource is the basis for the site's future.

The site is significant for the following reasons:

- It provides a range of ecological values, educational resources and recreational opportunities.
- Unlike the areas of sandstone country, less useful to settlement, which are protected by National Parks, few areas of Wiannamatta Shale country and its representative flora and fauna have been protected. This places further emphasis on the need to protect and enhance those pockets that do remain, such as this site. Remnants of urban bushland are a vital part of Sydney's natural heritage.
- It is a rare remnant of the Riverine Floodplain community once widespread in the area.

- The site's value as open space is heightened by the absence of comparable sites in the immediate vicinity.
- It provides an inherent active and passive recreation resource greater than many local playgrounds.
- It provides a break in the urban sprawl and softens the visual impact of the built environment.
- It gives definition and identity to the local area.
- Species previously unrecorded in this area, typically occurring in micro habitats, enhance the site's scientific and ecological significance
- It has a potential for providing a link with other areas of open space, particularly as a wildlife corridor.
- It has potential for improving water quality through establishment of a riparian zone as part of a vegetation conservation and management strategy within the Upper Parramatta River Catchment.

COMMUNITY LIAISON

Community liaison has been an integral part of the development of this Plan of Management. Following initial discussion at meetings of the Greystanes Creek Management Committee, Councils, Trust and other organisations, a questionnaire was prepared to canvas residents' opinions.

In the general resident survey the aims were to establish patterns and levels of usage, gauge concerns and problems relating to the site and seek input into their resolution as well as ideas for general improvements.

The questionnaire responses and extensive general discussion reveal a fairly high level of concern for the creek and its areas of open space among those who know the site well, generally decreasing with distance from the creek.

MANAGEMENT OBJECTIVES

- To rehabilitate, conserve and protect the natural environment.
- To encourage a regional approach to planning, design, conservation and maintenance of open space.
- To encourage community participation.
- To achieve an informed and positive attitude to the environment.
- To provide and maintain recreation opportunities based on community needs and within budget.
- To encourage the development of a Catchment Management Plan.
- To develop a management approach which addresses Catchment and Reserve based issues and outlines priorities actions.
- To rehabilitate the creek to as natural an ecosystem as possible, promoting natural regeneration and the reintroduction of indigenous plants and animals.
- To enhance the visual appeal, landscape character and scenic quality.

- To provide the area with appropriate recreational experiences.
- To identify the range of management issues and reserve values which should be addressed.
- To assess the current management actions in the Reserve and determine their overall value.
- To prepare immediate long and medium term strategies and identify specific actions, costs and responsibilities.
- To seek efficient provision and allocation of resources and services.
- To provide a workable basis for ongoing management of this site.

STRATEGIES

RECREATION

- Cooperate with Councils, State Government Departments and private landholders to prepare a feasibility study for the concept and implementation of regional tracks.
- Develop a nature reserve in Area I as an educational and recreational facility
- Consult with Councils landscape planners in park planning and development of better range of play ground settings.
- Protect the nature reserve area through fencing and circulation restrictions.
- Supply adequate seating, resting and picnic facilities at appropriate locations and in keeping with site character
- Design loop walking track in Area I offering as many diverse environmental experiences as possible, linked with an interpretive plan.
- Design low key and naturalistic walking tracks in the nature reserve.

VEGETATION

- Establish a nature reserve to conserve the remnant riverine communities and rare local species, with the exclusive use of indigenous vegetation.
- Revegetate the creek environment to approach natural conditions as closely as possible in Area I and II and in more modified form in all other Areas III-VII.
- Establish a vegetation buffer zone, particularly in Area III by formulating a Development Control Plan to limit development and protect vegetation at the rear of the properties.
- Investigate means of allowing flooding in nature reserve area to promote vegetation diversity.
- Use bush regeneration programs and techniques under the guidance of the Holroyd's Bushland Supervisor.
- To allow the re-introduction of plants propagated from the site, prior to channel earth works, and investigate provision of suitable growing conditions and protection measures.
- To investigate species occurring at comparable sites, eg Prospect Creek, to determine what species may have occurred on this site and to obtain local material.
- Connect the isolated tree groups to consolidate the canopy.

- Provide screen planting to reduce visual dominance of housing and fencing, while mindful of sunshine and views.
- Create landmark plantings at street intersections to enhance landscape character.
- Re-establishment a tree canopy to reduce the growth rate of grass and subsequent maintenance.
- Increase the use of native grasses, as they are deep rooted and adapted to low nutrient soils and consequently are more drought resistant, less dependent on soil fertility, are slower growing then most introduced grasses and require less maintenance.
- Discontinue mowing and control exotic grasses with herbicides under tree canopy, to allow natural regeneration.
- Use grasses to accentuate landform and define spaces for different uses by using distinct mowing regimes.
- Define, by pegging mowing zones under the direction of the Holroyd's Bushland Supervisor.

WEEDS

- Replace weeds on channel banks gradually, with plantings of native grasses using virocells.
- Removal of dense privet and briar gradually, only after extensive planting and establishment of native replacement species, particularly *Bursaria spinosa*.
- Control weed seed sources, particularly *Cirsium vulgare.*
- Install nutrient and sediment traps to reduce weeds.
- Consultation with Fox Hills Golf Course to control nutrient loading from fertilisers.
- Remove *Typha* from the creek bed selectively.
- Remove noxious weeds such as *Opuntia stricta* (Prickly Pear) and *Lucium ferocissium* (African Boxthorn) immediately.
- Establish bush regeneration program within reserve area.

WILDLIFE HABITAT

- Re-establish wildlife habitat using dense revegetation.
- Limit access to certain areas to provide wildlife refuges, particularly Areas I and II.
- Remove weeds gradually and only in conjunction with the establishment of native understorey replacement, eg *Bursaria spinosa*.
- Create increased variety of ecosystems and provide habitat for invertebrates, amphibians, reptiles and birds, by the establishment of a wetland in Area I.
- Establish linkages to nearby reserves, such as Metella Reserve to extend wildlife corridors.

WETLAND (AREA I)

- Establish diverse range of topographical elements and vegetation zones from dry to aquatic, with variable inundation levels
- Establish islands for habitat refuges
- Establish a complex rather than linear shoreline to provide an increased number of wildlife breeding sites.
- Revegetate using indigenous native species, recreating different vegetation communities including aquatic macrophytes, sedgeland, grassland and riverine woodland. In particular local species such as *Bolboschoenus caldwellii, Schoenoplectus validus, Juncus usitatus* and *Eriochloa pseudoacrotricha* to be re-established
- Optimise nutrient uptake by alternating reed beds and open water areas.
- Reinforce existing mature vegetation by additional planting to link and extend remnant tree groups
- Focus recreational use near the John Silverthorne Reserve and adjacent to Oklahoma Avenue, with some vantage points linked to the walking track system for bird watching in the core of the site
- Install gross pollutant trap and trash racks at inlet points to sedimentation pond.
- Coordinate design, planting and installation of wetland using wetland specialist.
- Control weed with herbicides prior to construction and revegetation
- Provide temporary fencing of areas to prevent access and wear.
- Stabilise banks with a combination of jute mesh, hydro mulching and high density planting of virocells.

STORMWATER AND WATER QUALITY

- Complete, implement and publicise the Water Quality Strategy and the Stormwater Management Plans being developed by the Trust and the Councils.
- Implement on-site detention in the catchment, especially on existing large development sites.
- Develop domestic stormwater policy encouraging on-site tank storage.
- Investigate adjustment of Fox Hills Golf Course detention basin discharge rates in order to achieve greater stormwater detention in smaller storm events.
- Investigate means of controlling nutrient loadings from fertilisers used on the golf course.
- Possible addition of a wetland area upstream near the Highway and also in Metella Reserve.
- Trace turbidity source in the upper catchment.
- Construction of trash racks to be continued, particularly at key points such as Metella Road Reserve (western side of Metella Road) and at smaller culverts, such as in Memphis Crescent, Junia Avenue and Cecilia Street.
- Develop public education program and liaison with EPA to coordinate pollution control measures and future funding in order to reduce general pollution in the catchment.
- Correlate and publicise Streamwatch results collected by Girraween High School and other water quality studies.

- Encourage industry sponsorship of more extensive water testing in the catchment.
- Establish vegetation cover in catchment, particularly along riparian zones.

EROSION

- Flow dissipaters, sediment traps and forebays, integrated with landform be provided at all eroding stormwater outlets.
- Reform eroded creek banks by reducing bank gradients, while retaining mature vegetation.
- Stabilise eroding areas using gabion structures following natural slopes and landform, while retaining mature native vegetation. Interfill gabions with soil mix and vegetate with virocells.
- Bare creek banks in all Areas require revegetation to improve soil stability.
- Revegetation strategies itemised in 5.2 will assist erosion control.

VANDALISM

- Evidence that the reserves, particular Area I are being well maintained, such as bush regeneration works, will counteract vandalism
- Sponsorship of reserve areas by local schools for ongoing stewardship, coordinated by the Bushland Supervisor.
- Provide interactive and adventure playground facilities or provision of raw material for play in designated areas
- Liaise with the schools, social workers and landscape / recreation planners to develop youth oriented programs (Toongabbie Graffiti art wall / exhibition)
- Investigate the role of honorary ranger and other forms of resident surveillance.
- Increase access points and associated lighting, especially in Area III.
- Camouflage seedlings with unmown grass on upper bank edges in Area III and IV.
- Greater usage of reserves following landscape improvements can deter undesirable uses.
- Increased surveillance due to greater usage.

INTERPRETATION

- Levels of signage with major entrance / address sign and directional signage for regional walking track connections. Low key signage for education and interpretation themes.
- Signage to fit in with Council's overall signage policy
- On regional level interpretation of points of interest discussed in brochure format keyed to stopping points along the track system.
- Distribution of information through the community (G.C.M.C.) newsletter and the Trust's Streamline publication.
- Explanation of site history: aboriginal use, settlement for agriculture, naming of the site
- Interpretation of past agriculture uses is a valid role of this site, in particular to reference to early colonial landgrants.

- Familiarise visitors with the site's dominant tree species and the less obvious rarer species and role of remnant urban bushland in conservation.
- Relate ecological function of native vegetation of native bird habitat, food and nesting sites to plantings in local gardens.
- Demonstrate significance of trees in erosion control.
- Relate flooding and stormwater problems to urban runoff and garden design
- Develop appreciation of native grasses for domestic landscapes
- Increase awareness of weed incursion into bushland and their control

DOGS

- Stronger Council Ranger presence to police dogs, particularly early mornings and weekends.
- Education program to encourage dog control and removal of faeces.
- Investigate and implement methods of dog faeces disposal (possible installation of dog toilets at key entry and exit points, eg exchangeable sandpit or below ground chemical toilets).

ACCESS

- Provide well landscaped pedestrian access point into Area III with seating and lighting from Toongabbie Road halfway between Gilba Road and Portia Road.
- Ensure that boundary landscaping and fencing of proposed community title development in Area II opposite Gilba Road is compatible with the reserves character.
- Construct low key stepping stone creek crossing points opposite the northern limit of reserves facing Memphis Crescent and opposite Lucretia Road at rear of 112 Metella Road with informal stone steps up the embankments.

MAINTENANCE

- Holroyd City Council is to be responsible for site management of all the Greystanes Creek Reserves.
- HCC's Bushland Supervisor is to be able to coordinate and engage private contractors to carry out specific tasks according to budget.
- To address the management issues and carry out the maintenance of Areas I to VI the current apprentice position is to be maintained to assist the Bushland Supervisor.

FIRE

- Monitor and record any occurrence of fire on site, to develop a historic reference and an understanding of fire effect on fauna and flora.

PERFORMANCE

The implementation of this Plan of Management needs to be evaluated at least twice a year, in conjunction with the Management Steering Committee meetings. The landscape as a whole and the management process in particular is a dynamic one. While the broad

directions for environmental improvement have been established in this plan, detailed feedback is required regularly and needs to be acted upon.

Both the annual Local Government State of the Environment reports and the Stormwater Management Plan for the Upper Parramatta River Catchment will be the best means of assessing progress in terms of the Plan of Management strategies. HCC's Bushland Supervisor will be responsible to provide data for these reports. Key shortcomings should be identified for resolution.

Performance indicators will be:

- Successful completion of identified actions in the works plan.
- No further loss of mature trees, apart from losses through natural processes and in accordance with the requirements of this plan (eg wetland construction).
- Improvement in canopy species establishment.
- Regeneration and increased species richness of shrubs and ground flora.
- Maintenance and enhancement habitat for all known animal species identified on site.
- Arresting weed dominance over the whole site.
- Marked reduction in litter / waterborne pollution.
- Increased levels of appropriate recreational use.
- Decrease in erosion of creek banks.

WORKS PROGRAM

A works program, outlining broad prioritisation of tasks and cost estimates, has been compiled. Apart from current maintenance, the planting program and certain capital improvements, which are currently budgeted for, funding sources for other capital improvements have been suggested.

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Plate 1 Greystanes Creek, looking south-east, with Girraween Industrial Area in the background

1.2 LOCATION

The study area lies approximately halfway between Blacktown and Parramatta. From the Great Western Highway to the Main Western Railway line the creek forms the boundary between the City of Holroyd on the east and the City of Blacktown on the west.

Greystanes Creek is a major tributary of Toongabbie Creek which is, in turn one of the two main arms of the Upper Parramatta River.

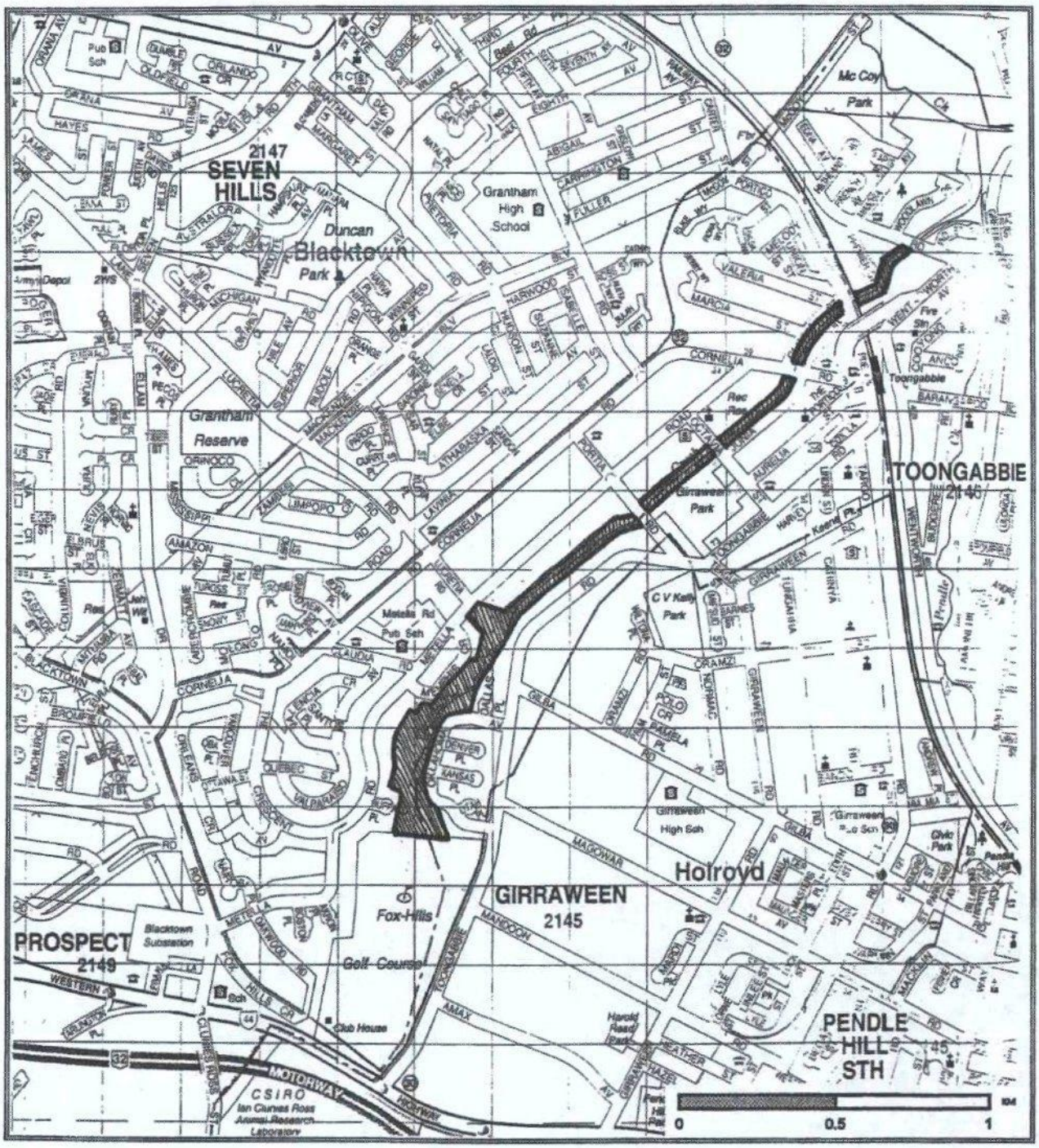


Figure 1 Location Map

1.3 AREA COVERED

The site encompasses the reserves adjacent to Greystanes Creek from Fox Hills Golf Course in the south to the main railway line at Toongabbie in the north, with broad consideration of the adjoining area to Station Road. They form a continuous, although variable corridor of approximately 2.5 km long

For the purposes of this study the site has been divided into seven management areas, based on landscape character and topographic features.

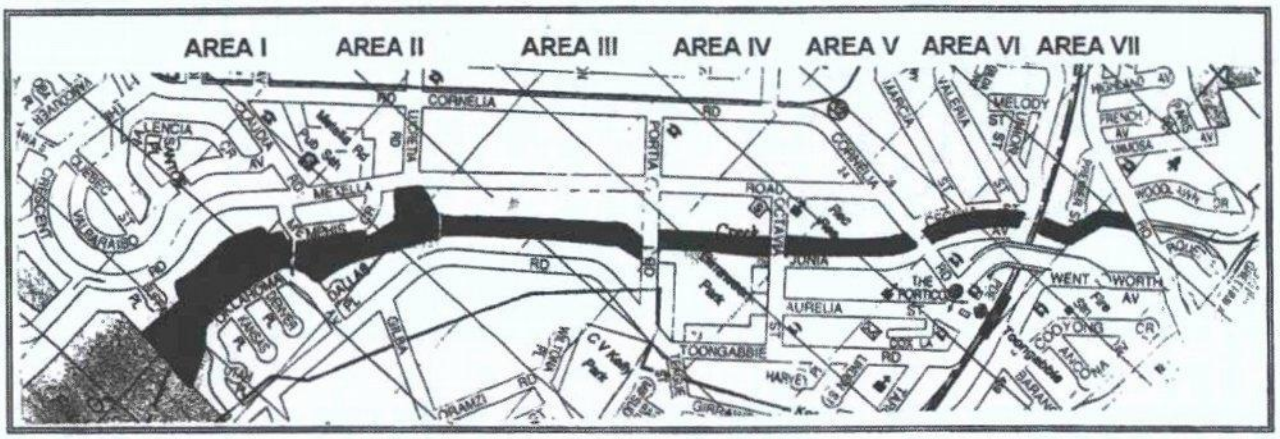


Figure 2 Greystanes Creek Reserve Management Areas

They comprise:

I From Fox Hills Golf Course to the northern end of Oklahoma Avenue.

II From the northern end of Oklahoma Avenue to the southern limit of the narrow channel corridor, in line with Lucretia Road.

III From Lucretia Road to Portia Road.

IV From Portia Road to Octavia Road.

V From Octavia to Cornelia Road.

VI Cornelia Road to Portico Parade.

VII Portico Parade to Station Road.

1.4 PLANNING AND LEGAL CONTEXT

1.4.1 LOCAL GOVERNMENT ACT

The Local Government Act 1993 provides the legislative framework for the recognition and protection of the natural values inherent in the site. The creek area is classified as an 'Area of Environmental Sensitivity', which calls for appropriate protection and care to minimise site disturbance.

The Local Government Act 1993 (Section 36) requires that Councils prepare a plan of management for community land. Such a plan must identify:

- Description, category, classification, ownership and leaseholds of land.
- The management issues, objectives and performance targets of the plan (outlined in chapter 4 & 5).

- The means by which these objectives and performance targets will be achieved (outlined in chapter 5 & 6),
- The methods which will be used to assess whether performance targets and objectives are being achieved (Council's Quality Assurance Assessment, Annual "State of Environment" Report, and the Upper Parramatta River Stormwater Management Plan).

STATE ENVIRONMENTAL POLICY NO. 19 - BUSHLAND IN URBAN AREAS

SEPP No. 19 - Bushland in Urban Areas gives protection to remnant bushland in urban areas within New South Wales. The policy applies to land zoned or reserved as public open space. Under the policy Councils may prepare plans of management for bushland areas within such land.

The policy defines bushland as "land on which there is vegetation which is either a remainder of the natural vegetation of the land or, if altered is still representative of the structure and floristic of the natural vegetation". Greystanes Creek Reserves does contain remnant bushland vegetation, to which the above policy applies.

The areas of remnant bushland under SEPP19, mapped as such in Vegetation Analysis, must be protected and rehabilitated as such.

Circular No. B13 of the Department of Planning states that a management plan should:

- Describe the bushland in light of the aims and objectives of the policy,
- Include measures to enable the recreational use of bushland, where appropriate,
- Specify the intended measures to prevent bushland degradation and restore degraded areas.

1.4.2 LOCAL ENVIRONMENTAL PLAN

The current Local Environmental Plans (City of Blacktown and City of Holroyd) for Greystanes Creek Reserves zone the reserves as 6(a) Public Open Space and Drainage Reserve.

1.4.3 STATE OF ENVIRONMENT REPORTING

As part of SoE reporting there is a requirement for annual assessment of the condition of the reserves and the bushland in particular. The ongoing evaluation of the implementation of this Plan of Management should be linked with this process.

1.4.4 OTHER RELEVANT LEGISLATION

The following State Government Legislation provides the framework for implementation of programs at Local Government level:

- Clean Waters Act 1970
- Environmental Planning & Assessment Act 1979
- State Pollution Control Commission Act 1970
- Environmental Offences and Penalties Act 1989
- The Catchment Management Act 1990

2. SITE DESCRIPTION

2.1 SITE HISTORY

The area was inhabited by groups of the Dharug Aboriginal tribe prior to European settlement. Evidence of Aboriginal camp sites has been recorded in the form of red silcrete artefacts in the area north of Fox Hills Golf Course (Elizabeth Rich, 1993) . The role of "fire stick farming" has increasingly been recognised as a fundamental component in the shaping of Australian landscapes. The abundant grasslands and open forests so created, indeed attracted settlers to this area.

The flood plain was used for farming and the creek for irrigation. Land grants in the area were among the earliest in the colony and the Prospect settlements of 1791 were the first occasion when sentence - expired convicts were settled as a community. The naming of John Silverthorne Reserve commemorates one of these settlers.

The period of extensive clearing saw bullock teams pass through the area using the creek as a watering stop (Tyler P., 1994). The creek has also been referred to as "Fox under the Hills" creek and the "Fox under the Hills" Inn, dating from the early years of settlement, stood in what is now the carpark of Fox Hills Golf Club.

Most of the land in this area has been farmed or grazed since the very early days of settlement, though since World War II it has become increasingly urbanised. Consequently very little of the native vegetation now remains in an undisturbed form.

Greystanes Creek takes its name from the area of its headwaters, named after Greystanes House, built by the Lawson family in the 1830's and refers to the grey "stanes" (Scottish for stones) or basalt outcrops in the vicinity.

2.2 CATEGORY OF LAND

The land is classified as Community Land.

In terms of section 36 (4) of the Local Government Act Greystanes Creek Reserves is defined as:

- Category - Natural Area
- Subcategory - Water Course / Creek Corridor

2.3 ZONING

The reserves in question are zoned as Open Space - 6(a) and Drainage Reserves. The major portion of the surrounding area is zoned Residential - 2(a), with significant areas zoned Light Industrial - 4(b) and a small area forming the commercial centre around Toongabbie Station zoned General Business - 3(a).

2.4 LAND TENURE

The land tenure of Greystanes Creek Reserves is shown in the Land Tenure Drawings on pages 7-11 and comprises:

- Blacktown City Council Open Space;
- Blacktown City Council Proposed Open Space;
- Blacktown City Council Land as yet to be zoned as Open Space;
- Holroyd City Council Open Space;
- Holroyd City Council Proposed Open Space;
- Holroyd City Council Open Space leased to Community Groups.

Some of the land zoned as Open Space is still privately owned, but is in the process of being acquired by Councils. These owners must be informed of the Plan of Management.

Leaseholds exist for sites occupied by the Girl Guides Association and the Country Womens Association in Junia Avenue, Area V.

The reserve boundaries are also shown on the Infrastructure Analysis Drawings, pages 41-46.

2.5 TOPOGRAPHY

The catchment of Greystanes Creek is generally flat except for the upper reaches which are characterised by undulating hills. The longitudinal creek slopes are less than 1%.

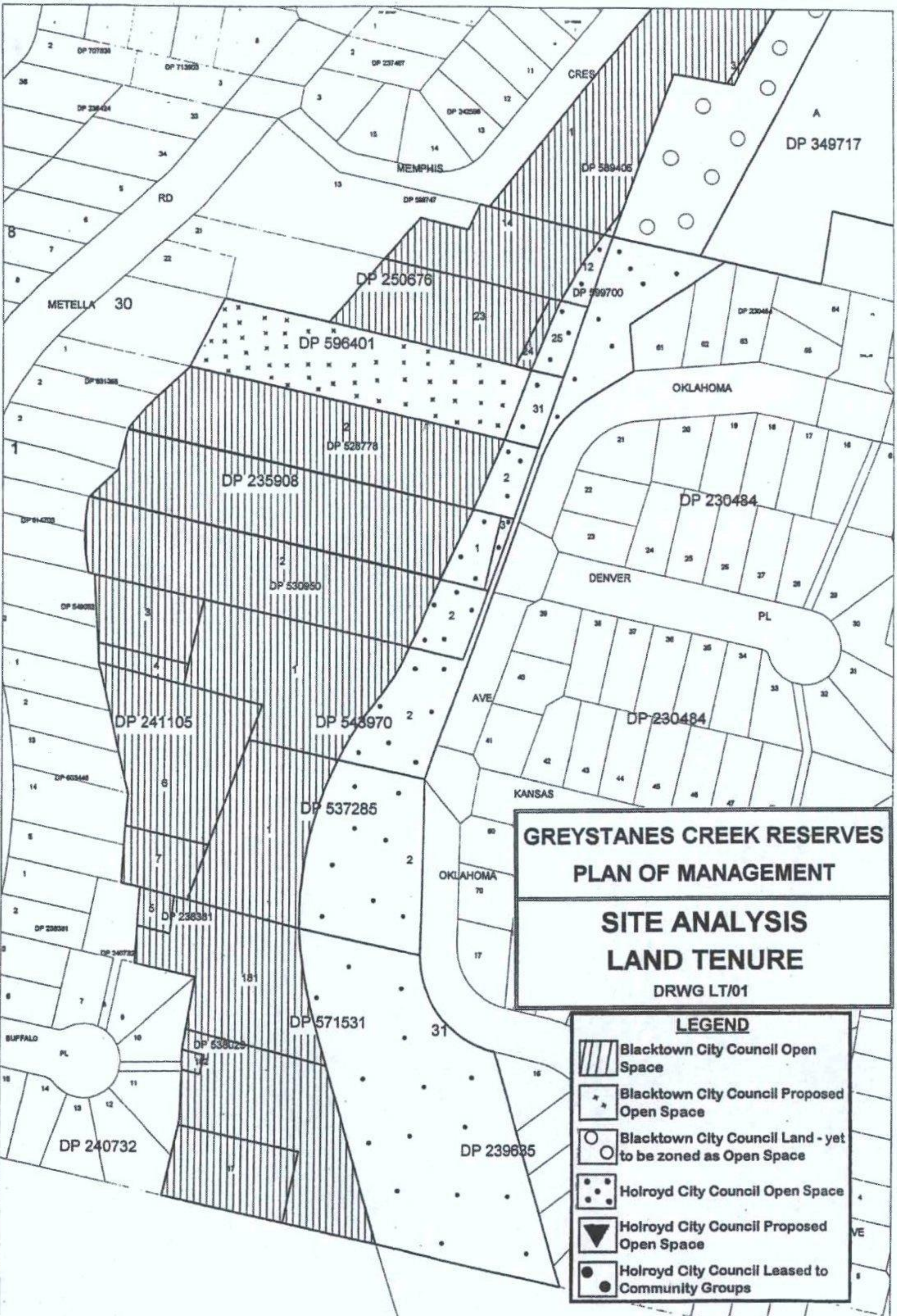
The upper reaches of Greystanes Creek are mainly open space, including land occupied by the CSIRO and the Fox Hills Golf Course. North of the Golf Course the catchment is urban, with the creek flowing through a flood plain up to 100 metres wide.

There have been significant changes to the natural topography of the site due to urbanisation, resulting in regrading and changes in creek alignment.

2.6 SOILS

Soils of the site have been described by the Soil Conservation Service of NSW as Fluvial - South Creek classification. These occur in flood plains, valley flats and drainage depressions of the channels on the Cumberland Plain. Landform is usually flat with incised channels, mainly cleared.

Soils are often very deep layered sediments over bedrock or relict soils. Structured plastic clays or structured loams occur in and immediately adjacent to drainage lines. Red and yellow podsolic soils are common on terraces, with small areas of leached clays and yellow solidic soils. This soil group's limitations are described as erosion hazard and frequent flooding. The soils on the site show saline, sodic and dispersive characteristics, increasing risks of erosion and making plant establishment difficult. (Chapman G.A. & Murphy C.L., 1989)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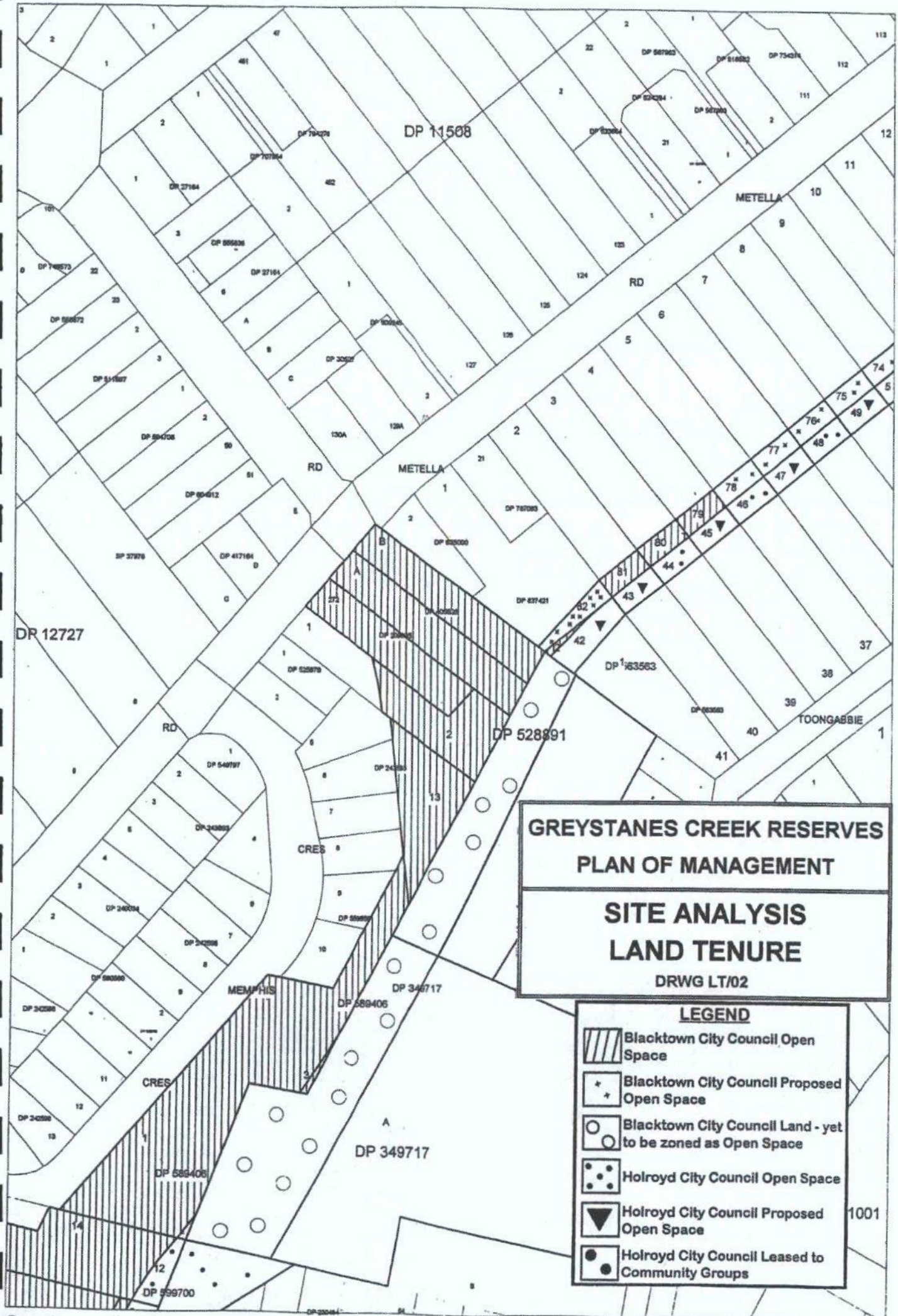
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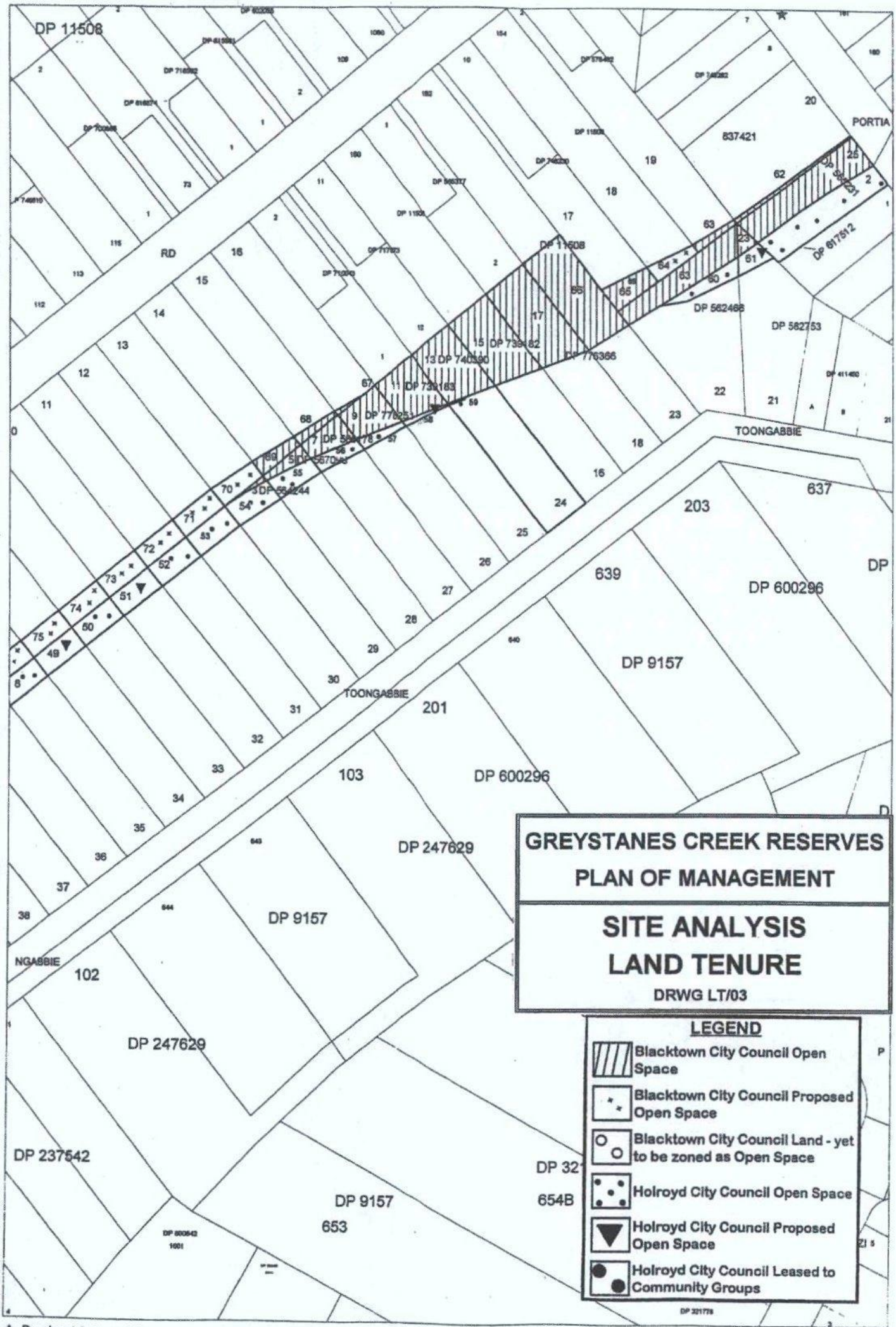
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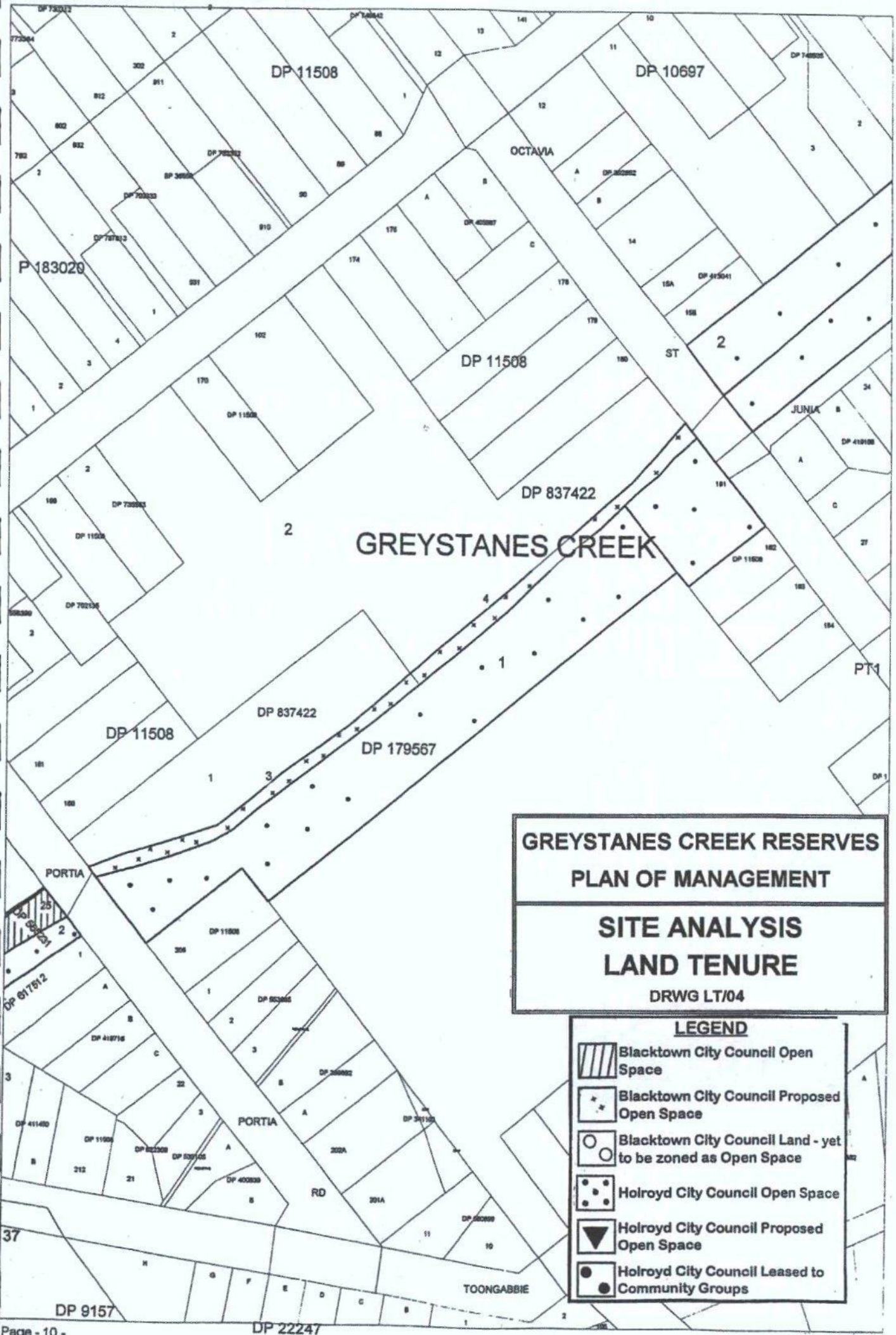
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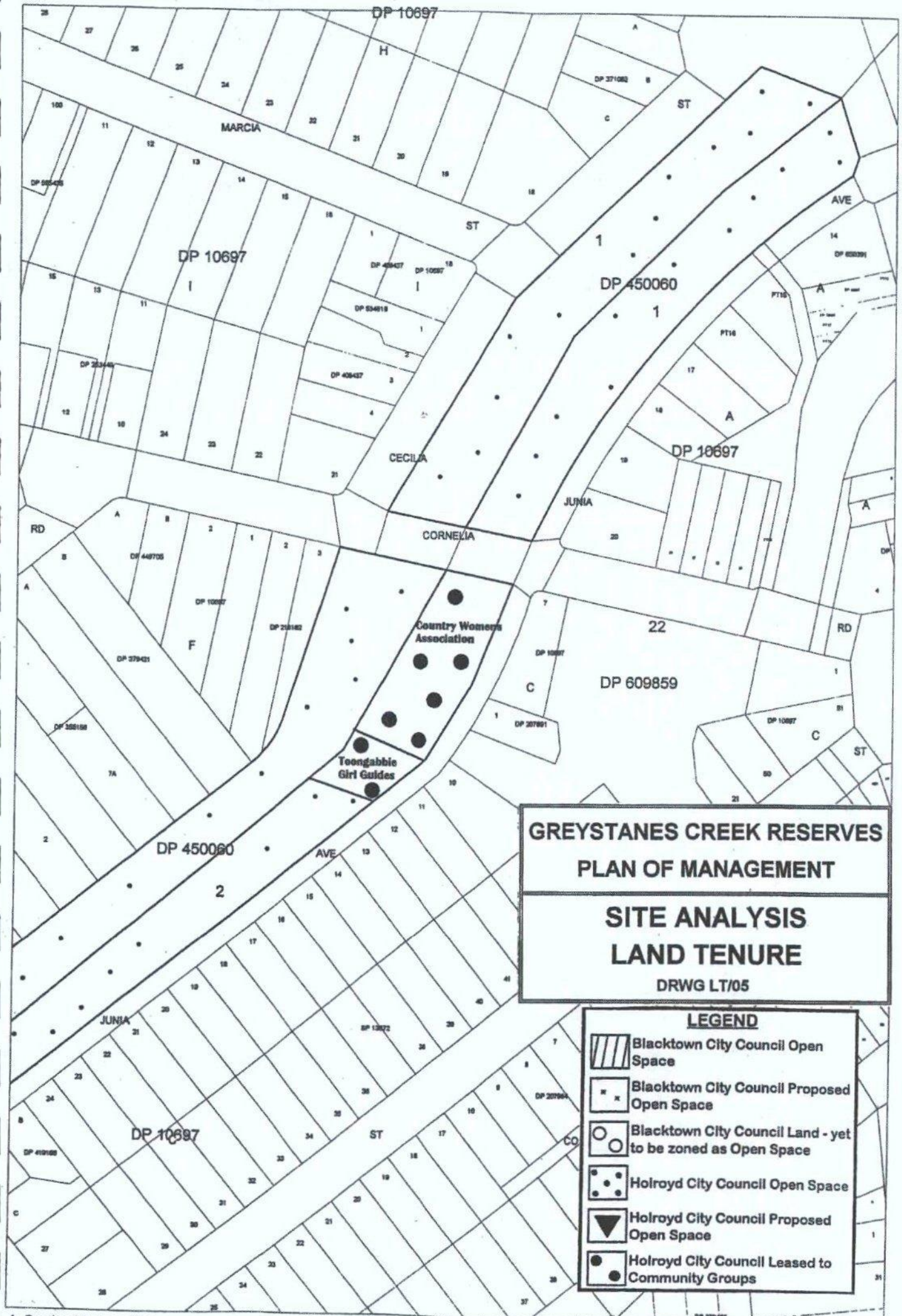
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Blacktown City Council Land - yet to be zoned as Open Space
Holroyd City Council Open Space
Holroyd City Council Proposed Open Space
Holroyd City Council Leased to Community Groups

2.7 DRAINAGE

2.7.1 CATCHMENT

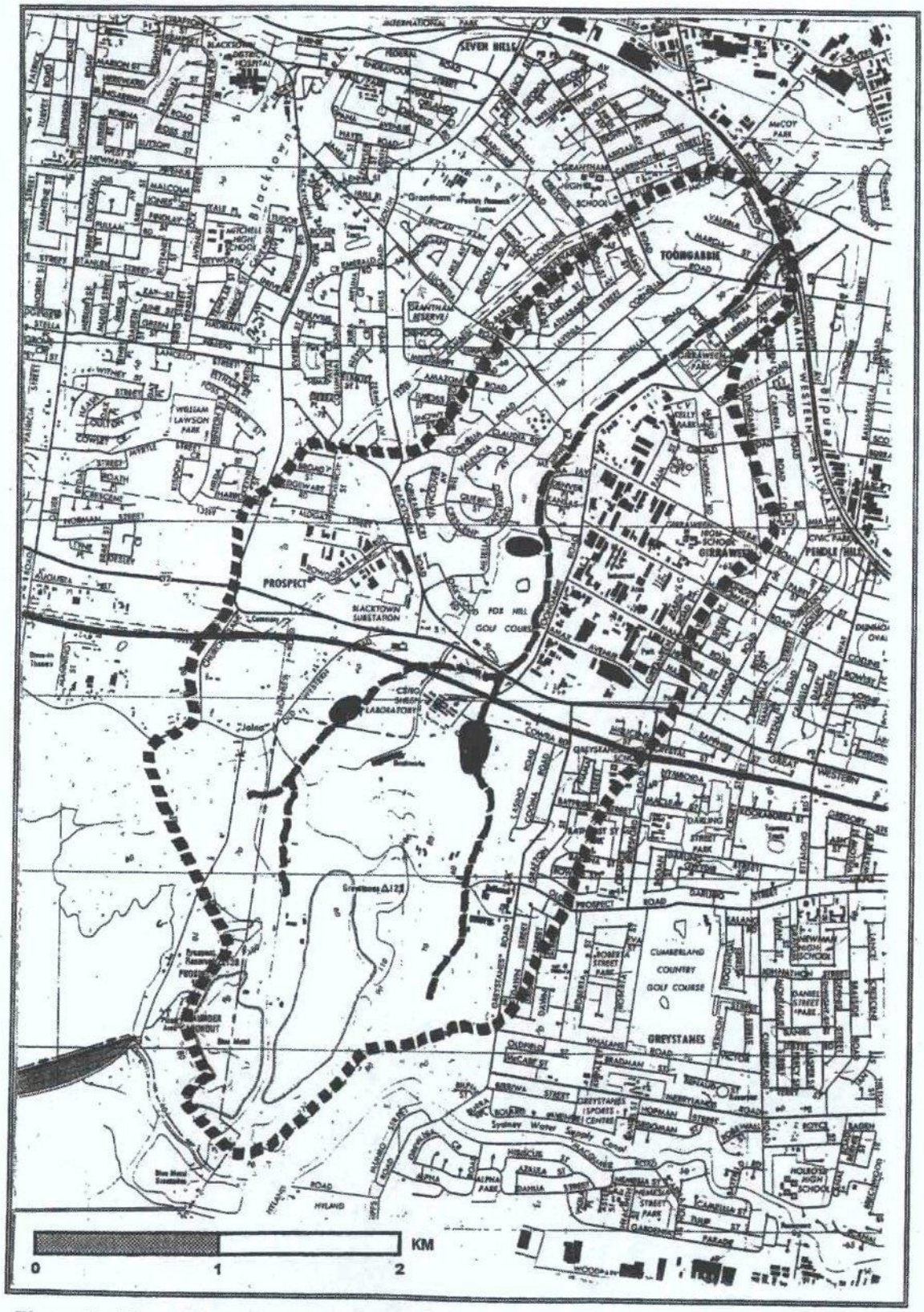


Figure 3 The catchment covers an area of 979 hectares.

Greystanes Creek is a major tributary of Toongabbie Creek which is, in turn, one of the two main arms of the Upper Parramatta River. The creek generally flows northward from its source at Prospect Hill. Its headwaters are undeveloped pasture land mostly occupied by CSIRO and the Boral Blue Metal Quarry which occupies about 1 square kilometre. The quarry receives runoff and the trapped stormwater is pumped out into the upper reaches of Greystanes Creek over considerable periods. This water provides the main low flow in the creek except during and after rainfall. Two substantial flood retarding basins have been constructed on the two arms of Greystanes Creek south of the Great Western Highway and the M4 Motorway. These are on land owned by CSIRO and the Department of Planning. A major flood retarding basin has been constructed in the Fox Hills Golf Course with an embankment along its northern boundary.

The study area lies generally low within the sub-catchment resulting in the concentration of urban runoff and stormwater pollution.

2.7.2 DRAINAGE

The creek's structure and location was changed to facilitate development twenty to thirty years ago. Anecdotal evidence suggests that the creek was a series of waterholes and meanders until an artificial channel was excavated to facilitate drainage. At the same time smaller tributary drainage lines were filled, concentrating water flow into one creek line. In some places this creek line was excavated and relocated without adequate soil stabilisation work or revegetation. The increased water flow into the new creek lines caused a deepening of the creek bed and combined with a loss of vegetation exacerbated erosion.

Since then, bank erosion occurred in numerous locations, undermining banks and causing slumping, particularly where stormwater outlets discharged into the creek. The area became a dumping ground and while it contained native plants, became heavily weed infested, further restricting water flow.

Continued development increased urban runoff, particularly from large areas of impervious surfaces in the Light Industrial zones, compounding local flooding. In early 1993, in order to improve the flow capacity of the creek channel obstructive vegetation was removed and a low flow invert was provided in a realigned channel in areas II - V. The portion of reconstructed creek, in the form of a trapezoidal section, has a total width of 20 metres and a maximum depth below the top of the bank of 4.1 metres, with a slope of generally $^1/_2$%.

2.8 CREEK EDGE CONDITION

Area I — Open creek cross section with flat earth banks, planted with native grasses and trees. Contains a rock weir. Gabion structures at the culverts adjacent to the golf course. Back channel embankment overgrown with Kikuyu. Where dense Casuarina stands occur the creek banks are relatively stable, with some undermining of root systems.

Area 2 — More open creek cross section, gentler slopes, reconstructed earth banks forming a transitional area before the engineered creek channel. Rock lined concrete low flow invert with grassed embankments. Gabion structures at culvert adjacent to Portia Road.

Area 3 & 4 — Rock lined concrete low flow invert with grassed embankments. Gabion structures at culvert in/outlets to Portia and Octavia Road.

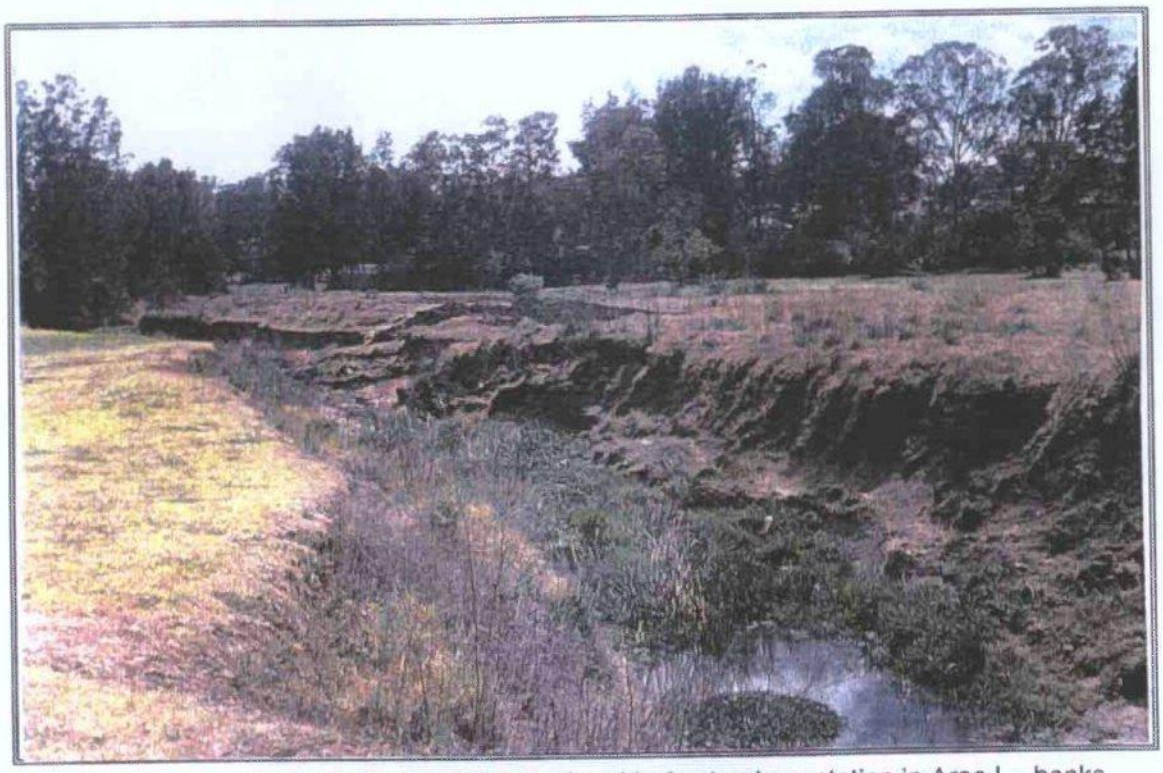


Plate 2 Deeply eroded creek banks devoid of natural vegetation in Area I – banks now flattened and planted, together with a rock weir – done in late 1996.

Area 5 Short section adjacent to Octavia Road rock lined concrete low flow invert with grassed embankments with gabion structure at culvert outlet adjacent to Octavia Road. Remaining length of embankments change from gentle grassed slopes to steep bare and eroded slopes, especially where vegetation cover is lacking.

Area 6 Grassed banks, with pronounced erosion at stormwater culverts and downstream of where those stormwater channels meet the creek line.

Area 7 Deeply incised, highly eroded banks with heavy weed infestation.

Plate 3 Relatively stable creek banks where vegetated with Casuarina glauca

AREA I

AREA II

Quebec Street

Valparaiso Avenue

Metella Road

Claudia Street

METELLA ROAD PUBLIC SCHOOL

Metella Road

Memphis Cresent

GREYSTANES CREEK

Buffalo Place

Oklahoma Avenue

Denver Place

Kansas Place

Toongabbie Road

Gilba Road

X HILLS GOLF COURSE

- Slope Gradient <= 15%
- Slope Gradient > 15%
- Creek Edge - Gabion Structures
- Creek Edge - Severe Soil Erosion
- Creek Drainage Line
- Low Flow Rockline Channel
- Drain Inlet - Culvert Headwall
- Drain Inlet - PVC Stormwater

N

Metres

0 20 40 60 80 100

GREYSTANES CREEK RESERVES
PLAN OF MANAGEMENT

SITE ANALYSIS
TOPOGRAPHY / DRAINAGE

SCALE: 1:2000

DATE: 10/02/95

DRAWING: TD/01

A. BERNHARD & ASSOCIATES - LANDSCAPE & ENVIRONMENTAL CONSULTANTS

AREA III

AREA IV

Metella Road

GREYSTANES CREEK

Toongabbie Road

Porria Road

TOONGABBIE BAPTIST CHRISTIAN COMMUNITY SCHOOL

GIRRAWEEN PARK

Octavia Road

Slope Gradient <= 15%
Slope Gradient > 15%
Creek Edge - Gabion Structures
Creek Drainage Line
Low Flow Rockline Channel
Drain Inlet - Culvert Headwall

Metres
0 20 40 60 80 100

GREYSTANES CREEK RESERVES
PLAN OF MANAGEMENT

SITE ANALYSIS
TOPOGRAPHY / DRAINAGE

SCALE: 1:2000
DATE: 10/02/95
DRAWING: TD/02

AREA V

AREA VI

AREA VII

Metella Road

Cornelia Road

Junia Avenue

Aurelia Street

Cox Lane

Marcia Street

Valeria Street

Cecilia Street

Junia Avenue

Portico Parade

The Portico

TOONGABBIE RAILWAY STATION

RAILWAY LINE

Premier Street

GREYSTANES CREEK

Station Road

BOWLING CLUB

Wentworth Avenue

Cooyong Cresent

- Slope Gradient <= 15%
- Slope Gradient > 15%
- Creek Edge - Gabion Structures
- Creek Edge - Severe Soil Erosion
- Creek Drainage Line
- Low Flow Rockline Channel
- Drain Inlet - PVC Stormwater

Metres

0 20 40 60 80 100

GREYSTANES CREEK RESERVES
PLAN OF MANAGEMENT

SITE ANALYSIS
TOPOGRAPHY / DRAINAGE

SCALE: 1:2000

DATE: 10/02/95

DRAWING: TD/03

2.9 VEGETATION

Historically, woodlands and open forest of large trees with relatively little undergrowth, have been documented as the dominant landscape type on the Cumberland Plain.

The site has remnants of the Riverine Floodplain Community in which the dominant tree association is *Casuarina glauca* (Swamp Oak) and *Eucalyptus amplifolia* (Cabbage Gum).

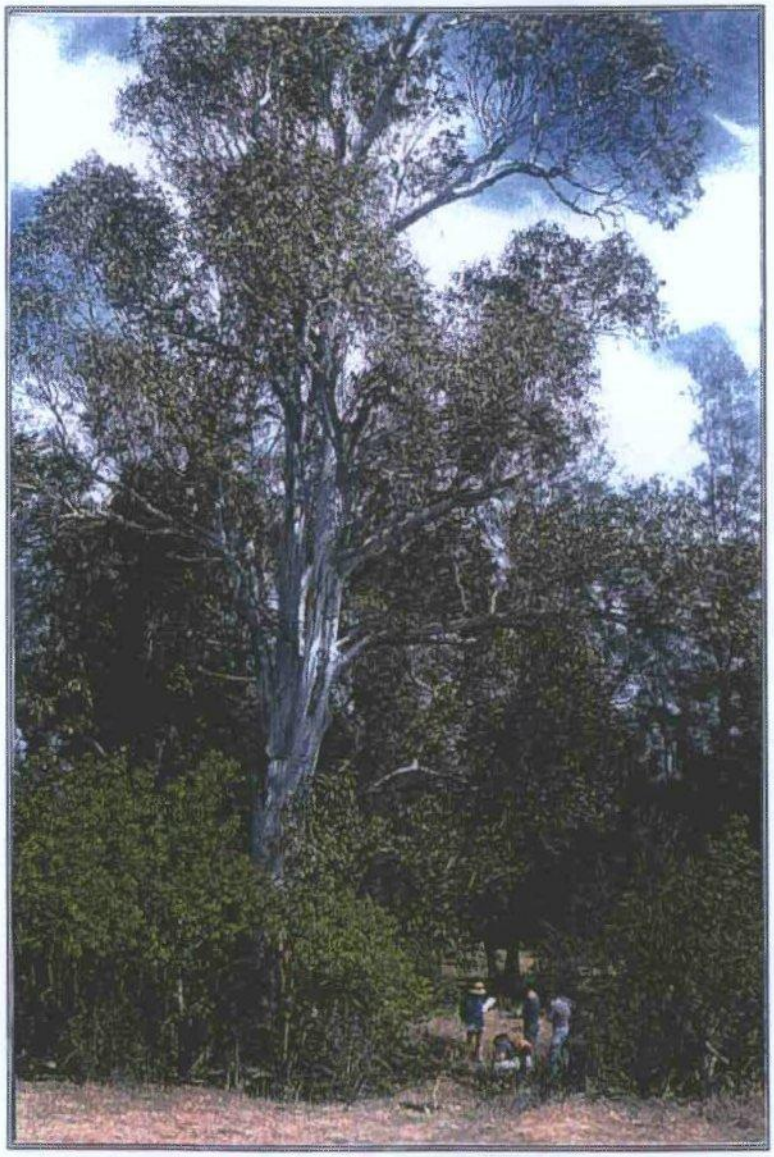


Plate 4 Superb specimen of Cabbage Gum providing a focus in Area I, the proposed nature reserve.

Both *Eucalyptus amplifolia* and *Casuarina glauca* occur as pure stands of either species on the quaternary and tertiary alluvium, as well as in depressions on Wianamatta Shale where the poorly drained soils will not support the Grey Box / Forest Red Gum association. Also presence in these poorly drained conditions are *Melaleuca decora, Melaleuca linariifolia* and *Melaleuca styphelioides*. Where however there is a distinct water course these species are replaced by *Allocasuarina cunninghamiana* (Benson & Howell, 1990).

Eucalyptus amplifolia is common on alluvial flats of tributary creeks and *Casuarina glauca* is common in drainage depressions. This species seems to indicate a saline influence in the

ground water. The distribution of *Casuarina glauca* on the site today follows previous drainage patterns. These groves have resulted from the root suckering ability of this species and its resilience in changing conditions.

The shrub stratum of this association is sparse, mostly *Bursaria spinosa*, of which little remains. Today the understorey is highly degraded by exotic species, mainly woody weeds and grasses.

While extensive grasslands have resulted from agricultural uses and regular mowing of these has favoured exotic grasses, the site supports micro habitats of plants considered to be vulnerable species (Andrews Neil, 1993), that is those not known to be adequately conserved in Western Sydney. These include:

Botanical Name	Family	Comments
Alisma plantago-aquatica	ALISMATACEAE	Aquatic habitat, very limited distribution, Area I
Atriplex semibaccata	CHENOPODIACEAE	Understorey plant in soils with saline groundwater, typically associated with *Casuarina glauca*, Area I
Bolboschoenus caldwellii	CYPERACEAE	Aquatic habitat, most abundant of the vulnerable species, occurring in the main drainage sweal near Memphis Crescent and in the creek bed downstream of the golf course, Area I, II & IV
Calystegia marginata	CONVOLVULACEAE	Small prostrate twiner on upper creek banks, Area I
Cayratia clematidea	VITACEAE	Climber, shaded areas near creek banks, Area I
Chamaesyce dallachyana	EUPHORBIACEAE	Low herb, close to concrete bridge, Area I
Einadia polygonoides	CHENOPODIACEAE	Understorey plant in soils with saline groundwater, typically associated with *Casuarina glauca* and *Eucalyptus sp.* in Area II
Eriochloa pseudoacrotricha	POACEAE	Aquatic habitat, in creek line of Area I
Pratia concolor	LOBELIACEAE	Low understorey plant, Area I
Schoeneplectus validus	CYPERACEAE	Aquatic habitat, in creek line of Area I, II & IV

The conservation assessment used is from 'Rare Bushland Plants of Western Sydney' by D. Benson and L. McDougall.

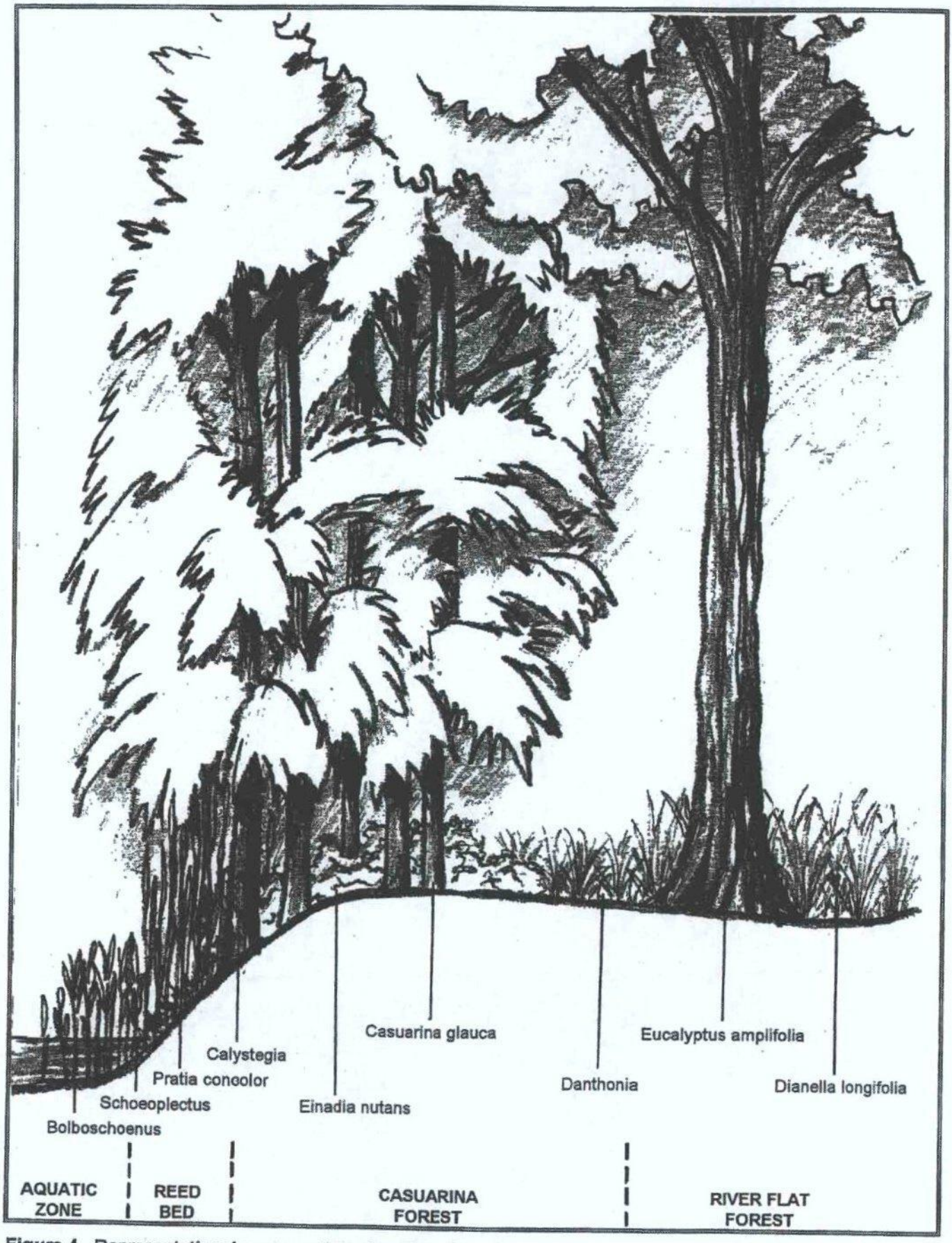


Figure 4 Representational cross section of a original creek bank vegetation

Native plant species found on the site are listed below:

A = Aquatic Plants
H = Herb
G = Grass
S = Shrub
T = Tree

Botanical Name	Common Name	Family	Type
Alisma plantago-aquatica	Water Plantain	ALISMATACEAE	A
Agrostis avenacea var. avenacea	Blow Grass	POACEAE	G
Aristida ramosa var. ramosa	Wire Grass	POACEAE	G
Alternanthera denticulata	Lesser Joyweed	AMARANTHACEAE	H
Alternanthera sp. A		AMARANTHACEAE	
Asperula conferta	Common Woodruff	RUBIACEAE	H
Atriplex australasica	Common Saltbush	CHENOPODIACEAE	H
Atriplex semibaccata	Creeping Saltbush	CHENOPODIACEAE	H
Bolboschoenus caldwellii		CYPERACEAE	A
Bothriochloa macra	Red Leg Grass	POACEAE	G
Bursaria spinosa	Boxthorn	PITTOSPORACEAE	S
Calystegia marginata		CONVOLVULACEAE	H
Carex appressa	Tall Sedge	CYPERACEAE	A
Carex inversa		CYPERACEAE	
Casuarina glauca	Swamp oak	CASUARINASEAE	T
Cayratia clematidea	Slender Grape	VITACEAE	V
Centaurim spicatum		GENTIANACEAE	H
Centella asiatica	Swamp Pennywort	APIACEAE	H
Chamaesyce dallachyana		EUPHORBIACEAE	H
Chloris truncata	Windmill Grass	POACEAE	G
Chloris ventricosa	Tall Chloris	POACEAE	G
Commelina cyanea	Scurvy Weed	COMMELINACEAE	H
Cotula australis	Button Flowers	ASTERACEAE	H
Cyperus difformis	Sedge	CYPERACEAE	A
Cyperus gracilis	Sedge	CYPERACEAE	A
Danthonia linkii var. linkii	Wallaby Grass	POACEAE	H
Dianella longifolia var. longifolia	Flax Lily	LILIACEAE	H
Dichanthium sericeum	Queensland Bluegrass	POACEAE	G
Dichondra repens	Kidney Weed	CONCOLVULACEAE	H
Echinochloa telmatophila		POACEAE	G
Echinopogon ovatus	Hedgehog Grass	POACEAE	G
Eclipta platyglossa	Yellow Twin Heads	ASTERACEAE	H
Einadia hastata	Saloop	CHENOPODIACEAE	H
Einadia nutans ssp. nutans		CHENOPODIACEAE	H

BOTANICAL NAME	COMMON NAME	FAMILY	TYPE
Einadia polygonoides		CHENOPODIACEAE	H
Einadia trigonos		CHENOPODIACEAE	H
Eleocharis pusilla	Rush	CYPERACEAE	A
Elymus scaber var. scaber		POACEAE	G
Epilobium hirtigerum	Willow Herb	ONAGRACEAE	H
Eragrostis leptostachya	Love Grass	POACEAE	G
Eriochloa pseudoacrotricha	Early Spring Grass	POACEAE	G
Eucalyptus amplifolia	Cabbage Gum	MYRTACEAE	T
Eucalyptus beyeri		MYRTACEAE	T
Eucalyptus moluccana	Grey Box	MYRTACEAE	T
Eucalyptus tereticornis	Forest Red Gum	MYRTACEAE	T
Fimbristylis dichotoma		CYPERACEAE	A
Geranium homeanum		GERANIACEAE	H
Glycine tabacina		FABACEAE	H
Haloragis heterophylla	Tootweed Herb	HALORAGACEAE	H
Isolepis platycarpa	Club Rush	CYPERACEAE	A
Juncus continuus x usitatus	Common Rush	JUNCACEAE	A
Juncus homalocaulis		JUNCACEAE	A
Juncus usitatus		JUNCACEAE	A
Lythrum hissopifolia	Lesse Loosestrife	LYTHRACEAE	H
Melaleuca linariifolia		MYRTACEAE	T
Melaleuca styphelioides		MYRTACEAE	T
Microlaena stipoides		POACEAE	G
Omalanthus populifolius	Bleeding Heart	EUPHORBIACEAE	H
Ottelia ovalifolia		HYDROCHARITACEAE	A
Oxalis perennans		OXALIDACEAE	H
Paspalum distichum		GRAMINEAE	A
Persicaria decipiens	Slender Knotweed	POLYGONACEAE	H
Persicaria lapathifolia	Pale Knotweed	POLYGONACEAE	A
Phragmites australis	Common Reed	POACEAE	A
Phyllanthus virgatus	Spurge	EUPHORBIACEAE	H
Pittosporum undulatum	Pittosporum	PITTOSPORACEAE	T
Plantago gaudichaudii	Narrow Leaf Plantain	PLANTAGINACEAE	H
Plantago varia		PLANTAGINACEAE	H
Polymeria calycina		CONVOLVULACEAE	H
Portulaca oleracea	Pigweed	PORTULACEAE	H
Pratia concolor		LOBELIACEAE	H
Ranunculus lappaceus	Common Buttercup	RANUNCULACEAE	H
Schoenoplectus validus	River Club Rush	CYPERACEAE	A
Sporobulus creber		POACEAE	G
Themeda australis	Kangaroo Grass	POACEAE	G
Triglochin procera		JUNCAGINACEAE	A

Botanical Name	Common Name	Family	Type
Typha domingensis		TYPHACEAE	A
Typha orientalis	Bulrush	TYPHACEAE	A

2.9.1 CHANNEL REVEGETATION

Following flood mitigation works revegetation of the realigned creek embankments has occurred according to guidelines established by Andrews Neil in 1993. Drought conditions and high levels of vandalism (pulling out plants) have resulted in very slow rates of revegetation.

Casuarina glauca is the most widely used species, planted on the top of embankments, with some areas of *Eucalyptus amplifolia* where there is sufficient space beyond the creek embankment.

The lower embankment slopes are grassed with reinforced turf, while the upper embankment slopes were hydroseeded with rye corn, which died after the first season and was replaced by fescues and rye grasses. A diversity of weeds and exotic species have also spread in this area.

Plate 5 The rock lined concrete channel in Area III

Initial plantings of native grasses, *Dichanthium sericeum* (Queensland Blue Grass) and *Themeda australis* (Kangaroo Grass), have been recently carried out on the upper slopes of the embankment of Area III.

AREA I

AREA II

Quebec Street

Valparaiso Avenue

Metella Road

Claudia Street

METELLA ROAD PUBLIC SCHOOL

Metella Road

Memphis Cresent

GREYSTANES CREEK

Buffalo Place

Oklahoma Avenue

Denver Place

Kansas Place

Toongabbie Road

Gilba Road

X HILLS GOLF COURSE

Remnant Bushland Area (SEPP 19)
Eucalyptus amplifiolia
Casuarina glauca
Melaleuca linariifolia
Salix alba
Sedge Land
Reed Beds / Aquatic Macrophytes

Other Exotic Trees (Prunus, Quercus, Malus)

Woody Weed Infestation

N

Metres
0 20 40 60 80 100

GREYSTANES CREEK RESERVES
PLAN OF MANAGEMENT

SITE ANALYSIS
VEGETATION / WOODY WEEDS

A. BERNHARD & ASSOCIATES - LANDSCAPE & ENVIRONMENTAL CONSULTANTS

SCALE: 1:2000
DATE: 10/02/95
DRAWING: VW/01

AREA III

AREA IV

Metella Road

Metella Road

GREYSTANES CREEK

TOONGABBIE BAPTIST CHRISTIAN COMMUNITY SCHOOL

Toongabbie Road

Portia Road

Octavia Road

GIRRAWEEN PARK

Toongabbie

Remnant Bushland Area (SEPP 19)
Eucalyptus amplifolia
Casuarina glauca
Grevillea robusta
Melaleuca styphelioides
Salix alba
Reed Beds / Aquatic Macrophytes

Other Exotic Trees (Jacaranda, Quercus)

Metres
0 20 40 60 80 100

GREYSTANES CREEK RESERVES PLAN OF MANAGEMENT

SITE ANALYSIS
VEGETATION / WOODY WEEDS

SCALE: 1:2000
DATE: 10/02/95
DRAWING: VW/02

A. BERNHARD & ASSOCIATES - LANDSCAPE & ENVIRONMENTAL CONSULTANTS

AREA V

AREA VI

AREA VII

Metella Road

Cornelia Road

Marcia Street

Valeria Street

Portico R

RAILWAY LINE

Premier Street

Station Road

Cecilia Street

Junia Avenue

BOWLING CLUB

Junia Avenue

Portico Parade

Wentworth Avenue

Aurelia Street

The Portico

TOONGABBIE RAILWAY STATION

Cox Lane

Cooyong Cresent

- Remnant Bushland Area (SEPP 19)
- Eucalyptus amplifiolia
- Casuarina glauca
- Grevillea robusta
- Salix alba
- Reed Beds / Aquatic Macrophytes
- Woody Weed Infestation

Metres

0 20 40 60 80 100

GREYSTANES CREEK RESERVES
PLAN OF MANAGEMENT

SITE ANALYSIS
VEGETATION / WOODY WEEDS

SCALE: 1:2000

DATE: 10/02/95

DRAWING: VW/03

A. BERNHARD & ASSOCIATES - LANDSCAPE & ENVIRONMENTAL CONSULTANTS

2.10 WEEDS AND EXOTICS

Exotic species dominate many areas of the site. Grassland weeds in particular are prevalent. Selective grazing of native grasses, which had attracted settlers to this area, resulted in pastures being invaded by weeds of Mediterranean and South African origin. Later introduced pasture grasses added to this change.

The channel banks support many weeds with seed sources upstream, such as Spear Thistle and Paddy's Lucerne. Woody weeds, such as Privets, predominate under the Casuarina glauca canopy. The heaviest concentrations of weeds occurs north of the railway line, with climbers such as Balloon Vine and Morning Glory covering the understorey and threatening the canopy. Some of the exotic species are benign and are acceptable as components of the reserve and creek bank areas (eg *Chloris gayana* and *Plantago lanceolata*).

The following list shows the species and distribution of weeds and exotic plants on the site:

Botanical Name	Common Name	Family	Area Present						
			I	II	III	IV	V	VI	VII
Vines / Climbers									
Anredera cordifolia	Anredera	BASELLACEAE	♦						♦
Araujia hortorum	Moth Vine	ASCLEPIDACEAE	♦						
Cardiospermum grandiflorum	Balloon Vine	SAPINDACEAE							♦
Ipomoea indica	Blue Morning Glory	CONVOLVULACEAE							♦
Woody Weeds									
Ligustrum lucidum	Large Leafed Privet	OLEACEAE	♦						♦
Ligustrum sinense	Small Leafed Privet	OLEACEAE	♦						♦
Lycium ferocissimum	African Boxthorn	SOLANACEAE	♦						
Rosa sp	Briar	ROSACEAE	♦						
Herbs / Grasses									
Apium graveolens	Celery	APIACEAE	♦	♦			♦		
Avena sterilis	Wild Oat	POACEAE		♦	♦	♦			
Bidens pilosa	Cobblers Peg	ASTERACEAE	♦						♦
Brassica fruticulosa	Twiggy Turnip	CRUCIFERAE		♦	♦	♦			
Briza minor	Shivery Grass	POACEAE	♦				♦		♦
Bromus catharticus	Prairie Grass	POACEAE	♦						
Chenopodium album	Fat Hen	CHENOPODIAEAE	♦	♦	♦	♦	♦	♦	
Chloris gayana	Rhodes Grass	POACEAE	♦	♦					
Cirsium vulgare	Black Thistle	ASTERACEAE	♦	♦	♦	♦			
Foeniculum vulgare	Fennel	APIACEAE	♦	♦					♦
Kickxia elatine	Toadflax	SCROPULARIACEAE	♦						
Juncus acutus	Spiny Rush	JUNCACEAE	♦						
Juncus articulatus		JUNCACEAE	♦						
Juncus capillaceus		JUNCACEAE				♦			
Juncus capensis		JUNCACEAE	♦						

Botanical Name	Common Name	Family	Area Present						
			I	II	III	IV	V	VI	VII
Herbs / Grasses									
Juncus cognatus		JUNCACEAE	♦						
Opuntia stricta	Prickly Pear	CACTACEAE	♦						
Lactuca serriola	Prickly Lettuce	ASTERACEAE		♦	♦				
Myrsiphyllum asparagoides	Bridal Creeper	LILIACEAE	♦						
Paspalum dilatatum	Paspalum	POACEAE	♦					♦	♦
Pennisetum clandestinum	Kikuyu	POACEAE	♦	♦	♦	♦	♦	♦	♦
Phalaris tuberosa	Phalaris	POACEAE	♦	♦					
Plantago lanceolata	Plantain	PLANTAGINACEAE	♦	♦	♦	♦	♦		♦
Plantago major	Plantain	PLANTAGINACEAE		♦	♦	♦	♦		
Raphanus raphanistrum	Wild Radish	CRUCIFERAE		♦	♦	♦			
Ricinus communis	Castor Oil Plant	EUPHORBIACEAE							♦
Rorippa nasturtium-aquaticum	Watercress	CRUCIFERAE	♦	♦			♦	♦	
Rumex crispus	Curled Dock	POLYGONACEAE	♦	♦	♦				
Rumex obtusifolius	Broad Leaf Dock	POLYGONACEAE	♦	♦					♦
Senecio madagascariensis	Fireweed	ASTERACEAE	♦				♦		
Sida rhombifolia	Paddy's Luceme	MALVACEAE	♦	♦	♦	♦	♦	♦	♦
Taraxacum officinale	Dandelion	ASTERACEAE	♦						
Trifolium repens	White Clover	FABACEAE	♦	♦	♦				
Verbena bonariensis	Purple Top	VERBENACEAE	♦						♦

2.11 WILDLIFE HABITAT

The highly disturbed and modified vegetation of the reserves limits the wildlife habitat potential of the area. Nevertheless pockets of dense weed growth supply excellent habitat for small animals and birds. The site still supports a large range of birds (B. de Bellin, 1994), a few fish, amphibians, reptiles and one species of mammal (Laxton, 1993), as listed below:

Scientific Name	Common Name	Native / Exotic	Area Present						
			I	II	III	IV	V	VI	VII
Birds									
Corvus coronoides	Australian Raven	N		♦	♦				
Anas superciliosa	Black Duck	N					♦	♦	
Elanus notatus	Black Shouldered Kite	N		♦	♦				
Turdus merula	Blackbird	E		♦	♦		♦	♦	
Accipiterfasciatus	Brown Goshawk	N	♦	♦					
Pycnootus jocosus	Bul Bul	E	♦	♦	♦		♦	♦	
Aridotheres tristis	Common Mynah	E	♦	♦	♦	♦	♦	♦	♦
Sturnus vulgaris	Common Starling	E	♦	♦	♦	♦	♦	♦	♦
Geophaps lophotes	Crested Pigeon	N		♦	♦	♦	♦	♦	

Scientific Name	Common Name	Native / Exotic	Area Present						
			I	II	III	IV	V	VI	VII
Birds									
Columba livia	Domestic Pigeon	E		♦	♦				
Platycercus eximius	Eastern Rosella	N		♦	♦				
Hirundo ariel	Fairy Martin	N	♦	♦	♦	♦			
Cacatua roseicapilla	Galah	N	♦	♦	♦	♦			
Erythrura gouldiae	Gold Finch	E		♦	♦				
Cracticus torquatus	Grey Butcherbird	N	♦						
Anas gibberifrons	Grey Teal	N		♦					
Passer domesticus	House Sparrow	E	♦	♦	♦	♦	♦	♦	♦
Gymnorhina tibicen	Magpie	N				♦	♦	♦	
Anseranas semipalmata	Magpie Goose	N	♦						
Manorina melanocephala	Noisy Miner	N	♦			♦	♦	♦	♦
Grallina cyanoleuca	Pee Wee	N	♦	♦	♦	♦	♦	♦	♦
Strepera graculina	Pied Currawong	N	♦	♦	♦		♦	♦	
Trichoglossus haematodus	Rainbow Lorikeet	N				♦			
Psephotus haemayonotus	Red Rumped Parrot	N				♦			
Anthochaera carunculata	Red Wattle Bird	N	♦						
Lonchura punctulata	Spice Finch	E		♦	♦				
Geopelia cuneata	Spotted Dove	E	♦	♦	♦	♦	♦	♦	♦
Malurus cyaneus	Superb Blue Wren	N	♦	♦	♦				
Hirundo neoxena	Welcome Swallow	N		♦	♦	♦	♦	♦	
Ardea Novaehollandiae	White Faced Heron	N	♦						
Lichenostomus penicillatus	White Plumed Honeyeater	N	♦						
Rhipidura leucophrus	Willie Wagtail	N	♦	♦	♦	♦	♦	♦	♦
Acanthiza nana	Yellow Thornbill	N	♦						
Acanthiza chrysorrhoa	Yellow Rumped Thornbill	N	♦						
Mammals									
Hydromys chrysogaster	Water Rat	N	♦						♦
Amphibians & Reptiles									
Limnodynastes peroni	Brown Striped Frog	N	♦						♦
Sphenomorphus quoyi	Water Skink	N	♦						♦
Fish									
Gambusia affinis	Mosquito Fish	E	♦	♦	♦	♦	♦	♦	♦

The woodland in the southern portion of the site contains the most continuous area of tree canopy and is furthest from houses, roads and other intrusions. A dense understorey, although composed mostly of weeds, offers the greatest wildlife habitat, particularly for small birds. The few mature trees, such as the Cabbage Gums provide valuable breeding sites for parrots.

Construction activity to form the realigned creek channel has resulted in a loss of the previous wildlife habitat. The aquatic habitat within the concrete invert is restricted due to the absence of any soil substrate and consequently aquatic vegetation. This habitat is also subjected to extensive exposure to sun, resulting in extreme temperature fluctuations and algae growth, which further limits the re-establishment fish and amphibians. The *Gambusia affinis* is tolerant of polluted water (P. Kravchenko).

The channel has become intensively used as a pedestrian access way and bike path, limiting future wildlife habitat potential.

2.12 ECOLOGICAL SIGNIFICANCE

Less than 5% of Cumberland Plain natural bushland remains and much of that is not adequately protected (Benson & Howell, 1990). Greystanes Creek Reserves contain small areas of remnant creek vegetation with species considered rare or vulnerable in Western Sydney (Benson & McDougall, 1991), reinforcing the ecological significance and high conservation value of the site.

The riparian vegetation also serves to improve water quality in the catchment.

The wildlife of the district depends on the presence of adequate habitat and the site forms part of a potential wildlife corridor. Consequently it is an important site for the conservation of local biodiversity.

The regeneration of those local indigenous species should form the basis for an ecological restoration of the site.

Without intervention to stop further degradation these pockets of bushland will slowly disappear. Due to the high number of external factors impacting on the site, these areas cannot be ecologically self-sustaining and have to be supported by appropriate management.

2.13 INFRASTRUCTURE / ELEMENTS

Infrastructure and elements within the site are:

- The new rock lined concrete channel, stretching from Area II to the first part of Area V.
- A concrete path 2.4 m wide, for bike and pedestrian traffic, follows the new creek work on the eastern side, from the southern extent of the rock lined concrete creek channel to Octavia Road in the north. Another concrete path 1.2 m wide connects Memphis Crescent to the northern end of Oklahoma Avenue. A new concrete path 2.4 m wide connects Buffalo Place with John Silverthorne Reserve.
- Two hardwood bridges provide access over creek lines adjacent to Fox Hills Golf Course. A timber bridge spans the creek at the northern end of Oklahoma Avenue.
- A network of informal dirt tracks is located in Area I, whereas in Areas 5 & 6 a single track runs north-south.
- Weldmesh fences occur along the boundary with Fox Hills Golf Course in Area I and between Girraween Park and the creek alignment in Area IV.
- Colourbond fences separate residential properties from the newly created channel alignment in Areas III and IV. Residential property boundaries in Areas I, II and VI have a variety of fencing.

- Post and rail fences separate John Silverthorne Reserve from Oklahoma Avenue and also run between Memphis Crescent and the concrete bridge at the northern end of Oklahoma Avenue. At Portia Road and Octavia Road post and rail fences provide safety railing around culverts and road intersections.
- In Area V along the southern end of Junia Avenue 3-strand wire fencing protecting revegetated areas.
- A line of hardwood fence posts remaining from farming in the area crosses the northern portion of Area I.
- Bicycle gates installed adjacent to John Silverthorne Reserve, access path from Buffalo Place and near the concrete bridge at the northern end of Oklahoma Avenue.
- Log vehicle barriers run along the western side of Oklahoma Avenue, from John Silverthorne Reserve to the timber bridge approach.
- Swings and minor play structures are located in John Silverthorne Reserve.
- One picnic table and benches are located between roadside carparks along Junia Avenue in Area V and another set in Area VI.
- A concrete slab near the western boundary of Area I indicates previous occupancy.

2.14 ACCESS AND CIRCULATION

The study area is located between the Western Railway Line and the Great Western Highway.

Public transport links exist from Toongabbie Railway station and along Metella Road by private bus. The Western Motorway (M4) and the Great Western Highway provide access to Toongabbie Road and Metella Road.

Streets intersecting the site and providing access points are Portia Road, Octavia Road, Cornelia Road and Portico Parade, while Junia Avenue, Memphis Crescent and Oklahoma Avenue have a direct street frontage to the reserves. Other access points exist from Buffalo Place, Metella Road near Lucretia Road and Girraween Park.

The dominant circulation pattern is along the reserves, generally to and from Toongabbie, with significant cross-creek movement in Area II between Memphis Crescent and Oklahoma Avenue and to a smaller extent in Area I between Buffalo Place and John Silverthorne Reserve.

Informal creek crossings occur in Area II, at the northern end of Memphis Crescent and opposite Lucretia Road, as a result of the general desire lines of many school children and mothers to schools and shops.

The bicycle track from Buffalo Place to Octavia Road links to Toongabbie Station. This track is a dual use path, 2.4 meters wide, for both bicycles and pedestrians, as well as providing truck access for creek maintenance.

The pathway crosses Portia Road, Octavia Road and Cornelia Road, without any pedestrian crossings.

A more random pattern of movement occurs in the track network in Area I.

2.15 VISUAL ANALYSIS

The most significant regional views are from Area I to Prospect Hill. The treed knoll at Quebec Street to the west of the site can be seen from both Area I and Area II. Otherwise the sites visual character is introspective, with internal views dominated by the creek axis. Within the site the creek provides a strong visual focus which is emphasised by the site's linearity.

Plate 6 The main visual focus of the site is provided by the creek

The Areas I to IV are generally not perceived from beyond the immediate vicinity, except from the streets intersecting the site, whereas Areas V and VI are generally more visible, as a result of streets running parallel and adjacent to the creek.

The greatest diversity of visual experience of enclosure and framed internal views is available in Area I, because of the presence of remnant canopy creating a variety of spaces and openings.

Strong containment is felt in areas III and IV, due to the narrowness of the site, regularity and continuity of fencing, coupled with an absence of visual stimulus.

Areas V and VI are more open to their surroundings and feel visually simple and calm, while the density of the vegetation in Area VII creates visual intricacy.

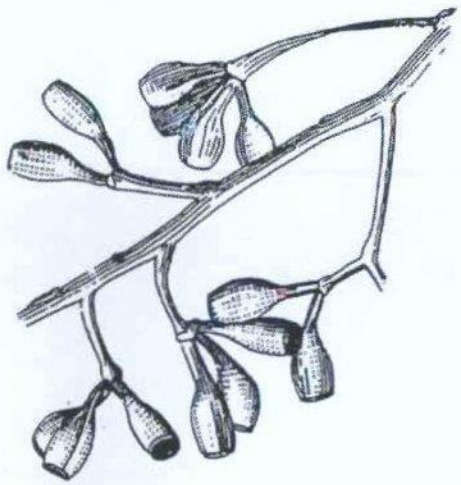
The following visually prominent trees are significant landmarks:

- Melaleuca styphelioides at the entrance to the reserve on the southern side of Octavia Rd.

Plate 7 Melaleuca styphelioides near Octavia Road

- Eucalyptus amplifolia in the western portion of Area I

Prominent vegetation is mapped on the Vegetation Analysis Drawings No. VW1, VW2, VW3, pages 27, 29, 31, respectively.



2.16 REGIONAL CONTEXT

The sites regional setting is midway between the headwaters of Greystanes Creek and the Upper Parramatta River. It is part of a potential regional recreational network comprising walking tracks and bicycle paths from Prospect Hill to Parramatta Park along Greystanes and Toongabbie Creeks.

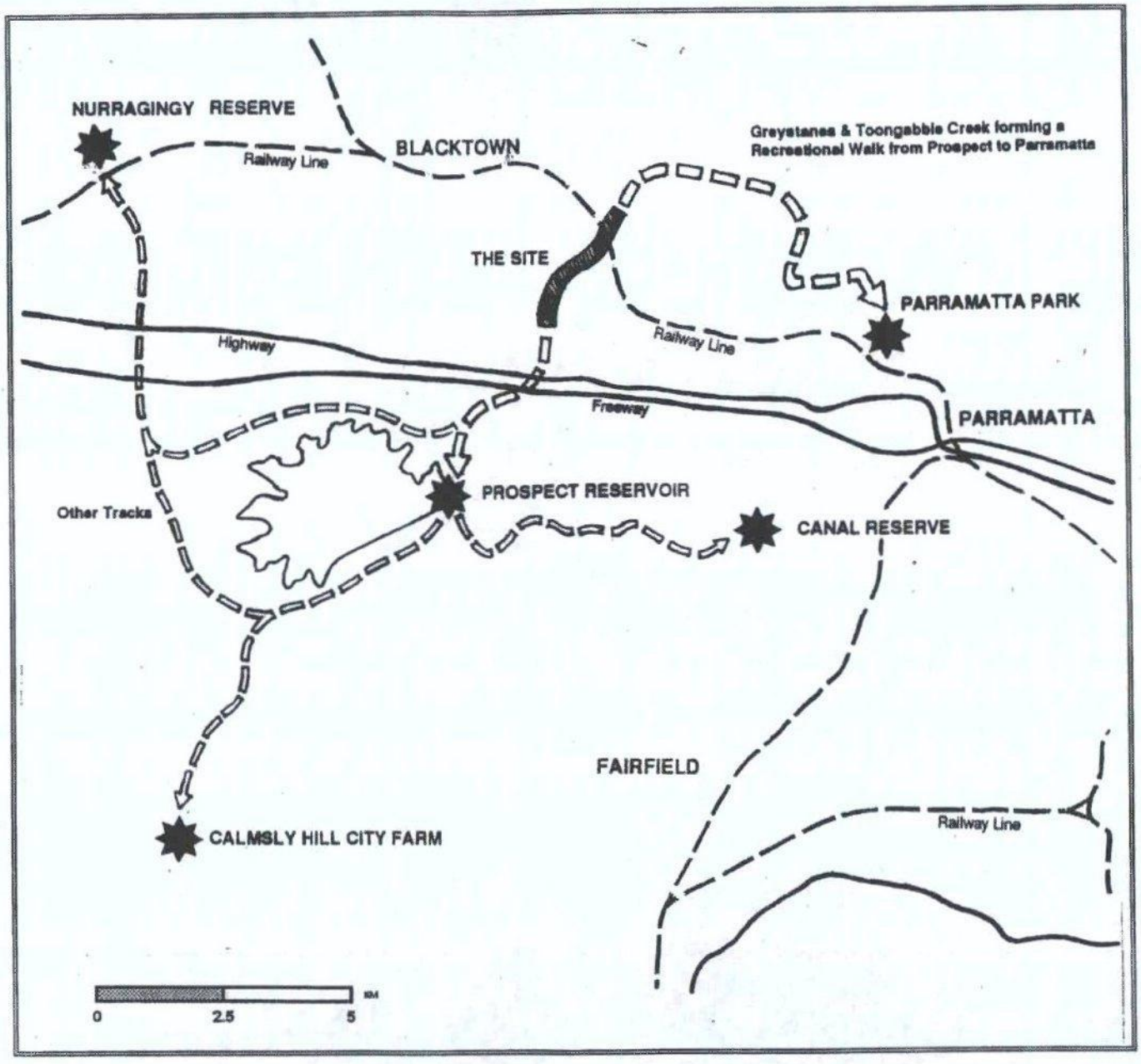


Figure 5 The regional context of the site

AREA I

AREA II

Quebec Street

Valparaiso Avenue

Metella Road

Claudia Street

METELLA ROAD PUBLIC SCHOOL

Metella Road

Memphis Cresent

GREYSTANES CREEK

Toongabbie Road

Buffalo Place

Oklahoma Avenue

Denver Place

Kansas Place

Gilba Road

FOX HILLS GOLF COURSE

- Major Access Points
- Access from Properties
- Creek Crossings - Informal
- Bridges - Timber / Concrete
- Bike Gates
- Path - Concrete
- Fence - Wire
- Fence - Timber / Metal
- Fence - Post and Rail
- Fence - Galvanised Tubing
- Fence - Log Barriers
- Fence - Old Timber Posts
- Electricity Transmission Line

N

Metres

0 20 40 60 80 100

GREYSTANES CREEK RESERVES PLAN OF MANAGEMENT

SITE ANALYSIS ACCESS / INFRASTRUCTURE

SCALE: 1:2000

DATE: 10/02/95

AREA III

AREA IV

Metella Road

Metella Road

GREYSTANES CREEK

TOONGABBIE BAPTIST CHRISTIAN COMMUNITY SCHOOL

Toongabbie Road

Portia Road

GIRRAWEEN PARK

Octavia Road

Toongabbie

- Major Access Points
- Access from Properties
- Proposed Access Point
- Creek Crossings - Informal
- Path - Concrete
- Fence - Wire
- Fence - Timber / Metal
- Fence - Post and Rail
- Fence - Galvanised Tubing
- Council Boundary

N

Metres

0 20 40 60 80 100

GREYSTANES CREEK RESERVES PLAN OF MANAGEMENT

SITE ANALYSIS
ACCESS / INFRASTRUCTURE

SCALE: 1:2000

DATE; 10/02/95

AREA V

AREA VI

AREA VII

Metella Road

Cornelia Road

Marcia Street

Valeria Street

Portico Rd

Premier Street

RAILWAY LINE

Station Road

GREYSTANES CREEK

Cecilia Street

Junia Avenue

BOWLING CLUB

Portico Parade

Wentworth Avenue

Aurelia Street

The Portico

TOONGABBIE RAILWAY STATION

Cox Lane

Cooyong Cresent

- Major Access Points
- Access from Properties
- Creek Crossings - Informal
- Track - Dirt / Gravel
- 90° Car Parking Bays
- Fence - Wire
- Fence - Galvanised Tubing
- Picnic Tables & Seats
- CWA Country Womens Association B.
- GG Girl Guide Building
- Council Boundary
- Path - Concrete

Metres

0 20 40 60 80 100

GREYSTANES CREEK RESERVES
PLAN OF MANAGEMENT

SITE ANALYSIS
ACCESS / INFRASTRUCTURE

SCALE: 1:2000

DATE: 10/02/95

DRAWING: A/03

2.17 STATEMENT OF SIGNIFICANCE

"The role of bushland in enriching our lives and enhancing our suburbs, as well as for its own intrinsic values, is beginning to be generally appreciated. History shows that if our bushland is taken for granted it will be quietly taken from us."

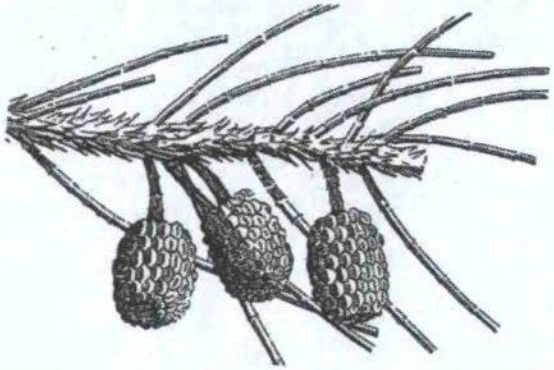
Benson and Howell

Clearing for residential, agricultural, recreational, flood control activities and stream stabilisation has significantly reduced the ecological values of the site. Nevertheless a high level of degradation does not prevent the area from being highly valued by local residents and providing significant local habitat.

The most significant or unifying element on the site is the creek itself, although it varies greatly in landscape character, habitat values and visual quality. The fundamental value of the creek as an ecological, recreational and visual resource is the basis for the sites future.

The site is significant for the following reasons:

- It provides a range of ecological values, educational resources and recreational opportunities.
- Unlike the areas of sandstone country, less useful to settlement, which are protected by National Parks, few areas of Wiannamatta Shale country and its representative flora and fauna have been protected. This places further emphasis on the need to protect and enhance those pockets that do remain, such as this site. Remnants of urban bushland are a vital part of Sydney's natural heritage.
- It is a rare remnant of the Riverine Floodplain community once widespread in the area.
- The site's value as open space is heightened by the absence of comparable sites in the immediate vicinity.
- It provides an inherent active and passive recreation resource greater than many local playgrounds.
- It provides a break in the urban sprawl and softens the visual impact of the built environment.
- It gives definition and identity to the local area.
- Species previously unrecorded in this area, typically occurring in micro habitats, enhance the site's scientific and ecological significance
- It has a potential for providing a link with other areas of open space, particularly as a wildlife corridor.
- It has potential for improving water quality through establishment of a riparian zone as part of a vegetation conservation and management strategy within the Upper Parramatta River Catchment.



3. EXISTING USES

3.1 COMMUNITY AND SURVEY RESPONSES

3.1.1 COMMUNITY LIAISON

Community liaison has been an integral part of the development of this Plan of Management. Following initial discussion at meetings of the Greystanes Creek Management Committee, Councils, Trust and other organisations, a questionnaire was prepared to canvas residents' opinions.

A letterbox drop of approximately 900 households in Toongabbie and Girraween was followed by door knocking of households in the area immediately surrounding the site, to collect completed questionnaires and to facilitate general discussion of site issues, primarily to raise the profile of the site. The response rate of fully completed questionnaires was 14%.

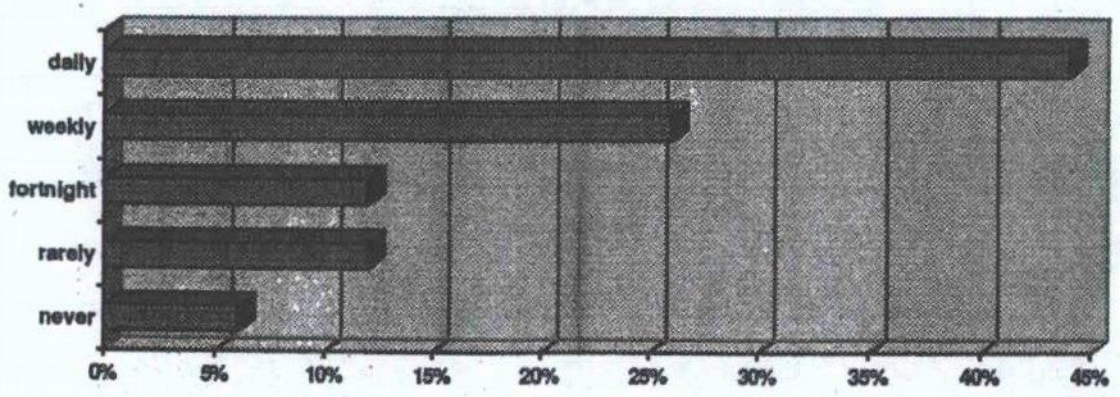
Concurrently, visits to Metella Road School, close to the largest area of open space in this study were planned to initiate discussion with a broad range of students in classes 2-5. Several hundred students responded showing a generally high level of environmental concern. Pollution control, wildlife and vegetation rehabilitation and provision of better recreational opportunities were key issues.

In the general resident survey the aims were to establish patterns and levels of usage, gauge concerns and problems relating to the site and seek input into their resolution as well as ideas for general improvements.

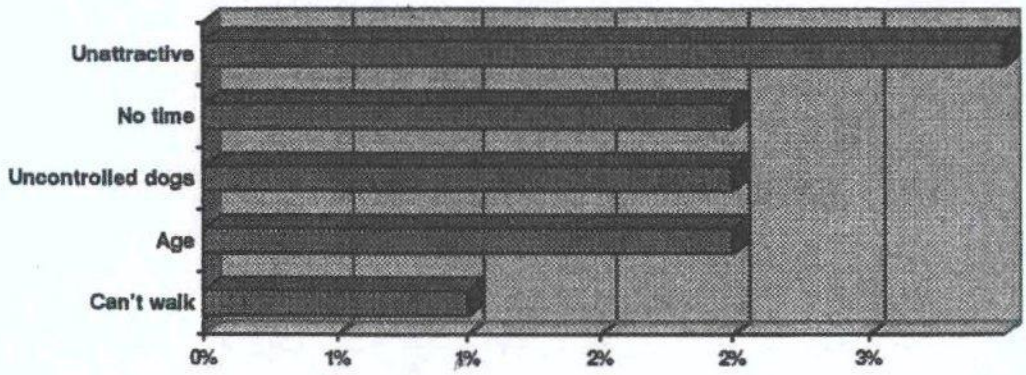
The questionnaire responses and extensive general discussion reveal a fairly high level of concern for the creek and its areas of open space among those who know the site well, generally decreasing with distance from the creek.

3.1.2 QUESTIONNAIRE RESPONSES AND STATISTICS

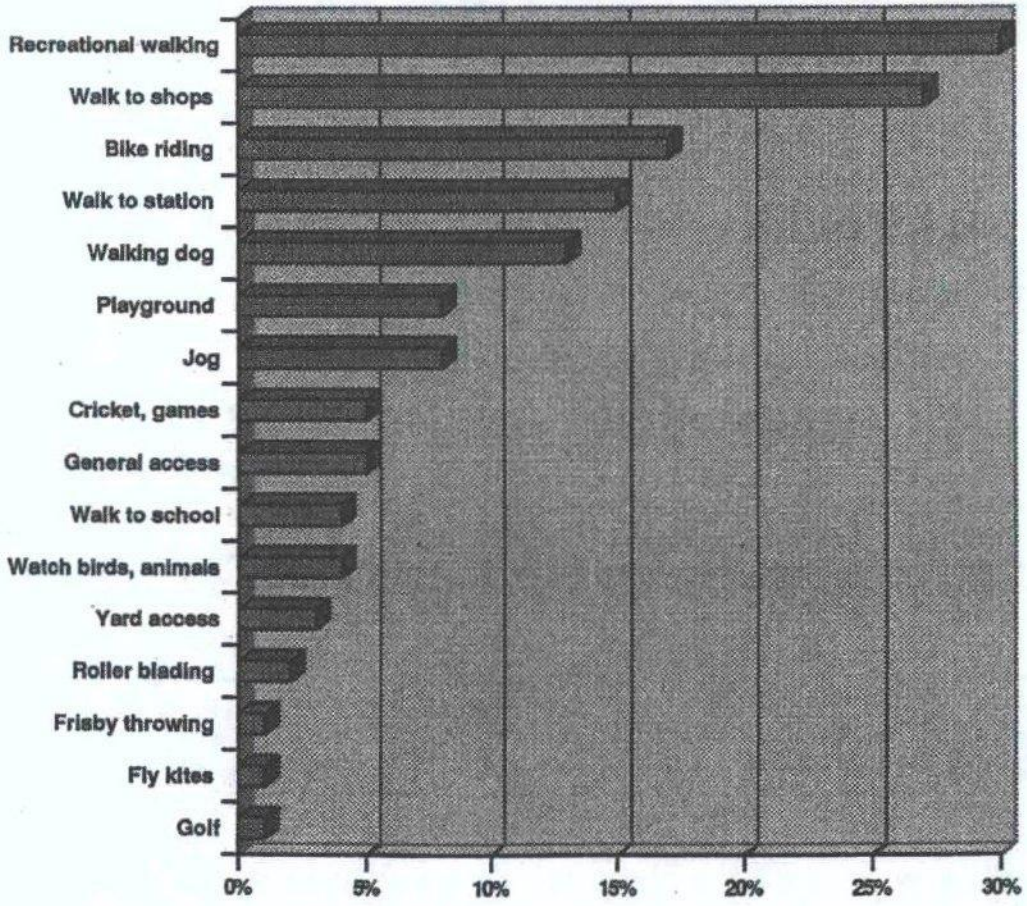
How often do you use the area of open space around Greystanes Creek?



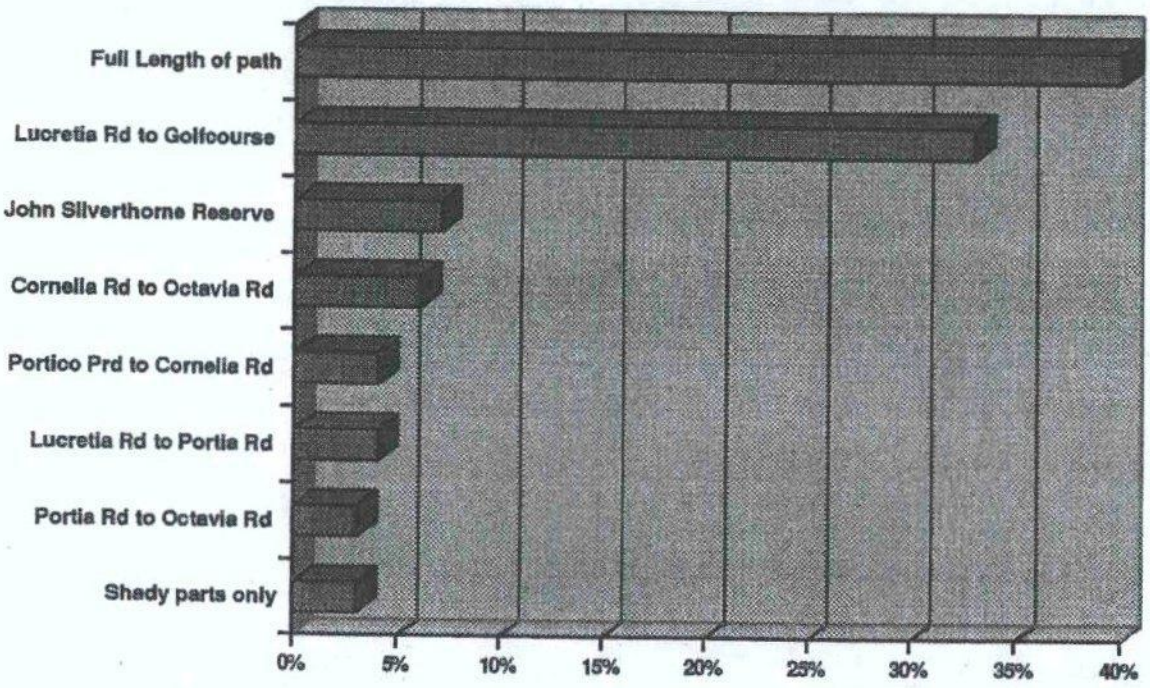
If you do not use the open space around Greystanes Creek, what are the reasons? (10%)



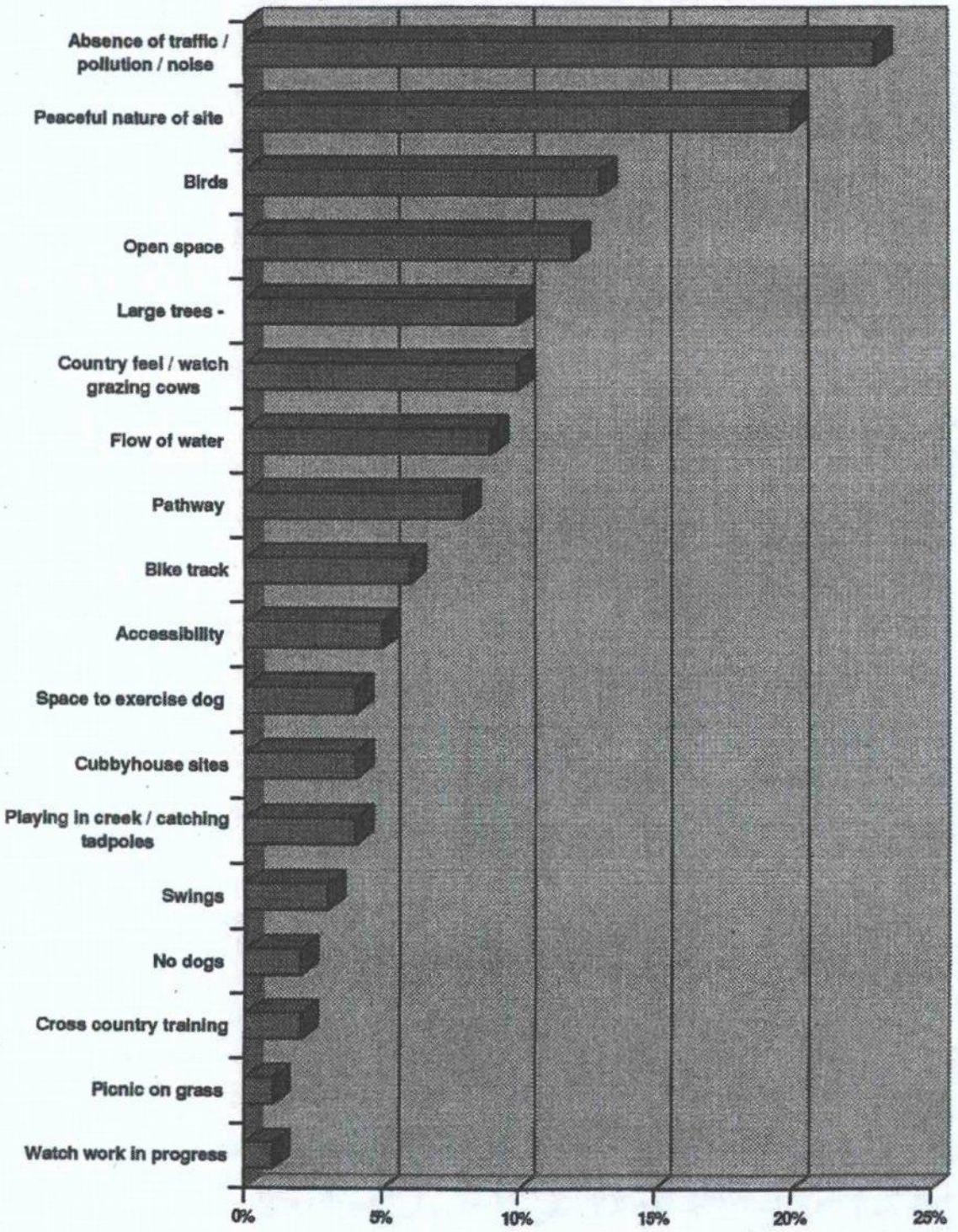
What activities do you do in this area, including walk to work and access through etc.?



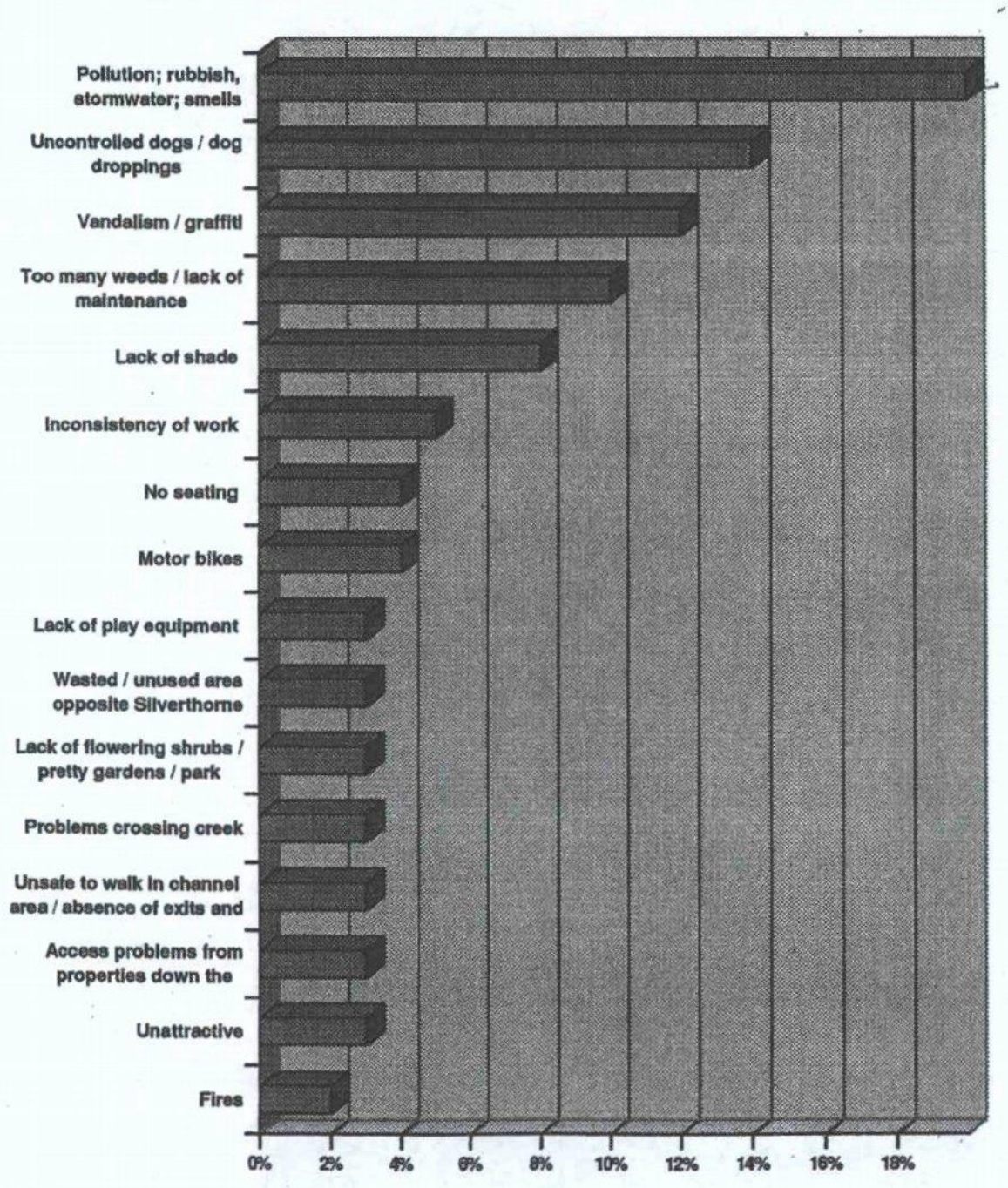
Where in the open space area do you do these activities?



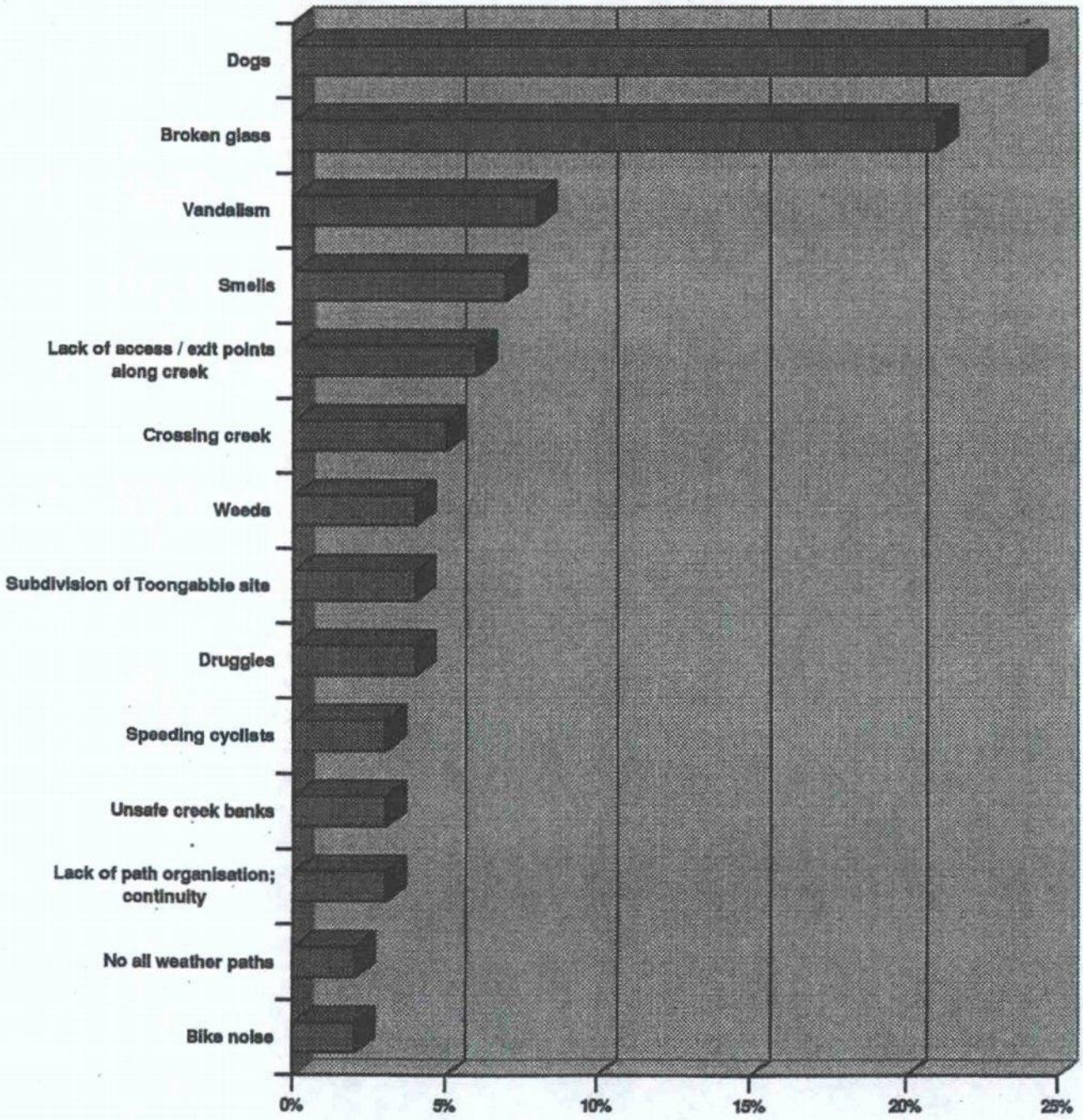
What are the specific features which attract you to the site?



What detracts from your enjoyment of the site?

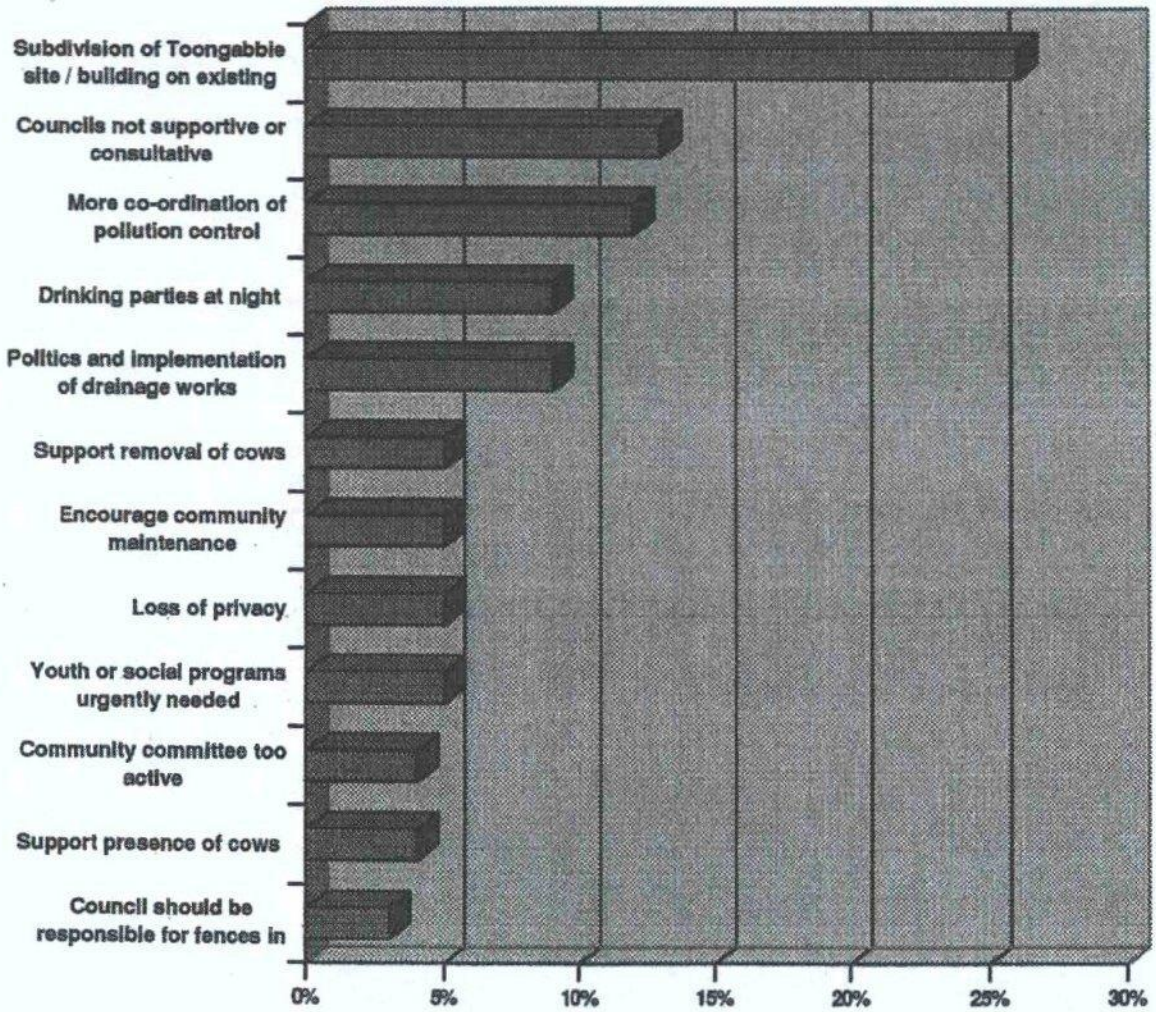


Do you have any problems using the open space and what are they?

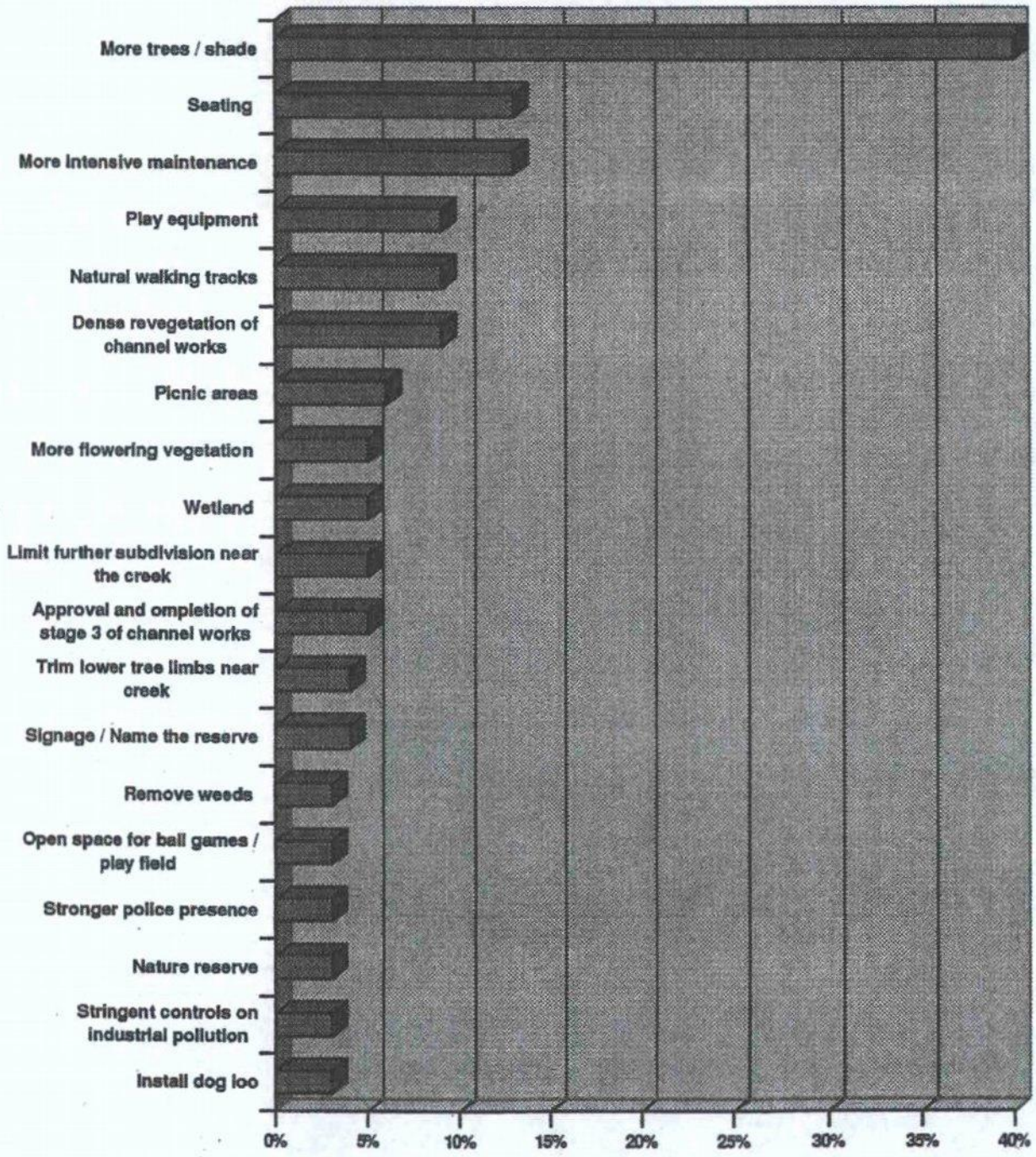


Are there any social or political issues in regard to Greystanes Creek and its open space that you feel strongly about?

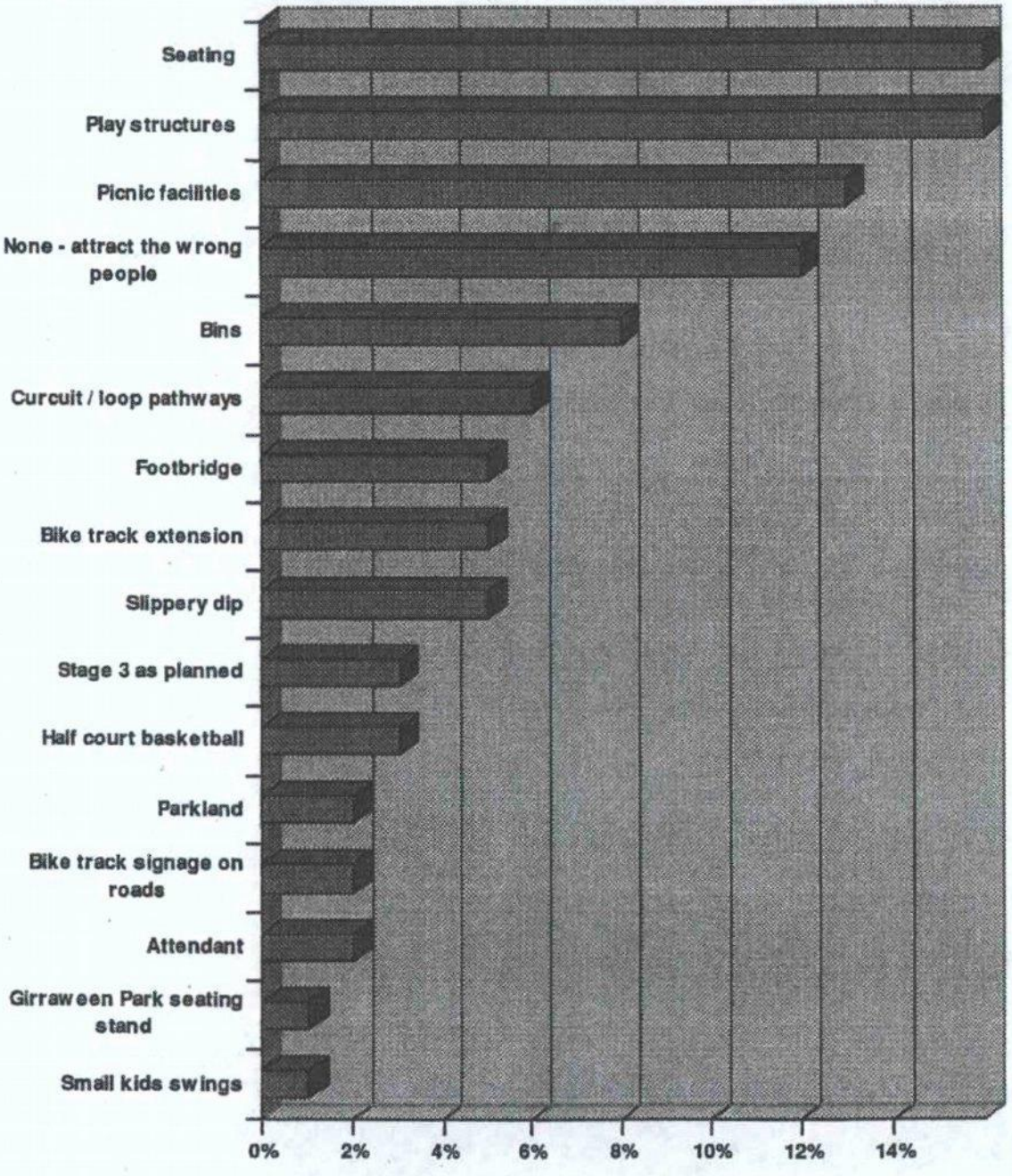
48% of respondents commented



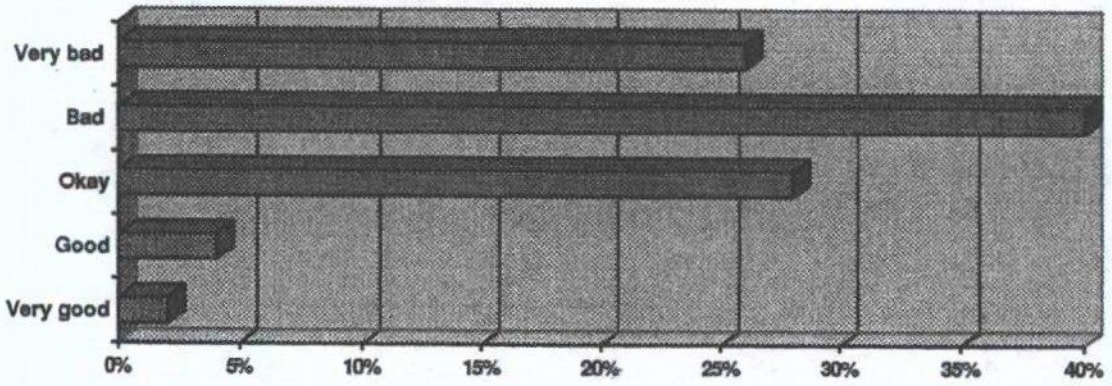
What ideas do you have to improve Greystanes Creek and the surrounding open space?



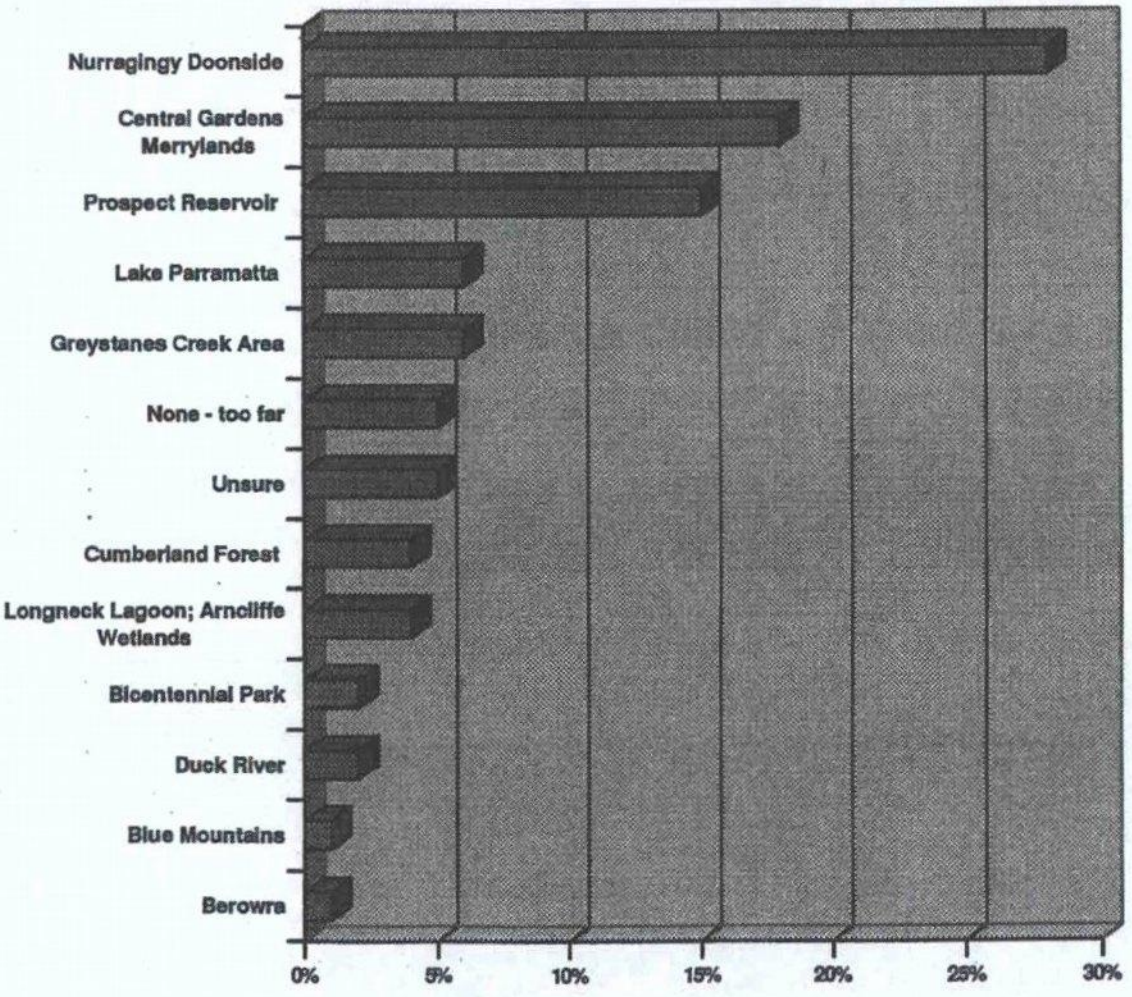
Would you like any facilities or equipment to be provided and what type?



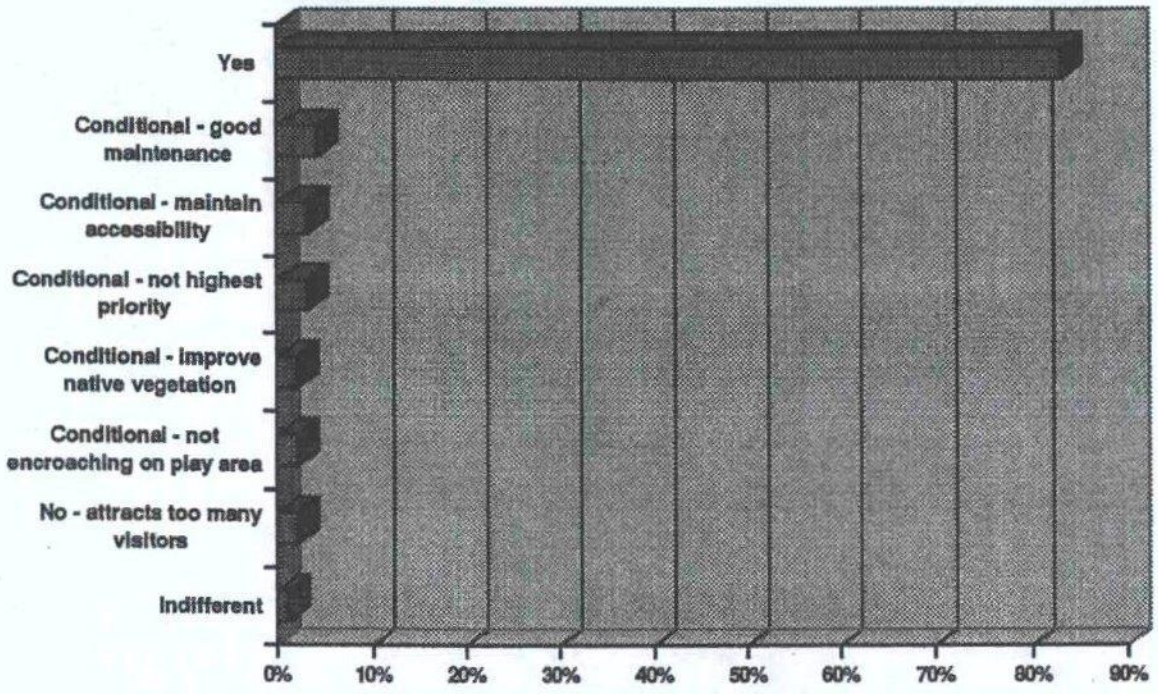
What are your feelings about the water quality of Greystanes Creek?



Where is the nearest nature reserve that you have visited?
75% of respondents commented



Would you like to see a nature reserve established within the site?



3.1.3 OVERVIEW OF QUESTIONNAIRE RESPONSES

The most unanimous response was the desire for a nature reserve to be established in Area I, although a broad diversity of examples visited showed the flexibility of this concept. Responses included not only nature reserves, but also mowed parkland not managed specifically as nature reserves, such as Central Gardens, Merrylands. Numerous conditional responses were given, such as the importance of proper maintenance, the need to regenerate vegetation and maintaining accessibility.

Water quality was generally not perceived to be very good based on a visual assessment, with a significant majority (66%) considering it to be bad or very bad. Stormwater, industrial and household pollution sources were often mentioned. Offensive smells and animals declining to drink the creek water were other benchmarks for peoples water quality assessment. Support for total catchment management principles was evident.

Most respondents were regular users of the creeks reserves, with a majority using it weekly or daily (70%).

Significant reasons for not using the reserves were lack of adequate shade or generally unattractive conditions and uncontrolled dogs.

Recreational walking was the highest category of use (30%), followed closely by walking to the shops and public transport, bicycle riding and walking dogs. General access, school access and yard access (12%), jogging (8%), use of the playground (8%) and bird watching (4%) were other significant uses, while a small number of respondents mentioned specific sporting and play activities (1-5%), such as cricket, golf, roller blading, kite flying, frisby throwing.

Activities were strongly concentrated along the full length of the path way (40%) and in the bushland Area I (33%), with very small percentages in individual sections of the pathway and the playground.

Absence of traffic noise and pollution and in particular the peaceful nature of the site were the strongest reasons for its use (43%). The presence of birds, large trees and flowing water also attracted users (30%). Open space, a country feeling and scope for unstructured play and the sites easy accessibility were other significant factors.

The need for more trees and shade was by far the most significant suggestion for site improvement (40%). A need for seating, more intensive maintenance, improved walking tracks, specific revegetation works in the channel area and play and picnic equipment were in the next category of priority (between 6-15%). A great diversity of more specific suggestions (1-5%) revealed the level of interest and concern shown for the site.

Requests for specific facilities highlighted the need for playground equipment (15%), seating (15%) and picnic facilities (13%), while concern was expressed (12%) that provision of facilities would attract the wrong people.

Of those who felt there were significant social or political issues relating to the site (48%), the strongest was the objection to future subdivision between the creek and Toongabbie Road opposite Gilba Road. Other issues were lack of adequate consultation, planning, allocation of resources and response to social issues by Councils.

3.2 RECREATION

The diversity of recreational use has been revealed in the questionnaire process.

The creek, particularly the presence of water and the inherent interest it provides, is the focus of the site's recreational attractions. The different spatial and landscape characteristics of the site add a diverse range of recreational opportunities.

The general linear nature of the site is conducive to goal directed bicycle riding and recreational walking.

Activities taking place along the full length are passive walking, access connections to shops, schools, work and public transport (Toongabbie Station), bike riding, walking dogs.

Sporting facilities in the immediate vicinity are Fox Hills Golf Course, sport fields for soccer, rugby, cricket at Girraween Park, the Bowling Club at Station Road Toongabbie, including playing fields at Metella Road Public School and Toongabbie Baptist Christian Community School.

Recreation patterns in specific areas are:

Area I John Silverthorne Reserve has a limited range playground equipment.

Recreation activities include bushland nature experience, informal play (adventure play, hideouts), interaction with creek ecology (collecting tapoles, catching insects for aquarium fish), bird watching, country experience (grazing cows - now gone), picnics, shade supply, drinking and smoking parties.

Area II Primary creek crossing from Blacktown to Holroyd Council sides over bridge. Informal creek crossings for access to schools and shops.

Recreation activities include informal kids play, informal and structured games near Memphis Crescent (frisby / ball throwing, kite flying, golf practice, cricket), country experience (cows - now gone), low bushland experience.

Area III Access from adjoining properties

Area IV Access to and from Girraween sports ground and Baptist school.

Area V Recreational activities are informal picnics, lunch spots for workers and shoppers.

Area VI Informal access and creek crossing from Marcia and Valeria Road to town centre and shops.

Recreational activities include informal picnics, lunch spots for workers and shoppers.

Area VII Under Portico Parade and railway bridge recreational activities include adventure play, hideouts, graffiti, drinking and smoking parties.

4. MANAGEMENT OBJECTIVES

4.1 CATCHMENT

- To rehabilitate, conserve and protect the natural environment.
- To encourage a regional approach to planning, design, conservation and maintenance of open space.
- To encourage community participation.
- To achieve an informed and positive attitude to the environment.
- To provide and maintain recreation opportunities based on community needs and within budget.
- To encourage the development of a Catchment Management Plan.
- To develop a management approach which addresses Catchment and Reserve based issues and outlines prioritised actions.

4.2 SITE

- To rehabilitate the creek to as natural an ecosystem as possible, promoting natural regeneration and the reintroduction of indigenous plants and animals.
- To enhance the visual appeal, landscape character and scenic quality.
- To provide the area with appropriate recreational experiences.
- To identify the range of management issues and reserve values which should be addressed.
- To assess the current management actions in the Reserve and determine their overall value.
- To prepare immediate long and medium term strategies and identify specific actions, costs and responsibilities.
- To seek efficient provision and allocation of resources and services.
- To provide a workable basis for ongoing management of this site.

4.3 CONSTRAINTS AND OPPORTUNITIES

4.3.1 CONSTRAINTS

- Increasing urbanisation and development of catchment, particularly pressures form medium density development.
- Stormwater pollution from industry, quarry, urban runoff and rubbish
- Large areas of light industry with extensive hard surfaces creating excessive runoff
- Increased access and usage levels on site resulting in increased pressure
- Adverse social conditions promoting vandalism and abuse of the site

- Site is narrow and long with a large perimeter exposed to urban development
- Continuity limited by Fox Hills Golf Course in the south
- Most of the original vegetation has been lost
- Loss of biodiversity in both ecosystem types and species, due to land modification and vegetation clearing.
- Remainder of vegetation is in a degraded condition and fragmented.
- Limit on height of vegetation within the realigned creek channel so as not to obstruct water flow.
- Colonisation of weeds along the creek line
- Natural drainage patterns have been highly modified
- Presence of uncontrolled dogs and dog faeces.
- Absence of shade, especially in Areas II to IV.
- Absence of seating or resting facilities
- Absence of lighting for safety reasons
- Limited exit points from the fenced creek channel in Area III causing insecurity and vulnerability
- Limited access across the creek in Areas I, II and V.
- Some backyards and continuous fence lines present unattractive visual context.
- Insufficient funding for environmental rehabilitation.

4.3.2 OPPORTUNITIES

- Regional connections with other open space corridors (Toongabbie Creek, Eastern Creek, Horsley Park, Lower Canal Corridor)
- Potential to improve water quality by revegetation and use of wetlands
- Reducing floodwaters by improved management of the upper catchment.
- Provision of passive recreation within a naturalistic environment
- The use of landscape design to enhance the sense of place and create a stronger landscape character
- Improvement of visual context, fences, backyards, structures.
- Re-establishing a variety of ecological systems and vegetation types, to increase biodiversity
- Conservation of Cumberland Plain flora and fauna within a recognised nature reserve.
- Re-establishing wildlife habitat
- The protection of remnant bushland under State Environmental Planning Policy (SEPP 19) by both Councils
- The interpretation of the site's history and rural character.

- The establishment of a stimulating play areas with a variety of material and structures. Possible theming to relate to the nature reserve
- The provision of low key facilities, such as seating, resting and picnic areas.
- The creation of a buffer zone of vegetation adjacent to the creek channel, especially at the rear of properties in Area III.
- Scope for community education and increased educational opportunities for schools.
- Involvement of schools and community organisations to increase sense of ownership.
- Voluntary rangers to monitor and protect the site

5. MANAGEMENT ISSUES AND STRATEGIES

Although the issues outlined below have been grouped to highlight particular problems and relevant strategies, they are largely interdependent. For example, issues related to habitat, soil erosion, stormwater and visual amenity are very largely ameliorated by the presence of appropriate vegetation patterns. The inter-relationship between vegetation and stream quality is outlined in the "Rivercare" evaluation strategies, issued by the Department of Water Resources.

While this listing of issues serves to highlight problems associated with the site, the fundamental value of the creek as an ecological, recreational and visual resource is the basis for the site's future. This focus must be optimised, emphasising an effective bush regeneration program in Areas I and II in particular, and gradual rehabilitation of vegetation along the whole length of the creek.

5.1 RECREATION MANAGEMENT

Issues:

- The management of this site should acknowledge the recreational opportunities of regional walking and bicycle tracks
- The kind of recreational experiences and qualities present (quietness, absence of traffic, tranquillity of site, country feeling) need to be reinforced and enhanced
- The linear nature of the site is conducive to directed bicycle riding and recreational walking, which restricts variety of experience and recreational scope.
- Increasing residential densities will result in greater recreational demand.
- The need for bushland for education and recreation will be a prime need in the future.
- The remaining vegetation is under much greater pressure due to the loss of large tracts of original dense vegetation available for adventure play before the re-alignment of the creek line
- Current playground facilities are inadequate, lacking stimulus and appropriate settings.
- Lack of seating, resting and picnic facilities

Strategies:

- Cooperate with Councils, State Government Departments and private landholders to prepare a feasibility study for the concept and implementation of regional tracks.
- Develop a nature reserve in Area I as an educational and recreational facility
- Consult with Councils landscape planners in park planning and development of better range of play ground settings.
- Protect the nature reserve area through fencing and circulation restrictions.
- Supply adequate seating, resting and picnic facilities at appropriate locations and in keeping with site character
- Design loop walking track in Area I offering as many diverse environmental experiences as possible, linked with an interpretive plan.
- Design low key and naturalistic walking tracks in the nature reserve.

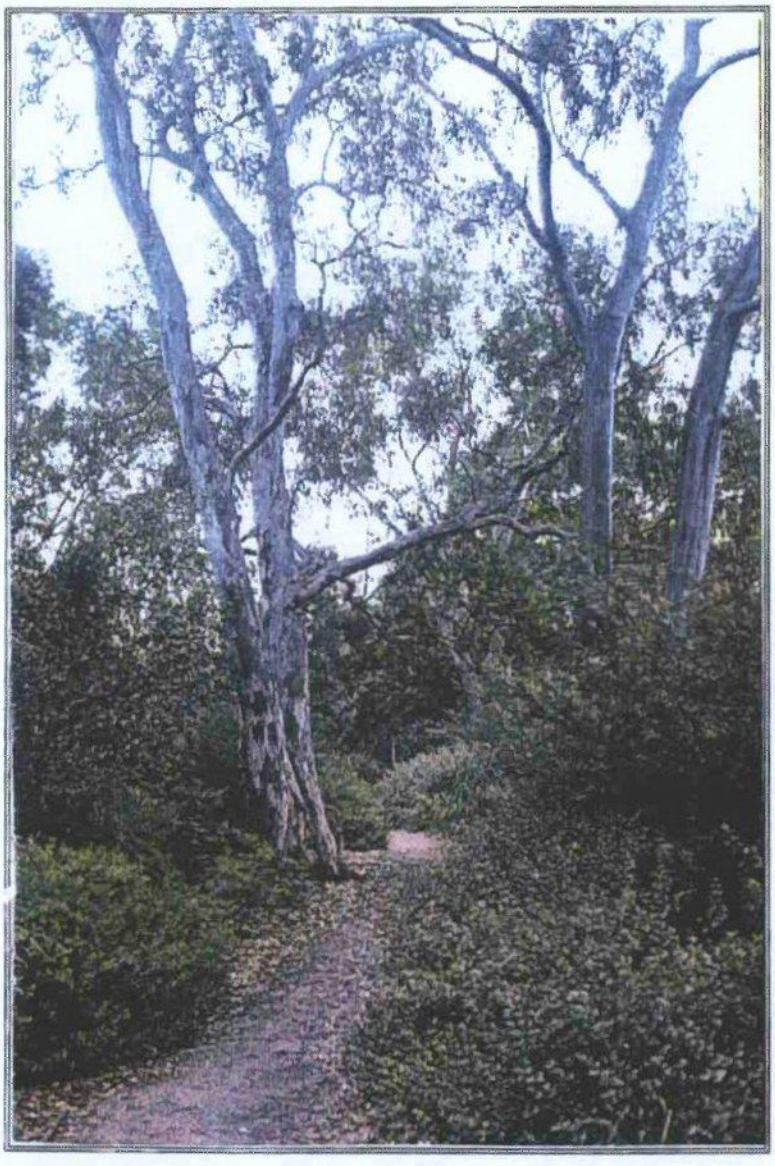


Plate 8 An example of appropriate walking tracks in a nature reserve area, with enriched understorey vegetation following a bush regeneration program

5.2 VEGETATION

Issues:

- The loss and fragmentation of vegetation, especially the absence of mature trees in the areas III and IV, from Memphis Crescent up to Octavia Road.
- Areas of remnant vegetation are under increased pressure, as they now provide the only areas of shade, seclusion, bushland character and sites for adventure play, particularly small, isolated pockets of trees
- Presence of species considered rare in the Sydney western region have been identified on site. Some are in exposed positions and vulnerable to destruction by disturbance.
- The importance of conserving the local biodiversity.
- Vandalism, in form of cutting down trees and saplings for cubby house construction and firewood.

- The lower layers of vegetation, shrub and groundcover, have been extensively displaced by weeds, but native species persist.
- Mowing of understorey plants is a major, though often unrecognised cause of bushland loss. It limits the regeneration of species and can be detrimental to the survival of native grasses. Eucalyptus and mown grass do not form a natural plant community.
- The grazing by cows and horses has a similar result as mowing, in limiting regeneration and particularly the growth of young trees. It also can result in the introduction of pasture weeds and an increase in soil nutrients from the cow manure.
- Flood reduction due to creek channelisation may result in the longterm loss of some riverine floodplain species.
- Restrictions in revegetation of trees and shrubs in the channel area to only the top of embankments
- The difficulty of re-establishing vegetation on the artificially constructed channel banks due to dispersive and saline soils.
- The difficulty of watering in dry periods due to slope, erosion risk and the hard subsoil.
- At times of low flow the concrete creek channel cannot replenish the groundwater to support aquatic and creek bank vegetation.
- Absence of vegetation in many areas of the site results in poor visual quality, lack of unity and visually intrusive fences and boundaries.
- Need for re-vegetation to enhance the landscape and visual character of the site.

Strategies:

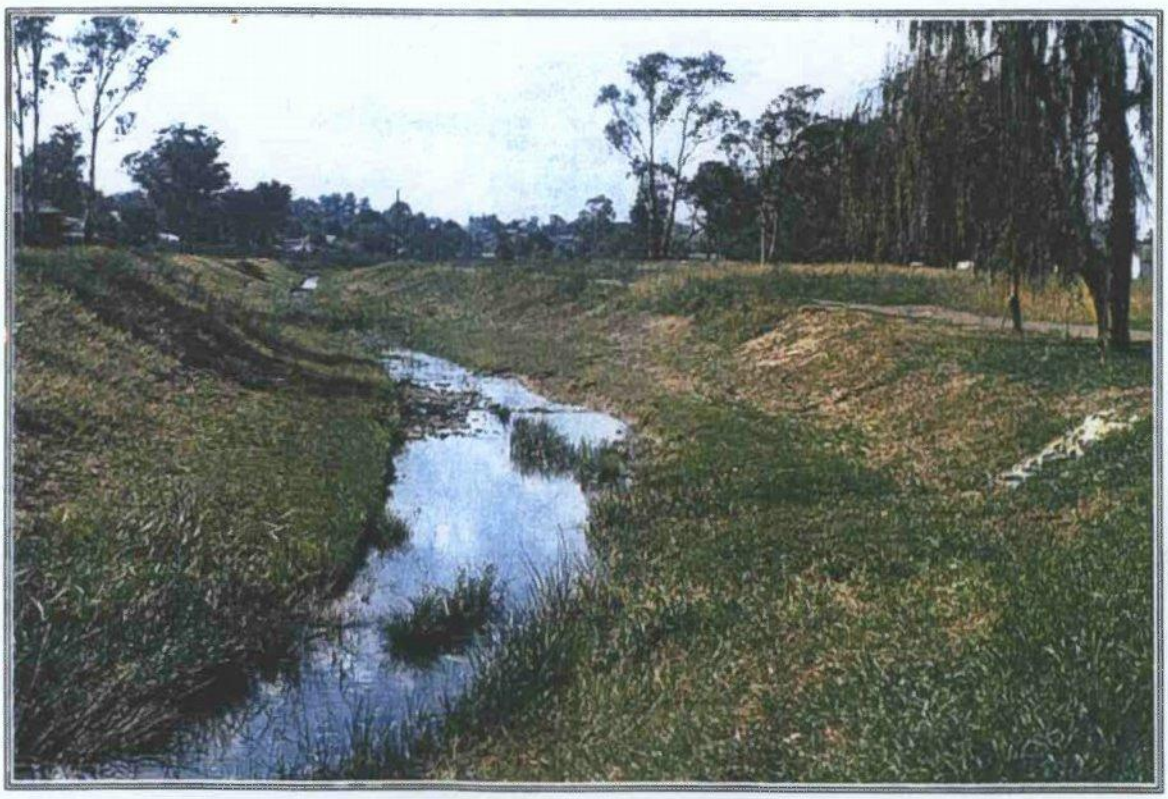


Plate 9 Canopy re-establishment and understorey enrichment are required along the creek banks (Area II)

Refer to the Concept Plan Drawings, pages 79 & 81

- Establish a nature reserve to conserve the remnant riverine communities and rare local species, with the exclusive use of indigenous vegetation.
- Revegetate the creek environment to approach natural conditions as closely as possible in Area I and II and in more modified form in all other Areas III-VII.
- Establish a vegetation buffer zone, particularly in Area III by formulating a Development Control Plan to limit development and protect vegetation at the rear of the properties.
- Investigate means of allowing flooding in nature reserve area to promote vegetation diversity.
- Use bush regeneration programs and techniques under the guidance of the Holroyd's Bushland Supervisor.
- Connect the isolated tree groups to consolidate the canopy.

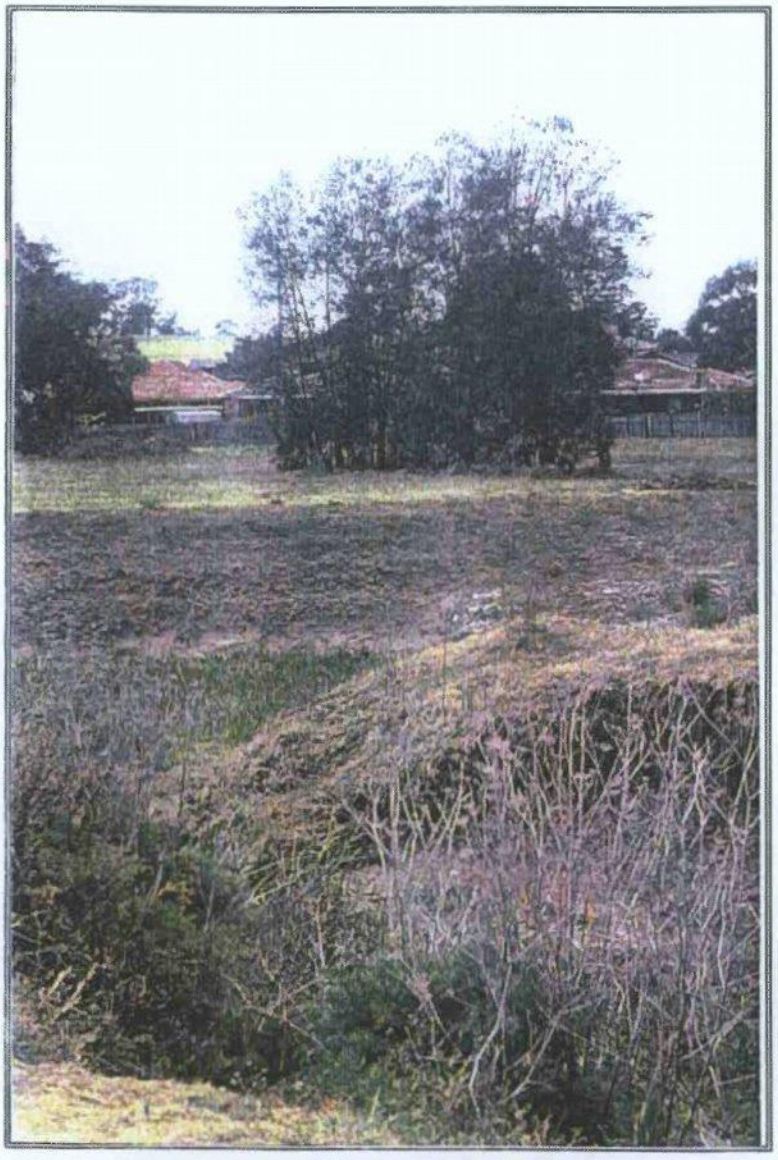


Plate 10 Islands of remnant riverine vegetation require connection

- To allow the re-introduction of plants propagated from the site, prior to channel earth works, and investigate provision of suitable growing conditions and protection measures.

- To investigate species occurring at comparable sites, eg Prospect Creek, to determine what species may have occurred on this site and to obtain local material.
- Fence vulnerable areas, possible on a rotational basis, to assist regeneration.
- Replenish the watertable adjacent to the rock lined concrete invert, using trial spillways or perforations.
- Provide screen planting to reduce visual dominance of housing and fencing, while mindful of sunshine and views.

Plate 11 Fences need screening to enhance the character of the nature reserve area

- Create landmark plantings at street intersections to enhance landscape character.
- Re-establishment a tree canopy to reduce the growth rate of grass and subsequent maintenance.
- Increase the use of native grasses, as they are deep rooted and adapted to low nutrient soils and consequently are more drought resistant, less dependent on soil fertility, are slower growing then most introduced grasses and require less maintenance.
- Discontinue mowing and control exotic grasses with herbicides under tree canopy, to allow natural regeneration.
- Use grasses to accentuate landform and define spaces for different uses by using distinct mowing regimes.
- Define, by pegging mowing zones under the direction of the Holroyd's Bushland Supervisor.

5.3 WEEDS

Issues:

- Weed establishment from dumped garden refuse by adjoining residents, landfill and physical disturbance of soil.
- Weed establishment in areas of increased nutrient and moisture.
- Continuous weed seed sources from stormwater and increased nutrient (phosphorus, nitrogen) supply.
- Windblown weed seed, changing with seasons, ie *Paspalum dilatum* (Paspalum) in wet years and *Cirsium vulgare* (Spear Thistle) in dry years.
- Birds spreading weed seeds such as privet and other exotic fruit trees.
- The channel banks in Areas III and IV are colonised by weeds such as thistle and plantain.
- Removal of the dense weed understorey, largely privet and briar in Area I would result in important habitat loss.
- Persistent perennial weeds are spreading through the site, eg *Sida rhombifolia* (Paddys Lucerne).
- Need to control large microphytes in the stream bed to avoid major obstructions to creek flow.

Strategies:

Refer to the Concept Plan Drawings, pages 79 & 81

- Replace weeds on channel banks gradually, with plantings of native grasses using virocells.
- Removal of dense privet and briar gradually, only after extensive planting and establishment of native replacement species, particularly *Bursaria spinosa*.
- Control weed seed sources, particularly *Cirsium vulgare*.
- Install nutrient and sediment traps to reduce weeds.
- Consultation with Fox Hills Golf Course to control nutrient loading from fertilisers.
- Remove *Typha* from the creek bed selectively.
- Remove noxious weeds such as *Opuntia stricta* (Prickly Pear) and *Lucium ferocissium* (African Boxthorn) immediately.
- Establish bush regeneration program within reserve area.

5.4 WILDLIFE HABITAT

Issues:

- Loss of habitat has been serious due to urban development and the need to modify its impact on flooding by increasing stream capacity. Large scale clearing of vegetation in Area II, III, IV and changes in hydrology are placing greater pressure on remaining areas.
- Due to increased human presence, even with successful revegetation, the previous habitat potential in Areas II, III and IV cannot be achieved.

- Revegetation along the re-aligned creek section has been slower than anticipated, delaying habitat replacement.
- Some weeds provide habitat and food sources for many animal species.
- The removal of the dense weed understorey in Area I would result in an immediate loss of habitat for small birds and reptiles.
- Creation of habitat is related closely to vegetation patterns and densities.

Strategies:

Refer to the Concept Plan Drawings, pages 79 & 81

- Re-establish wildlife habitat using dense revegetation.
- Limit access to certain areas to provide wildlife refuges, particularly in Areas I and II.
- Remove weeds gradually and only in conjunction with the establishment of native understorey replacement, eg *Bursaria spinosa.*
- Create increased variety of ecosystems and provide habitat for invertebrates, amphibians, reptiles and birds, by the establishment of a wetland in Area I.
- Establish linkages to nearby reserves, such as Metella Reserve to extend wildlife corridors.

5.5 WETLAND (AREA I)

Issues:

- Need for habitat creation, particularly in the context of habitat loss following creek realignment.
- Need for integration of the design with the sites riverine floodplain character
- Water quality improvement is necessary, particularly reduction of phosphorus and nitrogen levels and sedimentation control
- Integration of recreational demand and the need for open space adjacent to the wetland.
- Requirement for increased diversity in habitats
- Need for greater infiltration and dispersion of stormwater

Strategies:

- Establish diverse range of topographical elements and vegetation zones from dry to aquatic, with variable inundation levels
- Establish islands for habitat refuges
- Establish a complex rather than linear shoreline to provide an increased number of wildlife breeding sites.

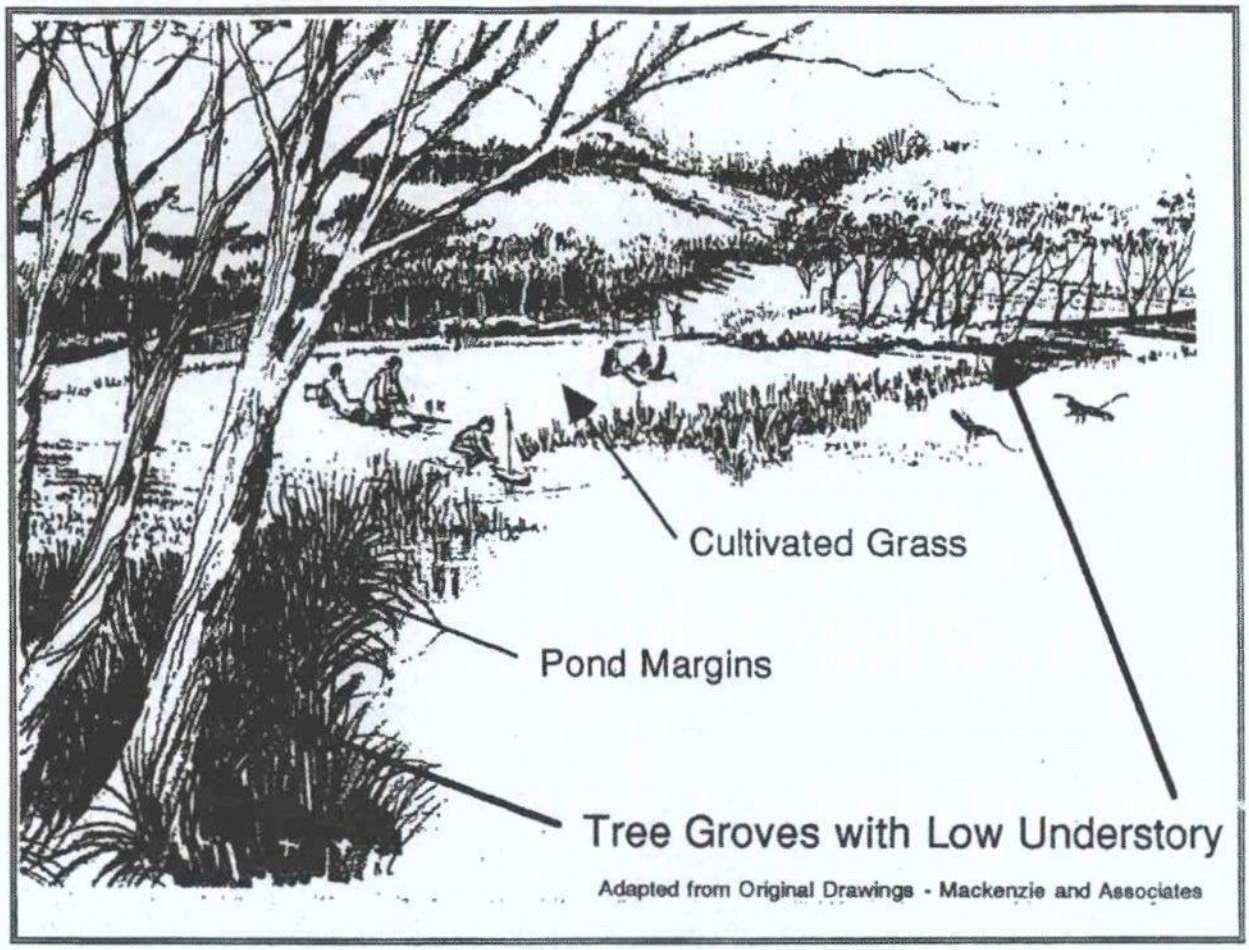


Plate 12 Pond margins with plantings to define recreational zones in the wetland area

- Revegetate using indigenous native species, recreating different vegetation communities including aquatic macrophytes, sedgeland, grassland and riverine woodland. In particular local species such as *Bolboschoenus caldwellii, Schoenoplectus validus, Juncus usitatus* and *Eriochloa pseudoacrotricha* to be re-established
- Optimise nutrient uptake by alternating reed beds and open water areas.
- Reinforce existing mature vegetation by additional planting to link and extend remnant tree groups
- Focus recreational use near the John Silverthorne Reserve and adjacent to Oklahoma Avenue, with some vantage points linked to the walking track system for bird watching in the core of the site
- Install gross pollutant trap and trash racks at inlet points to sedimentation pond.
- Coordinate design, planting and installation of wetland using wetland specialist.
- Control weed with herbicides prior to construction and revegetation
- Provide temporary fencing of areas to prevent access and wear.
- Stabilise banks with a combination of jute mesh, hydro mulching and high density planting of virocells.

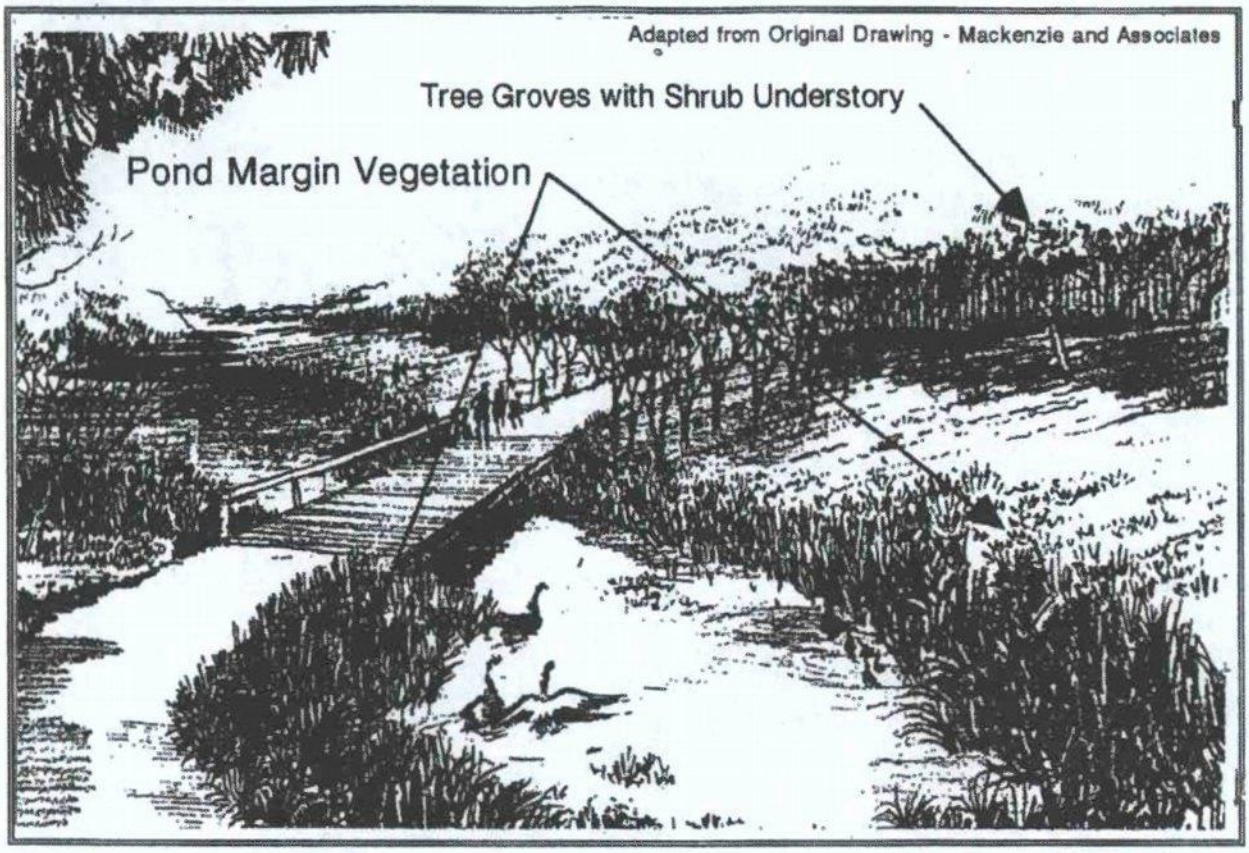


Plate 13 Landscape character of a transition zone from wetland to creek after bank rehabilitation

5.6 STORMWATER AND WATER QUALITY

Issues:

- The problems of the creek in the study area are inseparable from the catchment at large.
- Increases in urban runoff and decrease in natural infiltration are a major cause of flooding and will be exacerbated as urban consolidation occurs.
- Stormwater and particularly waterborne pollution are currently degrading the creek and reserves.
- Visible pollution: plastic and metal containers, bags and polystyrene.
- Increased nutrient sediment and industrial pollutants.
- Community survey shows stormwater related pollution to be a major concern.

Strategies:

- Complete, implement and publicise the Water Quality Strategy and the Stormwater Management Plan being developed by the Trust and the Councils.
- Implement on-site stormwater detention in the catchment, especially on existing large development sites.
- Develop domestic stormwater policy encouraging on-site tank storage.
- Investigate adjustment of Fox Hills Golf Course detention basin discharge rates in order to achieve greater stormwater detention in smaller storm events.

- Investigate means of controlling nutrient loadings from fertilisers used on the golf course.
- Possible addition of a wetland area upstream near the Highway and also in Metella Reserve.
- Trace turbidity source in the upper catchment.
- Construction of trash racks to be continued, particularly at key points such as Metella Road Reserve (western side of Metella Road) and at smaller culverts, such as in Memphis Crescent, Julia Avenue and Cecilia Street.
- Develop public education program and liaison with EPA to coordinate pollution control measures and future funding in order to reduce general pollution in the catchment.
- Correlate and publicise Streamwatch results collected by Girraween High School and other water quality studies.
- Encourage industry sponsorship of more extensive water testing in the catchment.
- Establish vegetation cover in catchment, particularly along riparian zones.

5.7 EROSION

Issues:

- Increased stormwater volumes and flow rates have seriously eroded the dispersive soils of the site
- Bank erosion is wide spread in Areas V, VI, VII, particularly where stormwater discharges into the creek.

Plate 14 Stormwater outlets require rock lined flow dissipaters, siltation traps and trash racks, where appropriate

- Minor slippage of top soil from channel banks in Area III, IV.
- Deeply incised eroding banks are dangerous, unattractive and hard to maintain.
- Erosion and vegetation issues are closely related, with vegetation loss resulting in increased erosion.

Strategies:

- Flow dissipaters, sediment traps and forebays, integrated with landform be provided at all eroding stormwater outlets.
- Reform eroded creek banks by reducing bank gradients, while retaining mature vegetation.
- Stabilise eroding areas using gabion structures following natural slopes and landform, while retaining mature native vegetation. Interfill gabions with soil mix and vegetate with virocells.
- Bare creek banks in all Areas require revegetation to improve soil stability.
- Revegetation strategies itemised in 5.2 will assist erosion control.

5.8 VANDALISM

Issues:

- Parts of the site are isolated and as such are exposed to vandalism.
- Graffiti on the fences in the realigned creek area and culverts, particular towards Toongabbie.
- Cutting down trees and saplings for firewood and cubby house building, now concentrated in the last areas of dense vegetation in Area I.
- Pulling out young trees from the bank revegetation in Area III and IV.
- Broken glass from drinking parties and rubbish associated with cubbyhouses.

Strategies:

- Evidence that the reserves, particular Area I are being well maintained, such as bush regeneration works, will counteract vandalism
- Sponsorship of reserve areas by local schools for ongoing stewardship, coordinated by the Bushland Supervisor.
- Provide interactive and adventure playground facilities or provision of raw material for play in designated areas
- Liaise with the schools, social workers and landscape / recreation planners to develop youth oriented programs (Toongabbie Graffiti art wall / exhibition)
- Investigate the role of honorary ranger and other forms of resident surveillance.
- Increase access points and associated lighting, especially in Area III.
- Camouflage seedlings with unmown grass on upper bank edges in Area III and IV.
- Greater usage of reserves following landscape improvements can deter undesirable uses.
- Increased surveillance due to greater usage.

5.9 INTERPRETATION

Issues:

- Informing and educating the general public and particularly reserve users.
- Generating popular appreciation of the site.
- Directing and controlling patterns of usage
- The need for an integrated interpretative plan
- Significant opportunities exist for development of historical and environmental interpretation on a regional level (First Settlement Reserve, Toongabbie, Parramatta Park and Prospect Hill)
- Relationship of signs on site to the broader area and even regional context.

Strategies:

- Levels of signage with major entrance / address sign and directional signage for regional walking track connections. Low key signage for education and interpretation themes.
- Signage to fit in with Council's overall signage policy
- On regional level interpretation of points of interest discussed in brochure format keyed to stopping points along the track system.
- Distribution of information through the community (G.C.M.C.) newsletter and the Trust's Streamline publication.
- Explanation of site history: aboriginal use, settlement for agriculture, naming of the site
- Interpretation of past agriculture uses is a valid role of this site, in particular to reference to early colonial landgrants.
- Familiarise visitors with the site's dominant tree species and the less obvious rarer species and role of remnant urban bushland in conservation.
- Relate ecological function of native vegetation of native bird habitat, food and nesting sites to plantings in local gardens.
- Demonstrate significance of trees in erosion control.
- Relate flooding and stormwater problems to urban runoff and garden design
- Develop appreciation of native grasses for domestic landscapes
- Increase awareness of weed incursion into bushland and their control

5.10 OTHER ISSUES

5.10.1 DOGS

Issues:

- Uncontrolled dogs and dog faeces
- Dog attacks have been reported by women with small children.

Strategies:

- Stronger Council Ranger presence to police dogs, particularly early mornings and weekends.
- Education program to encourage dog control and removal of faeces.
- Investigate and implement methods of dog faeces disposal (possible installation of dog toilets at key entry and exit points, eg exchangeable sandpit or below ground chemical toilets).

5.10.2 ACCESS

Issues:

- The absence of informal creek crossing points in Area II, where residents tend to cross on a daily basis.
- Absence of exit point along the fenced creek alignment in Area III, causing insecurity and fear among users and potential users of the path.

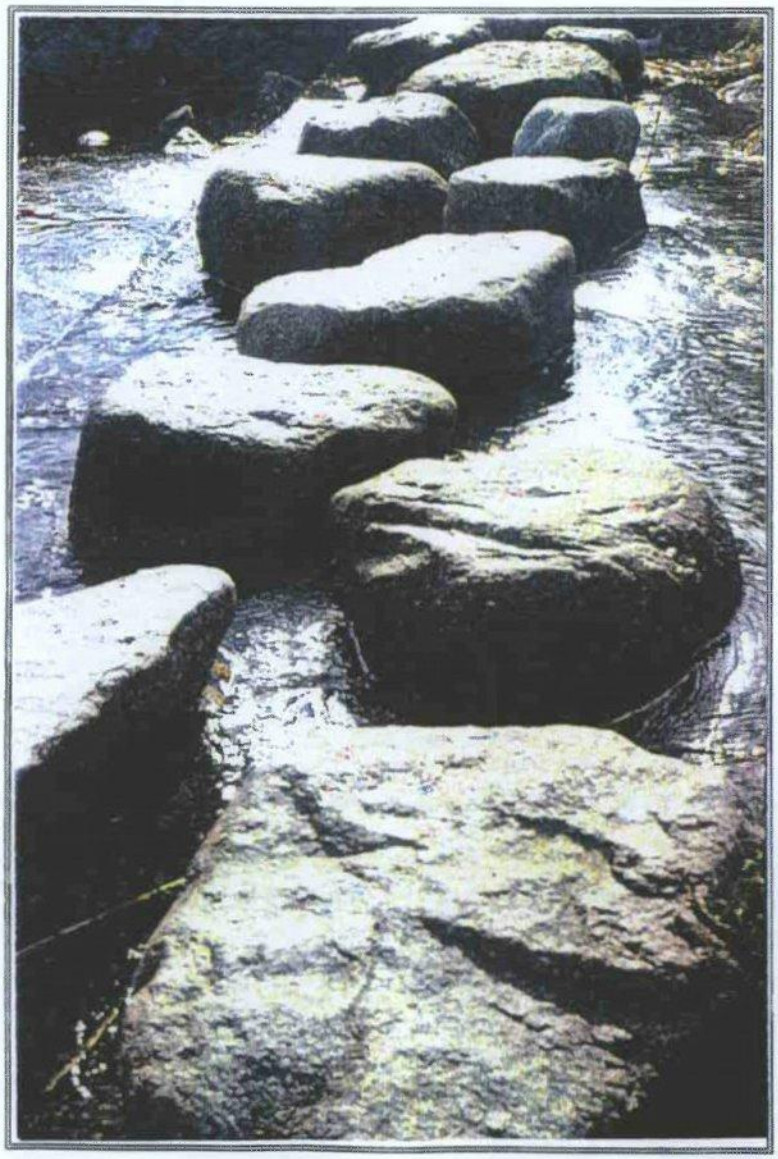


Plate 15 Stepping stones forming creek crossings with stone steps to stabilise embankments

- Absence of steps form property gates to path, creating erosion points.

Strategies:

- Provide well landscaped pedestrian access point into Area III with seating and lighting from Toongabbie Road halfway between Gilba Road and Portia Road.
- Ensure that boundary landscaping and fencing of proposed community title development in Area II opposite Gilba Road is compatible with the reserves character.
- Construct low key stepping stone creek crossing points opposite the northern limit of reserves facing Memphis Crescent and opposite Lucretia Road at rear of 112 Metella Road with informal stone steps up the embankments.

5.10.3 MAINTENANCE

Issues:

- The HCC Bushland Supervisor is currently responsible for the maintenance budget in Area I, II, III and IV.
- The budget appears inadequate to ensure a balance between ongoing maintenance and issues such as revegetation, targeted weed control and specialised horticultural tasks.
- Office time must be allocated for community liaison, coordination and meetings, and are not to be consumed by other tasks such as site maintenance work.
- The Plan of Management covers not only Areas I to IV, currently maintained by the Bushland Supervisor, but all areas of the reserves from I to VI, more than doubling the area to be maintained.
- Relationship between Blacktown Council and Holroyd Council on-site staff, responsibility and coordination.

Strategies:

- Holroyd City Council is to be responsible for site management of all the Greystanes Creek Reserves.
- HCC's Bushland Supervisor is to be able to coordinate and engage private contractors to carry out specific tasks according to budget.
- To address the management issues and carry out the maintenance of Areas I to VI the current apprentice position is to be maintained to assist the Bushland Supervisor.
- Encourage greater commitment from the three authorities.

5.10.4 FIRE

Issues:

- Fire and its relationship with regeneration and species diversity is very complex.
- Presently there is not enough information to provide clear guidelines for the use of fire as a management tool.
- Grass fires started by arsonists have occurred.
- The site is too fragmented and isolated for major fire events to occur.
- Creek and drainage channels form natural fire breaks.

Strategies:

- Monitor and record any occurrence of fire on site, to develop a historic reference and an understanding of fire effect on fauna and flora.

Buffalo Place

Oklahoma Avenue

M.I.

M.S.

B.S.

40

- Proposed Eucalyptus amplifiolia
- Proposed Casuarina glauca
- Proposed Screen Planting (Melaleuca linarifolia & Melaleuca styphelioides)
- Proposed Understorey Planting (Bursaria sp)
- Existing Sedge Land
- Existing Reed Beds / Aquatic Macrophytes
- Existing Eucalyptus amplifiolia
- Existing Casuarina glauca
- Mowing Zone
- Nature Reserve Walking Track
- Entry Signage
- Picnic Platforms
- Stepping Stone Creek Crossing

N

Metres

0 10 20 30 40 50

GREYSTANES CREEK RESERVES
PLAN OF MANAGEMENT

CONCEPT PLAN
VEGETATION & INFRASTRUCTURE

SCALE:

DATE: 30/05/95

DRAWING: CP/01

A. BERNHARD & ASSOCIATES - LANDSCAPE & ENVIRONMENTAL CONSULTANTS

Metella Road

Memphis Cresent

38

M.T.

GREYSTANES CREEK

36

Proposed Eucalyptus amplifiolia

Proposed Casuarina glauca

Proposed Screen Planting

(eg. Melaleuca linariifolia, Melaleuca styphelioides)

Existing Sedge Land

Existing Eucalyptus amplifiolia

Existing Casuarina glauca

Nature Reserve Walking Track

Entry Signage

Picnic Platforms

Metres

0 10 20 30 40 50

GREYSTANES CREEK RESERVES
PLAN OF MANAGEMENT

CONCEPT PLAN
VEGETATION & INFRASTRUCTURE

SCALE:

DATE: 30/05/95

DRAWING: CP/02

A. BERNHARD & ASSOCIATES - LANDSCAPE & ENVIRONMENTAL CONSULTANTS

6. IMPLEMENTATION

6.1 AGENCIES

Councils of the cities of Blacktown and Holroyd are responsible for the care, control and management of the reserves. An agreement has been reached between both Councils that Holroyd City Council be responsible for the Greystanes Creek Reserve Areas I to IV, with the management costs shared equally between Councils.

The Upper Parramatta River Catchment Trust is a small statutory authority whose main functions are to mitigate flooding and drainage surcharge, improve water quality and improve environmental and recreational values of stream banks within the catchment. The Trust is currently contributing half of the management costs of Areas I, II, III and IV.

While this budgetary arrangement is expected to continue to ensure the rehabilitation of the site, the role of the Upper Parramatta River Catchment Trust as a funding source may diminish within a few years. It is expected that the Trust will still have input in monitoring stream and flooding conditions and catchment issues.

The Greystanes Creek Management Committee (Section 355 Committee) has recently been established to advise Councils on reserve management. This committee is unique in the area as it has a Landcare focus.

Implementation of the Plan of Management cannot be carried out in isolation from public involvement and participation. Active Council support for the G.C.M.C., for example enabling staff attendance to the community meetings and information exchange is a prerequisite for effective community liaison and should be an integral part of future management.

HCC's Bushland Supervisor will be responsible for the co-ordination of the sites overall procedures and all communication relating to the site be directed to that person.

There is also a need for integration of community consultation, council planning and implementation of the Plan of Management. This could be achieved with a Management Plan Steering Committee. Its members should comprise of:

- HCC's Bushland Supervisor,
- Respective Parks Managers,
- Respective Landscape Architects/Planners,
- The Upper Parramatta River Catchment Trust Senior Engineer,
- Two representatives of the Greystanes Creek Management Committee.

Management Plan Steering Committee task will be to monitor the implementation and progress of the Plan of Management of the reserves and update it accordingly, with meetings at least twice a year, for which HCC's Bushland Supervisor will provide a report. . The timing of meetings should reflect Councils budgeting cycle. A review of the works program should be carried out annually with a broad review of the plan carried out every five years

6.2 PERFORMANCE INDICATORS

The implementation of this Plan of Management needs to be evaluated at least twice a year, in conjunction with the Management Steering Committee meetings. The landscape as a whole and the management process in particular is a dynamic one. While the broad directions for environmental improvement have been established in this plan, detailed feedback is required regularly and needs to be acted upon.

The annual Local Government State of the Environment reports and Upper Parramatta River Stormwater Management Plan will be the best means of assessing progress in terms of the Plan of Management strategies. HCC's Bushland Supervisor will be responsible to provide data for this report. Key shortcomings should be identified for resolution.

Performance indicators will be:

- Successful completion of identified actions in the works plan.
- No further loss of mature trees, apart from losses through natural processes and in accordance with the requirements of this plan (eg wetland construction).
- Improvement in canopy species establishment.
- Regeneration and increased species richness of shrubs and ground flora.
- Maintenance and enhancement habitat for all known animal species identified on site.
- Arresting weed dominance over the whole site.
- Marked reduction in litter / waterborne pollution.
- Increased levels of appropriate recreational use.
- Decrease in erosion of creek banks.

6.3 MAINTENANCE WORKS, GUIDELINES & ANNUAL COSTS

The frequency of necessary works are detailed in the maintenance plan below:

- Frequency: W = Weekly
  M = Monthly
  S = Seasonally
- Responsibility: HCC BS = Holroyd City Council Bushland Supervisor
- Work to be carried out as a combination of HCC BS, day labour (Blacktown and Holroyd Councils) and contractors.

6.3.1 MAINTENANCE AND EXISTING PLANTING PROGRAM

Item No.	Action	Fre-quency	Area	Respon-sibility	Annual Cost Estimate
	Mowing				
M 1	• Mow or slash according to mowing zones marked on site (property boundary, walking track in grass land, road verge and play ground). • Reduce mowing under mature canopy trees and commence mosaic mowing to favour regeneration and native grasses	M or as required	I, II, V, VI	HCC BS	$15,000
M 2	• Mow channel base allowing 50-100 mm from ground level, ensuring grass clipping do not enter the creek.	M or as required	II, III, IV,V	HCC BS	$4,000
M 3	• Tractor mow Paspalum and undesirable grasses before they set to seed.	S	I, II	HCC BS	$1,000
M 4	• Whipper snipper prior to planting. Limit mowing or whipper snippering between seedlings in revegetated embankments, currently protected from vandalism by surrounding grasses.	S	I, II, III, IV, V, VI	HCC BS	$2,000
	Weed Control				
M 5	• Control exotic grasses under tree canopy using herbicides.	S	I, II, V	HCC BS	$3,000
M 6	• Hand remove invasive weeds before seeding takes place, particularly Spear Thistle *(Cirsium vulgare)*, Paddys Lucerne *(Sida rhombifolia)*.	W	I, II, III, IV, V, VI	HCC BS	$15,000
M 7	• Remove Bulrushes *(Typha orientalis)* from rock lined streambed. • Avoid use of herbicides near open water and protect all native aquatic plants, excluding. Bulrushes *(Thyphus orientalis)*	S	I, II, III, IV, V, VI	HCC BS	$1,300
	Rubbish and Pollution				
M 8	• Monitor trash racks, arrange clearing and remove storm water debris and other litter from paths, creek banks and the water course, by which ever means are appropriate.	W	I, II, III, IV, V, VI	HCC BS	$8,600
M 9	• Clear trash racks as required	M or as required	I, II, III, IV, VI	HCC Overseer - Works	$3,500
	Plant Maintenance				
M 10	• Replacement of new plants in Area I due to vandalism and natural causes.	M or as required	I	HCC BS	$5,000

Item No.	Action	Fre-quency	Area	Respon-sibility	Annual Cost Estimate
M 11	• Mulch replacement	M or as required	I	HCC BS	$2,500
				Subtotal	**$60,900**

6.3.2 OTHER COSTS

Item No.	Action	Annual Cost Estimate
O 1	Materials & tools	$1,000
O 2	Bushland Supervisor administration or office cost	$6,000
O 3	Bushland supervision, public meetings, Park Committees, schools, and general public relations	$2,100
	Subtotal	**$9,100**

6.3.3 CREEK PLANTING PROGRAM

Item No.	Action	Priority	Area	Respons-ibility	Annual Cost Estimate
TYPP1	• Gradually replace weed species with native grasses along new channel banks, using virocells of Queensland Blue Grass *(Dichanthium sericeum)* and Kangaroo Grass (*Themeda australis),*	H	III, IV, V	HCC BS	$5,000
TYPP2	• Complete tree planting along top of bank of new channel	H	III, IV, V	HCC BS	$5,000
				Subtotal	**$10,000**

6.3.4 ANNUAL COST APPORTIONMENT

Proposed annual maintenance budget as outlined above	$80,000
Upper Parramatta River Catchment Trust Contribution	$40,000
Blacktown City Council Contribution	$20,000
Holroyd City Council Contribution	$20,000

The above total cost and hence funding apportionment will need to be reviewed each year prior to each organisations budget preparation. This review will be important as the creek planting program nears completion, probably around 2000/2001.

6.4 CAPITAL IMPROVEMENTS AND WORKS PROGRAM

The priorities of necessary works are detailed in the works program below:

- H = High Priority
  M = Medium Priority
  L = Low Priority
- Responsibility: HCC ADO = Holroyd City Council Assistant Director - Operations
  HCC BS = Holroyd City Council Bushland Supervisor
  HCC LP = Holroyd City Council Landscape Planner
  BCC EO = Blacktown City Council Environmental Overseer
  G.C.M.C. = Greystanes Creek Management Committee
  U.P.R.C.T. = Upper Parramatta River Catchment Trust

6.4.1 CAPITAL WORKS - AREAS I & II

(*See page 90 - 6.5 FUNDING)

Item No.	Action	Priority	Area	Respon-sibility	Cost Estimate	Source of Funds *
CW 1	• Plant a belt of Blackthorn *(Bursaria spinosa)* at the edge of current weed infestation.	H	I	HCC BS	$5,000	Current Project 1997
CW 2	• Manufacture and installation of interim project sign for nature reserve and wetland area.	H	I	HCC LP	$2,000	Current Project 1997
CW 3	• Fencing to protect core canopy area during bush regeneration work	H	I, II	HCC BS	$2,000	Current Project 1997
CW 4	• Replace existing concrete bridge at northern end of Oklahoma Avenue, with new hardwood bridge to match bridges near golf course.	H	I	Engineers	Completed	
CW 5	• Extend concrete path and cycle way from Oklahoma Avenue to existing path in Area II.	H	II	Engineers	Completed	
CW 6	Stage 1 – 1 ha area between Memphis Cr. and Kansas Pl • Plant Cabbage Gum *(Eucalyptus amplifolia)* and Swamp Oak *(Casuarina glauca)* in canopy extension and connection zones, as defined by the Bushland Supervisor, following marking of existing plants, mosaic mowing and spot spraying. Includes water service. • Secondary planting of Blackthorn *(Bursaria spinosa)* in Privet *(Ligustrum sinense & Ligustrum lucidum)* infested areas following their removal.	H	I	HCC BS	$75,000	Current Project 1997 & 1998

Item No.	Action	Priority	Area	Respon-sibility	Cost Estimate	Source of Funds *
CW 7	Stage 2 – As per CW 6	H	I	HCC BS	$70,000	CPU Future Funding
CW 8	• Installation of trash racks at Metella Reserve and downstream of the Fox Hills Golf Course boundary.	H	I	BCC Drainage Engineers	$40,000	New Project Future Grant
CW 9	• Provide and install 6 seat/bench seats, 1800 mm x 400 mm in nature reserve	M	I	HCC ADO	$10,000	New Project Future Grant
CW 10	• Construct 2 stepping stone* creek crossings and stone steps up creek embankment	M	II	HCC ADO	$12,000	New Project Future Grant
CW 11	• Regrade walking track loop through nature reserve. • Brushmulch over bare areas and unwanted tracks not part of the loop track.	M	I	HCC ADO	$20,000	CPU Future Grant
CW 12	• Place Log markers 200 mm diameters one metre long buried to half depth as track guide and mowing markers in grass land.	M	I	HCC ADO	$2,000	New Project Future Grant
CW 13	• Installation of two smaller trash racks at any other stormwater culverts	M	II	HCC Drainage Engineers	$5,000	New Project Future Grant
CW 14	• Perimeter screen planting with *Melaleuca linariifolia* and Swamp Oak *(Casuarina glauca)*.	L	I ,II,	HCC ADO	$4,000	C.P.U. Future Grant
CW 15	• Provide and install two park benches along creek line	L	II	HCC ADO	$2,000	Future Section 94 Funds
CW 16	• Provide & install playground equipment, including 2 benches and 1 picnic platform, integrated to wetland theme (bird hide or bush theme cubbyhouse structures). Design to be established by landscape architect, recreation planners and community input.	L	I	HCC LP G.C.M.C.	To detail $40,000	Future Section 94 Funds
CW 17	• Shade and screen planting in play ground area. Layout and species depending on detailed design, which is to be established by landscape architect, recreation planners and community input.	L	I	HCC LP	To detail. $1,000	Future Section 94 Funds
CW 18	• Design, manufacture and installation of interpretive signage for nature reserve and wetland area, as outlined in interpretive strategy.	L	I	HCC LP	$10,000	New Project Future Grant

(*See page 90 - 6.5 FUNDING)

Item No.	Action	Priority	Area	Respon-sibility	Cost Estimate	Source of Funds *
CW 19	• Re-establish native aquatic species, such as *Bolboschoenus caldwellii, Scheonoplectus validus, Alisma plantago aquatica, Pratia concolor* and *Calystegia marginata* along the creek.	L	I	HCC ADO	$8,000	C.P.U. Future Grant
CW 20	A design of the wetland which minimises excavation, earthworks and reduces scale of gabion reinforced earth wall construction of the current proposal, including weed control, landscaping, extensive revegetation.	L	I,II	UPRCT G.C.M.C. Wetland Planting Specialist Construction Contractor	450,000 (to detail)	C.P.U. Future Grant
				Total Areas I & II	**$838,000**	**($388,000)**

6.4.2 CAPITAL WORKS - AREAS III, IV, V, VI

(*See page 90 - 6.5 FUNDING)

Item No.	Action	Priority	Area	Respon-sibility	Cost Estimate	Source of Funds *
CW 21	• Street intersection grove plantings (advanced) of *Melaleuca linariifolia* at Portia Road, Prickly Paperbark *(Melaleuca styphelioides)* at Octavia Road, Cabbage Gums *(Eucalyptus amplifolia)* at Cornelia Road and Cabbage Gums *(Eucalyptus amplifolia)* linking with Brushbox *(Tristaniopsis conferta)* street tree plantings to The Portico	H	III, IV, V, VI	HCC BS	Completed	
CW 22	• Provide access to Toongabbie Road from Area III, incorporating, landscaping, lighting and seating, including land acquisition.	H	III	HCC LP	$230,000	Future Section 94 Funds
CW 23	• Construction of flow dissipaters and sedimentation traps using large rock structures and gabions at stormwater outlets.	M	VI	HCC Drainage Engineers	$6,000	New Project uture Grant
CW 24	• Installation of four smaller trash racks at any other stormwater culverts	M	IV, VI	HCC Drainage Engineers	$10,000	New Project uture Grant
CW 25	• Provide and install 8 park benches along creek line	L	III,IV, V,VI	HCC ADO	$8,000	Future Section 94 Funds
CW 26	• Perimeter screen planting with *Melaleuca linariifolia* and Swamp Oak *(Casuarina glauca)*.	L	V	HCC ADO	$2,000	New Project uture Grant

(*See page 90 - 6.5 FUNDING)

Item No.	Action	Priority	Area	Respon-sibility	Cost Estimate	Source of Funds *
CW 27	• Creek bank stabilisation planting, to detail by Bushland Supervisor. • Re-establish native aquatic species, such as *Bolboschoenus caldwellii, Scheonoplectus validus, Alisma plantago aquatica, Pratia concolor* and *Calystegia marginata* along the creek.	L	V, VI	HCC ADO	To detail $25,000	New Project uture Grant
CW 29	• Provide and install 2 timber picnic tables with benches 1800 mm x 1800 mm	L	V, VI	HCC ADO	$3,000	New Project uture Grant
				Total Areas III - VI	**$284,000**	

6.5 FUNDING

The Maintenance Works and the Creek Planting Program will be funded by the current maintenance budget.

The weed eradication and capital works require other funding sources, as outlined below:

- Current Project = Funds allocated through current flood mitigation project.
- CPU = (Current Project Unfunded) Was envisaged as part of current flood mitigation works, but requiring new funding.
- New Project = New Project requiring funding from grants or sponsorship.
- Section 94 Funds = Project to be funded through Future Section 94 contributions.

Based on the cost estimates and funding sources outlined, funding already allocated or still required in the short, medium and long term for specific works, are itemised in the two following tables:

Program / Priority / Funding Summary

Works Program	High Priority	Medium Priority	Low Priority	Total
Areas I & II - General Improvements	$194,000	$49,000	$65,000	$308,000
Areas I & II - Wetland	-	-	$450,000	$450,000
Areas III-VI - General Improvements	$230,000	$16,000	$38,000	$284,000
TOTAL	**$424,000**	**$65,000**	**$553,000**	**$1,042,000**

Total funds currently available and allocated are $84,000, and this should be immediately allocated to the following high priority work:

Areas I & II - General Improvement $84,000

Of the remaining projects, funding in the amount of $281,000 will ultimately come from private developer contributions (Open Space - S94) in the Holroyd City Council area, ie medium density development contributions under Holroyd City Council Section 94 Plan. Although one of these projects in the amount of $230,000 is high priority, it is not possible to place a time period on these works, as the contributions are paid as development occurs, and Council has no control over this private aspect. The best estimate would be within 5 years.

The medium priority projects, amounting to $65,000 will require special funding and this should be considered by both Councils and the Catchment Trust in their 1997/98 and 1998/99 budgets. Those authorities should also consider submissions for any relevant government grants, as detailed in section 6.5.2 below.

The low priority projects, excluding those funded by future developer contributions, amounts to $103,000 to $553,000, of which the major amount is for the wetlands in Areas I & II. These projects, other than the wetlands, should be considered by both Councils and the Catchment Trust in their 1999/2000 budget, as well as making submissions for relevant grants.

For the wetlands project, due to the high cost, this should be annually reviewed as to the likely sources of funds, with advertisements twice per year for parties interested in excavating and disposing of the spoil (eg a developer may need the spoil). If the latter does occur, funding will have to be found by the Catchment Trust and both Councils, to complete the wetlands. If there are no grants available, the cost will need to be spread over two financial years, to make it financially viable for all three authorities.

6.5.1 SPONSORSHIP

Scope for direct income generation or fundraising on a user pays basis is very limited. Possible funding sources include:

- Local industry to provide specific project support (eg school bush regeneration sponsorship, material or product donations to assist in site construction works), or ongoing sponsorship (caretaking) of a particular site.

- Polluting local industry and commercial/industrial sites contributing significantly to stormwater runoff may be encouraged to sponsor pollution control devices (trash racks, sedimentation basins, nutrient control plantings) and stormwater control devices (flow dissipaters and sedimentation traps). This is an opportunity for local industry and businesses to enhance their public relations with the community.

6.5.2 GRANTS

The site's regional significance is a strong argument justifying federal and state funding, especially where the development of regional recreational assets and environmental improvements are called for. Costs of wetland works are such as to require one off funding from state or federal programs.

The following are a range agencies and their respective grants which could be applicable to Greystanes Creek Reserves:

- National Landcare Program, specifically directed at combating soil erosion.

- Department of Urban Affairs & Planning's Metropolitan Green Space Program, provides assistance to open space planning and development projects that can be completed within 12 months.

- Department of Urban Affairs & Planning's Metropolitan Green Space Program, funding available for open space projects with regional significance, such as regional path and cycle way links.

- Greening Australia's National Landcare Program - One Billion Trees, for revegetation strategies.

- NP&WS's National Landcare Program - Save the Bush, for remnant bushland management and revegetation and in particular for wildlife corridor establishment. Must have broad community support.

- NSW EPA's Environmental Trust Grants, for environmental restoration and rehabilitation or for environmental education projects.

- NSW Agriculture and Fisheries, Noxious Plants Control Program, grants for weed removal of declared noxious weeds only. Council must have a weed inspector and a weed management program.

- Environment Protection Authority provides grants for stormwater management projects mainly aimed at improving water quality.

Source of Funding / Program / Priority Summary

	Current Project Funds			C.P.U. - Future Grant			Future Devel. Contribution (S94)			New Project			Total
	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low	
Areas I & II General Improvement	$84,000	-	-	$70,000	$20,000	$12,000	-	-	$43,000	$40,000	$29,000	$10,000	$308,000
Area I & II Wetland	-	-	-	-	-	$450,000	-	-	-	-	-	-	$450,000
Areas III - VI General Improvement	-	-	-	-	-	-	$230,000	-	$8,000	-	$16,000	$30,000	$284,000
Total Funds	$84,000	-	-	$70,000	$20,000	$462,000 ($12,000)	$230,000	-	$51,000	$40,000	$45,000	$40,000	$1,042,000 ($592,000)
Funds Available	$84,000	-	-	-	-	-	-	-	-	-	-	-	$84,000
Funds Required	-	-	-	$70,000	$20,000	$462,000 ($12,000)	$230,000	-	$51,000	$40,000	$45,000	$40,000	$958,000 $(508,000)

ACKNOWLEDGMENTS

THE COMMUNITY SURVEY PROGRAM

Thank you to:

- The residents of Toongabbie and Girraween who assisted in the questionnaire process,
- The teachers and students at Metella Road Public School for their enthusiasm and input,
- The Commonwealth Bank Toongabbie and Metella Road Public School for accepting questionnaire return boxes.

THE STUDY

Thank you to:

- Staff of Blacktown and Holroyd City Councils and the Upper Parramatta River Catchment Trust for their input and support,
- Members of the Greystanes Creek Management Committee for providing a diversity of views and a venue for valuable discussion and comments,
- B. DeBellin of the Cumberland Bird Observers Club, for carrying out a bird survey,
- Bruce Mackenzie for use of wetland graphics.
- Members of the Toongabbie Chamber of Commerce and individual shopkeepers, Country Womens Association and Girl Guides Association for their comments,
- Staff of Fox Hills Golf Club, Boral Resources and Home Base Centre Management for discussion of issues in relation to this Plan of Management,
- Officers of the Environment Protection Authority, Sydney Water, Department of Urban Affairs & Planning and the Department of Land & Water Conservation for feedback on issues in relation to this Plan of Management.

CONSULTANT TEAM

Alfred Bernhard	BSc, BArch, MAIH	Coordination of Community Liaison, Community Survey, Landscape Planning
Conny Kollmann		Community Survey, Landscape Analysis, Report Preparation
Kate Low	BLarch	Assistance with Community Survey
Neil Wilson	BArch, DipCivDes, Dip Environ Stud., ARAIA	Planning Issues

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GREYSTANES CREEK & RESERVES QUESTIONNAIRE

We are the landscape consultants working on a Plan of Management for Greystanes Creek and Reserves (from Fox Hill Golf Course to the Toongabbie Station area).

We look forward to the community playing a major role in decision making and this questionnaire is a vital means of beginning that process. To get a clearer picture of local needs, it would be valuable to have individual responses from all members of the household.

PLEASE TAKE THE TIME TO DO IT NOW!

How often do you use the area of open space around Greystanes Creek ?

If you do not use the open space around Greystanes Creek, what are the reasons?

What activities do you do in this area, including walk to work and access through etc.?

Where in the open space area do you do these activities?

What are the specific features which attract you to the site?

What detracts from your enjoyment of the site?

Do you have any problems using the open space and what are they?

Are there any social or political issues in regard to Greystanes Creek and its open space that you feel strongly about?

What ideas do you have to improve Greystanes Creek and the surrounding open space?

Would you like any facilities or equipment to be provided and what type?

What are your feelings about the water quality of Greystanes Creek?

Where is the nearest nature reserve that you have visited?

Would you like to see a nature reserve established within the site?

Demographics: Please circle whichever applies

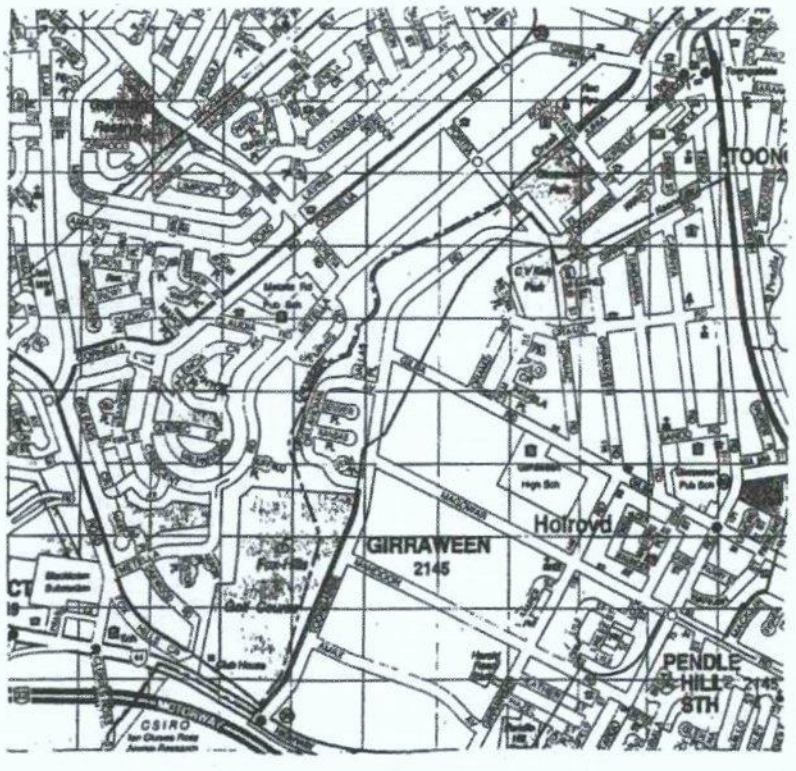
Sex • Male • Female

Age .....

How long have you lived at this address? .....

Residential Zone: Please circle the area you live in.

If you live outside the mapped area, please provide Street and Suburb of residence: .....



If you have any other comments or issues in relation to Greystanes Creek Reserve, not specifically handled in this survey, please place those on a separate piece of paper and attach to the survey.

Please return the questionnaire to the consultants present at the day.

If your household has not received a survey through the local mail drop and you believe that they would be interested to respond, survey papers are available at the Metella Road School Office or the Commonwealth Bank in Toongabbie, between between the 16 and 23 November 1994.

THANK YOU FOR YOUR EFFORT AND INPUT!
Alfred Bernhard, Conny Kollmann, Dominic Riitano, Kate Low, Neil Wilson.

How often do you use the area of open space around Greystanes Creek?

daily	44%
weekly	26%
fortnight	12%
rarely	12%
never	6%

If you do not use the open space around Greystanes Creek, what are the reasons? (10%)

Unattractive	3%
No time	2%
Uncontrolled dogs	2%
Age	2%
Can't walk	1%

What activities do you do in this area, including walk to work and access through etc.?

Recreational walking	30%
Walk to shops	27%
Bike riding	17%
Walk to station	15%
Walking dog	13%
Playground	8%
Jog	8%
Cricket, games	5%
General access	5%
Walk to school	4%
Watch birds, animals	4%
Yard access	3%
Roller blading	2%
Frisby throwing	1%
Fly kites	1%
Golf	1%

Where in the open space area do you do these activities?

Full Length of path	40%
Lucretia Rd to Golfcourse	33%
John Silverthorne Reserve	7%
Cornelia Rd to Octavia Rd	6%
Portico Prd to Cornelia Rd	4%
Lucretia Rd to Portia Rd	4%
Portia Rd to Octavia Rd	3%
Shady parts only	3%

Where in the open space area do you do these activities?

Full Length of path	40%
Lucretia Rd to Golfcourse	33%
John Silverthorne Reserve	7%
Cornelia Rd to Octavia Rd	6%
Portico Prd to Cornelia Rd	4%
Lucretia Rd to Portia Rd	4%
Portia Rd to Octavia Rd	3%
Shady parts only	3%

What are the specific features which attract you to the site?

Absence of traffic / pollution / noise	23%
Peaceful nature of site	20%
Birds	13%
Open space	12%
Large trees -	10%
Country feel / watch grazing cows	10%
Flow of water	9%
Pathway	8%
Bike track	6%
Accessibility	5%
Space to exercise dog	4%
Cubbyhouse sites	4%
Playing in creek / catching tadpoles	4%
Swings	3%
No dogs	2%
Cross country training	2%
Picnic on grass	1%
Watch work in progress	1%

What detracts from your enjoyment of the site?

Pollution; rubbish, stormwater; smells	20%
Uncontrolled dogs / dog droppings	14%
Vandalism / graffiti	12%
Too many weeds / lack of maintenance	10%
Lack of shade	8%
Inconsistency of work	5%
No seating	4%
Motor bikes	4%
Lack of play equipment	3%
Wasted / unused area opposite Silverthorne Reserve	3%
Lack of flowering shrubs / pretty gardens / park feeling	3%
Problems crossing creek	3%
Unsafe to walk in channel area / absence of exits and lighting	3%
Access problems from properties down the embankment	3%
Unattractive	3%
Fires	2%

Do you have any problems using the open space and what are they?

Dogs	24%
Broken glass	21%
Vandalism	8%
Smells	7%
Lack of access / exit points along creek	6%
Crossing creek	5%
Weeds	4%
Subdivision of Toongabbie site	4%
Druggies	4%
Speeding cyclists	3%
Unsafe creek banks	3%
Lack of path organisation; continuity	3%
No all weather paths	2%
Bike noise	2%

Are there any social or political issues in regard to Greystanes Creek and its open space that you feel strongly about?

48% of respondents commented

Subdivision of Toongabbie site / building on existing flood plain	26%
Councils not supportive or consultative	13%
More co-ordination of pollution control	12%
Drinking parties at night	9%
Politics and implementation of drainage works	9%
Support removal of cows	5%
Encourage community maintenance	5%
Loss of privacy	5%
Youth or social programs urgently needed	5%
Community committee too active	4%
Support presence of cows	4%
Council should be responsible for fences in new channel.	3%

What ideas do you have to improve Greystanes Creek and the surrounding open space?

More trees / shade	40%
Seating	13%
More intensive maintenance	13%
Play equipment	9%
Natural walking tracks	9%
Dense revegetation of channel works	9%
Picnic areas	6%
More flowering vegetation	5%
Wetland	5%
Limit further subdivision near the creek	5%
Approval and completion of stage 3 of channel works	5%
Trim lower tree limbs near creek	4%
Signage / Name the reserve	4%
Remove weeds	3%
Open space for ball games / play field	3%
Stronger police presence	3%
Nature reserve	3%
Stringent controls on industrial pollution	3%
Install dog loo	3%
Bike tracks	2%
More creek crossings	2%
Access to creek edge for play	2%

What ideas do you have to improve Greystanes Creek and the surrounding open space? (Continued)

Establishment of honorary rangers	2%
Bins	2%
Facilitate public participation	2%
Speed bumps and bike signs at Portia and Octavia Rd	2%
Regular cleanups	2%
Provide accessibility past golfcourse	2%
Fence off reserve	2%
Clean stormwater rubbish more often	2%
Establish Young Offenders project: landscaping	1%
Need skate structure	1%
Extend works to Metella Reserve	1%

Would you like any facilities or equipment to be provided and what type?

Seating	16%
Play structures	16%
Picnic facilities	13%
None - attract the wrong people	12%
Bins	8%
Circuit / loop pathways	6%
Footbridge	5%
Bike track extension	5%
Slippery dip	5%
Stage 3 as planned	3%
Half court basketball	3%
Parkland	2%
Bike track signage on roads	2%
Attendant	2%
Girraween Park seating stand	1%
Small kids swings	1%

What are your feelings about the water quality of Greystanes Creek?

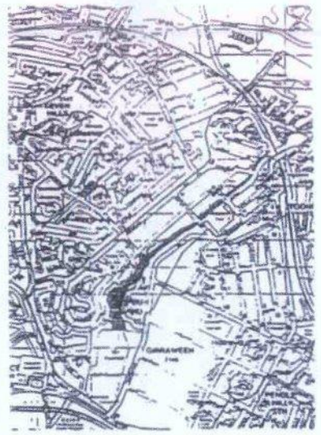
Very bad	26%
Bad	40%
Okay	28%
Good	4%
Very good	2%

Where is the nearest nature reserve that you have visited?
75% of respondents commented

Nurragingy Doonside	28%
Central Gardens Merrylands	18%
Prospect Reservoir	15%
Lake Parramatta	6%
Greystanes Creek Area	6%
None - too far	5%
Unsure	5%
Cumberland Forest	4%
Longneck Lagoon; Arncliffe Wetlands	4%
Bicentennial Park	2%
Duck River	2%
Blue Mountains	1%
Berowra	1%

Would you like to see a nature reserve established within the site?

Yes	83%
Conditional - good maintenance	4%
Conditional - maintain accessibility	3%
Conditional - not highest priority	3%
Conditional - improve native vegetation	2%
Conditional - not encroaching on play area	2%
No - attracts too many visitors	2%
Indifferent	1%



LOCATION PLAN

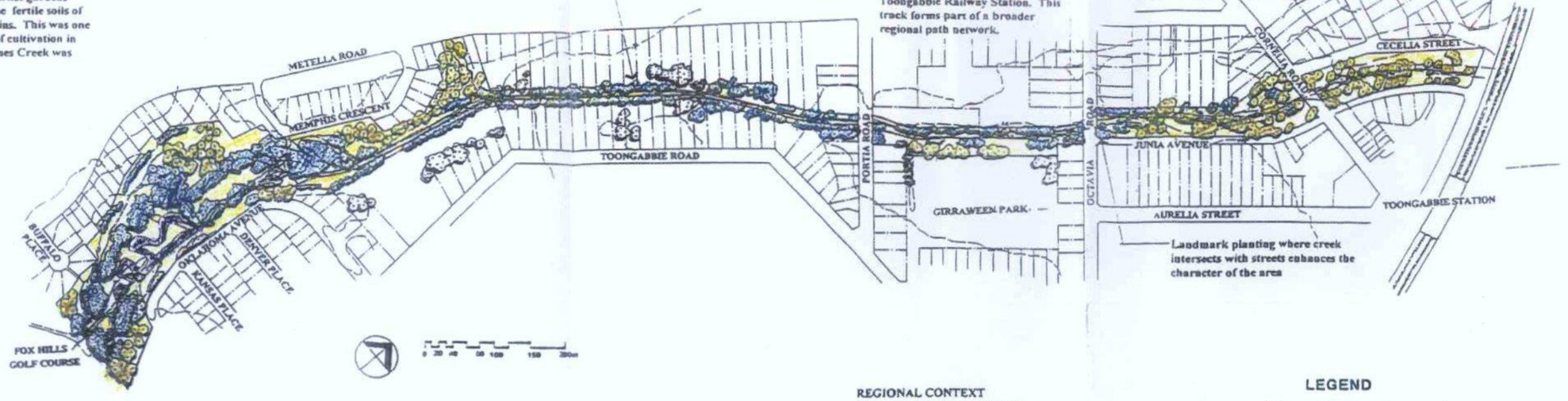
SITE HISTORY
Once inhabited by groups of the Dharug Aboriginal tribe, the main land use in this area since settlement until after the Second World War was agriculture. Market gardens took advantage of the fertile soils of the Cumberland Plains. This was one of the earlies areas of cultivation in the colony. Greystanes Creek was used for irrigation.

WATER QUALITY
Nutrient traps and trash racks installed to improve water quality

CREEK PLANTING
Planting along creek corridor screens houses and fences while still considering sunlight, safety and views

BICYCLE/WALKING PATH
A joint bicycle and walking path, which runs alongside Greystanes Creek, links Oklahoma Avenue and Memphis Crescent with with Toongabbie Railway Station. This track forms part of a broader regional path network.

SCHOOLS AND THE RESERVE
Encourage links between nearby schools and the reserve to enhance the sense of ownership of the reserve and maximise potential for education



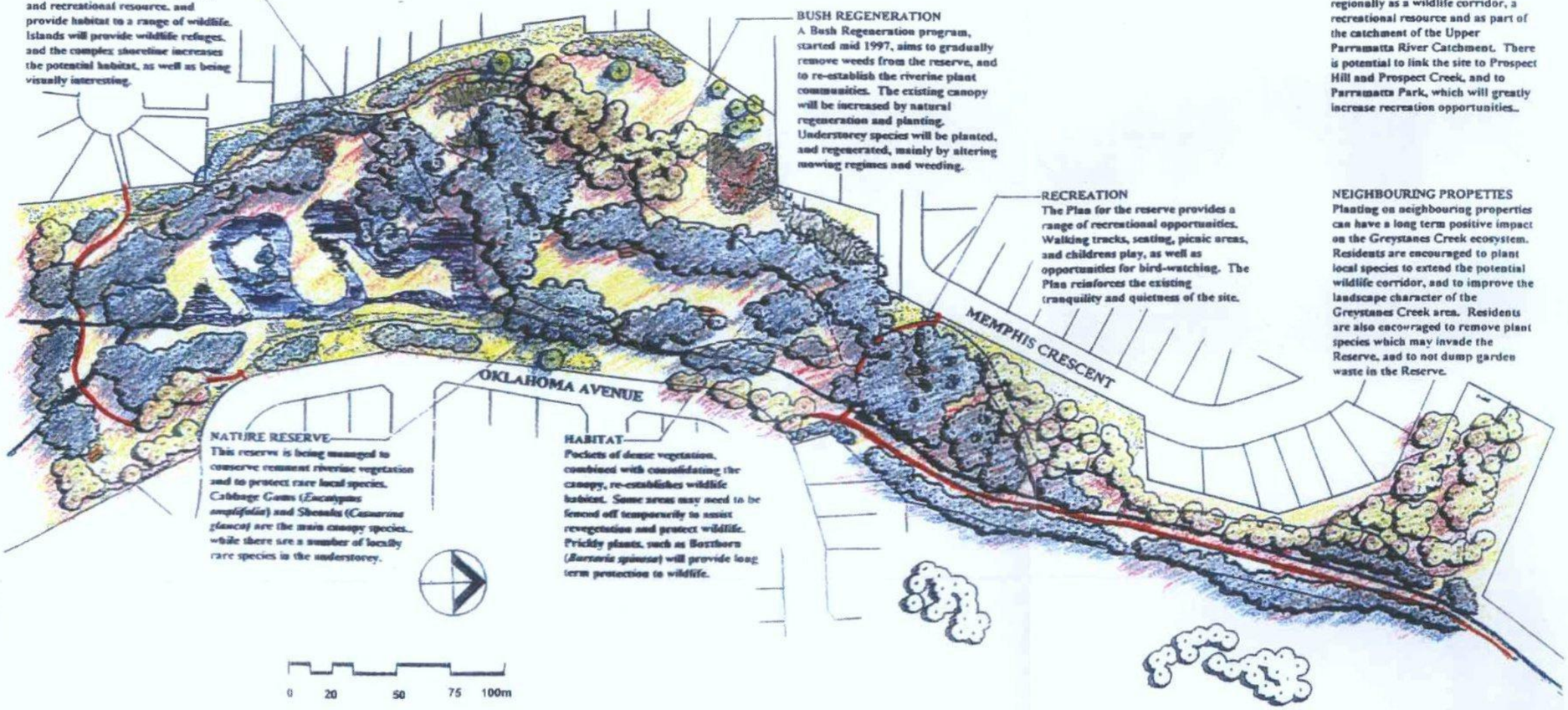
WETLAND
Future constructed wetland will improve water quality, be a visual and recreational resource, and provide habitat to a range of wildlife. Islands will provide wildlife refuges, and the complex shoreline increases the potential habitat, as well as being visually interesting.

BUSH REGENERATION
A Bush Regeneration program, started mid 1997, aims to gradually remove weeds from the reserve, and to re-establish the riverine plant communities. The existing canopy will be increased by natural regeneration and planting. Understorey species will be planted, and regenerated, mainly by altering mowing regimes and weeding.

RECREATION
The Plan for the reserve provides a range of recreational opportunities. Walking tracks, seating, picnic areas, and childrens play, as well as opportunities for bird-watching. The Plan reinforces the existing tranquility and quietness of the site.

NEIGHBOURING PROPETTIES
Planting on neighbouring properties can have a long term positive impact on the Greystanes Creek ecosystem. Residents are encouraged to plant local species to extend the potential wildlife corridor, and to improve the landscape character of the Greystanes Creek area. Residents are also encouraged to remove plant species which may invade the Reserve, and to not dump garden waste in the Reserve.

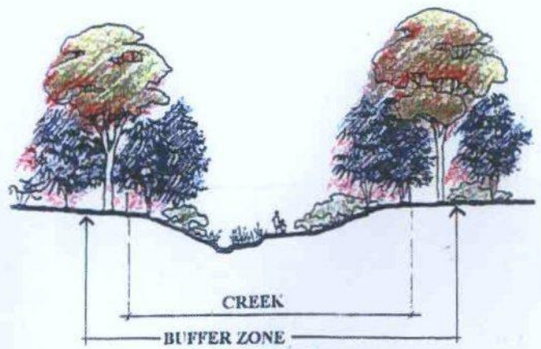
REGIONAL CONTEXT
Greystanes Creek is important regionally as a wildlife corridor, a recreational resource and as part of the catchment of the Upper Parramatta River Catchment. There is potential to link the site to Prospect Hill and Prospect Creek, and to Parramatta Park, which will greatly increase recreation opportunities..



NATURE RESERVE
This reserve is being managed to conserve remnant riverine vegetation and to protect rare local species. Cabbage Gums (*Eucalyptus amplifolia*) and Sheoaks (*Casuarina glauca*) are the main canopy species, while there are a number of locally rare species in the understorey.

HABITAT
Pockets of dense vegetation, combined with consolidating the canopy, re-establishes wildlife habitat. Some areas may need to be fenced off temporarily to assist revegetation and protect wildlife. Prickly plants, such as Boxthorn (*Bursaria spinosa*) will provide long term protection to wildlife.

LEGEND
- EXISTING TREE
- PROPOSED TREE
- SWAMP OAK (*Casuarina glauca*)
- CABBAGE GUM (*Eucalyptus amplifolia*)
- EXOTIC SPECIES
- PROPOSED UNDERSTOREY PLANTING (*Bursaria spinosa*)
- SNOW IN SUMMER (*Melaleuca linarifolia*)
- PRICKLY LEAVED PAPERBARK (*Melaleuca styphelioides*)
- PICNIC PLATFORM
- ENTRY SIGN
- EXISTING SEDGE LAND
- EXISTING REED BED
- WALKING TRACK
- BICYCLE TRACK
- MOWN AREA
- INFORMAL CREEK CROSSING
- BUSH REGENERATION IN PROGRESS (1997)



BUFFER ZONE
A 10 metre wide buffer zone in private properties extends the habitat on each side of the creek. This buffer zone will be implemented as properties are redeveloped.

GREYSTANES CREEK RESERVE

PLAN OF MANAGEMENT

BLACKTOWN CITY COUNCIL HOLROYD CITY COUNCIL UPPER PARRAMATTA RIVER CATCHMENT TRUST