PARRAMATTA CITY COUNCIL

QUARRY BRANCH CREEK: MAINTENANCE & REHABILITATION MASTER PLAN

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Quarry Branch Creek:

Creek Maintenance and Rehabilitation Master Plan

VOLUME 2
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Acronyms

AHIMS:	Aboriginal Heritage Information Management System
AHD:	Australian Height Datum
API:	Aerial Photograph Interpretation
BHSC:	Baulkham Hills Shire Council
BMX:	Bicycle Motor Cross
CBD:	Central Business District
CRC:	Cooperative Research Centre
DCP:	Development Control Plan
DEC:	NSW Department of Environment and Conservation
EPA:	NSW Environment Protection Agency
EPBC:	Environment Protection and Biodiversity Conservation Act 1999
GP:	Gross Pollutant
GPT:	Gross Pollutant Trap
GR:	Grid Reference
M2:	Motorway Two
MUSIC:	Modelling for Urban Stormwater Improvement Conceptualisation
NSW:	New South Wales
LEP:	Local Environment Plan
UBBS:	Urban Bushland Biodiversity Survey
UPRCT:	Upper Parramatta River Catchment Trust
PCC:	Parramatta City Council
NPWS:	National Parks and Wildlife Service
SMP:	Stormwater Management Plan
RSHA:	Rapid Stream Health Assessment
LGA:	Local Government Area
km:	Kilometres
PAD:	Potential Archaeological Deposit
PHS:	Potential Habitat Shelter
EPBC:	Environment Protection and Biodiversity Conservation
DLALC :	Deerubbin Local Aboriginal Land Council
DCAC :	Dharug Custodians Aboriginal Corporation
TSS:	Total Suspended Solids
TP:	Total Phosphorus
TN:	Total Nitrogen

1 INTRODUCTION

This Master Plan document has been prepared to ensure the on-going protection and enhancement of Quarry Branch Creek (Northmead Gully.

The existing natural, Aboriginal and European heritage values associated with this reserve are significant. The reserve is a valuable asset to the City of Parramatta yet has largely been overlooked as a community resource.

Recent enhancement works by local community volunteers, and Council, have initiated a significant shift toward enhancing the natural attributes of the area. The focus on vegetation and stormwater management has greatly improved the values associated with visual and habitat amenity.

The significance of this reserve to the City requires that further modest input and resources are required to ensure its long-term viability.

1.1 Objective

The objective of the Quarry Branch Creek Maintenance and Rehabilitation Master Plan is to plan strategically for the best management of this waterway and its corridor to the year 2020. This objective is consistent with the ideals of waterway rehabilitation which are to enhance the vegetation, structure, hydrology and water quality toward the original stream's condition occurring Pre-European settlement (Rutherfurd, 2000).

This process requires an understanding of the original and current environmental, heritage, social and economic condition and values associated with the creek corridor and it's surrounding catchment. The information produced in the preparation of the Master Plan will be used to create a clear direction for future management and ongoing protection and rehabilitation works. The study is built on the philosophy that rehabilitation and maintenance actions should be self-sustaining and not require continual intervention to retain the improved condition.

The development of the Maintenance and Rehabilitation Master Plan is consistent with the ten key biodiversity outcomes outlined in the 2003 Parramatta City Council Biodiversity Plan and founding objectives of the Upper Parramatta Stormwater Management Plan. The objectives of the plan are also consistent with Priority No 5 of the 2002 Parramatta City Council 'Rivers of Opportunity' report identifying development of maintenance and rehabilitation Master Plans for high priority waterways throughout the Local Government Area (LGA).

1.2 Background

1.2.1 Managing urban waterways

Urban waterways have long faced pressures from the increasing proportion of Australia's population who are choosing to reside in the urban areas. This has resulted in a loss of bushland and adverse changes to natural stream values and their surrounding interrelationships. Urban waterways are frequently seen as 'barometers' of their catchment because they are the result of inputs entering and outputs leaving the system (Brierley *et al*, 2002).

The five main features of waterways affected by urbanisation are hydrology, hydraulics, geomorphology, water quality and ecology & biodiversity (Cottingham

et al. 2003). The hydrology of these catchments has changed as a result of increased stormwater runoff in terms of total volumes, increased frequencies and magnitudes resulting in a decrease in groundwater infiltration and overall lowering of the groundwater table. Upstream land use pressures have increased contamination loads from nutrients, sediments and heavy metals resulting in a total decrease in water quality and changed aquatic environments due to alterations in the natural pH, temperature and mineral compositions.

The ecology surrounding urban waterways has been altered as a result of the altered water quality and hydrology resulting in simplification of habitats and reduction in flora and fauna biodiversity. Degradation of aquatic and riparian landscapes due to high nutrient loads and changed water chemistry has created suitable environments for exotic weeds that out-compete native recruitments resulting in an overall loss of biodiversity (Cottingham *et al*. 2003).

The culmination of the above features has resulted in the overall degradation of urban waterways similar to Quarry Branch Creek. These environments require management to aid their rehabilitation toward a system capable that is self-sustaining and representative of the original pre European ecosystem.

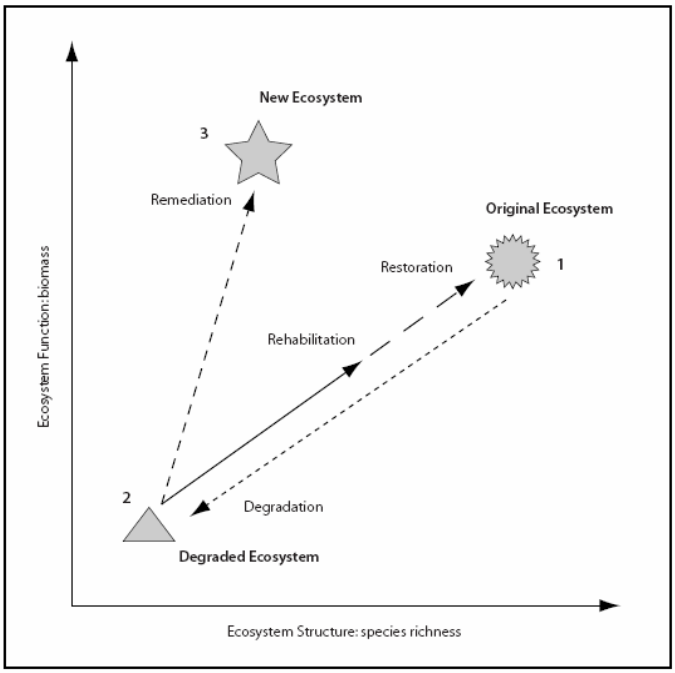


Figure 1 - Objectives of waterway rehabilitation (Source: Rutherfurd et al, 2000)

Figure 1 illustrates the objective of rehabilitating degraded urban waterways like Quarry Branch Creek to a condition close to the original ecosystem with high species richness resulting in successful ecosystem functioning. This should be undertaken with the view that Rehabilitation means making the degraded stream closer to the original condition. Rehabilitation is considered the correct path for Quarry Branch Creek because restoration involves returning the stream to the original condition and remediation involves recognising that the stream has changed so much that the original condition is no longer relevant (Breen & Walsh, 1996).

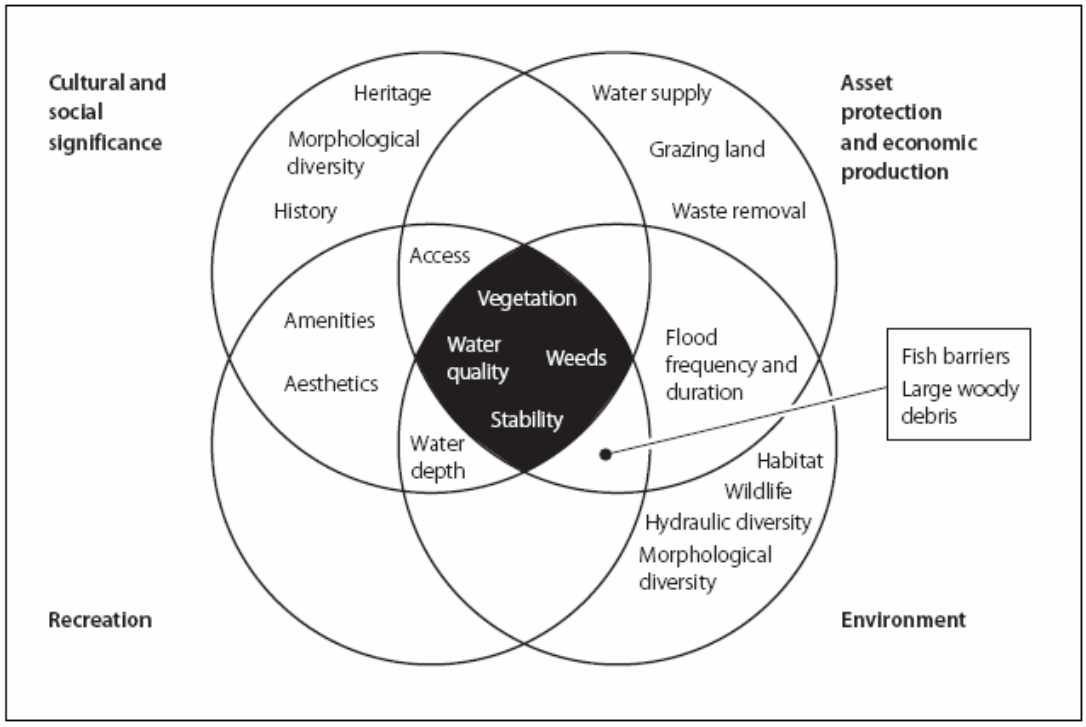


Figure 2 - The four basic values for management of urban streams (Source: Rutherfurd et al, 2000)

Figure 2 illustrates the interrelated values, an understanding of which is required by urban waterway managers. Many of the attributes associated with urban streams may be incompatible, for example vegetation density and flooding. This requires a compromise to be established based on the existing values and the overall vision for the creek. Establishing where the creek falls within the compromise requires assessment of the values, threats and objectives, in essence this Master Plan.

1.2.2 Background reports

A selection of previous studies were reviewed as part of this Master Plan to develop local and regional context. These can be viewed in Appendix 2. The studies undertaken specific to the Quarry Branch Creek (Northmead Gully) corridor have been the catalyst toward the development of the Master Plan. These have been undertaken with various objectives and scales making direct reference to project scope and outcomes. Studies reviewed include;

- Eco Logical Australia Pty Ltd (2005) *Waterways Prioritisation Methodology Discussion Paper*. Prepared for Parramatta City Council
- Dunphy and Beecham (2004). *Upper Parramatta Catchment Trust Detailed Creek Assessment; Volume 1: Summary Document*. Prepared for the Upper Parramatta Catchment Trust.
- Parramatta City Council (2002). *Rivers of Opportunity - Managing Parramatta's Waterways for 2020 and beyond.*
- Parramatta City Council (2003) *Biodiversity Plan – A Future For Our Natural Areas, Native Vegetation and Wildlife.*
- Jamieson Foley Traffic and Transport Pty Ltd (2001). *Multi-use Recreation Pathway Concept Plan. Final Study Report*. Prepared for The Upper Parramatta Catchment Trust.

- Upper Parramatta River Catchment Trust (1999) *Green Corridors Vegetation Management Strategy*.

1.2.2 Legislative framework

Legislation is vital to the management of natural resources because it clearly defines what a landholder or a local government officer can legally do (Lovett *et al*, 1999). This Master Plan is subject to a number of legal constraints which are integral to the best management of natural resources such as Quarry Branch Creek. The applicable legislation relating to riparian, vegetation and water management in an urban context requires a wide range of legislative instruments to ensure the best long-term management.

Appendix 2 provides a list of all relevant Local, State and Commonwealth legislation that that relates directly to the management of urban waterways.

1.2.3 Protection versus restoration

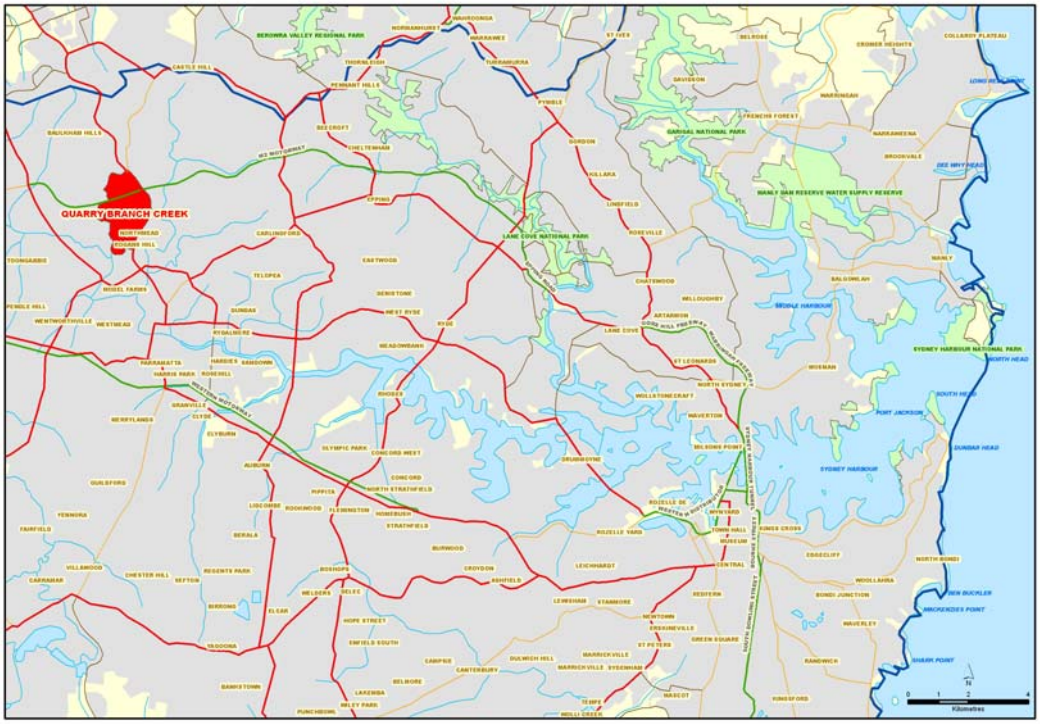
The enhancement of urban waterways follows the philosophy of protection of the valuable asset before the restoration of the degraded asset. With this in mind this Master Plan has sought to identify valuable assets and determine the threats to them.

The primary threats to the integrity of waterways are changes to the catchment imperviousness following development, reduction of the adjacent vegetated zone, pollution and weed invasion. These impacts can be reduced through the implementation of effective planning and development philosophies.

1.3 Location

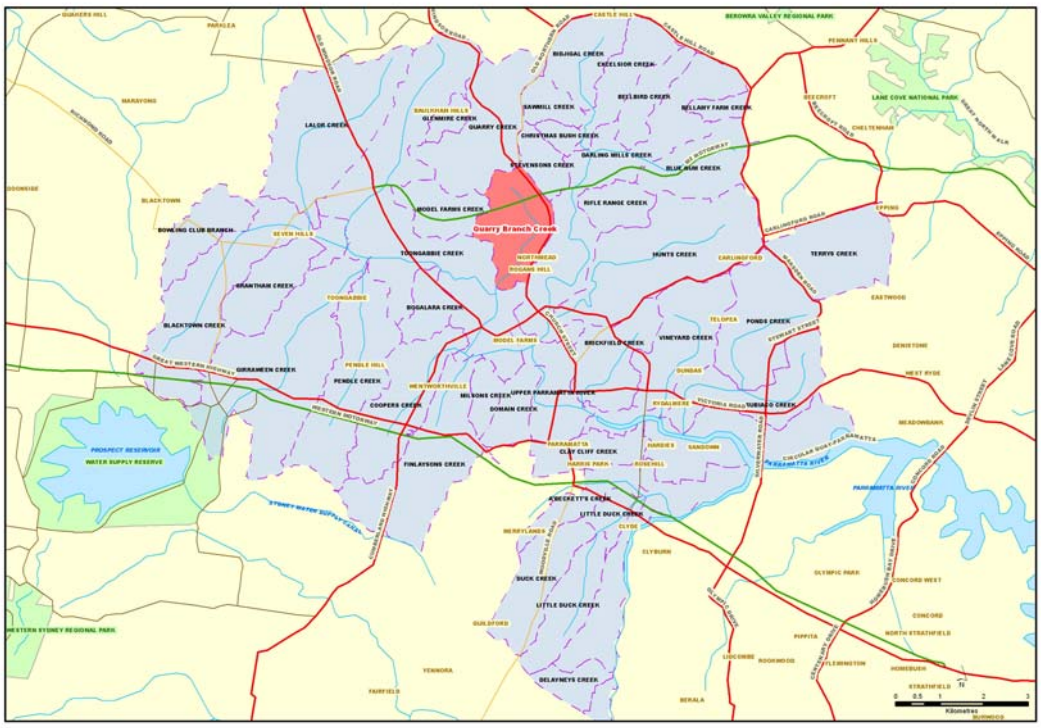
Quarry Branch Creek is located within the Parish of St. John, County of Cumberland in Upper Parramatta River catchment approximately 22.5 kilometres WNW from the Sydney CBD and three to five kilometres to the northwest of Parramatta CBD. The catchment covers a total area of 323ha with 241ha located within the study area to the M2 Motorway which is the boundary between Parramatta City Council and Baulkham Hills Shire Council. The corridor is zoned 6 (a) Public Open Space except for an area south of Model Farms Road on the western side zoned 7, Environmental Protection.

Quarry Branch Creek flows in a southerly direction into Toongabbie Creek which is a major tributary of the Parramatta River. The river eventually enters the ocean via Port Jackson and Sydney Harbour.



Map 1 - Regional location within Sydney

The location of Quarry Branch Creek at the upper extents of the Upper Parramatta Catchment ensures the trajectory of the bushland and waterway condition are not adversely impacted by major tributaries or land use changes elsewhere in the catchment.



Map 2 - Location within Upper Parramatta River Catchment Area

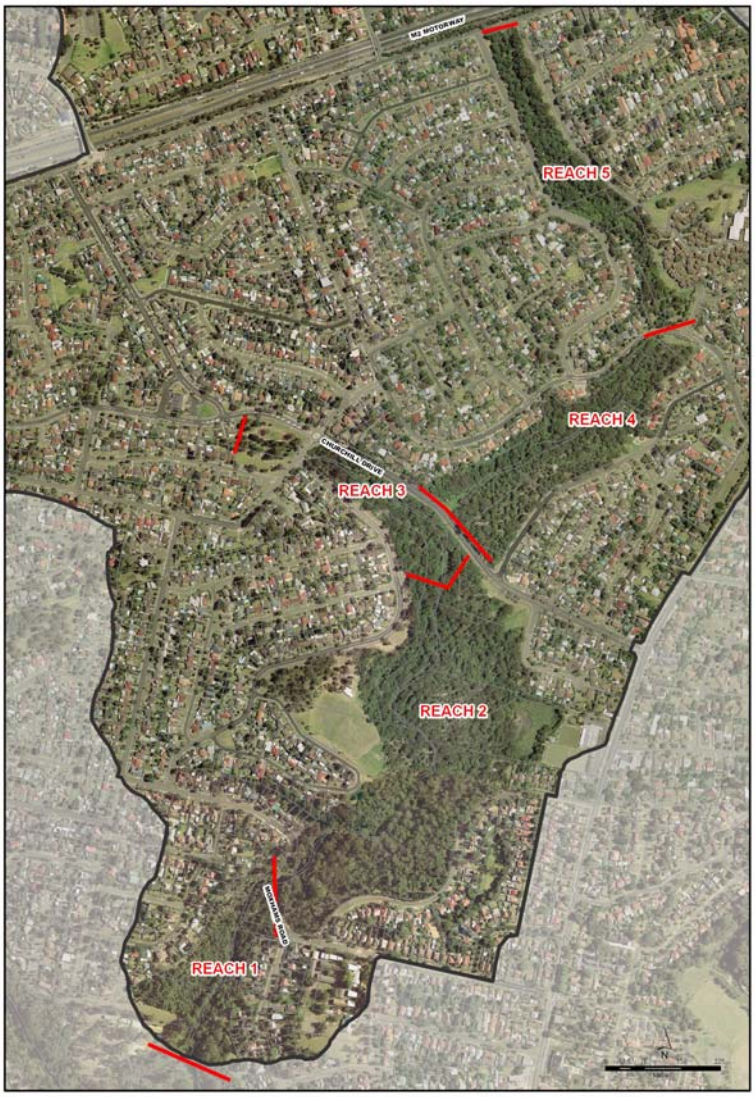
1.4 Management reaches

Delineation of the corridor into distinct management zones has been undertaken for the development and display of the Master Plan actions. There are numerous methods of classifying waterways and bushland areas into distinct zones or reaches including variation of landforms, vegetation and functional land uses. For the purpose of developing a tool which could be easily adopted by the various stakeholders it was determined to primarily use road boundaries to delineate the reaches, catchment, rehabilitation and maintenance actions. This was conducted for all reach boundaries with the exception of Reaches 2 and 3 where the tributary confluence was used as a reach boundary.

To define, partition and classify Quarry Branch Creek into zones of management allows for the source and impacts of particular degradation issues to be strategically managed on a reach by reach basis while preserving a 'whole of catchment' approach to rehabilitation and amelioration initiatives. This 'holistic' approach to catchment management assesses the condition of each reach within a framework of upstream threats, downstream impacts and the position of each reach within a trajectory of change.

Reach	Location	Length	Average corridor width
1	Toongabbie Creek Confluence to Moxhams Road	415m	125m
2	Moxhams Road to Churchill Drive	960m	130m
3	Tributary confluence to Willmott Avenue	350m	65m
4	Churchill Drive to Model Farms Road	580m	146m
5	Model Farms Road to Junction Road	690m	45m

Table 1 – Attributes of Quarry Branch Creek management reaches



Map 3 - Management reaches

2 CATCHMENT REVIEW

2.1 Catchment characteristics

2.1.1 Physiography

Quarry Branch Creek lies in the Cumberland Plain of Western Sydney. It is a sub catchment of Toongabbie Creek and the Parramatta River. The headwaters of Quarry Branch Creek rise in Winston Hills, near the M2 motorway (Refer map 4), and flow in a generally south-westerly direction to its confluence with Toongabbie Creek at Northmead.

2.1.2 Geology

Sydney lies at the geological centre of the sedimentary, Permian/Triassic , Sydney Basin (Bembrick *et al.* 1983) and within this basin there are a number of structural and morphologic landscape units. Most of the greater Sydney metropolitan area is situated on the Cumberland Plain, an area of generally low relief and rolling hills. Tectonics have uplifted the surrounding countryside to form a series of plateaux. These are the Hornsby Plateau, in the North, The Blue Mountains Plateau, in the West, and the Woronora Plateau, in the South.

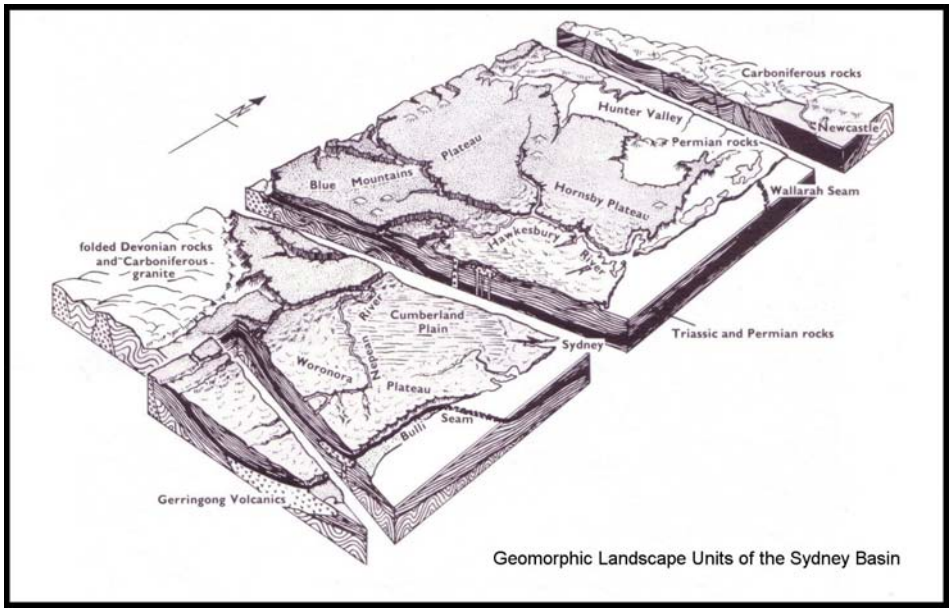


Figure 3. Geomorphic landscape units of the Sydney Basin.
(Source: Branagan et al. 1976; Herbert and Helby 1980)

Quarry Branch Creek lies on the north east margin of the Cumberland Basin (Herbert and Helby, 1980), which is morphologically analogous to the Cumberland plain that has developed on the generally horizontally bedded sediments of the Triassic Wianamatta Group, particularly the Ashfield Shale and the Bringelly Shale. It is the outcrop of these Wianamatta Group sediments that delineate the Cumberland Basin (Herbert and Helby 1980). However, Quarry Branch Creek is incising into the boundary between the Cumberland Plain and the Hornsby Plateau (Figure 3 and Map 5). The catchment and channel will therefore exhibit site-specific characteristics of both landscape units.

Understanding the geological inheritance of Quarry Branch Creek is essential to gain insights into, and a fundamental understanding of, the geomorphological characterisation of the channel and catchment. A discussion on the geology and

sedimentology is therefore presented in Appendix 18

2.1.3 Soils

The characteristics, texture and formative processes that determine the soil types in Quarry Branch Creek are intrinsically related to erosion potential of these soils.

In the upper catchment, where the Quarry Branch Creek channel and proximal zone are located on Ashfield or Bringelly Shale, the soils are predominantly clayey in texture. Lower in the catchment, where Quarry Branch Creek has incised through the overlying shale into Hawkesbury Sandstone, podsols, sandy loams and sandy clay loams predominate.

A full description of the soils in the Quarry Branch Creek Catchment is presented in Appendix 17. This should be read in context with the lithological descriptions and notes on geology presented in Appendix 18.

< Remove page insert Map 4 Catchment Relief >

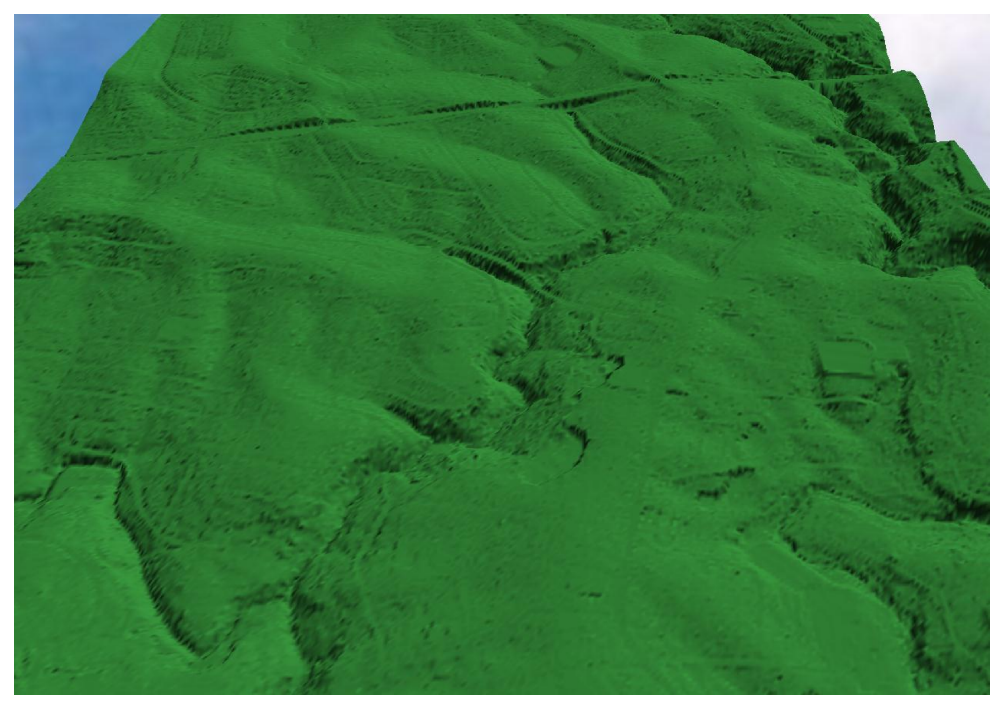
QUARRY BRANCH CREEK MASTER PLAN

Map 4: Quarry Branch Creek Relief

M2 MOTORWAY

MODEL FARMS ROAD

CHURCHILL DRIVE



Legend

- Contours (5m interval)
- Cadastre
- Catchment Boundary

N

0 60 120 240

Metres

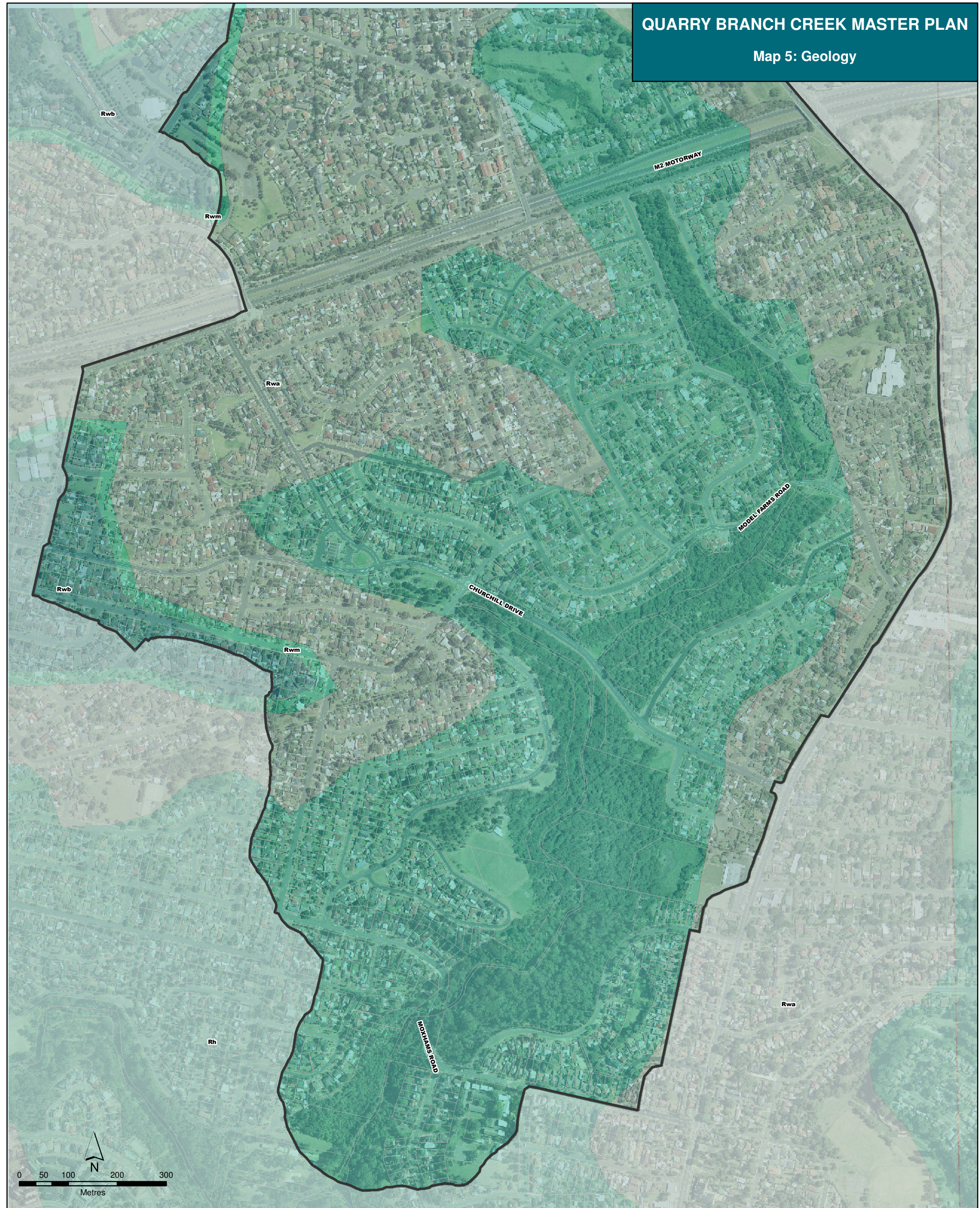
While every effort has been made to ensure the correctness of data supplied at the time of it's production, Paramatta City Council does not warrant the information or plans do not contain errors and the Council shall be in no way liable for any loss, damage or injury as a result of any such errors.

Earth Tech

< Remove page insert Map 5 Geology >

QUARRY BRANCH CREEK MASTER PLAN

Map 5: Geology



Legend

- Jp, Prospect Picrite, picrite, dolerite, minor basalt
- Jv, volcanic breccia, varying amounts of sedimentary breccia, and basalt
- Jvs, volcanics
- Qa, gravel and sand
- Qal, fine-grained sand, silt and clay
- Qha, quartz sand, silty sand, silt and clay
- Qpn, medium-grained sand, clay, silt
- Rh, Hawkesbury Sandstone, medium to very coarse-grained quartz sandstone, minor laminated mudstone and siltstone lenses
- Rhs, laminated mudstone, siltstone
- Rwa, Ashfield Shale, dark-gray to black claystone-siltstone and fine sandstone-siltstone laminite
- Rwb, Bringelly Shale, shale, carbonaceous claystone, laminite, fine to medium-grained lithic sandstone, rare coal and tuff
- Rwm, Minchinbury Sandstone, fine to medium-grained quartz-lithic sandstone
- WAT
- Catchment Boundary
- Cadastre

<Remove Page Insert Map 6 - Soils >

QUARRY BRANCH CREEK MASTER PLAN

Map 6: Soil Landscape

M2 MOTORWAY

MODEL FARMS ROAD

CHURCHILL DRIVE

MOXHAMS ROAD

COha

ERgn

COpn

ERlu

REbt

N

0 50 100 200 300

Metres

While every effort has been made to ensure the correctness of data supplied at the time of it's production, Paramatta City Council does not warrant the information or plans do not contain errors and the Council shall be in no way liable for any loss, damage or injury as a result of any such errors.

Earth Tech

Legend

- COha
- COpn
- ERer
- ERgn
- ERlu
- REbt
- RElh
- Catchment Boundary
- Cadastre

2.2 Historic channel morphology

Analysis of the early maps for Parish St John, County Cumberland reveal that during the period of early settlement the channel of Quarry Branch Creek existed as a continuous channel of low sinuosity with a chain of ponds morphology in the headwaters zone.

An assessment of the early parish maps for St. John is contained in Appendix 16.

2.3 Aboriginal heritage

A report on areas of indigenous heritage in the Quarry Branch Creek corridor was prepared by Jo McDonald Cultural Heritage Management Pty. Ltd.

The report was prepared from a combination of desktop review and field survey for Indigenous heritage sites within the Quarry Branch Creek waterways corridor. The study area falls within the boundaries of the Deerubbin Local Aboriginal Land Council (DLALC). It is also within an area of interest to the Dharug Custodians Aboriginal Corporation (DCAC), and the Dharug Tribal Aboriginal Corporation. All these stakeholders were involved in the development of this report.

The report is presented, in full, as an attachment to this Master plan. Therefore the conclusions and determinations of the report will not be reiterated here

2.4 European heritage and historical information

2.4.1 The written history

The area of Quarry Branch Creek has two areas of particular historical note. The Moxham park quarries and the Model Farm park.

The area north of Parramatta and west of Windsor Road was unincorporated until the establishment of Blacktown Shire in 1906 and looked to Parramatta for all its services. It was originally part of the Domain surrounding Government House at Parramatta until it was sold in the 1850s as small farming lots. Alongside orchards and some poultry farms two major enterprises operated in the area; Moxham's Whitehaven Quarry north of Moxhams Road and the Parramatta Woollen Mills, near Darling Mills Creek (Kass et al. 1996). It is Moxham's Quarry that is of interest to us.

The quarrying of sandstone went hand in hand with the development of towns. With the sandstone being used for a variety of things from private houses to public buildings and bridges. Historian Terry Kass (2005) states that:

"Parramatta, as the major centre was the principle area where sandstone was quarried for building purposes. Quarries were opened near the Cumberland hospital and Parramatta River and Toongabbie Creek."

The area was once part of the Oakes Estate and was quarried by the Moxham family before 1887 (Pike and Walker 1999: 1, Liston 1996: 231). Liston suggests that Tom Moxham, like many contractors in the mid to late 19th century, used timber as an entree to other business ventures in the district (Liston 1996: 200). As a corollary to the quarries the Moxham brothers were also horse breeders and operated orchards. The brothers were particularly successful in the horse trade and supplied horses to the British government for use in the Boer War in 1900 and in 1905 horses were being purchased for the Japanese market at Woolpack

saleyards (Kass et al. 1996). In 1907 the Moxhams brothers were making a combined profit of £1631 from these two pursuits. The histories contain no discussion of the financial state of the quarries; it appears they were also successful. Of the Moxham sandstone Liston (1996: 231) notes:

"A block of their finest white stone had pride of place in the centenary parade in 1888".

In addition Tom Moxham, active in the Orange lodges and a member of the central council of the Australian Protestant Defence Association, was a local Member of Parliament and one time Mayor of Parramatta. Involvement in local friendly societies provided him with a power base that cut across class relationships (Kass 2000: 298 –99, 305). In the early 20th century he acted as a local member to push vigorously for the reduction of working hours of asylum attendants. The Moxham family also owned land within Parramatta (now Thomas street) which was subdivided in 1915 (PCC 2001: A 71).

February 1914 saw the commencement of subdivision of the Moxhams family's extensive holdings south of Moxhams Road. In October 1935 W. D. Moxham's deceased estate passed to his trustees, and the Whitehaven Quarry was subdivided and offered for sale privately in June and December 1937 by the Sylvia Gardens Estate Ltd (Pike and Walker 1999: 1). This is the area that is currently enclosed by Whitehaven Road to the north and west and by Hartland Street to the east and Moxhams Road to the south. The Charles Herbert Reserve is at the centre with clear evidence of the quarrying.

There is no secondary source material available for the model farm. But it would have been one of several established in NSW in the 19th century.

2.3.2 The cartographic evidence

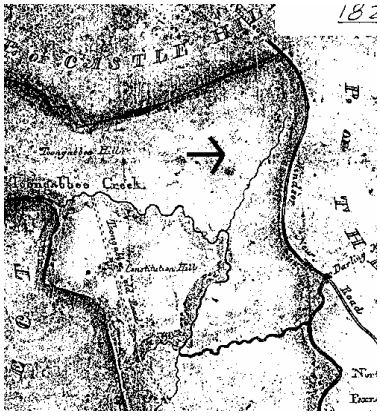
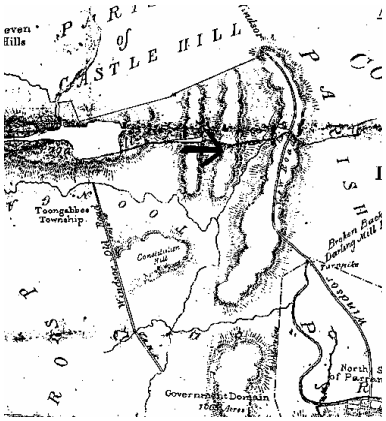
1828  (Source: Bickford 1993: Figure 5)	The 1828 map shows Toongabbie Creek with a branch of the creek running to the northeast, west of Windsor Road. On this map a nearby hill (to the southwest) is called Constitution Hill (and was also the site of a number of small quarries (Bickford 1993). There is no evidence of development within the study area.
1850  (Source: Bickford 1993: Figure 6).	The 1850 map indicates the hilly topography of the area. The creek is clearly marked as is Constitution Hill. New Windsor Road is shown to the west. Once again there is no evidence of development within the study area.

Figure 4 Early parish maps

A series of early parish maps were viewed on line at the Department of Lands and Survey website (www.lands.nsw.govt.au/OnlineServices/Parishmaps/default.htm). These were similar to the maps shown above and did not elucidate any further information regarding the area.

2.4.3 Clearing and cultivating

The steep topography in most of the study area made it unsuitable for agricultural purposes. However, on lower lying topography only a few kilometres to the west of the Toongabbie Creek confluence were some of the earliest government farming settlements in Australia.

In November 1788, Governor Arthur Philip had chose the location of a new settlement at Parramatta calling it "Rose Hill" (Fletcher et al. 1975). In March 1789, *"… the people were principally employed in clearing and cultivating land…"* (Fletcher et al. 1975).

With fresh ship loads of convicts arriving at Port Jackson, and severe food shortages, new land in surrounding districts was sought out for clearing and cultivation. In December 1791 Watkin Tench described a visit to two "public settlements" which used large parties of convicts to clear and cultivate "public ground" north of Rose Hill. One of these settlements was "about 1 mile north-west from the governor's house". Another was on the banks of Toongabbie Creek, west of the confluence with Quarry Branch Creek:

Figure 5: "A Western view of Toongabbie". Engraved plate by William Lowry in D.Collins Account of the English Colony of NSW, published 1798. National Library of Australia (Possibly in vicinity of Oakes Road)

> *"Walked on to the second settlement, about two miles further, through an uncleared country. Here met Daveney, the person who planned and now superintends all the operations carried on here. He told me that he estimated the quantity of cleared ground here at 300 acres. He certainly over-rates it one-third, by the judgment of every other person. Six weeks ago this was a forest. It has been cleared, and the wood nearly burnt off the ground, by 500 men, in the before-mentioned period, or rather in thirty days, for only that* number have the convicts worked. He said it was too late to plant maize, and therefore he should sow turnips, which would help to meliorate and prepare it for next year. On examining the soil, I though it in general light, though in some places loamy to the touch….he judged the soil to be good, from the limbs of many of the trees growing on it being covered with moss" (Flannery

1996).

In July 1792 Collins notes: “At the settlements beyond Parramatta (which had lately obtained and were in future to be distinguished by the name of Toongabbie) the convicts were employed in preparing the ground for the reception of next year’s crop of maize” (Fletcher et al. 1975). Collins further noted that by October 1792, on public land “at and leading to Toongabbie”, there were 696 acres of land under cultivation, sown with wheat, maize and barley (Fletcher et al. 1975).

An undated early survey map (Archives Office 5745, no date) shows Quarry Branch, with land holdings further north of what is now Junction Road (Figure 4) Jarvis (1933) mentions that land extending from Parramatta to the vicinity of Seven Hills, and from the western road to Junction Road (formerly known as Toongabbee).

3 CURRENT CONDITION

3.1 Ecology

3.1.1 Vegetation communities

Compared to other surrounding watercourses in Parramatta Local Government Area (LGA) the bushland corridor of Quarry Branch Creek has remained relatively intact and survived the spread of urban development. This is consistent with the idea of Sydney's bushland areas becoming 'suburban bush' that are primarily confined to creeks and steep slopes that are generally unsuitable for housing or industry (Benson & Howell,1995). Today the corridor is protected in a series of Reserves including Otto Losco, John Curtin, Moxham Park, Impeesa and Model Farms Reserves. The corridor currently varies in width from approximately 45 metres to 150 metres.

As a result of Council's planning in the forming of reserves and active bush regeneration activities significant remnant vegetation communities have been successfully retained. This ensures a degree of resilience providing habitat and wildlife corridors supporting biodiversity within the corridor which now would be considered to have regional significance.

The vegetation communities of the corridor were identified and mapped in 2002 by the NSW National Parks and Wildlife Service Urban Bushland Biodiversity Survey (UBBS) of Western Sydney. The communities identified were Turpentine Ironbark Forest and Turpentine/Ironbark Margin Transition Forest. These two communities form the Sydney Turpentine Ironbark Forest classification which is listed an endangered ecological community under the *Threatened Species Conservation Act*.

Within the Parramatta City Council LGA these vegetation communities now cover a total area of 184.7ha, this accounts for only 9.5% of the estimated Pre-1750 Sydney Turpentine Ironbark Forest extent of 1,935ha once covering the entire Parramatta LGA (NPWS 2002).

At a regional scale the estimated Pre-1750 Sydney Turpentine - Ironbark Forest communities once covered a total area of 26,516ha over the Cumberland Plain region from Ryde to Glenorie on the low rainfall Wianamatta Shale Soils (Benson & Howell 1990). The extent of this community can be seen in Figure 5 below which illustrates the estimated distribution of Turpentine Ironbark Forest pre-1788. Today only 1,182ha or 4.5% of this total area remains. Of the remaining portions of this community approximately 40ha is located within the Quarry Branch Creek corridor. Many of the remaining remnant Sydney Turpentine - Ironbark Forest community sites are in vulnerable positions that are susceptible to urban development and weed invasion caused by nutrient rich runoff (Benson & Howell 1994).

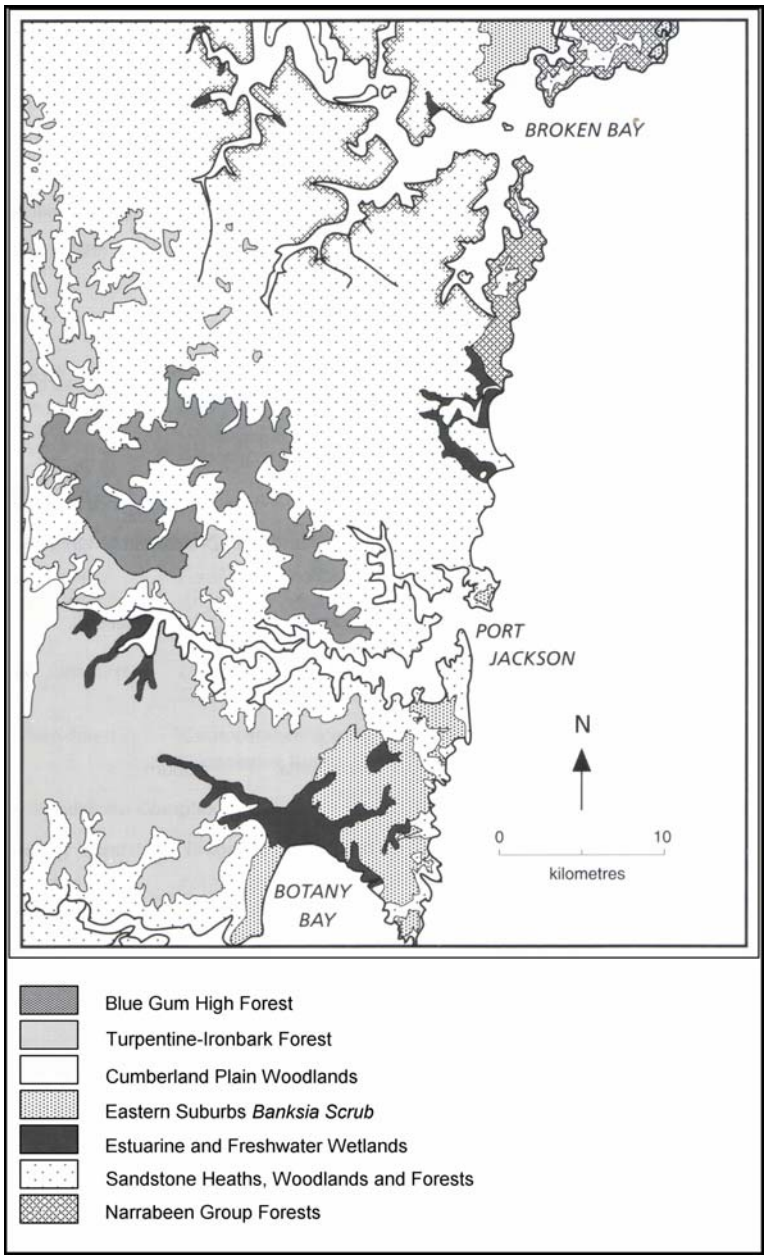


Figure 6 - Pre 1788 inferred vegetation communities of the Sydney 1:100 000 map sheet. (Source: Benson,D.H. & Howell,J.,1990)

The composition of the Sydney Turpentine Ironbark Forest assemblage is dominated by a canopy cover of Turpentine (*Syncarpia glomulifera)*, Grey Gum (*Eucalyptus punctata*), Grey Ironbark (*Eucalptus paniculata)* and Thin Leaved Stringybark (*Eucalpytus eugeniodes*). Smaller tree species forming an understorey averaging 10m prominent in this community are dominated by Sweet Pittosporum (*Pittosporum undulatum*), Native Peach (*Trema aspera*) and *Acacia sp*.

The middle storey shrub strata is generally sparse and dominated by Rough Fruit Pittosporum (*Pittosporum revolutum*), Breynia (*Breynia oblongifolia*), Paper Daisy (*Ozothamnus diosmifolius*), Hop Bush (*Dodonaea triquetra*), Elderberry Panax (*Polyscias sambucifolia*), Sickle Wattle (*Acacia falcata*) and *Acacia sp*.

The ground stratum of this species is generally dense with small herbs and grasses including Basket Grass (*Oplismenus aemulus*), Pastel Flower (Pseuderanthemum variable), Hedgehog Grass (*Echinopogon ovatus*), Kangaroo Grass (*Themeda australis*) and *Poa sp*. (NPWS 2002).

< Remove page and replace with MAP 8 Current Vegetation Communities >

QUARRY BRANCH CREEK MASTER PLAN

Map 8: Current Vegetation Communities

M2 MOTORWAY

MODEL FARMS ROAD

CHURCHILL DRIVE

MOXHAMS ROAD

Legend

- 1 - Shale Sandstone Transition Forest (Low Sandstone Influence)
- 2 - Shale Sandstone Transition Forest (High Sandstone Influence)
- 15 - Turpentine-Ironbark Forest
- 31 - Sandstone Ridgetop Woodland
- 43 - Turpentine-Ironbark Margin Forest
- 103 - Shale/Gravel Transition Forest
- Catchment Boundary

Source: New South Wales National Parks and Wildlife Service (2002) *Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney, Final Edition* NSW NPWS, Hurstville

N

0 50 100 200 300

Metres

3.1.2 Vegetation loss since 1951

An aerial photograph assessment was undertaken of the Quarry Branch Creek using 1951, 1977 and 2005 aerial photography. These images allowed a fifty year study of the changes in the land use and vegetation 'window' of the corridor to be determined. This analysis included identifying and mapping canopy cover where crowns of trees exceeded 50%. This method has limitations and gives no indication of the middle and ground strata or the presence of weed infestations.

This process procedure guides the maintenance and rehabilitation measures in the recommendations required to rehabilitate the corridor through gaining an understanding of the medium term past changes that have occurred to the riparian and terrestrial vegetation.

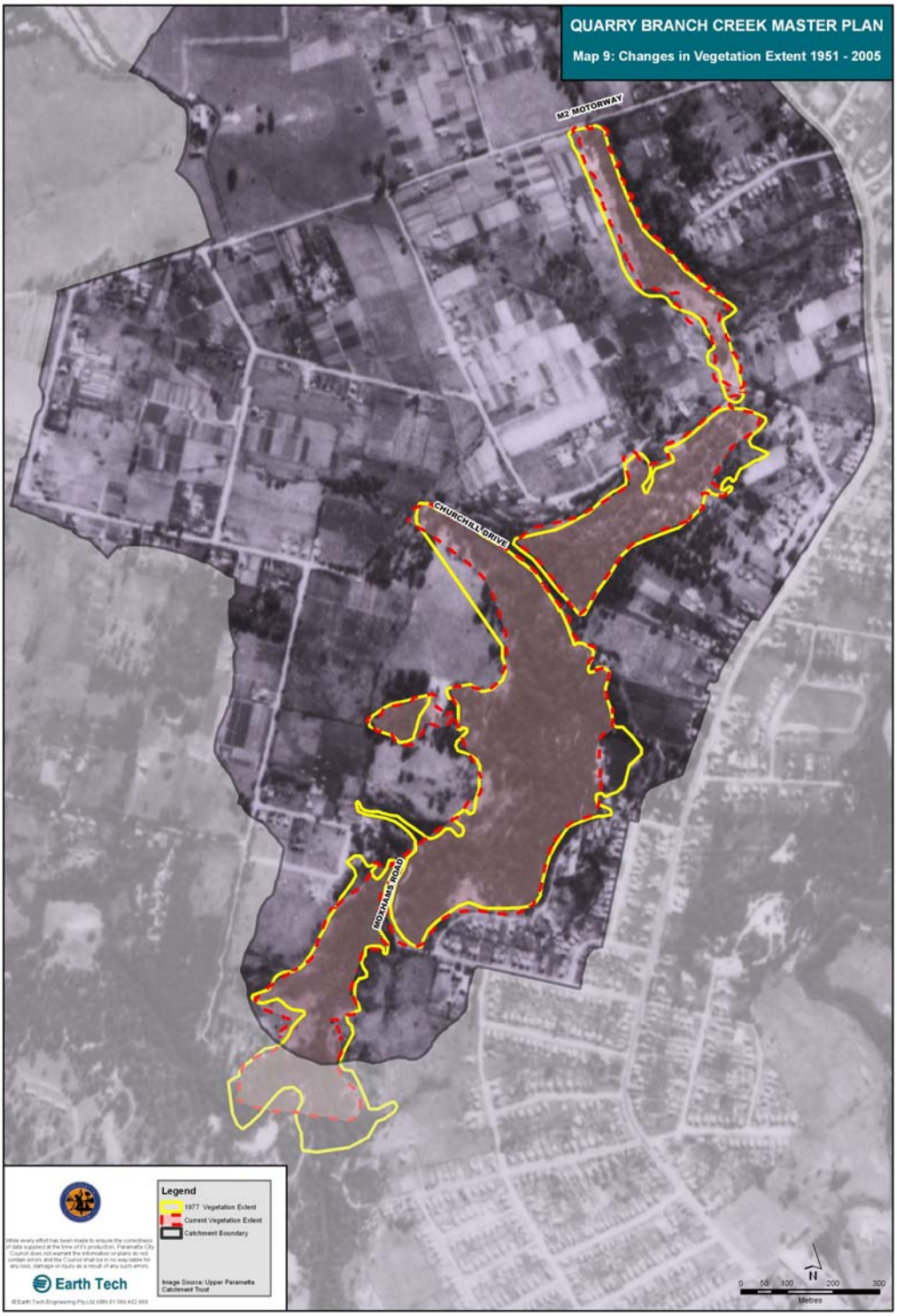
Year	Reach 1	Reach 2	Reach 3	Reach 4	Total
1951	7.8ha	37.876ha		3.8ha	49.4ha
1977	9.9ha	22.6ha	8.1ha	4.7ha	45.1ha
1997	5.6ha	22.1ha	7.6ha	4.3ha	39.6ha
2005	8.1ha	21.1ha	7.5ha	4.2ha	40.9ha

Table 3 - Changes in the area of corridor native vegetation area since 1951

The differences between the area of the bushland in the corridor between 1951 and present was calculated to be approximately 8.51ha. The reductions in the corridor size between 1951 and present were largely due to expansion of the urban area and the clearing for roads. The noticeable areas cleared since 1951 were;

- 1.1ha cleared for residential housing abutting the bushland corridor along Model Farms Road, Winston Hills
- 1.3ha cleared remnant patch disjoined from the main corridor cleared for residential housing around Braddock Place, Baulkham Hills
- 1.1ha cleared area joined to the corridor cleared for housing around Dale Place, Huxley Drive and Willmott Place, Winston Hills
- 2.9ha cleared area joined to the eastern bushland around the area around Yarabee Road, Northmead
- 1ha cleared area for the construction of Churchill Drive

An area of 2ha of riparian zone upstream of the present day Model Farms Road was cleared in 1951 presumably for stock access and watering. In 1951 the upper reaches of the catchment still retained considerable tracts of market gardens, orchards and intensive grazing whilst urban growth was establishing. This area has regrown with a variety of weed species dominated by Weeping Willow (*Salix babylonica*), Camphor Laurel (*Cinnamomum camphora*), Broadleaf Privet (*Ligustrum lucidum*) and Small-leaf Privet (*Ligustrum sinense*).This exotic canopy, middle and ground storey strata is representative of secondary re-growth from clearing for agriculture within the Sydney basin (Benson & Howell, 1995).The original composition of Cumberland Plain plant communities means they are highly vulnerable to weed invasion because of the relatively sparse middle storey and open canopy structure suitable for aggressive weed species.



MAP 9 - Vegetation losses since 1951 (1951 base map air photo)

3.1.3 Flora species

A total of 252 flora species were identified by the 2003 Parramatta City Council Biodiversity Plan in this area (Appendix 4), including 35 local and regionally significant species. During the field work many more species not listed in the biodiversity plan for this site were seen. The species present are typical of the Sydney Turpentine Ironbark Forest assemblage and riparian species common throughout the Sydney Harbour and Hawkesbury/Nepean Catchment areas. The list

of plant species was interpolated from the various reserves comprising the corridor in the Parramatta City Council Biodiversity Plan. Refer to Appendix 4 for full species listings from the 2003 PCC Biodiversity Survey.

For the purpose of applying maintenance and rehabilitation techniques within the corridor it was important to acquire a comprehensive understanding of the vegetation species within the study area including threatened species to ensure the techniques would be compliant with the relevant recovery plans. Searches of electronic databases were conducted;

- NPWS Wildlife Atlas Survey (http://wildlifeatlas.nationalparks.nsw.gov.au)
- Australian Natural Resources Atlas (http://www.environment.gov.au/atlas).
- NPWS Western Sydney Urban Bushland Biodiversity Survey (UBBS)

These searches summarise matters of national and regional environmental significance identified as occurring in the region. Flora species lists from the NPWS Wildlife Atlas Survey search can be referred to in Appendix 5.

The purpose of this Master Plan is not to undertake a full flora and fauna assessment but rather provide the relevant background information for planning the rehabilitation and on-going management of the Quarry Branch Creek Corridor. Flora and fauna lists exist for the reserve and these were built upon with opportunistic sightings.

Table 4 below contains a list of species that are considered significant and likely to occur within or near the study site.

Scientific Name	Common Name	PCC Biodiversity survey	NPWS Atlas	EPBC Search
Acacia bynoeana	Bynoe's Wattle		E1	Vulnerable
Acacia pubescens	Downy Wattle		V	Vulnerable
Asplenium australasicum	Birds Nest Fern	V1		
Bothriochloa macra	Red-leg Grass	V3		
Brachychiton populneus	Kurrajong	V3		
Callistemon citrinus	Crimson Bottlebrush	V3		
Cryptostylis hunteriana				Vulnerable
Danthonia racemosa	Wallaby Grass	V3		
Darwinia biflora				Vulnerable
Dichelachne crinata	Plume Grass	V3		
Doodia aspera	Rasp Fern	V3		
Einadia trigonus	Salt Bush	V3		
Epacris pupurascens			V	
Eucalyptus punctata	Grey Gum	V3		
Eucalyptus saligna	Sydney Blue Gum	V3		
Grevillea parviflora subsp. parviflora				
Hibbertia superans			E1	
Juncus subsecundus		V3		
Leucopogon juniperinus	Bearded Heath	V3		
Lobelia gracilis	-	V2		
Maytenus silvestris	Orange Wood	V3		
Omalanthus nutans	Bleeding Heart	V3		
Pimelia curvifolia ssp.	Curvifolia	REG V1		
Pimelia spicata			E1	
Platycerium bifurcatum	Elkhorn	V1		
Platylobium formosum	Handsome Flat-pea	V3		
Poa affinis	Tussock Grass	V3		
Rumex brownie		V3		
Tetratheca glandulosa				
Todea Barbara	King Fern	V3		
Wahlenbergia stricta		V2		

V1 - Vulnerable in Western Sydney, also a ROTAP or TSC Act listing, regionally significant and rare (5 or l records)
V2 - Vulnerable in Western Sydney, uncommon (6-10 records)
V3 - Vulnerable in Western Sydney, relatively common to widespread and unlikely to become regionally ex the near future.
Vun - Vulnerable under the EPBC Act 1999
REG V1 - Regionally significant in western Sydney

Table 4 - Identified significant flora species by NPWS Wildlife Atlas and PCC Biodiversity Survey

3.1.4 Weeds

Cumberland Plain Woodland communities are particularly susceptible to threats associated with urban development, for example recreation, dumping, grazing and stormwater related problems. The naturally sparse middle storey and high nutrient runoff has resulted in remnants such as Quarry Branch Creek becoming susceptible to weed invasion. These infestations dominate the vegetation throughout the riparian zone choking available light and covering the forest floor with organic litter. Lantana (*Lantana camara*) and Privet (*Ligustrum spp*) now dominate the riparian zone throughout much of the corridor, having detrimental effects on natural processes such as native recruitment and decomposition of organic matter. These species have created a 'monoculture' effect.

It is noticeable that in reaches cleared prior to 1950 the dominance of exotic canopy, middle storey and groundcover species is evident. Upstream of Model Farms Road was identified to have the poorest native vegetation values due to the narrow corridor width and proximity of residential encroachment. It is believed that this has been compounded by the previous clearing and land use.

The vegetative assemblage in the area north of Model Farms Road has a canopy and small tree stratum dominated by Weeping Willow (*Salix babylonica*) and Camphor Laurel (*Cinnamomum camphora*). This middle storey strata is dominated by Lantana (*Lantana camara*), Balloon Vine (*Cardiospermum grandiflorum*), Large-leaf Privet (*Ligustrum lucidum*), Small-leaf Privet (*Ligustrum sinense*) and Japanese Honeysuckle (*Lonicera japonica*). In some areas of this reach the Large-leaf Privet (*Ligustrum lucidum*) are becoming the dominant canopy species reaching heights of approximately 15-20m. The UPRCT Green Corridors Strategy identified the condition of Quarry Branch Creek as a heavily infested monoculture of weeds ranging from herbaceous weeds to trees, shrubs and vines (UPRCT 2000).

There are many areas within the corridor however that are essentially weed free and require little management. In addition, the severity of the weed species when control methods are considered is relatively low. The weeds are largely woody weeds and the types of weeds present are generally able to be controlled with a combination of clearing, burning and a reduction of the impacts associated with the changed water regime.

The resilience of the bushland areas that have not been previously cleared (Model Farms Road South – Reaches 1-4) is considered to be high with an appropriate fire regime in place.

Map 10 illustrates the weed densities identified by Parramatta City Council and modified for this Master Plan.

< Remove page and insert Map 10 - WEED DENSITIES >

QUARRY BRANCH CREEK MASTER PLAN

Map 10: Weed Densities
(as mapped by Paramatta Council)

M2 MOTORWAY

MODEL FARMS ROAD

CHURCHILL DRIVE

MOXHAMS ROAD

Legend

Weed Density

- 2-10%
- 10-30%
- 30-60%
- 60-90%
- Catchment Boundary
- Cadastre

N

0 50 100 200 300

Metres

3.1.5 Corridor connectivity

The Quarry Branch Creek corridor is one of the few remaining intact vegetated remnant areas in Western Sydney with the 2005 Parramatta Waterways Prioritisation study identifying the corridor as retaining 'high' vegetation values with connectivity to other vegetation and ecological nodes. This was consistent with the PCC Rapid Stream Health Assessment (RSHA) classifying the waterway as being in 'good' condition for a third order stream. Analysis of the 2003 Parramatta Biodiversity Survey results identified 50 species that inhabit reserves within the Quarry Branch Creek corridor (list of fauna can be viewed in Appendix 7). An investigation of the NSW NPWS Wildlife Atlas identified thirteen regionally or locally significant fauna species likely to occur within the study area (full fauna species list for the study are can be viewed in Appendix 8).

The in-stream environment within Quarry Branch Creek contains diverse instream biotopes creating suitable habitats for a range of aquatic fauna. Species indigenous to the Quarry Branch Creek at the time of European settlement would have migrated between Toongabbie and the Parramatta River. Examples of some of these species includes Long finned eels *Anguilla reinhardtii, S*hort finned eels (A*nguilla australis),* Mullet (*Myxus petardi*), Australian Bass (*Macquaria novemaculeata*), Mountain Galaxias (*Galaxias olidus*), Gudgeon (*Philypnodon sp*), and potentially Tortoise, Platypus and Waterbirds.

Natural barriers developed from the profile and sandstone bed of the waterway have resulted in a series of impediments for the movement of aquatic fauna in periods of low flow. The Department of Primary Industries (Fisheries Management) study "Reviewing and Restoring Fish Passage in Urbanised Waterways, Sydney Catchments" identified the breached weir upstream of Churchill Drive as not being a barrier to the impediment of aquatic movement.

Terrestrial fauna, especially birds and bats, are able to utilise the corridor to travel between other nodes of vegetation including Excelsior Park.

3.1.6 Fire

Fire is an essential tool for managing the ecology of Quarry Branch Creek. The vegetation of the site contains several forest/woodland types including several endangered ecological communities. These ecological communities contain threatened plant and animal species which require suitable habitat to be maintained. To keep the ecosystems healthy, robust and suitable for the threatened species and ecological communities, the area needs to have regular controlled burns. The appropriate fire frequency for the grassy woodlands ecological communities is between 5 and 40 years and 25 to 60 years for the wet sclerophyll forests.

Not enough is known about the fire response biology of the individual threatened species, that occur in this area to prescribe specific fire frequencies for these however a fire interval of 10 to 20 years is likely to be needed to keep the habitat suitable without reducing hollows or depleting the soil seed bank. The fire history of almost all of the site appears to be greater than 25 years.

Therefore It is recommended that a mosaic of burns be planned to cover the whole of the site starting as soon as possible and being completed within 10 years to reduce the chance of local extinctions. Where there has been fires, such as within Reach 2, threatened species have reappeared and the ecosystem has been greatly assisted with fewer weeds and extensive natural germination of native species. It is recommended that the mosaic pattern and specific prescription be determined by an Ecological Burn Plan based upon this Master Plan.

The plan will need additional input from the NSW Department of Environment and Conservation via the recovery teams for the various threatened species and

ecological communities that occur. Examples of species that will greatly benefit from a burn are *Epacris purpurecens var purpurecens* and *Pimelea curviflora var. curviflora* which have reappeared within Reach 2 after the 2002 burn.

3.1.7 Fauna

Due to the large number of tall old trees the site has a regionally significant concentration of hollows. This makes this site particularly important for threatened Gliders, insectivorous bats, and birds. Nectivorous birds will also find this habitat important as a food source. The creek may contain Platypus which are now only rarely being found in urban environments. There is a possibility that Green and Golden Bell frogs could occur in the old quarry that is now flooded and densely vegetated. Listening for frog calls at an appropriate time will allow confirmation.

A high density of wild exotic bee hives were found during the field work. These need to be eradicated as they occupy hollows that would be used by native fauna including threatened species and they disrupt the pollination and natural gene flow of several plant species which may lead to local extinctions of plants. Several hives of native bees were also seen which need protection as they are locally rare.

Scientific Name	Common Name	PCC Biodiversity survey	NPWS Atlas	EPBC Search
Mormopterus norfolkensis	Eastern Free-tail Bat	Vulnerable	Vulnerable	-
Pteropus poliocephalus	Grey-headed Flying Fox	Vulnerable	Vulnerable	Vulnerable
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable	Vulnerable
Miniopterus schreibersiioceanensis	Eastern Bentwing-Bat	Vulnerable	Vulnerable	-
Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	Vulnerable	-
Ixobrychus flavicollis	Black Bittern	Vulnerable	Vulnerable	-
Callocephalon fimbriatum	Gang Gang Cockatoo	E2	E2	-
Xanthomyza phrygia	Regent Honeyeater	E1	E1	-
Petroica rodinogaster	Pink Robin	Vulnerable	Vulnerable	-
Lathamus discolour	Swift Parrot	E1	E1	-
Polytelis swainsonii	Superb Parrot	Vulnerable	Vulnerable	-
Ninox connivens	Barking Owl	Vulnerable	Vulnerable	-
Rostratula australis	Australian Painted Snipe	Vulnerable	-	-
Hoplocephalus bungaroides	Broad-headed Snake	-	-	Vulnerable
Petrogale penicillata	Brush-tailed Rock-wallaby	-	-	Vulnerable
Dasyurus maculatus maculatus	Spot-tailed Quoll,	-	-	Endangered
Mixophyes iteratus	Southern Barred Frog	Endangered	-	-
Mixophyes balbus	Stuttering Frog	Vulnerable	-	-
Heleioporus australiacus *	Giant Burrowing Frog	Vulnerable	-	-
Littoria aure	Green and Golden Bell Frog	E1	E1	Vulnerable
Macquaria australasica *	Macquarie Perch	-	-	Endangered
Prototroctes maraena *	Australian Grayling	-	-	Vulnerable

Table 5. Significant fauna species by NPWS Wildlife Atlas and PCC Biodiversity Survey.

For full explanation of codes in the *Threatened Species Conservation Act (1995)* and the *National Parks & Wildlife Act (1974)* see Appendix 13.

Amphibians and Reptiles		
Name	**Habitat Requirements**	**Listed Threats**
Green and Golden Bell Frog *Litoria aurea* *TSC: E, EPBC: V* Recovery Plan in Prep	Inhabits unshaded, grassy or sedge areas adjacent to fresh water unpolluted ephemeral systems, stream sides, marshes and dams, especially those containing Eleocharis spp. or Typha spp. Sometimes found in areas of high disturbance, such as brick pits, landfill areas, disused industrial sites and cleared land (NPWS 1999b). This species is known to relocate during breeding season during the spring and summer months. Distribution is patchy and confined to the eastern seaboard of NSW and into coastal areas of Victoria. NPWS has initiated recovery actions including surveying and mapping, monitoring and research (NPWS 2003).	The key threatening processes that include this threatened fauna species are:- Predation by exotic fish particulaly the Plague Minnow *(Gambusia holbrooki*) and predation by feral animals such as foxes and cats. The threats identified in the determination of this listed threatened fauna species are;- changing patterns of drainage and stormwater runoff, and general changes to water quality; road mortality; loss of suitable breeding habitat through infilling and destruction of wetlands (Morgan & Buttemer 1996). A fungal pathogen has also been named as a threat, as have herbicides and other weed control methods

Mammals		
Name	**Habitat Requirements**	**Listed Threats**
Eastern Freetail bat *Mormopterus norfolkensis* *TSC: V, EPBC: -*	Distributed along east coast of NSW from south of Sydeny to north near Brisbane. Habitat preferences are unclear, but most specimens come from dry eucalypt forest and woodland (Strahan 1995). Associated with rainforests, open forests and woodland (AMBS 1995). Colonies have been found roosting under loose bark, in tree hollows, within the roofs of houses and in other modified habitats (EA 2000, Richards & Hall 1979, SFNSW 1995). NPWS has undertaken surveying and mapping for this species (NPWS 2003). Foraging takes place in the canopy and in uncluttered habitats, feeding on a variety of flying insects.	There are no key threatening processes that include this threatened fauna species. The threats identified in the determination of this listed threatened fauna species are;- habitat modification and destruction, including loss of mature hollow bearing trees and loss of nesting and roosting sites
Greater Broad-nosed Bat *Scoteanax rueppellii* *TSC: V, EPBC: -* **Recovery Plan in Prep**	Distributed along most of the eastern coast of mainland Australia, this bat roosts in tree hollows and branches as well as in the roofs of older buildings. Preferring moist gullies in rainforests or mature coastal forests, the Greater Broad-nosed Bat is also associated with wet and dry scleroplyll forests and open woodland (Churchill 1998). Within denser vegetation types use is made of natural and man-made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1995).	There are no key threatening processes that include this threatened fauna species. The threats identified in the determination of this listed threatened fauna species are;- loss of hollow bearing trees through clearing of woodland, habitat modification and destruction, leading to a reduction in the number of nesting sites.

Mammals		
Name	**Habitat Requirements**	**Listed Threats**
Grey-headed Flying Fox *Pteropus poliocephalus* *TSC: V, EPBC: V*	Distributed along the east coast of Australia, the Grey-headed Flying-fox inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Eby 1998). Bats commute daily to Foraging areas, and feed on the fruit from native figs (Ficus spp.), this forms a large part of their diet (Churchill 1998). Roost sites are commonly formed in gullies, typically not far from water and in nvegetation with a thick canopy. NPWS has completed surveying and mapping of this species (NPWS 2003).	There are no key threatening processes that include this threatened fauna species. The threats identified in the determination of this listed threatened fauna species are;- Disturbance to roost or breeding sites and destruction of foraging habitat, through the clearing and modification of native vegetation; direct harassment via shooting at roosts and destruction of camps; by being possible carriers of viral pathogens; potential competition and hybridisation from Black Flying-foxes

Birds (Avifauna)		
Name	**Habitat Requirements**	**Listed Threats**
Powerful Owl *Ninox strenua* *TSC: V, EPBC:* **Recovery Plan in Prep**	Powerful Owls are found close to riparian or rainforest vegetation, in areas of either wet or dry Eucalyptus sclerophyll woodland, forest or tall open forest (Greenyer 1999). Distributed from south-eastern South Australia to the Dawson Rover in Queensland, common along coastal hills and in low densities along the Great Dividing Range. Associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000). Roost trees include Coachwood, Turpentine and Black Wattle. (Skelton, 2003).	The threats identified in the determination of this listed threatened fauna species include;- Destruction of suitable forest and woodland roosting and foraging habitat, and the loss of old growth forest elements such as large tree hollows. Disturbance during the breeding period is also a treat. High frequency burning, and other inappropriate management practices, can reduce prey availability. The key threatening processes that include this threatened fauna species are loss of suitable habitat.
Regent Honeyeater *Xanthomyza phrygia* *TSC: E, EPBC: E* **Recovery Plan in Prep**	Associated with temperate eucalypt woodland (especially red ironbark, yellow gum, yellow box) and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Also found in riparian forests of River Oak (Casuarina cunninghamiana) (SFNSW 1995, Garnett 1993) and on mistletoe on River Oaks, streets and gardens (Pizzey 1997). Reliant on locally abundant nectar sources, especially flowering eucalypts that occur mainly in dry open woodland (SFNSW 1995), on richer soil types with different flowering times to provide reliable supply of nectar (EA 2000). NPWS have undertaken surveying and mapping, monitoring and research as recovery actions for this species (NPWS 2003). The species distribution is extremely patchy, with only a few known breeding sites in NSW, the most important sites as follows;- Warrumbungles NP, Pilliga NP, Barraba district and the central coast area aroung Gosford, Hunter Valley and Capertee Valley (NPWS 1999h).	There are no key threatening processes that include this threatened fauna species. The threats identified in the determination of this listed threatened fauna species are;- loss of habitat and fragmentation of habitat through clearing for agriculture, fencepost and fencing; reduction in tree age classes and specifically large flowing eucalypts in woodland habitat; grazing by domestic stock and rabbits prevents habitat regeneration; competition with other honeyeater species; tree decline and dieback.

Birds (Avifauna)		
Name	**Habitat Requirements**	**Listed Threats**
Superb Parrot *Polytelis swainsonii TSC:V, EPBC: V* **Recovery Plan in Prep**	Superb Parrot habitat is Black box, yellow box, red river gums and river oaks mostly close to rivers, and open woodland, pastures and gardens (Pizzey 1997). The birds forage on native grasses, wattle seeds, all stages of the fruit and flowers of eucalypt species and the berries of mistletoe. Known to breed on the river red gum forests on the Edward, Murrumbidgee and Lachlan Rivers. NPWS have completed surveying and mapping, monitoring and research on this species (NPWS 2003).	There are no key threatening processes that include this threatened fauna species. The threats identified in the determination of this listed threatened fauna species are;- Poor regeneration of nesting trees and food resources; Removal of hollow bearing trees; Clearing of woodland remnants; Traffic kills as a result of feeding on grain spills; Loss of hollows to feral bees and birds and Illegal trapping.
Pink Robin *Petroica rodinogaster TSC: V, EPBC:*	Open forest in autumn/winter. Breeds in dense gullies in tall open forest. A rare visitor to the Sydney region. The species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW	There are no key threatening processes that include this threatened fauna species. The threats identified in the determination of this listed threatened fauna species are;- clearing of rainforest and tall, wet forest habitat
Gang Gang Cockatoo *Callocephalon fimbriatum TSC:V, EPBC:-*	The species occurs in a variety of forest and woodland habitats and occasionally in more open areas in south-eastern New South Wales and Victoria. This species is distributed from southern Victoria to eastern New South Wales. NPWS has undertaken surveying and mapping for the Ku-ring-gai population of this species (NPWS 2003).	The key threatening processes that include this threatened fauna species are:- Infection by Psittacine circoviral (beak and feather) disease and clearing of native vegetation. The threats identified in the determination of this listed threatened fauna species are;- clearing for farmland and more recently to urban releases and road construction; loss of habitat, particularly core food and breeding trees; competition for nest hollows with other species.
KEY: *TSC - Threatened Species Conservation Act 1995; EPBC - Environmental Protection and Biodiversity Conservation Act 1999*		

Table 6. Significant fauna species by NPWS Wildlife Atlas and PCC Biodiversity Survey.

For full explanation of codes in the *Threatened Species Conservation Act (1995)* and the *National Parks & Wildlife Act (1974)* see Appendix 13

3.2 Stream morphology

Geomorphically, Quarry Branch Creek channel and floodplain are stable and in good condition. Although there are small isolated pockets of instability and erosion extant in the channel zone, these do not present a threat to morphological stability or habitat. The substrate of the channel has a variety of grainsizes from sand to gravel and cobbles. At other locations bedrock sheets form the base of the channel and extend for many metres. Cross channel bedrock outcrops form bars and steps in the longitudinal profile that have led to the formation of significant plunge pools.

For a full morphological characterisation of Quarry Branch Creek refer to Appendix 15.

< Remove page and replace with MAP 11 GEOMORPHIC REACH BREAKDOWN >

QUARRY BRANCH CREEK MASTER PLAN

Map 11: Geomorphology

M2 MOTORWAY

CHURCHILL DRIVE

MOXHAMS ROAD

Legend

- Catchment Boundary
- Geomorphic Reaches
- Geomorphic Waypoints
- Channel

N

0 50 100 200 300

Metres

3.3 Aboriginal heritage items

The report; *'Archaeological Survey for Indigenous Heritage along the Quarry Branch Creek Waterways Corridor (Northmead Gully)'* investigates and reports on indigenous cultural heritage within Quarry Branch Creek. Therefore that report will not be reiterated here.

3.4 European heritage items

The site visit was undertaken on 7/11/05 by archaeologists Anne Bickford and Kylie Seretis. A series of 16 heritage items (site numbers 1-16), encompassing several different site types, were visited in the course of the morning. Two sites (site numbers 17-18) were not visited. A summary of the sites, results and specific recommendations are provided below;

The study area provides a rich heritage resource in the form of the archaeological remains of sandstone quarries and associated features as well as remains from the model farm. The Moxham family were significant quarrymen and pastoralists, and a notable Parramatta family.

Further archaeological survey of the area is required in order to fully understand the significance and extent of survival of remains and to further elucidate the specific remains of each heritage item. More in-depth historical/archival research and field survey is needed to clarify the remains and associated issues such as rarity, uniqueness or integrity of remains.

A series of appropriate guidelines to allow more informed management of the European heritage sites in the future is required to ensure their long-term survival. These guidelines should cover appropriate treatment, alongside protection, why and how to assign significance value and the extent of such remains for government agencies/councils.

These guidelines allow greater assessment of the nature, quality, survival, extent and potential of the sites. These recommendations are general, and made in regard to gaining a further understanding of the sites, either to establish the extent of the site and/or providing additional information about the site. This brief study suggests that, in the first instance, we need to understand what the resource encompasses on a general level as a basis for future management and research.

Item	Location	
	Easting	Northing
Moxhams Road Bridge	313859.88	6259951.46
Historic bridge abutments	314187.91	6260492.23
Old road (east of creek)	314217.65	6260531.12
Old road (west of creek)	314147.19	6260569.51
Old road (north of Churchill Dr)	314271.98	6260683.75
Quarry 1	314287.93	6259972.55
Quarry 2	314360.86	6260259.71
Quarry 3	314406.11	6260768.07
Quarry 4	314473.79	6260814.02

Weir 1	314615.36	6261082.51
Weir 2	314495.52	6261267.67
Weir 3	314187.85	6261785.83
Old farm dams	314132.34	6261857.28

Table 8 – Locations of Heritage Items (also see map 12)

< Remove page and replace with MAP 12 - Post European Settlement Heritage Sites >

QUARRY BRANCH CREEK MASTER PLAN

Map 12: Post-European Settlement Heritage

M2 MOTORWAY

MODELL FARMS ROAD

CHURCHILL DRIVE

Legend

- Historic Bridge Abutments
- Moxhams Road Bridge
- Old farm dams
- Old road-east
- Old road-north
- Old road-west
- Quarries
- Weir 1
- Weir 2
- Weir 3
- Catchment Boundary

N

0 50 100 200 300

Metres

3.5 Disturbance within the corridor

3.5.1 Stormwater

The increase of rainfall runoff being channelled through drainage infrastructure off buildings, roads and car parks has adverse effects on waterway and bushland health. Site hardening occurs where runoff is channelled or piped directly toward waterways rather than infiltrating or running through a stream. Catchments no longer mimic their natural hydraulic regimes resulting in greater sediment and nutrients impacting the bush through weed infestation and soil erosion (EPA 1995).

Stormwater outlets within the study area were identified by field investigations and previous studies as potentially contributing high nutrient loads, resulting in downstream weed infestation and eutrophication of the creek. This is obvious for outlets greater than 300mm in diameter draining catchments with predominantly residential land use. Localised erosion was observed adjoining many of the stormwater outlets due to the concentration of flows exiting the drainage network. There were also sediment deposition from the catchment in some of these areas, typically those with flatter grades.

Little litter was observed within the creek or adjoining the stormwater outlets. The litter that was apparent was assumed to have been generated from the catchments that drain the main roads, Windsor Road in particular.

3.5.2 Dumping

Through the field investigations and community consultation phase of the study dumping was identified as an issue threatening corridor health. These materials included gross pollutants, domestic goods, car bodies, building materials and garden waste. These items pose threats to the current condition of the corridor by increasing fire risk, harbouring exotic weeds and feral animals as well as decreasing to the aesthetic appeal of the area. Maps 17-21 illustrate the location of major dumping, removal of which have been incorporated as actions as in this plan.

3.5.3 Recreation

Recreation within the corridor is mainly confined to bushwalking activities with numerous walking trails creating linkages between the reserves. The steep terrain limits cycling access or construction of a high quality multi-use pathway (Jamieson Foley Traffic and Transport Pty Ltd, 2001). The existing walking tracks and fire trails are being utilised to a minor degree by mountain bikers which may be causing localised erosion. This may increase as the corridor becomes more well known and there may be a requirement in the future to either create a path for cyclists, similar to that at Manly Dam, or exclude bikes altogether. In one location the construction of a series of obstacles and jumps in the riparian zone is increasing sediment loads mobilised from the banks into the creek. This requires immediate remedial action.

Walking of dogs was raised as an issue during the community forum and at a minimum there needs to be a policy and education on the cleaning up after the dogs and the enforcement of the dog-on-leash rule. Consideration should be given to prohibition of dogs in sensitive areas.

Another recreation activity identified in the study is the sport of bouldering, a form of rock climbing. This involves rock-climbing without a harness (ropes) over rock

overhangs or faces. Surrounding bushland areas in Bidjigal Reserve (North Rocks Gully) known as the 'Baulkans' is renowned for bouldering (Balint 2001). The sport damages rock faces, understorey vegetation and aesthetic appeal covering rocks in white chalk. There is potential for rock faces in the Quarry Branch Creek to be utilised for bouldering and would potentially damage areas of Aboriginal significance.

The Quarry adjoining the reserve on Whitehaven Road has experienced recent and ongoing damage from climbers carving climbing walls into the rock face with grinders.

3.5.4 Dieback

Dieback occurs when trees die or lose condition prematurely and often rapidly. Causes of dieback include insect infestations, increased salinity, waterlogging, lack of water, parasites and prolonged inundation due to river regulation. Tree death can result from fungal diseases, mistletoes, herbicide spray drift or spillage in waterways, girdling of trees by livestock, earthmoving, fire, frost, wind pruning, hail and self-thinning in dense regrowth stands (DEC 2005).

Dieback was noticed in three areas of the Quarry Branch Creek corridor which were mainly characterised by close proximity to housing and road crossings. This requires further investigation, primarily to presence of *Phytophara* - a tree parasite listed as a Key Threatening Process under the Threatened Species Conservation Act, 1995.

Remove Page and replace with

Map 13, Sites of disturbance

QUARRY BRANCH CREEK MASTER PLAN

Map 13: Disturbance Actions

M2 MOTORWAY

MODEL FARMS ROAD

CHURCHILL DRIVE

MOXHAMS ROAD

Legend

- Remove dumped materials
- Enforce bushrock theft
- Enforce garden dumping
- Investigate contamination
- Regularly clean GPT
- Remove BMX trail
- Remove derelict car body
- Drainage_polyline
- Catchment Boundary

N

0 50 100 200 300

Metres

3.6 Catchment runoff and water quality

3.6.1 Analysis of water quality

No physical water quality tests were taken as part of the Master Plan development. However, water quality modelling was conducted using the Modelling for Urban Stormwater Improvement Conceptualisation (MUSIC) urban stormwater model to predict flow rates and pollutant loads of stormwater flowing into the creek. From field observations of the creek and stormwater outlets, and understanding the disturbance history of the catchment corridor, it is suggested water quality is good to excellent for an urban stream.

As mentioned elsewhere in this plan the creek water quality has largely been protected by the filtration mechanism of stormwater running over vegetated areas. This serves to reduce the pollutants carried in runoff from roads and residential areas entering the creek. Steps must be taken to ensure this remains the case.

This said there was evidence the sewer network has frequently surcharged to the creek, probably during rainfall when illegal cross-connections (between sewer and stormwater pipes) and infiltration into cracked pipes overcomes the capacity of the sewer system. Many of the inspection covers were displaced indicating recent activity.

A number of locations were identified that were believed to be cross-connections of sewer to stormwater and these should be investigated.

3.6.2 Calculating catchment exports

Changed hydraulic regime and land use within the catchment were identified as the primary source of many of the threats identified to the Quarry Branch Creek corridor because of elevated nutrient levels and flows resulting in suitable environments for weed infestation ,in-stability and decreased aquatic biodiversity. Therefore, it was determined important to identify the contribution of each sub-catchment to the total annual flow and pollutants exported to appropriately mitigate risks to downstream environments.

The MUSIC model was used to obtain a greater understanding of the catchment pollutant exports. MUSIC is suitable for application for the purposed of simulating stormwater systems at a range of scales for areas from 0.01km² to 100km² (MUSIC User Guide, 2005). The stormwater export figures obtained from MUSIC includes;

a) Flow - mega litres /per year
b) Total Suspended Solids (TSS) – kilograms/ per year
c) Total Phosphorus (TP) - kilograms/ per year
d) Total Nitrogen (TN) - kilograms/ per year
e) Gross Pollutants (GP) - kilograms/ per year

The major factors utilised by the MUSIC model to generate these exports figures include land use, impervious surface percentage and local climatic data. The default figures for Sydney were utilised for factors such as soil storage capacity, field capacity, infiltration co-efficient and pollutant base flow concentration parameters.

The rainfall data used in the MUSIC model requires pluviograph data which was provided by the UPRCT for rainfall station number 66124 (Parramatta North) between the years 1997-2001. Drainage boundaries for individual catchments

were interpolated from detailed topographic data and analysis of the property tenure cadastre. This resulted in a total of 37 sub-catchments ranging from 0.48ha to 43.41ha with a cumulative catchment area of 204.61ha. Land use areas were delineated through Aerial Photograph Interpretation (API) allowing accurate classification of each sub-catchment which was largely homogenous with residential land use. This gave a breakdown of each land use within the sub-catchments which was required when determining the impervious area percentages. Impervious areas were determined for each land use type identified within the catchment. These used volumetric runoff co-efficient figures adopted from Parramatta City Council and the MUSIC Modelling of the Upper Parramatta River Catchment study. A cumulative impervious area relationship was determined for input into the MUSIC model.

Land Use	Impervious area
Residential	35%
Commercial	90%
Open Space	0%
Roads	100%

Table 9. Impervious land use percentage

A MUSIC model has already been undertaken for the entire Upper Parramatta River Catchment Trust to quantify the stormwater improvement actions outlined in the Stormwater Management Plan. This study acknowledged the water quality objectives outlined in the SMP applied primarily to base flow events (occurring between storm events) which occur approximately 90% of the time in this catchment.

The UPRCT study incorporated Quarry Branch Creek giving cumulative statistics for annual flows and pollutant exportation. Table 10 compares the parameters utilised for both MUSIC models giving results that differ due to different total catchment boundary sizes. These areas have been determined different because the UPRCT study included an additional area upstream area from the M2 Motorway in the Baulkham Hills Shire Council (BHSC) area and also included the Quarry Branch Creek bushland corridor rather than upslope from this area. This was considered the determinant in differing impervious ratings between the models and therefore fluxes in total flow and pollutant export amounts. Refer to Appendix 8 for MUSIC export data.

	UPRCT	Master Plan
Area assessed	322.19	204.61
Percent impervious	27%	49%
Percent pervious	73%	51%
Flow (ML/yr)	991	895
Total Suspended Solids (kg/yr)	139,000	164,803
Total Phosphorus (kg/yr)	288	345
Total Nitrogen (kg/yr)	1,660	2495

Table 10. Comparison of results from the UPRCT and Quarry Branch Creek model

Results for the MUSIC models were determined for the total cumulative exports at each drainage node, this was later refined to a figure of standardised exports per hectare allowing comparison between diffuse pollutant loads. Exports were

determined on an annual basis and later compared within the 39 sub-catchments allowing areas to be internally ranked against one another as high, medium and low exporters of pollution.

3.6.3 Comparison with other catchments

The Quarry Branch Creek catchment results are comparable to other catchments with a low density residential land use. Factors that may influence the results in the future are the increases in the areas of impervious surfaces within the catchment. This is a result of urban consolidation and the general trend toward the building of larger houses on smaller blocks of land.

The figure of 51% impervious for the whole catchment was determined from aerial photography and does not include the Quarry Branch Creek vegetated corridor. Results from other “new” residential catchments within Western Sydney have recorded impervious areas in excess of 80%. The greater the effective catchment impervious area the lower values that can be expected within the creek.

It was assumed that there were no Water Sensitive Urban Design components within the catchment. If incorporated these could dramatically reduce the potential pollutant loads.

The inclusion of two main roads within the catchment have influenced the potential for contaminants and the treatment of runoff from these would be beneficial to the creek.

3.6.4 Implications of the results on future planning

Although the catchment is already developed it will, as with almost all other urban areas, experience an increase in the impervious percentage in the coming years as further development progresses.

This will have a detrimental impact on the ecosystems within the creek and degrade the value of the creek as a whole. To counter this planning controls can be implemented to reduce the associated problems.

A suite of tools exist under the banner of water sensitive urban design including the incorporation of infiltration areas, rainwater tanks, bio-filtration, pervious paver and roof gardens. With good planning the creek values may be maintained or even improve over time as development occurs.

< INSERT MAP 14 MUSIC CATCHMENT MAP HERE >

QUARRY BRANCH CREEK MASTER PLAN

Map 14: Modelled Stormwater Pollution Catchment Locations

M2 MOTORWAY

MODEL FARMS ROAD

CHURCHILL DRIVE

MOXHAMS ROAD

1 2 3 4 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39

Legend

- Pipe Locations
- Sub-catchment Boundaries
- Catchment Boundary
- Cadastre

N

0 50 100 200 300

Metres

< INSERT Map 15 MUSIC LOAD RESULTS MAP HERE>

QUARRY BRANCH CREEK MASTER PLAN

Map 15: Total Modelled Catchment Pollutant Exports

15
Flow: 26.3 ML/ha/yr
Total Suspended Solids: 4800.00 kg/ha/yr
Total Phosphorus: 10.2 kg/ha/yr
Total Nitrogen: 76.9 kg/ha/yr
Gross Pollutants: 812 kg/ha/yr

16
Flow: 0.75 ML/ha/yr
Total Suspended Solids: 134.00 kg/ha/yr
Total Phosphorus: 0.28 kg/ha/yr
Total Nitrogen: 2.16 kg/ha/yr
Gross Pollutants: 22.7 kg/ha/yr

33
Flow: 159 ML/ha/yr
Total Suspended Solids: 29400.00 kg/ha/yr
Total Phosphorus: 61.3 kg/ha/yr
Total Nitrogen: 444 kg/ha/yr
Gross Pollutants: 4900.00 kg/ha/yr

35
Flow: 0.51 ML/ha/yr
Total Suspended Solids: 97.90 kg/ha/yr
Total Phosphorus: 0.19 kg/ha/yr
Total Nitrogen: 1.42 kg/ha/yr
Gross Pollutants: 15.40 kg/ha/yr

29
Flow: 189 ML/ha/yr
Total Suspended Solids: 35800.00 kg/ha/yr
Total Phosphorus: 72.7 kg/ha/yr
Total Nitrogen: 520 kg/ha/yr
Gross Pollutants: 5820.00 kg/ha/yr

30
Flow: 27 ML/ha/yr
Total Suspended Solids: 5170.00 kg/ha/yr
Total Phosphorus: 10.5 kg/ha/yr
Total Nitrogen: 75.8 kg/ha/yr
Gross Pollutants: 832.00 kg/ha/yr

31
Flow: 2.78 ML/ha/yr
Total Suspended Solids: 490.00 kg/ha/yr
Total Phosphorus: 1.05 kg/ha/yr
Total Nitrogen: 7.63 kg/ha/yr
Gross Pollutants: 85.20 kg/ha/yr

27
Flow: 87.6 ML/ha/yr
Total Suspended Solids: 15800.00 kg/ha/yr
Total Phosphorus: 33.8 kg/ha/yr
Total Nitrogen: 241 kg/ha/yr
Gross Pollutants: 2700.00 kg/ha/yr

3
Flow: 27.1 ML/ha/yr
Total Suspended Solids: 5090.00 kg/ha/yr
Total Phosphorus: 10.7 kg/ha/yr
Total Nitrogen: 75.7 kg/ha/yr
Gross Pollutants: 832 kg/ha/yr

1
Flow: 28.2 ML/ha/yr
Total Suspended Solids: 4740.00 kg/ha/yr
Total Phosphorus: 10.4 kg/ha/yr
Total Nitrogen: 76.5 kg/ha/yr
Gross Pollutants: 850 kg/ha/yr

MOXHAMS ROAD

Legend
- Very High Risk
- High Risk
- Medium Risk
- Low Risk
- Very Low Risk
- Catchment Boundary
- Cadastre
- Artificial Drainage

Earth Tech

N

0 50 100 200 300

Metres

4 DEVELOPING THE MASTER PLAN

4.1 A 'Vision' for Quarry Branch Creek

"A corridor that enables community access for the enjoyment and understanding of its significant natural and heritage values"

4.1.1 Consultation framework

A integral component of the development of the Master Plan was consultation with the surrounding community stakeholders. A community forum was held on the 11th October 2005 to assist in directing the formulation of a plan that had achievable and realistic goals and represented the community values . The meeting was held at Uniting Church Hall on Hammers Road with 22 people in attendance (See Acknowledgements). The focus group was comprised of community representatives interested in the long term vision and health of the Quarry Branch Creek corridor. These included resident members of the Quarry Branch Creek South Bushcare Group and Northmead Uniting Church.

The study area falls within the boundaries of the Deerubbin Local Aboriginal Land Council (DLALC). It is also within an area of interest to the Dharug Custodians Aboriginal Corporation (DCAC), and the Dharug Tribal Aboriginal Corporation Representatives from all three Indigenous groups participated in the field survey on different days. Separate reports outlining the cultural significance of the study area to these groups will be produced independently.

The forum consisted of a walkthrough of the lower reaches of the study area with informal discussions. This was useful in recognising the emergent themes and important matters for community members. An activity was run to gauge an understanding of the values, threats and priorities as defined by the attendees.

The values identified by attendees include;

- Aesthetically pleasing
- Natural qualities associated to bushland
- Involvement of local community in management
- European and indigenous heritage
- Native habitat and fauna
- Provides place for activities and walking

Threats	Importance as voted by community
Dumping	1
Damage to heritage items	1
Weed infestations of bush regeneration sites	1
Noxious weeds	1

Uncontrolled access on walking tracks	2
Sewer overflows	2
Natural subsidence of heritage items	2
Burn piles effecting bush regeneration	2
Loss of habitat	3
Unsustainable active recreation	3
Stormwater flow impact from outlets	3
Lack of education	3

Table 11- Priorities outlined at community forum

4.1.2 Objectives for the Corridor

Objectives are more tangible than a vision. They focus specifically on attributes or values, something worked toward or striven for. These objectives should be measurable and used to judge the on-going success of the Master Plan implementation.

Objectives:

Actions

1. Enhance community awareness of the value of Quarry Branch Creek
2. Educate community on the threats to Quarry Branch Creek and encourage active participation in protection of the creek
3. Remediate zones or locations of degradation or instability

Results

1. Expanded area of high habitat value for native fauna
2. In-stream habitats are protected and enhanced
3. Heritage values protected and enhanced

The objectives have been derived from the vision, based on discussion from the community workshop, and the current values that were determined from the fieldwork. These objectives translate into the target condition for the creek and associated corridor over the next twenty years.

The objectives for the corridor reflect those documented in the Local Government Act for areas classified (Zoned) waterway. These are:

a) to conserve, manage and enhance biodiversity, rare and threatened species, remnant habitat and the ecological viability of the land, and
b) to protect environmentally sensitive remnant habitats and communities, and
c) to increase the community's awareness and appreciation of remnant habitats and biodiversity, and
d) to protect the aesthetic, heritage, recreational, educational and scientific value of the bushland, and
e) to allow uses for scientific and educational purposes.

The corridor is currently zoned open space (6B) or Environmental Protection (7).

Measurable targets can be utilised in the assessment of the performance of the Master Plan implementation.

4.1.3 Detailed field investigations

Analysis of GIS data

Through preliminary assessment of available GIS data it was possible to identify areas where actions may be required or where threats have occurred within the corridor. Data available included aerial photography, contours, land-use, vegetation, soils and geology.

Rapid waterway assessment

To understand the ecological, disturbance and social issues occurring within each reach of Quarry Branch Creek it was necessary to undertake detailed site observations collecting information at pre-defined locations.

Definitions for parameters collected in the ecology, social and disturbance data were developed to reduce the degree of subjectivity involved in undertaking data collection. These definitions have been specifically developed with regard to the project outcomes and general benchmark condition of waterways in context of greater western Sydney as experienced by the project team. The 'rapid assessment' protocols used to evaluate Quarry Branch Creek returned a suite of results that enabled a 'snapshot' of the ecological, social and disturbance values to be encapsulated. This assessment methodology was adopted because it is an effective tool to gauge the current status of waterway condition. More details are contained in Appendix 11.

Terrestrial Vegetation	Terrestrial Habitat	Aquatic Habitat	Disturbance	Community Access
Longitudinal continuity	Native vegetation structure	In-stream Large Woody Debris (LWD)	Vegetation	Restricted
Woody vegetation width	Organic litter	Exposed Roots	Soils	Unrestricted
Overstorey Composition	Native large trees	Bed diversity	General litter	Private property
Middle storey composition	Tree Hollows	Undercut banks	Dumped material	Footbridge
Ground cover Composition	Terrestrial LWD	Deep Pools	Other	Road Crossing
Bank slope Vegetation		Emergent vegetation cover	Mowing	Fenced
Ground disturbance		Filamentous algae	Bridge	Walking trails

Terrestrial Vegetation	Terrestrial Habitat	Aquatic Habitat	Disturbance	Community Access
Recruitment			Culvert	Passive parklands
Noxious weeds			Pipe	Playgrounds
Noxious weeds			Wall	Sporting ovals
Noxious weeds			Canal	Other

Table 12 - Assessment components

Site	Reach	Riparian condition results
1	1	
2	1	
3	2	
4	2	
5	2	
6	2	
7	2	
8	4	
9	4	
10	5	

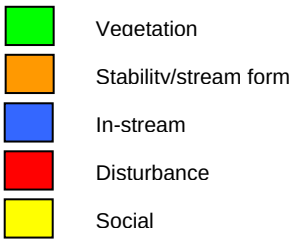


Figure 7 – Graphic representation of proportional values for waterway assessment sites.

The bar graph shows a proportional representation of the existing values of the assessment parameters for Quarry Branch Creek. The bar graph length is directly proportional to the condition assessment results.

(A map of the locations of the assessment site is in Appendix 12)

4.2 Development of an action suite

The initial suite of maintenance and rehabilitation actions was developed from a combination of the consultation forum, site investigations and understanding of the underlying threats, values and risks occurring within in the corridor. Each action developed as part of the plan has been assigned a Code that relates to the type of action. These codes will assist Council in the allocation of tasks to departments within the Council structure and enable a sub prioritisation of works within a category.

The action suite for the Quarry Branch Creek Master Plan has been tabulated and assigned an alpha numeric code to define the action applicability within the reach, or within the catchment. Each code has a prefix that denotes the type of recommended action and a sequential suffix. The code prefix definitions appear in Table 13(A).

All action sites and information collected has been provided in a Geographical Information System format (GIS) with the associated metadata. These can be linked to a database which allows Council to keep track of expenditure, progress and maintenance.

Table 13 is synopsis of the codes corresponding suite of recommended actions for Quarry Branch Creek. For full description of actions and definition of codes see Appendix 14.

Prefix	Definition	Prefix	Definition
A	Area based actions	H	Heritage based actions
C	Whole of catchment	I	In stream actions
CO	Community based actions	INF	Infrastructure management actions
D	Disturbance response actions	S	Stormwater response actions
E	Education/Enforcement	V	Vegetation based actions

Table 13(A). Definitions of Action Suite prefix codes.

Code	Action	Code	Action
A.1	Close secondary walking trails	S.3	Stabilise undercut outlets with rock/ concrete
A.2	Close access point	S.4	Clean existing trash racks
A.3	Formalise trails	S.5	Monitor erosion around outlet
A.4	Minor track works	S.6	Create a basin/wetland
A.5	Build stairs	S.7	Re-shape channel
C	Whole of catchment policy	S.8	Divert stormwater
CO.1	Construct amenities	S.9	Replace headwall apron
D.1	Remove dumped materials	S.10	Stabilise outlet and rock line
D.2	Remove derelict car bodies	S.11	Place rock to stabilise
D.3	Investigate contamination from materials	V.1	Community bush regeneration activities. (Bushcare)
D.4	Remove BMX tracks	V.2	Targeted removal of noxious middle storey weeds
D.5	Remove gross pollutant blockages	V.3	Burn weed piles
D.6	Remove honey bee hives	V.4	Controlled burn
D.7	Water quality testing for sewer leaks	V.5	Clear vegetation for safety and access
E.1	Conduct dogs on leach campaign	V.6	Plant middle and ground vegetation
E.2	Education and enforcement of garden dumping	V.7	Fox baiting
E.3	Enforcement of bush rock theft	V.8	Manage tree dieback
E.4	Community support	V.9	Targeted Willow removal
E.5	Interpretive signage	V.10	Targeted Camphor Laurel removal
H.1	Clear prior to burning	V.11	Increase habitat
I.1	Monitor aquatic weed infestations	V.12	Broad scale weed removal
INF.1	Protect existing infrastructure	V.13	Control vine weeds
S.1	Clear vegetation/rubbish from outlet	V.14	Fauna investigation
S.2	Clear sediment from outlet		

Table 13 - Maintenance and Rehabilitation Action suite codes

4.3 Threats to Quarry Branch Creek

The threats are prioritised based on the existing values determined through the site assessment and the apparent level of risk to those values.

Risk	Consequence	Proposed solutions
Stormwater quantities during frequent rainfall (3 month to 1 year events)	Frequent high flows in the creek lower the ability of microfauna to survive. Without the lower end of the food chain a stable ecosystem cannot function.	Reduction of 'effective catchment imperviousness' by the introduction of swales, rainwater tanks on houses, prevention of connection of piped areas directly to the creek. These measures reduce the volume of urban runoff and slow the water down to less than erosive velocities.
Loss of corridor intactness	Loss of vegetation adjoining the creek leads to instability in the channel and will lead to a reduction in the quality and value of the corridor.	Prevent any clearing of native vegetation and ensure no development occurs within the existing footprint of the vegetated area. Rezone the reserve to Bushland protection or Waterway.
Stormwater quality (acute)	A spill of a toxic substance such as pesticide, detergent or oil washed into the stormwater system during dry weather has the potential to kill all aquatic species and, without intervention, cause permanent degradation.	Maintain, where possible, a lack of direct connection between stormwater outlets and the creek. The further the water (or contaminant) has to travel over soil and vegetation the better protection afforded to the creek.
Damage to heritage	Heritage items, especially aboriginal shelters, have been degraded through vandalism and other antisocial behaviour. Fire can also cause damage to sandstone and reduce the value of important sites.	Prevent casual access to the Aboriginal sites and ensure walking tracks are located away from them. Interpretive signage to provide education on the significance of the sites for which access is desired or inevitable. Clearing around all the known sites prior to any planned burning activity.
Weed density	Weeds have become established in areas of high ecological value, changing the microclimate and shading conditions and enabling more weeds to establish.	Implement established bush regeneration techniques. In some areas maintain the present condition by periodically clearing weeds that threaten existing trees. Importantly, reintroduce a fire regime that will change the microclimate to favour natives and making weed control easier in the longer term. Support existing community bush regeneration groups. (Bushcare)
Terrestrial habitat loss and recruitment	A reduction of terrestrial habitat reduces the population of species responsible for seed transfer and opens a niche for exotic species. The integrity of the reserve, and size and structure of vegetation communities depend on suitable habitat being available.	Prevent removal of, and introduce new fauna refuges, including bush rock.

Risk	Consequence	Proposed solutions
Stormwater quality (chronic)	During rain pollutants contained in stormwater (such as nutrients, oils, heavy metals, tyre rubber and sediment) remain in the creek, degrading the environment for micro-organisms. Litter also lessens visual amenity.	Treatment at the pipe outlet can reduce the amount of material entering the creek, however, these devices are expensive to install and maintain. Retaining semi-natural channels between the pipe and the creek, allowing overbank flow of water in a controlled manner, reduces the concentration of nutrients and associated pollutants that make it to the creek. However, it will increase maintenance requirements in the bushland adjoining the pipe and vegetation types may change locally.
Aquatic habitat loss	Existing aquatic habitat values are very high. These habitats will be reduced with removal of canopy species (shade), in-stream rock, sediment and large woody debris. The addition of additional vegetative matter (deciduous leaf drop in autumn) will also have a deleterious effect.	No snags or other material (except litter) are to be removed from the channel. Where possible implement mosaic weed removal adjacent to the channel to retain some shade over the water, especially pools. Prevent deciduous tree species leaves entering the channel.
Feral fauna	Cats, foxes, off-leash dogs and rabbits have a damaging impact on the flora and fauna of the reserve: directly through predation or scent deterring native fauna movement. European honey bees have an impact through the occupation of important nesting hollows and displacing of native nectar feeding animals. Significant populations were observed.	Education and enforcement of companion animal legislation. Baiting for foxes and rabbits. Removal of honey bee colonies.
Urban interface	Baiting for rats or slugs in properties adjoining the reserve impact the Powerful Owl population. Weeds escaped from gardens have been observed adjoining most properties within the reserve. Nutrient runoff is promoting weed growth. Dumping of garden materials, grass clippings and general rubbish lessens visual amenity and introduces nutrients.	Education of residents adjoining the reserve. Information and brochures exist and can be easily rebadged for Parramatta.
Uncontrolled access	Increased access from the development and promotion of tracks as well as increased awareness from educational materials may impact adversely on the reserve. As use increases it becomes more important that there are defined walkways and access points to prevent additional damage to vegetation, habitat and heritage items.	Establish defined access points to the reserve with signage and interpretive information. Close off the multiple “goat tracks” throughout the reserve and formalise and repair existing main tracks. Construct stairs in steep areas and water crossings to prevent erosion and improve safety.

Risk	Consequence	Proposed solutions
Fire frequency	Frequent fires can damage the local flora and fauna populations, some of which are threatened. Lack of fire can change vegetation communities, promote weed growth and increase the danger to residents.	Establish a fire regime within the reserve consistent with the Threatened Ecological Community recovery plan. In the short term there are large areas that require burning to promote germination of native species and control weeds. See weed density above.

Table 14 - Threat and remediation techniques

4.4 Management priorities

From the field assessments it was evident that the study area holds many high values associated with the natural environment and heritage. The values should be protected and maintained.

Priorities are derived from the vision and objectives, and based on existing condition (value), trajectory (will it get better or worse if no action is taken), sensitivity to change and the associated threat:

Value + Trajectory + Sensitivity + Threat = Priority

A suite of over 100 actions were noted during the study and assessed as to how effective they were in addressing threatening factors and improving the overall values associated with the corridor. These actions include vegetation and fauna management, access and education, stormwater and pollutant control, and habitat and heritage preservation.

Actions have been ranked according to whether they:

- address a priority as defined in the vision
- target the cause rather than just a symptom
- protect a high value asset
- are effective in achieving the target condition.

Previous master plans had prioritised actions based on cost, not cost-benefit. By doing this expensive but worthy projects are prejudiced against. It was felt that prioritisation results should be presented in raw format based on field observations and community input. It is up to Parramatta City Council, the implementers of the Master Plan, to allocate resources based prioritisation, budget cycles/annual priorities and the opportunities for external funding. The latter is frequently the key driver for larger projects.

5 MASTERPLAN ACTIVITIES

The Master Plan activities have been sorted into two distinct action sets. Point actions relate to a specific action for a specific location within the study area, for example the construction of a set of steps or the repair of a stormwater pipe. These have been assigned priority scores based on risk, need, failure potential, community benefit and ability to address a threatening factor.

Area actions relate directly to vegetation management. This includes weed control, burning, dieback investigation etc. All areas within the study area have been assessed and allocated a broad suite of tasks and a priority. Typically these are accepted bush regeneration activities that have been in progress in recent years. More important than the type of activity is the priority that the activity has been assigned. This has been determined by the assessment of the bushland and a judgemental analysis of the condition, value, trajectory and threat to other areas. The priorities also take into consideration where work has already been initiated.

All actions are displayed on maps by reach and in tables both by reach and in priority order.

U	Urgent
H	High priority
M	Medium priority
L	Low priority

Table 15. All Actions Ranked by Priority and Location

See appendix 19 for actions ranked by priority and action type.

Priority	Map location	Action Type		Detail	Implementation	Maintenance year 1
U	All	C	Catchment	Policy (DCP) development to limit catchment imperviousness with new development	$6,000	$0
U	23	E.2	Enforce garden dumping	Tipping was identified in this area	$1,000	$500
U	30	V.2	Targeted weed control	Removal of *Ludwigia longifolia*/ Pampas Grass, *Salvinia*	$100,000	$40,000
U	39	D.3	Investigate contamination	Numerous (100's) dumped car batteries	$10,000	$0
U	40	D.1	Remove dumped materials	Asbestos and other rubbish	$6,000	$0
U	42	V.7	Fox baiting	Fox spotted in this area	$0	$1,000
U	74	S.10	Stabilise outlet	Erosion occurring around outlet	$8,000	$0
U	75	S.10	Stabilise outlet	Outlet is deepened	$8,000	$0
H	7	V.1	Support existing bush regeneration	Support existing program	$5,000	$5,000
H	8	V.11	Increase habitat	Place terrestrial timber	$2,000	$0
H	13	V.2	Targeted weed control	Remove Pittosporum which are becoming established	$10,000	$2,000
H	31	S.8	Divert stormwater	Divert stormwater to quarry for wetland	$7,000	$0
H	32	S.8	Divert stormwater	Divert stormwater to northern quarry	$5,000	$0
H	33	S.8	Divert stormwater	Divert stormwater to northern quarry	$1,000	$0
H	34	S.6	Create a basin/wetland	Raise natural drainage exit point to form a basin	$3,000	$0
H	51	S.4	Regularly clean GPT	Clean out trash rack after rainfall	$0	$8,000
H	54	V.10	Targeted Camphor	Remove along waterway and replant	$12,000	$0

Priority	Map location	Action Type		Detail	Implementation	Maintenance year 1
			removal			
H	58	D.7	Water quality testing	Testing to quantify sewer leaks	$500	$0
H	60	D.7	Water quality testing	Elevated nutrient levels require testing	$500	$0
H	63	E.3	Enforce bush rock theft	Listed as key threatening process	$1,000	$0
H	65	D.6	Remove Honey bees	Identified throughout corridor	$5,000	$1,000
H	69	E.1	Conduct dogs on leash education	Enforce dog walking on leash only	$2,000	$500
H	70	E.4	Support community	Support school in stream watch	$2,500	$1,500
H	71	E.4	Support community	Support scouts in bush regeneration/stream watch	$3,500	$4,000
H	80	V.10	Targeted Camphor removal	Remove along waterway and replant	$25,000	$0
H	86	V.1	Support existing bush regeneration	Support existing program	$20,000	$20,000
H	89	V.8	Manage tree dieback	Determine cause of dieback	$2,000	$0
H	94	V.8	Manage tree dieback	Determine cause of dieback	$2,000	$0
H	97	V.8	Manage tree dieback	Determine cause of dieback	$2,000	$0
H	99	A.1	Reach 2_Close / Formalise trails	Close informal trails and formalise others	$9,000	$2,000
H	101	A.1	Reach 4_Close / Formalise trails	Close informal trails and formalise others	$2,000	$2,000
H	103	S.7	Re-shape channel	Remove pipe & create channel with GPT	$200,000	$5,000

Priority	Map location	Action Type		Detail	Implementation	Maintenance year 1
H	106	V.2	Targeted weed removal	Minor woody weed removal	$15,000	$5,000
H	107	V.2	Targeted weed removal	Targeted woody weed	$10,000	$7,000
H	112	V.2	Targeted weed removal	Targeted woody weed removal	$5,000	$1,000
H	113	V.2	Targeted weed removal	Target weed removal	$20,000	$12,000
H	114	V.4	Controlled burn	Remove pittosporums and other woody weeds, broad burn	$20,000	$5,000
H	115	V.2	Targeted weed removal	Ongoing woody weed removal	$40,000	$20,000
H	117	V.2	Controlled burn	Controlled burn	$5,000	$2,000
H	119	V.4	Controlled burn	Drop weeds and burn	$30,000	$9,000
H	122	V.12	Broad scale weed removal	Pile & burn	$25,000	$6,000
H	125	V.2, V.3	Targeted weed removal	Required in this area	$15,000	$5,000
H	126	V.2	Targeted weed removal	Continue weed removal	$18,000	$6,000
H	132	D.1	Remove dumped materials	Asbestos, fill, tyres, metal, and other detritus in quarry	$30,000	$0
M	0	A.2	Close access point	Erosion from Scout access is causing instability	$300	$0
M	2	V.3	Burn weed piles	Existing weed piles to be burnt	$3,000	$0
M	4	INF.1	Protect infrastructure	Aerial pipe crossing	$10,000	$0
M	6	S.2	Clear outlet sediment	As described	$200	$0
M	10	V.11	Increase habitat	Install next boxes due to the majority being juvenile trees	$500	$0
M	17	INF.1	Protect	Erosion around aerial pipe pylon	$10,000	$0

Priority	Map location	Action Type		Detail	Implementation	Maintenance year 1
			infrastructure			
M	20	S.2	Clear outlet sediment	Outlet half covered with sediment	$100	$0
M	26	D.2	Remove derelict car body	Remove derelict car	$600	$0
M	28	S.6	Create a basin/wetland	Construct	$1,500,000	$50,000
M	35	D.2	Remove derelict car body	Remove derelict car	$600	$0
M	36	D.2	Remove derelict car body	Remove derelict car	$600	$0
M	38	S.8	Divert stormwater	Stormwater flow causing damage to heritage road	$500	$0
M	41	D.2	Remove derelict car body	Remove derelict car	$600	$0
M	45	A.5	Build stairs	Stairs required	$15,000	$0
M	46	A.2	Close access point	Close point of access	$200	$0
M	53	V.9	Targeted Willow removal	4 mature *Salix babylonica*.	$3,500	$0
M	56	CO.1	Construct amenities	Suitable location for amenities such as tables, toilets BBQ's etc.	$350,000	$2,000
M	57	A.5	Build stairs	Stairs required behind 'The Willows' due to formalise access and ensure safety	$15,000	$0
M	62	E.2	Education and enforcement	Dumping of garden material and grass clippings identified	$1,000	$100
M	64	S.7	Re-shape channel	Re-shape channel with small wetland / basin	$15,000	$3,000
M	66	H.1	Clear prior to burning	Clear around wall prior to burn	$1,000	$0
M	68	A.3	Formalise entry point	Formalise access point with signage	$1,500	$0
M	79	D.4	Remove BMX trail	Level and revegetate	$2,500	$0

Priority	Map location	Action Type		Detail	Implementation	Maintenance year 1
M	82	A.4	Minor track works	Clear, formalise and drain trail where necessary	$6,000	$0
M	83	E.5	Interpretive signage	Put signage at entrance to trail	$13,000	$0
M	84	E.5	Interpretive signage	Directions, maps etc	$3,000	$0
M	85	A.3	Formalise entry point	Entry point requires definition	$1,000	$0
M	98	A.1	Reach 1_Close / Formalise trails	Close informal trails and formalise others	$5,000	$2,000
M	100	A.1	Reach 3_Close / Formalise trails	Close informal trails and formalise others	$9,000	$2,000
M	102	V.2	Targeted weed removal	Create native mosaic	$10,000	$10,000
M	102	A.1	Reach 5_Close / Formalise trails	Close informal trails and formalise others	$6,000	$2,000
M	104	V.2	Targeted weed removal	Continue contracting regeneration	$5,000	$2,000
M	108	V.2	Targeted weed removal	Maintenance of planting site	$2,000	$2,000
M	114	V.2	Targeted weed removal	Control 'edge' effect	$2,000	$1,000
M	116	V.2	Targeted weed removal	Minimise spread of terrestrial weeds	$7,000	$2,000
M	118	V.2	Targeted weed removal	Continue weed removal	$5,000	$2,000
M	121	V.12	Broad scale weed removal	Heavy infestation, drill/ spray weeds leave in situ & burn	$45,000	$15,000
L	1	D.1	Remove dumped materials	Old lounges and other dumped materials	$400	$0
L	3	S.1	Clear outlet vegetation	Rubbish was identified around outlet	$300	$0
L	9	S.3	Stabilise undercut	Identified as required	$500	$0

Priority	Map location	Action Type		Detail	Implementation	Maintenance year 1
			outlet			
L	11	S.1	Clear outlet vegetation	High vegetation around outlet	$200	$100
L	12	S.1	Clear outlet vegetation	High vegetation around outlet	$200	$100
L	14	S.2	Clear outlet sediment	Clear sediment from blocked pipe	$500	$200
L	15	S.3	Stabilise undercut outlet	identified as required	$1,000	$0
L	16	D.5	Clear rubbish blockage	Build up around this point	$0	$2,000
L	18	S.2	Clear outlet sediment	Outlet half blocked with sediment	$200	$100
L	19	S.5	Monitor erosion	Monitor right bank erosion which is minor at present	$0	$100
L	24	S.1, S.2	Clear outlet sediment	Clean veg & sediment, create basin to capture low	$5,000	$500
L	27	E.5	Interpretive signage	Plunge pool	$1,000	$100
L	29	D.1	Remove dumped materials	Significant dumping in quarry. Remove refuse and replant	$5,000	$0
L	37	A.3	Formalise entry point	Formalise access from Windsor Road	$3,000	$0
L	43	S.3	Stabilise undercut outlet	Undercut headwall on rock requiring stabilisation	$1,000	$0
L	44	S.5	Monitor erosion	Minor erosion on right bank requires monitoring	$0	$200
L	47	S.3	Stabilise undercut outlet	Undercut off cliff	$1,000	$0
L	48	S.3	Stabilise undercut outlet	Outlet onto cliff face	$2,000	$0
L	49	S.9	Replace headwall apron	Apron missing	$1,000	$0
L	50	S.3	Stabilise undercut	Undercut headwall	$500	$0

Priority	Map location	Action Type		Detail	Implementation	Maintenance year 1
			outlet			
L	52	V.5	Clear for access	Resident complaints	$1,000	$1,000
L	55	S.1	Clear outlet vegetation	Willow roots coming out of outlet	$500	$0
L	59	S.3	Stabilise undercut outlet	Apron requires concrete under apron	$500	$0
L	67	D.5	Clear rubbish blockage	Gross pollutants getting caught in large woody debris	$0	$2,000
L	72	V.14	Fauna investigation	Investigate bat population in Hammers Rd Bridge	$1,200	$0
L	73	S.11	Place rock at outlet	Place rock to prevent deepening	$1,800	$0
L	76	I.1	Monitor aquatic weed infestation	Liaise with BHSC re weed infestations	$0	$0
L	77	V.6	Plant native strata	Plant to road verge to increase corridor width	$20,000	$5,000
L	78	E.2	Education and enforcement	Identified adjoining this property	$500	$0
L	81	V.5	Clear for access	Create buffer behind houses	$1,000	$500
L	92	V.3	Targeted weed removal	Control privet & Madeira vine	$20,000	$2,000
L	103	V.2	Targeted weed removal	Primary weed removal	$10,000	$2,000
L	105	V.2	Targeted weed removal	Primary weed removal with follow-up	$30,000	$10,000
L	109	V.2	Targeted weed removal	Primary woody weed removal	$15,000	$6,000
L	110	V.2	Targeted weed removal	Primary weed removal	$18,000	$6,000
L	111	V.2	Targeted weed removal	Primary clearance	$25,000	$14,000
L	120	V.2	Targeted weed removal	Control nutrients	$2,000	$1,000

Priority	Map location	Action Type		Detail	Implementation	Maintenance year 1
L	123	V.2	Targeted weed removal	Control privet & Madeira vine	$20,000	$5,000
L	124	V.2	Targeted weed removal	Primary control of woody weeds	$30,000	$20,000
L	127	V.2	Targeted weed removal	Clear understorey, landscaping	$5,000	$2,000
L	128	V.13	Control vine weeds	Control vines from mature trees	$5,000	$5,000
L	129	V.6	Plant middle storey	Bush regeneration has left the area denuded	$18,000	$5,000

Remove Page

Insert Prioritised Area Actions Map 16

QUARRY BRANCH CREEK MASTER PLAN

Map 16: Prioritised Area Actions

ID 97 - Action V.8: Manage tree dieback
ID 129 - Action V.6: Plant middle storey
Reach 5 Tracks - Medium Priority
ID 128 - Action V.16: Control weed vines
ID 127 - Action V.2: Targeted weed removal
ID 94 - Action V.8: Manage tree dieback
MODEL FARMS ROAD
ID 124 - Action V.2: Targeted weed removal
ID 126 - Action V.2: Targeted weed removal
ID 123 - Action V.3: Targeted weed removal
ID 125 - Action V.2 / V.3: Targeted weed removal
Reach 4 Tracks - High Priority
Reach 3 Tracks - Medium Priority
ID 122 - Action V.14: Broadscale weed removal
CHURCHILL DRIVE
ID 121 - Action V.14: Broadscale weed removal
ID 89 - Action V.8: Manage tree dieback
ID 117 - Action V.2: Controlled burn
ID 120 - Action V.2: Targeted weed removal
ID 119 - Action V.4: Controlled burn
ID 118 - Action V.2: Targeted weed removal
Reach 2 Tracks - High Priority
ID 115 - Action V.2: Targeted weed removal
ID 116 - Action V.2: Targeted weed removal
ID 114 - Action V.2: Targeted weed removal
ID 112 - Action V.2: Targeted weed removal
ID 111 - Action V.2: Targeted weed removal
ID 109 - Action V.2: Targeted weed removal
ID 114 - Action V.4: Controlled burn
ID 107 - Action V.2: Targeted weed removal
ID 113 - Action V.2: Targeted weed removal
ID 106 - Action V.2: Targeted weed removal
Reach 1Tracks - Medium Priority
ID 110 - Action V.2: Targeted weed removal
ID 105 - Action V.2: Targeted weed removal
ID 108 - Action V.2: Targeted weed removal
ID 104 - Action V.2: Targeted weed removal
ID 103 - Action V.2: Targeted weed removal
ID 102 - Action V.2: Targeted weed removal

N

0 45 90 180 270

Metres

While every effort has been made to ensure the correctness of data supplied at the time of it's production, Paramatta City Council does not warrant the information or plans do not contain errors and the Council shall be in no way liable for any loss, damage or injury as a result of any such errors.

Earth Tech

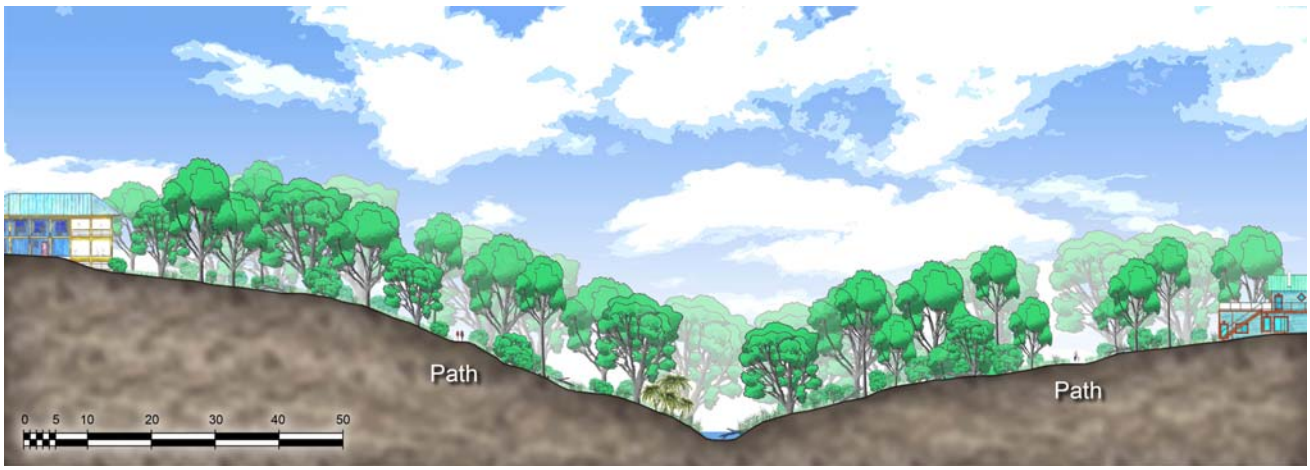
Legend

Tracks by Action

- Close trail
- Formalise trail
- New trail

Areas by Priority

- High
- Medium
- Low
- Catchment Boundary



5.1 Reach 1

Objectives
- → .Increase visual and social values through greater aesthetics.
- → Reduce canopy and middle strata weeds by 50%

Threats
- → Stormwater quality and quantity from upstream diffuse sources
- → Reduction in the status of bush regeneration groups

Opportunity
- → Supporting existing and new community groups
- → Creation of greater fauna habitat

POINT ACTIONS

Priority	Site ID	Action Code	Details
H	7	V.1	**Support existing bush regeneration** Bush regeneration activities should be supported with appropriate resources because they allow the community to be involved in the active management of their surrounding bushland.
H	8	V.11	**Increase habitat** Through installing or retaining habitat features such as terrestrial logs and nest boxes there will be greater fauna movement and protection within the corridor. These will also reduce predation from domestic pets such as cats.
H	13	V.2	**Targeted weed control** Control *Pittosporum undulatum* (Sweet Pitttosporum) should be undertaken because it dominates juvenile species. The populations in this reach were manageable with bush regeneration activities.
H	70	E.4	**Support community involvement** Support local community groups and individuals in the best management of the area. This increases ownership of the corridor

			and subsequent stakehold in their involvement in the areas long-term management.
H	71	E.4	**Support community involvement** Support local community groups and individuals in the best management of the area. This increases ownership of the corridor and subsequent stakehold in their involvement in the areas long-term management.
H	80	V.10	**Targeted Camphor Laurel removal** Targeted removal of Camphor Laurel juveniles and seedlings will reduce further spread throughout the corridor. Regular follow-ups will be required because they are actively spread by birds and possums.
H	82	A.4	**Minor track works** Through undertaking minor works to the existing trail such as drainage and formalisation of borders bush regeneration activities will be maximised while social amenity will also be improved.
H	103	S.7	**Reshape Channel** Remove pipe and create channel with Gross Pollutant Trap**.**
M	0	A.2	**Close access point** Points of entry into the corridor act as nodes for disturbance such as dumping and un-sustainable recreation. Closing these points using physical blockages, signage etc will encourage movement to formed trails.
M	2	V.3	**Burn weed piles** Burning of weed piles will remove dead weeds and also the visual and management problems associated with leaving piles to dry. This will also add nutrients to the regenerating areas and be a catalyst for native regeneration.
M	4	INF.1	**Protect existing infrastructure** Suitable protection of existing infrastructure with rocks and bank stabilisation materials will protect the structure and reduce the chances of failure and subsequent replacement in the future.
M	6	S.2	**Clear sediment from outlet** Clearing sediment from the outlet will remove material which would become mobilised and enter the waterway during periods of high flow. This should be removed manually where required and disposed of appropriately.
M	10	V.11	**Increase habitat** Through installing or retaining habitat features such as terrestrial logs

			and nest boxes there will be greater fauna movement and protection within the corridor. These will also reduce predation from domestic pets such as cats.
L	1	D.1	**Remove dumped materials** Manually remove dumped material to increase aesthetics and community ownership in the areas management. Once removed install appropriate temporary signage highlighting fines associated with dumping on Crown land.
L	3	S.1	**Clear vegetation from outlet** Removing overgrown vegetation from the outlet allows stormwater to exit down the main flow path reducing the likelihood of overland flows and damage to property. This should be removed manually and disposed of appropriately.
L	9	S.3	**Stabilise undercut outlet** Stabilisation of stormwater outlet headwalls by manually placing rock or concrete under the concrete apron will ensure the total lifecycle of the structure is achieved.
L	11	S.1	**Clear vegetation from outlet** Removing overgrown vegetation from the outlet allows stormwater to exit down the main flow path reducing the likelihood of overland flows and damage to property. This should be removed manually and disposed of appropriately.
L	12	S.1	**Clear vegetation from outlet** Removing overgrown vegetation from the outlet allows stormwater to exit down the main flow path reducing the likelihood of overland flows and damage to property. This should be removed manually and disposed of appropriately.
L	14	S.2	**Clear sediment from outlet** Clearing sediment from the outlet will remove material which would become mobilised and enter the waterway during periods of high flow. This should be removed manually where required and disposed of appropriately.
L	15	S.3	**Stabilise undercut outlet** Stabilisation of outlet headwalls by manually placing rock or filling concrete under the apron will prevent further undermining an ensure the total lifecycle of the structure is achieved.
L	72	V.14	**Fauna investigation** Investigate bat population in Hammers Rd Bridge
AREA ACTIONS			

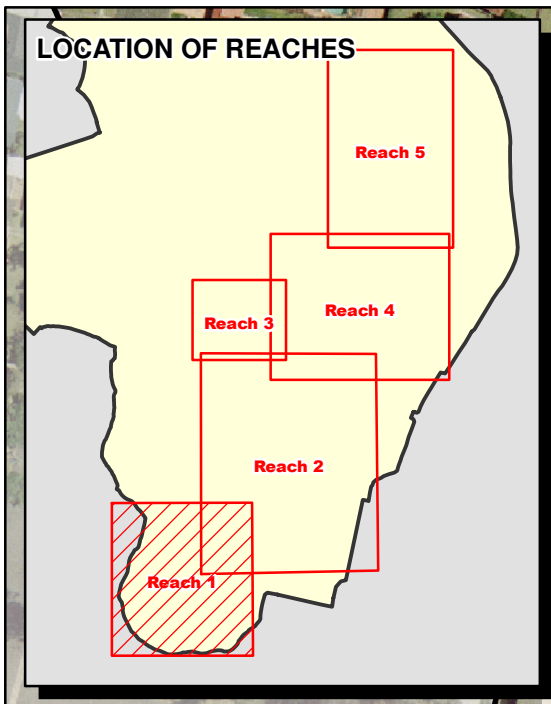
H	106	V.2	**Targeted weed removal** Remove noxious weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
H	107	V.2	**Targeted weed removal** Remove noxious weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
M	98	A.1	**Close informal walking trails** Informal walking trails allow access to parts of the reserve which are sensitive to human impact. This is exacerbated over time leading to increased sediment movement and rill erosion due to lack of suitable drainage.
M	102	V.2	**Targeted weed removal** Suitable removal of noxious weeds that are actively spreading such as Privets and Lantana that are having a high impact on the natural processes of the corridor and reducing native biodiversity.
M	104	V.2	**Targeted weed removal** Remove noxious weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
L	103	V.2	**Targeted weed removal** Suitable removal of noxious weeds that have high impact on the natural processes of the corridor and reduce the level of biodiversity a minor presence in the corridor.
L	105	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.

Remove Page

INSERT MAP 16 - Reach 1 Actions

QUARRY BRANCH CREEK MASTER PLAN

Map 17: Reach 1 - Prioritised Point Actions



ID: 14 - Clear outlet sediment

ID: 15 - Stabilise undercut outlet

MOXHAMS ROAD

ID: 12 - Clear outlet vegetation

ID: 10 - Increase habitat

ID: 11 - Clear outlet vegetation

ID: 9 - Stabilise undercut outlet

ID: 8 - Increase habitat

ID: 13 - Targeted weed control

ID: 7 - Support existing bush reg

ID: 81 - Clear for access

ID: 70 - Support community

ID: 3 - Clear outlet vegetation

ID: 82 - Minor track works

ID: 2 - Burn weed piles

ID: 80 - Targeted Camphor removal

ID: 6 - Clear outlet sediment

ID: 4 - Protect infrastructure

ID: 0 - Close access point

ID: 71 - Support community

ID: 1 - Remove dumped materials

Toongabbie Creek

Legend

Actions by Priority

- High
- Medium
- Low
- Catchment Boundary

N

0 15 30 60

Metres

5.2 Reach 2

Objective
- → Decease in stormwater quantity entering the watercourse
- → Greater social amenity and ownership of the reserves

Threats
- → Contamination from dumped domestic and industrial materials
- → Upstream weed species

Opportunity
- → Increase in number of community groups involved in management
- → Retain high quality significant remnant vegetation communities

POINT ACTIONS

Priority	Site ID	Action Code	Details
U	23	E.2	**Enforce garden dumping** Enforce residents dumping garden waste in bushland which a major source of invasive weed species. This will also increase other residents awareness on the responsibilities involved with adjoining bushland areas.
U	30	V.2	**Targeted weed control** Removal of high threatening weeds such as Ludwigia peruviana will have a high impact on the long-term natural processes of the corridor that threatens to reduce native biodiversity and eco-system functioning.
U	39	D.3	**Investigate contamination** Investigate and suitably remove of anthropogenic materials causing adverse risk or contamination to the groundwater and watercourse using appropriate methods.
U	40	D.1	**Remove dumped materials** Remove dumped domestic goods such as lounges, whitegoods to increase the social amenity for the community and install appropriate temporary signage highlighting fines associated with such activities.
U	42	V.7	**Fox baiting** Baiting of foxes within urban corridors is a common management technique to decrease fox predation of significance fauna species while also acting as a catalyst for domestic dogs to be leached at all times.
H	31	S.8	**Divert stormwater**

			Diversion of stormwater into existing landforms such as abandoned quarries will reduce the total peak flow quantities and frequencies while capturing low flow events and treating nutrients and heavy metals.
H	32	S.8	**Divert stormwater** Diversion of stormwater into existing landforms such as abandoned quarries will reduce the total peak flow quantities and frequencies while capturing low flow events and treating nutrients and heavy metals.
H	33	S.8	**Divert stormwater** Diversion of stormwater into existing landforms such as abandoned quarries will reduce the total peak flow quantities and frequencies while capturing low flow events and treating nutrients and heavy metals.
H	34	S.6	**Create a basin/wetland** Utilise existing drainage and landforms to create a 'blockage' effect whereby low flow events are captured in a basin/wetland. This will also treat pollutants and capture mobile sediments.
H	65	D.6	**Remove Honey Bees** *Removal of Honey Bees (Apis mellifera) should be undertaken because they* pose a threat to the natural ecology of native bees while posing a risk to residents using the walking trails within the reserve.
H	86	V.1	**Support existing bush regeneration** Bush regeneration activities should be supported with appropriate resources because they allow the community to be involved in the active management of their surrounding bushland.
M	17	INF.1	**Protect existing infrastructure** Suitable protection of existing infrastructure with rocks and bank stabilisation materials will protect the structure and reduce the chances of failure and subsequent replacement in the future.
M	20	S.2	**Clear sediment from outlet** Clearing sediment from the outlet will remove material which would become mobilised and enter the waterway during periods of high flow. This should be removed manually where required and disposed of appropriately.
M	26	D.2	**Remove derelict car body** Derelict car bodies should be removed from the bushland corridor because they reduce the visual amenity of the area and detract from the overall social values.
M	28	S.6	**Create a basin/wetland** Utilise existing drainage and landforms to create a 'blockage' effect whereby low flow events are captured in a basin/wetland. This will also treat pollutants and capture mobile sediments.
M	35	D.2	**Remove derelict car body**

			Derelict car bodies should be removed from the bushland corridor because they reduce the visual amenity of the area and detract from the overall social values.
M	36	D.2	**Remove derelict car body** Derelict car bodies should be removed from the bushland corridor because they reduce the visual amenity of the area and detract from the overall social values.
M	38	S.8	**Divert stormwater** Diversion of stormwater into existing landforms such as abandoned quarries will reduce the total peak flow quantities and frequencies while capturing low flow events and treating nutrients and heavy metals.
M	41	D.2	**Remove derelict car body** Derelict car bodies should be removed from the bushland corridor because they reduce the visual amenity of the area and detract from the overall social values.
M	45	A.5	**Build stairs** Construction of stairs allows access for a wider number of the community while also formalising the trails as regional walking areas. These can be made of low physical and visual impact materials to suit the location.
M	46	A.2	**Close access point** Points of entry into the corridor act as nodes for disturbance such as dumping and un-sustainable recreation. Closing these points using physical blockages, signage etc will encourage movement to formed trails.
M	83	E.5	**Install interpretive signage** Installation of interpretive signage (similar to existing) at strategic locations gives visitors a sense of ownership and greater understanding of the regional context.
M	84	E.5	**Install interpretive signage** Installation of interpretive signage(similar to existing) at strategic locations gives visitors a sense of ownership and greater understanding of the regional context.
M	85	A.3	**Formalise entry point** Formalising trails with appropriate amenities including signage and maps gives the users a degree of ownership while publicising the corridor to the wider community as a regional trail network.
L	16	D.5	**Clear rubbish blockage** Blockages of gross pollutants by natural or human sources should be removed by physical means because during periods of high flow these will mobilise into downstream reaches.

L	18	S.2	**Clear sediment from outlet** Clearing sediment from the outlet will remove the likelihood of this becoming mobilised and entering the waterway during periods of high flow. This should be removed manually where required and disposed of appropriately.
L	19	S.5	**Monitor erosion around outlet** Regularly monitor bank erosion around outlet should be initiated to ensure minor works can be identified prior to any major requirements. This should be conducted twice annually whilst maintaining surrounding areas.
L	24	S.2	**Clear sediment from outlet** Clearing sediment from the outlet will remove the likelihood of this becoming mobilised and entering the waterway during periods of high flow. This should be removed manually where required and disposed of appropriately.
L	27	E.5	**Install interpretive signage** Installation of interpretive signage (similar to existing) at strategic locations gives visitors a sense of ownership and greater understanding of the regional context.
L	29	D.1	**Remove dumped materials** Manually remove dumped material to increase aesthetics and community stakehold in the areas management. Once removed install appropriate temporary signage highlighting fines associated with dumping on Crown land.
L	37	A.3	**Formalise entry point** Formalising trails with appropriate infrastructures including signage affords the community a degree of ownership while publicising the corridor as a regional trail network.
L	43	S.3	**Stabilise undercut outlet** Stabilisation of outlet headwalls by manually placing rock or filling concrete under the apron will prevent further undermining an ensure the total lifecycle of the structure is achieved.
AREA ACTIONS			
H	89	V.8	**Manage tree dieback** Trees noticed to be dieing or in poor condition should be regularly monitored for canopy cover health with appropriate management actions if dieback is noted to be spreading.
H	99	A.1	**Close informal walking trails** Informal walking trails allow residents access to parts of the reserve that could be sensitive to human impact. This is exacerbated over time leading to increased sediment movement and rill erosion.

H	112	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
H	113	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
H	114	V.4	**Controlled burn** Instigation of a controlled burning regime will increase native regeneration and re-introduce nutrient cycling processes that occurred prior to the current alterations in structure and floristic of the vegetation communities.
H	115	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
H	117	V.4	**Controlled burn** Instigation of a controlled burning regime will increase native regeneration and re-introduce nutrient cycling processes that occurred prior to the current alterations in structure and floristic of the vegetation communities.
H	119	V.4	**Controlled burn** Instigation of a controlled burning regime will increase native regeneration and re-introduce nutrient cycling processes that occurred prior to the current alterations in structure and floristic of the vegetation communities.
M	108	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
M	116	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
M	118	V.2	**Targeted weed removal** Suitable removal of weeds that have high impact on the natural processes of the corridor and reduce the level of biodiversity a minor presence in the corridor.

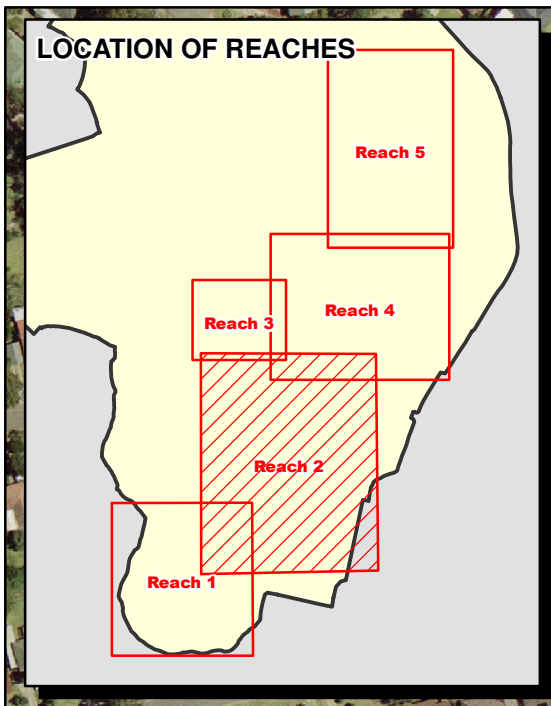
M	121	V.12	**Broad scale weed removal** This action requires non specific removal of weeds due to heavy infestations and overall lack of native ground and middle strata diversity. These areas are not suitable for the implementation of targeted removal of weeds.
L	109	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
L	110	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
L	111	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
L	120	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.

Remove page

INSERT MAP 17– Reach 2 Actions

QUARRY BRANCH CREEK MASTER PLAN

Map 18: Reach 2 - Prioritised Point Actions



CHURCHILL DRIVE

ID: 36 - Remove derelict car body
ID: 85 - Formalise entry point
ID: 43 - Stabilise undercut outlet
ID: 33 - Divert stormwater
ID: 35 - Remove derelict car body
ID: 34 - Create a basin/wetland
ID: 45 - Build stairs
ID: 32 - Divert stormwater
ID: 31 - Divert stormwater
ID: 38 - Divert stormwater
ID: 41 - Remove derelict car body
ID: 65 - Remove Honey bees
ID: 39 - Investigate contamination
ID: 37 - Formalise entry point
ID: 42 - Fox baiting
ID: 29 - Remove dumped materials
ID: 46 - Close access point
ID: 40 - Remove dumped materials
ID: 30 - Targeted weed control
ID: 28 - Create a basin/wetland
ID: 26 - Remove derelict car body
ID: 27 - Interpretive signage
ID: 84 - Interpretive signage
ID: 20 - Clear outlet sediment
ID: 19 - Monitor erosion
ID: 23 - Enforce garden dumping
ID: 18 - Clear outlet sediment
ID: 24 - Clear outlet sediment
ID: 17 - Protect infrastructure
ID: 16 - Clear rubbish blockage
MOXHAMS ROAD
ID: 86 - Support existing bush reg
ID: 83 - Interpretive signage

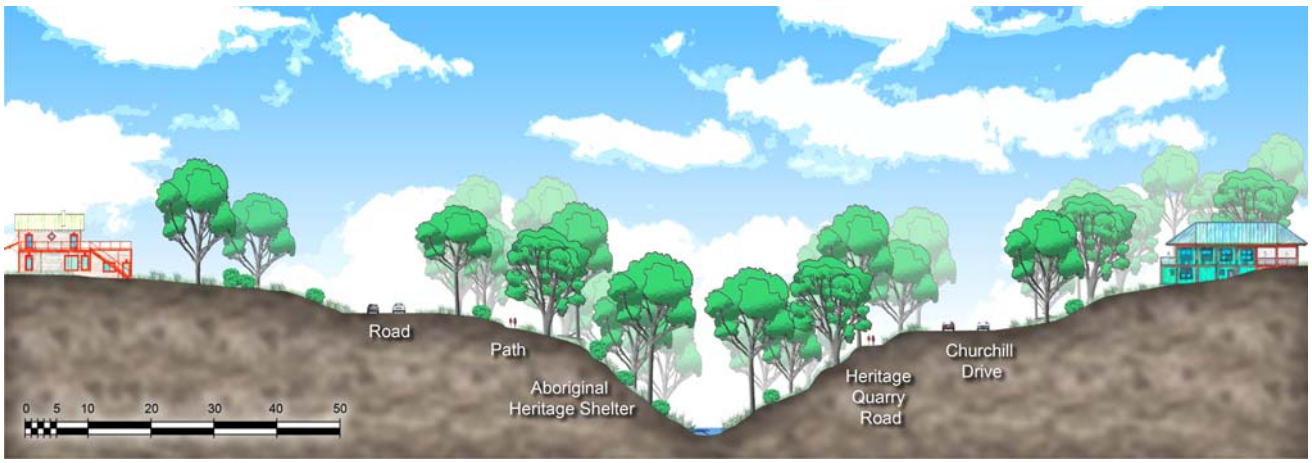
N
0 20 40 80
Metres

Earth Tech

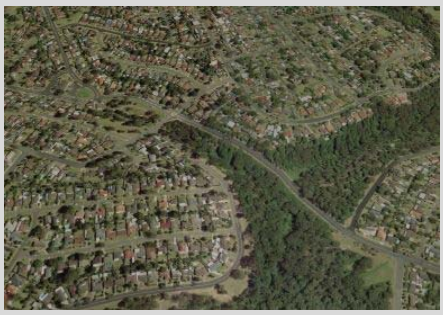
Legend

Actions by Priority

- High
- Medium
- Low
- Catchment Boundary



5.3 Reach 3



Objectives
- → Increase native biodiversity
- → Protect heritage assets

Threats
- → Dominance of weed species and lack of native recruitment
- → High levels of nutrients from upstream catchments

Opportunity
- → Existing GPT installed upstream
- → High social amenities in reserves

POINT ACTIONS

Priority	Site ID	Action Code	Details
H	51	S.4	**Regularly clean Gross Pollutant Trap (GPT)** Regular cleaning of gross pollutants from trash rack after storm events should be undertaken to ensure the maximum loads of rubbish are collected. This will decrease overall litter loads and create a more aesthetically pleasing waterway
M	66	H.1	**Clear prior to burning** Before any introduced burns are undertaken strategic clearing around areas of cultural or heritage significance should be undertaken to minimise risks associated with damage of these assets.
L	44	S.5	**Monitor erosion around outlet** Regular monitoring of bank erosion around outlet should be initiated to ensure minor works can be identified prior to any major requirements. This should be conducted twice annually whilst maintaining surrounding areas.
L	47	S.3	**Stabilise undercut outlet** Stabilisation of outlet headwalls by manually placing rock or filling

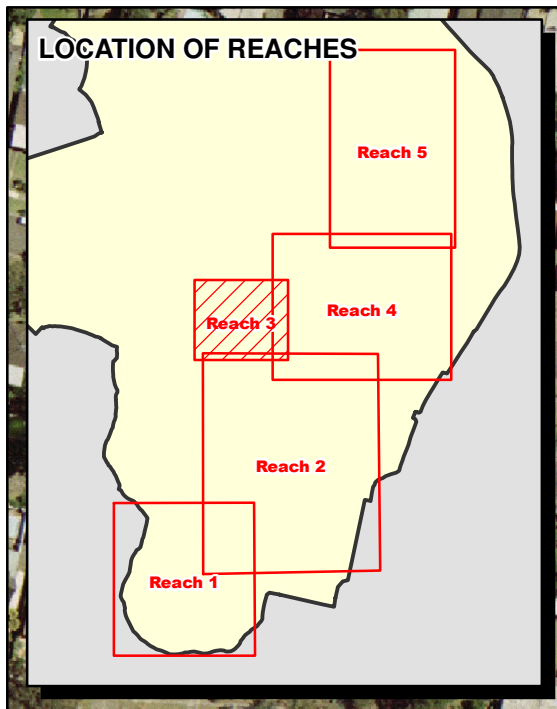
			concrete under the apron will prevent further undermining an ensure the total lifecycle of the structure is achieved.
L	48	S.3	**Stabilise undercut outlet** Stabilisation of outlet headwalls by manually placing rock or filling concrete under the apron will prevent further undermining an ensure the total lifecycle of the structure is achieved.
L	49	S.9	**Replace headwall apron** Replace concrete apron supporting the headwall because it is currently failing and likely to collapse further. This may require further works to the drainage infrastructure.
L	50	S.3	**Stabilise undercut outlet** Stabilisation of outlet headwalls by manually placing rock or filling concrete under the apron will prevent further undermining an ensure the total lifecycle of the structure is achieved.
AREA ACTIONS			
M	100	A.1	**Close informal walking trails** Informal walking trails allow residents access to parts of the reserve that could be sensitive to human impact. This is exacerbated over time leading to increased sediment movement and rill erosion.
M	121	V.12	**Broad scale weed removal** This action requires non specific removal of weeds due to heavy infestations and overall lack of native ground and middle strata diversity. These areas are not suitable for the implementation of targeted removal of weeds.

Remove Page

MAP 18 – Reach 3 Actions

QUARRY BRANCH CREEK MASTER PLAN

Map 19: Reach 3 - Prioritised Point Actions



ID: 51 - Regularly clean GPT

ID: 49 - Replace headwall apron

ID: 50 - Stabilise undercut outlet

ID: 66 - Clear prior to burning

CHURCHILL DRIVE

ID: 47 - Stabilise undercut outlet

ID: 48 - Stabilise undercut outlet

ID: 44 - Monitor erosion

Legend

Actions by Priority

- High
- Medium
- Low
- Catchment Boundary

N

0 15 30 60

Metres

5.4 Reach 4

Objectives
- → Protection and improvement of vegetation communities
- → High social access and utilisation

Threats
- → Informal access trails and entry points
- → High cover of exotic weeds along the watercourse

Opportunity
- → Formalise single walking trail
- → Involvement of local community in management

POINT ACTIONS

Priority	Site ID	Action Code	Details
H	58	D.7	**Water quality testing** Potential sewer leaks or polluted stormwater should be tested during dry periods to ascertain the upstream source/s and instigate appropriate management practices.
H	60	D.7	**Water quality testing** Potential sewer leaks or polluted stormwater should be tested during dry periods to ascertain the upstream source/s and instigate appropriate management practices.
H	63	E.3	**Enforcement of bush rock theft** Theft of bush rock throughout urban bushland areas reduces habitat for reptiles while leaving the ground open to disturbance and rill erosion. This activity should be stopped to retain a degree of ecological integrity.
H	69	E.1	**Conduct 'Dogs on Leash' campaign** A campaign to encourage residents to have their dogs on leach while using the trail network will protect native fauna and increase community awareness of the problems associated with domestic pets in bushland remnants.
H	132	D.1	**Remove dumped materials**

			Manually remove dumped material to increase aesthetics and community stakehold in the areas management. Once removed install appropriate temporary signage highlighting fines associated with dumping on Crown land.
M	62	E.2	**Enforce garden dumping** Enforcement of residents dumping garden waste in bushland is the source of many invasive weed species. This will also increase surrounding residents awareness on the responsibilities involved with adjoining bushland areas.
M	64	S.7	**Re-shape channel** Braided channels from upstream outlets should be re-shaped into a single line to reduce the spread of pollutants and sediments from the upstream catchment area.
M	68	A.3	**Formalise entry point** Formalising trails with appropriate infrastructures including signage affords the community a degree of ownership while publicising the corridor as a regional trail network.
L	52	V.5	**Clear for access** Clear a 5m wide buffer behind houses to ensure resident safety and access. These areas should be included in the regular maintenance regimes of surrounding reserves.
L	59	S.3	**Stabilise undercut outlet** Stabilisation of outlet headwalls by manually placing rock or filling concrete under the apron will prevent further undermining an ensure the total lifecycle of the structure is achieved.
L	81	V.5	**Clear for access** Clear a 5m wide buffer behind houses to ensure resident safety and access. These areas should be included in the regular maintenance regimes of surrounding reserves.
L	92	V.3	**Burn weed piles** Burning of weed piles will remove dead weeds and also the visual and management problems associated with leaving piles to dry. This will also add nutrients to the regenerating areas and be a catalyst for native regeneration.
AREA ACTIONS			
H	94	V.8	**Manage tree dieback** Trees noticed to be dieing or in poor condition should be regularly monitored for canopy cover health with appropriate management actions if dieback is noted to be spreading.
H	101	A.1	**Close informal walking trails** Informal walking trails allow residents access to parts of the reserve that could be sensitive to human impact. This is exacerbated over time leading to increased sediment movement and rill erosion.
H	122	V.12	**Broad scale weed removal** This action requires non specific removal of weeds due to heavy

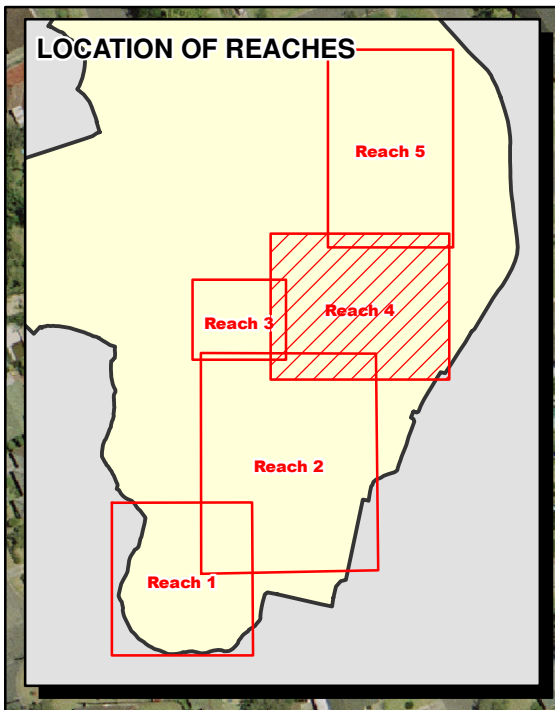
			infestations and overall lack of native ground and middle strata diversity. These areas are not suitable for the implementation of targeted removal of weeds.
H	125	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
H	126	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning..
M	121	V.12	**Broad scale weed removal** This action requires non specific removal of weeds due to heavy infestations and overall lack of native ground and middle strata diversity. These areas are not suitable for the implementation of targeted removal of weeds.
L	123	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning..
L	124	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.

Remove Page

INSERT MAP 19 – Reach 4 Actions

QUARRY BRANCH CREEK MASTER PLAN

Map 20: Reach 4 - Prioritised Point Actions



MODEL FARMS ROAD

ID: 58 - Water quality testing

ID: 52 - Clear for access

ID: 68 - Formalise entry point

ID: 64 - Re-shape channel

ID: 60 - Water quality testing

ID: 59 - Stabilise undercut outlet

ID: 132 - Remove dumped material

ID: 62 - Education and enforcement

ID: 63 - Enforce bushrock theft

CHURCHILL DRIVE

ID: 69 - Conduct dogs on leash cam

Legend

Actions by Priority

- High
- Medium
- Low
- Catchment Boundary

N

0 20 40 80

Metres

4.5 Reach 5

Objective
- → Increase native vegetation quality and habitat values
- → Reduction in the dominance of exotic weeds

Threats
- → Weed densities and garden dumping
- → Instable stormwater outlets

Opportunity
- → Stabilisation of outlets
- → Involvement of community in management

POINT ACTIONS

Priority	Site ID	Action Code	Details
U	74	S.10	**Stabilise outlet** Stabilise downstream from outlet has become unstable and requires rock lining to prevent deepening and appropriate bank protection to prevent further widening. Should be monitored post works to gauge any further works.
U	75	S.10	**Stabilise outlet** Stabilise downstream from outlet has become unstable and requires rock lining to prevent deepening and appropriate bank protection to prevent further widening. Should be monitored post works to gauge any further works.
H	54	V.10	**Targeted Camphor Laurel removal** Targeted removal of Camphor Laurel juveniles and seedlings will reduce further spread throughout the corridor. Regular follow-ups will be required because they are actively spread by birds and possums.
M	53	V.9	**Targeted Willow control** Stem injection and removal of Weeping Willows (*Salix babylonica)* should be undertaken because they are an invasive tree weed limiting native recruitment and cause problems to infrastructure.
M	56	CO.1	**Construct amenities** Social amenities should be installed such seating, tables, barbeques, bubblers and shelters. These allow residents to enjoy the bushland

			landscape in a controlled environment.
M	57	A.5	**Build stairs** Construction of stairs allows access for a greater percentage of the community while formalising the trails as formal walking areas. These can be made of low physical and visual impact materials which suit the location.
M	79	D.4	**Remove BMX track** Remove jumps by flattening and regenerate site with endemic plantings to reclaim the area. This should be conducted with appropriate temporary signage (or map) informing users of the formal BMX tracks within the area.
L	55	S.1	**Clear vegetation from outlet** Removing overgrown vegetation from the outlet allows stormwater to exit down the main flow path reducing the likelihood of overland flows and damage to property. This should be removed manually and disposed of appropriately.
L	67	D.5	**Clear rubbish blockage** Blockages of gross pollutants should be and removed by physical means because during periods of high flow these will mobilise downstream. Natural blockages of timber should be retained for aquatic habitat purposes.
L	73	S.11	**Place rock at outlet** Stabilisation of outlet headwall with rock under the concrete apron will ensuring the total lifecycle of the structure while reducing bank erosion in periods of high flow.
L	76	I.1	**Monitor aquatic weeds** Monitoring of weed infestations during Spring and Autumn will ensure subsequent management can be undertaken before the infestation becomes too large.
L	77	V.6	**Plant native strata** Increase bushland corridor closer to road reserve. This will increase community interest, create shade, increase biodiversity and further social amenity within the corridor.
L	78	E.2	**Enforce garden dumping** Enforcement of residents dumping garden waste in bushland is the source of many invasive weed species. This will also increase surrounding residents awareness on the responsibilities involved with adjoining bushland areas.
AREA ACTIONS			
H	97	V.8	**Manage tree dieback** Trees noticed to be dieing or in poor condition should be regularly monitored for canopy cover health and appropriate management undertaken if dieback is noticed to be spreading.
M	102	A.1	**Close informal walking trails** Informal walking trails allow residents access to parts of the reserve

			that could be sensitive to human impact. This is exacerbated over time leading to increased sediment movement and rill erosion.
L	127	V.2	**Targeted weed removal** Remove weeds currently spreading that have a high impact on the natural processes of the corridor through reduced native biodiversity and natural ecological functioning.
L	128	V.13	**Control vine weeds** Removal of climbing weed species that are competing with native canopy trees for resources. This should be conducted through cutting and paste method with manual removal of the vine biomass once dead.
L	129	V.6	**Plant native strata** Increase bushland corridor closer to road reserve. This will increase community interest, create shade, increase biodiversity and further social amenity within the corridor.

Remove Page

INSERT MAP 20 – Reach 5 Actions

QUARRY BRANCH CREEK MASTER PLAN

Map 21: Reach 5 - Prioritised Point Actions

M2 MOTORWAY

ID: 73 - Place rock at outlet

ID: 74 - Stabilise outlet

ID: 77 - Plant native strata

ID: 75 - Stabilise outlet

ID: 79 - Remove BMX trail

ID: 57 - Build stairs

ID: 67 - Clear rubbish blockage

ID: 78 - Education and enforcement

ID: 54 - Targeted Camphor removal

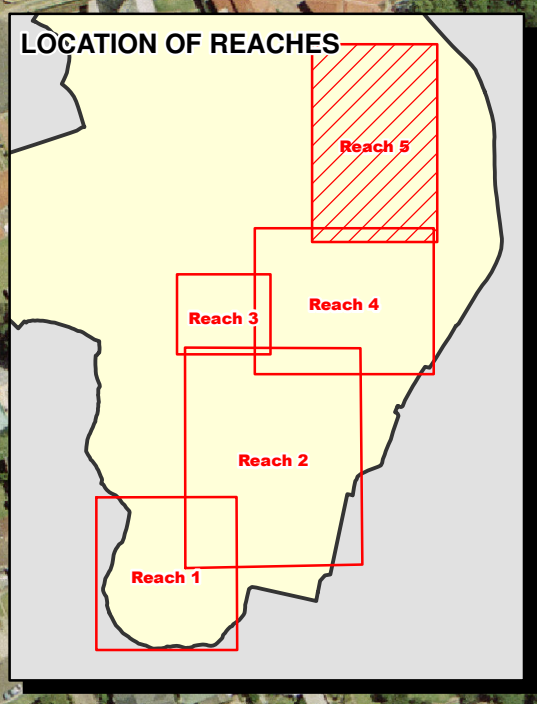
ID: 53 - Targeted Willow removal

ID: 56 - Construct ammenities

ID: 55 - Clear outlet vegetation

MODEL FARMS ROAD

LOCATION OF REACHES



Legend

Actions by Priority

- High
- Medium
- Low
- Catchment Boundary

N

0 15 30 60

Metres

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7 ACKNOWLEDGEMENTS

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Master Plan Prepared By:

EarthTech

GIS Environmental Consultants

Jo McDonald Heritage

Community Workshop No. 1. Attendees			
Title	**First Name**	**Last Name**	**Representation**
Councillor	Paul	Barber	PCC
Mr	Peter	Britton	
Mr & Mrs	Adrian and Pam	Caster	Quarry Branch (South) Bush Care Committee
Mrs	Karen	Cleary	Robin Hood Park
Mr	Bill	de Bellin	
Mrs	Judith	Dunn	Past Time Tours
Mr	Rob	Eagleson	Quarry Branch (South) Bush Care Committee
Ms	Marina	Gilmore	Danangarra and Timbergetters
Mr	Matti	Keentok	
Mr	David	Knowles	Robin Hood Park
Mr	David	Mikov	Quarry Branch (South) Bush Care Committee
Ms	Annie	Nielson	Impeesa Bushcare
Mrs	Meryn	O'Brien	
Mr & Mrs	Faye and John	Rogers	Caroline Chisholm Park Committee
Mr	Brian	Roweth	
Mr	Geoff	Stevenson	Quarry Branch (South) Bush Care Committee
Mr & Mrs	Peter and Aline	ter Horst	Vineyard Creek Bushcare
Mrs	Tabatha	Timbery-Cann	Catchment Management Authority
Mrs	Pam	Trimmer	

Community Workshop No. 2. Attendees			
Title	**First Name**	**Last Name**	**Representation**
Mr & Mrs	Luciano & Robin	Casmiri	
Mr & Mrs	Adrian and Pam	Caster	Quarry Branch (South) Bush Care Committee
Mrs	Karen	Cleary	Robin Hood Park
Mr	Bill	De Belim	Resident Platypus Survey
Mr	David	Knowles	Robin Hood Park
Ms	Diana	Kureen	Upper Parramatta River Catchment Trust
Mrs	Sandra	Lloyd	
Mr	David	Mikov	Quarry Branch (South) Bush Care Committee
Ms	Annie	Nielson	Impeesa Bushcare