RiverConnect
Waterway Health Activity Plan

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WATER TECHNOLOGY
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Cover Photo: Goulburn River Path, towards the Broken River Confluence at rear of Lake Victoria

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1. INTRODUCTION

Water Technology was commissioned by the Goulburn Broken Catchment Management Authority (Goulburn Broken CMA) to develop a Waterway Health Activity Plan (WHAP) for the Shepparton – Mooroopna area, encompassing the riparian zones of the Broken and Goulburn Rivers. The purpose for the development of the WHAP is twofold; to guide the implementation of river management works in the RiverConnect project area and to become a key reference document for the development of the RiverConnect Master Plan for the Shepparton urban area.

1.1 RiverConnect

RiverConnect is a concept that emerged in 2005 to encourage the community to embrace the values and significance of the Goulburn and Broken River systems in the Shepparton-Mooroopna urban areas. A Master Plan is currently under development for the RiverConnect area and the development of the Master Plan is being managed by the Greater Shepparton City Council (GSCC). The five key objectives of the RiverConnect Master Plan are:

1. Nurturing our natural environment (Thriving ecosystems)
2. Connecting our people with our rivers (General community participation and learning)
3. Learning from Aboriginal know-how (Aboriginal peoples participation and learning)
4. Raising the profile of our rivers (Feeding the Spirit of the river)
5. Securing the funds for our ecosystems survival (Revenue raising and management).

Aboriginal and educational organisations have built on the groundswell in interest and preliminary discussions between the Greater Shepparton City Council, the Goulburn Broken CMA and other natural resource management agencies. Together, these groups have identified the multi-agency, whole of community approach to future management of the Goulburn and Broken Rivers and surrounding Red Gum forests between Shepparton and Mooroopna.

1.2 Project Area

This project refers specifically to the reaches of Goulburn and Broken Rivers within the Shepparton-Mooroopna urban area. The project area for the RiverConnect WHAP is bounded to the north and south on the Goulburn River by McCracken Road and Raftery Road respectively, and further bounded to the east along the Broken River by Doyles Road. The project area is shown in Figure 1.

The WHAP focuses on the values, threats and actions that impact upon the health of the Goulburn and Broken Rivers. From a physical perspective, this includes the land directly influenced by the river within the channel, as well as the riparian land that adjoins the waterway. Riparian land within the RiverConnect project area includes land adjacent to the rivers that is managed as State Forest, Nature Conservation and Wildlife Reserves, Public Parks and Reserves, other Crown land and privately owned frontages. These varying land tenures have resulted in the current mosaic of land management responsibility and management regimes (SKM 2005).

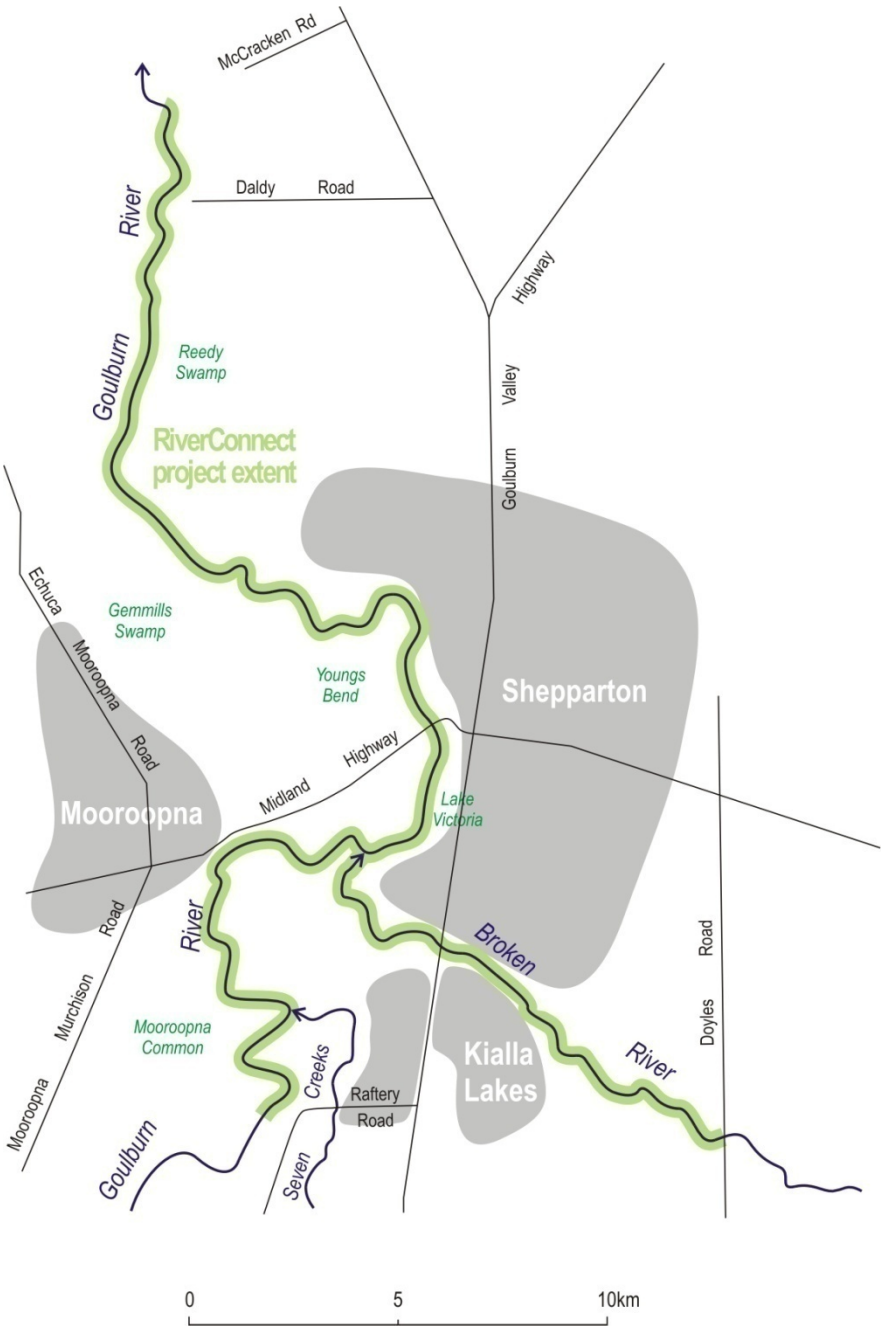

Figure 1 **RiverConnect Waterway Health Activity Plan project area**

1.3 Project Objectives

The objectives of the project were to develop the RiverConnect WHAP that:

- Identifies values and threats to those values within the project area
- Establishes management zones that allow for effective value/threat management across the varying land tenures and land managers
- Identifies management actions to protect and enhance existing values
- Recommends actions to reduce the identified threats to values
- Provides actions that are specific, achievable, costed and prioritised.

The Goulburn and Broken Rivers are highly valued for their environmental assets, recreational amenity, cultural significance, and positive economic benefits for agricultural production, tourism and local property values. The RiverConnect WHAP aims to focus solely on the management of the environmental assets of the project area, as social and economic values are addressed through separate studies or planning processes for the RiverConnect Master Plan.

1.4 Method

The outcomes of this project were developed based on the following method:

1. Review relevant reports and gather information to characterise the current condition of the waterways and riparian land within the project area and place the reach in context with regional priorities for waterway management
2. Review the site specific and reach based actions from previous management plans for this reach. Identify site specific actions completed in previous works programs and actions outstanding for implementation
3. Consult with the Land Management Working Group to determine key sites of concern, high value areas and key threats. Present options for a basis for designation of management zones and potential management zone areas
4. Assess geographic areas identified for further investigation, including outstanding and newly identified sites, reach based programs and confirmation of management zones
5. Further develop site and reach based actions, including prioritisation and costs based on information obtained during the site assessments
6. Spatially present the management zones, reach based programs and site specific actions for the RiverConnect WHAP project area.

1.5 Consultation

In 2008, a RiverConnect Community Advisory Committee was formed, replacing the former RiverConnect Steering Committee led by the Goulburn Broken CMA. The Community Advisory Committee is further broken into a series of four working groups targeting:

1. Communications
2. Education
3. Land Management
4. Aboriginal Participation and Elders Reference Group.

The Land Management Working Group (LMWG) represents the organisations who manage public land within the RiverConnect project area. The principal land managers are the Department of Sustainability and Environment (DSE) Crown Land Management and Forest Management, Parks Victoria and Greater Shepparton City Council (GSCC). The Goulburn Broken CMA are also a key partner of this group as they are responsible for the management of the Goulburn and Broken Rivers within the project area. All of these organisations are represented on the LMWG, in addition to representatives of the Goulburn Valley Environment Group and Shepparton Urban Landcare Group.

The key tasks of the LMWG are to:

- Assist in the development of a Waterway Health Activity Plan for the project area. For this reason, the Land Management Working Group represents the Steering Committee for this project

- Capture funding opportunities to support the land management efforts in the Shepparton-Mooroopna area
- Implement the recommendations from the Victorian Environment and Assessment Council (VEAC) for changes to the management arrangements and designation of public land in the RiverConnect project area. These final recommendations of the VEAC investigation are detailed in Appendix A, Section 4.

Initial consultation with members of the LMWG occurred on 2nd September 2008. The aim of this scheduled working group meeting was to:

- Identify high values assets and threats
- Identify specific areas/sites of concern
- Discuss the VEAC recommendations for land management
- Define potential management zone classifications and zone areas.

Due to the low attendance of this meeting by the working group members, consultation was also sought independently with representatives of GSCC. The results of the scheduled working group meeting and follow up consultation were a key component of the development of the RiverConnect WHAP.

2. RELEVENT LITERATURE

A review of relevant strategic plans at a regional and management reach level has been completed to characterise the current condition of the waterways and riparian land within the project area and place the reach in context with regional priorities for waterway management. The key documents reviewed that are of relevance the RiverConnect project area are:

1. Regional Catchment Strategy (GBCMA 2003)
2. Regional River Health Strategy (GBCMA 2005)
3. From the Fringe to the Mainstream: a Strategic Plan for Integrating Native Biodiversity 2004-2007 (GBCMA 2004)
4. River Red Gum Forest Investigation (VEAC 2008)
5. Mid Goulburn Waterway Health Activity Plan (Earth Tech 2005b)
6. Lower Broken Waterway Health Activity Plan (Earth Tech 2004)
7. Assessment of Crown Land in Urban Zones (SKM 2005)
8. Broken River Crown Land (Riparian) Assessment – Casey's Weir to Goulburn River (Earth Tech 2005a)
9. Reedy Swamp Management Plan (DPI 2003)
10. Gemmills Swamp Wildlife Reserve Masterplan (Thompson Berrill Landscape Design 2003).

Recommendations contained in the River Red Gum Forest Investigation (VEAC 2008) were outlined in the draft version of this report, released on 11/12/2008. These recommendations were largely accepted and passed by the Victorian Government in late December 2008. Details of changes to the management recommendations have since been incorporated into the literature review for this final document. However, at the time of finalising this report (02/03/2009), there was no indication of any changes to the proposed management of the Shepparton Regional Park.

Other documents of relevance to the project area that have not been reviewed in detail include:

- Mapping the current condition of river red gum stands along the Victorian Murray River floodplain (Cunningham *et al.* 2007)
- Priority Action Plan for Lower Broken River Wetlands (Ecology Australia 2007)
- Greater Shepparton Stormwater Management Plan (KBR 2003).

3. WATERWAY MANAGEMENT ZONES

3.1 Background

Indentifying and defining zones that have specific management regimes is a useful method of simplifying and consolidating the management requirements over larger areas of riparian land. Individual waterway management zones can be maintained in different ways, to enhance the values that they contain and minimise threats to these values. The use of management zones is particularly relevant to the RiverConnect project area, which is characterised by an array of land tenure types, land managers, land use and riparian condition. Co-ordinating the efforts of the land managers towards achieving a common vision for each management zone, should lead to a more efficient and effective use of management resources and improved outcomes for the project area.

Management zones were proposed by SKM (2005) in their assessment of Crown land frontages in urban areas of Shepparton-Mooroopna. This approach was based largely on the width of the riparian frontage (narrow, moderate and large) for each river. Similarly, management zones were also developed for the urban area of Wangaratta to assist in defining the management direction and maintenance regimes of instream and riparian areas (Earth Tech 2004). The management zones presented for the Wangaratta urban area were typically based around land use and included formal parkland, informal parkland, riparian reserve, rural riparian reserve, habitat reserve and constructed flood-ways. This management zone classification was applied to all riparian land in Wangaratta regardless of land tenure, as opposed to the urban assessment in Shepparton-Mooroopna which focused solely on Crown land.

3.2 Zone Definitions

A method for the creation of management zones was developed in consultation with the LMWG. Potential characteristics for management zone classification in the RiverConnect project area include land use, recreation type/intensity, width of riparian vegetation and riparian condition. Many of these characteristics are inter-related and are largely a function of the historical management of frontages within the project area. Due to the substantial area of remnant vegetation in the project area and the availability of existing condition assessment information (SKM 2005), it was considered desirable to include a measure of vegetation quality in the classification of management zones.

The following management zone classifications were adopted for riparian land within the RiverConnect project area:

- **Near Urban** – Near urban zones are narrow frontages adjoining residential or commercial properties that are typically maintained by the adjoining property owners. The land tenure is often unlicensed Crown water frontage or reserve managed by a Committee of Management. These zones are unlikely to have formed paths, but these may be proposed under future strategies. The vegetation in the near urban zone is typically characterised by an overstorey of mature River Red Gum and a highly modified understorey. Native shrub and ground species have generally been replaced by mown lawns and garden beds with specimen plantings. The ground is maintained clear of organic litter and logs and may be seasonally watered.
- **Informal Parkland** – Informal parklands are typically smaller reserves in both width and length that are managed specifically for their recreational values, including designated sporting areas and areas for visual and passive amenity. The land tenure is likely to be Crown land managed by a Committee of Management. These areas often have a number of paths, either formed or sealed, facilitating access and use of the area. Informal parkland zones typically have an overstorey of mature River Red Gum. The condition of the understorey may vary from mown or slashed exotic grasses to planted or remnant native shrubs and grasses. The frequency of

slashing or mowing at the site may depend on the ground conditions and site access. The vegetation on the bank face would typically comprise native tree, shrub and ground species, however Australian native and non-invasive exotic species may be planted on the verge. Weed control is routinely undertaken in these parklands.

- **Riparian Reserve (Low, Medium, High Quality)** – Riparian reserves are characterised by broad frontages often exceeding 1km in width that provide valuable habitat and vegetation corridors along the rivers. The land tenure is typically State Forest, Wildlife Reserve or Crown water frontage. Riparian reserves often have a network of paths and unsealed tracks providing for recreational access. While this access is supported, the impacts of recreation need to be monitored and managed. The quality of the habitat in these riparian reserves may vary from low to high and is usually influenced by historical land use and management of these areas. The overstorey in the riparian reserves is mostly characterised by River Red Gum, but may also include Grey Box and Yellow Box on slightly higher ground or sand hills within the floodplain. Native shrubs, predominantly Silver Wattle, vary in density and distribution and in some reserves may be limited to the bank face. The ground stratum is generally characterised by a mixture of annual exotic and native perennial grasses commonly including Tussock Grass, sedges and rushes. Understorey condition usually differentiates the habitat quality of the various riparian reserves. Woody and broad leaved weeds are also likely to be present. Regeneration in these reserves is encouraged and therefore they are not slashed or mown and the intensity of grazing, if present, is low. Fallen native trees and branches offer habitat and their retention is encouraged. The density of fallen timber in riparian reserves may be low due to the illegal collection of firewood for domestic and recreational use and possible hardwood timber harvesting.
- **Utility easement** – Utility easements are areas that are managed specifically for the provision of services. Typical easements include those for power lines, water supply, railways, roads and the proposed Goulburn Valley Highway Shepparton bypass. The management of these areas may be intensive and include the removal of all woody vegetation, or alternately there may be no management of the area. The presence and condition of the overstorey and understorey vegetation is dependent upon the purpose of the easement and access requirements. These easements may provide some complimentary values for river health, although their primary purpose is more socially and economically focused.
- **Rural riparian** – Rural riparian zones are areas of land that are typically managed indirectly for primary production purposes. This may include riparian land adjacent to rural freehold land where there is no distinct land use change (i.e. permitting stock access to the waterway) or land that is less intensively managed or mostly fallow adjacent to cultivated land (e.g. strips of riparian land adjacent to orchards and vineyards). The condition of rural riparian zones is driven by the historic and current attitudes and management regime of the adjoining landholder. The management of grazing pressures, fencing, pest animals, weed control, timber removal and revegetation, all tend to influence the overall habitat condition of the zone.

3.3 Determination of Zones

The determination of zones was based on advice and information given by the RiverConnect LMWG and field observations of the management and quality of frontages. Field inspection was carried out by assessors experienced in the assessment of riparian condition. The RiverConnect project area was broken into management parcels nominated as Near Urban, Informal Parkland, Riparian Reserve, Rural Riparian and Utility Easement.

The Riparian Reserves were further characterised by condition as Low, Medium and High quality. The habitat quality classification for Riparian Reserves was determined using a subset of metrics from the Rapid Habitat Assessment (RHA) method. The RHA method was adopted as it had previously been applied at 48 sites in the RiverConnect project area. The RHA is a single page assessment method based on 'habitat hectares approach', to provide a rapid measure of the quality of native vegetation assessed against the relevant vegetation type. The RHA assessment manual is included in Appendix B and further details of this method can be obtained from the Native Biodiversity Resource Kit (DSE 2004).

Existing RHA assessment information was obtained from Crown water frontage assessments (SKM 2005) and the Biodiversity Action Plan for the Southern Goulburn zone (Edmonds 2007). New assessments were also completed for this project at targeted locations where the condition had not previously been assessed. Based on the existing and additional sites assessed, a total of 60 assessments provided an indication of habitat quality across the RiverConnect project area. The condition assessment scores for assessed sites are also included in Appendix B.

The RHA contains metrics that are used to determine 'site condition' and 'landscape context' that together provide a final habitat quality score for a site. A habitat rating based on the habitat quality score has previously been adopted by the GBCMA for similar vegetation condition assessment projects (e.g. Low 0-6.5, Medium 7-11.5, High 12-20). As the relative 'site condition' is of primary interest to this project, the 'landscape context' metrics were excluded from the total habitat quality score calculation and a revised rating system was developed. The rating system was developed to reflect the very best, worst and average condition sites within the RiverConnect project area. The RiverConnect habitat quality classification adopted for the sum of these 'site condition' indicators is Low (0-4), Medium (4.5-8.5) and High (9-15).

The management zones developed for the RiverConnect project area are presented in Figure 2.

INSERT

Figure 2 **Management Zones developed for the RiverConnect project area.**

4. MANAGEMENT OF RIVER HEALTH

4.1 Vision for Management

It is important to define a vision for management of the RiverConnect project area that will, in combination with an assessment of the stream condition and identification of values and threats in the reach, guide the development of management objectives for the project area that will assist in achieving desirable outcomes for the project. The vision for the RiverConnect project area, in the context of River Health, has been defined as:

The Goulburn and Broken Rivers form an integral part of the landscape of the Shepparton-Mooroopna area. The Goulburn and Broken Rivers in the RiverConnect project area will be managed to maintain and enhance the habitat quality of the riparian and instream zones, whilst recognising and accommodating appropriate recreation and utilitarian activities in these areas.

4.2 Values and Threats

The values of the Goulburn and Broken Rivers were identified in detail by KBR (2003) during the development of the Greater Shepparton Stormwater Management Plan (SMP). As the key goal of the SMP is to protect and enhance the values of the receiving waterways, the identified values are also appropriate to this project. Values and threats were similarly defined in the Goulburn Broken RRHS (GBCMA 2005) and for individual reaches within the various WHAPs (Earth Tech 2004, Earth Tech 2005). Raven (1997) also identifies the Goulburn and Broken River floodplains in the RiverConnect project area as priority sites identified by the community for protection and revegetation. The degradation of native riparian vegetation along Victorian rivers and streams is also listed as a threatening process under Section 10 of the *Flora and Fauna Guarantee Act 1988* (DSE 2007).

The rating of the values for this project is largely reflected in the type of management zone assigned to a particular area (refer Sections 3.2 and 4.2). From a river health perspective, High Quality Riparian Reserve is more valued than informal Parkland, which is primarily valued for its social benefits. The development of a threat rating was considered necessary in order to prioritise the management zone objectives and actions, and site specific actions. Many of the threats developed in the Goulburn Broken RRHS apply to agricultural land and are not directly applicable to the RiverConnect project area due to the high degree of urbanisation. For this reason, a threat rating has been developed that specifically applies to each RiverConnect management zone type. The ratings have been assigned simply as Low, Medium or High. The threats are rated based on their potential impact on river health values in the RiverConnect project area. We appreciate that cultural, social and economic values are also significant, however these values will be addressed through separate consultation and investigations during the RiverConnect Master Plan process.

Based on the literature review, field assessments and consultation with the RiverConnect LMWG, the environmental and social values, and threats to these values have been compiled for the RiverConnect project area. A summary of the values and threats based on each of the management zone types is presented in Table 1.

Table 1 Environmental, social and economic values and threats in the RiverConnect project area.

Management Zone	Values	Threats	Threat Rating
Near Urban	• Facilitates an appreciation of the river as an environmental asset • Visual/landscape amenity • Readily accessible for passive recreation including walking, fishing, swimming and bird watching • Fauna corridor • River access increases value of adjacent property	• Limited access for general public • Increased number of informal tracks and structures including steps, leading to soil disturbance, weed invasion and native vegetation loss • Lack of responsibility for land management leading to neglect or inappropriate management • Lack of co-ordinated approach to management due to many land managers • Changed flood/fire regime leading to lack of recruitment • Chemical / nutrient runoff • Fragmentation / edge effect / encroachment • Exotic vegetation, planted and garden escapes • Introduced aquatic weeds • Introduced animals/pets • Removal of fallen timber/organic matter for habitat and soil conditioning • Rubbish and garden waste dumping	L H H M M M H H M M M H
Informal Parkland	• Passive and active recreational pursuits including walking, nature study, dog walking, bicycle riding, fishing, swimming, boating and exercise equipment • Encourages appreciation of the river as an environmental asset • Visual/landscape amenity • Transport corridor • Fauna corridor • Green space improves residential property values	• Changed flood/fire regime leading to lack of recruitment • Exotic vegetation (woody and non-woody) • Introduced animals/pets • Fallen timber/organic matter removal reducing habitat and soil condition • Rubbish dumping and stormwater litter • Chemical / nutrient runoff • Fragmentation / edge effect / encroachment • Infrequent slashing of the ground layer	M H M L M M H L

Management Zone	Values	Threats	Threat Rating
Riparian Reserve	• Riparian width and continuity • Proximity of reserve to urban centre • Structural intactness (High quality only) • Species diversity (High quality only) • Presence of rare vegetation species • Significance of vegetation type, particularly sand hills • Wetlands for habitat and water quality treatment • Recreational access • Passive recreational pursuits including walking, bicycle riding, dog walking, nature study, fishing, swimming, boating, horse riding and hunting (Reedy Swamp) • Habitat for threatened fauna, particularly Gemmills Swamp • Tourism generated income • Fauna corridor	• Removal of fallen timber for domestic firewood and campfires • Changed flood/fire regime leading to lack of recruitment • Frequency and timing of deliberately lit fires • Rubbish and garden waste dumping • Uncoordinated/multiple unsealed vehicle access tracks leading to an increase in soil disturbance and localised impacts on vegetation quality • Exotic vegetation (woody, broad leaved and annual grasses) • Introduced animals/pets • Introduced aquatic weeds • Incoming water quality, including nutrient rich stormwater causing eutrophication of receiving water bodies (e.g. Gemmills Swamp)	M M H H H H H M M
Utility Easement	• Land designated for the provision of important services • Ease of access to the river and riparian zones from maintained access tracks • Potential fire break	• Management/maintenance regime, particularly native woody vegetation/habitat removal • Exotic vegetation infestations (woody and broad leaved) • Break in habitat corridors for the passage of fauna • Fragmentation / edge effect / encroachment • Physical impact of vegetation clearance and faunal risk of exposure to predators • Rubbish and garden waste dumping • More frequent vehicle access leading to increased soil disturbance, litter, fires, nutrients and noise	H H M H M M H

Management Zone	Values	Threats	Threat Rating
Rural Riparian	• Access to water for stock and irrigation purposes • Food source for stock • Shade for stock • Increase in land values with river frontage • Responsibility for land management is usually defined i.e. usually licensed to the adjacent private land holder • If Crown land, access and passive recreational pursuits is provided for along the frontage • Primary production	• Stock access can impact soil structure, vegetation condition, vegetation diversity and structure, water quality and bank condition • Farm rubbish dumping • Chemical / nutrient runoff • Exotic vegetation infestations • Cultivation and soil disturbance leading to a permanently altered ground cover diversity and cover, and lack of natural regeneration • Deliberate planting of annual pasture grasses and exotic perennial grasses leading to invasion of native species • Difficulty in accessing Crown frontage for passive recreation • Removal of fallen timber	H L M H H M L M
All Zones	• Instream habitat quality • Native fish diversity • Planform stability (Goulburn River) • Goulburn and Broken Rivers are the receiving waters for stormwater • Near continuous access and Crown land throughout project area • Goulburn River is a Heritage River • Recreation • Biodiversity / riparian vegetation	• Incoming water quality, including gross pollutants such as litter • Introduced aquatic weeds • Fish barriers • Modifications to natural flow regimes through regulation • Reduced frequency of flooding through the construction of flood mitigation works • Historic modifications to river planform • Pest animals including carp	H H M M M L M

4.3 Management Objectives and Actions

Objectives for the management of each zone have been specified in order to protect the identified values from the threats presented in Section 4.2. From these management objectives, a series of management actions that support the objectives have been developed. The management objectives and actions for each of the management zone types are denoted by numeric and alpha characters respectively in the following section. The priority for each management objective are highlighted and shown in parenthesis.

It is intended that these objectives and actions will form the basis of river health management decisions in each management zone type (depicted graphically in Figure 3 to Figure 9), and can be used to discuss and negotiate for the implementation of works with relevant management authorities and adjacent land holders.

4.3.1 Near Urban

Figure 3 Example of a Near Urban management zone type, observed on the right bank of the Goulburn River

1. Enforce **appropriate use and management** of near urban zones through consultation (**High priority objective**)
    a. Clarify land tenure and define boundaries of these zones with the adjacent land holders
    b. Consider forming a Committee of Management for these areas including representation from adjacent land holders
    c. Encourage controlled pet access to the riparian zone to help protect native fauna
    d. Prohibit the construction of new structures, steps and private gardens on the bank face to minimise soil disturbance, native vegetation loss and weed invasion
    e. Prohibit the establishment of non-indigenous vegetation species
    f. Remove rubbish and garden waste from the riparian zone
    g. Prohibit the practice of green waste dumping by enforcing Council bylaws. Consider mail out of information sheet
    h. Define appropriate/acceptable infrastructure for these zones in consultation with the adjacent land holders and DSE Crown Land Management

   i. Remove existing inappropriate infrastructure from the bank face and verge through consultation with the adjacent land holder

2. **Reduce the cover** of declared noxious **weeds** and undeclared invasive weeds, and eradicate Weeds of National Significance (WoNS) (**High priority objective**)
   a. Eradicate infestations of blackberry, as a Weed of National Significance
   b. Provide financial incentives and/or in-kind support for adjacent landholders to undertake a weed control program through local Land Care and Environment groups, GSCC, Parks Victoria and/or Goulburn Broken CMA
   c. Implement community weed awareness program, including potential garden escapes, appropriate methods of weed control and discussion of the value of native vegetation in riparian zones
   d. Encourage planting of appropriate garden species in neighbouring gardens to avoid spread of seeding and fruiting material
   e. Remove all aquatic weeds (e.g. *Sagittaria* sp.) and garden escapes from the riparian and instream zone, including the bank face and verge (offstream beyond the top of bank) within the Crown boundary
   f. Develop a weed control program targeting infestations of declared noxious weeds (e.g. spear thistle) and other invasive weeds (e.g. date palms, ash, blue periwinkle and ivy) implemented jointly by GSCC, DSE and Goulburn Broken CMA
   g. Follow up successful weed control with planned revegetation programs targeting the establishment of native shrub and ground species
3. **Increase the cover and diversity of native understorey**, including indigenous shrub and ground cover species, across the full width of the Crown frontage (**Medium priority objective**)
   a. Protect mature shrubs on the bank face and verge from recreational and intentional damage
   b. Retain fallen logs and organic matter for habitat and soil conditioning on the bank face, and encourage the retention of these habitat components on the verge
   c. Encourage regeneration in desirable areas on the verge by designating patches/areas that are excluded from slashing and mowing activities
   d. Establish indigenous shrub and ground species on the bank face and verge through targeted revegetation activities
   e. Encourage adjacent land holders to undertake ongoing maintenance and watering of revegetation
   f. Encourage involvement of local school groups in revegetation activities based on the existing RiverConnect school program areas (refer Appendix C)
4. **Improve access** to the riparian zone to facilitate appropriate use and management of these narrow frontages and allow for monitoring and maintenance activities (**Low priority objective**)
   a. Support actions in existing strategies to establish a shared walking/bicycle path through these zones where the zone is wide enough to accommodate a path without significant vegetation/habitat loss
   b. Undertake regular monthly inspections to monitor recreational use, vegetation condition and required maintenance
   c. Schedule local information sessions on the value of riparian zones in urban areas to improve community awareness and appreciation of the values and threats facing the rivers in the RiverConnect project area

4.3.2 Informal Parkland

Figure 4 Example of an Informal Parkland management zone type, observed on the right bank of the Broken River

1. **Reduce the cover** of declared noxious **weeds** and undeclared invasive weeds and eradicate Weeds of National Significance (WoNS) (**High priority objective**)
    a. Eradicate infestations of Weeds of National Significance, including blackberry and isolated instream willows
    b. Develop a weed control program targeting infestations of declared noxious weeds (e.g. spear thistle, briar rose, fennel, bridal creeper, Paterson's curse) implemented jointly by GSCC, DSE and Goulburn Broken CMA
    c. Locate mature seeding populations of undeclared invasive woody weeds (e.g. ash and box elder) and control these species using appropriate techniques
    d. Target the removal of other undeclared invasive weeds capable of spreading by seed (e.g. Jerusalem cherry, peppercorn, date palm) and undeclared invasive ground weeds (e.g. wandering jew, blue periwinkle)
    e. Follow up successful weed control with planned revegetation programs targeting the establishment of native shrub and ground species
2. **Maintain and improve the current condition** of riparian vegetation and habitat (**Medium priority objective**)
    a. Ensure pet access to the riparian zone is controlled to protect native fauna
    b. Revegetate longitudinal overstorey vegetation gaps greater than 10m along the bank face and top of bank
    c. Revegetate the bank face to establish indigenous shrub and ground species, to assist in the survival and ensure longevity of mature overstorey species
    d. Frequently inspect and maintain revegetation as required to improve chances of successful establishment
    e. Consider planting indigenous shrubs to providing overhanging cover for fish
    f. Retain all terrestrial fallen timber and organic matter on the bank face
    g. Establish patches of understorey habitat on the verge in designated areas where only mature overstorey trees are present. This may involve revegetation using

indigenous shrub and ground species and retention of fallen timber and organic matter

h. Implement programs to control exotic grasses in areas of parkland where significant native ground species remain, including lifeforms such as tussocks, rushes and sedges. Possible techniques include spot spraying, targeted slashing and wick-wiping techniques

i. Assess for quality patches of the Plains Woodland Ecological Vegetation Class (EVC 803) which has a Bioregional Conservation Status of Endangered within Victoria. Protect the species diversity and vegetation structure of this vegetation community

3. **Maintain or improve the amenity** and passive recreational value of informal parklands (**Medium priority objective**)

   a. Encourage informal parklands to be used for passive and low intensity recreation

   b. Consider provision of additional seating, bicycle racks and rubbish bins

   c. Install interpretive signage focusing on river health and vegetation values

   d. Provide and maintain continuous paths through parklands with safe linkages for pedestrians and cyclists to adjacent roads, parks and facilities

   e. Remove rubbish, green waste and building rubble from the riparian zone

   f. Install litter traps on stormwater outlets discharging to the Goulburn and Broken Rivers (GSCC)

   g. Initiate more regular council litter collection and encourage involvement of local school groups based on the existing RiverConnect school program areas (refer Appendix C)

   h. Ensure the design, location and maintenance of new and existing infrastructure is consistent with the protection of ecological values

   i. Rationalise vehicle access through informal parklands to designated parking areas. Use bollards to contain vehicles and rehabilitate non-essential tracks and parking areas using revegetation

   j. Improve the visual amenity by establishing designated patches of native understorey, including shrub and ground species, within existing parklands characterised by an absence of understorey vegetation

   k. Develop recreational fishing access points with signage at appropriate locations

4.3.3 Riparian Reserve – Low Quality

Figure 5 Example of a Low Quality Riparian Reserve, observed on the right bank of the Goulburn River

1. **Protect** significant or threatened flora and fauna (**High priority objective**)
    a. Ensure pet access to the riparian zone is controlled to protect native fauna
    b. Identify patches of better quality vegetation within Low Quality reserves and protect these patches by removing obvious threats (e.g. exotic vegetation, moderate recreation access, garden rubbish dumping, firewood removal, etc.)
    c. Protect rare, interesting and restricted flora species as identified in Beauglehole (1986) for the study area, including *Isolepis vectoriensis*, *Leptospermum obovatum* (River Tea Tree) and *Dichanthium sericeum* (Silky Bluegrass)
    d. Identify quality remnant patches of Ecological Vegetation Classes which have a Bioregional Conservation Status of Endangered within Victoria, including Plains Woodland (EVC 803), Sand Ridge Woodland (EVC 264) and Shallow Sands Woodland/Plains Woodland Mosaic (EVC 867). Protect the species diversity and vegetation structure of these vegetation communities from obvious threats

2. **Reduce the impacts** of recreational access on the condition of the riparian zone (**High priority objective**)
    a. Consider seasonal limitations to vehicle access in areas or on trails characterised by poor drainage or inappropriate soils (e.g. clay tracks)
    b. Rationalise multiple and braided tracks through reserves. Use bollards to contain vehicles and rehabilitate non-essential tracks and parking areas using revegetation.
    c. Regularly maintain tracks by gravelling and filling potholes to avoid the formation of alternate tracks
    d. Consider designating an area already damaged by trail bikes as a permanent track area
    e. Initiate more regular collection of rubbish from reserves (e.g. garden waste, concrete, general litter and appliances) and report significant dumping to the Environmental Protection Agency (EPA), particularly when prosecution may be possible.

f. Recommend GSCC to consider methods that may assist in decreasing the incidence of garden refuse dumping (e.g. curbside collection, waive transfer station fees, transfer station vouchers for free disposal)

g. Erect signage at entrance to reserves clearly displaying the daily fire restriction. Consider routine inspections on days of total fire ban, particularly in areas where repeated fire damage could result in a permanent change in the vegetation structure and species diversity

h. Develop recreational fishing access points with signage at appropriate locations

3. **Reduce the cover** of declared noxious **weeds** and undeclared invasive weeds and eradicate Weeds of National Significance (WoNS) (**High priority objective**)

   a. Eradicate Weeds of National Significance using appropriate control methods, including blackberry and willows

   b. Develop a weed control program targeting infestations of declared noxious weeds (e.g. cape broom, spear thistle, briar rose, bridal creeper, Paterson's curse, fennel) implemented jointly by GSCC, DSE and Goulburn Broken CMA

   c. Remove aquatic weeds (e.g. Parrot's Feather, *Myriophyllum aquaticum*, Arrowhead, *Sagittaria graminea*) and undeclared weeds (e.g. Arum lilies, *Zantedeschia* sp.) from channels located on the floodplain

   d. Locate mature seeding populations of undeclared invasive woody weeds (e.g. ash and box elder) and control these species using appropriate techniques

   e. Target the removal of other undeclared invasive weeds capable of spreading by seed (e.g. Jerusalem cherry, date palm, firethorn, privet, *Prunus* sp.) and undeclared invasive ground and climbing weeds (e.g. wandering jew, blue periwinkle, Japanese honeysuckle)

   f. Consider the development of a weed control program targeting undeclared broad leaf weeds (e.g. prickly lettuce)

   i. Follow up successful weed control of large patches with planned revegetation programs targeting the establishment of native shrub and ground species

4. **Improve the condition** of the riparian reserves from low to medium quality (**Medium priority objective**)

   a. Reduce the cover of ground weeds to less than 50%

   b. Establish revegetation to increase the proportion of cover provided by native understorey lifeforms, planting a diversity of indigenous shrubs, herbs and graminoids

   c. Facilitate increased native woody species regeneration by:

      → implementing controlled grazing in licensed reserves where appropriate

      → completing revegetation in targeted areas on the verge

      → using fire as a regeneration tool in appropriate areas

      → reducing the biomass of exotic grass through slashing to reduce competition for emerging recruits

   d. Prohibit/police the removal of terrestrial timber or standing trees for domestic firewood

   e. Frequently inspect and maintain revegetation as required to improve chances of successful establishment

4.3.4 Riparian Reserve – Medium Quality

Figure 6 **Example of a Medium Quality Riparian Reserve, observed on the left bank of the Goulburn River**

1. **Protect** significant or threatened flora and fauna (**High priority objective**)
    a. Ensure pet access to the riparian zone is controlled to protect native fauna
    b. Protect rare, interesting and restricted flora species as identified in Beauglehole (1986) for the study area, including *Isolepis vectoriensis*, *Leptospermum obovatum* (River Tea Tree) and *Dichanthium sericeum* (Silky Bluegrass)
    c. Identify quality patches of Ecological Vegetation Classes which have a Bioregional Conservation Status of Endangered within Victoria, including Plains Woodland (EVC 803), Sand Ridge Woodland (EVC 264) and Shallow Sands Woodland/Plains Woodland Mosaic (EVC 867). Protect the species diversity and vegetation structure of these vegetation communities.
2. **Reduce the impacts** of recreational access on the condition of the riparian zone (**High priority objective**)
    a. Consider seasonal limitations to vehicle access in areas or on trails characterised by poor drainage or inappropriate soils (e.g. clay tracks)
    b. Rationalise multiple and braided tracks through reserves. Use bollards to contain vehicles and rehabilitate non-essential tracks and parking areas using revegetation.
    c. Regularly maintain tracks by gravelling and filling potholes to avoid the formation of alternate tracks
    d. Initiate more regular collection of rubbish from reserves (e.g. garden waste, concrete, general litter and appliances) and report significant dumping to the Environmental Protection Agency (EPA), particularly when prosecution may be possible.
    e. Consider complimentary methods to assist in decreasing the incidence of garden refuse dumping (e.g. curbside collection, waive transfer station fees, transfer station vouchers for free disposal)
    f. Prohibit/police the felling of standing trees for the construction of bicycle jumps. Consider designating an area where bicycle jumps are permitted

g. Erect signage at entrance to reserves clearly displaying the daily fire restriction. Consider routine inspections on days of total fire ban, particularly in areas where repeated fire damage could result in a permanent change in the vegetation structure and species diversity. High frequency fire results in disruption of life cycle processes in plants and animals and loss of vegetation structure and composition

h. Develop recreational fishing access points with signage at appropriate locations

3. **Reduce the cover** of declared noxious **weeds** and undeclared invasive weeds and eradicate Weeds of National Significance (WoNS) (**High priority objective**)

   a. Provide incentives for community groups to undertake weed control activities in the Medium Quality reserves

   b. Eradicate Weeds of National Significance including blackberry, crack willow, twisted willow and hybrid willow

   c. Develop a weed control program targeting infestations of declared noxious weeds (e.g. hawthorn, briar rose, boxthorn, tree of heaven, Paterson's curse, fennel, noogoora burr, slender thistle, spear thistle) implemented jointly by GSCC, DSE and Goulburn Broken CMA.

   d. Target isolated infestations of Chilean needle grass, a declared noxious weed adjacent to the Broken River and Mooroopna Causeway.

   e. Remove aquatic weeds (e.g. *Sagittaria* sp.) from the instream and channels located on the floodplain

   f. Locate mature seeding populations of undeclared invasive woody weeds (e.g. ash and box elder) and control these species using appropriate techniques

   g. Target the removal of other undeclared invasive weeds capable of spreading by seed (e.g. Jerusalem cherry, date palm, firethorn, privet, peppercorn, *Prunus* sp.) and undeclared invasive ground and climbing weeds (e.g. wandering jew, blue periwinkle, moth plant)

   h. Consider the development of a weed control program targeting undeclared broad leaf weeds (e.g. prickly lettuce, milk thistle)

   i. Follow up successful weed control of large patches with planned revegetation programs targeting the establishment of native shrub and ground species

4. **Maintain or improve the condition** of Medium Quality riparian reserves (**Medium priority objective**)

   a. Reduce the cover of ground weeds to less than 25%

   b. Enhance structural intactness and species diversity of the riparian zone through revegetation. Increase the cover provided by understorey lifeforms to at least 25% of the EVC benchmark levels, planting a diversity of indigenous shrubs, herbs and graminoids

   c. Facilitate increased native woody species regeneration by:

      → implementing controlled grazing in licensed reserves where appropriate

      → completing revegetation in targeted areas on the verge

      → using fire as a regeneration tool in appropriate areas

      → reducing the biomass of exotic grass through slashing to reduce competition for emerging recruits

   d. Prohibit/police the removal of terrestrial timber or standing trees for domestic firewood

e. Frequently inspect and maintain revegetation as required to improve chances of successful establishment

5. **Improve awareness** of the ecological value of the State Forest and Reserves within the RiverConnect area, focusing on the reserves of Medium Quality or better (**Medium priority objective**)
    a. Install interpretive signage explaining the importance of the various components of the riparian zone (i.e. canopy, understorey, recruitment, terrestrial fallen timber, organic litter)
    b. Consider running a campaign promoting the environmental, social and economic values of the RiverConnect area. Consider both printed and audiovisual media streams
    c. Develop a school education program focusing on the values and threats to the Goulburn and Broken rivers. Potential for this to be delivered through the Goulburn Broken CMA Waterwatch program
    d. Invite local schools identified in Appendix C to undertake tree planting activities in targeted areas of the reserves

4.3.5 Riparian Reserve – High Quality

Figure 7 Example of a High Quality Riparian Reserve, observed on the right bank of the Goulburn River

1. **Protect and enhance** structural intactness and high species diversity (**High priority objective**)
    a. Develop a weed control program targeting minor infestations of declared noxious weeds (e.g. briar rose, Paterson's curse) implemented jointly by GSCC, DSE and Goulburn Broken CMA
    b. Control exotic ground species including exotic grasses and broad leaved weeds
    c. Exclude grazing from the riparian zone
    d. Monitor the regeneration of native woody species and improve regeneration if required by:
        → completing revegetation in targeted areas on the verge
        → using fire as a regeneration tool in appropriate areas
        → reducing the biomass of exotic grass through slashing to reduce competition for emerging recruits
    f. Prohibit/police the removal of terrestrial timber or standing trees for domestic firewood
2. **Manage recreational access** to ensure environmental values are protected (**High priority objective**)
    a. Regularly inspect the riparian zone and remove rubbish
    b. Prohibit/police the construction of bike jumps and associated soil disturbance in these zones
    c. Manage for uncontrolled vehicle access through reserves

4.3.6 Utility Easement

Figure 8 Example of the Utility Easement management zone type, observed on the left bank of the Goulburn River

1. **Reduce the cover** of declared noxious **weeds** and undeclared invasive weeds and eradicate Weeds of National Significance (WoNS) (**High priority objective**)
    a. Eradicate infestations of blackberry, as a Weed of National Significance
    b. Develop a weed control program targeting infestations of declared noxious weeds (e.g. briar rose, Paterson's curse) implemented by the appropriate management authority
    c. Locate mature seeding populations of undeclared invasive woody weeds (e.g. ash) and control individuals using appropriate techniques
    d. Target the removal of other undeclared invasive weeds capable of spreading by seed (e.g. Jerusalem cherry, date palm)
    e. Follow up successful weed control of large patches with planned revegetation programs targeting the establishment of appropriate native species

2. Whilst recognising the primary objective of a utility easement is the provision of an essential service, implement an **appropriate riparian management** regime for individual easements (**Medium priority objective**)
    a. Clarify the authority responsible for management of individual utility easements
    b. Develop a memorandum of understanding with the relevant authority for ongoing management
    c. Remove rubbish and garden waste from the bank face and riparian zone
    d. Prohibit the practice of green waste dumping by enforcing Council bylaws where possible
    e. Improve the continuity of riparian habitat along the riparian zone by revegetating using appropriate indigenous species (e.g. shrubs and grasses beneath powerlines)
    f. Consider whether vehicle access to these areas is desirable and manage existing vehicle tracks accordingly. Consider prohibiting general vehicle access, except for management vehicles, by locking gates to easements

g. Reduce the level of soil disturbance and bare ground by revegetating with native understorey species

4.3.7 Rural Riparian

Figure 9 Example of the Rural Riparian management zone type, observed on the left bank of the Broken River

1. **Manage agricultural practices** to minimise impacts on the riparian zone, thereby protecting bank stability, water quality and riparian vegetation (**High priority objective**)
    a. At grazed frontages, negotiate with adjacent land holders for the implementation of riparian fencing, revegetation and offstream watering through grants programs (subject to availability). Discuss recommended practices for weed, pest animal and fire management within fenced riparian zones.
    b. Identify quality patches of the Plains Woodland Ecological Vegetation Class (EVC 803) which has a Bioregional Conservation Status of Endangered within Victoria. Protect the species diversity and structure of this vegetation community through stock exclusion. Patches of this EVC will generally be located offstream
    c. Investigate land tenure of the frontage and liaise with DSE Crown Land Management to ensure appropriately licensed (e.g. Grazing Licence or Agricultural Licence).
    d. Encourage Crown land occupiers to manage their frontage based on best management principles and through adoption of a Conservation licence
    e. Avoid cultivation and/or permanent cropping (e.g. orchards, vineyards) within 20m of the top of bank or on low lying land close to the river
    f. Encourage development of buffer/filter strips adjacent to grazed and cropped land by establishing a permanent cover of understorey vegetation, including native grasses to trap sediment and nutrients
    g. Avoid use of pesticides, fungicides and herbicides where there is potential for direct impacts on the waterway or riparian vegetation through either wind drift or direct spraying
    h. Remove dumped farm rubbish/machinery from the riparian zone

i. Discourage the deliberate planting of annual and perennial pasture grasses that have the potential to invade the riparian zone (e.g. *Phalaris aquatica*). Instead, encourage the planting of deep rooted native perennial grasses.

j. Encourage the retention of fallen timber on the bank face and verge for habitat

2. **Reduce the cover** of declared noxious **weeds** and undeclared invasive weeds and eradicate Weeds of National Significance (WoNS) (**High priority objective**)

    a. Eradicate infestations of blackberry, crack willow, and golden willow, as Weeds of National Significance

    b. Develop a weed control program targeting infestations of declared noxious weeds (e.g. hawthorn, Paterson's curse, noogoora burr, spear thistle). Goulburn Broken CMA to approach land holders and negotiate for the implementation of this program

    c. Locate mature populations of undeclared invasive woody weeds (e.g. ash and box elder) as key seed sources and control these species using appropriate techniques

    d. Monitor woody species that typically sucker invasively and remove if required (e.g. Lombardy poplar, white poplar)

    e. Target the removal of other undeclared invasive weeds capable of spreading by seed (e.g. Jerusalem cherry) and undeclared invasive ground weeds (e.g. wandering jew)

    k. Follow up successful weed control of large patches with planned revegetation programs targeting the establishment of native tree and shrub species

3. **Consider the right of access** for passive recreational pursuits (e.g. walking, fishing) on Crown land (**Low priority objective**)

    a. Provide stiles over fencing where appropriate

    b. Develop recreational fishing points where road access permits

    c. Improve awareness of adjacent land holders to the right for passive recreational access along Crown frontages

4.4 Site Specific Actions

A number of site specific concerns were highlighted during the consultation with the LMWG and field assessment phases of this project. These site specific issues could be effectively grouped into six categories that are further detailed in the following section:

1. Weeds
2. Recreation
3. Tracks
4. Rubbish
5. Structural
6. Native vegetation

Every effort has been made to identify all possible sites requiring specific actions in the project area. However, due to the considerable length of the waterways within the RiverConnect project area and the substantial width of their associated riparian zones, there may be site specific works that have not been identified during the three days of targeted field assessments completed for this project. It is anticipated that the zone based management objectives and actions provided in Section 4.3 should provide the overall guidance for the actions to be completed in each management zone. It is recommended that as new site concerns are raised by Goulburn Broken project staff, the community and/or other management authorities, they are compared to the objectives for the relevant management zone and the options for relevant actions are tested and applied as appropriate.

4.4.1 Weeds

Weeds cost the community millions of dollars each year in lost productivity and have a significant impact on the natural environment (GBCMA 2008). In order to implement the National Weed Strategy, a co-ordinated program against the 20 of Australia's worst invasive plants was launched in 1999. The program, titled Weeds of National Significance (WoNS), targets weeds that require co-ordinated action across all States and Territories to reduce their impact on Australia's productive capacity and natural ecosystems (Department of Primary Industries and Fisheries 2008).

In the Goulburn Broken catchment, there are also over 80 Declared Noxious Weeds proclaimed under the *Catchment and Land Protection Act 1994*. These weeds are classified under four categories: State Prohibited, Regionally prohibited, Regionally Controlled and Restricted. The responsibility for management of declared noxious weeds varies for each category.

In addition to declared noxious weeds, there are also a number of other invasive species that have been detected within the RiverConnect project area. These other invasive species are predominantly woody weeds that have the potential to spread rapidly through seed or fruit production (Figure 10) or are species capable of overtaking areas by climbing and/or spreading (Figure 11). Some of these other invasive species have been identified in the field guide to terrestrial and aquatic weeds in the Goulburn Broken catchment (GBCMA 2008).

The key weeds present in the RiverConnect project area have been identified in the process of targeted field inspections and detailed assessment in previous studies (Earth Tech 2004, Earth Tech 2005b). The locations of the WoNS, declared noxious weeds and undeclared invasive weeds are shown on Figure 12. A summary of the status of individual weed species recorded in the project area has been included in Table 2.

Figure 10 **A mature desert ash specimen (*Fraxinus angustifolia*) capable of producing masses of fertile seed and also suckering from roots**

Figure 11 **Infestation of an aquatic weed, Arrowhead (*Sagittaria graminea*) located on a drain flowing into the Goulburn River**

Priorities for weed control activities in the RiverConnect project area should be determined based on their proclaimed status. In order of priority for control, this would be justified as:

1. WoNS
2. Regionally Controlled Weeds
3. Restricted Weeds
4. Other mature seeding or fruiting undeclared invasive weeds capable of rapidly spreading
5. Juvenile undeclared invasive weeds.

Given that new and emerging weeds are often declared as Restricted Weeds, it would be prudent to target infestations of such species as a priority to ensure that they do not become widespread within the project area and/or catchment.

INSERT A2 PLAN

Figure 12 Weed Management Plan for the RiverConnect project area

Table 2 Current weed proclamation for weeds located in the RiverConnect project area (Department of Primary Industries and Fisheries 2008, GBCMA 2008)

Common Name	Scientific Name	WoNS	Declared Noxious Weed
Arum lily	*Zantedeschia aethiopica*		
Bathurst burr	*Xanthium spinosum*		Regionally Controlled
Blackberry	*Rubus fruticosis* agg.	✓	Regionally Controlled
Blue periwinkle	*Vinca major*		
Box elder	*Acer negundo*		
Boxthorn	*Lycium ferocissimum*		Regionally Controlled
Briar rose	*Rosa rubignosa*		Regionally Controlled
Bridal creeper	*Asparagus asparagoides*	✓	Restricted Weed
Cape broom	*Genista monspessulana*		Regionally Controlled
Chilean needle grass	*Nasella neesiana*	✓	Restricted Weed
Crack willow	*Salix rubens*	✓	Restricted Weed
Date palm	*Phoenix dactylifera*		
Deadly nightshade	*Solanum nigrum*		
Desert Ash	*Fraxinus angustifolia* ssp. *angustifolia*		
Elm	*Ulmus* sp.		
Fennel	*Foeniculum vulgare*		Restricted Weed
Firethorn	*Pyracantha angustifolia*		
Golden willow	*Salix alba* var. *vitellina*	✓	Regionally Controlled
Hawthorn	*Crataegus monogyna*		Regionally Controlled
Horehound	*Marrumbium vulgare*		Regionally Controlled
Japanese honeysuckle	*Lonicera janonica*		
Jerusalem cherry	*Solanum pseudocapsicum*		
Lombardy poplar	*Populus nigra* 'Italica'		
Milk thistle	*Sonchus oleraceus*		
Moth plant	*Araujia sericifera*		
Noogoora burr	*Xanthium strumarium*		Regionally Controlled
Norfolk Island Hibiscus	*Lagunaria patersonii*		
Parrots feather	*Myriophyllum aquaticum*		
Paterson's curse	*Echium plantagineum*		Regionally Controlled
Peppercorn	*Schinus areira*		
Prickly pear	*Opuntia* sp.		
Privet	*Ligustrum vulgare*		
Prunus/plum	*Prunus* sp.		
Sagittaria / Arrowhead	*Sagittaria* sp.		
Silver poplar	*Populus alba*		
Slender thistle	*Cardus tenuiflorus*		Restricted Weed
Spear thistle	*Cirsium vulgare*		Restricted Weed
Tree of heaven	*Ailanthus altissima*		Regionally Controlled
Twisted willow	*Salix matsudana* 'tortuousa'	✓	
Variegated thistle	*Silybum marianum*		Regionally Controlled
Wandering jew	*Tradescantia fluminensis*		
Weeping willow	*Salix babylonica*		

4.4.2 Recreation

Recreation is an important social and economic value in the RiverConnect project area (Figure 13), which is supported through the ongoing management of the various informal parklands and riparian reserves.

Figure 13 Canoeing on the Goulburn River near Kaieltheban Park, Mooroopna

Recreational issues identified during the course of the field assessments and through consultation with the LMWG include desirable locations for recreational facilities (e.g. boat launching areas, picnic facilities, signed nature walks, river viewing platforms), recommendations for improvements to existing recreational activities (e.g. continuation of the bike path network, provision of rubbish bins) and undesirable activities requiring investigation and/or remediation (e.g. felling of River Red Gums for the construction of bicycle jumps (Figure 14), trail bike tracks, recent felling of standing trees).

Figure 14 The construction of bicycle jumps and tracks has involved the felling of standing River Red Gums in some park areas

The location of the site specific works focusing on recreational issues is shown in Figure 21 and described further in Table 3.

Table 3 Proposed RiverConnect recreation works sites

Site	Easting	Northing	Description	Zone Type	Source	Priority	Est. Cost
1	353967	5974265	Rehabilitate bicycle jumps and tracks	High Quality Riparian Reserve	Inspection 1/10/2008	**High**	$1 000
2	354210	5968110	Informal boat launching area	Rural Riparian	Inspection 3/11/2008	**High**	$10 000
3	355327	5970096	Monitor/ rehabilitate felling of sub-canopy River Red Gum for construction of bicycle jumps	Medium Quality Riparian Reserve	Inspection 3/11/2008	**High**	$1 000 per annum
4	353565	5974532	Develop boat access, picnic facilities, nature walks	Low Quality Riparian Reserve	Consultation LMWG	**High**	$20 000
5	352427	5975574	Rationalise 4WD and trail bike impacts through signage/fencing	Low Quality Riparian Reserve	Consultation LMWG	**High**	$5 000
6	355972	5972048	Develop cycling track along river, in association with viewing platforms and revegetation of existing tracks	Informal Parkland	Consultation LMWG	**Medium**	$100 000
7	353580	5971038	Monitor recent felling of standing timber	Medium Quality Riparian Reserve	Inspection 22/10/2008	**High**	$1 000 per annum

Note: **High priority** actions shown in red, **Medium priority** actions shown in orange, **Low priority** actions shown in green

4.4.3 Rubbish

Rubbish dumping is an offense under the *Environment Protection Act 1970*. Responsibility for enforcement of the litter provisions of the Environment Protection Act is shared between a range of agencies, including local government, EPA, Victoria Police and public land management authorities (EPA 2008). The EPA has the ability to fine people or order clean up of a site, although it is often very difficult to trace offenders.

Rubbish observed within the project area includes construction rubble (e.g. concrete, bricks), garden clippings and refuse, large items (e.g. shopping trolleys, televisions) and general rubbish (e.g. paper, plastic, cans, glass). An example of rubbish found near Shepparton Weir is provided in Figure 15.

Figure 15 Bags of rubbish, containing general household rubbish, including personally addressed documents

Figure 16 Garden clippings dumped adjacent to a near urban zone in a medium quality riparian reserve

Rubbish is unsightly and has the potential to wash directly into rivers, causing a decline in water quality and potentially impacting on instream fauna. The dumping of garden refuse can also lead to the spread of invasive and undesirable garden species that may compete with or exclude native vegetation (Figure 16).

In all cases, the removal of rubbish from the riparian zone is costly and diverts funds that could be better spent on the implementation of onground works to improve river health (e.g. revegetation). Long-term, a comprehensive approach to litter management will be required in the project area, including media and education campaigns, the provision of infrastructure/services and the enforcement of litter prevention laws where possible. The clean-up of 14 sites has been identified through the targeted onground inspections. The location of the site specific works focusing on recreational issues is shown in Figure 21 and described further in Table 4.

Table 4 Proposed RiverConnect rubbish sites indentified for clean-up works

Site	Easting	Northing	Description	Zone Type	Source	Priority	Est. cost
8	353126	5980376	Rubbish	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$200
9	352598	5978732	Bricks, rubbish	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$500
10	352177	5975785	Rubbish off bank	Utility Easement	Inspection 1/10/2008	Medium	$200
11	352988	5974907	Rubbish	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$200
12	353163	5974668	Piles garden waste, concrete, litter	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$500
13	353501	5974507	Bags of foam and paper litter	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$200
14	354485	5974166	Garden clippings	Median Quality Riparian Reserve	Inspection 1/10/2008	High	$200
15	354910	5974494	Garden refuse dumped over bank	Near Urban	Inspection 1/10/2008	High	$200
16	356160	5972930	Rubble, concrete and assorted litter	Informal Parkland	Inspection 1/10/2008	Medium	$500
17	353317	5970747	Rubbish including shopping trolley and television	Low Quality Riparian Reserve	Inspection 22/10/2008	High	$500

Site	Easting	Northing	Description	Zone Type	Source	Priority	Est. cost
18	353650	5970077	Investigate potential illegal rubbish/fill dumping	Rural riparian	Inspection 3/11/2008	High	$1 000
19	353234	5974681	Rubbish dumping	Low Quality Riparian Reserve	Consultation LMWG	High	$500
20	356102	5972915	Remove dumped concrete and weeds, and revegetate	Informal Parkland	Consultation LMWG	Medium	$1 000

Note: **High priority** actions shown in red, **Medium priority** actions shown in orange, **Low priority** actions shown in green

4.4.4 Structural

There are relatively few structural works required in the RiverConnect study area relative to the majority of the rivers located adjacent to agricultural production areas in the region. This can be attributed mostly to the near continuous native vegetation cover throughout the reach and often substantial width of the riparian vegetation. Structural works recommended for specific sites includes repairs to stormwater outlets, installation of litter traps on stormwater outlets, repairs to existing boat ramps, bank stabilisation works and addressing erosion caused by sub-surface seepage (Figure 17). A total of 8 sites were identified as shown on Figure 21 and described further in Table 5.

Figure 17 **A small section of piping erosion observed adjacent to Aquamoves on the right bank of the Goulburn River**

Table 5 Proposed RiverConnect structural works sites

Site	Easting	Northing	Description	Zone Type	Source	Priority	Est. Cost
21	354910	5974494	Repair stormwater outlet	Near Urban	Inspection 1/10/2008	High	$20 000
21a	355604	5974371	Install litter trap on stormwater outlet	Informal Parkland	Meeting and inspection 18/2/2009	High	$172,000
22	355890	5973746	Install litter trap on stormwater outlet	Informal Parkland	Inspection 1/10/2008	High	$80 000
23	356200	5972933	Install litter trap on stormwater outlet	Informal Parkland	Inspection 1/10/2008	High	$80 000
24	353166	5970895	Formalise/maintain boat ramp	Informal Parkland	Inspection 22/10/2008	Medium	$10 000
25	355940	5972130	Monitor bank erosion at site	Low Quality Riparian Reserve	Inspection 22/10/2008	High	$1 000 per annum
26	355861	5971647	Erosion caused by piping/seepage (4-5 high, 2-3m wide) (Figure 17)	Informal Parkland	Inspection 22/10/2008	High	$20 000
27	355358	5971111	Investigate options for stormwater management	Medium Quality Riparian Reserve	Consultation LMWG	High	$10 000

Note: **High priority** actions shown in red, **Medium priority** actions shown in orange, **Low priority** actions shown in green

4.4.5 Tracks

Tracks throughout Crown land in the RiverConnect project area are varied in condition. Vehicle access in wet conditions has led to the deterioration of track condition (Figure 18) and the formation of braided tracks. Vehicle access has largely been unrestricted and unplanned in some areas, leading to the unnecessary duplication of tracks. Jumps and bike courses have also been constructed in specific locations for trail bikes and bicycles, leading to significant soil disturbance (Figure 19) and also damage to native vegetation.

Figure 18 Vehicle access in wet conditions has led to the development of ruts in riparian reserves. Tracks with poor drainage and clay bases appear to be more susceptible

Figure 19 Trail bike jumps and vehicle tracks in riparian reserve near the Shepparton Golf Course

The rationalisation of tracks, designation of parking areas and maintenance to existing tracks is required in many locations within Crown land reserves. Twelve locations have been identified where track works are required. The location of the site specific works focusing on recreational issues is shown in Figure 21 and described further in Table 6.

Table 6 Proposed RiverConnect sites requiring track maintenance or rationalisation

Site	Easting	Northing	Description	Zone Type	Source	Priority	Est. Cost
28	352598	5978732	Track maintenance required	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$5 000
29	352410	5975535	Rehabilitate trail bike tracks	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$20 000
30	352988	5974907	Track rationalisation required	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$5 000
31	352760	5975190	Extensive damage caused by tracks adjacent to Golf Course	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$5 000
32	353501	5974507	Rationalise multiple tracks	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$5 000
33	353966	5974268	Bike tracks/jumps	High Quality Riparian Reserve	Inspection 1/10/2008	High	$2 000
34	355860	5972955	Remove vehicle access from adjacent to path and rehabilitate	Informal Parkland	Inspection 1/10/2008	Medium	$10 000
35	353634	5971266	Bollard off unrequired tracks	Informal Parkland	Inspection 22/10/2008	Medium	$5 000
36	353317	5970747	Rationalise tracks and rehabilitate	Low Quality Riparian Reserve	Inspection 22/10/2008	High	$20 000
37	355970	5972098	Rationalise tracks and provide bins	Informal Parkland	Inspection 22/10/2008	Medium	$5 000
38	352447	5975157	Rationalise tracks in reserve	Medium Quality Riparian Reserve	Consultation LMWG	High	$10 000

Note: **High priority** actions shown in red, **Medium priority** actions shown in orange, **Low priority** actions shown in green

4.4.6 Native Vegetation

Large areas of remnant native vegetation are located within the RiverConnect project area. The protection and improvement of native vegetation within the project area is a key objective for each of the management zone types presented in Section 4.3, however a small number of site specific actions have also been identified during the course of the field assessments. The primary site specific actions nominated under this works category are to protect existing sites of significant vegetation (e.g. scattered mature River Tea Tree individuals; patches of *Bulbine bulbosa,* Figure 20) and improve the continuity and structure of native vegetation at existing bank stabilisation and revegetation sites.

Figure 20 Large patch of Bulbine Lily (*Bulbine bulbosa*) located just offstream in a medium quality riparian reserve

The location of these sites is shown in Figure 21 and details of the native vegetation works sites are presented in Table 7.

Table 7 Proposed RiverConnect native vegetation works sites

Site	Easting	Northing	Description	Zone Type	Source	Priority	Est. Cost
39	352368	5976413	Protect patch of *Bulbine bulbosa* by bollarding track	Medium Quality Riparian Reserve	Inspection 1/10/2008	High	$5 000
40	352567	5975291	Monitor and protect mature River Tea Tree individuals	Low Quality Riparian Reserve	Inspection 1/10/2008	High	$1 000 per annum
41	356889	5969029	Revegetate behind existing pile field site	Informal Parkland	Earth Tech 2004	Medium	$2 000
42	357874	5968305	Revegetate	Near Urban	Earth Tech 2004	Medium	$2 000
43	357276	5968791	Re-align instream timber	Rural Riparian	Earth Tech 2004	High	$500

Site	Easting	Northing	Description	Zone Type	Source	Priority	Est. Cost
44	353248	5971051	Improve continuity by revegetating with native shrubs and trees	Utility Easement	Inspection 22/10/2008	Medium	$2 000
45	353726	5968964	Dead revegetation plants, remove scattered guards or replant	Medium Quality Riparian Reserve	Inspection 22/10/2008	High	$1 000
46	355913	5971853	Increase width of vegetation by establishing indigenous shrubs	Informal Parkland	Inspection 22/10/2008	Medium	$15 000
47	355245	5970269	Revegetate behind existing pile field site	Medium Quality Riparian Reserve	Inspection 3/11/2008	High	$1 500
48	356108	5972566	Revegetate at rear of offices to establish native understorey	Informal Parkland	Consultation LMWG	Medium	$15 000

Note: **High priority** actions shown in red, **Medium priority** actions shown in orange, **Low priority** actions shown in green

INSERT A2 PLAN

Figure 21 Management plan for other works required the RiverConnect project area

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APPENDIX A REVIEW OF RELAVENT LITERATURE

1. Regional Catchment Strategy (GBCMA 2003)
2. Regional River Health Strategy (GBCMA 2005)
3. From the Fringe to the Mainstream: a Strategic Plan for Integrating Native Biodiversity 2004-2007 (GBCMA 2004)
4. River Red Gum Forest Investigation (VEAC 2008)
5. Mid Goulburn Waterway Health Activity Plan (Earth Tech 2005b)
6. Lower Broken Waterway Health Activity Plan (Earth Tech 2004)
7. Assessment of Crown Land in Urban Zones (SKM 2005)
8. Broken River Crown Land (Riparian) Assessment – Casey's Weir to Goulburn River (Earth Tech 2005a)
9. Reedy Swamp Management Plan (DPI 2003)
10. Gemmills Swamp Wildlife Reserve Masterplan (Thompson Berrill Landscape Design 2003).

1. Goulburn Broken Regional Catchment Strategy (GBCMA 2003)

The Goulburn Broken Regional Catchment Strategy sets the framework for natural resource management within the catchment. It is a document designed to guide managers in creating management policies that will effectively assist in meeting the identified targets and achieving the overall vision for the region as defined by the Board of the Goulburn Broken CMA. This vision is:

"*A catchment recognised locally, nationally and internationally for quality agricultural produce where community values contribute to the benefits of abundant and well-maintained environmental assets used for tourism and recreational activities.*

The environmental footprint of irrigation and dryland farming will be significantly reduced, with farmers occupying less land and using less water whilst managing their resources more sustainably. New opportunities will arise for increasing the ecosystem services provided by the land retired from agriculture and by improved environmental flows.

The region's economy will be robust, with much of the agricultural produce processed within the region, generating employment and wealth creation opportunities for a regional community actively engaging in natural resource management programs."

The Strategy describes the types of works actions, capacity-building actions and decision-making processes that are needed to make the vision a reality. Targets are also identified for the major regional assets of water, land and biodiversity over three time periods:

- Aspirational targets or long-term resource condition targets (20-50 years)
- Medium-term resource condition targets (10-30 years)
- Management actions that are required for implementation to achieve the medium-term resource condition targets identified above (1-10 years).

The targets specified within the Strategy apply to the entire Goulburn Broken Catchment. Supporting sub-strategies and plans have been developed addressing river health, salinity, biodiversity, pest plants and animals, climate change and soil health to help meet these targets. The key sub-strategies of relevance to this project are the Regional River Health Strategy and the Native Vegetation Management Strategy, both of which are reviewed in the following sections.

2. Regional River Health Strategy (GBCMA 2005)

The Goulburn Broken Regional Catchment Strategy (GBCMA 2003) identified river health and waterway management as one of the highest priority natural resource management issues in the Goulburn Broken catchment. The Goulburn Broken Regional River Health Strategy (RRHS) draws upon the key objectives and principles of the Victorian River Health Strategy (DNRE 2002). The RRHS provides a framework for the integration of strategies and programs to achieve the resource condition targets and management action targets outlined in the Regional Catchment Strategy. The RRHS is supported by a series of sub-strategies and discussion papers (GBCMA 2005), such as this Waterway Health Activity Plan.

The RRHS identifies that both the Goulburn and Broken Rivers are high priority waterways within the catchment due to the following high value assets:

- The high overall environmental and social significance of the Goulburn River
- Both the Goulburn and Broken Rivers are associated with wetlands of national significance
- The Goulburn River has been listed as a Heritage River, recognised for its environmental and social values

- The presence of Murray Cod and Silver Perch on both the Goulburn and Broken Rivers.

The management of the water, land and biota within the Goulburn Broken Catchment is critical to the future sustainability of the area and its community. The RRHS provides a framework for integrating the actions which will enable these rivers of high quality to be protected and improve in quality for current and future generations.

The RRHS Management Unit L1 – Lower Goulburn and Floodplain, covers the Goulburn River downstream of Goulburn Weir to the Murray River of which reaches 4, 5 and 6 are significant to this study. The Management Unit L5 – Lower Broken River covers the lower Broken River, downstream from Casey's Weir through to the confluence with the Goulburn River to which reach 1 is significant to this study. The focus of action on these reaches is to manage the threats to river health and assets; these are referred to in Table 8 and Table 9. Actions developed from consideration of these threats to the social, environmental and economic assets are presented in Table 10.

Table 8 Assets within the Management Unit L1 and L5 with a high or very high value.

Type	Goulburn River (L1)	Broken River (L5)
Social	Fishing, non-motor sports, motor sports, camping, swimming, European heritage, flagship species and passive recreation	Fishing, species – local significance and passive recreation
Environmental	Riparian width, riparian continuity, fish, fauna, flora, wetland significance, wetland rarity, heritage river and EVC significance	Fauna, flora, wetland significance, wetland rarity, EVC significance, riparian width and riparian continuity
Economic	Water supply delivery, infrastructure, land use and tourism	Water supply delivery, infrastructure, land value and tourism

Table 9 Threat to assets within relevant reaches of Management Unit L1 and L5.

Type	Rating Goulburn River (L1)	Rating Broken River (L2)
Stock Access	Very High	High
Flow Deviation	Very High	Very High
Decline in Water Quality (Nutrients)	Very High	High
Decline in Water Quality (Turbidity)	Very High	High
Water Quality Trend (pH, EC)	High	n/a
Loss of Instream Habitat	High	Medium
Bank Erosion	High	n/a
Channel Modification	High	Medium
Introduced Flora	Medium	Medium
Introduced Fauna	Medium	Medium
Bed Instability	n/a	Medium

Table 10 Actions and management action targets for Management Units L1 and L5 that may be addressed through the implementation of the RiverConnect WHAP.

Threat	Goulburn River (L1)	Broken River (L5)
Stock Access	• 40km fenced and revegetated with native species • Grazing managed using Current Recommended Practice over 390km of frontage • Grazing controlled on 390km of public waterfront	• 125km of frontage fenced and revegetated • Grazing managed using Current Recommended Practice over 125km of frontage • Grazing controlled on 125km of public waterfront
Flow Deviation	• Complete Goulburn environmental flow project • Review Bulk Entitlement for Goulburn River • Review operating procedures for Goulburn Weir	• Develop a Flow Rehabilitation Plan to establish an Environmental Water Reserve and improve the flow regime
Decline in Water Quality (Nutrients)	• 40km of frontage fenced and revegetated • Minimise nutrient discharge to rivers • Implement Best Management Practice for urban drainage	• 125km of frontage fenced and revegetated • Minimise nutrient discharge to rivers • Implement Best Management Practice for urban drainage
Decline in Water Quality (Turbidity and DO)	• Stabilise near stream erosion using appropriate methods over 65km of stream • 40km of frontage fenced and revegetated • Conduct an Ecological Risk Assessment for turbidity	• 125km of frontage fenced and revegetated • Conduct an Ecological Risk Assessment for turbidity and dissolved oxygen
Water Quality Trend (pH, EC)	• Conduct an Ecological Risk Assessment for ph and EC	n/a
Loss of Instream Habitat	• Enhance aquatic refugia to protect instream habitat, by completing habitat improvement works over 142.5km of river	• Monitor assets at risk from bed instability, namely Murray Cod populations
Bank Erosion	• Stabilise near stream erosion using appropriate methods over 65km of stream • Bank erosion managed using Current Recommended Practice over 65km of frontage	n/a
Channel Modification	• Enhance aquatic refugia to protect instream habitat, by completing habitat improvement works over 142.5km of river	• Monitor assets at risk from bed instability, namely Murray Cod populations
Introduced Flora	• Control exotic vegetation over 40km of waterway and revegetate with native species	• Monitor assets at risk from bed instability, including Murray Cod populations and wetland condition

Threat	Goulburn River (L1)	Broken River (L5)
	• Monitor assets at risk from exotic vegetation, including significant EVCs, wetland condition and Murray Cod populations, and develop actions to reduce threats if asset declines	
Introduced Fauna	• Support actions within the MDBC Native Fish Management Strategy including the control of introduced species	• Support actions within the MDBC Native Fish Management Strategy including the control of introduced species
Bed Instability	n/a	• Monitor assets at risk from bed instability, namely Murray Cod populations

3. From the Fringe to the Mainstream: a Strategic Plan for Integrating Native Biodiversity 2004 – 2007

For many years Goulburn Broken catchment communities have recognised the importance of native biodiversity and the need to include it as a key component of decision-making. The production of this strategic plan follows through on the Goulburn Broken CMA's commitment listed in Goulburn Broken Regional Catchment Strategy (1997), building on other strategic plans such as the Goulburn Broken Native Vegetation Management Strategy (2000). Major biodiversity gains come from assisting mangers to integrate conservation into their policies, plans and actions. This plan assists with such decision making processes and development of actions.

The native biodiversity mission statement developed in 1999 by the GBCMA is:

"The community will work in partnership with Federal and State Governments and other agencies to protect and enhance ecological processes and genetic diversity to secure the future of native species of plants, animals and other organisms within the Catchment"

A summary of the threatening activities that potentially impact on Rivers and Stream, as a natural biodiversity asset within the Goulburn Broken catchment are:

- Very High risks - stock grazing, irrigation and flow regulation as a result of on-stream storages
- High risks - water harvesting from off-stream storages and plantation reforestation
- Medium risks - native vegetation clearing, on-stream barriers including culverts and regulators, cultivating, cropping and pasture management, subdivision and introduction of genetically modified organisms.

Induced threats or threatening processes that may occur as a result of these threatening activities include:

- Very High risks - reduced habitat function due to size, quality or fragmentation, saline water and high water tables, changed flow patterns and water availability
- High risks - nutrient rich and turbid water, climate change and weed invasion
- Medium risks - species population size, isolation or genetic decline, soil sodicity and pest animals.

Native biodiversity resource condition targets established under this strategy for native vegetation, threatened species and wetlands include:

- Maintain extent of all native vegetation types at 1999 levels in keeping with the goal of 'net gain' listed in Victoria's Biodiversity Strategy 1997
- Improve the quality of 90% of existing (2003) native vegetation by 10% by 2030
- Increase the cover of all endangered and applicable vulnerable Ecological Vegetation Classes to at least 15% of their pre-European vegetation cover by 2030
- Increase 2002 conservation status of 80% threatened flora and 60% threatened fauna by 2030
- Maintain extent of all wetland types at 2003 levels where the extent (area and number) has declined since European settlement
- Improve condition of 70% of wetlands by 2030, using 2003 as the benchmark for condition

4. River Red Gum Forests Investigation (VEAC 2008)

The Victorian Environmental Assessment Council (VEAC) provides the State Government with independent advice on protection and management of the environment and natural resources of public land.

VEAC have recently released their final report investigating the River Red Gum Forests of the River Murray and its Victorian tributaries. The report makes a series of recommendations relating to the conservation, protection and ecologically sustainable use of public land. The investigation area encompassed a 1600 kilometre corridor of public land along the River Murray in Northern Victoria, between Wodonga and the South Australian border, and along tributary river systems such as the Avoca, Goulburn and Ovens Rivers. In carrying out its investigation, VEAC has had to take into account the protection of biodiversity and other environmental values along with competing demands on the land and its resources, as well as the full range of social and economic considerations.

Recommendations of relevance to the RiverConnect WHAP project area are shown on Figure 22 and are summarised below:

Formation of the **Lower Goulburn River National Park**. The Lower Goulburn River corridor has strong ecological integrity and is a recognised biolink through the landscape. Key recommendations relating to land use in this proposed national park include:

- Camping (in particular dispersed camping) will continue in accordance with recommendations, however camping with dogs will not be permitted
- Hunting will not be permitted, however, recreational shooters may assist authorities to control feral and introduced animals and maintain diversity under a new registration program
- Firewood will still be collected as a by-product of ongoing forest fire management
- Campfires will be allowed throughout the year, but not on fire ban days
- Cattle grazing would be discontinued in the new national park
- Areas of Kanyapella Basin cleared for agriculture and cropped would require restoration.
- Existing apiculture sites would continue to be permitted
- Wetlands and woodlands of the new national park will require manipulated watering to maintain health of the floodplain and associated ecosystems
- Existing water diversion licences would be allowed to continue where no other sources of water are available to adjoining land owners
- Horse riding will still be permitted on roads and tracks and camping overnight with horses will also be allowed.

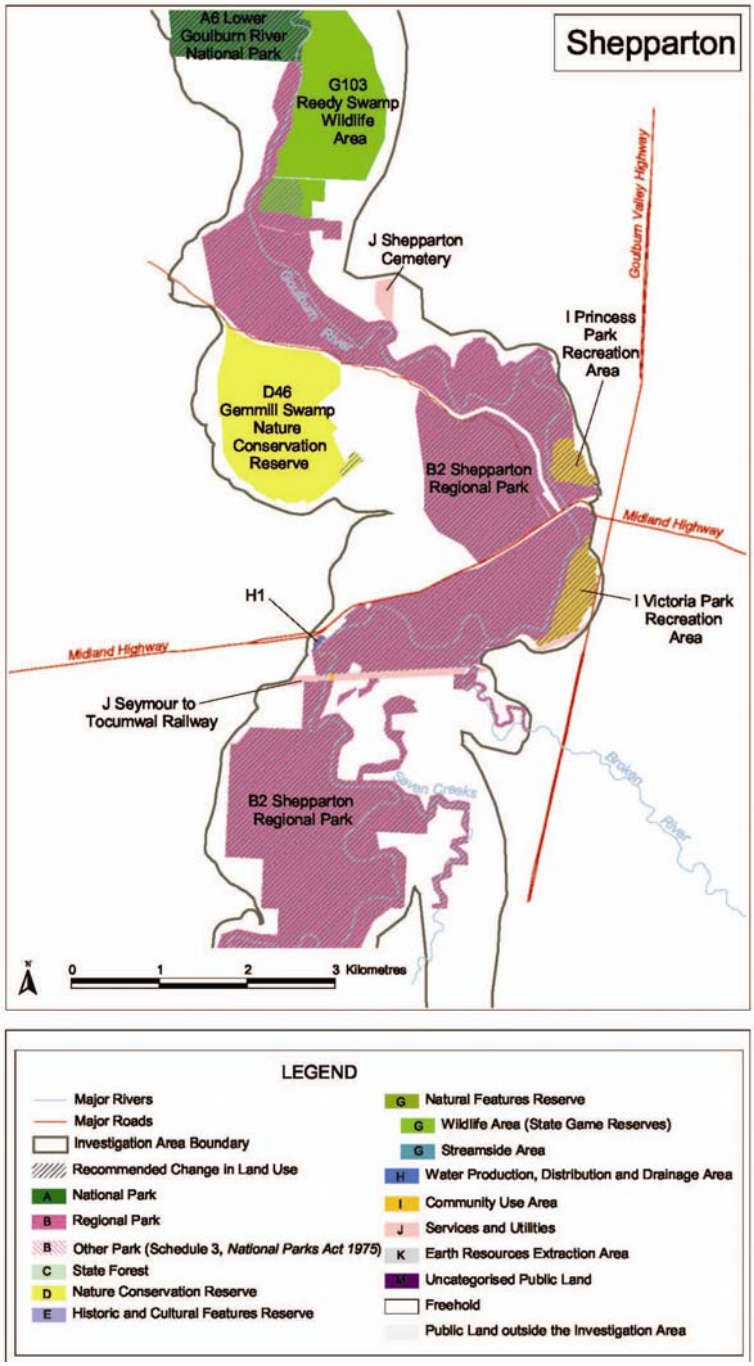

Figure 22 River Red Gum Investigation Final Recommendations for Public Land Use in Shepparton.

Creation of the **Shepparton Regional Park** to provide for recreation and tourism in natural bush settings. This regional park incorporates State Forest, reserves and public land water frontage. Key recommendations relating to land use in this proposed regional park include:

- Dog walking and camping with dogs is permitted
- Domestic firewood collection from designated zones is permitted.

Gemmill's Swamp Nature Conservation Reserve is formed from the existing Gemmill Swamp Wildlife Area. Nature Conservation Reserves are set aside to conserve rare or threatened species, significant plant associations or communities or valuable habitat for populations of significant fauna. The primary land use is nature conservation, although education, scientific research and passive

recreation are permitted subject to the maintenance of the particular values of the reserve. Key recommendations relating to land use in this proposed reserve include:

- Activities including bushwalking, nature observation, heritage appreciation, picnicking, car touring and four wheel driving on formed roads and tracks, apiculture of existing licensed sites and exploration and mining for minerals and searching for and extraction of stone resources subject to consent of the Crown land Minister be allowed
- Onlead dog walking is permitted on formed walking tracks
- Activities that are not permitted include grazing of domestic stock, hunting and use of firearms, harvesting of forest products, solid fuel fires and horse riding. Stock grazing contracted for ecological purposes or for short-term management purposes may be permitted.

Creation of the **Reedy Swamp Wildlife Area**. A Wildlife Area is a type of natural features reserve which protects the habitat of wetland plants and animals and provides for public recreation including hunting. Key recommendations relating to land use in this proposed reserve include:

- Public recreation, including hunting in season as specified by the land manager, and education where this does not conflict with the primary objective
- Activities that are not permitted include timber harvesting and domestic stock grazing. Stock grazing contracted for ecological purposes or for short-term management purposes may be permitted
- Prospecting, apiculture and exploration for minerals generally be permitted and mining subject to decisions on particular cases.

The development of **Community Use Areas**, including the Victoria Park and Princess Park Recreation Areas. These areas are primarily used for education, recreation or other specific community purpose. Recreation Areas are mostly small reserves close to townships with facilities for organised sports and information recreation. Key recommendations relating to the use of these areas include:

- Facilities appropriate to these activities be provided
- Where relevant and where compatible with the purpose of the reserve, features of cultural significance, natural surroundings and the local character and quality of the landscape be maintained or restored
- Activities including harvesting of forest products, hunting and stone extraction not be permitted.

The management of a **Water Production Area** and **Service and Utility Areas**. The key recommendations for these areas of relevance to the project area include:

- Railway lines and other service and utility sites be managed to protect natural values including remnant vegetation and habitat, as far as practical
- Protect remnant natural vegetation in cemeteries where it does not interfere with the primary aim of the cemetery
- Natural and cultural heritage values be protected in water production areas.

This investigation was submitted to the Minister for Environment and Climate Change in July 2008 for consideration. At this stage, recommendations contained within the document have not been accepted. Acceptance of these recommendations would lead to some changes in permissible activities along public land within the RiverConnect project area and potentially some changes in management responsibility for these areas.

5. Mid Goulburn Waterway Health Activity Plan (Earth Tech 2005b)

The Mid Goulburn WHAP was prepared for an 80km reach of the Goulburn River extending from the Goulburn Weir downstream to the Broken River confluence. A literature review and field condition assessment of the Mid Goulburn project area provided a basis for the development of a risk assessment and recommendations for actions to address the risks within the project area. The document provides a summary of the condition of various Crown reserves, river stability and riparian vegetation condition for each of the four reaches in the study area. Reaches were determined largely by adjacent land use and type and extent of vegetation cover.

The RiverConnect project area is located within Reaches 3 and 4 of the Mid Goulburn WHAP. Three sites were identified for site specific works within the RiverConnect project area. These works were located within reach 4 and involved the control of exotic flora and the removal of rubbish (car bodies). The Mid Goulburn WHAP also contains a number of reach based actions targeting threats within the entire Mid Goulburn reach. These reach based actions relevant to the RiverConnect project area are:

- Undertake works to maintain bank stability
- Investigate impact of Shepparton Weir on fish passage
- Maintain and enhance instream habitat
- Implement recommendations of Goulburn River environmental flow project
- Determine minimum flow levels to ensure navigatable boat access and maintain levels when possible
- Implement existing water quality programs
- Investigate water quality at drainage outfalls
- Undertake targeted weed programs of highly invasive species
- Implement community weed awareness program
- Conduct detailed investigation to determine individual wetland condition and flow requirements
- Ensure wetland values are protected
- Manage stock access within the riparian zone
- Manage recreational access within the riparian zone
- Improve width of vegetation and longitudinal continuity
- Protect infrastructure and assets
- Investigate water quality impacts from tributary inflows from the Pranjip, Castle and Sevens Creek catchments.

Many of the site specific actions from the Mid Goulburn WHAP have been implemented over the past 3 years and this plan is still actively used by the Goulburn Broken CMA for the planning and implementation of works in the Mid Goulburn study area.

6. Lower Broken Waterway Health Activity Plan (Earth Tech 2004)

The Lower Broken WHAP was prepared for a reach of the Broken River extending from Gowangardie Weir downstream to the Goulburn River confluence. A detailed field condition assessment considering river stability, instream habitat and riparian vegetation was undertaken, leading to a series of overall and reach based observations. Reaches were determined largely by land use. The condition assessment provided a basis for the development of a risk assessment and recommendations for actions to address the risks within the Lower Broken WHAP project area.

The RiverConnect project area is located within Reaches 3 and 4 of the Lower Broken WHAP. A total of 18 sites were identified for site specific works within the RiverConnect project area. These works were located within reaches 3 and 4 and recommended the implementation of fencing, revegetation, alignment training, willow control, snag realignment and woody weed control. The Goulburn Broken CMA Works Supervisor confirmed that a large number of the site specific actions from this plan have been implemented within Reaches 3 and 4.

The Lower Broken WHAP also recommends a number of reach based, general actions targeting threats within each of the four reaches. These reach based actions for Reaches 3 and 4 are:

- Fence and revegetate the riparian zone
- Install large woody debris
- Restrict public access to the riparian zone (Reach 4 only)
- Plant Phragmites (Reach 4 only)
- Create artificial habitat structures
- Review Crown frontage management
- Fence those areas protecting wetlands of significant value
- Stem inject willow
- Control Silver Wattle
- Remove rubbish from the riparian zone
- Investigate legislative avenues for managing rubbish and drainage
- Control woody weeds
- Install GPT (Reach 4 only)
- Investigate improved environmental flow options
- Investigate sedimentation in the study area.

7. Assessment of Crown Land Frontages in Urban Zones (SKM 2005)

An assessment of Crown land frontages was completed along the Goulburn and Broken rivers through the urban area of Shepparton-Mooroopna. The assessment was completed using three condition assessment methods at 42 sites of varying land tenure and management. The results of these field condition assessments have resulted in:

- A summary of condition scores, values, threats and priority actions for individual frontages
- The development of a minimum acceptable standard for frontage condition based on a subset of indicators taken from the three methods
- The allocation of assessment sites into management zones, generally based on the current condition
- Recommended actions for management zones that will assist the parcels in reaching the minimum acceptable standard for frontage condition.

A review of the management regimes implemented throughout the study area by each land management agency is also presented. Key agencies include the Greater Shepparton City Council, DSE Crown Land Management, DSE Forest Management and Parks Victoria. The key strategic plans also reviewed include the Forest Management Plan for the Mid-Murray Forest Management Area (DNRE 2002), the Gemmills Swamp Wildlife Reserve Management Plan (DNRE 1997) and the Reedy Swamp Environmental Management Plan (DPI 2003).

This assessment provides a 2005 baseline assessment of condition of Crown land along the Goulburn and Broken rivers in the urban area of Shepparton-Mooroopna. Given that the priority actions are mostly generic, it is not clear whether they have been implemented at individual frontages. The condition of the Crown land parcels was deemed to be a function of the land tenure, historical development and location. Management zones designated in this project are therefore biased towards land tenure, but provide a useful starting point for further development.

8. Broken River Crown Land (Riparian) Assessment (Earth Tech 2005a)

This Crown Land Assessment was prepared for the lower reach of the Broken River extending downstream from Casey's Weir to the Goulburn River confluence. A total of 28 licensed and a sample of five unlicensed parcels were assessed using three condition assessment methods. The project reporting was largely divided into two sections:

- Section 1 – Condition and Priority Actions. This section details the field assessment and condition results. A comparison of condition assessment results at frontages assessed in both 2000 and 2005 is also presented. Minimum standards and recommended actions are prescribed for all frontages following a review of values, threats and opportunities relevant to each frontage
- Section 2 – Review of Licensing and Future Management Controls. This section provides a review of the history of licensing, the current conditions and issues associated with these licenses and discusses future management options.

Two parcels assessed in this project are located within the RiverConnect project area. The land tenure type for both parcels is Reserve (No. 0802788 and 0802704). Values and threats are presented and priority management actions have been proposed for each of these parcels. It is not known whether these actions have been implemented.

9. Reedy Swamp Management Plan (DPI 2003)

The Reedy Swamp Management Plan, includes the area covered by the broader Reedy Swamp Wildlife Reserve. The swamp is an important component of the Goulburn River Floodplain and a high value wetland, providing valuable habitat and breeding sites for a large number of waterbirds, including regionally, nationally and internationally significant species (DPI 2003).

The Reedy Swamp Management Plan identifies the values and issues associated with the Wildlife Reserve and recommends a series of prioritised management recommendations and associated actions to address these issues. The management recommendations are grouped into the following categories and are presented in detail in DPI (2003):

1. Current land use including recreation (game hunting, facilities and opportunities, rehabilitation, community awareness and education, tracks and access), Mooroopna pipeline, water extraction, timber extraction, rubbish and community involvement
2. Vegetation management including pest plants, threatened species management, Giant Rush community, soil disturbance, tree health, grazing, revegetation and fire management
3. Wildlife management including waterbirds, pest animals and threatened wildlife management
4. Salinity and nutrients
5. Groundwater
6. Powerlines
7. Flood regime including regulating structure management
8. Surface water management
9. Environmental water allocation
10. Monitoring and implementation of wetland management

11. Ecological research and surveys

The Reedy Swamp Management Plan should be used in conjunction with this RiverConnect WHAP, as it is the key strategic planning document for the recommendation of actions in Reedy Swamp and the broader Reedy Swamp Wildlife Reserve.

10. Gemmills Swamp Wildlife Reserve Masterplan (Thompson Berrill Landscape Design 2003)

The Gemmills Swamp Wildlife Reserve Masterplan covers the area of Gemmills Swamp, a wetland of high conservation value, and the surrounding area of relatively natural River Red Gum forest. The three objectives of the Masterplan are to:

- To develop wider community understanding and appreciation of the ecological, cultural and hydrological values of Gemmills Swamp
- To prepare a Masterplan consistent with the Management Plan (1997) objectives, that identifies key values, threats and identifies practical actions that ensure the protection and survival of the reserves fragile ecology and dependent significant wildlife populations
- To identify recreational and educational opportunities that are complimentary and compatible with the long term survival and protection of the wildlife reserve.

The plan summarises the existing values and proposed actions and strategies for cultural, vegetation, water, avifauna and fauna and recreation themes. Site specific actions are also proposed at several locations. The Gemmills Swamp Wildlife Reserve Masterplan should be used in conjunction with this RiverConnect WHAP, as it is the key planning document for the recommendation of actions in this area.

APPENDIX B RAPID HABITAT ASSESSMENT

- Assessment Manual
- Condition Assessment Results

Table 11 **RHA 'site condition' indicator scores and total 'site condition' scores adapted for the RiverConnect WHAP. Site location co-ordinates are provided in MGA z55.**

Site	Source	Easting	Northing	Large Trees	Canopy	Under-storey	Weeds	Recruit	Litter	Logs	Site score	Quality Class
1.1	SKM (2005)	356600	5969745	1	1	2	0	1	0	0	3	Low
1.2	SKM (2005)	356224	5969928	1	1	5	2	1	1	0.5	9.5	High
1.3	SKM (2005)	355057	5970996	1	1	4	1	1	1	0	7	Medium
1.4	SKM (2005)	355130	5970509	2	1	3	1	1	0	0	5	Medium
1.5	SKM (2005)	355771	5970227	0	1	2	0	1	1	0	4	Low
1.6	SKM (2005)	352146	5975615	1	1	4	3	2	1	0	10	High
1.7	SKM (2005)	353193	5974514	1	0.5	5	2	0	1	0	8	Medium
1.8	SKM (2005)	354036	5974192	1	1	3	1	0	1	0	5	Medium
1.9	SKM (2005)	355587	5973420	1	0.5	3	1	1	1	0	6	Medium
1.10	SKM (2005)	356085	5972448	1	0	2	0	1	1	0	4	Low
2.1	SKM (2005)	352687	5977824	1	1	3	1	1	1	0.5	6.5	Medium
2.2	SKM (2005)	352563	5977629	1	0.5	4	1	1	1	0	7	Medium
2.3	SKM (2005)	352169	5976020	1	1	4	1	1	1	0	7	Medium
2.4	SKM (2005)	353428	5974442	1	0.5	2	0	1	1	0	4	Low
2.5	SKM (2005)	352807	5975062	2	0.5	3	0	1	1	0	5	Medium
2.6	SKM (2005)	354089	5974313	1	0.5	5	3	2	1	0	11	High
2.7	SKM (2005)	354393	5974368	0	1	0	0	1	1	0	2	Low
2.8	SKM (2005)	354519	5974151	0	1	4	1	2	1	0	8	Medium
2.9	SKM (2005)	354597	5974345	2	1	2	0	2	1	1	6	Medium
2.10	SKM (2005)	353797	5974487	1	1	5	1	1	1	1	9	High
3.1	SKM (2005)	354632	5974429	2	1	0	0	1	1	0.5	2.5	Low
3.2	SKM (2005)	354779	5974491	1	0.5	3	1	1	1	1	7	Medium
3.3	SKM (2005)	354932	5974464	1	1	2	0	1	1	0.5	4.5	Medium

Site	Source	Easting	Northing	Large Trees	Canopy	Under-storey	Weeds	Recruit	Litter	Logs	Site score	Quality Class
3.4	SKM (2005)	355160	5973980	1	1	2	0	1	1	0.5	4.5	Medium
3.5	SKM (2005)	355023	5973891	1	0.5	2	0	1	1	0	4	Low
3.6	SKM (2005)	354901	5974188	1	1	2	0	1	1	0	4	Low
3.7	SKM (2005)	355748	5972990	1	1	0	0	1	1	0	2	Low
3.8	SKM (2005)	355733	5973696	2	1	2	0	1	1	0	4	Low
3.9	SKM (2005)	357039	5969286	0	1	2	0	1	0	0	3	Low
3.10	SKM (2005)	356796	5969592	2	1	3	1	1	0	0	5	Medium
3.11	SKM (2005)	356488	5969791	1	0.5	2	0	1	1	0	4	Low
3.12	SKM (2005)	356991	5969420	1	1	2	0	1	0	0	3	Low
4.1	SKM (2005)	355497	5974122	1	1	3	1	1	1	0	6	Medium
4.2	SKM (2005)	355843	5971584	1	1	2	0	1	1	0	4	Low
4.3	SKM (2005)	355494	5971289	1	1	2	0	1	1	0	4	Low
4.4	SKM (2005)	355007	5971079	1	1	3	1	1	1	0	6	Medium
4.5	SKM (2005)	354545	5971019	1	1	3	1	1	1	0	6	Medium
4.6	SKM (2005)	354229	5971206	1	1	2	0	1	1	0	4	Low
4.7	SKM (2005)	353745	5971322	1	1	0	0	1	1	0.5	2.5	Low
4.8	SKM (2005)	354898	5971427	0	1	3	1	1	1	0	6	Medium
4.9	SKM (2005)	355346	5971291	1	1	2	0	1	1	1	5	Medium
4.10	SKM (2005)	356022	5972441	1	1	2	0	1	1	0	4	Low
0802704	Earth Tech (2005a)	354926	5970632	1	1	4	1	2	1	1	9	High
0802788	Earth Tech (2005a)	357378	5968964	1	0.5	0	0	2	1	0	3	Low
20081001A	RiverConnect	352731	5979612	2	1	0	0	1	1	0.5	2.5	Low
20081001B	RiverConnect	352326	5976427	2	1	4	0	0	1	1	6	Medium
20081006A	RiverConnect	355306	5974234	2	1	4	0	1	1	1	7	Medium
20081006B	RiverConnect	354809	5974031	2	1	4	0	0	1	1	6	Medium
20081006C	RiverConnect	352539	5975226	2	1	5	0	1	1	1	8	Medium

Site	Source	Easting	Northing	Large Trees	Canopy	Under-storey	Weeds	Recruit	Litter	Logs	Site score	Quality Class
20081006D	RiverConnect	352100	5976043	2	1	0	0	1	1	1	3	Low
20081006E	RiverConnect	352518	5977721	2	0.5	2	0	1	1	1	5	Medium
20081022A	RiverConnect	353317	5970747	2	0.5	0	0	1	1	1	3	Low
20081022B	RiverConnect	354042	5968563	2	1	0	0	1	1	1	3	Low
20081022C	RiverConnect	353355	5970080	2	1	4	0	2	1	1	8	Medium
20081103A	RiverConnect	353397	5970666	2	1	4	0	2	1	1	8	Medium
20081103B	RiverConnect	355271	5970051	2	1	4	0	1	1	1	7	Medium
20081103C	RiverConnect	355374	5970356	1	1	0	0	1	1	1	3	Low
Cooma Bend	GBCMA (2008)	352480	5979266	1	1	4	0	2	1	0.5	7.5	Medium
Youngs Bend	GBCMA (2008)	355254	5973091	1	0.5	5	2	2	1	0	10	High
Gemmills	GBCMA (2008)	352490	5973863	2	1	4	1	2	1	1	9	High

APPENDIX C RIVERCONNECT SCHOOL PROGRAM AREAS


St Luke's Primary School
Notre Dame Secondary College
and
St Brendan's Primary School
Shepparton High School
Shepparton Christian Primary School
Wanganui Park Secondary College
Gowrie Street Primary School
Mooroopna Park Primary School
and
Mooroopna Secondary College
Bouchier Street Primary School
Berry Street
St Georges Road Primary School
Mooroopna Primary School
Verney Road School
St Mary's Primary School
St Mel's Primary School
Guthrie Street Primary School
Wilmot Road Primary School
McGuire Secondary College
N
0 500 1,000 2,000 3,000 4,000 5,000
Metres