

# MILLARDS CREEK, ULLADULLA, URBAN STREAM CORRIDOR MANAGEMENT PLAN



Adopted 18th December 2007

File 2879-03

## FOREWORD

### **Why A Natural Resources Management Plan?**

Millards Creek is an important natural asset for environmental, economic, recreational, social, and tourism reasons. To ensure the long-term environmental quality and to meet community aspirations for recreation opportunity, access and amenity Shoalhaven City Council has fostered the development of this Natural Resources Management Plan for Millards Creek Urban Stream Corridor. It integrates past planning and rehabilitation plans and proposes some new approaches.

Shoalhaven City Council, in consultation with the community, has prepared this draft Management Plan for the Millards Creek Urban Stream Corridor. The draft Management Plan sets out how the area can be used, managed, developed and conserved, and specifies site improvements to better meet the needs of users of the area.

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## SUMMARY

The Millards Creek Urban Stream Corridor Management Plan (the Plan) provides a comprehensive and integrated set of objectives and actions to rehabilitate, protect and conserve the natural resources of the Millards Creek, to ensure that its use is ecologically sustainable in the long term. The Plan combines principles of ecologically sustainable development, catchment management and estuary management into one process.

The objectives and actions deal with a number of natural resources management areas, these include: Water Flow; Erosion and Sedimentation; Water Quality; Nature Conservation, Recreation and Access; as well as Visual Quality. The Plan identifies values, issues, aims, objectives and actions for management areas. The broad objectives for each management area are set out in the tables below. The actions proposed for carrying out each objective are set out in the Table 7, following the management areas. The various actions consist of five types: protective and remedial works; education programs; asset management; monitoring and research; and, development policy compliance initiatives.

The primary point of contact with the community during the preparation of the Plan has been through the Ulladulla Harbour and Millards Creek Natural Resources and Floodplain Management Committee (previously the Ulladulla Harbour Estuary Task Force). The Committee reviewed a number of drafts of the document and have contributed greatly to its preparation.

**Table 1: Management Area Objectives**

| <b>Water Flow Objectives</b> |   |
|------------------------------|---|
| WF1:                         | Support and maintain natural water flow variability                 |
| WF2:                         | Minimise negative impacts of stormwater drainage and overland flows |
| WF3:                         | Minimise negative effects of instream structures                    |

| <b>Erosion and Sedimentation Objectives</b> |   |
|---|---|
| ES1:  | Reduce human induced impacts both direct and indirect occurring within the creeks catchment (i.e. sediment and erosion) |
| ES2:  | Accommodate natural creek processes   |
| ES3:  | Utilise best practice stormwater management   |
| ES4:  | Minimise erosion of stream banks  |
| ES5:  | Protect Millards Creek Urban Stream Corridor from excess sedimentation from development areas                           |
| ES6:  | Ensure stormwater discharge points have adequate scour protection and are hydraulically stable                          |

| <b>Water Quality Objectives</b>  |
|--|
| WQ1: Minimise human induced impacts on stream water quality e.g. sediment, nutrients and waste dumping |
| WQ2: Maintain Secondary Recreation Water Quality Standards as per ANZECC                               |
| WQ3: Minimise negative impacts of concentrated stormwater discharges into creek                        |
| WQ4: Eliminate existing sources of sewage contamination  |
| WQ5: Educate residents and visitors on stormwater quality issues and best management practices         |
| WQ6: Encourage water sensitive urban design  |

| <b>Nature Conservation Objectives</b>  |
|--|
| NC1: Conserve and preserve the intrinsic values of Millards Creek Urban Stream Corridor  |
| NC2: Ensure human use of Millards Creek is sustainable                                   |
| NC3: Increase stakeholder awareness on the importance of protecting natural environments |
| NC4: Minimise negative human behaviours e.g.: dumping                                    |
| NC5: Reduce pest species of Flora and Fauna  |
| NC6: Minimise negative impacts of fire protection on the natural values of the area      |
| NC7: Protect recognised values through maintenance and rehabilitation efforts            |

| <b>Recreation and Access Objectives</b>   |
|---|
| RA1: Upgrade infrastructure and facilities to support the corridors values to the community                       |
| RA2: Improve access to and within the Millards Creek Urban Stream Corridor and improve links to Harbour foreshore |
| RA3: Maintain value of area through preservation of environment quality and creek amenity                         |
| RA4: Minimise negative human behaviours affecting the natural and built assets                                    |
| RA5: Incorporate recognition of heritage into current uses  |

| <b>Visual Quality Objectives</b>   |
|--|
| VQ1: Maintain visual amenity of the riparian vegetation                      |
| VQ2: Maintain existing vegetation canopy within Millards Creek               |
| VQ3: Design and implement infrastructure which complements natural surrounds |
| VQ4: Remove weeds and encourage native plant regeneration                    |

## **INTRODUCTION**

### **LOCATION**

Millards Creek Urban Stream Corridor is located in the Shoalhaven Local Government Area, 235km south of Sydney. The catchment occupies an area of approximately 4.5km<sup>2</sup> (Figure 1) and is centrally located within the Ulladulla urban area, flowing into Ulladulla Harbour.

### **OVERVIEW**

Millards Creek Urban Stream Corridor possesses environmental, social, economic and recreational values that make the area a popular place for a wide variety of activities and development. As the surrounding catchment, other than the main trunks of the stream, are entirely developed for urban residential and associated uses, the pressure on the natural resources of this important and centrally located natural asset, such as significant changes to the catchment hydrology and stream hydraulics, requires active management to maintain the environmental quality for community benefit.

### **AIM**

The aim of the Plan is to provide a comprehensive and integrated set of strategies to manage the natural resources of Millards Creek Urban Stream Corridor.

### **APPROACH TO PLAN PREPARATION**

A number of government agencies, community groups and individuals have been involved in managing some aspects of the area prior to the preparation of the Plan. The Plan has sought to integrate those past efforts and proposes some new approaches where gaps in the management approach have been identified. In simple terms, past efforts have broadly been focused on vegetation management. An identified management gap is the mitigation of impacts due to significant modifications to the catchment hydrology and the introduction of concentrated flows via the constructed drainage network.

Aims, objectives and actions contained in this Plan comply with legislative requirements as per:

- Environmental Planning and Assessment Act 1979
- Local Government Act 1993
- Rivers and Foreshores Improvement Act 1948
- Soil Conservation Act 1938
- Crown Lands Act 1989
- Coastal Protection Act 1979
- Fisheries Management Act 1994
- Threatened Species Conservation Act 1995
- Protection of the Environment Operations Act 1997
- Water Management Act 2000
- Shoalhaven Local Environmental Plan 1985
- Native Vegetation Act 2003
- Environment Protection and Biodiversity Conservation Act 1999
- State Environmental Planning Policy No. 14 - Coastal Wetlands



**Figure 1: Millards Creek Urban Stream Corridor Catchment Map**



- State Environmental Planning Policy No. 26 - Littoral Rainforest
- State Environmental Planning Policy No. 71 - Coastal Protection
- State Environmental Planning Policy No. 35 - Maintenance Dredging of Tidal Waterways

## **COMMUNITY INVOLVEMENT IN PLAN PREPARATION**

Council established, hosts and supports the Ulladulla Harbour and Millards Creek Natural Resources and Floodplain Management Committee.

The purpose of the Committee is to facilitate preparation of the Natural Resource Management Plan for Millards Creek catchment area; provide a focus for community consultation and a conduit for information flow to the broader community in respect to natural resource management issues. Since the establishment of the Committee Ulladulla Harbour proper is the focus of a major redevelopment project outside the auspices of this Council advisory Committee. Hence, the focus of this plan is refined towards Millards Creek. In respect to Ulladulla Harbour the main linkage is via minimisation of pollutant loads from the catchment into the harbour, these being particulate and dissolved pollutants; linkage of access to the residential areas via the stream corridor; continuation of a natural green area for leisure activities; the maintenance and/or improvement of the amenity of the stream corridor for community use; and, maintenance of the riparian corridor.

The Committee's role includes assisting Council in its prioritisation of projects for grant funding applications and subsequently overseeing implementation of natural resource management projects emergent from the Plan.

## **COMMITTEE MEMBERSHIP**

Council has appointed a Councillor to act as chair with an alternate chair also nominated. Where neither Councillor is available and the chair concurs, the Director Strategic Planning Group or their nominated representative may act as chairperson, or, the meeting may be re-scheduled.

Council representatives include:

- All relevant Council Groups and expert staff as required

Relevant State Government agencies are invited and are listed below. Agencies will be requested to attend when there is business of significance to them. Therefore, not all agencies are expected to attend all meetings:

- Department of Environment and Climate Change
  - Environment Protection Authority
  - NSW National Parks Service
- NSW Maritime Authority
- NSW Department Primary Industry (Fisheries)
- NSW Department of Lands
- NSW Catchment Management Authority

Community representation includes:

- existing peak consultative groups (community consultative bodies);
- user groups;
- conservation groups (inclusive of land council where relevant);
- primary production industry groups; and

- technical experts with extensive professional experience in natural resources or a related field.

The Committee seeks to balance representation across a range of community groups with interests in natural resource management but different foci.

Additionally, community representatives capable of attending in their capacity as delegates or office bearers for interest groups are favoured over individuals so that they can disseminate information more broadly and bring to the Committee a good understanding of community or interest group's views.

The Committee seeks to be inclusive. Therefore, individuals with particular issues may be invited to attend in an observer capacity and would be able to identify issues for discussion by the Committee. Alternately, individuals with a keen interest might utilise one of the consultative groups as the conduit for their issues being brought forward.

## MILLARDS CREEK CATCHMENT

### LOCATION AND CHARACTER

Millards Creek is the main watercourse within Ulladulla which discharges to the north-western corner of Ulladulla Harbour. The catchment comprises an area of approximately 4.5km<sup>2</sup>, and extends approximately 3km inland. Only the very lower reaches of the catchment are tidal, in part due to a stone weir within the main channel of Millards Creek.

The upper catchment extends to Slaughterhouse Road, Milton. Four major tributaries drain into Millards Creek from the south, running through the urban areas of Ulladulla. Millards Creek effectively dissects the urban areas of Ulladulla from west to east, with the central business district of the town being located on the southern side of the watercourse adjacent to the confluence with Ulladulla Harbour.

A shared cycle/pathway follows Millards Creek along the northern side of the watercourse, meandering through areas of remnant native forest and riparian vegetation which contains a diversity of flora assemblages and fauna species.

### GEOLOGY AND SOILS

Ulladulla and the Millards Creek Urban Stream Corridor lie within the southern Sydney Basin, a geological sequence which comprises sedimentary rocks with minor volcanic intrusions. This sedimentary basin is dominated by sandstones and shales of the Permian Shoalhaven Group dating back 270-250 million years. The Wandrawandian Siltstone unit is part of this Shoalhaven Group and constitutes the majority of the Millards Creek catchment (Rose, 1996). The Wandrawandian Siltstone consists predominantly of thinly bedded to massive siltstone, silty sandstone and in some parts, pebbly sandstone (Tye *et al*, 1996; Tye and Jones, 2000).

The northwest border of Millards Creek catchment is also the top, and begins on the edge of the Late Permian Milton Monzonite unit (Carr, 1998). Also, on the northern boundary Milton Monzonite, observed as an isolated outcrop, intrudes into the Wandrawandian Siltstone. A Tertiary unit of gravel, sand, clay, sandstone and conglomerate sediment with occasional remnants of the volcanic rock basalt overlies the Wandrawandian Siltstone to the north and south of the lower two-thirds of the catchment.

Millards Creek is confined within a low to moderate relief valley system with generally undulating morphology and occasional outcrops of harder rocks that form small cliffs and sections of the channel bottom.

The soils of an area are determined primarily by the nature of the parent material, slope and landscape stability. Parent material in the lower Millards Creek catchment includes Tertiary sediments, which may be the origin of the sands and gravels deposited in the creek, as the water passes through. The abundance of silt and clay soils in the upper catchment is related to the weathering of the underlying Wandrawandian Siltstone. The upper catchment is therefore relatively more fertile than the lower area.

## FLORA AND FAUNA

### RIPARIAN CORRIDOR

The riparian corridor is land immediately adjacent to streams; including areas of land where the interaction between aquatic and terrestrial environments occur, such as the area surrounding Millards Creek. These areas are a key in maintaining ecosystem functioning and diversity, containing both fluvial and terrestrial systems as well as the transitional systems between them.

Some functions and services of the riparian corridor include:

- habitat, foraging areas and bio-linkages for local and migratory species
- refuges for wildlife and biodiversity including common and threatened species
- a supply of food and habitat for aquatic life - maintaining healthy food webs
- assistance in maintaining local fisheries by providing fish passage and habitat
- repositories for seeds/propagules of plants for re-colonisation or revegetation of nearby remnants or parks etc.
- filtration and exchange of inputs such as air, water and nutrients
- soil, bank and channel stability
- flood mitigation and property protection
- an aesthetic visual buffer within highly developed urban areas
- a reduction in heat pollution of streams by shading waterways
- a buffer against pollutants
- visual buffers in developed areas
- areas for passive recreation
- areas for scientific research and educational activities

Three broad categories for riparian corridors have been identified, reflecting the relative importance of the watercourse within the catchment and its functioning. These categories are hierarchical, with Category 1 being of the highest value, and being achieved by a larger group of management requirements, and Category 3 being of relatively lesser value and being achieved by a reduced suite of management requirements. Spatial requirements also differ in order to achieve the objective or function assigned to each Category as can be seen in Table 2 (DIPNR, 2004).

#### Category 1 - Environmental Corridor

This category of riparian corridor provides linkages for wildlife between scattered natural areas, providing the greatest minimum width of riparian and buffer zone which typically includes the most intact riparian zones in remnant bushland areas. These areas have the greatest value for (aquatic and terrestrial) habitat, wildlife movement and conservation, water quality maintenance, fluvial/geomorphic processes and stream stability. A critical role for this category is to provide as much habitat complexity and continuity as possible so that movement of genetic material, via pollinators (insects, birds and animals) and seed and plant material dispersal, can occur. This will minimise the risk of isolating plant and animal populations and hence their decline through reduced fitness and inbreeding depression, and is fundamental to conserving biodiversity.

#### Category 2 - Terrestrial and aquatic habitat

Riparian category 2 contains useful basic habitat and preserve the natural features of a watercourse. The size and condition of these riparian zones and buffers is less than Category 1 but fluvial geomorphic processes can still occur, they have good habitat quality (but lesser wildlife movement value) and will be useful for water quality maintenance.

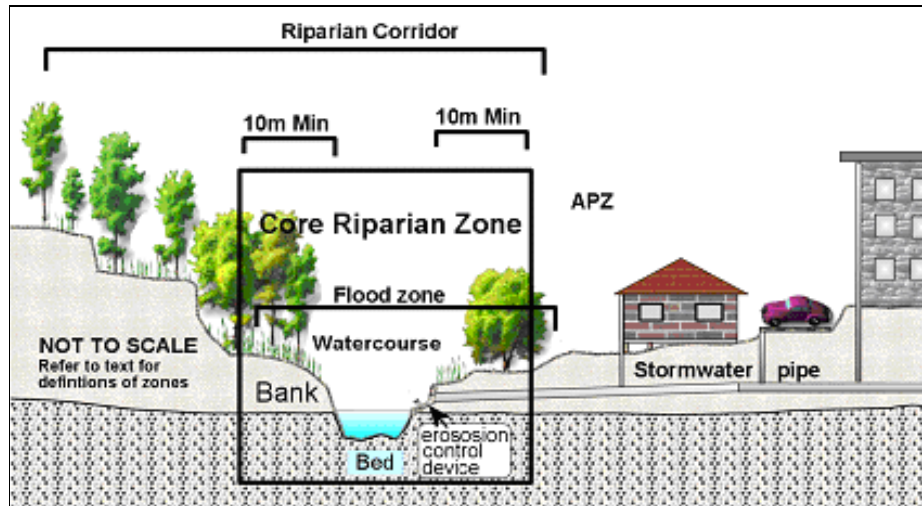
**Table 2: Summary of Riparian Corridor Management Objectives**

| <b>Minimum Environmental Objectives<br/>for Riparian Land</b>                        | <b>Category 1<br/>Environmental<br/>Corridor</b> | <b>Category 2<br/>Terrestrial &amp;<br/>Aquatic Habitat</b> | <b>Category 3<br/>Bank Stability &amp;<br/>Water Quality</b> |
|--|--|---|--|
| Identify whether or not there is a "river" present                                   | N/a  | yes   | yes  |
| Delineate riparian zone on a map and zone appropriately for environmental protection | Yes  | yes   | not required   |
| Provide a core riparian zone width greater than-                                     | 40 m from top of bank                            | 20 m from top of bank                                       | 10m  |
| Provide additional width to counter edge effects on the urban interface              | 10 m   | 10 m  | generally not required                                       |
| Provide continuity for movement of terrestrial and aquatic habitat                   | yes (including pierced crossings)                | Yes (piered crossings preferred)                            | where appropriate  |
| Rehabilitate/re-establish local provenance native vegetation                         | Yes  | yes   | where appropriate  |
| Locate services outside the core riparian zone wherever possible                     | Yes  | yes   |  |
| Locate playing fields and recreational activities outside core riparian zone         | Yes  | yes   |  |
| Treat stormwater runoff before discharge into riparian zone or the watercourse       | Yes  | yes   | yes  |

**Category 3 - Bank stability and water quality**

This riparian category would provide limited habitat value but provide an important contribution to the overall health of the catchment. Typically these would be narrow zones along highly modified streams that may have no native vegetation. These streams would be difficult, and in some cases not possible, to rehabilitate to a natural state (Figure 2). However, these areas will still contribute significantly to downstream water quality maintenance, and if piped or lined with concrete, would cause increased flooding and erosion potential.

Many of the riparian environments that fall into this category are on private property with the streams forming part of the landscape character of the garden. As a consequence the longer-term management of these systems will rely on strong partnerships with private property owners and the community.

**Figure 2: Bank stability and water quality**

The Core Riparian Zone (CRZ), as seen in Figure 2, is the area of land contained within and adjacent to the channel. The CRZ is to remain or become fully vegetated with local provenance native vegetation (including aquatic groundcovers, shrubs and other species) to a minimum width of 40m from the banks of the waterway.

A Vegetated Buffer (VB) is required to protect the environmental integrity of the CRZ from edge effects such as weed invasion from adjacent lands, micro-climate changes, litter, trampling and pollution. The minimum width for the VB is 10m though, as can be seen in Figure 2, is not always present for Category 3.

The Asset Protection Zone (APZ) is required by NSW Rural Fire Service to protect assets from potential bushfire damage, and should be measured from the outer edge of the vegetated buffer to the asset. It should never be considered to be part of or contained within the VB or the CRZ as this would result in clearing and reduced capacity of the CRZ and VB.

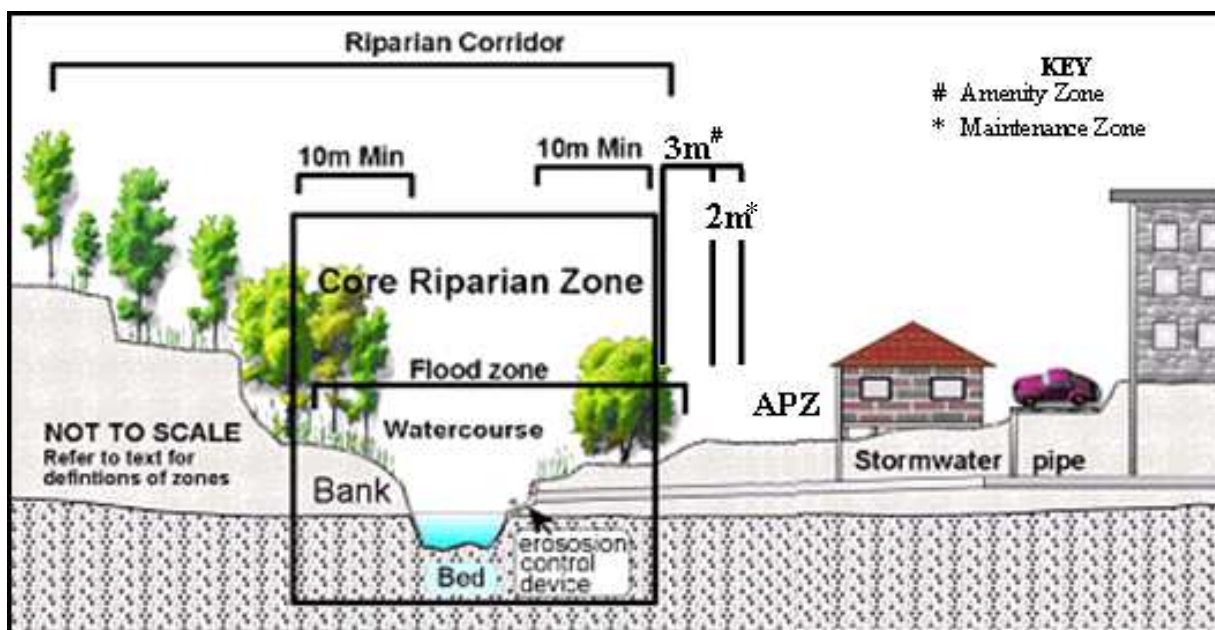
Past management practices have threatened the health of Millards Creek Urban Stream Corridor hindering its potential to maintain riparian Categories 1 and 2. It is therefore aimed to maintain Category 3 throughout the catchment, with sporadic areas enabling Categories 1 and/or 2 to be achieved. The objectives of Category 3 are to maintain and restore as much as possible the natural functions of a stream through:

- providing bank and bed stability
- protecting water quality
- protecting native vegetation
- protecting in-stream aquatic vegetation.

This is achieved by:

- emulating wherever possible a naturally functioning stream
- ensuring channel stability
- protecting the natural values within the channel
- providing lateral connectivity for in-stream function
- using pipes or other engineering devices as a last resort
- ensuring all stormwater discharge is treated before it enters the stream.

To further aid in the achievement and maintenance of riparian category 3 additional buffer areas have been suggested as can be seen in Figure 3 and referred to in Table 7.

**Figure 3: Additional Buffer/Amenity and Maintenance Zone**

These areas can be utilised for further extension of the vegetated area as well as the incorporation of pre-existing and potential maintenance practices and/or infrastructure.

### VEGETATION COMMUNITIES

There are currently eight vegetation classes present within Millards Creek Urban Stream Corridor. These eight vegetation classes are:

- Bangalay - Banksia Woodland (BOT-WLD)
- Bangalay Forest (BOT-BAN)
- Bangalay Sand Forest (EEC)
- Blackbutt Tall Forest (PIL-SYN)
- Mangrove Forest (AVI-MAR)
- Sandstone Heathland (SST-HTH)
- Silvertop Ash - Bloodwood Forest (SIE-GUM)
- Swamp Oak Forest (EEC)
- Turpentine Forest (SYN-FOR)

While there are eight classes in the catchment, Blackbutt Tall Forest (dominant canopy species) and Turpentine Forest (dominant sub-canopy species), cover the majority of the vegetated area. The vegetation classes are further described in Table 3.

**Table 3: Characteristics of Vegetation Classes found within Millards Creek Urban Stream Corridor**

| Vegetation Class                      | Characteristics   |
|---------------------------------------|---|
| Bangalay - Banksia Woodland (BOT-WLD) | This community is related to the Bangalay Forest with the main species being <i>Eucalyptus botryoides</i> and <i>Banksias serrata</i> , the latter species growing as old gnarled specimens. There is often little understorey because of frequent bushfires. Typical coastal species also occur in the community, including <i>Monotoca elliptica</i> and <i>Leptospermum laevigatum</i> . |



| Vegetation Class                           | Characteristics  |
|--|--|
| Bangalay Forest (BOT-BAN)                  | This forest is found along the coast on deep sand deposits. The main tree is <i>E. botryoides</i> ; there are usually no other eucalypts present, although <i>Angophora floribunda</i> occurs in some places. On wetter sites the community merges with the Swamp Oak Forest. The understorey is often open and grassy, because of frequent fires, or may be shrubby or, when unburnt, composed of rainforest, when it can be identified as Bangalay - Rainforest. Typical coastal species are always present, including <i>Banksia integrifolia</i> and <i>Monotoca elliptica</i> . |
| Blackbutt Tall Forest (PIL-SYN)            | Occurs in gullies throughout the region, and is closely associated with Blackbutt – Bloodwood Forest. The moister nature and abundance of <i>Syncarpia glomulifera</i> differentiate this community from the Blackbutt-Bloodwood Forest community. Associated species include rainforest species such as <i>Rapanea howittiana</i> , <i>Livistona australis</i> and <i>Ficus coronata</i> . The understorey usually contains rainforest species, including ferns and creepers.   |
| Mangrove Forest (AVI-MAR)                  | Monospecific stands of Mangrove Forest, containing the tree mangrove <i>Avicennia marina</i> occur around most of the tidal estuaries, lakes and lagoons along the entire coastline. Occasionally other species are present but usually no other plant can grow on the tidally inundated flats where this community is found.  |
| Sandstone Heathland (SST-HTH)              | This is the common heathland community found throughout the sandstone country of the region. It is species-rich, containing a huge range of shrub and other species. Species composition varies considerably, and local sub-communities can certainly be recognised; changes due to increasing altitude are the most obvious. Heathland also usually occurs as an understorey to Scribbly Gum – Bloodwood Woodland/Open Woodland.  |
| Silvertop Ash - Bloodwood Forest (SIE-GUM) | Is the common community on dry ridge crests in the extensive forests in the southern part of the region. <i>E. sieberi</i> often occurs as a monospecific stand, and it is often composed of small tress because of past fires that destroyed the stand; a common occurrence because of its location on ridge crests. The understorey is characteristically shrubby, including the key species <i>Acacia teminalis</i> and <i>Oxylobium ilicifolium</i> .  |
| Swamp Oak Forest (EEC)                     | This ecological community is associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines and estuarine fringes associated with coastal floodplains. Swamp Oak Forest generally occurs below 20m (rarely above 10m) elevation. The community is characterised by the following assemblage of species: <i>Acmena smithii</i> , <i>Melaleuca species</i> , <i>Casuarina glauca</i> and <i>Glochidion ferdinandi</i> .  |
| Turpentine Forest (SYN-FOR)                | This community is mostly associated with Blackbutt Tall Forest (PIL-SYN). May result from clearing and subsequent regeneration rather than begin a natural community.  |

(Jones, 2007)

Within this variety of vegetation classes Millards Creek Urban Stream Corridor supports a number of terrestrial plant and animal species. Mangroves located at the mouth of the creek provide suitable habitat for fish and crab species.

The tidal flats within the ecosystem are also of environmental importance, as they are feeding grounds for fish, invertebrates and birds providing a small but locally important biological pathway between coastal and estuarine ecologies and the broader catchment as well as refuge for avifauna. This diversity is further shown through the many native species that are bush foods, for example:

- *Acmena smithii* (Lillypilly)
- *Persoonia mollis* ssp. *caleyi* (Soft Geebung)
- *Podocarpus spinulosus* (Plum Pine)
- *Smilax glycyphylla* (Native Sarsaparilla)
- *Banksia spinulosa* (Hairpin Banksia)
- *Billardiera scandens* (Apple Berry or Dumplings)
- *Elaeocarpus reticulatus* (Blueberry Ash)
- *Lambertia formosa* (Honey Flowers)

### THREATENED SPECIES

A number of threatened species can be found within Millards Creek Urban Stream Corridor. Threatened species can be described as those species that are listed as critically endangered, endangered or vulnerable under the Threatened Species Conservation Act of 1995. A plant may be listed as protected under the National Parks and Wildlife Act of 1974.

A species is said to be critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future. A species is endangered when it is facing a very high risk of extinction in the wild in the near future. A species is said to be vulnerable when it is facing a high risk of extinction in the wild in the medium-term future (NPWS, 1995).

Species listed as protected are those that do not qualify as a threatened species however they play a key role within the environments they reside. These species can be protected directly or indirectly either through implementing measures to protect them or to protect the environment around them, therefore indirectly protecting the species.

There are many species of native vegetation, in the catchment, that are “Protected Native Plants” gazetted under the National Parks and Wildlife Act 1974. All of these are listed as P13 identifying them as protected plant species. Protected Flora found within Millards Creek can be seen in Table 4.

**Table 4: Protected Flora found within Millards Creek Urban Stream Corridor**

| Scientific Name  | Common Name        |
|--|--------------------|
| <i>Adiantum aethiopicum</i>                                  | Common Maidenhair  |
| <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> | River Sheoak       |
| <i>Caustis flexuosa</i>                                      | Curly Wig          |
| <i>Ceratopetalum gummiferum</i>                              | Christmas Bush     |
| <i>Cyathea australis</i>                                     | Rough Treefern     |
| <i>Cymbidium suave</i>                                       | Snake Orchid       |
| <i>Dicksonia antarctica</i>                                  | Soft Treefern      |
| <i>Dipodium punctatum</i>                                    | Hyacinth Orchid    |
| <i>Dipodium variegatum</i>                                   | Hyacinth Orchid    |
| <i>Lycopodium deuterodesum</i>                               | Mountain Club Moss |
| <i>Todea barbara</i>   | King Fern          |

A number of threatened Fauna species are likely to occur within the catchment because of the vegetation assemblages present; these can be seen in Table 5.

**Table 5: Threatened Fauna found within and around Millards Creek Urban Stream Corridor**

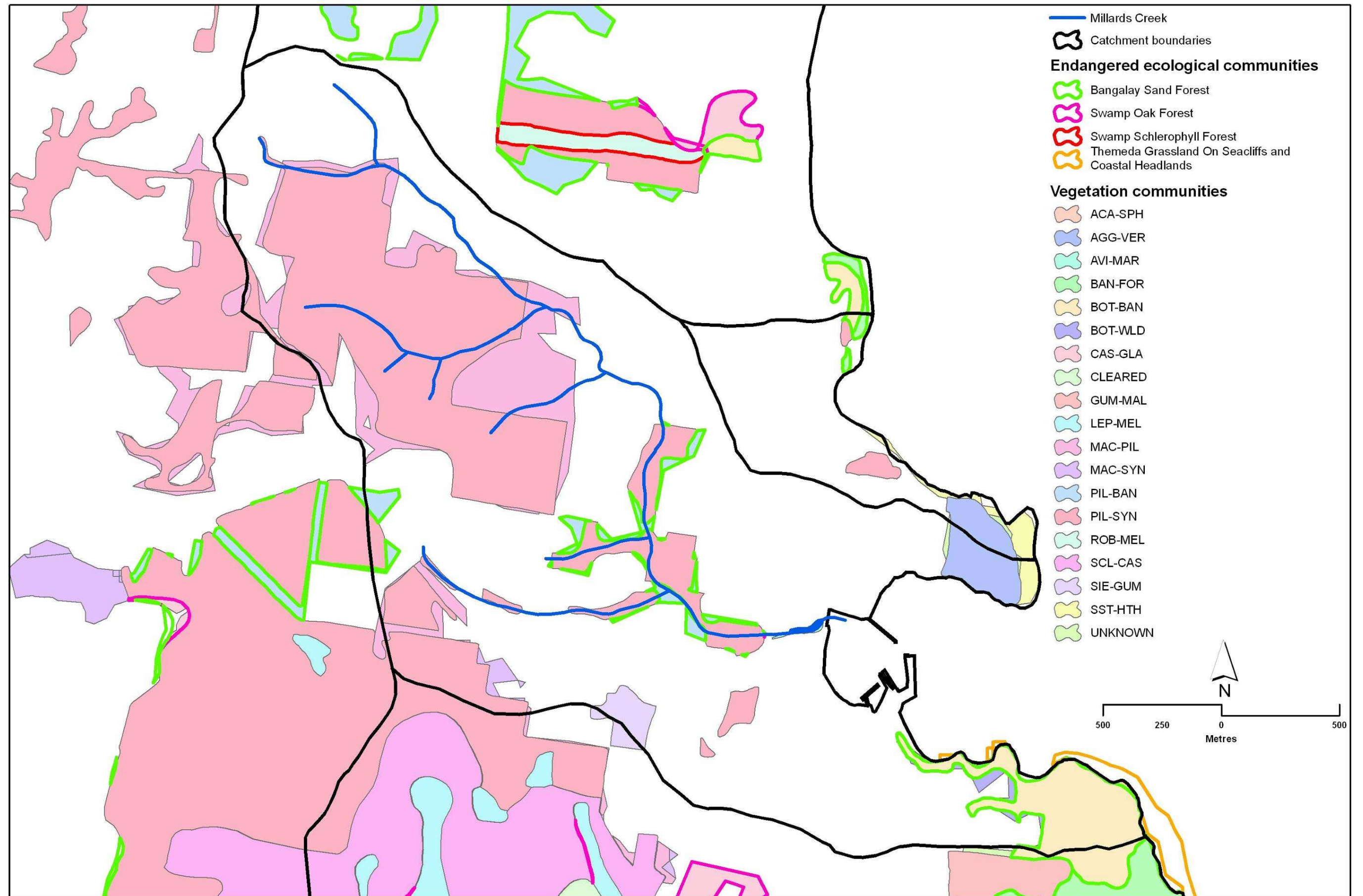
| Area                                 | Common Name            | Scientific Name                 | Listing    |
|--------------------------------------|------------------------|---------------------------------|------------|
| Millards Creek Urban Stream Corridor | Superb Fruit-Dove      | <i>Ptilinopus superb</i>        | Vulnerable |
|                                      | Glossy Black Cockatoo  | <i>Calyptorhynchus lathami</i>  | Vulnerable |
| Surrounding Area                     | Sooty Oystercatcher    | <i>Haematopus fuliginosus</i>   | Vulnerable |
|                                      | Gang-gang Cockatoo     | <i>Callocephalon fimbriatum</i> | Vulnerable |
|                                      | Grey-headed Flying Fox | <i>Pteropus poliocephalus</i>   | Vulnerable |
|                                      | Giant Burrowing Frog   | <i>Heleioporus australiacus</i> | Vulnerable |
|                                      | Hooded Plover          | <i>Thinornis rubricollis</i>    | Endangered |

**ENDANGERED ECOLOGICAL COMMUNITIES**

An Endangered Ecological Community (EEC) is an assemblage of species occupying a particular area which is at risk of extinction. An EEC exists within the area, Swamp Oak Forest. This EEC demonstrates the ecological value of the remnant vegetation, underpinning the need for active management to conserve the resource. Swamp Oak Forest has become endangered through land clearing, unauthorised management practices (such as mowing outside designated areas) and fragmented due to the nature of their coastal distribution.

The remnant areas of natural vegetation are limited as loss of catchment vegetation over the last forty years has been significant. This loss of vegetation also increases sediment loss within the catchment.

It is important from an ecological perspective to preserve and monitor the vegetation in the catchment. This is especially important when considering the threatened fauna of the catchment and surrounding areas. A depiction of the EECs and vegetation classes can be seen in Figure 3.

**Figure 4: Endangered Ecological Communities and Vegetation Classes within Millards Creek Urban Stream Corridor**

## WEEDS

Native vegetation that has been disturbed is prone to weed invasion by introduced species. Weeds, often described as introduced, exotic, alien or naturalised plants, are favoured by disturbances that change the soil structure, light levels, the local fire regime and the flow of water through the ecosystem.

Millards Creek Urban Stream Corridor has a high prevalence of weed species throughout the catchment. The causes of weed invasion include: physical disturbance to the vegetation structure of the community; dumping of landfill rubbish and garden refuse; polluted runoff from urban and agricultural areas; construction of roads and other utilities; and, grazing by domestic livestock. All of these processes occur within the catchment area.

Weeds generally grow more vigorously than native plants and once established have the potential to: out-compete native species, repress the juvenile indigenous species; change the natural fire regime because of their different responses to fire; enrich the soil by adding nutrients; change the food sources and habitats available to wildlife; and, so change the wildlife populations. These impacts are largely detrimental to the natural ecological values of an area.

These changes to the natural environment can also favour pest species such as foxes, rabbits, introduced birds and feral cats. For example, the invasion of weed species such as Blackberry and Lantana provides harbour for foxes and rabbits. Feral animals compete with and prey on native species and cause disturbance to the soil further reducing diversity and habitat and compromising the riparian corridor by impairing natural regeneration.

Weed species present within Millards Creek Urban Stream Corridor as listed in Table 6.

**Table 6: Weed species found within Millards Creek Urban Stream Corridor**

| Scientific Name                | Common Name               |
|--------------------------------|---------------------------|
| <i>Acetosa sagittate</i>       | Turkey Rhubarb            |
| <i>Ageratum houstonianum</i>   | Blue Billygoat Weed       |
| <i>Artemisia verlotioun</i>    | Chinese Wormwood          |
| <i>Bidens pilosa</i>           | Cobbler's Pegs/ Pitchfork |
| <i>Conyza albida</i>           | Tall Fleabane             |
| <i>Coprosma repens</i>         | Mirror Bush               |
| <i>Coreopsis lanceolata</i>    | Coreopsis                 |
| <i>Cortaderia</i> spp.         | Pampas Grass              |
| <i>Hedychium gardnerianum</i>  | Ginger Lily               |
| <i>Hydrocotyle bonariensis</i> | Pennywort                 |
| <i>Impatiens</i> spp.          | Balsam                    |
| <i>Lantana camara</i>          | Lantana                   |
| <i>Ligustrum sinense</i>       | Small-leaved privet       |
| <i>Lilium formosanum</i>       | Formosa Lily              |
| <i>Lonicera japonica</i>       | Honeysuckle               |
| <i>Myriophyllum aquaticum</i>  | Parrots feather           |
| <i>Agastache urticifolia</i>   | Mint                      |
| <i>Nephrolepis cordifolia</i>  | Fishbone Fern             |
| <i>Ochna serrulate</i>         | Mickey Mouse plant        |
| <i>Paspalum</i> spp.           | Paspalum                  |
| <i>Pennisetum clandestinum</i> | Kikuyu                    |

| Scientific Name                                 | Common Name           |
|---|-----------------------|
| <i>Physalis peruviana</i>                       | Cape Gooseberry       |
| <i>Protasparagus aethiopicus</i>                | Asparagus Fern        |
| <i>Pyracantha angustifolia</i>                  | Firethorn             |
| <i>Romulea rosea</i>                            | Onion Grass           |
| <i>Rubus fruticosus</i>                         | Blackberry            |
| <i>Senna coluteoides</i> var. <i>glabrate</i>   | Cassia                |
| <i>Solanum mauritianum</i>                      | Wild Tobacco tree     |
| <i>Solanum nigrum</i>                           | Blackberry Nightshade |
| <i>Stenotaphrum secundatum</i>                  | Buffalo Grass         |
| <i>Thunbergia alata</i>                         | Black-eyed Susan      |
| <i>Tradescantia albiflora</i>                   | Wandering Jew         |
| <i>Watsonia meriana</i> cv. <i>Bulbillifera</i> | Wild Watsonia         |
| <i>Crocodylus x crocosmiiflora</i>              | Montbretia            |
| <i>Delairea odorata</i>                         | Cape Ivy              |
| <i>Erythrina x sykesii</i>                      | Coral Tree            |
| <i>Ficus elastica</i>                           | Rubber Tree           |
| <i>Freesia alba x leichtlinii</i>               | Freesia               |
| <i>Hedera helix</i>                             | English Ivy           |

## HERITAGE

### ABORIGINAL HERITAGE

Aboriginal and cultural heritage encompasses past and present cultural associations of all people in Australia including tradition, knowledge and customs. It can be tangible (have a physical manifestation) or intangible (spiritual or social associations).

Tangible evidence of Aboriginal heritage can be seen through the Midden deposits which are scattered in caves of Ulladulla Harbour. A more comprehensive understanding of Aboriginal heritage within the Millards Creek area could facilitate greater recognition of Aboriginal heritage.

As previously mentioned some bush-food species do occur such as Lilly Pilly (*Acmena smithii*) and may contribute to understanding and recognition of Aboriginal Heritage in future management of Millards Creek.

### EUROPEAN HERITAGE

The European History of 'Millards Creek' can be traced back to 1854 when the Millard brothers established a tannery on the northern bank of the creek. The effects of the tannery were felt until 1939 when the industry declined.

In 1861 Millards Creek was dammed on the western side of St Vincent Street to create water supply for industry. A sawmill was also constructed in this time but burnt down in 1939. That site is now where the Civic Centre is located inclusive of the local library, visitor information centre, function room and car park. Ice making factories along with a sandstone quarry were also situated adjacent to Millards Creek but are no longer present.

In the 1970's sewerage piping was laid within the creek corridor and these cleared dirt tracks left after the pipes were laid became access tracks for residents up until the early 1980's. These desire lines were formalised by a combined cycle and pedestrian pathway constructed in the early 1980's.

## **WATERWAYS**

Millards Creek Urban Stream Corridor plays a key role in maintaining the ecological diversity of the area. The waterway is the main freshwater input into Ulladulla Harbour, which is sensitive to pollutant inputs. Improvements in upper catchment health will have trickledown effects, benefiting downstream areas of the Creek and Harbour.

Maintaining the health of the local water source plays a key role in retaining the intrinsic value of the area while safeguarding biodiversity within this urban catchment. The connection between Creek and Harbour health is highlighted at the entrance, where mangroves and seagrasses play vital roles in providing aquatic species habitat for spawning, breeding, feeding and other purposes. It is fundamental to the functioning of these systems/processes that stream health be maintained.

Significant challenges are faced in this area due to considerable and ongoing impacts/pressures the corridor faces, requiring external assistance to maintain ecological integrity.

The community has demonstrated a keen interest in the management and planning of Millards Creek through community initiatives such as the Millards Creek Bushcare Group, Rivercare projects and Ulladulla Primary and High Schools interactive education programs. Through good management of the influent stormwater and continued vegetation and weed management, the health of the waterway can be maintained and its uses maximised.

## **LAND USE**

A collage of land uses surrounds the Millards Creek Urban Stream Corridor. The majority being residential land with associated business, industrial, open space, rural and special use zones. As can be seen in Figure 4, developed land occupies the vast majority of the catchment with only the main influent truck drainage lines and Millards Creek proper retaining remnants of the natural habitat.

## **ACCESS AND AMENITY**

The area is a highly valued resource in terms of access to and from Ulladulla CBD. Individuals and community groups have utilised the area as a walking track for leisure and as an access path between work, school and social occasions as regularly as on a daily basis.

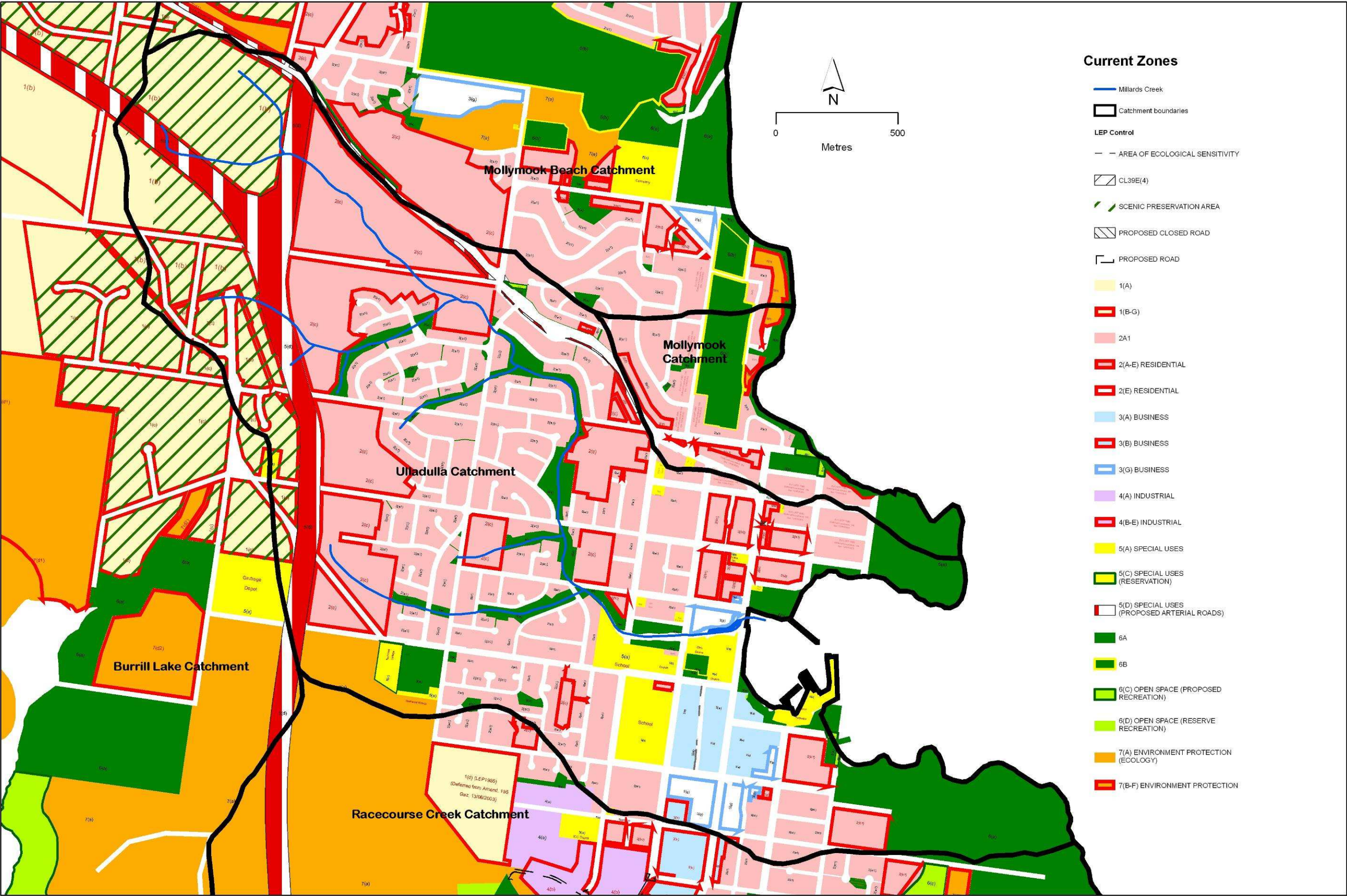
School groups also utilise Millards Creek Urban Stream Corridor as an educational resource for Science, Geography, Art and Personal Development/Health/Physical Educational.

Active recreational uses of Millards Creek as a waterway are limited by the small size of the waterway. However, the entrance area may be used for wading and swimming, particularly atop high tides when seawater enters the tidal reach.

Additionally, the area is further appreciated for its scenic value and for a range of passive recreation activities that are associated with water sources, such as bird watching or as a place of rest. .



Figure 5: Land use zones within Millards Creek Urban Stream Corridor





## KEY VALUES OF THE MILLARDS CREEK URBAN STREAM CORRIDOR

To equitably manage a natural resource requires identification of the key environmental, social and economic values that stakeholders consider important and wish to see preserved or enhanced into the future. Values can be important at a local, regional or national scale.

Through the identification of key values along with the development of an understanding of recognised threats, a series of aims, objectives and actions has been formulated to protect these key values.

Through the inclusion of stakeholder groups in formulating the Plan, key values have been identified to guide management. Processes undertaken to achieve this include:

- Establishment of the Council Committee (Ulladulla Harbour and Millards Creek Natural Resources and Floodplain Management Committee)
- Following the process of plan making with the Committee and the broader community, through public exhibition
- Receipt of submissions followed by the review and response
- Adoption of plan by Council so that resources can be attracted to support the plan's implementation

During preparation, the following were integrated to build up responses and actions to protect identified values and threats.

Recommendations have been made through two student university projects: *The collection of baseline data and the assessment of the health of Millards Creek, Ulladulla* (Priddle, 2006) and the *Development of an interpretive educational program for the Millards Creek Urban Stream Corridor* (Schofield, 2006).

Priddle (2006) states a number of key areas of concern, or areas for improvement as can be seen below:

- Increase water monitoring both in frequency and sample size
- Maintain log of all methodologies and results
- Compare and contrast results more frequently
- Monitor during varied weather conditions
- Monitor and manage sewage overflow which may occur during peak use periods
- Minimise/manage stormwater overflow, sedimentation and erosion from upstream developments.

Further recommendations and key issues have also been noted by Schofield (2006), as can be seen below:

- Negative visitor behaviour
- Lack of supportive infrastructure for amenity and access
- Identification of interpretation preferences
- High use value
- Degraded state of the built environment
- Erosion, sedimentation and compaction

The *Millards Creek Rehabilitation Plan* (SCC, 2005) has also been utilised to build on past efforts and link key areas of the actions. Actions recognised within the Rehabilitation Plan and integrated into the Plan are:

- Remove identified pest plant species

- Identify and reduce negative visitor behaviours
- Minimise and formalise crossing sites
- Improve stormwater management
- Monitor and manage erosion and sedimentation
- Improve and maintain structural integrity of infrastructure.

Studies funded by the now Department for Environment and Climate Change including the: *Investigation and Design of Erosion Protection at Millards Creek Entrance, Ulladulla Harbour* and *Foreshore Reclamation and Protection with Rock Revetment at Millards Creek Entrance, Ulladulla Harbour*, have further highlighted the links between Millards Creek Urban Stream Corridor and Ulladulla Harbour. With these links making particular reference to the need for, and recognition of, Coastal Processes and Total Catchment Management.

Onsite visits conducted throughout the preparation of the report have aided in the identification of key issues for management. Priority areas for management are:

- Areas of low structural integrity
- Stormwater outlets
- Erosion and compaction
- Areas with abundance of weed species
- Sites for educational facilities and materials

Through these processes and a variety of community actions has demonstrated value attributed to the natural resource of Millards Creek in its current form as an urban stream corridor and its link to the CBD, Harbour and Schools.

Values can be examined through the triple bottom lines of social, environmental and economic criteria. These values in their respective categories are:

#### Social Values

- Leisure: the area provides opportunity to partake in passive and active recreation during leisure time
- Equity: ensuring that facilities and services are provided equally to all
- Aesthetics: ensuring that the natural beauty of the area is maintained for generations to come
- Heritage: incorporating the past, present and future uses of the area to retain its valued character
- Community area: the provision and maintenance of the area supports community participation and ownership as well as public awareness
- Use: the area supports a healthy lifestyle through the provision of facilities and infrastructure, hence encouraging use
- Education: by providing a supportive educational environment through infrastructure and informational material where individuals or groups can learn
- Health: provides an easily accessible area for recreation and access in turn promoting and supporting a healthy lifestyle

#### Environmental Values

- Maintenance of biological diversity: ensures continued ecological health for generations to come
- Conservation: preserves remnant vegetation, flora and fauna and in doing so the intrinsic values of the area
- Supportive natural environment: provides areas of wildlife habitat and corridors while allowing positive human interaction

- Bed and Bank stability: aim to effectively drain the urban catchment to Ulladulla harbour without risk of flooding or bank and bed erosion to maintain stability of environment
- Maintenance of clean water: to deliver relatively clean water to Ulladulla harbour that will not detract from the aesthetic and environmental value of the area

#### Economic values

- Tourism and Promotional value: ensures the maintenance of natural beauty of which attracts visitors and new residents to the area.
- Natural educational resource: provides a facility for students, community members and visitors alike to enjoy and learn in a natural pre-existing ecosystem
- Reduced community travel expenses: fuel saving via pedestrian network
- Health saving: minimises cost to attain and maintain health through promoting a healthy lifestyle of outdoor leisure activities

## MANAGEMENT ISSUES

Key issues and conflicts associated with the area were identified by the community, previous task force and new Committee members, Government representatives and from previous studies and reports.

Concerns have been raised by the community about pressures on some of the area's natural resources and the degradation that may occur in the future. If left unchecked these pressures have potential to degrade the values of Millards Creek Urban Stream Corridor that stakeholders wish to retain.

These pressures will be discussed in detail within the management plan section and where appropriate, mitigating management actions have been proposed. To further aid in the identification of key issues they have been prioritised in order of urgency within the action strategy.

### Key Issues

- Stormwater outflow
- Native Vegetation decline
- Overland flows
- Obtrusive infrastructure within creek bed
- Declining water quality
- Access
- Provision of supportive facilities/infrastructure
- Erosion and sedimentation
- Coastal processes
- Negative user behaviour: compaction, encroachment, vandalism, dumping
- Weed species
- Maintenance of best management practices and quality infrastructure
- Effects of changed ecosystem
- Safety
- Unrecognised heritage values
- Integration of management practices with surrounding areas
- Effects of issues on surrounding areas
- Maintenance of riparian corridor
- Integration of natural and built environment
- Connectivity of area with surrounding areas

## MANAGEMENT PLAN

### STRUCTURE OF PLAN

**Values** are statements of what is important about Millards Creek Urban Stream Corridor. These are what the Plan will be trying to protect.

The **issues** of concern are documented in detail. Issues are problems/threats/pressures that, if left unchecked, might degrade the values which stakeholders want to retain.

This Plan is grouped into six management areas that capture the issues in order to maintain key stakeholder values. These management areas are:

1. Water Flow
2. Erosion and Sedimentation
3. Water Quality
4. Nature Conservation
5. Recreation and Access
6. Visual Quality

Each management area is discussed in further detail. For each management area the Plan contains aims, objectives and actions.

**Aims** and **objectives** were developed to ensure that the area's key values are maintained or improved.

**Actions** required to meet specific objectives are detailed for each management area within Table 7, as are the **performance evaluation** which will gauge the effectiveness of the actions. The various actions consist of:

- protective and remedial works
- education programs
- asset management
- monitoring and research
- development policy compliance initiatives

### IMPLEMENTATION

Responsibility for implementation of the Management Plan resides with Council with contribution from landowners, volunteers, builders and other key stakeholders, where they are directly related to or can assist in the management of Millards Creek Urban Stream Corridor. The Ulladulla Harbour and Millards Creek Natural Resources and Floodplain Management Committee will oversee implementation.

Actions will occur quarterly, annually, biannually, in sync with developments (development specific) or as indicated under the heading frequency in the action plan tables. For actions to meet their performance evaluation their completion will be in accordance with their allocated frequency.

Implementation will depend on cost of the actions and the availability of funds. Consequently, some low priority strategies may be implemented in the short term because they require little or no additional funding for implementation.

## **FUNDING SOURCES**

Council may choose to fund many of the actions set out in this Plan. The level of resources provided by Council will be considered along with all of Council's other areas of expenditure within the budget/Management Plan process each year.

A wide range of funding sources could be utilised to implement the plan. These include the Council's own resources and where suitable, grant opportunities from State and Federal Government bodies. Over the last five years State agencies' roles and responsibilities have been reorganised and re-badged on a regular basis. Because of these fluctuations and a desire to maintain this plan's currency in the short to medium term, this plan minimises the use of particular agencies' titles and specific funding programs.

As part of this development it is perceived that grant applications will be made on an annual basis in consultation with the relevant Natural Resources and Floodplain Management Committee so that forward projection of potential budget commitments by Council are captured in Council's Management Plan Process.

## **ADAPTIVE MANAGEMENT - REVIEW**

The priorities in the management plan will be reviewed on an annual basis by Council in consultation with the relevant Natural Resources and Floodplain Management Committee, relevant State government agencies and the wider community if required. Council's State of the Environment reporting is one of the key sources of environmental information that can contribute to this review and trigger adaptation of the priority actions.

## MANAGEMENT AREA 1 – WATER FLOW (WF)

### WF VALUES

The timing, duration and size of freshwater and tidal flows have a significant effect on the ecology and human use of our waterways. The freshwater flows in Millards Creek fluctuate due to the amount of rain, increasing dramatically during downpours and reducing just as quickly. Only the lower reaches of the catchment below the weir leading into Ulladulla Harbour are affected by tides. It is important that these fluctuations in flow are understood and managed accordingly.

Rises in water flows can trigger migration of animals and reproduction in both plants and animals. They can also replenish wetlands and floodplain communities. Pools and wet areas are refuges for plants and animals during dry times.

### WF ISSUES

- Localised overland flow of stormwater into the Creek occurs at times
- Artificial structures in Millards Creek such as the weir and concrete stormwater discharge structures effect water flow
- Weeds can be introduced by stormwater inflows and overtake natives and/or impact on hydraulic conveyance within this area

### WF AIMS

To ensure that water flow in Millards Creek is managed to:

- Minimise negative impacts of concentrated stormwater inflows
- Maintain natural flow variability
- Minimise negative effects of weirs and other structures
- Maintain endemic habitat including the estuarine area
- Encourage development to meet predevelopment hydrology and minimise negative hydraulic impacts such as instability of the bed and banks of the creek

### WF OBJECTIVES

- WF1: Support and maintain natural water flow variability
- WF2: Minimise negative impacts of stormwater drainage and overland flows
- WF3: Minimise negative effects of instream structures

## MANAGEMENT AREA 2 – EROSION AND SEDIMENTATION (ES)

### ES VALUES

Stable soils and creek banks allow the land to remain productive, and sustain ecological and human uses. Waterways are subject to some natural infilling by sediment transported throughout the catchment and eroded from banks. However the rate of erosion and sedimentation may be accelerated by human activities in the catchment.

Erosion and sedimentation also affect the creek ecology by changing the nature of physical conditions such as bed sediment and character and turbidity and nutrient loading.

### ES ISSUES

- The sediment load to Millards Creek is contributed from, but not limited to, erosion of tracks, erosion of unsealed road verges and stormwater drains. Millards Creek, inclusive of its tributaries, discharges into Ulladulla Harbour and therefore affects the harbour water quality, delivering suspended and bedload sediment into harbour.
- Sediment eroded from new urban developments is transported into the creek system.
- Maintenance of the integrity and ecological function of instream and riparian corridor vegetation.
- Stormwater can increase erosion and sedimentation through inappropriate placement of drainage infrastructure.
- Soil compaction and encroachments onto public land can exacerbate erosion potential as can informal track networks and creek crossings.

These issues above increase erosion leading to further sedimentation and higher nutrient loads within the stream corridor. Increased sediment can lead to:

- Reduced light penetration and photosynthesis rates of algae, macrophytes and seagrass
- Clogged gills of fish and affecting the ability of some macroinvertebrates to feed
- Smothers benthic fauna and aquatic vegetation
- Reduced substrate habitat value, filling of voids.
- Changes in composition and rate of sediment deposition can change and limit food supplies for benthic fauna.

Increased nutrient loads can lead to:

- Eutrophication
- Increased algal bloom frequencies
- Changes in structure of aquatic flora and fauna communities – often a reduction in diversity
- Increased turbidity associated with algal blooms
- Reduced levels of dissolved oxygen associated with decay of algae (EPA, 1997)

### ES AIMS

- Minimise negative impacts of erosion and sedimentation on health and amenities of Millards Creek

### ES OBJECTIVES

- ES1: Reduce human induced impacts both direct and indirect occurring within the creeks catchment (i.e. sediment and erosion)
- ES2: Accommodate natural creek processes
- ES3: Utilise best practice stormwater management
- ES4: Minimise erosion of stream banks



- ES5: Protect Millards Creek Urban Stream Corridor from excess sedimentation from development areas
- ES6: Ensure stormwater discharge points have adequate scour protection and are hydraulically stable

## MANAGEMENT AREA 3 – WATER QUALITY (WQ)

### WQ VALUES

Water quality is one of the key factors determining the ecological health of streams. The waters of Millards Creek are important in contributing to the health of the system and adjoining areas.

It is also important to people using Millards Creek for recreational purposes and for those living on its foreshores and adjacent areas.

Millards Creek Urban Stream Corridor is valued for passive recreation and ecological diversity. Problems do occur with water quality from time to time, particularly with bacterial pollution. If the biological communities and habitats of ecological value found in the creek and a variety of recreational opportunities are to be maintained, it is essential the water is of an acceptable quality.

### WQ ISSUES

If water quality is not protected, several key stream and estuarine attributes can degrade as follows:

- The ecology of an estuary (i.e. the diversity and abundance of plant and animal communities) may degrade if water quality levels deteriorate sufficiently
- The visual characteristics and aesthetic appeal of water may diminish (e.g. the water may appear 'dirty', or contain nuisance algae)
- The recreational values of the creek may be degraded or lost

Local industries that rely on existing attributes of a stream or estuary may be affected through reduced tourist interest.

The issues identified during the preparation of this plan were:

- Pollutants washed into the creek through litter, stormwater and dumping
- Sewage contamination, known to have an effect on water quality in the creek from time to time caused by inadequate holding/transporting systems triggered during peak tourist season
- Other pollutants, such as chemical runoff from homes, enter the creek through urban stormwater
- Poor stormwater management practices during construction phase of development
- Erosion and sedimentation can degrade water quality and introduce weeds
- Infrastructure obstructions such as weir and concrete slabs hinder flow allowing build up of pollutants
- Compaction and encroachment lead to reduction of vegetation quantity, health and coverage thereby potentially reducing water quality.
- Open channel discharge points, specifically at Princes Highway and Church Street lack best management practices, contributing to decreased water quality.

### WQ AIMS

To ensure the water quality in the creek is adequate for the protection of:

- Aquatic ecosystems
- Visual amenity
- Secondary contact recreation
- Supporting vital ecological functions
- Ensure landowners seek balance between ecological value, aesthetics, amenity and drainage

**WQ OBJECTIVES**

These objectives are based on the NSW Governments' water quality interim environmental objectives as recommended for systems similar to Millards Creek (EPA, 1999).

- WQ1: Minimise human induced impacts on stream water quality e.g. sediment, nutrients and waste dumping
- WQ2: Maintain Secondary Recreation Water Quality Standards as per ANZECC
- WQ3: Minimise negative impacts of concentrated stormwater discharges into creek
- WQ4: Eliminate existing sources of sewage contamination
- WQ5: Educate residents and visitors on stormwater quality issues and best management practices
- WQ6: Encourage water sensitive urban design

## MANAGEMENT AREA 4 – NATURE CONSERVATION (NC)

### NC VALUES

Millards Creek Urban Stream Corridor supports a range of ecological communities, which is important from a conservation perspective and is also an attractive attribute of the area for many residents and visitors. The following specific nature conservation values were identified during the preparation of this plan:

- The banks of the creeks are mostly vegetated, providing habitat corridors and protecting the creek banks from instream erosion
- Populations of a number of rare or threatened plant and animal species are known to exist in the area
- Holds educational value for local schools, training organisations and broader community

### NC ISSUES

The issues identified during the preparation of this plan were:

- Feral animals known to occur in the Millards Creek area include rabbits, foxes, rats and introduced bird species which threaten native species, both flora and fauna, particularly native birds, small mammals, reptiles and frogs
- Loss of habitat quality
- Loss of vegetation integrity
- Impact of development on water flow and quality
- Decline in water quality
- Weeds impede and outgrow native flora
- Negative user behaviour including but not limited to dumping and encroachment are causing changes within the environment which support weed species and impede on the ecological functions
- Increased erosion through the reduction of supportive native environment due to encroachment and compaction
- Instream and riparian vegetation, including canopy cover, protects pools in low flow times from overheating and loss of dissolved oxygen and triggering of algal blooms

### NC AIMS

To maintain or, where appropriate, rehabilitate the ecological integrity and biodiversity of the urban stream corridor.

### NC OBJECTIVES

- NC1: Conserve and preserve the intrinsic values of Millards Creek Urban Stream Corridor
- NC2: Ensure human use of Millards Creek is sustainable
- NC3: Increase stakeholder awareness on the importance of protecting natural environments
- NC4: Minimise negative human behaviours e.g.: dumping
- NC5: Reduce pest species of flora and fauna
- NC6: Minimise negative impacts of fire protection on the natural values of the area
- NC7: Protect recognised values through maintenance and rehabilitation efforts

## **MANAGEMENT AREA 5 – RECREATION AND ACCESS (RA)**

### **RA VALUES**

Millards Creek Urban Stream Corridor provides opportunities for a diverse range of recreational activities, including nature appreciation, educational activities, exercise, relaxation and as an access path to and from destinations. It supports the tourism industry which is prominent within the Ulladulla area as it creates a place of environmental beauty and interaction.

### **RA ISSUES**

- Absence of walkway connection between the Millards Creek Urban Stream Corridor and Ulladulla Harbour foreshore
- Low quality of facilities
- Provision of supportive recreation and leisure facilities
- Safety of the environment, both natural and built
- Unrecognised site value through key environmental attractions such as the waterfall as well as the unrecognised heritage values of past Indigenous and European use
- Negative visitor behaviour which degrades the quality of visitor experience
- Encroachment and compaction occurring from residents properties as well as users further impedes the productivity of the natural environment destroying the attraction users have come to enjoy

### **RA AIMS**

- To provide high quality amenity and access for residents and visitors whilst protecting and rehabilitating where necessary the natural resources of Millards Creek Urban Stream Corridor.

### **RA OBJECTIVES**

- RA1: Upgrade infrastructure and facilities to support the corridors values to the community
- RA2: Improve access to and within the Millards Creek Urban Stream Corridor and improve links to Harbour foreshore
- RA3: Maintain value of area through preservation of environment quality and creek amenity
- RA4: Minimise negative human behaviours affecting the natural and built assets
- RA5: Incorporate recognition of heritage into current uses

## MANAGEMENT AREA 6 – VISUAL QUALITY (VQ)

### VQ VALUES

The scenic qualities of Millards Creek Urban Stream Corridor are important natural assets for both residents and visitors.

The significance of the area is that it provides a place of natural scenic beauty and an array of distinctive Australian plants and animals. Millards Creek can contribute to a person's sense of place through its provision of walkways, crossings and a waterfall, while offering scenic views from surrounding areas.

### VQ ISSUES

- Degraded aesthetic state due to litter and dumping affecting both the terrestrial and aquatic environments
- Weed growth is promoted through dumping
- Reduction of vegetation through clearing, encroachment and compaction leading to a less productive ecosystem
- Degraded aesthetic value of catchment scenery from unsightly infrastructure
- Weeds look unsightly and impede the natural production of the native environment
- Erosion and sedimentation both contribute to a degraded aesthetics of water and land
- Negative visitor behaviour has created a less safe environment deterring users from the area as there is limited supportive infrastructure for their desired uses

### VQ AIMS

- To maintain, rehabilitate where necessary and enhance where appropriate the high visual qualities of the area
- Maintain aesthetic values attaining high visitor satisfaction

### VQ OBJECTIVES

- VQ1: Maintain visual amenity of the riparian vegetation
- VQ2: Maintain existing vegetation canopy within Millards Creek
- VQ3: Design and implement infrastructure which complements natural surrounds
- VQ4: Remove weeds and encourage native plant regeneration

ACTION PLAN

Table 7: Action Plan

= Responsible Groups/Sections within SCC  
CSO = City Services and Operations Group  
DES = Development and Environmental Services Group

**Key**  
SP = Strategic Planning Group  
SW = Shoalhaven water  
All = All groups within SCC

| Issue                           | Action   | Management area  | Management objective | Priority | Frequency            | Funding       |                      |                        |             | Performance Evaluation  |
|---------------------------------|--|--|----------------------|----------|----------------------|---------------|----------------------|------------------------|-------------|---|
|                                 |  |  |                      |          |                      | Capital Works | Funded               | Operational Activities | Funded      |   |
| STORMWATER                      |  |  |                      |          |                      |               |                      |                        |             |   |
| Stormwater                      | Audit current stormwater infrastructure to identify issue areas and prioritise areas for installation of best management practices   | <ul style="list-style-type: none"><li>Water Flow</li><li>Erosion &amp; Sedimentation</li><li>Water Quality</li></ul> | WF2, ES3             | High     | Biannually           | ✘             | ✘                    | ✓                      | SCC & Grant | <ul style="list-style-type: none"><li>Audit completed</li><li>Installed BMP</li></ul>   |
|                                 |  |  |                      |          |                      |               |                      | CSO & SP               |             |   |
|                                 | Maintain best management practices through continued monitoring and upgrades   |  | WF2, ES3             | Medium   | Annually             | ✘             | ✘                    | ✓                      | SCC & Grant | <ul style="list-style-type: none"><li>Schedule of tasks completed</li></ul>   |
|                                 |  |  |                      |          |                      |               |                      | CSO & SP               |             |   |
|                                 | Reduce/manage discharge velocity at stormwater outlets   |  | ES6, WQ3, WF2        | High     | Development Specific | ✓             | SCC, Grant & Private | ✓                      | SCC & Grant | <ul style="list-style-type: none"><li>Stream Health</li><li>Lack of Scour Basins</li></ul>  |
|                                 |  |  |                      |          |                      | CSO, SP &DES  |                      | CSO, DES & SP          |             |   |
|                                 | Design future developments to minimise impacts on stormwater hydrology   |  | ES6, WQ3, WF1        | Medium   | Development Specific | ✘             | ✘                    | ✓                      | SCC         | <ul style="list-style-type: none"><li>Impact from stormwater outlets</li><li>DA Assessment</li></ul>  |
|                                 |  |  |                      |          |                      |               |                      | CSO, DES & SP          |             |   |
| INFRASTRUCTURE WITHIN CREEK BED |  |  |                      |          |                      |               |                      |                        |             |   |
| Infrastructure within creek bed | Minimise disturbance from instream structures through installation and utilisation of best management practices for current and future infrastructure                                  | <ul style="list-style-type: none"><li>Water Flow</li><li>Erosion and Sedimentation</li><li>Visual Quality</li></ul>  | WF1, WF3, ES2,       | Medium   | Development Specific | ✓             | SCC                  | ✓                      | SCC         | <ul style="list-style-type: none"><li>Unhindered creek flow</li><li>Stream health</li><li>Annual audits</li><li>Structures do not trigger erosion</li></ul> |
|                                 |  |  |                      |          |                      | CSO & SP      |                      | CSO & DES              |             |   |
|                                 | Ensure future structures do not negatively affect flow   |  | WF3,                 | High     | Annually             | ✓             | SCC, Grant & Private | ✘                      | ✘           | <ul style="list-style-type: none"><li>Unhindered creek flow</li><li>Stream health</li></ul>   |
|                                 |  |  |                      |          |                      | CSO, SP & DES |                      |                        |             |   |
|                                 | Utilise natural stream processes in hydraulic design of structures and use natural materials   |  | WF1, VQ3             | High     | Development Specific | ✘             | ✘                    | ✓                      | SCC & Grant | <ul style="list-style-type: none"><li>Unhindered creek flow</li><li>Stream health</li></ul>   |
|                                 |  |  |                      |          |                      |               |                      | CSO & DES              |             |   |
| WATER QUALITY                   |  |  |                      |          |                      |               |                      |                        |             |   |
| Water quality                   | Identify key areas for action, prioritise and implement best management practices for current and future developments  | <ul style="list-style-type: none"><li>Water Quality</li></ul>  | WQ3                  | High     | Annually             | ✘             | ✘                    | ✓                      | SCC         | <ul style="list-style-type: none"><li>Areas identified</li><li>BMP implemented</li></ul>  |
|                                 |  |  |                      |          |                      |               |                      | DES                    |             |   |
|                                 | Monitor water quality in accordance with the ANZECC Recreational Water Quality Guidelines and implement management strategies when the water does not meet Secondary Contact standards |  | WQ2                  | Medium   | Annually             | ✘             | ✘                    | ✓                      | SCC         | <ul style="list-style-type: none"><li>Attain ANZECC levels</li></ul>  |
|                                 |  |  |                      |          |                      |               |                      | DES                    |             |   |
|                                 | Control pollutants at source to prevent entering stormwater utilising actions such as sediment and erosion control at building sites and education                                     |  | WQ3                  | Medium   | Annually             | ✘             | ✘                    | ✓                      | SCC         | <ul style="list-style-type: none"><li>Annual stream health evaluation</li></ul>   |
|                                 |  |  |                      |          |                      |               |                      | DES                    |             |   |
|                                 | Continue to monitor creek for indication of sewage   |  | WQ3, WQ4             | Medium   | Quarterly            | ✘             | ✘                    | ✓                      | SCC         | <ul style="list-style-type: none"><li>Identified</li></ul>  |
|                                 |  |  |                      |          |                      |               |                      |                        |             |   |

| Issue                     | Action  | Management area             | Management objective | Priority | Frequency            | Funding       |             |                        |             | Performance Evaluation   |
|---------------------------|---|-----------------------------|----------------------|----------|----------------------|---------------|-------------|------------------------|-------------|--|
|                           |   |                             |                      |          |                      | Capital Works | Funded      | Operational Activities | Funded      |  |
|                           | contamination   |                             |                      |          |                      |               |             | SW & DES               |             | contamination sites<br>▪ Reduction in contamination  |
|                           | Maintain high quality of infrastructure and to reduce risks of contamination occurring  |                             | WQ3, WQ4             | High     | Biannually           | ✓             | SCC         | ✓                      | SCC & Grant | ▪ Reduction in contamination   |
|                           |   |                             |                      |          |                      | CSO, SP & DES |             | CSO & SP               |             |  |
|                           | Ensure all onsite infrastructure is designed keeping in mind water sensitive urban design   |                             | WQ6                  | Medium   | Development Specific | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Reduced damage to surrounding area   |
|                           |   |                             |                      |          |                      |               |             | DES                    |             |  |
|                           | Rehabilitate and promote riparian vegetation along creek banks to prevent human-induced creek bank erosion while supporting natural erosion processes                         |                             | WQ6                  | High     | Annually             | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Increased productivity and health of riparian areas<br>▪ Reduction erosion<br>▪ Reduced desire lines                                       |
|                           |   |                             |                      |          |                      |               |             | All                    |             |  |
|                           | ACCESS  |                             |                      |          |                      |               |             |                        |             |  |
| Access                    | Identify areas for installation, upgrade and maintenance of access infrastructure utilising best management practices   | ▪ Recreation and Access     | RA1, RA2             | High     | Biannually           | ✓             | SCC & Grant | ✓                      | SCC & Grant | ▪ Areas identified<br>▪ Best management practices utilised<br>▪ Increased and improved infrastructure<br>▪ Higher use of this infrastructure |
|                           |   |                             |                      |          |                      | SP            |             | SP & CSO               |             |  |
|                           | Create structural link from Ulladulla Harbour to Millards Creek through sight and infrastructure  |                             | RA2                  | Low      | Development Specific | ✓             | Grant       | ✓                      | Grant       | ▪ Safer access<br>▪ Increased links  |
|                           |   |                             |                      |          |                      | SP            |             | SP                     |             |  |
|                           | Identify recreational values to be maintained and aim to uphold these in future planning options  |                             | High                 | High     | Biannually           | ✗             | ✗           | ✓                      | SCC         | ▪ Values identified and supported  |
|                           |   |                             |                      |          |                      |               |             | SP                     |             |  |
| EROSION AND SEDIMENTATION |   |                             |                      |          |                      |               |             |                        |             |  |
| Erosion and sedimentation | Encourage new developments to undertake water sensitive urban design  | ▪ Erosion and Sedimentation | ES1                  | High     | Development Specific | ✗             | ✗           | ✓                      | SCC         | ▪ DA assessment  |
|                           |   |                             | DES                  |          |                      |               |             |                        |             |  |
|                           | Ensure best management practices are utilised during planning, maintenance and installation of current and future infrastructure through continued maintenance and monitoring |                             | ES1                  | High     | Development Specific | ✗             | ✗           | ✓                      | SCC         | ▪ Maintained stream health<br>▪ Compliance with DA inspection  |
|                           |   |                             |                      |          |                      |               |             | DES                    |             |  |
|                           | Rehabilitate and promote riparian vegetation along creek banks to prevent human-induced creek bank erosion  |                             | ES1                  | Medium   | Annually             | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Stream health<br>▪ Reduced desire lines  |
|                           |   |                             |                      |          |                      |               |             | All                    |             |  |
|                           | Account for natural processes when developing future installations  |                             | ES3                  | Medium   | Development Specific | ✗             | ✗           | ✓                      | SCC         | ▪ Stable new installations   |
|                           |   |                             |                      |          |                      |               |             | SP                     |             |  |
|                           | Rehabilitate and promote riparian vegetation along creek banks  |                             | ES4                  | High     | Annually             | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Stream Health<br>▪ Maintained riparian corridor  |
|                           |   |                             |                      |          |                      |               |             | CSO & SP               |             |  |
|                           | Identify causes of stream bank erosion and implement best management practices to target these  |                             | ES4                  | High     | Annually             | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Stream health<br>▪ Reduced expenditure   |
|                           |   |                             |                      |          |                      |               |             | CSO & SP               |             |  |



| Issue  | Action   | Management area  | Management objective    | Priority | Frequency                      | Funding       |             |                          |             | Performance Evaluation   |
|--|--|--|-------------------------|----------|--------------------------------|---------------|-------------|--------------------------|-------------|--|
|  |  |  |                         |          |                                | Capital Works | Funded      | Operational Activities   | Funded      |  |
|  | During development and after completion ensure residents utilise natural environment and landscape accordingly   |  | ES5                     | Medium   | Biannually                     | ✗             | ✗           | ✓                        | SCC         | ▪ Stream health<br>▪ Degree of weed infestation  |
|  |  |  | DES & CSO               |          | ▪ Compliance review            |               |             |                          |             |  |
|  | Undertake sediment and erosion control on building sites   |  | ES5                     | High     |                                | Annually      | ✗           | ✗                        | ✓           | SCC  |
|  |  |  | DES                     |          |                                |               |             |                          |             |  |
| COASTAL PROCESSES  |  |  |                         |          |                                |               |             |                          |             |  |
| Coastal processes  | Monitor and manage coastal processes of Ulladulla Harbour and Millards Creek entrance ensuring DECC are consulted and/or made aware of findings and management aims and procedures | ▪ Erosion and Sedimentation<br>▪ Nature Conservation<br>▪ Recreation and Access  | ES4, NC1, NC7, RA1, RA3 | High     | Ongoing                        | ✓             | SCC & Grant | ✓                        | SCC & Grant | ▪ DECC informed of findings/developments<br>▪ Processes identified and appropriate management undertaken |
|  |  |  |                         |          |                                | All           |             | All                      |             |  |
| NEGATIVE USER BEHAVIOUR  |  |  |                         |          |                                |               |             |                          |             |  |
| Negative user behaviour: compaction, encroachment, vandalism, dumping  | Reduce negative user behaviour through identification of negative user groups and associated behaviours, targeting works to reduce these   | ▪ Erosion and Sedimentation<br>▪ Water Quality<br>▪ Nature Conservation<br>▪ Recreation and Access<br>▪ Visual Quality | ES1, WQ1, WQ5, RA4      | Medium   | 5 years                        | ✗             | ✗           | ✓                        | SCC         | ▪ Behaviours identified<br>▪ Reduction in behaviour  |
|  |  |  | All                     |          |                                |               |             |                          |             |  |
|  | Ensure human use, such as compaction, does not negatively effect natural processes   |  | ES2                     | Medium   | Biannually                     | ✗             | ✗           | ✓                        | SCC         | ▪ Reduced desire lines   |
|  |  |  | CSO                     |          |                                |               |             |                          |             |  |
|  | Rehabilitate and promote riparian vegetation along creek banks to prevent human-induced creek bank erosion while supporting natural erosion processes                              |  | ES1, ES2                | Medium   | 5 years                        | ✗             | ✗           | ✓                        | SCC & Grant | ▪ Healthier riparian corridor<br>▪ Reduced desire lines  |
|  |  |  | All                     |          |                                |               |             |                          |             |  |
|  | Assess user impacts against Ecological Sustainable Development principles and manage to preserve these   |  | NC2                     | Medium   | Biannually                     | ✗             | ✗           | ✓                        | SCC         | ▪ Maintenance of ESD principles  |
|  |  |  | DES                     |          |                                |               |             |                          |             |  |
|  | Engage community participation throughout area to increase awareness of importance and role in protecting this natural area  |  | NC3, RA3                | Medium   | Development Specific           | ✗             | ✗           | ✓                        | SCC & Grant | ▪ Increased community use<br>▪ Reduction negative user behaviours  |
|  |  |  | CSO & DES               |          |                                |               |             |                          |             |  |
|  | Increase community consultation to increase community awareness and appreciation for area  |  | NC3, NC4, RRA3          | Medium   | Development Specific           | ✗             | ✗           | ✓                        | SCC & Grant | ▪ Increased community use<br>▪ Reduction negative user behaviours  |
|  |  |  | CSO & DES               |          |                                |               |             |                          |             |  |
|  | Remove rubbish from area   |  | VQ1                     | Medium   | Annually/ Development Specific | ✗             | ✗           | ✓                        | SCC & Grant | ▪ Redacted rubbish<br>▪ Reduced maintenance  |
|  |  |  | Waste & CSO             |          |                                |               |             |                          |             |  |
| Continue to monitor and management identified negative user behaviours   | ES1  | Medium   | 5 years                 | ✗        | ✗                              | ✓             | SCC         | ▪ Reduction in behaviour |             |  |
|  |  | CSO & SP   |                         |          |                                |               |             |                          |             |  |
| Ensure those partaking in negative behaviours are aware of the effects of their actions through enforcement and monitoring | RA4  | Medium   | Ongoing                 | ✗        | ✗                              | ✓             | SCC         | ▪ Reduction in behaviour |             |  |
|  |  | CSO, DES & Rangers   |                         |          |                                |               |             |                          |             |  |
| PEST SPECIES   |  |  |                         |          |                                |               |             |                          |             |  |
| Pest species of flora and fauna  | Identify causes of weed introduction and target actions to stop this   | ▪ Nature Conservation<br>▪ Visual Quality  | NC5                     | Medium   | Annually                       | ✗             | ✗           | ✓                        | SCC         | ▪ Reduced introduction   |
|  |  |  |                         |          |                                |               |             | CSO                      |             |  |

| Issue  | Action  | Management area  | Management objective | Priority | Frequency                        | Funding       |             |                        |             | Performance Evaluation   |
|--|---|--|----------------------|----------|----------------------------------|---------------|-------------|------------------------|-------------|--|
|  |   |  |                      |          |                                  | Capital Works | Funded      | Operational Activities | Funded      |  |
|  | Encourage land owners to utilise native plant species to minimise spread of introduced species  |  | VQ3, VQ4             | High     | Ongoing/<br>Development Specific | ✗             | ✗           | ✓                      | SCC         | ▪ Reduced spread of introduced species<br>▪ Increased habitat for native species<br>▪ Increased number of native species |
|  |   |  |                      |          |                                  |               | DES         |                        |             |  |
|  | Identify key areas of weed infestation, removing species which threaten and compete with native habitat and rehabilitate through the utilisation of best management practices |  | VQ1, VQ3, VQ4        | High     | Annually                         | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Reduced weed infestation   |
|  |   |  |                      |          |                                  |               | CSO & SP    |                        |             |  |
|  | Ensure follow up removal and revegetation takes place   |  | VQ4                  | High     | Development Specific             | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Reduced weed infestation<br>▪ Increased native vegetation  |
|  |   |  |                      |          |                                  |               | CSO         |                        |             |  |
|  | Utilise best management practices to remove items from dumping sites  |  | NC7                  | Medium   | Annually                         | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Decreased dumped materials   |
|  |   |  |                      |          |                                  |               | Waste       |                        |             |  |
|  | Stop the introduction of pest species through monitoring and community education  |  | NC5                  | High     | Annually                         | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Reduced spread of species  |
|  |   |  |                      |          |                                  |               | CSO         |                        |             |  |
|  | Continue to encourage Bushcare and other volunteer organisations to implement weed control action plans   |  | NC5                  | Medium   | Ongoing                          | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Weed control plan in place   |
|  |   |  |                      |          |                                  |               | CSO         |                        |             |  |
|  | Identify pest species, target key areas for action and utilise best management practices to reduce amount and affect these are having   |  | NC5                  | Medium   | Annually                         | ✗             | ✗           | ✓                      | SCC & Grant | ▪ Decreased numbers  |
|  |   |  |                      |          |                                  |               | CSO         |                        |             |  |
| UNRECOGNISED HERITAGE VALUES                               |   |  |                      |          |                                  |               |             |                        |             |  |
| Unrecognised heritage values                               | Identify heritage areas of value ensuing their management and maintenance is considered throughout planning, development and management                                       | ▪ Recreation and Access  | RA5                  | Low      | Development Specific             | ✗             | ✗           | ✓                      | SCC         | ▪ Maintained health/character of these sites   |
|  |   |  |                      |          |                                  |               | SP          |                        |             |  |
|  | Create awareness and foster appreciation of heritage values   |  | RA5                  | Low      | Development Specific             | ✗             | ✗           | ✓                      | SCC         | ▪ Increased awareness<br>▪ Maintenance of heritage areas<br>▪ Identification of heritage sites                           |
|  |   |  |                      |          |                                  |               | CSO & SP    |                        |             |  |
|  | Further investigate known heritage of area  |  | RA5                  | Low      | 5 years                          | ✗             | ✗           | ✓                      | SCC         |  |
|  |   |  |                      |          |                                  |               |             |                        |             |  |
| INTEGRATION OF MANAGEMENT PRACTICES                        |   |  |                      |          |                                  |               |             |                        |             |  |
| Integration of management practices with surrounding areas | Identify key values and work to integrate these into all management bodies practices and objectives   | ▪ Recreation and Access<br>▪ Water Quality<br>▪ Nature Conservation<br>▪ Visual Quality<br>▪ Erosion and Sedimentation<br>▪ Water Flow | All                  | High     | Development Specific             | ✓             | SCC & Grant | ✓                      | SCC & Grant | ▪ Integrated management practices  |
|  |   |  |                      |          | All                              |               | All         |                        |             |  |
|  | Adopt a holistic management approach ensuring pre-existing management practices are acknowledged and integrated into future management practices and objectives               |  | All                  | High     | Development Specific             | ✓             | SCC & Grant | ✓                      | SCC & Grant | ▪ Integrated management practices  |
|  |   |  |                      |          | All                              |               | All         |                        |             |  |
|  | Integrate management bodies so as to ensure holistic and informed development/management decisions are made   |  | All                  | High     | Development Specific             | ✓             | SCC & Grant | ✓                      | SCC & Grant | ▪ Integrated management practices  |
|  |   |  | All                  |          | All                              |               |             |                        |             |  |
| MAINTENANCE OF RIPARIAN CORRIDOR                           |   |  |                      |          |                                  |               |             |                        |             |  |

| Issue                            | Action  | Management area  | Management objective                   | Priority | Frequency                     | Funding       |             |                        |             | Performance Evaluation  |
|----------------------------------|---|--|--|----------|-------------------------------|---------------|-------------|------------------------|-------------|---|
|                                  |   |  |  |          |                               | Capital Works | Funded      | Operational Activities | Funded      |   |
| Maintenance of riparian corridor | Recreate vegetation links from stream trunk to tributaries through greening of streetscape utilising recommended flora from species list (Appendix 1)   | <ul style="list-style-type: none"> <li>▪ Nature Conservation</li> <li>▪ Erosion and Sedimentation</li> <li>▪ Visual Quality</li> <li>▪ Water Quality</li> <li>▪ Recreation and Access</li> </ul> | ES4, WQ6, NC1, NC7, RA3, VQ1, VQ2, VQ4 | High     | Ongoing/ Development Specific | ✘             | ✘           | ✓                      | SCC & Grant | <ul style="list-style-type: none"> <li>▪ Increased aesthetics</li> <li>▪ Increased vegetation along streetscape</li> </ul>  |
|                                  | Rehabilitate riparian corridor (trunk and tributaries) to achieve categories 2/3 riparian corridor through revegetation of riparian area utilising recommended flora from species list (Appendix 1) |  | ES4, WQ6, NC1, NC7, RA3, VQ1, VQ2, VQ4 | High     | Ongoing/ Development Specific | ✘             | ✘           | ✓                      | SCC & Grant | <ul style="list-style-type: none"> <li>▪ Increased width of riparian corridor</li> </ul>  |
|                                  | Advocate category 3 riparian corridor along full length of main stream trunk, through maintenance of 10m riparian zone, 3m amenity zone and 2m maintenance zone (Figure 3)                          |  | ES4, WQ6, NC1, NC7, RA3, VQ1, VQ2, VQ4 | High     | Ongoing/ Development Specific | ✘             | ✘           | ✓                      | SCC & Grant | <ul style="list-style-type: none"> <li>▪ Maintenance of prescribed widths</li> </ul>  |
|                                  | Rehabilitate native vegetation through the minimisation of weed species and the utilisation of native vegetation in revegetation/regeneration works   |  | ES1                                    | Medium   | Annually                      | ✘             | ✘           | ✓                      | SCC & Grant | <ul style="list-style-type: none"> <li>▪ Stream health</li> <li>▪ Reduced desire lines</li> </ul>   |
|                                  | Ensure the provision and maintenance of infrastructure which promotes and supports positive user behaviour  |  | NC1                                    | Low      | Biannually                    | ✘             | ✘           | ✓                      | Grant       | <ul style="list-style-type: none"> <li>▪ Change behaviour</li> <li>▪ Maintained areas health</li> </ul>   |
|                                  | Encourage land owners to use native species within gardens to minimise spread of weed species   |  | NC5, VQ4                               | High     | Annually                      | ✘             | ✘           | ✓                      | SCC         | <ul style="list-style-type: none"> <li>▪ Reduced spread of introduced species</li> <li>▪ Increased habitats for native species</li> <li>▪ Increased number of native species</li> </ul> |
|                                  | Ensure developments meet guidelines for Ecological Sustainable Development  |  | NC1                                    | High     | Development Specific          | ✘             | ✘           | ✓                      | SCC         | <ul style="list-style-type: none"> <li>▪ DA Application</li> </ul>  |
|                                  | Maintain natural processes through rehabilitation and the protection of riparian vegetation   |  | NC1                                    | Medium   | Annually                      | ✘             | ✘           | ✓                      | SCC & Grant | <ul style="list-style-type: none"> <li>▪ Maintained health</li> </ul>   |
|                                  | Maintain support for Bushcare groups  |  | NC7                                    | Medium   | Ongoing                       | ✘             | ✘           | ✓                      | SCC & Grant | <ul style="list-style-type: none"> <li>▪ Involvement in projects</li> </ul>   |
|                                  | Increase and continue monitoring of key environmental indicators  |  | NC7                                    | Medium   | Annually                      | ✘             | ✘           | ✓                      | SCC & Grant | <ul style="list-style-type: none"> <li>▪ Increased/maintained health of system</li> </ul>   |
|                                  | Ensure all works meet standards of fire conscious design  |  | NC6                                    | High     | Development Specific          | ✘             | ✘           | ✓                      | SCC         | <ul style="list-style-type: none"> <li>▪ DA Application</li> </ul>  |
|                                  | Maintain objectives and width of Category 3 riparian corridor   |  | All NC                                 | High     | Development Specific          | ✓             | SCC & Grant | ✓                      | SCC & Grant | <ul style="list-style-type: none"> <li>▪ Maintained objectives</li> </ul>   |
|                                  | Where viable maintain objectives and width of Category 1 and 2 riparian corridor  |  | All NC                                 | High     | Development Specific          | ✓             | SCC & Grant | ✓                      | SCC & Grant | <ul style="list-style-type: none"> <li>▪ Maintained objectives</li> </ul>   |
|                                  | Minimise fire hazards on property and within urban  |  | NC6                                    | High     | Development                   | ✘             | ✘           | ✓                      | SCC         | <ul style="list-style-type: none"> <li>▪ DA Application</li> </ul>  |

| Issue   | Action   | Management area  | Management objective | Priority             | Frequency            | Funding       |             |                        |                                 | Performance Evaluation  |
|---|--|--|----------------------|----------------------|----------------------|---------------|-------------|------------------------|---------------------------------|---|
|   |  |  |                      |                      |                      | Capital Works | Funded      | Operational Activities | Funded                          |   |
|   | stream corridor through monitoring and continued maintenance of fire safety standards  |  |                      |                      | Specific             |               |             | SP & CSO               |                                 | ▪ Area identification   |
|   | Identify key values to be protected which will determine key areas for rehabilitation  |  | NC7                  | Medium               | Biannually           | ✘             | ✘           | ✓                      | SCC                             |   |
|   |  |  | SP & CSO             |                      |                      |               |             |                        |                                 |   |
| INTEGRATION OF NATURAL AND BUILT ENVIRONMENT  |  |  |                      |                      |                      |               |             |                        |                                 |   |
| Integration of natural and built environment  | Utilise natural products and sensitive urban design during the design and implementation of infrastructure   | ▪ Visual Quality   | VQ3                  | Medium               | Development Specific | ✘             | ✘           | ✓                      | SCC                             | ▪ Maintained levels of sensitive urban design<br>▪ Maintained aesthetics of area              |
|   |  |  | CSO, SP & DES        |                      |                      |               |             |                        |                                 |   |
|   | Utilise natural surrounds in design stages to maintain and incorporate pre-existing environment  | VQ3  | Medium               | Development Specific | ✘                    | ✘             | ✓           | SCC                    | ▪ Maintained aesthetics of area |   |
|   |  |  | CSO & DES            |                      |                      |               |             |                        |                                 |   |
| INTEGRATION OF KEY ENVIRONMENTAL PROCESSES  |  |  |                      |                      |                      |               |             |                        |                                 |   |
| Integration of key environmental process between Millards Creek and Ulladulla Harbour | Understand and incorporate into management practices, the integration of environmental processes (such as key threatening processes) within the catchment area   | ▪ Recreation and Access<br>▪ Water Quality<br>▪ Nature Conservation<br>▪ Visual Quality<br>▪ Erosion and Sedimentation<br>▪ Water Flow | All                  | High                 | Development Specific | ✓             | SCC & Grant | ✓                      | SCC & Grant                     | ▪ Integrated management achieved  |
|   |  |  | All                  |                      | All                  |               |             |                        |                                 |   |
|   | Maintain and enhance connectivity of management practices for integration of environmental processes   |  | All                  | High                 | Development Specific | ✓             | SCC & Grant | ✓                      | SCC & Grant                     | ▪ Integrated management achieved  |
|   |  |  | All                  |                      | All                  |               |             |                        |                                 |   |
|   | Ensure holistic management is maintained and achieved within and between Millards Creek and Ulladulla Harbour  |  | All                  | High                 | Development Specific | ✓             | SCC & Grant | ✓                      | SCC & Grant                     | ▪ Integrated management achieved  |
|   |  |  | All                  |                      | All                  |               |             |                        |                                 |   |
| EDUCATION   |  |  |                      |                      |                      |               |             |                        |                                 |   |
| Education   | Utilising key values and recognised issue areas to conduct targeted education  | ▪ Recreation and Access<br>▪ Water Quality<br>▪ Nature Conservation<br>▪ Visual Quality<br>▪ Erosion and Sedimentation<br>▪ Water Flow | NC7                  | Medium               | Biannually           | ✘             | ✘           | ✓                      | SCC & Grant                     | ▪ Maintenance of values   |
|   |  |  | DES & SP             |                      |                      |               |             |                        |                                 |   |
|   | Conduct community education to facilitate environmental appreciation   |  | RA3                  | Medium               | 5 years              | ✘             | ✘           | ✓                      | SCC & Grant                     | ▪ Reduced negative impacts<br>▪ Health environment  |
|   |  |  | CSO, SP & DES        |                      |                      |               |             |                        |                                 |   |
|   | Run education sessions on appropriate management of building sites   |  | ES5, WQ3             | Medium               | 5 years              | ✘             | ✘           | ✓                      | SCC & Grant                     | ▪ Compliance records  |
|   |  |  | DES                  |                      |                      |               |             |                        |                                 |   |
|   | Through education and supportive infrastructure and management processes ensure user impacts do not increase naturally occurring processes   |  | ES4                  | Medium               | Biannually           | ✘             | ✘           | ✓                      |                                 | ▪ Stream Health<br>▪ Reduced desire lines   |
|   |  |  | SP & CSO             |                      |                      |               |             |                        |                                 |   |
|   | Utilise varied education techniques (pamphlets, interpretation, community involvement, events, tours, programs, demonstrations) to reduce negative user behaviours and encourage positive user behaviour |  | ES1, WQ5, NC3, VQ1   | High                 | Ongoing              | ✘             | ✘           | ✓                      | SCC & Grant                     | ▪ Stream Health<br>▪ Reduction in litter<br>▪ Increased understanding of management practices |
|   |  |  | SP &DES              |                      |                      |               |             |                        |                                 |   |
|   | Identify negative user behaviours and reduce these through targeted education  |  | NC1, NC2, NC4        | High                 | Biannually           | ✘             | ✘           | ✓                      | SCC & Grant                     | ▪ Maintained area health  |
|   |  |  | CSO & SP             |                      |                      |               |             |                        |                                 |   |
|   | Minimise pollutants entering creek though maintaining best management practices and  |  | WQ3                  | High                 | Annually             | ✘             | ✘           | ✓                      | SCC & Grant                     | ▪ Stream health<br>▪ Reduced  |

| Issue | Action  | Management area | Management objective | Priority | Frequency            | Funding       |        |                        |             | Performance Evaluation   |
|-------|---|-----------------|----------------------|----------|----------------------|---------------|--------|------------------------|-------------|--|
|       |   |                 |                      |          |                      | Capital Works | Funded | Operational Activities | Funded      |  |
|       | stopping at source  |                 |                      |          |                      |               |        | CSO                    |             | maintenance  |
|       | Provide opportunity for community participation to foster and heighten community understanding                                  |                 | WQ6                  | Medium   | Development Specific | ✘             | ✘      | ✓                      | SCC         | ▪ Increased participation<br>▪ Reduced negative impacts  |
|       |   |                 |                      |          |                      |               |        | CSO                    |             |  |
|       | Promote positive user behaviour through education and the installation of supportive infrastructure                             |                 | NC1                  | Low      | Development Specific | ✘             | ✘      | ✓                      | SCC & Grant | ▪ Changed behaviour<br>▪ maintained area health  |
|       |   |                 |                      |          |                      |               |        | CSO & DES              |             |  |
|       | Educate residents on appropriate use and disposal of chemicals, fertilisers and house and garden waste                          |                 | WQ3                  | Medium   | Annually             | ✘             | ✘      | ✓                      | SCC & Grant | ▪ Reduced rates of runoff<br>▪ Improved stream health  |
|       |   |                 |                      |          |                      |               |        | CSO Waste              |             |  |
|       | Utilise community/organisations to implement key changes where viable through consultation and participation                    |                 | RA3, NC4             | High     | Development Specific | ✘             | ✘      | ✓                      | SCC         | ▪ Continued support from organisations<br>▪ Increased knowledge base of individuals<br>▪ Reduced cost to managing body |
|       |   |                 |                      |          |                      |               |        | All                    |             |  |
|       | Educate users as to what effect their actions have on the environment   |                 | NC3, RA4, RA3, VQ1   | Medium   | Biannually           | ✘             | ✘      | ✓                      | SCC         | ▪ Decreased negative behaviour<br>▪ Reduced need for maintenance   |
|       |   |                 |                      |          |                      |               |        | CSO & SP               |             |  |
|       | Ensure those partaking in negative behaviours are made aware of the effects of their actions through enforcement and monitoring |                 | RA4                  | Medium   | Annually             | ✘             | ✘      | ✓                      | SCC         | ▪ Reduction in negative impacts<br>▪ Reduced need for monitoring   |
|       |   |                 |                      |          |                      |               |        | CSO, DES & Rangers     |             |  |
|       | Continue to monitor behaviour and health of environment, refocusing education to meet newly identified needs                    |                 | NC4                  | Medium   | Annually             | ✘             | ✘      | ✓                      | SCC & Grant | ▪ Maintained health  |
|       |   |                 |                      |          |                      |               |        | DES & CSO              |             |  |

## REFERENCES

- Australian and New Zealand Environment and Conservation Council (ANZECC), 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality: Chapter 5 - Guidelines for recreational water quality and aesthetics, ANZECC.
- Carr, P.F., 1998, Subduction-related Late Permian shoshonites of the Sydney Basin, Australia. *Journal of Mineralogy and Petrology*, Vol. 63, No. 1-2, Pp. 49-71.
- Department of Industry, Planning and Natural Resources (DIPNR), 2004, Riparian Corridor Management Study covering all of the Wollongong Local Government Area and Calderwood Valley in the Shellharbour Local Government Area. DIPNR, Wollongong.
- Environment Protection Authority (EPA), 1999, Water Quality and River Flow Interim Environmental Objectives: Guidelines for River, Groundwater and Water Management Committees - Clyde River to Jervis Bay Catchments, EPA, Sydney.
- Jones, S., 2006, Explanatory Notes: SCC Vegetation Mapping Project, Unpublished.
- National Parks and Wildlife Service (NPWS), 1995, Threatened Species Conservation Act, NPWS, Sydney.
- National Parks and Wildlife Service (NPWS), 1974, National Parks and Wildlife Act, NPWS, Sydney.
- Priddle, L., 2006, The collection of baseline data and the assessment of the health of Millards Creek, Ulladulla, Unpublished.
- Rose, G. (Compiler), 1996, Australia 1:25000 Geological Series Sheet SI 56-13 Ulladulla, Geological Survey of NSW, Sydney.
- Schofield, A., 2006, Development of an interpretive educational program for the Millards Creek Urban Stream Corridor, Unpublished.
- Shoalhaven City Council (SCC), 2005, Draft Millards Creek Rehabilitation Plan January 2005 and beyond, SCC, Unpublished.
- Tye, S. C., Fielding, C. R., and Jones, B.J., 1996. Stratigraphy and Sedimentology of the Permian Talaterang and Shoalhaven Groups in the southernmost Sydney Basin, NSW. *Australian Journal of Earth Sciences* Vol. 43, pp. 57-69.
- Tye, S. C. and Jones B.J., 2000, Sydney Basin Field Trip, Prepared for Oil Company of Australia, Brisbane, Unpublished.

## APPENDIX

### Appendix 1: Species List

| Trees |  |  |
|-------|--|--|
| 1     | <i>Acacia longifolia</i> var. <i>longifolia</i>      | Sydney Golden Wattle                   |
| 2     | <i>Acacia longifolia</i> var. <i>sophorae</i>        | Coastal Wattle                         |
| 3     | <i>Acacia mabellae</i>                               | Mabel's Wattle                         |
| 4     | <i>Acacia mearnsii</i>                               | Black Wattle                           |
| 5     | <i>Acacia terminalis</i> ssp. <i>angustifolia</i>    | Sunshine Wattle                        |
| 6     | <i>Acmena smithii</i>                                | Lillypilly                             |
| 7     | <i>Backhousia myrtifolia</i>                         | Grey Myrtle                            |
| 8     | <i>Banksia serrata</i>                               | Saw Tooth Banksia                      |
| 9     | <i>Callicoma serratifolia</i>                        | False Wattle / Black Wattle            |
| 10    | <i>Casuarina cunninghamiana</i>                      | River She-oak                          |
| 11    | <i>Casuarina glauca</i>                              | Swamp She-oak                          |
| 12    | <i>Ceratopetalum apetalum</i>                        | Coachwood                              |
| 13    | <i>Ceratopetalum gummiferum</i>                      | NSW Christmas Bush                     |
| 14    | <i>Clerodendrum tomentosum</i>                       | Hairy Clerodendrum                     |
| 15    | <i>Corymbia gummifera</i>                            | Red Bloodwood                          |
| 16    | <i>Davidsonia jerseyana</i>                          | Davidson's Plum                        |
| 17    | <i>Doryphora sassafras</i>                           | Sassafras                              |
| 18    | <i>Elaeocarpus reticulatus</i>                       | Blueberry Ash                          |
| 19    | <i>Eucalyptus botryoides</i>                         | Bangalay                               |
| 20    | <i>Eucalyptus pilularis</i> ssp. <i>pilularis</i>    | Blackbutt                              |
| 21    | <i>Eucalyptus saligna</i>                            | Sydney Blue Gum                        |
| 22    | <i>Eucalyptus tereticornis</i>                       | Forest Red Gum                         |
| 23    | <i>Ficus macrophylla</i>                             | Moreton Bay Fig                        |
| 24    | <i>Glochidion ferdinandi</i>                         | Cheese Tree                            |
| 25    | <i>Hakea salicifolia</i>                             | Willow-leafed Hakea                    |
| 26    | <i>Melaleuca armillaris</i>                          | Bracelet Honeymyrtle                   |
| 27    | <i>Melaleuca ericifolia</i>                          | Swamp Paperbark                        |
| 28    | <i>Melaleuca hypericifolia</i>                       | Hillock Bush                           |
| 29    | <i>Melaleuca squarrosa</i>                           | Scented Paperbark                      |
| 30    | <i>Melaleuca styphelioides</i>                       | Prickly-leaved Paperbark               |
| 31    | <i>Notelaea venosa</i>                               | Mock Olive                             |
| 32    | <i>Omalanthus populifolius</i>                       | Bleeding Heart                         |
| 33    | <i>Pittosporum revolutum</i>                         | Rough Fruit Pittosporum                |
| 34    | <i>Pittosporum undulatum</i>                         | Sweet Pittosporum                      |
| 35    | <i>Polyscias murrayi</i>                             | Umbrella Tree / Pencil Cedar           |
| 36    | <i>Polyscias sambucifolia</i>                        | Elderberry Panax                       |
| 37    | <i>Schizomeria ovata</i>                             | Crab Apple / White Cherry / Snow Berry |
| 38    | <i>Seringia arborescens</i>                          |  |
| 39    | <i>Syncarpia glomulifera</i> ssp. <i>glomulifera</i> | Turpentine                             |
| 40    | <i>Synoum glandulosum</i>                            | Bastard Rosewood                       |
| 41    | <i>Trema tomentosa</i> var. <i>viridis</i>           | Peach-leaf Poison Bush                 |
| 42    | <i>Tristaniopsis collina</i>                         | Mountain Water Gum / Hill Kanuka       |

| Shrubs |  |   |
|--------|--|---|
| 43     | <i>Acacia browniei</i>                                 | Prickly Moses.                            |
| 44     | <i>Acacia myrtifolia</i>                               | Myrtle Wattle                             |
| 45     | <i>Acacia suaveolens</i>                               | Sweet-scented Wattle                      |
| 46     | <i>Acacia ulicifolia</i>                               | Prickly Moses                             |
| 47     | <i>Amperea xiphoclada</i> var. <i>papillata</i>        | Broom Spurge                              |
| 48     | <i>Aotus ericoides</i>                                 | Aotus                                     |
| 49     | <i>Avicennia marina</i> var. <i>australasica</i>       | Grey Mangrove                             |
| 50     | <i>Babingtonia pluriflora</i>                          | Heath-myrtle                              |
| 51     | <i>Banksia spinulosa</i> ssp. <i>spinulosa</i>         | Hairpin Banksia                           |
| 52     | <i>Bauera rubioides</i>                                | River Rose                                |
| 53     | <i>Bossiaea obcordata</i>                              | Spiny Bossiaea                            |
| 54     | <i>Breynia oblongifolia</i>                            | Breynia                                   |
| 55     | <i>Cassinia aculeata</i>                               | Common Cassinia / Dogwood / Mountain Itch |
| 56     | <i>Cassinia uncata</i>                                 | Bent Cassinia                             |
| 57     | <i>Correa lawrenciana</i>                              | Mountain Correa                           |
| 58     | <i>Correa reflexa</i> var. <i>reflexa</i>              | Common Correa / Native Fuschia            |
| 59     | <i>Dillwynia floribunda</i> var. <i>floribunda</i>     |   |
| 60     | <i>Dodonaea triquetra</i>                              | Common Hop Bush                           |
| 61     | <i>Galium binifolium</i>                               | Bedstraws                                 |
| 62     | <i>Geranium homeanum</i>                               | Northern Cranesbill                       |
| 63     | <i>Gompholobium latifolium</i>                         | Glory Wedge Pea / Golden Glory Pea        |
| 64     | <i>Gonocarpus teucroides</i>                           | Germander Raspswort                       |
| 65     | <i>Goodenia ovata</i>                                  | Hop-Goodenia                              |
| 66     | <i>Goodenia paniculata</i>                             | Swamp Goodenia                            |
| 67     | <i>Grevillea shiressii</i>                             | Forest Rambler                            |
| 68     | <i>Hibbertia diffusa</i>                               | Guinea Flower                             |
| 69     | <i>Hibbertia empetrifolia</i> ssp. <i>empetrifolia</i> | Trailing Guinea Flower                    |
| 70     | <i>Hibbertia monogyna</i>                              | Leafy Guinea Flower                       |
| 71     | <i>Hibbertia obtusifolia</i>                           | Grey Guinea Flower                        |
| 72     | <i>Hovea longifolia</i>                                | Hovea                                     |
| 73     | <i>Indigofera australis</i>                            | Austral Indigo                            |
| 74     | <i>Isopogon anemonifolius</i>                          | Drumsticks                                |
| 75     | <i>Kunzea ambigua</i>                                  | Tick Bush                                 |
| 76     | <i>Lambertia formosa</i>                               | Mountain Devil / Honey Flowers            |
| 77     | <i>Leptospermum juniperinum</i>                        | Prickly Tea-tree                          |
| 78     | <i>Leptospermum polyanthum</i>                         | Slender Tea-tree                          |
| 79     | <i>Leptospermum polygalifolium</i>                     | Lemon-scented Tea-tree                    |
| 80     | <i>Leucopogon juniperinus</i>                          | Bearded Heath                             |
| 81     | <i>Leucopogon lanceolatus</i>                          | Lance Bearded Heath                       |
| 82     | <i>Leucopogon parviflorus</i>                          | Coast Beard Heath                         |
| 83     | <i>Lomatia ilicifolia</i>                              | Holly Lomatia                             |
| 84     | <i>Marsdenia suaveolens</i>                            | Sweet-scented Doubah                      |
| 85     | <i>Olearia viscidula</i>                               | Daisy Bush                                |
| 86     | <i>Opercularia diphylla</i>                            | Stinkweed                                 |
| 87     | <i>Ozothamnus diosmifolium</i>                         | Everlasting / Paper Daisy                 |
| 88     | <i>Persoonia levis</i>                                 | Smooth Geebung                            |
| 89     | <i>Persoonia linearis</i>                              | Narrow-leafed Geebung                     |
| 90     | <i>Persoonia mollis</i> ssp. <i>caleyi</i>             | Soft Geebung                              |



|              |   |   |
|--------------|---|---|
| 91           | <i>Petrophile pulchella</i>                       | Conesticks  |
| 92           | <i>Phyllota phyllicoides</i>                      | Heath Phyllota  |
| 93           | <i>Pimelea linifolia</i> ssp. <i>linifolia</i>    | Rice Flower   |
| 94           | <i>Platysace lanceolata</i>                       | Native Parsnip  |
| 95           | <i>Plectranthus parviflorus</i>                   | Cockspur Flowers  |
| 96           | <i>Podocarpus spinulosus</i>                      | Plum Pine   |
| 97           | <i>Pomaderris discolor</i>                        | Pomaderris  |
| 98           | <i>Pomaderris elliptica</i>                       | Smooth Pomaderris   |
| 99           | <i>Pomax umbellata</i>                            | Pomax   |
| 100          | <i>Poranthera corymbosa</i>                       | Clustered Poranthera  |
| 101          | <i>Poranthera microphylla</i>                     |   |
| 102          | <i>Prostanthera violacea</i>                      | Violet Mint Bush  |
| 103          | <i>Pultenaea daphnoides</i>                       | Large-leaved Bush Pea                                       |
| 104          | <i>Pultenaea flexilis</i>                         | Graceful Bush Pea   |
| 105          | <i>Pultenaea linophylla</i>                       | Small Bush Pea  |
| 106          | <i>Pultenaea polifolia</i>                        | Bush Pea  |
| 107          | <i>Pultenaea villosa</i>                          | Bush Pea  |
| 108          | <i>Ranunculus plebeius</i>                        | Buttercups  |
| 109          | <i>Santalum obtusifolium</i>                      | Sandalwood Bush   |
| 110          | <i>Scaevola ramosissima</i>                       | Fan / Snake Flower  |
| 111          | <i>Stackhousia monogyna</i>                       | Creamy Candles / Creamy Stackhousia                         |
| 112          | <i>Stackhousia viminea</i>                        | Slender Stackhousia   |
| 113          | <i>Stellaria flaccida</i>                         | Forest Starwort   |
| 114          | <i>Stylidium graminifolium</i>                    | Grass Trigger Plant   |
| 115          | <i>Tetradlea thymifolia</i>                       | Black-eyed Susan's  |
| 116          | <i>Trachymene incisa</i> ssp. <i>incisa</i>       | Native Parsnip  |
| 117          | <i>Westringia fruticosa</i>                       | Coast Rosemary  |
| 118          | <i>Xanthosia pilosa</i>                           | Woolly Xanthosia  |
| 119          | <i>Zieria laevigata</i>                           | Smooth Zieria / Smooth-leaved Zieria /<br>Twiggy Midge Bush |
| 120          | <i>Zieria smithii</i>                             | Sandfly Zieria  |
| <b>Ferns</b> |   |   |
| 121          | <i>Adiantum aethiopicum</i>                       | Common Maiden Hair Fern                                     |
| 122          | <i>Adiantum hispidulum</i> var. <i>hispidulum</i> | Rough Maidenhair  |
| 123          | <i>Asplenium australasicum</i>                    | Bird's Nest Fern  |
| 124          | <i>Blechnum ambiguum</i>                          | Fern  |
| 125          | <i>Blechnum cartilagineum</i>                     | Gristle Fern  |
| 126          | <i>Blechnum nudum</i>                             | Fishbone Water Fern   |
| 127          | <i>Calochlaena dubia</i>                          | Soft / False Bracken Fern                                   |
| 128          | <i>Cyathea australis</i>                          | Rough Tree Fern   |
| 129          | <i>Cyathea cunninghamii</i>                       | Slender Treefern  |
| 130          | <i>Davallia solida</i> var. <i>pyxidata</i>       | Hare's Foot Fern  |
| 131          | <i>Dicksonia antarctica</i>                       | Soft Tree Fern  |
| 132          | <i>Doodia aspera</i>                              | Rasp Fern   |
| 133          | <i>Gleichenia dicarpa</i>                         | Pouched Coral Fern  |
| 134          | <i>Lindsaea linearis</i>                          | Screw Fern  |
| 135          | <i>Lindsaea microphylla</i>                       | Lacy Wedge Fern   |
| 136          | <i>Pteridium esculentum</i>                       | Bracken   |
| 137          | <i>Schizaea dichotoma</i>                         | Branched Comb Fern  |

|                          |  |  |
|--------------------------|--|--|
| 138                      | <i>Selaginella uliginosa</i>                   | Swamp Selaginella                          |
| 139                      | <i>Sticherus flabellatus</i>                   | Umbrella Fern                              |
| 140                      | <i>Todea barbara</i>                           | King Fern                                  |
| <b>Creepers</b>          |  |  |
| 141                      | <i>Billardiera scandens</i>                    | Apple Berry / Dumplings                    |
| 142                      | <i>Calystegia marginata</i>                    | Bindweed                                   |
| 143                      | <i>Cassytha glabella</i>                       | Slender Devil's Twine                      |
| 144                      | <i>Cassytha pubescens</i>                      | Common Devil's Twine                       |
| 145                      | <i>Cissus hypoglauca</i>                       | Native Grape                               |
| 146                      | <i>Clematis aristata</i>                       | Old Man's Beard                            |
| 147                      | <i>Clematis glycinoides</i>                    | Forest Clematis / Old Man's Beard          |
| 148                      | <i>Commelina cyanea</i>                        | Wandering Jew                              |
| 149                      | <i>Desmodium varians</i>                       | Slender Tick-trefoil                       |
| 150                      | <i>Dichondra repens</i>                        | Kidney Weed                                |
| 151                      | <i>Eupomatia laurina</i>                       | Bolwarra / Native Guava                    |
| 152                      | <i>Eustrephus latifolius</i>                   | Wombat Berry                               |
| 153                      | <i>Geitonoplesium cymosum</i>                  | Scrambling Lily                            |
| 154                      | <i>Glycine clandestina</i>                     | Love Creeper / Twinning Glycine            |
| 155                      | <i>Glycine microphylla</i>                     | Love Creeper                               |
| 156                      | <i>Glycine tabacina</i>                        | Love Creeper                               |
| 157                      | <i>Hardenbergia violacea</i>                   | False Sarsaparilla                         |
| 158                      | <i>Hibbertia dentata</i>                       | Twinning Guinea Flower                     |
| 159                      | <i>Hibbertia scandens</i>                      | Golden Guinea Flower                       |
| 160                      | <i>Kennedia rubicunda</i>                      | Dusky Coral Pea or Red Bean                |
| 161                      | <i>Morinda jasminoides</i>                     | Jasmine Morinda                            |
| 162                      | <i>Pandorea pandorana</i>                      | Wonga Wonga Vine                           |
| 163                      | <i>Parsonsia straminea</i>                     | Monkey Rope / Common Silkpod               |
| 164                      | <i>Pratia purpurescens</i>                     | White Root                                 |
| 165                      | <i>Rubus moluccanus</i> var. <i>trilobus</i>   | Molucca Bramble                            |
| 166                      | <i>Rubus parvifolius</i>                       | Native Raspberry                           |
| 167                      | <i>Smilax australis</i>                        | Lawyer Vine / Wait-a-while / Barbwire Vine |
| 168                      | <i>Smilax glyciphylla</i>                      | Native Sarsaparilla                        |
| 169                      | <i>Stephania japonica</i> var. <i>discolor</i> | Stephania / Snake Vine                     |
| 170                      | <i>Tylophora barbata</i>                       | Bearded Tylophora                          |
| <b>Herbs and Orchids</b> |  |  |
| 171                      | <i>Callitriche stagnalis</i>                   | Aquatic Herb                               |
| 172                      | <i>Caladenia catenata</i>                      | White Lady's Fingers                       |
| 173                      | <i>Caleana major</i>                           | Large Duck Orchid                          |
| 174                      | <i>Calochilus campestris</i>                   | Copper Beard Orchid                        |
| 175                      | <i>Calochilus robertsonii</i>                  | Purple Beard Orchid                        |
| 176                      | <i>Centaurium spicatum</i>                     | Australian Centaury                        |
| 177                      | <i>Cryptostylis erecta</i>                     | Hooded Orchid                              |
| 178                      | <i>Cryptostylis subulata</i>                   | Large Tongue / Duck Orchid                 |
| 179                      | <i>Cymbidium suave</i>                         | Snake Flower                               |
| 180                      | <i>Dianella caerulea</i> var. <i>caerulea</i>  | Blue Flax Lily                             |
| 181                      | <i>Dianella caerulea</i> var. <i>producta</i>  | Blue Flax Lily / Paroo                     |
| 182                      | <i>Dianella longifolia</i>                     | Blue Flax Lily                             |
| 183                      | <i>Dipodium punctatum</i>                      | Hyacinth Orchid                            |
| 184                      | <i>Dipodium variegatum</i>                     | Hyacinth Orchid                            |

|                           |   |  |
|---------------------------|---|--|
| 185                       | <i>Diurus sulphurea</i>                           | Tiger Orchid                           |
| 186                       | <i>Drosera peltata</i>                            | Sundews                                |
| 187                       | <i>Drosera spatulata</i>                          | Common / Rosy Sundew                   |
| 188                       | <i>Hydrocotyle geraniifolia</i>                   | Forest Pennywort                       |
| 189                       | <i>Hydrocotyle peduncularis</i>                   | Pennywort                              |
| 190                       | <i>Hydrocotyle tripartita</i>                     | Pennywort                              |
| 191                       | <i>Lagenifera stipitata</i>                       | Blue Bottle-daisy / Common Lagenophora |
| 192                       | <i>Lobelia gibbosa</i>                            | Lobelia                                |
| 193                       | <i>Microtus parviflora</i>                        | Slender Onion Orchid                   |
| 194                       | <i>Nemacianthus caudatus</i>                      | Mayfly Orchid                          |
| 195                       | <i>Ottelia ovalifolia</i> ssp. <i>ovalifolia</i>  | Swamp Lily                             |
| 196                       | <i>Patersonia glabrata</i>                        | Leafy Purple Flags                     |
| 197                       | <i>Plantago debilis</i>                           | Slender Plantain                       |
| 198                       | <i>Pterostylis nutans</i>                         | Nodding Greenhood                      |
| 199                       | <i>Schelhammera undulata</i>                      | Lilac Lily                             |
| 200                       | <i>Thelymitra media</i> var. <i>media</i>         | Sun Orchid                             |
| 201                       | <i>Thelymitra pauciflora</i>                      | Slender Sun Orchid                     |
| 202                       | <i>Viola hederacea</i>                            | Native Violet                          |
| 203                       | <i>Viola sieberana</i>                            | Tiny Violet                            |
| 204                       | <i>Wahlenbergia gracilis</i>                      | Native Bluebell                        |
| <b>Grasses and Sedges</b> |   |  |
| 205                       | <i>Anisopogon avenaceus</i>                       | Oat Speargrass                         |
| 206                       | <i>Baloskian gracile</i>                          | Cord Rush                              |
| 207                       | <i>Caustis flexuosa</i>                           | Old Man's Beard / Curly Wigs           |
| 208                       | <i>Dichelachne crinita</i>                        | Longhair Plume Grass                   |
| 209                       | <i>Entolasia marginata</i>                        | Grass                                  |
| 210                       | <i>Entolasia stricta</i>                          | Grass                                  |
| 211                       | <i>Fimbristylis dichotoma</i>                     | Common Fringe-sedge                    |
| 212                       | <i>Gahnia clarkei</i>                             | Saw Sedge                              |
| 213                       | <i>Gahnia sieberiana</i>                          | Saw Sedge                              |
| 214                       | <i>Juncus continuus</i>                           | Rush                                   |
| 215                       | <i>Juncus kraussii</i>                            | Sea Rush                               |
| 216                       | <i>Juncus usitatus</i>                            | Common Rush                            |
| 217                       | <i>Lepidospermum filiforme</i>                    | Rapier Sedge                           |
| 218                       | <i>Lepidospermum laterale</i>                     | Flat-leaved Sword Sedge                |
| 219                       | <i>Lomandra brevis</i>                            |  |
| 220                       | <i>Lomandra filiformis</i> ssp. <i>filiformis</i> | Wattle Mat-rush                        |
| 221                       | <i>Lomandra longifolia</i>                        | Mat Rush                               |
| 222                       | <i>Lomandra obliqua</i>                           | Fish Bones                             |
| 223                       | <i>Panicum simile</i>                             | Two Colour Panic                       |
| 224                       | <i>Phragmites australis</i>                       | Native Reed / Thatch-reed              |
| 225                       | <i>Schoenus apogon</i>                            | Fluke Bogrush                          |
| 226                       | <i>Xanthorrhoea minor</i>                         | Forest Grass Tree                      |