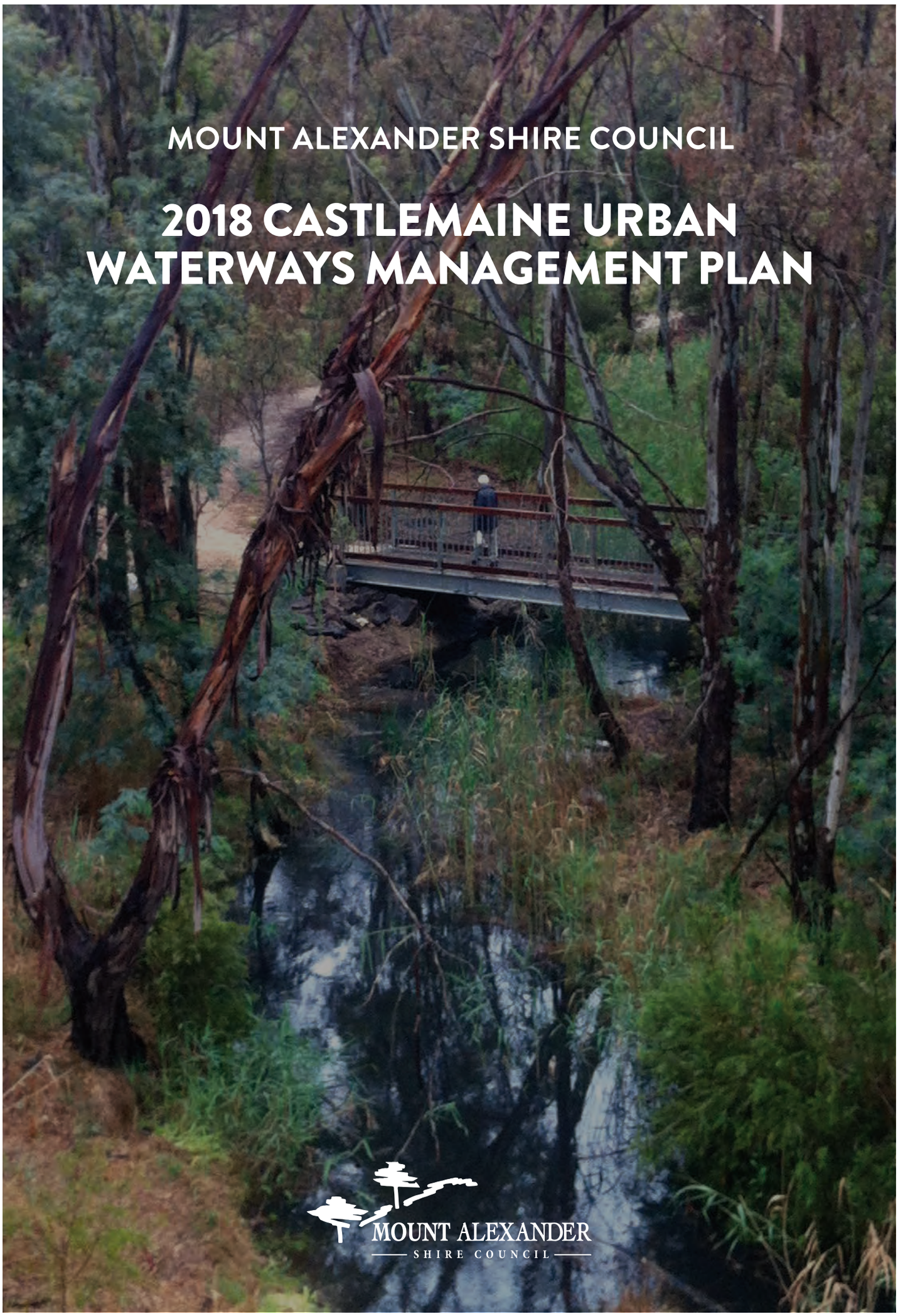

MOUNT ALEXANDER SHIRE COUNCIL

2018 CASTLEMAINE URBAN WATERWAYS MANAGEMENT PLAN

MOUNT ALEXANDER
SHIRE COUNCIL

Thanks to the Echidna Kindergarten group of the Castlemaine Child Care Co-operative, the Friends of Campbells Creek Landcare and Castlemaine Landcare groups for supplying many of the photos included in this document.

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TRADITIONAL OWNERS ACKNOWLEDGEMENT

Mount Alexander Shire Council acknowledges the Dja Dja Wurrung as the traditional owners of the lands and waters (Djandak) of Mount Alexander Shire.

Council acknowledges the vital role of the traditional owners and that European colonisation caused disruption and grief to the indigenous population including alienation from their traditional Country (Djandak) and their cultural practices.

Council acknowledges that with strength and wisdom Dja Dja Wurrung people proudly survive and continue to practice their culture and customs, experiencing a close cultural, spiritual, physical, social, historical and economic relationship with their Country (Djandak) which includes Mount Alexander Shire.

Council recognises the traditional and cultural association of Dja Dja Wurrung people to their Country today.

Council recognises the Recognition and Settlement Agreement 2013 between the Dja Dja Wurrung Clans Aboriginal Corporation and the Victorian Government and the implications this has for consulting with the Dja Dja Wurrung when activities are undertaken on Crown Land. Council will actively work with the Dja Dja Wurrung under the guidance of this Recognition and Settlement Agreement when implementing this management plan on the Crown Land.

RECOGNITION OF LANDCARE'S ACHIEVEMENT

The Castlemaine Landcare Group and Friends of Campbells Creek Landcare Group have both worked hard along the creek side land for a number of decades. What was once a weed infested environment with minimal public access is now an important community asset in a state of ecological recovery.

The two Landcare groups have successfully advocated to local, state and federal governments, bringing many resources and direct financial funding towards their project areas. Their contribution of funds and volunteer effort is valued in the millions of dollars.

In late 2012 Mount Alexander Shire Council took a licence over the public land. Since that time Council, the Department of Environment, Land, Water and Planning and the two Landcare groups have been developing their collaborative relationship thanks to the leadership and initiative of the two Landcare groups.

Acronyms

CLG	Castlemaine Landcare Group Inc
CMA	Catchment Management Authority
DELWP	Department of Environment, Land, Water and Planning
EVC	Ecological Vegetation Class
FCC	Friends of Campbells Creek
MASC	Mount Alexander Shire Council
MZ	Management Zone
WSUD	Water Sensitive Urban Design

EXECUTIVE SUMMARY

Mount Alexander Shire Council (Council), the Friends of Campbells Creek Landcare Group (FCC), the Castlemaine Landcare Group (CLG), and other contributors have worked together to develop the Castlemaine Urban Waterways Management Plan (the Plan).

The Plan has been developed and will be implemented in a spirit of collaboration. The framework for this collaboration is outlined by the International Association for Public Participation (IAP2's) Public Participation Spectrum. The Spectrum states the goal of collaboration is *'to partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution'*. The inherent promise of Council to collaborators is that *'we will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible'*.

The purpose of the Plan is to guide the management of the approximately 70 hectares of Crown Land creek corridor within the townships of Castlemaine and Campbells Creek.

Council and partners will collaboratively implement priority actions from the Plan utilising funding and resources as they become available.

Implementing the Plan will provide benefits to the public including an urban connection to biodiversity, climate mitigation through shade and cooling, beautiful places for passive contemplation, safer, better connected and more appealing transportation trails, and new recreation opportunities such as trail running.

The environmental, social and economic 'edge effect' of having healthy and inviting 'waterways' meandering through the urban areas of Castlemaine, Chewton and Campbells Creek is significant.

The Plan will be reviewed 5 years after its adoption by Council. Key actions over the next five years include removing woody and other weeds, revegetate areas in need, complete and maintain the trails, and promote community visitation. Risks from fire, flooding, and vegetation have been considered and form a foundation of the Plan.

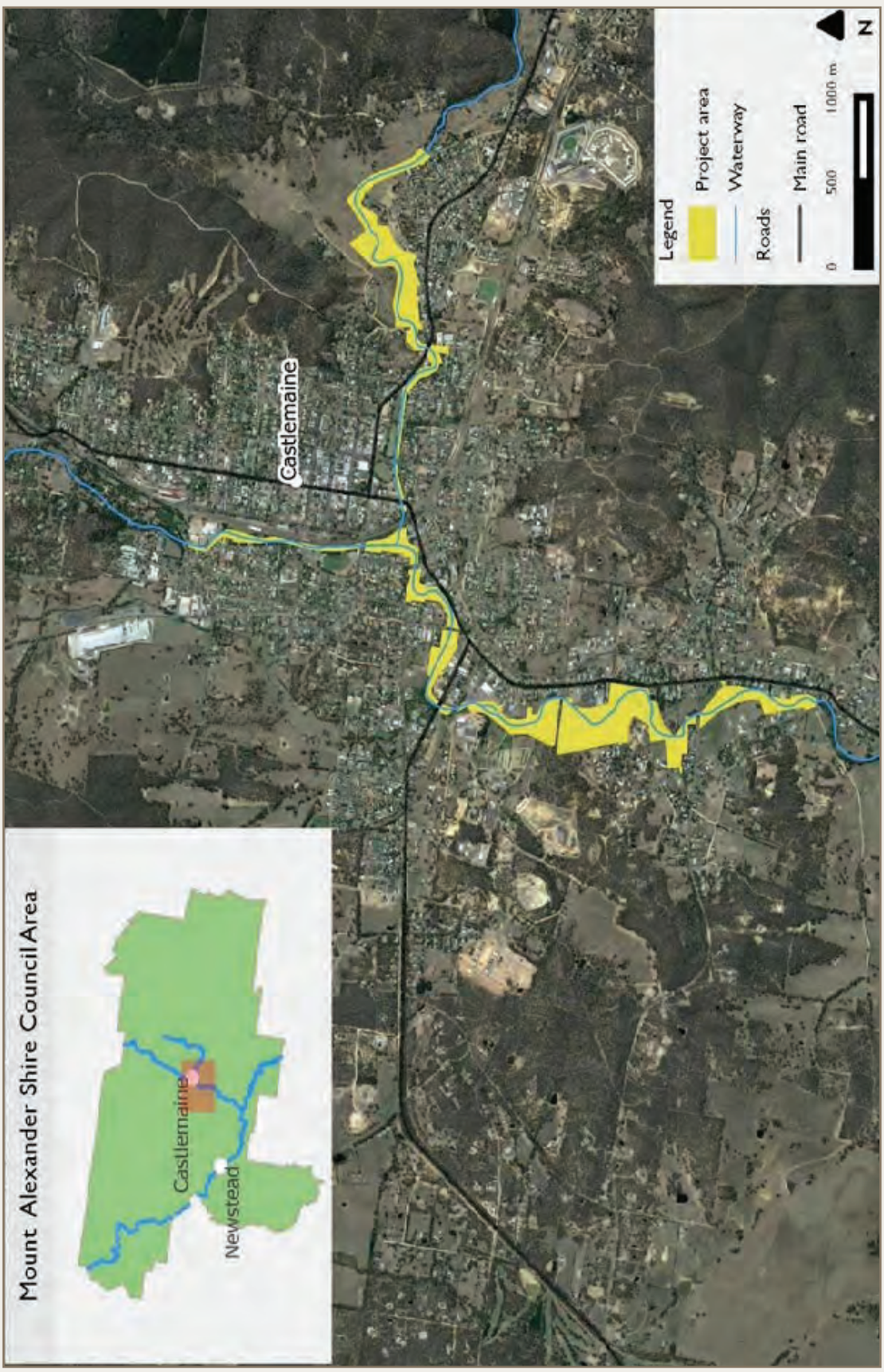

Figure 1: Castlemaine Urban Waterways Project Area

INTRODUCTION

Scope

The Castlemaine Urban Waterways reserve covers 70 hectares of Crown land encompassing approximately 7.7 linear kilometres of waterway and adjoining riparian area running through urban areas of Castlemaine, Chewton and Campbells Creek. Specifically the area covers (Figure 1):

- **Barkers Creek** south of the Botanic Gardens to the Forest Creek confluence.
- **Forest Creek** from Colles Road to the Barkers Creek confluence.
- **Campbells Creek** from where it forms following the confluence of Barkers Creek and Forest Creek, south to Cemetery Road (Alexandra Street).

Forest Creek originates from the slopes of Mount Alexander, Barkers Creek from Mount Barker just to the north. Following their confluence in Castlemaine the creeks join to become Campbells Creek, which flows to meet the Loddon River at Guildford.

This Plan is concerned principally with the Crown land project area but acknowledges that the waterways do not exist in isolation. The quality of water coming into the waterways from upstream flows, storm water inputs, treated sewage, and from all other sources has a significant effect on stream health. These inputs and their effects are within the scope of improvement efforts outlined in this Plan.

Purpose

The purpose of the Plan is to develop the collaborative arrangements and works program to improve and protect community values in the project area while managing risk.

Implementation of the Plan is expected to deliver the following long-term outcomes:

- **Environment**: Measurable improvement in stream and ecosystem health.
- **Social:** Increased, safe, well connected access and safety to enable recreational usage for walking and cycling and passive connectedness with the waterways and nature.
- **Economic:** Coordinated community collaboration to manage and improve these spaces, primarily via formalised working arrangements with Landcare groups and Connecting Country for improved community and visitor experience.

The roles and responsibilities of the three core groups involved in management - Council, FCC and CLG - will be outlined in a formal Memorandum of Understanding.

Vision

The vision for the waterways is:

> **'Working collaboratively we will protect and improve the Castlemaine Urban Waterways' environmental, social and cultural values whilst minimising risks.'**

Governance

Council currently holds a licence agreement with the Victorian Government regarding the management of the unreserved crown land that makes up the Castlemaine Urban Waterways project area. This agreement is overseen by the Department of Environment, Land, Water, and Planning (DELWP), and is renewed annually.

Council and DELWP commenced discussions in 2016 concerning the governance arrangements of the project area. Further

investigations will continue to determine the most suitable management arrangement.

One outcome being considered is for the licenced land to be 'reserved' for public purposes and for Council to be appointed as the Committee of Management. This process would occur in accordance with the *Crown Land (Reserves) Act 1978*. It is likely that the reservation process will occur progressively, rather than all at once, and will include resolving land management matters such as occupations and the best use of Crown land. The purpose of the reservation must also be determined which must take into account the lands values and Council's and the community's long term vision for the land.

Plan development

Council commissioned Riverness Pty. Ltd. to facilitate the Plan's development.

Key project tasks comprised:

- Implementing a robust and efficient stakeholder engagement program
- Setting overarching goals for the management of the project area
- Identifying the values, threats and risks to the values
- Developing a works program
- Providing visually appealing maps suitable for ongoing community and stakeholder engagement

An advisory group with representation from Council, FCC, CLG, North Central Catchment Management Authority and DELWP has strategic oversight for the project and provided early and ongoing input into the development of the Plan.

Advisory group members participated in three workshops (held on the 8th March, 7th April and 3rd August 2017). The three workshops covered the following respective topics:

- Identifying high value assets and defining goals.
- Identifying threats and setting targets.
- Clarifying the purpose, program logic framework and priority actions.

The plan was available for public comment for a six week period during early 2018.

POLICY CONTEXT

The **Mount Alexander Shire Council Plan 2017-2021** includes a number of strategic objectives that are progressed by implementing the plan:

Improved health and wellbeing

- Strategy: Improve health through use of our public spaces and trails.
- Action: Invest in footpaths and trails.
- Action: Promote use of footpaths, trails and open spaces as a form of recreation.

A clean and green community

- Strategy: Protect and enhance the natural environment.
- Action: Advocate for improved urban water sensitive designs to reduce environmental impacts.
- Action: Work with community groups on land management and weed control.

The Mount Alexander Shire Council Environment Strategy 2015-2025 includes a key strategic task to *'develop a strategic plan for the urban waterways in Castlemaine, Campbells Creek and Chewton'.*

It also includes an intermediate outcome to ensure that *'priority natural assets are protected and are in improving ecological condition.'*

The vision for the **Mount Alexander Shire Council Walking and Cycling Strategy 2010-2020** is that: *'We will have continued to build, improve and connect up a network of off-road tracks for walkers and cyclists that will give people access from townships to their community and their local environment in a car-free environment. These tracks will also be a major attractor to the area for recreational walkers and cyclists. The Shire's natural and cultural beauty and significance will be easily accessible on these tracks with clear signage, quality maps and good facilities along the way."*

Other relevant strategy and policy documents include the:

- Mount Alexander Shire Council Public Open Space Strategy 2016-2031.
- The North Central Catchment Management Authority 2015 Castlemaine, Campbells Creek and Chewton Flood Management Plan
- The Friends of Campbells Creek Landcare Group 2009 Campbells Creek Precinct Plan
- Options for the management of Forest Creek through Castlemaine (Rutherford et al 2016).
- Water for Victoria – Water Plan 2016.
- Victorian Waterway Management Strategy 2013.
- North Central Waterway Strategy 2014 – 2022.
- The Integrated Water Forums currently being run by Coliban Water, are considered to be a key potential project that could positively influence this plan.

ASSETS

Barkers Creek, Campbells Creek and Forest Creek connect the northern, southern and eastern parts of Castlemaine and surrounding areas of Campbells Creek and Chewton.

The location of the waterways and adjoining public land means that most residents live in close proximity to part of the project area.

On the 8th March 2017, the Advisory Group met to consider the most valuable assets of the project area. 'High value assets' were identified under three categories:

Natural assets

- Native flora
- Native fauna
- Aquatic habitats
- Terrestrial habitats
- Water quality

Cultural assets

- Indigenous connections to country
- European history and heritage

Recreational & Infrastructure assets

- Walking and cycling tracks
- Passive spaces for enjoyment

NATURAL ASSETS

Native flora

The project area supports fifteen species of local Eucalypts (remnant or re-introduced) and a similar number of wattle species.

Aquatic/wetland species of note include:

Water plantain *(Alisma plantago-aquatica)*

Water ribbons (*Cycnogeton procerum*)

Common Reed (*Phragmites australis)*

Common Spike-sedge (*Eleocharis acuta*)

Cumbungi (*Typha orientalis*)

Streaked Arrow-grass (*Triglochin striata*) (strap-leaf form)

Common Reed (*Phragmites australis)*

Marsh Club-rush (*Bolboschoenus medianus*)
Large Bindweed (*Calystegia sepium*)

Australian Gipsywort (*Lycopus australis*)

Knotweeds (*Persicaria subsessilis, P. decipiens*)

River Club-sedge (*Schoenoplectus tabernaemontani*)

Riparian/Floodplain key species of note include:

Angled Lobelia (*Lobelia anceps*)

Cherry Ballart (*Exocarpus cupressiformis*)

Mat Grass (*Hemarthria uncinata var. uncinata*)

Common Tussock-grass (*Poa labillardierei*)

Mat Rush (*Lomandra longifolia*)

Rough barked honey myrtle (*Melaleuca parvistaminea*)

Tree Violet (*Melicytus dentatus*)

River Bottlebrush (*Callistemon sieberi*)

River Tea-tree (*Leptospermum obovatum*)

Grassy Woodland key species of note include:

Kangaroo Grass (*Themeda triandra*)

Creamy candles (*Stackhousia monogyna*)

Plain Sun-orchid (*Thelymitra nuda*)

Sweet hound's tongue (*Cynoglossum suaveolens*)

Lemon Beauty-heads (*Calocephalus citreus*)

Onion-orchid (*Microtis parviflora*)

Common riceflower (*Pimelea humilis*)

Nationally endangered Matted Flax-lily (*Dianella amoena*), introduced by planting by the Friends of Campbells Creek,

Silver banksia (*Banksia marginate*) (this plant is almost extinct in the Castlemaine district. Landcare members are actively reintroducing).

Late-flowering Flax Lilly, Cut-leaf Goodenia and Scaly Buttons, all recorded at Montgomery Street.

Heathy Dry Forest/Heathy Woodland/Box-Ironbark key species of note include:

Daphne Heath (*Brachyloma daphnoides*)

Showy Parrot-pea (*Dillwynia sericea)*

Scarlet Sundew (*Drosera glanduligera*)

Fringe Myrtle (*Calytrix tetragona*)

Rare Goldfields Grevillea (*Grevillea dryophylla*)

Bushy Needlewood (*Hakea decurrens*)

Hoary sunray (*Leucochrysum albicans*)

Sticky Everlasting (*Xerochrysum viscosum*)

The project area also includes the Montgomery Street Grasslands area within MZ1. It contains some of the best (and only) examples of remnant groundcover along the project area.

Native fauna

Mammals of note include:

Platypus *(Ornithorhynchus anatinus)*. Preferred habitat: freshwater stream with earth banks and native vegetation that provides shading of the stream and cover near the bank. The presence of logs, twigs, and roots, as well as cobbled or gravel substrate result in increased macroinvertebrates fauna (a main food source), and the Platypus also tends to be more abundant in areas with pool-riffle sequences.

Echidna (*Tachyglossus aculeatus)*

Bird Species of note include:

Brown Treecreeper (*Climacteris picumnu victoriae)* – near threatened. Preferred habitat: drier woodlands, forest clearings, eucalypts along streams. Often on ground, fallen timber.

Hardhead (*Aythya australis*) – vulnerable. Preferred habitat: deep vegetated swamps.

Powerful Owl *(Ninox strenua*) –. Vulnerable. Preferred habitat: open forests and woodlands, as well as along sheltered gullies in wet forests with dense understoreys, especially along watercourses. Needs old growth trees to nest.

Nankeen Night Heron (*Nycticorax caledonicus hillii*) – near threatened. Preferred habitat: swamps, rivers, creeks, ornamental ponds. Feeds nocturnally; roosts in trees close to water by day.

Speckled Warbler (*Chthonicola sagittatus*) – vulnerable. Preferred habitat: open woodlands. Nests, forages in ground litter.

Reptiles of note include:

Common Long-necked Turtle (*Chelodina longicollis*). Preferred habitat: occupies a broad range of freshwater aquatic habitats but is more abundant in shallow, ephemeral wetlands often remote from permanent rivers.

Pobblebonk Frog (*Liimnodynastes dumerli)*

Spotted Marsh Frog (*Limnodynastes tasmaniensis*)

Common Froglet (*Crinia signifera*)

Peron's Tree-frog *(Litoria peronii)*

Southern Brown Tree Frog *(Litoria ewingii)*.

Possible new residents:

In addition to the fauna currently residing in the project area, a number of species have been identified that used to occur and could again if habitats are restored, including: River Blackfish (*Gadopsis marmoratus*); Growling Grass Frog (*Litoria raniformis*); Tree Goanna /Lace Monitor (*Varanus varius*); and Koala (*Phascolarctos cinereus*).

Aquatic habitats

Prior to gold-mining, the waterways would have consisted of a series of small pools interconnected by shallow wetlands. Whilst some deep pools (typically up to one metre, rarely to two metres) still remain, the interconnecting wetlands have either gone or are highly degraded e.g. the wetland downstream from trestle bridge across Campbells Creek.

Good quality aquatic habitats remain. They consist of pools with interconnecting shallows, reed beds and woody debris over a gravelly streambed. These are permanent downstream of the sewage treatment plant, elsewhere tend to be ephemeral features except in the deeper pools.

Terrestrial habitats

When the vegetation communities exist in a healthy condition, they can provide a number of beneficial functions including:

- binding and protecting streambanks
- filtering, purifying and protecting waterways and wetlands
- creating essential habitats for birds, fish, frogs and other animals
- providing aesthetic and landscape significance.

The ecological vegetation classes (EVCs) along and adjacent to the creeks are:

- Creekline Grassy Woodland. This vegetation community consists of an open canopy of River Red gum with an understorey of shrubs and small trees (including Sweet Bursaria, Tree Violet and a number of wattle species e.g. Silver Wattle, Wirilda, Black Wattle and Blackwood) and a ground layer of tussock grasses, rushes, sedges and herbs.
- Alluvial Terraces Herb-rich Woodland. This vegetation community consists of an open canopy of Yellow Box and River Red-gum, (with occasional other Box species) with an understorey of wattles (e.g. Silver, Black, Golden and Gold-dust Wattles) originally over a species rich ground-layer.
- Grassy Woodland. Kangaroo Grass dominated ground flora with mostly Yellow Box canopy.
- On higher land, vegetation has elements typical of Box-ironbark Forest - Heathy Dry Forest - Heathy Woodland, including Long-leaf Box, Red Stringybark and heathy shrubs.

Water quality

Water quality is an important attribute for the urban waterways as it determines aquatic ecosystem health. Only limited water quality data exists. There are some indications that aquatic ecosystem health is poor: algal blooms occur regularly in late summer downstream from the point of treated sewage discharge indicating a combination of high water temperature and nutrient levels with low flows and oxygenation. On the other hand, a recent aquatic invertebrate survey showed surprisingly good biodiversity in Campbells Creek two kilometres downstream from the point of treated sewage effluent discharge.

CLG have been systematically collecting and analysing Waterwatch data along Forest

Creek for over a decade. This data shows that salinity levels become very high when Forest Creek stops flowing, and phosphorus in urban runoff increases following storm events.

Residents and visitors can come in to contact with the urban waterways through recreation or coordinated community activities e.g. monitoring, education, clean-ups. Water quality is also important for downstream consumptive and irrigation use.

As significant flow inputs are derived from urban stormwater and/or treatment plant discharge, more detailed understanding of water quality, including macroinvertebrate surveys is required.

CULTURAL ASSETS

Indigenous connections to country

The Dja Dja Wurrung or Jaara People are the traditional owners of the land upon which the townships of Castlemaine, Chewton and Campbells Creek are located.

The Dja Dja Wurrung people have been living on this land for 40,000 years. Even in the most intensively developed areas, the landscape holds the imprint of thousands of generations of Aboriginal people. The project area is within an Aboriginal Cultural Sensitive Area and is also relevant to a Land Use Activity Agreement.

Dja Dja Wurrung Aboriginal objects and places are present along the project area and are protected under the Aboriginal Heritage Act 2006.

Consultation with Dja Dja Wurrung representatives is a key component of planning for waterways management.

European history and heritage

The project area includes a mix of both natural and built heritage. Examples of European heritage include:

- Tute's Cottage – state heritage listing
- The high three span railway bridge over Forest Creek – state heritage listing
- The trestle bridge across Campbells Creek
- The Forest Creek channel - including sandstone channels and drains
- Mature European trees that are integral to the amenity and rural atmosphere whose cultural heritage values should be considered as part of any future project.

RECREATIONAL AND INFRASTRUCTURE ASSETS

Council's licence agreement with DELWP has enabled it to upgrade and construct significant infrastructure along the project area. This infrastructure upgrade came at considerable cost to Council and Council is committed to realising the trails networks potential. The trail network has the potential to connect the community with the project area.

The infrastructure upgrade has included footbridges and trails and drainage works. These works now provide access for people to walk or and cycle along the waterways.

The opportunity now exists to link (and complete) these trails to form a continuous network to:

- connect the townships of Castlemaine, Chewton and Campbells Creek
- provide safe routes to destinations e.g. schools and recreation reserves
- cater for different recreation groups e.g. young, old, and varied fitness/ ability levels
- enable access to places of interest e.g. the creek confluence
- provide and showcase links to history – social/cultural/geological
- encourage active community stewardship.

User safety will be the key priority.

The opportunity also exists for creating spaces without trails for passive enjoyment and appreciation of our waterways and biodiversity without damaging that biodiversity or water quality.

THREATS

Threats are defined as either human activities or natural disturbances that have caused, are causing, or may cause impacts to high value assets.

Identification of threats to the high value assets of the project area is a critical step in determining appropriate management responses.

Threats from human activities

The waterways are still recovering from the massive impact from the gold digging that started with the 'gold rush' in 1851 and continued with gold dredging in some parts until the 1950s. During this period all native vegetation was lost and massive erosion and siltation occurred. In places new, straightened creek-alignments were created through excavation.

Development

Threats under this category relate to the actual footprint from human settlements.

Historically, the largest footprint that impacted the three creeks was from urban, commercial and industrial developments within the floodplain. The physical impact of taking out land and habitat corridors from the floodplain included:

- Replacement of natural vegetation, wetlands and depressions with streets, parking lots, houses and drains
- Filling of the floodplain, which reduced the flood storage capacity and blocked the natural conveyance properties of floodplains, leading to increased flooding
- Constructing impervious surfaces which

reduced infiltration and increased runoff and impact on the quality of water in the creeks.

This is particularly true for Barkers Creek and Campbells Creek.

Today, a significant threat to the project area comes from encroachment from adjoining land uses into the public land e.g. boundary creep or infilling.

Other Infrastructure

The waterways within the project area are crossed by a number of road bridges (including major arterials) and railway bridges. Bridges and their abutments create choke points that exacerbate flooding damage.

These transport corridors can impact flora and fauna values either directly through wildlife mortality or indirectly through fragmentation of habitats or harbour and dispersal of invasive pest plant and animal species.

Unauthorised use

This threat relates to recreational activities that alter or disturb habitats and species. The level of impact recreational activities can have on the environment and water quality depends largely upon the characteristics of the land (i.e. vegetation, soils) and the type and intensity of the recreational use.

Recreational activities can harmonise with the natural environment if planned and maintained appropriately. However, unstructured and/or inappropriate activities have the potential to alter, destroy and disturb habitats and species. Within the project area, this is most likely to occur where people do not follow defined trails1, or allow dogs to wander off-lead within the project area.

Natural system modifications

Key threat types identified for the project area include:

Water storages

A number of storages exist upstream of the project area, including farm and lifestyle dams. These storages can impact the project area through reductions in stream flows which influence the key ecological process in the development and maintenance of waterways and adjoining floodplains.

Flood control works

The major flood control works that have been undertaken in the past are:

Channelisation

Channel deepening and straightening can reduce flooding in the immediate area of the channel, but can also aggravate flood heights and velocities downstream. Channelisation also disconnects the floodplain from the stream, decreasing habitat diversity.

Drains

Smaller scale channelisations (drains) of minor tributaries are widespread and may be counter-productive by accelerating flows and increasing flood heights of the main waterways, and causing erosion either within the drain or at the discharge point with the main waterway.

Levee banking

Levees are constructed to protect surrounding land from problem flooding. Most problem flooding occurs when urban development and infrastructure (such as roads) have constricted the floodplain or blocked natural drainage lines and flow paths. Consequently, the location of levees is generally dictated by existing development and land use, particularly in Campbells Creek.

Levees also raise the water depth during flood conditions, potentially causing deeper inundation that can lead to soil, vegetation

and habitat loss and can increase flooding of upstream infrastructure/buildings. Council has plans to construct further levees and/or modify existing levees to protect human life and assets. Once completed these construction works may alter threat levels or different threats may emerge.

Maintenance and management

A major value within the project area is recreational use, it should be acknowledged that managing for safety and accessibility can impact other values, for example establishment of recreation areas can alter natural habitats, particularly if vegetation is removed/simplified or the surface is levelled e.g. to remove shallow, ephemeral wetlands.

Pest Species

Non-native species

Pest plants and animals are major threats to native biodiversity because of their ability to change and destroy habitats and ecosystems. They are the number one cause of native animal extinctions in Australia, the second biggest threat to river and stream areas and nationally important wetlands, and the third biggest threat to threatened ecosystems.

Invasive plants, can pose a serious threat to biodiversity in and along the waterways. Two of the main contributors to weed proliferation are soil disturbance and excessive levels of nutrients. Research shows that native vegetation struggles to survive both in combination. The massive disturbances of the gold rush era removed or severely degraded most of the soil of the waterways. Any areas with soil remaining in a close to pre-European state is an asset and the presence of *Themeda triandra* (Kangaroo Grass) indicates this fairly reliably.

Grass weeds are also the major source of fire risk, growing tall annual crops of early cured fine fuel.

Exotic stipoids such as Chilean needle grass, Texas needle grass and Espartillo, amongst the most invasive exotic grasses in Victoria, are becoming widespread throughout the Shire, spread particularly by slashing and movement of vehicles, humans and animals through these areas.

Pest animals can pose a serious threat to biodiversity. They contribute to the loss of native animals (through competition for food and habitat, direct predation and the spread of disease) and can significantly disturb native vegetation.

For example, rabbits (whilst not as problematic as in previous times, though some persist in a few places such as near the junction of Moonlight and Forest Creeks and in and around Honeycomb Bushland Reserve) will prevent most native vegetation species from regenerating.

Problematic Native Species

In some areas (Campbells Creek in particular), wallabies may cause damage to revegetation projects through browsing of young trees and shrubs and pulling out of seedling plants. They also gnaw bark off immature Silver Banksia trees which need long term protection.

The Landcare group in Campbells Creek now use tall (90 cm) rabbit netting guards to protect young plants. For very palatable species like Sweet Bursaria, guards need to be even higher.

Eastern Grey Kangaroos exert heavy grazing pressure in the Wesley Hill / Moonlight Flat areas along Forest Creek. Although they prefer grazing low herbaceous vegetation, small young seedlings of woody vegetation are often 'collateral damage'. Landcare groups guard its plants appropriately, but at greater initial cost, to ensure minimal damage.

Pollution

The key pollution sources observed within the project area were:

Urban stormwater

With urbanisation, the area of impervious surfaces within a catchment increases dramatically. This high proportion of sealed area greatly reduces the amount of water infiltrating the soil and, consequently, most rainfall is converted to run-off. The increased volume of run-off from urban areas (particularly street drains and the Castlemaine CBD) carries with it significant pollutant loads such as oils and sediment from roads1, fertilizers and pesticides from lawns, and organic matter including faeces. If these pollutants, particularly excessive nutrients, reach the Waterways, they can enable vigorous weed growth that out-competes most native vegetation, prevents regeneration and increases fuel loads. If they enter aquatic environments, they can be lethal to fish and other aquatic organisms (e.g. by lowering dissolved oxygen or releasing toxins).

Treated wastewater

Wastewater is collected from Castlemaine, Campbells Creek, Newstead, Maldon, Harcourt and Chewton and delivered to Coliban Water's Water Reclamation Plant, located in Langslow Street on the west bank of Campbells Creek. The water is treated through a series of processes including screening, biological nutrient removal, aeration, chemical dosing, clarification and UV disinfection. The Environment Protection Authority (EPA) Victoria licence allows discharge of Class B reclaimed water to Campbells Creek. Although effluent quality has improved since the treatment plant upgrade in 2000, nutrient levels (and possibly salinity) may still be impacting Campbells Creek downstream of the discharge point e.g. algal blooms occur most years in late summer/early autumn and the creek-side vegetation is dominated by weeds that thrive in a high nutrient environment.

Gross pollutants

This pollution type refers to rubbish and other solid materials (e.g. litter from pedestrians, vehicles, waste collection systems, construction sites, illegal dumping) or organic materials (e.g. leaf-fall from trees, lawn clippings/garden refuse deposited 'over the back fence'). These pollutants can impact the aesthetic appeal within the project area but can also:

- result in fauna fatalities from eating and choking on the material
- introduce weed seeds or other plants parts to the project area
- increase nutrient levels that promote weed growth and increase fuel loads.

Threats from natural disturbances

Strictly speaking, climatic events may be part of natural disturbance regimes in many ecosystems. However, they can pose a threat if a species or habitat is damaged from other threats and has lost its resilience and is thus vulnerable to the disturbance.

This is particularly relevant to climate change which may potentially bring change to rainfall, soil moisture, groundwater, flooding, floodplain functions, agriculture and government policy.

Three specific climatic events have been identified that can potentially impact the project area: fire; flood and drought.

Fire

The CFA recently released a resource document providing information about bushfire behaviour and how to manage any actual or perceived bushfire risks associated with riparian land and riparian management programs. Whilst this document focuses on

rural land, a short section is included on fire management in urban areas and is therefore relevant to the project area.

The report states that a fire starting in or burning into smaller and/or isolated urban riparian areas, could present a lower threat and risk to the surrounding community as:

- The fire has much less time to grow in length and width before reaching assets and may not achieve peak behaviour (fire generally needs to be at least 100 to 450 m wide before it achieves peak rates of spread).
- Fire growth may be restricted by lower fuel areas such as paths or roads.
- Early detection by the surrounding community is more likely.
- While houses may be at risk, occupants are probably less reliant on houses to survive fire, as they can walk to low fuel areas deeper in the urban area (although exposure to smoke and heat may still cause issues for more vulnerable members of the community).

However, fire may still pose a risk to urban development, particularly where:

- The community has a low awareness of fire risk.
- Neighbouring properties are not well-prepared.
- There are larger areas of fuel or long potential fire runs adjacent to urban areas.
- Fuel management in riparian areas is limited by access and other management considerations including the need to protect water quality.
- The community does not have ready access to accurate information about fire risk from vegetation.

Flood

Increases in frequency and severity of extreme flood events (e.g. flash floods) can impact both natural and built assets within the project area e.g. trails, bridges, vegetation, deep pools etc.

Where possible, works should be designed so that they are more resilient to flood events, particularly bridges and trails. This may increase initial costs but will greatly reduce maintenance costs over time and increase the accessibility of the Waterways.

In managing flood risks (such as through implementation of the Castlemaine, Campbells Creek and Chewton Flood Management Plan), opportunities can arise that provide economic, social and environmental benefits e.g. willow replacement programs, changes to bridge arrangements, re-engaging floodplains.

Drought

The reduction in instream flows and terrestrial inundation during droughts can lead to habitat degradation which in turn can result in flora and fauna decline. This is exacerbated by the network of drains in the project area which efficiently transport even small runoff flows directly to the main waterways rather than spreading out and providing moisture to floodplain soils.

WORKS PROGRAM

Program logic framework

Program logic is an approach to planning that uses a diagram to demonstrate the rationale for a program of works and express how change is expected to occur.

The program logic below shows how actions will lead towards the achievement of the vision.

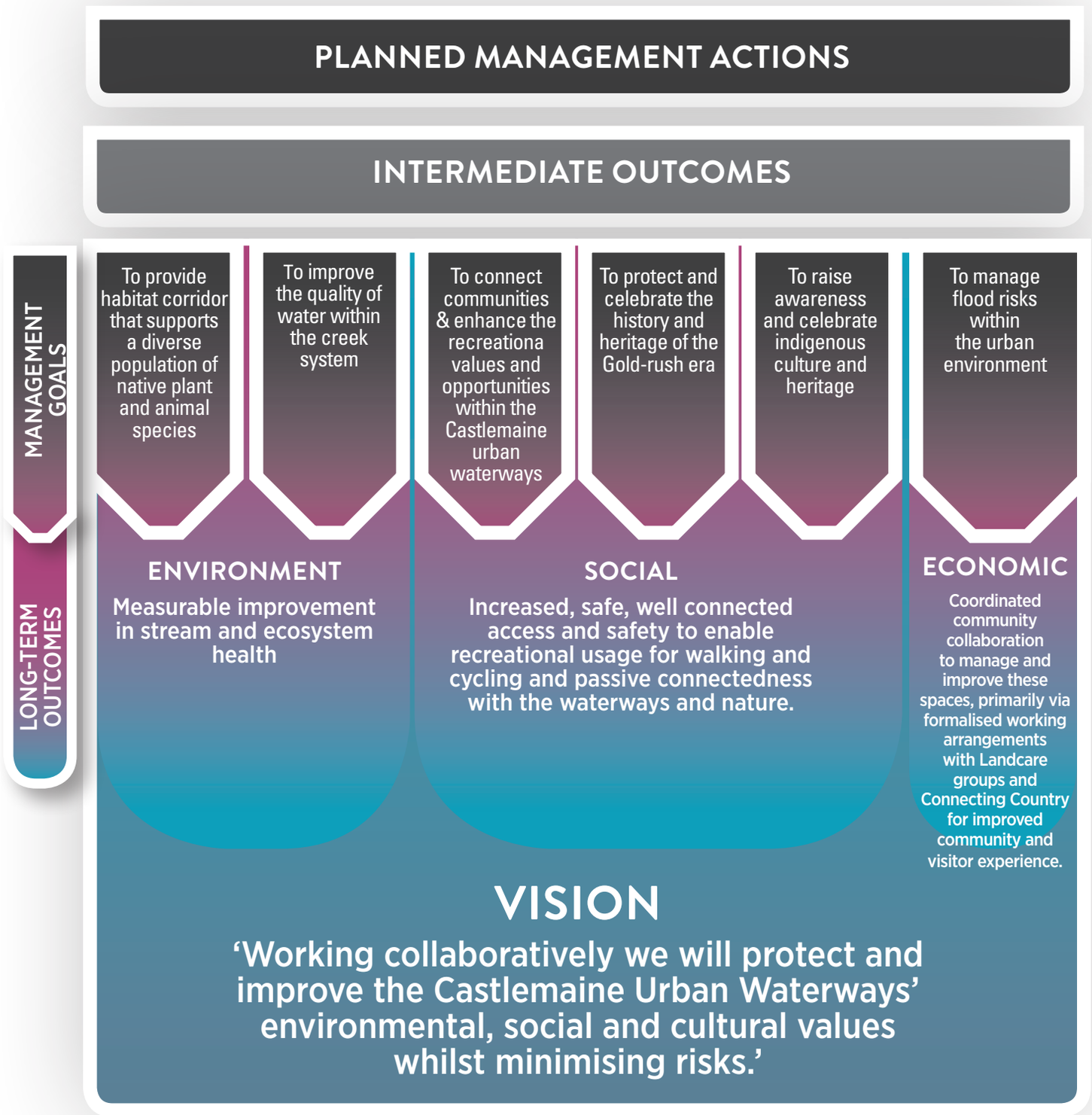

Figure 2 - Program logic for the proposed Castlemaine Urban Waterways Management Plan

MANAGEMENT GOALS AND INTERMEDIATE OUTCOMES

Six management goals have been developed to guide the works program. Each management goal has intermediate outcomes attached.

The six management goals are linked to the long-term environmental, social and economic outcomes.

The goals apply to a timeframe generally longer than 10 years, are relevant to the entire project area, and drive operational priority setting.

Management Goals		Intermediate outcomes
1	To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area	• Enhanced community awareness and appreciation of the project area • Increased community use of the project area • Increased volunteer participation in the support and maintenance of the project area • Safe, expanded and better connected user access to the project area • Establish effective governance for the project area
2	To provide a habitat corridor that supports a diverse population of native plant and animal species	• Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species • Zero cover of woody weeds • Reduced and/or maintained low cover of exotic grasses, scramblers and herbs • Established and/or maintained dense ground layer of indigenous grasses and sedges • Improved instream diversity • Maintained creek flow • Improved current knowledge of the presence/abundance/preferred habitats of native bird species • Improved current knowledge of the presence/abundance/preferred habitats of aquatic species • Protected native fauna and flora species from predation • Improved/increased biodiversity • Protected and re-introduced threatened species • Improved native vegetation extent and condition
3	To improve the quality of water within the creek system	• Improved stormwater and urban runoff quality entering the creek • Reduced sediment inputs from tributaries • Improved instream water quality • Improved wastewater discharge quality
4	To protect and celebrate the history and heritage of the Gold-rush era	• Protected built heritage
5	To raise awareness and celebrate indigenous culture and heritage	• Enhanced community awareness of indigenous culture • Indigenous culture reflected in Landcare's planning and delivery.
6	To manage flood risks within the urban environment	• Managed flood risks

Monitoring, Evaluation and Review

Monitoring, Evaluation and Reporting (MER) are integral components of natural resource management programs. A simple MER approach will be applied to The Plan.

To determine the effectiveness of the Plan, Council will produce a MER plan in collaboration with Landcare groups and the community that utilises citizen science and other evidence-based methodologies and includes:

A short implementation report for the community every year outlining:

- a summary of activities completed
- a summary of key issues or events that occurred

A mid-term 5 year review report (2022) of implementing the Plan, including:

- the findings from the short annual implementation reports
- progress against the program logic
- a review of stakeholder participation and satisfaction
- identification of any new actions
- updating of the works Plan

MER for the Plan will also be included in the work undertaken to determine the effectiveness of the Mount Alexander Shire Council Environment Strategy 2015-2025, including the following key evaluation questions:

- What evidence is there that prioritised natural environment assets are being protected and have improved?
- What evidence is there that Council has developed collaborations and that these are delivering tangible community benefits?
- What opportunities have there been for the community to engage in sustainability and environment as a result of partnerships with Council?
- What evidence is there that Council sustainability and environment leadership is recognised in the Shire community and more broadly?

Development of the works program

To enable management the Project Area has been divided into ten Management Zones (MZs) as described in Table 1 and Figure 3.

MZ	Waterway	Description
All zones – actions that apply to the entire project area		
1	Forest Creek	Colles Road to Duke Street
2	Forest Creek	Duke Street to Ten foot bridge
3	Forest Creek	Ten foot bridge to Barker Street
4	Barkers Creek	Walker Street to Forest Street
5	Two creek confluence	lower Barkers, lower Forest and upper Campbells Creeks
6	Campbells Creek	Winters Flat footbridge to Elizabeth Street
7	Campbells Creek	Elizabeth Street to Lewis Drive carpark
8	Campbells Creek	Lewis Drive carpark to Princess Street
9	Campbells Creek	Princess Street to Cemetery Road

For each MZ specific management actions have been determined.

Each identified management action has then been prioritised (high, medium or low) considering:

- The current impact of the threat on the high value asset.
- The likelihood of success i.e. will the action reduce the threat.
- The urgency of the actions e.g. is the impact of the threat continuing to degrade the value

Cost estimates were also determined and rated (high, medium or low) as follows:

- high >$15,000
- medium $3,000 - $15,000
- low <$3,000

Appendix A presents the management goals, intermediate outcomes, and planned management actions (the works program) for each MZ.

Many actions included in the works program are new commitments and are such are unbudgeted. Implementation will be subject to available funds. To achieve this MASC will work together with all relevant partner agencies, organisation and community groups to identify projects from this works program when funding opportunities arise to maximise integration and leverage further funding opportunities.

NEW COMMITMENTS

EXISTING COMMITMENTS

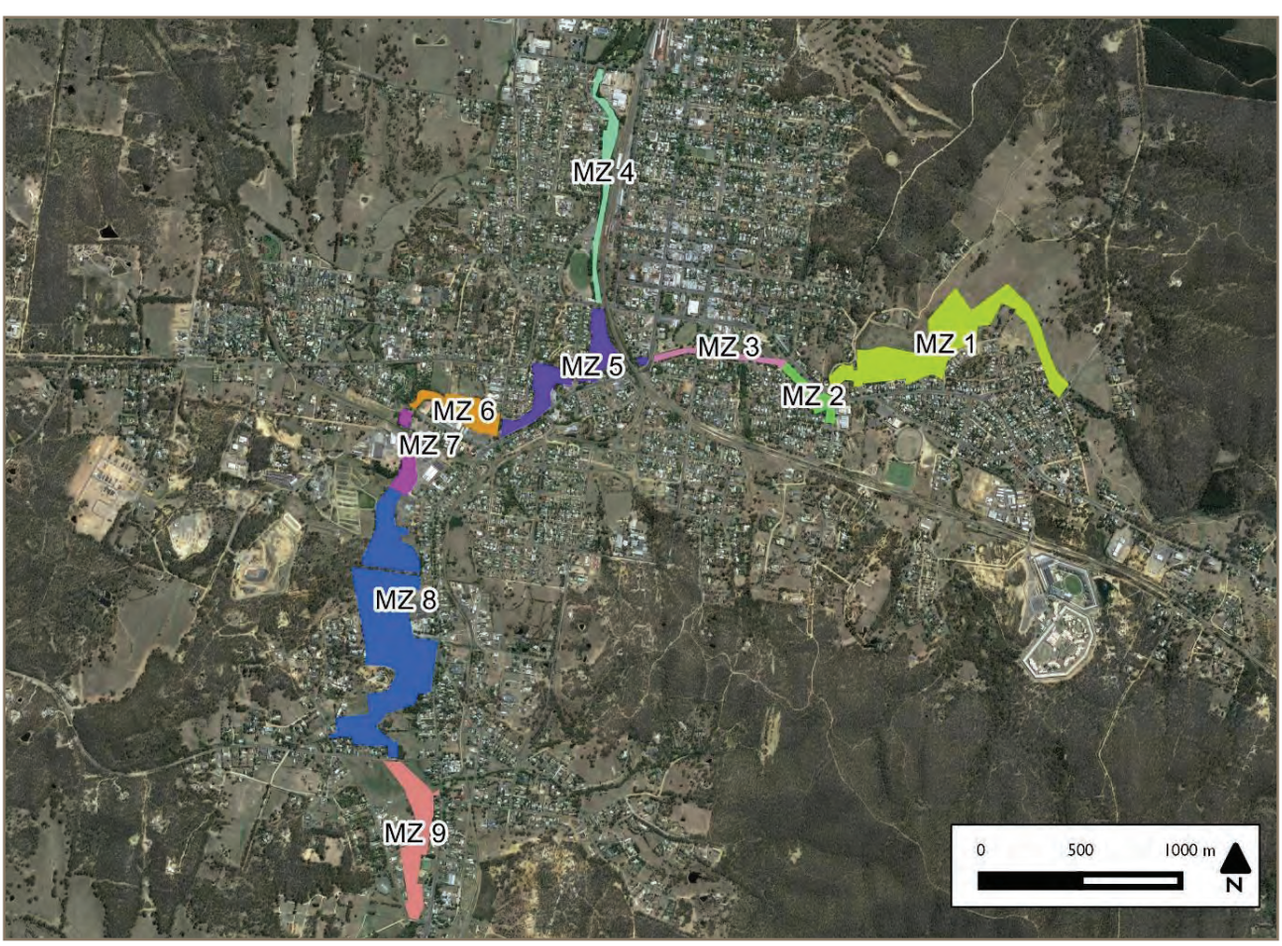

Figure 3 - Management Zone locations

APPENDIX A – RECOMMENDED WORKS PROGRAM

All zones

Long-term Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Enhanced community awareness and appreciation of the Project Area	Investigation	Investigate the feasi bility of proclaiming the project area as a 'dog on lead area' only	H	L	MASC
	Education and Awareness	Install signs at strategic locations throughout Trail network to inform users of general codes of conduct e.g. no rubbish dumping	H	H	MASC
	Maintenance	Maintain built assets (seating, picnic tables, signs) and repair/replace as required	H	H	MASC
	Education and Awareness	Identify opportunities to run events that promote access and enjoyment of the waterways values e.g. fun runs, bike rides, educational tours	M	L	CLG, FCC, MASC
	Education and Awareness	Organise school events for local students around waterways	H	L	CLG, FCC
	Planning	Map 40 m minimal fuel management areas to the fire sector (west) of fire vulnerable infrastructure and assets. Ensure that fuel reduction activities are focussed within this zone	H	L	MASC, FCC, CLG
	Education and Awareness	Develop and install consistent directional signage style along the length of the waterways between the 2 Landcare group areas	H	H	MASC, FCC, CLG
	Education and Awareness	Develop a communication plan to drive awareness and use of the waterways e.g. branding, promotion and engagement program.	H	M	MASC, FCC, CLG
	Education and Awareness	Map trail into Google Maps as a pedestrian + cycling route	M	L	FCC
Establish effective governance for the project area	Legislation and Policy	With DELWP, determine the reserve area, reserve the land for public purpose, appoint Council as the Committee of Management	H	H	MASC
	Legislation and Policy	Convene and coordinate a committee comprising community representatives and partner agencies with primary responsibility for implementing the management plan Roles and responsibilities of the core groups involved in management – DELWP, Council, FCC and CLG - will be outlined in a formal Memorandum of Understanding	H	M	MASC
	Monitoring and Evaluation	Develop a monitoring, evaluation and reporting plan	H	M	MASC
	Maintenance	Upgrade (where required) and maintain all trails for all abilities access	H	H	MASC
	Education and Awareness	Showcase achievements of Castlemaine Landcare Group and Friends of Campbells Creek and other relevant community groups	H	L	CLG, FCC, MASC
Increased community use of the project area	Incentive	Continue to support the Castlemaine Landcare Group and Friends of Campbells Creek and other relevant community groups	H	M	MASC
Increased volunteer participation in the support and maintenance of the project area	Maintenance	Undertake inspection of trees adjacent to trail on a two-year cycle	H	M	MASC
Safe, expanded and better connected user access to the project area	Investigation	Conduct audit of all built assets (eg picnic tables, signs and seating).	H	H	MASC

Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved current knowledge of the presence/ abundance/ preferred habitats of aquatic species	Education and Awareness	Seek support from NCCMA to hold a freshwater circus event - including electro fishing, macro invertebrate sampling and in situ water quality measurements	H	L	MASC
	Education and Awareness	Investigate opportunities for local schools to participate in the NCCMA River Detectives Program	M	M	MASC
	Protection Strategy	Develop fact sheet/promotion about the value of the project area and its waterways	H	L	MASC, CLG, FCC
	Investigation	Seek support from Connecting Country to develop and implement a five-year quarterly bird survey for the project area	H	L	MASC
	Investigation	In conjunction with Connecting Country, seek funding for Citizen Science activities including Waterwatch, frog & bird monitoring, mammal monitoring, basic stream and riparian condition assessments	H	M	MASC, CLG, FCC
	Monitoring	Seek funding to conduct regular macro invertebrate surveys	M	M	MASC, CLG, FCC
Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species	Education and Awareness	Partner with CFA to model and publish fire behaviour, risk and 'fire wicking' scenarios for the project area, to inform the public of the real risks and benefits of undertaking vegetation projects.	H	M	MASC
	Education and Awareness	Monitor and report on the effects of slashing, particularly in the significant grasslands area of Montgomery Street, and other control treatments upon natural plant recruitment and human safety	H	H	MASC, CLG, FCC
Improved/ increased biodiversity	Maintenance	Continue to control noxious and other priority weeds through the project area, meeting statutory responsibilities and providing support to undertake this work	H	H	MASC, CLG,FCC
	Education and Awareness	Develop guidelines and standard operating procedures for management actions that involve maintenance	H	M	MASC, CLG,FCC
	Management Strategy	Conduct an audit of all natural environment assets, including investigating and locating suitable locations that can be managed for biodiversity outcomes and set these areas aside with the view of managing them as 'biodiverse areas'	H	H	MASC, CLG, FCC
Maintained creek flow	Investigation	In partnership with Parks Victoria, Coliban Water and NCCMA, identify and negotiate possibilities for environmental flows under suitable circumstances	L	H	MASC
Protected native fauna and flora species from predation	Management Strategy	Investigate the feasibility of developing and implementing a targeted control program for pest animals	L	H	MASC
Reduced and/ or maintained low cover of exotic grasses, scramblers and herbs	Education and Awareness	Work with neighbours to prevent dumping of garden and other refuse	H	M	MASC
	Education and Awareness	Work with neighbours to minimise the impact of adjoining land management on the project area e.g. fertiliser application/nutrient run-off, growing of invasive species	H	M	MASC

Goal 3 - To improve the quality of water within the creek system

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved instream water quality	Monitoring and Evaluation	Support Waterwatch monitors in partnership with NCCMA to undertake monthly water quality monitoring, including macroinvertebrates	H	L	MASC
Improved stormwater and urban runoff quality entering the creek	Planning	Investigate the feasibility of incorporating Water Sensitive Urban Design Practices into existing and proposed developments	H	H	MASC
Minimised litter entry via any means	Management Strategy	Support 'Clean Up Australia Day' events organised by the community along the waterways	H	L	CLG, FCC, MASC
	Management Strategy	Minimise the amount of litter entering the waterways through infrastructure and education	M	M	MASC

Goal 5 - To raise awareness and celebrate indigenous culture and heritage

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Enhanced community awareness of indigenous culture	Planning	Work to incorporate Aboriginal cultural heritage values in planning activities via consultation with Dja Dja Wurrung and other local Aboriginal groups such as Nelderun	H	M	MASC
Indigenous culture reflected in Landcare's planning and delivery	Education	Maintain ongoing beneficial conversations with Dja Dja Wurrung Clans and capture Aboriginal cultural aspirations in joint Landcare planning and delivery	H	L	MASC, CLG, FCC

Goal 6 – To manage flood risks within the urban environment

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Managed flood risks	Management Strategy	Implement priority structural and non-structural flood mitigation works to complement existing levees (based on Castlemaine, Campbells Creek and Chewton Flood Management Plan - North Central CMA 2015)	H	H	MASC, NCCMA


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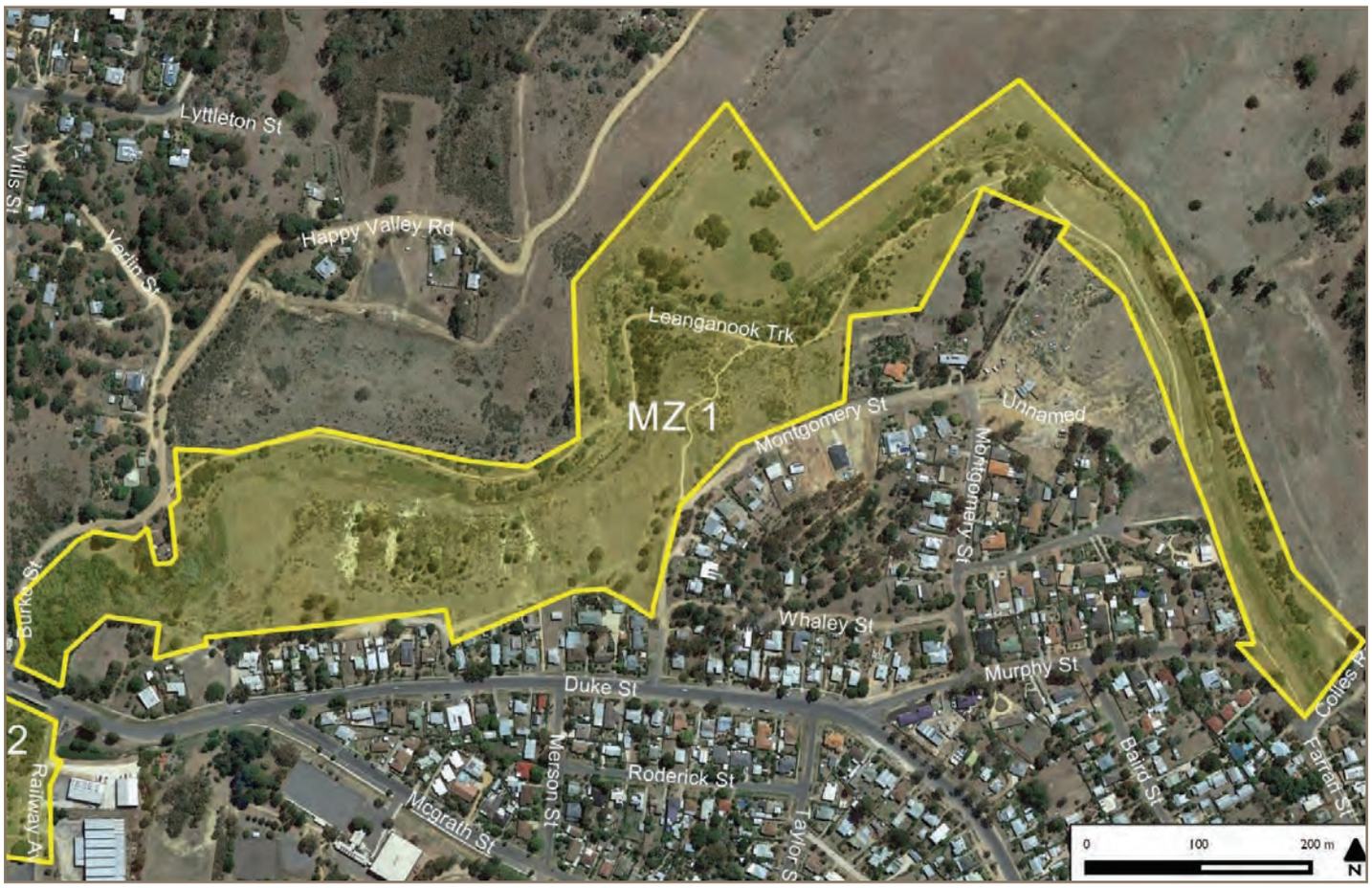
Management Zone 1 Forest Creek - Colles Road to Duke Street

Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Enhanced community awareness and appreciation of the project area	Education and Awareness	Improve trail signage at Colles Road e.g. include distance to Castlemaine and key trail features	H	L	MASC
	Education and Awareness	Create and install new information signs (larger, less text, simple language, common/conspicuous species)	H	H	MASC, CLG
Increased community use of the project areaß	Management Strategy	Install seating at pool near junction of Forest and Moonlight Creeks	M	L	MASC
	Planning	Consider developing remnant Red gum area as a picnic spot e.g. provide table/s and seating	M	L	MASC
	Management Strategy	Consider upgrading trail (widening and condition) downstream of Colles Road	H	H	MASC
	Management Strategy	Relocate trail to less flood prone (higher) ground downstream of remnant Red gums (Rabbit Flat)	H	H	MASC
	Management Strategy	Consider constructing a track extension to link existing trail across the floodplain near Happy Valley Road	M	H	MASC
	Planning	Considering designing trail to link with Duke Street as follows: - dry weather access (traverse under Duke Street with ramp up to south side of bridge) - wet weather access (ramp up to north side of bridge)	H	H	MASC
	Management Strategy	Investigate the feasibility of constructing an underpass beneath Duke Street and access ramps to north and south banks and possibility of linking to Wesley Hill Recreation Reserve	M	M	MASC
	Investigation	Identify location (and develop feasibility study) for a nature playground and/or adult fitness stations e.g. within the proposed trail extension envelope	M	M	MASC
	Planning	Plan development of a picnic spot downstream of Colles Road (north bank) i.e. plant shade trees, provide table/s and seating	M	M	MASC
	Management Strategy	Plant shade trees and riparian species along creek bank (north) downstream of Colles Road that won't obscure views to water	H	M	CLG
	Planning	Consider establishing informal walking trail along Moonlight Creek to provide loop walk opportunity	L	M	MASC
	Maintenance	Obtain hydrological advice to minimise over-track flow during flooding	H	H	MASC



Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Safe, expanded and better connected user access to the project area	Management Strategy	Install bollards at carpark boundary adjacent to Happy Valley Road	M	L	MASC
	Investigation	Consider solutions to steep gradient at entrance to trail from Happy Valley Road	H	M	MASC
	Maintenance	Obtain hydrological advice regarding flooding management upstream of and around the footbridge	M	H	MASC
	Legislation and Policy	Consider installing signage to inform users that trail is closed on Total Fire Ban days	H	L	MASC
	Management Strategy	Signed bollards placed in strategic areas with information stating trail closed during a total fire ban day and grid reference points/ coordinates to assist with emergency service agency response (similar to that used for the Castlemaine Maldon Rail Trail).	H	M	MASC
	Management Strategy	Identification and possible construction of Emergency Service Agency access/egress locations (may include gates with locks).	M	M	MASC
	Planning	Strategic planning around placement of any new vegetation plantings to incorporate fire risk mitigation strategies	H	M	MASC, CLG
	Maintenance	Undertake vegetation management immediately adjacent trail during the fire danger period to reduce chances of fire ignition.	H	L	MASC
	Planning	Ensure that potential fire risks are considered in new vegetation plantings	H	L	MASC, CLG

Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Established and/or maintained dense groundlayer of indigenous grasses and sedges	Management Strategy	Replant tussock grasses, sedges, rushes and other ground layer plants within Phalaris-managed areas	H	H	CLG
	Management Strategy	Monitor the effectiveness of the trial fence at the Montgomery street grasslands to determine its usefulness in protecting the grassland.	M	M	MASC, CLG
Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species	Management Strategy	Revegetate woody weed area upstream of Duke Street with indigenous tree, shrub and grass species and ensure that view to rock outcrop (adjacent Happy Valley Road) is not blocked by replanting	H	M	CLG
	Management Strategy	Re-establish canopy cover along Moonlight Creek from Happy Valley Rd downstream to Forest Creek and revegetate public land both sides	H	M	CLG
Maintained creek flow	Investigation	In partnership with Parks Victoria, Coliban Water and NCCMA, identify and negotiate possibilities for environmental flows under suitable circumstances	M	L	MASC
Reduced and/or maintained low cover of exotic grasses, scramblers and herbs	Management Strategy	Control pockets of spiny rush	M	M	MASC, CLG
	Management Strategy	Reduce the cover of Phalaris (priority is left bank from Colles Road to Red gum remnants)	H	H	MASC, CLG, FCC
Zero cover of woody weeds	Maintenance	Support Landcare group to continue control of woody weeds e.g. gorse	H	H	MASC, CLG
	Management Strategy	Control woody weeds, particularly willow, pine, poplar, periwinkle and blackberry upstream of Duke Street bridge	H	H	MASC, CLG

Goal 3 - To improve the quality of water within the creek system

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved stormwater and urban runoff quality entering the creek	Management Strategy	Identify options to install WSUD/storm water treatment at outlets (Colles Road/Murphy Street to Happy Valley Road) with vegetated filters to trap sediments and nutrients	M	L	MASC, CLG

Management Zone 2 Forest Creek - Duke Street to Ten Foot bridge

Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Increased community use of the project area	Management Strategy	Install access steps adjacent/behind the bridge crossing along Forest creek.	L	M	MASC, CLG
	Planning	Design trail along Duke St to existing trail at the Rotunda (currently informal goat track)	H	H	CLG, MASC
	Legislation and Policy	Resolve title boundaries to allow public land to return to public access	H	M	MASC
Safe, expanded and better connected user access to the project area	Management Strategy	Advocate for VicRoads to install refuge island on Duke Street at the end of private land.	M	L	MASC
	Management Strategy	Install safety fence (post and rail) along levee bank	M	H	MASC

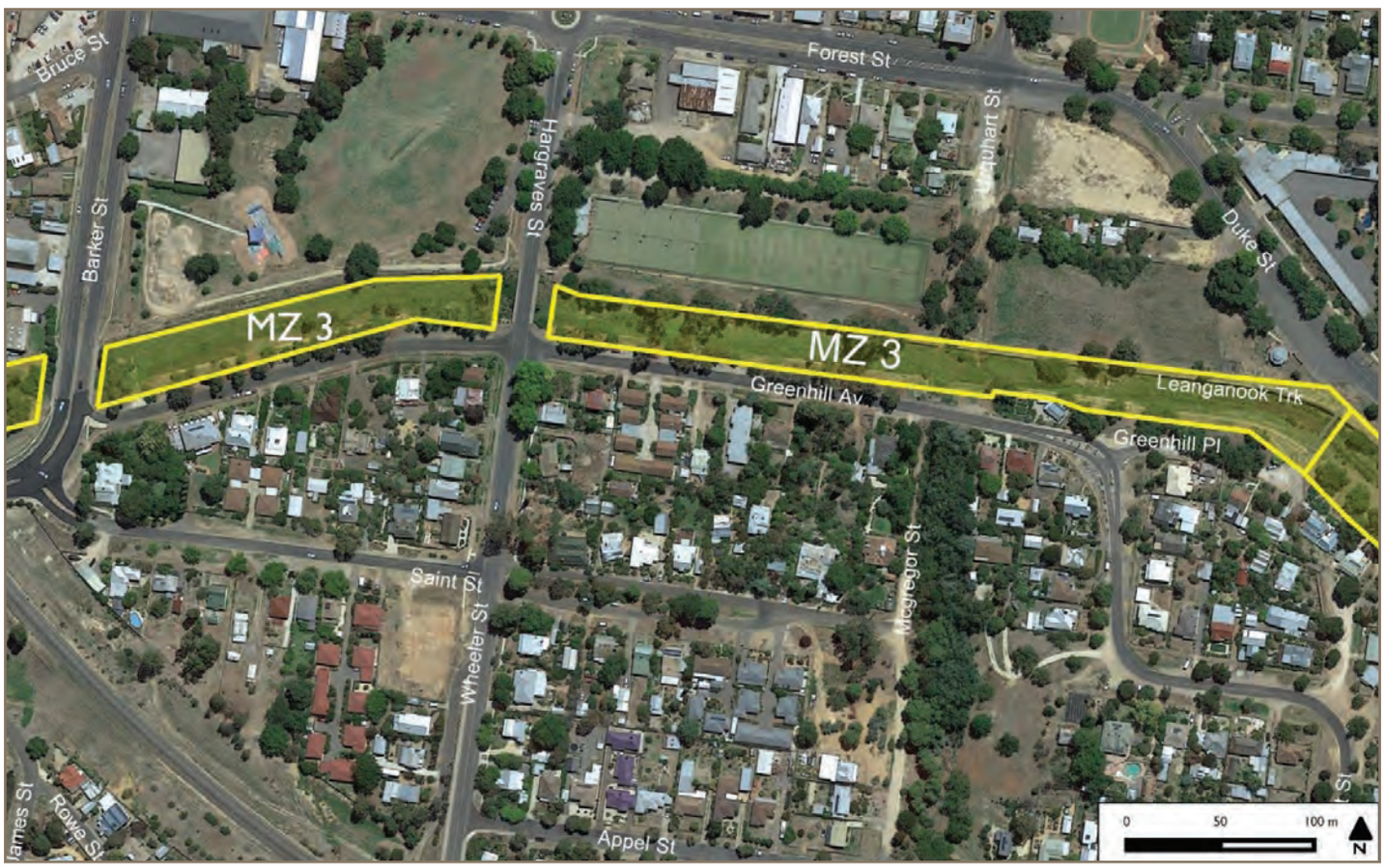
Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Established and/or maintained dense groundlayer of indigenous grasses and sedges	Management Strategy	Re-introduce appropriate herbaceous species (e.g. *sedges, poa, lomandra*) to replace weeds	M	H	CLG, MASC
Improved instream diversity	Management Strategy	Increase number and diversity of aquatic plants along edges of existing pools	H	M	CLG
Reduced and/or maintained low cover of exotic grasses, scramblers and herbs	Management Strategy	Control garden escapes including cacti, couch grass and other perennial grass weeds. Replace with suitable competitive indigenous species	H	M	MASC, CLG
	Management Strategy	Eradicate populations of American stipoid grasses	H	H	MASC, CLG
Zero cover of woody weeds	Maintenance	Control woody weed regrowth, particularly willow, blackberry and gorse	H	M	CLG
	Maintenance	Protect and expand population of locally rare *Enneapogon nigricans* and other native herbaceous spp. on rocky outcrops (left hand side of creek)	H	H	CLG

Goal 3 - To improve the quality of water within the creek system

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved wastewater discharge quality	Monitoring and Evaluation	Support ongoing Waterwatch and other monitoring	H	L	CLG, MASC
Reduced sediment inputs from tributaries	Investigation	Identify sediment inputs from road drainage	H	H	MASC
	Planning	Develop priority sediment control program	M	H	MASC
	Management Strategy	Implement sediment control program	M	H	MASC

Management Zone 3 Forest Creek – Ten Foot bridge to Barker Street



Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Increased community use of the project area	Management Strategy	Widen trail (>2m) and reseal (north side from Rotunda to Barker Street)	M	H	MASC
Safe, expanded and better connected user access to the project area	Management Strategy	Install safety fence (post and rail) along levee bank from Rotunda to Wheelers Street ensuring that it does not compromise levee integrity or impede ability for Council maintenance	H	H	MASC
	Investigation	Consider upgrading stormwater crossings at end of Urquhart Street	H	H	MASC
	Investigation	Identify options to safely cross Hargreaves Street	H	H	MASC
	Investigation	Consider separating bike/skate track from trail e.g. garden strip	H	M	MASC

Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species	Management Strategy	Revegetate in-channel from Ten Foot bridge to Victoria Gully. Use revegetation upstream of Ten Foot bridge as a template i.e. shrubs and groundcovers.	H	H	CLG
	Management Strategy	Revegetate north bank (above stone wall) upstream of Barker Street with indigenous tree and shrub species including herbaceous (native grasses, etc.). Tree species selection and location is important to protect wall from tree root growth damage.	M	H	MASC. CLG
Improved instream diversity	Planning	In partnership with NCCMA, develop aquatic habitat plan (for reach between Urquart Street and Hargreaves Street) i.e. artificial riffles and pools (see: Options for the management of Forest Creek through Castlemaine - Rutherfurd et al 2016).	H	H	MASC, CLG
	Management Strategy	In partnership with NCCMA, implement aquatic habitat plan e.g. installation of large rocks or other large structures to initiate scour pools and sinuosity (as per recommendations in 2016-17 Forest Creek study)	M	H	MASC, CLG
	Management Strategy	Investigate feasibility of removing inappropriate recent plantings of exotic tree species close to the creek that will grow to compromise the creek's habitat values	H	L	MASC

Goal 3 - To improve the quality of water within the creek system

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved instream water quality	Investigation	Investigate the feasibility of identifying options to install WSUD/storm water treatment in Urquhart Street extension between Forest Street and waterway	M	L	MASC
Improved stormwater and runoff quality entering the creek	Investigation	Identify source control opportunities to avoid or minimise stormwater impacts e.g. education, regulation and operational practices.	H	L	MASC

Goal 4 - To protect and celebrate the history and heritage of the Gold-rush era

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Protected built heritage	Management Strategy	Uncover low relief stone trail (behind Tute's Cottage)	M	H	MASC
	Maintenance	Maintain sandstone steps and low relief stone trail (adjacent Greenhill Avenue)	M	H	MASC
	Maintenance	Ensure vegetation does not damage, or impede views to, sandstone walls	H	M	MASC, CLG
	Education and Awareness	Provide an information display about the original stream path of Forest Creek and the effects of gold mining upon the vegetation and soil	M	M	MASC, CLG

Management Zone 4 Barkers Creek - Walker Street to Forest Street

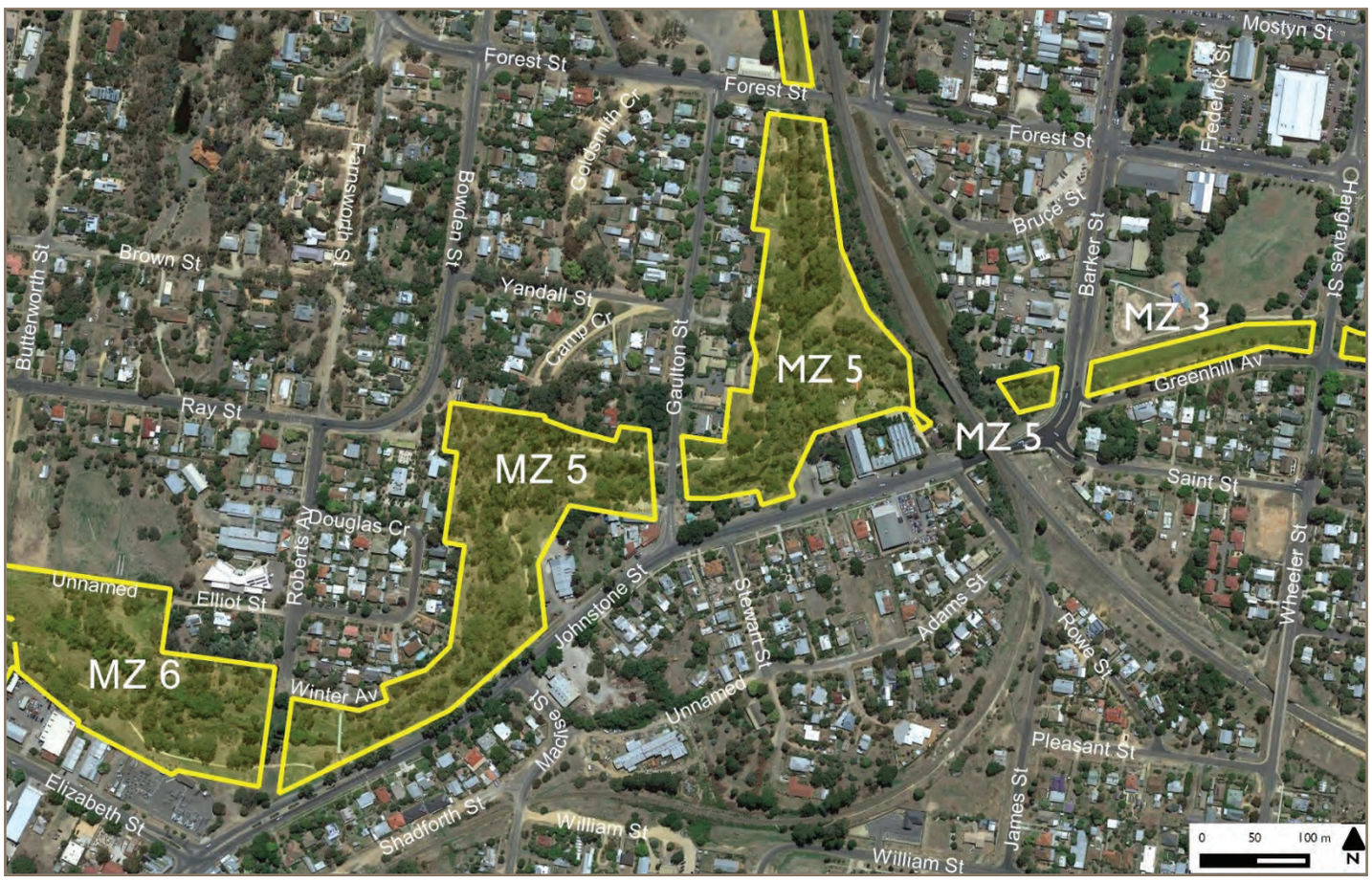
Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Increased community use of the project area	Investigation	Investigate establishment of trail along west bank of creek (from railway footbridge to Forest Street - between Barkers Creek and Camp Reserves) so that trail is available during events.	H	L	MASC
	Investigation	Investigate to develop a plan to extend trail from railway bridge to Forest Street (between Barkers Creek and Camp Reserve)	M	L	MASC
	Management Strategy	Advocate to install trail from railway footbridge to Forest Street (design as per existing trail)	M	L	MASC
Safe, expanded and better connected user access to the project area	Investigation	Advocate for DELWP to identify boundary of Camp Reserve in relation to existing chainmesh fence. This action will need to be considered in connection with the current work to review the Camp Reserve Master Plan	H	L	MASC
	Investigation	Investigate options to safely cross Forest Street e.g. underpass or refuge island	H	M	MASC

Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Established and/or maintained dense groundlayer of indigenous grasses and sedges	Management Strategy	Re-establish robust tussock grasses, sedges and rushes within the zone	H	M	MASC, FCC, CLG
	Management Strategy	Replant tussock grasses, sedges and rushes within the elm-control area	M	M	MASC, CLG
Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species	Management Strategy	Revegetate the zone with indigenous tree and shrub species (minimise tree species behind houses towards Walker Street)	H	M	MASC
	Management Strategy	Revegetate creek banks from railway foot bridge to Forest Street with indigenous tree and shrub species	M	M	MASC, CLG
Improved instream diversity	Investigation	In partnership with NCCMA, investigate opportunities to increase instream diversity (riffles and pools)	M	M	MASC, FCC, CLG
Zero cover of woody weeds	Management Strategy	Control woody weed regrowth, particularly elms adjacent Gingell Street and willows, elm, box-elder and peppercorn downstream of railway footbridge	H	H	MASC, FCC, CLG
	Maintenance	Investigate replacing street trees along Gingell Street with indigenous species when existing elm trees died	M	M	MASC
	Maintenance	Advocate for VicTrack to maintain railway banks to ensure area is not re-infested with invasive species (blackberry, gorse, rabbits, foxes)	H	L	MASC

Management Zone 5 Two creek confluence - lower Barkers, lower Forest and upper Campbells Creeks



Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Enhanced community awareness and appreciation of the project area	Maintenance	Maintain vegetation to enable viewing experiences of rock outcrop	M	L	FCC
Safe, expanded and better connected user access to the project area	Management Strategy	Control couch grass and other weeds between stonewall and trail prior to revegetation.	H	M	MASC
	Management Strategy	Revegetate between stonewall and trail with spiky plants (e.g. Lomandra, Carex and Dianella species) to create natural barrier without interrupting views	H	M	MASC, FCC
	Management Strategy	Upgrade trail along Johnstone Street section to ensure drainage of track without pooling	H	M	MASC
	Management Strategy	Replace the damaged Gaulton St connection to the Trail with a durable surface (including safe transfer of stormwater)	H	L	MASC

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Increased community use of the project area	Investigation	Identify options to traverse under Midland Highway and Gaulton Street (preferably along the south bank of Forest Creek and Campbells Creek). Enlarging flow area beneath road bridge (e.g. lowering creek level) may have significant benefits	H	H	MASC
	Management Strategy	Conduct feasibility study to determine appropriateness of constructing an underpasses beneath Midland Highway and Gaulton Street	M	H	MASC
	Investigation	Identify preferred location to run trail from Midland Highway to existing Trail (downstream of Gaulton Street)	H	H	MASC
	Planning	Develop trail extension plan - Midland Highway to existing trail (downstream of Gaulton Street)	H	H	MASC
	Management Strategy	Construct trail extension to link existing trails (Forest Creek to Campbells Creek)	H	H	MASC
	Investigation	Identify opportunities for 'bush' picnic area.	M	L	MASC, FCC
	Legislation and Policy	Confirm title boundaries between public land and freehold land, including commercial properties and return public access to public land	H	H	DELWP
	Compliance and Enforcement	Advocate for Coliban Water to reduce odours from sewage pump and sewer inspection ports	L	L	MASC
	Investigation	Consider design options to either: - improve all weather access and durability of the trail upstream of Gaulton Street, underneath Gaulton Street and between Gaulton Street - relocate the trail above active floodways	H	H	MASC

Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species	Management Strategy	Develop a plan, that includes the revegetation of the rock outcrop to prevent people falling off southern cliff edge	H	L	FCC
Improved native vegetation extent and condition	Management Strategy	Advocate for PowerCor to establish powerline rationalisation strategy for lines running parallel with Campbells Creek (adjacent to Midland Hwy). This also includes Management Zone 6.	H	L	MASC
Improved/ increased biodiversity	Management Strategy	In partnership with Winters Flat Primary School, continue revegetation within the Management Zone	H	M	FCC

Protected and re-introduced threatened species	Management Strategy	Expand the nationally endangered Matted Flax-lily *(Dianella amoena)* population	M	L	FCC
Reduced and/ or maintained low cover of exotic grasses, scramblers and herbs	Management Strategy	Eradicate the localised infestation of Redshank *(Persicaria maculosa)*	H	L	FCC
	Management Strategy	Reduce the cover of weeds at the rock outcrop hill	M	L	FCC
Zero cover of woody weeds	Management Strategy	Control poplars in drainage line adjacent to Gaulton Street	H	M	MASC
	Management Strategy	Advocate for VicTrack to control feral plums, blackberry, desert ash and other invasive spp. on railway embankment	H	L	MASC
	Management Strategy	Control all woody weeds within public land	H	L	MASC, FCC
	Investigation	Investigate option to fell pine trees on the old Lands Department depot site	L	M	MASC
	Investigation	Advocate for DELWP to conduct a site contamination survey of the old Lands Department depot site to determine suitability for revegetation	M	M	MASC

Goal 3 - To improve the quality of water within the creek system

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved wastewater discharge quality	Investigation	Identify options to install WSUD/storm water treatment	M	H	MASC

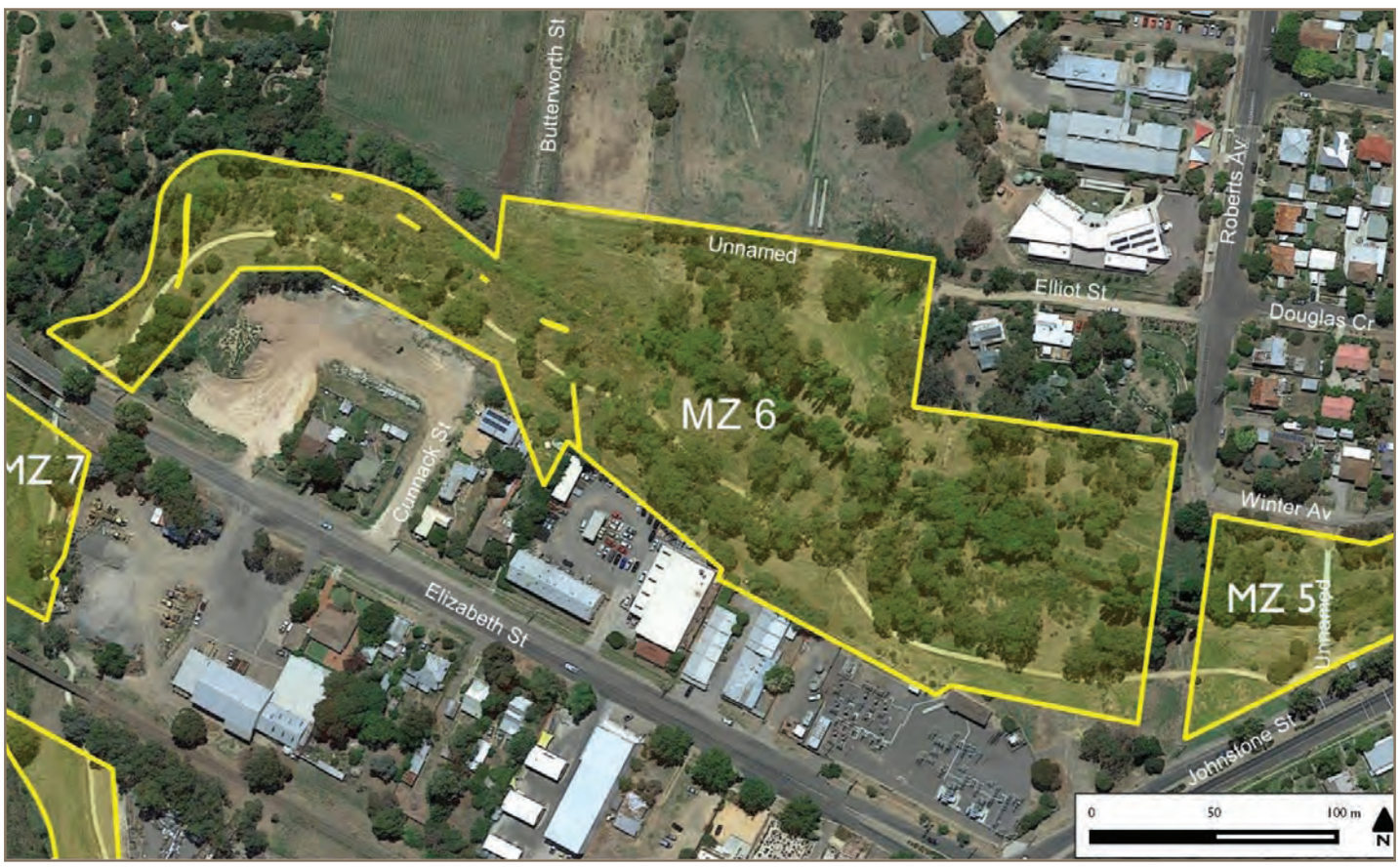
Goal 4 - To protect and celebrate the history and heritage of the Gold-rush era

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Protected built heritage	Education and Awareness	Work with Castlemaine Historical Society to explore possibility of historic marker at appropriate location along creeks.	L	L	MASC, FCC

Goal 6 - To manage flood risks within the urban environment

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Managed flood risks	Compliance and Enforcement	Investigate the removal of dumped soil from historic stone wall to increase flow capacity during floods	M	L	MASC

Management Zone 6 Campbells Creek - Winters Flat footbridge to Elizabeth Street



Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Safe, expanded and better connected user access to the project area	Investigation	Advocate for EPA to investigate industrial odours	M	L	MASC
	Investigation	Review location/design of trail in lowest lying section	M	L	MASC

Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species	Management Strategy	Encourage NCCMA and landholders to fence and revegetate north bank (d/s of Winters Flat Primary School)	H	M	MASC, FCC

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved native vegetation extent and condition	Maintenance	Maintain areas of open grassland, taking opportunities as practical to reintroduce native species, and to improve habitat and links	H	H	MASC
	Management Strategy	Develop a detailed precinct plan for this most visible part of the Project Area taking account of all stakeholders	H	M	MASC
	Management Strategy	Advocate for Powercor to establish powerline rationalisation strategy for lines running parallel with Campbells Creek (adjacent to Midland Hwy). This also includes Management Zone 5	H	L	MASC
	Compliance and Enforcement	Address unauthorised maintenance (e.g. mowing) activities that occur within the project area. These activities are an environmental and public safety issue	H	L	MASC
Improved/ increased biodiversity	Management Strategy	In partnership with Winters Flat Primary School, restore riparian vegetation between Winters Flat footbridge and Cunnack Street (both sides of creek) - utilising the area as an Education Precinct	H	M	FCC
Reduced and/ or maintained low cover of exotic grasses, scramblers and herbs	Management Strategy	In partnership with landholders, eradicate American stipoid grasses in lower Butterworth Street and adjoining private property	H	L	MASC, FCC
Zero cover of woody weeds	Management Strategy	In partnership with DELWP and NCCMA, control mature poplars and willows (Winters Flat footbridge to Cunnack Street)	H	H	MASC
	Management Strategy	In partnership with DELWP, NCCMA and landholders, control mature willows (Cunnack Street to Elizabeth Street)	H	M	MASC
	Management Strategy	Work with Butterworth Street landowners (west) to control Hawthorn along property boundaries	H	L	MASC, FCC

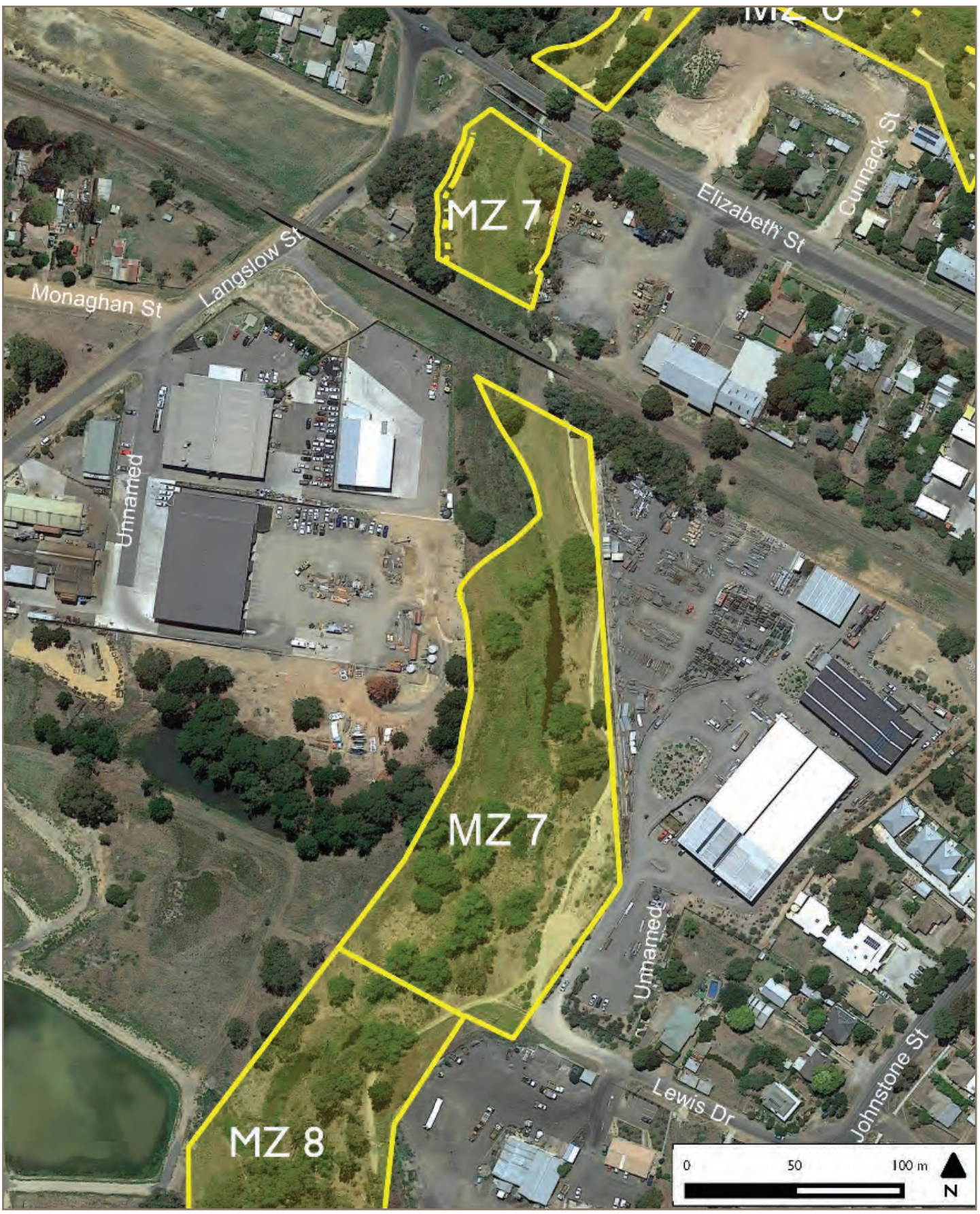
Goal 3 - To improve the quality of water within the creek system

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improve the quality of stormwater entering the creek	Management Strategy	Upgrade stormwater drainage outlet (downstream of Winters Flat footbridge) with vegetated filter to trap sediments and nutrients	H	H	MASC
	Management Strategy	Fill in the Butterworth Street drains on the floodplain	H	M	MASC

Goal 5 - To raise awareness and celebrate indigenous culture and heritage

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Enhanced community awareness of indigenous culture	Planning	Work with Dja Dja Wurrung to develop an indigenous cultural heritage walk along the creek including interpretative signage and use of Bush Tucker plants between Winters Flat footbridge and Cunnack Street	H	H	FCC

Management Zone 7 Campbells Creek - Elizabeth Street to Lewis Drive carpark



Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Enhanced community awareness and appreciation of the project area	Management Strategy	Improve aesthetics views from seating (currently weedy and branchy under the Yellow Box trees)	H	L	FCC
Increased community use of the project area	Maintenance	Upgrade gravel track between trestle bridge and Lewis Drive	H	L	MASC
	Management Strategy	Establish replacement shading over seating (currently shaded by pine tree)	H	L	FCC

Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

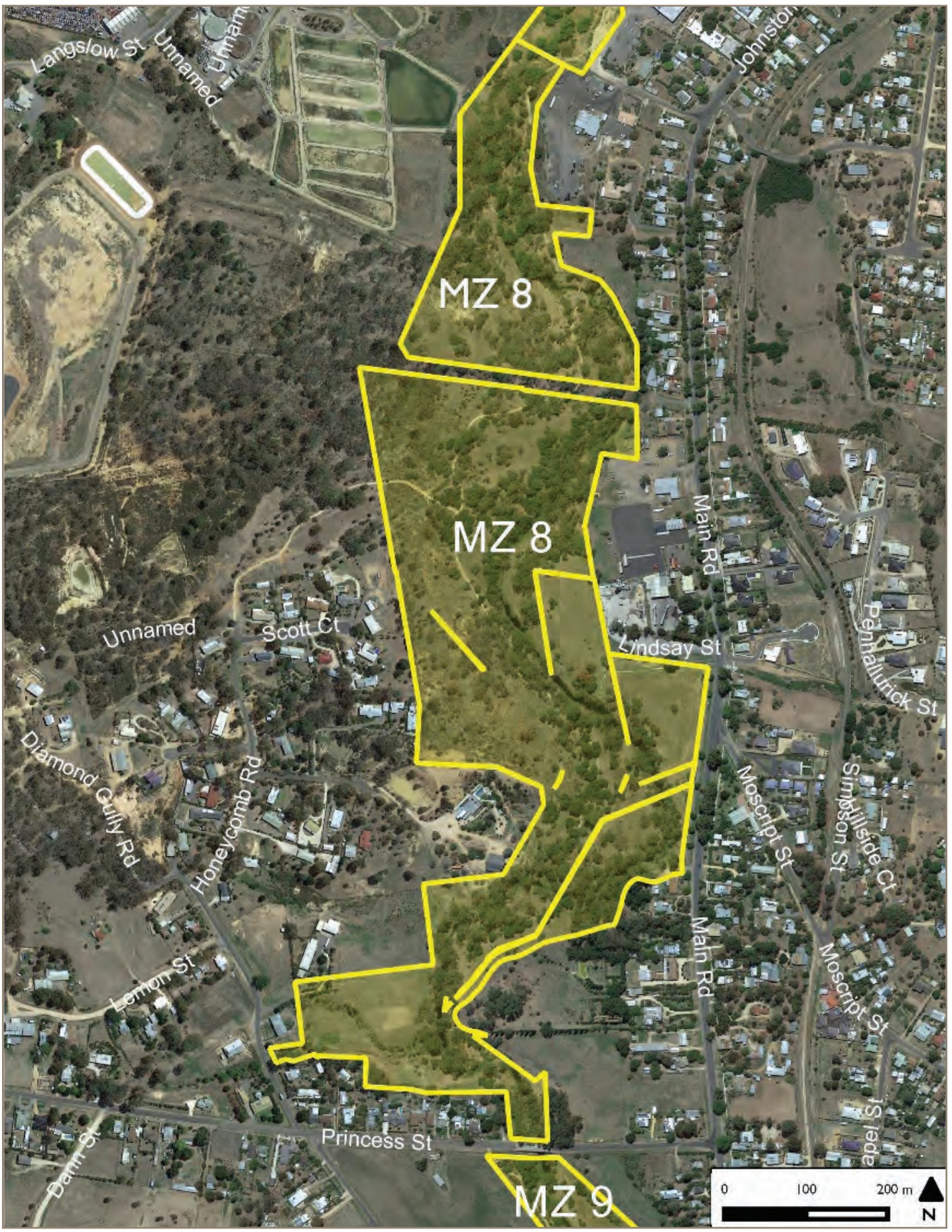
Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Established and/or maintained dense groundlayer of indigenous grasses and sedges	Management Strategy	Allow re-establishment of wetland and recolonization of appropriate vegetation on lowest lying part of east flood plain	M	L	MASC, FCC
Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species	Legislation and Policy	Develop Memorandum of Understanding with businesses to allow joint management of unused freehold land on the floodplain.	M	L	MASC
	Management Strategy	Reduce and/or maintain a low cover of exotic grasses, scramblers and herbs	H	M	FCC
Improved native vegetation extent and condition	Management Strategy	Establish River Red-gum at fringes of Lewis Drive precinct wetland	M	L	FCC
	Management Strategy	Establish native vegetation on steep fill slopes adjacent to the land	M	L	FCC
	Management Strategy	Establish River Red gum canopy over treeless parts of creek	H	L	FCC
	Management Strategy	Establish some shading (at least) along exposed parts of the trail	M	L	FCC
	Management Strategy	Improve native vegetation diversity on prior gravel pit area	M	L	FCC
	Management Strategy	Revegetate, and improve biodiversity and vegetation links along the corridor	M	M	FCC
	Compliance and Enforcement	Address unauthorised maintenance (e.g. mowing) activities that occur within the project area.	H	L	MASC

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved/ increased biodiversity	Management Strategy	Eradicate priority weeds on western floodplain and replace with native vegetation	M	M	FCC
Reduced and/ or maintained low cover of exotic grasses, scramblers and herbs	Management Strategy	In partnership with Coliban Water, eradicate Chilean Needle Grass infestation on west bank adjoining and within Coliban Water land [MASC to seek cooperation of Coliban Water for weed control within CW site]	H	L	FCC
	Management Strategy	Eradicate Reed Canary-grass *(Phalaris arundinacea)* infestation in the swampy area	M	M	FCC
Zero cover of woody weeds	Management Strategy	In partnership with DELWP, control woody weeds, particularly willow	M	M	MASC
	Compliance and Enforcement	With DELWP, advocate for Maldon Historic Railway to control noxious weeds (gorse) along the rail reserve	H	L	MASC

Goal 3 - To improve the quality of water within the creek system

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved instream water quality	Investigation	Identify options to enhance wetland function for the Lewis Drive precinct wetland	H	L	MASC, FCC
	Management Strategy	Implement preferred option to enhance wetland function for the Lewis Drive precinct wetland (to improve water quality)	M	H	FCC

Management Zone 8 Campbells Creek - Lewis Drive carpark to Princess Street



Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Enhanced community awareness and appreciation of the project area	Education and Awareness	Install trail information sign at Lewis Drive carpark	H	L	MASC, FCC
	Management Strategy	Install viewing station/seating at deep pool upstream of footbridge	H	L	MASC
	Education and Awareness	Install signage at Midland Highway to locate Lewis Drive carpark	M	L	MASC
	Maintenance	Maintain footbridge as focus area with attractive surrounds	M	L	FCC
Increased community use of the project area	Management Strategy	Continue trail to Princess Street bridge (may require two footbridge crossings to navigate public land)	H	H	MASC
	Planning	Construct trail to traverse under Princess Bridge (west bank) using Pyrenees Bridge underpass as model	H	M	MASC
	Maintenance	Maintain trail as a low impact, earthen track	H	L	MASC
	Management Strategy	Formalise car park at Lewis Drive	L	H	MASC
	Legislation and Policy	Confirm title boundaries between public land and private property and return public access to public land	H	H	MASC
	Investigation	Explore use of unused roadway as another entrance point to trail	L	L	MASC
	Planning	Plan use of public land to the north of un-named unused roadside north of the housing along Princess Street.	M	M	MASC
	Investigation	Investigate and build a trail link from Lindsay St to the Trail	M	H	MASC
Safe, expanded and better connected user access to the project area	Compliance and Enforcement	Work with landholders to stabilise fill bank	M	M	MASC
	Management Strategy	Remove half buried metal and other heavy industrial rubbish from rear of properties backing onto the creeks	M	M	MASC
	Management Strategy	Remove the barbed wire fence north of the creek	M	L	FCC

Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Established and/or maintained dense groundlayer of indigenous grasses and sedges	Management Strategy	Continue revegetation along low-lying creek flats (both banks)	H	M	FCC
	Management Strategy	Revegetate along Coliban Water boundary down to creek with suitable indigenous spp.	H	L	FCC
	Management Strategy	Enhance low-lying swampy area east of creek located opposite the centre of private land	H	M	FCC
	Management Strategy	South of the above, maintain nationally endangered *Dianella amoena* population, replace weeds with native herbs *Poa labillardiere*, etc.	M	L	FCC
	Management Strategy	Increase cover and diversity of native herbaceous spp. in Lindsay Park with attention paid to fire risk	M	M	FCC
Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species	Management Strategy	Revegetate around the rocky outcrop opposite the proposed seating/ viewing station	M	L	FCC
	Management Strategy	Revegetate with suitable indigenous species on private land fill bank	M	M	FCC
	Investigation	Investigate revegetating unused roadway	M	M	FCC
	Management Strategy	Reinstate more diverse vegetation in land south of old Coliban Water fence and north of trail	M	M	FCC
	Planning	Develop plan for Ranters Gully 'flat' (north of 18 Princess St) e.g. establishment of open woodland of River Red gum and Yellow Box with wattles and other shrubs at the fringes. Remove derelict shed	M	M	MASC
	Management Strategy	Thin out River Red gum saplings just north of Princess St bridge then re-establish mid, under and ground storey native vegetation.	H	M	MASC, FCC
	Management Strategy	Continue work to improve vegetation biodiversity and habitat along the corridor	M	M	FCC
Improved native vegetation extent and condition	Management Strategy	In 'wildflower' area to north west of information sign shelter, maintain existing orchid, lily spp and increase other native spp., eradicate sorrel (*Acetosella vulgaris*)	M	L	FCC
	Management Strategy	In gravelly hill to the west of trail, maintain and increase native vegetation cover and diversity. Reduce weed cover	M	H	FCC
	Compliance and Enforcement	Address unauthorised maintenance (e.g. mowing) activities that occur within the project area.	M	L	MASC
Maintained creek flow	Maintenance	Advocate for Coliban Water to continue to release from Waste water treatment plant	H	L	MASC

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Reduced and/ or maintained low cover of exotic grasses, scramblers and herbs	Management Strategy	Continue control of priority weeds along low-lying creek flats (both banks)	H	M	FCC
	Management Strategy	In partnership with landholder, eliminate priority weeds on private land fill bank	M	M	FCC
	Management Strategy	Continue eradication of priority weeds along Coliban Water boundary down to creek	H	M	FCC
	Management Strategy	Eradicate priority weeds on 'Lewis Rise'	M	M	FCC
	Management Strategy	Eradicate priority weeds downstream of footbridge and continue expanding revegetation extent and diversity	M	M	FCC
	Management Strategy	Eliminate priority weeds in land south of old Coliban Water fence and north of trail	M	M	FCC
	Management Strategy	Eradicate African weed orchid (hilly terrain)	H	L	FCC
	Management Strategy	Continue Chilean Needle Grass eradication program	L	M	FCC
	Planning	In partnership with CFA, develop a fuel reduction plan for Lindsay Park	H	M	MASC
	Management Strategy	Eradicate *Moraea fugacissima* infestation (south east of the Honeycomb trail interchange)	H	L	FCC
Zero cover of woody weeds	Management Strategy	In partnership with DELWP, remove willows upstream of footbridge	H	M	MASC
	Management Strategy	Remove the Oak (*Quercus robur*) tree in Lindsay St and replace with suitable indigenous tree species planted between the drain and the street	M	L	MASC
	Management Strategy	Remove Elms from the eastern side of the un-named road adjacent to 10 and 10A Princess St.	L	M	MASC

Goal 3 - To improve the quality of water within the creek system

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved instream water quality	Investigation	Investigate options to utilise existing weir to raise (and re-lower) water levels in swamp area	M	L	MASC
	Management Strategy	Protect the outside bend of the creek to the north of un-named unused roadside north of the housing 10-18 Princess Street from erosion	M	L	FCC
Improved stormwater and urban runoff quality entering the creek	Investigation	Investigate diversion of stormwater outlet that currently discharges straight into creek near 146 Johnstone St Castlemaine	M	M	MASC
	Investigation	Investigate storm water options for drain on south side of Lindsay St	M	M	MASC
Improved wastewater discharge quality	Compliance and Enforcement	Advocate for Coliban Water to improve quality of discharge water from Coliban Water	H	L	MASC
	Management Strategy	Advocate for Coliban Water to upgrade wastewater effluent discharge point	H	L	MASC
Reduced sediment inputs from tributaries	Investigation	Work with Coliban Water to control water flows into, and management of, the eroding gullies on west bank	H	H	MASC
	Investigation	Investigate establishment of wetland in Ranters Gully	M	L	FCC, MASC
	Maintenance	Improve management and maintenance standards for the Princess Street drains to minimise sediment transport into the creek	H	L	MASC

Goal 6 - To manage flood risks within the urban environment

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Managed flood risks	Management Strategy	Remove spoil dump (post creek excavation) that exists on eastern side of creek near concrete mix plant	M	M	MASC

Management Zone 9 Campbells Creek - Princess Street to Cemetery Road

Goal 1 - To connect communities and enhance the recreational values and opportunities within the Castlemaine Urban Waterways Project Area

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Enhanced community awareness and appreciation of The Project area	Education and Awareness	Install Trail information sign within Campbells Creek Park	M	M	MASC
	Education and Awareness	Install interpretative signs at footbridge	L	M	FCC, MASC
	Planning	Design a more attractive entrance point to the southern trail and creekside land including the 'traffic island' between the northernmost trail segments (where the 'Cared for by Friends of Campbells Creek ' sign is located)	H	M	MASC
Increased community use of the Project Area	Investigation	Reduce steep gradient at entrance to Trail from Campbells Creek Park	H	L	MASC
	Management Strategy	Upgrade footbridge approaches to minimise scour/outflanking	H	L	MASC
	Management Strategy	Provide barrier to prevent track falls (downstream of Princess Street)	H	M	MASC
	Planning	Investigate continuation of trail along levee bank - from Campbells Creek Park to Alexandra Street	L	M	MASC
	Planning	With DELWP, formalise car park at SW corner of Cemetery Road bridge	L	M	MASC
	Planning	Establish new trail from Main Road into public land via Olivet 'Creek'	M	H	MASC

Goal 2 - To provide a habitat corridor that supports a diverse population of native plant and animal species

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved health and active recruitment of indigenous tree and shrub layer with a diversity of species	Management Strategy	In partnership with local schools, extend revegetation into 'Sheehan's paddock' to reduce potential fire risk	H	M	FCC
	Management Strategy	Re-establish River Red gums to grow into canopy cover over the treeless sections of the creek	H	L	FCC
	Management Strategy	In partnership with local schools, increase native vegetation cover in the public land adjacent to 'Shona's' track east and north of 49 Elizabeth St.) to reduce potential fire risk	H	M	FCC
	Management Strategy	In partnership with local schools, revegetate south-westernmost part of the project area.	M	M	FCC
	Management Strategy	In partnership with local schools, improve native vegetation condition in south-easternmost part of public land. Reduce noxious weed cover.	M	M	FCC
Reduced and/ or maintained low cover of exotic grasses, scramblers and herbs	Management Strategy	Continue eradication of Chilean Needle-grass in 'Sheehan's paddock'	L	L	FCC
	Management Strategy	Eradicate infestation of *Moraea setifolia* in 'Sheehans paddock'	H	L	FCC

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Zero cover of woody weeds	Maintenance	In partnership with DELWP, control woody weeds, particularly willow, poplar downstream of Princess Street bridge and elm, pine upstream of Cemetery Road	H		MASC
	Management Strategy	Remove poplars opposite the bowls club	L	M	MASC
	Management Strategy	Remove elms west of the bowls club	H	M	MASC
	Management Strategy	In partnership with DELWP, remove willows and any other woody weeds at rear of 88-94 Main Road	M	M	MASC

Goal 3 - To improve the quality of water within the creek system

Intermediate outcomes	Approach	Planned management actions	Priority	Cost	Lead
Improved stormwater and urban runoff quality entering the creek	Management Strategy	Redesign the Princess St south side roadside drain to direct flows across the surface (rather than being concentrated) to reduce sediment delivery from storm water	M	M	MASC
	Investigation	Review the deep drains in Elizabeth St and consider option to direct the outfall away from Shona's track	M	M	MASC
	Management Strategy	Spread the flow of stormwater from pipe NW of bowls club over wide area instead of concentrated flow into creek	M	L	MASC
	Management Strategy	Spread the flow of stormwater from pipe between 108 & 118 Main Rd) over wide area instead of concentrated flow into creek	L	L	MASC
Reduced sediment inputs from tributaries	Investigation	Redesign Olivet creek drain to spread the flow of storm water over wide area to keep flood plain moister and absorb sediment and nutrients	M	H	MASC