Management Plan

Lower Dandenong Creek

Mark Shepherd
Ecological Consulting

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Ecological Consulting
shepherdecological.com.au

Prepared for:	City of Greater Dandenong c/o Phoenix Wolfe Conservation Projects Officer Mob: 0423 895 927 phoenix.wolfe@cgd.vic.gov.au	
Author(s):	Mark Shepherd Mob: 0413 688 730 markshepherd@outlook.com shepherdecological.com.au	Mark Elliston Plants of Provenance Mob. 0439 899 598 provence@bigpond.net.au
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Acknowledgments:
Practical Ecology provided spatial data that is displayed in maps used in this report. This report also builds upon certain aspects of the Practical Ecology Peri-urban Weed Management Partnership management prescriptions.

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1. Introduction

City of Greater Dandenong with partners; City of Casey, City of Knox, Melbourne Water and Parks Victoria engaged Mark Shepherd Ecological Consulting (hereafter *Shepherd Ecological*) in October 2020 to prepare a Management Plan for the Lower Dandenong Creek and associated public land (hereafter the *management area*).

This management plan has been prepared as a collaboration between Mark Shepherd of Shepherd Ecological and Mark Elliston of Plants of Provenance. Plants of Provenance is currently engaged by City of Casey and Parks Victoria as a land management contractor for various reserves within the management area and has contributed key inputs into the land management prescriptions contained within this report.

This management plan also draws upon extensive background information including spatial data collected during previous detailed studies by consultancies including Practical Ecology and Ecological Perspective.

This management plan is intended primarily for land managers, contractors and on-ground works crews. A supplementary background technical report (hereafter the *Technical Report*) accompanies this management plan, which provides a detailed review of:

- background information including biophysical values,
- relevant reports and other literature,
- various strategies, and the policy and funding stream context of the management area.

Please also note that a *Management Actions* spreadsheet accompanies the two reports, which provides detailed management prescriptions for each management zone within the management area.

1.1 Management area

The management area consists of approximately nine kilometres of the lower (southern) reach of the Dandenong Creek, and adjacent public land between Illawarra Avenue (Rowville) to the north and McCrae Street (Dandenong) to the south (Figure 1). The management area is approximately 678 hectares in area.

Prior to European colonisation, the management area was occupied by the First Peoples of the Kulin Nations (Terra Culture 2001). The management area also has a rich history for Aboriginal Peoples post-European colonisation, including the use of the Police Paddocks as the headquarters of the Native Police Corps (du Cros & Assoc 1995).

The management area is located approximately 25 kilometres to the southeast of Melbourne's Central Business District and is situated with the municipalities of:

- City of Greater Dandenong
- City of Casey
- City of Knox
- City of Monash

The management area incorporates the following precincts referred to hereafter in this report (Figure 1; from north to south):

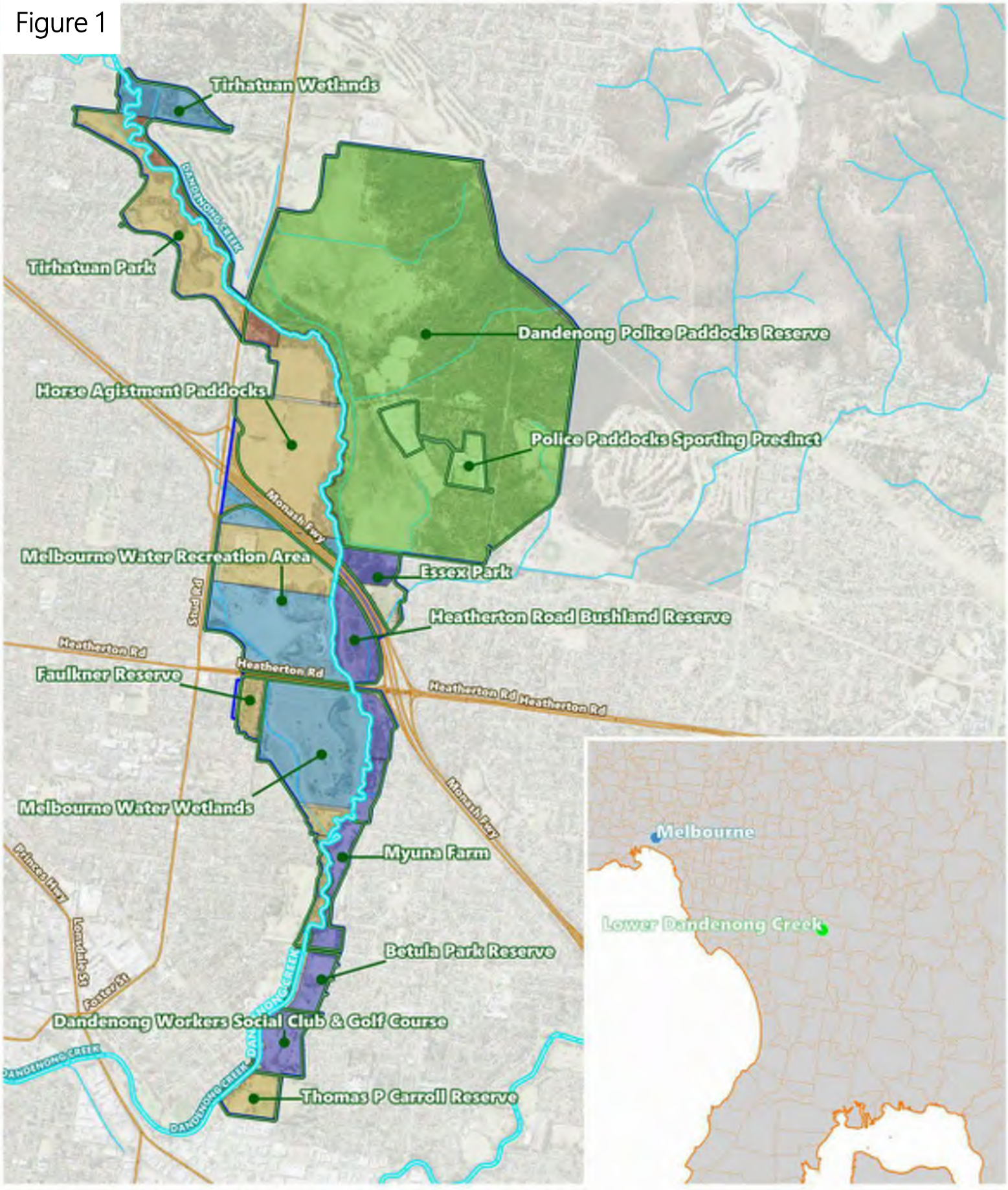
- Tirhatuan Wetlands Conservation Reserve (referred to hereafter as the *Tirhatuan Wetlands*),
- Tirhatuan Park,
- Dandenong Police Paddocks Reserve,

- Police Paddocks Sporting Precinct,
- Cleared farmland that is leased for horse agistment,
- Melbourne Water Recreation Area (incorporating the Heatherton Road North Wetlands),
- Essex Park,
- City of Casey Heatherton Road Bushland Reserve,
- Falkiner Reserve,
- Melbourne Water Wetlands (incorporating the Heatherton Road South Wetlands),
- Myuna Farm (part thereof),
- Betula Park Reserve,
- Dandenong Workers Social Club and Golf Course,
- Thomas P Carroll Reserve.

The management area is located within the Port Phillip and Westernport Catchment Management Authority area.

Figure 1 displays the location of the management area and the locations listed above.

Figure 1



Management area location

Lower Dandenong Creek Management Plan

Major watercourse
Major roads

Property ownership
City of Casey
City of Greater Dandenong
DELWP
Melbourne Water
Parks Victoria

Mark Shepherd Ecological Consulting
Map Version: 03
Date: 19/02/2021
Scale: 1:30000 @A4
Coordinate system: GDA94 MGA Zone 55

0 250 500 750 1000 m

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1.2 Conservation management objectives

The primary objective of this Land Management Plan is to specify appropriate management regimes and land-uses for designated management zones at the management area. The primary purpose of this Land Management Plan is to protect, maintain and enhance the biodiversity values throughout the site, including habitat values for the range of flora and fauna (both common, rare and threatened) that have been recorded at the management area (or are considered likely to occur).

1.3 Conservation management philosophy

The hydrology, vegetation structure and composition, fire regimes and fauna assemblages at the management area have been significantly altered compared to pre-European settlement condition. The alignment of the Dandenong Creek has been altered in some sections and channelised in others, and drainage channels have been installed throughout low-lying areas, all with the aim of faster draining of the floodplains, to mitigate floods and create more arable land for farming. Furthermore, the majority of the management area has been historically cleared of native vegetation, fire has been largely absent from the management area in recent history and the assemblage of browsing animals has changed.

As a result of these extensive modifications to the management area, the ecological processes are now significantly different compared to pre-European settlement, whereby the overall biodiversity is anticipated to be lower, however, plants and animals have adapted to the changes in surprising ways that have not always resulted in poor habitat values. For example, vegetation with a significant exotic or non-indigenous component provides harbour and food resources for many fauna species, and constructed wetlands provide extensive deep water aquatic habitats that didn't likely exist prior to European settlement.

The fundamental geomorphology of the flat low-lying areas of the site partly retains of its pre-European function as a flood plain from the over-flowing banks of the Dandenong Creek (no amount of channelisation, deepening or straightening is able to fully disperse the large quantities of water that flow down the creek following significant rainfall events). The semi-regular inundation of large areas of the site has fostered a wide range of riparian, wetland, marshland and scrub vegetation, characterised variously by both indigenous and exotic dominated vegetation, that is significantly altered compared to the expected pre-European type and extent (but non-the-less utilised by a wide range of fauna as habitat).

A relatively wide range of flora and fauna have adapted to the diverse range of habitats (created both purposefully and unintentionally) that the management area now provides. These factors render the management area an important site within the Melbourne region for the maintenance of biodiversity, albeit it's highly modified state. There is the potential to further modify vegetation assemblages through various management actions, including hydrological changes to provide a greater diversity of habitats for a greater diversity of species (both flora and fauna).

The overarching philosophy guiding this management plan is the recognition that these new ecosystem processes and modified environments, and that these so-called *artificial habitats* often consist of complex and diverse ecosystems with considerable biological value for flora, fauna and ecosystems. And importantly, given the highly populated and largely residential context of the management area, the biodiversity and habitats provide immeasurable value for the many human visitors to the site.

2. Current and historic management

2.1.1 Current management agencies

The management area is currently managed primarily by City of Casey, City of Greater Dandenong, Parks Victoria and Melbourne Water.

Current land management within City of Greater Dandenong is undertaken primarily by:

- Council department specialist bush regeneration crew on sites of high conservation value,
- Weed management contractors and specialist bush regeneration contractors on sites of high and low conservation value,
- Melbourne Water within constructed retention ponds and within the Melbourne Water Wetlands (south of Heatherton Road),
- Friend's Groups.

Current land management within the City of Casey is undertaken primarily by:

- Specialist bush regeneration contractors on sites of high conservation value,
- Weed management contractors on sites of lower conservation value,
- Friend's Groups,
- Melbourne Water within vicinity of certain sections of the Dandenong Creek, primarily south of Stud Road,
- Parks Victoria within the Dandenong Police Paddocks Reserve.

Other organisations involved in the management or funding of the management area include:

- City of Knox,
- City of Monash,
- Department of Environment Land Water and Planning (DEWLP),
- Port Phillip and Westernport Catchment Management Authority.

2.1.2 Current and historic land management programs

The management area is currently and has been historically included in numerous land management and revegetation funding programs, including:

- Peri-urban Weed Management Partnerships (PWMP) Initiative (discussed in the following section)
- Living Links
- Web of Green (City of Casey)
- Annual environment Council funding programs, including a carbon offsetting program
- Parks Victoria revegetation and management funding
- Liveable Communities, Liveable Waterways Program (Melbourne Water)
- Our Catchments, Our Communities

2.1.3 Peri-Urban Weed Management Partnership

The Peri-urban Weed Management Partnerships (PWMP) program provided $4 million of funding over four years to protect native plant and animal species in Melbourne's peri-urban areas from high-risk weeds. The program is delivered in partnership between state and local governments. Local land managers work with the local community to identify native habitats on public land that have significant environmental and community value (DELWP 2017b).

Practical Ecology was engaged in 2017 to provide, as part of the PWMP initiative:

- Biodiversity Mapping Report (Practical Ecology 2017a)
- Weed Mapping Report (Practical Ecology 2017b)
- Weed Action Plan (Practical Ecology 2017c)

Practical Ecology defined management zones for the management area as part of the Peri-Urban Weed Management Partnerships (PWMP) initiative. Practical Ecology defined weed management objectives and management actions for each zone, which formed the basis of a four-year weed management program undertaken by various stakeholders between 2016-2020. In the interests of consistency, this management plan generally retains the zonation defined by Practical Ecology (2017), along with the general weed objectives that correspond to each zone. Additional zones have been added where additional properties were added to the management area in the southern sector.

A summary of management zones is provided in Figure 2.

3. Land management

3.1 Holistic land management principles

The following sections provide specifications for site management components. However, each component must be considered in the context of the other components being implemented. Management inter-relationships include:

- Overstorey revegetation can be used to establish suitable conditions for understorey revegetation, through the suppression of grassy and herbaceous weeds at least several years after canopy planting,
- The control of dense woody weed infestations such as Blackberry **Rubus anglocandicans* and Gorse **Ulex europaeus* can remove harbour for pest animals such as rabbits and foxes.
- Broad-scale changes to vegetation structure and composition including reduced weed species cover and abundance can be achieved through alterations to hydrology and through the use of fire as a management tool.

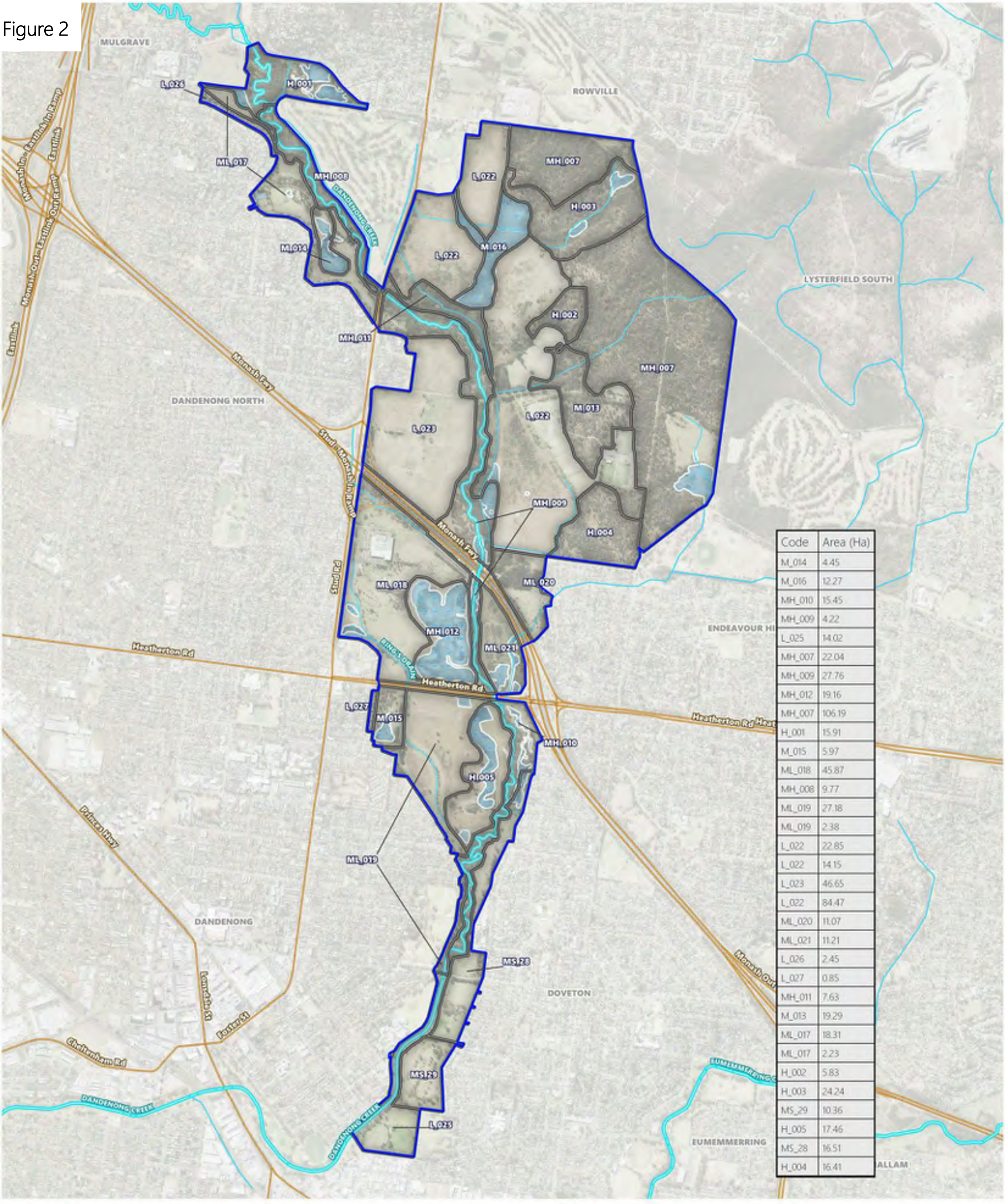
Furthermore, the management area contains significant cultural heritage values (Shepherd Ecological 2021; Heritage Victoria 2016). Therefore, the engagement of Aboriginal Peoples is recommended as part of holistic land management considerations.

3.2 Management Zones

Land Management Zones were defined by Practical Ecology (2017) as part of the PWMP based on broad bio-physical values. The management zones contained within this report are consistent with Practical Ecology zones, with the exception of additional properties within the City of Casey that are outside of the PWMP area. Please note that the management zone ranking designated by Practical Ecology, which is represented in the zone names with rank abbreviations (eg. MH_008 has a Medium-High ranking), has been superseded by the Management Prioritisation Matrix (Section 4). However, the zone names have been retained where applicable in the interests of consistency.

The following sections prescribe general management actions for the management area, while a Schedule of Works itemises specific actions for each management zone (provided separately in spreadsheet format and in section 5). Management Zones are displayed in Figure 2.

Figure 2



Code	Area (Ha)
M_014	4.45
M_016	12.27
MH_010	15.45
MH_009	4.22
L_025	14.02
MH_007	22.04
MH_009	27.76
MH_012	19.16
MH_007	106.19
H_001	15.91
M_015	5.97
ML_018	45.87
MH_008	9.77
ML_019	27.18
ML_019	2.38
L_022	22.85
L_022	14.15
L_023	46.65
L_022	84.47
ML_020	11.07
ML_021	11.21
L_026	2.45
L_027	0.85
MH_011	7.63
M_013	19.29
ML_017	18.31
ML_017	2.23
H_002	5.83
H_003	24.24
MS_29	10.36
H_005	17.46
MS_28	16.51
H_004	16.41

Management Zones

Lower Dandenong Creek Management Plan

- Management Area
- Major roads
- Watercourse
- Major watercourse
- Vehicular access
- Wetlands
- Management Zones

Mark Shepherd Ecological Consulting
Map Version: 01
Date: 14/12/2020
Scale:1:20000 @A3
Coordinate system: GDA94 MGA Zone 55

0 250 500 750 1000 m

Mark Shepherd Ecological Consulting

3.3 Weed management

The following sections outline the recommended approach and specific weed management techniques for the management area. The accompanying Management Zone spreadsheet provides details of priority weeds and weed control targets.

3.3.1 Weed management context

Weeds likely pose the greatest threat to the biodiversity values of the management area due to the potential to:

- Reduce the diversity of plants and habitats,
- reduce the suitability of the management area as habitat for a wide range of native fauna,
- create suitable conditions for the establishment of introduced animals,
- alter ecological and geophysical processes such as water-nutrient cycles and soil chemistry, and increase erosion,
- pollute gene pools of site-indigenous flora through hybridisation.

Furthermore, weeds may have a negative affect the human experience of natural areas for many visitors to the management area (Ansong & Pickering 2015), particularly in relation to well-known and easily recognisable weeds such as Blackberry.

The management of weeds requires a coordinated and well-planned response that draws upon the attest scientific research and is closely supervised by experienced practitioners, that are operating within a clearly defined weed management strategy.

3.3.2 Weed prevention

Any management action that can reduce the potential for weeds to establish in the first instance should be prioritised over chemical treatment or physical removal. For example, the flooding of pasture can create conditions that favour indigenous aquatic and semi-aquatic vegetation that are too wet for the majority of exotic plants. Similarly, the planting of indigenous overstorey can result in the suppression of weeds in the understorey.

In many circumstances, the periodic selective slashing of grassy and herbaceous weeds with a brush-cutter (avoiding native species where practical) can remove weed flowering material and seeds, and give native species an advantage over time, thus reducing the reliance on herbicides. The primary aim for slashing is to remove seed heads, which typically form in spring and the frequency of slashing is determined by the formation of seed heads. The minimum standard for each management area is the aim to prevent woody and herbaceous weeds from bearing flowering material (including seeds) at all times of the year, while the aim for grassy weeds is to reduce flowering material in areas of highest native understorey cover.

Fire can be also be used as a tool to kill weeds and germinate soil-stored seed over broad areas. Any opportunity to influence the bio-physical processes that result in weed establishment, such as hydrological changes, revegetation and the use of fire requires detailed planning and funding, however, such actions may result in reduced management costs in the longer-term, while reducing reliance on herbicides. Weed prevention strategies are discussed in the accompanying technical report.

3.3.3 Major weed infestations within the management area

Practical Ecology (2017) undertook broad-scale mapping of naturally established exotic plants at the management area as part of the PWMP initiative. Ecological Perspective (2018) undertook detailed mapping within proximity to the

Dandenong Creek between Stud Road and Monash Freeway. A total of 66 weed species were recorded by Practical Ecology (2017) while 24 weed species were determined as priority weeds by Ecological Perspective (2018).

The Practical Ecology (2017) mapping revealed that a suite of highly invasive weeds are well suited to the generally highly fertile and high moisture content soils of the floodplains, including large infestations of:

- Blackberry **Rubus anglocandicans*
- Gorse **Ulex europaeus* and
- Wandering Tradescantia **Tradescantia fluminensis*
- Watsonia **Watsonia meriana* var. *bulbillifera*
- Toowoomba canary-grass **Phalaris aquatica*

Woody weeds were commonly recorded by Practical Ecology on the less fertile foothills of the Police Paddocks, including (but not limited to):

- African Boneseed **Chrysanthemoides monilifera* subsp. *monilifera*
- Desert Ash **Fraxinus angustifolia*.
- Flax-leaved Broom **Genista linifolia*
- Hawthorn **Crataegus monogyna*,
- Sweet Briar **Rosa rubiginosa*
- Sweet Pittosporum **Pittosporum undulatum*,

Many of the larger weed infestations have since been significantly reduced in area and cover over the course of the PWMP program and other weed management programs since the inception of the PWMP program in 2016 and since the Ecological Perspectives (2018) study. However, Practical Ecology's and Ecology Perspective's baseline mapping will continue to be a useful resource as a reference for the areas where weed infestations are most likely to persist or most likely to re-colonise.

3.3.4 Blackberry

Blackberry **Rubus anglocandicans* has been mapped by Practical Ecology throughout large areas of the Police Paddocks Reserve, the Melbourne Water Wetland and the riparian corridor of the Dandenong Creek and associated drains. Large infestations were observed by Shepherd Ecological within the Wetland Walk section of the Police Paddocks (Photo 11). Smaller but numerous infestations were observed within dense Toowoomba Canary-grass **Phalaris aquatica* thickets throughout large areas of the Melbourne Water Wetlands.

The high fertility and damp conditions throughout much of the management area provide ideal conditions for the establishment of Blackberry, which can take root wherever the canes touch the ground and can form thickets several meters tall. The control of Blackberry needs to be undertaken over an extended period with several follow up treatments. Control methods vary, depending on the maturity of the plant, and the size of the infestation.

Physical removal is possible for small plants. All root material must be extracted from the ground as new plants can form from any root fragments left in the soil. Medium sized plants can be cut and painted with undiluted Glyphosate, or Vigilant® or similar. However, it is important to cut through the root nodule that sits below the ground and paint immediately with Glyphosate or Vigilant (simply cutting and painting the stems will not likely be effective).

Larger plants can be cut and painted after removing the canes by slashing with a brush-cutter and then using secateurs and thick gloves to carefully remove the remaining canes. Access to the root nodule can then be gained. However, most larger infestations are more efficiently treated with herbicide spray. Grazon® Extra (or equivalent) is considered an effective herbicide and doesn't need to be applied while the plant is flowering (unlike more traditional Blackberry

herbicide treatments, which may become less effective outside of the flowering time), however, herbicide application in warmer months is generally more effective. Grazon Extra is an effective all-round broad-leaf herbicide (to enable other broad-leaf weeds to be targeted at the same time).

Larger infestations such as at the Grey-headed Flying-Fox colony and within the Dandenong Police Paddocks Reserve will likely need access paths slashed into the thickets (using a brush-cutter) to enable access to the plants with a back-pack sprayer or rig-spray unit (refer to Section 3.7.1 for specific constraints associated with the Grey-headed Flying-fox colony).

Photo 11. Blackberry thickets within the Dandenong Police Paddocks Reserve (November 2020)

3.3.5 Gorse

Gorse **Ulex europaeus* is widely distributed within the lower elevations of the Police Paddocks Reserve and the Melbourne Water Wetlands (Photo 12) and has been previously targeted as part of weed management works to date. The primary goal for Gorse management is therefore to at least prevent an increase in the cover and extent of infestations, compared to the existing cover and extent, and with the aim of preventing plants from reaching maturity wherever possible. Blackberry and Gorse are considered the main weed control priorities for the Police Paddocks Reserve.

Photo 12. Gorse infestation within the south-eastern sector of Police Paddocks (Wetland walk) (November 2020)

The Victorian Gorse Taskforce Control Strategy 2014-2019 (VGT 2014) has published detailed recommendations relating to the management and control of Gorse, much of which is relevant to the management area. In summary, VGT (2014) recommends the following strategy for gorse control:

- A long-term commitment from the land manager;
- Treating all plants before they set seed;
- The use of a combination of control methods;
- To be persistent and regularly follow up with inspections of previous season's work;
- Revegetation and a change in the land use practices that allowed gorse to spread and grow.

Source: CGT (2014)

Chemical control is recommended as the primary control method for Gorse at the management area and revegetation is recommended as the primary land-use change that will suppress Gorse. Given the large areas that are potentially infested, spraying is seen as the preferred option over cut and painting, however, cut and painting can be used on small outlying infestations by Friend's Groups or other personnel without an Agricultural Chemical Users Permit (ACUP). Glyphosate based herbicide or Vigilant® (or similar) are recommended for cut and painting (cutting as close to the ground as possible and painting immediately with undiluted herbicide.

Spot-spraying with a broadleaf specific formulation is recommended. Gorse can be controlled any time of year in the suitable weather conditions. Grazon Extra (or similar) is effective on Gorse and is an effective all-round herbicide that can be used on a wide range of broad-leaf weeds.

Controlled burning of gorse infestations could be used to kill mature plants and germinate soil-stored seed. A hot burn will also kill soil-stored seed (CGT 2014), however, it's likely only cool burns could be safely undertaken in the context of the surrounding residential areas and major roads. Controlled burning as a management tool is discussed further in Section 3.10.1.

Many of the areas affected by Gorse such as within the Police Paddocks and the Melbourne Water Wetland co-exist with tall Toowoomba Canary-grass *Phalaris aquatica* or Tall Reed *Phragmites Australis*. The height and density of

these plants make Gorse difficult to locate and treat. It is therefore recommended that a GPS or similar device is used to navigate along transects by personnel undertaking control to ensure that all areas are assessed and treated. High resolution orthomosaic aerial photography captured by an RPA is another option to efficiently map Gorse infestations (refer to Section 1.1.1). Furthermore, if safe and practical to do so, Gorse infestations within Toowoomba Canary-grass can be burnt and intensively managed to supress their re-establishment in the months and years following the burn.

3.3.6 Bulbil Watsonsia

Bulbil Watsonsia *Watsonia meriana* var. *bulbillifera* can form dense mono-specific stands that can prevent the recruitment of native plants. Bulbil Watsonia reproduces by stem bulbils and corms. Stem bulbils are the primary means of reproduction, which can be dispersed by water, slashing, and physical transportation. Bulbil Watsonia plants are known to live for at least 35 years (Muyt 2001).

Several large infestations of Bulbil Watsonia were observed extending throughout an extensive area of the Police Paddocks and the weed has been recorded throughout the wetter areas of the site (Practical Ecology 2017) (Photo 13). The general location of the infestations were generally consistent with Practical Ecology (2017) mapping. However, systematic survey and mapping for weeds, including Bulbil Watsonia was beyond the scope of this study and the Practical Ecology (2017) data is four years old at the time of this report. It is therefore recommended to undertake a grid style assessment of favourable habitat (generally damp low-ling areas) to accurately determine the full extent of the infestations.

Bulbil Watsonia can be managed several ways, including:

- Digging out the plants,
- Slashing,
- Herbicide spraying.

Bulbil Watsonia can be physically removed by digging out, ensuring that all underground corms are carefully removed with the plant. However, this method is labour intensive and better suited to smaller infestations limited to groups of isolated plants, where access is relatively easy.

If physical removal or spraying is not an option, then slashing the bulbil laden stems prior to maturity (typically in early summer) will weaken the plant and prevent bulbils from reaching maturity (slashing after the bulbils have formed to maturity has the potential to spread the bulbils many metres from the parent plant and should therefore be avoided). Repeated slashing after several or many years has the potential to weaken the plant to the point of killing the plant (as has been observed by the authors with other bulbous plants), however, this technique is un-proven at this stage. The potential benefits of such a non-herbicide control method warrants a systematic trial to determine the longer-term effects of repeated slashing.

The spraying of a selective herbicide is recommended to treat Bulbil Watsonia for the larger infestations at the management area. Research undertaken by (Brown et al 2007) trialled the use 2-2DPA (Dalapon®, Propon®) on Watsonia in a site in Western Australia which reported that there was a 97% reduction in the cover of Watsonia in the first year with little evidence of off-target damage. A trail of this herbicide at the management area is therefore recommended. Other herbicides which are known to be effective include Grazon Extra with a wetting agent such as Pulse.

Spraying should occur as soon as flower spike starts to appear. If flowering is any more advanced then brushcutting the flowers prior to spraying is recommended, which can be done as a precaution regardless of flower spike development, to ensure that no plants are allowed to advance to maturity. Regular and repaeated slashing will also further weaken the plant.

Photo 13. Bulbil Watsonia; Dandenong Police Paddocks Reserve (October 2020)

3.3.7 Toowoomba canary-grass

Toowoomba Canary-grass **Phalaris aquatica* occupies the majority of the grassed areas of the Melbourne Water Wetlands on the fertile flood plain to the Dandenong Creek (up to approximately 25 hectares) and other areas including sections within the Police Paddocks and the Heatherton Road Bushland Reserve (Photo 14).

Toowoomba Canary-grass forms dense mono-specific thickets that outcompete almost all other flora species (with the exception of certain woody weeds including Blackberry and Gorse). However, Toowoomba Canary-grass is assumed to be utilised as habitat by a range of native and exotic fauna (the degree to which is unstudied and therefore unknown).

Toowoomba Canary-grass, like many other grass species, is difficult to control over broad areas due to its seeding and establishment means and the mono-specific composition of the grassland makes plant succession with other exotic flora following control to be inevitable without intervention. Given these considerations, Toowoomba Canary-grass is not a priority for complete removal, rather, management that changes the suitability of Toowoomba Canary-grass to establish and persist is the primary management aim, including:

- Regular or periodic inundation through the alteration to hydrology, such as the creation of spillways to divert stormwater or surface water onto the floodplain, if prolonged and regular enough, will kill Phalaris and favour flora species better suited to wetter conditions,
- Regular slashing – Toowoomba Canary-grass is a short-lived species, and several repeated slashings will greatly reduce the vigour of the population and change the grassy composition,
- Revegetation, in the form of isolated canopy trees or un-guarded broad-acre plantings (refer to Section 3.4.3) will gradually out-compete Toowoomba Canary-grass and establish conditions that are favourable for a range of other grasses that are less dense (facilitating greater floristic diversity, including potential partial colonisation by indigenous grasses and herbs),
- Burning can be used over small areas to remove biomass, after which herbicide can be applied once re-growth reaches 5-10cm. Establishment of a dense understorey following burning can out-compete Toowoomba

Canary-grass, as seedlings are slow to establish and susceptible to competition (Muyt 2001). Regular follow-up selective slashing with a brush-cutter can further exhaust the plants and provide an additional competitive advantage to indigenous understorey plants.

Photo 14. Toowoomba Canary-grass within the Melbourne Water Wetlands

3.3.8 Wandering Tradescantia

Wandering Tradescantia **Tradescantia fluminensis* occurs throughout much of the Dandenong Creek banks, particularly to the east of Stud Road and within wetter areas of the Police Paddocks (Photo 15). Extensive Wandering Tradescantia beds have formed within the Grey-headed Flying-fox colony and areas of creek line to the south of the colony, where it is dominated the understorey and preventing indigenous tree and shrub recruitment.

Given that Tradescantia can regenerate from plant fragments that are easily transported in floods; the approach to Tradescantia management needs to be suppression rather than elimination, as floods will inevitably bring new infestations, originating from infestations upstream. However, infestations that occur above an elevation that is subject to regular flooding should be prioritised, as these areas are less likely to be re-colonised, compared to lower elevations next to the creek. Infestations on higher elevations can be sprayed with selective herbicides (repeat applications will be required).

In areas below the regular flood elevation, revegetation can reduce Tradescantia density through competition. Brush-cut holes and/or rake clearings for micro-planting within the Tradescantia. Plant mature tube stock or super tubes (70mm diameter). Follow-up manual clearing is essential over the next 12-18 months (or longer depending on the species and growth rates) to ensure that the Tradescantia does not smother the plants.

Smaller infestations can be manually removed by rolling up the mats and either transporting off-site or heaped in a warm sunny location above the regular flood level and covered with black plastic – the piles will likely rot down after several weeks in warm weather under the plastic (Muyt 2001).

Photo 15. Tradescantia infestation within the Dandenong Police Paddocks Reserve

3.3.9 Creepers such as Blue Periwinkle, Japanese Honeysuckle and English Ivy

Creepers such as Blue Periwinkle **Vinca major*, Japanese Honeysuckle **Lonicera japonica* and English Ivy **Hedera helix* were mapped by Practical Ecology (2017) and observed by Shepherd Ecological as continuing to persist within the management area; particularly within the Police Paddocks (Photo 16 & 17).

Japanese honeysuckle and Blue Periwinkle can be slashed prior to spraying to reduce the biomass and therefore minimise the amount of herbicide used after the plants have re-grown (in warmer months). Creepers are difficult to control using herbicide – multiple treatments will typically be required. Only spray in optimum conditions (moderate temperatures during the warmer months with low winds). Aim for complete coverage of the plant and use a surfactant. English Ivy is particularly resistant to the uptake of herbicides and will require repeated follow-up treatments over a 2-4-year period.

When chemical control is not an option, aim to reduce the biomass of the plants through manual removal of biomass prior to seed set (slashing, or cutting at the base of stems). Cutting and painting larger stems may also be an option depending on the species and size of the stems, and if large enough they can be drilled and filled with Glyphosate.

Photo 16. Blue Periwinkle within the Police Paddocks

Photo 17. Japanese Honeysuckle within the Police Paddocks

3.3.10 Weed treatments other than herbicide spraying

A range of weed management techniques other than herbicide spraying should always be prioritised as weed management techniques. While the initial outlay of resources may be higher, the longer-term outcome may be more effective (and therefore more cost-efficient) compared to herbicide spraying and will likely result in reduced off-target damage. For example, cut and painting woody weeds with herbicide typically requires less follow-up and does not result in off-target damage.

Hand pulling

Hand-pulling does not utilise herbicides and is therefore the preferred method of woody weed control, if appropriate. However, in general, only immature woody weeds and woody herbaceous weeds can be hand-pulled.

Many species such as Blackberry will re-sprout from root fragments left in the ground, so the use of hand-pulling must be evaluated for the maturity of the plant and the species in question.

Drill and Fill Method

This method is for large established woody weeds:

- Drill hole to 2-3cm deep, as close to the base of the tree as possible.
- Fill the hole immediately with herbicide (typically a glyphosate-based herbicide using a specialised stem injection gun), taking care not to over-fill.
- Repeat this process at intervals of 3-5 cm around the entire base of the tree including larger exposed roots.
- Leave the plant in situ for habitat if there is no seeds or other propagules present

Plants that are drilled and filled should be left in situ as bird habitat when there are no seeds or other propagules present. However, when seeds or propagules are present, then the plant should be removed above the drill and fill holes and transported off-site. When transporting off-site is not practical, the cut branches should be heaped in piles to contain the spread of seeds.

Regular cleaning and maintenance of injecting equipment is required to ensure the safe and efficient use of these technologies. When equipment becomes clogged with debris, the delivery of herbicide can become unpredictable,

thereby resulting in the potential for spills or splashes. Safety googles, gloves and other personal protective equipment must be used at all times when using herbicide.

Cut and Paint Method

The cut and paint method is for small woody weeds where the stem is less than 5cm in diameter. The cut and paint method must be undertaken in the following manner:

- cut the plant at the base (as close as possible to the ground) with secateurs or handsaw
- herbicide (typically a Glyphosate based product or a broad-leaf specific herbicide) is applied to the cut stem within seconds (typically using a herbicide 'dabber')
- monitor cut stumps for re-sprouting within six months of initial treatment. Cut and reapply herbicide if re-sprouting is evident or use the drill and fill method.

As a general rule, when cutting and painting or drill and filling, neat (undiluted) Glyphosate or Vigilant® (or similar) should be applied to the cut or drill hole at the closest possible point to the ground, and immediately after drilling or cutting (within seconds). Broad-leaf specific herbicides may be more appropriate than Glyphosate based products on plants that sucker or other plants that are not reliably killed by Glyphosate.

Note: Established pines can be effectively controlled by cutting off the plant at the base without herbicide application.

Thermal weed control

A range of new methods and technologies are now available that apply heat to weeds, including applicators that apply:

- steam
- flame
- hot air
- hot water
- saturated hot water (high pressure hot water)
- infrared radiation

These methods typically have limitations associated with site access due to the portability of the equipment, however, where vehicular access can be provided, such as revegetation plots within amenity areas, such methods could be a viable alternative to herbicide spraying. Thermal weed control is most effective on plants that have limited capacity to regenerate from root-stock.

3.3.11 Herbicide spraying

Herbicide spraying is an efficient and effective method of managing weeds over large areas. However, for various reasons including the proximity to wetlands and waterways, human health, off-target damage, and general ecosystem health; herbicide spraying must be minimised and used as a last option.

Herbicides, in particular non-selective herbicides have the potential to create conditions that will be readily colonised by herbaceous weeds. A wide range of herbicides are available on the market, including many selective herbicides, which are generally preferred in most situations due to their targeted mechanism that results in less off-target damage and less bare soil. Glyphosate based products are attractive due to their long shelf life once mixed with water (unlike many selective herbicides), however, as a non-selective herbicide, Glyphosate has high potential to result in bare soil and off-target damage following treatments. Bare soil dries out quickly and is likely to reduce soil microbial activity due to decreased moisture and increased heat. Furthermore, Glyphosate has a positive association with non-Hodgkin

lymphoma and is probably carcinogenic to humans (Group 2A) (IARC 2016). Glyphosate should therefore be avoided unless used in a limited and targeted manner.

In general, it is recommended to trial low concentrations of herbicide (lower than the label rates) in order to minimise the detrimental or unintended effects of herbicide use, including off-target mortality of indigenous plants. Penetrants should also be minimised where possible, if for example, when using a monocot-specific herbicide on grasses, the penetrant additive to the herbicide has the potential to harm indigenous herbaceous plants.

It is recommended that all contractors and works crews undertake herbicide trail plots within their management areas and keep detailed records of the results of trails to determine the most effective and least harmful herbicide treatments. This information should also be shared between contractors, or between works crews / site managers to ensure all personnel and different sub-sections of the management area benefit from site-specific knowledge that is accumulated over time (refer to Section 1 for recommended protocols relating to information systems and data handling).

The minimisation of herbicide spraying can be achieved by aiming to treat individual plants in a single herbicide application for most weed species (rather than repeat applications), through:

- appropriate herbicide and additive product choices,
- appropriate herbicide and additive rates,
- undertaking herbicide use in appropriate weather,
- taking the time and attention to achieve complete coverage of the plant,
- the use of marker dye to monitor treated areas and coverage during and after application,
- keeping detailed records of herbicide selections, herbicide rates, weather conditions and other variables to ensure optimum effectiveness,
- the continual trialling of different herbicides and rates to ensure optimum effectiveness.

3.3.12 Brush-cutting and slashing

Brush-cutting can be an effective tool to manage grassy and herbaceous weeds in certain situations, such as when a combination of indigenous plants and introduced grassy and herbaceous weeds occur together with a low cover of shrubs and other indigenous plants over 30cm tall. Indigenous grasses are typically more tolerant of repeated brush-cutting, thereby providing them with an advantage over introduced grasses over time, which are generally shorter lived and more easily weakened by brush-cutting. Brush-cutting can also be used to cut the flowering stems of grassy and herbaceous weeds prior to seed maturation to prevent seed shed.

Brush-cutting requires proficient plant identification skills, and a knowledge of how different plants respond to cutting and is therefore only suited to suitably experienced and knowledgeable personnel.

A medium to long-term commitment to consistent brush-cutting must be made, as the benefits will only be seen after several seasons. As with any management technique, if unsure whether brush-cutting will be effective, it may be appropriate to establish a demarcated trial plot and record detailed notes of when the treatments were undertaken. Photo-point monitoring within trial plots can assist with evaluating vegetation change over time.

Slashing using a ride-on mower or tractor mounted slasher may also be appropriate in some situations. In general, a slasher may be appropriate when more than 50% of the grass composition comprises grassy weeds, while if less than 50% grassy weeds, a brush-cutter will be more appropriate.

3.3.13 Weed management personnel experience and training

Ecology Perspective (2018) noted that native vegetation is interspersed with populations of exotic flora within their 2018 management area, and therefore a high level of diligence will be necessary when undertaking weed control works

to limit the amount of off-target damage to indigenous flora. Similar vegetation compositions were observed by the authors throughout the remainder of the management area (to varying degrees). The knowledge and experience of contractors and other personnel engaged to undertake weed control, should therefore include relatively high plant identification skills in order to accurately differential between target and non-target species. Where personnel have limited plant identification skills, adequate supervision by team leaders is essential.

3.4 Revegetation

3.4.1 Revegetation context

The majority of the low elevations of the management area currently consists of either pasture, unmanaged grassland, or revegetation that generally doesn't comprise an understorey dominated by indigenous species. Therefore, there is an opportunity to continue the implementation of broad-scale revegetation throughout the lower elevations of the management area. The grassy woodlands on the higher elevations are typically dominated by indigenous species in the understory and are therefore a lower priority for revegetation or supplementary planting.

The planting of trees has been nominated by *City of Greater Dandenong's Draft Climate Change Strategy* (CGD 2020) as a key climate change mitigation measure (CGD 2020). Carbon Offsets (or Carbon Credits) have been nominated by CGD (2020) to offset Council's corporate emissions, which could include the generation of Council's own offsets through revegetation projects. A target of 1,800 trees and 18,000 tube stock (understorey plants) per annum have been nominated by CGD (2020) to achieve carbon storage, which would be implemented through City of Greater Dandenong's *Greening our City Strategy – Urban Tree Strategy* (2018-2028).

3.4.2 Revegetation planning and landscape design

All public open space within the management area holds dual values for both amenity and biodiversity. While revegetation is often regarded as simply a biodiversity conservation or carbon capture measure, revegetation is also an important component of the amenity values of the management area and therefore requires careful consideration of the revegetation landscape design. The degree to which revegetation can provide pleasing amenity outcomes does not necessarily come at the expense of biodiversity conservation if designed appropriately. For example, maintaining sightlines through the stratification of revegetation, such as grading a diverse ground-storey planting through to taller canopy within proximity to shared-user paths creates a pleasing open environment with good sight-lines while also providing a greater diversity of fauna habitats.

The detailed landscape design of revegetation also provides an opportunity to properly consider elevations and water availability. Most areas proposed for revegetation on the floodplain will contain a mosaic of lower (wetter) and higher (drier) sites, which will influence the suitability of individual species selection and positioning. High resolution LiDAR derived elevation contours (eg 0.5m resolution) may have previously been collated and should be utilised by designers to ensure the most appropriate species are selected for planting at the micro-site scale. An ecologist or experienced bush regenerator must oversee the species selection process to ensure appropriate site-indigenous species are selected that are also suitable for propagation.

Furthermore, safety is an important consideration in the design of revegetation. All revegetation must consider Crime Prevention through Environmental Design (CPTED) principles in order to discourage inappropriate or criminal behaviour, in accordance with the *Urban Design Guidelines for Victoria* (DELWP 2017b). Revegetation must incorporate bushfire risk planning (Section 0).

3.4.3 Revegetation types

The management area consists of vegetation in various states of regeneration and conservation value, while a broad range of land-uses from high-use public amenity areas, through to horse agistment and conservation areas apply to the site. The diversity of the vegetation types and land-uses within the management area necessitates the definition

of a range of revegetation types to be applied to different scenarios. Furthermore, habitat connectivity has been considered in the prioritisation of certain areas for revegetation, in order to build upon existing connections at the local and regional scales.

The following sections describe the range of revegetation types that could be applied to the management area. The specific type of revegetation appropriate for any given area will depend on the amount of funds and on-going resources available.

Figure 4 below nominates suggested areas for the general type of revegetation appropriate for the management area, incorporating a 150-metre buffer from residential areas and other potentially vulnerable buildings for bushfire safety. The total area potentially suitable for revegetation is approximately 209 hectares (Map Appendix 1).

Broad-acre

Broad-acre revegetation consists of large-scale plantings within paddocks or areas consisting of exotic grass (without middle-storey or canopy). Broad-acre planting is typically undertaken with a planting density of 2-5 plants per sq. meter and consists of canopy species along with taller, hardy shrubs. The aim for broad-acre revegetation is for minimal maintenance; usually broadleaf weed control & perimeter slashing, without the need for grassy weed control.

Broad-acre revegetation can used as the initial step in a longer-term strategy to establish a canopy and shrub layer that provides competition to broadleaf and grassy weeds, which can then establish suitable conditions for a more structurally and species diverse revegetation comprising understorey plants to be installed at a later stage.

Mulched beds

Mulched beds are a time and resource intensive revegetation that typically consist of a dense planting of a wide range of plants, including a dense understorey of less hardy understorey shrubs, grasses, lilies, and herbs. Mulched bed plantings can be planted at varying densities; depending on the species and level of maintenance, typically in the range of 8-16 plants per square metre.

Mulched beds are typically planted within high profile locations, such as along shared user paths, picnic grounds and other high-use amenity areas and therefore require that particular attention is given to aesthetics in the context of landscape design.

Eyelet plantings

Eye shaped beds to allow for areas of mown grass for public use in spaces between the beds, while the shape allows large mowers to easily and efficiently mow around the perimeters (Figure 3). Eyelet plantings will typically comprise mulched beds (as detailed in the previous section). Eyelet plantings may also be appropriate for broadacre revegetation where slashing is required for fire safety or within areas that may become high-use amenity areas in future.

If eyelets are staggered correctly then sightlines can be maintained, and canopies will connect in future (as opposed to circular beds).

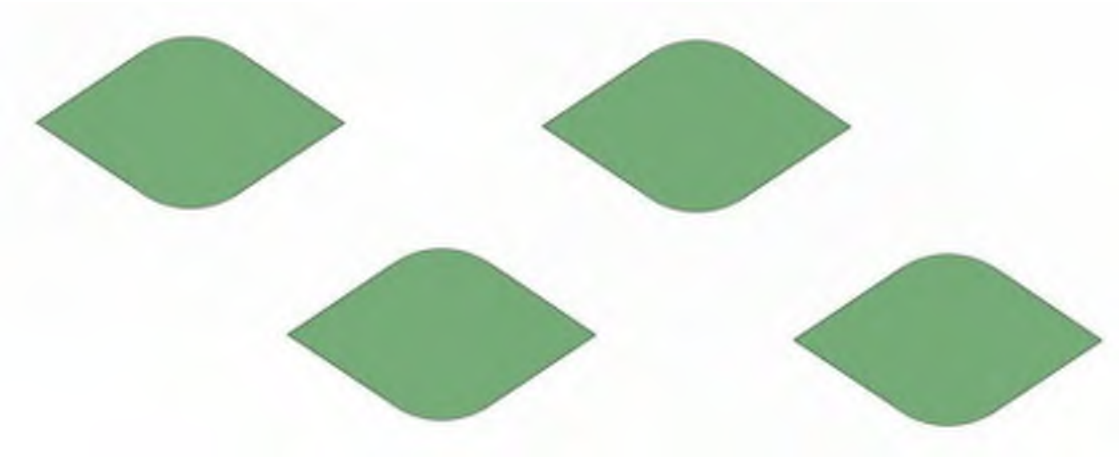


Figure 3. Eyelet planting concept design for efficient mowing

Isolated canopy trees

Isolated canopy trees can be planted in a range of scenarios, including within amenity areas where mown grass is retained for public use, or when funds aren't available for a higher density revegetation. Similar to broad-acre planting, isolated trees can be used as the initial step in a longer-term strategy to establish a canopy layer that provides competition to broadleaf and grassy weeds, which can then form the basis of more structurally and species diverse revegetation to be planted at a later stage.

Isolated trees can be planted straight into tall grass, in which case 'super-tubes' (larger tube stock, typically 70mm pot diameter) are ideally used. Isolated trees can also be used where canopy replacement is required; that is, where indigenous understorey remains relatively intact and canopy trees are lacking, due to die-back, historic clearing or other causes.

Infill planting

Infill planting consists of a complete range of strata and species that are installed within established revegetation to supplement areas that have failed due to drought, pest animals, disease, poor stock or inappropriate species selection.

Infill understory planting

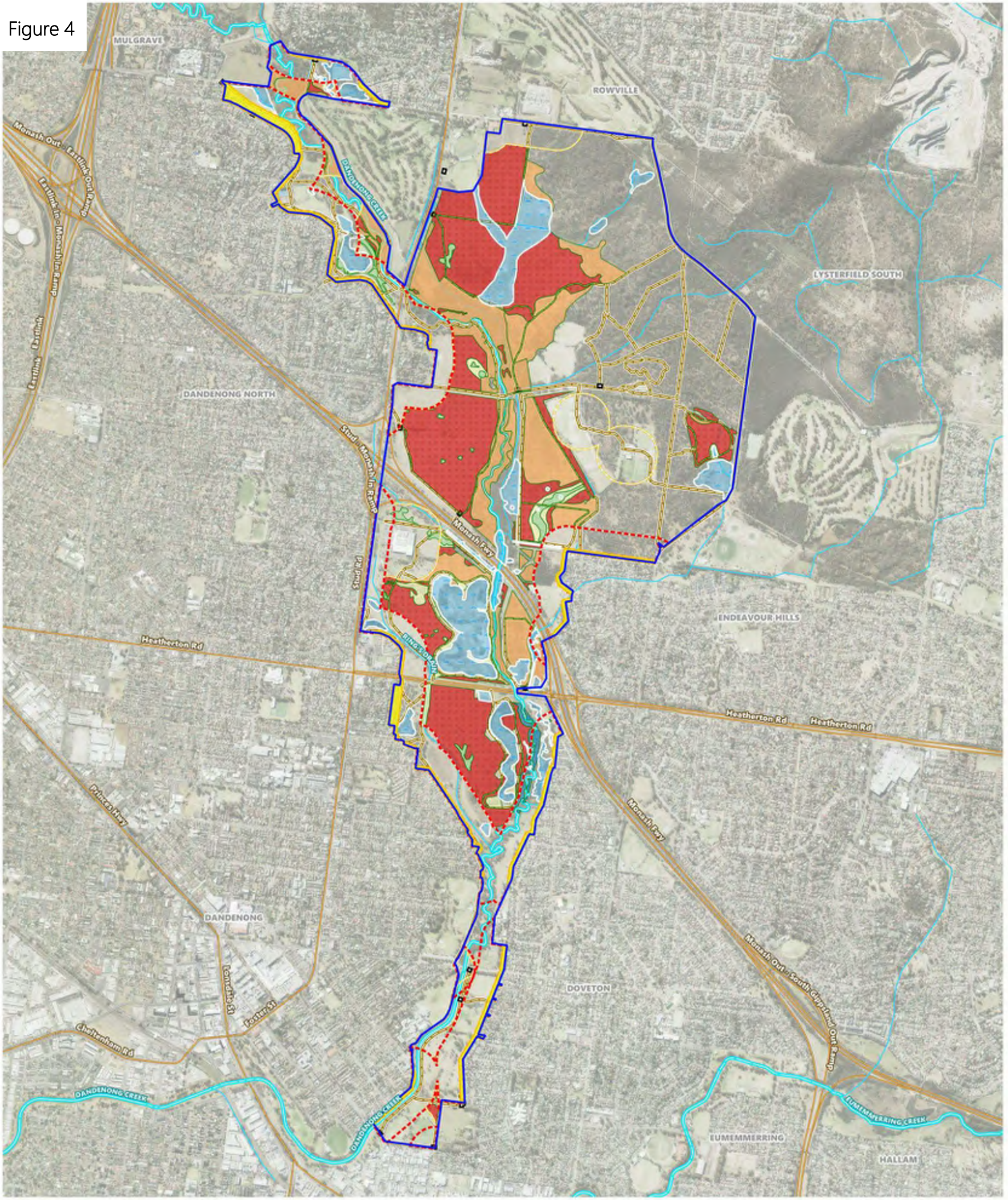
Understorey planting is appropriate for older revegetation where trees are established enough to provide significant competition against grassy and herbaceous weeds, through uptake of water and nutrients, and through the partial closure of the canopy (reducing light availability in the understorey).

Infill understorey planting are highly site specific in terms of species selection, which will depend on moisture availability, and weed composition and cover. The species selected for infill understorey planting will also depend on the degree to which the planting can be maintained.

Grey-headed Flying-fox planting

A Grey-headed Flying-fox colony in the eastern sector of the Melbourne Water Wetlands has resulted in significant Eucalypt die-back. The methods and actions for the proposed replacement of canopy trees and tall shrubs is detailed by Ecology & Infrastructure (2020). In summary, revegetation within proximity to the Flying-fox colony was focussed on canopy replacement to serve as flying-fox roost trees and comprised a limited range of canopy trees and tall hardy shrubs.

Figure 4



Revegetation types

Lower Dandenong Creek Management Plan

- Management Area
- Major roads
- Watercourse
- Major watercourse
- Residential 150m buffer
- 19m Residential 100mm grass buffer
- Wetlands
- Vehicular access

Revegetation types

- Revegetation - all strata
- Understorey infill planting
- Understorey planting
- Wetland understorey planting
- Grey-headed Flying-fox revegetation

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Map Version: 01
Date: 14/12/2020
Scale: 1:20000 @A3
Coordinate system: GDA94 MGA Zone 55

0 250 500 750 1000 m

Mark Shepherd
Ecological Consulting

3.4.4 Plant preparation and protection

Plant protection factors

Plant protection options vary depending on the circumstances and needs to be considered in the context of available budget, and whether the budget would be better spent on additional plants. Trails by the authors have demonstrated that plant protection is often unwarranted when considered in the context of a cost-benefit analysis. For example, the cost of installing plant protection guarded is typically at least 60% of the total cost to install a plant. When comparing the attrition rate of unguarded versus guarded plants, the net result may be that more plants survive after three years when the budget for plant protection is spent on additional plants. However, the success of unguarded revegetation will depend on:

- Populations of European Rabbits, Swamp Wallaby, and Eastern Grey Kangaroo. The extent to which European Rabbits can be successfully controlled is an important consideration when deciding to install plant protection.
- The timing of the planting (planting in Autumn will result in cool temperature dormancy over winter during which the plant will not quickly grow beyond the reach of Swamp Wallaby and other predators, which increases the likelihood of browsing).
- The size of the tube stock. Super tubes have greater resistance to browsing due to reaching sufficient height earlier (Photo 18).

Plant protection in the form of a stake and guard is only considered necessary when high density rabbit populations are present and there are no options for rabbit control. In almost all other circumstances, plant protection will likely be unwarranted (subject to detailed consideration of site-specific circumstances, such as when plants need protection from pedestrians or slashers).

Photo 18. Super tube (left) compared to a forestry standard tube (right)

Revegetation delineation for slashing exclusion

In many circumstances, plants will be installed into tall grass which may have historically been subject to tractor-mounted slashing. In such circumstances it is recommended to consider how to delineate the zone so that slasher operators can easily see and therefore avoid the revegetation zone (particularly if the plants are un-guarded in tall

grass). A star picket fence constructed with standard gauge fencing wire that is lightly tensioned with Gripple wire joiners (or similar) will likely be sufficient.

Jute mat squares

Jute matting squares are considered unnecessary within the management area and possibly detrimental in almost all circumstances, as there is little evidence to suggest that jute mat square suppress weeds (weeds grow through the stake holes and around the squares) and in most situations will reduce the amount of water reaching the plant roots. Furthermore, the cost of the jute square and the time taken to install it increase the per unit cost of each plant.

Plant protection in areas subject to in-stream flooding

The decision to install plants within areas that will likely be subject to in-stream flooding will need to account for possible high mortality of plants due primarily to flood debris within fast-flowing water. If plants are installed within in-stream flood zones, then it is recommended to install a single heavy duty hardwood stake (minimum 38mm width) on the up-stream side of the plant (within ~150mm of the plant) which will intercept flood debris. The stake needs to be buried ideally greater than 400mm to ensure its structural integrity.

Jute mat rolls are often used in revegetation near watercourses; however, jute matting is easily dislodged during floods and may contribute to debris within the creek (which could be a potentially detrimental to Dwarf Galaxias) and is not considered cost effective.

Plant protection within areas populated by Swamp Wallaby and Eastern Grey Kangaroo

Swamp Wallaby *Wallabia bicolor* is known to actively browse the leaf material on revegetation and can significantly impact the time taken for revegetation to reach maturity. In extreme cases, Swamp Wallaby browsing can lead to the failure of revegetation plots (MCMC 2013), as has happened in certain areas of the Police Paddocks Reserve (in combination with other environmental factors).

MCMC (2013) trialled the use of Sen-Tree™ (a deterrent sprayed on the foliage of the plant prior to planting) with moderately successful results for certain species and no discernible deterrent effects on other species. Sen-Tree is recommended for trail plots at the management area within areas that Swamp Wallaby lives.

A more certain (yet expensive) option for Wallaby predation is the construction of physical barriers (minimum 1 metre tall). Several design options are available to create physical barriers. Steel or plastic mesh fencing around each plant has shown to be effective however is expensive. A recommended un-trialled design is the re-use of temporary fencing panels, to create triangular, square or rectangular shaped Wallaby exclusion areas (on flat ground only). A triangular design is suggested as the design to have the greatest structural integrity (Figure 5). Temp-fencing are readily available at reduced cost as a used material and typically comes in heights of 2.4m long and 2.1m tall. A triangular shaped exclusion zone using 2.4m long panels would comprise an internal are of approximately 2.5m^2, which could readily accommodate up to 10 plants.

Once the plants have reached approximately 1.2 metres tall, the fencing can be removed and re-used, which increases the costs efficiency compared to traditional stakes and guards.

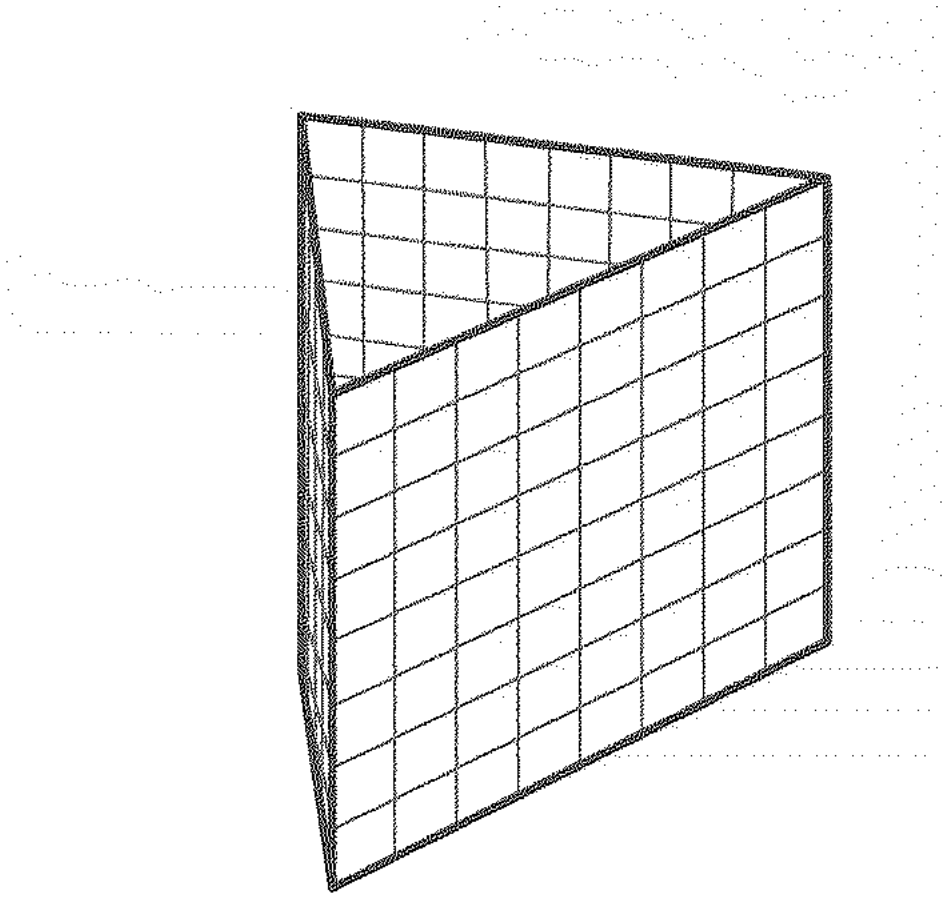


Figure 5. Three-sided used temp-fencing panel design for wallaby exclusion

A large population of Eastern Grey Kangaroo resides in the Police Paddocks. Eastern Grey Kangaroo are typically grazers, rather than browsers; that is, they prefer grasses over shrubs and herbs unless grass becomes scarce (de Munk 1999). However, physical barriers that are constructed for Swamp Wallaby will also likely be useful in the protection of plants against Eastern Grey Kangaroo after extended dry periods, or simply to protect against occasional low-level browsing and trampling. The construction of fencing pods using three panels will ensure that macropods won't jump inside the fence. Constructing pods using a larger number of panels will increase the area and therefore the efficiency of the structure but the structural integrity will be reduced, and macropods are more likely to jump inside the fence. A trail of various layouts is recommended to determine the most suitable panel arrangement.

3.4.5 Revegetation species

Species selection for revegetation should be based on a combination of factors:

- The Ecological Vegetation Class (EVC) that occurs, or was likely to occur, within the revegetation micro-site (based primarily on topography, moisture availability, geology, and aspect), taking into account variations in topography and moisture and availability within a revegetation site.
- How much on-going maintenance and rabbit control will be allocated to the revegetation – smaller, delicate plants can be included in the species list if adequate maintenance and protection from grazing / browsing is certain.
- The type of revegetation required - whether the revegetation requires canopy, mid-storey, understorey or all strata and the density of the planting.
- The anticipated vigour and general suitability of individual species to revegetation, including the known tolerance to browsing.

A list of recommended core species for revegetation categorised for each Ecological Vegetation Class (EVC) are provided in Appendix 1. Comparison to reference sites (intact EVC examples within the local area) should be used to guide species selection. Various resources are also available to determine whether a certain species may be suitable for any given EVC, including:

- *Benchmarks by Bioregion* (DELWP 2020a)
- *Vegetation Mapping of the Port Phillip & Westernport Region* (Oates & Taranto 2001)

The supervision of revegetation installation must be undertaken by personnel with sufficient plant knowledge to guide the micro-siting of species within a revegetation site to ensure that species selection accounts for sub-site variations in topography and moisture availability.

3.4.6 Revegetation timing and watering

The optimal timing for revegetation establishment is dependent on a range of factors including seasonal conditions and threats and is always site specific. Large revegetation projects may have additional timing constraints associated with the supply and installation of large numbers of plants (large numbers of plants may not be able to be supplied and planted over a short period due to resourcing). It may also be wise to stagger the planting of large numbers of plants so that extreme frost, flood, excessive browsing, accidental slashing or other threats will have a lower chance of destroying the entire planting.

In most cases, it is recommended to undertake planting in late July, when soil moisture is at its highest so that plants have a faster establishment as the weather begins to warm up, rather than remaining dormant over autumn and early winter when they will be exposed to more browsing and frosts. However, browsing will likely be more of an issue on the eastern side of the Dandenong Creek where larger numbers of Kangaroos and Wallabies are present; therefore, autumn or winter plantings may be appropriate for the western side of the creek, depending on the season. Other strategies to combat browsing could include the planting of tougher, taller, woody tube stock that is more resistant to browsing earlier in the planting season, while plants more susceptible to browsing could be planted in late winter. Planting during summer should generally be avoided. Planting of understorey flora may establish well in late autumn if watered well and if there is minimal browsing pressure.

Supplementary watering is generally expensive, time consuming and has limited effectiveness in providing water to plants compared to natural rainfall, however, it can be beneficial, particularly during extended dry conditions where plantings are at risk of failure. Supplementary watering will be more likely to be required beneath existing canopy compared to greenfield sites. The relatively high cost of supplementary watering will need to be balanced against the cost of supplying and installing tubes (which are relatively cheap).

3.5 Ephemeral wetland habitat creation

Following the widespread loss of natural wetlands, artificial wetlands are becoming increasingly important as habitat for waterbirds (Murray et al 2013). Wetland birds are known to readily adapt to artificial wetland habitats, such as sewerage treatment ponds and stormwater treatment wetlands, which are colonised by macroinvertebrates, amphibians and other prey sought after by waterbirds (Low 2002). Furthermore, wetlands provide habitat for a wide range of other fauna, including reptiles, amphibians and insects. The re-introduction of such wetlands at the management area would represent a major conservation achievement for the south-east Melbourne region.

While the management area currently provides relatively small areas of ephemeral wetlands that draw down in summer and fill in winter, such as the Plains Grassy Wetlands at Falkiner Reserve Wetlands and Tirhatuan Wetlands; the majority of wetlands at the management area are relatively deep wetlands that retain water all year. Some of these wetlands comprise boggy margins or sections within the wetland that are shallower, which provides niche habitats for species such as the migratory Latham's Snipe *Gallinago hardwickii*. However, ephemeral or shallow wetlands have a restricted distribution in the management area, and within the greater Melbourne region in general. The creation of such

wetlands would be highly beneficial for threatened wetland birds that specialise in such habitats, including for threatened species that have been recorded at the management area, or within the region.

Several sections of the management area that have been subject to seasonal inundation have been historically excluded from the mowing regime and managed to facilitate the natural regeneration of indigenous wetland flora. Such examples include the Tirhatuan Wetlands and the Falkiner Reserve Wetlands.

A brief inspection of a selection of inundated areas and recent aerial photography revealed that several additional areas could also potentially benefit from a similar management regime. Such areas include an area to the south of the Tirhatuan Wetlands, areas immediately to the north and east of the Dandenong Stadium (270 Stud Road, Dandenong), and an area within the south-western sector of the Police Paddocks that is receiving additional water due to the creation of a spillway for Dwarf Galaxias ponds (Photo 19). These areas, and other potential areas are naturally low-lying areas that appear to consistently flood after reasonable rainfall.

As part of habitat improvement works undertaken by Melbourne Water the flood levels along Dandenong Creek were determined based on flow data at two gauges along Dandenong Creek (Police Road, Rowville and Wantirna Road, Heathmont) and LiDAR derived channel cross-sections (Coleman et al 2018). From this analysis, it was estimated that the creek overtops approximately 3-4 times per year (Coleman et al 2018). This suggests that the extent and regularity of inundation could be sufficient to warrant management as ephemeral wetlands, however, further study of hydrology using Water balance modelling such as MUSIC (Model for Urban Stormwater Improvement Conceptualisation) (eWater 2016) to understand the reliability of the water supply and inspection at various times of the year to determine flooding extent is recommended.

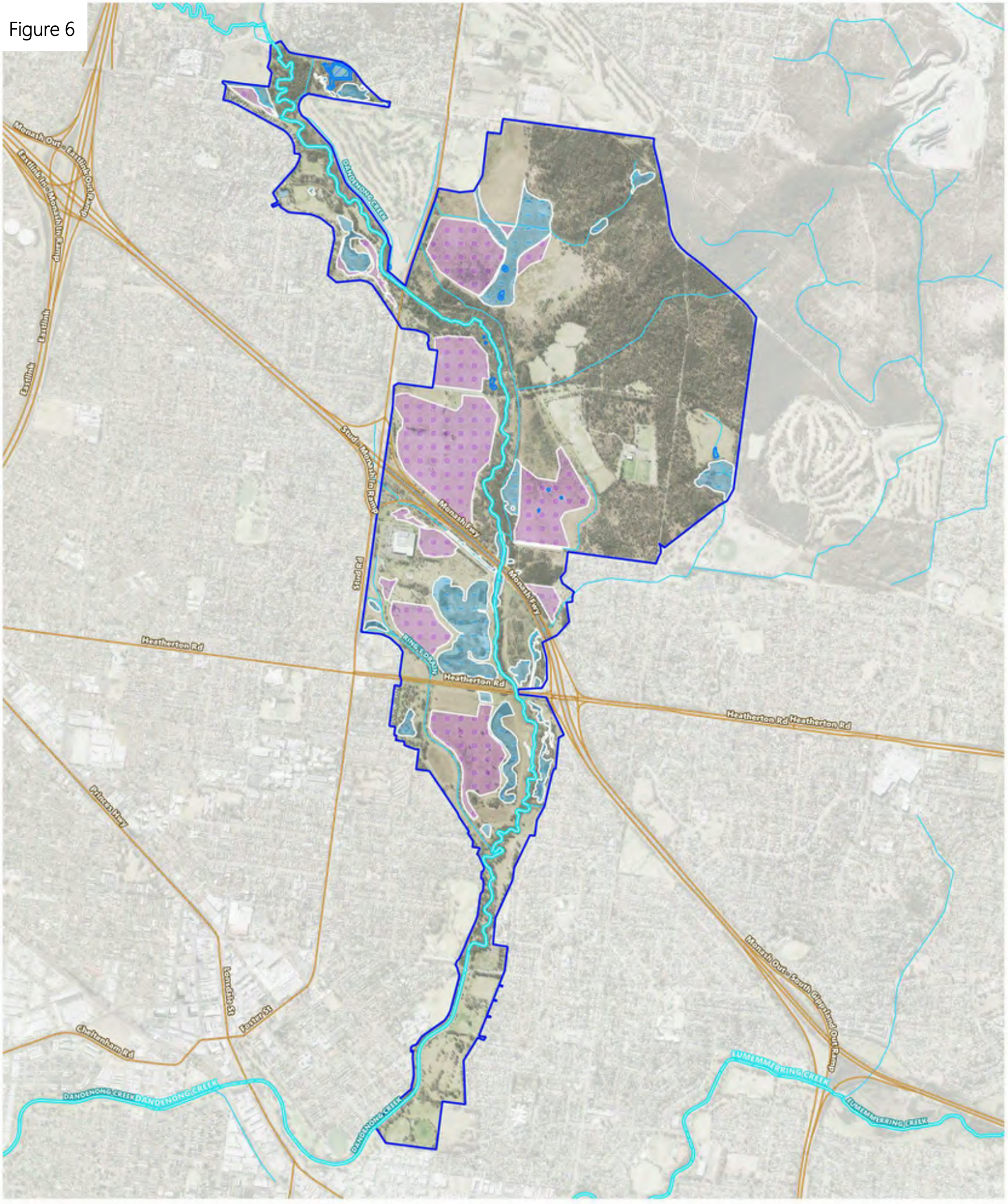
Furthermore, any opportunity to alter the hydrology so that the conditions are suitable for the creation of ephemeral wetlands and habitat for the group of threatened and restricted wetland birds that are adapted to these niche habitats is recommended for prioritisation. Modifications were completed by Melbourne Water, through the installation of a spillway on a minor drainage-line within the Police Paddocks in order to divert water into constructed Dwarf Galaxias ponds (Coleman et al 2018) (Figure 6).

Tirhatuan Park also presents an opportunity make relatively minor changes to levels in key areas to allow for the diversion of additional water into low-lying areas in order to facilitate ephemeral wetland creation. Once detailed hydrological studies have demonstrated that a certain volume of water can be safely accommodated within the low-lying areas (without causing flooding or safety issues in adjacent areas) is recommended to trail increased water levels using a diesel-powered pump to transport water from the constructed wetland to the north-west into lower elevations to the south-east in order to evaluate the precise extent and depth of inundation. The outcomes of such a trial should be incorporated into any future landscape re-development designs including any new boardwalk bridge designs to elevate the footpath over inundated areas.

Figure 6 below provides an overview of existing wetlands, and areas that are nominated as investigation areas for potential ephemeral wetland creation.

Photo 19. Inundation within drainage-line; Tirhatuan Park (October 2020)

Figure 6



Ephemeral wetland creation

Lower Dandenong Creek Management Plan

- Management Area
- Major roads
- Watercourse
- Major watercourse
- Potential ephemeral wetland creation (investigation areas)
- Existing wetlands
- Dwarf Galaxias ponds

Mark Shepherd Ecological Consulting
Map Version: 02
Date: 15/03/2021
Scale: 1:20000 @A3
Coordinate system: GDA94 MGA Zone 55

0 250 500 750 1000 m

Mark Shepherd
Ecological Consulting

3.6 Pest animals

3.6.1 Rabbits and hares

Rabbits have been reported throughout the Police Paddocks and have the potential to occur in all areas north of the Monash Freeway in significant numbers. Hares have also been recorded in low numbers within the Police Paddocks. Rabbits are also likely to exist to the south of the Monash Freeway, however, high rabbit numbers have not been reported within these areas to date.

Rabbits are known to impact wetlands, as described by DELWP (2017c), including preferential gazing and browsing of native flora, and impacts on soil and water quality. Rabbits commonly browse native seedlings and can therefore impede the regeneration of native flora.

Rabbit monitoring is recommended throughout the management area to determine whether control is warranted. Various rabbit abundance monitoring methodologies have been described by various authors such as Mitchell and Balogh (2007a), including:

- Spotlighting,
- Sight counts,
- Warren counts,
- Other rabbit signs, including scats and diggings,
- Motion-sensor infrared camera survey.

Given the dense vegetation structure throughout a large proportion of the site, certain methods such as spotlighting may be limited in their effectiveness at accurately detecting rabbit numbers. Therefore, a combination of survey methods including a search for rabbit scats and diggings, and a brief three-night motion-sensor camera survey is recommended in this instance.

Furthermore, monitoring of rabbit impacts using methods such as exclusion plots may provide valuable information on the degree to which rabbits are altering native vegetation structure and composition and therefore whether control is warranted (Mitchell and Balogh 2007).

Rabbit control is best done over a wide geographic area as part of an ongoing integrated plan. All rabbit warrens within at least 300-400 metres of un-guarded revegetation will need to be destroyed, while hares have a large home range and will therefore need to be controlled over wider areas compared to rabbits (Greening Australia 2003). The destruction of all exotic harbour such as large Blackberry, Gorse and Watsonia thickets will remove harbour and allow access to warrens. If sufficiently dense harbour is present then rabbits may not reside in burrows, however, female rabbits will always burrow to give birth, so exposing warrens beneath Blackberry is warranted for this reason.

A basic approach to controlling rabbits should consist of the following actions, in order of priority, depending on the density of the population:

- Ongoing monitoring of the rabbit activity: scats, diggings, grazing, sightings and recording the location of rabbit warrens.
- Remove or limit surface harbour such as Blackberry and Gorse thickets and rubbish piles / other man-made materials.
- Fumigate warrens Hand collapsing warrens (with or without fumigation).
- A baiting program to be undertaken by a professional operator, particularly in areas where harbour cannot be removed (such as if it consists of indigenous vegetation).

- Introduction of RHDV1 (K5 strain) Calicivirus (or similar) into the population to initiate an outbreak of this rabbit specific disease.

The fumigation and hand collapsing of warrens (without the use of heavy machinery) is preferred over baiting. However, much of the Police Paddocks contains dense understorey vegetation where Rabbits are likely residing without the need to burrow unless they are rearing young. The effectiveness of fumigation and warren destruction at the management area is therefore recommended in combination with baiting to account for a large proportion of rabbits not residing in warrens, or the warrens being too difficult to locate and destroy. Please note that baiting has limited efficacy when abundant green growth is present, due to the baits not being taken in sufficient quantities.

Rabbit baiting has the potential to harm domestic pets. Rabbit baiting is therefore more viable in low-visitation areas. Baiting in areas that are used for dog walking and recreation can still be baited however, clear signage and a letter box drop to inform landholders that the baiting will be undertaken is recommended. The choice of bait and delivery method can also be optimised to minimise the potential for non-target poisoning. Any contracted pest controller must be able to demonstrate extensive knowledge and experience in baiting in urbanised areas.

Information on rabbit control and initiating community rabbit control programs is available from the Agriculture Victoria website (Agriculture Victoria 2021).

3.6.2 Foxes

The impacts of Red Fox on the biodiversity values present at the site requires careful consideration, due to the known presence of a range of fauna, including EPBC Act listed migratory waders, Latham's Snipe, Australasian Bittern, and other state and nationally listed birds, all of which are thought to be susceptible to Red Fox predation.

The management area is surrounded predominantly by residential areas, which are likely to support high Red Fox populations, and within which no Red Fox control is likely being undertaken. Therefore, Red Foxes will always have the potential to recruit into the site from adjoining residential areas, which are likely providing food resources and harbour for the species. It is therefore recommended that the first management option to consider is to focus on the removal of harbour (dense woody weed thickets), and the installation of artificial nesting and roosting habitat for wetland birds (Section 3.8.1).

The monitoring of Red Fox populations is recommended to determine whether the abundance of foxes warrants control. Mitchell and Balogh (2007b) suggest that Red Fox monitoring methods can include:

- Transect based spotlighting counts,
- Bait stations,
- Track, scat and den counts,

Motion-sensor infrared camera surveys undertaken over several nights can also be effective.

Fox poisons can be considered for deployment if the results of population monitoring warrants control. Fox poisons including sodium fluoroacetate (1080) have the potential to cause secondary poisonings on non-target species, through direct ingestion of the baits or through consumption of poisoned Foxes, such as by scavenging raptor species. A range of poisons and delivery systems are now available. For example, the Canid Pest Injector has greater target specificity and can deliver para-aminopropiophenone (PAPP), which is understood to have less potential for secondary poisoning in birds (Mallick et al 2016).

If Red Fox control is deemed necessary for the management area, it is recommended that only pest animal contractors with demonstrated knowledge and experience in the control of pest animals in the context of biodiversity conservation should be considered for pest animal control contracts at the management area. Furthermore, a contractor must demonstrate a detailed understanding of the latest scientific trails and other evidence-based findings relating to fox poisons and delivery systems, in order to determine the safest and most effective control options.

3.7 Location specific management requirements

3.7.1 Grey-headed Flying-fox colony – Myuna Wetlands

A Grey-headed Flying-fox colony of up to 50,000 animals (seasonal dependent) exists within and around the Myuna Wetlands, in the eastern sector of the Melbourne Water Wetlands (Figure 7). Ecology & Infrastructure (2020) in collaboration with Shepherd Ecological prepared a management plan for the colony to address specific management issues.

The Ecology & Infrastructure (2020) management plan provides:

- A history of Grey-headed Flying-fox at the site, including population size and dynamics and distribution of the colony at the site
- A brief summary of the ecology of Grey-headed Flying-fox, including their conservation status and ecological role
- Current management implemented at the site by relevant land managers
- EVC mapping comprising detailed ground-truthed EVC mapping for the core management zone (the primary area currently and historically occupied by the colony between Floriana Ave and Heatherton Rd, and broad-scale vegetation mapping into simplified categories, from the edge of the colony to the Monash Freeway to the north (~1.3 km) and Kidds Rd to the south (~1.1 km)
- Description and mapping of threats to the colony
- Details of management actions, including a description of works, location, timing, responsibilities and any additional planning and studies that may be required
- Detailed revegetation plan for the core management zone, including EVC-appropriate species lists, maps showing revegetation areas, description of management actions and timing of works. Areas of potentially suitable for revegetation in the broad management are identified.

Any contractors working within or near the Grey-headed Flying-fox colony must be familiar with the Ecology & Infrastructure (2020) management plan, as there are non-standard contract requirements, including:

- the need to limit noise and works to prevent disturbance to the colony (particularly during the breeding and pup rearing seasons),
- Occupational Health and Safety requirements to avoid exposure to Lyssavirus (a disease carried by Grey-headed Flying-fox).

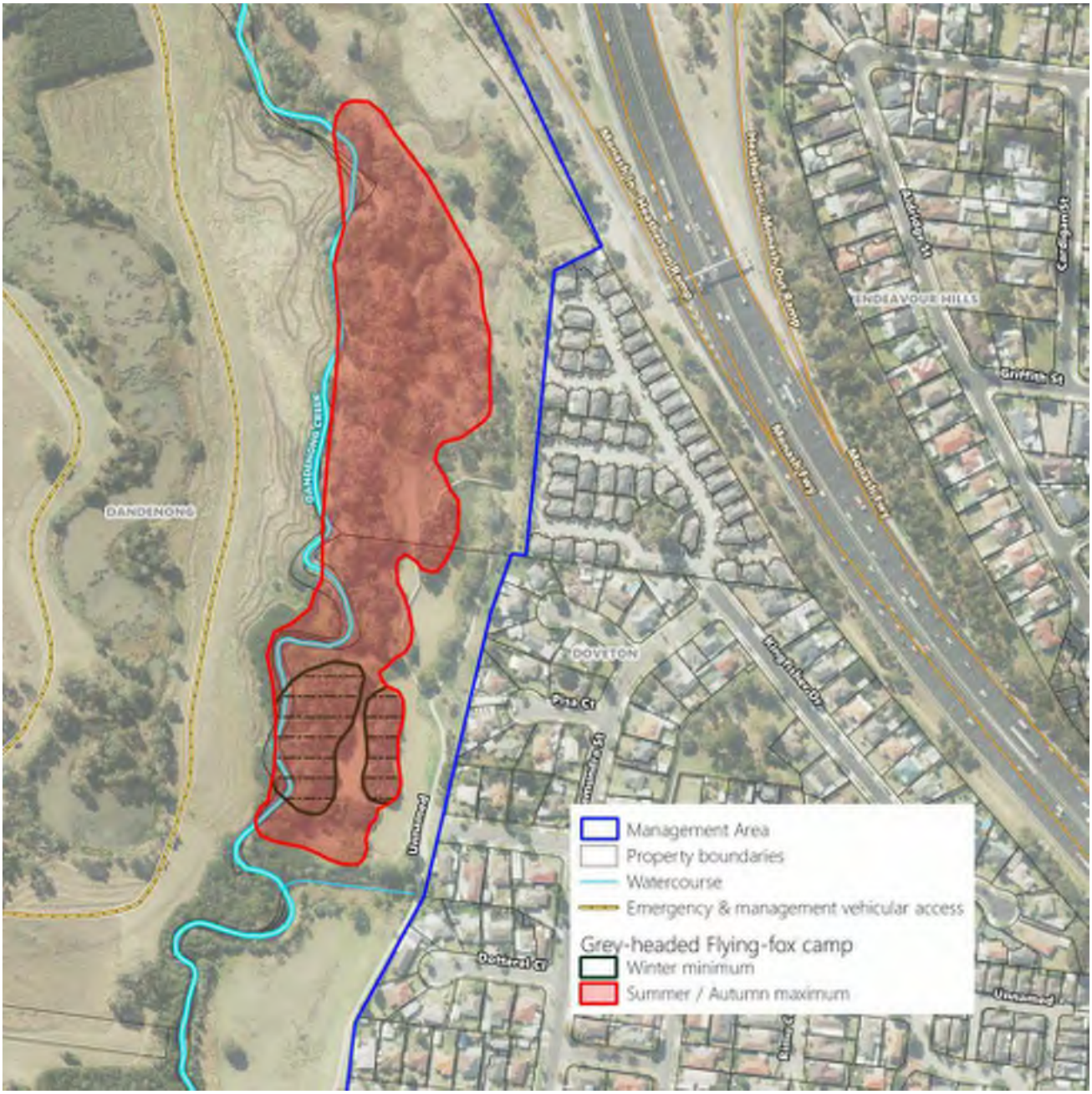


Figure 7. Grey-headed Flying-fox colony

3.7.2 Aboriginal cultural heritage at Dandenong Police Paddocks Reserve

An area with recognised Aboriginal cultural heritage importance has been defined for a sub-section of the Dandenong Police Paddocks Reserve within the south-western sector (du Cros & Assoc 1995). The Aboriginal cultural heritage of the Police paddocks includes artefacts, relics and Aboriginal burial sites originating from:

- Aboriginal occupation and use prior to and at first contact with Europeans
- Headquarters of the first Native Police Corps, 1837
- Westernport Aboriginal Protectorate Station, 1840-1843
- Headquarters of the Third Native Police Corps, 1843-1853

Source: du Cros & Assoc (1995)

The area is considered highly culturally significant due to aesthetic, historical, scientific and social values, and is of great significance to Victorian Aboriginal Peoples (du Cros & Assoc 1995). The Native Police Headquarters site is registered as an Aboriginal archaeological site with Aboriginal Affairs Victoria (site 7922/0003) and an historic archaeological site with Heritage Victoria (site H7922/0001), which is listed as protected under relevant state and commonwealth legislation (du Cros & Assoc 1995). In 2016, the site was included in the Victorian Heritage Register as a heritage site by the Victorian Heritage Council (VHR number H2348).

Two cultural heritage zones apply to the Police Paddocks; a broader historic zone, and a core zone that lies within the historic zone (Figure 8). Consent must be granted by the relevant regulatory authorities and the and the local Registered Aboriginal Parties as defined by the Victorian Aboriginal Heritage Council (VAHC 2021) prior to undertaking any works that have the potential to disturb the site are carried out within the zones identified in Figure 8.

An assessment of Cultural Heritage Significance (Heritage Victoria 2016) outlines the various management actions that may require a permit under the *Heritage Act 1995*. Any action that proposes ground disturbance requires careful consideration and may not be permitted. Any other action that involves management of plants or animals also requires consideration, while certain other actions are exempt.

The following actions will require careful consideration with reference to the Heritage Victoria (2016) document:

- Weeds such as Blackberry, Robinia and Blue Periwinkle can serve to protective artifacts and buildings and may need to be left in situ,
- Any soil excavation resulting from management actions such as revegetation or fence construction may not be permitted,
- Management vehicles should remain on defined vehicular tracks within the management zone (as shown on Figure 8).
- European Rabbit within proximity of building remains may be contributing to damage of the remains due to burrowing activity and may need to be controlled.

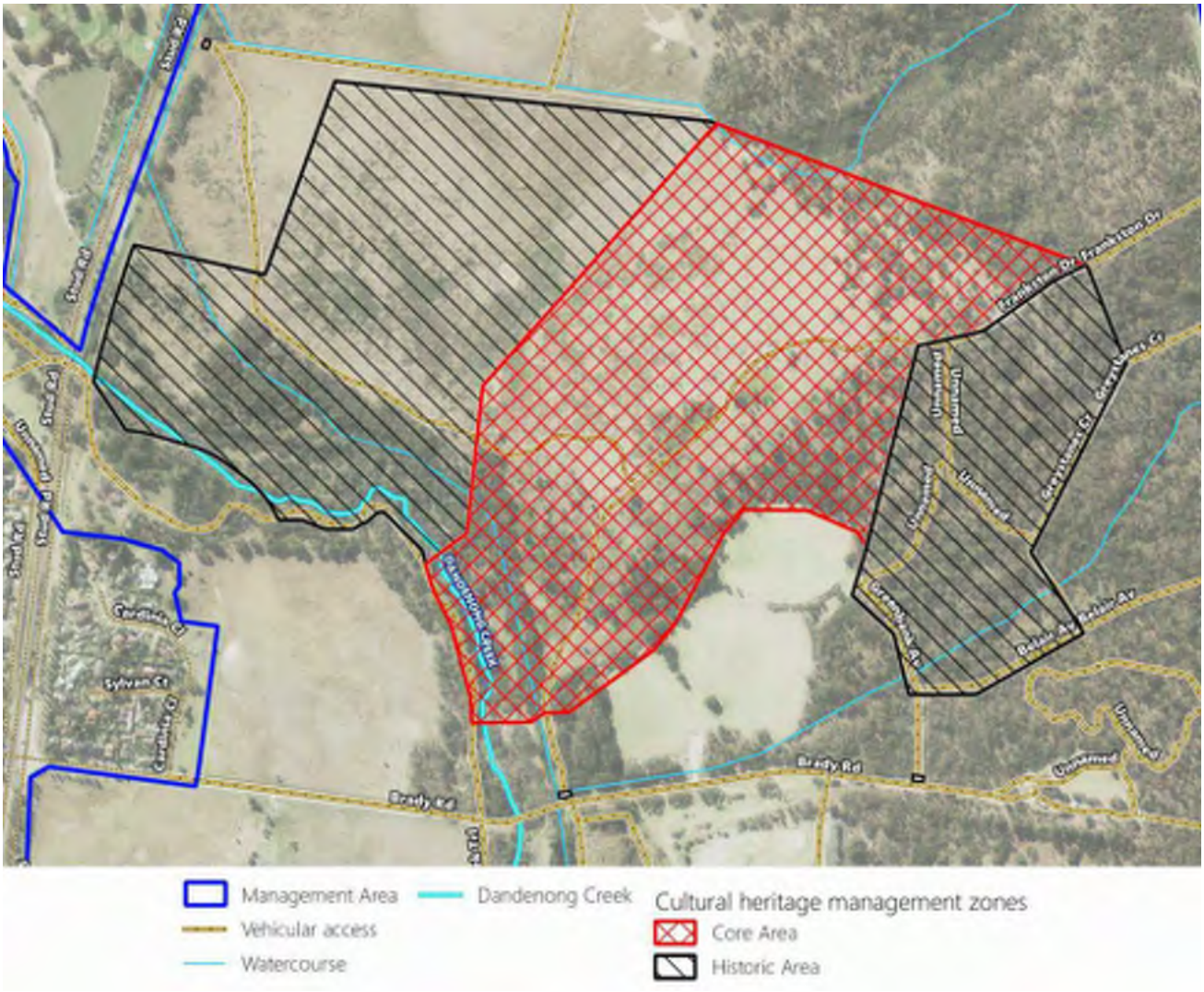


Figure 8. Cultural heritage management zones: Dandenong Police Paddocks Reserve

3.7.3 Alligator weed

Alligator weed is a state prohibited weed listed under the *Catchment and Land Protection Act*. Two Alligator Weed infestations are known to currently occur within the management area (Figure 9):

- Tirhatuan Wetlands
- A quarantine area in the western wetland complex within the Melbourne Water Recreation Area (opposite the intersection of Judith Street and Stud Road)

Alligator weed infestations have been reported to Agriculture Victoria and are currently subject to eradication or quarantine. The Alligator Weed quarantine area within the Melbourne Water Recreation Area must not be disturbed in any way, unless as part of management works sanctioned by Agriculture Victoria and or DELWP.

If any other Alligator Weed (or other State prohibited weeds) are observed within the management area, they must be reported immediately to Agriculture Victoria weed.spotters@agriculture.vic.gov.au.

3.7.4 Transmission lines

Electrical lines transverse the management area (Figure 9; Map Appendix 1). Ausnet Services define planting distances from powerlines and the corresponding width of transmission easements (Ausnet Services 2020). It is unclear if the

powerlines within the management area are defined as *transmission lines* or *distribution lines*. It is assumed that the majority of powerlines within the management area are 66kV transmission lines, with the exception of large pylons that intersect the north-west of the Police Paddocks Reserve, which are assumed to be 500kV transmission lines. The following transmission easements therefore apply to the management area, as defined by Ausnet Services (2020):

- 30-metre-wide transmission easement width for 66kV (15 metre buffer on the powerline alignment)
- 60-metre-wide transmission easement width for 500kV (30 metre buffer on the powerline alignment)

The actual easement details might vary from the specifications listed above, which are recorded on the Certificate of Title (which must be the first point of reference).

Revegetation is allowed within transmission line easements with restrictions. For the purpose of this management plan, no revegetation is proposed within transmission easements as there is ample area outside of transmission easements. However, if planting is required within transmission easements, the following key points must be adhered to:

- Choose species that have a maximum maturity height of no more than three metres.
- Trees or shrubs should be scattered or clumped across the easement (an overall vegetative cover for mature trees and shrubs of up to 10 per cent is acceptable).
- Vehicle access along the easement should not be inhibited.
- As maintenance vehicle access is required, only grasses or low growing vegetation should be planted within a distance of 20 metres from each tower centre. (In special circumstances, such as in gullies or watercourses, these requirements may be varied. Contact AusNet Services for guidance)
- When planting adjacent to, but not within an easement, make sure the vegetation will not impede vehicle access or pose a fire risk if it were to fall onto the easement.

Source: Ausnet Services (2020)

Powerline alignments and easements are displayed in Figure 9 and Map Appendix 1.

3.7.5 Weirs, drainage inlets and outlets

Revegetation must not be installed within at least five metres of weirs, drainage inlets and drainage outlets, including drainage infrastructure within Melbourne Water managed constructed wetlands. Such distances are required in order to minimise the potential for revegetation to affect the hydrological function of this infrastructure.

3.7.6 Tirhatuan Wetlands

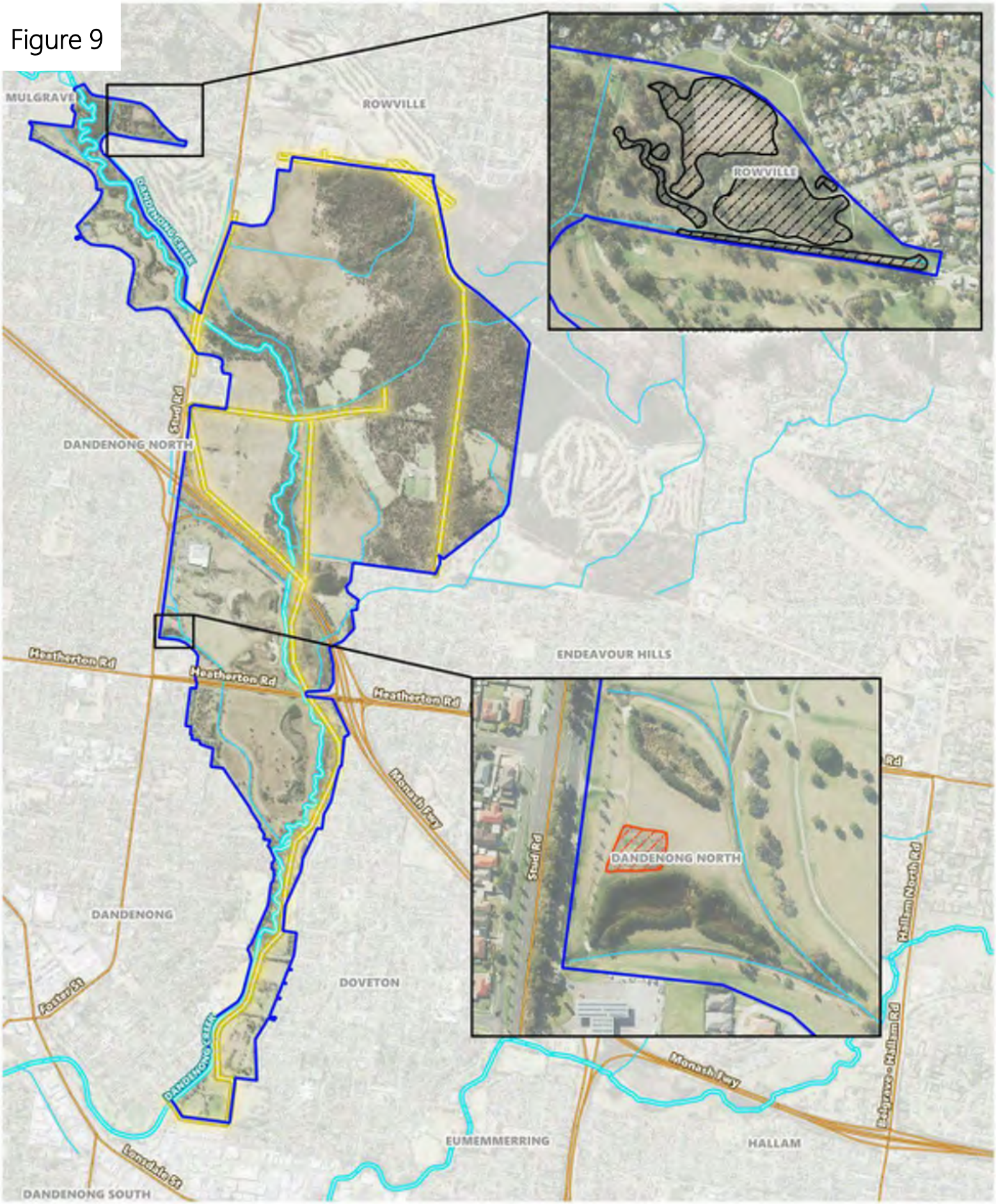
Melbourne Water commissioned Ecological Perspective to prepare a management plan for the Tirhatuan Wetlands in 2020 (Ecological Perspective 2020). A detailed description of site values, management issues and management prescriptions are provided by Ecological Perspective (2020).

Key components of the report that have particular relevance to this management plan include:

- Detailed mapping and description of Ecological Vegetation Classes (EVCs), including various wetlands EVCs,
- A detailed explanation of the hydrology and dynamics of the wetland, including historical and proposed watering regimes (the timing and quantity of water that is pumped into the wetland from the Dandenong Creek),
- Identification of specific management issues pertaining to significant flora, fauna and threatened ecological communities, including EPBC Act listed migratory birds, *Seasonal Temperate Wetlands (Freshwater) of the Temperate Lowland Plains* vegetation community, and Dwarf Galaxias,
- Revegetation and species enrichment plantings,

- Environmental weeds, and over-abundant indigenous flora

Figure 9



Alligator Weed and powerline easements

Lower Dandenong Creek

- Management Area
- Vehicular access
- Watercourse
- Dandenong Creek
- Wetlands
- Alligator Weed Quarantine
- Alligator Weed Tirhatuan Wetlands
- Powerlines
- 30m powerline easement

Mark Shepherd Ecological Consulting
Map Version: 02
Date: 21/12/2020
Scale: 1:30,000 @A4
Coordinate system: GDA94 MGA Zone 55

0 250 500 750 1000 m

Mark Shepherd
Ecological Consulting

3.8 Artificial habitat creation

3.8.1 Artificial wetland nesting and roosting habitat

The constructed wetlands at the management area were generally lacking structures within the wetlands that could be utilised by wetland birds for roosting and breeding. It is therefore recommended to consult a specialist wetland ecologist to determine the most appropriate structures that could be introduced into such wetlands.

As a minimum, salvaged mature Eucalypts lawfully removed by contractors within the local area could be craned into place (without disturbing native vegetation). Alternative structures may include floating platforms and elevated platforms, that can be used as nesting platforms. Consultation with an ornithologist specialising in wetland birds is recommended to guide the design of artificial habitat, which is recommended to prioritise habitat creation for significant wetland bird species.

3.8.2 Artificial tree hollows

Mature hollow-bearing trees have been removed from many parts of the management area. Furthermore, a general absence of canopy trees was observed in the central riparian areas, and significant tree die-back was observed in the Dandenong Police paddocks and within riparian vegetation within Tirhatuan park. Many fauna species, including bird, possums and bats depend on tree hollows for breeding. Artificial tree hollows in the form of nest boxes and hollows created logs or by carving a hollow using a chainsaw can be effective in providing critical habitat resources for a range of arboreal fauna (Ross et al 2009).

Artificial habitat in the form of nest boxes and chainsaw hollows have been installed in the riparian areas of the central sector of the management area (Photo 20). Additional habitat creation is recommended throughout the treed areas of the management area.

Front-entry plywood boxes have been used extensively by some species however low thermal insulation inherent in this design is recognised as a problem for some species (Ross et al 2009). Alternative designs including log-hollows and hollows cut into the tree are also known to be effective and may offer additional insulation. Fauna species tend to use artificial hollows that have entrance sizes that are sufficient for their body size (no larger), and this principle should guide hollow design (Ross et al 2009). The use of artificial hollows by a range of non-target species (native and non-native) is likely to have a detrimental influence on artificial hollow use by target species and must be considered in any management program involving artificial hollows (Ross et al 2009).

A zoologist with skills and experience in artificial tree hollows should be engaged to guide the further implementation of artificial hollows at the management area.

Photo 20. Artificial log-hollow installed at Tirhatuan Park

3.8.3 Terrestrial habitat logs

Terrestrial logs provide habitat for a wide range of mammals, insects, and reptiles. Introduced habitat logs are suggested to be an effective habitat-restoration technique in grassy landscapes insects through the increase in structural habitat complexity (Michael et al 2004).

Introduced habitat logs were observed within revegetation at the Melbourne Water Recreation Area (Photo 21). Additional logs ideally consisting of Eucalyptus logs that are large, wide, and contain many holes are recommended to be installed within any areas of revegetation or grassy EVCs where logs are currently lacking. If large Eucalyptus logs with numerous holes are unavailable, then the introduction of logs of size and type are considered beneficial.

Photo 21. Habitat logs within the Melbourne Water Recreation Area

3.9 Environmental monitoring

3.9.1 Monitoring approach

Monitoring is essential for evidence-based evaluation of the effectiveness of management actions and to facilitate an adaptive management approach. Given the complexity of natural systems, monitoring has inherent challenges associated with the collection of data in sufficient detail to accurately evaluate change. For example, many vegetation monitoring methodologies rely on subjective judgements, particularly with regards to cover determinations, which studies have shown there to be significant observer bias and variation between assessors (Elzinga et al 1998). Furthermore, it is difficult to accurately monitor large geographic areas when there are wide variations in vegetation condition and land-uses.

Environmental monitoring as part of an adaptive management approach needs to carefully consider how the monitoring data feeds back into management decisions. Complex monitoring methodologies may accurately detect environmental change but may be difficult to interpret or insufficient for the purpose of guiding the prioritisation of management funding and resources. Furthermore, monitoring methodology and results should be readily accessible to the personnel undertaking the on-ground works, in order to facilitate immediate adaption to changing conditions and prioritisation of works by the staff undertaking the works.

The type of monitoring appropriate for the management area requires evaluation of the trade-offs between detail, the resources available, and the experience of those collecting the monitoring data (Duncan & Moxham 2014). Given these challenges and requirements, it is recommended that relatively fast and simple monitoring methodologies are deployed and undertaken by field-based personnel in order to facilitate rapid and direct feedback and adaption. Simple yet effective monitoring protocols is recommended in the following sections, based on photo-point methodology, Level of Service (LoS) mapping and revegetation monitoring. Other more detailed and empirical methodologies, such as the Eastern Alliance for Greenhouse Action (EAGA) biodiversity monitoring method (Threlfall *et al*. 2015) could also be considered if funds become available and are described in the accompanying Technical Report (Shepherd Ecological 2020).

Existing and suggested monitoring methods that are suggested as appropriate methodologies for on-ground works crews and contractors are discussed in the following sections.

3.9.2 Revegetation monitoring

Arthur Rylah Institute (ARI date unknown) have designed a simple yet effective revegetation monitoring methodology, which is recommended for the management area.

Monitoring of revegetation is important to understand how survivorship of individual species, the effects of maintenance techniques on revegetation, and the implications of different planting densities and browsing animals. The basis of the methodology requires participants to:

- Mark two or more monitoring plots within a planting site
- Record all plants that are planted within the plot area directly after planting
- Note information on the land-use history, a description of the landscape being planted, the site preparation undertaken and the planting techniques
- Revisit these sites after the first summer and record plants that are alive in the monitoring plots and their approximate height.

A detailed explanation of the monitoring methodology is provided on the ARI website:

https://www.ari.vic.gov.au/research/field-techniques-and-monitoring/assessing-the-conservation-benefits-of-revegetation.

3.9.3 Photo-point monitoring

Photo-point monitoring is a simple and inexpensive technique to monitor visual changes in the natural environment over time. Photo-point monitoring requires that a series of photographs at a consistent location and field of view are captured at regular time intervals, which can then be compared to monitor physical change.

In order to achieve consistency, photographs must be taken at the same location, at the same time of day, with the same (or equivalent) camera, at the same camera direction angle, and preferably in the same weather conditions.

The key to achieving consistency is installing pre-defined and permanently marked photo-point locations, which are de-marked with a star picket (or similar) to allow for easy and accurate re-location of the precise photo-point location. The star picket can also be used as a reference for a consistent camera height.

It is recommended that a robust file handling protocol is developed to ensure that photographs are effectively logged and backed-up, as per Section 1. It is further recommended that on-ground works crew undertake the photo-point monitoring, so that immediate and direct management adaptations can made by the personnel completing the works.

3.9.4 Level of Service mapping

Level of Service (LoS) mapping can serve as a rapid-assessment monitoring tool. City of Greater Dandenong have historically applied a vegetation categorisation technique referred to as *Level of Service* zone mapping. LoS applies a three-tiered vegetation categorisation at the site scale:

Vegetation categories vary from High to Low:

- High; Green, 80% - 100% Indigenous Flora, Retention
- Medium; Blue, 50% - 80% Indigenous Flora, Restoration
- Low; Orange, 0% -20% Indigenous Flora, Rehabilitation

The categories are referred to by contractors when providing a quotation on management works and by on-ground works crews to gain an understanding of the basic vegetation condition and to assist in the prioritisation of works in different areas of the site. Level of Service (LoS) zonation mapping is ideally undertaken by the works crews doing the on-ground works, as it assists in gaining a site-scale understanding of the condition of the vegetation, and where weed infestations and other site features are located. While the LoS method is not strictly repeatable (there will likely be significant assessor variability); the method is rapid (time efficient) and can provide a coarse indication of vegetation composition change over time. Furthermore, LoS mapping is designed to be undertaken by the personnel implementing the on-ground works, which increases its relevancy and likelihood that it will facilitate an adaptive management response and results in field crew gaining a greater understanding of the type and distribution of weed infestations within their management areas.

Figure 10 below provides an example of LoS mapping. Please note that other categories can be added, such as revegetation plots or weed infestations, depending on the attributes of the site.

Figure 10. Level of Service mapping example

3.10 Fire

3.10.1 Fire as a management tool

Fire has been a part of the Australian environment for millions of years and has been instrumental in shaping the, composition, distribution and adaptations of the flora and fauna that are present in Australia today. Fire has been used by the First Nations People for millennia as a vegetation management tool and continues to be used for cultural purposes throughout Victoria. Studies suggest that the structure and composition of pre-European flora and fauna assemblages was highly influenced by regular burning by Aboriginal Peoples (Low, 2002; Bowman 1998). While the floristic assemblages and land-uses within the management areas have changed considerably compared to the pre-European era; the use of fire as a vegetation management tool is considered appropriate at the management area, providing health and safety issues can be mitigated and the responses of exotic flora species can be anticipated and appropriately managed.

The use of fire could play a key role in controlling weeds and promoting the recruitment of indigenous plants at the management area. For example, a cool temperature burn is known to kill mature Gorse plants and will germinate the majority of soil-stored seed, which providing if enough resources are available, presents an opportunity to target germinating plants and exhaust the seed bank (VGT 2018). Furthermore, fire will remove the majority of above ground biomass, making access easier for follow-up spraying (VGT 2018) and will reduce the volume of required herbicide.

Many other weeds respond similarly to Gorse, whereby soils-stored seed will either be killed or germinated, which presents a weed management opportunity.

The *Victorian Traditional Owner Cultural Fire Strategy* (Federation of Victoria Traditional Owner Corporations 2020) was introduced in May 2020 and provides a policy directive and framework across Victoria's fire and land management agencies to support Traditional Owners to undertake cultural burning for the range of cultural values entailed by caring for Country. It is recommended to consult the Bunurong Land Council Aboriginal Corporation, Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation, Dandenong and District Aborigines Co-operative and Local Aboriginal and Torres Strait Islander Peoples at the Doveton Gathering Place prior to any proposed burning given the identified cultural heritage values at the management area, and the objectives of the Traditional Owner Cultural Fire Strategy (Federation of Victoria Traditional Owner Corporations 2020).

Tolerable fire intervals, as described by Cheal (2010) and an evaluation of the suitability of fire as a management tool for a range of Ecological Vegetation Classes that occur within the management area are provided in the accompanying Technical Report (Shepherd Ecological 2021).

Mosaic burning

Mosaic burning is the deliberate creation of a mosaic of burned patches representing different fire histories. Mosaic style cool temperature burning was commonly undertaken by Aboriginal People to promote food plants and to encourage animal prey into the area. Mosaic burning is also recognised for its propensity to facilitate floristic and habitat diversity.

Mosaic burning is generally safer than broad scale burning and will not create as much smoke. It is therefore recommended to undertake mosaic style burning within appropriate areas of the management area that have good access and natural fire breaks (such as the Dandenong Creek and wetlands).

Controlled burn planning and considerations

When planning to utilise fire as a management tool, the following will need considerations:

- Notify Emergency Management Victoria (EMV), the Country Fire Authority (CFA) and the local municipal fire prevention officer / department to inform of the intent to burn and to seek guidance on appropriate safety measures that need to be considered.
- Consider wind speed and direction, and moisture content of the vegetation to be burnt with regards to the anticipated quantity, direction and dispersal time for smoke that will be generated, with the particular aim of avoiding excessive smoke impacting high-density residential areas.
- Engage contractors with appropriate training, experience, and insurances for the task of controlled burning.
- Seek assistance from the local CFA brigade (which may take the opportunity to supervise the burn as a training exercise).
- Prior to burning, notify all nearby residences, businesses, and other relevant parties that may see or smell smoke, or flames, of the intent to undertake controlled burning for vegetation management purposes.
- Only undertake controlled burning for vegetation management purposes if follow-up treatments are well resourced with secure funding and consider the potential detrimental implications of fire, such as increased erosion and subsequent invasion by a different suite of weeds to the target weed.
- Consider a trial plot prior to broad scale burning to test the results over the medium term.

4. Management prioritisation matrix

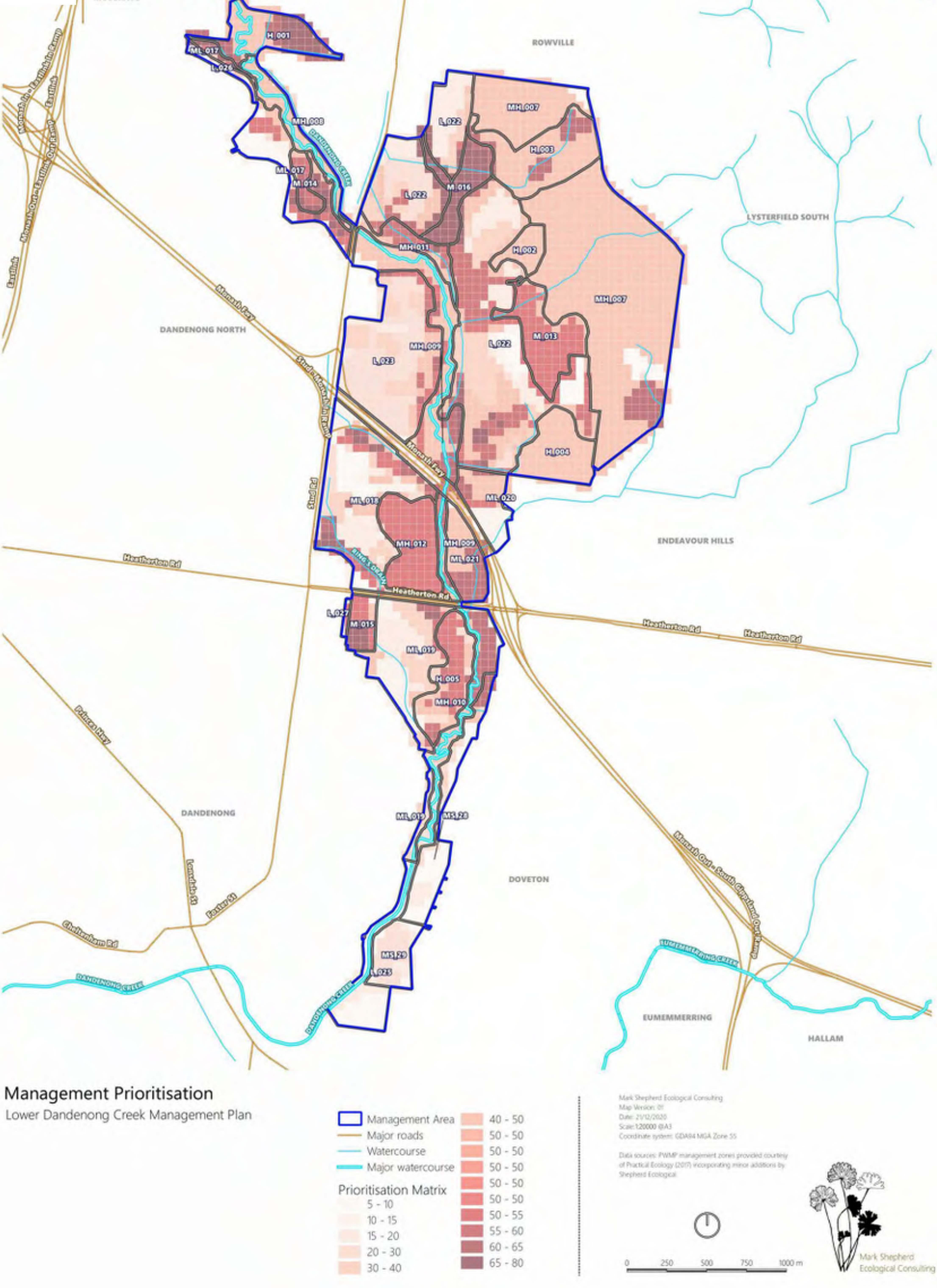
A prioritisation matrix was applied using a Geographic Information System (GIS) to guide the prioritisation of management effort according to a set of parameters based on site values and habitat connectivity potential (Table 1).

A 50-metre grid was applied over the management area using a GIS, resulting in 2980 individual 50m x 50m grid cells. Each grid cell was populated with a score for each of the GIS attributes listed in Table 1 below. Individual scores for each grid cell were totalled to arrive at an overall score for each grid cell, which is symbolised with a graduated hatch in Figure 11, whereby darker shades equate to higher scores and vice versa.

Table 1. Management prioritisation matrix

GIS Attribute	Description	Points assigned
Wetlands	Wetland vegetation and open water, including drainage lines and marshes	10
ThrComm	Threatened ecological communities	10
ThrSpp	Known or potential habitat for more than 10 significant species	10
	Known or potential habitat for less than 10 significant species	5
HabQual	Native vegetation patch	10
	Non-native vegetation including low-density revegetation amenity plantings, exotic grassland	5
	Amenity areas or constructed features	0
PatchSz	Native vegetation patch size <1ha	5
	Native vegetation patch size>1ha	10
ConnImpr	Areas identified to facilitate increased habitat connectivity, based on existing connectivity and future connectivity achieved through revegetation	20
PotEmpWtld	Potential for ephemeral wetland creation	5
Inundat	Area subject to October 2020 inundation (with added 10m buffer)	10
Weeds	<5% 2020 weed cover	5
	<8% 2020 weed cover	10
	<10% 2020 weed cover	15
ConstWtld	Constructed wetland. Minus 10 points to account for the generally lower management effort required within permanently inundated areas.	-10
BaselineM	Baseline management required for areas with few if any other values	5

Figure 11



Management Prioritisation

Lower Dandenong Creek Management Plan

5. Schedule of Works

A ten-year works program has been developed, which builds upon PWMP management prescriptions and targets set out by Practical Ecology (2017) and responds to completed management actions and new targets set by City of Greater Dandenong. The ten-year works program sets out a timeline for implementation of management actions and presented in Table 2.

A detailed breakdown of management requirements for each zone is attached as the Management Actions spreadsheet in electronic format accompanying this report. The Management Actions spreadsheet can be accessed via OneDrive using the following link:

Management Actions spreadsheet

Table 2. Schedule of Works

Management objective	Management action	Description	Timing of action
Weed management	PWMP	Continue weed management program using PWMP as template for planning and implementation	All years commencing Year 1
	Brush-cutting	Implement broad-scale targes program of brush-cutting within higher quality micro-sites	All years commencing Year 1
	Grey-headed Flying-fox colony	Implement weed control in accordance with specific requirements of the Grey-headed Flying-fox Management Plan	All years commencing Year 1
Revegetation	Landscape design	Complete a detailed landscape design prior to installing revegetation and choose the most appropriate revegetation type, including the options itemised below	Year 1 and on-going, as required
	Grey-headed Flying-fox colony	Implement revegetation in accordance with specific requirements of the Grey-headed Flying-fox Management Plan	Autumn- Year 1 and on-going, as required
	All strata (full revegetation)	Install full suite of species within areas of exotic grassland	All years commencing Year 1 following landscape design and bushfire hazard assessments
	Understorey infill planting	Install understorey within existing areas of canopy (either revegetation canopy or natural canopy)	All years commencing Year 1 following landscape design and bushfire hazard assessments
	Understorey planting	Install understorey species within exotic grassland	All years commencing Year 1 following landscape design and bushfire hazard assessments
	Wetland understorey planting	Install understorey wetland species within exotic grassland	All years commencing Year 1 following landscape design and bushfire hazard assessments
Plant protection	Temp-fencing panels	Trial temp fencing panels (3-sided or other designs) for Wallaby and Kangaroo protection within the northern sectors of the management area. Broadscale implementation if demonstrated to be successful	Year 1 and on-going, as required
	Revegetation delineation	Instal basic post and wire fencing around revegetation plots to delineate a no-slashing zone (where appropriate)	All years commencing Year 1
Ephemeral wetland creation	Hydrological study	Undertake hydrological studies in key areas that are currently subject to regular inundation or have the potential to be inundated through hydrological modifications - determine viability of ephemeral wetland creation	Year 1 and on-going, as required

Management objective	Management action	Description	Timing of action
	Changes to slashing regimes	Identify and map areas where slashing can be excluded to promote the regeneration of indigenous wetland flora - change slashing regime accordingly	Year 1 and on-going, as required
	Hydrological change simulation	Simulate increased inundation through the installation of temporary diesel powered water pump in selected locations	Year 1 and on-going, as required
	Implement permanent hydrological changes	Implement hydrological changes through earthworks, spillways or other mechanism in order to increase inundation of low-lying areas once studies have demonstrated safety and efficacy	Year 2 and on-going, as required
	On-going management	On-going management including altered slashing regimes and weed control	Year 2 and all following years
Past animals	Rabbits	Monitor Rabbit numbers and implement broad-scale control within infested areas if required	Year 1 and on-going, as required (prior to revegetation that does not utilise plant protection)
	Foxes	Monitor Fox numbers and implement broad-scale project area wide control program if required	Year 1 and on-going, as required
Artificial habitat creation	Wetland nesting and roosting habitat	Design and implement artificial wetland nesting and roosting habitat in consultation with a wetland bird specialist	Year 1 and on-going, as required
	Artificial tree hollows	Continue the design and implementation of artificial tree hollows in consultation with a specialist	Year 1 and on-going, as required
	Terrestrial and wetland habitat logs	Continue the introduction of habitat logs in consultation with a specialist	Year 1 and on-going, as required
Fire	Bushfire safety	Investigate bushfire safety in relation to existing hazards, potential future revegetation hazards and controlled burning safety	Year 1 and repeat at least biannually or as required
	Biodiversity burning	Plan controlled burns for specific management outcomes, such as Gorse control, or increased floristic and structural diversity within remnant woodland	After bushfire safety
	Cultural burning	Liaise with relevant Aboriginal organisations and plan cultural burning, in conjunction with biodiversity management objectives	Year 1 and on-going, as required
Measure success	Photo-point monitoring	Continue or introduce mandatory photo-point monitoring to be undertaken by all personnel and site managers	All years commencing Year 1
	Revegetation monitoring	Introduce mandatory revegetation monitoring to be undertaken by all personnel and managers	All years commencing Year 1
	Level of Service mapping	Continue or introduce mandatory Level of Service mapping to be undertaken by all personnel and site managers	All years commencing Year 1

Management objective	Management action	Description	Timing of action
Information management system	Design system	Design basic Information Management System.	Year 1
	Trial system	Trial Information Management System on small sub-set of personnel working within the management plan. Adapt the system in response to feedback	Year 1 or 2
	Implement system	Implement basic system and slowly add complexity, if and when the demand arises	Year 2 and ongoing
Additional studies / information	Detailed survey & mapping of values	Engage specialists to undertake detailed mapping of values	Year 1 and on-going, as required

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APPENDIX 1. Revegetation species

EVC	Type	Scientific Name	Common Name
Grassy Woodland	Core species	*Acacia melanoxylon*	Blackwood
		Acacia paradoxa	Hedge Wattle
		Allocasuarina littoralis	Black Sheoak
		Bursaria spinosa	Sweet Bursaria
		Daviesia latifolia	Hop Bitter-pea
		Eucalyptus ovata	Swamp Gum
		Eucalyptus radiata s.l.	Narrow-leaf Peppermint
		Leptospermum continentale	Prickly Tea-tree
		Lomandra longifolia	Spiny-headed Mat-rush
		Olearia lirata	Snowy Daisy-bush
	Understorey diversity	*Lomandra filiformis*	Wattle Mat-rush
		Microlaena stipoides var. stipoides	Weeping Grass
		Microseris walteri	Yam Daisy
		Rytidosperma spp.	Wallaby Grass (various species)
Plains Grassy Woodland	Core species	*Acacia mearnsii*	Black Wattle
		Acacia melanoxylon	Blackwood
		Acacia paradoxa	Hedge Wattle
		Bursaria spinosa	Sweet Bursaria
		Dianella spp.	Flax Lily
		Eucalyptus camaldulensis	River Red-gum
		Eucalyptus ovata	Swamp Gum
		Gahnia sieberiana	Red-fruit Saw-sedge
		Lomandra longifolia	Spiny-headed Mat-rush
		Themeda triandra	Kangaroo Grass
	Understorey diversity	*Arthropodium milleflorum*	Pale Vanilla-lily
		Arthropodium strictum	Chocolate Lily
		Austrostipa spp.	Spear Grass (various species)
		Hypericum gramineum	Small St John's Wort
		Lomandra filiformis	Wattle Mat-rush
		Microseris walteri	Yam Daisy

EVC	Type	Scientific Name	Common Name
Swampy Woodland	Core species	*Acacia mearnsii*	Black Wattle
		Acacia verticillata	Prickly Moses
		Acaena novae-zelandiae	Bidgee-widgee
		Carex appressa	Tall Sedge
		Coprosma quadrifida	Prickly Currant-bush
		Eucalyptus ovata	Swamp Gum
		Juncus spp.	Rush (various species)
		Leptospermum scoparium	Manuka
		Melaleuca ericifolia	Swamp Paperbark
		Melicytus dentatus	Tree Violet
		Poa labillardierei	Common Tussock-grass
	Understorey diversity	*Bulbine bulbosa*	Bulbine Lily
		Centella cordifolia	Centella
		Lobelia anceps	Angled Lobelia
		Persicaria decipiens	Slender Knotweed
Plains Grassy Wetland	Core species	*Amphibromus nervosus*	Common Swamp Wallaby-grass
		Centella cordifolia	Centella
		Eleocharis acuta	Common Spike-sedge
		Eryngium vesiculosum	Prickfoot
		Montia australasica	White Purslane
		Myriophyllum crispatum	Upright Water-milfoil
		Ornduffia reniformis	Running Marsh-flower
		Poa labillardierei	Common Tussock-grass
		Rytidosperma duttonianum	Brown-back Wallaby-grass
		Rytidosperma semiannulare	Wetland Wallaby-grass
		Triglochin striata	Streaked Arrowgrass

Map Appendix 1. Revegetation zones

Proposed revegetation zones for the management area are presented in the following pages.

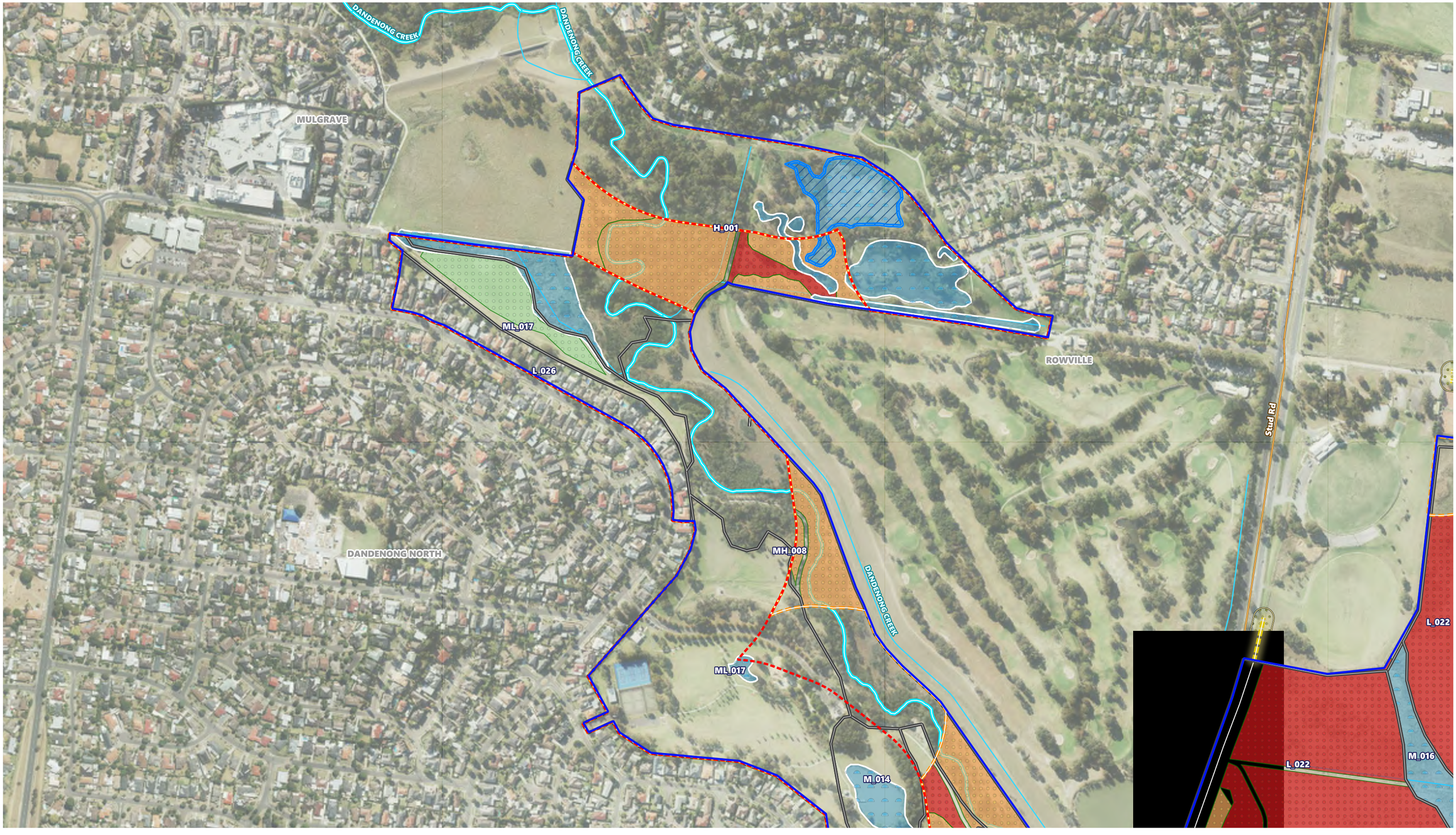


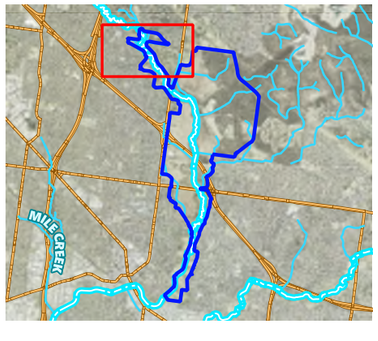
Figure 1: Revegetation zones proposed for the management area

Lower Dandenong Creek Management Plan

- Management Area
- Property boundaries
- Major watercourse
- Watercourse
- Major roads
- Existing wetlands
- Dwarf Galaxias ponds
- Vehicular access
- Gates
- Residential 150m bushfire safety buffer
- Constructed features 150m bushfire safety buffer
- Management Zones
- Powerlines
- 30m powerline easement

Revegetation Zones

- Revegetation - all strata
- Understorey infill planting
- Understorey planting
- Wetland understorey planting
- Grey-headed Flying Fox planting



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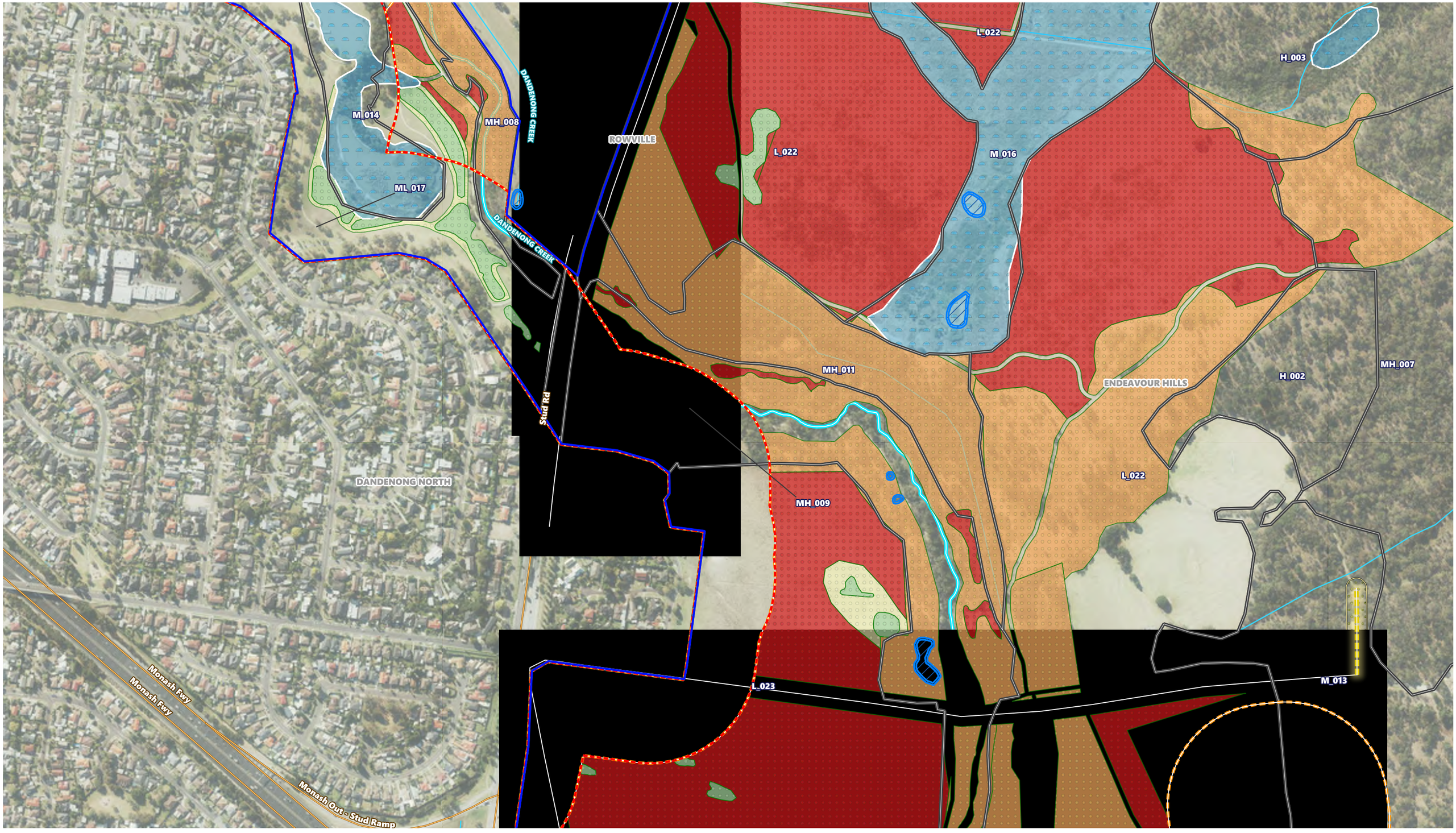

Figure 2: Revegetation zones proposed for the management area

Lower Dandenong Creek Management Plan

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Revegetation Zones

- Revegetation - all strata
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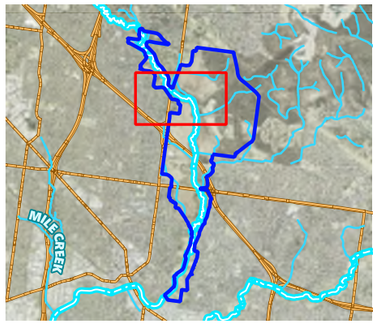
- Understorey planting
- Wetland understorey planting
- Grey-headed Flying Fox planting



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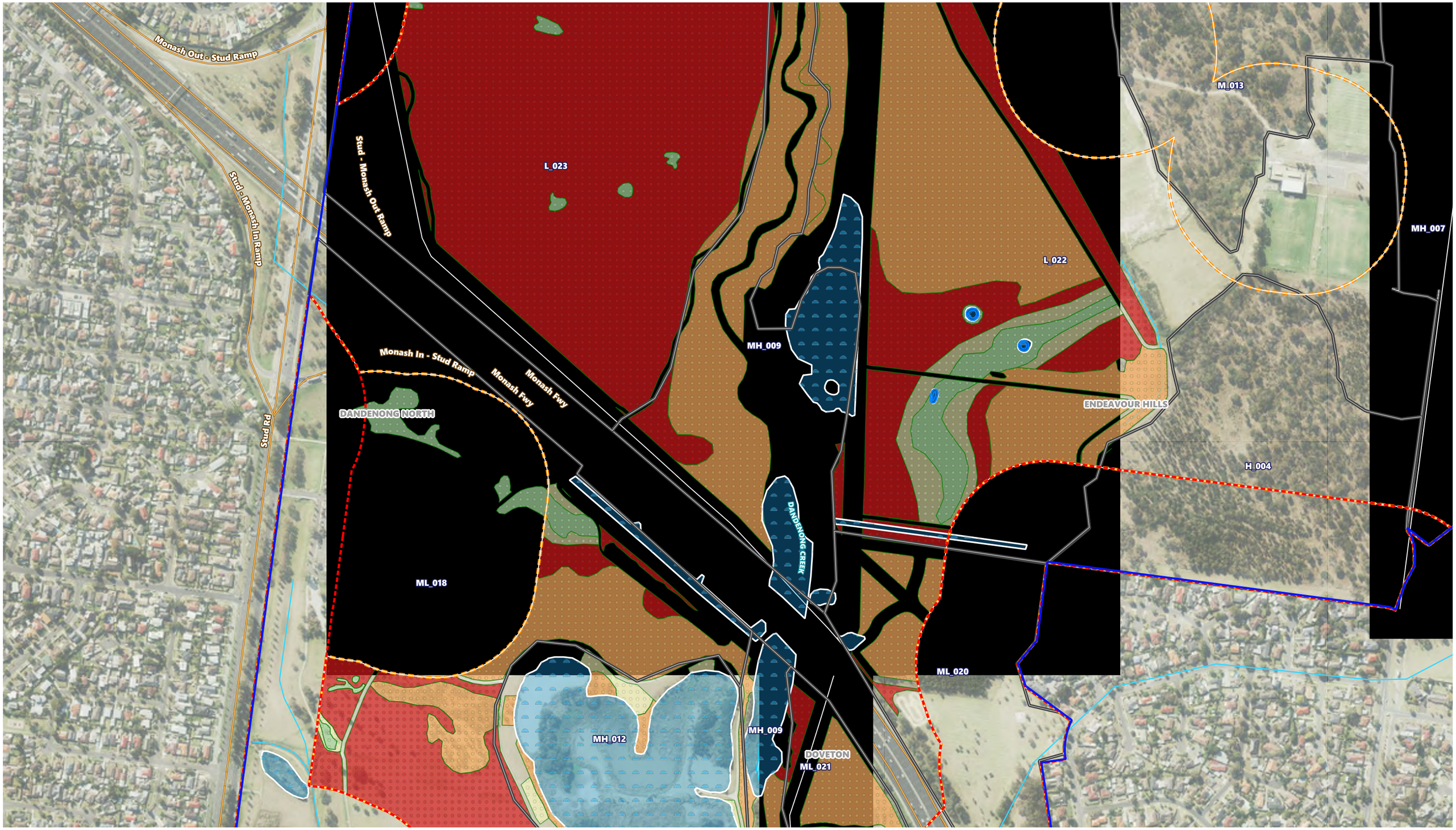

Figure 3: Revegetation zones proposed for the management area

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Revegetation Zones

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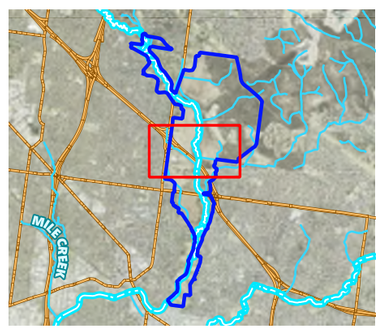
- Understorey infill planting
- Understorey planting
- Wetland understorey planting
- Grey-headed Flying Fox planting



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ML_018
DANDENONG NORTH
RING'S DRAIN
MH_012
MH_009
ML_021
ML_020
Monash Out - Heatherton Ramp
Heatherton - Monash In Ramp
Heatherton Rd
Heatherton Rd
Heatherton Rd
DANDENONG CREEK
Heatherton Rd
Heatherton Rd
ENDEAVOUR HILLS
Heatherton Rd
Heatherton Rd
Stud Rd
L_027
M_015
DOVETON
Monash Fwy
Monash In - Heatherton Ramp
Heatherton - Monash Out Ramp
Monash Fwy
ML_019
MH_010
DANDENONG
H_005
MS_28

Figure 4: Revegetation zones proposed for the management area

Lower Dandenong Creek Management Plan

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Revegetation Zones

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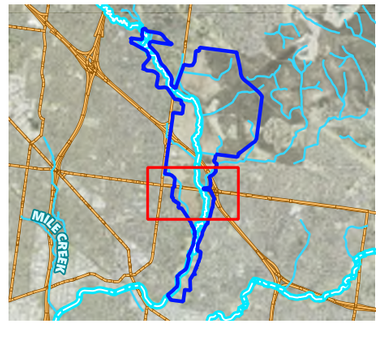

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Figure 5: Revegetation zones proposed for the management area

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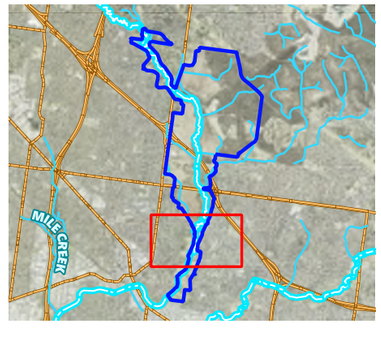

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Figure 6: Revegetation zones proposed for the management area

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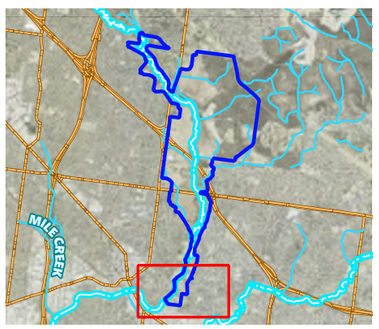

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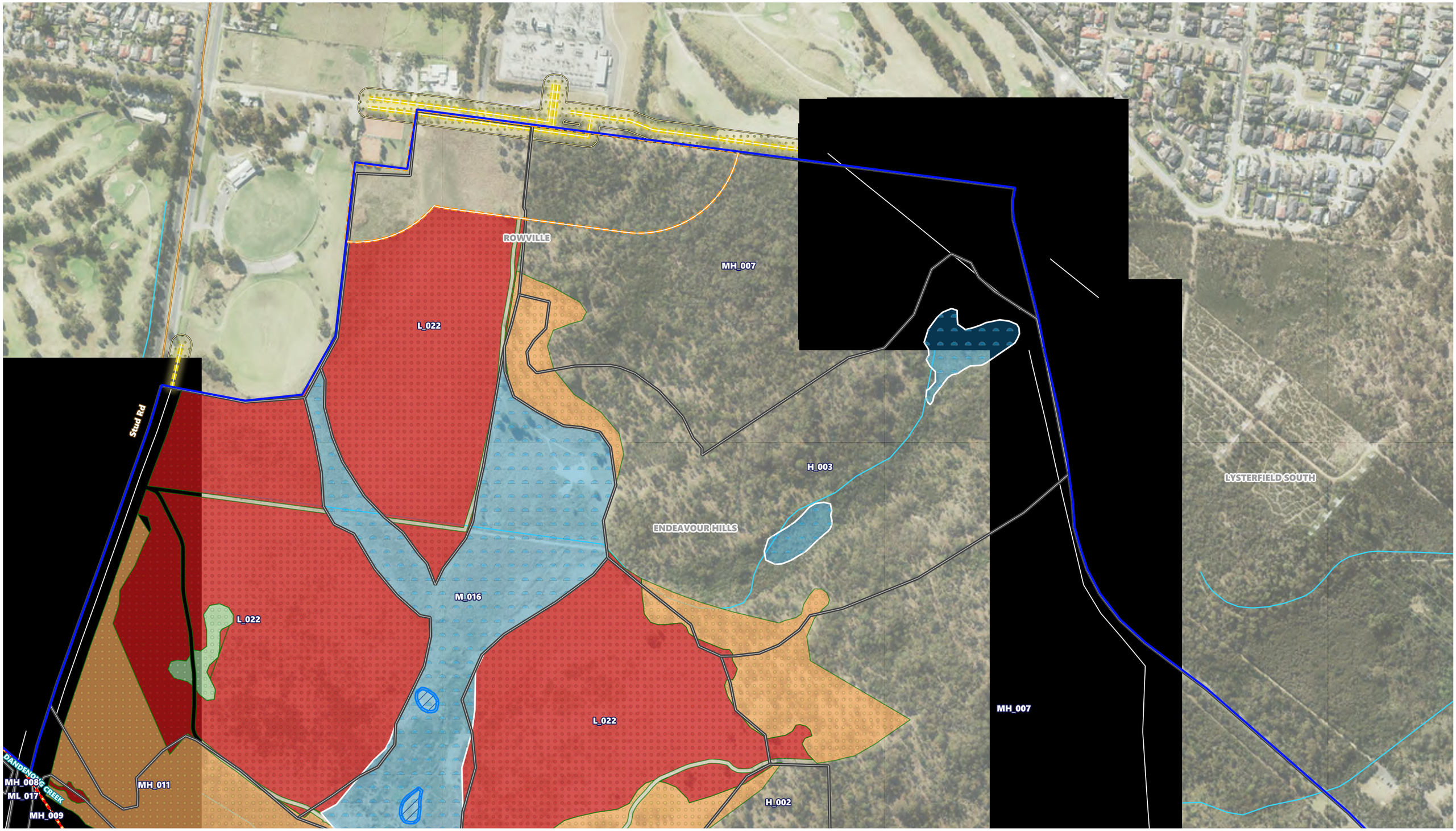

Figure 7: Revegetation zones proposed for the management area

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Coordinate system: GDA94 MGA Zone 55

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L_022
M_016
MH_011
H_002
LYSTERFIELD SOUTH
MH_007
MH_009
DANDENONG CREEK
ENDEAVOUR HILLS
M_013
L_022
DANDENONG NORTH
L_023
H_004

Figure 8: Revegetation zones proposed for the management area

Lower Dandenong Creek Management Plan

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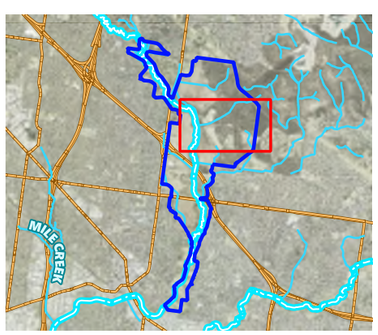

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Coordinate system: GDA94 MGA Zone 55

0 50 100 150 200 m

Mark Shepherd
Ecological Consulting

L_023
MH_009
L_022
H_004
MH_007
Monash In - Stud Ramp
Monash Fwy
Monash Fwy
ENDEAVOUR HILLS
DANDENONG NORTH
ML_018
DANDENONG CREEK
ML_020
MH_012
MH_009
DOVETON
ML_021
Monash Out - Heatherton Ramp
Heatherton - Monash In Ramp
RINGS DRAIN
Heatherton Rd
Heatherton Rd
ML015L_019

Figure 9: Revegetation zones proposed for the management area

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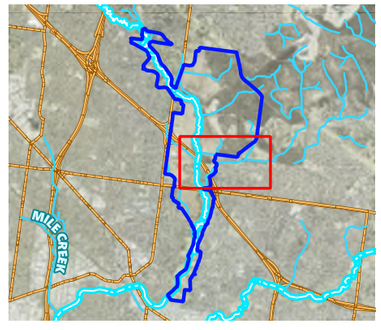

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Mark Shepherd
Ecological Consulting