

Barry Road Development Plan

Prepared for Barry Road Project Pty Ltd

August 2017

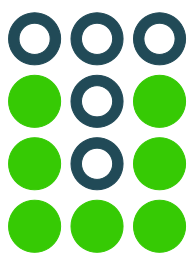


Barry Road Development Plan

The Development Plan was approved by the City of Whittlesea on 21 March 2017, in accordance with Clause 43.04 Schedule 35 of the Whittlesea Planning Scheme.

20/09/2017

[Signature]
Signature of the Responsible Authority



urbanterrain
town planning urban design project management



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1 Introduction

The Barry Road Development Plan (BRPD) has been prepared by Urban Terrain on behalf of Barry Road Project Pty Ltd which owns 135-161 Barry Road in Thomastown. In December 2015, Amendment C179 to the Whittlesea Planning Scheme rezoned this property from Farm Zone to General Residential Zone and created Schedule 35 to the Development Plan Overlay. The amendment included the Downs Road Reserve which runs along the eastern side of the site.

This Development Plan has been prepared in accordance with the requirements of Schedule 35 to the Development Plan Overlay (DPO) at Clause 43.04 of the Whittlesea Planning Scheme. The BRPD includes this document and all appendices. It addresses key issues which need to be resolved prior to applying for a planning permit application for subdivision of the site. As a result, the Development Plan provides the framework that informs any future subdivision or development of the site.

The Development Plan has been prepared in consultation with Council and key stakeholders related to native vegetation, the associated reserves and gas easement. It has been informed by a number of reports and advice from qualified specialists including:

- Environmental Management Plan with associated Native Vegetation Management Plan, Offset Management Plan, and Matted Flax-lily Translocation Plan prepared by Ecology and Heritage Partners.
- Storm Water Management Plan and Drainage Strategy prepared by TGM
- A Traffic Management Plan prepared by Cardno
- Landscape Concept Plan prepared by John Patrick Landscape Architects

1.1 Requirements for the Development Plan

Section 3.0 of Schedule 35 to the DPO outlines the information required to be provided as part of the development plan. This includes a variety of 'plans' including Environmental Management Plan, Traffic Management Plan, Road Layout Plan, Subdivision Layout Plan, Pedestrian and Cycle Network Plan, and Landscape Plan. As a result of preparing the required information, it has been concluded that all of the information can be presented in 6 plans with supplementary information provided in this document. Three of these plans form part of the main Development Plan document. They are:

- **Site Plan** – this is the main plan which shows generally how the site will be developed. It includes the road network, traffic management features, conservation and open space areas, pedestrian and cycle infrastructure, key infrastructure locations and reserves.



- **Infrastructure Plan** – this plan includes storm water management calculations and features, water sensitive urban design (WSUD) features, information related to the gas pipe easement and overhead electricity lines.
- **Subdivision Layout Plan** – this provides specific details related to the subdivision including lot information, building footprints, design guidelines, street lighting, on-street parking and crossovers.

The following plans have a significant amount of detail on multiple pages and have been provided in the Appendices to this document. They are:

- **Landscape Plan** – this plan includes a planting schedule across the site including fencing details for conservation areas and crown land reserves. It implements water sensitive urban design components and addresses landscaping of the gas pipeline reserve.
- **Environmental Management Plan** – this is an extensive document that includes a Native Management Plan, Offset Management Plan and Translocation Plan for Matted Flax-lily.
- **Storm Water Management Plan** – This provides greater detail regarding stormwater, drainage and WSUD as outlined in the Infrastructure Plan.

The three plans in the report, appendices and supplementary information provided in this document include all information required as part of the Development Plan.



2 Site and Context

The site is identified as 135-161 Barry Road, Thomastown and consists of two land parcels:

- Lot 1 on Title Plan 810113H (8.192 ha)
- Lot 1 on Title Plan 837807V (2.063 ha)
- Downs Road Reserve (1.55 Ha)

Together, the full site is 11.81ha of vacant land located between an existing residential subdivision and a strip of Crown land on the east side of the Hume Freeway. The site is triangular in shape, with the widest section to the north and abutting the Whittlesea Public Gardens. To the east of the northern section is the RGC Cook Reserve.

Downs Road Reserve is a decommissioned road along the eastern boundary of the site and adjacent to the back fence of the existing residential area. This road reserve is being incorporated into the site to form part of the overall development. This is a requirement of Schedule 35 to the Development Plan Overlay to incorporate existing service infrastructure.

For the most part, the study area is relatively flat consisting of both indigenous and exotic grassland vegetation, with areas of intact remnant grassland containing embedded basalt rocks. Historically, the site was used for grazing stock. More recently it has been unused with recent surveys suggesting the site is subject to dumping of rubbish and vehicle disturbance. As the site does not appear to have been subjected to any form of management aside from a firebreak slashed around the perimeter, its condition appears to be degrading, and currently contains a significant infestation of the woody weed Sweet Briar *Rosa rubiginosa*.

The site is significantly constrained by regional infrastructure including a gas pipeline and easement running north south through the site. A 66kV overhead power lines run along the eastern boundary before heading northwest through the middle of the property.

Native vegetation including matted flax-lilies can be found throughout the site but are concentrated in the northwest corner which is to become a conservation reserve. The reserve will consist partially of land from the site and partially of crown land. The City of Whittlesea is the Committee of Management which will be responsible for the long term management of the reserve.



Figure 1. Site Context and Features





3 Key Actions Required to Implement the Development Plan

Implementing the Development Plan will depend on a number of key actions which include:

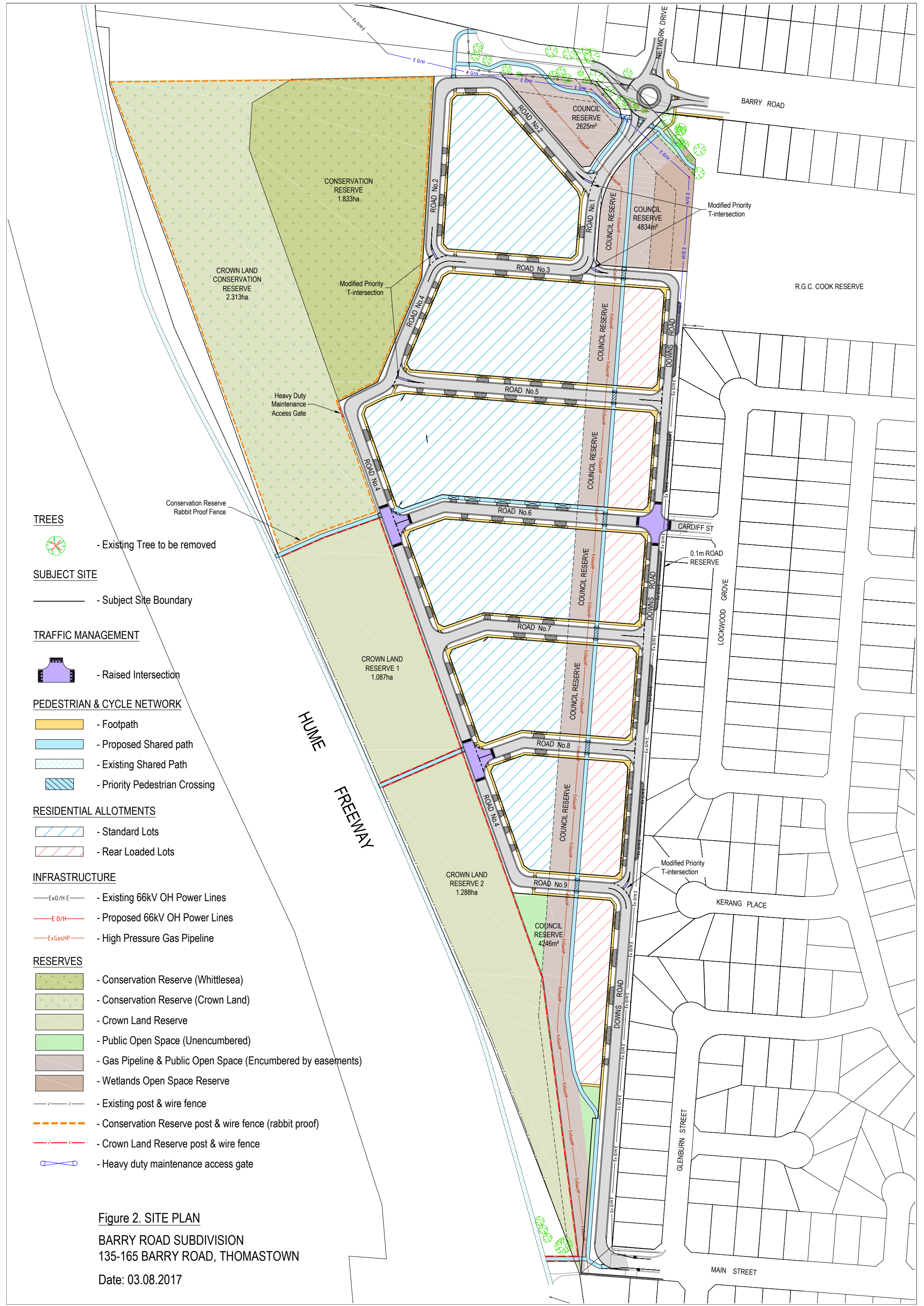
- Creation of a 1.83ha Conservation Reserve in the northwest corner of the site. The reserve will include a portion of Crown Land and will be used as translocation site for Matted Flax-lilies identified within the residential component in accordance with the Environmental Management Plan. This site will be overseen by a Committee of Management and funded by Barry Road Projects, as per the Environmental Management Plan.
- Fencing of two Crown Land Reserves between the residential development and the Hume Freeway. These areas will be managed by the Committee of Management.
- Construction of a new roundabout at Barry Road and Network Drive to provide access to the northern portion of the development and Whittlesea Public Gardens.
- Relocation of existing 66kV overhead powerlines between the northern part of Downs Road reserve and Barry Road.
- Reduction of a portion of the gas pipeline easement from 35m to 20m and shifting of the easement to the west. This will facilitate townhouse development along the eastern boundary of the site.
- A new connection to Main Street with development contributions for new cycle infrastructure extending to Victoria Drive.
- Development contributions for social infrastructure provided as part of a separate Section 173 agreement with the City of Whittlesea.
- New pedestrian and cycle connections through the crown reserve, to Whittlesea Public Gardens, and from Main St to the Hume Freeway shared path.
- Purchase of Downs Road Reserve from Council to incorporate into development site.
- Stormwater from Catchment 2 will need to discharge into Central Creek to the south. A number of WSUD options have been prepared in consultation with Council engineers and will be subject to further approvals as part of the planning permit stage.



4 Development Plan

The following Site Plan, Infrastructure Plan and Subdivision Layout illustrate the key features of the site. They are consistent with the Environmental Management Plan, Storm Water Management Plan and Concept Landscape Plan that are included as appendices to this document.

Supporting information that can't be shown on these plans has been provided in Section 5 of this document.



TREES

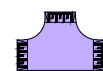


- Existing Tree to be removed

SUBJECT SITE

- Subject Site Boundary

TRAFFIC MANAGEMENT



- Raised Intersection

PEDESTRIAN & CYCLE NETWORK



- Footpath



- Proposed Shared path



- Existing Shared Path



- Priority Pedestrian Crossing

RESIDENTIAL ALLOTMENTS

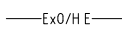


- Standard Lots



- Rear Loaded Lots

INFRASTRUCTURE



- Existing 66kV OH Power Lines



- Proposed 66kV OH Power Lines



- High Pressure Gas Pipeline

RESERVES



- Conservation Reserve (Whittlesea)



- Conservation Reserve (Crown Land)



- Crown Land Reserve



- Public Open Space (Unencumbered)



- Gas Pipeline & Public Open Space (Encumbered by easements)



- Wetlands Open Space Reserve



- Existing post & wire fence



- Conservation Reserve post & wire fence (rabbit proof)



- Crown Land Reserve post & wire fence



- Heavy duty maintenance access gate

Figure 2. SITE PLAN

BARRY ROAD SUBDIVISION
135-165 BARRY ROAD, THOMASTOWN

Date: 03.08.2017

ELECTRICITY

- 66kV OH Power Lines (to be relocated)
- 66kV OH Power Lines (to be retained)
- 66kV OH Power Lines (new alignment)
- Electricity Sub-Station
- Electricity Easement

GAS PIPELINE

- 600Ø High Pressure Gas Pipeline
- Gas Pipeline Easement (new alignment)

STORMWATER MANAGEMENT

- Stormwater Catchment Boundary
- Stormwater Pipe (300Ø to 600Ø)
- Outfall Stormwater Drain
- WSUD Wetland - Catchment 1 (if required)
- WSUD Wetland - Catchment 2 (SWMP Option 2)
- Underground Stormwater Detention Storage - SWMP Option 3 - if wetlands not required

CATCHMENT NO.	CATCHMENT AREA	PRE-DEVELOPMENT PEAK FLOW	POST-DEVELOPMENT PEAK FLOW	POST-DEVELOPMENT PEAK FLOW	POST-DEVELOPMENT PEAK FLOW	ON-SITE DETENTION VOLUME	WETLAND SURFACE AREA
	(ha)	(m³/sec)	5 Yr ARI (m³/sec)	10 Yr ARI (m³/sec)	100 Yr ARI (m³/sec)	10 Yr ARI (m³)	(m²)
1	4.730	0.160	0.428	0.506	0.880	230	330
2	7.080	0.186	0.590	0.693	1.188	665	1800

NOTES:

1. SIZE AND DETAIL OF UNDERGROUND STORMWATER RETENTION TANKS WILL BE DETERMINED AT THE PLANNING PERMIT STAGE.
2. UNDERGROUND STORMWATER RETENTION TANKS ARE REQUIRED TO MAINTAIN STORMWATER FLOWS TO PRE-DEVELOPMENT RATES.
3. INFRASTRUCTURE WITHIN EASEMENTS IS SUBJECT TO APPROVAL FROM THE RELEVANT AUTHORITY.
4. DRAINAGE INFRASTRUCTURE LOCATED WITHIN PUBLIC OPEN SPACE IS CONSIDERED ENCUMBERED LAND.
5. ALL WORKS WITHIN THE GAS PIPELINE EASEMENT INCLUDING DRAINS, LANDSCAPING, SERVICES AND PATHWAYS ARE SUBJECT TO APPROVAL BY THE PIPELINE LICENSEE (APA VTS).

Figure 3. INFRASTRUCTURE PLAN

BARRY ROAD SUBDIVISION
135-165 BARRY ROAD, THOMASTOWN

Date: 03.08.2017

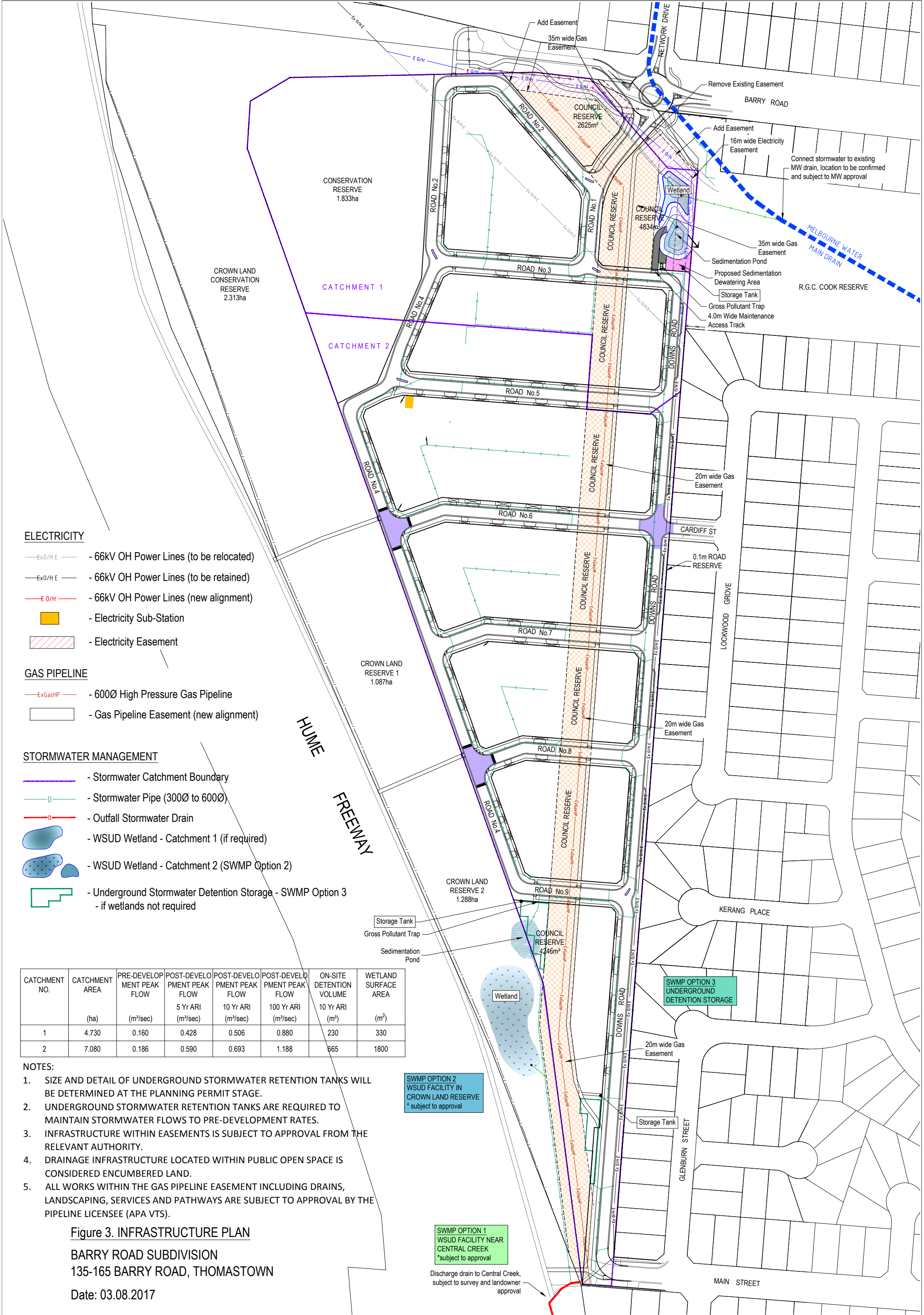




Figure 4. SUBDIVISION LAYOUT PLAN
BARRY ROAD SUBDIVISION
135-165 BARRY ROAD, THOMASTOWN
Date: 03.08.2017



5 Supporting Elements

The following sections provide supporting information related to the development plan and appendices to this document. They provide both an explanation of some components as well as information required by Schedule 35 to the Development Plan Overlay.

5.1 Environmental Management

Ecology and Heritage Partners has prepared an Environmental Management Plan (EMP) for the Development Area. This includes the subject site as well as a portion of the Crown Reserve to the west. Requirements for the EMP include:

A **Native Vegetation Management Plan** for the on-site (1.83 hectare minimum land area) and any other identified conservation reserve(s);

An **Offset Management Plan** for native vegetation to be removed to facilitate development of the land that includes:

- the offsets required.
- locations, within the municipal district in which the land is situated, where offsets will be provided.
- the types of offsets to be provided for each location.
- details of revegetation and means of interim protection for newly established vegetation until established.
- any earthworks, drainage and other works associated with the provision of offsets.
- methods of permanent protection for the offsets.
- persons responsible for implementing and monitoring the offsets.
- time frames for implementing the offsets.

A **Translocation Plan** for Matted Flax-lily translocation and any other species to the satisfaction of Victorian Department of Environment, Land Water and Planning and Commonwealth Department of the Environment.

The EMP addresses Schedule 35 to the Development Plan Overlay (DPO35) in the City of Whittlesea planning scheme, and partially meets the 'Request for Additional Information' as requested by the Commonwealth Department of the Environment (DoE) as part of referral 2014/7364 under the Environment Protection and Biodiversity Act 1999 (EPBC Act).

A series of ecological assessments and targeted surveys have been undertaken at the study area between 2010 and 2016 with the purpose of identifying ecological implications associated



with the development of the study area. The following matters of ecological significance have been identified within the study area:

- One nationally significant flora species Matted Flax-lily *Dianella amoena*, listed as Endangered under the EPBC Act;
- One nationally listed ecological community, Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) listed as Critically Endangered under the EPBC Act; and,
- One State-listed ecological community Western (Basalt) Plains Grassland;
- Three state-significant flora species Slender Bindweed *Convolvulus angustissimus* subsp. *omnigracilis*, Arching Flax-lily *Dianella* sp. aff. *longifolia* (Benambra), and Fragrant Saltbush *Rhagodia parabolica*.

Areas to be impacted by the proposed development and areas proposed to be retained within the conservation reserve are presented in Figure 2 and summarised in Table 1 of the EMP. They are also shown on the Site Plan within this document. The conservation reserve has been specifically designed in accordance with the requirements of DPO35, and to retain and protect habitat for Matted Flax-lily, and areas of Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) community. The conservation reserve provides strategic connectivity to the adjacent Crown Land to the west, and the Whittlesea Public Gardens to the north, and is in close proximity to the existing conservation reserve on the other side of the Hume Freeway to the west.

The full EMP has been included in Appendix A and design details regarding infrastructure to implement the plan are included in the Concept Landscape Plan.



5.2 Traffic Management

Information in this section has been provided by qualified traffic engineers at Cardno. Cardno has reviewed the need for traffic management infrastructure within the Barry Road Subdivision and have recommended a number of Local Area Traffic Management (LATM) devices that should be installed within the subdivision. The LATM devices are now incorporated within Site Plan.

The Barry Road development provides for approximately 150 residential lots with access predominately provided via Barry Road to the north and Main Street to the south. It is anticipated that the subdivision will generate a maximum of 1,500 vehicles per day (vpd) and is expected to be distributed evenly towards Barry Road and Main Street.

Accordingly, it is evident that traffic volumes on the entire local street network within the subdivision are expected to be less than 1,000 vpd (or 100 vehicles per hour) noting a majority of the internal east-west roads would accommodate less than 300 vpd. This level of traffic is considered to be on the low side and well within the theoretical capacity of the proposed road cross sections.

It is expected that a default local speed limit of 50km/h would apply to the subdivision.

Local Area Traffic Management Devices

The following provides a description and summary of the LATM devices selected for the Barry Road Subdivision to satisfy the requirements of DPO35.

LATM devices nominated within the Barry Road Subdivision have been designed generally in accordance with the relevant guidelines specified within Austroads GTMP Part 8 – Local Area Traffic Management. The key objective of the LATM study and implementation is to:

- Discourage speeding and reduce vehicle speeds at locations where there is a need to;
- Reduce crash risk; and
- Promote traffic flow and define priorities at critical intersections.

To discourage speeding and to promote traffic flow along the desired route, the following LATM devices have been nominated for the reasons set out below:

Raised intersection treatments are appropriate for use where a reduction of vehicle speeds is required and to highlight the presence of an intersection. In this instance, the treatment has been nominated at three key intersections being at both ends of Road No. 6 and intersection of Road No. 4 and 8.



Modified priority T-intersections are appropriate where there is a need to regulate traffic movements and where there is a need to promote/define priority at a T-intersection. This treatment has been recommended at four locations generally to promote the main traffic movement at the following intersections on a curve:

Road No. 1 and 2, priority movement to Road No. 1.

Road No. 1, 3 and Downs Road, priority movement to Road No. 1 and 3,

Road No. 3, 4 and 2, priority movement to Road No. 3 and 4,

Road No. 4 and 5, priority to Road No. 4. and

Road No. 9 and Downs Road, priority to Road No. 9.

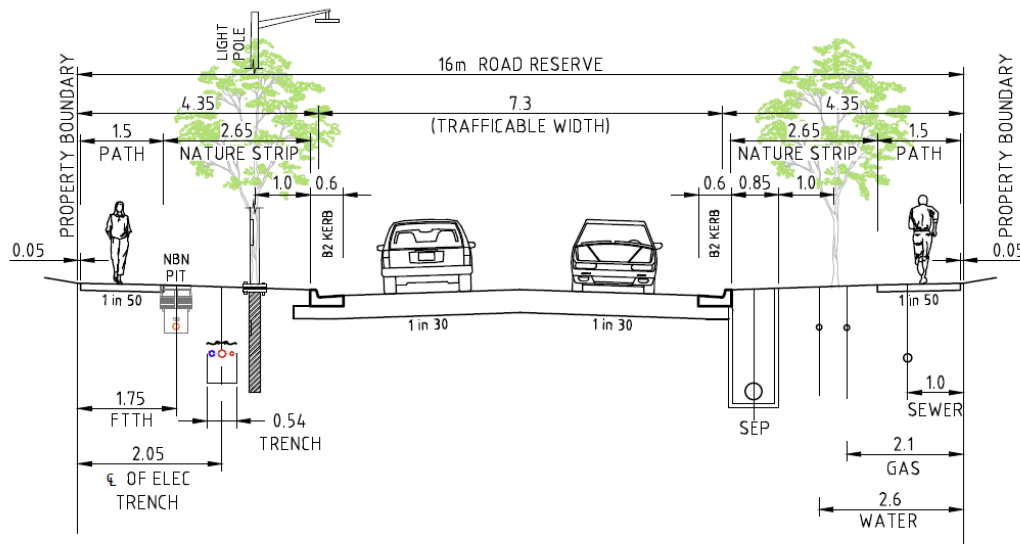
Refer to the Site Plan for location and design of LATM devices.

Alternative Access Design from the North may be considered at the planning permit stage if supported by Whittlesea City Council and the applicant. This may not prevent or delay a permit being issued for the development as illustrated in this document. It must not result in any additional cost to the developer of the Barry Road Development Area.

5.3 Road Cross Sections

The following cross sections are provided for the local road network.

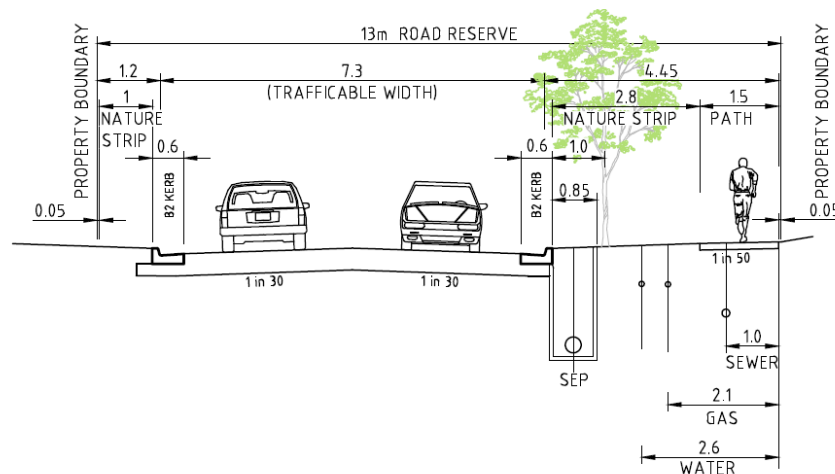
Figure 5. 16m Road Cross Section



16.00m WIDE ROAD RESERVE – LOCAL ACCESS ROAD

ROAD No. 3, ROAD No. 5, ROAD No. 7, ROAD No. 8 & ROAD No. 9

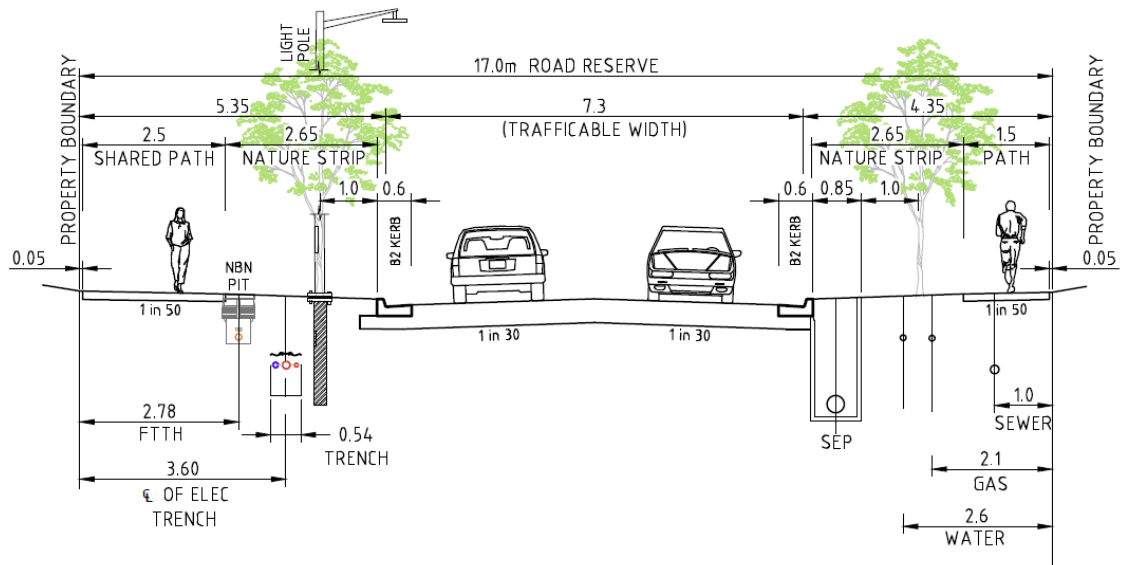
Figure 6. 13m Road Cross Section



13.00m WIDE ROAD RESERVE – PARK EDGE

DOWNS ROAD (LOT 144 TO 152), ROAD No. 2 & ROAD No. 4

Figure 7. 17m Road Cross Section



17.0m WIDE ROAD RESERVE - LOCAL ACCESS ROAD ROAD No. 6

Figure 8. 14m Downs Road Cross Section including 0.1m Reserve

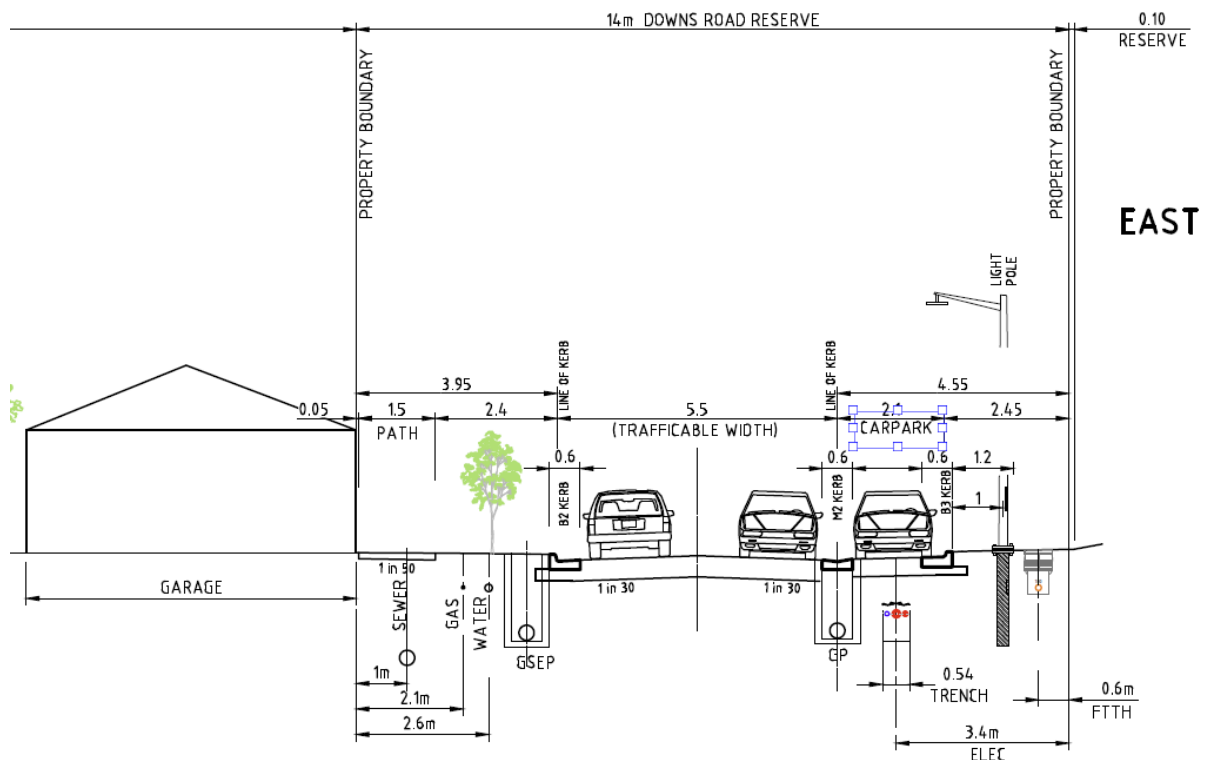


Figure 9. 2.5m Shared Path within Gas Pipeline Reserve

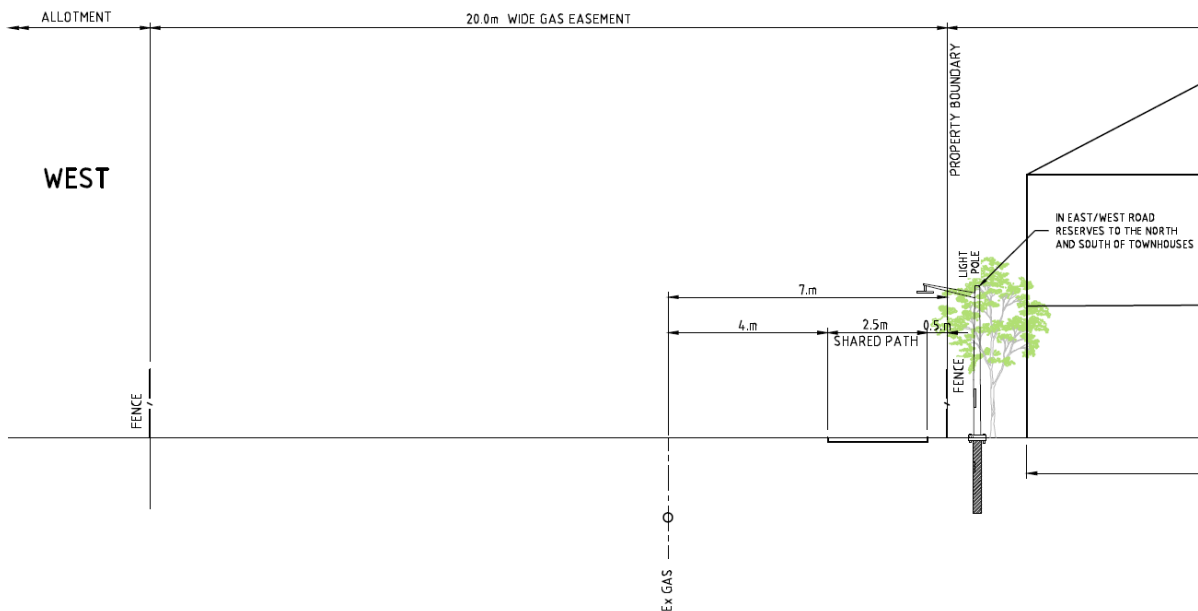
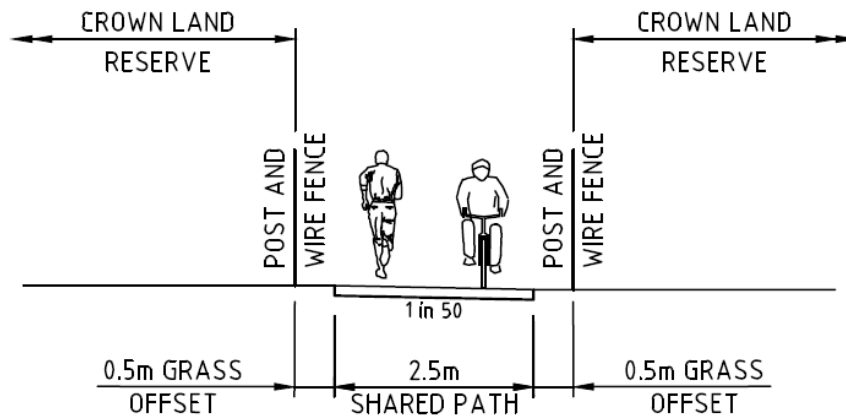


Figure 9 Notes:

1. All works in APA VTS gas pipeline easement subject to APA VTS approval.
2. A co-user agreement will be required to be entered into with any utilities providers wishing to co-locate within the APA VTS gas pipeline easement.

Figure 10. Shared Path Link through Crown Reserve



CROWN LAND SHARED PATH



5.4 Pedestrian and Cycling Network

The development plan aims to provide an intuitive and highly connected pedestrian and cycling network. From a contextual perspective, it links into a variety of key connection points including:

- Whittlesea Public Gardens to the north
- the existing shared path along the Hume Freeway (west of the crown land)
- Barry Road footpath
- Network Drive footpath
- existing footpath on Main Street
- proposed cycling infrastructure on Main Street to Victoria Street being provided as developer contributions
- Cardiff Street on eastern boundary connecting into the existing residential area.

The pedestrian and cycling network through the subdivision uses a variety of on-road, off-road, footpath and laneway connections to provide a highly permeable outcome through the site.

Some key features include:

- Shared path connection from the Whittlesea Public Gardens through the R. G.C Cook Reserve and south through the gas pipeline reserve to Main Street. (final alignment to be approved at planning permit or functional layout plan stage and subject to APA VTS approval)
- Shared Path connection along the north side of Road No. 1 to the Barry Road roundabout.
- A shared path connection from Barry Road roundabout to the east through R.G.C. Cooke Reserve. (final alignment to be approved at planning permit or functional layout plan stage and subject to APA VTS approval)
- A 2.5m shared path connection through the Crown Land Reserve that extends from the Hume Freeway, along the north side of Road No. 6 and connects to the shared path in the gas pipeline easement.
- A 2.5m shared path connection across the Crown Land Reserve at Road No. 6.
- New shared path connection from Main Street to the Hume Freeway shared path.
- Six road connections with footpaths across the gas pipeline reserve including a connection through to Cardiff Street.

Priority treatment should be provided across all the intersecting roads within the gas pipeline easement (i.e. Road No. 1, 3 5, 6, 7, 8 and 9)



5.5 Stormwater Management and Water Sensitive Urban Design

A Stormwater Management Plan has been included as an appendix to this report. The development area has two catchments which are highlighted on the Infrastructure Plan.

Catchment 1 is planned to include a stormwater sedimentation pond and wetland in the northeast open space area to incorporate water sensitive urban design. The wetland must be located outside the gas pipeline easement and not extend into the R.G.C Cook Reserve. Due to these constraints in this location, the wetland will be limited in size and offsets will be required in relation to stormwater treatment by Melbourne Water.

Catchment 2 to the south is highly constrained by its narrowing area, Crown Land Reserve, Gas Easement, Electricity Easement and Downs Road Reserve. Stormwater will need to discharge into Central Creek about 300m to the south. Consultation with City of Whittlesea engineers has highlighted three options for addressing stormwater. In order of preference, they are:

Option 1: WSUD sedimentation ponds and wetland in the Hume Freeway Reserve near Central Creek. This will require landholder consent and ensure that there is no impact on neighbouring dwellings.

Option 2: WSUD sedimentation ponds and wetland within Crown Land Reserve 2. This required area has been calculated and shown on the Infrastructure Plan. This option will result in removal of some native vegetation and offsets will be required. However, the extent of native vegetation removed should be limited. This option will require consent from both, the City of Whittlesea (Committee of Management) and DELWP (land owner).

Option 3: The Infrastructure Plan and Stormwater Management Plan have identified areas for underground water retention tanks in open space areas either side of the gas easement. These tanks will only be required if no form of wetland is provided for either catchment. This will limit stormwater runoff generated by the development to pre-development flow rates. This is the least preferred outcome and will be subject to Melbourne Water approval. Contribution payments to Melbourne Water will be required.



5.6 Subdivision Layout and Key Design Guidelines

This development plan has regard for City of Whittlesea's subdivision guidelines, "Guidelines for Urban Development" from December 2015. This development plan area is for residential uses only. Sensitive uses such as medical facility, place of worship, aged care facilities and child care centres are not permitted within the development plan area and have been restricted via Section 173 agreement which has been placed on the title of the property, and will transfer to individual allotments as part of the subdivision.

The subdivision plan demonstrates the following:

- Site conservation area greater than 1.83ha
- Range of lot sizes predominantly no smaller than 300square metres.
- An average lot size of 323m²
- A high pressure gas easement creates a reserve running north south through the site with rear-loaded dwellings fronting onto the reserve.

There are two main types of housing lots within the subdivision. There are standard lots west of the gas easement and rear-loaded lots east of the gas easement. Therefore, this development plan includes guidelines for the two types of lots. Individual lots with specific requirements have been identified in each set of guidelines.

Standard Lot Guidelines

- As part of the planning permit application or as a condition of permit, a Building Envelope Plan may requested by Council to be submitted for endorsement.
- Building heights are limited to 2 storeys.
- Dwellings should be set back 4m from the front boundary.
- Garages should be set back at least 0.5m from the front building line (excludes an articulation zone comprising features such as piers, porches, verandahs) of the dwelling and 5.5m from the front boundary.
- Garages for single storey dwellings should not exceed 50% of the dwelling width.
- Lot 34, 43, 60, 69, 90, 112, 120 and 134 which have side fences on the shared boundary with the gas pipeline reserve, must provide 2 storey dwellings with passive surveillance opportunities facing the open space.
- Lot 128-131 have back fence facing the gas pipeline reserve. They must provide 2 storey dwellings with balconies or second storey windows to provide passive open space opportunities facing east.
- Lot 34, 43, 60, 69, 90, 98, 112, 120 and 134 which have side fences on the shared boundary with the gas pipeline reserve:
 - o Must provide 2 storey dwellings with passive surveillance opportunities facing the open space.
 - o Should minimise the amount of side fence along the interface with the reserve



Rear Loaded lots

Town planning plans for each row of townhouses east of the gas easement must be provided Council for endorsement. The plans must have regard to the following guidelines:

- Building envelopes demonstrate the maximum building envelope and siting on each property.
- wellings are to be orientated onto the gas pipeline reserve with vehicle access from Downs Road.
- Dwellings must be set back a minimum of 1m from the gas pipeline reserve.
- Must provide variation in façade treatment for each row of townhouses between the east-west local roads such that each row of townhouses has it's own distinct character.
- Dwelling heights are limited to 2 storeys.
- There is no restriction on site coverage for these lots.
- Private open space may be provided via internal courtyards and/or balconies and must have a combined total of 20m².
- A shared path in the gas pipeline reserve provides pedestrian access to the front of the dwellings. A cross section for the gas pipeline reserve is provided in this development plan.
- Townhouses must provide second storey passive surveillance opportunities to the gas easement.
- Lots 35, 42, 61, 68, 91, 97, 113, 119, 135, 143 and 144 are on the ends of each row and must provide articulated built form and side windows for passive surveillance to the road network.
- Lot 144-152 may be detached dwellings rather than townhouses.
- Lot 35-37 must have an east facing balcony to provide attractive built form and passive open surveillance to R.G.C. Cook Reserve.
- Lot 152 should minimise fencing on the southern boundary by providing dwelling frontage to both the western and southern boundary.
- Lot 152 must provide passive surveillance opportunities to the south.

Notes:

- Building envelopes for both types of lots can be varied with the consent of Council.
- Final number of lots will be determined through the planning permit process.
- Detailed Building Design Guidelines will be prepared as part of the planning permit process. The detailed guidelines are to be consistent with Clause 54 of the Whittlesea Planning Scheme and generally in accordance with the BRDP. The guidelines may vary from the guidelines within the BRDP with the consent of Council.



5.7 Concept Landscape Plan

A Concept Landscape Plan has been prepared by John Patrick Landscape Architects and included as an appendix to this document. The Concept Landscape Plan responds to other portions of this development plan by providing details on:

- Landscaping through the street network
- Fencing and gate details for the Conservation Area and Crown Land Reserves in accordance with the Environmental Management Plan
- Planting within reserves.

The Concept Landscape Plan provides the general landscape concept for the development. A detailed Landscape Plan addressing the final outcomes will be submitted as part of the planning permit application and will:

- Account for the final WSUD option; and
- Require final planting associated with storm water treatment that is commensurate with the species list contained within *Constructed Wetland Systems Design Guidelines for Developers* (MW 2005)



5.8 Regional Infrastructure

The following items are illustrated on the Infrastructure Plan.

Gas Pipeline and Easement

The existing gas pipeline has a 35m easement across the site. For the purposes of facilitating this development, it has been agreed the 35m easement will be retained to the north of Road 3. To the south of Road 3, the easement will be reduced to 20m and shifted to the west. This will result in 13m of the easement being to the west of the existing gas pipe and 7m being to the east of the existing gas pipe.

The new easement will be created as part of the planning permit application and subdivision of the site. This has been agreed through consultation with APA Group.

A Construction Management Plan (CMP) will be required for any development within 50m of the gas pipeline. The CMP must be approved by APA VTS.

Overhead Power Lines

There is an existing 66kV overhead powerline along the eastern boundary of the site within the Downs Road Reserve. For the most part, these powerlines can be retained and have they have been incorporated into the road layout. However, at the northern portion of the development they currently change direction and are located in the middle of the proposed residential development. These lines will need to be relocated as per the alignment shown on the Infrastructure Plan. This indicative alignment has been discussed with SP Ausnet but will require formal approval at Planning Permit Stage.

5.9 Energy Efficiency and Water Conservation Statement

The Barry Road Development will implement Energy Efficiency and Water Conservation

Principles including:

- Where possible, use water sensitive urban design to treat and control storm water to improve the health of surrounding waterways
- Use environmentally sustainable design for passive heating and cooling of buildings such as, maximising sun access through appropriate building orientation.
- Encourage sustainable dwellings with renewable energy and energy saving features.

These principles will be implemented by complying with:

- Minimum requirement of 6-star energy rating for all new homes.
- Planning permit applications require a pass using the STORM or MUSIC rating tool.
- Whittlesea Council's Guidelines: Design, Construction & Maintenance of WSUD
- Energy Assessment using the BESS rating tool for all residential buildings.
- Sales office will offer solar photovoltaic systems and energy efficient appliances as a purchase option with all housing packages.
- Clause 55 and 56 of the Whittlesea Planning Scheme.



6 Appendices

6.1 Appendix A - Environmental Management Plan (E & H Partners)

6.2 Appendix B - Concept Landscape Plan (John Patrick Landscape Architects)

6.3 Appendix C – Storm Water Management Plan (TGM)

Final Report

Environmental Management Plan: Barry Road Development, Thomastown, Victoria

Prepared for

Urban Terrain Pty Ltd on behalf of Barry Road Project Pty Ltd

August 2016



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GLOSSARY

Acronym	Description
CaLP	<i>Catchment and Land Protection Act 1994</i>
CMA	Catchment Management Authority
CMP	Conservation Management Plan
DELWP	Victorian Department of Environment, Land, Water and Planning
DoE	Federal Department of Environment
EMP	Environmental Management Plan
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVC	Ecological Vegetation Class
FFG Act	<i>Flora and Fauna Guarantee Act 1988</i>
FIS	Flora Information System
MFL	Matted Flax-lily <i>Dianella amoena</i>
NES	National Environmental Significance
NTG	Natural Temperate Grassland
NTGVVP	Natural Temperate Grassland of the Victorian Volcanic Plain
PMST	Protected Matters Search Tool (DoE)
VBA	Victorian Biodiversity Atlas (DEPI)

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1 INTRODUCTION

1.1 Background

Ecology and Heritage Partners Pty Ltd was commissioned by Urban Terrain Pty Ltd on behalf of Barry Road Project Pty Ltd to develop an Environmental Management Plan (EMP) detailing the conservation and ongoing management objectives and actions for an *in-situ* conservation reserve located at 135-161 Barry Road, and the adjacent Crown land parcel located at 163-209 Barry Road, Thomastown, Victoria (the study area) (Figure 1).

This EMP addresses the 'Environmental Management Plan' requirement of Section 3.0 of Schedule 35 to the Development Plan Overlay (DPO35) in the City of Whittlesea planning scheme, and partially meets the 'Request for Additional Information' as requested by the Commonwealth Department of the Environment (DoE) as part of referral 2014/7364 under the *Environment Protection and Biodiversity Act 1999* (EPBC Act).

A series of ecological assessments and targeted surveys have been undertaken at the study area between 2010 and 2016 with the purpose of identifying ecological implications associated with the development of the study area. The following matters of ecological significance have been identified within the study area:

- One nationally significant flora species Matted Flax-lily *Dianella amoena*, listed as *Endangered* under the EPBC Act;
- One nationally listed ecological community, *Natural Temperate Grassland of the Victorian Volcanic Plain* (NTGVVP) listed as *Critically Endangered* under the EPBC Act; and,
- One State-listed ecological community *Western (Basalt) Plains Grassland*;
- Three state-significant flora species Slender Bindweed *Convolvulus angustissimus* subsp. *omnigracilis*, Arching Flax-lily *Dianella* sp. aff. *longifolia* (Benambra), and Fragrant Saltbush *Rhagodia parabolica*.

Areas to be impacted by the proposed development and areas proposed to be retained within the conservation reserve are presented in Figure 2 and summarised in Table 1. The conservation reserve has been specifically designed in accordance with the requirements of the DPO35, and to retain and protect habitat for Matted Flax-lily, and areas of Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) community. The conservation reserve provides strategic connectivity to the adjacent Crown Land to the west, and the Whittlesea Public Gardens to the north, and is in close proximity to the existing conservation reserve on the other side of the Hume Freeway to the west.

Table 1. Matters of ecological significance to be impacted and retained

Ecological Value	Impacted	Retained	Total
NTGVVP	5.009 hectares	3.691 hectares	8.700 hectares
Matted Flax-lily	36*	38*	74#
Plains Grassland	5.009 hectares	3.713 hectares	8.722 hectares
Plains Grassy Wetland	0.01 ha	0.00 ha	0.01 ha

Note: *These plants are proposed to be salvaged and translocated in to the conservation reserve as per the Translocation Plan detailed in Section 4; # A total of 74 Matted Flax-lily were recorded during the 2015/2016 targeted surveys conducted by Ecology and Heritage Partners Pty Ltd.

1.2 Study Area

The study area is located at 135-161 Barry Road (the private land) and the adjacent Crown land parcel located at 163-209 Barry Road, Thomastown, Victoria, approximately 20 kilometres north of Melbourne's CBD (Figure 1). The private land covers approximately 11.7 hectares and is triangular in shape, with the adjacent Crown Land being approximately 5.1 hectares in area. The study area is bordered by the Craigieburn Bypass (to the north and west) and existing residential development (to the east). The City of Whittlesea Public Gardens and Barry Road adjoins the northern boundary of the study area.

For the most part, the study area is relatively flat consisting of both indigenous and exotic grassland vegetation, with areas of intact remnant grassland containing embedded basalt rocks. Historically, the site was used for grazing stock. It was unused at the time of the ecological assessments and more recent surveys, with evidence suggesting the site is subject to dumping of rubbish and vehicle disturbance. As the site does not appear to have been subjected to any form of management aside from a firebreak slashed around the perimeter, it's condition appears to be degrading, and currently contains a significant infestation of the woody weed Sweet Briar *Rosa rubiginosa*.

The parcel at 135-161 Barry Road was subject to Amendment C179 of the Whittlesea planning scheme, and has been rezoned General Residential Zone – Schedule 1 (GRZ1), and is affected by a Design and Development Overlay – Schedule 2 (DDO2), a Development Plan Overlay – Schedule 35 (DPO35), and a Melbourne Airport Environs Overlay – Schedule 2 (MAEO2) in the northern half of the site. The adjacent Crown Land parcel is zone Public Use Zone – Transport (PUZ4), and is affected by the DDO2 and MAEO2 (DELWP 2016a).

According to the Department of Environment, Land, Water and Planning (DELWP) Biodiversity Interactive Map (DELWP 2016b), the study area occurs within the Victorian Volcanic Plain Bioregion. It is located within the jurisdiction of the Port Phillip and Westernport Catchment Management Authority (CMA) and the City of Whittlesea municipality.

1.3 Objectives

The objective of this EMP is to respond to the application requirements for development plan as required by Clause 3.0 of the DPO35 in the Whittlesea planning scheme. Specifically, the EMP includes the following components:

1. A Native Vegetation Management Plan for the on-site conservation reserve, as well as additional conservation areas in the adjacent Crown Land;
2. An Offset Management Plan for the native vegetation to be removed to facilitate the development of the remainder of the study area; and,
3. A Matted Flax-lily Translocation Plan.

For the purposes of this report, given the overlap of many requirements for both the Native Vegetation Management Plan and Offset Management Plan, these plans have been incorporated into Section 2 and Section 3 of this Environmental Management Plan (EMP). Section 2 details the vegetation impacts and associated offset obligations and offset strategy, while Section 3 (Conservation Management Plan) provides a framework for management of the proposed conservation areas in order to maintain and enhance the identified ecological values present in the form of remnant Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) community and the Matted Flax-lily population, and provide applicable, transparent governance arrangements that allow ongoing management objectives and performance targets to be readily measured, monitored, audited and enforced.

The Matted Flax-lily Translocation Plan is provided in Section 4 of this report, and solely relates to the activities required to translocate salvaged plants into the identified recipient site, and ongoing management actions to maintain the health of the salvaged individuals, and enhance the habitat within the recipient area.

2 EXISTING CONDITIONS

This section relates to the conditions, proposed impacts and offset obligations generated under State and local policy of the development site at 135-161 Barry Road, Thomastown (the private land).

2.1 Site of Proposed Vegetation Removal

The private land covers approximately 11.7 hectares and contains a total of 6.83 hectares of Plains Grassland (EVC 132_61) vegetation, and 0.01 hectares of Plains Sedgy Wetland (EVC 647). Of this, a total of 5.01 hectares of Plains Grassland and 0.01 hectares of Plains Sedgy Wetland is proposed to be removed to facilitate the development of the private land for residential use, and a total of 1.82 hectares of Plains Grassland will be retained within the proposed 1.83 hectare conservation reserve established in the north-west of the private land (Figure 2a).

All Plains Grassland recorded within the private land corresponds to the nationally significant ecological community *Natural Temperate Grassland of the Victorian Volcanic Plain* (NTGVVP). A total of 74 Matted Flax-lily were recorded during targeted surveys undertaken by Ecology and Heritage Partners in 2015/2016.

2.1.1 Connectivity to adjacent parks and reserves

The private land exists as an isolated grassland remnant, fragmented from nearby Merri Creek and Cooper Street Grasslands by the Craigieburn Bypass.

The study area is immediately adjacent (on the other side of the Hume Freeway) to the Galada Tamboore Conservation Area currently managed by Parks Victoria. The Cooper Street Grassland Nature Conservation Reserve is located approximately 1.5 kilometres to the north-west of the study area. The proposed conservation reserve to be established as part of the development is also immediately adjacent to the Whittlesea Public Gardens to the north.

2.1.2 Ecological Vegetation Classes

2.1.2.1 Plains Grassland

The field assessment identified large areas of Plains Grassland within the study area which were consistent with the condition thresholds for NTGVVP, providing a complex and inherently variable ecological community (Figure 2a). A total of seven Plains Grassland habitat zones of varying quality were recorded during the site assessment (Ecology and Heritage Partners 2014), with patches differing in quality predominantly due to native species diversity, weed cover, and extent of bare ground available for recruitment (Table 2).

Observed vegetation throughout the majority of the study area consisted of a dense cover of indigenous Kangaroo Grass *Themeda triandra*. A sparse yet diverse mixture of other indigenous grasses and forbs was interspersed amongst the dominant Kangaroo Grass matrix (Plates 1 and 2). The more dominant interspersed species were Wallaby grasses *Rytidosperma* spp, tussock grasses *Poa* spp, Yellow Rush-lily

Tricoryne elatior, Blue Devil *Eryngium ovinum*, Wattle Mat-rush *Lomandra filiformis* and Grassland Woodsorrel *Oxalis perennans*.

Scattered occurrences of Sheeps Burr *Acaena echinata*, Ruby Saltbush *Enchylaena tomentosa* var. *tomentosa*, Berry Saltbush *Atriplex semibaccata*, as well as the State-significant Slender Bindweed *Convolvulus angustissimus* subsp. *omnigracilis* (Plate 3), Arching Flax-lily *Dianella* sp. aff. *longifolia* (Benambra), and Fragrant Saltbush *Rhagodia parabolica* were also recorded (Figure 2a)

Introduced species varied in their dominance and diversity with the more notable introduced species including Sweet Briar *Rosa rubiginosa*, Large Quaking-grass *Briza major*, French Flax *Linum trigynum*, Ribwort *Plantago lanceolata*, Bearded Oat *Avena fatua*, and the Weed of National Significance Chilean Needle-grass *Nassella neesiana*.



Plate 1. Plains Grassland within the study area



Plate 2. Plains Grassland within the study area

2.1.2.2 Plains Sedgy Wetland

One small patch of Plains Sedgy Wetland was identified within the private land during the field assessment (Ecology and Heritage Partners 2014). This patch was dominated by Common Spike-sedge *Eleocharis acuta*, with no other wetland species recorded (Plate 4).

Introduced species present included Large Quaking-grass, Ribwort, Bearded Oat, and Chilean Needle-grass.



Plate 3. Slender Bindweed within the study area



Plate 4. Plains Sedgy Wetland within the study area

Table 2. Habitat hectare assessment within the private land

Vegetation Zone		A	B	C	D	E	F	G	H
Bioregion		VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC / Tree		PG(HS)	PG(HS)	PG(HS)	PG(HS)	PG(HS)	PG(HS)	PG(HS)	PSWe
EVC Number		132_61	132_61	132_61	132_61	132_61	132_61	132_61	647
Patch Condition	Large Old Trees /10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Canopy Cover /5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Under storey /25	20	15	5	15	15	15	5	5
	Lack of Weeds /15	4	0	4	4	0	0	0	7
	Recruitment /10	6	3	3	3	3	3	3	3
	Organic Matter /5	5	3	3	3	2	3	2	3
	Logs /5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Treeless EVC Multiplier	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Subtotal =	47.6	28.56	20.4	34	27.2	28.56	13.6	24.48
Landscape Value /25		10	10	10	10	10	10	10	10
Habitat Points /100		57.6	38.56	30.4	44	37.2	38.56	23.6	34.48
Habitat Score		0.58	0.39	0.3	0.44	0.37	0.39	0.24	0.34
Total Area (ha)		2.837	1.142	0.116	0.582	0.816	0.264	1.071	0.01
Area (ha) to be removed		1.034	1.142	0.116	0.582	0.816	0.264	1.071	0.01
Area (ha) to be retained		1.803	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2.1.3 Predominantly Introduced Vegetation (Grasslands)

2.1.3.1 Vegetation Condition

The remainder of the conservation area consists of predominantly exotic vegetation dispersed throughout existing EVC patches within the conservation reserve. These areas have little or no native vegetation present. These disturbed areas are dominated by exotic grasses, including, Chilean Needle-grass and Rye-grasses

Lolium spp. Exotic herbs such as Galenia, Ribwort and Artichoke Thistle are prevalent with scattered stands of the woody weed Sweet Briar. These areas are considered to be in poor condition as they support a large number of introduced grasses and weeds, many of which are highly invasive (Plate 5-6).



Plate 5. Sweet Briar within the study area



Plate 6. Sweet Briar within the study area.

2.1.4 Significant Communities

The critically endangered EPBC Act-listed NTGVVP ecological community is present in the study area (Figure 2). In accordance with relevant guidelines (DSEWPaC 2011), the habitat zone meets the following condition thresholds of the EPBC Act-listed NTGVVP:

- At least 50% of perennial native tussock cover consists of *Themeda*, *Austrostipa*, *Poa* and/or *Rytidosperma* (synonym *Austrodanthonia*) genera; and,
- For a native vegetation remnant greater than one (1) hectare in size, the contiguous grassland patch should be at least 0.5 hectares in size.

Plains Grassland is dominated by Kangaroo-grass and Wallaby-grass, which comprise approximately 60% of the total vegetation cover in the area. The area of NTGVVP is 6.83 hectares (Figure 2). Plains Grassland in the study area is also listed as the FFG Act Western (Basalt) Plains Grassland ecological community. The FFG Act community does not have cover and condition thresholds and all Plains Grassland is generally considered part of the ecological community.

2.2 Permitted Clearing Assessment (the Guidelines)

2.2.1 Vegetation proposed to be removed

The study area is within Location A, with 5.009 hectares of native vegetation proposed to be removed. As such, the permit application falls under the Moderate Risk-based pathway (Table 3). The condition scores for vegetation proposed to be removed are based the habitat hectare assessment undertaken by Ecology and Heritage Partners (2014) (Table 2).

Table 3. Permitted Clearing Assessment (the Guidelines)

Risk-based pathway	Moderate
Total Extent	5.009
Remnant Patch (ha)	5.009
Scattered Trees (no.)	0
Location Risk	A
Strategic Biodiversity Score (SBS)	0.242

2.2.2 Offset Targets

The offset requirement for native vegetation removal is 0.731 General Biodiversity Equivalence Units (BEU). No Specific offset obligations are generated by the proposal.

A summary of proposed vegetation losses and associated offset requirements is presented in Table 4 and the Biodiversity Impact and Offset Requirements (BIOR) Report is presented in Attachment 1.

Table 4. Offset targets

General Offsets Required	0.731 General BEUs
Specific Offsets Required	N/A
Vicinity (catchment / LGA)	Port Phillip and Westernport CMA / City of Whittlesea
Minimum Strategic Biodiversity Score*	0.194

Note: BEU = Biodiversity Equivalence Units

2.3 Offset Strategy

2.3.1 Commonwealth (EPBC Act)

The Australian Government's EPBC Act Environmental Offsets Policy (DSEWPac 2012) outlines a framework for the use of environmental offsets under the EPBC Act including when they can be required, how they are determined and the framework under which they operate. Clear guidelines on what constitutes a suitable offset are provided and should be considered as part of any proposed offset strategy.

A detailed offset strategy pertaining to obligations under the EPBC Act in accordance with the preliminary document request for EPBC referral 2014/7364 will be provided to the Department of the Environment (DoE) separately to this document.

2.3.2 State (The Guidelines)

2.3.2.1 Offset Strategy

Ecology and Heritage Partners are a DELWP accredited OTC offset broker. We have been assisting permit holders meet their native vegetation offset obligations since 2006. Ecology and Heritage Partners broker native vegetation credits between permit holders and credit holders across all CMAs, and have an excellent knowledge of the type and extent of available credits in the marketplace.

The offset obligation of 0.731 General BEUs generated by native vegetation removal associated with the development is proposed to be secured via two methods as described below.

Enhanced management of existing vegetation

This offset is available on the basis that the conservation reserve will be secured with an on-title agreement (Section 173 agreement) and contains an approved 10-year Management Plan outlining the management actions required to protect and improve the current condition, and achieves the gain targets outlined in this report.

Security gain

Currently no prior vegetation security agreements cover the proposed offset site. To achieve the relevant security requirement for the offset site, it is proposed to place a Section 173 agreement under the *Planning and Environment Act 1987* over the offset area.

Maintenance gain

A maintenance gain will be achieved through the management of the offset site with a focus on:

- Preventing removal of existing vegetation and excluding grazing;
- Installation of fencing and signage to minimise future disturbance; and,
- Monitoring for, and eradicating any new weed species.

Improvement gain

An improvement gain will be achieved through the management of the offset site with a focus on:

- Eliminating high threat woody weeds;
- Biomass control of herbaceous and grassy weeds, thus facilitating the natural regeneration of native species through soil stored seed and recruitment from existing plants; and,
- Pest animal control

Through the enhanced management of 1.821 hectares of existing native vegetation within the private land, and 1.241 hectares within the Crown Land, a total of **0.248 General BEUs** with an SBS of 0.268 will be generated (Attachment 2). These credits meet both the minimum SBS, and the 'Vicinity' attributes as required by DELWP, and as requested by Council, can be used towards meeting the overall offset target. This would leave an outstanding obligation of **0.377 General BEUs** to be sourced outside of the City of Whittlesea (Table 5).

Section 3 of this report details how the 3.062 hectares of Plains Grassland vegetation within the conservation reserve will be managed and protected in order to generate the required gain.

Third party offsets

City of Whittlesea

Council has indicated a preference that all offsets be achieved within the City of Whittlesea. Ecology and Heritage Partners have an agreement with a credit owner who have native vegetation credits situated within the City of Whittlesea to broker their credits for offset purposes. The credit owner (Melbourne Water

Corporation) has generated these credits from a site adjacent to Toorourrong Reservoir, approximately five kilometres north-east of the Whittlesea township. This site is registered with Bushbroker, and is identified as Site BBA-677.

However, of the credits available at this site, only a total of 0.106 General BEUs (at the time of writing) meet the minimum SBS requirement. Based on our current knowledge and liaison with DELWPs Native Vegetation Credit Register (*pers. comm* Native Vegetation Credit Register (NVCR) Team, DELWP; 16 March 2016, 23 May 2016 and 26 August 2016), there are no other offset sites currently listed within the City of Whittlesea municipality. As such, the remaining offset obligation will be sourced elsewhere within the Port Phillip and Westernport CMA as permitted by DELWP (Table 5).

Port Phillip and Westernport CMA

Ecology and Heritage Partners can confirm that the remaining offset obligations generated by this proposal can be satisfied through existing credits registered in our OTC database. Several landowners registered in our offset database have suitable General Biodiversity Equivalence Unit (BEUs) native vegetation credits available within the Port Phillip and Westernport CMA (Macedon Ranges Shire, Mornington Peninsula Shire, and the City of Greater Geelong), and it is anticipated that the remaining offset obligation of 0.377 General BEUs can be secured through an OTC scheme without any difficulty should a permit be issued for the development.

We will provide a formal quote to the proponent once this offset strategy has been approved by the City of Whittlesea.

Table 5. Breakdown of Offset Strategy mechanism

Offsets Required	General Offsets Required (BEU)	0.731	
	Enhanced management of existing vegetation within the Conservation Reserve	0.248 (Conservation Reserve)	0.248
Offsets Generated	3 rd Party Offsets	0.106 General BEUs (City of Whittlesea)	0.354
	3 rd Party Offsets	0.377 General BEUs (Port Phillip CMA)	0.377
Target			0.731

3 CONSERVATION MANAGEMENT PLAN

The following section of the report presents the actions required to implement the management strategy for conservation reserve, and generate the estimated gain described in Attachment 2. It is essential to control the spread of weeds and introduced species within this community and bring the ecosystem back to its most natural state to enhance the habitat for the persistence of Matted Flax-lily, and the suite of other native species associated with the broader community.

By maintaining a high value habitat for the species present within the conservation reserve, it can act not only as habitat for the extant population but also as a connecting site between the adjacent conservation areas, as well as a refuge area for neighbouring populations in the case of habitat destruction and degradation.

In combatting introduced grasses and weeds, particularly Chilean Needle-grass and Sweet Briar which are highly invasive, it should be recognised that there may be some impact to the NTGVVP community and habitat for Matted Flax-lily, and that management actions must be conducted in a phased approach, whereby only small sections of the conservation reserve are treated at any one time. Adaptive, flexible and to some degree experimental management will therefore play a critical role in the ongoing success of the reserve.

3.1 Conservation Reserve

The conservation reserve is proposed to comprise a single area of 4.151 hectares, comprising 1.833 hectares within the private land (Shown as Reserve No. 2 TGM [2016]) and 2.318 hectares within the Crown Land (Figure 2b). The conservation reserve is to be managed solely for the purposes of conservation. In addition, the conservation reserve will be managed in order to achieve a gain of approximately 0.248 General BEUs to partially offset the loss of native vegetation associated with the proposed development of the private land. This management will involve the control of environmental weeds and pest animals, and biomass reduction within the offset site.

Specifically, this management plan has the following objectives:

- The land is managed for conservation purposes;
- Rehabilitate the site and maintain habitat important for Matted Flax-lily;
- Weed control works should be undertaken by a suitably experienced and qualified contractor to eliminate all high threat woody weeds within the offset site;
- Ensure weed cover does not increase above current levels;
- Install and maintain fencing and signage;
- Undertake supplementary planting/direct seeding of native grasses where necessary;
- Monitor threatened flora and fauna;
- Control pest animal populations (i.e. rabbits and foxes) beyond the legal duty of care; and,

- Implement this plan over the prescribed 10 year offset period to achieve the potential habitat gains.

The offsets are proposed to be located within native vegetation of Habitat Zone A of the offset site, which involves the management of 3.048 hectares of *Heavier Soils* Plains Grassland (Figure 2),

In addition, the conservation reserve will comprise an area of approximately 0.777 hectares of predominantly non-native vegetation for use as a recipient site for 36 translocated Matted Flax-lily individuals (Figure 2b). Management actions specific to the recipient site are further detailed in Section 4 of this report.

3.1.1 Matted Flax-lily

3.1.1.1 Conservation Status

Matted Flax-lily was described by Carr and Horsfall (1995). It is listed as endangered under the Commonwealth EPBC Act, endangered under the Victorian Advisory List of Rare or Threatened Plants in Victoria (DSE 2013) and listed as Threatened under FFG Act.

3.1.1.2 Species Description

Matted Flax-lily is a perennial, tufted, mat-forming lily which can form patches of up to five metres wide. The plant can grow vegetatively, through sending underground rhizomatous roots, which rise above the ground with a tiller of several leaves, spread over a distance from the parent plant. This in turn can prove problematic in determining the number individual plants within a close proximity (< one metre). Therefore any tillers not separated by at least one metre are in most circumstances considered to be a single individual plant.

The leaves of the Matted Flax-lily are generally glaucous, blue in colour and usually but not always having small hooks (teeth) along the margins and midrib. The leaves taper to approximately 45 centimetres long depending on site and climatic conditions, and are born on tillers with the leaves arranged alternatively, with several leaves per tiller (DSE 2006). Matted Flax-lily generally flowers between November and January but may continue flowering with summer and autumn rains. It has pale blue to violet flowers with bright yellow stamens and berries, which are generally purple in colour (Plates 7-8). The flowers and berries are born on culms extending to typically 30 centimetres in height but this may alter depending on plant location and season (Carter 2010).



Plate 7. Matted Flax-lily within the study area (Ecology and Heritage Partners 2016)



Plate 8. Matted Flax-lily within the study area (Ecology and Heritage Partners 2016)

3.1.1.3 Ecology

Plants typically occur in grasslands, grassy woodlands and grassy wetlands in Victoria (Carter 2010). Grasses typically dominate the understorey layer (Carr and Horsfall 1995), including native species such as Kangaroo Grass *Themeda triandra*, Weeping Grass *Microlaena stipoides* var. *stipoides*, Common Tussock-Grass *Poa labillardierei*, and Clustered Wallaby-grass *Austrodanthonia racemosa* var. *racemosa*. In grassy woodlands, a variety of eucalypt species dominate, with Blackwood a common understorey component at many sites (Carter 2010). Rocks are often present on sites in the Victorian Volcanic Plain bioregion, and usually offer protection from grazing by stock, pest animals and native fauna.

3.2 Security Arrangements

Please note: The below security arrangements are still in Draft form, and are yet to be finalised. Following further discussions to be held with the relevant parties, the security arrangement proposed for the Conservation Reserve (both public and private land) and will be updated and submitted for approval.

In accordance with the requirements of the DPO35, the proposed conservation reserve will have an on-title legal agreement in the form of a Section 173 agreement under the *Planning and Environment Act 1987* put in place to ensure it is secured and managed appropriately in perpetuity (Table 6). The agreement will be implemented and the conservation reserve secured prior to commencement of construction activities associated with the proposed development.

Barry Road Project Pty Ltd or their nominated Development Manager is responsible for ensuring all actions detailed in this CMP are undertaken to ensure the objectives and performance targets are met.

It is understood that the management of the Conservation Reserve and other public reserves are proposed to be transferred to the City of Whittlesea and a Committee of Management established to ensure the management objectives are met in perpetuity. Discussions relating to the proposed timing and transfer of management and responsibility are currently ongoing.

Should the Conservation Reserve and/or the recipient site be transferred to the City of Whittlesea, or any other party, the responsibility for ongoing managing, monitoring and reporting will also be transferred to the new entity.

Table 6. Security and Management Responsibility

Offset Security and Management Responsibility	
Who is responsible for meeting offset requirements?	Barry Road Project Pty Ltd
Type of security agreement	Section 173 of the <i>Planning and Environment Act 1987</i>
Agreement or Planning Permit Number (ID) *	TBC
Date 10-year offset management to commence	TBC
Date 10-year offset management expires	TBC
Registered on title?	Yes
Offset site management responsibility Name	Barry Road Project Pty Ltd
Responsible Authority	City of Whittlesea

Note. The need for formal endorsement of this EMP and security agreement shall be a condition of the subdivision planning permit.

3.3 Management Actions

Management actions described below are to be implemented for a mandatory period of 10 years. Following this period, the responsible authority (or landowner) will continue to manage the conservation reserve after the completion of year 10 as specified in this plan, such that:

- Weed cover is managed in perpetuity to ensure it does not increase beyond the level attained at year 10 of management;
- NTGVVP ecological community is maintained or improved; and,
- Matted Flax-lily habitat and population is maintained or improved.

Any proposed uses or development of the site which conflict with the landowners commitments are not permitted under this plan. The sensitivities of the site should be considered with all management actions and all contractors entering the site need to be made aware of the values.

3.3.1 Mitigation Measures during Construction

A series of mitigation measures will be implemented during the construction phase of the proposed development to ensure that construction activities do not impact on environmental values present within the reserve or in surrounding areas, and that appropriate environmental protection measures are implemented during construction works. At a minimum, the following measures will be implemented prior to commencement of construction:

- Erect temporary fencing on the title boundary of the conservation reserve and along the eastern interface of the Crown Land. The fence will be constructed with minimal impact to the conservation reserve and Crown Land (i.e. no materials or soil stock piling). Particular care must be taken in areas where significant ecological values are present.

- The temporary fence around the Conservation Reserve must be replaced by a permanent fence at the time when the Section 173 agreement (or other security mechanism) is placed on-title;
- Fencing of the conservation area and Crown Land must be completed and clearly designated as a “No Go Zone”, prior to any construction or development activities reaching within 50 metres of any part of the conservation reserve or Crown Land; and,
- Interpretive and educational signs will be placed around the reserve to highlight the importance of the conservation reserve. Fence and signage condition will be monitored on a weekly basis with any gaps or holes repaired immediately.

In addition to the above, a Construction Environment Management Plan must be prepared to ensure impacts to the conservation reserve during the construction phase are avoided. The plan should include:

- Environmental site induction to inform contractors of the environmental values present on site and the importance of protecting these areas;
- Fencing and No-Go Zones;
- Dust management;
- Erosion and sedimentation control;
- Pest plant control;
- Waste management;
- Fire management; and,
- Noise management.

As a condition of the future subdivision permit and Section 173 Agreement a bond or bank guarantee to the value of \$100,000.00 (incl. GST) shall be lodged for the duration of the conservation reserve to ensure adequate rectification or reinstatement works are completed which may result from damage by the owner or its agents through construction works and/or maintenance period prior to transfer of land ownership and management responsibilities to Council.

3.3.2 Access Control and Fencing (Conservation Reserve)

Without active management and appropriate fencing, unrestricted access into the conservation reserve by vehicles and machinery may result in loss of native vegetation cover, soil disturbance and compaction, and weed facilitation. As such, permanent fencing will be required to protect the conservation reserve. In order to ensure a more pleasing visual amenity, the fencing treatment around the Conservation Reserve will be as follows:

- Erect a permanent rabbit-proof fence surrounding the conservation reserve with at least one access gate for maintenance works and emergency access.
- The fence must be located one (1) metre back of kerb, be constructed with minimal impact to the conservation reserve (i.e. no materials or soil stock piling), and be in accordance with Standard Detail SR.2.07 of the City of Whittlesea Parks and Open Space landscape construction detail;

- Append rabbit-proof fencing to the existing fence along the Western boundary of the Conservation Reserve;
 - This style of fence must be erected along the northern boundary of the Conservation Reserve abutting the VicRoads land (see Landscape Plan for further detail);
- Interpretive and educational signs will be placed around the reserve to highlight the importance of the conservation reserve and the significance of NTGVVP and Matted Flax-lily; and,
- Fence and signage condition will be monitored on an annual basis with any gaps or holes repaired immediately.
- 3.6 metre width Rabbit-proof retrofitted access gate (see Figure 2 for gate location and access point).

Additional detail regarding fencing and gate specification, and relevant location is provided in the Landscape Management Plan (John Patrick Pty Ltd 2016) submitted as part of the Development Plan.

3.3.3 Biomass Control

Biomass control or reduction is essential for protection against grass fires, and for the maintenance of flora and fauna values. In particular, although Matted Flax-lily is naturally found in grassy habitats, the species requires relatively open structured grassland with inter-tussock spaces and the closure of inter tussock space from a lack of fire or grazing may reduce the areas available for occupancy within the site.

In order to avoid adversely impacting Matted Flax-lily, it is crucial that any prescribed burns are low-intensity and patchy. Furthermore, prescribed burns should be conducted in early spring (September/October) to avoid summer breeding season, or early autumn (March/April) to avoid removing large areas of vegetation during winter.

With regard to weed control, it is recommended to conduct burning before plants set seed in early spring. In theory, the use of fire also offers greater opportunity for the germination of native grasses and herbs, although it will inevitably also promote germination of weed species. While the promotion of weed seed germination is far from ideal, the process also aids in the exhaustion of the soil seed bank over time.

The following principles should be considered with regard to biomass control:

- Develop a burn plan that includes consideration of nearby properties and landholders and submit for approval by Municipal Fire Prevention Officer in consultation with the District 14 CFA, MFB and DELWP;
- Evaluate the need for biomass control on an annual basis;
- For safety reasons any prescribed burns must be conducted in calm weather conditions only, especially as the subject conservation reserve is directly adjacent to residential dwellings; and,
- Establish management zones and conduct burns in a patchy or mosaic fashion over no more than one third to half the site on any occasion.

3.3.4 Weed Control

Weed control activities will be strategically employed in a mosaic fashion to ensure that habitat remains suitable for Matted Flax-lily.

The conservation reserve contains weeds that are considered to be a high threat to grassland communities, with Sweet Briar and Chilean Needle Grass considered a particular threat to the biodiversity values of the site. These species can rapidly colonise areas where appropriate management regimes are not implemented (i.e. regular burnings and weed control), and 'crowd-out' species, such as Matted Flax-lily, which persist in the inter-tussock space. Appropriate management measures must be implemented to: a) reduce the prevalence of these species; and, b) ensure they are appropriately controlled over the medium to long term.

The following general guidelines should be taken as basic management principles in regards to weed control:

- Weed control methodology for eradicating graminoid and herbaceous weeds will consist of manual removal and/or spot spraying weeds with an appropriate herbicide. Care should be taken when spraying herbicide to ensure that the poison does not affect native vegetation in the local application area. Weed species should be treated before seed is set, which may involve localised slashing if spot-spraying proves ineffective. A dye should be used in the spray to mark where the spraying has occurred;
- Selective herbicide application is preferable to broad area application but clearly the loss of non-target species needs to be balanced with the threat of incomplete control of the existing weed population;
- Eliminate high threat environmental weeds (cover reduced to <1%) within higher quality vegetation with low weed cover and controlling high threat environmental weeds within vegetation with medium cover of weeds (cover reduced to <5%);
- Control all other weeds within the conservation reserve (cover reduced to <5%);
- Any weed control should be done in a manner that minimises soil disturbance;
- Where herbicide application is employed, waterway sensitive products and non-residual herbicides are to be employed;
- Pest plants that reproduce sexually (by seed) are best controlled before seed set. A summary of weed control protocols is provided in Table 7;
- To reduce the amounts of herbicide used, the target biomass should be reduced (e.g. slashed) before application so the herbicide can also be absorbed by the actively regrowing plants. Herbicides are only effective when plants are actively growing; and,
- Weed control works should be monitored regularly to assess their effectiveness, perform follow up works and evaluate the feasibility of management objectives.

Table 7. Control protocols for key weed species recorded within, or have the potential to occur in the study area.

Species	Weed Type	Treatment Methods	Timing of Treatment	Desired Outcome
<i>Avena fatua</i> Bearded Oat	Graminoid	Annual Spraying (before seeding)	Mid-Winter – Late Spring	C

Species	Weed Type	Treatment Methods	Timing of Treatment	Desired Outcome
<i>Anthoxanthum odoratum</i> Sweet Vernal-grass	Graminoid	Annual Spraying (before seeding)	Mid-Winter – Late Spring	C
<i>Briza major</i> Large Quaking-grass	Graminoid	Annual Spraying (before seeding)	Mid-Winter – Late Spring	C
<i>Cirsium vulgare</i> Spear Thistle	Herbaceous	Manual Removal, Annual Spraying (before seeding)	All Year	E
<i>Cynara cardunculus</i> Artichoke Thistle	Herbaceous	Manual Removal, Annual Spraying (before seeding)	All Year	E
<i>Echium plantagineum</i> Paterson's Curse	Herbaceous	Manual Removal, Annual Spraying (before seeding)	Late winter - mid Spring	C
<i>Foeniculum vulgare</i> Fennel	Herbaceous	Manual Removal, Annual Spraying (before seeding)	All Year	C
<i>Hypochoeris radicata</i> Flatweed	Herbaceous	Annual Spraying (before seeding)	Early-mid Spring	C
<i>Lolium perenne</i> Perennial Rye-grass	Graminoid	Annual Spraying (before seeding)	Early-mid Spring	C
<i>Lycium ferocissimum</i> African Boxthorn	Woody	Manual Removal, Spot Spraying, Cut and Paint	All Year	E
<i>Nassella hyalina</i> Cane Needle-grass	Graminoid	Annual Spraying (before seeding)	Early-mid Spring	E
<i>Nassella neesiana</i> Chilean Needle-grass	Graminoid	Annual Spraying (before seeding)	Early-mid Spring	E
<i>Nassella trichotoma</i> Serrated Tussock	Graminoid	Annual Spraying (before seeding)	Early-mid Spring	E
<i>Phalaris aquatica</i> Toowoomba Canary-grass	Graminoid	Annual Spraying (before seeding)	Early-mid Spring	C
<i>Plantago lanceolata</i> Ribwort	Herbaceous	Annual Spraying (before seeding)	Early-mid Spring	C
<i>Romulea rosea</i> Onion Grass	Herbaceous	Annual Spraying (before seeding)	Early-mid Spring	C
<i>Rosa rubiginosa</i> Sweet Briar	Woody	Cut and Paint, Spot Spraying	All Year	E
<i>Brassica</i> spp. Turnip	Herbaceous	Manual Removal, Annual Spraying (before seeding)	Early-mid Spring	C
<i>Trifolium</i> spp. Clover	Herbaceous	Annual Spraying (before seeding)	Early-mid Spring	C
<i>Xanthium spinosum</i> Bathurst Burr	Herbaceous	Annual Spraying (before seeding)	Early-mid Spring	C

Notes: C = Control (<5% cover), E = Eliminate (<1% cover)

3.3.4.1 Spot Spraying

The application of herbicides is an effective and efficient control technique for a range of woody, herbaceous and grass weeds. The correct use and application of herbicides can provide targeted control of a range of species. However, all herbicides must be used in accordance with the manufacturer's specifications and occupational health and safety policies.

Application methods for herbicides include: spot spraying with a knapsack, dabbing of weeds in sensitive areas with a foam-tipped application device, rig spraying with a pump for larger areas, dabbing of cut stumps and injection of woody weeds.

Timing of the interval of spot spraying is dependent upon many factors such as plant age and growth seasons, plant stress levels and climatic factors. All these factors need to be considered when developing methodologies for the application of herbicides to ensure successful outcomes. Surrounding native plants' susceptibility to herbicides and ongoing uses of the treated areas should also be considered when choosing the right herbicide to be used in a weed control program, as some herbicides are residual and may persist within the soil for varying durations.

3.3.4.2 Cut and Paint

The cut and paint method requires the cutting of the generally woody species at the very base, below any foliage, and the immediate application of herbicide (usually Glyphosate within 30 seconds of cutting the stump). The application can be done through a 'dabber' bottle or paint brush. Care should be undertaken during application to avoid splash of herbicide causing non-target damage.

Once cut down, the biomass of the target species requires removal. This is particularly necessary if it bears fertile seeds or has the potential to reshoot from contact with ground (i.e. African Boxthorn) or covers native vegetation. As Sweet Briar is the main woody weed species, biomass should be removed from the site and disposed of in a waste disposal site as the woody debris will provide harbour to pest animals.

3.3.5 Pest Animal Control

Cats and foxes may predate locally common fauna, and these two species should be the target of a pest animal control program within the conservation area. European Rabbits remain a threat for the regeneration/recruitment of native species throughout western Victoria. The land owner/contractor is to monitor pest animal use of the offset site whilst undertaking vegetation management works. Any changes in the influences of pest animals may require a change in the management actions.

The following key management actions will be undertaken to ensure success of the pest animal program:

- Identify potential harbour and burrows, and destroy if soil disturbance can be minimised and all native vegetation retained;
- Undertake a pest animal control program (e.g., trapping of foxes, hares, rabbits or feral cats); and,
- Monitor the population of pest animals during weed control works and adapt management as considered appropriate.

All pest animal control needs to be undertaken by suitably qualified contractors familiar with the ecology of Plains Grassland of the Victorian Volcanic Plain. Inappropriate pest animal control techniques may lead to off target damage or the wrong species being targeted. The sensitivities of the site should be considered with all management actions and all contractors entering the site need to be made aware of the values. The pest animal contractor will be responsible preparing and undertaking an adaptive management plan for the monitoring and eradication of pest animals from the offset site.

3.3.5.1 Rabbits and Hares

Given the conservation will be located immediately adjacent to residential development, options for control are limited. Rabbit proof fences in the first instance should be installed and maintained to limit rabbit movements throughout the conservation reserve. The removal of rabbit harbour (e.g. stockpiled rocks and

dense woody weed infestations) should then be undertaken, while warrens if present should be fumigated and closed.

3.3.5.2 Foxes

It is likely that foxes will utilise the site and may be also residents. The removal of fox harbour such as rock piles, rubbish and woody weeds will eliminate hiding spots. Further control techniques such as shooting or baiting should not be undertaken in the urban area around the development.

3.3.6 Direct Seeding or Supplementary Planting

To encourage rapid colonisation with native grasses of areas devoid of native vegetation direct seeding with native grasses should be undertaken. Areas with a moderate to high cover of introduced flora or areas which are unnaturally bare (areas subject to previous disturbance or weed cover) should be targeted for direct seeding. Grasses which could be used in direct seeding can include Kangaroo Grass, Wallaby-grass species, Spear-grass species and other grassland graminoids which are indigenous to the local areas. Grass seed should be locally sourced and collected in summer as seed matures. Seed is best collected by brushcutting grass including foliage and culms (thatch), collected in large bags, stored in cool dry places and baited for insects.

Prior to direct seeding commencing, intensive weed control should be undertaken to clear high threat weeds, especially grasses. The weed control should be undertaken over two visits in late spring and summer to control grasses. Prior to distribution of grass seed, a follow up weed control event should be conducted to target germinating weeds. After sufficient autumn rains and moisture content has built up in the soil, seed collected during the previous summer should be evenly distributed over the bare areas. After winter, seed should have dropped into the soil. Follow up sensitive weed control must be undertaken.

As such, the overarching management strategy for these areas is to progressively replace the Chilean Needle-grass Sweet Briar with native vegetation consistent with the Plains Grassland EVC. Management activities will be conducted in a mosaic fashion, aiming to introduce connectivity to areas of high quality vegetation through revegetation and supplementary planting. Site preparation and revegetation efforts will radiate outwards from each patch with the ultimate aim of uniting all patches throughout the site.

Revegetation and supplementary planting will proceed in accordance with the following aims:

- Areas to be direct seeded require at least one year of site preparation before supplementary planting or seeding can commence. Site preparation will include herbicide application on at least two occasions, with the final application in mid-spring prior to the plants setting seed;
- Direct seeding efforts will focus on establishing native grasses to competitively replace pasture grasses and high threat weeds. Other grasses may include Red-legged Grass, wallaby grasses. Once a sward of native grasses has been established, revegetation efforts can start to introduce other herbaceous species that contribute to grassland diversity appropriate to the local EVC;

3.4 Other areas of retained native vegetation

3.4.1 Public Reserve

Areas to the south of the conservation reserve located within the Crown Land contain Plains Grassland vegetation and Matted Flax-lily (Figure 2b). These areas will not be impacted by the proposed development and are proposed to be retained and incorporated into a public reserve. The Development Plan requires the construction of two shared paths through the Crown Land Reserve. The path locations have been guided by a suitably qualified ecologist and will be constructed through the public reserve in such a way as to minimise impacts on any retained natural values.

Management actions within the Public Reserve should focus on the prevention of weeds spreading into these areas and discouraging access to these areas. Actions which need to be undertaken in these areas include:

- Weed control for species listed under the *Catchment and Land Protection Act* including Chilean Needle Grass, Sweet Briar and Boxthorn, with weed control following the prescriptions detailed in Section 3.4.4;
- Biomass control as per Section 3.3.3;
- Installation of a timber post and cable fence around the perimeter of the public reserve at one (1) metre back of kerb. This fence will be constructed in accordance with Standard Detail SDL.3.05 of the City of Whittlesea Parks and Open Space landscape construction detail;
 - Rabbit proofing of fences is not a requirement of the fencing standards of the Public Reserve.
- The post and cable fencing (SDL.3.05) will extend either side of the shared path connections to the Hume Freeway shared path;
- Installation of a heavy duty maintenance access gate to allow emergency and maintenance access into the public reserve. The specifications of this gate will be in accordance with Standard Detail SR.1.19 of the City of Whittlesea Parks and Open Space landscape construction detail;
- Any areas disturbed on the edges of the construction footprint should be revegetated/direct seeded with local provenance species from the Plains Grassland EVC;
- Retained Matted Flax-lily marked and labelled with individual tags made from galvanised steel, and anchored by stainless steel orchid pins for monitoring purposes. Further, the retained plants should be marked with GPS points and detailed on a map for reference; and,
- Report to the City of Whittlesea as per the reporting regime detailed in Section 3.5 on outcomes of the management of the public reserve.

Additional detail regarding fencing and gate specification, and relevant location is provided in the Landscape Management Plan (John Patrick Pty Ltd 2016) submitted as part of the Development Plan.

3.4.1.1 Potential Wetland

As part of the Water Sensitive Urban Design (WSUD) strategy required by the Development Plan, a potential wetland may be created within the Public Reserve in the southern portion of the Crown Land (Figure 2a;

Figure 2c). This wetland is one of three (3) potential options being investigated, with ongoing discussions taking place between the City of Whittlesea and Barry Road Projects Pty Ltd. to resolve the strategy. Should this option be chosen, an amendment to Section 2.3.2 of this Plan will be required to address the biodiversity implications, and associated offset obligations generated by native vegetation removal.

3.4.2 Fire protection and biomass reduction

Given the highly modified nature of the surrounding landscape, the fire risk is considered to be low. However, to minimise the fire hazard posed to the surrounding properties, particularly to the east and south, a two (2) metre firebreak will be installed and maintained along the eastern and southern boundary of the public reserve. This firebreak will be regularly (at least three times per year) maintained, with the grass slashed to a height of 75 millimetres.

Throughout the remainder of the conservation and public reserves site, biomass should be controlled, through slashing of the grass at least twice a year (early Spring & mid-Summer) to a height of 100 millimetres, or mosaic burning. Along with biomass control, fire risk will be reduced through the control of woody and herbaceous weeds. When slashing, care should be taken not to destroy existing seedlings/recruits present in the offset site, or Matted Flax-lily plants.

3.5 Monitoring and Reporting

Monitoring of native vegetation (NTGVVP) and Matted Flax-lily habitat by a suitably qualified ecologist should be undertaken to ensure key performance targets are met and the responsible authorities notified of the successes and failures of works through regular progress reports. Progress reports will be provided to the responsible authority at the end of year 1, 2, 5 and 10 of the program (Table 8). Ongoing monitoring will also provide feedback to inform an adaptive management approach, which is critical to tailor management actions to prevailing environmental conditions and also for the provision of contingency plans. For example, if monitoring data suggests that one form of management, such as burning compared to slashing or scraping for direct seeding, appears to be having a detrimental effect, or alternatively a positive effect on localised ecological values, then management will be adapted accordingly.

3.5.1 Monitoring

3.5.1.1 Native vegetation

Monitoring is required to assess the positive and negative impacts of management actions on the integrity of the study area, and to implement change if required. Vegetation monitoring will be conducted annually, with progress reports provided to the responsible authority at the end of year 1, 2, 5 and 10 of the program.

This monitoring will be undertaken by a suitably qualified ecologist, with some input from the landowners. However, the frequency of monitoring may need to vary to allow for seasonal variations and to target periods of active weed growth. Similarly, pest animal monitoring should be undertaken at a time of year when these animals are most active so that an accurate assessment of population sizes can be made.

It is recommended that monitoring be undertaken by qualified ecological consultants familiar with the methodology as well as any offset and EPBC Act referral requirements. Monitoring and progress reports should include the following:

- Collection of baseline data to be used as a reference point to assess the impacts of management actions;
- Overall condition and composition of vegetation as well as consideration of Gain outcomes;
- Biomass levels;
- Distribution and abundance of significant flora species;
- The extent, severity, trend and presence of current weed species and any new and emerging weed species; and,
- Implementation of permanent photo points. Photographs must be taken at the same location and during the same time of each year. Photo points will allow monitoring of weed populations and maintenance of the current condition of native vegetation within the offset site. Details of photo points and photographs will be provided to DELWP where required as evidence of progress.

3.5.1.2 Matted Flax-lily

Long-term independent monitoring of the plants within the conservation area is crucial to ensuring ongoing survival of Matted Flax-lily (Vallee *et al.* 2004). All existing plants in the conservation area must be monitored to compare growth, survival and recruitment. These will be tagged and monitored.

Monitoring at the conservation area will involve the documentation of key threatening processes such as drought stress, the presence of pest plants and animals, biomass and other site disturbances, together with the growth and survival rates of the existing population and new recruits.

If plants perish, the immediate area should be assessed for seed recruitment. All recruits will be tagged and monitored in accordance with the existing population.

Translocated Matted Flax-lily

A total of 36 Matted Flax-lily plants are estimated to be impacted as part of the proposed development. These plants are proposed to be translocated in to the conservation reserve, pending further discussion with the City of Whittlesea, DELWP and DoE. Should this course of action be approved, the monitoring and reporting of translocated Mated Flax-lily plants will be in accordance the translocation plan detailed in Section 4 of this report

3.5.1.3 Other Monitoring

Information relating to fencing and signage, weed control and pest animal control will be provided by landowners and the relevant contractors. This information will be included in the progress report, discussed below.

3.5.2 Reporting

Progress reports will be provided to the responsible authority at the end of year 1, 2, 5 and 10 of the program. Information to be provided in the progress report includes:

- A copy of the Management Actions Table (Table 10) detailing actions completed during the reporting period;

- A description of the specific monitoring results from ecological surveys undertaken for Matted Flax-lily;
- Success of weed and pest animal control work;
- Successful management tools (i.e. techniques used to control weed species, protection of new plants, monitoring technique, etc.);
- Any problems or issues experienced (i.e. new infestation of weed species, etc.);
- Any corrective actions and contingency measures where monitoring indicates that there has been a deterioration in NTGVVP, or Matted Flax-lily populations; and,
- Photographs showing evidence of works.

If any agreed management actions or commitments are incomplete or have not been undertaken in the times specified, the contractor is to document the justification and the actions that will be undertaken to implement management requirement.

3.5.2.1 Template for a Landowner Monitoring and Reporting Form

The landowner agrees to submit the Monitoring and Report Form to the appropriate authority. The template for a landowner monitoring and reporting form is shown in Table 8. Information required includes:

- A copy of the Management Action Table from the CMP (Table 10) with information on which actions have been completed for year/s of this reporting period;
- A description of the specific monitoring results from surveys undertaken;
- Details of any fencing or security works;
- Success of weed and pest animal control work;
- Successful management tools (i.e. techniques used to control weed species, protection of new plants, monitoring technique, etc.);
- Any problems or issues experienced (i.e. new infestation of weed species, storm damage to fencing, etc.); and,
- The provision of photographs showing evidence of works.

If any agreed management actions or commitments are incomplete or have not been undertaken in the times specified, the responsible party (Hanson) must explain the reasons why and what program of action/s will be undertaken to implement the action. If no action has been undertaken please explain the reason(s) and how the targets specified will be met.

3.6 On-going Management after 10 years

At the end of the formal 10 year management period, the management responsibilities for the conservation reserve, and the public reserve must ensure the quality of the site is maintained at their Year 10 levels in perpetuity.

The landowner will continue to manage the conservation reserve and public reserve after the completion of Year 10 as specified in this CMP, such that:

- Regular clean-up of litter during weed control works will be undertaken;
- Weed cover does not increase beyond the level attained at completion of Year 10; and,
- Pest animals are controlled to the level attained at the completion of Year 10.

Table 8. Landowner Monitoring and Reporting Form.

Landowner of offset site		
Location and address of offset site		
Offset site number (if applicable)		
Offset plan reference number (if applicable)		
Responsible Authority	City of Whittlesea	
Report #		
Actions completed within the offset site (since commencement)	Date and details of action	Key performance target met (Y/N)
Signature		
Date		

3.7 Management Actions Table

Management actions are summarised in Table 10. The actions constitute the minimum management requirements for the conservation reserve over the mandatory 10 year management period.

4 MATTED FLAX-LILY TRANSLOCATION PLAN

4.1 Permits and Approval

Prior to translocation of 36 Matted Flax-lily recorded within the development footprint into the nominated recipient site, approval will be sought from the City of Whittlesea, DELWP and the Department of the Environment (DoE). Details regarding the proposed impacts and measures to mitigate and manage the translocated plants at the recipient site are provided in this report to ensure all stakeholders are fully informed and all statutory obligations are met. Further information regarding the Matted Flax-lily has been provided separately to the Commonwealth as part of the request for further information relating to referral EPBC 2014/7364.

4.2 Recipient site

4.2.1 Selection of Potential Recipient Sites

Several elements are required for an acceptable recipient site. An acceptable recipient site should have the following attributes:

- The site must suit the biology and ecology of the translocated species;
- The recipient site should be of similar quality to the salvage site (i.e. the same EVC);
- The site must be large enough to support a self-sustaining population;
- The site should be free from grazing and erosion;
- The recipient site should be in close proximity to the salvage site; and,
- The site should be secure and protected through covenants or agreements against future development.

The recipient site will be included as a component within the conservation reserve established across the Crown Land and private land (Figure 2b). As the recipient site is immediately adjacent to the construction footprint, suitable habitat for Matted Flax-lily is considered to be present. The close proximity and similar ecological conditions should increase the likelihood of success for the translocated specimens.

Management access to the recipient site will be provided for from gate on the eastern side of the recipient site, from an internal road from within the residential development. This will be established prior to translocation, and construction activities.

Translocation should not be undertaken in areas which support significant amount of embedded basalt rock as it will be difficult to successfully dig recipient holes for translocated specimens. Rocks should not be removed to create a recipient site as this may cause unnecessary damage to the grassland, while removing important habitat for small fauna. A site inspection by a botanist familiar with the ecology of Matted Flax-lily will be undertaken prior to translocation to identify suitable locations within the recipient site for the transplanted individuals.

4.2.2 Current Conditions at the Recipient Site

The proposed recipient site comprises an area within the Crown Land at the southern edge of the Conservation Reserve, and is currently vacant Crown Land subject to regular disturbance through mowing for the purposes of maintaining a firebreak. Specifically, the proposed recipient site is dominated by exotic grassland, and free of the woody weed Sweet Briar which is present throughout much of the rest of the study area. As such, while the recipient site is adjacent to a large existing population of Matted Flax-lily, and contains suitable habitat, the translocation of Matted Flax-lily into the recipient site will not result in degradation of existing Plains Grassland vegetation, and will not require woody weed control prior to translocation.

The broader management actions detailed in the CMP (Section 3) will be undertaken within the recipient site to ensure that the recipient site is enhanced, and that suitable habitat for the Matted Flax-lily is maintained in perpetuity. Specific management actions relating to the translocation and ongoing management within the recipient site are detailed below

4.3 Roles and Responsibility

Barry Road Project Pty Ltd or their nominated Development Manager is responsible for ensuring all actions detailed in this translocation plan are undertaken to ensure the translocation and management of the Matted Flax-lily over the five year period are conducted in a manner which ensures that performance targets are met.

Barry Road Project should employ a specialist contractor to undertake the salvage and translocation of the Matted Flax-lily and also undertake negotiations with a nursery that specialise in indigenous plants to manage the nursery plants for the duration of the five year period. A botanist familiar with the species and ecology of Matted Flax-lily should be employed to ensure the salvage is undertaken in accordance with the plan and provide ongoing monitoring and reporting obligations to the relevant authorities. Prior to removal, a pre-salvage survey must be undertaken to ensure all Matted Flax-lily plants within the development footprint are identified and marked.

The weed and biomass management of the recipient site should be undertaken by a specialist contractor, familiar with Matted Flax-lily to ensure weed control does not impact on replanted salvage material.

Should the Conservation Reserve and/or the recipient site be transferred to the City of Whittlesea, or any other party, the responsibility for ongoing managing, monitoring and reporting will also be transferred to the new entity.

4.4 Timing

The salvage of all Matted Flax-lily material within the development footprint will be undertaken prior to the start of construction and once the necessary approvals have been provided.

The ideal time for any salvaged material to be translocated is early winter (June – July), however plants can be relocated outside of the hottest, driest months (i.e. December, January, February and March) provided adequate watering and detailed monitoring is undertaken to ensure the continued health and vigour of

plants. Regardless of timing, supplementary watering of replanted salvaged material is recommended with the frequency of this being dependent on rainfall and climatic conditions.

4.5 Removal Technique

The removal will be supervised by a qualified botanist, and all patches and their full extent assessed by measuring the size of the patch, number and height of tillers, general health, and whether it is flowering or not. During removal plants will be labelled according to the patch number and segment, to ensure once they arrive at the recipient site and/or nursery they are easily identifiable as to which patch they have been removed from and the total number of divided segments.

All vegetative material to be disturbed should be removed from the impact site. The procedure for removal will be:

1. All patches to be removed will be identified with marker paint, and plants will be recorded against the monitoring sheet;
2. Plants will be watered the day before the proposed removal to loosen the soil and to ensure the plants are not drought stressed during salvage and movement;
3. Material will be dug from the ground by hand using spades clean of dirt; and,
4. During excavation, soil will be maintained around the root system, however plants can survive if exposed to air for short periods.

The patches will be divided into a size which fits into a polystyrene box or similar to allow for ease of handling and transport. Generally plants will be divided into three near equal segments. However, this may change depending on the conditions on the day, including how well the soil binds together and the size of the patches. Once plants are lifted from the ground and placed into polystyrene boxes, two thirds of the salvaged material will be immediately taken to a nursery experienced in the propagation of *Dianella* (Section 4.6.2 below), the final third will be taken to the recipient site to be immediately placed into pre-excavated and systematically arranged holes (Section 4.6.3).

4.6 End Use of Salvaged Material

After the necessary approvals are obtained, all 36 of the Matted Flax-lily recorded during the recent targeted survey within the development site will be removed. This material will be divided at the time of salvage, to allow for ease of management and to allow for a variety of end use of the plants.

Three uses are recommended for any salvaged material:

1. One third of material salvaged be immediately transferred to the recipient site (direct translocation);
2. One third of material taken to a suitable nursery and 'grown on' in pots, once the plants have taken to the potting medium and site conditions allow replanting, the plants will be planted into the recipient site (delayed translocation); and,
3. One third of the material kept in a nursery for a period of five years to provide a contingency if plants within the recipient site fail to establish, these plants will be transferred to the Whittlesea City

Council or other relevant organisations to be utilised in projects for revegetation or landscaping in the local area once the five year period is up.

If material is required for another purpose then the proponent and referral authorities need to be notified, at least a third of *in situ* material should not be removed from the nursery within the first five years to ensure enough material is kept as contingency for the loss of plants within the recipient site.

4.6.1 Direct Translocation

The direct translocation from the impact site to a recipient site needs to take place on the same day as the material is removed to minimise stress on the plants.

Material will be removed as discussed in Section 4.5 and transported directly to the recipient site. The following steps will be taken to ensure successful establishment at the recipient site:

1. Soil from around the salvaged material will be kept in place as a sod, to help the plants establish within the recipient site. This also helps with moisture retention around the root zone;
2. Holes at the recipient site will be prepared before the salvage of plants at the impact site, to minimise the time out of the ground for the salvaged material;
3. Holes will be dug deeper than the clod of soil from the impact site, soil will also be broken up at the base of the hole to allow quick penetration of the soil by the roots of the salvaged material;
4. Holes should be filled with water before the translocation to soften and loosen the surrounding soil, also helping to remove air pockets in the soil;
5. A weed free medium will be placed in the hole to allow an easy fit and manoeuvrability for the clod of soil;
6. The sod containing the material will be placed into the medium in the hole, ensuring the medium is tightly packed around the sod, removing air pockets and binding the medium together to prevent erosion;
7. The area around the plant will be mulched with certified weed free mulch, consisting of either wood chips or pea straw; and,
8. After planting the sod will be watered by hand until it is wet enough for water to no longer penetrate the soil.

The placement of the salvaged material will be recorded with a GPS and labelled, according to the patch from which it was removed, with a metal 'dog tag' held in the ground with a peg. Where possible, the holes will be systematically lined up to allow for ease of monitoring.

4.6.2 Nursery Management

Material which is taken to a nursery will have the soil removed and be thoroughly washed to allow for division of the rootstock/tillers. Rootstock/tillers will be divided into segments that will fit into an eight inch pot (or similar) and filled with a suitable medium (native potting mix). Each divided segment will be labelled according to their patch number, box number and then also its end use, to ensure they are tracked through the translocation process.

After the plants are divided into segments and placed within pots, they must be managed correctly to ensure survival within the nursery environment. This can be dependent on conditions and the length of time they will stay in the nursery. Watering and fertilisation will need to be undertaken correctly throughout the period and generally *Dianella* within a nursery environment will do well and will spread within their container. If plants become pot bound, division and correct labelling must be undertaken. Before being planted into the recipient site, plants need to be hardened off to ensure they are not stressed by a sudden change in conditions including frost, wind and reduced water.

Disease and pest control is important to ensure no diseases or pests are introduced to the recipient site, and plants suspected of being diseased will be treated according to nursery guidelines and/or destroyed appropriately. At no time will plants suspected of carrying a disease or having pests be introduced to a recipient site. Weeding of pots will also be undertaken periodically and correct hygiene procedures practiced at all times within the nursery. Nursery populations will be monitored by a qualified person every three months in the first year, and then twice a year for the remainder. It is anticipated that the nursery population will be translocated back in to the recipient site at the first suitable opportunity.

Discussions with the City of Whittlesea have indicated that there is existing space within their nursery for basic management of stock. However, the nominated ecologist monitoring and managing the other translocated individuals must undertake regular visits (3 monthly) to the nursery for weeding and other maintenance obligations until such a time when the Conservation Reserve and associated responsibilities are vested with Council, or another party.

4.6.3 Delayed Translocation

The delayed translocation will occur once plants have become established within the nursery environment and site conditions at the recipient site are favourable e.g. soil moisture, climatic conditions, weed control has been undertaken and fencing erected, if required.

The ideal time to plant the salvaged material into the recipient site is outside the hottest and driest months (December to March) and preferably in early winter (June or July) when rainfall is highest and conditions are cool. Adequate rainfall will reduce the potential requirement for supplementary watering of replanted material. Planting the material at the earliest stage before summer will also maximise the growth of the material, allow for a higher rate of establishment, and maximise the potential for long-term survival within the recipient site.

The delayed planting is similar to that of the direct translocation:

1. Holes need to be pre dug systematically and filled with water the day before material from the pots is removed;
2. Holes need to be dug approximately 100 millimetres wider and 50 millimetres deeper than the pot in which the material is grown in, this allows the soil to be loosened and increases the soils permeability and allows moisture to penetrate the soil to a deeper level;
3. Pots containing material will be well watered before planting into the hole;
4. Plants from the nursery will be 'hardened' before they are planted;
5. Care will be taken when removing the material from the pot to keep the medium intact around the root system before placing into the hole.

6. Extra medium may need to be placed into the hole to ensure the material is tightly packed into the hole;
7. The material and medium will then be covered in certified weed free mulch, consisting of either wood chips or pea straw.
8. Watering by hand will then be undertaken; care will be undertaken not to wash medium away.

Each plant will be labelled according to the nursery number and a waypoint taken from a GPS.

4.7 Management of Salvaged Material within the Recipient Site

4.7.1 Salvaged Material Placement at the Recipient Site

Planting of the material at the recipient site should be done in systematic order to help the monitoring of the plants. Material should be placed away from perimeter fencing, areas of pest animal or pest plants and in areas which limit impacts on native vegetation when digging holes. Plants should be approximately placed no closer than two metres from one another to ensure over time, plants can be counted as individuals. Once placed into the recipient site, plants should be marked with a stake to enable identification and also a GPS waypoint taken to record the location on a GIS layer.

4.7.2 Watering

Watering of both direct and delayed translocated material will be undertaken to ensure plants establish quickly. The requirement for watering is dependent on a number of factors including timing of the planting, soil type and topography, rainfall and mulch. The plants will be monitored for drought and heat stress and supplementary watering undertaken when required to ensure the health of any translocation plants.

The period between October and March is crucial for the establishment of translocation plants, with those that survive this period over the first year more likely to establish successfully (G. French. pers. comm.). Once plants survive the initial summer, ongoing watering is unlikely to be required unless extreme, drought conditions are experienced. Table 9 below is a suggested period for watering after replanting, however the periods between watering may vary depending on climatic conditions, and monitoring of the plants will be important to ensure successful establishment.

Table 9. Watering requirements for replanted salvaged MFL plants

Months after planting	Period between significant rainfall events (<5mm) that will trigger watering	Watering Required
0 - 3	2 weeks	Weekly thereafter until significant rainfall
3 - 9	3 - 4 weeks	Fortnightly thereafter until significant rainfall
9 - 21	1 – 2 Months	Monthly thereafter until significant rainfall
21 - 36	1 – 2 Months	Only if plants display signs of stress

4.7.3 Grazing

Grazing pressure by introduced and native animals can have a considerable effect on the successful outcome of the proposed salvage and translocation. A rabbit-proof fence will be establish around the perimeter of the recipient site (and greater conservation reserve) in part to reduce grazing pressure upon replanted

salvaged material, as kangaroos and rabbits are currently known to occur at the site. Caging or using tree guards may be an option to protect individual plants if fencing of the entire recipient site is not effective in protecting the salvaged material. Pest animal control will be undertaken as part of the overall management of the conservation reserve. Fencing along with signage will also protect the site from accidental and potentially intentional human disturbance.

4.7.4 Pest Plant Management

Pest plant control will be required within the recipient site and should be undertaken before and after the planting of the salvaged material. The focus of control efforts should be on pest plants which compete with the salvaged material for available space, light, water and nutrients. Initially the focus of any management actions should be on high threat/high impact species at first and as numbers reduce over time the focus should shift to other species which are not considered high threat but may still compete with the replanted salvage material. Hand weeding around the salvaged plants must occur on a regular basis, especially on plants directly translocated which may carry weeds not already established within the recipient site. Given that Matted Flax-lily is susceptible to some herbicides it is important that skilled contractors familiar with Matted Flax-lily be used to ensure off-target damage is avoided.

4.7.5 Biomass Reduction

As Matted Flax-lily is generally found in grassy habitats, it can be self-maintaining in areas of high ground storey biomass e.g. dense grassy swards. However, the closure of inter tussock space from a lack of fire or grazing may reduce the areas of available occupancy within a recipient site. Grass length should be monitored around replanted salvaged material to ensure both native and exotic grass species are not limiting the growth of the salvaged material. If required, measures such as slashing, mosaic burning or weed control should be employed to lower the levels of the recipient site biomass. All measures to lower biomass measures must be done in consultation with a botanist familiar with the growth of Matted Flax-lily and also the management of native vegetation to limit potential impacts on replanted salvaged material. Slashing, burning or grazing may also be employed as forms of weed control.

4.7.6 Labelling

The correct labelling of all salvaged material should be undertaken to ensure plants can be tracked through the entire process. Plants should be labelled with small metal dog tags prior to their removal from the impact site, labelling should follow an alphabetic system for whole distinct plants in the ground e.g. A, B, C, D etc. Once plants are broken up at the impact site they should then form a numeric system e.g. A1 would describe the first plant part to be removed, this plant would be directly taken to the recipient site, A2 would be taken to the nursery to be grown on in tubes to be planted in year two or three, A3 would be taken to a nursery as backup for the loss of plants. If further plants are removed from the same patch then they follow on A4 direct translocation, A5 delayed translocation, A6 back up material. The main priority is to be able to extract three plants from every patch for all end uses; however the size of patches may only enable two or one plant to be removed, in these cases reducing the size of salvaged material may enable the desired number of patches to be salvaged.

Plant growth in a nursery often exceeds the pots capacity within a year or two. If repotting is required then labelling of divided material should be followed with numeric numerals, for example A2i, A3i and so forth.

Within the nursery the side of pots should be labelled with a permanent marker along with a tag. At the recipient site plants need to be labelled with a small metallic dog tag, embedded in the ground with a peg to prevent removal by animals or humans.

4.7.7 Access and Signage

The recipient site will be adequately fenced to demarcate it from the developed area. A lockable vehicle access gate will be installed in at least one section of the fence to provide access to the recipient site (Figure 2). At the entrance, signs will be erected that show activities that are allowed or prohibited in the area (e.g. no pets, no dumping of rubbish).

Signs will be erected highlighting the area's role in protection of the Matted Flax-lily and Natural Temperate Grassland of the Victorian Volcanic Plain. Signage will remain in place for the duration of the management plan.

4.7.8 Monitoring

Monitoring is critical to the success of any salvage and translocation of flora species (Vallee *et al.* 2004). Monitoring by a qualified botanist familiar with the ecology and growth habits of Matted Flax-lily should be undertaken to ensure the on-going survival of the plants and reporting to the relevant approval authorities. Monitoring will look at drought stress, pest plant and animal impacts, biomass and other site disturbances, along with measuring the replanted salvaged materials growth. Monitoring should be undertaken fortnightly for the first two months, monthly for the next four months, bi-monthly for the remainder of the first year and then every 3 to 6 months for the remainder of the five year monitoring and management period. This should occur for each planting event, i.e. direct translocation, any planting of nursery stock, etc. Water will be provided as required during monitoring and management visits.

Should extreme weather events, such as periods of prolonged heat, occur during the first year of translocation, additional monitoring and management visits may be required.

To enable accurate monitoring and ongoing assessment of the health of the translocated plants, the following measurements will be recorded:

- dimensions of the plants;
- number of "leaflets" or "tillers" associated with each plant;
- average tiller height; and,
- whether or not the plant is flowering and the number of flowering spikes or culms from that season present.

A report should be prepared for the proponent and relevant referral authorities six months after replanting the salvaged material, then ongoing at every 12 months. The report will detail the growth level of the plants and include information on disturbances, deaths, further plantings and conditions at both the recipient site and nursery.

4.7.9 Performance Targets

The ultimate aim of translocation is to ensure the conservation of the genetic diversity of a species. The conservation of genetics is especially critical for endangered species and the loss of genetics from even a single plant can be seen as a failure of the translocation process.

The translocation of any species can be inherently difficult and may put excessive stress on material which is disturbed. However, Matted Flax-lily has been successfully translocated for several projects within the Melbourne region where disturbance was unavoidable. The success of these translocations is due in part to its strong tuberous root system which is dividable and generally tolerates disturbance. However, previous success should not be relied upon and each salvage and translocation must be carefully planned and managed to ensure success.

The aim of translocating flora is to ensure no genes are lost, regardless of whether they are contained in a single individual or entire population. Conserving genetic diversity drives the success of translocation, with any loss from the death of material seen as a failure to conserve the genetics of an individual.

Vallee *et al.* (2004) has detailed stringent criteria for determining the success of translocated plant species, criteria is broken into segments for short and long term success, and also the success of management of material in an *ex-situ* situation.

In the short term biological success can be determined through:

- Greater than 70% of transplants surviving, with representatives from the range of genetic individuals planted;
- The new or enhanced populations have similar characteristics to the natural population(s), such as the survival and growth of translocated individuals;
- Survival of transplants to reproductive stage (producing flowers and fruit);
- The reproduction of translocated individuals, including the production of flowers and fruit at levels consistent with naturally occurring plants; and,
- Seed viability is consistent with that in naturally occurring plants.

Long Term Criteria includes:

- New seedlings are established;
- The number of individuals within the population being maintained or increased by natural recruitment; and,
- Adequate levels of biodiversity, particularly genetic variation, are maintained through generations.

Criteria for determining successful establishment and maintenance of the *ex situ* collection:

- The required number of transplants were available for the translocation proposal;
- Correct labelling and documentation maintained through cultivation;
- Techniques for successful propagation of the taxon are understood; and,
- A genetically representative collection was maintained.

Due to recruitment of Matted Flax-lily in a natural system being currently poorly known, the measurement of success through recruitment is not possible. The conservation of all genetic material should therefore be kept as a higher goal in determining success of the translocation.

Table 10. 10-year Conservation Management Plan for the Conservation Reserve.

Year	Action No.	Land use and management actions to be completed	Resource/personnel required	Timing of action	Key performance target
Year 1					
0	0.1	Approve Environment Management Plan	Liaise between Council, DELWP/DoE	Pre-commencement of any works associated with the construction of the residential development.	EMP approved by relevant parties. No construction works to occur until Action 0.1 and 0.2 are satisfied.
0	0.2	Secure Conservation Reserve with Section 173 Agreement	Landowner/Council	Once EMP approved	Conservation Reserve secured with on-title agreement. No construction works to occur until Action 0.1 and 0.2 are satisfied.
0	0.3	Commence salvage of Matted Flax-lily plants	Landowner/ Bushland Manager/ Qualified Ecologist	Once Conservation Reserve secured with s.173	All impacted Matted Flax-lily salvaged from development footprint.
1	1.1	Install Perimeter Rabbit Proof Fence around Conservation Reserve	Landowner/Fencing Contractor	Prior to the commencement of all construction works including any approved early works or site clearing.	Permanent fence is installed and signs erected prior to commencement of residential development works
1	1.2	Install temporary construction fencing around Public Reserve	Landowner/Fencing or Building Contractor	Prior to the commencement of all construction works including any approved early works or site clearing.	Temporary fence is installed and signs erected prior to commencement of residential development works
1	1.3	Removal of all existing rubbish from site and rubbish removed immediately if further dumping occurs.	Landowner/Contractor	Prior to commencement of residential development works – Ongoing.	All rubbish removed and removed immediately if dumping occurs
1	1.4	Removal of all woody weeds specifically African Boxthorn and Sweet Briar. Remove all woody debris from site.	Bushland Mgt Contractor/Landowner	Before seed heads mature in spring/summer.	Reduce cover of woody weeds to <1%
1	1.5	Undertake control of exotic grasses and herbaceous broad leaves. Two visits in spring, one visit in summer, autumn, winter	Bushland Mgt Contractor/ Landowner	Before seed heads mature in spring/summer Five visits per year	Reduction in weed cover to <5% cover

Year	Action No.	Land use and management actions to be completed	Resource/personnel required	Timing of action	Key performance target
1	1.6	Conduct rabbit control if required. (Warren fumigation and/or thatch removal)	Pest Contractor/Landowner Mgt	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
1	1.7	Undertake biomass reduction either through weeding or small mosaic burns in selected areas.	Bushland Contractor/ Landowner Mgt	Autumn	Areas of intertussock space opened up to allow recruitment
1	1.8	Undertake collection of grass seeds for direct seeding in Year 2	Bushland Contractor/ Landowner Mgt	Summer	Enough seed collected to cover areas to be direct seeded in Year 3
1	1.9	Prepare area to be direct seeded in year 2.	Bushland Contractor/ Landowner Mgt	Spring/Summer	Area of low native cover prepared to be directed seeded
1	1.10	Install signage detailing significance of area for ecological values	Landowner	Immediately after acceptance of Offset Management Plan	Signage is installed and remains in place for the duration of the offsets
1	1.11	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Qualified Ecologist/ Landowner	12 months after CMP is implemented	Report provided to relevant authorities detailing monitoring results.
Year 2					
2	2.1	Undertake control of woody weeds.	Bushland Contractor/Landowner. Mgt	Before seed heads mature in spring/summer.	Ensure cover of woody weeds is <1%
2	2.2	Undertake control of exotic grasses and herbaceous broadleaves. Four visits per year	Bushland Contractor/Landowner. Mgt	Before seed heads mature in spring/summer	Reduce perennial grass cover to <40% and annual grasses/broadleaves to <5%
2	2.3	Conduct rabbit control if required.	Pest Contractor/Landowner Mgt	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
2	2.4	Maintain Perimeter Fence	Bushland Contractor/Landowner. Mgt	Ongoing	Fence is maintained and fixed if broken
2	2.5	Undertake biomass reduction either weeding/mosaic burns in selected areas	Bushland Contractor/Landowner. Mgt	Autumn	Areas of intertussock space opened up to allow recruitment
2	2.6	Undertake direct seeding with native grasses in bare areas.	Bushland Contractor/Landowner. Mgt	Spring/Summer	Areas prepared in year 1 are direct seeded
2	2.7	Undertake collection of seeds (herbs) for planting in Year 3 and	Bushland Mgt	Summer	Seed collected to allow nursery to

Year	Action No.	Land use and management actions to be completed	Resource/personnel required	Timing of action	Key performance target
		provided to nursery to grow	Contractor/Nursery/ Landowner.		grow plants for year 3 planting
2	2.8	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Landowner/ Qualified Ecologist	Early Summer	Progress report to satisfaction of relevant authorities
2	2.9	Removal of all existing rubbish from site and rubbish removed immediately if further dumping occurs.	Landowner/Contractor	At least every 2 months	All rubbish removed, and removed immediately if dumping occurs.
Year 3					
3	3.1	Undertake control of woody weeds.	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer.	Ensure cover of woody weeds is <1%
3	3.2	Undertake control of exotic grasses and herbaceous broadleaves (See Table 9). Four visits per year	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer	Reduce perennial grass cover to <40% and annual grasses/broadleaves to <5%
3	3.3	Conduct rabbit control if required.	Pest Mgt Contractor/Landowner	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
3	3.4	Maintain Perimeter Fence	Landowner	Ongoing	Fence is maintained and fixed if broken
3	3.5	Undertake biomass reduction either weeding/mosaic burns in selected areas	Bushland Mgt Contractor/Landowner.	Autumn	Areas of intertussock space opened up to allow recruitment
3	3.6	Undertake supplementary planting of herbs.	Bushland Mgt Contractor/Landowner.	Winter	Supplementary planting undertaken during winter in intertussock spaces
3	3.7	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Landowner/ Qualified Ecologist	Early Summer	Progress report to satisfaction of relevant authorities
3	3.8	Removal of all existing rubbish from site and rubbish removed immediately if further dumping occurs.	Landowner/Contractor	At least every 2 months	All rubbish removed, and removed immediately if dumping occurs.
Year 4					
4	4.1	Undertake control of woody weeds.	Bushland Mgt	Before seed heads mature in	Ensure cover of woody weeds is <1%

Year	Action No.	Land use and management actions to be completed	Resource/personnel required	Timing of action	Key performance target
			Contractor/Landowner.	spring/summer.	
4	4.2	Undertake control of exotic grasses and herbaceous broadleaves (See Table 9). Four visits per year	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer	Reduce perennial grass cover to <40% and annual grasses/broadleaves to <5%
4	4.3	Conduct rabbit control if required.	Pest Mgt Contractor/Landowner	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
4	4.4	Maintain Perimeter Fence	Landowner	Ongoing	Fence is maintained and fixed if broken
4	4.5	Undertake biomass reduction either weeding/mosaic burns in selected areas	Bushland Mgt Contractor/Landowner.	Autumn	Areas of intertussock space opened up to allow recruitment
4	4.6	Replacement of plant deaths from supplementary planting of herbs.	Bushland Mgt Contractor/Landowner.	Winter	80% survival target for supplementary planting
4	4.7	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Landowner/ Qualified Ecologist	Early Summer	Progress report to satisfaction of relevant authorities
4	4.8	Removal of all existing rubbish from site and rubbish removed immediately if further dumping occurs.	Landowner/Contractor	At least every 2 months	All rubbish removed, and removed immediately if dumping occurs.
Year 5					
5	5.1	Undertake control of woody weeds.	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer.	Ensure cover of woody weeds is <1%
5	5.2	Undertake control of exotic grasses and herbaceous broadleaves. Three visits per year	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer	Reduce perennial grass cover to <40% and annual grasses/broadleaves to <5%
5	5.3	Conduct rabbit control if required.	Pest Mgt Contractor/Landowner	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
5	5.4	Maintain Perimeter Fence	Landowner	Ongoing	Fence is maintained and fixed if broken
5	5.5	Undertake biomass reduction either weeding/mosaic burns in	Bushland Mgt	Autumn	Areas of intertussock space opened

Year	Action No.	Land use and management actions to be completed	Resource/personnel required	Timing of action	Key performance target
		selected areas	Contractor/Landowner.		up to allow recruitment
5	5.6	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Landowner/ Qualified Ecologist	Early Summer	Progress report to satisfaction of relevant authorities
5	5.7	Removal of all existing rubbish from site and rubbish removed immediately if further dumping occurs.	Landowner/Contractor	At least every 2 months	All rubbish removed, and removed immediately if dumping occurs.
Year 6					
6	6.1	Undertake control of woody weeds.	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer.	Ensure cover of woody weeds is <1%
6	6.2	Undertake control of exotic grasses and herbaceous broadleaves (See Table 9). Three visits per year	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer	Reduce perennial grass cover to <40% and annual grasses/broadleaves to <5%
6	6.3	Conduct rabbit control if required.	Pest Mgt Contractor/Landowner	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
6	6.4	Maintain Perimeter Fence	Landowner	Ongoing	Fence is maintained and fixed if broken
6	6.5	Undertake biomass reduction either weeding/mosaic burns in selected areas	Bushland Mgt Contractor/Landowner.	Autumn	Areas of intertussock space opened up to allow recruitment
6	6.6	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Landowner/ Qualified Ecologist	Early Summer	Progress report to satisfaction of relevant authorities
6	6.7	Removal of all existing rubbish from site and rubbish removed immediately if further dumping occurs.	Landowner/Contractor	At least every 2 months	All rubbish removed, and removed immediately if dumping occurs.
Year 7					
7	7.1	Undertake control of woody weeds.	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer.	Ensure cover of woody weeds is <1%
7	7.2	Undertake control of exotic grasses and herbaceous broadleaves. Three visits per year	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer	Reduce perennial grass cover to <40% and annual grasses/broadleaves to

Year	Action No.	Land use and management actions to be completed	Resource/personnel required	Timing of action	Key performance target
					<5%
7	7.3	Conduct rabbit control if required.	Pest Mgt Contractor/Landowner	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
7	7.4	Maintain Perimeter Fence	Landowner	Ongoing	Fence is maintained and fixed if broken
7	7.5	Undertake biomass reduction either weeding/mosaic burns in selected areas	Bushland Mgt Contractor/Landowner.	Autumn	Areas of intertussock space opened up to allow recruitment
7	7.6	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Landowner/ Qualified Ecologist	Early Summer	Progress report to satisfaction of relevant authorities
7	7.7	Removal of all existing rubbish from site and rubbish removed immediately if further dumping occurs.	Landowner/Contractor	At least every 2 months	All rubbish removed, and removed immediately if dumping occurs.
Year 8					
8	8.1	Undertake control of woody weeds.	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer.	Ensure cover of woody weeds is <1%
8	8.2	Undertake control of exotic grasses and herbaceous broadleaves (See Table 9). Three visits per year	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer	Reduce perennial grass cover to <40% and annual grasses/broadleaves to <5%
8	8.3	Conduct rabbit control if required.	Pest Mgt Contractor/Landowner	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
8	8.4	Maintain Perimeter Fence	Landowner	Ongoing	Fence is maintained and fixed if broken
8	8.5	Undertake biomass reduction either weeding/mosaic burns in selected areas	Bushland Mgt Contractor/Landowner.	Autumn	Areas of intertussock space opened up to allow recruitment
8	8.6	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Landowner/ Qualified Ecologist	Early Summer	Progress report to satisfaction of relevant authorities
8	8.7	Removal of all existing rubbish from site and rubbish removed	Landowner/Contractor	At least every 2 months	All rubbish removed, and removed

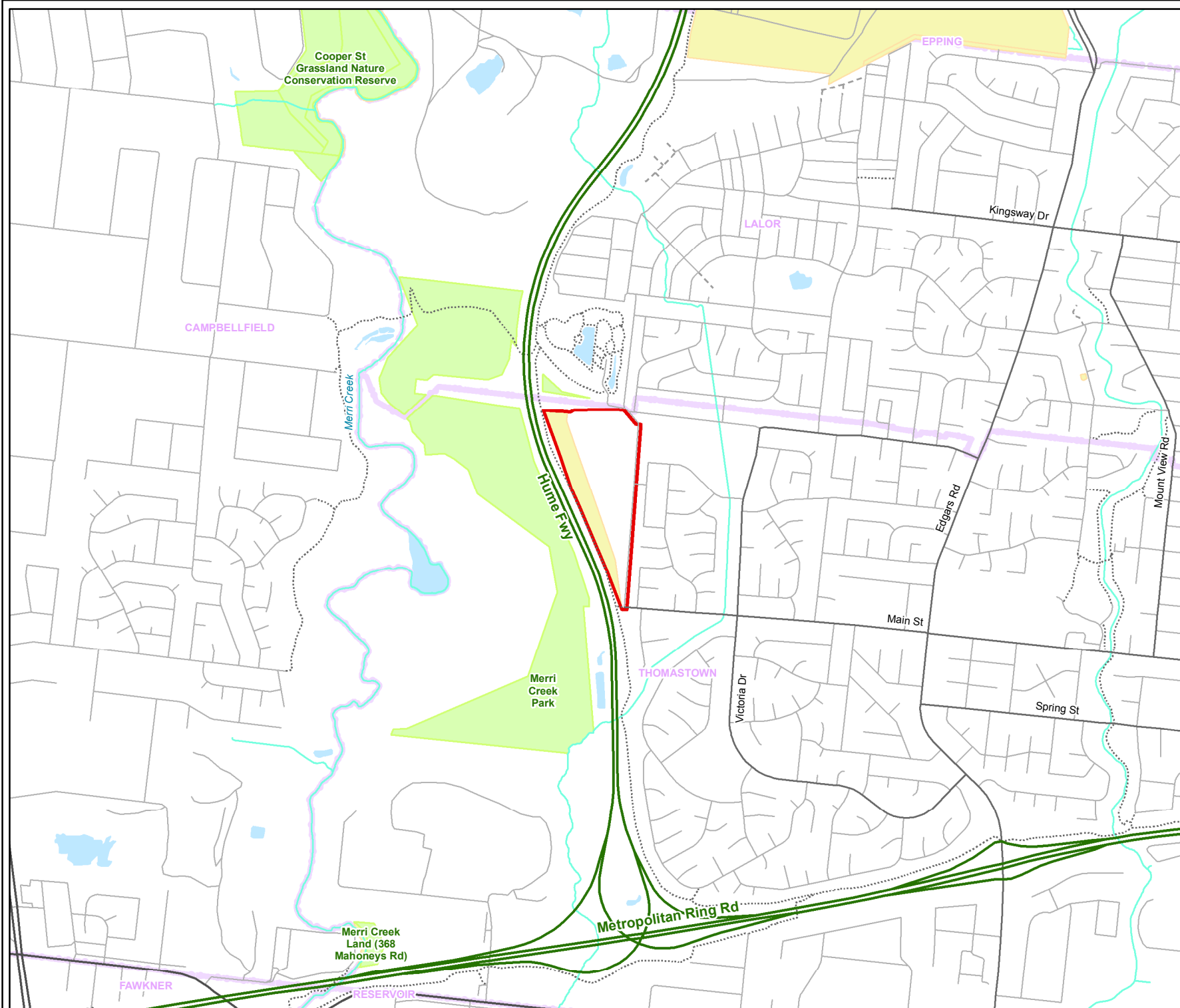
Year	Action No.	Land use and management actions to be completed	Resource/personnel required	Timing of action	Key performance target
		immediately if further dumping occurs.			immediately if dumping occurs.
Year 9					
9	9.1	Undertake control of woody weeds.	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer.	Ensure cover of woody weeds is <1%
9	9.2	Undertake control of exotic grasses and herbaceous broadleaves. Three visits per year	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer	Reduce perennial grass cover to <40% and annual grasses/broadleaves to <5%
9	9.3	Conduct rabbit control if required.	Pest Mgt Contractor/Landowner	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
9	9.4	Maintain Perimeter Fence	Landowner	Ongoing	Fence is maintained and fixed if broken
9	9.5	Undertake biomass reduction either weeding/mosaic burns in selected areas	Bushland Mgt Contractor/Landowner.	Autumn	Areas of intertussock space opened up to allow recruitment
9	9.6	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Landowner/ Qualified Ecologist	Early Summer	Progress report to satisfaction of relevant authorities
9	9.7	Removal of all existing rubbish from site and rubbish removed immediately if further dumping occurs.	Landowner/Contractor	At least every 2 months	All rubbish removed, and removed immediately if dumping occurs.
Year 10					
10	10.1	Undertake control of woody weeds (Table 9).	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer.	Ensure cover of woody weeds is <1%
10	10.2	Undertake control of exotic grasses and herbaceous broadleaves. Three visits per year	Bushland Mgt Contractor/Landowner.	Before seed heads mature in spring/summer	Reduce perennial grass cover to <40% and annual grasses/broadleaves to <5%
10	10.3	Conduct rabbit control if required.	Pest Mgt Contractor/Landowner	After peak breeding season - late summer/early autumn.	Significant reduction in number/signs of rabbits.
10	10.4	Maintain Perimeter Fence	Landowner	Ongoing	Fence is maintained and fixed if broken

Year	Action No.	Land use and management actions to be completed	Resource/personnel required	Timing of action	Key performance target
10	10.5	Undertake biomass reduction either weeding/mosaic burns in selected areas	Bushland Mgt Contractor/Landowner.	Autumn	Areas of intertussock space opened up to allow recruitment
10	10.6	Removal of all existing rubbish from site and rubbish removed immediately if further dumping occurs.	Landowner/Contractor	At least every 2 months	All rubbish removed, and removed immediately if dumping occurs.
10	10.7	Prepare a new management plan that reflects the ongoing management activities required to maintain the biodiversity gains achieved over the previous 10 years of management into perpetuity. This should include ongoing Matted Flax-lily management and monitoring requirements.	Qualified Ecologist	Prior to the end of the CMP actions	Approved to the satisfaction of relevant authorities.
10	10.8	Monitor status of vegetation condition, and the status Matted Flax-lily and the condition of habitat within the reserves and provide annual report to relevant authorities.	Landowner/ Qualified Ecologist	Early Summer	Progress report to satisfaction of relevant authorities

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FIGURES



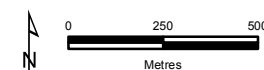
Legend

- Study Area
- Freeway
- Major Road
- Collector Road
- Minor Road
- Proposed Road
- Walking Track
- Minor Watercourse
- Permanent Waterbody
- Parks and Reserves
- Crown Land
- Localities



Figure 1

Location of the study area
Environmental Management Plan for 135-161 Barry Road, Thomastown



VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.



Figure 2a
Ecological values and development plan
Environmental Management Plan for 135-161 Barry Road, Thomastown

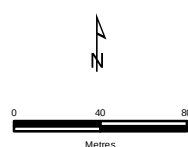
Legend

- Study Area
- Conservation Area
- Development plan
- Bike access / access
- Public reserve
- Potential wetland
- Potential Matted Flax-lily recipient site

- Matted Flax-lily records
- + Arching Flax-lily
- + Rhagodia
- + Slender Bindweed

Ecological Vegetation Classes

- Plains Grassland
- Plains Sedgy Wetland



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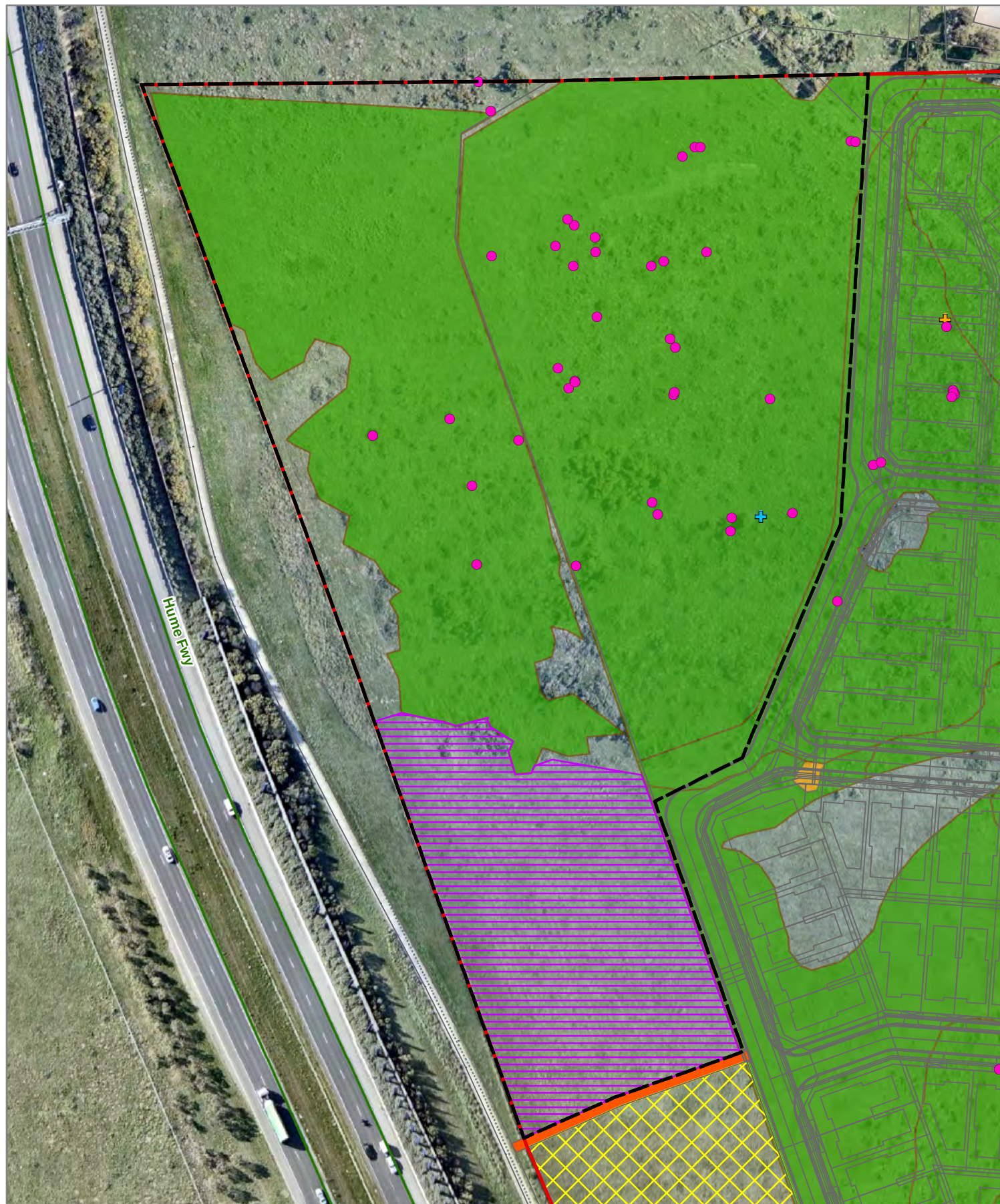


Figure 2b
Ecological values in
the Conservation Area
Environmental
Management Plan for
135-161 Barry Road,
Thomastown

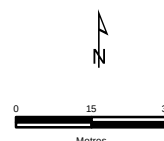
Legend

- Study Area
- Conservation Area
- Development plan
- Bike access / access
- Public reserve
- Potential Matted Flax-lily recipient site

- Matted Flax-lily records
- + Arching Flax-lily
- + Rhagodia

Ecological Vegetation Classes

- Plains Grassland
- Plains Sedgy Wetland



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Figure 2c
Ecological values in the Public Reserves
Environmental Management Plan for 135-161 Barry Road, Thomastown

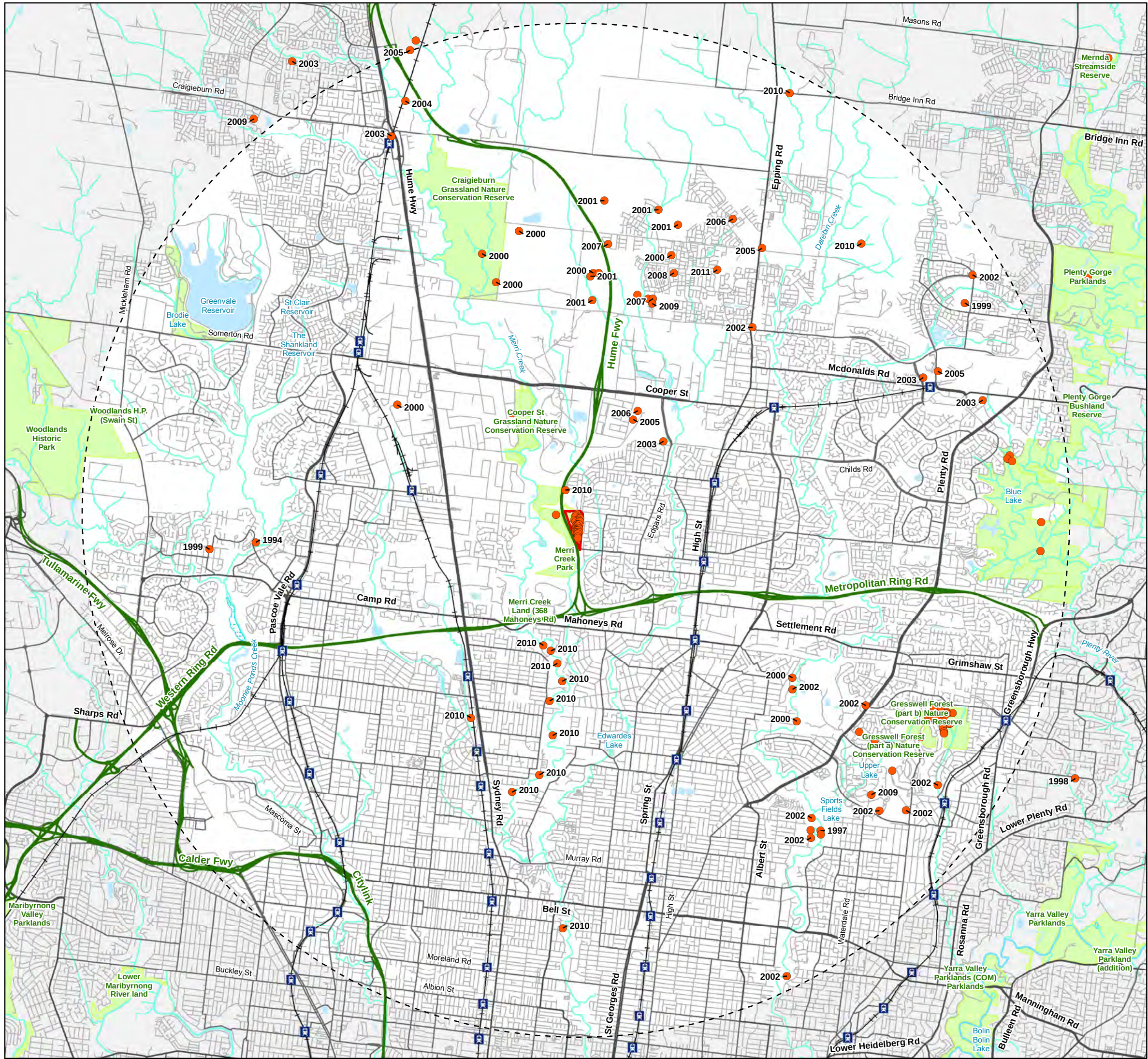
Legend

- Study Area
- Conservation Area
- Development plan
- Bike access / access
- Public reserve
- Potential wetland
- Potential Matted Flax-lily recipient site

- Matted Flax-lily records
- Ecological Vegetation Classes**
- Plains Grassland



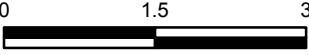
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- Legend**
- Study Area
 - Matted Flax-lily records (VBA 2016)



Figure 3
Previously documented Matted Flax-lily records within 10km of the study area
Ecological Management Plan for 135-161 Barry Road, Thomastown



Kilometres



VBA 2016. Victorian Biodiversity Atlas. // Sourced from: 'VBA_FLORA25' and 'VBA_FLORA100', January 2016 © The State of Victoria, Department of Environment, Land, Water and Planning. Records prior to 1949 not shown. Ecology and Heritage Partners recorded species have been submitted to but are not yet included in the VBA as at October 2014.
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7479 Fig03 MFL Records 29/04/2016 melsby

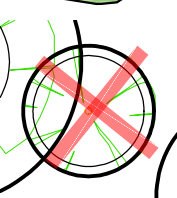
ATTACHMENT 1 - PERMITTED CLEARING ESTIMATE

ATTACHMENT 2 – ESTIMATED OFFSET SITE DETAILS

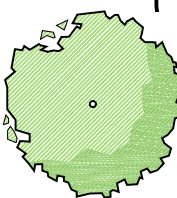
LEGEND



Existing Tree to be Retained



Existing Tree to be Removed

Proposed New Street Trees
Location & Species To Council Approval

Proposed New Hydro-seed Nature Strip

Conservation Reserve
City Of Whittlesea
No Proposed Works

Proposed POS Reserve

Conservation Reserve

Proposed New Post & Wire Fence
Offset 500mm From Shared PathHigh Pressure Gas Main Refer to
Engineers Drawings

Existing Steel Post & Rail Fence

PLANT SCHEDULE #1- STREET TREES

SYM	BOTANICAL NAME	COMMON NAME	D/E N/Ex*	HEIGHT X WIDTH AT MATURITY	MIN SUPPLY SIZE	QTY
TREES						
Ba	<i>Brachychiton acerifolius</i>	Ilawarra Flame Tree	D/N	10-15 x 8-10m	40cm/1.5mH	TO LATER DETAIL
CcS	<i>Corymbia citriodora</i> 'Scentuosus'	Dwarf Scentuosus Lemon-scented Gum	E/N	6-8 x 4-5m	40cm/1.5mH	
BEED	<i>Eucalyptus leucocylon</i> 'Euky Dwarf'	Dwarf Yellow Gum	E/N	6 x 5m	40cm/1.5mH	
GLRL	<i>Gleditsia triacanthos</i> var. <i>inermis</i> 'Ruby Lace'	Ruby Lace Honey Locust	D/Ex	6 x 6m	40cm/1.5mH	
LXN	<i>Lagerstroemia indica</i> x <i>L. lauriei</i> 'Natchez'	Natchez Crepe Myrtle	D/Ex	8 x 6m	40cm/1.5mH	
MaE	<i>Melia azedarach</i> 'Elite'	Low-fruited White Cedar	D/N	8-10 x 8-10m	40cm/1.5mH	
UpT	<i>Ulmus parvifolia</i> 'Todd'	Chinese Elm	D/Ex	10 x 11m	40cm/1.5mH	
					TOTAL	
*D/E = Deciduous/Evergreen			N/Ex = Native/Exotic			

PLANT SCHEDULE #2- RESERVE TREES

SYM	BOTANICAL NAME	COMMON NAME	D/E N/Ex*	HBGHT X WIDTH AT MATURITY	MIN SUPPLY SIZE	QTY
TREES						
Ad	<i>Acacia dealbata</i>	Silver Wattle	E/N	10-15 m x 5-7 m	30cm/1.2mH	COUNCIL APPROVAL
Al	<i>Allocasuarina littoralis</i>	Black Sheoak	E/N	5-12m x 2-6m	30cm/1.2mH	
Bm	<i>Eucalyptus melliodora</i>	Yellow Box	E/N	10-30 x 8-25m	30cm/1.2mH	
Ep	<i>Eucalyptus polyanthemus</i>	Red Box	E/N	7-15 x 5-12	30cm/1.2mH	
Ev	<i>Eucalyptus viminalis</i>	Manna Gum	E/N	10-50 x 8-15m	30cm/1.2mH	
					TOTAL	
N/Ex = Native/Exotic						

PLANT SCHEDULE #3- DOWNS ROAD RESERVE SHRUBS

SYM	BOTANICAL NAME	COMMON NAME	D/E N/Ex*	HEIGHT X WIDTH AT MATURITY	MIN SUPPLY	QTY
SHRUBS						
Aa	<i>Acacia acinacea</i>	Gold Dust Wattle	E/N	1.5-2 x 2-4 m	140mm pot	COUNCIL APPROVAL
Cg	<i>Correa glabra</i>	Rock Correa	E/N	1.2 x 1.2m	140mm pot	
Cr	<i>Correa reflexa</i>	Common Correa	E/N	1 x 1 m	140mm pot	
Go	<i>Goodenia ovata</i>	Hop Goodenia	E/N	1 x 1.5m	140mm pot	
Me	<i>Melaleuca ericifolia</i>	Sw amp Paperbark	E/N	4-9 x 2-6m	50mm tube	
					TOTAL	
N/Ex = Native/Exotic						

SPECIFICATION NOTES

Retention of Site Topsoil

Prior to the commencement of site works the builder is to scrape the site topsoil and preserve it for later use in naturestrips and tree planting areas. Builders' rubble and any other matter deleterious to plant growth (e.g. large rocks) shall be removed from the site of new plantings.

Reinstated site topsoil is to be used for new naturestrips and tree planting areas throughout the site. If an insufficient quantity is available, then imported topsoil with the following characteristics may be used. Imported topsoil is to be free of weeds, rubble and other materials deleterious to plant growth and is to be of a medium texture (sandy loam) with a pH of 6.0-7.0. It is to be free of silt and non-hydrophobic. It is imperative that site topsoil be used in tree planting bays to help reduce the risk of root girdling and subsequent tree failure. Top soil is to be laid over a prepared sub-base which has had any materials deleterious to plant growth (e.g. rubble and large rocks) removed. This soil is then to be spread to the appropriate depth and cultivated into the existing site soil to a minimum depth of 150mm. Imported top soil is to be lightly and uniformly compacted in 100mm layers to a minimum depth of 100mm on new naturestrips areas and 450mm in tree planting areas.

Planting

Planting shall be carried out using accepted horticultural practices with all plants conforming to the species, size and quantities indicated on the Landscape Plan and Plant Schedule. Plants shall be thoroughly soaked through immersion in water prior to planting and if the planting soil is very dry then the planting hole is also to be filled with water and allowed to drain completely.

All plants shall be appropriately hardened off in the nursery. Use plants with the following characteristics: Large healthy root systems with no evidence of root curl or pot bound restriction or damage, vigorous, well established, free from disease and pests and of good form, consistent with the species or variety.

Semi-advanced tree planting holes are to be the same depth as the rootball and 2-3 times its diameter, with the top of the rootball being at grade.

A 75mm high berm is to be constructed at edge of root-ball to hold water. All plants are to be thoroughly watered after planting and slow release fertiliser added at the quantities specified by the manufacturer.

Weed Removal

All weeds shall be thoroughly removed. All vegetative material, including roots and rhizomes of non-woody perennials and woody suckering weeds, is to be removed or appropriately controlled using chemical means. The stumps of non-suckering woody perennials are to be stump ground. All vegetative material shall be appropriately disposed of off site in a manner which will not allow their re-establishment elsewhere. Any chemical controls are to be used in accordance with manufacturer's instructions and standard occupational health and safety procedures.

Care must be taken to ensure that all trees to be retained are not damaged during weed removal. This also implies that any herbicides used are suitable for use around the vegetation to be retained.

Hydro-mulched Lawn

Thoroughly eradicate weeds prior to the installation of lawn seed. This is to be done by approved methods such as manual removal, non-residual systemic or knock-down herbicides.

Hydroseed mix is to be of a ratio of 70% Kikuyu, 15% Ryegrass & 15% Tall Fescue. Pre-treat seed for Hydro-mulching no more than 24 hours prior to installation in accordance with accepted standards as prescribed to achieve the intended application method. All appropriate inoculants are to be used as required to achieve maximum germination and survival of lawn seed. Material slurry is to be formed in a purpose-made mechanical mixer. Seed, fertiliser, cellulose binder and water are to be incorporated to form a mix suitable for hydraulic application. Topsoil is to be moistened to its full depth prior to the application of the slurry, which is to be applied using high pressure pumping equipment operated by a trained professional. A thoroughly mixed supply of slurry is to be spread under pressure in a manner which achieves even distribution. The Hydro-mulched area is to be irrigated immediately following sowing, either by hand or through an irrigation system, and is to continue to be irrigated until grass is fully established. Any areas of lawn which have failed to germinate (achieve an evenly green 95% covering of a consistent height) are to be re-seeded within one month of original sowing date.

Gravel Path Surface

Gravel is to be installed where shown comprising of a 50mm layer of gravel (Tuscan Toppings or similar) over a base course of 75mm deep gently compacted Fine Crushed Rock. Each layer, including the subgrade is to be appropriately compacted.

Timber Edges

Provide 75 x 25mm treated pine edges to all borders between gravel mulch paths and garden beds using 75x25x300mm long treated pine stakes at 1200mm maximum centres. An additional stake is to be provided at joins in the plinth.

Timber Post & Cable Fence

Timber Post & Cable fence to property boundary of Conservation Reserve and Crown Land & Public Reserves. Posts to be max 3 meters apart.

Rabbit Proof Fence

Rabbit Proof Fence setback 600mm from Post and Wire Fence. 1,050mm width; 40mm mesh diameter; and 1.4mm wire diameter rabbit-proof netting. Support fence to withstand stock or native animals. Rabbit netting fixed so that it reaches at least 900mm above the ground.

Netting buried (to 150mm depth) or laid down and secured with pegs, rocks or timber.

Heavy Duty Maintenance Access Gate

Gate to be retrofitted with Rabbit Proof mesh and pegged down rather than buried.

Landscape Maintenance Period

The landscaping shown on the approved plans must be maintained over two summers to the satisfaction of the Responsible Authority and used for no other purpose. During this time, any dead, diseased or damaged plants are to be replaced.



Stormwater Management Plan

135-165 Barry Road, Thomastown

Sim Development Pty Ltd

February 2017

RP001 Rev03

TGM Group Pty Ltd

135-165 Barry Road, Thomastown

Stormwater Management Plan

RP001 Rev03

February 2017

Document Status

Version	Document type	Reviewed by	Checked by	Date Issued
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Rev02	Report	B.Vocale	A. Kumar	18/08/2016
Rev03	Report	B. Vocale	A. Kumar	27/02/2017

Project Details

Project Name:	135-165 Barry Road, Thomastown
Client	Sim Development Pty Ltd
Client Project Manager	Joe Lynch
Authors	Joe Lynch
TGM Reference:	RP001 Rev03

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Appendices

Appendix A – Detention Storage

Appendix B – Calculations for Pre- Development flow rate, Post Development flow rate and on-site detention sizing

- Appendix B0 Drainage design criteria
- Appendix B1 Pre-Development Flows
- Appendix B2 Catchment 1 Detention & Storage
- Appendix B3 Catchment 2 Detention & Storage

Appendix C – Wetlands Options

- Appendix C1 option 1
- Appendix C2 Option 2

1 Introduction

This report outlines the stormwater management plan for the proposed 152 lot subdivision at 135-165 Barry Road, Thomastown. The site is currently a semi-rural undeveloped property which is accessed via Barry Road, Cardiff Street and Main Road as per the below.



Figure 1– Site Locality Melway Reference 8 B6

The purpose of this assessment is to identify the necessary infrastructure required to ensure the development adheres to City of Whittlesea Planning Scheme Stormwater Management Plan. The basis of the report accords with Melbourne Water engineering design criteria for land development projects. Conceptual design outlines the proposed drainage system and method of conveyance of rainfall runoff from all contributing catchments. A preliminary estimate of the onsite detention storage required to restrict stormwater discharge to a pre-development rate has been prepared. It also includes discussions on the best method to provide water quality treatment necessary to ensure all best practice pollutant removal targets.

For the purposes of this investigation all calculations have been performed assuming fully developed catchments. The calculations are representative of the ultimate development for the entire Barry Road Thomastown precinct. As such, the total detention volume and water quality calculations provide an estimation of the land required to treat the full contributing catchment.

The proposed stormwater management option described in this report is presented in the Stormwater Management Plan; Appendix A.

2 Existing Conditions

The subject site is approximately 11.81 hectares in area (includes Downs Road Reserve) and has minimal natural tree coverage as shown in Figure 2. There is a moderate variation in height across the site with natural ground levels ranging from approximately 120 m AHD in the north-west area of the site to 111 m AHD at the southern end of the site. The site is bordered by Hume Freeway and Galada Tamboore Pathway to the west. To the north is City of Whittlesea Public Gardens while to the east is existing dwellings and RGC Cook Reserve. Finally to the south the site tapers to Main Road. A high voltage electricity easement and overhead powerlines pass through the site and extend along the eastern border of the site. A high pressure gas supply main also runs through the site in a north-south direction.

Very little evidence of any existing drainage systems exists with the northern section draining towards the RGC Cook Reserve, while the balance of the surface runoff generally flowing south towards the freeway reserve. There is no external catchments runoff that effects the development site.



Figure 2– Photo of site looking south from Cardiff Street

3 Stormwater Quantity - Hydrology

The natural topography of the site has two main drainage catchments. To the north of the site is Catchment 1 which is draining to RGC Cook reserve. The catchment area is 4.73 hectares as shown on the Stormwater Management Plan (Appendix A). It is unclear at this stage whether the connection from the proposed development shall connect to the Melbourne Water drainage asset or City of Whittlesea drainage asset. At the time of this report TGM are seeking further existing information on the Melbourne Water main drain. The second catchment (Catchment 2) is 7.08 hectares and is likely to be draining via underground drains directly into Central Creek. This route is subject to existing land owner approval.

Council advised the Permissible Site Discharge (PSD) shall be based on the pre-development coefficient and a rainfall intensity for a 1 in 5 year ARI. On-site detention shall be provided for a 1 in 10 year ARI based on a post-development flow rate in accordance with Council guidelines for Urban development and using the IFD chart for Thomastown (refer to Appendix B). These calculations were applied to determine pre-developed and post-developed discharge rates for the contributing catchment. Detailed calculations are shown in Appendix B.

Table 1. Peak Discharge

			Pre-development	Post-development
			5 yr ARI	10 yr ARI
Peak No.1 (m ³ /s)	Discharge	Catchment	0.300	0.544
Peak No.2 (m ³ /s)	Discharge	Catchment	0.325	0.715

Development of the site increases the total impervious surface and therefore peak runoff generated within the catchment. In order to ensure there is no adverse downstream affect from increased discharge rates a number of mitigation options exist which allow stormwater to be temporarily detained onsite and released at an equivalent pre-developed rate.

A comparison of the pre-development and post-development discharge rates was performed to establish a preliminary estimate of the detention required for the site. (For the purpose of sizing the on-site detentions for the ultimate development of the site an average run off coefficient was adopted for each catchment). Calculations were performed in accordance with Australian Rainfall & Runoff Standards. Refer the calculation spreadsheet in Appendix B for required detention storage volume calculations.

4 Stormwater Quantity – Hydraulic Design

The Stormwater Management Plan (refer Appendix A) outlines the proposed major and minor conveyance systems for the proposed development. The expected time of concentration for each contributing catchment has been calculated in accordance with Melbourne Water hydraulic design guidelines. Assumptions that were adopted for the time of concentration calculation included an initial time of five minutes, and a pipe travel velocity of 0.9 m/s.

All post-development major stormwater flows from a 1% AEP storm event are conveyed to RGC Reserve for Catchment 1 and for Catchment 2, directed southwards (i.e. between the freeway reserve and the rear of Ostia Court allotments towards Central Creek), and is subject to landowner consent.

Preliminary detention sizing calculated the required on site storage volume for the respective catchments as shown on the stormwater management plan (Detention Storage). Given the proposed development layout it is proposed to provide underground storage in the form of concrete box culverts where located under trafficable areas or other approved systems such as modular crate or chamber systems that are commonly used for stormwater detention systems.

However, where the WSUD option is adopted, the sedimentation pond and wetlands have been designed to cater for the storage capacity.



Figure 3– Photo of an underground detention system during construction

5 Stormwater Quality

The proposed subdivisional layout provide limited opportunity to implement stormwater quality treatment measures, as required by Schedule 35 of the Development Plan Overlay (DPO35 - Barry Road Thomastown Development Plan) and Clause 56 of the Whittlesea Planning Scheme.

Whittlesea City Council (WCC) advised they will not support 100% stormwater offset contribution, and that some stormwater quality treatment measures must be provided as part of this development.

Following meeting with Council, several alternative locations of wetlands were proposed as follows:

Catchment 1

Located along the north-east corner of the site, discharge directly into the existing Melbourne Water underground drain and subject to Melbourne Water approval (refer to Appendix C).

Catchment 2

Two options proposed as follows:

Option 1: Located along crown land north of Central Creek, and bounded on the west by the freeway reserve and on the east by residential properties. This option is subject to land owners approval (refer to Appendix C).

Option 2: Located within crown reserve between the freeway reserve and development site (refer to Appendix C). This proposal is also subject to land owners approval.

The stormwater quality management objectives have been assessed by measuring the pollutant removal efficiency of the proposed stormwater treatment components. Refer to Table 4.

6 MUSIC Modelling

Sizing of a wetland system to meet stormwater quality 'best practice' standards was analysed using MUSIC software Version 6.2. The MUSIC model network is shown in Figure 4 below.

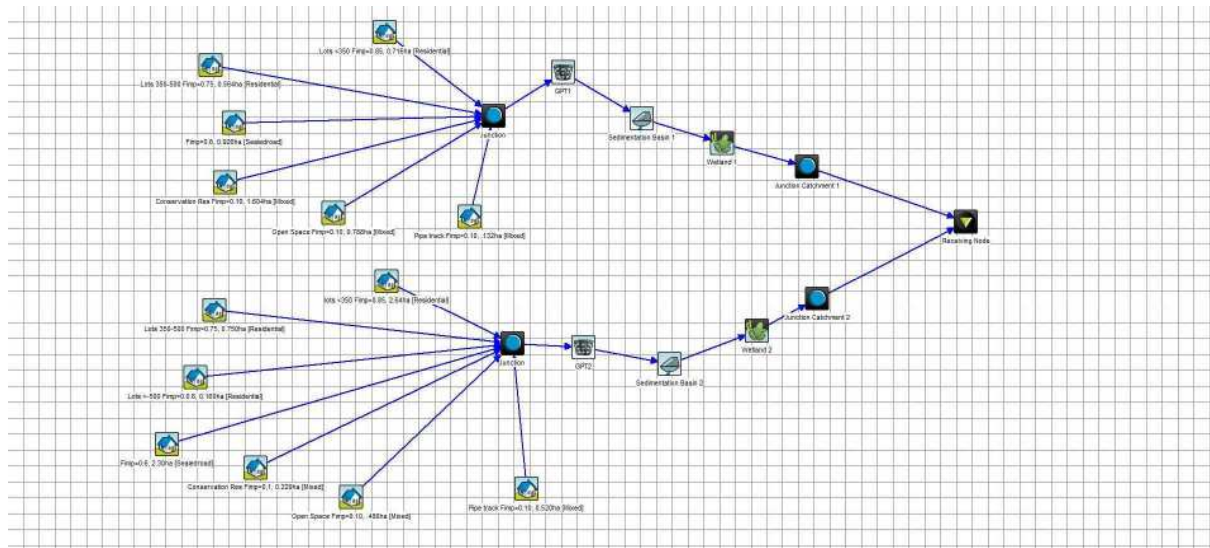


Figure 4– MUSIC Model

The following land use and catchment characteristics were adopted.

Table 2. Catchment Details

Land Use	Fraction Impervious	Area (Ha)	
		Catchment 1	Catchment 2
Residential <350m ²	0.85	0.716	2.640
Residential 350-500m ²	0.75	0.564	0.750
Residential >500m ²	0.60	0.00	0.169
Sealed Road	0.60	0.926	2.300
Conservation Reserve	0.25	1.604	0.229
Open Space	0.25	0.788	0.480
Pipe Track	0.25	0.132	0.520

The modelled characteristics for the Wetlands are as follows:

Table 3. Treatment Device

Treatment Device	Catchment 1 Surface Area (m ²)	Catchment 2 Surface Area (m ²)
Sedimentation Pond	250	400
Macrophyte Zone	330	1800

The treatment results are as follows:

Table 4. Modelled Results

Criteria	Catchment 1			Catchment 2		
	Sources	Residual Load	Reduction %	Sources	Residual Load	Reduction %
Flow (ML/yr)	14.4	13.8	4.2	28.0	25.5	9.1
Total Suspended Solids (kg/yr)	2940	494	83.2	6460	819	87.3
Total Phosphorus (kg/yr)	5.62	1.86	67.0	11.0	2.9	74.1
Total Nitrogen (kg/yr)	34.9	21.5	38.6	63.4	34.8	45.0
Gross Pollutants (kg/yr)	422	0	100	985	0	100

As shown in Table 4 above, the current best practice requirements of 80% TSS, 45% TP, 45% TN and 70% pollutants can be met by the proposed sedimentation pond and wetlands system for Catchment 2.

For Catchment 1 there is limited land that is conducive to wetlands or bio-retention system and therefore does not meet the current best practice requirements.

Therefore it is recommended stormwater contributions are paid by the developer to reduce the impacts of stormwater pollution from urban development. Developers pay a contribution to the water authority (Melbourne Water) for necessary stormwater management works. Contributions are paid as development occurs.

7 Conclusion

The proposed 152 lot subdivision at 135-165 Barry Road, Thomastown shall include a pipe system to convey all minor stormwater flow. All gap flows shall be conveyed overland via the proposed road network and discharged to RGC Cook Reserve for Catchment 1 and Central Creek for Catchment 2.

The report shows that the proposed underground detention storage satisfies Council requirements to retard the Post-development flow (10 year ARI) back to the 5 year ARI Pre-development flow before entering the downstream drainage system.

However, in the case where the WSUD option is adopted, the sedimentation pond and wetlands have the capacity to retard the Post-development flow (10 year ARI) back to the 5 year ARI Pre-development flow. Therefore, there will be no need for on-site underground retention.

Altogether, the proposed development does not provide opportunity to implement on-site stormwater quality treatment measures. Therefore it is proposed to contribute financially with developer funded stormwater offer contributions. The wetland concept design shown in this report addresses Council requirements that stormwater quality treatment measures must be provided to meet current best practice requirements. The location of the wetlands is subject to further negotiations with current land owners.

Appendix A – Detention Storage



Appendix B – Calculations for Pre-development flow rate, Post-development flow rate and on-site detention sizing

Appendix B0 Drainage Design Criteria

Drainage Design Criteria

Table 5. Intensity Frequency Duration Values – For Thomastown

2 Year Average Recurrence			50 Year Average Recurrence		
1 Hour Duration	12 Hour Duration	72 Hour Duration	1 Hour Duration	12 Hour Duration	72 Hour Duration
19.47	3.99	1.11	39.84	7.12	2.24

Average Regional Skewness (G) = 0.34

Geographical Factor (F2) = 4.29

Geographical Factor (F50) = 14.96

Permissible Site Discharge (PSD) (Pre-development)

- Base Case Site Fraction Impervious ($f=0.35$)
- Average Recurrence Interval (ARI) = 5 years
- 10 year ARI, 1 hour intensity (I_{10}) = 2.94mm/hr
- Pervious Area Run Off Co-efficient (C'_{10}) = 0.159
- 10 year ARI Run Off Co-efficient (C_{10}) = 0.42
- 5 year ARI Run Off Co-efficient (C_5) = 0.40

Table 6. Site Storage Requirement (Post-development)

Land Use		Fraction Impervious	Catchment 1		Catchment 2	
Zone	Code		Area (ha)	Ae (ha)	Area (ha)	Ae (ha)
Medium Densities 450-600m ²	R2Z	0.6	0.092	0.055	0.26	0.156
High Densities <450m ²	R2Z	0.8	1.187	0.950	3.30	2.640
Road	RDZ2	0.6	0.927	0.556	2.300	1.380
Conservation	PCR2	0.25	1.604	0.401	0.220	0.055
Reserve	PPR2	0.25	0.920	0.230	1.000	0.250
		TOTAL	4.730	2.192	7.08	4.481

	Catchment 1	Catchment 2
Catchment Area (ha)	4.73	7.08
Ae (ha)	2.192	4.481
Fraction Impervious (f)	0.46	0.63
C' ₁₀	0.159	0.159
C ₁₀	0.50	0.63
C ₅	0.48	0.60
C ₁₀₀	0.60	0.75

Appendix B1 Pre-Development Flows

DRAINAGE COMPUTATIONS

Pre-Development Flows

Ref: 13558-201
Project: 135-165 Barry Road, Thomastown
Date: 05-May-16
Designer: J.Lynch
Revision: C

Reference -

Australian Rainfall and Runoff
Chapter 14

TGM Group Pty Ltd
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Engineers, Surveyors & Planners



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CATCHMENT no. 1

Gross Catchment Area	A	4.730	ha
Coefficient of Runoff	C _r	0.4	Pre-development site
Equivalent Area	A _e	1.892	ha
Average Recurrence Interval	ARI	5	years
Time of Concentration	t _c	14.0	minutes
Rainfall Intensity at t _c	I _c	57.1	mm / hr Whittlesea IFD Chart
Pre- Development Flow	Q _{pre}	0.300	m ³ / s

CATCHMENT no.2

Gross Catchment Area	A	7.08	ha
Coefficient of Runoff	C _r	0.4	Pre-development site
Equivalent Area	A _e	2.832	ha
Average Recurrence Interval	ARI	5	years
Time of Concentration	t _c	26.0	minutes
Rainfall Intensity at t _c	I _c	41.4	mm / hr Whittlesea IFD Chart
Pre- Development Flow	Q _{pre}	0.325	m ³ / s (ADOPT 0.186m ³ /s)

Appendix B2 Catchment 1 Detention & Storage

Catchment 1 Detention & Storage.xls

16/08/2016



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PROJECT : Barry Road Thomastown
JOB NO.:

REGION : Thomastown

Designed : AK _____ Date : May-16, _____ Checked : _____ Date : _____

DETENTION - RATIONAL METHOD CATCHMENT 1

Gross Catchment Area	A	4.730	ha
Coefficient of Runoff	C_r	0.50	
Equivalent Area	A_s	2.365	ha
Average Recurrence Interval	ARI	10	years
Time of Concentration	t_c	9.0	minutes
Rainfall Intensity at t_c	I_c	82.8	mm / hr
{ calculated	Q_c	0.544	m^3 / s
Peak Inflow { inflow	Q_{inflow}		m^3 / s
{ TOTAL	Q_p	0.544	m^3 / s
Allowable Outflow	Q_o	0.300	m^3 / s
Storm Duration Interval	t_d	1	minutes
Number of (Integer) Intervals	N	20	

Max Storage Volume = 133.8						
n	t	I	Q_i	V_i	V_o	V_s
	minutes	mm / hr	m^3 / s	m^3	m^3	m^3
0	9.0	82.8	0.544	293.8	162.0	131.8
1	10.0	79.0	0.519	311.2	177.8	133.4
2	11.0	75.5	0.496	327.6	193.7	133.8
3	12.0	72.5	0.476	342.9	209.6	133.3
4	13.0	69.7	0.458	357.4	225.6	131.8
5	14.0	67.3	0.442	371.1	241.7	129.5
6	15.0	65.0	0.427	384.2	257.7	126.4
7	16.0	62.9	0.413	396.6	273.9	122.8
8	17.0	61.0	0.401	408.5	290.0	118.5
9	18.0	59.2	0.389	419.9	306.2	113.7
10	19.0	57.5	0.378	430.8	322.4	108.4
11	20.0	56.0	0.368	441.3	338.6	102.7
12	21.0	54.5	0.358	451.4	354.8	96.6
13	22.0	53.2	0.349	461.2	371.1	90.0
14	23.0	51.9	0.341	470.6	387.4	83.2
15	24.0	50.7	0.333	479.7	403.7	75.9
16	25.0	49.6	0.326	488.5	420.0	68.4
17	26.0	48.5	0.319	497.0	436.4	60.6
18	27.0	47.5	0.312	505.3	452.8	52.5
19	28.0	46.5	0.306	513.3	469.1	44.2
20	29.0	45.6	0.300	521.1	485.5	35.6

Appendix B3 Catchment 2 Detention & Storage

Catchment 2 Detention & Storage.xls

23/02/2017



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REGION : Thomastown

Designed : AK Date : May-16 Checked : _____ Date : _____

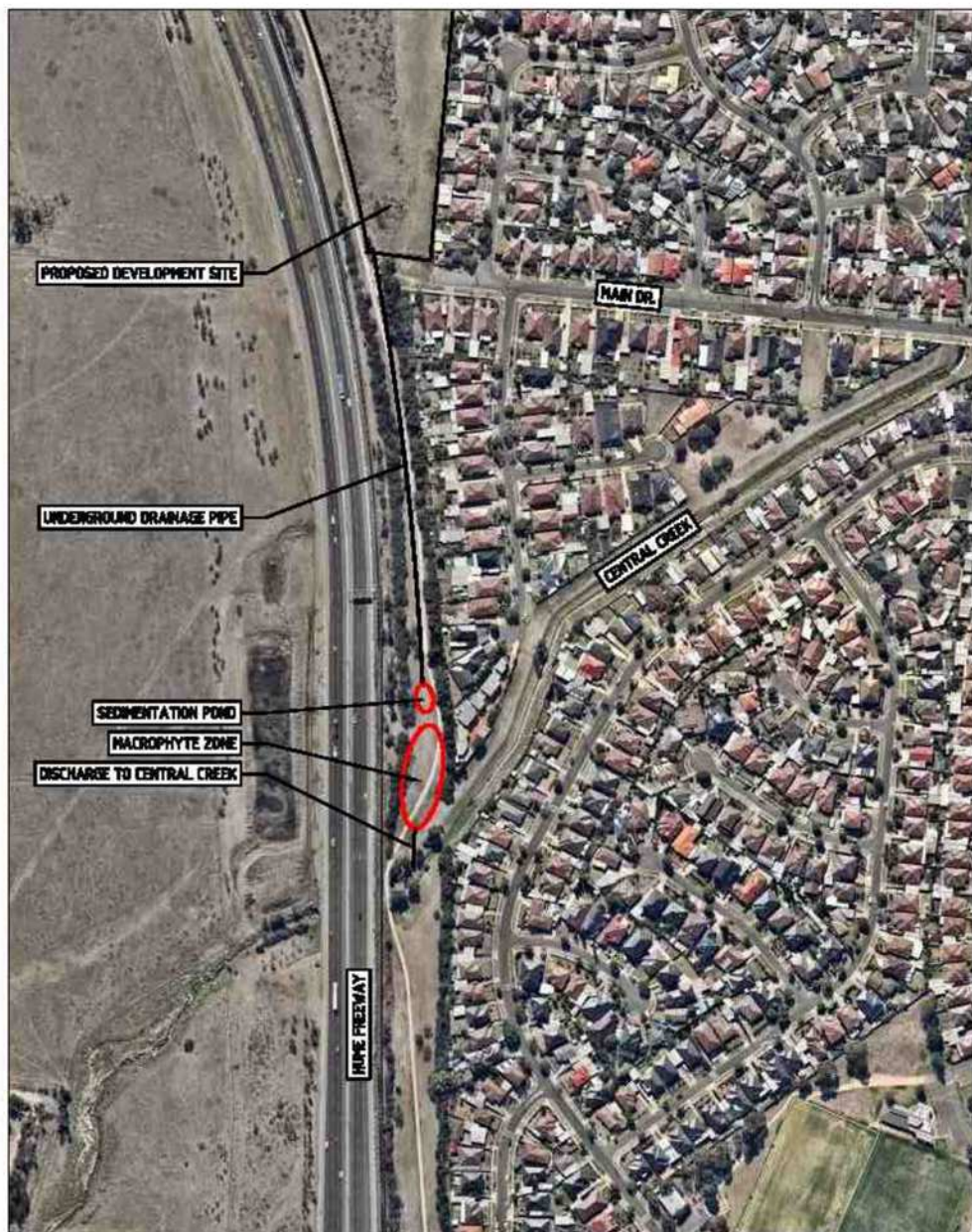
DETENTION - RATIONAL METHOD CATCHMENT 2

Gross Catchment Area	A	7.080	ha
Coefficient of Runoff	C _r	0.63	
Equivalent Area	A _s	4.460	ha
Average Recurrence Interval	ARI	10	years
Time of Concentration	t _c	19.0	minutes
Rainfall Intensity at t _c	I _c	57.5	mm / hr
{ calculated	Q _c	0.713	m ³ / s
Peak Inflow { inflow	Q _{inflow}		m ³ / s
{ TOTAL	Q _p	0.713	m ³ / s
Allowable Outflow	Q _o	0.325	m ³ / s
Storm Duration Interval	t _d	2	minutes
Number of (Integer) Intervals	N	20	

Max Storage Volume = 448.1						
n	t	I	Q _i	V _i	V _o	V _s
	minutes	mm / hr	m ³ / s	m ³	m ³	m ³
0	19.0	57.5	0.713	812.5	370.5	442.0
1	21.0	54.5	0.676	851.4	404.9	446.5
2	23.0	51.9	0.643	887.5	439.4	448.1
3	25.0	49.6	0.614	921.3	473.9	447.3
4	27.0	47.5	0.588	953.0	508.6	444.3
5	29.0	45.6	0.565	982.9	543.4	439.5
6	31.0	43.9	0.544	1011.2	578.2	432.9
7	33.0	42.3	0.524	1038.0	613.1	424.9
8	35.0	40.9	0.506	1063.6	648.1	415.5
9	37.0	39.6	0.490	1088.0	683.1	404.9
10	39.0	38.3	0.475	1111.3	718.2	393.1
11	41.0	37.2	0.461	1133.7	753.3	380.4
12	43.0	36.1	0.448	1155.2	788.5	366.7
13	45.0	35.1	0.436	1175.9	823.7	352.1
14	47.0	34.2	0.424	1195.8	859.0	336.8
15	49.0	33.4	0.413	1215.0	894.3	320.7
16	51.0	32.5	0.403	1233.6	929.6	304.0
17	53.0	31.8	0.394	1251.6	965.0	286.6
18	55.0	31.0	0.385	1269.0	1000.4	268.6
19	57.0	30.3	0.376	1285.9	1035.8	250.1
20	59.0	29.7	0.368	1302.3	1071.3	231.0

Appendix C – Wetlands Options

Appendix C1 Wetland Option 1



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APPENDIX C1
WETLAND OPTION 1

Appendix C1 Wetland Option 2

