

Appendix B Landscape Management Plan

LANDSCAPE MANAGEMENT PLAN

Tract



SYDNEY WATER UPPER SOUTH CREEK ADVANCED WATER RECYCLING CENTRE

Prepared for John Holland

Acknowledgement of Country

We pay our respects to the Traditional Custodians of Country throughout Australia, their Elders and ancestors, recognising their rich heritage and enduring connection to Country and acknowledging the ongoing sovereignty of all Aboriginal and Torres Strait Islander Nations.

We recognise the profound connection to land, waters, sky and community of the First Nations peoples, with continuing cultures that are among the oldest in human history. We recognise that they are skilled land shapers and place makers, with a deep and rich knowledge of this land which they have cared for, protected and balanced for millennia.

Our Country, 2022

88 x 119 cm Acrylic on canvas

Original artwork by

Alfred Carter

Gunaikurnai

Quality Assurance

LANDSCAPE MANAGEMENT PLAN
SYDNEY WATER UPPER SOUTH CREEK ADVANCED WATER RECYCLING CENTRE

Project Number
221-0062-00

Document Number
AWRC-TRA-PLN-DES-0003

Revisions

No.	Date	Description	Prepared By	Reviewed By	Project Principal
00	04/04/2024	Draft for Review	Julie Lee	Matthew Easton	Julie Lee
01	16/07/2024	Draft for Review	Eliza Fagan	Julie Lee	Julie Lee
02	17/07/2024	Final Issue	Eliza Fagan	Julie Lee	Julie Lee
03	16/09/2024	Revised following Sydney Water review	Alyce Harrington Mark Trethewy	Julie Lee	Julie Lee
04	04/10/2024	Revised following Sydney Water review and issue to DPHI	Alyce Harrington Mark Trethewy	Julie Lee	Julie Lee

Contents

1	Introduction	8
1.1	Background	8
1.2	Purpose and Scope	10
1.2.1	Where this Plan Applies	11
1.3	Vision and Principles	12
1.4	Legislation, standards, guidelines and other references	13
1.5	Climate Positive Design	16
1.6	Landscape Management Objectives	16
1.7	References	18
2	General Site Conditions	19
2.1	Soil	19
2.2	Vegetation Communities	19
3	Landscape Management Zones	22
3.1	Zone 1: Operations Zone (generally within fence line)	22
3.2	Zone 2: Wianamatta South Creek (Vegetation Management Plan)	22
3.3	Zone 3: Potential Future Greenspace including access paths, road and fire trails	23
3.4	Proposed Planting Species	23
4	Specific Landscape Management Activities	24
4.1	Introduction	24
4.2	General Maintenance	25
4.3	Fertilising, composting and mulching	26
4.4	Mowing	26
4.5	Removal of Dead or Dying Plant Material and Pruning	26
4.6	Replacement Plantings (including tree staking)	28

4.7	Weed Management	28
4.8	Tree Planting in Grassed Areas	29
4.9	Rubbish Removal	30
4.10	Graffiti and Vandalism Repairs	30
4.11	Fungal and Insect Attack	30
4.12	Pest Control	30
4.13	Watering	30
4.14	Management of permanent stockpiles	31
4.15	Parabolic antennae landscape cross array	32
4.16	Summary of Activities	33
5	Protective Measures	37
5.1	Bushfire Protection Actions	37
5.2	Wildlife Strike Mitigation	39
5.2.1	Species selection	40
5.2.2	Density of vegetation cover	40
5.2.3	Detention and Bioretention Basins	40
6	Monitoring and Reporting	41
6.1	Monitoring Procedures and Performance Indicators	41
7	Performance criteria	42
8	Adaptive Management	49
	Appendices	50
	Appendix A Plant Species	
	Appendix B Solar Farm Plans	
	Appendix C Landscape Design Drawings	
	Appendix D Weed Mapping	

Figures

Figure 1 Local Context Plan (Tract)	8
Figure 2 Stage 1 Plan	9
Figure 3 Stage 1 Render	9
Figure 4 Staged Development of AWRC site	10
Figure 5 Landscape Management Zones	11
Figure 6 PCTs present at the AWRC site prior to construction (Source: USC EIS, Appendix J Biodiversity Assessment Report, Figure 5.17 (Biosis, 2021))	20
Figure 7 Asset Protection Zones	38
Figure 8 Wildlife Buffer Zone Map, adapted from State environment Planning Policy	39

Tables

Table 1: Landscape Management Principles	13
Table 2: Conditions of Approval	14
Table 3 Vegetation communities	21
Table 4 Zone 1 and 3 General Maintenance Requirements	25
Table 5 Fertilising and Pruning Standards	27
Table 6 Watering Program for Zone 1 and 3	31
Table 7 Summary of Maintenance Activities	Error! Bookmark not defined.
Table 8 Summary of Activities Related to grassland areas	Error! Bookmark not defined.
Table 9 Summary of Activities Related to garden beds	Error! Bookmark not defined.
Table 10 Landscape Performance Criteria	43
Table 11 Landscape Management Actions	46

1 Introduction

1.1 Background

This Landscape Management Plan (LMP) has been prepared by Tract Consultants for John Holland Group (JHG) on behalf of Sydney Water (SW) for the Upper South Creek Advanced Water Recycling Centre (AWRC) on Dharug Country. The AWRC is located at the confluence of the Wianamatta South Creek and Kemps Creek and is within an open space and environmental corridor. It is directly below Western Sydney Airport's flight path and will be bordered to the south by the M12 Motorway which is currently under construction by another contractor. Refer Figure 1 Local Context Plan, Figure 2 Stage 1 Plan, and Figure 3 Stage 1 Render.

Sydney Water will operate the wastewater infrastructure to service the southwest and Western Sydney Aerotropolis Growth areas. Through treating wastewater, the AWRC will produce high quality water suitable for a wide range of non-drinking uses in homes, various industrial services, businesses, agriculture, and public open spaces.



Figure 1 Local Context Plan (Tract)



Figure 2 Stage 1 Plan



Figure 3 Stage 1 Render

1.2 Purpose and Scope

The AWRC has been planned to be implemented in stages to grow according to demand. Stage 1 will be completed by 2026 and (of the SSI-8609189 approval scope relevant to this LMP), includes the following:

- construction and operation of a sewage treatment plant at Kemps Creek sized to treat an average dry weather flow of 35ML/day during Stage 1
- construction and operation of the overland flow swale from the plant to Wianamatta South Creek
- the vegetation riparian zone (VRZ) immediately adjacent to Wianamatta South Creek, to the extent of the northern and southern boundaries of the AWRC site.

Collectively, the area subject to construction of the sewage treatment plant and the overland flow swale, are referred to as the AWRC Operational site in this document and is the geographical scope of this Landscape Management Plan (LMP). The purpose of the LMP is to provide a description of the management activities to be undertaken for the long-term care of the environment within the AWRC Operational site. The VRZ is addressed in the Vegetation Management Plan (VMP) (Appendix 1 of the Urban Design and Landscape Plan (UDLP)).

This LMP will be implemented following construction of Stage 1 of the AWRC. The ongoing management of the landscape is fundamental in creating and maintaining a safe environment within the AWRC operational site constraints and establishing a biodiverse environment supporting networked systems through the use of endemic native species.

The LMP identifies post construction activities that ensure design intent and compliance with relevant approvals has been achieved. This LMP documents a standardised approach to the maintenance of landscape plantings and re-vegetation works, both in technique and frequency.

Stage 2 is proposed to be completed by 2035 with the space required for the potential future expansion allowed for within the AWRC Operational site. Outside of the AWRC Operational site and VRZ, is 38 hectares of green space and a potential Circular Economy Zone. Figure 4 provides an indicative representation of the stage development of the AWRC site.

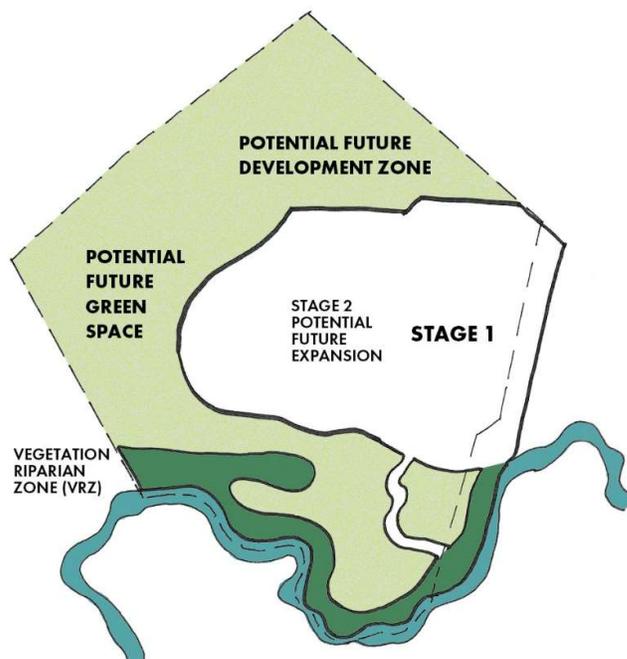


Figure 4 Staged Development of AWRC site

1.2.1 Where this Plan Applies

For clarity and to assist with implementation of the LMP, three distinct landscape management zones have been established as detailed below and are presented in Figure 5.

Zone 1: Operations Zone

The treatment plant zone, access road, fire trails and overland flow swale.

Zone 2: Wianamatta South Creek Zone

The restored areas adjoining Wianamatta South Creek and billabongs, documented in the Vegetation Management Plan (VMP).

Zone 3: Potential Future Greenspace

Future master planning of the Greenspace and the Circular Economy Zone is proposed, and the landscape management of these areas will need to be reevaluated should any development occur.

This LMP applies to Zone 1 and Zone 3 (to the extent of maintaining walking access to riparian areas in Zone 2). Use of this zoning is also adopted throughout the plan to assist with the identification of vegetation zones, landscape management requirements, and maintenance requirements. Section 3 provides additional detail on each of the landscape management zones beyond what is visually presented in Figure 5 below.

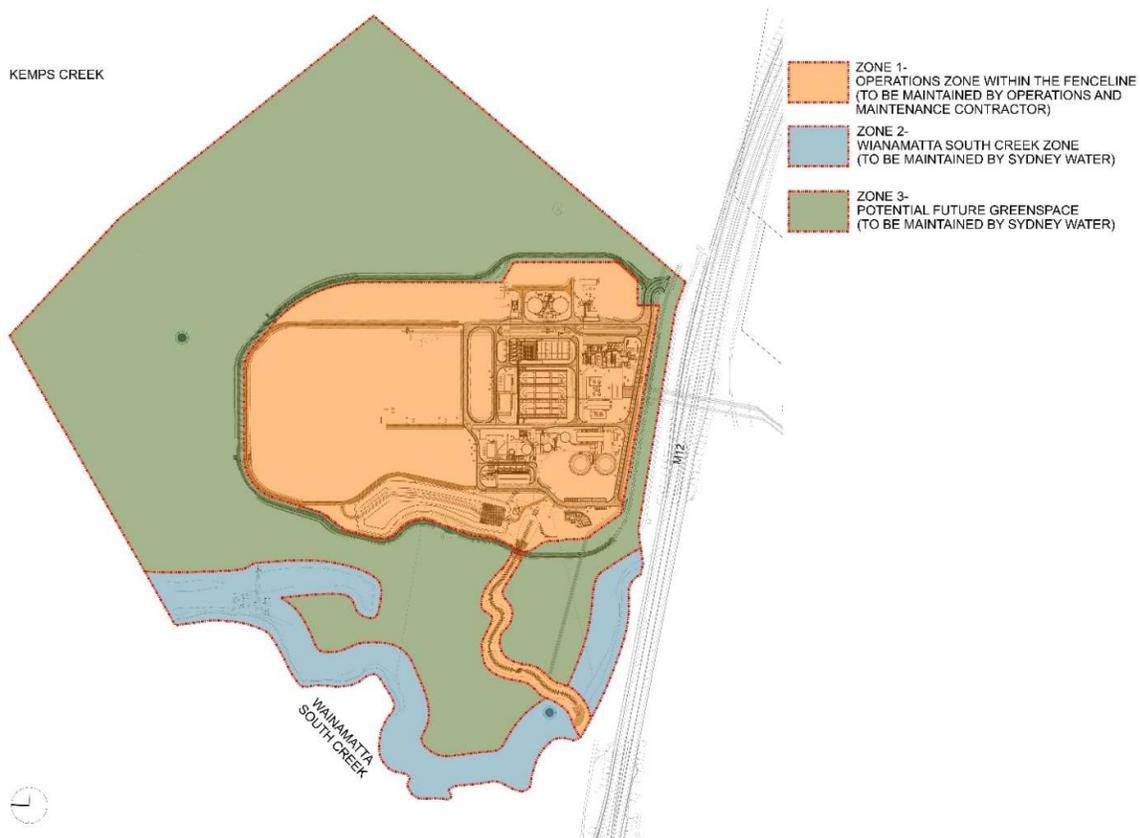


Figure 5 Landscape Management Zones

1.3 Vision and Principles

The creation of high quality, robust and sustainable urban design underpins the integration of the site's development with the existing landscape and adjoining waterways. The following outlines the vision and key principles as required as part of the urban and landscape outcomes that are described in the project Urban Design and Landscape plan.

The project vision is:

Upper South creek AWRC is a place where the connection of people to the land, water and sky are appreciated and deepened, bringing community together to restore, discover, meet and enjoy.

Landscape Management Principles incorporated into this LMP are expressed in the USC AWRC Urban Design and Landscape Plan – Stage 1 (Tract 2023). How they are explored in this plan is detailed in Table 1: Landscape Management Principles.

Table 1 Landscape Management Principles

	Principle	LMP Reference /comment
1	Minimise environmental impacts that may result from landscape management activities and utilise environmentally sustainable practices.	Refer to Section 4
2	Enhance and promote the Cumberland Plain character of the site.	Plant species Appendix A
3	For new and replacement plantings, use of endemic plant species.	Plant species Appendix A
4	Provide a safe environment, minimising potential risks to people, buildings, and property.	Sections 5.1, 5.2, and specific landscape management activities in Section 4.
5	Continue to incorporate water sensitive urban design (WSUD) techniques to manage stormwater, slow runoff, recharge groundwater, store for re-use and to passively irrigate landscape areas.	Constructed bioretention and retention basins and grass swales adjoining roads.
6	Apply best practice bush regeneration in revegetated areas and best practice landscape maintenance in the Treatment Plant zone.	Documented in Section 4 Specific Landscape Maintenance Activities.
7	Provide a high-quality path network that provides for safe, equitable movement.	To be considered in the development of the Greenspace Masterplan.
8	Ensure that all new works comply with the requirements of AS 1428 Access and Mobility Design.	Appendix C
9	Target noxious weeds and feral animals using integrated pest management approaches	Sections 4.7, 4.12.
10	Provide opportunities for Aboriginal, environmental, and informal learning and study in the landscape.	To be considered in the development of the Greenspace Masterplan.
11	Maintain high quality outdoor spaces and public interfaces.	Visitors will access the Administration Building precinct & this area is the public interface for this project.
13	Manage bushfire risk in accordance with recognised guidelines	Section 5.1
14	Manage wildlife hazard risks in accordance with the Wildlife Management Plan.	Section 5.2
15	Provide opportunities for greater community involvement.	To be considered in the development of the Greenspace Masterplan.
16	Appropriately fund, plan and manage landscape maintenance to provide a measurable improvement of the AWRC landscape appearance, safety and amenity.	This LMP

1.4 Legislation, standards, guidelines and other references

The Minister of Planning gave the works consent under Section 5.19 of the Environmental Planning and Assessment Act 1979. The CSSI-8609189 Minister's Conditions of Approval specific to the project and relevant to this LMP are listed below in Table 2, along with a reference to what stage and where each condition will be addressed within the relevant chapter of the LMP.

Table 2 Conditions of Approval

ID	Condition	Reference in this document
E64	<p>(b) The UDLP (including this LMP) must document how the following matters have been considered in the design and landscaping of the project:</p> <ul style="list-style-type: none"> ○ The requirements of the Wildlife Management Plan under condition E130; 	Section 5.2 Wildlife Strike Mitigation
	<p>(f) The UDLP (including this LMP) must document how the following matters have been considered in the design and landscaping of the project:</p> <ul style="list-style-type: none"> ○ Constraints associated with bushfire, flooding and airport safeguarding; 	<p>Section 5.1 Bushfire Protection Actions Section 5.2 Wildlife Strike Mitigation</p> <p>The Operational zone will be constructed and operated entirely within the 1% AEP flood level. This is reflected in the landscape design drawings presented in Appendix C.</p>
	<p>(g) The UDLP (including this LMP) must document how the following matters have been considered in the design and landscaping of the project:</p> <ul style="list-style-type: none"> ○ Vegetation management that considers the principles of Guidelines for Vegetation Management Plans on Waterfront Lands (NSW Office of Water, DPI 2012) ○ Draft Western Sydney Aerotropolis Riparian Re-vegetation Strategy ○ Riparian Revegetation Strategy (RRS) in Section 4 of the Western Sydney Aerotropolis (initial Precincts) Riparian Corridors Assessment by Sydney Water (December 2021) 	<p>Not applicable to the LMP as the guideline is applicable to vegetation management zones only.</p> <p>The RRS aims to identify strategies for enhancing, protecting, and maintaining waterways, riparian corridors, and water-dependent ecosystems. It aims to stabilise waterways, enhance, and protect native riparian and floodplain ecology and create VRZs that support waterway health and social objectives. The RRS is not applicable to the LMP as the Operational zone is outside of these areas.</p>
	<p>(j) The UDLP (including this LMP) must document how the following matters have been considered in the design and landscaping of the project:</p> <ul style="list-style-type: none"> • Inputs from relevant experts in architecture, landscape architecture, bushfire management, heritage, revegetation, ecology, wildlife 	This condition is addressed in Chapter 1.3 of the Urban Design and Landscape Plan (UDLP) of which the LMP is an appendix of.

ID	Condition	Reference in this document
	hazard management and flooding.	
E65	<p>The UDLP (including this LMP) must include descriptions and visualisations (as appropriate) of:</p> <p>(c) design of the project landform and landscaping elements;</p>	<p>This condition is addressed in Chapters 6.1, 8, 9.1, 10 of the UDLP of which the LMP is an appendix of.</p> <p>Appendix A and C</p>
	<p>(e) details of strategies to rehabilitate, regenerate or revegetate disturbed areas with local native species;</p>	<p>This condition is addressed in Chapter 17 of the UDLP of which the LMP is an appendix of.</p> <p>Appendix C</p>
	<p>(f) management and routine maintenance standards and regimes for design elements and Landscaping work (including adequate watering of plants following planting depending on forecast weather conditions and weed management) to ensure the success of the design and landscape outcomes.</p>	<p>Section 1.6 Climate Positive Design</p> <p>Section 1.7 Landscape Management Objectives</p> <p>Section 3 Landscape Management Zones</p> <p>Section 4 Specific Landscape Management Activities</p>
E66	<p>The ongoing maintenance and operation costs of urban design, open space, landscaping and recreational items and work implemented for the AWRC site as part of this approval remain the Proponent's responsibility until satisfactory arrangements have been put in place for the transfer of the asset to the relevant authority. Before the transfer of assets, the Proponent must maintain items and work to at least the design standards established in the UDLP, required by Condition E65.</p>	<p>Section 4 Specific Landscape Management Activities</p> <p>Section 5 Protective Measures</p> <p>Section 6 Monitoring and Reporting</p> <p>Section 7 Performance Criteria</p>

1.5 Climate Positive Design

The United Nations Decade of ecosystem Restoration 2021-2030 aims to prevent, halt and reverse degradation of ecosystems on every continent. Climate positive design assists in the delivering of cool green cities, climate resilient landscapes and beautiful places that foster health and mental well-being. (AILA Climate Positive Design Action Plan Oct. 2022)

In southern Australia, climate projections suggest that hot days will become hotter and more frequent, rainfall will decrease, droughts will increase, harsher fire weather will occur, and extreme rainfall events will become more intense (CSIRO & BOM 2022).

Management actions detailed in this LMP have been designed to maximise the resilience of re-vegetated areas to climate change as much as possible:

- Using local seed banks to propagate plants that will be best adapted to local conditions.
- Using species and densities consistent with plant community types that have been removed.
- Specifying performance criteria that ensure the regenerated areas meet suitable benchmarks to restore the ecological integrity of the communities.
- Consideration of fauna habitat restoration to attract wildlife that will be integral in creating resilient ecosystem functioning.
- Compliance with the aims and objectives of the NSW Rural Fire Service's Planning for Bush Fire Protection (PBP) 2019 and Australian Standard 3959 (Sydney Water 2021b)
- Ensuring adequate watering occurs during the establishment phase based on the prevailing weather conditions.
- Continued watering through the maintenance phase to support the survival and successful establishment of young plants during times of limited resources and stress (Section 3.5).
- Weed control in both the establishment and maintenance phases to maximise survivorship of installed plants and minimise competition for resources from weeds.

1.6 Landscape Management Objectives

The following landscape management objectives and outcomes are consistent with the Urban Design Landscape Plan (Tract 2023) and will be monitored according to the requirements of this plan to ensure the performance criteria set out in Section 7 are achieved:

- Minimise environmental impacts that may result from landscape management activities and utilise environmentally sustainable practices.

- Preserve, enhance, and promote the reestablishment of the Cumberland Plain Woodland communities relevant to the site.
- Provide a safe environment, minimising potential risks to people, buildings, and property.
- Apply best practice landscape maintenance.
- Give precedence to biodiversity outcomes.
- Target noxious weeds and feral animals through the use of integrated pest management approaches.
- Provide opportunities for Aboriginal social impact, supply nation, trainee programs.
- Maintain high quality landscaped spaces.
- Maintain high quality Administration precinct.
- Maintain high quality passive recreation areas.
- Manage bushfire risk in accordance with Risk Assessment Report.
- Minimise aviation risk in accordance with Wildlife Management Plan (WMP).
- Maintain Ecological outcomes as identified in the Vegetation Management Plan (VMP).
- Appropriately fund, plan, and manage landscape maintenance to provide a measurable improvement in the establishment and adaptive landscape outcomes to form green networks.
- Establish ongoing stewardship.
- Maintain assets of heritage significance and value through protecting and preserving the two remaining radio telescope arrays from the Fleurs Radio Telescope Site.
- Heritage enhancement through the design and inclusion of elements that reflect and symbolise the history of the Project site which would be the landscape features that mark the previous location of the arrays with signage to hold onto the history of the site

1.7 References

This report is to be read in conjunction with the following documents:

- *Upper South Creek Advanced Water Recycling Centre - Urban Design and Landscape Plan – Stage 1, Tract Consultants*
- *Upper South Creek Advanced Water Recycling Centre – Vegetation Management Plan, Tract Consultants*
- *Kemps Creek Sewerage Network ST0079 Water Resource Recovery Facility-Kemps Creek- Landscape documentation prepared by Tract Consultants*

2 General Site Conditions

2.1 Soil

The AWRC is in the Wianamatta South Creek Alluvial soil landscape, characterised by floodplains, valley flats and drainage depressions (>5%) on the flat, incised channels of the Cumberland Plain with local relief of 10 metres. Soils consist of deeply layered sediments over bedrock comprising structured plastic clays or structured loams in or adjacent to drainage lines, red and yellow podzolic soils on terraces, usually in combination with patchy structured grey clays, leached clay, and yellow formerly saline soils. Soils exhibit low fertility, are strongly acidic, have hard-setting surfaces, poor drainage, and are susceptible to extreme erosion. Vegetation associated with this soil landscape consists of riparian forests and wetlands.

Soil health will be restored if required as part of the implementation and establishment of the landscape. Primary and secondary amelioration for all areas of the LMP will be confirmed by more detailed testing and/or assessment by the landscape contractor of existing information available and visual inspection of site conditions at the commencement of landscaping works, to the approval of JHG.

2.2 Vegetation Communities

The USC AWRC Biodiversity Development Assessment Report (Biosis, 2021) identifies the Plant Community Types (PCTs) relevant to the project.

The BDAR identified three Plant Community Types (PCTs) on the AWRC site, as summarised in Table 3 below. Clearing of some of these PCTs has occurred to facilitate construction within the plant operational zone, including:

- PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion – Thinned

- PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

Figure 6 provides a visual representation of the location of the PCTs that were present on the AWRC site prior to the commencement of construction.

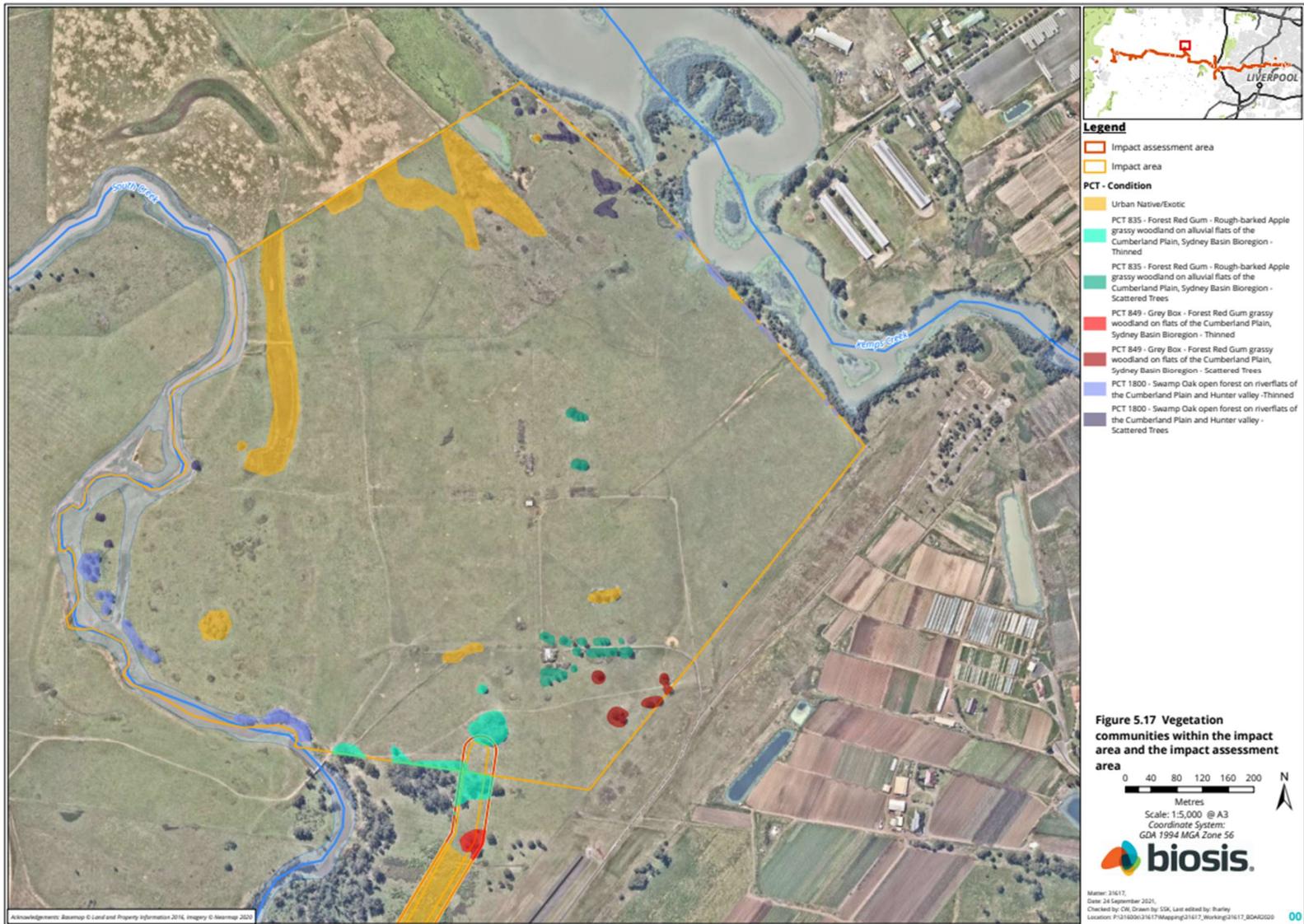


Figure 6 PCTs present at the AWRC site prior to construction (Source: USC EIS, Appendix J Biodiversity Assessment Report, Figure 5.17 (Biosis, 2021))

Table 3 Vegetation communities

PCT ID	PCT NAME	COMMON NAME	CONDITION	EPBC Act TEC	BC Act TEC
835	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland River-flat Forest	Thinned, scattered trees	River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (CEEC)	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin, and South East Corner Bioregions (EEC)
849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland Shale Plains Woodland	Scattered trees	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CEEC)	Cumberland Plain Woodland in the Sydney Basin Bioregion (CEEC)
1800	Swamp Oak open forest on river-flats of the Cumberland Plain and Hunter Valley	Cumberland Swamp Oak Riparian Forest	Thinned, scattered trees	Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community (EEC)	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin, and South East Corner Bioregions (EEC)

3 Landscape Management Zones

Three distinct landscape strategies have been used to align with the three Zones established in Section 1.2.1 and identified in Figure 5 and are referred to as Landscape Management Zones. Zone 2 should be read in conjunction with the USC AWRC Vegetation Management Plan. The three zones are to be implemented in the following form:

3.1 Zone 1: Operations Zone (generally within fence line)

Zone 1 includes the treatment plant zone and overland flow swale.

- Planted garden areas with shrubs and groundcovers.
- Trees spaced to meet fire protection requirements associated with Inner Protection Zone (IPZ). Refer Figure 6.
- Bioretention and retention basin landscape.
- Grass areas.
- Administration Building area where planting design has been used to create a public facing precinct.
- The grassed overland drainage swale linking to Wianamatta South Creek.
- Permanent stockpiles placed within the Operational Zone.
- Zone to be established in accordance with the information set out in Appendix A Plant Species, Appendix 2 Solar Farm Panels and Appendix 3 Landscape Document Package.

Maintenance for Zone 1 will be undertaken by JHG until contract completion and Trility / JHG (Operations & Maintenance Contractor) thereafter during operation of the AWRC.

3.2 Zone 2: Wianamatta South Creek (Vegetation Management Plan)

Zone 2 includes the proposed areas to be restored adjoining Wianamatta South Creek and the billabongs. Refer Figure 5 Vegetation Management Zones.

The vegetation management zones will be managed to control and remove exotic weed species. The retention of native, remnant elements of the degraded Cumberland Swamp Oak Riparian Forest will be prioritised to foster natural regeneration.

Revegetation will occur with a diverse array of native canopy trees, shrubs, and groundcovers of the Cumberland Swamp Oak Riparian Forest along the riparian zone, including within:

- Vegetation Management Zone 1: Revegetation of Existing Cumberland Swamp Oak Riparian Forest
- Vegetation Management Zone 2: Wianamatta South Creek Embankment Revegetation
- Vegetation Management Zone 3: Wianamatta South Creek Edge Revegetation

Maintenance for Zone 2 will be undertaken by JHG until contract completion and Sydney Water thereafter during operation of the AWRC.

3.3 Zone 3: Potential Future Greenspace including access paths, road and fire trails (generally outside the fence line and excluding Zone 2)

Zone 3 includes the area of remnant trees and pasture grasses that are outside Zone 1 and Zone 2. Whilst Zone 3 is being preliminarily scoped as part of a Greenspace Master Plan and will be documented in detail via future landscape management documentation, there are some items / areas within the zone that will be implemented and maintained according to the following:

- Individual plantings around the outer perimeter of the APZ. Refer Figure 6.
- The fire trail established as part of the perimeter APZ requirements. Refer Figure 6.
- Access paths to Wianamatta South Creek and planting areas developed as part of Stage 1 and delivered as part of the Zone 2 VMP works.

Maintenance for only the above elements within Zone 3 will be undertaken by JHG until contract completion and Sydney Water thereafter during operation of the AWRC.

3.4 Proposed Planting Species

The selection of proposed planting species associated with this LMP have been selected to suit soil conditions and existing vegetation communities. Refer to Appendix A for the full species list.

4 Specific Landscape Management Activities

4.1 Introduction

Section 4 of the LMP addresses landscape management activities in Zones 1 and 3, unless otherwise specified to address a key requirement that may be unique to a specific zone.

Planting in Zone 1 garden beds contain advanced trees, low shrubs and groundcovers. All beds are planted with native species in ameliorated site soils where deemed required by the Bush Regeneration Contractor to maximise biodiversity outcomes. Management of native plants requires low phosphorous fertilisers and a lower fertiliser rate than exotic species generally. Natives also have lower water requirements in comparison to exotics and adapted to the local conditions.

The long-term landscape management of the landscape should replace any failures with native species before exotic species.

The following sections detail maintenance activities that are to be implemented in Zone 1 and 3 of the AWRC. Unless noted otherwise, during the landscaping maintenance period, these activities are the responsibility of the Operation and Management Contractor. Refer to the following tables in this section for maintenance frequencies for each activity.

Supporting information is available in the following appendices to support the LMP:

- Appendix A - full plant species list
- Appendix B - the solar farm plans
- Appendix C - landscape design drawings
- Appendix D - weed mapping

It should be noted that the information provided in Appendices 1 to 3 represent documentation approved by Sydney Water at the time of submitting the LMP for approval. These items may be subject to revision, pending the onboarding of subcontractors who will perform the work, ad-hoc advice received by specialists engaged to support the implementation of the landscape design (for example a bush regeneration specialist), and/or other factors including availability and supply of listed species at the time. These documents will remain live, and the ongoing status tracked in the project's document management system, Aconex.

Sections 4.2 to 4.16 detail maintenance activities to be undertaken during the landscape maintenance period in Zones 1 and 3 in the following areas:

- Grassed areas
- Individual plantings
- Garden beds and bioretention basin

4.2 General Maintenance

General maintenance requirements for Zone 1 and 3 are outlined in Table 4 below.

Table 4 Zone 1 and 3 General Maintenance Requirements

Issue/ Element	Type of Activity	Work Required	Frequency	Responsibility
Landscape planting and revegetation	Monitoring	Landscape establishment in accordance with Technical Specification WL 21 Urban Design Landscape to assess landscape plant establishment and growth. Assessment of progress, recording of activities and identification of emergent issues.	Monthly	Site Manager, Landscape Supervisor and Landscape Maintenance staff
Mowing	Maintenance	Mowing and weed control in grass areas in accordance with Technical Specification WL 21 Urban Design Landscape. Recommendations arising from monitoring (refer above).	Implemented as required. Mowing where grasses exceed 75mm.	Site Manager, Landscape Supervisor and Landscape Maintenance staff
Weeding and replacement planting	Maintenance	Application of herbicide and manual removal where applicable. Plants to be replaced where assessed as dead.	Replacement plantings to occur within 14 days of detection. Weeding to occur at not more than 4 weekly intervals.	Site Manager, Landscape Supervisor and Landscape Maintenance staff
Administration Building precinct	Maintenance	Plant replacement, mowing or pruning to maintain presentation	Ongoing	Site Manager and Landscape Maintenance Manager

4.3 Fertilising, composting and mulching

All mass planted areas whether native or exotic will perform better when the soil conditions are healthy. Building healthy soils is the key to achieving the long-term maintenance goals of mass planted landscape areas.

Soil health is primarily achieved with regular applications of organic soil conditioners such as animal manures, decomposed green waste or proprietary blends of compost.

Fertilising and composting are not critical maintenance activities except where there are obvious deficiencies but should be assessed on an annual basis by observation and leaf analysis. For all trees, shrubs and grass species, Table 5 Table 5 outlines the required fertilising regime. These standards apply to tree, shrub and groundcover associated with Zone 1.

Maintain mulch to a depth of 75mm in the garden beds.

4.4 Mowing

Management of grass is dependent on variety and location and will be undertaken so as to achieve an appropriate level of presentation and to meet Inner Protection Zone requirements for bushfire risk.

Zone 1:

Turf grass zones no lower than 25mm and no higher than 75mm and area is to be tidied post mowing.

The solar farm is to be on mown and maintained in a low fuel condition (<100 mm in length). Refer to appended plans on solar farm arrangement.

Zone 3:

Native grass zones are to be slashed frequently to reduce fire loading. Grass within pathways should not exceed 100mm.

4.5 Removal of Dead or Dying Plant Material and Pruning

All dead or dying plant material is to be removed during maintenance activities, including mass planted areas on the site as required. This may become necessary as plantings mature, after damage or adverse environmental conditions.

Ground cover and shrubs should be maintained at a maximum height of 0.5m along path edges for personal security. Monitor vegetation growth to ensure bushfire risk and safety is maintained.

Pruning will be carried out to remove dead and damaged branches and to retain natural shape and to improve health and vigour. Lower branches should be removed as per APZ requirements (refer Section 5.1).

Where die-back of plant material has been identified, new plants will be planted as soon as possible using species originally specified or that maintain the character and continuity of planting

Trees shall be pruned to the extent that:

- Dead branches should be removed so it does not build up a fuel load for fire.
- Tree form should be maintained.

For all trees, shrubs and grass species, Table 5 outlines the required pruning. These standards apply to tree, shrub and groundcover associated with Zone 1.

Table 5 Fertilising and Pruning Standards

Type	Action	Frequency of Work
Trees	Fertilising	
	<p>2 X 20-gram slow-release fertiliser tablet per plant. N:P: K ratio– 18:3:10</p> <p>Only to be applied if plants are obviously under stress and it has been agreed that the plant/s will benefit from application of the fertiliser.</p>	<p>Inspect annually but apply late Spring if, and when, required.</p>
	Pruning	
	<p>Prune to remove split leaders, remove dead limbs, and remove heavily damaged limbs.</p> <p>As maturity permits prune lower branches to collar to 5.5m above ground level where these overhang carriageways and roads. In other areas, prune lower branches to 3.3m above ground level.</p>	<p>As required</p>
Shrubs	Fertilising	
	<p>2 x 20-gram slow-release fertiliser tablet per plant. N:P: K ratio– 18:3:10</p> <p>Only to be applied if plants are obviously under stress and it has been agreed that the plant/s will benefit from application of the fertiliser.</p>	<p>Inspect annually but apply late Spring if, and when, required</p>
	Pruning	
	<p>Pruning of shrubs would not occur unless there is evidence of dieback or were creating issues within the vicinity of the planting. Pruning of shrubs would be undertaken at the discretion of the maintenance contractor and dependent on</p>	<p>As required</p>

Type	Action	Frequency of Work
	the assessment of the plant made at the time. Pruning would not be a regular occurrence due to the selection of native species. Lower branching of shrub species is preferable to create habitat for fauna and shade for groundcovers.	

4.6 Replacement Plantings (including tree staking)

Replacement of plants is to occur as specified in Technical Specification: WL 21 Urban Design-Landscape (the 'Specification'). This includes the replacement of any missing or dead plants, or plants nominated by the Landscape Supervisor as unsatisfactory, within fourteen (14) days of detection.

Plantings that are failed, senescent or damaged are to be replaced and densities, sizes, and species used are to be similar to those being replaced. All replacements must be planted in accordance with the Specification.

With respect to tree staking:

- Repair any ties that have been broken.
- Replace any missing stakes as required.
- When trees are established, remove stakes.

4.7 Weed Management

In NSW all plants are regulated with a general biosecurity duty to prevent, eliminate, or minimise any biosecurity risk they may pose. Weeds that compete with and suppress growth of vegetation established by the landscape works are to be removed without damaging other plants. As part of this process, invasive weeds may be listed as one of the following:

- Weeds of National Significance
- National Environmental Alert List Weeds
- Water Weeds
- Native plants considered weeds
- Plants not to be sold in all or parts of NSW

The various listings have different requirements on the management of the specific weed. Once identified within the landscape, the management of an invasive weed should be undertaken in accordance with the relevant listed requirements.

Weed management is often a concern in new areas of mass planting in garden beds. A noxious weed is a plant declared to be noxious under the NSW Noxious Weeds Act 1993. Noxious weeds can be agricultural weeds, environmental weeds or have a direct impact on human health.

Environmental weeds are non-local plants that can invade and change natural areas and threaten the survival of native plants and animals. After land clearing, environmental weeds are considered to be the next greatest threat to our indigenous biological diversity. Environmental weeds have the potential to readily invade garden bed areas and potentially impact on the adjacent lands.

In addition to the environmental hazard posed by weeds, weeds occurring in mass planted beds, growing from the base of trees and from pavement can be unsightly and presents an untidy appearance. To ensure that environmental and noxious weeds do not reproduce within or spread into mass planted areas and compete with plantings and spread to other areas or nearby Wianamatta South Creek, weed management is a critical maintenance action. Active monitoring of weeds is critical to ensuring appropriate management within Zone 1, including in garden beds and lawn at the Administration Building Precinct.

Weed management will be completed during construction in accordance with the Upper South Creek (USC) Biodiversity CEMP Sub-plan, Appendix F Weed and Pathogen Management Procedure and will be maintained to less than or equal to 10% Percent Foliage Cover (PFC) across the entire footprint.

Initial weed mapping has been undertaken by AMBS Ecology and Heritage at the AWRC site. The mapping undertaken thus far is to assist with the development of the landscape design and subcontract package and pending timing of the commencement of landscaping works, may need to be refreshed by a suitably qualified ecologist at a later time to ensure consistency with the requirements specified in the Weed and Pathogen Management Procedure. A copy of the weed mapping provided by AMBS Ecology and Heritage is provided in Appendix D.

Carry out weed removal at intervals consistent with the details provided in Table 8 and ensure that weeds do not flower to form seed heads. Upon Construction Completion, weed monitoring and removal must be undertaken and occur throughout the Landscaping Maintenance Period.

Where herbicide has the potential to makes its way into a waterbody or bioretention basin or when wind conditions could cause drift outside the area to be treated or onto desirable plants, herbicide approval must be sought from the O&M Contractor prior to commencement of the activity. Herbicide use to be in accordance with regulation rates and manufacturers recommendations.

After spraying, lop any dead weeds flush with the ground surface and dispose of the cuttings to an appropriately licensed waste facility, ensuring that these are not mulched and included for reuse onsite.

Remove by hand any weeds which cannot be controlled by herbicide. Ensure that the entire weed including all roots is removed and disposed of to an appropriately licensed landfill.

In grassed areas, the management of weeds will occur using approved selective herbicides, where weed is a visual issue or noxious. Herbicide use to be in accordance with regulation rates and manufacturers recommendations. Dye shall be added to herbicides to show extent of treated area.

4.8 Tree Planting in Grassed Areas

Soil moisture levels are to be maintained around plantings during the landscape establishment and maintenance period. Watering is to be carried out to ensure this occurs.

Maintain mulch to a depth of 75mm around the base of the individual tree and shrub beds. Mulched areas to be free from grasses and weeds.

Prune plantings in accordance with AS 4373-2007 Pruning of Amenity Trees.

4.9 Rubbish Removal

Remove all rubbish and debris that is within area of landscape planting, and recycle or dispose in a responsible manner, and leave Zone 1 in a clean and tidy condition.

4.10 Graffiti and Vandalism Repairs

Notify Site Manager as soon as possible following graffiti or vandalism attacks on site. All vandalism and graffiti attacks are to be reported to the Site Manager for recommended action to be taken. Notwithstanding the above, the Landscape Supervisor is to ensure that the site is left in a neat, tidy, and safe state.

4.11 Fungal and Insect Attack

Regular inspections of the landscape works are to include identification of any outbreaks of pests or disease. Where pests are known, and a strategy of control has been identified this should be undertaken after approval from the Site Manager.

Where issues are unknown, samples are to be collected and sent for testing to confirm the pest species or type of disease. A program of control based on recommendations of the testing organisation is to be implemented and monitored to confirm effective control has been achieved.

Control of pests and disease should be undertaken to minimise loss of plant material or impacts to plant material health and future growth.

4.12 Pest Control

A pest control program for the site should be implemented based on identification of pests during monitoring activities (Section 6). If rabbit warrens, foxes, and other pests are identified, fumigation will occur. This is to be undertaken in consultation with Local Land Services. The site is to be constantly monitored for evidence of pest activity. Monitoring will occur during the establishment and maintenance periods. Any damage by pests, primarily due to grazing on young plants, will require rectification to reduce impacts to and loss of plants.

4.13 Watering

Trees in grass and mass planted areas shall be watered regularly with an evenly deep penetrating application to ensure continuous healthy growth. All other plants will be watered according to the watering program provided in Table 6. It should be noted that the information presented is indicative and subject to confirmation by the onboarded landscape contractor, including nominating appropriate methods of irrigation at the time of undertaking the work, with consideration of the weather conditions. The frequency of watering will be gradually reduced as the plantings mature.

The Administration Precinct is to be maintained to a high quality for the operations staff and visitors to the site. The landscape has been designed to create amenity and suitable outdoor spaces for staff use. These areas should be maintained to a higher level than the Plant. Therefore, should be watered more regularly and as required to ensure the grass remains green and all plants are established and reach their growth potential.

Table 6 Watering Program for Zone 1 and 3

Phase	Implementation				Establishment	Maintenance	
	Week 1	Week 2-4	Months 2-5	Months 5-6		12-18 Months	18-36 Months
Timing	Week 1	Week 2-4	Months 2-5	Months 5-6	Months 6-12	12-18 Months	18-36 Months
Frequency	Daily	Weekly	Fortnightly	Monthly	Monthly	Monthly	Monthly
Per m2 of Zone	6 Litres	6 Litres	30 Litres	30 Litres	30 Litres	30 Litres	30 Litres
<p><i>Note* Watering ONLY to occur post 18 months if periods of prolonged dry and hot weather are experienced in excess of one (1) month.</i></p>							

4.14 Management of permanent stockpiles

Stockpiles placed permanently in the Operational Zone will be vegetated in accordance with the approved landscape management documents (Appendix C).

Stockpiles will be managed consistently with relevant requirements set out in Section 4 of this LMP. Access to stockpiles for the purpose of undertaking maintenance and monitoring activities are to be consistent with the AWRC site Safety Management System.

4.15 Parabolic antennae landscape cross array

The site was used for radio astronomy when it was leased to CSIRO. The Fleurs Field station was a major technological innovation. Master planning of the Greenspace is currently underway by Tract, on behalf of Sydney Water and will include detail around key heritage elements to be implemented and retained at the AWRC site.

Remnant antennae

The two remaining antennae will be protected via the installation of permanent fencing that will serve as an interim solution prior to final decision-making being made for Greenspace Master Planning.

The presentation of the approximate location of the remnant antennae is provided in greater detail in Appendix C, drawings ST0079-A9008-01 (northern antennae) and ST0079-A9008-14 (south-western antennae).

Cross-array markers

The interpretation of the cross-array points is acknowledged in the landscape design. There are two cross array markers placed at locations within the Operational zone. The markers consist of curved steel edging to radii. The locations are set to important historical alignments and should not be altered.

The curved and straight alignments of steel plate are to be maintained to the design levels. Gravel areas are to be topped up where it has settled below the steel edge. Remove weeds and maintain adjoining garden beds to the levels to match steel edging.

The presentation of the cross-array layout is provided in greater detail in Appendix C, drawing ST0079-A9008-21.

4.16 Summary of Activities

Error! Reference source not found. to **Error! Reference source not found.** summarise the landscape maintenance and inspection requirements, including the time frames and frequencies required, for the different maintenance activity categories in Zones 1 and 3.

Table 7 Summary of maintenance activities

General Maintenance Activities	Timeframe / Frequency		Responsibility	
	Inspections	Performance of the work		
Pruning of Vegetation for Bush Fire and aviation Risk Safety		Yearly	Once per year as required	Landscape Supervisor
Management & removal of dead tree branches		Yearly	Once per year as required	Landscape Supervisor
Noxious weed control	Monthly		As required	Landscape Supervisor
Prevent reproduction of weeds by destroying seedlings and established weeds before seed set or other propagules form. Remove by hand in the first instance (where infestations are low). Ensure that the entire weed including all roots is removed. Dispose of the weeds off site	Monthly		Monthly, however, may increase to fortnightly during Summer months subject to the advice of the Landscape Supervisor.	Landscape Supervisor
Remove by Herbicide application any weeds which cannot be controlled by hand removal. Herbicide application must occur before weed seed set. Non-target species and areas must be reinstated if damaged by herbicide application.	Monthly		Monthly, however, may increase to fortnightly during Summer months subject to the advice of the Landscape Supervisor.	Landscape Supervisor
Herbicide use to be in accordance with regulation rates and manufacturers' recommendations. Herbicide use must comply with the requirements of the Noxious and environmental weed control handbook: A guide to weed control in non-crop, aquatic and bushland situations (New South Wales Weed Control Handbook A Guide to weed control in non-crop, aquatic and bushland situations, NSW Department of	Monthly		Monthly, however, may increase to fortnightly during Summer months subject to the advice of the Landscape Supervisor.	Landscape Supervisor

General Maintenance Activities	Timeframe / Frequency		Responsibility
	Inspections	Performance of the work	
Primary Industry, Seventh Edition).			
After spraying, lop any dead weeds flush with the ground surface and dispose of the cuttings. Not to be mulched or added to green waste.	Monthly		Monthly, however, may increase to fortnightly during Summer months subject to the advice of the Landscape Supervisor.
Use of bio-degradable herbicide is mandatory.	Monthly		Monthly, however, may increase to fortnightly during Summer months subject to the advice of the Landscape Supervisor.
Fungal and disease control	Monthly		As required
Rubbish removal	Monthly		As required
Auditing and Reporting	Monthly		Monthly
			Landscape Supervisor

Table 8 Summary of Activities Related to grassland areas

Maintenance Activities (Grasslands only)	Timeframe / Frequency			Responsibility
	Inspections		Performance of the work	
Mowing	Monthly		As required	Landscape Supervisor
Replacement of damaged grass areas	Monthly		Once per Year as required	Landscape Supervisor
Tree Planting in Grassland (along Zone 3)	Monthly		As required	Sydney Water
Maintain mulch around base of Plant at 75mm depth		Yearly	Every year for first 4 years	Sydney Water
Prune and fertilise as per specified horticultural maintenance		Yearly	As required	Sydney Water
Watering (Administration Precinct)	Fortnightly		As required	Landscape Supervisor

Table 9 Summary of Activities Related to garden beds

Maintenance Activities (Garden Beds only)	Timeframe / Frequency			Responsibility
	Inspections		Performance of the work	
Weed garden beds prior to weeds setting flower	Monthly		As required (priors to weeds setting flowers)	Landscape Supervisor
Mulching within 0.5m of the boundary of a planted area		Yearly	As required	Landscape Supervisor
Removal of Dead/Dying Plant Material		Yearly	As required	Landscape Supervisor
Replacement Plantings	Monthly		As required	Landscape Supervisor
Replace failed plantings		Yearly	Every year for first 4 years	Landscape Supervisor
Inspect replacement plantings		Yearly	As required	Landscape Supervisor
Water the replacement plantings	Not applicable (n/a)		A minimum of 12 weeks	Landscape Supervisor
Tree stakes - replace stakes during establishment	Monthly		As required	Landscape Supervisor
Fertilising and Pruning				
Fertilise all plantings at specified rates		Yearly		Landscape Supervisor / Landscape Architect*
Prune planting in specified manner	n/a		n/a	n/a
Trees		Yearly	n/a	Landscape Supervisor / Landscape Architect*
Tall, medium, low shrubs		Yearly	n/a	Landscape Supervisor / Landscape Architect*
Watering (Administration Building Precinct)	Fortnightly		As required	Landscape Supervisor

Note *Denotes inspection only.

5 Protective Measures

5.1 Bushfire Protection Actions

A ten-metre perimeter APZ has been established around the Operations Zone perimeter fence line, as indicatively presented in Figure 7 and includes an accessible fire trail for the purpose of implementing bushfire management requirements and responding to emergencies should they occur.

The APZ performance requirements for the Operational Zone where it is being maintained as an inner protection area as defined under Planning for Bushfire Protection PBP, are as follows:

- Tree canopy cover <15% at maturity
- Trees at maturity do not touch or overhang buildings
- Lower limbs to be removed up to 2 m above the ground
- Tree canopies separated by 2-5 m
- Preference for smooth barked and low flammability trees and shrubs
- Large gaps between shrubs
- Shrubs not placed directly under trees
- Shrubs form <10% ground cover
- Shrubs separated from doors and windows by a distance of at least twice shrub height
- Grass mown/slashed, maintained at no more than 100mm
- Remove leaves and vegetation debris.

If internal landscaping is not maintained to the APZ standards, it should be separated from external bush fire-prone vegetation by the facility's APZ (as a minimum) such that there is no connectivity, and no pathway for fire to travel into the facility. Any vegetation within 15m of site buildings should be planned and maintained to comply with the above considerations.

Note: All buffer planting areas are required to have annual assessment by a bush fire and aviation risk contractor and maintenance carried out if required. Refer to Table 11.

The solar farm is to be on mown or dwarf grass substrates, maintained in a low fuel condition (<100 mm in length). This can be achieved through regular mowing.



Figure 7 Asset Protection Zones

5.2 Wildlife Strike Mitigation

The Aviation Safeguarding Guidelines Western Sydney Aerotropolis and surrounding areas (NSW Department of Planning, Industry and Environment 2021) sets out planning guidelines to inform land use planning decisions on land impacted by safeguarding controls. The objectives allow for the assessment on land surrounding Western Sydney International (Nancy-Bird Walton) Airport (WSI) where wildlife may present risk to operation and ensure wildlife management provisions when undertaking land use planning.

The activity of birds and animals in the vicinity of the WSI Airport is a recognised potential source of hazard to the safe operation of aircraft. This hazard results from the possibility of a collision between an aircraft and one or more birds or animals i.e., a bird strike. The site falls within the 8km wildlife buffer zone, refer Figure 8. National Airports Safeguarding Framework Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports has been incorporated into the Aerotropolis SEPP and Aerotropolis DCP provides a framework for how to manage the risk of wildlife strike on aircrafts. New land uses within 13km of airport property should be regularly monitored and action plans created to mitigate any unacceptable risk of bird strike.

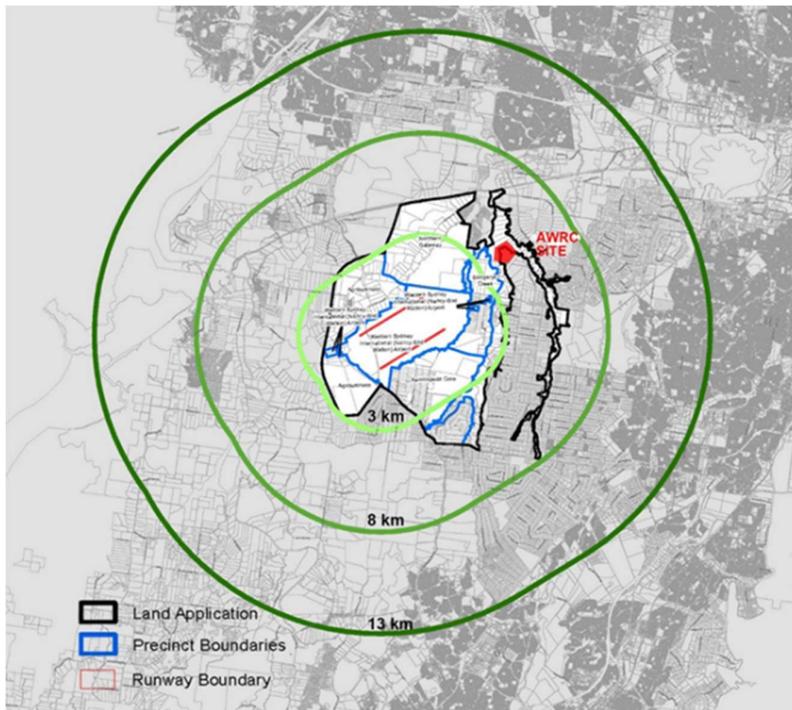


Figure 8 Wildlife Buffer Zone Map, adapted from State environment Planning Policy

Wildlife management will be an important aspect of operations and maintenance at the AWRC. Aviation risks mitigated in the landscape design are around the creation of habitats that are attractive to birds and bats. Key considerations include ensuring that the design does not create wildlife attractive features (natural and built), bird and bat populations are monitored to assess strike risk. The Wildlife Management Plan (WMP) will identify mitigation actions where hazards are identified. Further the WMP will integrate routine monitoring, wildlife awareness, wildlife management and performance standards, wildlife deterrent and surveillance patrols.

The wildlife strike mitigation strategy should not preclude the development of the site to improve biodiversity in the region by attracting and supporting microfauna. The design of the landscape has considered plant species selection, density of vegetation cover, depth of wetlands and the operation of the site to minimise habitats that attract wildlife hazards.

5.2.1 Species selection

The Western Sydney Aerotropolis Draft Wildlife Management Assessment Report (Western Sydney Planning Partnership & Avisure 2020) provides guidelines for planting species to minimise the attraction of birds and flying foxes within the Aerotropolis. It is recommended that “trees and shrubs planted in the area should not bear edible berries, fruits, seeds, nuts, nectar, or bear flowers profusely. Such vegetations attract flying foxes and birds such as lorikeets. Plants that attract insects may also pose a risk in attracting small numbers of birds.

Landscape implementation proposes a variety of different species sparsely inter-mixed to allow local biodiversity to evolve. For example, the planting of *Acacia* spp. will improve soil fertility through nitrogen fixation and allow cross pollination.

This Landscape Management Plan will allow for the continual monitoring and maintenance of the landscape across the entire site to minimise wildlife hazards.

5.2.2 Density of vegetation cover

Planting density has been predominately determined using bushfire risk criteria, except for the planting proposed along the Wianamatta South Creek which is part of the regional green networks and falls within the category of enhanced riparian and wetland corridor landscape to improve biodiversity.

Additionally, hazardous wildlife deterrents have been considered in the design and ongoing management of the landscape. A Wildlife Management Plan will be prepared to inform the operation of the AWRC prior to operations commencing. Particular consideration includes the design and management of the landscape to deter bird populations. The facilities' grass areas will be kept to 100mm in height for the solar farm zone and 75mm for turf areas in accordance with guidelines for asset protection within fire zones. Large, still permanent water bodies will be netted. Monitoring will inform the need for the introduction of sonic devices or ultrasonic repellents to deter wildlife.

The Landscape Management Plan describes the management activities to be undertaken for the long-term care of the environment. There will be focus on particular management activities which support the goals and objectives of wildlife and bush fire management.

5.2.3 Detention and Bioretention Basins

The restoration of Wianamatta South Creek has a strong emphasis on waterway and catchment health to satisfy commitments to tree planting, align with biodiversity principles in the Cumberland Plain Conservation Plan, enhance ecological value and mitigate impacts against threatened species. Slow moving water and where water accumulates for extended periods of time can be attractive to wildlife. Artificial wetlands can attract significant numbers of wildlife and as such haven't been implemented. The retention basin is ephemeral and only holds water after rain which dissipates within 24 -48 hours. The bioretention basin is fully planted and not at a depth for wading birds.

Specific measures that have been incorporated into the landscape include:

- Bioretention and detention basins: Temporarily hold water and fully drain within 24-48 hours.
- Retention basin embankments: 4 horizontal to 1 vertical to basin bank slopes
- Drainage grass swale depth: 200 - 400mm maximum in height
- Billabong water depth: between 0.5m and 1.18m is less likely to attract hazardous flocking bird such as pelicans, swans, and cormorants; or upending ducks such as Pacific Black Ducks; or wading birds such as ibis and egrets.
- Sedge/wetland planting: designed with steeper slopes.
- Bioretention basins: vegetation 300 - 600mm in height.

6 Monitoring and Reporting

6.1 Monitoring Procedures and Performance Indicators

General monitoring procedures will be adopted in Zones 1 and 3 to assess if the revegetation has achieved an acceptable standard as measured against the performance criteria. Areas of landscaping that have failed will be clearly identified and the nature of the failure documented.

Based on the results of the monitoring program appropriate remedial action will be determined and implemented until vegetation has established and the required landscape performance is achieved.

The planting survivorship method includes:

- Planting success recorded as either ALIVE or FAILED (failed includes missing and deceased).
- Signs of predation or disturbance (plant damaged, presence of scat, tree guard damaged or removed, etc..)
- General management: correctly planted, sufficient watering undertaken, plant health and vigour (observed nutrient deficiencies).

Monitoring of the landscape works will commence from the time of installation and extend until maintenance responsibilities for the project are handed over to Operations Maintenance Contractor.

Monitoring will be carried out monthly in two phases as summarised below and with reference to the relevant performance criteria detailed in Table 10:

1. **Initial establishment and maintenance period** – monitoring to assess the trajectory of the outcomes after approval of the work until contract completion; the purpose is to enable timely intervention or corrective actions if required to ensure vegetation growth.
2. **Post-completion** – monitoring will continue throughout the maintenance period; the purpose is to ensure that each landscape area has reached a condition that indicates a high probability that the intended mature outcome is achieved in the longer term.

7 Performance criteria

Performance criteria are detailed below within Table 16. Failure to achieve the stated performance criteria may require the 6 to 12 month establishment period to be extended and relevant actions proposed and agreed between all relevant parties. Therefore, the establishment phase must continue until the performance criteria are achieved and evidenced to Sydney Water for formal acceptance, concluding the establishment phase and commencing the maintenance phase.

A suitably qualified and experienced person in landscaping must prepare a statement certifying compliance with the performance criteria at the end of the establishment period.

If monitoring indicates that the LMP tasks are not achieving the performance criteria, the management actions and program will be revised. The client (JHG or Sydney Water) and the landscape contractor can adapt the criteria and actions as required in response to the success of rehabilitation works.

The performance criteria are detailed below within Table 10 and the management actions within

Table 11.

Table 10 Landscape Performance Criteria

Performance Action	Zone	Responsibility	Performance Criteria	Timing (Phase)
Weed control	Zones 1 & 3	<p>JHG (Principal Contractor) - Implementation, Establishment and Maintenance until contract completion.</p> <p>Trility/JHG (O&M Contractor) – Maintenance for Zone 1 during Operation.</p> <p>Sydney Water – Maintenance for Zone 3 during Operation.</p>	<p>All weeds within the area of the Landscape Management Plan (LMP), must be maintained to less than or equal to 10% Percent Foliage Cover (PFC) across the entire footprint. Weeds for the purpose of this requirement are defined within:</p> <ul style="list-style-type: none"> Section 4.7 Weed Management, Landscape Management Plan (Revision 2) John Holland Upper South Creek AWRC - Weed Mapping report (AMBS: 24447) dated 10/09/2024, all weeds identified as High Threat Weeds (HTW), Weeds of National Significance (WONS) & Priority Weeds. 	<p>From the commencement of landscape management plan works:</p> <ul style="list-style-type: none"> Implementation Establishment Maintenance
Revegetation / Planting Maintenance	Zone 1 & 3	<p>JHG (Principal Contractor) - Implementation, Establishment and Maintenance until contract completion.</p> <p>Trility/JHG (O&M Contractor) – Maintenance for Zone 1 during Operation.</p> <p>Sydney Water – Maintenance for Zone 3 during Operation.</p>	<p>A minimum 80% survival rate of individual plant species must be achieved. The survival rate should be calculated based on the species percentage (%) coverage rate per square meter (m2) reference to the coverage nominated in the design, landscape specification, vegetation and landscape</p>	<p>From the commencement of landscape management plan works:</p> <ul style="list-style-type: none"> Implementation Establishment Maintenance

Performance Action	Zone	Responsibility	Performance Criteria	Timing (Phase)
			<p>management plans for the respective management zone or area of the riparian corridor.</p>	
			<p>The measurement of plant survival rates will be undertaken by the landscape contractor at the following prescribed milestones:</p>	
			<ul style="list-style-type: none"> • Establishment completion • Maintenance completion • Handover from John Holland to another party (if required) 	
			<p>These milestones serve as checkpoints to assess and monitor the survival rates of the planted species. The landscape contractor will be responsible for conducting the measurements and ensuring that the minimum survival rate of 80% is achieved for each individual plant species based on the specified coverage rate per square meter.</p>	
			<p>For relevant areas within the operational space, a minimum of 90% coverage of grass growth/strike per square meter (m2) must be achieved and maintained. The coverage rate should be calculated based on the percentage (%) of the area that is covered by grass in the respective management zone or area.</p>	

Table 11 Landscape Management Actions

Management Action (MA#)	Management Zone	Responsibility	Task/ Performance Criteria	Timing (Phase)
MA1 - Weed control	Zone 1 & 3	JHG (Principal Contractor) - Implementation, Establishment and Maintenance until contract completion. Trility/JHG (O&M Contractor) – Maintenance for Zone 1 during Operation. Sydney Water – Maintenance for Zone 3 during Operation.	Primary and secondary weed control works are to include the following actions: <ul style="list-style-type: none"> All priority, environmental, vine and woody weeds are to undergo initial primary treatment in accordance with Project Biodiversity CEMP sub-plan weed and pathogen movement procedure. Commencement of maintenance works will occur once mature exotic species have been reduced in accordance with project Biodiversity CEMP sub-plan weed and pathogen management procedure. 	From the commencement of landscape works: <ul style="list-style-type: none"> Implementation Establishment Maintenance
MA2 - Revegetation	Zone 1 & 3	JHG (Principal Contractor) - Implementation, Establishment and Maintenance until contract completion. Trility/JHG (O&M Contractor) – Maintenance for Zone 1 during Operation. Sydney Water – Maintenance for Zone 3 during Operation.	Following the preliminary works (weed control, mulch/ jute installation), revegetation is to be undertaken to ensure sufficient vegetation cover exists to prevent soil erosion and to assist in the rehabilitation of the area.	Following the preliminary works (weed control, mulch/ jute installation).
MA3 - Planting maintenance	Zone 1 & 3	JHG (Principal Contractor) - Implementation, Establishment and	<ul style="list-style-type: none"> Installed plantings are to be maintained with key elements of water, 	Establishment – Commence immediately post plant installation.

Management Action (MA#)	Management Zone	Responsibility	Task/ Performance Criteria	Timing (Phase)
		Maintenance until contract completion.	prevention of predation and suppression of smothering weeds.	Maintenance – Post establishment until completion.
		Trility/JHG (O&M Contractor) – Maintenance for Zone 1 during Operation.	<ul style="list-style-type: none"> Replacement planting is to be carried out throughout the maintenance period to sustain the 80% survival rate at the completion of the maintenance period. 	
		Sydney Water – Maintenance for Zone 3 during Operation.	<ul style="list-style-type: none"> Losses of greater than 20% of originally installed plantings may have the maintenance period extended until survival rates have been achieved. 	
Maintenance	Zone 1 & 3	JHG (Principal Contractor) - Implementation, Establishment and Maintenance until contract completion.	All mature priority weeds are to be appropriately managed prior to commencement of maintenance period.	The maintenance period will run for a 24-month term following successful completion of establishment.
		Trility/JHG (O&M Contractor) – Maintenance for Zone 1 during Operation.	Works to be undertaken utilising best practice regeneration techniques.	The commencement of this maintenance period may be adjusted if there are delays beyond the contractor's control.
		Sydney Water – Maintenance for Zones 3 during Operation.	Plants will be maintained according to aviation safety considerations and the Wildlife Hazard Management Plan.	Commencement and completion dates of the maintenance period will be determined by the Vegetation management consultant assessment of performance against the criteria in Table 16. The outcomes of performance will be reported for discussion to the John Holland, Sydney Water, and relevant
			Mowing of grasses is to be undertaken regularly in accordance with the maximum and minimum heights specified in section 4.4 to manage bushfire risk.	

Management Action (MA#)	Management Zone	Responsibility	Task/ Performance Criteria	Timing (Phase)
				authorities where necessary.

8 Adaptive Management

As this is a long-term project implemented over several years, an adaptive management approach will enable the contractor to learn from and respond to successful and unsuccessful techniques used on the site and inform future priorities and work plans. In its simplest form, this may include substituting species identified in the planting tables or undertaking advanced direct seeding techniques instead of manual planting techniques for revegetation. A record will be kept of such changes through the monitoring and reporting scheme as outlined in Section 6.

The success of the works will be determined by meeting the performance criteria identified in Section 7. Contractors can implement different techniques to those specified here providing that performance criteria are met. However, any major departures from the LMP or proposed changes to performance criteria must be approved in writing by JHG, Sydney Water, and where necessary, resubmission to the Planning Secretary in accordance with the CSSI-8609189 Minister's Conditions of Approval.

Appendices

Appendix A Plant Species

Appendix B Solar Farm Plans

Appendix C Landscape Design Drawings

Appendix D Weed Mapping

Appendix A Plant Species

OPERATIONAL ZONE PLANTING

TREE PLANTING				
CODE	BOTANIC NAME	COMMON NAME	SIZE	QUANTITY
FIRE TRAIL TREES				
ANG flo	<i>Angophora floribunda</i>	Rough-barked Apple	25L	41
ANG sub	<i>Angophora subvelutina</i>	Broad leaved Apple	25L	41
COR mac	<i>Corymbia maculata</i>	Spotted Gum	25L	67
EUC amp	<i>Eucalyptus amplifolia</i>	Cabbage Gum	25L	67
EUC cre	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	25L	41
EUC mol	<i>Eucalyptus molucanna</i>	Grey Box	25L	41
EUC sid	<i>Eucalyptus sideroxylon</i>	Red Ironbark	25L	40
EUC ter	<i>Eucalyptus tereticornis</i>	Forest Red Gum	25L	67
			Total	405
FEATURE TREE				
MEL dec	<i>Meleuca decora</i>	White Feather Honeymyrtle	25L	27
			Total	27

GARDEN BED TYPE 1					7270m ²
SHRUBS					
CODE	BOTANIC NAME	COMMON NAME	DENSITY	SIZE	QUANTITY
ACA flo	<i>Acacia floribunda</i>	White Sally	As shown	25L	24
BUR spi	<i>Bursaria spinosa</i>	Blackthorn	1/4m ²	Forestry Tube	606
Cal cit	<i>Callistemon citrinus</i>	Crimson Bottlebrush	1/4m ²	Forestry Tube	606
MEL nod	<i>Melaleuca nodosa</i>	A Tea Tree	As shown	25L	24
IND aus	<i>Indigofera australis</i>	Native Indigo	1/4m ²	Forestry Tube	606
Total					1866
GRASSES 4/m²					
AUS ten	<i>Austrodanthonia tenuior</i>	Wallaby Grass		Viro Tube	4847
IMP cyl	<i>Imperata cylindrica</i>	Bladey Grass		Viro Tube	4847
LOM lon	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		Viro Tube	4847
MIC sti	<i>Microlaena stipoides</i>	Weeping Grass		Viro Tube	4847
POA lab	<i>Poa labillardieri</i> var. <i>labillardierei</i>	Common Tussock Grass		Viro Tube	4846
THE tri	<i>Themeda triandra</i>	Kangaroo Grass		Viro Tube	4846
Total					29080
FORBS 1/m²					
COM cya	<i>Commelina cyanea</i>	Scurvy Weed		Viro Tube	1818
DIC rep	<i>Dichondra repens</i>	Kidney Weed		Viro Tube	1818
EIN pol	<i>Einadia polygonoides</i>	Knotted Goosefoot		Viro Tube	1817
GER sol	<i>Geranium solanderi</i> var. <i>solanderi</i>	Native Geranium		Viro Tube	1817
Total					7270
CLIMBERS 1/10m²					
CLE gly	<i>Clematis glycinoides</i> var. <i>glycinoides</i> fgg	Headache Vine		Viro Tube	243
BIL sca	<i>Billardiera scandens</i>	Apple Berry		Viro Tube	242
GEI cym	<i>Geitonoplesium cymosum</i>	Scrambling Lily		Viro Tube	242
Total					727

GARDEN BED TYPE 2					630m²
GRASSES 4/m²					
LOM lon	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	Viro Tube	1260	
LOM lim	<i>Lomandra longifolia confertifolia</i> 'Lime Tuff'	Basket Grass	Viro Tube	1260	
Total				2520	
GROUNDCOVERS 1/m²					
DIC rep	<i>Dichondra repens</i>	Kidney Weed	Viro Tube	630	
Total				630	

GARDEN BED TYPE 3						10662m²
SHRUBS						
CODE	BOTANIC NAME	COMMON NAME	DENSITY	SIZE	QUANTITY	
BUR spi	<i>Bursaria spinosa</i>	Blackthorn	1/4m ²	Forestry Tube	889	
Cal cit	<i>Callistemon citrinus</i>	Crimson Bottlebrush	1/4m ²	Forestry Tube	889	
IND aus	<i>Indigofera australis</i>	Native Indigo	1/4m ²	Forestry Tube	889	
Total					2667	
GRASSES 4/m²						
AUS ten	<i>Austrodanthonia tenuior</i>	Wallaby Grass		Viro Tube	7108	
IMP cyl	<i>Imperata cylindrica</i>	Bladey Grass		Viro Tube	7108	
LOM lon	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		Viro Tube	7108	
MIC sti	<i>Microlaena stipoides</i>	Weeping Grass		Viro Tube	7108	
POA lab	<i>Poa labillardieri</i> var. <i>labillardierei</i>	Common Tussock Grass		Viro Tube	7108	
THE tri	<i>Themeda triandra</i>	Kangaroo Grass		Viro Tube	7108	
Total					42648	
FORBS 1/m²						
COM cya	<i>Commelina cyanea</i>	Scurvy Weed		Viro Tube	2666	
DIC rep	<i>Dichondra repens</i>	Kidney Weed		Viro Tube	2666	
EIN pol	<i>Einadia polygonoides</i>	Knotted Goosefoot		Viro Tube	2665	
GER sol	<i>Geranium solanderi</i> var. <i>solanderi</i>	Native Geranium		Viro Tube	2665	
Total					10662	
CLIMBERS 1/10m²						
CLE gly	<i>Clematis glycinoides</i> var. <i>glycinoides</i> fgg	Headache Vine		Viro Tube	356	
BIL sca	<i>Billardiera scandens</i>	Apple Berry		Viro Tube	355	

GEI cym	<i>Geitonoplesium cymosum</i>	Scrambling Lily	Viro Tube	355
			Total	1066

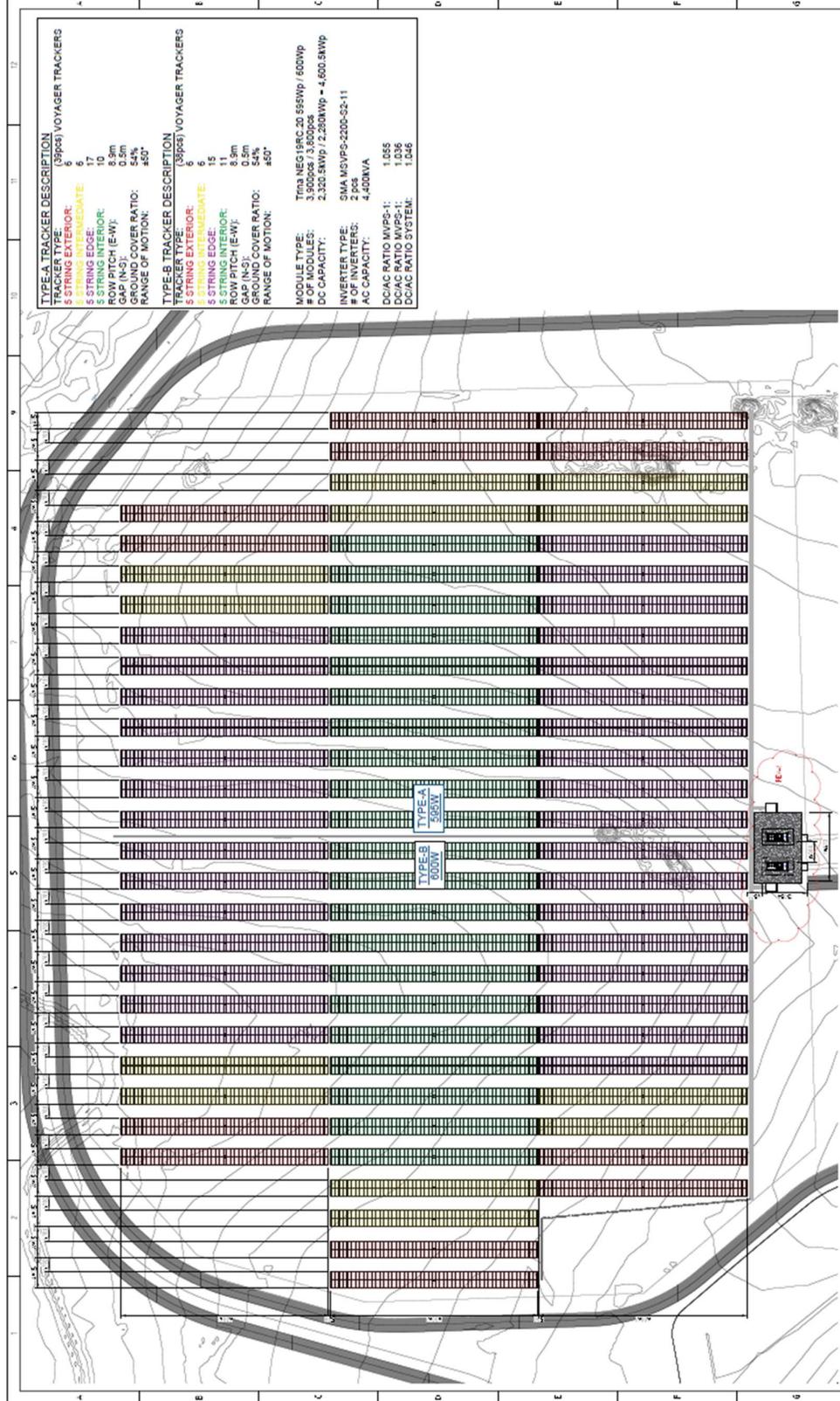
BIORETENTION PLANTING				319m²
SEDGES 8/m²				
CAR app	<i>Carex appresa</i>	Tall Sedge	Viro Tube	340
FIC nod	<i>Ficinia nodosa</i>	Knobby Club Rush	Viro Tube	340
JUN usi	<i>Themeda australis</i>	Kangaroo Grass	Viro Tube	340
JUN kra	<i>Juncus kraussii</i>	Sea Rush	Viro Tube	766
JUN usi	<i>Juncus usitatus</i>	Common Rush	Viro Tube	766
			Total	2552

BIORETENTION PLANTING (DRY)				1148m²
GRASSES/SEDGES 8/m²				
CAR app	<i>Carex appresa</i>	Tall Sedge	Viro Tube	1225
FIC nod	<i>Ficinia nodosa</i>	Knobby Club Rush	Viro Tube	1225
JUN usi	<i>Themeda australis</i>	Kangaroo Grass	Viro Tube	1225
AUS sti	<i>Austrostipa stipoides</i>	Coast Spear Grass	Viro Tube	1102
DIA lon	<i>Dianella longifolia</i>	Blueberry Lily	Viro Tube	1102
GAH fil	<i>Gahnia filum</i>	Chaffy Saw-sedge	Viro Tube	1102
LOM lon	<i>Lomandra longifolia</i>	Tanika, Spiny Mat-rush	Viro Tube	1102
MIC sti	<i>Microlaena stipoides</i>	Weeping Grass	Viro Tube	1102
			Total	9185

BATTER PLANTING				1525m²
SHRUBS 1/2 m²				
DAV uli	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	Viro Tube	190
DOD vis	<i>Dodonaea viscosa</i>	Sticky Hop Bush	Viro Tube	190
GOO ova	<i>Goodenia ovata</i>	Hop Goodenia	Viro Tube	190
MEL eru	<i>Melaleuca erubescens</i>	Pink Honey Myrtle	Viro Tube	190
GRASSES 4/m²				
LOM lon	<i>Lomandra longifolia</i>	Tanika, Spiny Mat-rush	Viro Tube	3050
DIA lon	<i>Dianella longifolia</i>	Blueberry Lily	Viro Tube	3050
			Total	6860

GRASS TYPES					
CODE	BOTANIC NAME	DESCRIPTION			
GRASS TYPE 1					
TYPE 1	<i>Empire Zoysia</i>	Turf as specified on 100mm improved site fill over 200mm cultivated site fill			
				Total Area (m²)	17158
GRASS TYPE 2					
TYPE 2	<i>Sir Grange Zoysia</i>	Turf as specified on 100mm improved site fill			
				Total Area (m²)	17032
GRASS TYPE 3					
TYPE 3	<i>Empire Zoysia</i>	Turf sprigging as specified on 100mm improved site fill over 200mm cultivated site fill			
				Total Area (m²)	165757
GRASS TYPE 4					
CODE	BOTANIC NAME	COMMON NAME	MINIMUM APPLICATION RATE (kg/ha)	QUANTITY (kg)	
Type 4	<i>Echinochloa esculenta</i> or <i>Secale cereale</i>	Japanese Millet @ 20kg/ha (warmer months) or Rye Corn @25kg/ha (cooler months)	20-25	14-18	
	<i>Microlaena stipoides</i>	Weeping Grass	12	9	
				Total Area (m²)	7039

Appendix B Solar Farm Plans



TYPE-A TRACKER DESCRIPTION
 TRACKER TYPE: 6 (3695) VOYAGER TRACKERS
 # OF TRACKERS: 6
 # OF STRINGS: 17
 # OF STRINGS INTERMEDIATE: 6
 # OF STRINGS EDGE: 10
 # OF STRINGS INTERIOR: 17
 # OF STRINGS INTERIOR (E-W): 17
 # OF STRINGS INTERIOR (N-S): 17
 GROUND COVER RATIO: 54%
 RANGE OF MOTION: 45°

TYPE-B TRACKER DESCRIPTION
 TRACKER TYPE: 6 (3695) VOYAGER TRACKERS
 # OF TRACKERS: 6
 # OF STRINGS: 15
 # OF STRINGS INTERMEDIATE: 6
 # OF STRINGS EDGE: 9
 # OF STRINGS INTERIOR: 9
 # OF STRINGS INTERIOR (E-W): 9
 # OF STRINGS INTERIOR (N-S): 9
 GROUND COVER RATIO: 54%
 RANGE OF MOTION: 45°

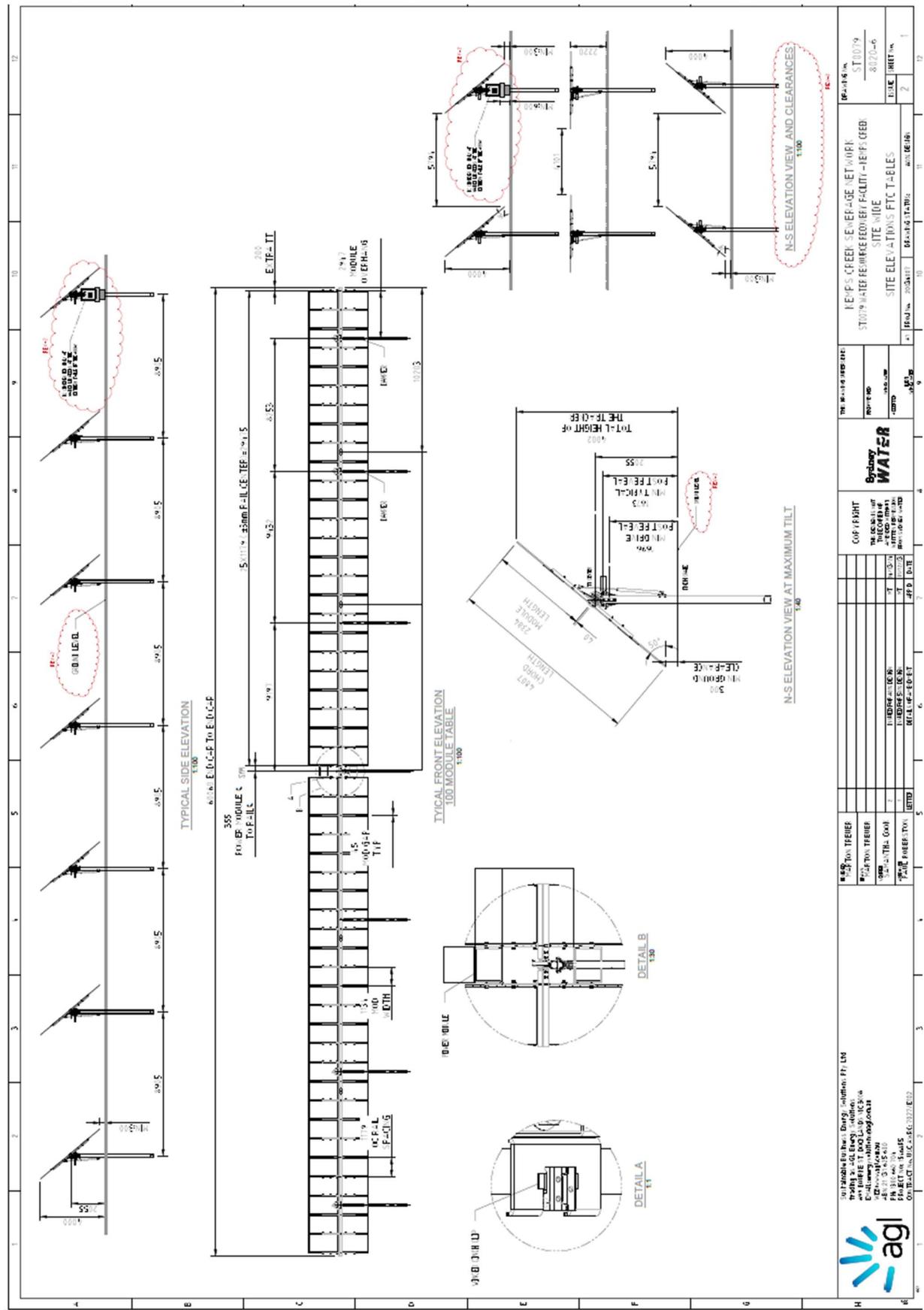
MODULE TYPE: Tima NEG 16RC 20 95Wp / 600Wp
OF MODULES: 3,900pcs / 3,900pcs
DC CAPACITY: 2,320 MWp / 2,280 MWp = 4,600 kWp

INVERTER TYPE: SMA M3VPS-2200-S2-11
OF INVERTERS: 2 pcs
AC CAPACITY: 4,400kVA

DC/AC RATIO MWPS-1: 1.055
DC/AC RATIO MWPS-1: 1.036

OVERALL SITE PLAN
 1:500

		301 South 4th Street, Des Moines, IA 50319 Phone: 515.281.1111 Email: info@agi.com Website: www.agi.com	
CLIENT: ICF PROJECT NAME: ICF-5 CHEER SEWERAGE NETWORK PROJECT ADDRESS: 3700 79th Street, Des Moines, IA 50317	DATE: 10/20/24 SCALE: 1" = 100'-0"	DESIGNER: AGI PROJECT NO.: 2024017	DATE: 10/20/24 SCALE: 1" = 100'-0"
PROJECT TYPE: WATER PROJECT PHASE: PRELIMINARY	PROJECT NO.: 2024017 PROJECT NAME: ICF-5 CHEER SEWERAGE NETWORK	PROJECT ADDRESS: 3700 79th Street, Des Moines, IA 50317	PROJECT NO.: 2024017 PROJECT NAME: ICF-5 CHEER SEWERAGE NETWORK
PROJECT NO.: 2024017 PROJECT NAME: ICF-5 CHEER SEWERAGE NETWORK	PROJECT ADDRESS: 3700 79th Street, Des Moines, IA 50317	PROJECT NO.: 2024017 PROJECT NAME: ICF-5 CHEER SEWERAGE NETWORK	PROJECT NO.: 2024017 PROJECT NAME: ICF-5 CHEER SEWERAGE NETWORK



AGI
 1000mm C TO P-HLC
 1000mm P-HLC TO E-TE
 200 E-TE-TT

NO.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	10/10/2024
2	FOR INFORMATION	10/10/2024
3	FOR INFORMATION	10/10/2024
4	FOR INFORMATION	10/10/2024
5	FOR INFORMATION	10/10/2024
6	FOR INFORMATION	10/10/2024
7	FOR INFORMATION	10/10/2024
8	FOR INFORMATION	10/10/2024
9	FOR INFORMATION	10/10/2024
10	FOR INFORMATION	10/10/2024
11	FOR INFORMATION	10/10/2024
12	FOR INFORMATION	10/10/2024

NO.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	10/10/2024
2	FOR INFORMATION	10/10/2024
3	FOR INFORMATION	10/10/2024
4	FOR INFORMATION	10/10/2024
5	FOR INFORMATION	10/10/2024
6	FOR INFORMATION	10/10/2024
7	FOR INFORMATION	10/10/2024
8	FOR INFORMATION	10/10/2024
9	FOR INFORMATION	10/10/2024
10	FOR INFORMATION	10/10/2024
11	FOR INFORMATION	10/10/2024
12	FOR INFORMATION	10/10/2024

NO.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	10/10/2024
2	FOR INFORMATION	10/10/2024
3	FOR INFORMATION	10/10/2024
4	FOR INFORMATION	10/10/2024
5	FOR INFORMATION	10/10/2024
6	FOR INFORMATION	10/10/2024
7	FOR INFORMATION	10/10/2024
8	FOR INFORMATION	10/10/2024
9	FOR INFORMATION	10/10/2024
10	FOR INFORMATION	10/10/2024
11	FOR INFORMATION	10/10/2024
12	FOR INFORMATION	10/10/2024

NO.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	10/10/2024
2	FOR INFORMATION	10/10/2024
3	FOR INFORMATION	10/10/2024
4	FOR INFORMATION	10/10/2024
5	FOR INFORMATION	10/10/2024
6	FOR INFORMATION	10/10/2024
7	FOR INFORMATION	10/10/2024
8	FOR INFORMATION	10/10/2024
9	FOR INFORMATION	10/10/2024
10	FOR INFORMATION	10/10/2024
11	FOR INFORMATION	10/10/2024
12	FOR INFORMATION	10/10/2024

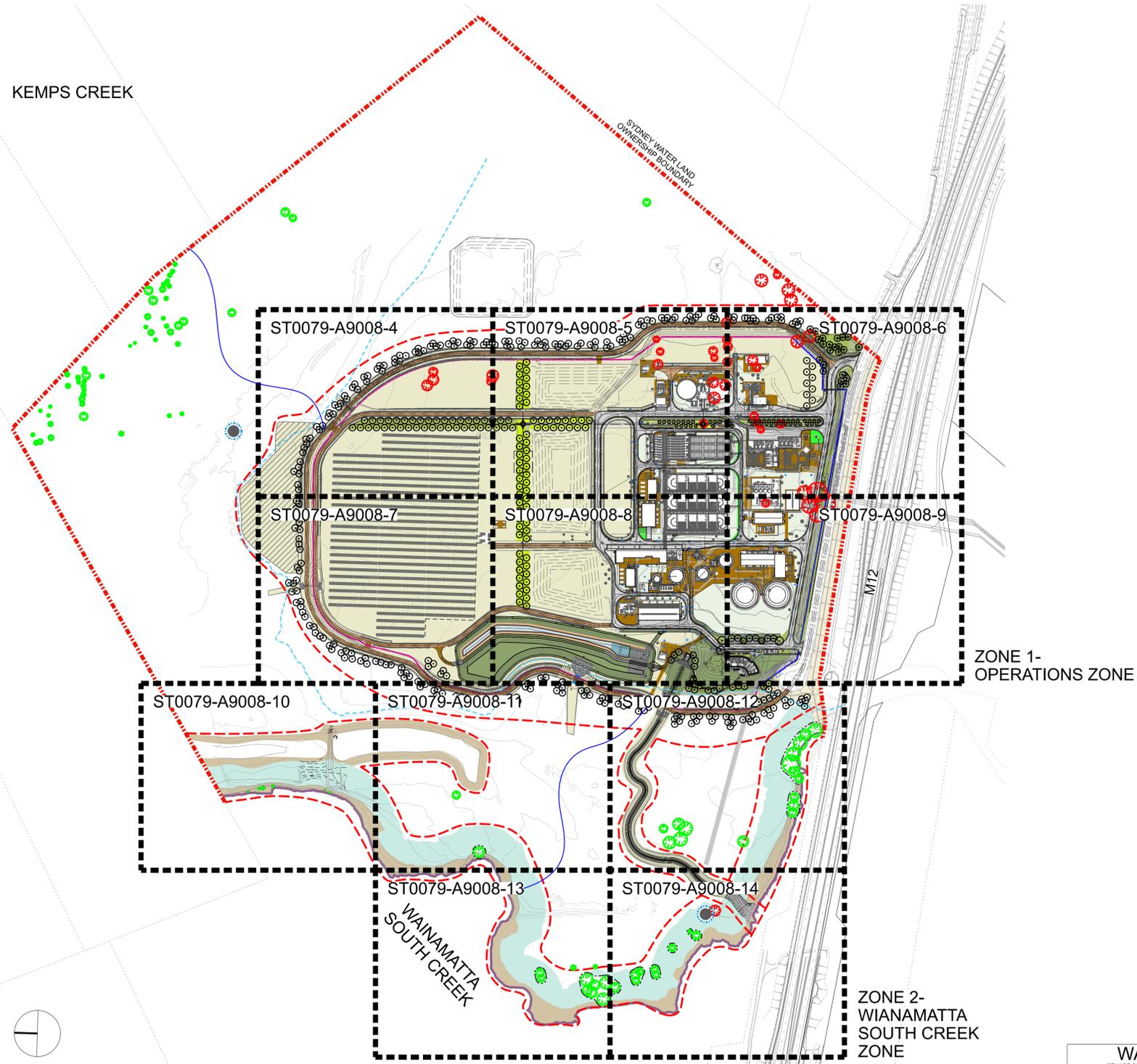
NO.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	10/10/2024
2	FOR INFORMATION	10/10/2024
3	FOR INFORMATION	10/10/2024
4	FOR INFORMATION	10/10/2024
5	FOR INFORMATION	10/10/2024
6	FOR INFORMATION	10/10/2024
7	FOR INFORMATION	10/10/2024
8	FOR INFORMATION	10/10/2024
9	FOR INFORMATION	10/10/2024
10	FOR INFORMATION	10/10/2024
11	FOR INFORMATION	10/10/2024
12	FOR INFORMATION	10/10/2024

NO.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	10/10/2024
2	FOR INFORMATION	10/10/2024
3	FOR INFORMATION	10/10/2024
4	FOR INFORMATION	10/10/2024
5	FOR INFORMATION	10/10/2024
6	FOR INFORMATION	10/10/2024
7	FOR INFORMATION	10/10/2024
8	FOR INFORMATION	10/10/2024
9	FOR INFORMATION	10/10/2024
10	FOR INFORMATION	10/10/2024
11	FOR INFORMATION	10/10/2024
12	FOR INFORMATION	10/10/2024

NO.	DESCRIPTION	DATE
1	ISSUED FOR TENDER	10/10/2024
2	FOR INFORMATION	10/10/2024
3	FOR INFORMATION	10/10/2024
4	FOR INFORMATION	10/10/2024
5	FOR INFORMATION	10/10/2024
6	FOR INFORMATION	10/10/2024
7	FOR INFORMATION	10/10/2024
8	FOR INFORMATION	10/10/2024
9	FOR INFORMATION	10/10/2024
10	FOR INFORMATION	10/10/2024
11	FOR INFORMATION	10/10/2024
12	FOR INFORMATION	10/10/2024

Appendix C Landscape Design Drawings

KEMPS CREEK SEWERAGE NETWORK ST0079 WATER RESOURCE RECOVERY FACILITY- KEMPS CREEK LANDSCAPE



DRAWING INDEX:

ST0079-A9008-1	COVER SHEET	1 OF 1
ST0079-A9008-2	PLANTING SCHEDULE	1 OF 2
ST0079-A9008-3	PLANTING SCHEDULE	2 OF 2
ST0079-A9008-4	GENERAL ARRANGEMENT: ZONE 1	1 OF 11
ST0079-A9008-5	GENERAL ARRANGEMENT: ZONE 1	2 OF 11
ST0079-A9008-6	GENERAL ARRANGEMENT: ZONE 1	3 OF 11
ST0079-A9008-7	GENERAL ARRANGEMENT: ZONE 1	4 OF 11
ST0079-A9008-8	GENERAL ARRANGEMENT: ZONE 1	5 OF 11
ST0079-A9008-9	GENERAL ARRANGEMENT: ZONE 1	6 OF 11
ST0079-A9008-10	GENERAL ARRANGEMENT: ZONE 1	7 OF 11
ST0079-A9008-11	GENERAL ARRANGEMENT: ZONE 2	8 OF 11
ST0079-A9008-12	GENERAL ARRANGEMENT: ZONE 2	9 OF 11
ST0079-A9008-13	GENERAL ARRANGEMENT: ZONE 2	10 OF 11
ST0079-A9008-14	GENERAL ARRANGEMENT: ZONE 2	11 OF 11
ST0079-A9008-15	DETAIL - ADMIN BUILDING PLAN	1 OF 10
ST0079-A9008-16	DETAIL - ADMIN BUILDING & FIRETRAIL SECTIONS	2 OF 10
ST0079-A9008-17	DETAIL - GARDEN BED TYPE 1 - OPERATIONS ZONE	3 OF 10
ST0079-A9008-18	DETAIL - GARDEN BED TYPE 1 - CROSS ARRAY	4 OF 10
ST0079-A9008-19	DETAIL - TYPICAL PLANTING	5 OF 10
ST0079-A9008-20	DETAIL - ENTRY WALL	6 OF 10
ST0079-A9008-21	DETAIL - CROSS ARRAY MARKERS	7 OF 10
ST0079-A9008-22	DETAIL - BIORETENTION & CHANNEL SECTIONS	8 OF 10
ST0079-A9008-23	DETAIL - PLANTING SETOUT	9 OF 10
ST0079-A9008-24	DETAIL - ZONE 2	10 OF 10

PATHWAYS TO KEMPS CREEK AND WIANAMATTA SOUTH CREEK FOR MAINTENANCE ACCESS. REFER SPECIFICATION

ZONE 1- OPERATIONS ZONE

ZONE 2- WIANAMATTA SOUTH CREEK ZONE

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

FOR CONSTRUCTION

JOHN HOLLAND
JOHN HOLLAND PTY LTD
ABN: 11 004 282 268
ADDRESS: Lvl 3/43-45 Pirrama Rd, Pyrmont NSW 2009
PHONE: (02) 9552 4288

TRILITY
TRILITY PTY LTD
ABN: 48 053 122 562
ADDRESS: Lvl 10/115 Grenfell St, Adelaide SA 5000
PHONE: (08) 8408 6500

Tract
TRACT CONSULTANTS PTY LTD
ABN: 75 423 048 489
Lvl 8/80 Mount St, North Sydney NSW 2060
PHONE: (02) 9954 3733

DESIGNED JULIE LEE TRACT CONSULTANTS 23.04.24	DRAWN MICHAEL GOCK TRACT CONSULTANTS 23.04.24	VERIFIED ADAM JEFFERY TRACT CONSULTANTS 23.04.24	APPROVED JULIE LEE TRACT CONSULTANTS 23.04.24
LETTER A			
ISSUED FOR CONSTRUCTION			
APP'D J.L.		DATE 23.04.24	

COPYRIGHT
THIS DESIGN IS NOT TO BE COPIED OR AMENDED WITHOUT WRITTEN PERMISSION FROM SYDNEY WATER

Sydney WATER

THIS DRAWING SUPERSEDES:
RECOMMENDED 23.04.24
MANAGER SYDNEY WATER
ACCEPTED 23.04.24
SYDNEY WATER

KEMPS CREEK SEWERAGE NETWORK ST0079 WATER RESOURCE RECOVERY FACILITY - KEMPS CREEK LANDSCAPE COVER SHEET		DRAWING No. ST0079 A9008-1
A1 PROJ No 20036007		DRAFT SHEET No. 1
DRAWING STATUS: FOR CONSTRUCTION		

594
594

TREE PLANTING				
CODE	BOTANIC NAME	COMMON NAME	SIZE	QUANTITY
FIRE TRAIL TREES				
ANG flo	<i>Angophora floribunda</i>	Rough-barked Apple	25L	41
ANG sub	<i>Angophora subvelutina</i>	Broad leaved Apple	25L	41
COR mac	<i>Corymbia maculata</i>	Spotted Gum	25L	67
EUC amp	<i>Eucalyptus amplifolia</i>	Cabbage Gum	25L	67
EUC cre	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	25L	41
EUC mol	<i>Eucalyptus molucana</i>	Grey Box	25L	41
EUC sid	<i>Eucalyptus sideroxylon</i>	Red Ironbark	25L	40
EUC ter	<i>Eucalyptus tereticornis</i>	Forest Red Gum	25L	67
			Total	405
FEATURE TREE				
MEL dec	<i>Meleuca decora</i>	White Feather Honeymyrtle	25L	27
			Total	27

HOLD
(PMI 01490)

GARDEN BED TYPE 1						7270m ²
SHRUBS						
CODE	BOTANIC NAME	COMMON NAME	DENSITY	SIZE	QUANTITY	
ACA flo	<i>Acacia floribunda</i>	White Sally	As shown	25L	24	
BUR spi	<i>Bursaria spinosa</i>	Blackthorn	1/4m ²	Forestry Tube	606	
Cal cit	<i>Callistemon citrinus</i>	Crimson Bottlebrush	1/4m ²	Forestry Tube	606	
MEL nod	<i>Melaleuca nodosa</i>	A Tea Tree	As shown	25L	24	
IND aus	<i>Indigofera australis</i>	Native Indigo	1/4m ²	Forestry Tube	606	
					Total	522
GRASSES 4/m ²						
AUS ten	<i>Austrodanthonia tenuior</i>	Wallaby Grass		Viro Tube	4847	
IMP cyl	<i>Imperata cylindrica</i>	Bladey Grass		Viro Tube	4847	
LOM lon	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		Viro Tube	4847	
MIC sti	<i>Microlaena stipoides</i>	Weeping Grass		Viro Tube	4847	
POA lab	<i>Poa labillardieri</i> var. <i>labillardieri</i>	Common Tussock Grass		Viro Tube	4846	
THE tri	<i>Themeda triandra</i>	Kangaroo Grass		Viro Tube	4846	
					Total	29080
FORBS 1/m ²						
COM cya	<i>Commelina cyanea</i>	Scurvy Weed		Viro Tube	1818	
DIC rep	<i>Dichondra repens</i>	Kidney Weed		Viro Tube	1818	
EIN pol	<i>Einadia polygonoides</i>	Knotted Goosefoot		Viro Tube	1817	
GER sol	<i>Geranium solanderi</i> var. <i>solanderi</i>	Native Geranium		Viro Tube	1817	
					Total	7270
CLIMBERS 1/10m ²						
CLE gly	<i>Clematis glycinoides</i> var. <i>glycinoidesfgg</i>	Headache Vine		Viro Tube	243	
EUS lat	<i>Eustrephus latifolius</i>	Wombat Berry		Viro Tube	242	
GEI cym	<i>Geitonoplesium cymosum</i>	Scrambling Lily		Viro Tube	242	
					Total	727

GARDEN BED TYPE 2					630m ²
GRASSES 4/m ²					
LOM lon	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	Viro Tube	1260	
LOM lim	<i>Lomandra longifolia confertifolia</i> 'Lime Tuff'	Basket Grass	Viro Tube	1260	
				Total	2520
GROUNDCOVERS 1/m ²					
DIC rep	<i>Dichondra repens</i>	Kidney Weed	Viro Tube	630	
				Total	630

GARDEN BED TYPE 3						10662m ²
SHRUBS						
CODE	BOTANIC NAME	COMMON NAME	DENSITY	SIZE	QUANTITY	
BUR spi	<i>Bursaria spinosa</i>	Blackthorn	1/4m ²	Forestry Tube	889	
Cal cit	<i>Callistemon citrinus</i>	Crimson Bottlebrush	1/4m ²	Forestry Tube	889	
IND aus	<i>Indigofera australis</i>	Native Indigo	1/4m ²	Forestry Tube	889	
					Total	2667
GRASSES 4/m ²						
AUS ten	<i>Austrodanthonia tenuior</i>	Wallaby Grass		Viro Tube	7108	
IMP cyl	<i>Imperata cylindrica</i>	Bladey Grass		Viro Tube	7108	
LOM lon	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		Viro Tube	7108	
MIC sti	<i>Microlaena stipoides</i>	Weeping Grass		Viro Tube	7108	
POA lab	<i>Poa labillardieri</i> var. <i>labillardieri</i>	Common Tussock Grass		Viro Tube	7108	
THE tri	<i>Themeda triandra</i>	Kangaroo Grass		Viro Tube	7108	
					Total	42648
FORBS 1/m ²						
COM cya	<i>Commelina cyanea</i>	Scurvy Weed		Viro Tube	2666	
DIC rep	<i>Dichondra repens</i>	Kidney Weed		Viro Tube	2666	
EIN pol	<i>Einadia polygonoides</i>	Knotted Goosefoot		Viro Tube	2665	
GER sol	<i>Geranium solanderi</i> var. <i>solanderi</i>	Native Geranium		Viro Tube	2665	
					Total	10662
CLIMBERS 1/10m ²						
CLE gly	<i>Clematis glycinoides</i> var. <i>glycinoidesfgg</i>	Headache Vine		Viro Tube	356	
EUS lat	<i>Eustrephus latifolius</i>	Wombat Berry		Viro Tube	355	
GEI cym	<i>Geitonoplesium cymosum</i>	Scrambling Lily		Viro Tube	355	
					Total	1066

NOTE:
REFER TYPICAL PLANTING SETOUT ON A9008-23

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE
ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO
GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

FOR CONSTRUCTION

 JOHN HOLLAND PTY LTD ABN: 11 004 282 268 ADDRESS: Lvl 3/63-65 Pirrama Rd, Pyrmont NSW 2009 PHONE: (02) 9552 4288	 TRILITY PTY LTD ABN: 48 053 122 562 ADDRESS: Lvl 10/115 Greenfell St, Adelaide SA 5000 PHONE: (08) 8408 6500	 TRACT CONSULTANTS PTY LTD ABN: 75 423 048 489 Lvl 8/80 Mount St North Sydney NSW 2060 PHONE: (02) 9954 3793	DESIGNED JULIE LEE TRACT CONSULTANTS 23.04.24	DRAWN MICHAEL GOCK TRACT CONSULTANTS 23.04.24	VERIFIED ADAM JEFFERY TRACT CONSULTANTS 23.04.24	APPROVED JULIE LEE TRACT CONSULTANTS 23.04.24	A	ISSUED FOR CONSTRUCTION	JL	23.04.24	COPYRIGHT THIS DESIGN IS NOT TO BE COPIED OR AMENDED WITHOUT WRITTEN PERMISSION FROM SYDNEY WATER		THIS DRAWING SUPERSEDES	RECOMMENDED 23.04.24 MANAGER SYDNEY WATER ACCEPTED 23.04.24 SYDNEY WATER	KEMPS CREEK SEWERAGE NETWORK ST0079 WATER RESOURCE RECOVERY FACILITY - KEMPS CREEK PLANTING SCHEDULE	DRAWING No. ST0079 A9008-2
			DRAFT	SHEET No. 2	A1	PROJ No. 20036007	DRAWING STATUS: FOR CONSTRUCTION	A	2							

BIORETENTION PLANTING					319m ²
SEDGES 8/m ²					
CAR app	<i>Carex appresa</i>	Tall Sedge	Viro Tube	340	
FIC nod	<i>Ficinia nodosa</i>	Knobby Club Rush	Viro Tube	340	
JUN usi	<i>Themeda australis</i>	Kangaroo Grass	Viro Tube	340	
JUN kra	<i>Juncus kraussii</i>	Sea Rush	Viro Tube	766	
JUN usi	<i>Juncus usitatus</i>	Common Rush	Viro Tube	766	
Total				2552	

BIORETENTION PLANTING (DRY)					1148m ²
GRASSES/SEDGES 8/m ²					
CAR app	<i>Carex appresa</i>	Tall Sedge	Viro Tube	1225	
FIC nod	<i>Ficinia nodosa</i>	Knobby Club Rush	Viro Tube	1225	
JUN usi	<i>Themeda australis</i>	Kangaroo Grass	Viro Tube	1225	
AUS sti	<i>Austrostipa stipoides</i>	Coast Spear Grass	Viro Tube	1102	
DIA lon	<i>Dianella longifolia</i>	Blueberry Lily	Viro Tube	1102	
GAH fil	<i>Gahnia filum</i>	Chaffy Saw-sedge	Viro Tube	1102	
LOM lon	<i>Lomandra longifolia</i>	Tanika, Spiny Mat-rush	Viro Tube	1102	
MIC sti	<i>Microlaena stipoides</i>	Weeping Grass	Viro Tube	1102	
Total				9185	

BATTER PLANTING					1525m ²
SHRUBS 1/2 m ²					
DAV uli	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	Viro Tube	190	
DOD vis	<i>Dodonaea viscosa</i>	Sticky Hop Bush	Viro Tube	190	
GOO ova	<i>Goodenia ovata</i>	Hop Goodenia	Viro Tube	190	
MEL eru	<i>Melaleuca erubescens</i>	Pink Honey Myrtle	Viro Tube	190	
GRASSES 4/m ²					
LOM lon	<i>Lomandra longifolia</i>	Tanika, Spiny Mat-rush	Viro Tube	3050	
DIA lon	<i>Dianella longifolia</i>	Blueberry Lily	Viro Tube	3050	
Total				6860	

NOTE:
REFER TYPICAL PLANTING SETOUT ON A9008-23

Additional landscaping drawings were removed due to the large file sizes

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

FOR CONSTRUCTION

 JOHN HOLLAND PTY LTD ABN: 11 004 282 268 ADDRESS: Lvl 31/63-65 Pirrama Rd, Pyrmont NSW 2009 PHONE: (02) 9552 4288	 TRILITY PTY LTD ABN: 48 053 122 562 ADDRESS: Lvl 10/115 Grenfell St, Adelaide SA 5000 PHONE: (08) 8408 6500	 TRACT CONSULTANTS PTY LTD ABN: 48 053 122 562 Lvl 8/80 Mount St, North Sydney NSW 2060 PHONE: (02) 9954 3733	DESIGNED JULIE LEE TRACT CONSULTANTS 23.04.24	COPYRIGTH THIS DESIGN IS NOT TO BE COPIED OR AMENDED WITHOUT WRITTEN PERMISSION FROM SYDNEY WATER 	THIS DRAWING SUPERSEDES	KEMPS CREEK SEWERAGE NETWORK ST0079 WATER RESOURCE RECOVERY FACILITY - KEMPS CREEK PLANTING SCHEDULE	DRAWING No. ST0079 A9008-3
			DRAWN MICHAEL GOCK TRACT CONSULTANTS 23.04.24		RECOMMENDED 23.04.24		DRAFT SHEET No. A 3
			VERIFIED ADAM JEFFERY TRACT CONSULTANTS 23.04.24	APP'D DATE JL 23.04.24	MANAGER SYDNEY WATER	PROJ No 20036007 DRAWING STATUS: FOR CONSTRUCTION	
			APPROVED JULIE LEE TRACT CONSULTANTS 23.04.24		ACCEPTED 23.04.24		

594
594
841

Appendix D Weed Mapping

AMBS Ref: 24447

10/09/2024

Ryan Maxwell
John Holland Group
Level 3, 65 Pirrama Road
Pyrmont, NSW 2009



Dear Ryan,

Upper South Creek AWRC – Weed Mapping

On the 4th of July 2024, AMBS Ecology & Heritage undertook a weed mapping assessment of the riparian corridor of South Creek on the western boundary of the Advanced Water Recycling Centre (AWRC) and an area in the facility designated as a future solar farm. This weed assessment will be used by the client to make informed decisions on appropriate weed management prior to revegetation.

Study Area

The first assessment area is part of the Advanced Water Recycling at Paper Rd, Kemps Creek NSW 2178. It comprises of the riparian corridor of 40m width (approximately 4.2ha) from the eastern bank of South Creek which runs along the western boundary of the property on Lot 211 DP 1272676 and Lot 212 DP1272676 (Figure 1-3). The second assessment area is in the northern part of the property designated as the solar farm on Lot 211 DP 1272676 (approximately 4ha). Both assessment areas are in the Cumberland subregion of the Sydney basin IBRA bioregion. Both assessment areas are not mapped as a PCT (DCCEEW, 2021a) and could be classed as cleared exotic grassland due to the high abundance of exotic ground cover and limited native species abundance, however both upstream and downstream of South Creek are mapped as PCT 4025 Cumberland Red Gum Riverflat Forest.

Methods

A walkthrough of assessment area one was undertaken on July 4th 2024 by Lachlan Palmes and Julian Herting, in area two where a 5x30m representative floristic plot was undertaken. Assessment area two was slashed prior to the weed assessment, potentially limiting the number of species that can be identified. During the walkthrough assessment, large continuous patches of weeds were recorded, additionally incidental occurrences of weed species were recorded.

Results

Riparian corridor

In total forty different non-native species from thirty-five genera have been recorded in the riparian corridor (Table 1). Ten species of these species are classified as high threat weeds by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW,

2021b), of which three species are designated manageable high threat exotics (Table 1). Additionally, four species classified as weeds of national significance (WONS) as classified by the Department of Primary Industry (DPI, 2024) have been recorded (Table 1).

The riparian corridor is dominated by *Paspalum dilatatum* (Paspalum) which covers approximately 50-75% of the assessment area, with cover becoming less dense closer to the creek bank. Unless otherwise indicated on the map, other exotic species are generally found interspersed within the cover of *Paspalum dilatatum* (Paspalum) (Figures 1-3). Figures 1-3 depict patches where cover were highest for that particular weed species.

Close to the bank of South Creek patches dominated by *Cenchrus clandestinus* (Kikuyu) or *Andropogon virginicus* (Whisky Grass) were observed. In addition, there are significant patches of *Alternanthera philoxeroides* (Alligator Weed) and *Nassella neesiana* (Chilean Needle Grass) along the drainage of a billabong and along the bank of the creek.

Table 1 Exotic species recorded in the riparian corridor of the South Creek. Listing the scientific name, common name, high threat weed status according to DCCEEW and DPI.

Scientific Name	Common Name	High Threat Weed Status	Weed of National significance Status	Priority Weed for Greater Sydney region
<i>Alternanthera philoxeroides</i>	Alligator Weed	HTW	WONS	Priority Weed
<i>Andropogon virginicus</i>	Whiskey Grass	HTW	–	–
<i>Arujia sericifera</i>	Moth Vine	HTW – manageable	–	–
<i>Bidens pilosa</i>	Cobbler's Pegs	HTW	–	–
<i>Briza subaristata</i>		HTW	–	–
<i>Bromus catharticus</i>	Prairie Grass	–	–	–
<i>Bromus sterilis</i>	Sterile Brome	–	–	–
<i>Carduus</i> spp.	Thistles	–	–	–
<i>Cenchrus clandestinus</i>	Kikuyu	HTW	–	–
<i>Cestrum parqui</i>	Green Cestrum	HTW	–	Priority Weed
<i>Cinnamomum camphora</i>	Camphor Laurel	HTW – manageable	–	–
<i>Cirsium vulgare</i>	Spear Thistle	–	–	–
<i>Eragrostis curvula</i>	African Lovegrass	HTW	–	–
<i>Galium aparine</i>	Goosegrass	–	–	–
<i>Leontodon</i> spp.		–	–	–
<i>Ligustrum sinense</i>	Small Leaved Privet	HTW	–	–
<i>Lycium ferocissimum</i>	African Boxthorn	HTW – manageable	WONS	Priority Weed
<i>Modiola caroliniana</i>	Red-Flowered Mallow	–	–	–
<i>Nassella neesiana</i>	Chilean Needle Grass	HTW	WONS	Priority Weed
<i>Paspalum dilatatum</i>	Paspalum	HTW	–	–
<i>Paspalum</i> spp.	Paspalum	HTW	–	–
<i>Pavonia hastata</i>		–	–	–
<i>Phalaris</i> spp.		–	–	–

<i>Phytolacca octandra</i>	Inkweed	–	–	–
<i>Plantago lanceolata</i>	Plantain	–	–	–
<i>Prunus</i> spp.	Peach/Plum	–	–	–
<i>Rubus fruticosus</i> species aggregate	Blackberry	HTW	WONS	Priority Weed
<i>Rumex obtusifolius</i>		–	–	–
<i>Senecio madagascariensis</i>	Fireweed	HTW	WONS	Priority Weed
<i>Setaria parviflora</i>	Pale Pigeon Grass	–	–	–
<i>Sida rhombifolia</i>	Paddy's Lucerne	–	–	–
<i>Solanum nigrum</i>	Blackberry Nightshade	–	–	–
<i>Solanum pseudocapsicum</i>	Jerusalem Cherry	–	–	–
<i>Solanum sisymbriifolium</i>	Sticky Nightshade	–	–	–
<i>Sporobolus africanus</i>		–	–	–
<i>Taraxacum officinale</i>		–	–	–
<i>Trifolium</i> spp.		–	–	–
<i>Verbena bonariensis</i>	Purpletop	–	–	–
<i>Vicia sativa</i>	Common Vetch	–	–	–
<i>Vicia</i> sp.	Vetch	–	–	–

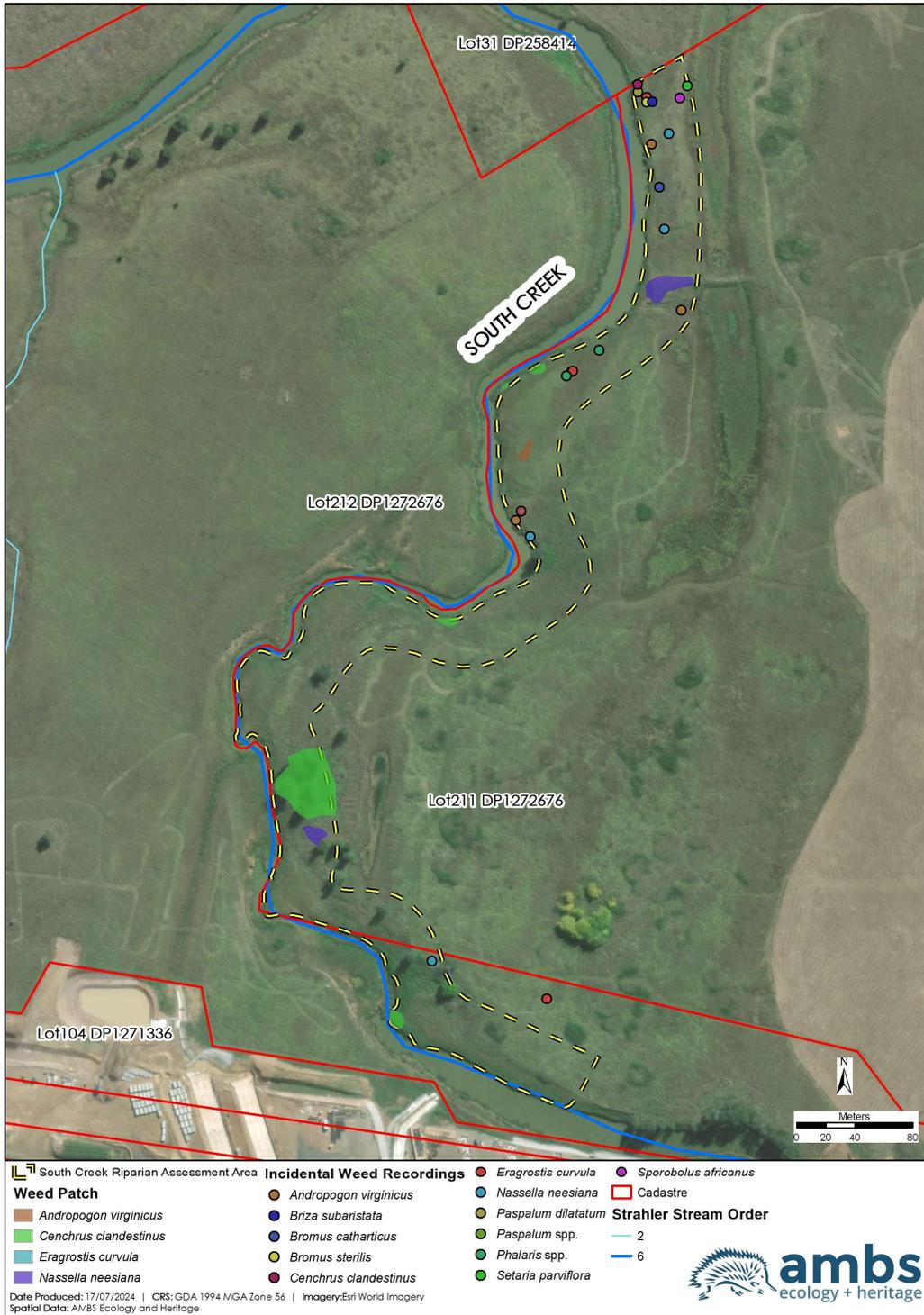


Figure 1 Weedy grass species recorded on riparian corridor of South Creek

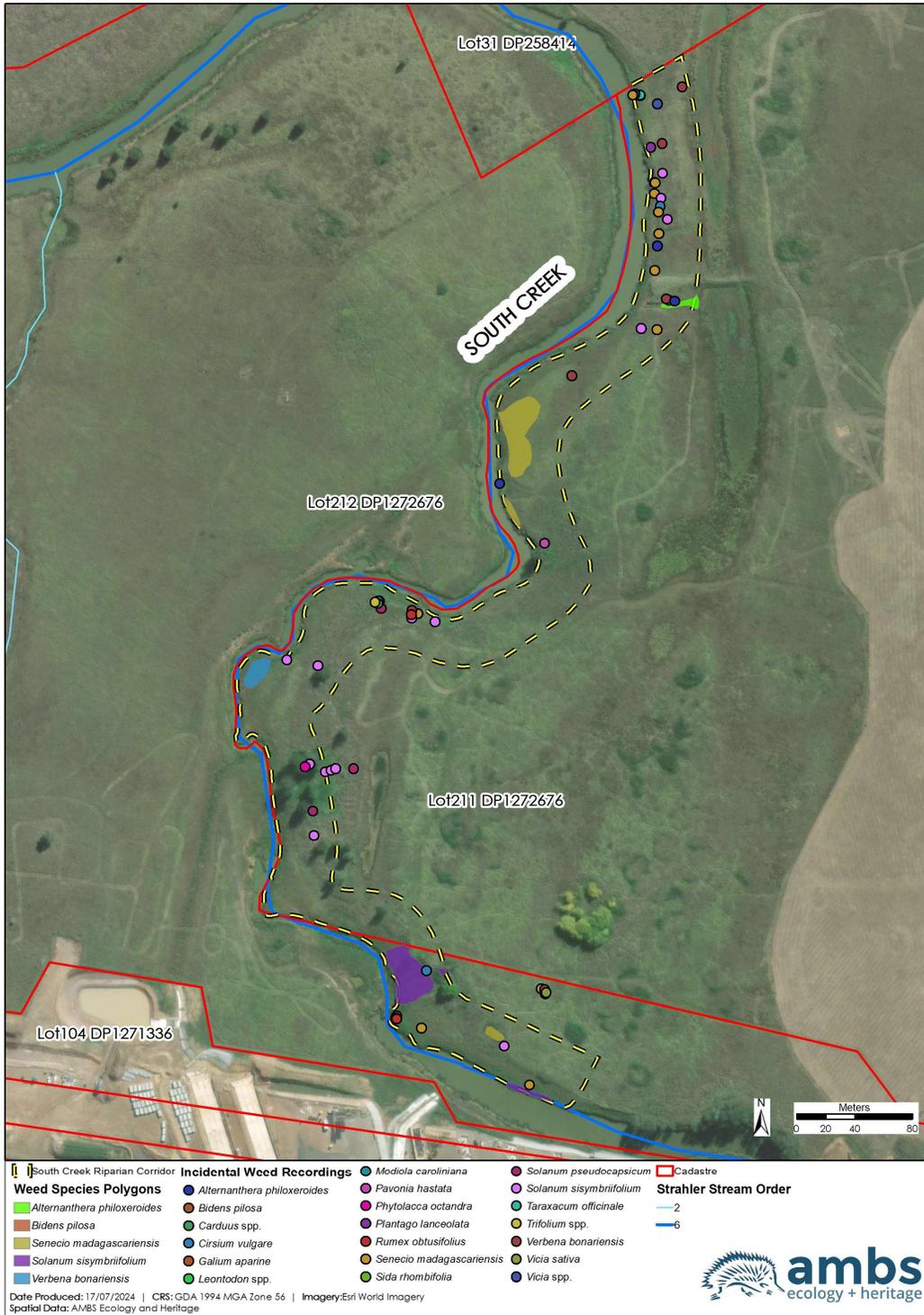


Figure 2 Weedy herb species recorded on riparian corridor of South Creek

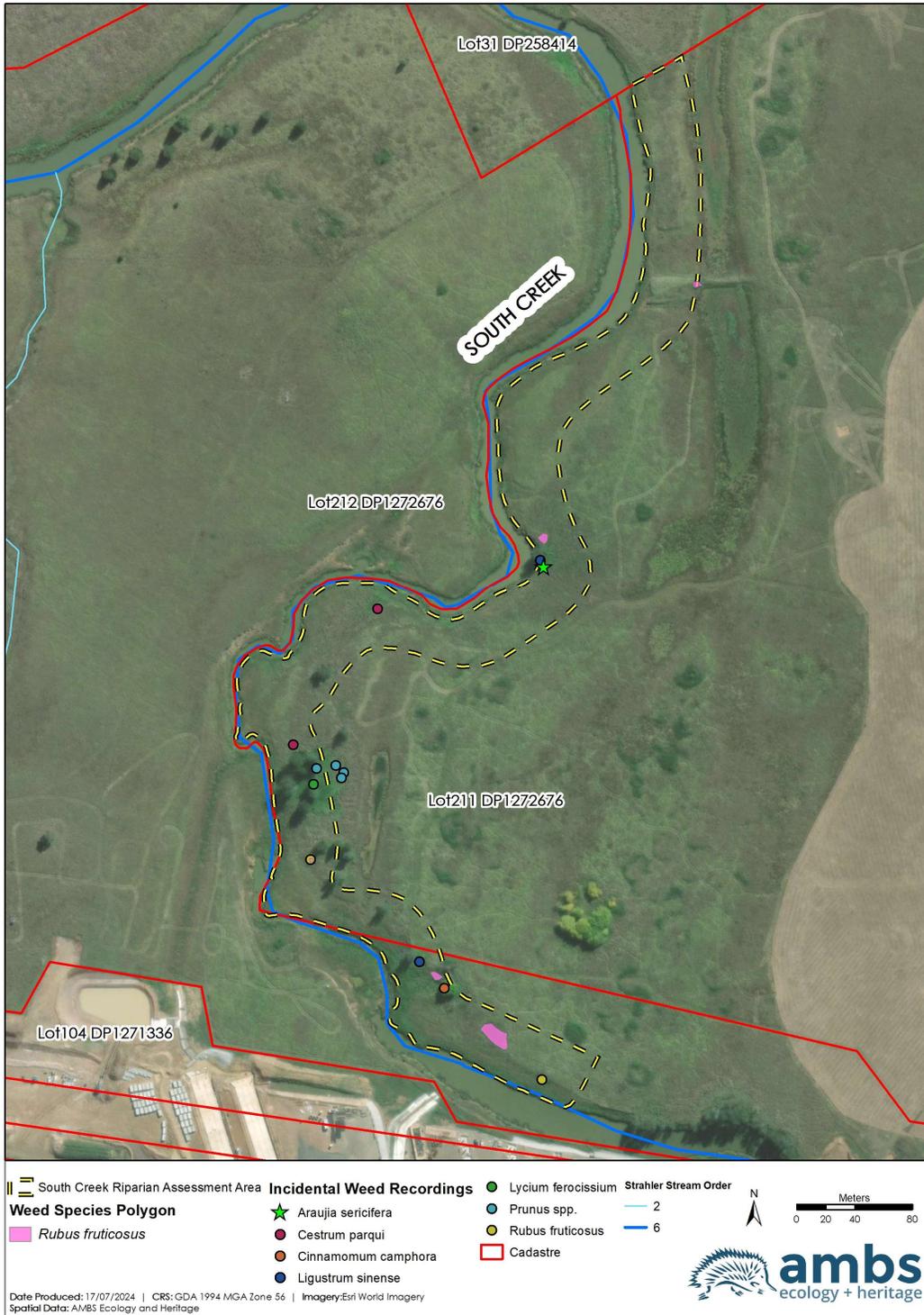


Figure 3 Weedy woody and vine species recorded on riparian corridor of South Creek

Solar Farm

In total, eight different non-native species have been recorded in assessment area two Solar Farm (Table 2). Two of the recorded species are classified as high threat weeds and one additional species as a weed of national significance (Table 2; DCCEEW, 2021b). Similar to the riparian corridor, the Solar Farm is dominated by *Paspalum dilatatum* interspersed with the recorded species in Table 2.

Table 2 Exotic species recorded in the Solar Farm. Listing the scientific name, common name and classification according to DCCEEW and DPI.

Scientific Name	Common Name	High Threat Weed Status	Weed of National significance Status	Priority Weed for Greater Sydney region
<i>Cirsium vulgare</i>	Spear Thistle	–	–	–
<i>Eragrostis curvula</i>	African Lovegrass	HTW	–	–
<i>Leontodon</i> spp.		–	–	–
<i>Paspalum dilatatum</i>	Paspalum	HTW	–	–
<i>Senecio madagascariensis</i>	Fireweed	HTW	WONS	Priority Weed
<i>Setaria parviflora</i>	Pale Pigeon Grass	–	–	–
<i>Solanum sisymbriifolium</i>	Sticky Nightshade	–	–	–
<i>Verbena bonariensis</i>	Purpletop	–	–	–

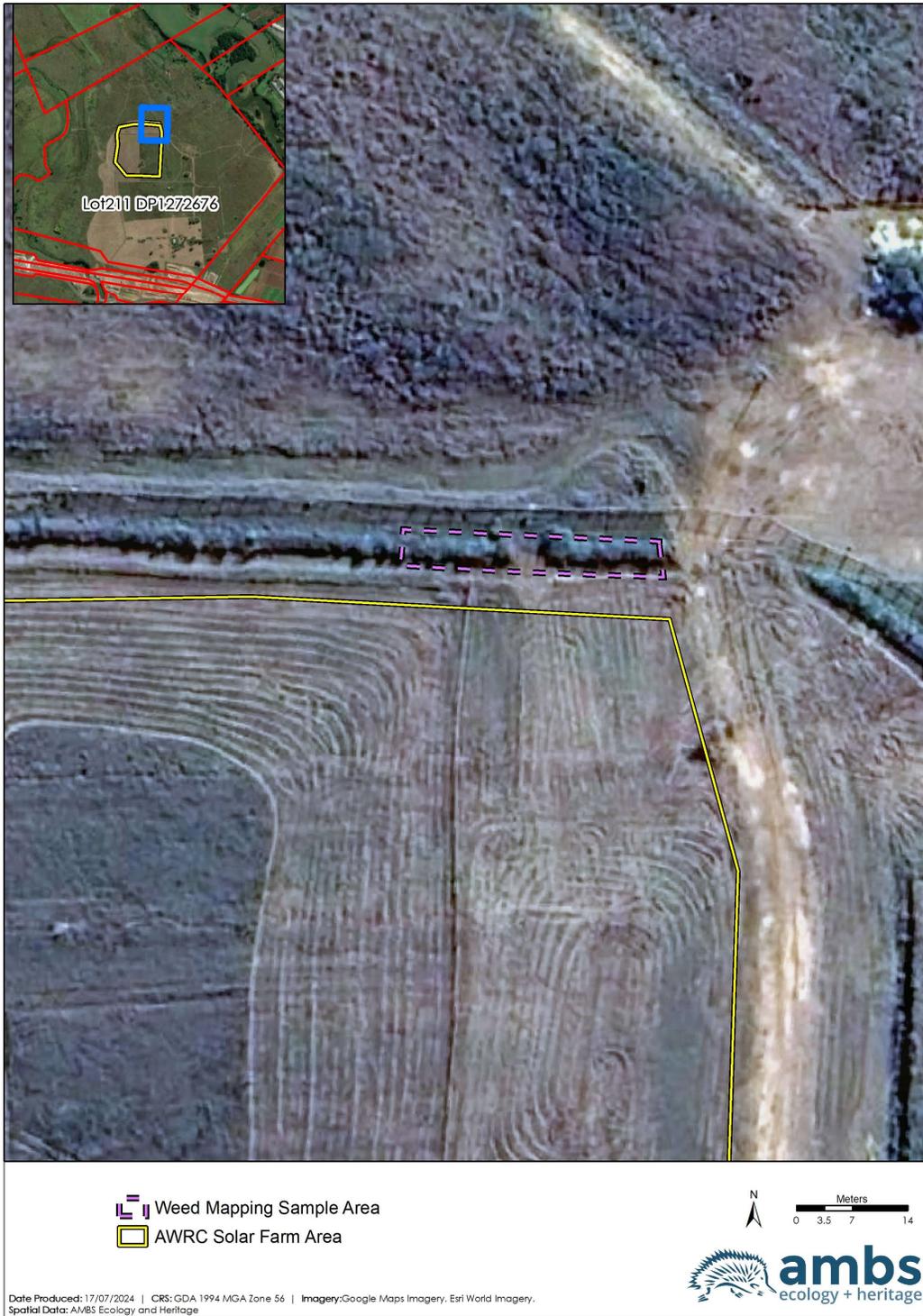


Figure 4 AWRC Solar Farm weed mapping extent

Discussion

High threat weeds (HTWs) listed in Tables 1 and 2 are weeds which if uncontrolled, will invade and outcompete native plant species (DPIE 2020). Manageable HTWs are a subset of high threat weeds that have sufficient evidence to suggest that with appropriate management, their impact and abundance can be effectively reduced (DPIE 2020).

In total, six weeds of national significance (WONS) were identified during the weed mapping survey (Table 3). WONS are regarded as the worst weeds in Australia due to their invasiveness, potential for spread and economic and environmental impacts. These weeds require coordination across governments, organisations and individuals for effective management, with land managers being primarily responsible for their control.

These weeds have state and regional priorities under the *Biosecurity Act 2015* and the Greater Sydney Regional Strategic Weed Management Plan (LLS 2023). All WONS identified on the AWRC site have a General Biosecurity Duty for NSW to prevent, eliminate or minimise any biosecurity risk it poses, so far as is reasonably practicable (DPIE 2020). *Alternanthera philoxeroides* (Alligator Weed) and *Cestrum parqui* (Green Cestrum) have an additional Regional Recommended Measure for Greater Sydney where land managers should mitigate the risk of the plant being introduced on their land and mitigate the spread of the plant from their land (LLS 2023).

Management recommendations

Due to the riparian corridor being dominated by mostly grassy and herbaceous weed species, a combination of slashing and spraying with appropriate herbicides is recommended. Special attention should be paid to controlling WONS and priority weeds of the Greater Sydney region listed in Table 3 with appropriate recommended control options (see NSW WeedWise for a full list of control options).

Table 3 Recommended weed control options for Weeds of National Significance and Greater Sydney region priority weeds.

Scientific Name	Common Name	Recommended Control Options
<i>Alternanthera philoxeroides</i> *	Alligator Weed	Chemical Control <ul style="list-style-type: none">• Three treatments per growing season with herbicide containing metsulfuron-methyl Physical removal <ul style="list-style-type: none">• Deep manual or shallow machine digging up
<i>Cestrum parqui</i>	Green Cestrum	Chemical Control <ul style="list-style-type: none">• Treat actively growing plants. Mature plants early spring, seedlings autumn• Spraying• Cut stump• Cut scrape and paint Mechanical removal <ul style="list-style-type: none">• Repeated cutting down and digging up Competition <ul style="list-style-type: none">• Planting vigorous pasture to suppress seedling

<i>Lycium ferocissimum</i>	African Boxthorn	<p>Chemical Control</p> <ul style="list-style-type: none"> Foliar spraying, spring actively growing plants Soil spraying, before bud burst Cut stump treatment Stem injection Basal bark treatment <p>Physical removal</p> <ul style="list-style-type: none"> Remove as much root as possible
<i>Nassella neesiana</i>	Chilean Needle Grass	<p>Chemical Control</p> <ul style="list-style-type: none"> Spot-spraying with regular follow-up
<i>Rubus fruticosus species aggregate</i>	Blackberry	<p>Chemical Control</p> <ul style="list-style-type: none"> Spray actively growing plants Follow-up after Slashing <p>Physical removal</p> <ul style="list-style-type: none"> Slashing, only in combination with chemical control follow-up <p>Biological Control</p> <ul style="list-style-type: none"> Grazing, goats can make start on controlling infestations
<i>Senecio madagascariensis</i>	Fireweed	<p>Chemical Control</p> <ul style="list-style-type: none"> Spraying, best time late autumn <p>Biological Control</p> <ul style="list-style-type: none"> Grazing, goats and sheep intended for slaughter

* Aquatic weeds such as Alligator Weed can be difficult to effectively control. Water input from upstream is likely to introduce new infestations, and due to the AWRC location on the catchment, it is unlikely that Alligator Weed can be eradicated. A local biosecurity or council weed officer should be consulted prior to treatment of aquatic species to ensure treatment is in keeping with local catchment management strategies.

Should you require any additional information or if I can be of assistance in any way, please contact me on (02) 9518 4489 or email lachlan.palmes@ambs.com.au.

Yours sincerely



Lachlan Palmes
Ecologist
AMBS Ecology & Heritage

References

Department of Climate Change, Energy, Environment and Water, 2021a. Trees Near Me NSW, available at: <https://treesnearme.app/explore>. Access 10th July 2024.

Department of Climate Change, Energy, Environment and Water, 2021b. NSW BioNet, available at <https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet>. Access 15th July 2024.

Department of Planning, Industry and Environment, 2020. Biodiversity Assessment Method. Available at: <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-2020-200438.pdf>

Department of Primary Industries, 2024. NSW WeedWise. Available at <https://weeds.dpi.nsw.gov.au/>. Access 15th July 2024.

Local Land Services, 2023. Greater Sydney Regional Strategic Weed Management Plan 2023 – 2027. Available at: https://www.lls.nsw.gov.au/_data/assets/pdf_file/0010/722368/Greater-Sydney-Regional-Strategic-Weed-Management-Plan-2023-2027.pdf

Appendix C Greenspace Masterplan



st

Badu Yarragul Greenspace Masterplan

28 Badu Muru Grove, Kemps Creek



Acknowledgement of Country

We acknowledge and pay respect to the Traditional Custodians of Badu Yarragul, the Dharug people, and acknowledge their continuing connection to Country for thousands of years. We extend that respect to the Dharawal people who also have custodial obligations for this area and Wianamatta South Creek, which flows from Dharawal into Dharug Country. We also extend that respect to the many other Aboriginal and Torres Strait Islander peoples who have lived in Western Sydney for many generations.

We understand that Wianamatta South Creek is significant to Dharug and Dharawal people. Her name means 'the Mother Place', and like all water bodies, she is critical to the cultural and spiritual health of Country.

Badu Yarragul provides Sydney Water with an opportunity not only to learn about the cultural value of Wianamatta, but also to help restore and rehabilitate her, while also educating the broader community about her role in Country. We hope to be part of that process.



QUALITY ASSURANCE

BADU YARRAGUL GREENSPACE MASTERPLAN

28 Badu Muru Grove, Kemps Creek

Project Number 224-0012-00

Document number: BYGM-TRA-LAN-DES-00

Revision

Issue	Date	Description	Prepared By	Reviewed by	Project Principal
00	16/07/2025	Draft Issue	Julie Lee/Eliza Fagan	Anne Lucas	Julie Lee
01	29/08/2025	Draft issue	Julie Lee/Eliza Fagan	Anne Lucas	Julie Lee
02	20/10/2025	Draft Issue	Julie Lee/Eliza Fagan	Anne Lucas	Julie Lee
03	09/12/2025	Final Issue	Julie Lee/Eliza Fagan	Anne Lucas	Julie Lee

Tract

Gamaragal Country

Level8, 80 Mount Street, North Sydney NSW 2060

(02) 9954 3733

www.tract.com.au



QUALITY ASSURANCE

3

Executive Summary

10

Introduction	10
Design Approach.....	11
Sustainability	11
Engagement.....	11

Glossary

12

1. Project overview

14

Introduction	14
Badu Yarragul Journey.....	15
Background and Scope.....	16
Ministers Conditions of Approval.....	17
Sydney Water Vision	20
Project Objectives and Principles.....	21
Planning Approval Framework & Compliance	23
Strategic Context.....	23
Western Sydney Aerotropolis Precinct Plan.....	24

2. Design Context

30

Regional context	30
Local Context	31
Penrith Local Government area context.....	32

3. Site Conditions

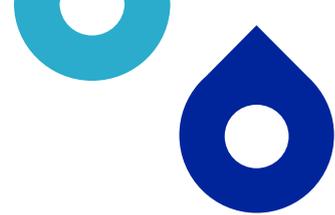
35

Biodiversity, Landscape Communities and focal species at Badu Yarragul.....	36
Contextual analysis	37
Site analysis	40
Opportunities and Constraints.....	41
Constraints	42
Opportunities.....	43

4. Responding to Site Conditions

44

Wildlife Strike Mitigation	44
Bushfire Risks	46
Flooding	48



5. Connection to Country 50

Historical and Cultural Significance.....	50
What is Country?.....	51
Recognising Country.....	52
Connecting and Designing with Country.....	54
Country Centred Approach.....	55
Outcomes for Country.....	56

6. Community & Stakeholder Engagement 61

Engagement activities.....	61
Recommendations and next steps.....	62

7. Greenspace Masterplan Specifics 66

Hydration and Ecological Restoration.....	68
Improving water retention in the landscape.....	69
Flood impacts.....	71
Cultural burning.....	72
Key Views.....	73
Crime Prevention Through Environmental Design (CPTED).....	74
Heritage Interpretation.....	75

8. Masterplan Precincts 78

Precinct 1 Wianamatta South Creek Connection.....	79
Precinct 2 Billabong Cultural Zone.....	80
Precinct 3 Northern Phragmites Zone.....	86
Precinct 4 Kemps Creek Connection.....	88

9. Restoring Biological Communities 90

Tree Species.....	92
Shrubs and Small Trees.....	93
Grasses and Groundcover Species.....	94
Wetland Species.....	95
Fauna Species.....	96

10. Proposed Implementation Strategy 98

11. Maintenance and Monitoring 103



Actions 105

12. Appendices **109**

A | Referenced Documents 109

B | Badu Yarragul Preliminary Concepts 112

C | Multi-Criteria Assessment 118

D | Active transport network 120



Figures

Figure 1 Badu Yarragul Greenspace site at AWRC	10
Figure 2: Journey to Badu Yarragul	15
Figure 3: Context plan.....	16
Figure 4 Wianamatta South Creek Precinct (Image: Department of Planning and Environment)	24
Figure 5: A Metropolis of Three Cities: Western Parkland City (Greater Sydney Commission)	30
Figure 6 Badu Yarragul Local Context (Image: Tract).....	31
Figure 7: Site drone aerial photo (2025).....	35
Figure 8: Ecological context	37
Figure 9: Site Context.....	38
Figure 10: Urban heat island effect and tree canopy cover range (Department of Planning and Environment, ABS).....	39
Figure 11: Site analysis.....	40
Figure 12: Site constraints.....	42
Figure 13: Site opportunities	43
Figure 14: Wildlife Buffer zone Map, adapted from State Environment Planning policy (Western Sydney Aerotropolis) (NSW Department of Planning Industry & Environment 2020)	44
Figure 15: Existing billabong near Kemps Creek	45
Figure 16: Fire Asset Protection Zones	47
Figure 17: Wianamatta South Creek 2019 flood extent	48
Figure 18: Badu Yarragul Greenspace site: The Water, Infinite Land, and Sky	50
Figure 19: Layers of Country (Government Architect of NSW)	51
Figure 20 Wianamatta South Creek	54
Figure 21 Human-centred or country-centred approach (Connecting with Country Framework Government Architect)	55
Figure 22 Perspective 1 overall site	66
Figure 23 Overall masterplan landscape format	67
Figure 24: Badu Yarragul hydrological system	68
Figure 25: Hydration Structure	69
Figure 26 Linear wetland Typical Section.....	70
Figure 27: along Eastern Creek, Doonside shows a potential vegetation outcome for riparian zones (Peter Breen)	71
Figure 28: Emu in the Sky sculpture, M12 Motorway (TfNSW 2025)	73
Figure 29: Key Views	73
Figure 30: Location of Fleurs Field Crosses	76
Figure 31: Mills Cross Array (Image: ATNF Archive 3476-3)	76
Figure 32: Antennae remnants on site	76
Figure 33 Masterplan precincts	78
Figure 34: Badu Yarragul Precincts	78
Figure 35: Precinct 1 – Wianamatta South Creek connection	79
Figure 36: Precinct 2 – Billabong Cultural Zone	80
Figure 37: Cultural gathering space plan.....	81
Figure 38: Cultural gathering space plan and section	82
Figure 39: Cultural gathering space render	83
Figure 40: Billabong section	84
Figure 41: Kidney wetland section	85
Figure 42: Precinct 3 – Northern Phragmites Zone	86



Figure 43: Phragmites wetland /section	87
Figure 44: Kemps Creek Connection	88
Figure 45: Salvaged logs creating habitat along Wianamatta South Creek.....	90
Figure 46: Eastern short-necked turtles (Steve Dew).....	91
Figure 47: Focal tree species	92
Figure 48: Focal shrub species	93
Figure 49: Focal grass species	94
Figure 50: Focal wetland species.....	95
Figure 51: Focal fauna species	96
Figure 52: Blackberry and African Lovegrass infestations on site (drone imagery).....	98
Figure 53: Floodplain Hydration diagram. Source (Habitat Innovation & Management) (2025)	99
Figure 54: Revegetation establishment.....	101
Figure 55: Concept 1 – Badu Yarragul Greenspace – Regional Recreation	113
Figure 56: Concept 2 – Badu Yarragul Greenspace – Passive Recreation.....	114
Figure 57: Concept 3 – Badu Yarragul Greenspace – Ecological Restoration.....	115
Figure 58: Concept 4 – Badu Yarragul Greenspace – Circular Economy Stormwater Management.....	116
Figure 59: Concept 5: Badu Yarragul Greenspace Masterplan – Hydration and Revegetation.....	117
Figure 60: Strategic Cycleway Corridors (TfNSW 2023)	120
Figure 61: M12 cycleway corridor (orange) (TfNSW).....	121

Tables

Table 1 Conditions of Approval	17
Table 2 Alignment of Vision and Principles established during the RFT Stage.....	21
Table 3 Urban Design Objectives and Principles	22
Table 4: Summary of PCTs within Badu Yarragul.....	36
Table 5: Healthy Country (adapted from Connecting with Country Framework)	56
Table 6: Healthy Community (adapted from Connecting with Country Framework).....	57
Table 7: Protecting Aboriginal cultural heritage (adapted from Connecting with Country Framework).....	58
Table 8: Cultural Competency (adapted from Connecting with Country Framework).....	58
Table 9: Better Places (adapted from Connecting with Country Framework).....	59
Table 10: Stakeholder feedback, recommendations and next steps	62
Table 11: Tree species plant list.....	92
Table 12: Shrubs and small trees plant list.....	93
Table 13: Grasses and groundcover species plant list.....	94
Table 14: Wetland species plant list.....	95
Table 15: Focal fauna species list	96
Table 16: Proposed Green Space Program	106
Table 17 Expected monitoring timeline	107
Table 18: Complete List of Referenced Documents.....	109
Table 19: Multicriteria assessment table	119



Executive Summary



Executive Summary

Introduction

The Badu Yarragul Greenspace Masterplan is guided by Connecting with Country principles having been developed through meaningful engagement with Traditional Custodians and recognised knowledge holders. The project's name comes from the Dharug language, Badu Yarragul (Ba-doo Yarra-gool) translates to “freshwater cleaning” to reflect the project's function while also acknowledging its position on Wet (freshwater) Country. This Country-led approach will continue to inform the Design and Construction phases, ensuring cultural values are embedded in both the delivery and long-term management of the site.

This Masterplan provides a strong foundation for Badu Yarragul, integrating place-making and landscape-led design as core pillars. The site will contribute to both local identity and regional resilience by restoring ecosystems, supporting biodiversity, and creating opportunities for learning through Country and water education. It also strengthens green and blue networks critical to cooling and sustaining the emerging Western Parkland City.

As a key project within a growing polycentric city, Badu Yarragul Greenspace is a strategically significant asset. This Masterplan sets the framework for the site's transformation, outlining the contextual analysis, opportunities, and constraints that have shaped the vision. Sydney Water's design objectives reflect a policy-driven commitment to designing with Country, delivering lasting environmental, cultural, and social outcomes.



Figure 1 Badu Yarragul Greenspace site at AWRC

Design Approach

The design approach for Badu Yarragul Greenspace sets a new benchmark in integrating essential infrastructure with broader Community, Cultural, and ecological outcomes. The development of the Upper South Creek Advanced Water Recycling Centre (AWRC) responds to the site's natural character and cultural heritage by:

- Enhancing existing natural features
- Creating a landscape-led, biodiverse environment
- Use best practice water sensitive urban design
- Employing human-scale, nature-based solutions
- Enabling long-term adaptability and future uses
- Ensuring sustainable and feasible design outcomes
- Integrating cultural heritage interpretation and response

The design is grounded in the guiding principles outlined in the *Upper South Creek Advanced Water Recycling Centre Urban Design Report (Sydney Water, 2021)*, including Wastewater Treatment, Resource Recovery, Sustainability, Community, and Built Environment. These have informed a shared vision with Sydney Water to deliver a project that considers land, water, and sky—bringing nature back through ecological restoration. Cultural values are further embedded through the principles established in the *Heritage Interpretation Strategy (Extent Heritage, 2021)*, which ensures Connecting with Country principles and Aboriginal heritage are integral to the site's planning and identity.

Sustainability

Sydney Water is committed to delivering high sustainability outcomes at Badu Yarragul Greenspace, targeting an Infrastructure Sustainability Council (ISC) rating of Gold, with aspirations for Platinum in the Design and As-Built categories. This aligns with Sydney Water's broader climate goals, including achieving net zero carbon operations by 2030.

To minimise visual and landscape impacts, the urban design frames the site within a Cumberland Plain Woodland setting and reflects the ecological and cultural context. As the surrounding area transitions to industrial and employment uses, the visual impact of the operational zone will lessen over time, while Badu Yarragul Greenspace remains a vital green and cultural anchor for the region.

Engagement

Sydney Water has undertaken detailed engagement with the community, external stakeholders and Traditional Custodians to inform the design approach. Sydney Water will continue this engagement to inform future embellishment and use of the Greenspace, as well as cultural heritage interpretation and ongoing caring for Country. During detailed design and construction phases, Sydney Water will consider the implementation of elements identified through the engagement process which are beneficial to the project, aiming to share our understanding of the site and progress to enhancing ecological condition. These actions will ensure the Green Space is grounded in cultural values, ecologically resilient and responsive to the needs of future users.

Glossary

PROJECT DEFINITIONS

Stage 1 Upper South Creek AWRC	<p>Stage 1 development of the Upper South Creek AWRC project, comprising construction and operation of:</p> <ul style="list-style-type: none"> • a sewage treatment plant at Kemps Creek sized to treat an average dry weather flow of up to 50 ML/day during Stage 1 • approximately 17 kilometres (km) of pipeline for the transmission of treated water from the AWRC to the Nepean River at Wallacia (treated water pipeline) • approximately 24 km of pipeline for the transmission of brine from the AWRC to the sewage reticulation system at Lansdowne • new infrastructure from the AWRC to South Creek, to release excess treated water during significant wet weather events and stormwater • new green space area around the AWRC, adjacent to South Creek and Kemps Creek • energy generation and resource recovery activities, including renewable energy generation from solar panels and/or cogeneration, and production of biosolids for beneficial re-use • ancillary development
--------------------------------	--

Abbreviation	Definition	Abbreviation	Definition
AEP	Annual Exceedance Probability	ISC	Infrastructure Sustainability Council
AHIMS	Aboriginal Heritage Information Management System	LMP	Landscape Management Plan
AWRC	Advanced Water Recycling Centre	MCoA	Ministers Conditions of Approval
BYG	Badu Yarragul Greenspace	MoU	Memorandum of Understanding
CE	Circular Economy	PMF	Probable Maximum Flood
CPTED	Crime Prevention Through Environmental Design	RAP	Registered Aboriginal Participant
CPW	Cumberland Plain Woodland	Reference Design	Upper South Creek Advanced Water Recycling Centre Urban Design Report (Sydney Water July 2021)
CSSI	Critical State Significant Infrastructure	RFT	Request For Tender
DCP	Development Control Plan	SSI	State Significant Infrastructure
D&C	Design and Construction	UMM	Updated Management Measures
DPHI	Department of Planning, Housing and Infrastructure	USC	Upper South Creek
ECI	Early Contractor Involvement	VMP	Vegetation Management Plan
EIS	Environmental impact Statement	WSUD	Water Sensitive Urban Design
ESD	Ecological Sustainable Development	WSA	Western Sydney Aerotropolis
FPL	Flood Planning Level	WSAGA	Western Sydney Aerotropolis Growth Area
ISC	Infrastructure Sustainability Council	WSAP	Western Sydney Aerotropolis Plan
IQL	Independent Qualified Individual	WHMP	Wildlife Hazard Management Plan
IS	IS Rating Scheme		



Project Overview



1. Project overview

Introduction

Water, land, and the sky are the greatest assets of the Western Parkland City. The waterways and green networks will define the character of the city. Sydney Water has developed a Masterplan to restore a natural landscape that links the floodplains of Wianamatta and Kemps Creek and connects, enhances and cools the City. The site will restore Country, recycle water, recover resources, promote biodiversity and celebrate heritage, providing opportunities for research and education.

Stage 1 of the Badu Yarragul Water Resource Recovery Facility (Formerly Advanced Water Recycling Centre AWRC) was approved on 28 November 2022. The facility will be delivered in stages, with the Stage 1 Operational Site being delivered by 2026, Stage 2 is for the expansion of assets within the same operational site with ultimate capacity in approximately 2035. The Badu Yarragul Greenspace Masterplan is part of the Stage 1 Critical State Significant Infrastructure (CSSI) approval, and the development of the masterplan has been subject to an extensive program of consultation with key stakeholders. The BYG Masterplan will be delivered in stages by Sydney Water, progressively from 2026.

The *Upper South Creek Advanced Water Recycling Centre Urban Design and Landscape Plan (UDLP) Sydney Water/Tract July 2024* formed the basis for an integrated approach to the staged urban design development. Strategically located within a developing city, the UDLP presented a vision and principles that will see the delivery of critical infrastructure within a restored natural environment.

This Masterplan demonstrates Sydney Water's approach to urban design for the greenspace portion of the site and addresses the relevant Ministers Conditions of Approval (MCoA), and applicable guidelines and standards.

Greening is fundamental to strengthening the broader ecological and physical connections across the Western Parkland City. The site's landscape design highlights the importance of integrated ecological systems and physical networks, establishing a thoughtful benchmark to guide the future rehabilitation of Wianamatta South Creek and Kemps

Creek. The precinct is undergoing a major transformation, driven by infrastructure and land use changes linked to the Western Sydney Airport and Aerotropolis. Much of the current rural land will transition to urban uses—predominantly employment uses—while existing and new urban centres will accommodate a growing population.

The Badu Yarragul Greenspace Masterplan recognises the objectives and strategic directions of the local Green Grid. Wianamatta South Creek is a priority project and will be developed from the principles as set in the Government Architects NSW's 2017 Sydney Green Grid document. The Masterplan forms the basis for future investment in the BYG to support Caring for Country, greening and cooling, enhance bushland and support ecological resilience.

The Masterplan plays a critical role in the Badu Yarragul Greenspace Masterplan, with Sydney Water prioritising place-making and landscape led design principles to guide both immediate and long-term outcomes. As part of the evolving Western Parkland City, the restoration of natural systems will contribute to mitigating environmental degradation. Stage 1 of Badu Yarragul Water Resource Recovery Facility established a foundational framework for the ongoing stewardship of the site for both Sydney Water and the broader community.

Making use of the attributes of the site, along with a range of other goals, the Masterplan will contribute to the liveability of the Western Parkland City promoting the rehabilitation of the Cumberland Plain Floodplain with a genuine sense of place woven throughout.

Badu Yarragul Journey



Figure 2: Journey to Badu Yarragul



Background and Scope

The Masterplan site is part of a broader regional development initiative aimed at enhancing infrastructure, supporting economic growth, and promoting sustainable urban expansion. The site has undergone assessments related to environmental sensitivity, demographic trends, and land use potential. Several stakeholder consultations and policy alignments have also been undertaken, providing baseline data to inform the strategic direction for the site.

The broader Badu Yarragul site is approximately 78 ha in size and is in the suburb of Kemps Creek, bounded by Wianamatta-South Creek to the west, Kemps Creek to the northeast and the new M12 Motorway to the south. The site, accessed from Badu Murli Grove via Elizabeth Drive and Clifton Avenue, comprises three core components:

1. Operational site – Sydney Water wastewater treatment infrastructure to be completed in 2026 as part of the Stage 1 work, including:
 - buildings, infrastructure and equipment for wastewater treatment
 - ancillary infrastructure including an administration building, carparking, internal roads, renewable energy generation, onsite detention basins, chemical storage and switch rooms.
 - infrastructure to release treated water and stormwater to Wianamatta-South Creek during major storm events.

2. The Circular Economy Zone (CEZ) east of the operational area is part of the broader AWRC development for a future circular economy precinct.
3. The Badu Yarragul Greenspace comprises 38ha that will be restored with open Cumberland Plain Woodland vegetation and manage runoff from the Operational site through a series of ephemeral and permanent wetlands.

The Stage 1 works also includes the restoration of the Wianamatta-South Creek riparian corridor along the western site boundary.

Project Scope – Masterplan Development

Sydney Water's 2021 Environmental Impact Statement (EIS) proposed that the greenspace would include:

- landscaping to develop a green space that enhances biodiversity, uses best practice water sensitive urban design and provides visual screening of the AWRC.

The greenspace area is envisaged to become an important link in the green spine along Wianamatta-South Creek envisaged in the State Environmental Planning Policy's (SEPP) vision for the Western Sydney Aerotropolis Growth Area (WSAGA).

It also links the floodplains of Wianamatta and Kemps Creek, representing a strategically important feature of the geomorphology of the catchment.



Figure 3: Context plan



Ministers Conditions of Approval

An Environmental Impact Statement (EIS) for the AWRC was exhibited from 21 October to 17 November 2021 for public comment. In October 2022 a report was prepared in response to submissions received during the EIS exhibition period. The AWRC Stage1 was approved on 28 November 2022.

The Badu Yarragul Greenspace Masterplan report has been prepared to satisfy conditions E27, E63, E64, E65, and E66 of the Ministers Conditions of Approval (MCoA). Compliance with the Conditions is noted and referenced in this report. Many of the compliance obligations for these conditions have

been addressed in the UDLP and the masterplan specifically addresses the greenspace area noted in E65(b). The preparation of the masterplan was also required by DPHI following the staged approval of the UDLP.

The Masterplan focuses on the BYG (this Project) and is generally consistent with and further refines the indicative vision identified in the *Upper South Creek Advanced Water Recycling Centre Urban Design Report, July 2021*. If required a consistency assessment will be completed to assess works proposed by this Masterplan.

Table 1 Conditions of Approval

CONDITIONS OF APPROVAL		
ID	Condition	Chapter reference / Comment
FLOODING		
E27	<p>Prior to the commencement of construction within the green space area as mapped in Figure 4- 7 and Figure 4-8 of the Environmental Impact Statement listed in Condition A1, the Proponent must prepare a Flood Impact and Risk Assessment (FIRA) for the proposed concept design of the green space area. The FIRA must incorporate all proposed elements (including but not limited to vegetation, walking paths, fences, irrigation area and outdoor learning spaces). The FIRA must be prepared by a suitably qualified and experienced flood consultant in consultation with EHG and provided to the Planning Secretary for approval.</p> <p><i>Note: Condition E27 excludes construction of elements required for effective operation and management of operational components of the AWRC plant. This includes release infrastructure to South Creek, fences around the AWRC operational area and fire trail around the AWRC operational area.</i></p>	Chapter 4, 7
DESIGN OUTCOMES		
E61	<p>The place making, design and landscape outcomes for the AWRC site of Stage 1 of the CSSI must be: (a) informed by and be consistent with the Upper South Creek Advanced Water Recycling Centre Urban Design Report, dated July 2021 (provided as Attachment A to RFI 1, dated 1 June 2022) and identified in the documents listed in Condition A1, including but not limited to the objectives and design principles, requirements, and opportunities; and</p> <p>(b) prepared in consultation with the community (including the affected landowners and businesses or a representative of the businesses), LALCs, RAPs and relevant council(s).</p>	Chapter 1 Chapter 6
E62	Where work results in the temporary removal of a recreational or community use, and no similar use with sufficient capacity for regular users is located within two (2) kilometres of the site, then a temporary facility of comparable scale must be provided for the duration of the use of that site.	Not applicable to Masterplan



CONDITIONS OF APPROVAL

ID	Condition	Badu Yarragul Greenspace Chapter reference/ Comment
URBAN DESIGN AND LANDSCAPE PLAN		
E63	<p>An Urban Design and Landscape Plan (UDLP) must be prepared for the AWRC site to document and illustrate the permanent built works and landscape design of Stage 1 of the CSSI and how these works are to be maintained. The UDLP must be:</p> <p>(a) prepared by a suitably qualified and experienced person(s) in place, urban and landscape design and bush regeneration.</p> <p>(b) prepared in consultation with relevant council(s) and the community, including affected landowners and businesses.</p> <p>(c) submitted to the Planning Secretary for approval no later than one month before the construction of permanent built surface works and/or landscaping in the area to which the UDLP applies; and</p> <p>(d) implemented during construction and operation of Stage 1 of the CSSI.</p> <p>Note: The UDLP may be developed and considered in stages to facilitate design progression and construction. Any such staging and associated approval would need to facilitate a cohesive final design and not limit final design outcomes.</p>	<p>Items (a)-(d) met as part of the Stage 1 UDLP.</p> <p>This report describes the Badu Yarragul Greenspace and its alignment with the Stage 1 UDLP.</p>
E64	<p>The UDLP must document how the following matters have been considered in the design and landscaping of the project:</p> <p>(a) the requirements of Conditions E61 to E62;</p> <p>(b) the requirements of the Wildlife Management Plan under Condition E130;</p> <p>(c) demonstrated integration of Crime Prevention Through Environmental Design (CPTED) principles;</p> <p>(d) Designing with Country and the principles and objectives of the draft Connecting with Country Framework;</p> <p>(e) the finalised version of the draft guideline 'Recognise Country – Draft Guidelines for development in the Aerotropolis';</p> <p>(f) constraints associated with bushfire, flooding, and airport safeguarding;</p> <p>(g) vegetation management that considers the principles of Guidelines for Vegetation Management Plans on Waterfront Land (NSW Office of Water, DPI 2012), draft Western Sydney Aerotropolis Riparian Revegetation Strategy, and the tree planting provisions in the draft Western Sydney Aerotropolis Development Control Plan – Phase 2 (October 2021);</p> <p>(h) architectural design to soften the industrial aesthetic;</p> <p>(i) integrating heritage character of the site with treatment and finishes of the new design; and</p> <p>(j) inputs from relevant experts in architecture, landscape architecture, bushfire management, heritage, revegetation, ecology, wildlife hazard management and flooding.</p>	<p>Chapters 1, 6</p> <p>Chapters 1, 3, 4, 6, 9</p> <p>Chapter 7</p> <p>Chapter 4</p> <p>Chapter 5</p> <p>Chapter 3, 4, 7, 10</p> <p>Chapter 10, 11</p> <p>Not applicable to Masterplan</p> <p>Chapter 3, 7</p> <p>Chapter 10</p>



CONDITIONS OF APPROVAL

ID	Condition	Badu Yarragul Greenspace Chapter reference/ Comment
E65	<p>The UDLP must include descriptions and visualisations (as appropriate) of:</p> <p>(a) the design of the permanent built elements for the AWRC site including their form, materials and detail;</p> <p>(b) place, design, and landscape outcomes for the proposed green space area, consistent with the Upper South Creek Advanced Water Recycling Centre Urban Design Report, dated July 2021 (provided as Attachment A to RFI 1, dated 1 June 2022) and identified in the documents listed in Condition A1;</p> <p>(c) the design of the project landform and landscaping elements;</p> <p>(d) the type and design of public and open space;</p> <p>(e) details of strategies to rehabilitate, regenerate or revegetate disturbed areas with local native species; and</p> <p>(f) management and routine maintenance standards and regimes for design elements and landscaping Work (including adequate watering of plants following planting depending on forecast weather conditions and weed management) to ensure the success of the design and landscape outcomes.</p> <p>OPERATIONAL MAINTENANCE</p>	<p>Not applicable to Masterplan</p> <p>Chapters 4, 7</p> <p>Chapter 7, 8</p> <p>Chapter 7, 8</p> <p>Chapters 9, 10, 11</p> <p>Chapter 11</p>
E66	<p>The ongoing maintenance and operation costs of urban design, open space, landscaping and recreational items and work implemented for the AWRC site as part of this approval remain the Proponent’s responsibility until satisfactory arrangements have been put in place for the transfer of the asset to the relevant authority. Before the transfer of assets, the Proponent must maintain items and work to at least the design standards established in the UDLP, required by Condition E65.</p>	<p>Chapter 11</p>

Sydney Water Vision

Sydney Water Strategy 2020-2030

The regeneration of the Badu Yarragul Greenspace aligns and contributes towards Sydney Water's '**thriving, liveable and sustainable cities**' outcomes. In doing so, it will assist in delivering on the following Sydney Water corporate objectives:

- Our cities' waterways are clean, healthy, and safe for swimming and recreation.
- Our system is resilient to shocks and disruptions (e.g., we have achieved advanced system reliability and performance).
- Our water and waterways are world class and support thriving liveable and sustainable cities.
- Our environmental performance is world class.
- We are a resource recovery business with an increasing portfolio of circular economy products and services.
- We have made substantial progress towards zero impact on the environment (focusing on water, waste, and carbon).



Badu Yarragul Greenspace is a legacy project that is grounded in a shared vision developed during Sydney Water's Request for Tender stage:

Upper South Creek AWRC is a place where the connection of people to the land, water and sky are appreciated and deepened, bringing community together to restore, discover, meet and enjoy.



Project Objectives and Principles

The core urban design objectives and principles align with those set out in the *Upper South Creek Advanced Water Recycling Centre Urban Design Reference Design Report* (Aurecon Arup, July 2021) and are consistent with key state and regional planning frameworks. These include the *NSW Government Architect's Design and Place SEPP*, the *Greener Places* policy, the *Western Sydney District Plan*, and the *State Infrastructure Strategy*. These principles have been embedded throughout the detailed design process to deliver

place-based outcomes that reflect a commitment to designing with and caring for Country, particularly through the restoration and enhancement of local biodiversity.

The following table identifies the Urban Design objectives and aspects that have been addressed in line with urban design principles set out in the Australian Urban Design Protocol (Commonwealth of Australia 2011). Additional information can be found in relevant sections of the Masterplan as listed in the table.

Table 2 Alignment of Vision and Principles established during the RFT Stage.

Design Objective	Aspect	Approach	Chapter ref.
Integrating with existing and likely future infrastructure and development	The Masterplan integrates with Stage 1 of the facility and considers the proposed Circular Economy Zone.	The masterplan places nature as a key component by maximising green infrastructure aligning with blue and green networked systems. Blue-green grid could be mentioned here – preserves opportunities for the delivery of the blue-green grid. Rehabilitates and restores blue-grid connections between Wianamatta and Kemps Creek.	Chapter 7, 8
Public and active transport	Active transport links and potential future walking trails along waterways	M12 transport route runs parallel to site, additional opportunities for formalised cycle paths and pedestrian access onsite can be considered in the future when restoration is established.	Appendix B
Green infrastructure integration, including water urban sensitive design	Green infrastructure that responds to site's constraints and restores the landscape	The Masterplan identifies a landscape that supports an environmentally sustainable future, considering the interconnectivity of humans, nature and culture where humans are not the dominate species. It focuses on the long-term regeneration of the Cumberland Plain floodplain through cultural burning practices, revegetation and floodplain hydration.	Chapter 7
	Water Sensitive Urban Design	Retention and slowing of water to maximise opportunities to integrate green infrastructure outcomes through hydration, permeability and revegetation.	Chapter 6, 7
	Planting of diverse species and restoring network connections.	The proposed Cumberland Plain Woodland and wetland species will support a biodiverse environment that will restore and enhance existing fauna numbers and create opportunities for a networked environment that reinforces a greater number of species interactions.	Chapter 7, 8, 9
Biodiversity and habitat connectivity	Creation of swales and wetlands	Rehydration methodology will improve growing conditions and soil health, reducing erosion and assist in cooling the environment while providing habitat to support endangered species.	Chapter 7, 8
	Heat island mitigation	The establishment of tree cover and improved water quality supports the broader Aerotropolis and Western Parkland City objectives including the need to mitigate heat island effects.	Chapter 3, 7
Response to the natural landscape	Use of Cumberland Plain Woodland species to create linking landscape to broader communities	Appropriate local species suitable to the ground and climatic conditions and informed by consultation with Traditional Custodians.	Chapter 9



Connection to Country is the overarching principle for engaging with Country – and therefore community and culture.

The master planning of the green space further reinforces this approach through meaningful engagement with the local Indigenous community and key stakeholders. This process ensures that cultural knowledge, environmental values, and

social equity are integral to the site’s management— supporting the NSW Government’s broader objectives for resilient, liveable, and inclusive communities across the Western Parkland City.

Table 3 Urban Design Objectives and Principles

CONNECTING TO COUNTRY, CULTURE AND PEOPLE	
OBJECTIVE	PRINCIPLES
<p>1. Placemaking</p> <p>To create and support a sense of place drawing on the character of the local area</p>	Placemaking. Create a strong sense of place that derives a narrative from ‘Connection to Country’
	Existing natural context. Rediscover the natural context of the site to provide a strong set of visual and physical markers through contextual planting that reference the sites’ natural identity.
	Integration with strategic urban design principles of district, precinct plans and policy.
	Consideration of aerial view experienced from flights as part of the experience.
	Creation of a vibrant place for workers.
	Landscape led design approach aligned with Western Sydney Aerotropolis Plan (WSAP) and Western Parkland City Vision
	Integration of water to support a landscape that mitigates urban heat island effect in Western Sydney
<p>2. Leading edge environmental responsiveness</p> <p>Ensure environmental practices respond to the natural systems of the area and promotes sustainability</p>	Existing vegetation. Provide a robust revegetation strategy that features Indigenous plant species that are suitable for the local climate and references the Cumberland Plain plant communities.
	Protect and enhance waterways.
	Landscape restoration. Provide a landscape restoration strategy that allows for landscape to be restored. Engage in sensitive landscape management post-restoration, including strategies such as cultural burning.
	Green infrastructure and biodiversity. Integrate natural patterns and ecology into the design, protect Wianamatta South Creek and manage drainage to support new landscape.
<p>3. Urban renewal and liveability</p> <p>Fit the AWRC sensitively into the unique natural, built, and cultural environment of the bridging landscape between Kemps Creek and Wianamatta South Creek</p>	Incorporate leading edge WSUD strategies into the design. Provide measures to reduce the urban heat island effect and engage in floodplain hydration strategies integrated across the entire site
	Improved environment. Develop a unified landscape strategy that enhances and improves the site. Highlight enhanced connection between the floodplains of Wianamatta and Kemps Creek
	Improved Cultural Awareness through interpretation strategies that reflect Country.
	Improved Connectivity. Provide improved access for Traditional Custodians and ecological connections for fragmented fauna populations.
	Safety and Security. Integrate Crime Prevention Through Environmental Design (CPTED) strategies into all aspects of the design to ensure that they are safe and comfortable to use at all times.

Planning Approval Framework & Compliance

The site contributes to the vision and delivery of the Western Parkland City. It acts as both a beneficiary and a driver of the region's transformation—bridging established urban communities with emerging global economic hubs like the Aerotropolis, while also shaping resilient, sustainable, and inclusive urban growth.

Strategic Context

Western City District Plan

The Badu Yarragul Greenspace is located within the Western Parkland City - a city in the landscape. The Western City District Plan is a 20-year integrated plan to guide and manage the growth of the Western Parkland City.

The following metropolitan-wide actions will deliver sustainability objectives:

Objective 25

The coast and waterways are protected and healthier.

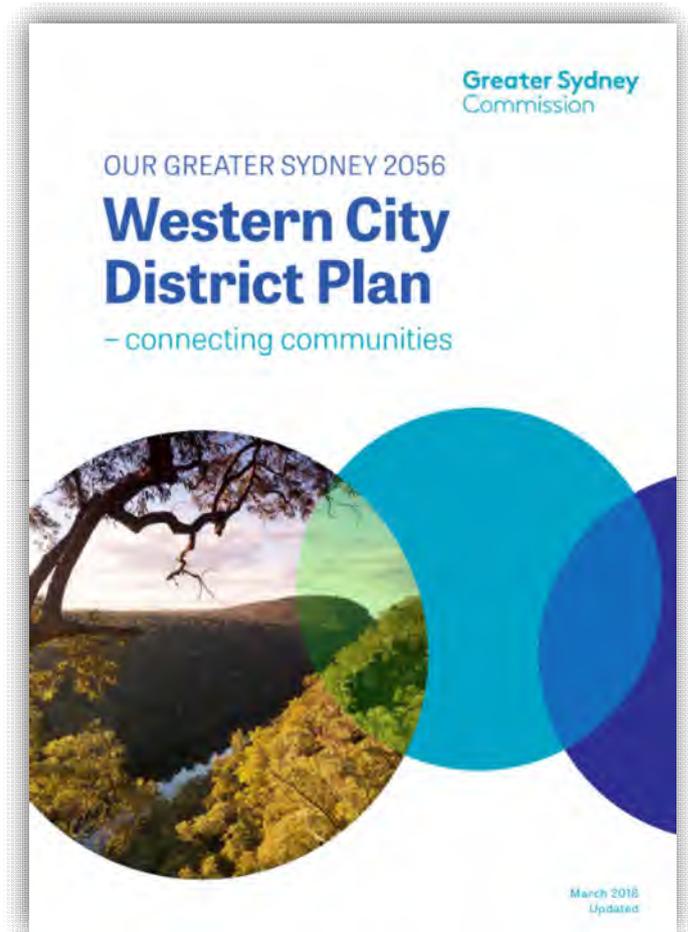
Objective 26

A cool and green parkland city in the Wianamatta South Creek corridor.

Objective 27

Biodiversity is protected, urban bushland and remnant vegetation is enhanced.

The Western Sydney Airport is the key catalyst for growth in the Western Economic Corridor, driving infrastructure investment and regional transformation. Major transport projects, including the Sydney metro Western Sydney Airport Rail Line and the M12 Motorway (which adjoins the site), are progressing to support this evolution. As peri-urban lands transition into a thriving metropolitan region, Western Sydney is projected to be home to over 1.5 million people by 2056, with enhanced connectivity, economic opportunities, and sustainable urban expansion.





Wianamatta South Creek Corridor

Wianamatta South Creek stands as the central urban feature of the Western Parkland City, shaping its ecological and urban landscape.

Running along the site's western boundary, it contributes approximately 80% of the city's total catchment. Flowing through one of Greater Sydney's flattest, driest, and hottest regions, it plays a crucial role in water management, environmental sustainability, and urban cooling.

Recognised as a key objective within both A Metropolis of Three Cities and the Western City District Plan, Wianamatta South Creek underpins efforts to create a resilient and liveable city.

Wianamatta South Creek forms one of the thirty-eight objectives outlined in 'A Metropolis of Three Cities' and the 'Western City District Plan':

Objective 26/Planning Priority W13: A cool and green parkland city in the Wianamatta South Creek Corridor. The objective reflects the vision of the Corridor as forming the identity and acting as a defining spatial element at the heart of the parkland city.

Western Sydney Aerotropolis Precinct Plan

The Western Sydney Aerotropolis Precinct Plan provides the place-based objectives and requirements to guide development in the Aerotropolis in a consistent and sustainable manner over time.

Western Sydney Aerotropolis, Phase 2 Development Control Plan, includes two accompanying documents:

- Recognise Country Guideline: Guidelines for development in the Aerotropolis (Guidelines)
- Aviation Safeguarding Guidelines: Western Sydney Aerotropolis and surrounding areas



Figure 4 Wianamatta South Creek Precinct (Image: Department of Planning and Environment)



Recognise Country Guidelines

The NSW Government's Recognise Country Guidelines are a pioneering framework embedding Aboriginal culture, values and knowledge into the planning and development of the Western Sydney Aerotropolis.

- **Embedding Aboriginal Culture in urban development** – reflecting the wisdom and culture of local Aboriginal communities.
- **Supporting meaningful consultation** – facilitating genuine engagement with Traditional Custodians and Aboriginal stakeholders.
- **Promoting industry accountability** – providing clear benchmarks and templates to guide respectful planning processes.
- **National leadership and innovation** – setting a national precedent for culturally responsive urban development.

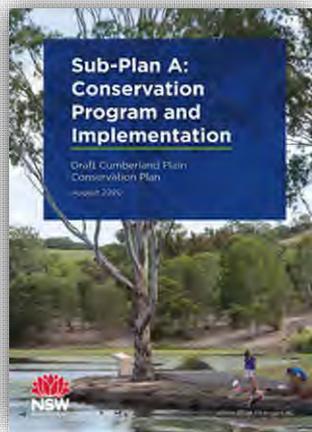
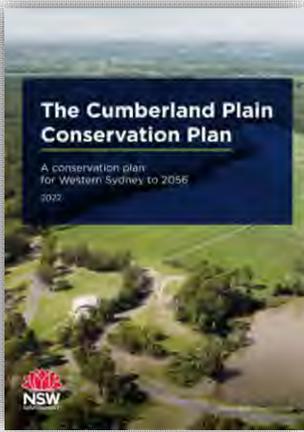


Aviation Safeguarding Guidelines

These guidelines are part of the broader implementation of the National Airports Safeguarding Framework (NASF) to balance long-term urban growth and community wellbeing with aviation safety by:

- **Protecting airport operations** – managing risks to safeguard 24-hour operations such as lighting, wildlife, building height.
- **Managing aircraft noise** – noise attenuation measures in affected areas.
- **Mitigating wildlife strike risk** – establishing 13km wildlife buffer zone and regulating land uses that attract fauna.
- **Strategic land use planning** – guidelines integrated into LEPs and DCPs to guide local planning.
- **Prioritising community safety and amenity** – enhancing safety and liveability near airports.

Wildlife strike risk mitigation and community safety & amenity are of particular interest to the Badu Yarragul Greenspace project, which will see a Wildlife Management Plan being developed.



Cumberland Plain Conservation Plan 2020-2056

The Cumberland Plain Conservation Plan (CPCP) is one of Australia’s largest strategic conservation efforts, protecting vital ecological values across 200,000 hectares balanced with urban growth.

It outlines 28 commitments and 161 actions across four key areas:

- Avoiding & minimising impacts
- Mitigating indirect & prescribed impacts
- Conserving flora, fauna & habitats
- Managing landscape threats

The Plan has been prepared to meet biodiversity certification and assessment requirements under state and federal laws. It receives internal reviews ever 2.5 years and independent public reviews every 5 years to assess the effectiveness of the implementation of the plan and revise actions where required, demonstrating adaptive management of the fragmented Cumberland Plain vegetation communities.

Badu Yarragul Greenspace has historically been cleared and used for agricultural and scientific purposes for over a century, leading to severe degradation of endemic ecosystems and vegetation communities. However, the site and surrounding region still host remnant patches of the critically endangered Cumberland Plain Woodland vegetation community.

Adopting a landscape-led approach to deliver Badu Yarragul in alignment with the CPCP actions and outcomes presents a major opportunity to minimise environmental impacts and contribute to the ecological restoration of the waters and surrounding regional health, in line with other restorative projects.

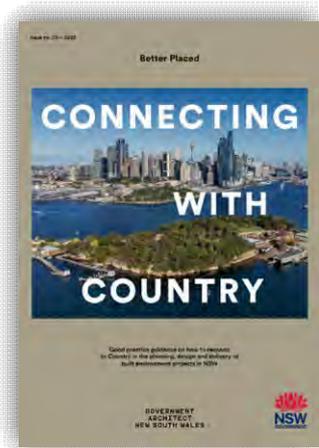
Sydney Green Grid

The Sydney Green Grid promotes green connectivity across Sydney’s regions to support biodiversity, recreation and water health. It is split into six districts and Badu Yarragul Greenspace is part of the West District.

The document presents a framework to create an interconnected Sydney network through:

- **Enhanced liveability** – improving access to greenspaces.
- **Environmental resilience** – stormwater management, UHI mitigation, air quality improvement and biodiversity protection.
- **Urban integration** – combining green infrastructure with urban development to keep pace with population growth trends.

The Sydney Green Grid is a valuable strategic planning tool that guides local and state government to identify, prioritise and deliver greenspace projects that align with broader metropolitan strategies.



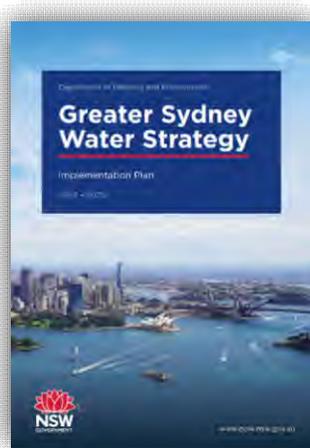
Connecting with Country

This framework established by the NSW Government Architect aims to unite all involved in delivering built environment projects to adopt the following commitment:

All NSW built environment projects will be developed with a Country-centred approach guided by Aboriginal people, who know that if we care for Country, Country will care for us.

The health and wellbeing of Country will help to:

- **Reduce the impacts of natural events** such as fire, drought, and flooding through sustainable ways of using land and water.
- **Value and respect Aboriginal cultural knowledge** with Aboriginal people co-leading design and development of all NSW infrastructure projects.
- **Ensure Country is cared for** appropriately and sensitive sites are protected by Aboriginal people having access to their homelands to continue their cultural practices.



Sydney Water Strategy

Responding to key challenges of today and the future, this strategy outlines the activities and ambitions of Sydney Water in achieving their vision to create a better life with world-class water services over the next decade. The strategy identifies four outcomes, detailing what success looks like, and what is required to accomplish this. The four strategic outcomes include:

- First choice of customers and partners
- Successful and innovative business
- High performance culture
- Thriving, liveable and sustainable cities

NSW Aboriginal Water Strategy

This Strategy recognises the significance of water to Aboriginal peoples as a key part of their connection to Country and the lifeblood of culture and communities. 4 key priorities are identified as follows:

- Aboriginal peoples' access to and ownership of water to support cultural, social, economic and intergenerational outcomes
- Strengthen the role of Aboriginal peoples in water management through representation, engagement and respectful partnerships
- Respect, recognise and embed Aboriginal knowledge to care for Country and support culturally informed water management
- Recognise and support the importance of healthy water systems to Aboriginal wellbeing, culture and connection to Country



Greener Places

Aligned with the Premier's Priorities: 'Greening Our City' and 'Greener Public Spaces,' Greener Places builds on the Sydney Green Grid, which forms part of the 'Plan for Growing Sydney and the District Plans.' Greener Places is a state green infrastructure policy which aims to create healthier, more liveable, and sustainable communities by improving the quality and access to natural and semi-natural systems such as parks and recreation, and waterways and bushland.

Greener Places highlights the social, environmental, and economic benefits of green infrastructure and the need for well designed, planned, and green infrastructure to support the ecological health of our environments, supporting biodiversity and habitat, and strengthening climate resilience.

The four principles for designing green infrastructure are:

- **Integration** – Combine Green Infrastructure with urban development and grey infrastructure.
- **Connectivity** – Create an interconnected network of open space.
- **Multi-functionality** – Deliver multiple ecosystem services simultaneously.
- **Participation** – Involve stakeholders in development and implementation.



Better Placed

The state's first design-led policy, Better Placed recognises the role our built environment has on shaping our lives and how the quality of design affects how places and spaces function and integrates with the broader context.

The policy defines well designed architecture, public spaces, and environments as being: Healthy; Responsive; Integrated; Equitable; and Resilient.

The seven key objectives are:

- **Better fit** – Contextual, local and of its place.
- **Better performance** – Sustainable, adaptable and durable.
- **Better community** – Inclusive, connected and diverse.
- **Better for people** – Safe, comfortable and liveable.
- **Better working** – Functional, efficient, and fit for purpose.
- **Better value** – Creative and adding value.
- **Better look and feel** – Engaging, inviting and attractive.



Design Context

2. Design Context

Regional context

The Greater Sydney Regional Plan identifies the Western Parkland City as one of the strategic Three Cities for Sydney. The plan is structured around infrastructure, productivity, sustainability and implementation.

The population of the Western Parkland City is projected to grow from 740,000 in 2016 to 1.1 million by 2036, and well over 1.5 million by 2056. The city will emerge with the development of new neighbourhoods and centres, and with urban renewal close to existing centres. The regional landscape will generally be characterised by a transition from market gardens and rural residential to employment lands and industrial uses, with the closest large population centre in Penrith LGA lying approx. 5km north of the site.

Place-making will help to design neighbourhoods with fine grain fabric and human scale. This will support healthy lifestyles and connected communities.

Development along the spine of Wianamatta South Creek and its tributaries will re-imagine liveability and sustainability, providing new cool and green neighbourhoods and centres with generous open space in a parkland city.

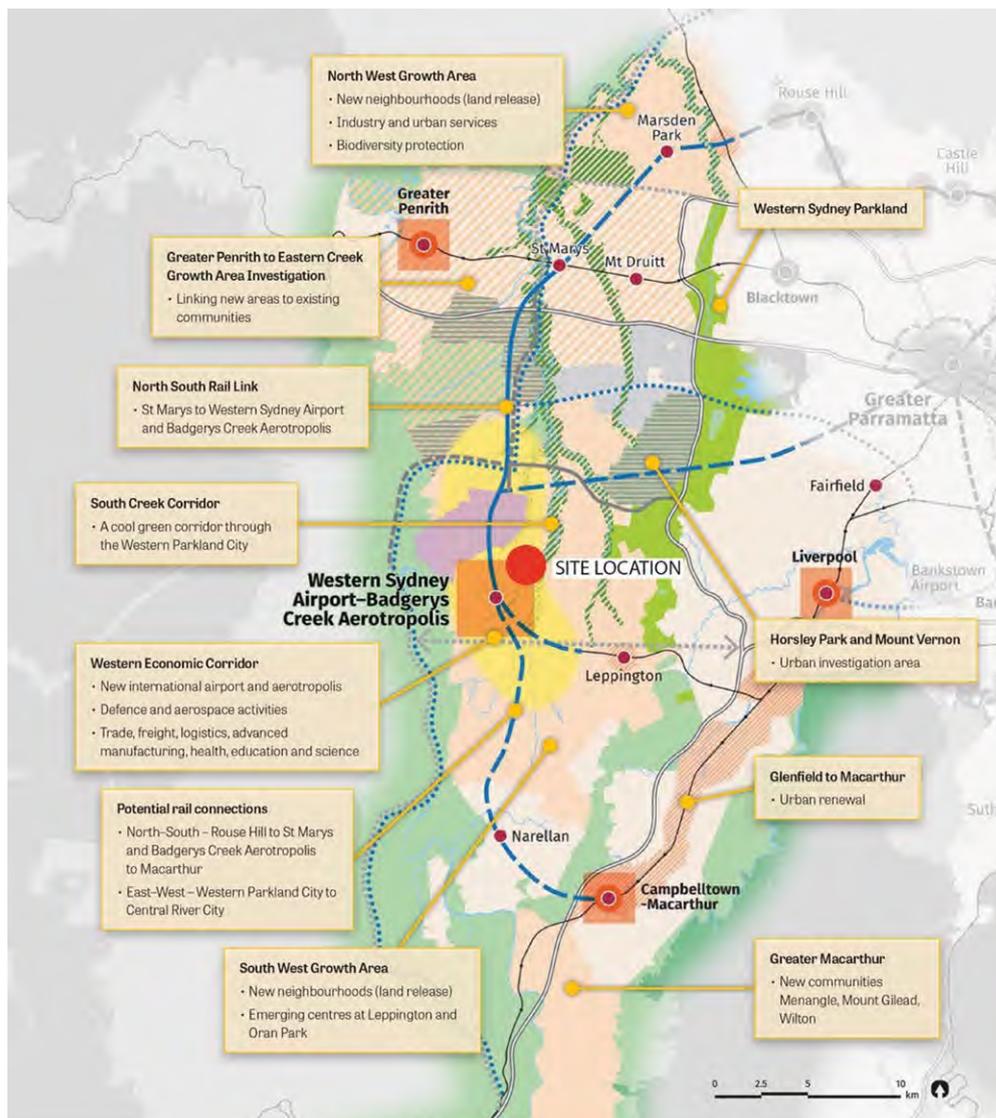


Figure 5: A Metropolis of Three Cities: Western Parkland City (Greater Sydney Commission)

Local Context

The Badu Yarragul Greenspace is located at the confluence of the Wianamatta South Creek and Kemps Creek and is within an open space and environmental corridor. It is directly below Western Sydney Airport's flight path and is bordered to the south by the M12 Motorway. The M12 Motorway will provide an active transport link connecting broader communities from the Penrith, Blacktown, and Fairfield Local Government Areas.

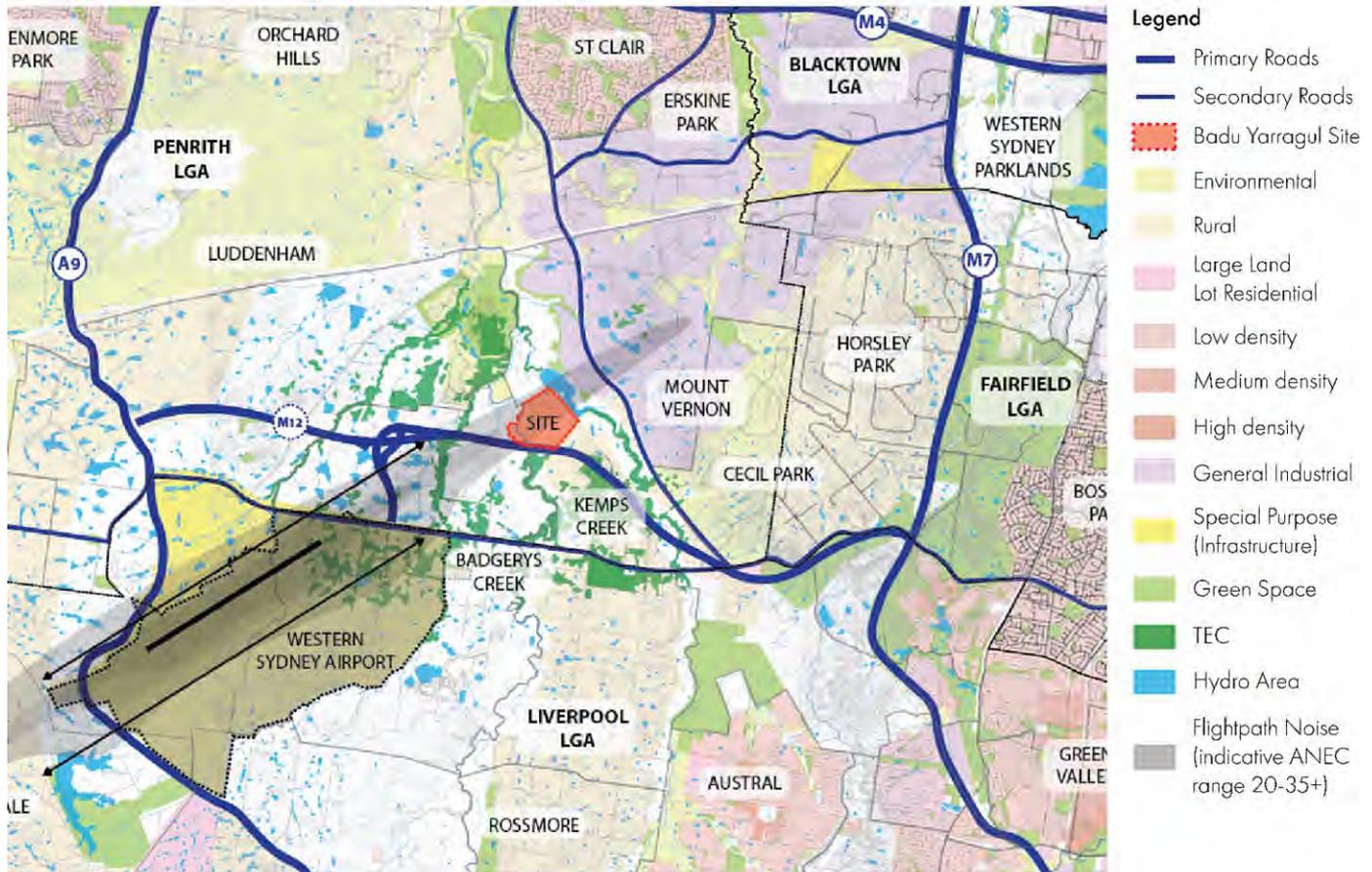


Figure 6 Badu Yarragul Local Context (Image: Tract)

Penrith Local Government area context

Badu Yarragul Greenspace is located in Greater Sydney's peri-urban region between the Blue Mountains and the Sydney CBD, approximately 30 km south-west of Parramatta CBD, within the future Western Parkland City. Strategically positioned six kilometres north-east of the future Western Sydney International Airport, under the flight path, the proposed site forms part of the Western Sydney Aerotropolis – the future international gateway to Sydney in the west.

Badu Yarragul Greenspace sits on the confluence of Wianamatta South Creek and Kemps Creek. Wianamatta South Creek is particularly significant within the Western Parkland City context as it accounts for around 80% of the regional catchment, running through some of the flattest, driest, and hottest parts of Greater Sydney. Approximately 1,280m of this creek is connected directly with the western site boundary.

The Badu Yarragul Greenspace site is located within the Penrith Local Government Area and key strategic documents include:



Local Strategic Planning Statement 2020

The Penrith Local Strategic Planning Statement (LSPS) 2020 focuses on delivering sustainable, culturally rich, and ecologically resilient outcomes. Key alignments include:

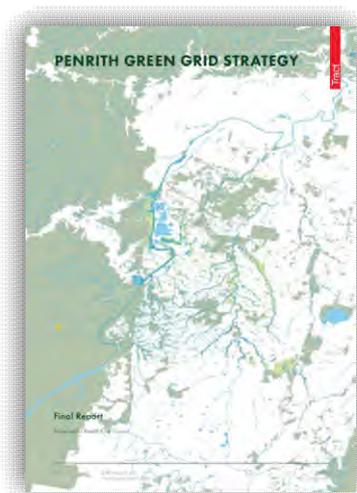
Connection to Country: Embeds Aboriginal cultural values and supports Traditional Custodian involvement in land management and design.

Environmental Restoration: Enhances the Wianamatta South Creek corridor through revegetation, wetland creation, and biodiversity support.

Cool and Green City: Contributes to tree canopy goals and mitigates heat through nature-based solutions.

Ecological Education: Provides limited and controlled access for educational tour groups to support connection with nature.

Waterway Protection: Integrates swales and wetlands for stormwater management and water quality improvement.



Penrith Green Grid Strategy

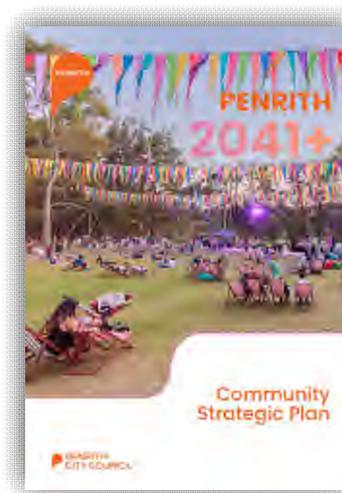
The Penrith Green Grid Strategy is part of a new strategic framework being developed by Council to provide direction for future growth in Penrith.

The Strategy puts forward a plan to support the creation of cool, green neighbourhoods by connecting human centres to greenspaces. The Strategy also identifies and addresses challenges which are unique to Penrith such as increasing canopy cover to reduce urban heat.

Council's new strategic framework consolidates the planning priorities outlined in the Local Strategic Planning Statement and aims to establish a place-based vision for our city.

Funding to develop the Penrith Green Grid Strategy was provided by the NSW Government's Metropolitan Greenspace Program as a way to improve access to open space and increase liveability in Penrith.

The Penrith Green Grid Strategy builds on existing strategic work already undertaken by Council including strategies for Cooling the City, Sport & Recreation, and Street & Park Tree Management.



Penrith Community Strategic Plan

The 2041 Community Strategic Plan outlines key outcomes to improve Penrith's community health and wellbeing over the next 15 years. It harnesses the community's voice to involve residents in decision-making to steer the future of Penrith. It reflects the shared vision, aspirations and values of the community.

To achieve this, the document identifies key issues and challenges, outlines regional, state and global impacts and draws on community quotes to determine where Penrith needs to be.

Actions are grouped underneath five major strategic directions within the strategy:

- Nurture our environment
- Support our wellbeing
- Shape our growing city
- Provide for our lifestyle
- Work together

Badu Yarragul Site Conditions





3. Site Conditions

The Badu Yarragul Greenspace is situated within the Wianamatta South Creek catchment in Western Sydney, a region characterised by low-lying topography, gently undulating terrain, and broad floodplains. The site's natural form has been significantly shaped by historical land use practices, including agriculture and grazing directly, and extractive industry in surrounding areas, which have modified the landscape and hydrological patterns of the region over time.

Hydrologically, the site forms part of a larger stormwater and surface water system that ultimately drains into Wianamatta South Creek. Man made drainage lines and depressions contribute to localised water retention and episodic inundation. The modification and refinement of these existing features present an opportunity for integrated water management, including hydration and revegetation of the site.

The underlying geology consists predominantly of Wianamatta Group shales, contributing to the formation of clay-rich soils with poor drainage and moderate to high erodibility. The subsoils are often dispersive, saline, and acidic, which can limit plant establishment without careful amelioration and selection of resilient locally endemic species.

Together, these site conditions—topographic flatness, modified hydrology, degraded soils, and a legacy of disturbance—inform the design challenges and opportunities for ecological restoration and water management within the Badu Yarragul Greenspace.



Figure 7: Site drone aerial photo (2025)

Biodiversity, Landscape Communities and focal species at Badu Yarragul

Badu Yarragul Greenspace sits between Wianamatta South Creek and Kemps Creek—two key riparian corridors that link fragmented vegetation and support species movement, genetic exchange, and habitat continuity in an otherwise cleared and modified landscape. Beyond these corridors, surrounding land is dominated by low-diversity agricultural use, positioning the site as a vital transition zone for ecological restoration.

Historical clearing has left tree cover across the site sparse and fragmented, with remnant native species and introduced exotics largely confined to creek edges. Prior to colonisation, the area supported open woodland ecosystems of scattered trees and grassy understorey, providing diverse microhabitats and seasonal resources. The project offers a unique opportunity to re-establish this structure using locally appropriate native species.

Targeted revegetation and habitat enhancement will help restore the critically endangered Cumberland Red Gum Riverflat Forest and Castlereagh Ironbark Forest plant community types (PCTs), improving habitat quality for focal species and strengthening ecological function. These efforts will increase biodiversity, support ecosystem services such as carbon storage and water filtration, and reinforce cultural values tied to Country—making Badu Yarragul Greenspace a key contributor to regional conservation and resilience.

Plant Community Types

The *USC AWRC Biodiversity Development Assessment Report (Biosis, 2021)* identified three Plant Community Types (PCTs) on the site, as summarised in Table 4 below. These vegetation zones are presented in Figure 7. Clearing of some of these PCTs within approved project limits has occurred to enable construction within the operational zone.

Table 4: Summary of PCTs within Badu Yarragul

PCT ID	PCT NAME	COMMON NAME	CONDITION	EPBC Act TEC	BC Act TEC
835	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland River-flat Forest	Thinned, scattered trees	River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (CEEC)	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin, and South East Corner Bioregions (EEC)
849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland Shale Plains Woodland	Scattered trees	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CEEC)	Cumberland Plain Woodland in the Sydney Basin Bioregion (CEEC)
1800	Swamp Oak open forest on river-flats of the Cumberland Plain and Hunter Valley	Cumberland Swamp Oak Riparian Forest	Thinned, scattered trees	Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community (EEC)	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin, and South East Corner Bioregions (EEC)

Contextual analysis

Biodiversity value

Biodiversity directly on-site is limited due to a history of land clearing and weed infestation, however its position in relation to Wianamatta South Creek and Kemps Creek places it along locally significant biodiversity corridors. The site is thus a transition zone, a space with the potential to restore ecological function and reintroduce native biodiversity. Through targeted revegetation and habitat enhancement, the project can help rebuild the ecological integrity that once defined the region, contributing to broader conservation goals in a highly modified landscape.

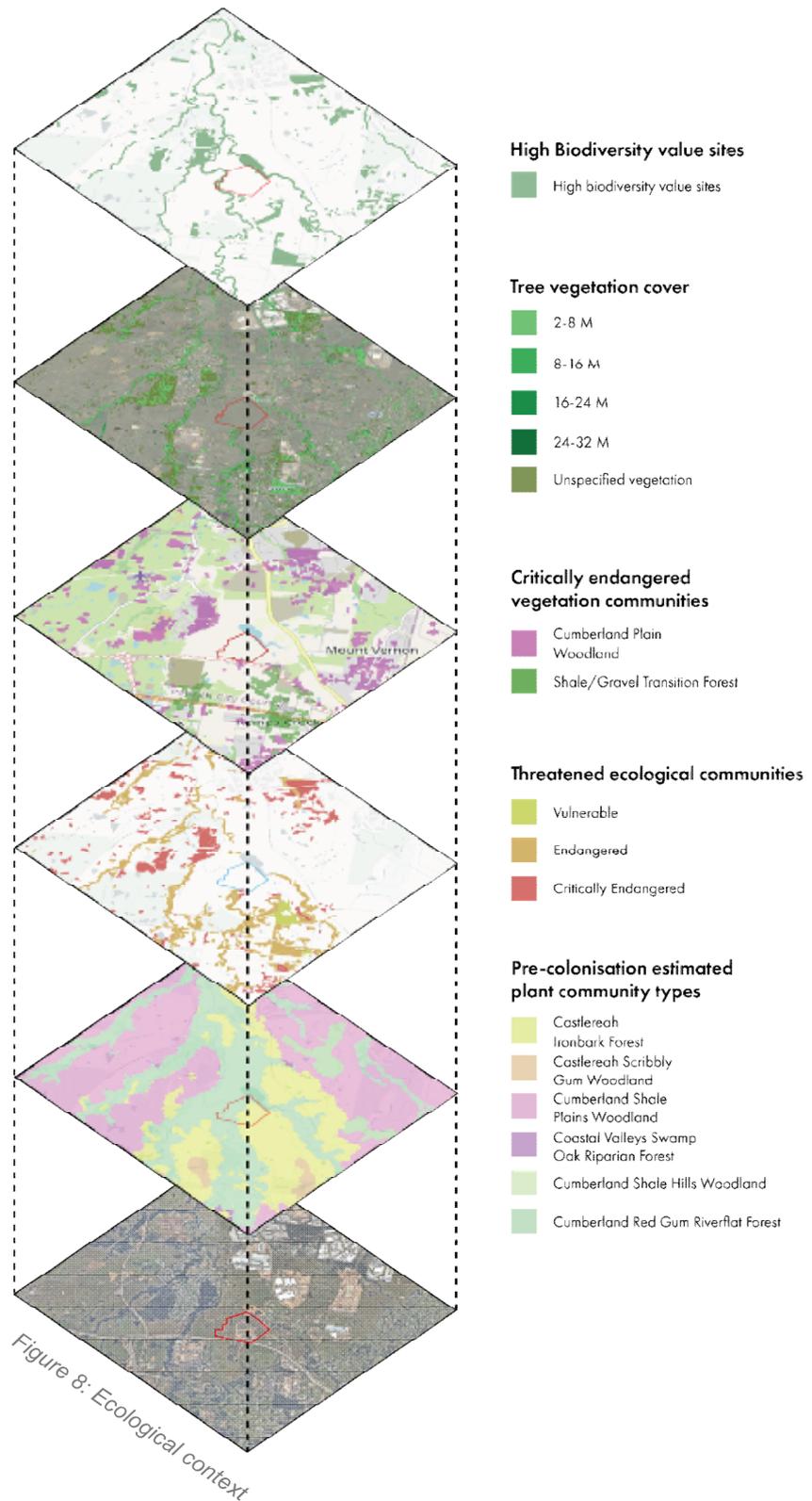
Tree cover

The existing tree cover across the site and its surroundings is characterised by a sparse and fragmented profile, the result of extensive historical clearing for agricultural and scientific use. Remnant trees are primarily located in isolated patches along the creek corridors, including a mix of endemic native species and introduced exotics which reflect the site's altered ecological identity.

Pre-colonisation, this area supported a more robust tree population, forming an open woodland ecosystem characterised by scattered trees with a grassy understorey rather than a dense, closed canopy forest. This structure would have supported a wide range of flora and fauna, offering diverse microhabitats and seasonal food sources. The project presents an opportunity to re-establish this open woodland character and its ecological functionality, using locally appropriate native species.

Vegetation communities

Situated within the Cumberland Plain, the site region is populated by fragmented remnants of various vegetation communities, many of which are endangered or critically endangered. Estimates of pre-colonisation plant community types present a patchwork of dense vegetation communities, with riparian/river-flat forests following waterways while shale woodlands populate the plains. The site is specifically characterised by remnant patches of Cumberland River-flat Forest, Cumberland Shale Plains Woodland and Cumberland Swamp Oak Riparian Forest communities.





Hydrology

Kemps Creek, located along the northwestern boundary of the Badu Yarragul Greenspace site, has been dammed for agricultural irrigation, resulting in a large permanent waterbody. This alteration has impacted the region's hydrology. Most of the Badu Yarragul Greenspace lies within the 1:100 floodplain, and the area's flat topography contributes to slow drainage. Both Wianamatta South Creek and Kemps Creek flow northward, traversing this low-lying floodplain.

Population density

Human populations in close proximity to the site remain small. Development of the Western Sydney airport and surrounding urban areas may bring a larger visitor base. However, the area has been designated for employment uses and thus, population growth in the immediate vicinity of the site is not expected to grow significantly in the next 30 years.

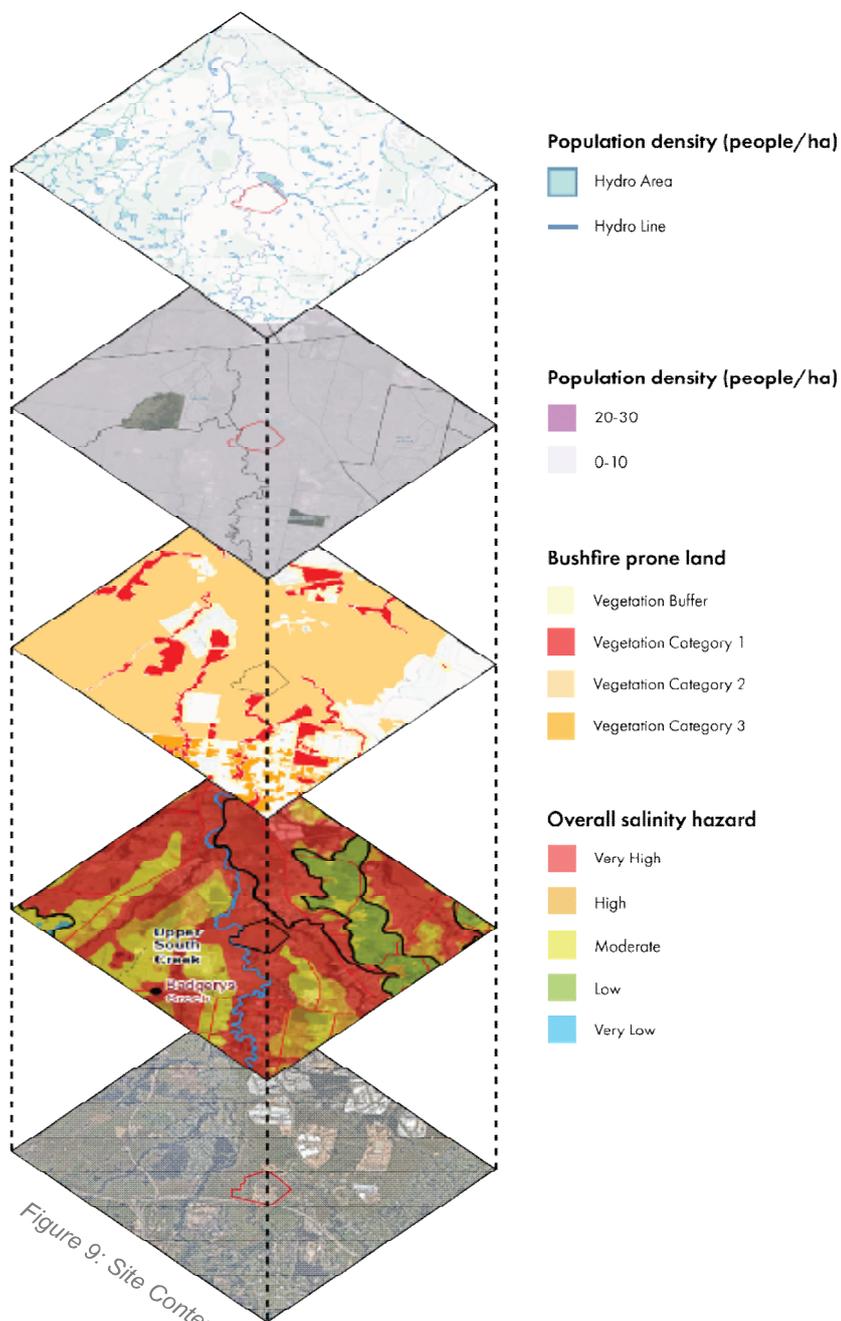
Bushfire risk

Bushfire risk is a critical concern and the site is mostly classified as Vegetation Category 3 with medium bushfire risk. The Badu Yarragul Greenspace design incorporates targeted mitigation measures to reduce vulnerability and enhance site resilience.

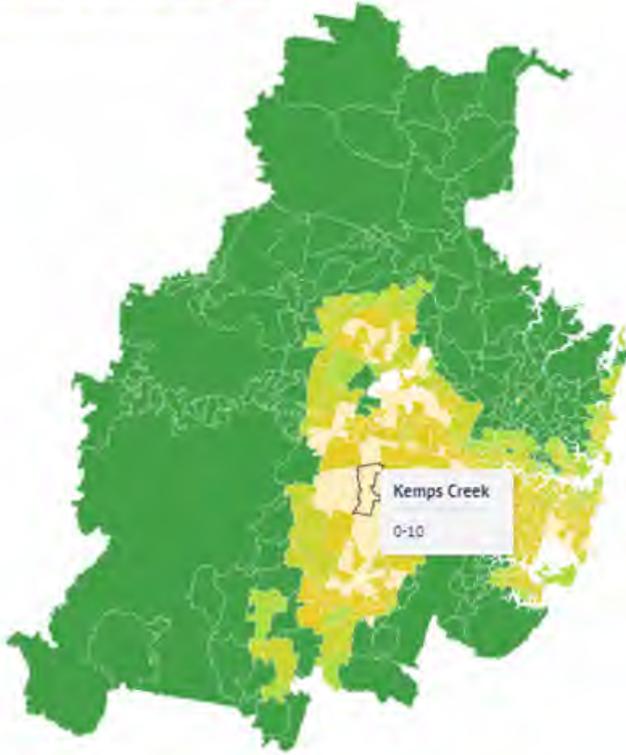
Existing soil conditions

A soil assessment undertaken by SESL Australia revealed that the site's soil is typically consistent with Western Sydney soil conditions. Key soil limitations include acidic pH, poor cation balance, low nutrients and consistently high manganese levels, likely caused by regular flooding.

The topsoil is generally low in organic matter, acidic, high in magnesium and lacks sodic conditions or dispersion. The subsoil is hostile to plant growth and highly erodible due to acidic pH, high sodium levels and heavy texture, which restrict water nutrient uptake by plants and increase the risk of waterlogging occurrence. Subsoil constraints must be addressed before topsoil placement and planting to ensure landscape success.



Suburban canopy tree cover and temperature differences



Suburban canopy tree cover and temperature differences

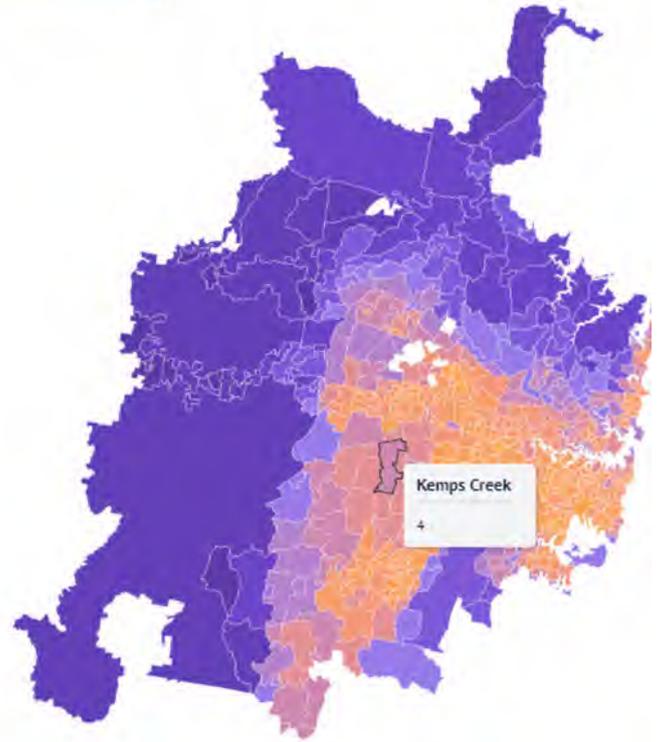


Figure 10: Urban heat island effect and tree canopy cover range (Department of Planning and Environment, ABS)

Site analysis

Topography

The site is situated within the Wianamatta South Creek catchment, one of the flattest and most expansive lowland systems in Greater Sydney. The terrain is predominantly gently undulating to flat, shaped by ancient alluvial processes that have created broad floodplains and subtle ridgelines. This topography naturally channels surface water into a network of creeks and ephemeral drainage lines.

Land use history

The site of the Badu Yarragul Greenspace has a complex history shaped by both cultural heritage and land development. Traditionally connected to the Dharug people, the area contains several Aboriginal archaeological sites, including artefact scatters and culturally significant locations, evidencing long-term occupation and use. Subsequent European land use centred on agriculture and grazing, followed by infrastructure development to support Western Sydney's urban growth.

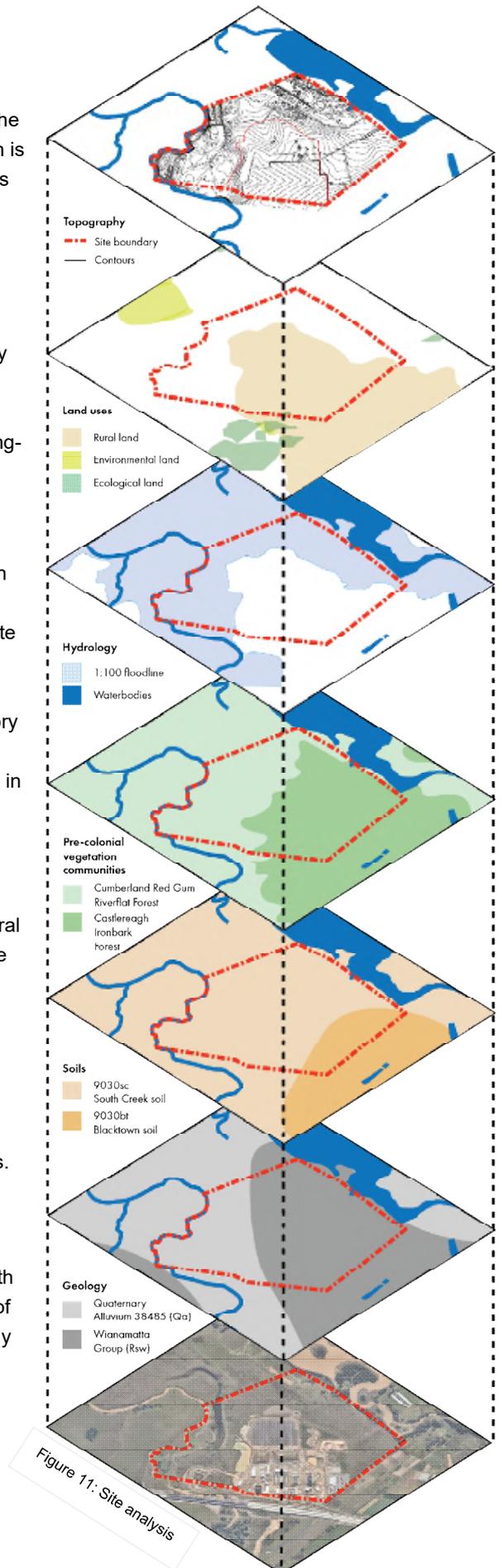
In 1954, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) established the Fleurs Radio Observatory at Kemps Creek, transforming the former World War II Fleurs Aerodrome into a pioneering site for radio astronomy. The observatory became a hub for innovation, hosting three significant cross-type radio telescopes: the Mills Cross, Shain Cross, and Chris Cross. These instruments positioned the Fleurs Radio Observatory as a leading centre for radio astronomy from the 1950s through the 1980s. The site was eventually closed in 1988, marking the end of a significant era in Australian scientific research. Sydney Water's AWRC Operations Zone is within the centre of the site and will be operational in 2026.

Hydrology

The Badu Yarragul Greenspace site encompasses several billabongs integral to the Wianamatta South Creek system. These shallow waterbodies provide essential habitats for species such as dotterels. Additionally, two natural depressions on the site form damp, ephemeral wetlands that support seasonal biodiversity. An artificial drainage channel, previously carved through the area, has been mostly levelled during the construction of the Operational Zone. However, the channel's terminus remains as a moist, grass-filled depression leading into Kemps Creek. These interconnected aquatic features contribute to ecological diversity and hydrological functions.

Soils and geology

The site comprises Quaternary Alluvium bedrock with South Creek soils underneath hydrologically significant zones and Wianamatta Group rock with Blacktown soil in drier zones at a slightly higher elevation. The distribution of the Alluvium bedrock provides insight into where waterways have historically flowed across the site.





Opportunities and Constraints

Site Constraints Considered in the Masterplan

The masterplan responds to several key site constraints to ensure feasibility, safety, and resilience:

- **Flooding:** Most of the site outside of the Operational Zone footprint is subject to 1-in-100-year flood events, requiring sensitive siting of infrastructure (cultural gathering zone, maintenance tracks) and resilient landscape planning.
- **Bushfire Risk:** Bushfire mitigation strategies, including the Outer Protection Zone requirements to manage fire intensity and protect infrastructure.
- **Wildlife Strike Risk:** Given proximity to the Western Sydney Airport, the landscape is designed to minimise bird strike risk through careful habitat planning and management.
- **Urban Heat:** The design addresses extreme heat by expanding green cover and restoring natural systems, contributing to a cooler and more resilient environment.

Opportunities Considered in the Masterplan

The Badu Yarragul Greenspace Masterplan explores a range of opportunities that promote engagement with **Water, Land and Sky** to enhance ecological function, cultural connection, and community benefit, including:

- **Celebration of Aboriginal Cultural Landscape:** Integrating interpretation and design elements that acknowledge and respect the stories, practices, and knowledge of First Nations peoples.
- **Restoration of Cumberland Plain Woodland:** Reviving critically endangered vegetation communities to provide vital habitat for threatened flora and fauna and support regional biodiversity.
- **Urban Cooling:** Enhancing vegetation cover to provide shade, improve thermal comfort, and reduce the Urban Heat Island effect across Western Sydney.
- **Preserving Opportunities for Future Active Transport Connections:** Potential to strengthen connections to existing and proposed infrastructure, including active transport links along the proposed M12 Motorway.
- **Water-Sensitive Urban Design (WSUD):** Incorporating integrated stormwater systems to manage water quality and quantity while supporting landscape regeneration.
- **Regional Connectivity:** Creating ecological corridors and visual connections that link the site to surrounding natural systems and ecological communities.
- **Visual and Experiential Access:** Preserving existing sightlines and establishing new viewing points along creeks, across the site, and from key transport corridors such as the M12.
- **Connection to Nature:** Designing shared spaces where ecological restoration coexists with public use, facilitating local stewardship with Traditional Custodians and education (tours will be limited to small school groups).
- **Long-Term Resilience:** Embedding climate-adapted systems and adaptive management practices to ensure enduring ecological and community outcomes.

Constraints

Site constraints have been carefully evaluated to ensure the feasibility and safety of Badu Yarragul. Given its proximity to Western Sydney Airport, flood-prone areas, and a history of land clearing, the design responds to these challenges with strategies that support ecological restoration, public safety, and long-term resilience.

Funding model and design demand

The funding model and public demand influences the Masterplan's ability to pursue certain design features. For example, lack of both Traditional Custodian endorsement and public demand for the site to be open to public use and lack of funding to provide facilities influences design features. The site is isolated from nearby population hubs that would create potential demand for open public space.

Wildlife strike

Measures to mitigate wildlife strikes are a key component of the design. Badu Yarragul Greenspace's location beneath the Western Sydney Airport flight path makes bird strike during take-off and landing a significant concern. The design will prioritise safe coexistence between human activity and native fauna, finding safe ways to encourage on-site biodiversity.

Habitat fragmentation

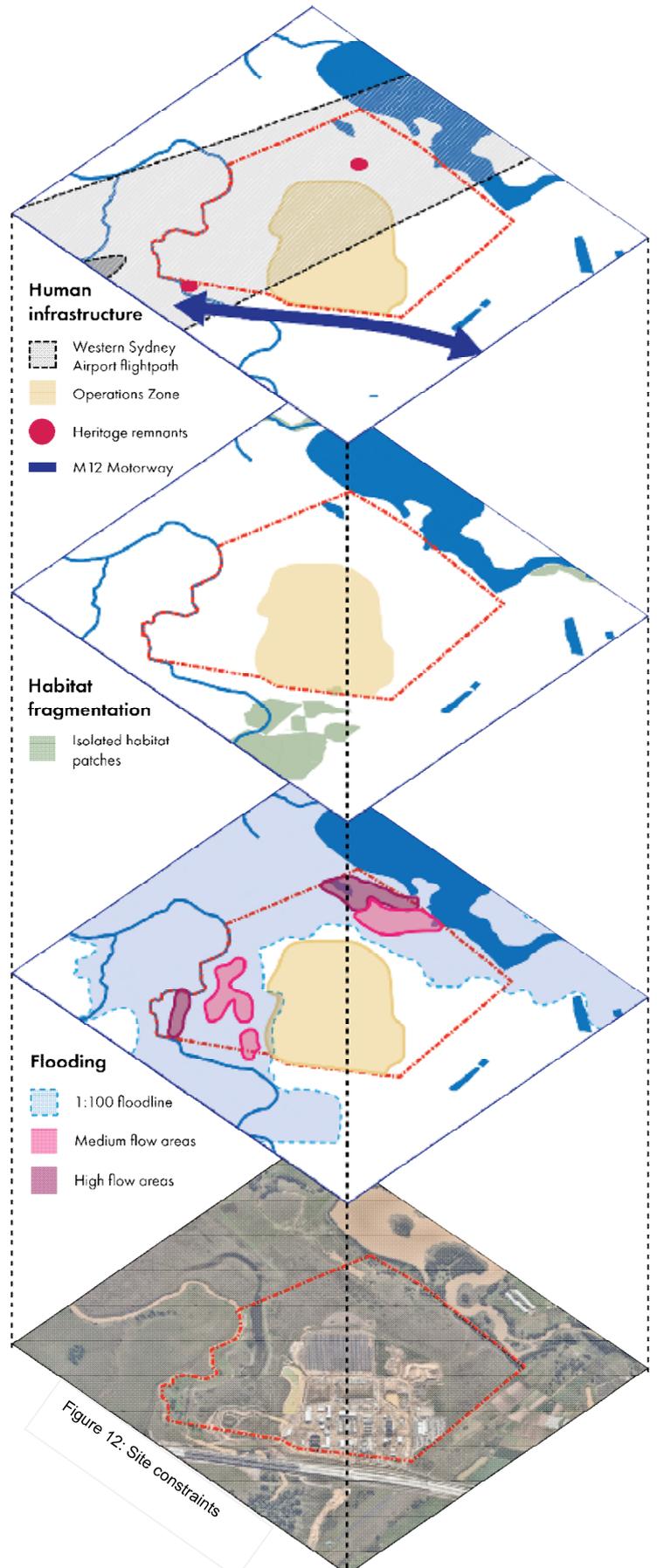
Due to a long history of rural agricultural use, the site and its surroundings have been heavily cleared and compacted. As a result, only small remnants of endemic vegetation remain, limiting biodiversity and restricting genetic flow across the landscape.

Flooding

A large portion of the site is affected by 1-in-100-year flood events, requiring careful planning for flood mitigation and resilient infrastructure. The operations zone is strategically located above the 1-in-100-year flood level.

Urban Heat Island Effect

The Urban Heat Island effect is a significant challenge in Western Sydney. At Badu Yarragul Greenspace, increasing vegetation cover can help mitigate this by providing shade, reducing heat absorption, and improving on-site thermal comfort.



Opportunities

At Badu Yarragul Greenspace, a range of opportunities have been explored to enhance the site's ecological, cultural, and social value. These include restoring native vegetation, strengthening connections to First Nations cultural practices, improving biodiversity corridors, and creating inclusive, spaces that foster limited and targeted community engagement and environmental stewardship.

Aboriginal cultural landscape and interpretation

A central focus of the Badu Yarragul Greenspace design is the interpretation and preservation of the Aboriginal cultural landscape. The project seeks to respectfully acknowledge and embed the heritage, knowledge, and stories of First Nations peoples.

Critically endangered vegetation restoration

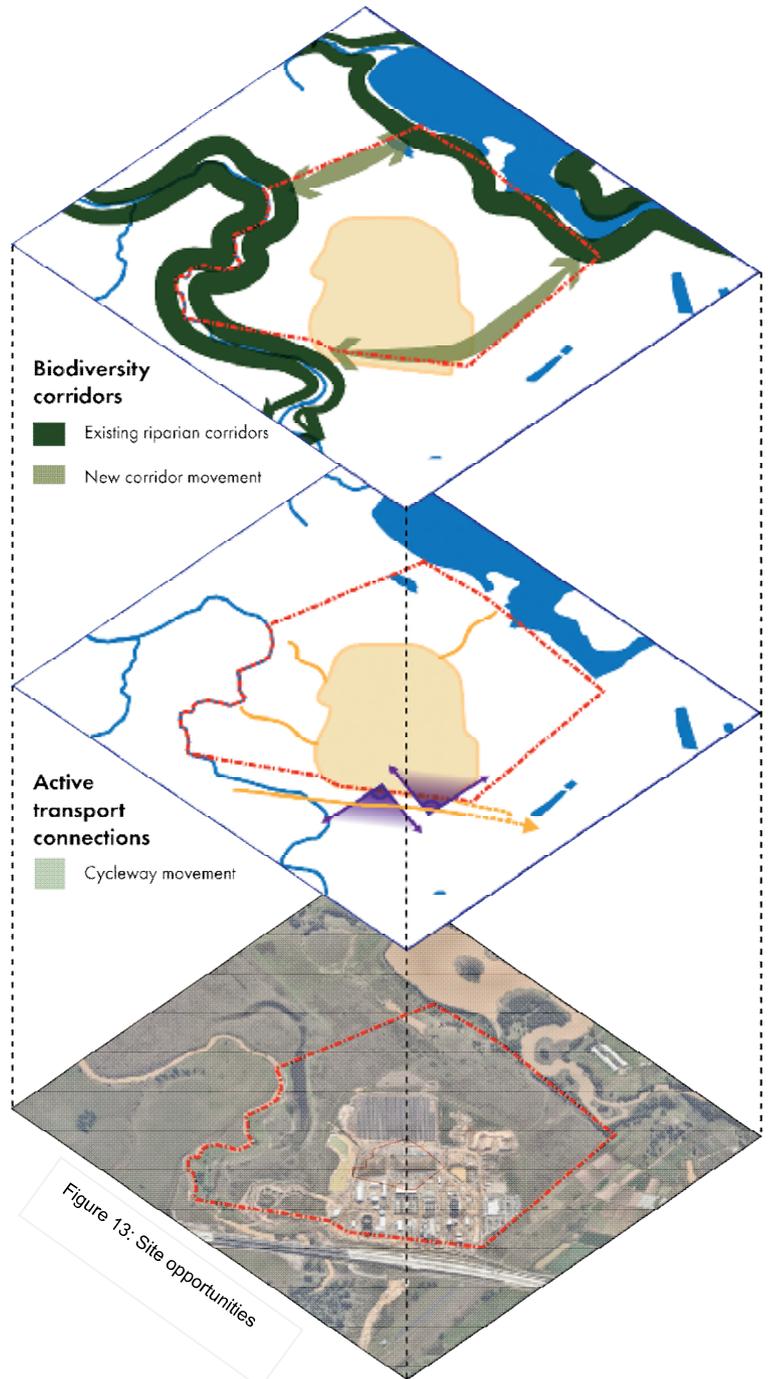
Restoring the critically endangered Cumberland Plain Woodland is a key priority for the Badu Yarragul Greenspace project. This will help re-establish essential habitat for threatened flora and fauna, enhancing on-site biodiversity and ecological resilience, supporting broader environmental objectives, including carbon sequestration and improved water infiltration.

M12 active transport link

Active transport connectivity opportunities with the M12 cycleway will be preserved, potentially integrating the Badu Yarragul Greenspace into the broader regional cycleway network. This would encourage sustainable travel options and improve accessibility for the community.

Slowing water flow

Strategies to slow water movement and rehydrate soils will support the establishment and maintenance of vegetation cover, improve soil condition, assist with the sustainable management of stormwater, improve climate resilience and reduce the impact of runoff. This will ensure the long-term sustainability of the Badu Yarragul Greenspace and improve the survival rate of new plants to establish a stable open woodland ecosystem.



Integrated stormwater design

An integrated stormwater management system interfacing with the Circular Economy Zone (CEZ) creates opportunities to implement innovative water reuse strategies that enhance resource efficiency. This approach aligns with a regenerative design philosophy, working in harmony with the landscape and its natural cycles to sensitively manage CEZ runoff.

4. Responding to Site Conditions

The Badu Yarragul Greenspace Masterplan has been carefully developed to address environmental risks while enhancing ecological and community outcomes. The site presents unique challenges, including wildlife strike mitigation, bushfire risk, and flooding. The design responds with integrated strategies such as managing vegetation to reduce bird strike potential, establishing Asset Protection Zones (APZs) to mitigate bushfire threats, and siting infrastructure, a cultural gathering space for Traditional Custodian use, outside of 1-in-100-year flood areas. Together, these measures ensure a safe, resilient, and sustainable landscape that supports and enhances environmental values.

Wildlife Strike Mitigation

The objectives of the Western Sydney Aerotropolis present a tension between wildlife strike mitigation and the goal of achieving 40% tree canopy cover. On one hand, increasing urban tree canopy is essential for cooling the region, enhancing biodiversity, and improving liveability—key objectives aligned with the Aerotropolis vision for a green, sustainable city. On the other hand, extensive vegetation of particular types, particularly in proximity to flight paths, can attract birds and other wildlife, increasing the risk of aircraft-wildlife collisions. Balancing these goals requires innovative landscape strategies such as selecting low-attractant species, managing habitat structure, and locating dense planting away from critical flight zones.

The Aviation Safeguarding Guidelines Western Sydney Aerotropolis and surrounding areas (NSW Department of Planning, Industry and Environment 2021) sets out planning guidelines to inform land use planning decisions on land impacted by safeguarding controls. The document informs the assessment on land surrounding Western Sydney International (Nancy -Bird Walton) Airport (WSI) where wildlife may present a risk operation and ensure wildlife management provisions when undertaking land use planning.

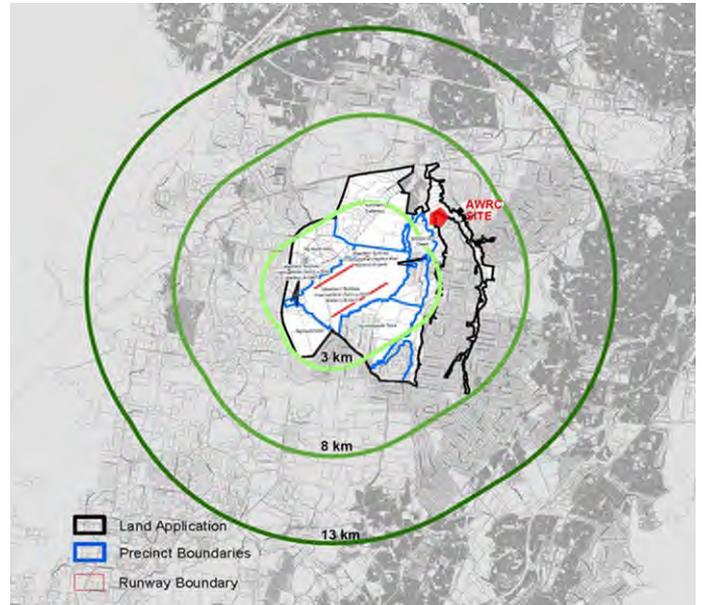


Figure 14: Wildlife Buffer zone Map, adapted from State Environment Planning policy (Western Sydney Aerotropolis) (NSW Department of Planning Industry & Environment 2020)

The activity of birds and animals in the vicinity of the WSI Airport is a recognised potential source of hazard to the safe operation of aircraft. This hazard results from the possibility of a collision between an aircraft and one or more birds or animals i.e. bird strike. The site falls within the 8 km wildlife buffer zone, refer Figure 14: Wildlife Buffer Zone Map. New land uses within 13km of airport property should be regularly monitored and action plans created to mitigate any unacceptable risk of bird strike.

Aviation risks to be mitigated in the landscape design centre around the creation of habitats that are attractive to birds and bats. Key considerations include ensuring that the design does not create wildlife attractive features (natural and built) and monitoring bird and bat populations to assess strike risk.

Species Selection

The wildlife strike mitigation strategy should not preclude the development of the site to improve biodiversity in the region by attracting and supporting microfauna. The design of the landscape has considered plant species selection, density of vegetation cover, depth of wetlands and the operation of the site to minimise habitats that attract wildlife hazards.

The Western Sydney Aerotropolis Draft Wildlife Management Assessment Report (Western Sydney Planning Partnership & Avisure 2020) provides guidelines for planting species to minimise the attraction of birds and flying foxes within the Aerotropolis. It is recommended that “trees and shrubs planted in the area should not bear edible berries, fruits, seeds, nuts, nectar, or bear flowers profusely. Such vegetations attract flying foxes and birds such as lorikeets. Plants that attract insects may also pose a risk in attracting small numbers of birds.”

The landscape design proposes a variety of different species sparsely intermixed to allow local biodiversity to evolve. For example, the planting of *Acacia* sp. will improve soil fertility through nitrogen fixation and allow cross pollination.

Wildlife Management Plan

A Wildlife Management Plan (WMP) identifying mitigation actions where hazards are identified will be prepared for the Greenspace. Further, the WMP integrates routine monitoring, wildlife awareness, wildlife management and performance standards, wildlife deterrent and surveillance patrols. Additionally, to meet condition E64(b), hazardous wildlife deterrents have been considered in the design and ongoing management of the landscape. Consideration includes the design and management of the landscape to deter bird populations. Monitoring will inform the need for the introduction of sonic devices or ultrasonic repellents to deter wildlife.

Landscape Management Plan

The Landscape Management Plan will describe the management activities to be undertaken for the long-term care of Badu Yarragul. There will be focus on management activities which support the goals and objectives of ecological enhancement. The LMP allows for the continual monitoring and maintenance of the landscape across the entire site to minimise wildlife hazards, manage invasive weed species and reduce bushfire risk.

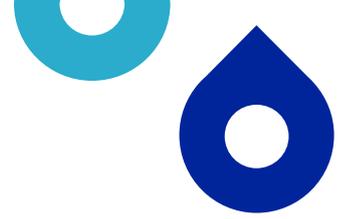
Design of Wetlands

The restoration of Badu Yarragul Greenspace has a strong emphasis on waterway and catchment health. There are a number of existing small wetlands and drainage depressions onsite. The Greenspace Masterplan harnesses these wetlands for their biofiltration capabilities and capacity to reduce sedimentation and erosion while creating diverse wetland microhabitats for endemic flora and fauna species. Wetlands can attract significant numbers of wildlife. Mitigation measures will be adopted to reduce bird strike risk for the nearby airport, whilst also supporting broader objectives for the waterway corridors. Specific existing and proposed site features to be incorporated include:

- Existing billabong (restored as part of UDLP and VMP works) & wetland water depth: between 0.5m and 1.2m is less likely to attract hazardous flocking bird such as pelicans, swans, and cormorants; or upending ducks such as Pacific Black Ducks; or wading birds such as ibis and egrets.
- New wetlands will have shallow depth and support dense vegetation to improve water quality (and limit areas of open water).
- Sedge/wetland planting: designed with steeper slopes.



Figure 15: Existing billabong near Kemp's Creek



Bushfire Risks

The Greenspace Masterplan incorporates control measures to manage the risk of bushfire as outlined in the *Bushfire Constraints and Opportunities Report Upper South Creek Advanced Water Recycling Centre, Kemps Creek, NSW Bushfire Hazard Solutions August 2020* and the *Planning for Bush Fire Protection 2019* guide.

Badu Yarragul builds on the measure established for the implementation of the AWRC Operations zone. Existing measures include:

- A 10 metres Asset Protection Zone (APZ) around the facility including the perimeter fence and fire trail.
- A further 20 metres of pasture grass zone to the outside of the fire trail will be slashed to keep vegetation low.
- The future green space zone will be maintained to minimise fire risks.

Within the Inner Protection Area (IPZ):

- Low fuel condition (<100 mm in length) grass has been incorporated within the solar farm (native grass) and the Treatment plant (turf grass). Both species will be regularly mown or slashed.
- Tree canopy cover <15% at maturity, will not touch or overhang buildings and canopies separated by 2-5 m.
- Species selection focused on smooth barked and low flammability trees and shrubs.
- Shrubs are not directly placed under trees and form <10% ground cover.
- The landscape within the Operations Zone will be maintained and monitored to minimise risks as part of the site's Landscape Management Plan.

Within the Asset Protection Zone (APZ):

- Fire trail around the perimeter of the Operational Zone will be 4m wide, as per regulations
- Irrigation line will run alongside the trees planted along the fire trail, hydrating them with recycled water during drought to prevent them becoming additional fuel and compromising the fire trail when it is needed.

- Hydration areas will form part of the adaptive management control where appropriate across all areas. Filled with stormwater and/or recycled water within the APZ (and OPZ and IPZ where appropriate as part of an adaptive management approach).

The Outer Protection Zone (OPZ) is a vital element of bushfire risk management, positioned beyond the Inner Protection Zone (IPZ) and forming part of the broader Asset Protection Zone (APZ). Its primary function is to reduce bushfire intensity before it reaches more vulnerable areas near buildings, balancing fire protection with environmental conservation. Protective actions include:

- Vegetation will be maintained as sparse clusters, managed to eliminate ladder fuels that enable fire to climb from the ground into the canopy.
- Understorey shrubs will be carefully spaced, and fuels such as leaf litter and fallen branches will be reduced through slashing or hazard reduction burns.
- Habitat features like logs and sparse vegetation will be retained where they do not significantly increase fire risk.
- Access tracks connected to fire trails will facilitate maintenance, supported by regular inspections and adaptive management to ensure ongoing effectiveness.

Utilising the Badu Yarragul Water Resource Recovery Facility hydrological resources, there is capacity to provide irrigation to low vegetation underneath the solar panel operation zone.

Density of vegetation cover

Planting density has been predominately determined using bushfire risk criteria in consultation with Traditional Custodians, while replicating the sparse nature of the Cumberland Plain Woodland vegetation community which was once present across the region. Proposed plant densities will be based on trees/shrubs installed at 1 per 100 m² and hydro seeding of grasses and groundcovers. The denser planting along the Wianamatta South Creek, established during the VMP works, is the exception to this density approach as it is part of the regional green networks and falls within the category of enhanced riparian and wetland corridor landscape to improve biodiversity.

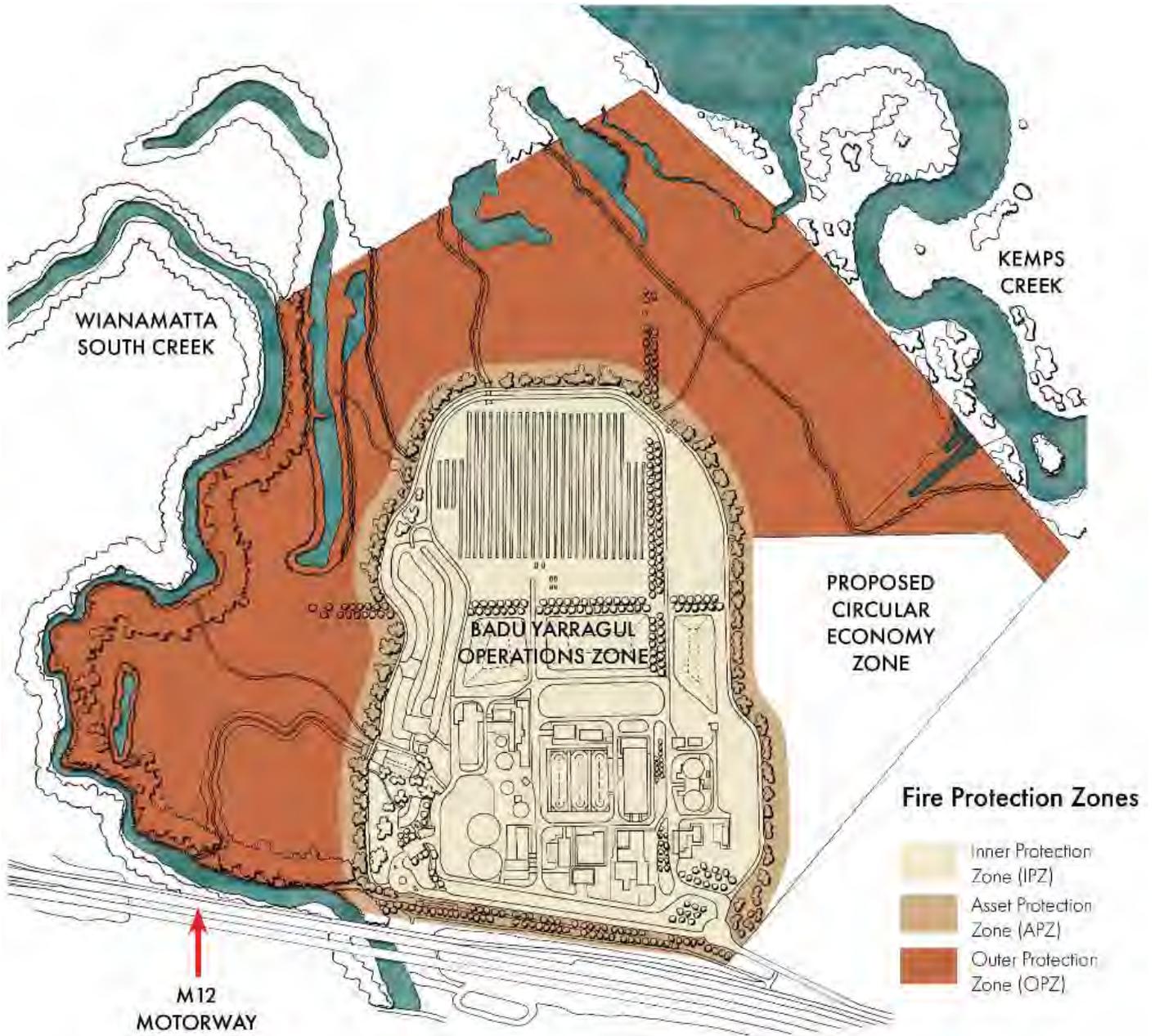


Figure 16: Fire Asset Protection Zones



Flooding

The operational footprint is located on a topographically high point between Wianamatta South Creek and Kemps Creek above the Flood Planning Level (FPL). This means that the built surface of the Badu Yarragul Water Resource Recovery Facility (BYWRRF) will remain free from inundation. While the BYWRRF operational area is above the 1% AEP, the Green Space area is below the 1% AEP and susceptible to flooding. A full flooding assessment will be undertaken once the Badu Yarragul Greenspace is developed to meet the requirements of MCoA E27.

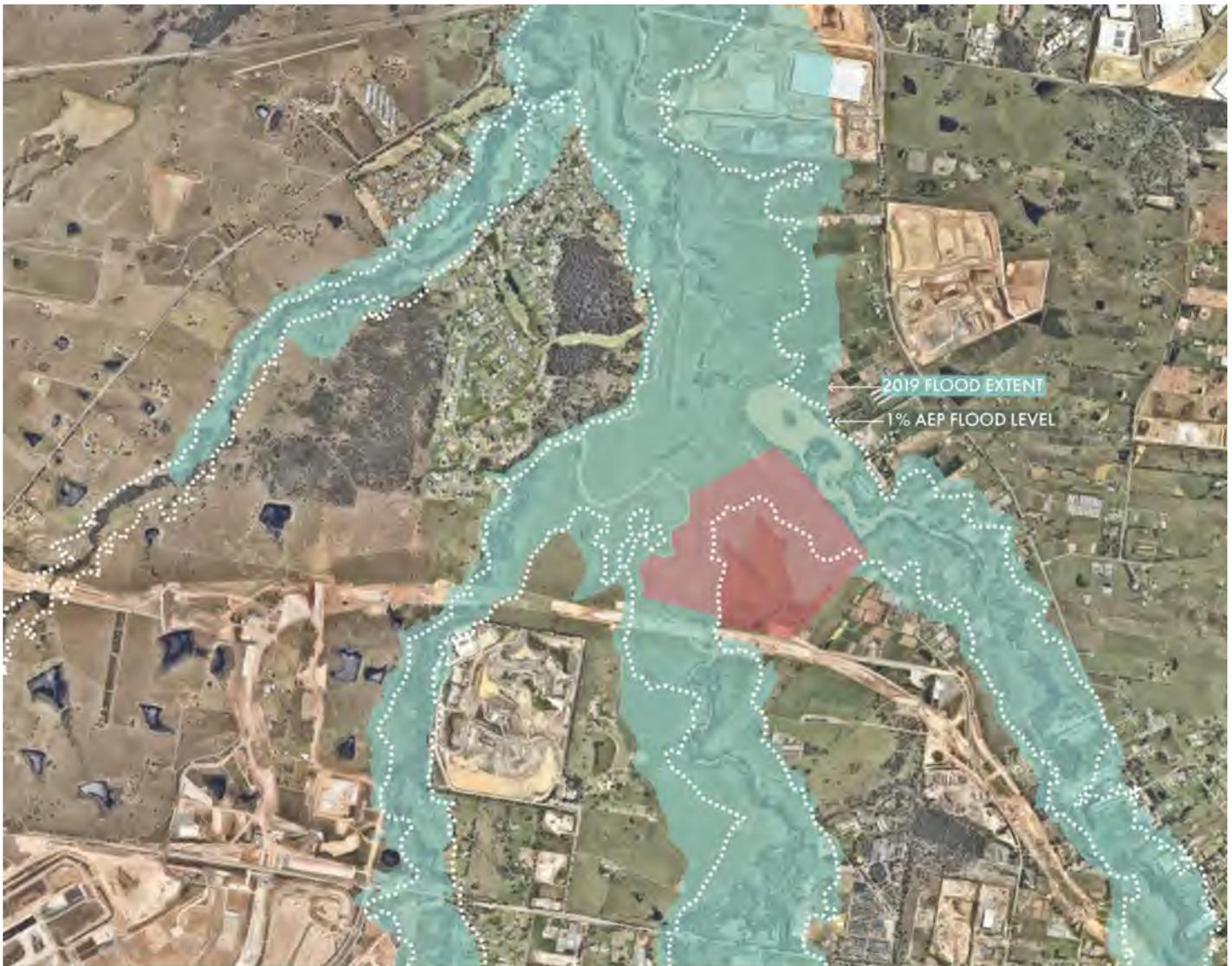


Figure 17: Wianamatta South Creek 2019 flood extent



Connection to Country

5. Connection to Country

Historical and Cultural Significance

The Badu Yarragul Greenspace site has strong historical and cultural significance. The *Heritage Interpretation Strategy* (Extent Heritage October 2021) is a comprehensive review of potential interpretation opportunities to ensure that traditional, historical, and contemporary values and meanings are integrated. Three preliminary interpretative themes from Country were identified:

The Ebb and Flow (water),
The Infinite Land (land), and
To The Stars (sky).

Source: AWRC UDLP

These themes have been refined through engagement with key Knowledge Holders to understand Wianamatta South Creek as a source of life, how the local topography was used as way-finding markers and how the spaces between stars guided journeys at night.

The three themes form the basis of three significant and circular stories:

- **Night sky** used for navigation by Aboriginal people and how the site's former use as Fleurs Field Station for radio astronomy researched the sun's outer atmosphere.
- **The story of the creeks** as a water source and the proposed Badu Yarragul hydration and revegetation strategy.
- **The Lands** were rich in food for Aboriginal communities, subsequently used for farming and grazing and the proposal to revegetate the site to reinforce biodiversity outcomes.

This Project has the opportunity to re-establish lost networks and the restoration of a denuded landscape. Through knowledge sharing to broaden our understanding, interpretation will be informed by continuing feedback and guidance from the Aboriginal community. Refer to **Chapter 6 Community and Stakeholder Engagement**.



Figure 18: Badu Yarragul Greenspace site: The Water, Infinite Land, and Sky

What is Country?

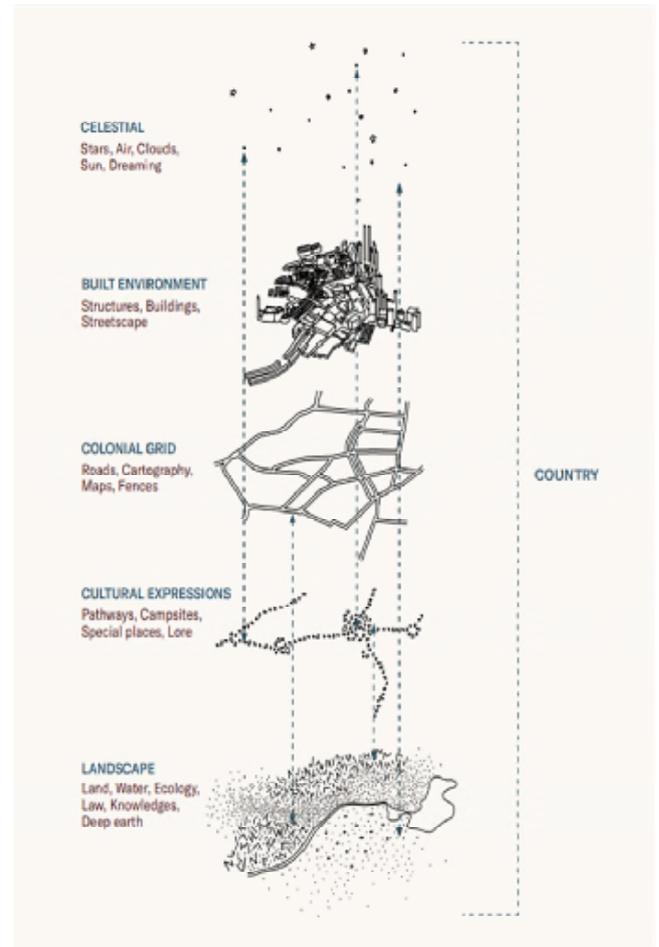
For Aboriginal peoples, "Country" signifies more than just land; it embodies a complex system of lore, custom, identity, and spiritual belief tied to specific ancestral lands, waters, and sea country. It encompasses the land, living things, and even the physical space in between, and carries deep responsibilities to nurture and protect it. Caring for Country is a profound connection and obligation to maintain ecological balance and spiritual vitality, viewed as a living relative, rather than mere ownership.

~ Dharug Elders Group

The health and wellbeing of Country will help to:

- Reduce the impacts of natural events such as fire, drought and flooding through sustainable ways of using land and water.
- Value and respect Aboriginal cultural knowledge, with Aboriginal people co-leading design and development of all NSW infrastructure projects.
- Ensure Aboriginal people with responsibilities to care for Country, protect sensitive sites and continue living cultural practices are given access to their homelands.

Figure 19: Layers of Country (Government Architect of NSW)





Recognising Country

Multiple chapters of the *Recognise Country: Guidelines for Development in the Aerotropolis (NSW Government 2022)* have been considered in the masterplan.

Starting with Country

The master planning for Badu Yarragul Greenspace considers how values can be revitalised through a cultural lens. The need to start with Country and making appropriate design decision responding to Country's needs have been considered and continue to be considered in the development and post construction management of the site.

Traditional Custodians have been consulted and will continue to be part of this process, including social impact opportunities associated with building enterprise. Walks on Country with Traditional Custodians and Registered Aboriginal Participants have occurred, and engagement outcomes and recommended actions are being incorporated into the project outcomes. This will ensure that the local Traditional Custodian values and assets are not only maintained but further enhanced.

The design will respond to Country through the emphasis on healing Country, focusing on minimal impact and maximum benefit to ecological systems and community.

The proposed restoration of fragmented ecological systems associated with the Cumberland Plain Woodland landscape across the site will support a biodiverse environment that will enhance existing fauna numbers and create opportunities for a networked environment that reinforces a greater number of species interactions.

The restoration of Badu Yarragul Greenspace will improve waterway quality, reduce erosion, and support aquatic species. The establishment of tree cover and improved water quality supports the broader Aerotropolis and Western Parkland City objectives including the need to mitigate heat island effects. Water, land and sky are key principles for the project interpretation strategy.

Cultural Safety

A balanced approach to engagement is being taken to reduce the cultural load on Traditional Custodians. Engagement will focus on the opportunity to revitalise place through a cultural lens to establish Badu Yarragul Greenspace as Country that is living and offers different experiences at different times of the day and year, allowing Traditional Custodians to come on site and engage in cultural practices safely. The establishment of an area for cultural practice and consideration of post construction opportunities for co-management will be explored to further foster cultural safety and collaboration with Traditional Custodians.

Economic development opportunities

Sydney Water's Aboriginal Procurement Participation Plan 2021-2023 informs the procurement process for the development of the Badu Yarragul Greenspace. Specific employment opportunities have included archaeological investigations, seed collection for the establishment of local plant material suitable for the site, supply of goods and services, including the establishment and on-going maintenance of the landscape. There are also opportunities in the development of the Heritage Interpretation Framework and implementation for the site.

Cultural Landscape

Badu Yarragul Greenspace is within the expansive waterway system of Wianamatta and the 'site' does not exist in the broader context when viewed as land, sky, and water. Instead, it is part of a much larger, cohesive view of Country without site boundaries and land ownership. It is clear when approached in this way the site is within land that is communal, reflecting traditional, scientific, ecological and knowledge values. There is a specific identity associated with the Dharug as a unique people and language. We are focusing on the restoration of a living culture at the Badu Yarragul Greenspace.



Landscape

The Badu Yarragul Greenspace Masterplan will respect sightlines and views to nearby landforms and key geographic markers such as the Blue Mountains, Kemps Creek, and Wianamatta South Creek, and reinforce opportunities for Traditional Custodians to connect to the broader cultural landscape. The existing endemic fragmented vegetation will be supplemented with the local Cumberland Plain Woodland species to restore a networked ecosystem. This nature-based solution will maximise biodiversity outcomes, particularly around the creek networks within and beyond the site. The landscape design will be developed to include select indigenous species focusing on the use of plant material grown from seeds of provenance honours the original landscape. Alongside this is understanding the challenges of the salinity in the on-site soils in reestablishing plant communities.

Water supporting plants for food and fibre

The design should use water systems (including riparian corridors and drainage flow paths) and flood mapping as a base layer to inform spatial decisions. The Operational Zone is located above the 1% AEP flood extent to protect assets, while the remaining Greenspace topography will be retained. The restoration of billabongs and wetlands promotes the opportunity to engage with water and the story of water.

The existing floodplain lands feature some areas of wetland plants that thrive in wetter conditions. These plants are sustained in subtle drainage paths and respond to the soil, water and vegetation conditions.

The Greenspace Masterplan aims to re-establish the native plants that indigenous people used for food and fibre (e.g. berries, tubers, flour from seed, weaving, string, traps for hunting) as well as the habitat for animals that were a critical protein source for indigenous people. The masterplan includes use of cultural plants (refer section 9, Tables 11 – 14).

Cultural activation

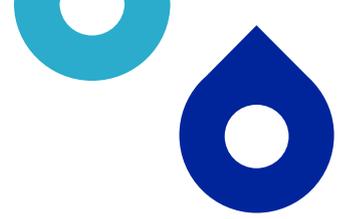
Aboriginal interpretation is to be embedded into the Interpretation Strategy elements for the site's development. Opportunities include stories of place, cultural activation, and sensing Country. Badu Yarragul Greenspace has been identified as part of a broader area of cultural practice. A specific cultural gathering space has been selected in consultation with Traditional Custodians to harness the opportunity to engage with cultural education and connection through the landscape, alongside the Wianamatta South Creek billabong area.

Language and naming, wayfinding and signage

The project's name, Badu Yarragul Greenspace, comes from the Dharug language and was selected in consultation with Traditional Custodians. Badu Yarragul (Bar-doo Yarra-gool) translates to "freshwater cleaning" to reflect the project's function while also acknowledging its position on Wet (freshwater) Country. Other names were also considered:

- Ngara (Nar-ah) translates to "listen, learn, think" and reflects the site's potential to be a place for education and reflection on Traditional Custodians' cultural connections.
- Ngalawa (Nul-a-wah) means "live/sit and remain" and represents the continual connection between the Dharug people and Country, while also demonstrating the unrelenting and ongoing nature of Country.

A local language name recommendation was also provided for the Access Road. The preferred naming option from the shortlist is "Badu Muru" translating to "Fresh water path." It is a combination of two Dharug language words to signify this Country as a pathway for fresh water, reflecting the many waterways and tributaries that traverse Dharug Country. Other shortlisted names include "Daragun" meaning "creek/waterway" and "Muru" meaning "Journey/path."



Connecting and Designing with Country

Sydney Water is committed to delivering positive outcomes for Country and the community. The masterplan will be developed with a country-centred approach guided by Aboriginal people informing the design, advising the design principles, project values, landscape and local needs.

Using water to tell a new story about Place, we have and will continue to engage with local Aboriginal people and Traditional Custodians.

Water is life, linking our ecosystems. Building on the Connecting to Country Framework and Designing with Country discussion paper established by the Government Architect of NSW, the Recognise Country- Guidelines for the development in the Aerotropolis and the Consultation Outcomes Report Aerotropolis Stormwater Catchment Scheme Plans- Aboriginal Engagement (Sydney Water Corporation GHD Zion, Waters 29 November 2022).

The Upper South Creek Advanced Water Recycling Centre Heritage Interpretation Strategy (Extent Heritage for Sydney Water October 2021) outlines the need to engage with Aboriginal and broader community to develop the site's Interpretation Framework, encompassing both Aboriginal and non-Aboriginal heritage interpretation requirements for the whole site, which is to be prepared in 2026.

A comprehensive and integrated approach will include a range of initiatives that develop an increased understanding and response to Dharug Country and the cultural context of Wianamatta South and Kemps Creek to guide landscape outcomes more meaningfully. The engagement strategy is expanded upon in **Chapter 6 Community and Stakeholder engagement**.



Figure 20 Wianamatta South Creek

Country Centred Approach

The Government Architect NSW's *Connecting with Country Framework 2024* provides guidance for embedding Aboriginal perspectives in the planning and design of built environments. Badu Yarragul Greenspace integrates this framework into its design process and outcomes, ensuring a Country-centred approach that respects and reflects Aboriginal cultural values.

The framework emphasises that caring for Country leads to Country caring for us, advocating for designs that prioritise the health and wellbeing of the land, water, and communities. By adopting this approach, Badu Yarragul Greenspace aligns with the framework's principles, fostering sustainable and culturally respectful development.

A **human-centred** approach to design prioritises the needs, values, and experiences of people—often focusing on functionality, comfort, safety, and aesthetics for human users. It tends to frame land and resources in terms of human benefit, with nature viewed as something to be used, shaped, or managed to serve human purposes.

In contrast, a **Country-centred** approach shifts the focus to prioritise the health, knowledge, and authority of **Country**—a holistic Aboriginal concept that encompasses land, waters, skies, people, culture, and all living beings. Rather than seeing nature as a backdrop or a resource, a Country-centred approach understands that humans are part of a larger, interdependent system and must act in service to Country, not just from it.

This approach requires listening to and embedding First Nations perspectives, valuing ongoing cultural relationships with land, and designing with the intention to care for Country in culturally, ecologically, and spiritually meaningful ways. It's about working *with* Country, not just *on* it.

Figure 6: Human-centred or Country-centred
Diagram adapted from German architect Steffen Lehmann's 'Eco v Ego' diagram, 2010

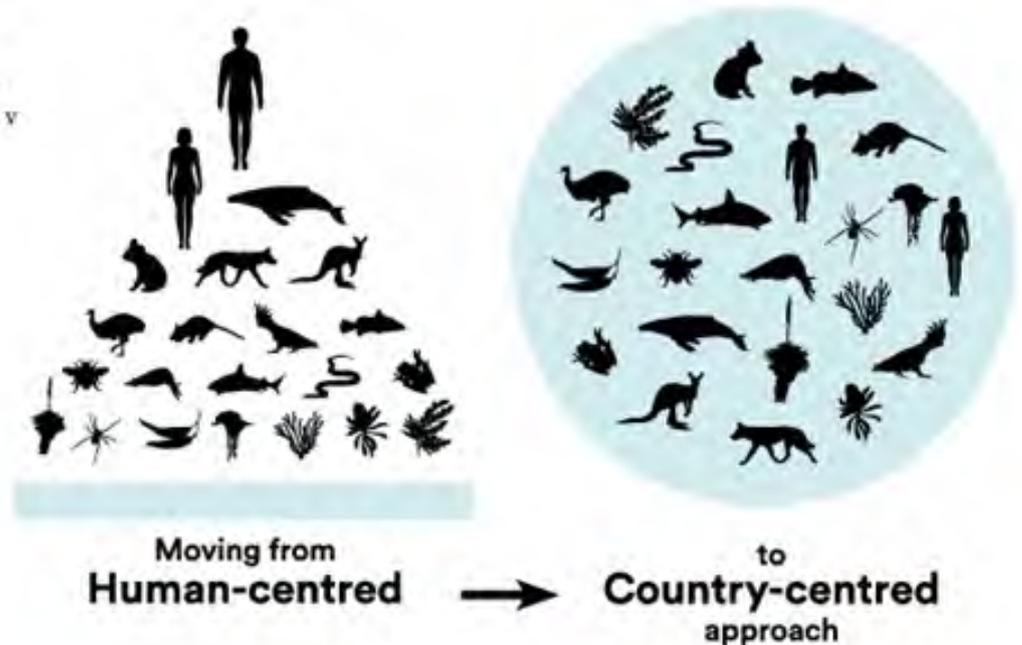


Figure 21 Human-centred or country-centred approach (Connecting with Country Framework Government Architect)



Outcomes for Country

At Badu Yarragul Greenspace, a Country-centred approach guides design and planning by prioritising the health and integrity of Country—understood as a living, interconnected system of land, water, culture, and community. The *Connecting with Country Framework* defines **Healthy Country** as the overarching outcome, supported by regenerative environmental practices and shared

sustainability values between Aboriginal and Western worldviews. Practical indicators of success include restoring ecosystems, enabling Aboriginal communities to fulfil their cultural responsibilities, and creating opportunities for education, employment, and social connection, as demonstrated in the following tables:

1. Healthy Country

Healthy Country describes healthy, interconnected natural ecosystems, supported by regenerative practices based on Aboriginal knowledge.

Table 5: Healthy Country (adapted from *Connecting with Country Framework*)

What this looks like	Indicators for success	Badu Yarragul Greenspace Integration
Healthy ecology	High biodiversity is home to a wide variety of plant and animal species, including those that are rare or endangered.	Profiling remnant vegetation communities and catering design to key endangered fauna and flora species
	Clean air and water are free of pollutants.	Water pollutant management through naturalised wetland filtration system. Tree canopy to produce oxygen, absorb carbon dioxide and pollutants.
	Porous development allows rainwater to soak the ground as well as flow freely across land into original waterways.	Hydration and revegetation system to slow water runoff before flowing to Kemps Creek and Wianamatta South Creek.
	Stormwater infrastructure that has replaced original water systems is naturalised and opened up to daylight.	On site drainage is all based on an open system.
	Ecological systems are resilient to impacts from drought, floods, fires, as well as human-induced disturbances such as habitat destruction and pollution.	When established, the revegetation should be able to regenerate over time through seed germination to restore biodiversity and ecological function despite disturbance from natural events.
The physical form of Country remains recognisable and restored where possible.	Alternative solutions are found to excavating, cutting into and reshaping the ground.	Minimal ground reshaping to improve natural drainage system and integrate with existing natural systems through utilising existing contouring.
	Interference with natural water systems is minimal.	Permanent waterbodies enhanced and ephemeral waterbodies identified and protected.
	Original landscapes are restored and protected, and isolated pockets are reconnected.	Connectivity across the landscape improved through revegetation with Cumberland Plain species.



2 Healthy Community

Built environment projects can provide opportunities for employment and capacity building within the Aboriginal community, and support Aboriginal communities' connection to their cultural identity, which supports positive health and wellbeing.

Table 6: Healthy Community (adapted from Connecting with Country Framework)

What this looks like	Indicators for success	Badu Yarragul Greenspace Integration
Strong cultural identity, connected to place and community	Aboriginal community see their cultural heritage appropriately reflected in the design of places where they live and work.	Cultural heritage woven into design through engagement on site's use and the location of artefact repatriation and cultural gathering areas. Art and history interpretation to be in Administration building.
Cultural safety	Aboriginal people feel safe, respected, and supported in how they express their cultural identity.	Cultural space and artefact repatriation site codesigned with Dharug Traditional Custodians to ensure the project creates a safe place for cultural identity expression and education. An Access Management Plan (AMP) to be prepared for the use of the site.
	Aboriginal consultants with spatial design expertise aren't burdened by an expectation to represent the voice of many within Aboriginal communities.	Collective and collaborative design input has allowed multiple voices to be heard and documented through workshops, consultation sessions and partnerships with local Aboriginal organisations.
Relief for Aboriginal communities who are fatigued by the workload imposed on them by project teams seeking their advice on Country	A strategic plan or register is established to identify technical and cultural skills of Aboriginal community.	The <i>Community Engagement Plan</i> AWRC project (2020) developed and subsequently refined for the Greenspace has established the contacts and process for advice seeking to undertake early and continuing involvement.
	Community is involved early in the decision-making about which projects they are best placed to work on.	As per above.
Employment opportunities	Employment opportunities are provided throughout all stages of project life cycles.	Consultation at each project stage, multiple Walks on Country and information sessions to identify opportunities including educational opportunities to be led by Traditional Custodians. Aboriginal Participation Plan (APP) to be developed for the implementation and post construction stages of the project.
	Aboriginal businesses are supported in the project procurement strategy.	Aboriginal businesses involved and supported in cultural burning, seed collection and plant stock provision, implementation and maintenance and monitoring activities.



3. Protecting Aboriginal cultural heritage

It is critical that Aboriginal cultural heritage is protected in the built environment, both through the design and development of projects, and by acknowledging and respecting the rights of Aboriginal people and community over their cultural intellectual property.

Table 7: Protecting Aboriginal cultural heritage (adapted from Connecting with Country Framework)

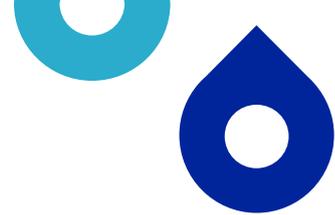
What this looks like	Indicators for success	Badu Yarragul Greenspace Integration
Aboriginal cultural advisers guiding project teams and clients to better connect with Aboriginal community	Aboriginal cultural heritage is protected and celebrated within planning and design outcomes.	Caring for Country principles adopted in design outcomes to support the existing natural systems onsite.
	Aboriginal community actively participate in shared decision-making processes related to precinct/regional planning or program workstreams, particularly those that significantly impact Country they are responsible to care for.	Aboriginal community actively involved in decision-making process throughout all stages of the project.
Project teams and processes for project delivery respect ICIP	Aboriginal community endorses the project outcomes and behaviour of the project team.	Staged consultation process to ensure project outcomes and behaviour are endorsed.
Aboriginal language place names are used	Aboriginal place names are used for suburbs, parks and streets. Dual naming, or returning the original name, is used for natural features such as mountains, waterways, beaches, forests.	Project renamed from Advanced Water Recycling Centre to the Badu Yarragul Water Resource Recovery Facility and access road renamed to Badu Muru Grove, acknowledging the place identity as a wet place.
Access to Country is provided	Access to Country enables community to practice ceremony and undertake obligations to care for Country.	Cultural gathering space is provided for community to care for Country. Aboriginal artefact repatriation site placed respectfully within the landscape.

4. Cultural Competency

Implementing the Connecting with Country Framework through built environment projects provides educational opportunities for project teams, clients and the public, to develop a deeper cultural awareness and respect for Aboriginal people and culture.

Table 8: Cultural Competency (adapted from Connecting with Country Framework)

What this looks like	Indicators for success	Badu Yarragul Greenspace Integration
Ongoing cultural awareness training develops skills and competency in delivering Country-centred design projects	Workplace culture supports training, immersion and learning for built environment professionals, including individuals, project teams and across agencies.	Embedded into the design stage through the involvement of Aboriginal consultants and Sydney water personnel with Country experience.
	Cultural awareness training is embedded into continuing professional development requirements (e.g. NSCA).	To be embedded into the Implementation stage for the Contractor.
	Proof of cultural awareness training is required in procurement contracts.	Aboriginal Procurement Participation Plan 2021-2023 outlines training to ensure culturally sensitive engagement with Traditional Custodians.



5. Better Places

Adopting a Country-centred approach creates better places, informs sustainable designs, integrates with the broader landscape to form place-based design responses, and promotes strong community engagement to create welcoming and accessible places.

Table 9: Better Places (adapted from Connecting with Country Framework)

What this looks like	Indicators for success	Badu Yarragul Greenspace Integration
Planning and design projects create places that are connected with Country	Project sites are connected to broader landscapes beyond property or project boundaries.	Strong focus on how the site is connected to broader landscape through the surrounding waterways and green corridor pathways.
	First placenames guide design and planning outcomes: place naming, dual naming and wayfinding.	Site renaming in Dharug language, ongoing discussion with Traditional Custodians about wayfinding and signage opportunities.
	The memory of significant cultural, historic and natural events can be read and traced within Country's landscape.	The acknowledgement of the transient nature of the waterway system across the site in the establishment of a landscape that allows for low and peak flows.
	Where possible, locally sourced, sustainable building materials are used; they have a relationship with and belong to the Country they come from.	Recycling sustainable materials onsite where possible e.g. reuse of site soil, logs salvaged and utilised for habitat shelters.
Planning and design outcomes support living cultural practices	Cultural burning is used to maintain the health of landscapes and protect against unplanned bushfires.	Cultural burning incorporated as long-term land management strategy, particularly in the management of bushfire risk and prolific invasive weeds.
	Projects support ongoing opportunities for on-Country cultural tours, ceremony, and sourcing Indigenous food and materials.	Cultural gathering space accessible for on-Country educational and ceremonial engagement.
Original landscapes are repaired or restored	Landscapes are regenerated from seed banks stored within the soil, activated by warming the ground through traditional cultural burning. When this is possible there may be no need to reconstruct or guess what the original Indigenous landscape was like before it was disturbed by colonisation.	Cultural burning planned for ongoing site maintenance, killing dominant weed species and allowing native species to re-establish naturally, supplemented by additional direct plantings and seeding.



Community & Stakeholder Engagement



6. Community & Stakeholder Engagement

Engagement activities

The Badu Yarragul Greenspace Masterplan has been developed through a collaborative engagement approach, with input from multiple stakeholder sources. A *Community Stakeholder and Engagement Plan (Sydney Water, GHD & MR Communications Services, March 2025)* has guided engagement activities.

A specific approach was outlined to best engage with key Aboriginal, local council and state government stakeholders throughout the master planning process and was guided by the following principles:

- **Respect and cultural awareness** of both Indigenous and non-Indigenous people.
- **Genuine and meaningful engagement** to create a transparent design journey characterised by deep listening and two-way knowledge sharing with Indigenous communities.
- **Valuing storytelling** by planning engagement approach to allow time and space for culturally sensitive storytelling as a way of communicating.

Engagement with Traditional Custodians

In early 2025, a series of engagement activities were undertaken. The purpose was to ensure the master plan reflected the cultural, ecological, and community values of the site, and to provide opportunities for Traditional Custodians to shape the vision and priorities for the Greenspace. Activities included a Walk on Country and online workshops.

Discussions covered a wide range of topics including artefact repatriation, cultural burning, community access to site for cultural purposes, gathering spaces, stormwater management, biodiversity and educational opportunities. The engagement process was designed to support both immediate planning needs and longer-term aspirations for the site in alignment with Traditional Custodian preferences and goals.

Government and other stakeholder engagement

In 2025, two workshops were held for government agencies and local councils. The purpose was to present the initiatives to be included in the draft master plan and seek feedback on how the Greenspace would be used over the short and longer term.

See Appendix B to review Concept design iterations refined during stakeholder workshops that explore a variety of project themes. See Appendix C for a detailed review of the potential to include active transport incorporation into the design and reasoning as to why it was discarded in the final design iteration.



Recommendations and next steps

Table 10: Stakeholder feedback, recommendations and next steps

STAKEHOLDER FEEDBACK		
Theme	Comment/Question	Recommendations
Aboriginal engagement feedback and recommendations		
Country-centred Repatriation	A Country-centred approach to repatriation returns artefacts in a way that honours cultural protocols and supports intergenerational knowledge transfer. Stakeholders emphasised the importance of selecting a site that is undisturbed, shaded, and symbolically significant—such as the area above the billabong. The use of cultural markers and way finding tools are proposed.. This approach reflects a deep respect for Country and the spiritual significance of returning cultural materials to the land.	<ul style="list-style-type: none"> Finalise the endorsed repatriation site above the billabong, ensuring it remains undisturbed and shaded. Cultural markers and wayfinding tools to be used.. Engage in collaboration led by Dharug Traditional Custodians to develop and implement culturally appropriate repatriation protocols, including ceremonies and intergenerational involvement.
Intergenerational Cultural Access and Use	Creation of a dedicated cultural gathering space reflects the need for a place that supports ongoing cultural practice, ceremony, and community connection for Traditional Custodians. Stakeholders proposed that this space be designed with Elders and future generations in mind, incorporating natural seating, shade, and visibility to key landscape features. Intergenerational access agreements involving Dharug organisations were recommended to support long-term cultural governance and stewardship of the site	<ul style="list-style-type: none"> Progress the design of a dedicated cultural gathering space that includes natural seating, shade, and visibility to key landscape features. Develop intergenerational access agreements with Dharug organisations to support long-term cultural governance and use of the site. Make the space suitable for ceremony, storytelling, and cultural learning, including with educational groups, but do not open the greenspace for public use, as per Traditional Custodian recommendation.
Ecological Restoration through Cultural Knowledge	The vegetation strategy proposed by stakeholders integrates traditional ecological knowledge with contemporary restoration practices. A layered planting approach using native species such as Warrigal Greens and Yam Daisies supports biodiversity, food and fibre use, and habitat creation. Logs are to be retained as microhabitats, and regular monitoring through drone and ground-level photography will track ecological change. This theme reflects a holistic view of land care that is grounded in cultural values.	<ul style="list-style-type: none"> Implement a layered planting strategy using native species such as Warrigal Greens and Yam Daisies to support biodiversity and cultural use. Retain logs as microhabitats and continue drone and ground-level monitoring to track ecological change. Integrate traditional ecological knowledge into restoration practices and seek opportunities to partner with universities and wildlife groups, where feasible, for habitat creation and monitoring.



STAKEHOLDER FEEDBACK

Theme	Comment/Question	Recommendations
Aboriginal engagement feedback and recommendations cont.		
Cultural Fire Management and Youth Empowerment	<p>Cultural burning was identified as an on-going key land management tool opportunity to control invasive species, support native vegetation, and maintain ecological balance. Stakeholders proposed patchwork burning to protect fauna and recommended collaboration with NPWS and the Rural Fire Service to support youth training and community-led fire practices. This theme highlights the role of fire as a cultural and ecological tool, and the importance of passing on knowledge through active participation.</p>	<ul style="list-style-type: none"> • Develop a phased cultural burn strategy in collaboration with Crown Lands, NPWS, and the Rural Fire Service. • Use patchwork burning to protect native fauna and target invasive species. Create opportunities for youth training and community-led fire practices to support knowledge transfer and cultural empowerment.
Storytelling and Cultural Interpretation	<p>Art and interpretation were seen as essential to embedding cultural narratives in the landscape. Stakeholders proposed elements such as educational videos, and interpretive signage to share Dharug stories and knowledge.</p> <p>Their input has informed Sydney Water's approach intended to foster understanding, respect, and connection to Country among all site users through art and interpretation. This theme supports the use of creative media to communicate cultural values and histories in accessible and engaging ways.</p>	<ul style="list-style-type: none"> • Opportunities for videos, artwork and digital media accessible to wide audience
Waterways and impact on design and Site Infrastructure	<p>The masterplan incorporates water-sensitive urban design principles that align with both ecological and cultural objectives. Stakeholders supported the use of natural contours and shallow bunds to manage stormwater, reduce erosion, and restore soil health.</p> <p>A potential retention basin was identified, and its integration into the broader landscape was encouraged. This theme reflects a commitment to working with natural systems and respecting Wet Country.</p>	<ul style="list-style-type: none"> • Apply WSUD principles using natural contours and shallow bunds to manage stormwater, reduce erosion, and restore soil health. • Design all water infrastructure to respect cultural values and support ecological function.



STAKEHOLDER FEEDBACK

Theme	Comment/Question	Recommendations
Government and Stakeholder feedback and recommendations		
Wildlife Management Plan (WMP)	<p>A request from Western Sydney Airport stakeholders to view the Wildlife Management Plan (for the whole Sydney Water site including the Green Space) so that risks to aviation can be understood and managed.</p> <p>Interest from Greater Sydney Parklands in reviewing the Wildlife Management Plan in relation to regional connections of parklands and the management of feral animals.</p>	<ul style="list-style-type: none"> Issue existing AWRC Wildlife Management to stakeholders and Badu Yarragul Greenspace WMP when drafted. Any recommendations and mitigations in the final agreed Wildlife Management Plan that are consulted with external stakeholders, in particular Western Sydney Airport, are taken forward through detailed design of the Greenspace.
Plant species	<p>Recommendation to learn from other nearby projects such as the new M12 motorway and Western Sydney Parklands in terms of heritage interpretation and the success (or otherwise) of different plant species.</p>	<ul style="list-style-type: none"> Western Sydney Parklands and M12 plant lists reviewed and incorporated when appropriate. Refer Focal Species Fauna and Flora.
Public access	<p>Request from stakeholders for Sydney Water to confirm in the master plan how the Green Space will be used by other stakeholders, including members of the public, over the short and longer term and how this aligns with options explored in the Upper South Creek Environmental Impact Statement.</p>	<ul style="list-style-type: none"> Public access options explored in Masterplan concept proposals. Connectivity limited by low demand studies caused by low population nearby and limitations from creek constraints and property boundaries.
Active transport Links	<p>Interest from Transport for NSW's Active Transport Team in the medium to longer term opportunities to connect the site to the M12 shared user path and whether the Green Space could in the future incorporate a public walking and cycling track, subject to the various constraints that were discussed during the workshop. A further suggestion was made by Greater Sydney Parklands for Sydney Water to think about the longer term and make allowances for any future connectivity now so that impacts to revegetated areas within the Green Space can be minimised.</p>	<ul style="list-style-type: none"> Access from M12 connection explored in Masterplan concept proposals. Connectivity limited by low demand studies caused by low population nearby and limitations coming from creek constraints and property.
NSW Rural Fire Service	<p>Request from Rural Fire Service that their vehicles will be able to access the site (AWRC and Green Space) to respond to fire.</p>	<ul style="list-style-type: none"> Access provision of a fire trail around the AWRC facility. Gravel maintenance access tracks are provided in the Green Space itself
Transport for NSW	<p>Supportive of Sydney Water incorporating heritage interpretation into the Green Space. Interest from TfNSW regarding heritage interpretation and coordination with their heritage interpretation work on the M12 Motorway This includes:</p> <ul style="list-style-type: none"> Heritage interpretation images & information on the M12 cycleway near the AWRC Aboriginal artwork on local bridge. Interest in opportunities for use/ interpretation of old radio telescopes. 	<ul style="list-style-type: none"> Establish on-going pathways for coordination of projects.



Badu Yarragul Greenspace Masterplan

7. Greenspace Masterplan Specifics

The Badu Yarragul Greenspace is being transformed through a nature-led approach focused on hydration and ecological restoration. Central to this vision is healing and caring for Country by recharging groundwater, restoring hydrated floodplain ecologies by directing local stormwater to floodplain areas and reintroducing native vegetation, creating a resilient and biodiverse landscape.

The Masterplan strategically connects green networks, biodiversity corridors, to create a cooler, more resilient, and liveable environment. Wianamatta South Creek acts as a central blue-green spine, supporting flood management, habitat connectivity, and microclimate regulation. The Badu Yarragul Greenspace creates a green network and biodiversity corridors linking to this waterway, enhancing ecological resilience and cooling.

Two interconnected strategies guide the restoration:

- **Hydration**, achieved through shallow swales and ephemeral wetland zones, infiltrates and retains water on site to support plant growth, reduce runoff, and enhance cooling through evapotranspiration.
- **Revegetation** focuses on reinstating diverse native plant communities to improve soil health, sequester carbon, and restore habitat and ecological function.

Importantly, the greenspace supports cultural access and connection to Country, offering opportunities for Aboriginal communities to engage with, care for, and share knowledge of the landscape through ongoing custodianship and place-based practice.

Together, these initiatives deliver long-term environmental, cultural, and community benefits, contributing to a cooler, healthier, and more connected region.



Figure 22 Perspective 1 overall site



Badu Yarragul Masterplan

-  Woodland tree canopy
 -  Lineal wetland
 -  Gravel access pathway
 -  Native grasses and understorey
 -  Shrubs/riparian vegetation
- 1** Existing wetland to be enhanced
 - 2** Billabong
 - 3** Cultural gathering zone
 - 4** Ephemeral kidney wetland
 - 5** Ephemeral phragmites wetland
 - 6** Cross array tree planting
 - 7** Existing drainage channel - moist depression



Figure 23 Overall masterplan landscape format



Hydration and Ecological Restoration

A diverse range of habitats will support a rich variety of plant and animal life to allow natural biological variability enabling species and ecosystems to be resilient. This diversity of biological communities produces variation in the functions that ecosystems perform across the catchment, such as the uptake of nutrients or processing of organic matter. This can even help to diversify food webs.

The restoration of the site through ecosystem recovery will be supported by hydration and revegetation.

- The hydration component will ensure optimum water availability for plants in the shallow swales. This reduces runoff from the site and increases the water use by plants.

- The revegetation component focuses on restoring a diverse range of plants from native ecological communities. Plants sequester carbon and improve soil and ecosystem health. This restores habitat and creates resources (food and fibre).

These two processes will be intertwined encompassing specific water management strategies to support success. Benefits include increasing evapotranspiration (and cooling) as well as soil moisture and appropriate groundwater recharge from areas that support wetland plants/emergent and ephemeral vegetation (Figure 24) The proposal will improve soil health for microorganisms.

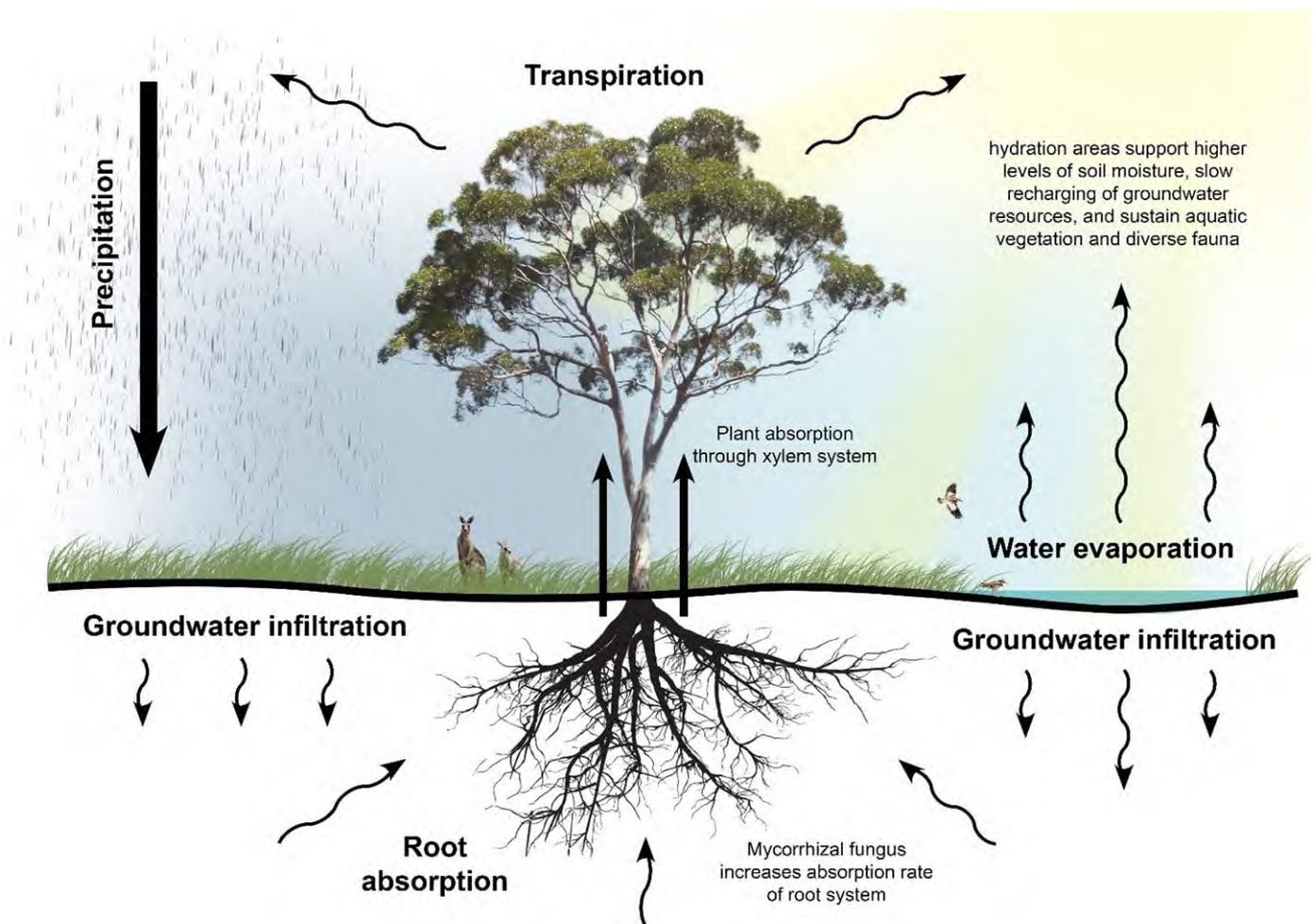


Figure 24: Badu Yarragul hydrological system

Improving water retention in the landscape

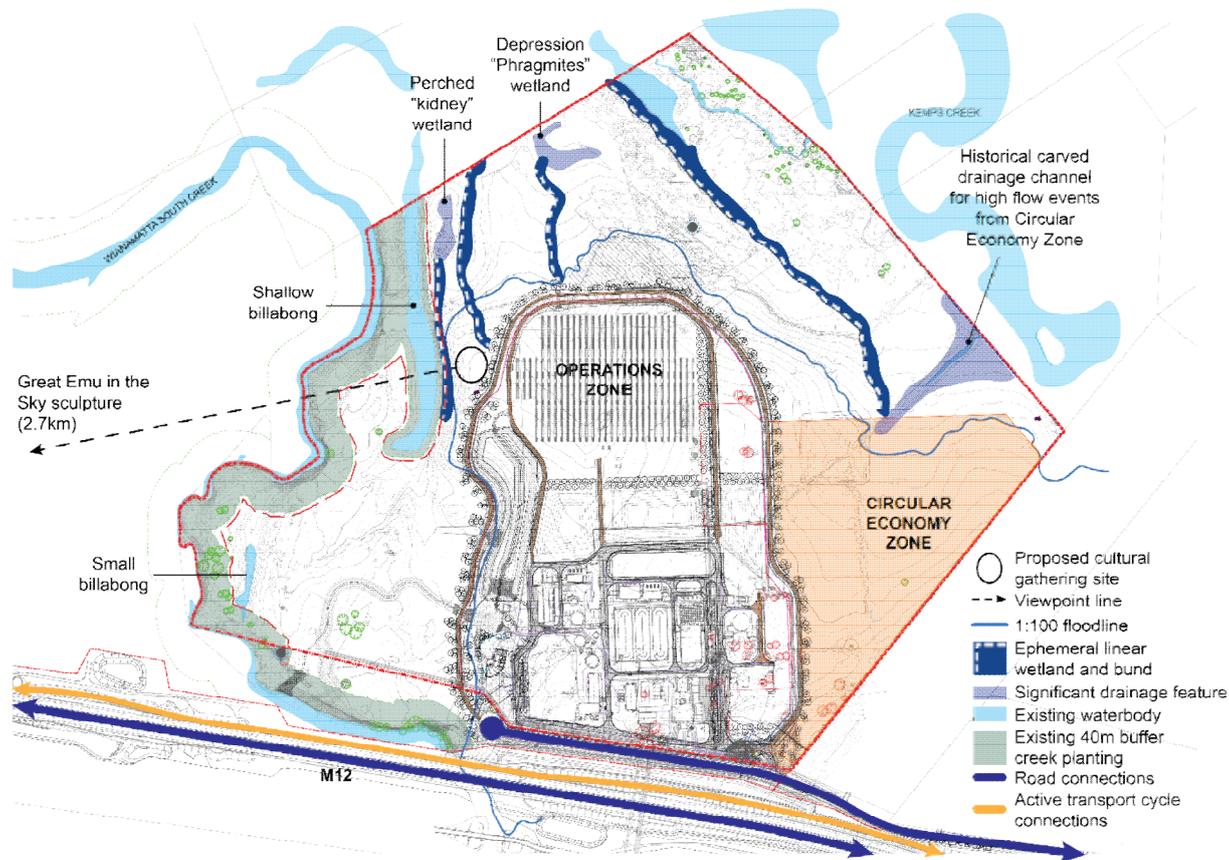


Figure 25:
Hydration
Structure

Hydration Area Design and Stormwater Management

Stormwater runoff from the Operations and Circular Economy zones, which would otherwise discharge directly into waterways, will be redirected to shallow lineal wetlands. These wetlands are designed to retain water for extended periods, supporting the development of ephemeral and permanent linear wetlands and contributing to the broader restoration of native plant communities across the site.

The lineal wetlands will specifically assist in flood events by slowing water movement across the site to waterways and thus increase water infiltration rate and holding capacity of the ground. Retaining water in the landscape will also enhance evaporation and plant water use, improving overall site hydrology.

Refining the Design of Hydration Areas

Lineal wetland and Bund Construction:

Lineal wetland and berm systems will be constructed to spread and retain water within hydration areas. These areas are defined by minor modifications to surface levels including forming berms typically 60 cm above the surrounding ground level, with bunds (level spreading weirs) that are typically 30 cm high and 20 metres long. The lineal wetlands will typically be between five (5) and twenty-five (25) metres wide, configured as flat, low-lying terraces to retain shallow water.

These structures will support wetland vegetation and the intermittent planting of Casuarinas and Eucalypts along the edges.

A berm is a flat raised bank bordering the lineal wetland passage. A series of shallow berms will be constructed and will be critical to control the movement of water through the landscape and achieve associated vegetation outcomes. Existing high rates of infiltration from the sandy clay soils will need to be maintained through low impact construction avoiding the compaction of these structurally delicate soils. New berms will be located to link with existing berms and raised if needed. Excavation of these fragile soils will be avoided wherever possible. During construction, opportunities for habitat creation, through the deliberate placement of woody debris and rock islands will help the restored floodplain to home its new faunal inhabitants.

Water Retention Modelling:

The final extent of hydration areas, including bund heights and lineal wetland widths, will be informed by a detailed water retention model with consideration of flood impacts according to MCoA E27. This model will assess upstream catchment areas, expected flows, soil properties, and water losses through evaporation, evapotranspiration, infiltration, and runoff.



Flow Distribution Systems:

Spreader pipes and passive flow distribution systems will be installed to manage both typical and high-flow scenarios. Flow will be distributed using diversion structures, side-cast weirs, and earthen platforms, allowing low flows to be sequentially guided through the system while high flows will be directed to suitable pathways, including discharge points into Kemps Creek, subject to further investigation. The development of the CEZ will be subject to a separate environmental assessment.

Catchment Runoff Control:

Hydration zones are designed to capture and retain runoff from approximately 10% of the upstream catchment (e.g. a 1-hectare swale for a 10-hectare catchment). Varying water depths across the swales and wetlands will support ecological diversity and the processes to reduce excess runoff volumes, consistent with the Wianamatta Stormwater Management Targets.

Berm Formation and Integration:

Berms will be constructed with minimal reshaping of existing floodplain soils and supplemented with site-derived fill as

needed. Typical berm height will be 0.3 metres, allowing efficient shaping by small-scale machinery with limited site disturbance. A pre-existing one (1) metre high berm between Precincts 3 and 4 will be extended at a reduced height to facilitate stormwater distribution and support adjacent hydration areas. Final shaping of this berm will be integrated with proposed maintenance paths and drainage outcomes.

Water Supplementation and Soil Monitoring:

During dry conditions, hydration areas may be supplemented with stormwater or recycled water from the facility in the future. Volumes will be regulated using soil moisture monitoring to optimise delivery, promote plant growth, and enhance carbon sequestration by supporting healthy vegetation and soils.

Site Integration and Adaptive Design:

Hydration areas are being developed in alignment with existing landforms and vegetation types. The design will be further refined through ongoing observation of water movement during higher rainfall events and as additional soil data becomes available.

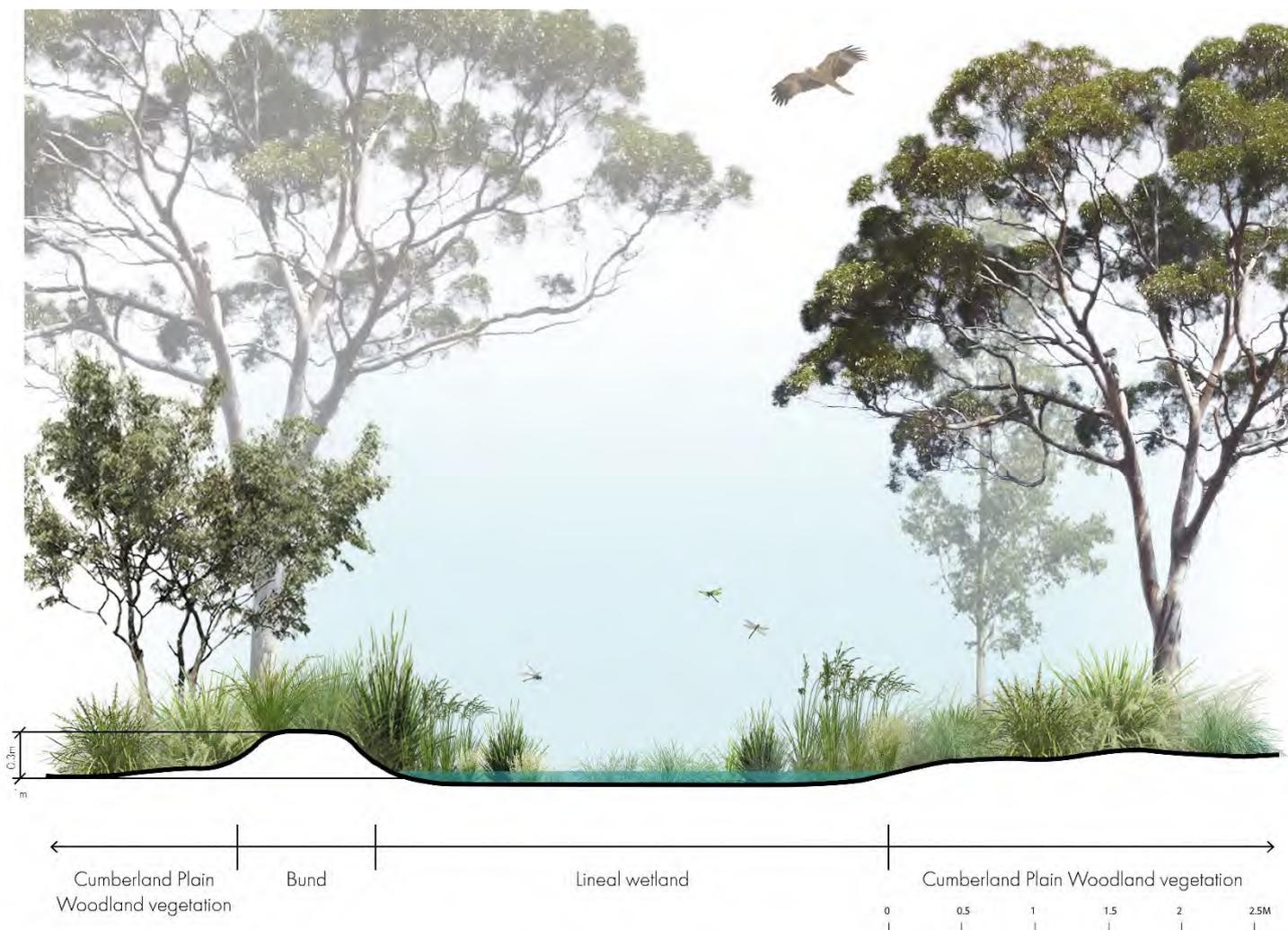


Figure 26 Linear wetland Typical Section



Flood impacts

Badu Yarragul Greenspace includes management of stormwater to rehydrate the floodplain. This approach aims to decrease annual runoff volumes by slowing and retaining water on site. This restores appropriate floodplain hydration, infiltration, evapotranspiration and revegetation. Vegetation in the floodplain improves habitat outcomes and rehabilitation of the riparian corridors. Sparse canopy trees would be complemented by typical floodplain vegetation.

The Project maintains floodplain storage and does not adversely impact flows or flood hazards. The development will not impact on the local flooding behaviour within the catchment and will be subject to further flood assessment in accordance with condition E27. The design will not impede access to existing road networks and is not expected to have any impacts on the existing community emergency management arrangements for flooding.



Figure 27: along Eastern Creek, Doonside shows a potential vegetation outcome for riparian zones (Peter Breen)

The proposal will assist in mitigating flood impacts and will reduce the contribution of flows from the site to flooding downstream. Minimal earthworks are proposed (with only small berms created to direct and retain runoff in shallow lineal wetlands). There is no impact proposed on floodplain storage within the site. The proposed management of runoff indicates the proposal will have minimal impact on existing flood levels. Over time the approach proposed should assist in reducing flood impacts by increased retention on site.

The hydration approach supports plant growth. The enhanced vegetation will assist in managing stormwater by:

- Reducing erosion; the plants intercept rainfall, slow stormwater runoff and reduce impacts on soils.
- Increasing the soil health; with greater water holding capacity and initial losses.
- Increasing water use; revegetation across the site will draw down soil moisture more rapidly after rainfall / irrigation.

- Improving groundwater conditions; Trees and plants with deep roots will draw on groundwater resources, reducing the negative impacts on groundwater levels associated with land clearing. Hydration areas will allow for appropriate infiltration and slow replenishment of groundwater.
- Waterway health; improved health of drainage pathways across the site and reduced impact on receiving waters (Kemps Creek and Wianamatta South Creek) through more natural flow hydrology (and water quality) from the site.

The enhanced vegetation in the hydration areas will be managed with the addition or withholding of water. This requires flexibility in the design to divert flows along alternative paths when available or desirable. This approach provides a cost-effective approach to manage various weeds and support plant growth.



Cultural burning

Cultural burning where appropriate will be utilised to manage weeds and aid regeneration of native grass seeds. The creation of biochar post burning will maintain aeration whilst supporting microbial activity for improved soil health. A fire management plan for ongoing cool burning will be developed as part of cultural burning actions.

Sydney Water (SW) and John Holland Group (JHG) team members have undertaken consultation with Traditional Custodians regarding cultural burning practices. Prior to engagement, SW sought permission from Uncle Greg Simms, Dharug Elder, to engage Den Barber as a Cultural Fire Practitioner.

Following an initial consultation with Den Barber, Wiradjuri Man and Cultural Fire Practitioner, a Walk on Country was undertaken with Dharug Traditional Custodians at Badu Yarragul Greenspace. This Walk on Country explored site-specific Country and facilitated discussion of perceived risks and anticipated mitigation strategies. Den will provide a Risk Assessment and Cultural Burn Plan, combining ancient practices with all feedback received to date from Dharug Traditional Custodians.

SW can confirm that all necessary Cultural Protocols relevant to the Dharug Traditional Custodians have been followed and will continue to be adhered to as part of the Cultural Burning Initiative for the Badu Yarragul Greenspace Site.



Figure 28 Cultural burning (Josh Stains, 2024)



Key Views

Key views from the Badu Yarragul Greenspace connect the site to its broader cultural and natural context, offering visual and symbolic links across the landscape. To the west, long-range views extend toward the Blue Mountains, framing the site within its wider geographical setting and reinforcing a connection to Country. Along the M12 Motorway, travellers experience views into the site. These moments are anchored by the Emu in the Sky sculpture, a significant cultural marker inspired by Aboriginal astronomy that speaks to deeper spiritual narratives and the enduring presence of Country. Within the site, internal views from the cultural gathering space orient toward the billabong, offering a quiet focal point that grounds visitors in place and reinforces the relationship between land, water, and sky. These layered view lines support cultural interpretation, reflection, and ongoing connection with landscape and sky Country.



Figure 28: Emu in the Sky sculpture, M12 Motorway (TfNSW 2025)

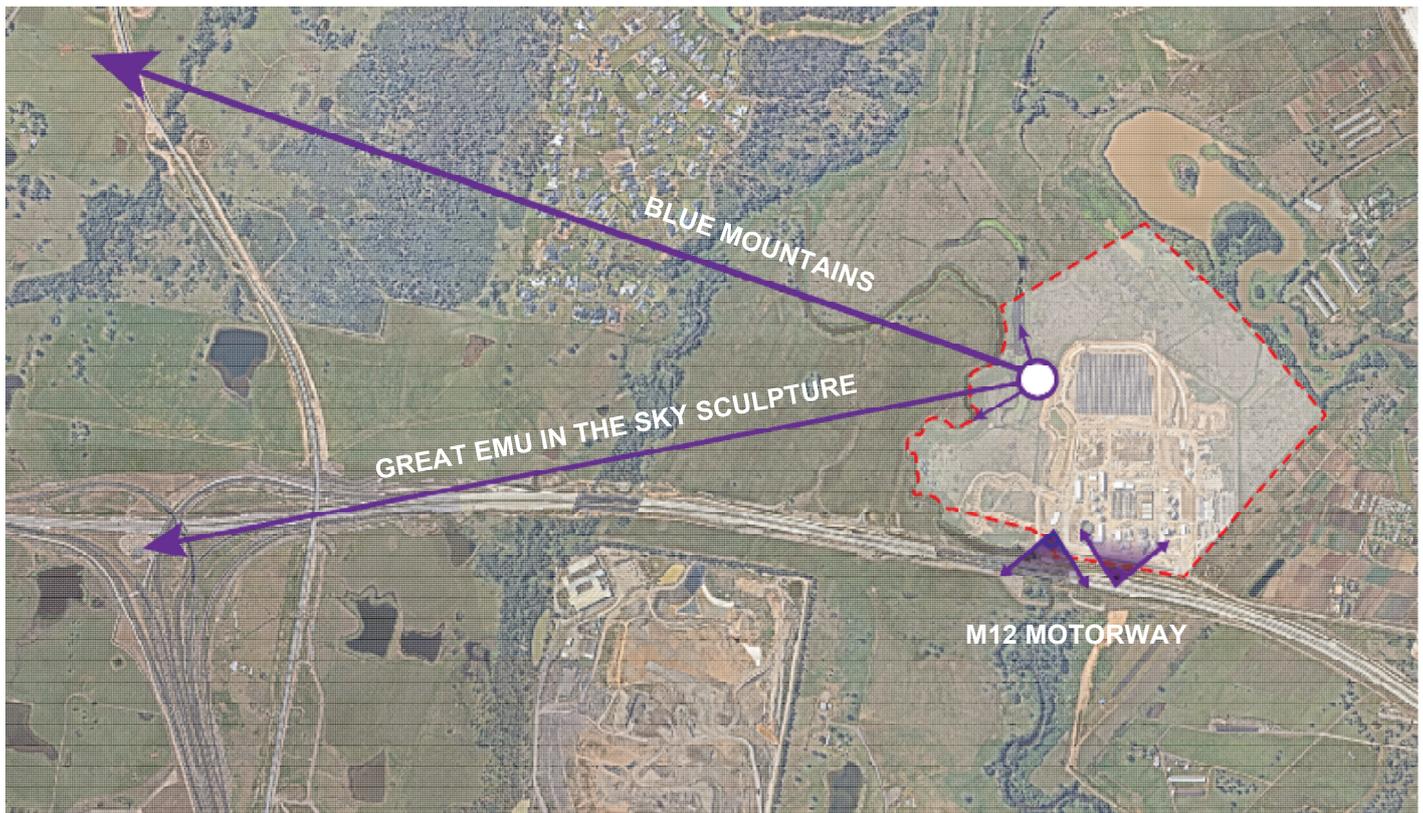
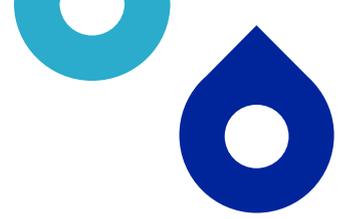


Figure 29: Key Views



Crime Prevention Through Environmental Design (CPTED)

Applying Crime Prevention Through Environmental Design (CPTED) principles to the restored landscape at Badu Yarragul necessitates a balanced approach that enhances safety while honouring the cultural practices and access rights of Traditional Custodians.

The following CPTED strategies can be thoughtfully integrated:

1. Surveillance

Both natural and electronic surveillance strategies deter criminal activity:

- **Vegetation Management:** Proposed tree planting will be sparse, and grasses will be low. Adjoining the cultural gathering space, low-growing native plants will be maintained and trees pruned if required to ensure clear sightlines along pathways and the gathering area, reducing potential hiding spots and criminal activity by enhancing visibility.
- **Security cameras:** Electronic surveillance of entry points will deter illegal entry and dumping onsite.

2. Natural Access Control

Guiding movement through the landscape helps prevent unauthorised access and protects sensitive areas:

- **Defined Pathways:** There is an existing fire trail around the AWRC Operations zone that will be well-maintained and several maintenance tracks linking across the site from the fire trail will blend with the environment to allow landscape maintenance and Traditional Custodian cultural uses to take place safely.
- **Signage and Wayfinding:** Culturally respectful signage that indicates restricted zones and discourages prohibited activities (e.g. no camping, no illegal dumping, no access) will be incorporated at key locations.

3. Territorial Reinforcement

- **Community Engagement:** Involving local Indigenous communities in the planning and ongoing management of the landscape to reinforce their connection to Badu Yarragul.
- **Maintenance:** Regular maintenance will demonstrate active management and care, discouraging vandalism and neglect.

4. Maintenance

Consistent maintenance will ensure the landscape remains safe, welcoming, and respectful of its cultural significance

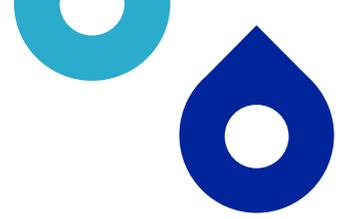
- **Routine Inspections:** As part of the maintenance and management of the site, regular reviews for hazards, vandalism, or environmental degradation, addressing issues promptly.
- **Sustainable Practices** Land management techniques aligned with Traditional Custodian knowledge, such as controlled burns and native species care to maintain ecological balance.
- **Community Programs:** Establish volunteer groups or partnerships with Indigenous organizations to participate in maintenance activities, fostering community ownership.

Integrating Traditional Custodian Access

Respecting and facilitating Traditional Custodian access is paramount:

- **Consultative Planning:** Continue to engage with Indigenous leaders and communities from the outset to ensure their needs and perspectives shape the design and management of the landscape.
- **Cultural Protocols:** Recognise and accommodate cultural practices, ceremonies, and access requirements, ensuring these are protected and facilitated within the landscape design.
- **Education:** Encourage educational programs that inform controlled visitor groups about the cultural significance of the area, promoting understanding and respect.

The application of CPTED principles in collaboration with Traditional Custodians, the restored Cumberland Plain landscape can be a safe, respectful, and culturally rich environment that honours its heritage and serves the broader community.



Heritage Interpretation

A seamless integration of heritage to the physical environment of place will need to occur in conjunction with the determination and confirmation of the audience for interpretation.

The indicative heritage interpretation opportunities detailed in the Heritage Interpretation Strategy will be refined and documented in a Heritage Interpretation Framework. This document will address Indigenous and non-Indigenous interpretation devices and methods to be implemented across the whole site, inclusive of both the operational footprint and the Badu Yarragul Greenspace.

Interpretative devices can be incorporated progressively, and some initial interpretation opportunities include:

- Aboriginal cultural interpretation
 - Connecting to Country through the establishment of Cumberland Plain Woodland species and care for Country actions such as seasonal cold burning of understorey plant species.
 - Establishment of Aboriginal cultural space for the connecting of Traditional Custodians to their culture. Location and space have been designed in collaboration with Traditional Custodians.
 - Incorporation of Aboriginal language in naming and wayfinding and signage.
 - Interpretation Strategy opportunities include planting, growing and cultivating to create cultural spaces, storytelling on site, and temporal works (artworks, media etc.) that respond to longer narratives of place.
- Restoration of Cumberland Plain Woodland, creek health and biodiversity corridors to promote a diverse range of flora and fauna, food sources and medicinal plants
 - The establishment of a range of local native species will reconnect the site with its pre-colonial identity, increase biodiversity through the provision of habitat and food for native fauna (balanced with airport safeguarding restrictions on fruit-bearing trees).
 - The restoration of the natural hydration system onsite will improve water quality and re-establish a key cultural element for Traditional Custodians.
- Connecting trails and networks to the broader precinct
 - Understanding of the night sky and views to local landforms.
 - Potential educational tours can showcase the site's Indigenous and non-Indigenous connection

to the night sky. Tours can convey information through story telling.

- Vantage points to local landforms be reinforced in the Masterplan.
- Language, Story, Place naming
 - Street and place names, and Dharug stories throughout the site where appropriate.
- A gathering place, education programs including small invited tours, demonstrations, and interactive elements
 - Opportunities for learning and interpretation. The site offers a variety of potential interpretation opportunities associated with storytelling, water, food, local fauna and flora.

Sydney University Water Harvesting Project

The local area was used as a research facility by Sydney University in the early 1950s to apply science to farm management. Associate Professor H.J Geddes developed water harvesting to improve the optimisation of rainfall for pastures which informed P. A. Yeoman's Keyline Design techniques where amplified contour ripping captured and conserved water to restore soil depth and fertility.

The Green Space Masterplan incorporates a hydration methodology utilising existing contour lines as an element to harvest and manage on-site water, building on historical hydrologically significant site features.

- Historical drainage channel across site
 - This channel once spanned the entire site but parts have been levelled for construction purposes in Operational Zone. The end of this channel in the Northern-Eastern Hydration Zone forms a large moist depression, connecting the site to Kemps Creek.
- Agricultural billabong dam
 - Removing the agriculturally dammed wall (undertaken as part of the UDLP VMP Stage 1 works) that has historically separated the billabong into two waterbodies will restore the hydrological health of the billabong to its original natural form.
- Lineal wetland system and bunds
 - The lineal wetland system across the site responds to existing historical bund structures in the Northern-Eastern Hydration Zone, allowing water to move across site slower and soak into the ground, reducing runoff and flooding risk.



Flours Field Crosses

The site was used for Radio Astronomy when it was leased to CSIRO. The Flours Field Station accommodated the Mills Cross, Shain Cross, and Chris Cross arrays that were major technological innovations in cross type telescopes. The road network of the facility has been orientated to the crosses of the former field station. At the crossing points of the former arrays, the landscape is marked with feature pavements.



Figure 30: Location of Flours Field Crosses 3)

Within the Greenspace, the cross arrays have been signified with tree planting, as lineal planting arrangement extends from within the Operations Zone out into the Greenspace. This approach highlights the different experiences of the site from the sky and the ground; the cross array planting arrangement, while not obvious from a ground level perspective, will be clearly visible from planes passing over the site.



Figure 31: Mills Cross Array (Image: ATNF Archive 3476-3)

Parabolic Antennae

There are two remaining parabolic antennae from the previous use of the site. One is located within the Badu Ya fenced for safety reasons due to their state of decay. Interpretive signage could be incorporated in the future as part of a site wide strategy.

Figure 32: Antennae remnants on site





Masterplan Precincts

8. Masterplan Precincts

The site has been divided into five zones which may inform staging of Greenspace implementation (Figure 33):

- Zone 1 Wianamatta South Creek connection
- Zone 2 Billabong Cultural zone
- Zone 3 Northern Phragmites zone,
- Zone 4 Kemps Creek Connection
- Zone 5 Circular Economy Zone.

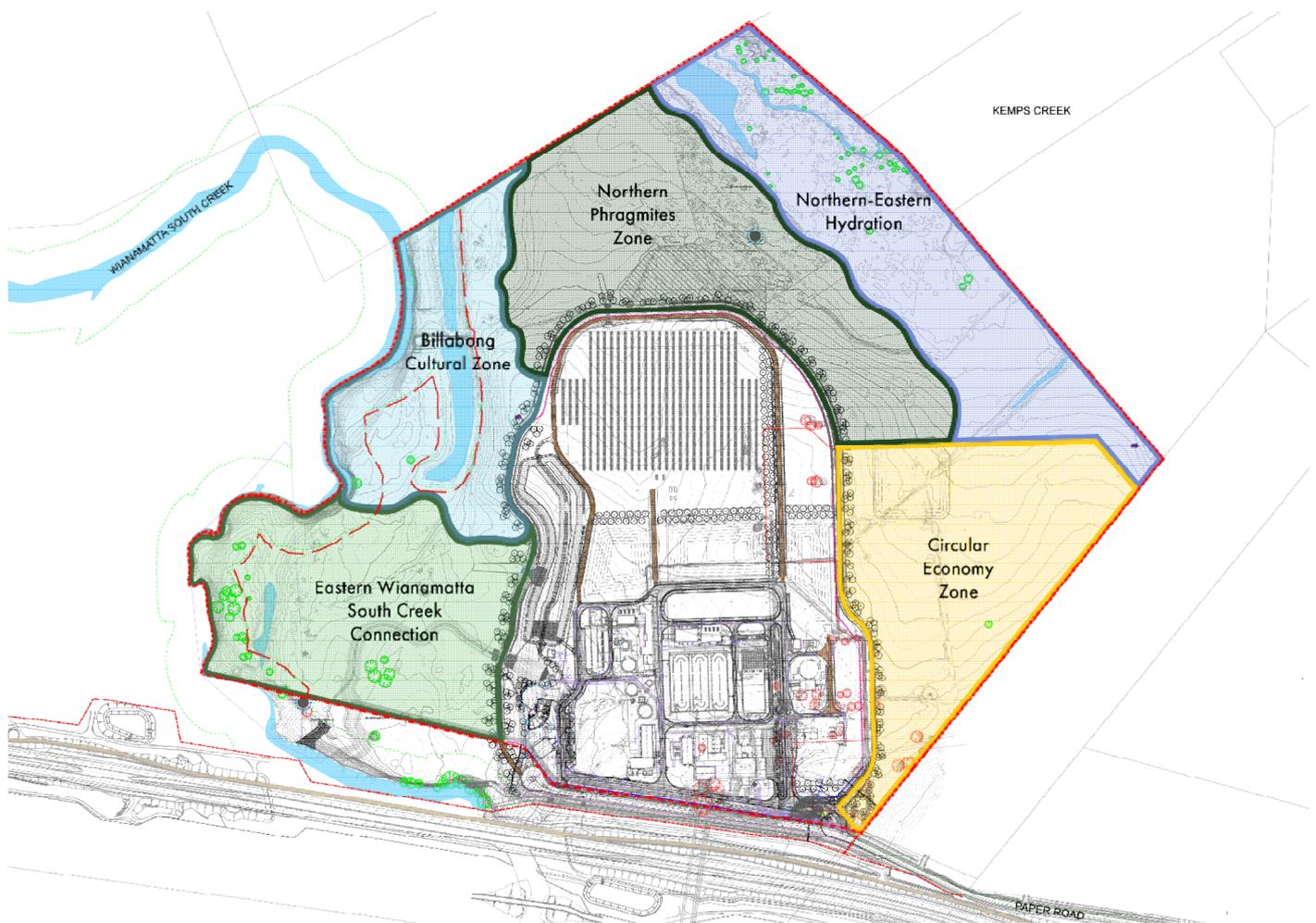


Figure 33: Badu Yarragul Precincts

Precinct 1 Wianamatta South Creek Connection



Figure 34: Precinct 1 – Wianamatta South Creek connection

Revegetation works have commenced in this precinct as part of Stage 1 of the AWRC implementation, guided by the Wianamatta South Creek Vegetation Management Plan (VMP). The VMP outlines the ecological objectives and planting strategies for the area directly adjoining Wianamatta South Creek as an approx. 40m wide riparian corridor, aiming to restore native vegetation and enhance biodiversity.

Key features of this zone include:

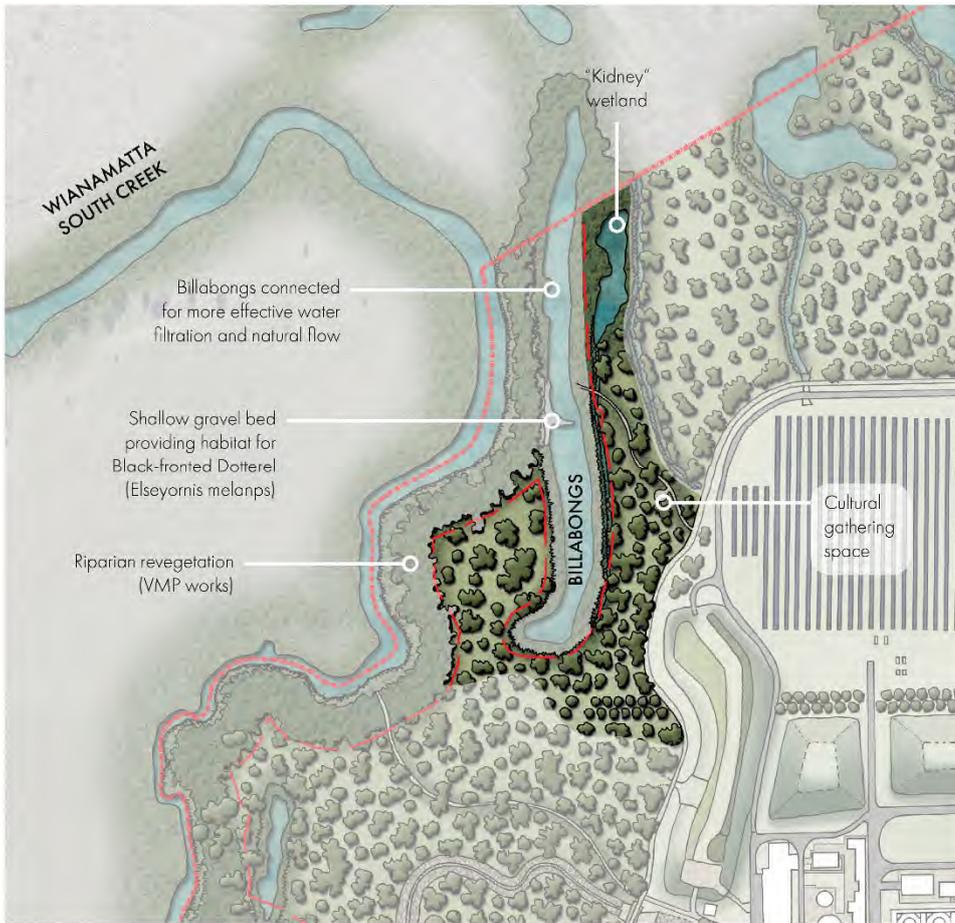
- **Woodland Vegetation** – Revegetation with Cumberland Plain Woodland species to re-establish regionally significant ecological communities.
- **Remnant Casuarina Clusters** – Existing native tree stands have been retained and integrated into the revegetation strategy, preserving established habitat and supporting ecological continuity.

- **Billabongs** – Located parallel to Wianamatta South Creek, a billabong is being restored and replanted to create a shallow-water habitat supporting amphibians, aquatic invertebrates, and waterbirds.

To strengthen ecological outcomes, a diverse mix of native grasses, shrubs, and woodland species will be planted. These will help stabilise soils, reduce erosion, improve water infiltration and filtration, and provide habitat for local fauna, including pollinators and small mammals. The plantings will also support the long-term regeneration of the Cumberland Plain Woodland.

This precinct represents a vital step in transforming previously degraded or underutilised land into a thriving ecological corridor, contributing to the site's broader biodiversity goals and landscape resilience.

Precinct 2 Billabong Cultural Zone



Badu Yarragul Precinct 2

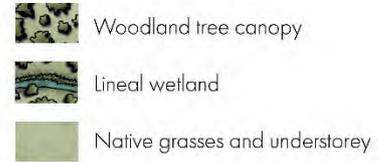


Figure 35: Precinct 2 – Billabong Cultural Zone

The large billabong area was reformed into a single water body as part of Stage 1 landscape implementation by removing the dam created for irrigation purposes. During consultation and Walk on Country, this precinct was identified by Traditional Custodians as appropriate for the return of artefacts, cultural gathering and education.

The proposed repatriation site will be established near to the cultural gathering space and will contain the 19,000+ artefacts uncovered during the archaeological site analysis.

The exact site location will not be advertised to the wider community to respect the cultural significance of the artefacts, however the precinct will be registered in the Aboriginal Heritage Information Management System (AHIMS).

Cultural gathering space

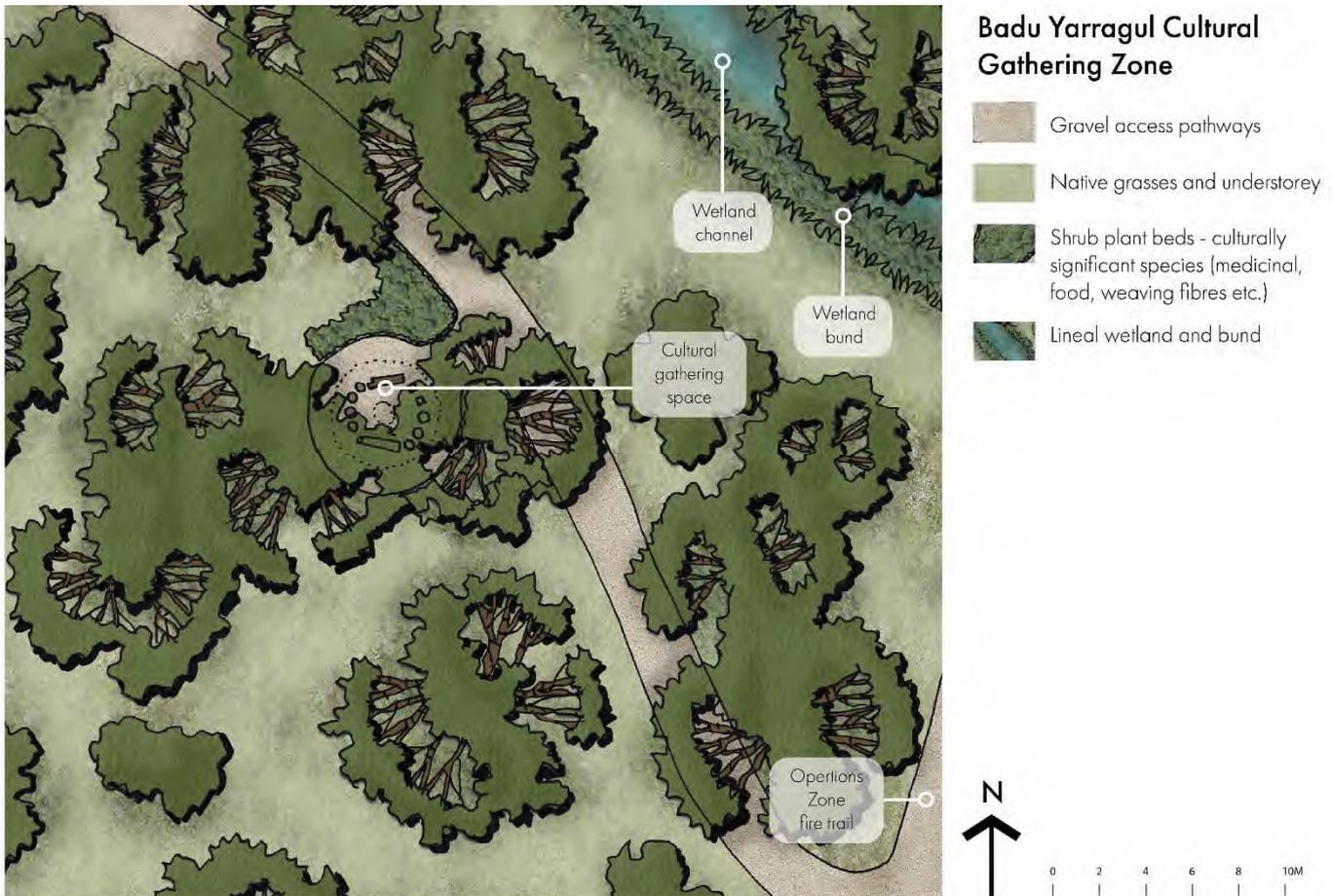


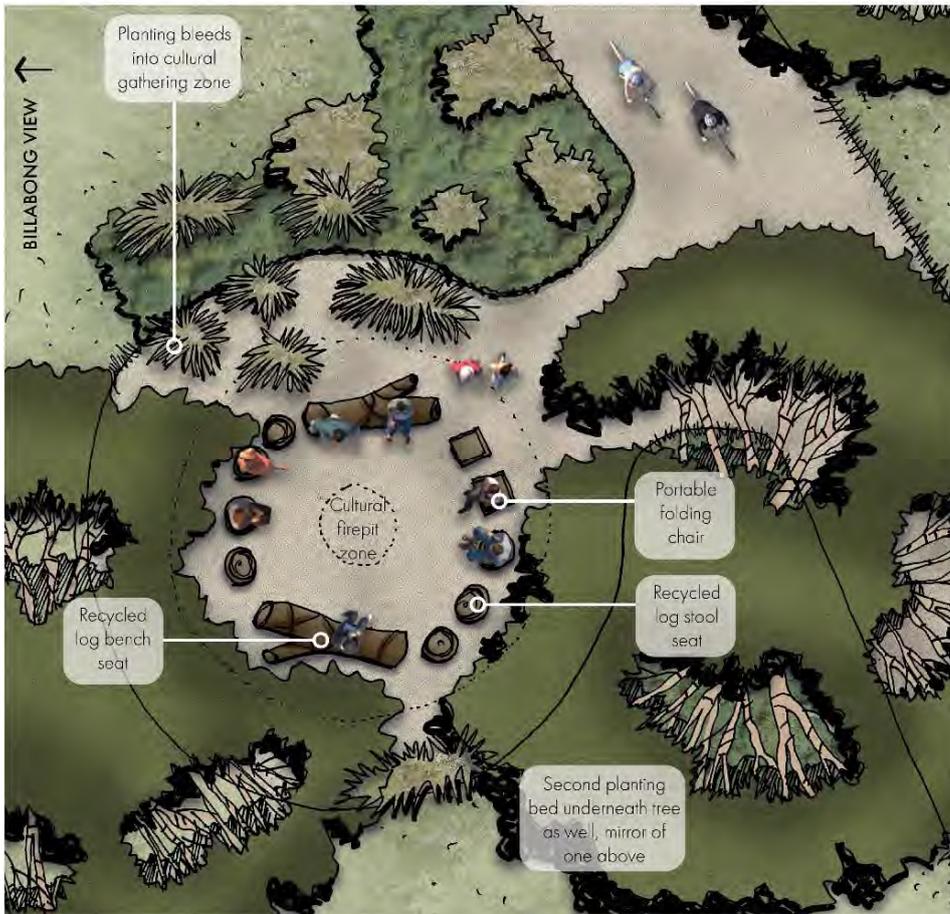
Figure 36: Cultural gathering space plan

The cultural gathering space has been carefully located above the 1:100 flood level to overlook the billabong, with a visual connection to the 'Emu in the Sky' sculpture along the M12 Motorway. Integrated into the surrounding landscape, the space offers a setting for storytelling and cultural activities, supporting the celebration and sharing of Aboriginal culture and its deep connection to Land, Water, and Sky.

Designed for inclusive access, the area connects to the fire trail and includes controlled vehicle and pedestrian entry, ensuring it is accessible to all visitors in controlled groups, such as Traditional Custodians and educational school groups. The space accommodates wheelchairs and folding

chairs, and a path leads to an intimate circular clearing. Seating will be created from salvaged logs, either as cut stumps or laid horizontally, with the central area kept clear to allow for ceremonial use. Shade from Eucalypts will provide a cool, welcoming environment for gatherings.

While not open to the general public, amenities for organised visitors are located nearby at the Water Resource Recovery Facility Administration building. As the design progresses, further engagement with Traditional Custodians will help refine the cultural gathering space and guide the implementation of the broader Badu Yarragul landscape.



Badu Yarragul Cultural Zone

- Gravel access pathways
- Native grasses and understorey
- Shrub planting beds - culturally significant species (medicinal, food, weaving fibres etc.)

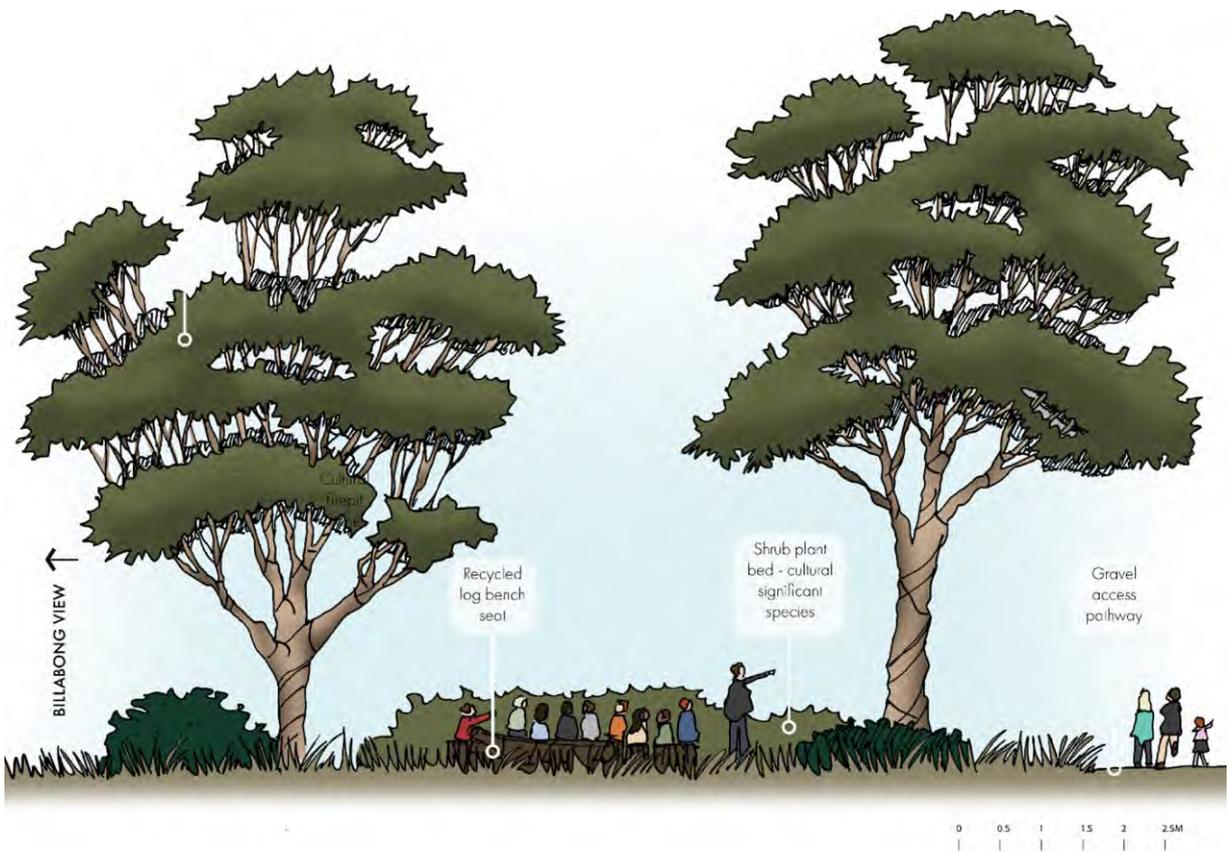
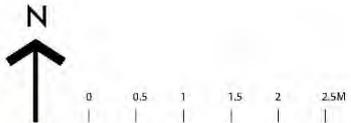


Figure 37: Cultural gathering space plan and section



Figure 38: Cultural gathering space render



Billabong

The extensive billabong area revegetated during Stage 1 will provide vital habitat for a rich diversity of fauna, including native fish, frogs, and dragonflies. These species will benefit from the restored aquatic vegetation and improved water quality, which together create a thriving wetland ecosystem.

A designated zone featuring gravel beds with shallow inundation is proposed to specifically support ground-nesting birds such as black-fronted dotterels, which have been observed on site. This habitat mimics the flat, sparsely

vegetated wetland edges preferred by dotterels and similar shorebirds. The shallow water and exposed substrate will also foster an abundance of invertebrates, particularly worms and insects that will provide a reliable food source for these birds. Accommodating these small bird species will not increase bird strike risk at the Western Sydney Airport.

By integrating varied microhabitats within the billabong, the project aims to enhance biodiversity and support both aquatic and terrestrial species that rely on wetland environments.

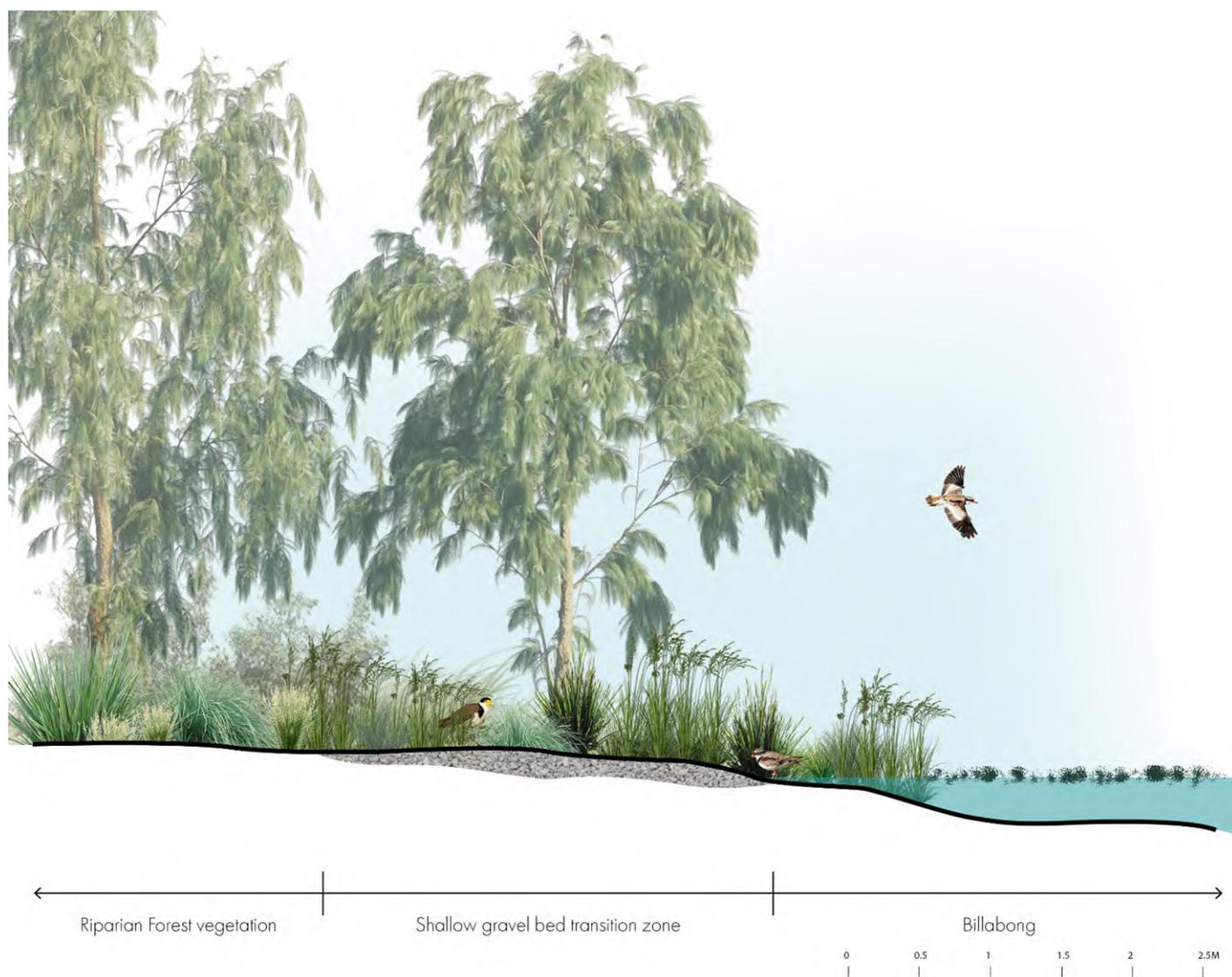


Figure 39: Billabong section



A north-south berm will be constructed in alignment with the billabong to capture and direct stormwater into the newly established linear wetland. This system will also facilitate the flow and recharge of the existing kidney-shaped sedgeland, which is predominantly vegetated with Common Reed (*Phragmites australis*). By enhancing hydrological connectivity, the design supports both water retention and ecological resilience across the site.

The broader floodplain will be revegetated with a mix of native grasses, shrubs, and woodland species, contributing to habitat diversity and landscape stability. In the designated

hydration zones, a rich assemblage of wetland plants will be introduced alongside native wattles (*Acacia* spp.), *Casuarina*, and *Eucalyptus* species. These plantings will provide essential shade, structural complexity, and foraging opportunities for local fauna, while also supporting soil health and water filtration.

Together, these interventions aim to restore natural hydrology, enhance biodiversity, and create a self-sustaining wetland ecosystem that integrates aquatic and terrestrial habitats.

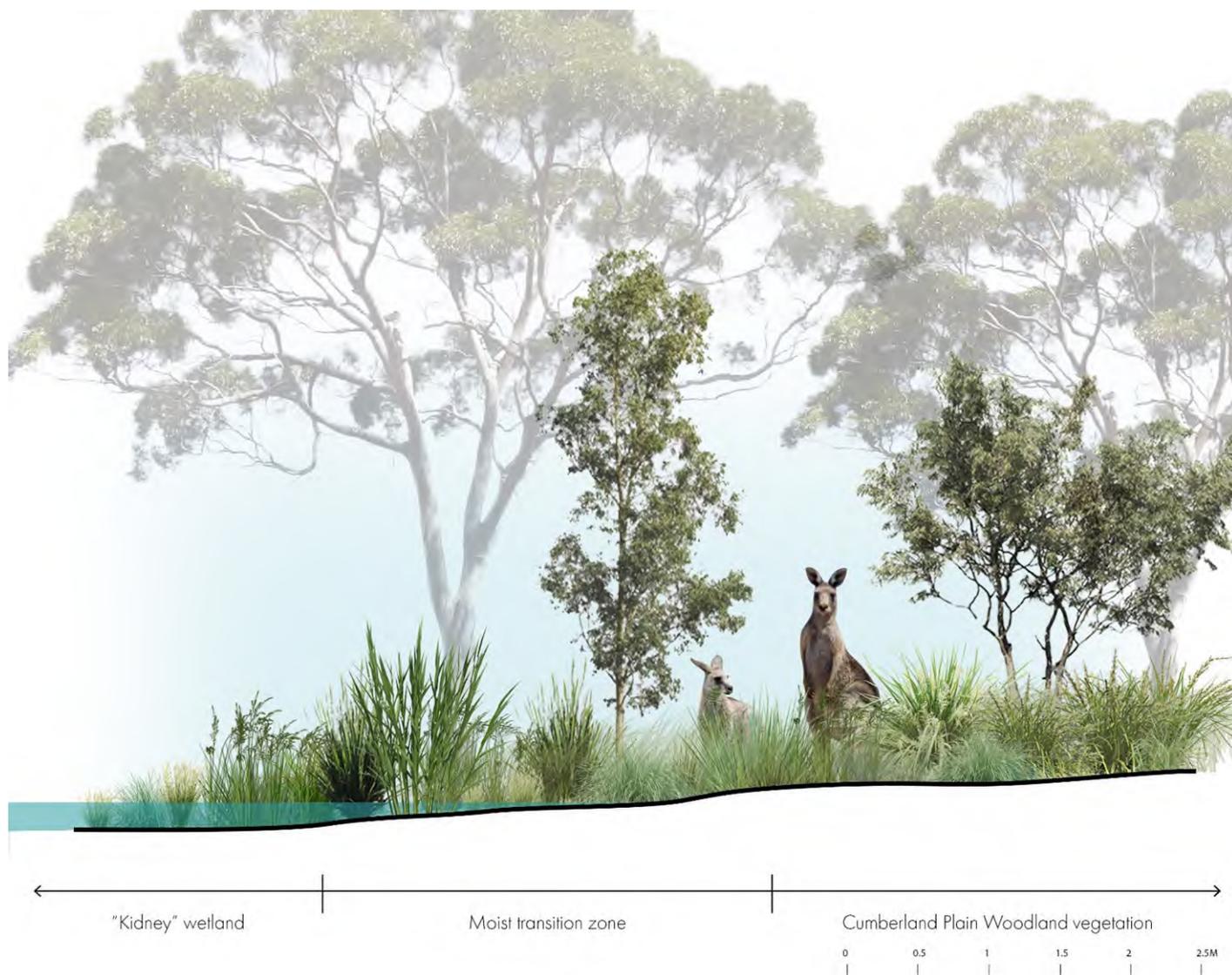
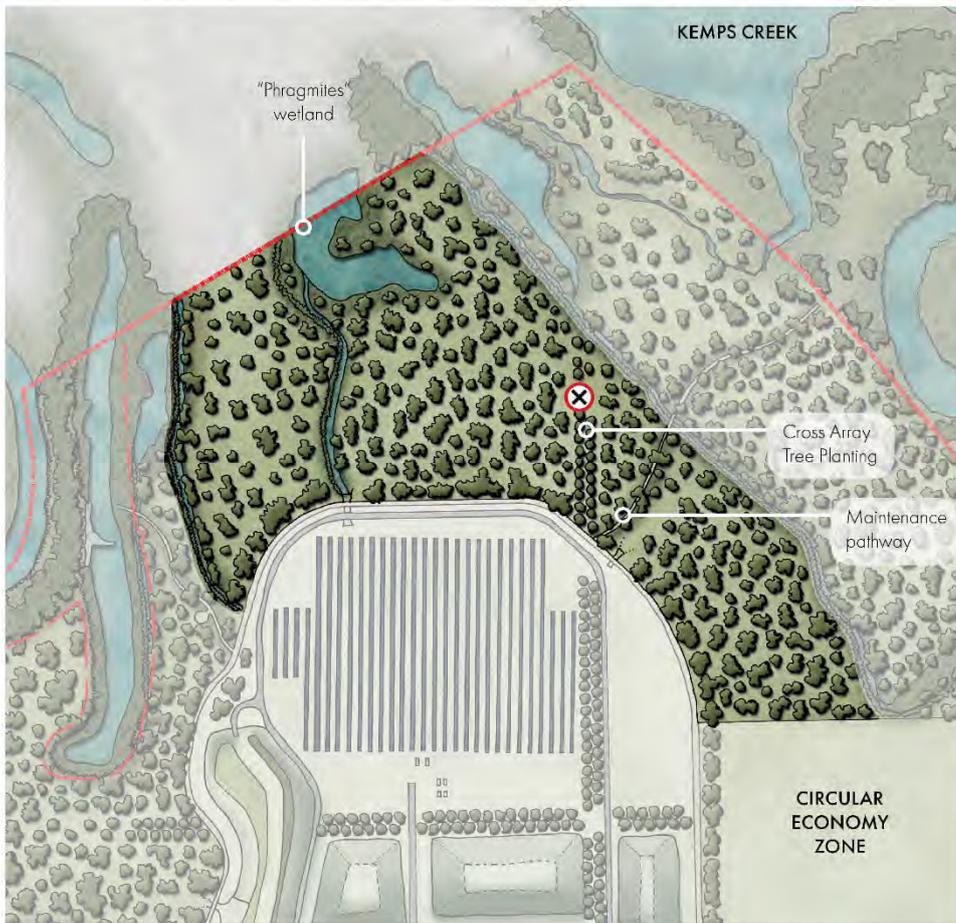


Figure 40: Kidney wetland section

Precinct 3 Northern Phragmites Zone



Badu Yarragul Precinct 3

-  Woodland tree canopy
-  Lineal wetland
-  Native grasses and understorey
-  Parabolic antennae

Figure 41: Precinct 3 – Northern Phragmites Zone

The northern floodplain is designed to intercept and capture runoff from the solar farm located within the Operations Zone, enhancing site-wide water management and ecological function. Two berm and swale systems are proposed to facilitate this process. The centrally positioned lineal wetland will channel water into a *Carex* meadow, promoting moisture retention and supporting a diverse wetland plant community. At the northern boundary, this swale connects to an existing sedgeland dominated by Common Reed (*Phragmites australis*), reinforcing hydrological connectivity and habitat continuity.

The western lineal wetland is designed to drain toward the billabongs located beyond the northern property boundary, contributing to regional wetland recharge and biodiversity support. These swales not only manage stormwater but also serve as ecological corridors, guiding water flow and supporting native vegetation.

The broader floodplain will be revegetated with a mix of native grasses, shrubs, and woodland species to enhance habitat diversity and landscape resilience. In the designated hydration zones, a rich palette of wetland plants will be established alongside wattles (*Acacia* spp.) and *Casuarina* species. These plantings will provide essential shade, structural complexity, and foraging opportunities for local fauna, while also contributing to soil stabilization and water filtration.

Together, these integrated landscape features aim to restore natural hydrology, support native biodiversity, and create a multifunctional wetland system that complements the surrounding infrastructure.

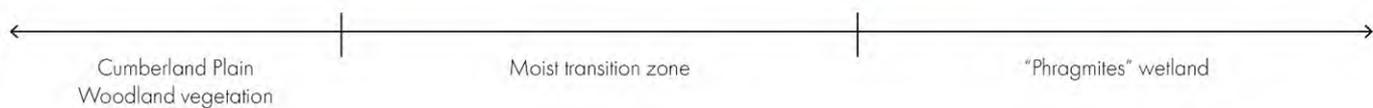
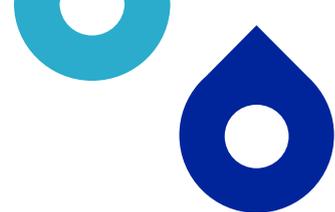
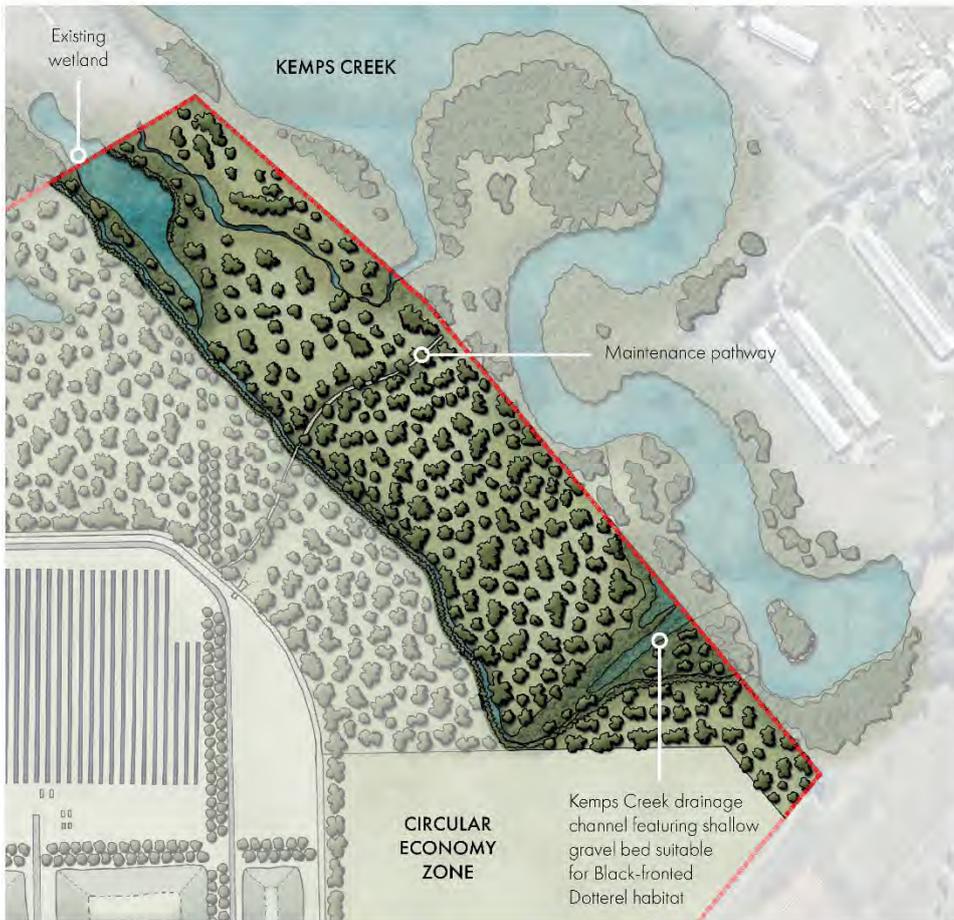


Figure 42: Phragmites wetland /section

Precinct 4 Kemps Creek Connection



Badu Yarragul Precinct 4

-  Woodland tree canopy
-  Lineal wetland
-  Native grasses and understorey
-  Shrubs/riparian vegetation

Figure 43: Kemps Creek Connection

Stormwater runoff from the Operational site in this precinct will be managed through a network of extensive shallow swales integrated into the landscape, reducing the need for formal engineered bioretention and flood retention basins.

This nature-based approach aligns with the preferences of the Traditional Custodians, who have requested minimal site disturbance, particularly in relation to excavation activities. Eventually, this precinct will be connected to manage stormwater runoff from the Circular Economy Zone, however its development is not dependent on the completion of the CEZ as it builds on existing natural infrastructure.

Low-flow stormwater will be directed along a proposed berm toward the north-west, building into an existing partial berm structure on-site and forming a linear wetland that connects to an existing pond dominated by Common Bulrush (*Typha latifolia*). The system supports passive water movement and enhances wetland connectivity, promoting ecological function and habitat diversity.

During peak flow events, excess water will be diverted toward Kemps Creek via an enhanced existing wetland. This wetland will be reshaped to improve hydrological performance and ecological value, with modifications including the introduction of gravel flats and a broader range of wetland plant species to increase habitat complexity and resilience.

The surrounding floodplain will be revegetated with native grasses, shrubs, and woodland species to support biodiversity and landscape stability. Hydration zones will be planted with a diverse mix of wetland flora, including wattles (*Acacia* spp.), *Casuarina*, and *Eucalyptus* species, which will provide shade, structural diversity, and habitat for local fauna.

This integrated water-sensitive design not only supports sustainable stormwater management but also enhances cultural and ecological values across the site.



**Restoring
Diverse
Biological
Communities**

9. Restoring Biological Communities

Protecting and enhancing biodiversity is vital for maintaining a healthy and resilient environment. Biodiversity plays a critical role in carbon sequestration by storing carbon in vegetation and soil and contribute to the overall stability and functionality of ecosystems.

The Badu Yarragul Greenspace will include targeted revegetation efforts designed to support important focal species which have been identified as under threat within the local area. These species act as ecological indicators, guiding restoration efforts to where they are most needed to lift the entire ecosystem. This approach will help re-establish connected habitat corridors by linking the riparian lands between Wianamatta South Creek and Kemps Creek and restoring species from the threatened ecological communities associated with the Cumberland Plain Woodland.

To accelerate habitat creation and biodiversity, the following features will be integrated across the site:

- **Nesting boxes** – initially installed on existing remnant trees, then progressively implemented across the landscape as tubestock trees mature to provide shelter and breeding sites for smaller birds, microbats and possums.
- **Gravel beds with shallow inundation** – new habitat to attract and support birds like dotterels that forage in flat, moist environments typically at the edge of wetlands (where conditions will support abundant worms and bugs).
- **Salvaged logs** – repurposes from nearby pipeline construction works, these logs will be placed throughout the site to create microhabitats for insects, reptiles and small mammals, while also contributing to soil health and moisture retention.
- **Rock islands** – boulders and rocks along creek edges and in waterbodies will enhance freshwater turtle habitat with sunning spots and places to safely exit waterbodies.
- **Varied waterbody habitat** – waterbody habitats of varying depths will be established to suit a wide variety of species. The kidney and phragmites wetlands will be shallow and ephemeral, the billabong will be deeper and the neighbouring dammed kemps creek provides the deepest waterbody.



Figure 44: Salvaged logs creating habitat along Wianamatta South Creek



Focal flora and fauna species

A focal species is a species chosen to guide conservation because it represents broader ecosystem health or supports other species. Protecting focal species can help conserve entire habitats and biodiversity. The following key focal species have been identified for the Badu Yarragul Greenspace according to three criteria.

The basis of the planting list is rooted in remnant PCTs to tie into existing fragmented vegetation communities and has been further refined by alignment with the existing M12 planting list and Western Sydney Parklands planting list to ensure that the species selected will thrive in Western Sydney's site-specific conditions. Continuity between the M12 planting list and the Badu Yarragul Greenspace planting list

will also create biodiverse continuity across site boundaries. Species that hold cultural significance to Dharug people for medicinal, edible or other properties have also been identified in consultation with Traditional Custodians, linking with local site heritage and cultural identity.

Focal fauna species were selected with consideration of the project's context and location. In close proximity to the Western Sydney Airport, encouraging large bird species or flocking species to the area is of particular concern with wildlife strike risk. Thus, Badu Yarragul Greenspace focuses on attracting ground-dwelling species and small birds of varying conservation status, fostering a biodiverse environment that is safe for both people and fauna to coexist.



Figure 45: Eastern short-necked turtles (Steve Dew)



Tree Species

Table 11: Tree species plant list

Scientific Name	Common Name	Height	Width	Cultural Plant	M12 List	WSP List
<i>Angophora bakeri</i>	Narrow-leaved Apple	5	4			
<i>Angophora floribunda</i>	Rough-barked Apple	15	10			
<i>Casuarina glauca</i>	Swamp She-Oak	15	10			
<i>Eucalyptus amplifolia</i>	Cabbage Gum	20	10			
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	10	4			
<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark	30	15			
<i>Eucalyptus longifolia</i>	Woollybutt	30	10			
<i>Eucalyptus moluccana</i>	Grey Box	10	4			
<i>Eucalyptus punctata</i>	Grey Gum	20	10			
<i>Eucalyptus radiata</i>	Narrow-leaved Peppermint	25	10			
<i>Eucalyptus tereticornis</i>	Red Forest Gum	30	15			
<i>Melaleuca stypheloides</i>	Prickly-leaved Paperbark	10	6			



Narrow-leaved Apple
Angophora bakeri



Rough-barked Apple
Angophora floribunda



Swamp She-Oak
Casuarina glauca



Cabbage Gum
Eucalyptus amplifolia



Narrow-leaved Ironbark
Eucalyptus crebra



Thin-leaved Stringybark
Eucalyptus eugenioides



Woollybutt
Eucalyptus longifolia



Grey Box
Eucalyptus moluccana



Grey Gum
Eucalyptus punctata



Narrow-leaved Peppermint
Eucalyptus radiata



Red Forest Gum
Eucalyptus tereticornis



Prickly-leaved Paperbark
Melaleuca stypheloides

Figure 46: Focal tree species

Shrubs and Small Trees

Table 12: Shrubs and small trees plant list

Scientific Name	Common Name	Height	Width	Cultural Plant	M12 List	WSP List
<i>Acacia decurrens</i>	Green Wattle	7	4			
<i>Acacia implexa</i>	Lightwood / Hickory Wattle	10	6			
<i>Acacia parramattensis</i>	Parramatta Wattle	7	3			
<i>Bursaria spinosa</i>	Blackthorn	3	3			
<i>Cassinia aculeata</i>	Common Cassinia	2	2			
<i>Daviesia ulicifolia</i>	Gorse Bitter-pea	2	1			
<i>Dillwynia sieberi</i>	Sieber's Parrot-pea	2	1			
<i>Dodonaea viscosa subsp. Cuneata</i>	Sticky Hop Bush	2	2			
<i>Indigofera australis</i>	Native Indigo	2	2			
<i>Kunzea ambigua</i>	Tickbush	4	3			
<i>Leptospermum polygalifolium</i>	Tantoon	2	2			
<i>Melaleuca linariifolia</i>	Snow-in-Summer	6	3			



Green Wattle
Acacia decurrens



Lightwood / Hickory Wattle
Acacia implexa



Parramatta Wattle
Acacia parramattensis



Blackthorn
Bursaria spinosa



Common Cassinia
Cassinia aculeata



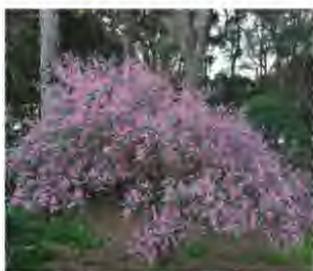
Gorse Bitter-pea
Daviesia ulicifolia



Sieber's Parrot-pea
Dillwynia sieberi



Sticky Hop Bush
Dodonaea viscosa subsp. cuneata



Native Indigo
Indigofera australis



Tickbush
Kunzea ambigua

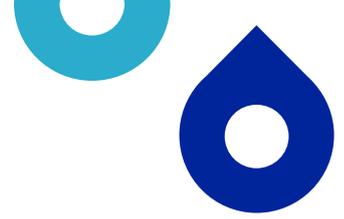


Tantoon
Leptospermum polygalifolium



Snow-in-Summer
Melaleuca linariifolia

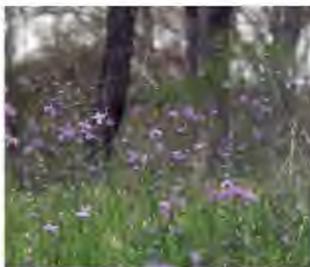
Figure 47: Focal shrub species



Grasses and Groundcover Species

Table 13: Grasses and groundcover species plant list

Scientific Name	Common Name	Height	Width	Cultural Plant	M12 List	WSP List
<i>Anthropodium strictum</i>	Chocolate Lily	0.5	0.5			
<i>Austrodanthonia caespitosa</i>	Wallaby Grass	0.5	0.5		Yellow	
<i>Austrostipa ramosissima</i>	Stout Bamboo Grass	1	0.5			
<i>Carex appressa</i>	Tall Sedge	1	1		Yellow	Light Green
<i>Dichelachne micrantha</i>	Shorthair Plumegrass	1	1		Yellow	Light Green
<i>Dianella caerulea</i>	Flax Lily	1	0.5	Blue		
<i>Einadia hastata</i>	Berry Saltbush	0.5	0.5		Yellow	
<i>Eremophila debilis</i>	Winter apple	0.5	1	Blue	Yellow	
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	1	1	Blue	Yellow	Light Green
<i>Microlaena stipoides</i>	Weeping Grass	0.5	0.5		Yellow	
<i>Murnong</i>	Yam Daisy			Blue		
<i>Oxalis perennans</i>	Native Oxalis	0.5	0.5		Yellow	
<i>Themeda triandra</i>	Kangaroo Grass	1	0.5		Yellow	Light Green



Chocolate Lily
Anthropodium strictum



Wallaby Grass
Austrodanthonia caespitosa



Stout Bamboo Grass
Austrostipa ramosissima



Tall Sedge
Carex appressa



Shorthair Plumegrass
Dichelachne micrantha



Flax Lily
Dianella caerulea



Berry Saltbush
Einadia hastata



Spiny-headed Mat-rush
Lomandra longifolia



Weeping Grass
Microlaena stipoides



Yam Daisy
Murnong

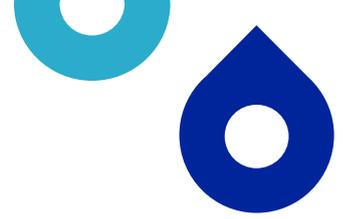


Native Oxalis
Oxalis perennans



Kangaroo Grass
Themeda triandra

Figure 48: Focal grass species



Wetland Species

Table 14: Wetland species plant list

Scientific Name	Common Name	Height	Width	Cultural Plant	M12 List	WSP List
<i>Baumea articulata</i>	Jointed Twig-rush	1	0.5			
<i>Bolboschoenus caldwellii</i>	Marsh Twig-rush	0.5-	1			
<i>Carex gaudichaudiana</i>	Fen Sedge	0.5	0.5			
<i>Eleocharis acuta</i>	Spike Rush					
<i>Ficinia nodosa</i>	Knobby Club-rush	0.5	0.5			
<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge	1.5	1.5			
<i>Juncus usitatus</i>	Common Rush	1	1			
<i>Panicum effusum</i>	Hairy Panic	0.5	0.5			
<i>Phragmites australis</i>	Common Reed	3	2			
<i>Poa labillardierei</i> var. <i>labillardierei</i>	Common Tussock Grass	1	1			
<i>Schoenoplectus validus</i>	River Club-rush	2	1.5			
<i>Typha domingensis</i>	Narrow-leaved Cumbungi / Southern Cattail / Bulrush	3				



Jointed Twig-rush
Baumea articulata



Marsh Twig-rush
Bolboschoenus caldwellii



Fen Sedge
Carex gaudichaudiana



Spike Rush
Eleocharis acuta



Knobby Club-rush
Ficinia nodosa



Red-fruit Saw-sedge
Gahnia sieberiana



Common Rush
Juncus usitatus



Hairy Panic
Panicum effusum



Common Reed
Phragmites australis



Common Tussock Grass
Poa labillardierei



River Club-rush
Schoenoplectus validus



Narrow-leaved Cumbungi
Typha domingensis

Figure 49: Focal wetland species



Fauna Species

Table 15: Focal fauna species list

Scientific Name	Common Name	Status
Mammals		
<i>Macropus robustus erubescens</i>	Common Wallaroo (Euro)	Least Concern
<i>Myotis Macropus</i>	Southern Myotis / Australian Fishing Bat	Vulnerable
<i>Vombatus ursinus</i>	Common Wombat	Least Concern
Birds		
<i>Chenonetta jubata</i>	Australian Wood Duck	Least Concern
<i>Dasyurus maculatus</i>	Black-fronted Dotterel	Least Concern
<i>Haliastur spheurnus</i>	Whistling Kite	Least Concern
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	Least Concern
Amphibians & Reptiles		
<i>Crinia signifera</i>	Common Eastern Froglet	Least Concern
<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake	Least Concern
<i>Emydura macquarii</i>	Eastern Short-necked Turtle	Vulnerable
Crustacean & Gastropod species		
<i>Cherax destructor</i>	Common Freshwater Yabby	Vulnerable
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	Endangered



Australian Wood Duck
Chenonetta jubata



Black-fronted Dotterel
Dasyurus maculatus



Whistling Kite
Haliastur spheurnus



Little Black Cormorant
Phalacrocorax sulcirostris



Common Wallaroo (Euro)
Macropus robustus erubescens



Southern Myotis / Australian Fishing Bat
Myotis macropus



Common Wombat
Vombatus ursinus



Common Eastern Froglet
Crinia signifera



Red-bellied Black Snake
Pseudechis porphyriacus



Eastern Short-necked Turtle
Emydura macquarii



Common Freshwater Yabby
Cherax destructor



Cumberland Plain Land Snail
Meridolum corneovirens

Figure 50: Focal fauna species



Proposed Implementation Strategy

10. Proposed Implementation Strategy

Establishing the landscape at Badu Yarragul Greenspace on a predominately cleared, compacted and weed-infested site requires a staged and carefully managed approach to improve soil conditions and suppress invasive species. A ‘light touch’ approach is proposed including using smaller machinery through construction and minimizing the import and export of materials (where possible).

After the master plan is finalised, a detailed procurement and delivery strategy will be developed to confirm the exact methodology and staging how the work will be delivered.

Burn, weed and plant to establish landscape

Implementation will incorporate cool burning to target specific areas of weed infestation, contributing to a coordinated program for weed control and native plant restoration, responsive to site conditions.

Weeds will be sprayed with herbicide prior to burning, and spot sprayed as required to follow up and control difficult weeds. As described in *Weed Management Plan Environmental Sustainability Division of Infrastructure and Commercial Western Sydney University august 2023*; *African Lovegrass Using Fire to Manage Priority Weeds in Cumberland Plain vegetation Nature Conservation Council of NSW Bushfire Program January 2016*. Cool burning and spot spraying can be effectively combined to manage both Blackberry and African Lovegrass infestations, but their application differs slightly between species. The opportunity to shallow rip or direct plant following burning and weed management can support establishment of shrubs and canopy in a naturalistic mosaic.

For Blackberry, cool burning can provide an initial knockdown by removing dense growth and exposing regrowth, which is then effectively targeted with spot spraying. Multiple follow-up sprays are essential to deplete the root system and prevent re-establishment.

For African Lovegrass, burning can reduce biomass and improve site access but can also stimulate regrowth if not carefully managed. Immediate and ongoing spot spraying after burning is critical to control new shoots before they mature. In both cases, long-term monitoring, repeated treatments, and strategic revegetation with competitive native species are necessary to achieve sustained weed suppression and prevent reinfestation.

In the terrestrial areas (approximately 90% of the site) a ‘grid’ approach is proposed. This would formalise a 5-year staged approach that targets revegetation efforts to follow the cultural burning works.

Cool burns are targeted on the wood weeds of concern (for example Blackberry and African Lovegrass). Spot spraying and planting following the burns will support landscape establishment.



Figure 51: Blackberry and African Lovegrass infestations on site (drone imagery)



Hydration areas – working with water

Floodplain management measures are proposed to sensitively integrate with the landscape and use available stormwater runoff volumes and recycled water to enhance hydration and ecological outcomes within the site.

The revegetation approach will distinguish between the aquatic, emergent and ephemeral vegetation (blue) and terrestrial vegetation (green). In the hydrated (blue) zones, cover approximately 5 ha of the site (~10%). The design and works aim to establish suitable surface levels and water depths (where modification is required to enhance hydration). An Ecological Monitoring and Management Plan will adaptively manage the regeneration and support the return of native species to enhance and showcase biodiversity.

Ephemeral wetland species will be chosen that mimic the boom-and-bust cycle of wetland vegetation and ecology. The planting palette mimics natural changes seen in the river flat forest landscape. At five years, establishment of acacia, bursaria and other shrub species grow alongside small sparse canopy trees. By 20 years, canopy trees have established and mostly shaded out shrub species, leaving grasses to thrive beneath the trees.

Careful monitoring for problematic aquatic weed species will be required (and proven management techniques adopted to control any issues).

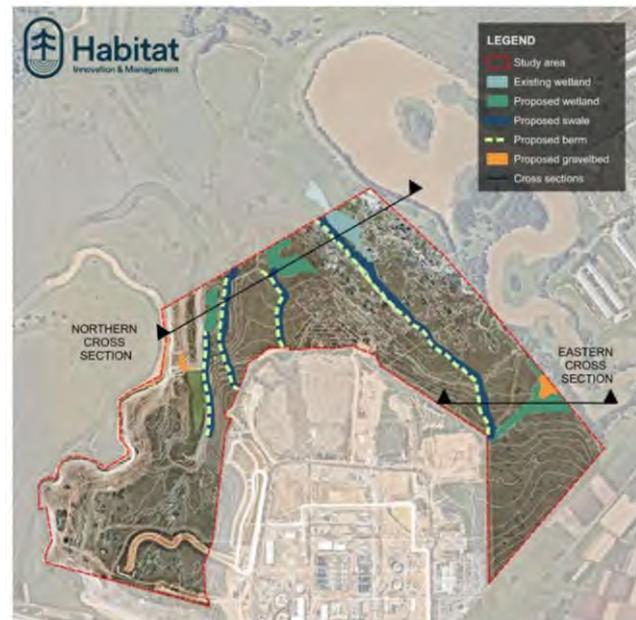


Figure 52: Floodplain Hydration diagram. Source HABITAT INNOVATION AND MANAGEMENT (2025).

Water distribution and retention

Chapter 7 describes the hydration approach including

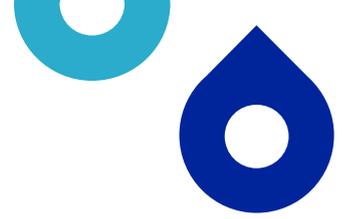
- Hydration processes within soil/plant/water systems
- Map of key water retention areas / linear wetlands, building on the existing site drainage features
- Function of bunds and berms to passively control the flow of water and maximise retention
- Model simulation of rainfall, runoff, infiltration, evapotranspiration to ensure consistency with Wianamatta stormwater management targets.
- Mitigation of flood impacts
- Monitoring soil conditions, hydration, vegetation and ecological response to optimise outcomes.

The implementation of this approach will manage stormwater runoff from the proposed Circular Economy Zone (12 ha) and other catchments. For the CEZ, runoff volumes and peak flows up to 6 m³/s have been considered (peak flow for 1% AEP). The CEZ runoff can be intercepted by the proposed chain of linear wetlands at a maximum depth of 300mm. Each wetland becomes a large infiltration basin, but with capacity to convey higher flows. Saturated Hydraulic Conductivity measurements for this area ranged from 12 – 24 mm/hr, indicative of sandy clay material.

Ecological Monitoring and Management

Baseline Ecological Monitoring will be undertaken using ‘transects’ that document the initial condition of vegetation, soil, and fauna (e.g. bats, birds, frogs, snails and reptiles). The transects would represent a cross section of the ecological areas within the site. This approach will align with and support broader monitoring of soils, water movement, salinity, vegetation, fauna, weeds, pest species.

An Ecological Monitoring and Management Plan will be developed to track benefits and progress towards implementation of the ecological objectives of the masterplan. Habitat enhancements are proposed to support biodiversity outcomes, e.g. nest boxes (for birds, possums and bats), woody debris, and use of trail cameras and smart monitoring techniques to assess changes in site condition.



Landscape establishment

The proposed methodology for establishing the landscape includes a combination of native grassland seeding and targeted tree and shrub planting to restore structure, biodiversity, and long-term site resilience. Native grassland species will be directly seeded across open areas to provide rapid ground cover, suppress weed regrowth, stabilise the soil, and support native habitat functions. Seed mixes will be carefully selected to include a diverse range of local provenance species suited to the site's soil, aspect, and moisture conditions, with a focus on fast-establishing grasses and forbs that can compete effectively with residual weeds.

Tree and shrub planting will complement the grassland by providing vertical structure, shade, and habitat diversity. Trees, small trees, and shrubs should be planted at an approximate density of 100 plants per hectare, arranged in naturalistic groupings of 3–5 plants. This clustered planting approach mimics natural vegetation patterns of the Cumberland Plain Woodland, promotes mutual protection from wind and sun exposure, and creates focal points for habitat development. Groupings should be spaced to allow light penetration to encourage native grassland growth while maintaining open sightlines and fire-safe separation where required.

Prior to planting, ground preparation should involve targeted soil cultivation in compacted areas to facilitate root establishment, while the broader site should be minimally disturbed to protect soil structure and reduce weed activation. Mulch will be applied around planting clusters to retain moisture and suppress weeds. Post-planting management will include regular watering (if necessary), weed control, and plant replacement to ensure successful establishment. Ongoing monitoring will track vegetation cover, survival rates, and weed suppression, allowing for adaptive management as the landscape develops.

Maintenance tracks

Maintenance tracks will be included in the Greenspace development to provide safe and reliable access for maintenance personnel, equipment, and emergency services, including bushfire management teams. These tracks enable routine activities such as weed control, planting, mulching, monitoring, and rubbish removal, supporting the long-term health, functionality, and resilience of the greenspace.

The tracks connect to the waterways, swales and wetlands allow for the maintenance and management of vegetation supporting stormwater function and biodiversity. These access routes ensure that waterways can be regularly inspected, managed for blockages or erosion, and maintained in accordance with landscape and water management objectives.

The tracks minimise disturbance by concentrating vehicle movements and reduce soil compaction, supporting both environmental protection and efficient site management. Once the landscape has been properly established, there is potential in the future for these maintenance tracks to be converted to walking trails if the demand or land use objectives change.

Note Year 1-5: These show typical expectations for establishment; cultural practices will guide weed control during landscape establishment.

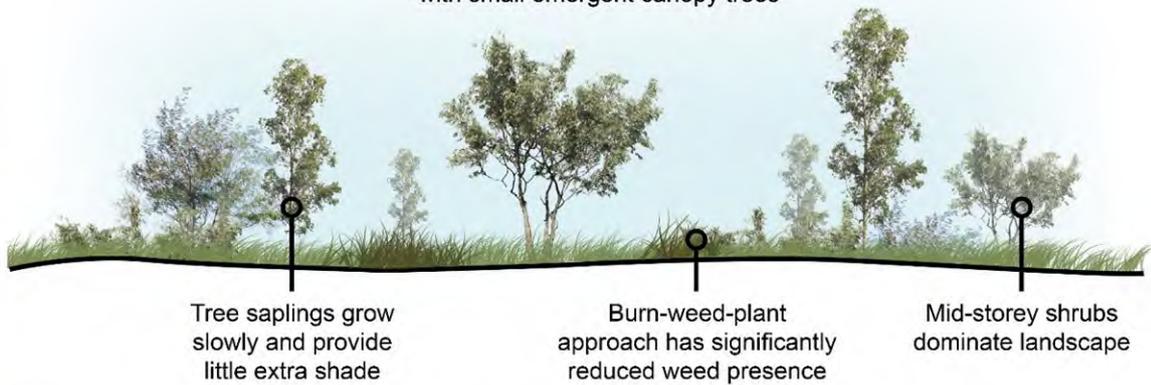
1 YEAR

Revegetation planting of shrubs and trees



5 YEARS

Establishment of acacia and bursaria with small emergent canopy trees



20+ YEARS

Established canopy trees with shrubs more shaded out

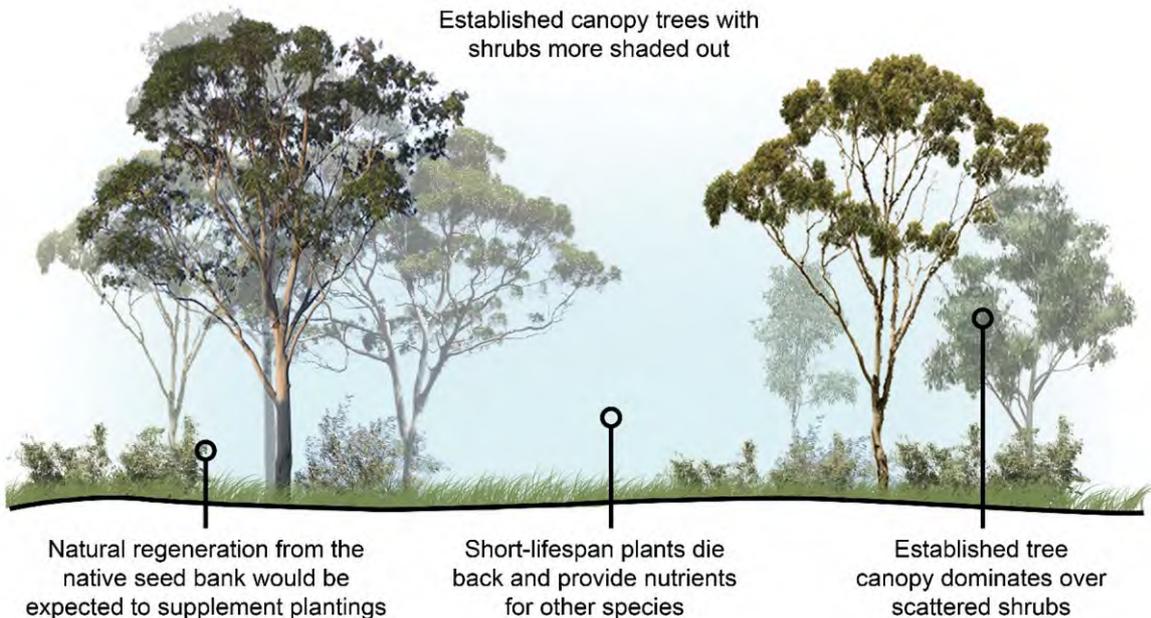


Figure 53: Revegetation establishment



Management, Maintenance & Monitoring



11. Maintenance and Monitoring

The process of monitoring and management for the implementation and maintenance of the Badu Yarragul Greenspace landscape will ensure that intended biodiversity and cooling outcomes are achieved through establishing clear performance indicators, setting baseline conditions, and applying regular, systematic data collection to track ecological health, species diversity, vegetation growth, and microclimate regulation.

The monitoring will enable adaptive management, allowing the refinement of strategies in response to observed trends, emerging challenges, or changing site conditions.

Maintenance activities are expected to be more intensive during the establishment phase and then reduce in frequency as the landscape becomes established and more self-sufficient as an ecosystem. Through this proactive and iterative approach, Sydney Water will support the long-term success of the Greenspace and contribute meaningfully to urban resilience and ecological enhancement.

Biodiversity Stewardship

A Biodiversity Stewardship Agreement (BSA) is a legal agreement between landholders and government to establish a biodiversity stewardship site for the purpose of generating biodiversity credits under the Biodiversity Offsets Scheme (BOS). Under the BOS, Sydney Water can generate biodiversity credits by enhancing or maintaining biodiversity on the Greenspace. Credits are then sold to developers that need to offset their environmental impacts. In return, management plans are established that can then be funded through the Total Fund Deposit (TFD) to cover the cost of management actions. Land under a BSA is also exempt from land tax, reducing costs for Sydney Water.

Species credit generation varies by species and dual credit species have potential to generate species credits where breeding habitat or otherwise important habitat has been mapped on site for that species. The foraging component for that species is included in the ecosystem credits for that Plant Community Type (PCT). Both ecosystem and species credits can be sold through the Biodiversity Conservation Trust (BCT) or Biodiversity Credits Supply Fund.

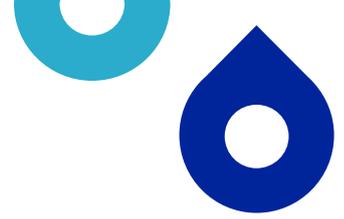
Sydney Water has undertaken a feasibility assessment on the credits that may be generated if the Greenspace is managed as a stewardship site. The options assessment indicated that as the site lacks ecosystems credits in its current state, it would be preferable to revegetate the Greenspace with the appropriate PCT and then reassess the feasibility of a Biodiversity Stewardship Agreement (BSA) when planting is established. Given the uncertainty of future BSA feasibility, the Management Plan will focus on strategies that aim to maximise biodiversity value within a prudent land management budget.

Greenspace Management Plan - Enhancing Hydration, Vegetation and Biodiversity

Typically a suite of coordinated management documents, including the Landscape Management Plan, Vegetation Management Plan, Wildlife Risk Assessment and Bushfire Risk Assessment provides a comprehensive framework to support implementation, maintenance, and long-term sustainability.

- **The Landscape Management Plan** outlines how the site will be maintained to achieve key outcomes such as improved biodiversity, urban cooling, and community amenity.
- **The Vegetation Management Plan** focuses specifically on the protection, establishment, and care of plant species, with actions to support ecological health and prevent weed invasion.
- **The Wildlife Risk Assessment** identifies potential risks associated with local fauna and provides strategies to manage these risks safely and responsibly.
- **The Bushfire Risk Assessment** assesses the potential risk of bushfire to a site and provides strategies to minimise harm to people, property, and the environment.

In addition, an **Ecological Monitoring and Management Plan** will track progress from the baseline condition to enhance habitat and ecological outcomes (including management of water and hydration zones as well as soil conditions, nutrients and salt).



To demonstrate compliance, the following activities are typically required:

1. Regular Site Inspections

- Conduct scheduled inspections to assess vegetation health, weed presence, wildlife activity, and bushfire readiness.
- Document inspection findings with photos and site notes.

2. Monitoring and Data Collection

- Measure key performance indicators (e.g. plant survival rates, species diversity, canopy cover, cooling outcomes).
- Record wildlife sightings, hazards, and any fauna management actions.
- Track bushfire management activities like fuel load reduction and maintenance of Asset Protection Zones (APZ).

3. Maintenance Activities

- Carry out weed control, plant replacement, pruning, mulching, and irrigation as required.
- Manage wildlife risks through signage, exclusion measures, or updated work practices.
- Maintain bushfire safety zones, access paths, and emergency infrastructure.

4. Record Keeping

- Keep detailed logs of maintenance activities, wildlife incidents, and bushfire management tasks.
- Maintain up-to-date plans, inspection reports, and action records for audit purposes.

5. Reporting

- Submit regular compliance reports to Sydney Water or relevant authorities, summarising monitoring outcomes, completed actions, and any non-conformances.
- Provide evidence of corrective actions where targets or requirements are not met.

6. Review and Adaptive Management

- Periodically review the plans and site performance to ensure ongoing relevance.
- Adjust management practices in response to monitoring results, site changes, or regulatory updates.

These activities collectively demonstrate that the site is being managed in line with the approved plans and Sydney Water's environmental, safety, and sustainability obligations.



Actions

Reporting

The project will begin with the development of a comprehensive Vegetation Management Plan, outlining strategies for flora and fauna enhancements that prioritise native species and ecological integrity. A detailed hydration Area Adaption Plan will also be prepared to investigate soil improvements and water retention strategies to support long-term vegetation establishment and on-going resilience.

Assessment and Management

To ensure restoration success throughout the restoration process, quarterly assessments will be conducted to monitor management and maintenance activities and identify any restoration areas that require further intervention or correction. The implementation of all plans will be adjusted based on observed outcomes and environmental conditions. This adaptive management approach will allow the project to respond to challenges over the 20+ year restoration timeline.

Measuring environmental and biodiversity outcomes

Vegetation Monitoring and Maintenance

Vegetation growth will be tracked against target transition stages at 1-, 5- and 20-year intervals to assess rate of maturity. Key actions include reducing invasive weeds, conducting cool burns to rejuvenate ecosystems and establishing vegetation complexity across canopy, shrubs, sedges and valued ecological areas suited to local species (eg. mudflats, wetland areas, swales etc.) Satellite monitoring of vegetation through technologies such as NDVI will be used to assess vegetation health and development over time, complemented by on-ground surveys using transects and quadrats.

Ecological Monitoring

Habitat creation and biodiversity enhancement are important features of this project's restorative actions that have to be monitored. The installation of nest boxes and introduction of woody debris will help create microhabitats to encourage local species move back onto site (eg. raptors, bats, small birds, possums, frogs, fish and macroinvertebrates). Target outcomes will be set for selected species and video monitoring will provide insights into wildlife activity and habitat usage patterns to assess effectiveness of ecological restorative actions.

Water Movement

Water balance will be assessed through measures such as estimated runoff, evapotranspiration rate and infiltration figures, ensuring compliance with NSW Government Waterway Health Objectives. Water will be managed onsite through the use of soil moisture probes and active controls (eg. valves) to help retain water within hydration zones.

Soil, Nutrient and Salt Balance

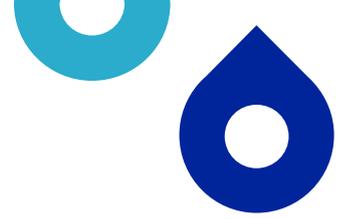
Regular soil testing will help track the movement of nutrient and salinity levels through and across the soil profile. This data will be analysed to identify trends and inform recommendations for managing risks and improving soil health. Strategies will include amendments to enhance nutrient cycling and maintain soil structure.

Potential Future Offsets

The project will explore opportunities for implementing biodiversity offsets to improve habitat value and simulate nutrient and carbon balance (eg. soils and vegetation and losses). This will contribute to broader ecological restoration goals in Western Sydney.

Cooling and Amenity

To measure microclimate benefits, air temperature will be monitored and compared across the site using approx. 5 probes. A photographic record will also be maintained to document changes in landscape structure and amenity over time and record cooling improvements.



Proposed Green Space Program

After the master plan is finalised, a detailed procurement and delivery strategy will be developed to confirm the exact methodology and staging how the work will be delivered.

Table 16: Proposed Green Space Program

	Cultural Burns and Vegetation Management	Habitat Enhancements	Hydration	Monitoring and Reporting
0 – 1 year	Initial burns (5 – 10 ha)	Install nest boxes (bird, possum and microbat)	Detailed design of wetlands and stormwater connections	Prepare Management Plan (vegetation, cultural burning, habitat, hydration and monitoring aspects)
2025-26	Slashing native grasses (15-20 ha) Weed management Initial planting Adapt vegetation management plan to enhance flora/fauna values Assess response on site from Burn-Weed-Plant approach	Position large woody debris Install trail camera monitoring and communication strategy (and link to management plan)	Model spill containment pumps (first flush) and bio / green space valve configuration to achieve stormwater targets Initial works for berms and hydration zones (trial 3 revegetation approaches from minimal planting to more intensive revegetation)	Commence Spring/Autumn assessment and reporting Install soil moisture probes and gather baseline data along transects (nutrients, salt, carbon, soil properties, vegetation and images from photographic points)
Yr 1	Deliver works in line with Management Plan focusing on 20% of the site in each year from Year 1 – Year 5.	Adapt approach as needed considering habitat, food and reproductive needs of target species	Extend works (building on successful approaches in previous year)	Reporting including community engagement Adapt management plan as needed sharing lessons to optimise and formalise cost-effective management of natural assets
Yr 2 – 5	Implement initial 5-year plan and transition to low cost maintenance	Maintain equipment, consider enhancements	Complete any remaining works on hydration areas and establish maintenance protocols.	Continue monitoring and reporting. Ensure any issues are promptly identified.
Yrs 6 – 10	Implement maintenance plan (years 6 – 10)	Maintain equipment, consider enhancements	Implement maintenance plan (years 6 – 10)	Continue monitoring and reporting (reduce frequency as appropriate)
Yrs 11-20	Implement long term maintenance plan (years 11 – 20)	Maintain equipment, consider enhancements	Implement long term maintenance plan (years 11 – 20)	Continue monitoring and reporting (reduce frequency as appropriate)



Table 17 Expected monitoring timeline

Description of phase		Expected outcomes
0 – 1 year	Prepare management plans Commence initial burns, vegetation management and planting Design and commence hydration works	Establish baseline monitoring and the approach for initial 5 years of management and remediation. Establishment works (Year 0 – 1).
Yr 1 – 5	Initial 5-year plan	Demonstrated cost-effective remediation, improvements in biodiversity and ecological values.
Yrs 6 – 10	Maintenance plan (Yr 6-10)	Demonstrated cost-effective maintenance of natural assets. Documented improving trends in ecological values (and any threats to maintenance).
Yrs 11-20	Long term maintenance plan (Yr 11-20)	Low costs maintained under long term maintenance with biodiversity and ecological values protected.



Appendices

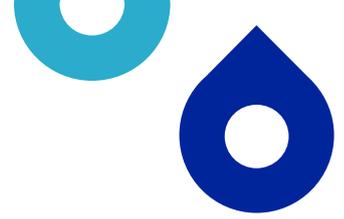
12. Appendices

A | Referenced Documents

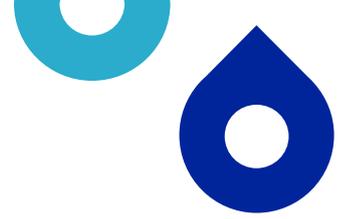
All relevant standards, guidelines, assessments, and reports that have been referenced and complied with during the development of the UDLP are listed below.

Table 18: Complete List of Referenced Documents

Reference	Governing Body	Date
A Liveability Framework for Sydney	NSW Government Department of Planning and Environment, ARUP	2017
AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting	Standards Australia	2019
ASTM E1980-11 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces	ASTM International	2001
Australian Standard AS1428.1 Design for access and mobility	Standards Australia	2009
Aviation Safeguarding Guidelines – Western Sydney Aerotropolis and surrounding areas	NSW Government	2022
Australian Urban Design Protocol	Commonwealth of Australia	2011
Better Placed	Government Architect NSW	2017
Circular Economy and Resource Recover Strategic Blueprint	Sydney Water	2022
Commonwealth Environment Protection and Biodiversity Conservation Act 1999	NSW Government	1999
Connecting with Country framework	Government Architect NSW	2023
Consultation Outcomes Report Aerotropolis Stormwater Catchment Scheme Plans – Aboriginal Engagement	Sydney Water, GHD, Zion	2022
Cumberland Plain Conservation Plan	NSW Government Department of Planning and Environment	2022
Cumberland Plain Recovery Plan	NSW Department of Planning and Environment	2022
Cumberland Plain Western Sydney Interpretation Guidelines	National Parks and Wildlife Service	2002
Dark Sky Planning Guideline	NSW Department of Planning and Environment	2023
Designing with Country discussion paper	Government Architect NSW	2020
Development and Assessment BASIX	NSW Government	2023
Greener Places Design Guide	Government Architect NSW	2020
Ecological Sustainable Development tool	Infrastructure Sustainability Council	2023
EIS amended flood impact assessment	Sydney Water	2022
Environmental Impact Statement	Sydney Water	2021
Everyone Can Play grant program	NSW Government Department of Planning and Environment	2021-2022
Floodplain Development Manual	NSW Office of Environment and Heritage	2005
Floodplain Risk Management Guidelines	NSW Office of Environment and Heritage	2015
Greater Sydney Regional Plan – A Metropolis of Three Cities	NSW Greater Sydney Commission	2018
Guidelines for Vegetation Management Plans on Waterfront Land	NSW Office of Water	2012
Heritage Interpretation Strategy	Extent Heritage	2021



Reference	Governing Body	Date
Infrastructure Sustainability Council IS Rating Scheme for Level 1 and Level 2	Infrastructure Sustainability Council	2023
IS v2.1 Design & As Built	Infrastructure Sustainability Council	2023
Local Strategic Planning Statement 2020	Penrith City Council	2020
Ministers Conditions of Approval	NSW Government	2023
National Airports Safeguarding Framework Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports	Australian Government Department of Infrastructure, Transport, Regional Development, Communications and the Arts	2014
National Airports Safeguarding Framework Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports	Australian Government Department of Infrastructure, Transport, Regional Development, Communications and the Arts	2014
National Construction Code	Australian Building Codes Board	2023
Net Zero Directional Statement	Sydney Water	2022
Net Zero Plan 2030	NSW Government Department of Planning, Industry and Environment	2020
Net-Zero Carbon Plan	Sydney Water	2022
NSW Biodiversity Conservation Act 2016	NSW Government	2016
NSW Climate Change Policy Framework	Office of Environment and Heritage	2016
Penrith Green Grid Strategy	Penrith City Council, Tract	2021
Penrith Local Environmental Plan 2010	Penrith City Council, NSW Government	2010
Penrith 2041+ Community Strategic Plan	Penrith City Council	2025 Draft
Planning for Bush Fire Protection 2019	NSW Rural Fire Service	2019
Recognise Country – Guidelines for the development in the Aerotropolis	NSW Government	2022
Recovering bushland on the Cumberland Plain – Best Practice Guidelines for the Management and Restoration of Bushland	NSW Department of Environment and Conservation	2005
Re-Imagining water in Western Sydney – Western Sydney Regional Master Plan	Sydney Water	March 2020
Review of Bushfire Constraints and Opportunities report	Sydney Water	2022
Scoping Report Upper South Creek Advanced Water Recycling Centre	Sydney Water	July 2020
Section 78A (8) of the Environmental Planning and Assessment Act 1979	NSW Government	1979
Soil Re-Use Assessment and Advice – Advanced Water Recycling Centre (AWRC)	SESL Australia	2023
Standard Secretary’s Environmental Assessment Requirements	NSW Government	1979
State Environmental Planning Policy	Western Sydney Aerotropolis	2020
State Environmental Planning Policy (Western Sydney Aerotropolis) 2020	NSW Government	2020
Submissions Report March 2022	Sydney Water	March 2022
Sub-Plan A: Conservation Program and Implementation	NSW Government	2020
Sydney Green Grid	Government Architect NSW, Tyrrell Studio	2017
Sydney Green Grid Plan 3 – South West District	Government Architect NSW, Tyrrell Studio	2017
Sydney Water Environmental Policy	Sydney Water	2021
Sydney Water Strategy 2020-2030	Sydney Water	2020
Sydney Water Upper South Creek – Advanced Water Recycling Centre Vegetation Management Plan	Sydney Water, Tract	July 2023
Technical guidelines for Urban Green Cover in NSW	NSW Office of Environment and Heritage	2015
The Penrith Community Plan 2017	Penrith City Council	2017



Reference	Governing Body	Date
Updated Management Measures	Sydney Water	June 2021
Updated South Creek Flood Study	Penrith City Council, WorleyParsons	2015
Upper South Creek Advanced Water Recycling Centre Final Submission ECI Deliverables	John Holland, Trility, Jacobs, GHD, Tract	May 2022
Upper South Creek Advanced Water Recycling Centre Heritage Interpretation Strategy	Sydney Water	October 2021
Upper South Creek Advanced Water Recycling Centre Urban Design	Aurecon, ARUP	July 2021
Upper South Creek Advanced Water Recycling Centre Urban Design Report	Sydney Water	July 2021
Western City District Plan	NSW Greater Sydney Commission	2018
Western Sydney Aerotropolis Development Control Plan	NSW Government	November 2022
Western Sydney Aerotropolis Draft Wildlife Management Assessment Report	Western Sydney Planning Partnership, Avisure	May 2020
Western Sydney Aerotropolis (Initial Precincts) Riparian Corridors Assessment	Sydney Water	December 2021
Western Sydney Aerotropolis Precinct Plan	NSW Government Planning and Environment	March 2022



B | Badu Yarragul Preliminary Concepts

Project Themes

For the Badu Yarragul Greenspace Masterplan, preparing multiple masterplan options was essential to ensure the design meaningfully responded to its unique context and project themes. Each concept design explored all these themes in different ways, often placing greater focus on one particular theme:

First Nations Cultural Practice

Badu Yarragul sits on Country with deep cultural significance. Multiple design options allowed for co-design with Traditional Custodians to embed cultural knowledge, support practices of caring for Country, and provide space for ceremony, learning, and connection.

Waterway Health

Situated within the Wianamatta South Creek catchment, the site's masterplan options tested how to protect and restore hydrological function. This included re-establishing natural flow paths, improving water quality through WSUD, and enhancing riparian zones.

Through this hydrological concept exploration, the final masterplan meets the stormwater management targets for Wianamatta-South Creek which exceed typical WSUD requirements.

Ecological Regeneration

The site's degraded soils and fragmented vegetation communities require thoughtful ecological responses. Options explored native planting regimes and habitat corridors to support biodiversity uplift while aligning with First Nations land management principles.

Recreation

Masterplan concept options allowed flexibility in balancing passive uses without compromising ecological or cultural values.

Recreation opportunities regarding spatial separation, shared use and integration with the natural landscape were explored in the iterative design process, however were not pursued in the final masterplan design due to the site's remote location, Traditional Custodian recommendations and ecological protection priorities.

Educational opportunities were included in all concepts, which will likely be limited to small school and community groups managed through the administration centre.

Active Transport

As part of the broader Western Sydney Parkland City network with the M12 cycleway running nearby, Badu Yarragul Greenspace has the potential to be well-connected. This presented the opportunity to explore safe and legible walking and cycling routes that connect with adjacent neighbourhoods, waterways, and the regional active transport spine, promoting inclusive, car-free access.

Badu Yarragul Greenspace is not a destination site, however, with no demand for the site to have significant active transport connections and no support from Traditional Custodians. This opportunity may be re-evaluated in the future, once the greenspace planting has established.



Concept 1 – Regional Recreation

This initial concept is designed to support a broad range of active sport and leisure activities, with a strong focus on connectivity and recreation. Key features include a full-sized cricket oval, three (3) multipurpose sports fields, and fourteen (14) hard courts accommodating basketball and tennis. Supporting infrastructure such as amenities blocks, change rooms, and car parking is also integrated into the design.

Due to the scale and functionality of the facilities, significant earthworks will be required to meet the necessary site gradients. Strategically located picnic areas will provide shaded seating and vistas over adjacent water bodies, enhancing user experience and encouraging informal recreation.

A future opportunity exists to partner with University of Sydney to revegetate the western bank of Wianamatta South Creek, though this measure is currently outside of the project scope.

The complexity of this development extends beyond the remit of Sydney Water and will require coordination with multiple external stakeholders to develop and manage the site. High capital investment and ongoing maintenance costs are anticipated, particularly in relation to floodplain mitigation measures. Additionally, the site's relative isolation from high-density residential areas may pose challenges for community access and integration.

Overall, while the concept offers a well-equipped recreational precinct, its implementation will demand careful planning, cross-agency collaboration, and considerable financial and operational commitment. It is also not supported by Traditional Custodians in consultation workshops.

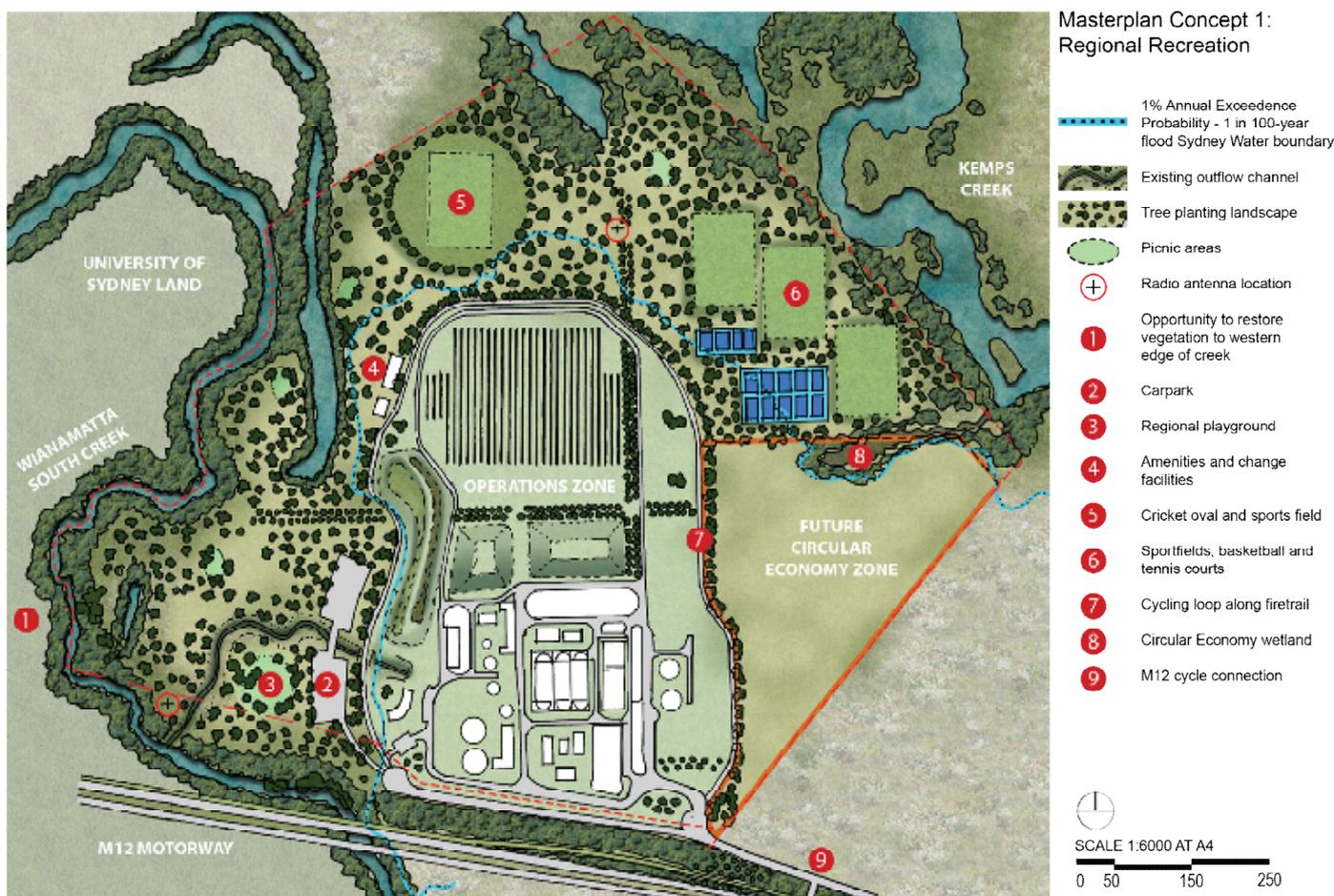


Figure 54: Concept 1 – Badu Yarragul Greenspace – Regional Recreation

Concept 2 – Passive Recreation

This concept features an interconnected network of pathways that guide visitors through the site. They link a series of passive recreation areas including picnic spots and playgrounds, which are varied in size and layout to support diverse forms of engagement. This allows a range of user groups, from intimate family gatherings to larger group activities, encouraging flexible and inclusive site usage.

Each picnic spot is designed to enhance visitor experience by capturing a particular point of interest, such as a nearby wetland, creek or historical antennae artefact. This arrangement invites relaxation and exploration to visit each unique picnic area. The pathways are designed to be

accessible, promoting easy movement and discovery through the Badu Yarragul landscape.

A key environmental feature of this concept design is the strategic tree planting arrangement. Trees are planted in rows which follow the natural site topography. This approach enhances the visual rhythm of the landscape while the controlled spacing and fuel load management mitigates bushfire risk. This planting arrangement, however, was not supported by Traditional Custodians in initial engagement and would require significant development and maintenance costs.

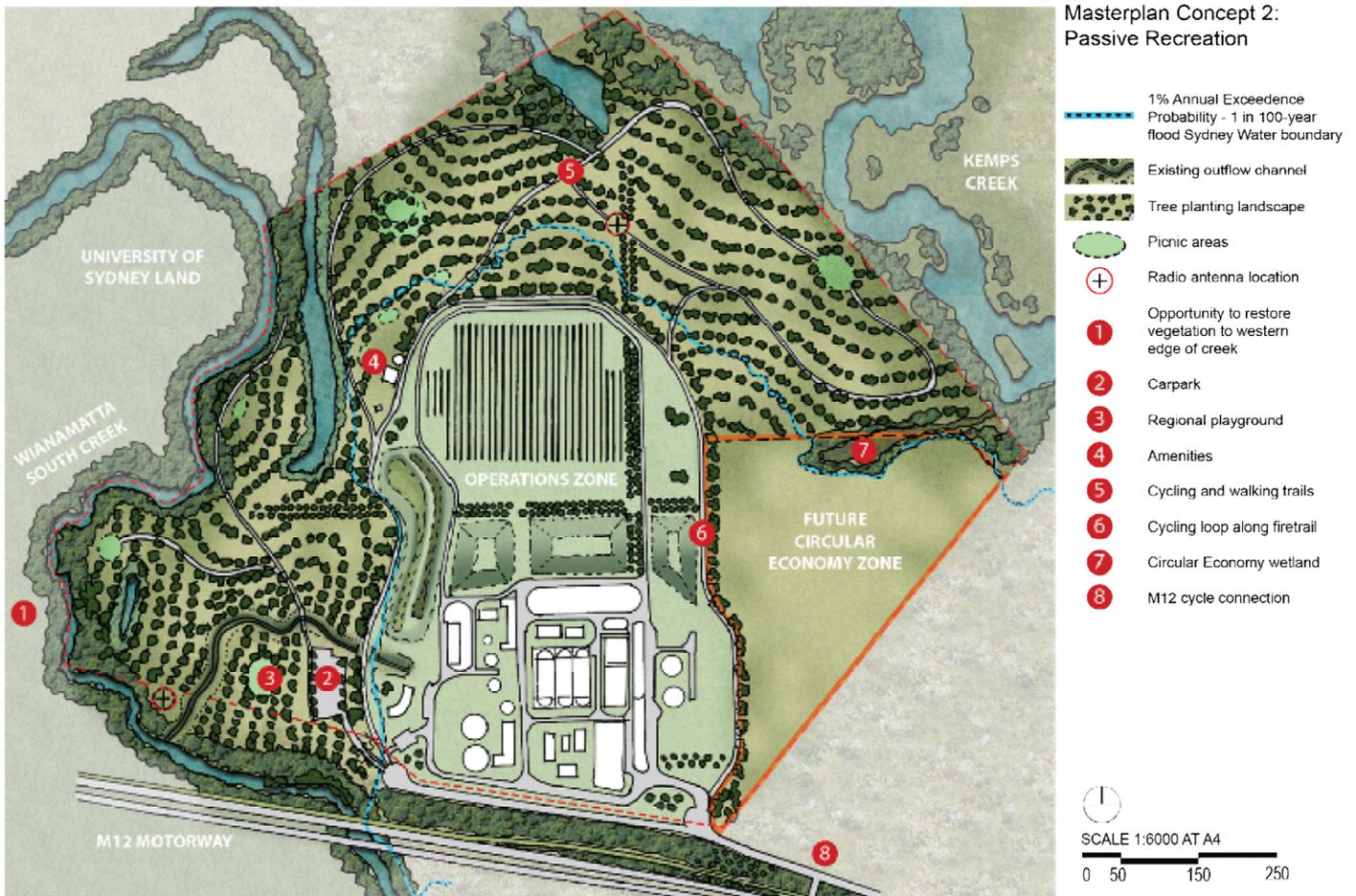


Figure 55: Concept 2 – Badu Yarragul Greenspace – Passive Recreation

Concept 3 – Ecological Restoration

This masterplan concept advances the contour-based planting strategy of Concept 2 by incorporating an understorey layer of shrubs, grasses and groundcovers to create a multi-layered habitat structure. This inclusion enhances habitat complexity onsite, fostering a rich environment for local flora and fauna and promoting ecological resilience. The enhanced planting approach will strengthen ecological corridors to support movement and survival of native wildlife.

Bushfire mitigation strategies are employed through the strategic spacing of trees and the use of low-flammability understorey species. Ongoing management through the employment of strategies such as cultural burning will further reduce serious bushfire risk.

Integrating ecological restoration principles allows this design to meaningfully contribute to the conservation of Western Sydney's unique and threatened biodiversity. Similar to Concept 2, however, the planting arrangement is costly, not supported by Traditional Custodians and doesn't provide extra biodiversity support.

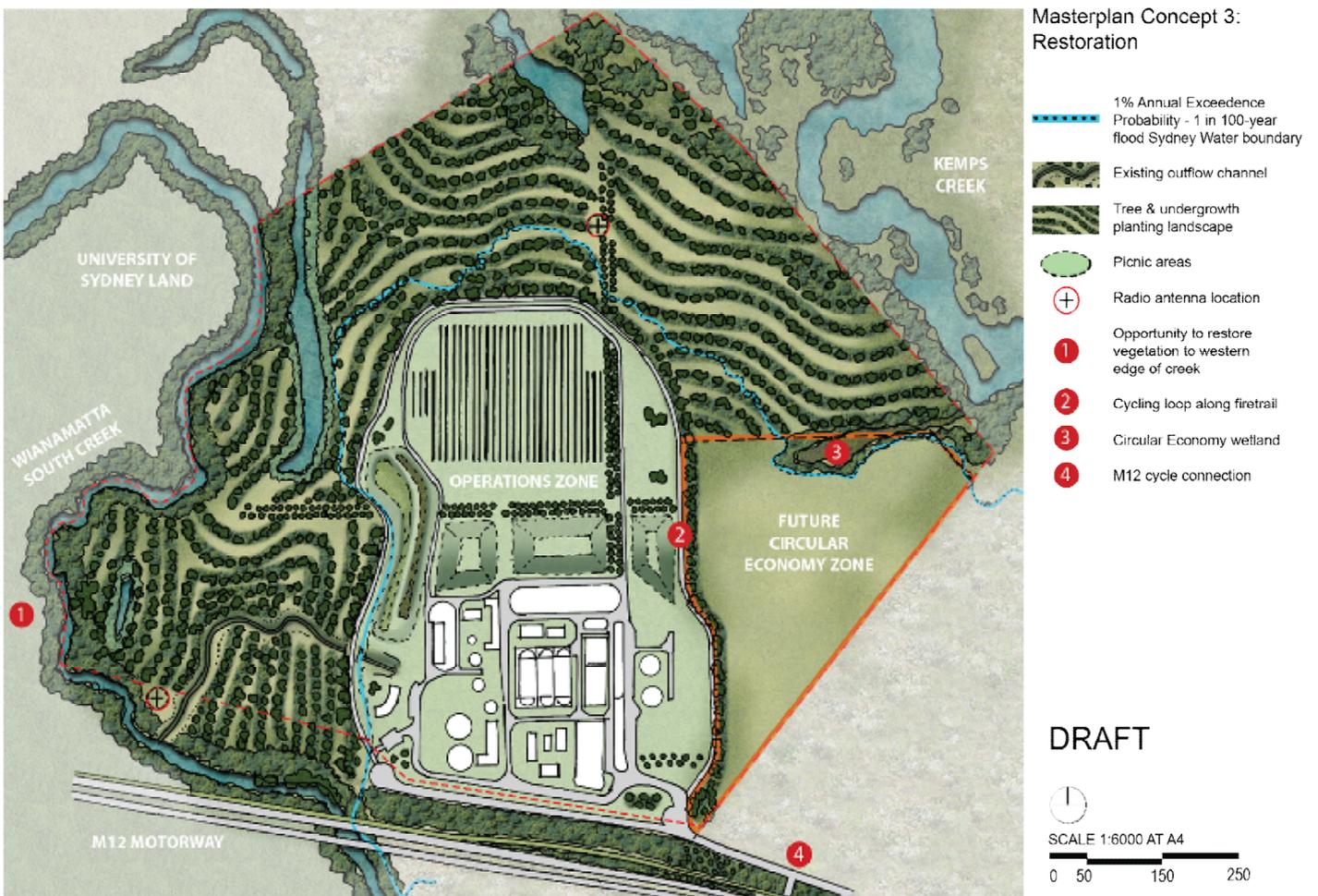


Figure 56: Concept 3 – Badu Yarragul Greenspace – Ecological Restoration

Concept 4 – Circular Economy Stormwater Management

Masterplan Concept 4 proposes a naturalised approach that balances ecological enhancement with bushfire resilience and sustainable water management. In contrast to the linear planting arrangement from Concepts 2 and 3, the vegetation strategy mimics more natural clumps of native species which are spaced to maintain appropriate canopy separation for bushfire requirements. This layout reduces bushfire risk by limiting fuel continuity while supporting biodiversity in the creation of a mosaic of habitats across the site.

The stormwater management exploration in Concept 4 directly informed the final masterplan, which adopts a more holistic, integrated approach to water management across the entire site. This concept also indicated two distinct stormwater management solutions for the proposed Circular Economy Zone:

1. **Conventional retention basin and wetland biofiltration** – this option involves engineered earthworks to form a dedicated stormwater retention basin. Integrated wetland zones in the raised basin provide biofiltration to improve water quality by removing sediments and pollutants before water is released.
2. **Biofiltration with floodplain retention storage** – this option leverages an existing drainage depression in the landscape, transforming it into a functional floodplain retention area. This design reduces earthworks to align with Country outcomes while maximising ecological and hydrological performance through landscape-led biofiltration strategies.

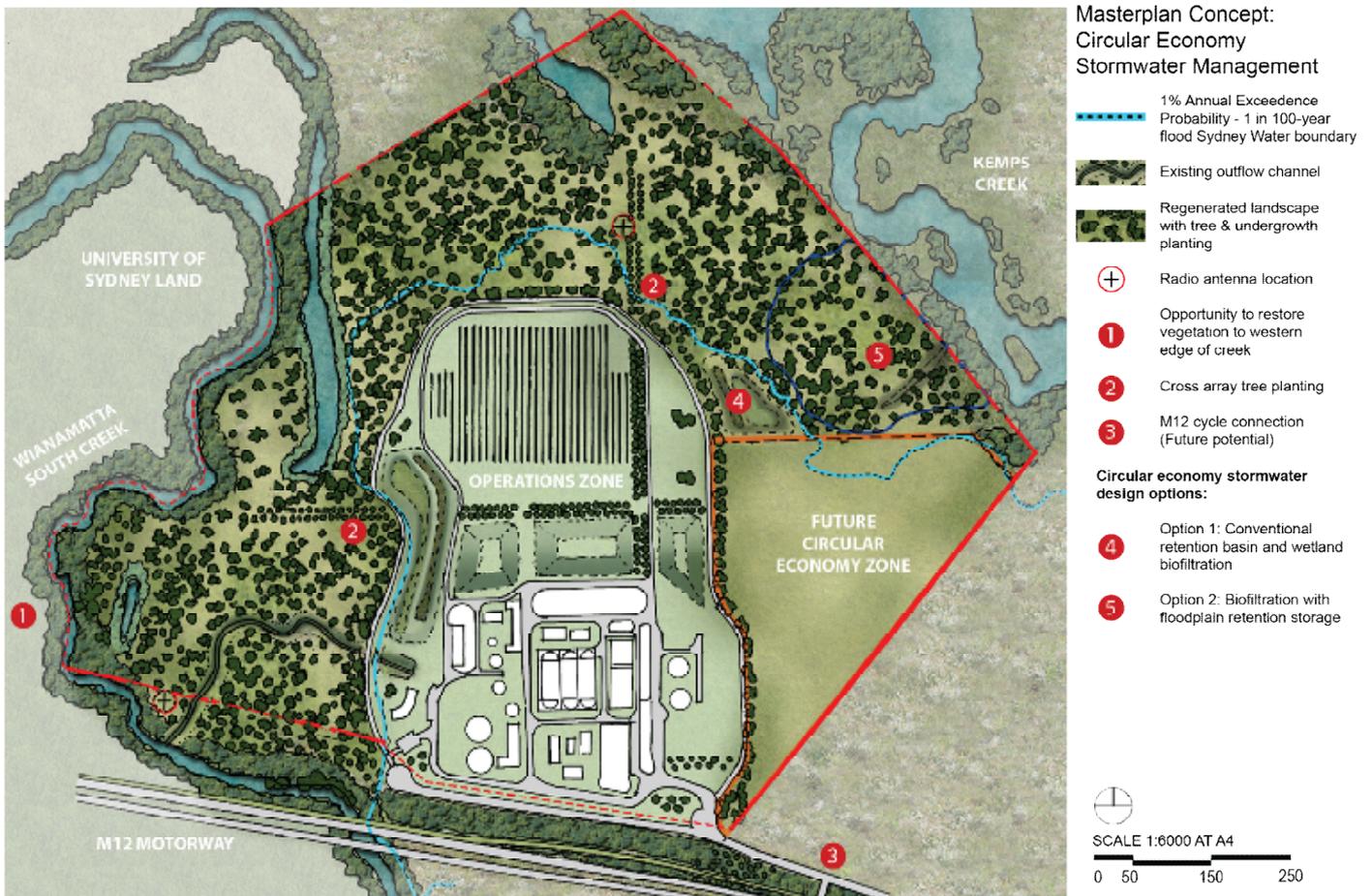


Figure 57: Concept 4 – Badu Yarragul Greenspace – Circular Economy Stormwater Management



Concept 5 (Preferred) - Hydration and Revegetation Masterplan

Concept 5 places maximum ecological regeneration through strategic replanting that leverages the site's natural stormwater flows. By harnessing existing landforms and hydrological patterns, a series of interlinked hydration zones have been designed to collect and retain rainwater. These zones build upon the site's contours and drainage lines to create microenvironments where moisture is retained for extended periods to support the establishment of resilient, site-appropriate plant communities, enhancing habitat diversity and mitigating soil erosion.

In addition to the hydration zones, new and expanded wetlands will be nourished by localised runoff, improving water quality through natural filtration while creating essential habitats for aquatic and bird life. Over time, these dynamic ecosystems will form ecological corridors that strengthen biodiversity and climate resilience.

The stormwater runoff from the Circular Economy Zone will be treated within the Greenspace and not require substantial

excavation and earthworks associated with the construction or retention basins.

The inclusion of a dedicated cultural practice area overlooking the billabong enriches Indigenous heritage and living culture. Positioned to align with the Emu in the Sky sculpture associated with the M12, this elevated vantage point offers a space for storytelling, ceremony, and community engagement—blending ecological restoration with cultural recognition and education.

The cross array tree planting arrangement has been shortened from previous concept iterations, retaining reference to the radio telescope heritage of the site while allowing more room for the hydrological and natural ecological systems to function effectively.



Figure 58: Concept 5: Badu Yarragul Greenspace Masterplan – Hydration and Revegetation



C | Multi-Criteria Assessment

Following the concept development phase of the Badu Yarragul Greenspace Masterplan, a Multicriteria Assessment (MCA) was undertaken to evaluate the developed masterplan options against the project's core values and performance objectives. This process ensured that the final preferred option reflects a balanced and transparent alignment with the themes of First Nations cultural practice, waterway health, ecological regeneration, public recreation, and active transport. MCA has been used as a structured approach to select a preferred masterplan utilising a wide range of factors in a logical and methodical way. Through MCA, the Badu Yarragul concepts have been compared to each other by testing their performance against a range of assessment criteria that encompass the values of the stakeholders and specific project objectives.

Through the MCA process, the relative importance of each criterion is considered by assigning a weighting to it.

Concepts have been assessed and compared to each other, by considering their performance against the weighted criteria. This process has allowed decision makers to identify the options that provide the most beneficial outcomes, by giving due consideration to the complex set of issues and benefits associated with each option.

Methodology

The Methodology for this MCA consists of four steps:

1. Identify and agree on the evaluation criteria
2. Rank each identified criteria against each other to obtain a weighting of criteria importance
3. Score each option.
4. Evaluate each option against the weighted criteria to obtain and overall option rating
5. Obtain final ranking of each option analysed

Table 19: Multicriteria assessment table

Evaluation Criteria		Concept 1 Regional recreation	Concept 2 Passive Recreation	Concept 3 Restoration	Concept 4 Circular Economy stormwater management	Concept 5 Hydration and Revegetation
1	Aboriginal cultural and heritage value	0	1	2	2	2
2	Traditional Custodian support	0	0	1	2	2
3	Biodiversity	1	2	2	2	2
4	Active Transport	1	1	1	1	1
5	Carbon Sequestration	0	1	2	2	2
6	Cooling benefits	1	1	2	2	2
7	Recreational benefits	2	2	1	1	1
8	Future value -Stewardship Agreement	0	1	2	1	2
9	No urban development within Flood zone	0	2	2	2	2
10	Research and Education benefits	0	1	1	1	2
Financial						
11	Lower Capital Cost	0	1	2	1	2
12	Lower Maintenance Cost	0	1	2	2	2
Sydney Water core business						
13	Does not require leasing of land to another party	0	1	2	2	2
14	EIS aspirations	1	2	2	2	2
15	Stormwater management. Improving in ground water quality	0	0	0	0	2
TOTAL		6	17	24	23	28

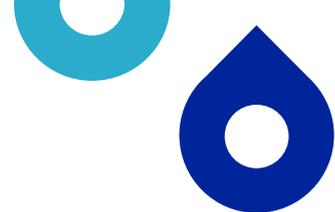
Criteria Scoring

- 0 – Does not meet criteria
- 1 – Partially meets criteria
- 2 – Meets criteria

Multicriteria Assessment Summary

Concept 5 achieves the highest score on the multifunctional criteria assessment due to its comprehensive approach to landscape restoration. It stands out by integrating multiple ecological, social, and environmental benefits, effectively addressing a wide range of needs and goals. By focusing on holistic restoration, Concept 5 not only rehabilitates the landscape but also enhances biodiversity, improves water management, and supports local ecosystems.

It promotes Aboriginal community engagement and accessibility, creating a space that serves both environmental and educational functions. This multi-layered approach maximises the long-term resilience of the area, ensuring the restoration is sustainable and beneficial on multiple fronts, which is why it outperforms other concepts in the multifunctional assessment.



D | Active transport network

The Transport for NSW (TfNSW) Strategic Cycleway Corridors identify key active transport routes that connect people to major centres, public transport, and open spaces across Greater Sydney. While not directly incorporated into the design, the Badu Yarragul Greenspace retains the opportunity to integrate a future connection between the M12 Motorway shared path and the site's internal fire trail and maintenance track network, potentially integrating with Sydney's regional cycle network.

The alignment provides a direct east–west connection from the M12 into the site, offering access for both recreational users and cycleway commuters. The existing fire and maintenance tracks have been designed to accommodate multi-use access, enabling them to be adapted in the future as part of the active transport network while also supporting landscape management and emergency services. This approach aligns with the Penrith Local Strategic Planning Statement (LSPS) 2020 objective to promote active transport and improved connectivity, particularly within new urban areas.

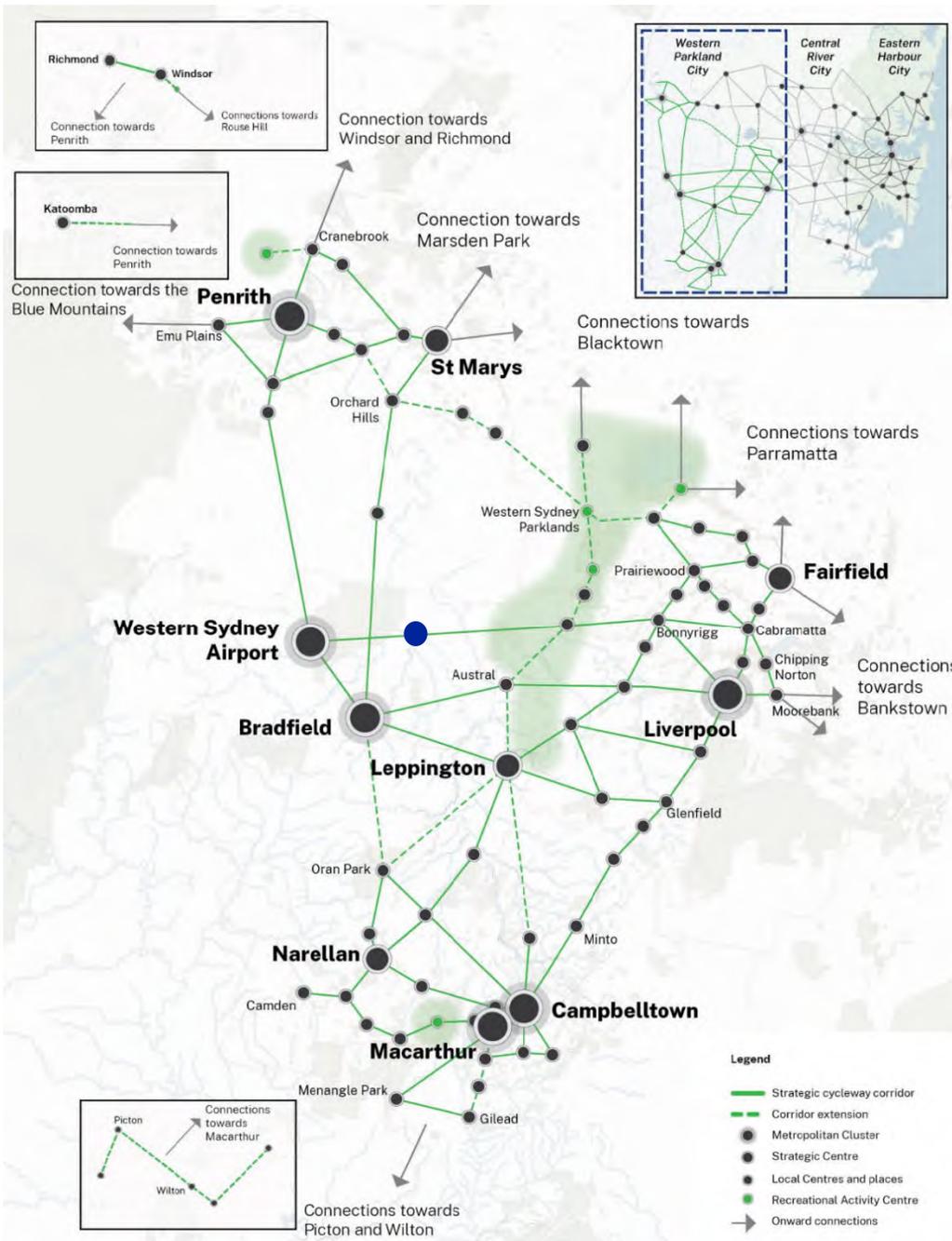


Figure 59: Strategic Cycleway Corridors (TfNSW 2023)



Figure 60: M12 cycleway corridor (orange) (TfNSW)