Structure Plan No 64

Wetland Management and Rehabilitation Strategy

Contents

Introduction

Background

The City of Wanneroo Structure Plan 64 (SP64) covers a parcel of land in the locality of Woodvale, within the south-western extent of the City's municipal boundary. In total, SP64 covers an area of approximately 25 hectares and includes 15 individual lots, inclusive of Lots 0, 800, 22, 23, 26-28, 32-34, 90, 83 and part lots 35 and 1 Wanneroo Road (**Figure 1**). The SP64 area is bounded by Wanneroo Road to the east, the Wallubuenup swamp to the west and south, and Woodvale Drive to the north.

This Wetland Management and Rehabilitation Strategy (WMRS), focuses on the Wallubuenup Swamp and its associated buffer zone within and adjacent to the boundary of SP64. Wallubuenup Swamp (referred to as 'the wetland' in this document) is classified as a Conservation Category Wetland (Unique Feature Identifier number (UFI) 8168)) and is displayed in **Figure 2**. The wetland is located to the west and south of SP64 and is part of the Yellagonga Regional Park. The Yellagonga Regional Park is a 1400ha wetland system that also includes Lake Joondalup, Beenyup swamp, Lake Goollelal and surrounding lands reserved under the Metropolitan Region Scheme for 'Parks and Recreation.'

Watsons Property Group (WPG), on behalf of the combined landowners within the SP64 area, undertook structure planning for the area now covered by SP64. One of the key aspects that required consideration during the preparation of the structure plan was the presence of the wetland that is adjacent to the SP64 area, and in some areas extends within the structure plan area.

SP64 provides for the development of a WMRS to detail the strategic measures to be undertaken to protect and enhance the wetland area.

Purpose

The WMRS lays out the framework to coordinate the rehabilitation of the wetland in association with the SP64 development. This document is designed to demonstrate the onground rehabilitation outcomes, at an appropriate strategic level, to support the SP64 development.

The WMRS is not a wetland management plan; specific management plans will be developed as a condition of subdivision in accordance with planning processes. The Strategy, rather, provides a benchmark and standards for more detailed management plans, to ensure consistency of efforts across fragmented landholdings in the development of individual Wetland Management Plans (WMP).

Approvals

As a condition of subdivision, each approval for a lot that is adjacent to Yellagonga Regional Park will require the preparation and implementation of a WMP. The WMRS will be provided to each applicant and it will be necessary for the applicant to demonstrate that the WMP prepared is consistent with the strategic requirements.

In some circumstances, it is likely that some of the larger landholdings will be subdivided/developed in a staged manner and there may be multiple subdivision applications lodged. In these cases, applicants should prepare a single WMP that spans their full landholding to provide a broader context for their individual applications (given the wider landholdings) and are also encouraged to liaise with adjoining landowners to ensure consistency across landholdings with aspects such as a dual use path and fencing alignments. Where possible, landholders should consider collaborative development of a WMP that extends across individual landholdings.

Both the City of Wanneroo (CoW) and the Department of Environment and Conservation (DEC) will be the clearing authorities for the condition requiring the production of a WMP. It is therefore recommended that applicants discuss the intended approach to address the requirements of this document with both of these stakeholders prior to commencing the preparation of a WMP and before submitting any document for review and clearance.

Existing Environment

Climate

The rainfall average for Perth from 1905-2007 is around 807mm (rainfall data from the Bureau of Meteorology Perth Regional Office). Since 1976, a nine percent reduction from the long-term average has been observed. From 2001 to 2007, average rainfall was recorded at 683mm, reflecting a further decline of 15 percent below the long-term average. A drying climate and resultant groundwater decline is a key threat for the Yellagonga wetlands (City of Wanneroo and City of Joondalup, 2009). From 1981 to 2008, mean daily evaporation ranged from 10.1mm in January to 2.1mm in July.

Regional Context

Wallubuenup Swamp forms part of Yellagonga Regional Park. The Park, made up of Lake Joondalup, Beenyup and Wallubuenup Swamps, Lake Goollelal and surrounds, provides regional importance from its natural, cultural, and recreational resources in a growing suburban area (Yellagonga Regional Park Management Plan 2003-2012). The wetlands within Yellagonga Regional Park are some of the last remaining freshwater wetland systems on the Swan Coastal Plain.

Geology, Geomorphology and Soils

The SP64 development is located on Karrakatta soils within the Spearwood Dune system. Regional Acid Sulphate Soils (ASS) mapping indicates that the western portions of the lots are within an area of high risk of ASS being found within 3 metres from the surface. However, the majority of this high-risk area is located in the portion of the study area that will be used for Public Open Space (POS); thus, it is not expected that these potential ASS will be disturbed.

Wetland soils are generally black, fine grain and peaty soils with an organic topsoil layer. These soils were inundated and saturated in some areas, with hydric soils also evident. Dry land soils are categorised as grey, medium to fine-grained sands, dry to a depth of at least 0.5 metres (Cardno, 2006).

Hydrology

Groundwater within the SP64 area flows in a westerly direction towards Wallubuenup Swamp. Within the wetland rehabilitation area, predicted Historical Maximum Groundwater levels give an estimated depth to groundwater of zero to two metres (Cardno, 2009).

Hydrological studies found that the separation distance between the surface and the Annual Average Maximum Groundwater Level across the study area is greater than 1.2m (maximum level allowed for building construction) for all but six lots proposed by SP64 (Cardno, 2009). The majority of the site has a separation distance of more than 4m. Management of maximum groundwater levels is only required for these six lots and this will be achieved by utilising sand fill.

To facilitate water sensitive urban design techniques proposed by the Local Water Management Strategy, some fill would be introduced to the area adjacent to the wetland buffer. The impact of fill on wetland function must be considered by WMP and Urban Water Management Plan developed as conditions of subdivision.

Vegetation and flora

Vegetation and flora surveys undertaken for the entire wetland, identified three plant community types present (Cardno, 2006). Communities were classed as Melaleuca-Tuart woodland, Melaleuca-Typha shrubland, and exotic grassland dominated by Typha and Kikuyu with intermittent exotic trees. Community types are displayed in **Figure 3.** No declared rare or priority flora species or threatened ecological communities were identified in the wetland. Vegetation condition mapping was also completed as part of surveys and is included in **Figure 4**.

Significant weed species, such as Kikuyu (*Pennisetum clandestinum*) and Typha (*Typha orientalis*), are present in the rehabilitation area. Both of these weed species are aggressive colonisers and require control and management over time. The control of large woody weeds within the rehabilitation area (for example exotic *Eucalyptus* species) also requires attention.

Fauna

A reconnaissance fauna survey based on assessment of potential habitat quality suggests that the range and diversity of potential fauna habitats in the study area is very low. However, the wetland area to the west of SP64 and the wider Yellagonga Regional Park does provide suitable habitat for many mammals, reptiles and bird species.

Within the study area, there is limited habitat available for native fauna. *Typha* is extensive within the wetland area and is known to provide some nesting habitat for native birds. The removal of *Typha* may require staging to prevent any impact on existing habitat values.

Ecological Linkages

The site forms part of the eastern boundary of Wallubuenup Swamp, which forms part of Yellagonga Regional Park. The Park provides an important north south link with Neerabup National Park and Yanchep National Park.

Due to the nature of the surrounding urban catchment there is limited scope within the SP64 area to contribute to any linkages from the Park to wetlands in the east, however rehabilitation of the site does enhance the ecological linkage provided in the local area.

Cultural and Social Values

Within the local community, Yellagonga Regional Park, including Wallubuenup Swamp, is viewed as a place to relax and unwind, providing important natural aesthetic in an urban environment.

There is significant Indigenous and European history centred on the wetlands of Yellagonga Regional Park. Wetlands were, and continue to be, places of important spiritual connected for Aboriginal people. Also, the area was important for European settlers for gardening and agriculture. A number of listed Aboriginal and European heritage sites are listed and known in the surrounding area (City of Wanneroo and City of Joondalup, 2009).

Past and Existing Landuses

The past and existing landuses of the SP64 development area ranged from broadscale agricultural to viticulture and poultry farming. The section of the poultry farm (Lot 801) shown in **Figure 5** that is located outside the SP64 area was previously earmarked for rehabilitation as part of this strategy. The Water Corporation have since agreed to remediate and rehabilitate this area as part of a separate offsets package (GHD 2009) associated with the installation of the

Gnangara sewer main proposed to be installed along the border of the SP64 boundary (**Figure 6).**

Potential Impacts and Threats

Previous land uses in the structure plan area and adjacent wetland area are displayed **Figure 5.**

Possible impacts and threats to the surrounding environment resulting from previous land uses to be addressed at a site specific level in each WMR Plan may include:

- High levels of nutrient runoff;
- Clearing of native fringing wetland vegetation;
- Continued presence and spread of established environmental weed species; and
- Soil contamination from agricultural and industrial runoff.

Residential development proposed by SP64 may potentially impact on the wetland, if not appropriately managed. Potential threats include weed infestation from landscaping and gardens, recreation impacts, and nutrient input due to stormwater runoff.

Key mechanisms to alleviate impact of previous land use and manage any potential impact from SP64 include:

- Local Water Management Strategy and Urban Water Management Plans to address urban water runoff and reduce nutrient input;
- Wetland Management and Rehabilitation Strategy and Wetland Management and Rehabilitation Plans to rehabilitate Wallubuenup Swamp and its buffer; and
- Structure Plan No. 64, which includes provisions to manage wetland impacts and provide information to purchasers regarding wetland protection.

Overall, it is expected that the implementation of the key mechanisms above will result in a net benefit to Wallubuenup Swamp and Yellagonga Regional Park.

Strategic Management Commitments

Detailed management commitments will be set out in WMPs as a condition of subdivision. Key guidelines and information sources to be used in the development of a WMP are set out in **Appendix 1**. The development of a WMP will require further consultation and site assessment, as guided by the strategic direction of the WMRS in accordance with key guidelines, particularly *Guidelines Checklist for Producing a Wetland Management Plan* (DEC 2008).

The following provides a strategic commitment for the rehabilitation of the subject area to support Local Structure Plan 64.

Vision

The overall vision for the WMRS, and subsequent WMPs, is to provide a greater understanding of all the impacts and threats to wetland functions, attributes and values of Wallubuenup Swamp and to provide a detailed management approach for the restoration of the wetland and buffer area. The restoration and management of the wetland and buffer will aim to improve the level of ecological function of the wetland and interface (buffer) area both within and adjacent to the management area.

Objectives

Ensure consistency in delivery of the overall wetland management and restoration outcomes across the individual landholdings as envisaged during the structure planning process for the entire wetland and wetland buffer area.

Provide a greater understanding of all functions, attributes and values of the wetland through a robust and consistent assessment process.

Provide for restoration and rehabilitation of the wetland and associated buffer to improve the level of ecological function.

Provide for an increase in bushland connectivity within the wetland and wetland buffer areas with the remainder of the Yellagonga Regional Park.

Promote recreational interaction and environmental awareness within the management area while protecting the local environment from adverse human disturbance impacts.

Provide for a decrease in all weed species within the management area to a point where they are not adversely affecting planted and established native vegetation.

Provide for consultation with the COW and the DEC in the rehabilitation of Wallubuenup Swamp adjacent to SP64.

Wetland Rehabilitation

Management Zones

The rehabilitation area will divided into two different management zones which are shown in **Figure 7**. These zones will indentify which agency will assume management of these areas once the completion criterion has been met at the end of the monitoring and maintenance period. The delineation boundary of these zones will be defined by the dual use path, with all areas to the west of the path falling under the management of the DEC and the areas to the east of the path (including the dual use path) under the CoW.

The dual use path is to be located approximately 5 metres to the east of the wetland boundary which will also delineate the wetland and dryland plant communities. The exact alignment of this path will be determined by actual flooding levels of the wetland, access to active POS areas, access to the development and passive surveillance of the path from the development. Communication between the landholder, the CoW and the DEC should be undertaken before the installation of the path to ensure these particular aspects are taken into account.

Management Strategies

The Wetland Interface and Landscape Masterplan (**Figure 6**) provides a strategic plan for the rehabilitation of Wallubuenup Swamp within and adjacent to the Woodvale Structure Plan area.

Specific management strategies, in addition to the requirements of *Guidelines Checklist for Producing a Wetland Management Plan* (DEC 2008) and the *Yellagonga Regional Park Management Plan 2003-2013*, which are to be undertaken in the development of a WMP are set out in **Table 1**.

The implementation of the WMP would be separated into three different stages:

- The first stage would be a weed control program which would be undertaken for one year before any revegetation works and then throughout the maintenance period where needed;
- The second stage would be the revegetation program which would involve the installation of seedlings, fertilizer and access control fencing in the revegetation areas (which would take place in winter to spring); and
- The third stage of the program would be a three year maintenance and monitoring program which would commence after the initial revegetation program has been completed. This program would aim to maintain the revegetation areas and report on the success of revegetation activities required for signoff under the subdivision applications.

Weed Control

Weed control within the rehabilitation areas should be dealt with in the following manner:

- Identify and map the intensity of weed species in the management areas;
- Develop a weed control program to eradicate or significantly control the presence of weed species (including woody weeds), consistent with the Yellagonga Regional Park Weed Control and Revegetation Plan;
- Spraying of weeds to be undertaken 12 months prior to planting program at times that will minimize seed set for the following seasons. Only herbicides such as Roundup Bio-active should be used in and near the wetland to reduce the impacts of herbicide on sensitive animal species such as frogs;
- Develop and implement management actions, including techniques and maintenance requirements to minimise and manage reinfestation of rehabilitated areas; and

- Targeted weed control should be undertaken prior to and after planting, as required, where weed species comprise more than 20% ground cover and should continue for the three year maintenance period.

Revegetation

Revegetation activities required to be undertaken within the rehabilitation areas both within the wetland and within the associated buffer areas should be addressed in the following ways:

- Develop and implement rehabilitation strategies to establish native plant communities that are self sustaining and that approach the density, diversity and species richness of the communities that would likely have existed before clearing for agricultural purposes;
- Rehabilitation work is to be planned and implemented by a suitably qualified and experienced rehabilitation specialist/contractor;
- Establish a mix of *Melaleuca rhaphiophylla/Eucalyptus rudis* forest community in dryland areas of the buffer;
- Establish a *Baumea articulata/Schoenoplectus validus* sedgeland community and *Melaleuca rhaphiophylla* open forest community within the wetland areas of the buffer; and
- Species used to establish the plant communities need to be consistent with the Yellagonga Regional Park Weed Control and Revegetation Plan (Regeneration Technology Pty Ltd 2002). A list of appropriate species is provided in **Appendix C.**

<u>Revegetation techniques:</u>

- Planting of tubestock should be the primary means of revegetation;
- Tubestock should preferably be sourced from the nursery of Friends of Yellagonga or alternatively any NIASA accredited nurseries;
- Rehabilitation may also use direct seeding in areas that are relatively free of weeds. Seed should preferably be collected from within the park or from the surrounding region by a suitable qualified and licensed seed collection contractor. Relevant seed germination treatment techniques such as smoking and scarification should be applied to the seed where required;
- Any mulch applied should be 'Biowise' (or approved equivalent), which is certified as being weed and pathogen (dieback) free;
- Opportunities for maintaining views across Wallubuenup Swamp should be considered in the development of the WMP; and
- The DEC should be consulted during the development of the detailed WMP.

<u>Suggested revegetation densities:</u>

To meet the rehabilitation completion criteria stated below, the following revegetation densities are suggested:

- *Melaleuca rhaphiophylla/Eucalyptus rudis* forest communities be planted to a density of 1 plant per m^2;
- *Melaleuca rhaphiophylla* open forest communities be planted to a density of 4 to 6 plant per $10m^2$ for shrub and tree species (ie *Melaleuca rhaphiophylla*) and 5 to 8 plants per m^2 for rush and sedge species; and
- *Baumea articulata/Schoenoplectus validus* sedgeland community be planted to a density of 6 to 8 plants per m^2.

Suggested plant community installation locations:

- *Melaleuca rhaphiophylla/Eucalyptus rudis* forest communities (Dryland) should be installed in dryland areas of the wetland buffer, which are not inundated with water or heavily waterlogged for any time of the year;
- *Melaleuca rhaphiophylla* open forest community (Transitional) should be installed between the wetland and dryland areas of the buffer zone. A site assessment would need to be undertaken to identify accurate community boundary locations to reduce the likelihood of installing in unsuitable areas; and
- *Baumea articulata/Schoenoplectus validus* sedgeland community (Wetland) should be only installed in areas of the wetland which are inundated with water for part or all of the year.

Contamination

Develop, and implement, a soil remediation program, to remediate (if applicable) any contaminated soils within SP64 development area in accordance with the requirements of the *Contaminated Sites Act 2003*, as part of the subdivision approval and condition clearing process.

Contours

In association with the Local Water Management Strategy and Urban Water Management Plans for SP64, provide for appropriate re-contouring of ground levels to manage altered topography in the development area. Any fill material that is brought onto site for the use in re-contouring work, must be free of pathogens (ie. Dieback), weeds and other contaminants.

Access Control

Provide for access control fencing, consistent with the CoW specification for conservation style fencing, Standard Drawing TS01-7, to act as a barrier to recreational users adversely affecting wetland rehabilitation consistent with **Figure 9** – Access Controlled Fencing Locations. Revegetation should be set back at least three metres from both sides of the dual use path to reduce maintenance from overhanging tree branches, increase fire protection mesures and increase visual surveillance of the area.

Monitoring

Develop a rehabilitation monitoring and reporting program to assess plant survival, condition and weed cover. Monitoring should occur twice per year for the entire three year monitoring period at the end of summer and in mid-winter to evaluate weed control maintenance requirements. Reporting of monitoring results is to be provided in report form to the CoW.

Timings and Priorities

Develop a schedule that outlines the proposed timing for all works associated with the implementation of WMPs. Consult with the DEC, Water Corporation and other adjacent landholders to stage revegetation and weed control works especially for the removal of *Typha*.

Performance Criteria

There are set performance criteria that will enable the evaluation of rehabilitation works that are divided up into the areas of the dryland and wetland buffers. Compliance of the criteria set down should be met following the end of the three year maintenance and monitoring period. If these criteria are not met then remedial work would be required to be undertaken till such time there is an agreement of completion from the CoW and DEC regarding their respective management zones.

The rehabilitation performance criteria are stated as follows:

Dryland revegetation areas:

- All woody weeds are to be removed from site;
- Weeds are effectively controlled with weed species comprising less than 20% of the groundcover;
- A stable *Melaleuca rhaphiophylla/Eucalyptus rudis* forest community has been established with the following characteristics:
  - All species used in the rehabilitation works (listed in **Appendix C**) are represented at the site; and
  - Plants are established at a rate of 0.75 per m^2 and have a diversity of at least 4 species per 10 m^2 over at least 70% of the area planted.

Wetland revegetation areas:

- Weeds are effectively controlled with weed species comprising less than 20% of the groundcover;
- A stable *Baumea articulata/Schoenoplectus validus* sedgeland community has been established with the following characteristics:
  - Both species used in the rehabilitation works (listed in **Appendix C**) are represented at the site;
  - Plants are established to an average projective foliage cover of 75% and/or at a minimum rate of 6 plants per m^2 and both species are present over at least 70% of the area planted;
- A stable *Melaleuca rhaphiophylla* open forest community has been established with the following characteristics:
  - All species used in the rehabilitation works (listed in **Appendix C**) are represented at the site;
  - Rush/sedge species are established with an average projective foliage cover of 50% and/or at a rate of 5 plants per m^2 and have a diversity of at least 4 species per 10 m^2 over at least 70% of the area planted;
  - *Melaleuca rhaphiophylla* plants are established at a rate of 4 per 10 m^2 over at least 70% of the area planted;

If for any reason that the rehabilitation performance completion criteria are not met for one or more areas, then the rehabilitation program should be to the satisfaction of the CoW and the DEC.

Roles and Responsibilities

The overall responsibility for the production of the WMP, implementing proposed works, and the subsequent three-year maintenance and monitoring period (of the wetland and associated buffer areas) will ultimately lie with individual landholders. Specific roles for individual contractors, supervisors, superintendents and the like should be provided within the WMP.

Recreational Activation

Management Strategies

The Wetland Interface and Landscape Masterplan (**Figure 6**), provides a strategic plan for recreation adjacent to Wallubuenup Swamp. The provision of recreational facilities shall be in accordance with the Masterplan (**Figure 6**).

Specific strategies to provide and manage recreation to be undertaken in the development of the WMP are set out in **Table 1**. Plates illustrating the type of recreational facilities expected within the area are set out in **Appendix 2**.

Table 1: Key strategies to activate wetland buffer for recreational use.

Fencing	Install conservation style fencing in accordance with CoW Standard Drawing TS01-7 to restrict access in accordance with locations depicted on **Figure 9.**
Dual Use Path	Install dual use paths through the rehabilitation area, as guided by the locations identified on **Figure 6** and the Structure Plan. Where possible the path should be located five metres from the mapped wetland boundary, varied as required by the Structure plan to achieve passive surveillance and integrate with active open space areas.
	Ensure all constructed access paths are consistent with the existing paths in the Yellagonga Regional Park***** and Australian Standards, in particular: • Dual use paths – Austroads Part 14 (bicycles), AS 1742, AS2809.3, AS2156.1, and AS2156.2; and • Wetland boardwalks – AS1170.1 and AS2156.2.
Active areas	Provide two active recreational areas depicted by **Figure 6 and 9**, to be a minimum distance of 20m from the mapped wetland boundary, one of which to be a minimum size of 25m by 50m.
Timing and priority	Provide a detailed schedule for proposed works associated with recreational infrastructure, and how works shall be integrated with the wetland rehabilitation and management.

*****: - The dual use paths that are to be installed within the Yellagonga Regional Park are to be asphalt sealed (30mm compacted), 2.4 metres wide and coloured red using a crushed granite aggregate with 2% red oxide intrinsic colouring. There is to be a 3 metre wide, 75mm crushed limestone base providing two 300mm limestone shoulders on each side of the asphalt path. The subgrade is to be boxed out to a depth of 200mm.

Roles and Responsibilities

The management responsibilities for the recreational use of the areas adjacent to the wetland area and within the buffer will lie with the landholder/developer during the rehabilitation, maintenance and monitoring period. The WMP should outline specific roles and responsibilities for individual contractors, supervisors, superintendent and the like.

Recreational and revegetation areas shall revert to the management of the authority in which the reserve is vested after the three year maintenance and monitoring period. Modified management zones, as recommended by **Figure 7**, will be negotiated and coordinated by the DEC and CoW at that time

Wetland Management

Management Strategies

Ongoing management of Wallubuenup Swamp and its buffer is essential to achieve an environmental benefit and secure offset proposals.

Key management strategies, in addition to the requirements of *Guidelines Checklist for Producing a Wetland Management Plan* (DEC 2008), to be undertaken in the development of the WMP are set out in **Table 2**.

Table 2: Specific strategies for monitoring and maintenance.

Monitoring	Monitoring requirements are stated above in the Wetland Rehabilitation section.
Maintenance	Provide details for a three-year period of maintenance following the initial revegetation and rehabilitation works proposed. This shall include the maintenance of all works in the rehabilitation areas, including additional weed control, replacement planting, fire management, and infrastructure.
	Develop a schedule for the works associated with the monitoring and maintenance program for the management areas.
Timing and priority	Provide a detailed schedule for maintenance works for within the three year maintenance period, and an annual schedule of works for ongoing maintenance for the time thereafter.

Roles and Responsibilities

The short-term management responsibility for the wetland and buffer areas will lie with the individual landholders within SP64. Implementation roles for individual contractors, supervisors, superintendents and the like should be provided within the WMP.

The location of the dual use path is recommended to define the future management zones, with all areas located to the west to be vested with the DEC and all areas to the east (including the dual use path) with the CoW (**Figure 7**). Upon meeting the completion criteria following the rehabilitation program and three year monitoring and maintenance period, consultation with the CoW and the DEC would determine the manner in which this management handover should occur.

Wetland Offsets Package

As part of the structure planning process, a wetland management package was formulated as an "offset" for the rationalisation of the wetland buffer distance. The overall principle of the package is that works to be undertaken within and adjacent to the structure plan area would improve the ecological values of the wetland. The package would create a better environmental outcome than simply providing a generic 50-metre separation distance from the existing Conservation Category wetland boundary. **Table 3** details the areas of wetland and wetland buffers that will be revegetated, which is illustrated in **Figure 6, 8 and 9**.

Each WMP must address the area outside the SP64 area (and individual lot areas) that are part of the overall offset package and comply with all relevant commitments made in the offsets package as described within **Table 3** as well as all other requirements/commitments contained within this strategy. Each WMP shall provide a detailed schedule for the timing of the offsets works, with rehabilitation works undertaken as early as possible in the development process.

Securing Offsets Works

Given that works will be undertaken as part of a subdivision approval process, it is envisaged that the preparation of the WMP and the implementation of associated works will be conditional on the subdivision approval. Each WMP should provide details of the works program in relation to the expected issue of individual lot titles, and outline how works undertaken after the issue of title would be secured (for example bonded with the CoW).

Each WMP shall provide details of how the full suite of offset works, particularly those outside lot boundaries, will be secured.

Table 3: Offset details to support rationalisation of wetland buffer width.

Direct Offsets	Rehabilitate the wetland and associated wetland buffer both within and adjacent to the SP64 area, up to the most westerly point of either the structure plan boundary plus a 20 metre wetland rehabilitation strip or the Conservation Category wetland boundary plus a 20 metre wetland rehabilitation strip.	
	Undertake a weed control program to address weed infestation both within and adjacent to the wetland and buffer area.	
	Install access control fencing around the rehabilitation areas in the wetland and wetland buffer.	
Indirect Offsets	Promote community awareness and provide an education program for the wetland values and restoration process.	
	Install interpretive signage to contribute to education and awareness of the wetland in consultation with all other landowners and DEC.	
	Encourage involvement and support from local community groups in the restoration programs, including facilitated establishment of a "Friends of" group for the Wallubuenup Swamp or promoted participation in the Friends of Yellagonga group to provide additional maintenance of rehabilitation works.	
	Undertake a three year monitoring and maintenance program for the wetland and wetland buffer rehabilitation areas.	
Offset Area	Area of passive POS (revegetation areas to the east of the dual use path) adjacent to the wetland to be rehabilitated.	2.24 ha
	Area of wetland to be directly impacted by development.	0 ha
	Area of wetland vegetation cleared through future development.	0 ha
	Area of wetland outside LSP to be rehabilitated (proposed 20 metre strip).	3.70 ha
	Area of wetland buffer outside LSP area to be rehabilitated.	1.68 ha
	Total area of wetland buffer to be rehabilitated.	5.82 ha
	Total area inside the wetland to be rehabilitated	4.14 ha

References

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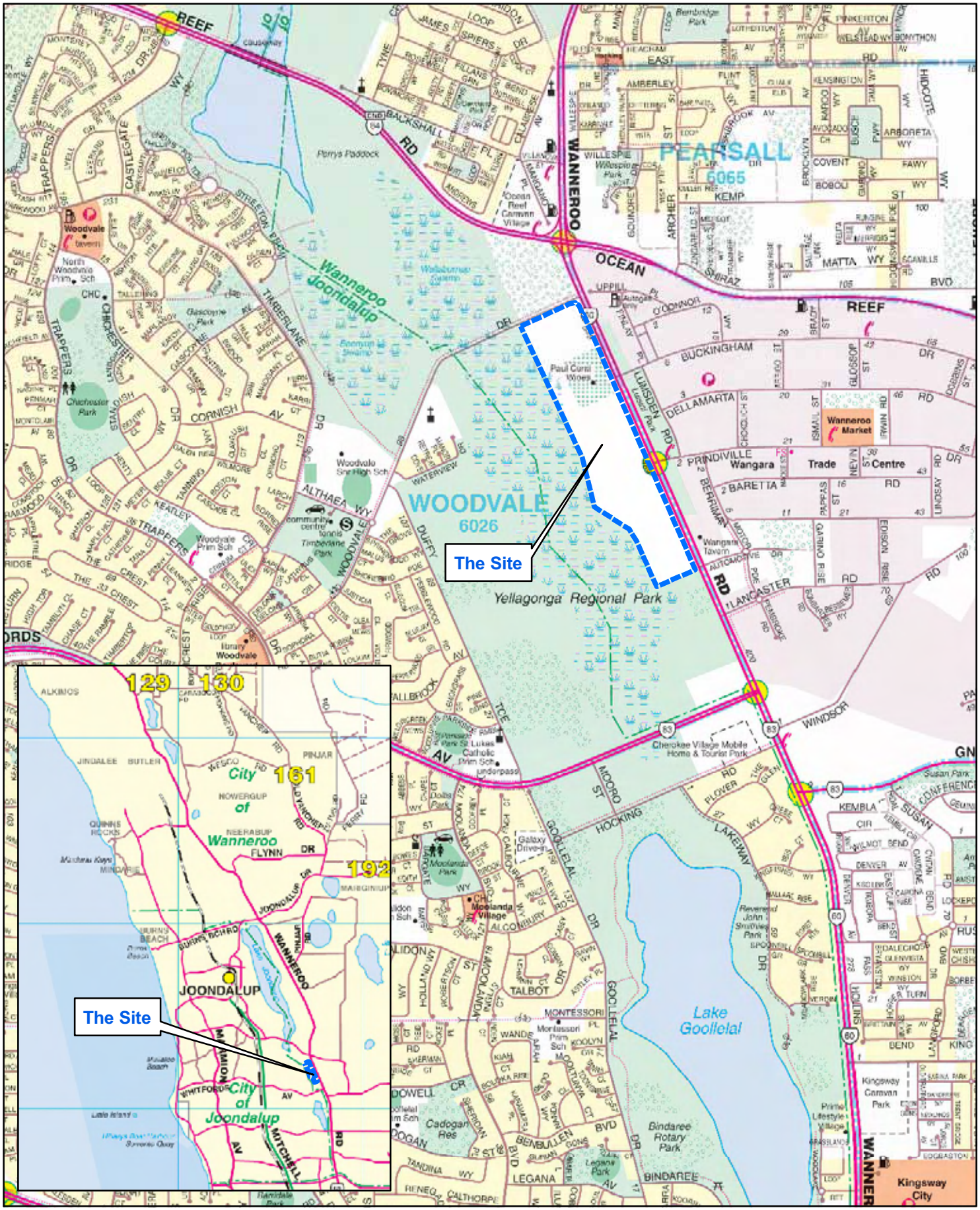
Figures



DATE	No.	ACTIVITY - REVISION DESCRIPTION	DES	DRN	CHK'D	APPD

DATE	No.	ACTIVITY - REVISION DESCRIPTION	DES	DRN	CHK'D	APPD

Cardno

CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS

Cardno Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904

Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Scale: 1:20,000

0 200 400 800 1,200 1,600 2,000 Metres

PROJECT Woodvale - Wetlands Revegetation Management Plan

DRAWING TITLE FIGURE 1 : Locality Plan

PRINCIPAL Watson Property Group Northern Aspect Ltd

Project Number V7016

Original A4

Drawing Number SK01

Revision

Designed MF

Checked

Drawn MGW

Approved

Local Authority City of Joondalup

Sheet 1 of 1

Date 26/02/09

DATE	No.	ACTIVITY - REVISION DESCRIPTION	DES	DRN	CHK'D	APPD

DATE	No.	ACTIVITY - REVISION DESCRIPTION	DES	DRN	CHK'D	APPD

Cardno

CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS

Cardno Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904

Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Scale: 1:3,500

0 50 100 200 300 400 500 Metres

PROJECT Woodvale Wetland Revegetation Management Plan

DRAWING TITLE FIGURE 2: Management & Wetland Boundaries

PRINCIPAL Watson Property Group Northern Aspect Ltd

Project Number V7016

Original A3

Drawing Number SK02

Revision

Designed MF Checked

Drawn MGW Approved

Local Authority City of Joondalup

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CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS

Cardno Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904

Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Scale: **1:3,500**

0 50 100 200 300 400 500 Metres

PROJECT **Woodvale Wetland Revegetation Management Plan**

DRAWING TITLE **FIGURE 3: Plant Communities**

PRINCIPAL **Watson Property Group Northern Aspect Ltd**

Project Number **V7016**

Original **A3**

Drawing Number **SK03**

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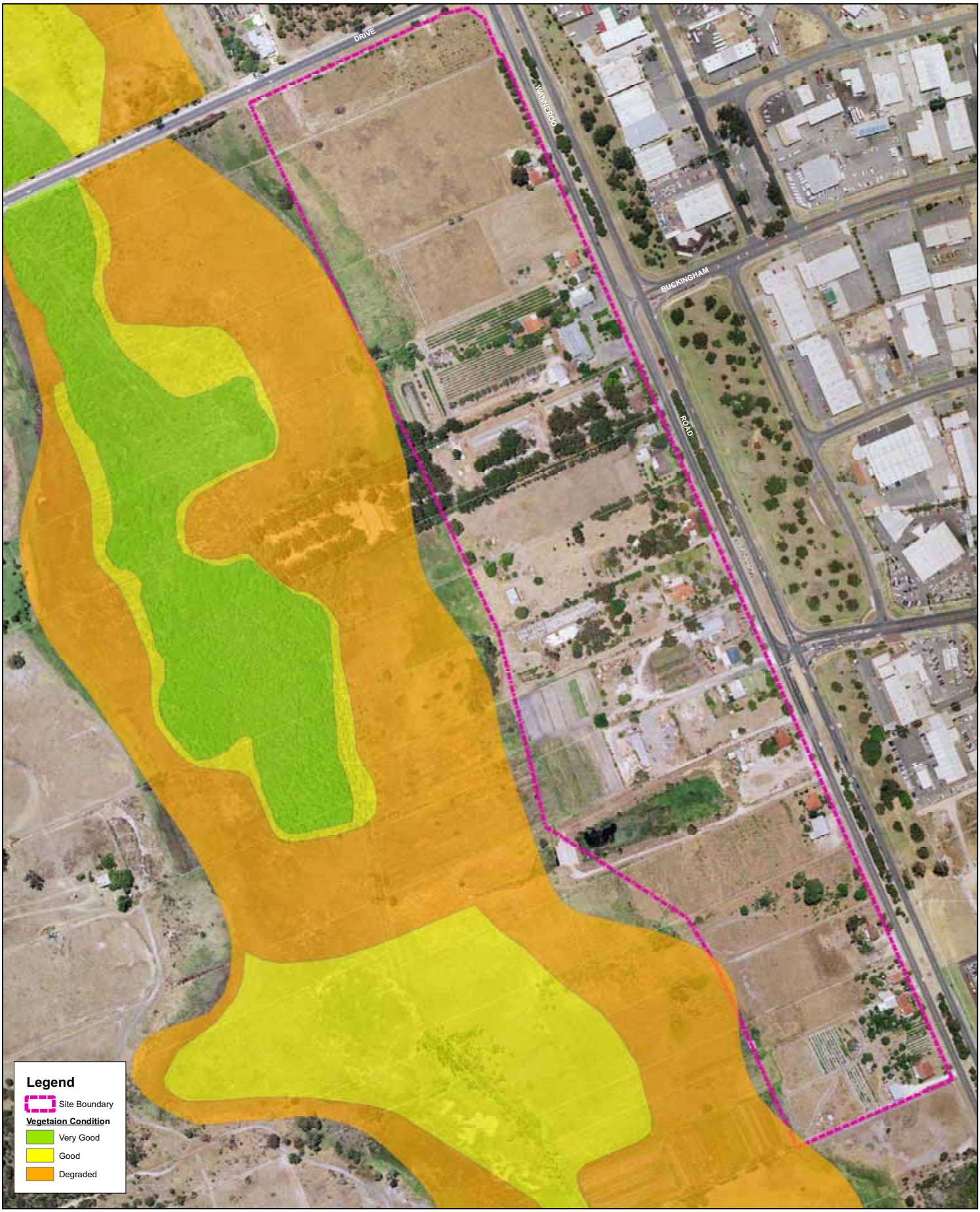

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ENVIRONMENTAL CONSULTANTS

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P.O. Box 155 Subiaco
Western Australia 6904

Telephone (08) 9273 3888
Facsimile (08) 9388 3831

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PROJECT **Woodvale Wetland Revegetation Management Plan**

DRAWING TITLE **FIGURE 4: Vegetation Condition**

PRINCIPAL **Watson Property Group Northern Aspect Ltd**

Project Number **V7016**

Original **A3**

Drawing Number **SK04**

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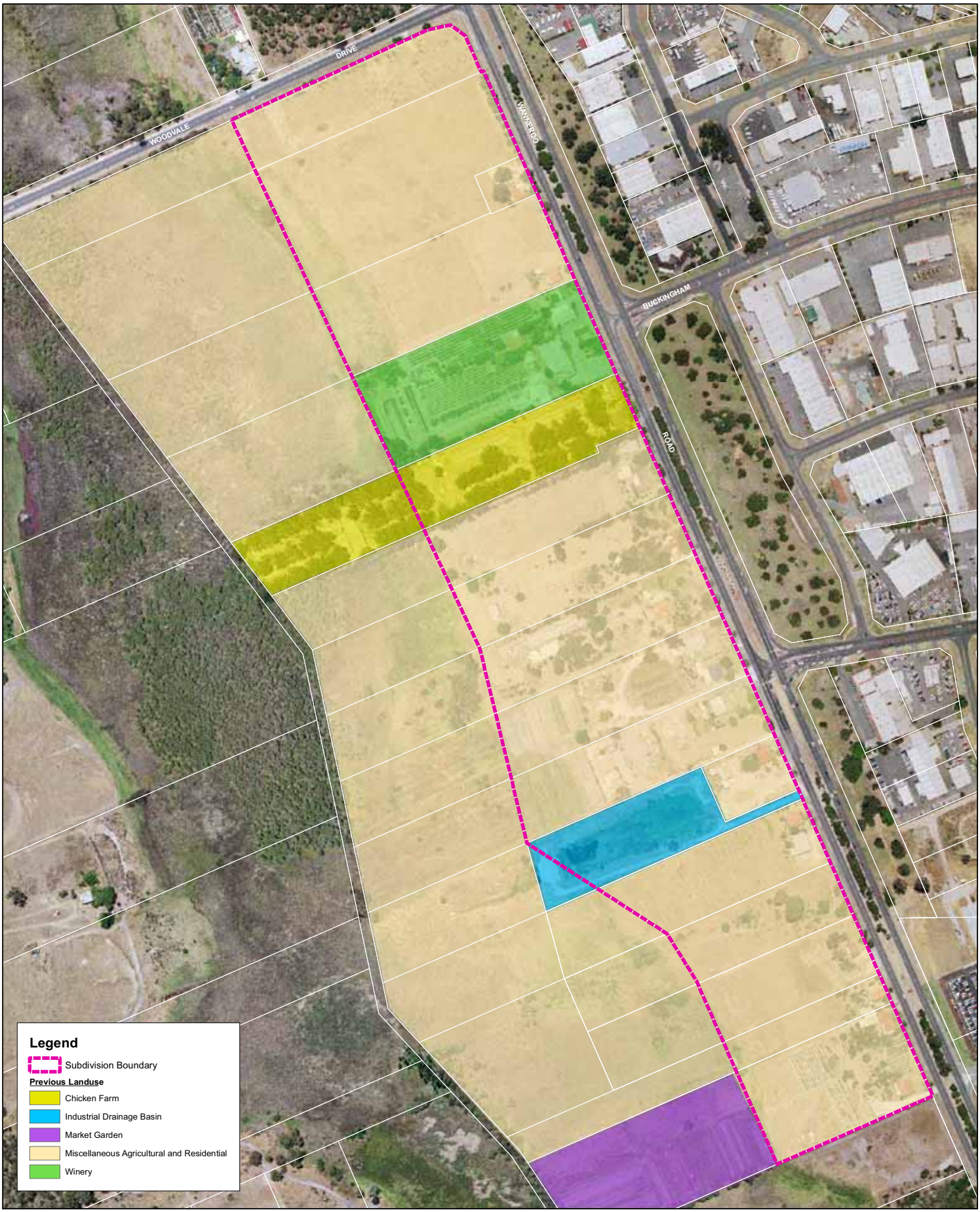

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P.O. Box 155 Subiaco
Western Australia 6904

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PROJECT **Woodvale Wetland Revegetation Management Plan**

DRAWING TITLE **FIGURE 5: Previous Landuse**

PRINCIPAL **Watson Property Group Northern Aspect Ltd**

Project Number **V7016**

Original **A3**

Drawing Number **SK05**

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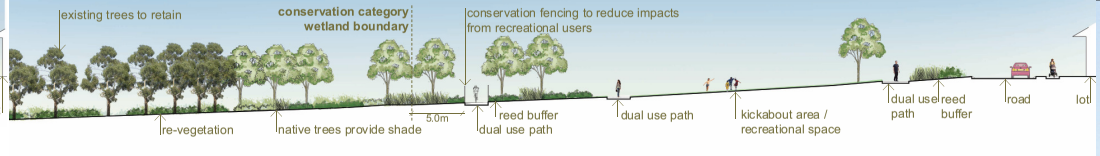


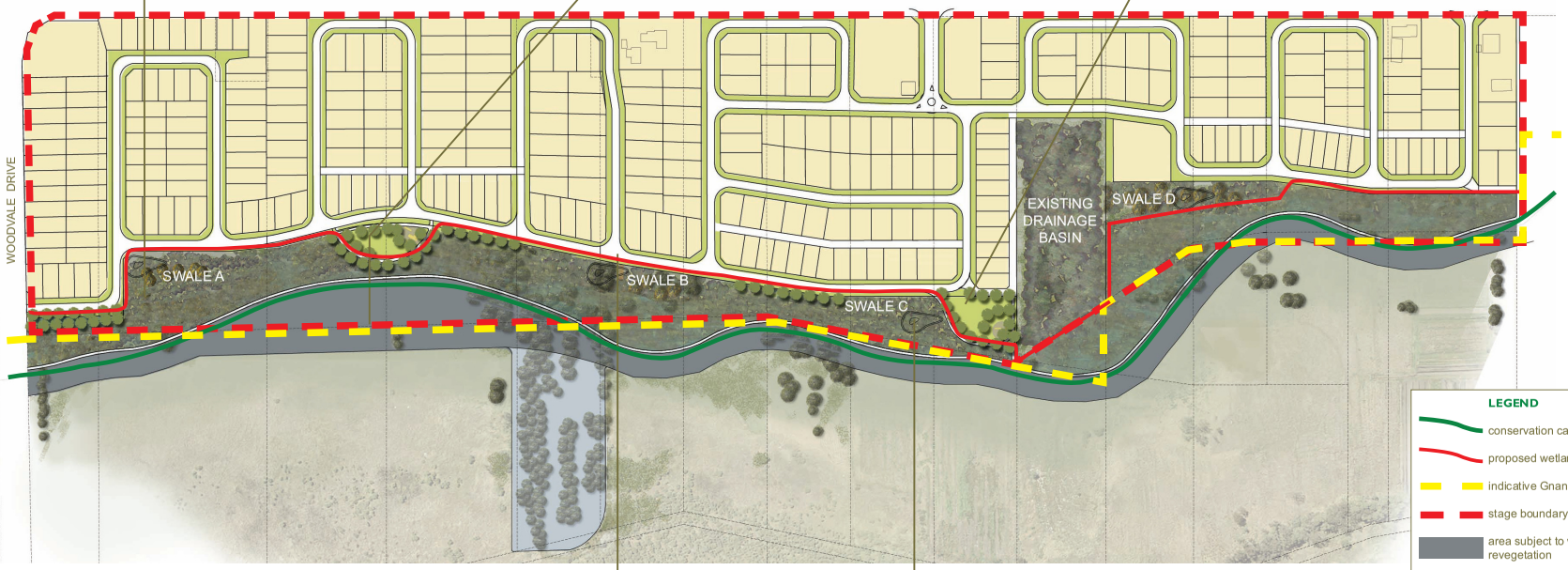
B typical section - kickabout /recreational space
1:500 @ A3

A typical section - swale A - planted swale option
1:500 @ A3

passive recreational space
- A community park.
- Used for informal recreation, and safe public use.
- Opportunity for a playground.
- Intimate kick-about area, seating, shade,
- Barbecue & picnic area
- Mixture of soft & hardscape treatments.
- Semi-formal layout - winding paths.

re-vegetation

re-vegetation of wetland species

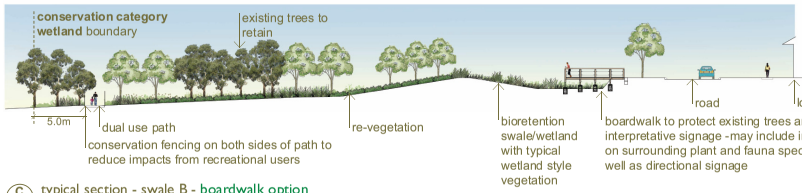


LEGEND
- conservation category wetland
- proposed wetland buffer
- indicative Gnangara main sewer
- stage boundary
- area subject to wetland rehabilitation / revegetation
- area subject to dryland rehabilitation/ revegetation
- area subject to rehabilitation and contamination investigation / remediation by Water Corporation
- existing trees / vegetation

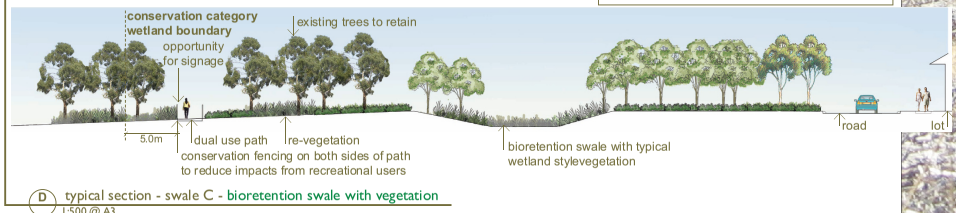
NOTE:
All trees in sections are shown at 2/3 of their mature tree size.

boardwalk to be constructed of steel/aluminium or recycled wood

conservation fencing



C typical section - swale B - boardwalk option
1:500 @ A3
- Retains existing Eucalyptus and Melaleuca trees.
- Re-vegetate wetland plant species
- Will retain existing native endemic species.



D typical section - swale C - bioretention swale with vegetation
1:500 @ A3

NTS

FIGURE 6

wetland interface & landscape masterplan
august 2009

structure plan 64

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Cardno Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904

Telephone (08) 9273 3888
Facsimile (08) 9388 3831

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PROJECT **Woodvale Wetland Revegetation Management Plan**

DRAWING TITLE **FIGURE 7: Recommended Indicative Future Management Zones**

PRINCIPAL **Watson Property Group Northern Aspect Ltd**

Project Number **V7016**

Original **A3**

Drawing Number **SK07**

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ENVIRONMENTAL CONSULTANTS

Cardno Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904

Telephone (08) 9273 3888
Facsimile (08) 9388 3831

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PROJECT **Woodvale Wetland Revegetation Management Plan**

DRAWING TITLE **FIGURE 8: Revegetation**

PRINCIPAL **Watson Property Group Northern Aspect Ltd**

Project Number **V7016**

Original **A3**

Drawing Number **SK08**

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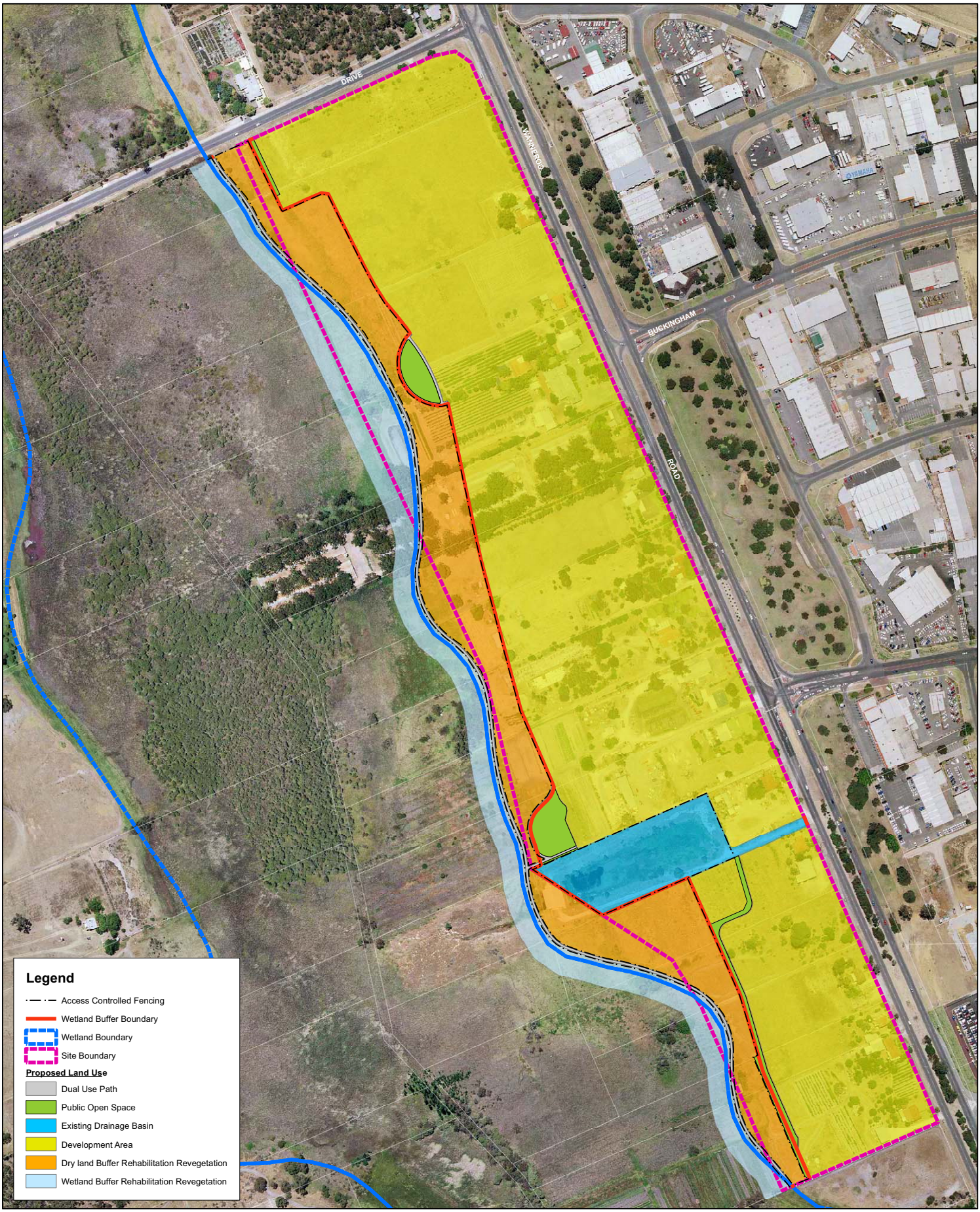

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Western Australia 6904

Telephone (08) 9273 3888
Facsimile (08) 9388 3831

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PROJECT **Woodvale Wetland Revegetation Management Plan**

DRAWING TITLE **FIGURE 9: Access Controlled Fencing Locations**

PRINCIPAL **Watson Property Group Northern Aspect Ltd**

Project Number **V7016**

Original **A3**

Drawing Number **SK09**

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Appendix A: Key Information Sources and Guidelines

Detail regarding the existing environment of Wallubuenup Swamp is available within:

- Cardno (2006). *Wetland Boundary Review and Management Category Re-evaluation – Wetland 8168 Woodvale.* Prepared for Watson Property Group Northern Aspects Ltd;
- Cardno (2009). *Woodvale LSP 64 – Local Water Management Strategy*. Prepared for Watson Property Group Northern Aspects Ltd; and
- Local Structure Plan No. 64 – Part 2 Explanatory Report.

General information regarding the Yellagonga Regional Park and its catchment is available within:

- Yellagonga Integrated Catchment Management Plan – Part 1 Technical Report (City of Wanneroo and City of Joondalup); and
- Yellagonga Regional Park Management Plan 2003-2013 (Department of Environment and Conservation).

Information on the requirements of a wetland management plan is provided by *Guidelines Checklist for Producing a Wetland Management Plan* (DEC 2008). Specific guidance for rehabilitation within and adjacent to Yellagonga Regional Park is available within the *Yellagonga Regional Park Weed Control and Revegetation Plan*. Any WMR Plan prepared within SP64 should be consistent with these documents (as amended) and will be required to address each section to a standard suitable (i.e. to the satisfaction of the DEC and the City of Wanneroo) for clearance of the relevant subdivision conditions.

WMR Plans shall be developed in consideration of the above information sources. Further information and surveys may be required in the development of WMR Plans to meet the requirements of wetland management plans. This is likely to include:

- Detailed site investigations undertaken to support subdivision process, as detailed by Structure Plan No. 64;
- Weed and vegetation survey; and
- Level 1 fauna survey.

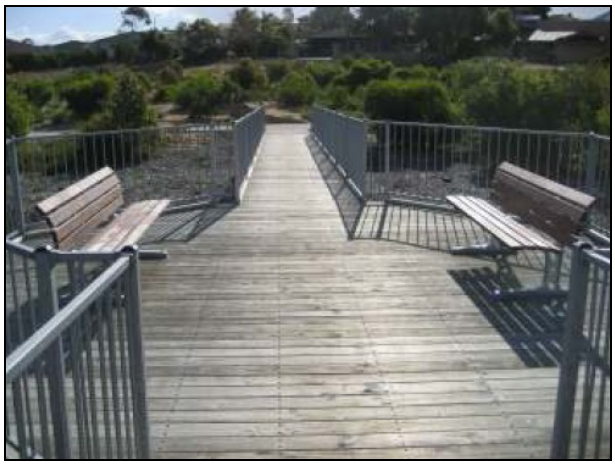
Appendix B: Examples of Recreational Infrastructure

Conservation Style Fencing



Dual Use Path

Wetland Boardwalks/Lookouts




Appendix C: Examples of Species List for Revegetation

Community Type	Species Name	Common Name	Family	Growth Form
***Baumea articulata/ Schoenoplectus validus* Sedgeland**				
	Baumea articulata	Jointed Twig Rush	Cyperaceae	Rush or Sedge
	Schoenoplectus validus	Lake Club Sedge	Cyperaceae	Rush or Sedge
***Melaleuca rhaphiophylla* Open Forest**				
	Baumea juncea	Bare Twig Rush	Cyperaceae	Rush or Sedge
	Baumea preissii	Broad Twig Rush	Cyperaceae	Rush or Sedge
	Baumea vaginalis	Sheath Twig Rush	Cyperaceae	Rush or Sedge
	Bolboschoenus caldwellii	Marsh Club Rush	Cyperaceae	Rush or Sedge
	Carex appressa	Tall Sedge	Cyperaceae	Rush or Sedge
	Carex fasicularis	Tassel Sedge	Cyperaceae	Rush or Sedge
	Carex inversa	Knob Sedge	Cyperaceae	Rush or Sedge
	Melaleuca rhaphiophylla	Swamp Paperbark	Myrtaceae	Shrub or Tree
***Melaleuca rhaphiophylla/ Eucalyptus rudis* Forest**				
	Banksia littoralis	Swamp Banksia	Proteaceae	Shrub or Tree
	Eucalyptus rudis	Flooded Gum	Myrtaceae	Shrub or Tree
	Melaleuca rhaphiophylla	Swamp Paperbark	Myrtaceae	Shrub or Tree
	Melaleuca teretifolia	Marsh Honey Myrtle	Myrtaceae	Shrub or Tree
	Melaleuca thymoides		Myrtaceae	Shrub or Tree
	Rhagodia baccata		Chenopodiaceae	Shrub or Tree
	Viminaria juncea	Swishbush	Papilionaceae	Shrub or Tree