

Technical Paper 5

Landscape and Visual

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Transport Infrastructure
Development Corporation

South West Rail Link Glenfield to Leppington Rail Line

Landscape & Visual Assessment Report

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Executive Summary

To achieve the project brief for a "world class public transport product", the integration of the Glenfield to Leppington Rail Line, into the existing and future environment must be carefully assessed and mitigation measures addressed. Landscape and Urban Design is crucial to this integration.

The Glenfield to Leppington Rail Line (The Project) is a proposed new approximately 11km passenger rail link from Glenfield to Leppington, within the South West Growth Centre (SWGEC), located in Sydney's South West, between Liverpool and Campbelltown. This study investigates the visual and landscape impacts of the proposal; in the context of both the existing landscape and future landscapes.

An assessment of the existing conditions has been carried out and identifies:

- A rolling topography, creating substantial cutting and embankments with varied visual impacts;
- Existing vegetation that consists of Cumberland Plain Shale Hill Woodland, Cumberland Plain Shale Plains Woodland, Alluvial Woodland and disturbed areas featuring scattered trees. This vegetation serves to substantially decrease the visual catchment of the project, in selected areas;
- Existing landuse of predominantly rural residential and market gardens, that again serve to reduce the visual catchment of the project;
- Future landuse that would substantially change the character of the SWGEC and reduce the visual impact of the proposal; and
- Heritage items, particularly Macquarie Field House, whose open views are to be retained.

A detailed visual analysis has identified that, within the existing landscape framework of South West Sydney, the project would have a relatively small visual catchment area due to existing vegetation and the rolling topography of the proposal area. However areas, have been identified where the project proposals would have a high visual impact, when viewed within the existing landscape framework. In particular these are;

- Campbelltown Road Crossing;
- Forest Lawn Memorial Gardens Cemetery;
- Camden Valley Way; and
- Cowpasture Road.

The analysis also identified areas of high visual impact that must be assessed within the known framework of proposed landuse, including the new town centres of Edmondson Park and Leppington. Here, the visual impact of the project is countered by the role it would play in encouraging the growth of these proposed town centres, and the proposed density of housing and commercial uses surrounding the rail corridor.

Mitigation measures through Landscape and Urban Design are recommended, these include;

- Planting of rail embankments with dense screening vegetation;
- Use of mounding and low barriers to mitigate noise impact;
- Careful design of urban structures, such as bridges and retaining walls, in order that there is integration into existing and future land use, and a unique project identity is created; and
- Detailed station precinct planning to create integration into proposed town centres.

The intent of this report is not to suggest that the project be visually "hidden" through the creation of thick vegetated screens, but instead, to appreciate the value of glimpsed views of a rail line within the landscape setting. Views would be opened up to the corridor at key locations and within proposed high density town centres.

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In conclusion, through visual analysis and landscape recommendations, this report identifies areas of the project that require mitigation measures to reduce the visual impact. The report proposes a landscape concept that indicates areas requiring dense visual screen planting, along with those areas that should remain open to views both in and out of the project. The report summarises much of the master planning work that has been carried out in order that there is integration of the station and transport interchanges into the future environments of Leppington and Edmondson Park.

1. Introduction

1.1 Background

On 9 June 2005, the New South Wales (NSW) Government announced it would develop the South West Rail Link (SWRL) as part of the then Metropolitan Rail Expansion Programme (MREP). In October 2008, the NSW Minister for Transport announced that the SWRL would be delivered in stages to match population growth in the area. The announcement included a direction to proceed with the Glenfield Transport Interchange. In November 2009, the NSW government directed TIDC to resume the Glenfield to Leppington Rail Line.

The Environmental Assessment (EA) has been prepared to satisfy assessment and project approval requirements for the SWRL Stage B2 works (which are hereafter referred to as the Glenfield to Leppington Rail Line or the project) under Part 3A of the EP&A Act. This report is part of the EA.

Importantly, the SWRL (shown in Figure 1-1) is being delivered as a two-stage process, comprising:

- Glenfield Transport Interchange — delivery of all components associated with the Stage A and Stage B1 works as defined in the Concept Plan, as well as additional early works approved under Part 5 of the EP&A Act (in separate Review of Environmental Factors reports); and
- Glenfield to Leppington Rail Line — delivery of all components associated with the project. This stage of the work is the subject of this report and the EA.

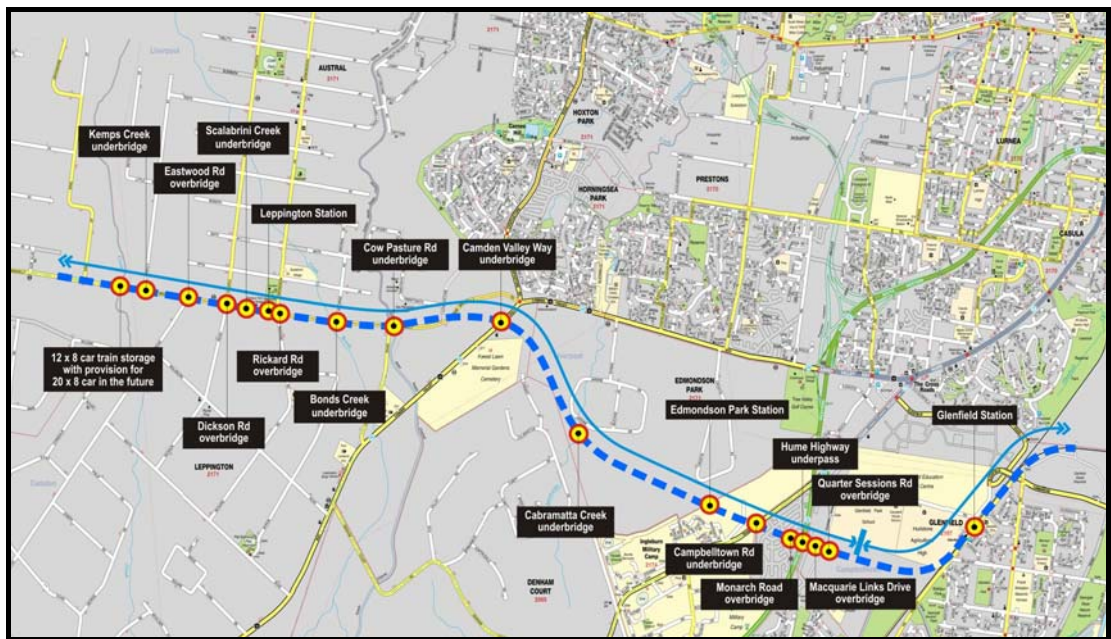


Figure 1.1: South West Rail Link

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1.2 Context

The design of the project has been split into a number of Technical Advisor Packages, with Aurecon AECOM Joint Venture engaged to undertake the following:

- PSC1374 Technical Advisor for Engineering, Rail Systems, Architecture and Urban Design Services.

The design of the PSC1374 project has been split into a number of stages, these stages are:

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1. Stage A – Project Options Report (Review of Previous Concept Design);
2. Stage B – Pre-Concept Design;
3. Stage C – Concept Design; and
4. Stage D – Reference Design and Contract Documentation.

The Aurecon AECOM Joint Venture (AA) has been commissioned to undertake the Phase 1 Services comprising Stage A, Stage B & Stage C, and with TIDC approval, Phase 2 Services Stage D. With reference to the Services Brief for PSC1374, these are described as follows:

Phase 1 Services

Phase 1 Services comprises of Stage A – Project Options Report, Stage B – Pre-Concept Design and Stage C – Concept Design. With reference to the Services Brief, these are described as follows:

1. Stage A – Project Options Report

The objective of the Stage A is to review the previously completed Concept Design documents for completeness and compliance with newly defined criteria. The TA shall divide the design into manageable design packages and define the program, execution plan and deliverables for each including a preliminary schedule of reports, drawings specifications and other documents.

2. Stage B – Pre-Concept Design

The objective of the Pre-Concept Design is to prove the preferred option identified in Stage A. The TA shall produce, finalise and agree a Design Manual for each individual design package. In addition, the design documentation produced shall be of a standard suitable for RailCorp's 10% design review.

The design of PSC 1374 project works has been divided in three design packages, namely:

- Stations & Buildings;
- Rail Systems; and
- Civil Design.

3. Stage C – Concept Design

The objectives of the Concept Design are twofold; one is to develop the design to the level required by the Principal's Environmental and Planning TA such that they can prepare, exhibit and lodge the Environmental Assessment and Project Plan. Two is to develop the design to the level required by RailCorp and to raise a Configuration Change Request (CCR).

The primary objective is the production of drawings and documentation defining all elements of the works in sufficient detail to illustrate that they have been fully defined, sized, co-ordinated across all disciplines and specified to a degree where the design can proceed without affecting other disciplines and interfacing parties.

The TA shall obtain all relevant reviews including but not limited to Building Code of Australia (BCA), equitable access, Disability Discrimination Act (DDA) requirements etc. The TA shall agree and address all stakeholder requirements and take these into account in the design of the Works.

Phase 2 Services

Phase 2 comprises Stage D – Reference Design and Contract Documentation.

4. Stage D – Reference Design and Contract Documentation.

The objective of the Reference Design and Contract Documentation stage is to obtain Configuration Change Request (CCR) approval from RailCorp and produce all design documentation required for tendering for those design packages as Design and Construct (D&C) contracts. The design documentation to be prepared shall include, but is not limited to:

- Reference and tender drawings, specifications, room data sheets and other documents;

- *Construction interface specifications;*
- *Signalling Functional Specification (by Others);*
- *Work packages and contract schedules as required;*
- *Information for the preparation of a pre-tender cost estimate;*
- *Approved waivers; and*
- *Closed out RailCorp Comments Register.*

1.3 Purpose of Study

The purpose of this landscape and visual assessment report is to assess the potential visual impacts of the proposed project, and describe the urban and landscape design principles that are required in order to mitigate these impacts.

This report describes the visual, landscape and cultural qualities of the study area and subject site. It assesses the visual impacts of the proposed development during both construction and operation (focusing particularly on operation), and makes recommendations for protecting these values. The report describes the measures required for mitigating the changes in the current rural landscape and recognises the future changes to surrounding landscape character with the development of the SWGC and associated development.

The report will outline how the urban and landscape architecture will serve to provide a high quality visual solution to a 'world class' rail project.

1.4 Project Overview

The project is a stand alone project which involves the construction, operation and maintenance of a twin track passenger railway, approximately 11km long, between Glenfield Junction and a proposed stabling facility at Rossmore, in the South West of Sydney, as indicated on Figure 1.2. It includes the provision of two new railway stations, interchanges and commuter car parks at Edmondson Park and Leppington.

Key Benefits of the project include:

- *Infrastructure, including new stations at Leppington and Edmondson Park to facilitate sustainable development in Edmondson Park, Leppington and the South West Growth Centre (SWGC) by providing for early transit orientated development;*
- *Long term stabling requirements for Sector 2 of the metropolitan rail network;*
- *Congestion relief on the rail network by providing extra capacity on the existing Main South and East Hills lines through the reconfiguration of Glenfield Station, which currently imposes a significant timetabling and capacity constraint on the existing network;*
- *A direct transport link to and from the south-west region of Sydney and key regional destinations (such as Liverpool); and*
- *Curtailment of growth in road network congestion in the south-west region of Sydney.*

Following the exhibition of the project Environmental Assessment and Concept Plan and preparation of the Submissions Report, the Minister for Planning granted concept approval on 29th August 2007. This concept approval confirmed the location of the stations and rail corridor.

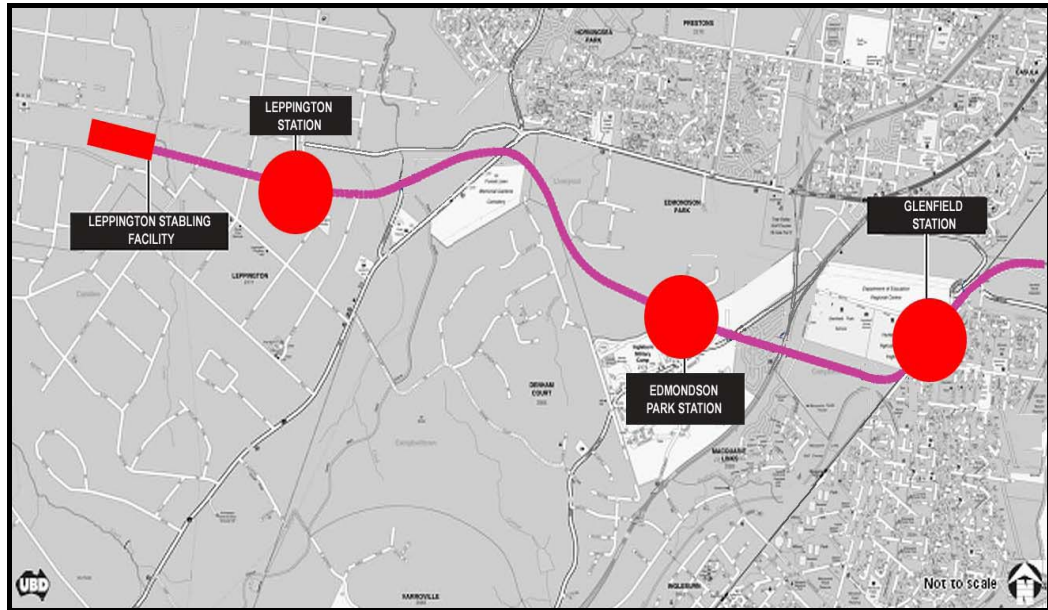


Figure 1.2: Project Route Indicating Proposed Stations and Stabling Facility (Source: TIDC)

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1.5 State Government Consultation

As part of the ongoing design process the following State Government departments have been consulted with:

- Department of Planning (Land Management Branch) - regarding Western Sydney Parklands;
- Department of Planning (Heritage Branch) - regarding Macquarie Field House and Sydney Water Upper Canal;
- RTA - regarding future road up grades and all under / over bridge requirements;
- Sydney Catchment Authority - regarding Cowpasture Road / Sydney Water Upper Canal;
- Department of Planning - ongoing consultation regarding proposed Leppington Town Centre; and
- Landcom - ongoing consultation regarding proposed Edmondson Park residential area.

A series of workshops were held with relevant stakeholders including RTA, Growth Centres Commission (now Department of Planning), Liverpool City Council, Campbelltown City Council, Camden Council, Sydney Catchment Authority, and NSW Department of Planning.

Relevant issues and measures have been incorporated and dealt with through the design process.

1.6 Ministers Conditions of Approval and TIDC Statement of Commitments

	Ministers Condition of Approval (2.4)(f)	Response
1.	Describe the visual and urban design impacts and mitigation requirements for the project in accordance with the Statement of Commitments B36 to B40 and B43	The impacts and mitigation measures of the project have been assessed in the context of both existing and future landscape characters. The visual impacts are described through Section 3, with mitigation measures proposed in Sections 4 and 5.
2.	Describe the timing of implementation of urban design and landscaping measures, how effectiveness of landscaping measures would be monitored and maintenance responsibilities for relevant urban design and landscape measures	A detailed construction program is not available, but the implementation of works is covered in Section 3.3, and maintenance in Section 4.6
	TIDC Statement of Commitments	
B36	Visual impact assessment would be undertaken as part of design development. This would be undertaken considering both the existing and future urban environment to identify and mitigate the impacts with architectural, landscape and/or urban design treatments. Additional assessments would apply to pedestrian and cycle facilities, proposed bridging structures; cutting and embankment treatments; landscape treatment projects; design of the stations and stabling facility; proposed acoustic treatments; and any visual buffer areas as required.	<p>An assessment of the visual impact of the project proposals in the context of existing and future landscape characters, are described in Section 3.</p> <p>Proposed Urban Design elements, which integrate the project into the existing and future landscape characters are described in Section 5.</p>
B37	<p>The following architectural, landscape and urban design principles would be used to guide the design of the stations and transport interchanges, civil works (such as noise walls, embankments, bridge crossings) and the stabling facility concepts:</p> <p>a) reinforce the role of the station and transport interchange within its surrounding neighbourhood as the principal transport and community facility within the locality;</p> <p>b) stations would be designed in the context of the scale, character and image of the surrounding area and enhance the presentation of the area to visitors, residents and travellers;</p> <p>c) maintain or improve the links across the project and to surrounding areas and activities. Where a connection between adjacent areas is desirable, pedestrian bridges or underpasses</p>	<p>a) Refer Section 6 of this report</p> <p>b) Refer Section 6 of this report</p> <p>c) Refer Figures 2.6, 4.9 – 4.13</p> <p>d) Refer Section 6.2</p> <p>e) Refer Section 6</p> <p>f) Refer Section 5.1</p> <p>g) Refer Section 6</p> <p>i) Refer Section 6</p>

	<p>would be considered;</p> <p>d) easy access facilities would be incorporated into the station designs and integrated with the associated transport interchanges;</p> <p>e) movement networks should establish comfortable and inviting pedestrian environments and should ensure equitable access within the railway station and associated facilities.;</p> <p>f) a design theme would be established for bridges and flyovers to link the overall rail design together. The design would ensure that the structures are simple, integrated with the surrounding area and finished to a high quality. Fencing, parapets and any railing on the bridges would also be integrated with the overall design;</p> <p>g) establish a hierarchy of access to stations consistent with NSW Govt policy package "Integrating land –use and transport" i.e prioritise public transport and other non-car based access to the rail stations and adjoining areas where possible; and</p> <p>h) station precinct design should facilitate new development that reflects the highest standards of design.</p>	
B38	<p>TIDC's Design Review Panel would guide the application of urban design principles throughout the design development.</p>	<p>The project proposals were presented to TIDC Design and Sustainability Review Panel on 29th April 2008, and its findings are summarised in Section 4.7, 5.6 and 6.3.</p> <p>The Design and Sustainability Review Panel consisted of :-</p> <ul style="list-style-type: none"> - Peter Mould - Government Architect - Peter-John Cantrill - Alexander Tzannes & Associates - Matthew Yates - Lend Lease Design - Kim Crestani - Order Architects - James Hadaway - TIDC
B39	<p>Measures to mitigate visual impacts and deliver high quality design outcomes would include:</p> <p>a) where noise walls are proposed, potential visual impacts would be minimised by implementation of urban design measures, to be developed in</p>	<p>Mitigation measures are described in the following sections;</p> <p>a) & b) noise measures - Section 5.3</p> <p>c) CPTED measures - Section 5.4</p> <p>d) Light Spill - Section 5.5</p>

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	<p>consultation with adjacent land owners (mitigation might include plantings and high quality facings near residential areas, Glenfield Station and the planned town centres);</p> <p>b) earth mounding would be considered where space allows and where significant vegetation would not be lost;.</p> <p>c) the design of any underpasses would adopt CPTED principles, including the need for unobstructed views into and outside of the underpass, effective drainage and ventilation, wide corridors and good lighting; and</p> <p>d) light spill would be minimised as much as possible to reduce impacts on surrounding existing and future residents in accordance with relevant standards.</p>	
B40	<p>Public art and interpretation would be incorporated into architectural elements or urban design treatments and would be assessed and implemented with design themes and urban design criteria (eg. graffiti management).</p>	<p>Public Art is to be considered for incorporation into Urban Design elements, and also represented at Station Precincts. It is proposed that urban artwork incorporates heritage interpretation. This is described through Section 5.7</p>
B43	<p>NSW Police CPTED guidelines would be applied to all elements of the project to guide the design of appropriate lighting, fencing of the railway corridor, security measures (including surveillance cameras), graffiti management, help points at stations and other issues.</p>	<p>Acknowledgement of CPTED requirements are discussed through Section 5.4</p>

1.7 Reference Documents

“The planned outcome is that the project will be a “world class” public transport product”

SWRL PSC1374 Services Brief - TIDC 2009

“The design should ensure.....the demonstration of excellence in the architectural, engineering, urban and environmental sustainability outcomes”

SWRL PSC1374 Services Brief - TIDC 2009

RTA / Austroads Specifications

- Austroads Guide to Traffic Engineering Practice Part 14 – Bicycles;
- Austroads Guide to Traffic Engineering Practice Part 11 – Parking;
- Austroads Guide to Traffic Engineering Practice Part 13 – Pedestrians;
- RTA NSW Bicycle Guidelines;
- RTA NSW Bridge Aesthetics Design Guidelines;
- RTA NSW Shotcrete Design Guidelines;
- RTA NSW Noise Wall Design Guidelines; and
- RTA Road Design Guide.

Railcorp Standards

- Railcorp Crime Prevention Through Environmental Design;
- Revegetation Treatments for Railcorp Lands – Design Guidance and Specification (2006);
- EMS-09-GD-0074 - Revegetation Guide;
- EMS-09-GD-0068 - Sowing Guide for Disturbed Site Stabilisation;
- EMS-09-GD-0067 - Vegetation Management in the Rail Corridor;
- EMS-09-TP-0066 - Revegetation Technical Specification;
- EMS-09-TP-0095 - Station Garden Bed Technical Specification; and
- EMSF05 - Biodiversity Framework - Appendix 2 - Revegetation Treatments.

Project Related Documents / Briefing Documents

- PSC 1374 Services Brief (Revision 1, December 2009);
- TIDC Sustainable Design Guidelines (2009);
- SWRL RailCorp Business and System Requirements Volume A, Revision V1.0 dated 21 Dec 07;
- TIDC Project Requirements Table SWRL – V.1 (Jan 08);
- Concept Plan Approval issued by the NSW Government Department of Planning dated 29 Aug 07;
- TIDC Statement of Commitments for SWRL (undated); and
- SWRL Environmental Assessment - Parson Brinkerhoff (2005).

Australian Standards

- AS 1428 Design for Access and Mobility Parts 1 and 2;
- AS 4419 Soils for Landscaping and Garden Use; and
- AS 4454 Composts Soil Conditioners and Mulches.
- AS 1680 Interior and Workplace Lighting

NSW Police

- Crime Prevention through Environmental Design standards.

2. Existing Conditions

2.1 Landscape Character

Landform - Refer Figure 2.1

The project travels generally through the Bunbury Curran Creek Plain adjacent to Glenfield, before crossing gently undulating rural land to the Hume Highway crossing. Here, the land gently rises to north and south of corridor, towards Macquarie Field House to south and Mirvac's Panorama development to north.

West of the Hume Highway, the corridor traverses undulating rural-residential lands adjacent to Denham Court and future Edmonson Park development areas, and passes through existing woodland associated with the Ingleburn Military Camp.

As the corridor crosses Camden Valley Way, the landform rises to a north/south ridgeline with expansive views to the north, south and east.

The corridor crosses the Sydney Water Upper Canal and travels through further gently undulating land, crossed by a number of creeks and associated tributaries.

The rolling topography has led to the vertical alignment requiring substantial cutting and embankment treatments, in order to obtain the most efficient rail system. This creates a variation in the visual impact of the project, with those areas in cutting being visually, substantially less intrusive than those on high embankment.

The majority of the visual impact, relating to topography, is in the short to medium distance, as long distance views, from higher ground are generally impeded by intermediate vegetation and land uses.

Creek and Drainage Lines - Refer Figure 2.2

The project crosses the Bunbury Curran Creek floodplain, as well as crossing the upper tributaries of Kemps Creek and its associated tributaries of Bonds Creek and Cabramatta Creek. In total there are 14 creek and drainage crossings proposed.

Natural Vegetation - Refer Figure 2.2

The project passes generally through rural-residential areas, dominated by market gardens and grazing areas.

Ecological Studies (PB, 2006 and 2008) have identified three native vegetation communities that are evident in the study area and listed as endangered under the *NSW Threatened Species Conservation Act 1995*.

These are:-

- Cumberland Plain Woodland - Shale Hill Woodland;
- Cumberland Plain Woodland - Shale Plains Woodland; and
- Sydney Coastal River Flat Forest - Alluvial Woodland.

Of these areas the Shale Plains Woodland was the most dominant, but generally in poor condition due to grazing and other man made impacts. Similarly the Shale Hill Woodland was assessed to be in a poor condition. The Alluvial Woodland was found to be in a fair condition, and is associated with the various creek lines that traverse the corridor.

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The extent of scattered trees through the study area, and areas of remnant vegetation, provides substantial visual screening to the proposal. In particular, areas adjacent to Denham Court and the Cemetery are screened, to a large extent, by existing vegetation.

Areas that have been grazed, such as, within the view curtilage of Macquarie Field House, within the James Meehan Estate lands, are lacking in intermediate existing vegetation. However, these areas should remain with open views, and not be broken by dense, newly planted screen planting, due to the heritage nature of the views.

The remainder of the vegetation on site has been mapped as “No native vegetation overstorey” (NSW National Parks and Wildlife Service 2002b).

Typical vegetation is indicated in the following figures; 2.3, 2.4 and 2.5.



Figure 2.1: TOPOGRAPHY

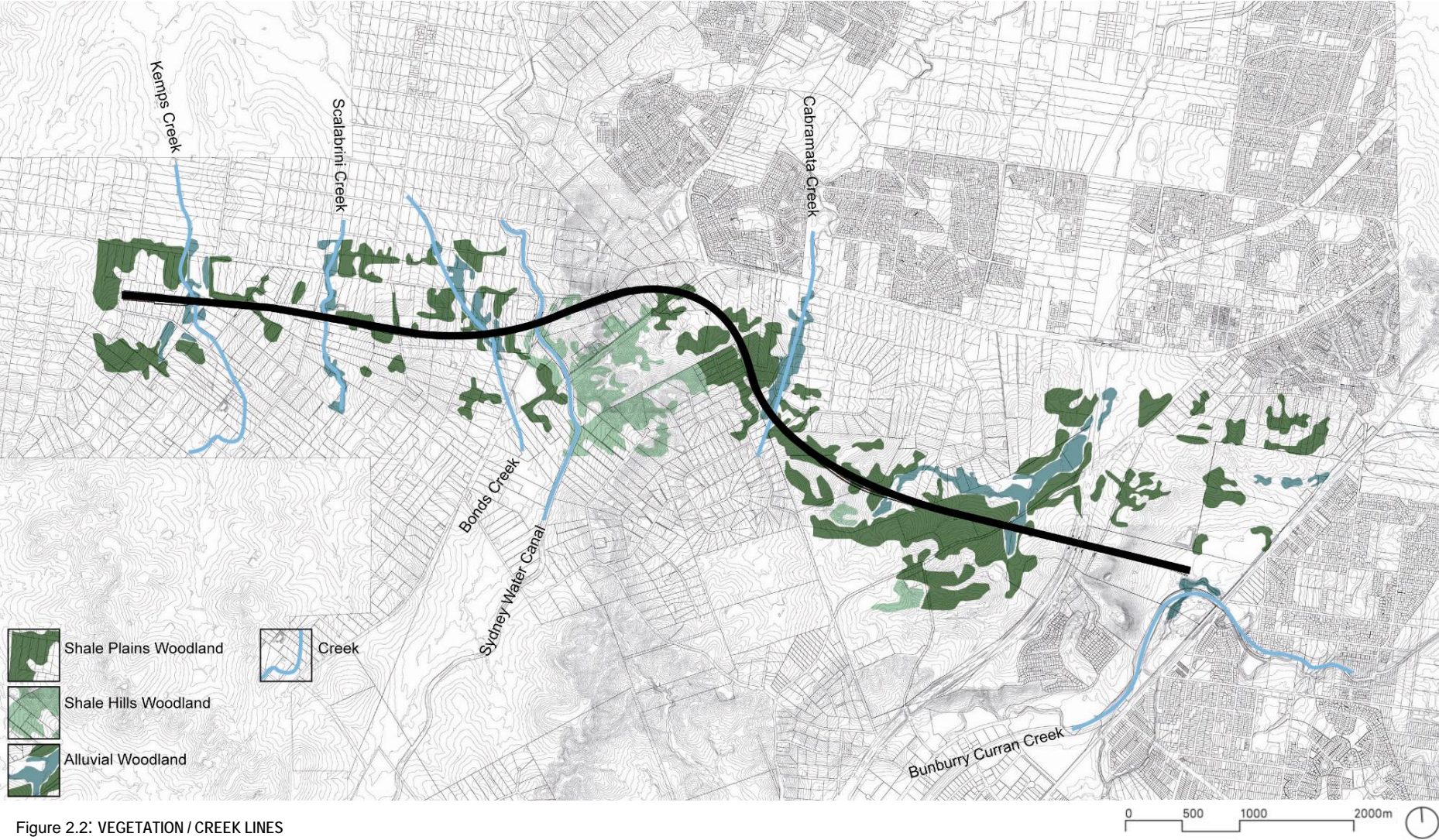


Figure 2.2: VEGETATION / CREEK LINES



Figure 2.3: Alluvial Woodland adjacent to Campbelltown Road



Figure 2.4: Open Grassland view from Glenfield Park School



Figure 2.5: Transmission line cuts through Denham Court residential area and area of Shale Hills Woodland.

2.2 Circulation

The project is crossed by a number of major highway routes, many of which have planned upgrades and in some cases road widening is planned, as they begin to feed the SWGC. Refer to Figure 2.6.

Each of these crossings would have a visual impact on the surrounding landuses, both existing and future, and the proposal would address this impact, through the urban design of the proposed structures. Each structure must allow for future upgrades to roads, as well as make allowance for pedestrian / cycleway and vegetation links.

2.3 Existing Landuse

The project travels east of Glenfield through open, lightly grazed pasture land set on the Bunburry Creek flood plain.

The corridor then crosses the Hume Highway, through open pasture that is currently being developed as the Ingleburn Gardens residential area.

From here, the corridor passes through rural-residential properties, areas of grassland and remnant vegetation. The corridor passes the Ingleburn Military Camp and Bardia Barracks Heritage Precinct adjacent to the proposed Edmonson Park residential areas.

It crosses Cabramatta Creek and travels through rural residential properties adjacent to Denham Court, and the adjoining Forest Lawn Memorial Lawn Gardens Cemetery.

From Camden Valley Way to the proposed Leppington Stabling Facilities in Rossmore at the end of the corridor, the line passes through almost exclusively, rural-residential properties with market gardens and light intensity grazing.

2.4 Future Landuse

Much of the landscape passed through by the project has been zoned for residential / town centre use, see Figure 2.7. This would have major impacts on the study area, and the visual impact of the corridor cannot be assessed without taking this into account.

The project is central to the development of two, future, major developments:

Leppington - The Sydney Metropolitan Strategy (Dec 2007) describes Leppington as a future major centre in the SWGC, similar in scale to Penrith. Although currently a rural residential area with a large lot subdivision pattern and only 2 main roads, by 2030 it is proposed that Leppington will be developed to have:

- *A shopping centre with 60,000 to 80,000sqm retail and commercial area;*
- *A TAFE;*
- *Medium density apartments and town houses; and*
- *Council, community and recreation facilities.*

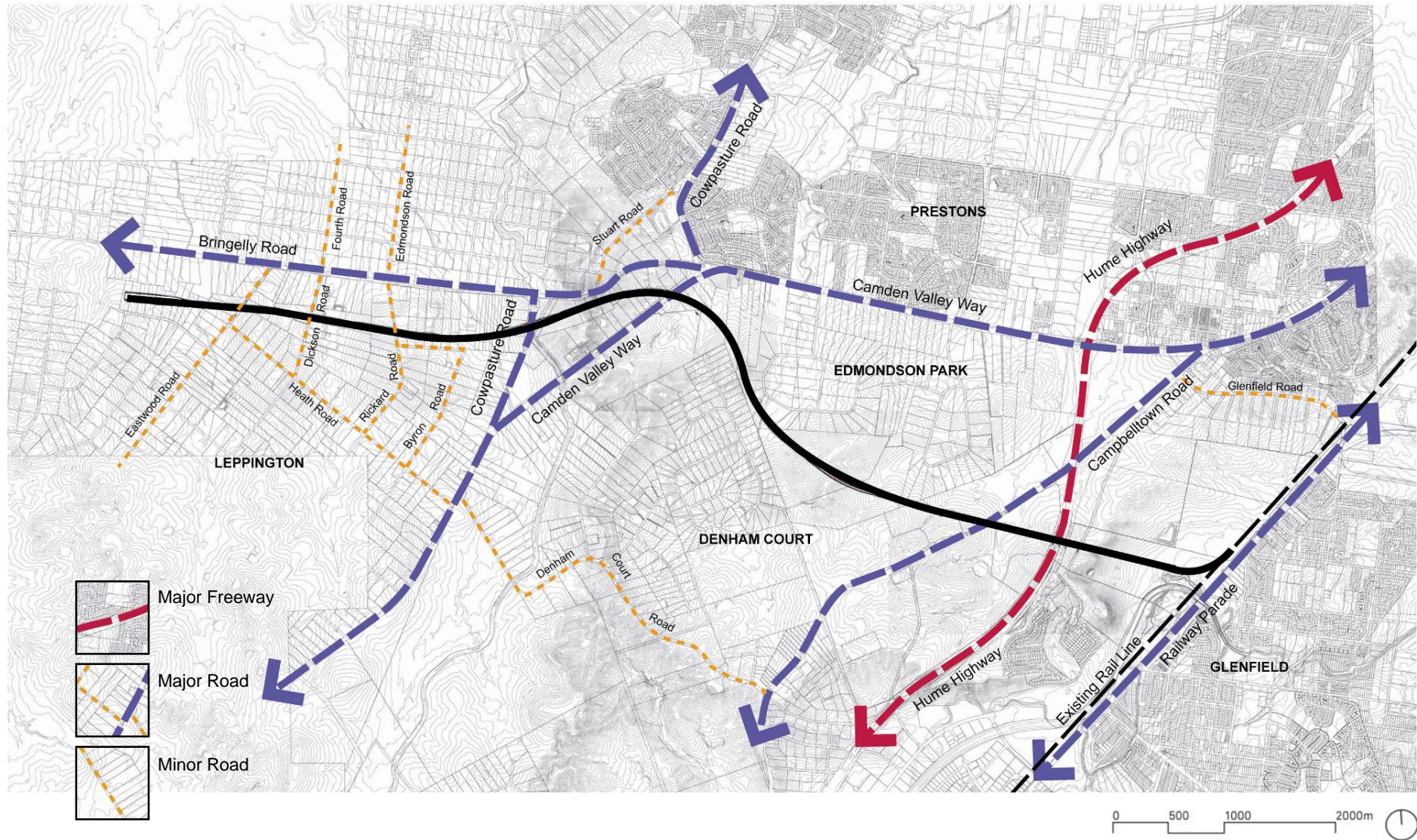


Figure 2.6: EXISTING CIRCULATION

SOUTH WEST GROWTH CENTRE STRUCTURE PLAN (EDITION 3)

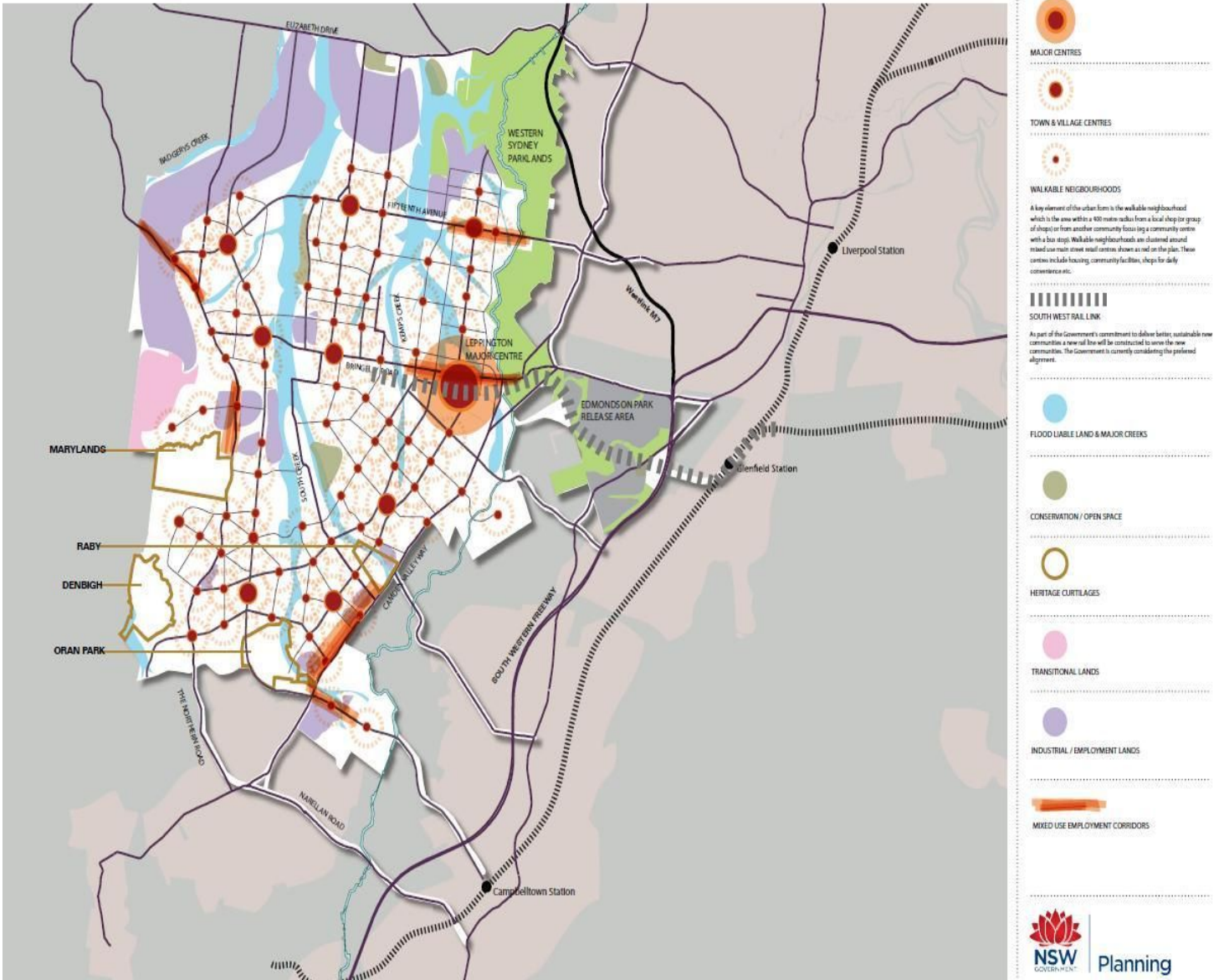


Figure 2.7: South West Growth Centre Structure Plan – Department of Planning 2006.

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Edmondson Park - Plans are being developed by Landcom. The plans are for:

"creation of distinctive, vibrant communities supported by appropriate transport and services, while preserving and enhancing the open space and natural features of the site." Liverpool City Council 2008

"It is anticipated that this proposed release area will provide residential accommodation for an anticipated 25,000 people..... The town centre for the new suburb is centred around a future bus/rail interchange. The town centre will provide approximately 25,000m² of retail floor space which is equivalent to two supermarkets, a discount department store and potential for a cinema complex. This will be supported by mixed use retail development and high density residential development." Liverpool City Council, 2008.

In addition, there is a proposed development, which is currently under construction at Ingleburn Gardens to the west of the Hume Highway.

A portion of the project passes adjacent to the proposed Western Sydney Parklands, located north of Bringelly Road.

"Western Sydney Parklands is a vast conservation, lifestyle and recreation haven that stretches for 27km, from Quakers Hill in the north to Leppington in the south. Equivalent in size to 25 Centennial Parks, making it one of the biggest urban parklands in the world, it is situated in one of the fastest growing regions of Australia." NSW Government, Department of Planning, 2008.

2.5 Heritage - Indigenous

Aboriginal heritage sites have been identified within the vicinity of the Glenfield to Leppington alignment. Current investigations indicate that none of the existing artefact sites would require the realignment of the project, however further archaeological investigations have been recommended prior to construction commencing.

2.6 Heritage - European

There are a number of items of heritage that could be potentially impacted by the project, the following items are listed on the State Heritage Register:

Macquarie Field House - This property lies to the south of the project proposed route, between Bunbury Curran Creek, and the Hume Highway. Whilst not directly impacted upon, there are potential views from the estate to the proposed corridor. See Figure 2.8 below.

Sydney Water Upper Canal - The canal is the only item along the corridor that is directly impacted, in that the project would cross the canal adjacent to Cowpasture Road. In addition there is a row of three Bunya Pines adjacent to the canal that are heritage listed.

In addition, the broader areas contain elements, such as the Ingleburn Barracks, that whilst not affected by the proposal, provide the opportunity for interpretative elements at key points along the corridor, such as Edmondson Park Station.



Figure 2.8: Historic Macquarie Field House -image - Campbelltown City Council

3. Visual Analysis

3.1 Methodology

The objective of visual and landscape assessment is to identify scenic resources that should be protected because of their value to the community.

This report uses a well-recognised approach to visual quality assessment that is systematic, consistent and based on professional value judgment of commonly adopted and accepted criteria. Figure 3.1 below outlines this approach.

The visual impact of the proposed development is determined by evaluating the visual effect of the development in the context of the visual sensitivity of the surrounding land use areas from which the proposed development may be visible. The following chart describes the visual assessment methodology undertaken for this project, which is described in more detail below.

Once environmental constraints including those imposed by visual and landscape significance have been assessed, more detailed strategies for the conservation and management of these valued landscape character and elements can be developed.

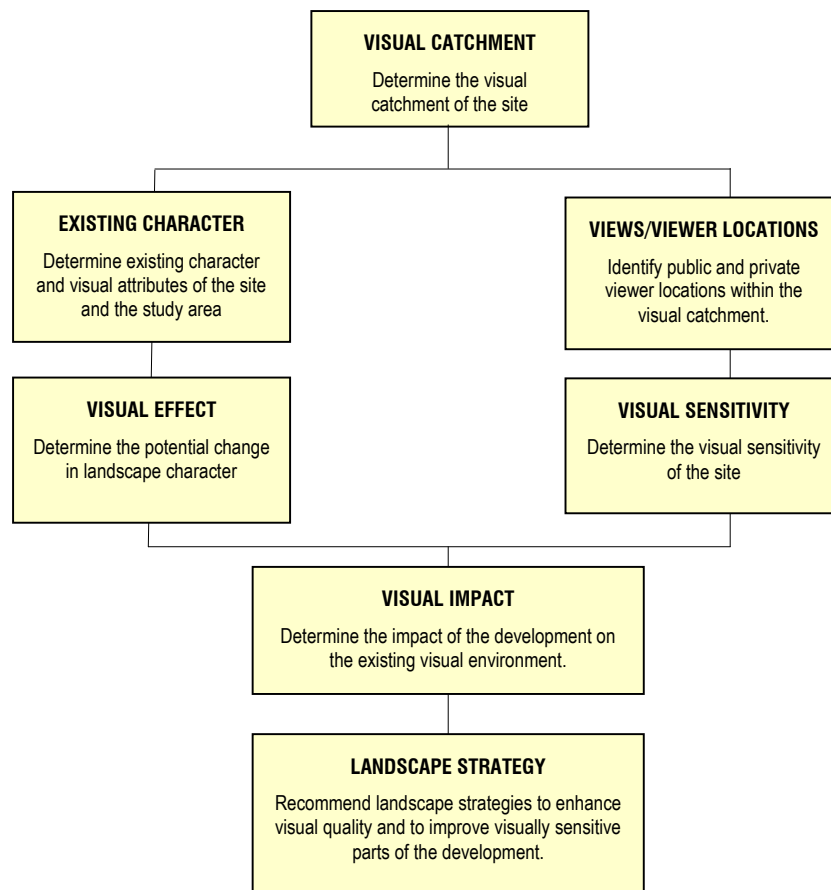


Figure 3.1: Visual Quality Assessment Approach.

Visual Catchment

The visual catchment of a site is the extent of the landscape that can be viewed from the site and likewise the extent of locations from which the site can be seen.

The landscape vegetation, land use and landform play key roles in determining the visual catchment. For example, where a development is surrounded by vegetation, the visual catchment is likely to be significantly restricted. Conversely, grazing land does not create the same impediment to views.

The visual catchment was initially approximated by topographic analysis. Where possible, ground truthing was then undertaken to ascertain the influences of the surrounding vegetation and land use, and to adjust the catchment if necessary. Some private lands located within the nominated visual catchment area were not accessible and were not able to be accurately ground truthed.

Landscape Character

Landscape character is the recognisable pattern of elements that occurs in a particular landscape. Variations in geology and soils, landform, land use and vegetation, land use and settlement patterns and building styles, give rise to different landscapes each with its own distinctive character and unique sense of place. The landscape character of the project corridor was assessed in order to determine the degree of change to the landscape character that would occur as a result of the proposed route.

Visual Effect

The visual effect of the proposed development is the expression of the change in landscape character created by the interaction between the development, and the existing environment. It can also be expressed as a level of contrast between the development and the visual setting within which it is placed. Critical issues are:

- *Foreground zone - areas within 0-300 metres of the viewer - (within this range the observer experiences maximum discernment of landscape details, (Great Lakes Council, 2002)) eg. such as shape, colour and contrast;*
- *Middle ground zone - areas between 300 metres and 1 kilometre - (within this range, vegetation textures and land use patterns are visible to the observer, (Great Lakes Council, 2002)); and*
- *Background zone - areas greater than 1 kilometre from the proposed development - (within this range, vegetation textures and land use patterns are indistinct to the observer, (Great Lakes Council, 2002)). The viewer is unaware of individual details and discerns broader landscape units as patterns of light and dark.*

Viewer locations that fall within the foreground zone are considered to be in the zone of highest visual impact because the proposed development would be part of their ground views. Changes to views in the middle ground are considered to be important, but less important than in the foreground. This is because the subject site is further from the viewer and would therefore likely occupy a lower proportion of the total views from the viewer location. It is considered that visual impact or viewer locations within the background one is of least significance, however, still worthy of consideration. In some cases, wholesale change of broad distant views in terms of colour, texture and pattern can still be significant.

Visual Impact

Visual impact is a measure of the potential effect that the proposed development (including both natural and built elements) would have on the visual environment without any ameliorative landscape treatment. Visual impact depends upon the visual catchment area (extent of visibility), visual sensitivity (the number of views and viewers affected, duration of views, and distance) and visual change (the degree of visual intrusion or obstruction that would occur). These visual impacts can be positive or negative.

Table 3.1 below illustrates the visual impact as a result of the relationship between visual effect and visual sensitivity.

Visual Sensitivity Levels	Visual Effect Levels			
		HIGH	MODERATE	LOW
HIGH		High Impact	High Impact	Moderate Impact
MODERATE		High Impact	Moderate Impact	Low Impact
LOW		Moderate Impact	Low Impact	Low Impact

Table 3.1: Visual Impact Relationships.

Typical Site Views for the project are shown in Figures 3.2, 3.3 and 3.4.



Figure 3.2: Panoramic view south from Bringelly Road, towards Forest Lawn Garden Cemetery



Figure 3.3: Panoramic view south on Eastwood Road



Figure 3.4: Panoramic view north on Rickard Road towards proposed Leppington Station site

3.2 Views and Viewer Locations

Each of the views have been assessed using the methodology presented in *Section 3.1*, and are presented below in Table 3.2. Figure 3.5 also shows the existing view catchment and viewer locations.

Figure 3.5: VIEW CATCHMENT AND VIEWER LOCATIONS

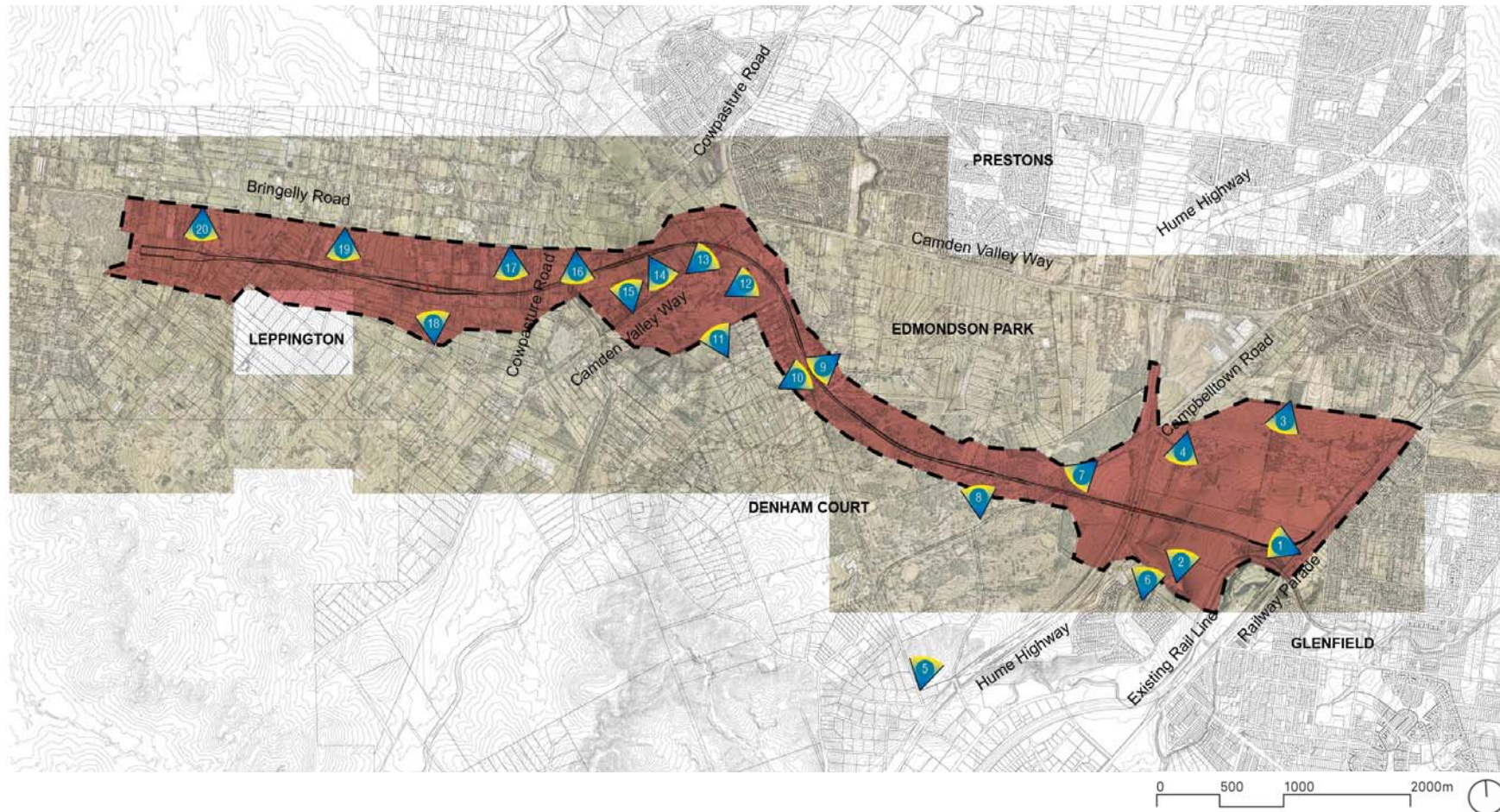


Table 3.2: Visual Analysis

	Vantage Point	Visual Effect	Visual Sensitivity	Visual Impact	Recommendations
1	Railway Parade, Glenfield (west)	The project passes through views from Railway Parade on embankment, and fly over. There is little existing vegetation, the visual effect is high.	Visual sensitivity is high due to a high number of potential residents, and long duration of views from Railway Parade.	HIGH Significant impact due to height of fly over and embankment.	Detailed urban and landscape proposals to create a sympathetic setting of flyover and embankment. Vertical, earth reinforced retaining walls would be softened with substantial endemic planting. (Refer Appendix F)
2	Macquarie Field House(north)	The project passes through views to the north on both embankment and in cutting. There is little existing vegetation in views, the visual effect is high.	Visual sensitivity is moderate, due to heritage nature of views.	HIGH Significant impact due to height of fly over and embankment.	Detailed planting proposals to limit trees planted on embankment, to maintain open nature of view, rather than planted visual buffer.
3	Panorama Estate (south)	Visual effect is low, due to intermediate vegetation, topography and distance.	Visual sensitivity is moderate due to heritage setting and potential for glimpsed views for residents.	LOW Visual impact is low due to distance from proposal.	Detailed planting proposals to limit trees planted on embankment, to maintain open nature of view, rather than planted visual buffer.
4	Glenfield Park School (south)	Visual effect is moderate in views to south as the project is located in heritage views between the school and Macquarie Field House.	Visual sensitivity is moderate, due to heritage setting and number of viewers.	MODERATE Although visual setting would be affected, much of line is in cut and views are over 300m distance.	Detailed planting proposals to limit trees planted on embankment, to maintain open nature of view, rather than planted visual buffer.
5	Scenic Hills (north)	Visual effect is low as there would be no discernable change to the existing landscape character, due to intermediate vegetation and topography.	Visual sensitivity is low, because views are long distance and viewed for short/moderate duration.	LOW Visual impact is low because existing natural landscape features obscure views.	No mitigation measures required due to low impact.

	Vantage Point	Visual Effect	Visual Sensitivity	Visual Impact	Recommendations
6	Macquarie Links (north)	Visual effect is low as there would be no perceivable change in existing landscape character.	Visual sensitivity is low, due to topography and distance, there are no views to the project.	LOW Visual impact is low due to topography.	No mitigation measures required due to low impact.
7	Campbelltown Road (south)	Visual effect is high as corridor would contrast strongly with existing character, despite future road widening proposals.	Visual sensitivity is moderate due to low frequency (no residences) and medium duration views.	HIGH Significant impact although future road widening and future residential proposals must be taken into account.	Detailed urban and landscape proposals to create a sympathetic setting of bridge, and mitigation of effects on existing remnant vegetation.
8	Lawson Road, Edmondson Park (north)	The visual effect of the new rail station, associated access ways and transport interchange, would initially be high due to the rural nature of area, however in the context of a proposed new town centre the effect is considered to be moderate.	Visual sensitivity is high due to the number and duration of views from future Edmondson Park residential proposals.	HIGH Visual impact would be high, due to both the current rural nature of site, and the future setting of the project in new town centre.	Detailed landscape and urban design proposals for both the project and Edmondson Park to create an integrated design solution. (Refer Appendix C)
9	Jardine Drive and Cabramatta Creek (west)	Visual effect of the project would be high initially, due introduction of urban element in rural residential area, however in the context of proposed new residential areas, the effect is considered to be moderate.	Visual sensitivity is high due to the number and duration of views from future Edmondson Park residential proposals.	HIGH Visual impact would be high, due to both the current rural nature of site, and the future setting of the project in new town centre.	Detailed landscape and urban design proposals for both the project and Edmondson Park to create an integrated design solution.
10	Denham Court (east)	Visual effect moderate, due to existing intermediate vegetation, and the corridor is in cut for much of this area.	Visual sensitivity is high due to proximity of Denham Court residences.	HIGH Visual impact would be high because the project would be visible from a	Detailed landscape proposals to minimize impacts on existing intermediate vegetation and planting of extensive buffer

	Vantage Point	Visual Effect	Visual Sensitivity	Visual Impact	Recommendations
		However this vegetation is not continuous and views would be glimpsed, particularly from Cassidy St. and Culverston Av.		number of residences.	planting within the corridor.
11	Denham Court (north)	Visual effect is high , due to the construction of Integral Energy substation adjacent to properties, a change in character, within area of existing woodland.	Visual sensitivity is high due to proximity of substation to residences.	HIGH The project would have high visual impact on some views from Denham Court looking north due to the sub station.	Detailed planting proposals to green embankment, but with a mix of visual buffer planting and open character. Existing vegetation surrounding the substation is to be maintained to mitigate views to substation.
12	Forest Lawn Memorial Gardens Cemetery (east)	Visual effect is high due to rural / open context of site, and little intermediate vegetation.	Visual sensitivity is high due to distance, frequency and duration.	HIGH The project would have a high visual impact on views from the Cemetery A proposed substation would be located adjacent to the Cemetery.	Detailed planting proposals to green embankment, but with a mix of visual buffer planting and open character. Existing vegetation surrounding the substation is to be maintained to mitigate views to substation.
13	Camden Valley Way (east)	Visual effect is moderate considering context of future road widening and removal of adjacent vegetation.	Visual sensitivity is moderate as main impact is on road users rather than residences.	MODERATE Visual impact would be moderate, considering context of future road widening.	Detailed urban and landscape proposals to create asympathetic setting of bridge. (Refer Appendix A)
14	Bringelly Road (south)	The visual effect is moderate as the project is located in cutting, at closest point to Bringelly Road.	Visual sensitivity is moderate as main impact is on road users rather than residences, and is in cutting.	MODERATE Visual impact would be moderate due to few residences and the project is in cutting.	Detailed planting proposals to provide further screening.
15	Camden Valley	The visual effect is high	Visual sensitivity is	HIGH	Detailed planting proposals

	Vantage Point	Visual Effect	Visual Sensitivity	Visual Impact	Recommendations
	Way (north)	as the project is located in cutting, but nature of topography would expose northern face of cut to views from south, and location is on raised elevation.	moderate as main views are from main road that would be widened, losing all intermediate vegetation.	Visual impact is high due to elevation and topography.	to provide screening and greening to all embankments.
16	Cowpasture Road (south)	The visual effect is high as large bridge structure is located in rural situation, over both Sydney Water Canal and Cowpasture Road.	The visual sensitivity is high in both the context of existing land users and proximity of future residential development.	HIGH Visual impact is high due to large scale of bridge in existing and future residential context.	Detailed landscape and urban design proposals for both the project and Leppington to create an integrated design solution. (Refer Appendix B)
17	Bringelly Road (south)	Visual effect of the project would be high initially, due to introduction of urban element (embankment) in rural residential area, however in the context of proposed new residential areas, the effect is considered to be moderate.	Visual sensitivity is high due to the number and duration of views from future Leppington residential proposals.	HIGH Visual impact would be high, due to both the current rural nature of site, and the future setting of the project in new town centre.	Detailed landscape and urban design proposals for both the project and Leppington to create an integrated design solution.
18	Rickard Road (north)	Visual effect of the project would be high initially, due to introduction of urban element (station and corridor) in rural residential area, however in the context of proposed new residential areas, the effect is considered to be moderate.	Visual sensitivity is high due to the number and duration of views from future Leppington residential proposals.	HIGH Visual impact would be high, due to both the current rural nature of site, and the future setting of the project in new town centre.	Detailed landscape and urban design proposals for both the project and Leppington to create an integrated design solution. (Refer Appendix D)
19	Eastwood Road (south)	Visual effect of the project would be	Visual sensitivity is high due to the number and	HIGH Visual impact would	Detailed landscape and urban design proposals for

	Vantage Point	Visual Effect	Visual Sensitivity	Visual Impact	Recommendations
		moderate initially, due to introduction of urban element (corridor) in rural residential area in a cutting, and in the context of proposed new residential areas, the effect is considered to be moderate.	duration of views from future Leppington residential proposals.	be high, due to both the current rural nature of site, and the future setting of the project in new town centre.	both the project and Leppington to create an integrated design solution.
20	Bringelly Road (south)	Visual effect of the project would be high initially, due to introduction of urban element (stabling facility) in rural residential area, and in the context of proposed new residential areas, the effect is considered to be high.	Visual sensitivity is high due to the number and duration of views from future Leppington residential proposals.	HIGH Visual impact would be high, due to both the current rural nature of site, and the future setting of the project in residential areas.	Detailed landscape and urban design proposals for both the project and Stabling Yards to create an integrated design solution. (Refer Appendix E)

3.3 Implementation and Visual Impact During Construction

Construction of the project is anticipated to commence in 2010 (subject to project approval and is estimated to take approximately five to six years to complete (refer Section 6.4.1 in Volume 1 of Environmental Assessment)).

The construction of the project may cause temporary adverse visual amenity impacts for surrounding residents and land uses, rail commuters (with respect of works within the vicinity of the Glenfield Junction) and occupants of vehicles using nearby roads due to:

- The establishment of construction compounds , stockpile sites and worksites (refer Figure 6-18 in Volume 1 of Environment Assessment);
- Creation of temporary construction access roads/tracks within the site and temporary construction access routes (refer Figure 6-1 of Volume 1 of Environmental Assessment);
- Erection of fencing, barricades, gates and lighting for the provision of safe and secure worksites;
- Construction vehicle movements both within construction sites and along haulage routes;
- Traffic disruption associated with construction traffic;
- Visual impacts associated with vegetation clearing, earthworks and the parking/use of construction plant and vehicles.

The impact of the project on individual sensitive receivers would be dependent on the stage of the project, their location and severity of the impact. Visual amenity impacts during construction of the project would be greatest at locations where residential/sensitive receivers have an unscreened view of the construction sites.

In general, it is anticipated that the majority of sensitive receivers located within close proximity to the construction works, construction compounds, stockpile sites and construction access routes would experience a temporary reduction in visual amenity.

Construction of the Glenfield Southern Flyover, road underbridges and bridged waterway crossings are anticipated to be highly visible construction activities due to the height of the proposed structures and the topography of the surrounding landscape.

Light spill from construction sites would also affect the visual amenity of adjacent land uses. Light spill occurs where light falls outside the area intended to be lit, for instance, by shining over a fence into a neighbouring property. During construction, security lighting would be required at site compounds to prevent/discourage the unauthorised access of construction compounds by members of the public. This lighting would need to be managed to minimise light spill to adjacent land uses, while also ensuring that security requirements are not compromised.

It should be noted, however, that the visual amenity impacts associated with the construction of the project would be temporary in nature and would be reduced in the medium to long term through the revegetation/rehabilitation of the work areas to their pre-construction state, where practicable.

Mitigation

To avoid unnecessary visual impacts during the construction of the Project, the following mitigation measures would be adopted:

- Construction zones, accessways and compound sites would be located to minimise impacts on sensitive receivers and vegetation;
- Work and compound sites would be kept in a tidy condition and within clearly defined boundaries.
- Additional screening of security fencing would be provided to minimise views of the site from sensitive receivers;
- Stockpiling of construction materials and waste would not be permitted outside of the designated construction compounds and stockpile sites.
- The parking/storing of construction vehicles/plant and equipment would not be permitted outside of the designated construction compounds and stockpile sites.
- Sites, particularly the construction compound sites, would be restored to their preconstruction condition or better as quickly as possible.

3.4 Substations

An Integral sub-station is proposed to be located north of Denham Court, within an existing transmission easement.

The footprint of the substation is proposed to be 90m x 50m. The height of the transformer gear will be approximately 10m to the top of bushings and is proposed to be a sky blue and grey colour scheme. A security fence is required around the station, with a 6m wide access track located all round. It will be accessed from Cassidy Street at Denham Court. It would be located within dense existing vegetation. An

indicative Landscape and Urban Design plan would be required in order that suitable measures are taken and create view that are mitigated through the use of existing vegetation and the planting of additional endemic vegetation. Additional planting of endemic vegetation to the surrounds would be required to minimize the visual impact to residents of Denham Court. Refer Figure 4.15.

Two traction substations are located along the project, these have a proposed footprint of 50m x 20m, containing a 1 storey building approximately 9m x 27m and approximately 3 car parking spaces.

A traction substation is located in the vicinity of Camden Valley Way, accessed from Bringelly Road, and is located as the corridor transitions from embankment to cutting. The landscape character is open and rural, with potential views available from Bringelly Road. There are potential glimpsed views from the Forest Lawn Cemetary. The second traction substation is located adjacent to the Leppington Stabling Facility at Rossmore. This is also located in an open and rural landscape character zone, and there will be views from McCann Road. Refer Figure 4.15.

An indicative Landscape and Urban Design plan will be required to so that suitable measures are taken and create views that are mitigated through the use of existing vegetation and the planting of additional endemic vegetation.

3.5 Leppington Stabling Facilities

The stabling facilities are located in Rossmore in an area of relatively flat rural residential landscape. Initially the visual impact of the facilities would be substantial due to the rural nature of the site. It should be noted however that the region is subject to master planning proposals associated with Leppington and land use will change over a period of time.

An indicative Landscape and Urban Design plan will be required in order that sufficient endemic planting is utilized to mitigate long distance views to the development.

3.6 Summary and Conclusions

The visual analysis identified that, within the existing landscape framework of South West Sydney, the impact of the project would be mitigated in many areas by existing vegetation and the rolling topography of the proposal area, which creates a relatively small visual catchment area.

Where the visual analysis, has identified that the project proposals would have a high visual impact, when viewed within the existing landscape framework, it would be necessary to mitigate these impacts as described in the following section.

The analysis, however, must be assessed within the known framework of proposed landuse, including the new town centres of Edmondson Park and Leppington. The visual impact of the project is countered by the role it would play in encouraging the growth of these proposed town centres, and the proposed density of housing and commercial uses surrounding the rail corridor.

4. Mitigation Issues

4.1 Introduction

Landscape strategies have been recommended to mitigate the visual impact of the project development. They have been developed as a response to the existing landscape framework, as well as the potential impact on future land use proposals, currently being developed.

The project corridor provides the opportunity to create over 30ha of revegetation and landscape treatments. The design intent is to plant all areas of the corridor outside of the central 14m wide rail shoulder, allowing for all necessary drainage, maintenance and rail systems access / requirements.

The landscape proposals create a series of characters through the corridor, some that enclose the site in dense visual buffer planting, and others that allow views out of the corridor into proposed parkland areas.

The approach should not be, to suggest that the rail corridor be visually “hidden” through the creation of thick vegetated screens, but instead, to appreciate the value of glimpsed views of a rail line within the landscape setting. Views would be opened up to the corridor at key locations and within proposed high density town centres.

Figure 4.1 shows an example of the proposed vegetation.



Figure 4.1: Typical native planting on embankment

4.2 Planting Medium

The grade of the cut slopes and fill embankments ultimately drives the sustainability of any proposed planting works, a shallower grade would aid plant establishment, reduce slope erosion and reduce future maintenance costs.

The project being located in a “green fields” location provides the opportunity to challenge existing standards for embankments, and aim for more sustainable and successful landscape outcomes. It is suggested that embankments must be kept to a minimum of 2.5H : 1V.

For the successful establishment of proposed planting, a minimum of 300mm of top soil would be required. This would be existing site top soil, ameliorated on site, to an approved specification and replaced in all proposed planting areas. It would be necessary to cultivate and ameliorate all subgrade areas to a depth of 250mm.

A mulch layer would reduce future maintenance and watering costs. Mulch would be derived from vegetation cleared from the site, during construction. Should additional mulch be required, it must be obtained from recycled waste timber.

4.3 Planting Mix

The proposed planting mix should be informed by the existing Cumberland Plain species, see Figure 4.2, without attempting to fully recreate this protected habitat. It is impractical in the restricted areas available for planting. Species would be selected for their proven track record in large scale revegetation projects, and their low maintenance requirements.

It is proposed that large scale seed collection should be carried out prior to construction commencing, and suitable species grown on for this project.

Typical planting mixes are detailed on Figure 4.15



Figure 4.2: Typical Cumberland Plain Woodland

4.4 Monitoring

The site should be visited at intervals not exceeding fourteen (14) days to determine the status of the revegetation plantings and the effectiveness of maintenance previously carried out and in progress. However this is a minimum requirement and if the site conditions requires more frequent visits such as for watering plants in dry weather conditions then a more regular visitation program is to be instigated.

4.5 Proposed Landscape Concept

Figure 4.3 indicates the effect of the concept vertical alignment, in terms of cutting and embankment extents. Figure 4.4 provides a broad overview landscape concept of the mitigation measures required to mitigate the visual impacts.

This overall landscape concept leads to a number of typical section treatments, for cuttings, embankments and noise mitigation areas. These are detailed on Figures 4.5, 4.6, 4.7 and 4.8.

With these typical details established, a detailed landscape concept is proposed indicating important view corridors and feature tree planting, as well as detailed extent of buffer screen planting. This is detailed in Figures 4.9 to 4.14.

Typical planting mixes are detailed in Figures 4.17 and 4.18.

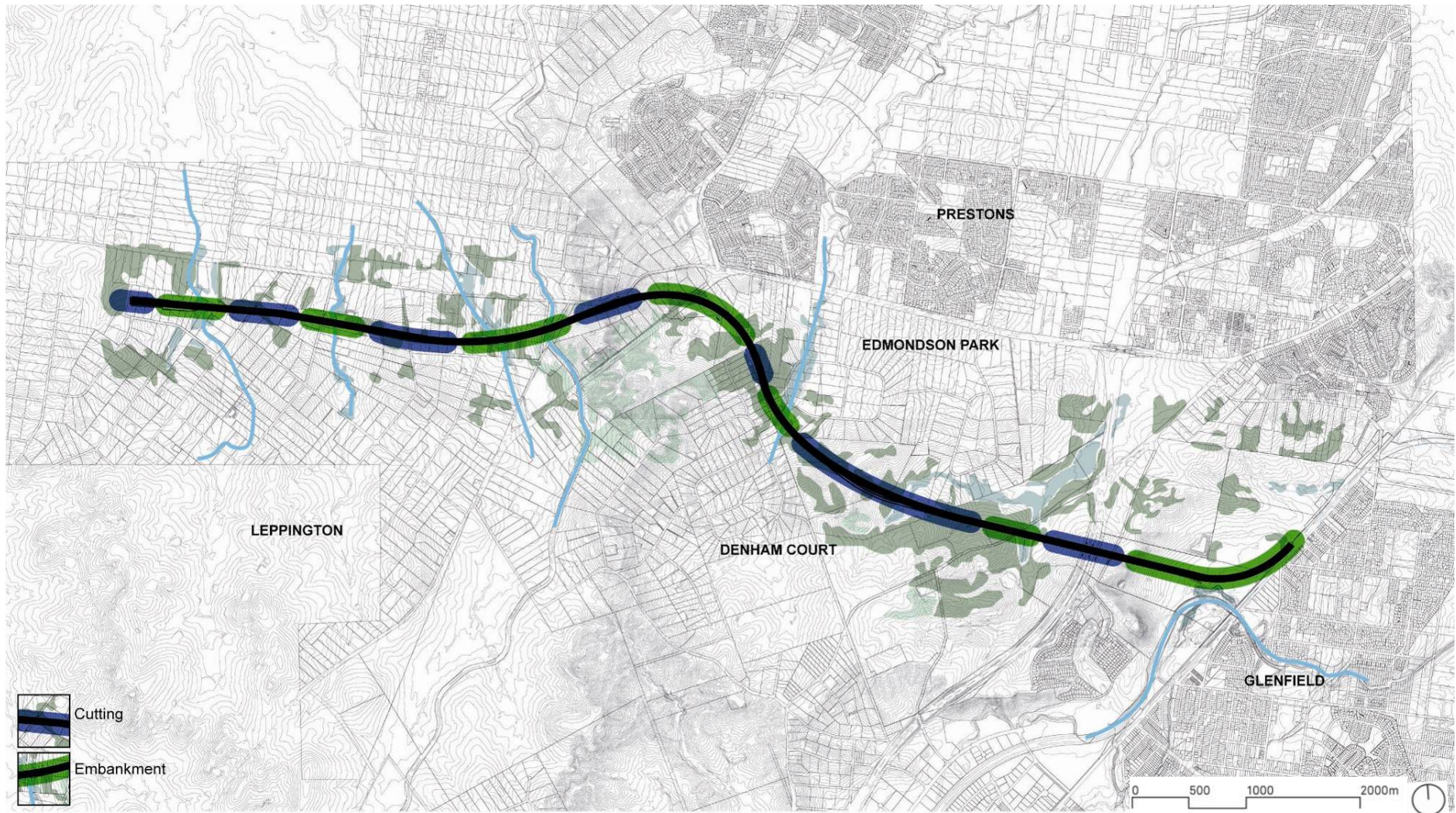


Figure 4.3: PROPOSED CUT AND FILL EXTENTS

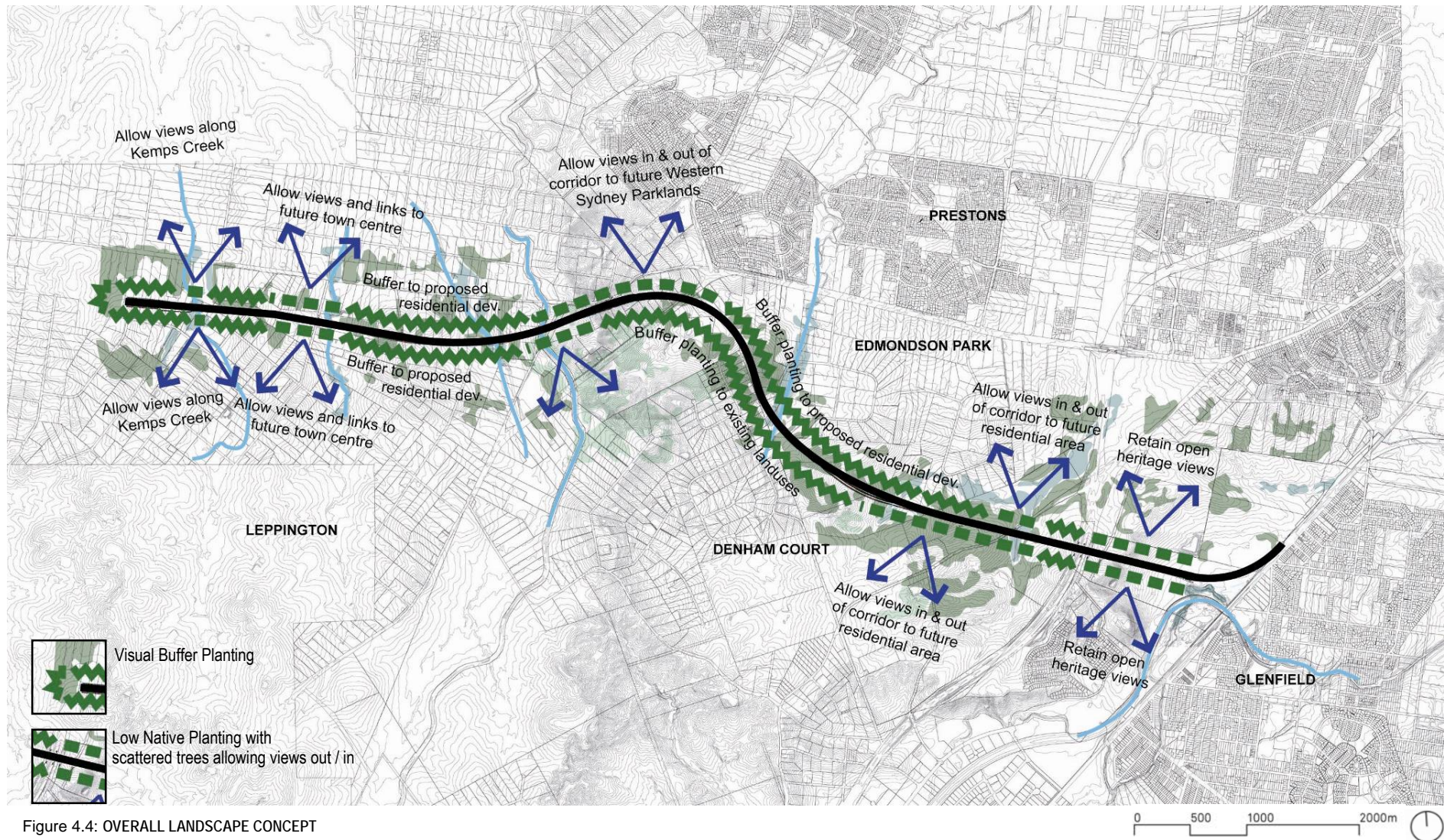
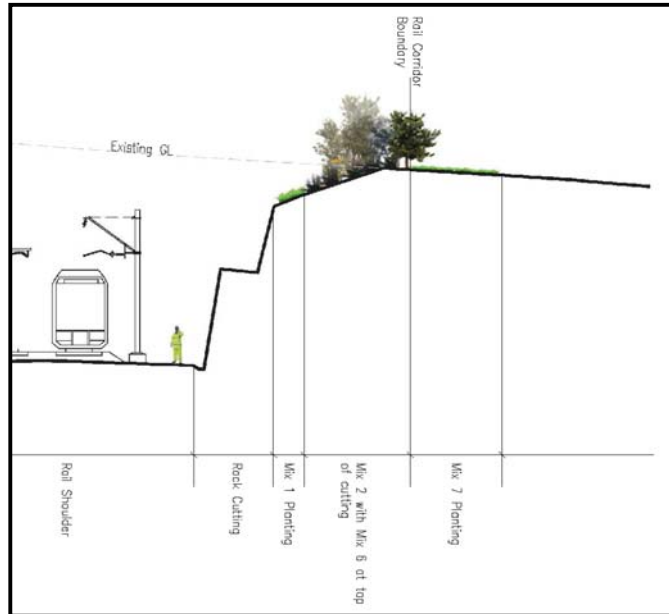


Figure 4.4: OVERALL LANDSCAPE CONCEPT

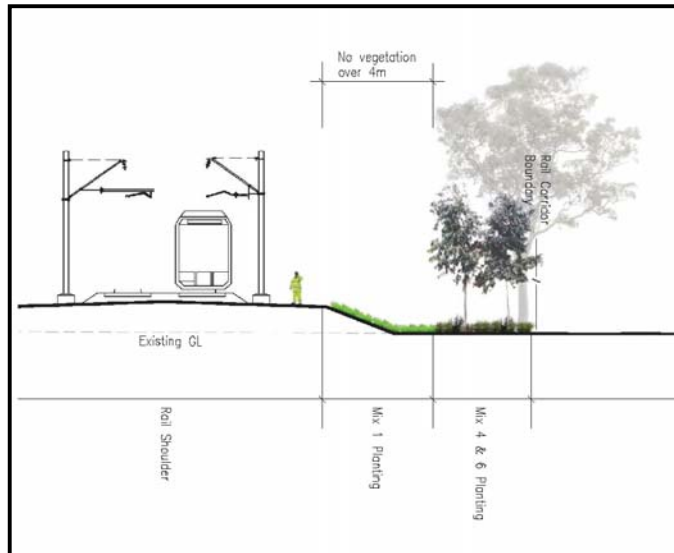
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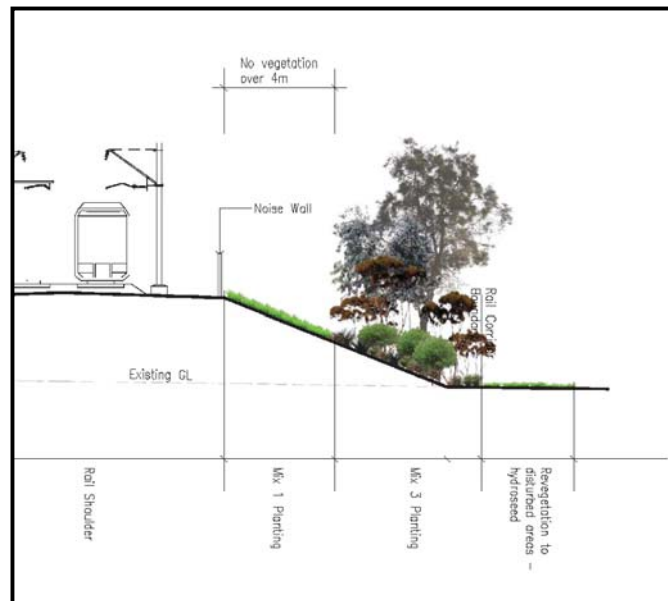
(a) - Typical cutting, with no / scattered tree canopy



(b) - Typical cutting, shrub and groundcover on cut, and scattered trees on natural ground at top of cut
Figure 4.5: TYPICAL SECTIONS - CUTTING

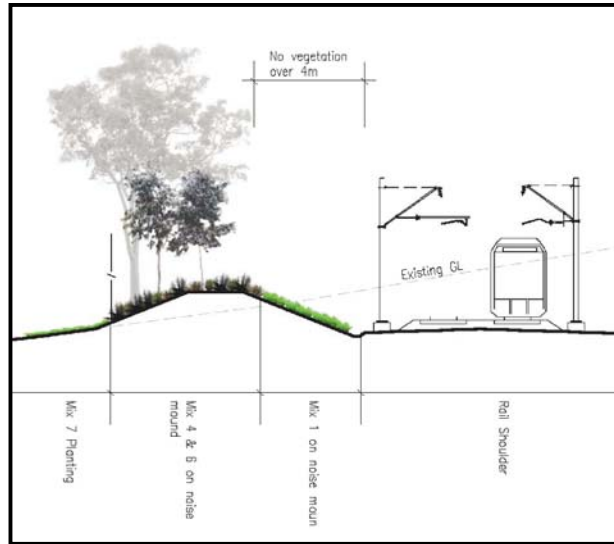


(a) - Typical embankment, with scattered tree canopy

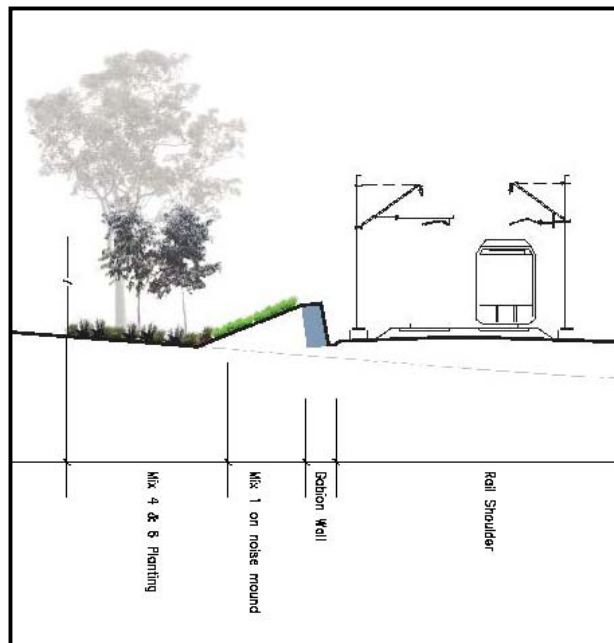


(b) - Typical embankment, with fully structured planting acting as a visual barrier

Figure 4.6: TYPICAL SECTIONS - EMBANKMENT



(a) - Typical noise mound treatment



(b) - Typical noise wall - gabion type

Figure 4.7: TYPICAL SECTIONS - NOISE MITIGATION



(a) - Typical fly over treatment

Figure 4.8: TYPICAL SECTIONS – FLY OVER