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Goulburn Mulwaree Council

Report for Highlands Source Project

Landscape and Visual Impact Assessment

January 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Glossary of Terms

Built Form	The component features of buildings, streets and spaces that make up built structure/s.
Chainage	The chainage at a location along a pipeline is the distance of that point in relation to the start of the pipeline based on 0.000 kilometres being located at the off-take at Wingecarribee Reservoir.
Concept design	Initial functional layout of a concept, such as for the proposed duplication, to provide a level of understanding to later establish detailed design parameters.
Construction Environmental Management Plan	A document setting out the management, control and monitoring measures to be implemented during construction of a development, to avoid or minimise the potential environmental impacts identified during an environmental impact assessment process.
Cumulative impact	The sum on the environment resulting from the successive effects of several different impacts.
Cut	An excavation for constructing below the natural ground level.
Cut batters	The side slopes of cuttings.
Detailed design stage	The stage at which the project design is detailed on the basis of an approved concept design.
Director-General's Requirements	Requirements for an environmental assessment issued by the Director-General of the NSW Department of Planning in accordance with the *Environment Planning and Assessment Act 1979*.
Element	A component, part or feature of the landscape (e.g. river, tree, hedges, bush). Groups of features of the soft landscape, for example roadside planting, street trees, open space.
Enhancement	Landscape improvement through restoration, rehabilitation, reconstruction or creation.
Erosion	A natural process where wind or water detaches a soil particle and provides energy to move the particle.
Fauna	The animals of a given region or period, taken collectively.
Flora	Plants of a particular region that make up the vegetation of a site.
Fill	Earth used to construct an embankment.
Gradient	The degree of ascent or descent with a uniform slope.
Heritage	Historic or cultural associations.
Indirect impact	Impacts on the environment that are not a direct result of the development but are often produced away from it or as a result of a complex association, such as off-site traffic movements.
Landscape	Soft features of the urban, suburban, rural or natural environment, such as vegetation and green open spaces.

Landscape baseline	A description of the environment as it is currently (year 2008) and as it could be expected to develop if the project were not to proceed (up to the planned opening year).
Landscape condition	Based on judgements about the physical state of a particular landscape/area, and about its visual and functional intactness. It also reflects the state of repair of individual features and elements that make up the character of any one place.
Landscape evaluation	The process of attaching value (non-monetary) to a particular landscape area, usually by the application of previously agreed criteria, including consultation and third party documents, in the context of the assessment.
Landscape impact	Change in the elements, characteristics, character and qualities of the landscape as a result of development. These impacts can be positive or negative.
Landscape feature	Prominent eye-catching elements, or example a church spire, monument, distinctive landmark building, significant mature specimen tree that contributes to landscape character through appearance or specific civic use.
Landscape quality	Largely subjective judgement based on particular characteristics that influence the way in which the environment is experienced, including special interests such as cultural associations or heritage interests, the presence and/or type of elements and condition.
Landscape resource	The combination of elements that contribute to landscape context, character and value.
Landscape sensitivity	The extent to which landscape can accept a change of a particular type and scale without unacceptable adverse impacts on its character.
Landscape value	Areas of formally designated landscape that through national or local consensus, reflect the value placed by society on particular environments and/or their features.
Local area	According to the NSW Department of Environment and Climate Change guidelines for Section 5A of the *Environmental Planning and Assessment Act* 1979 (NSW) 'significance assessment tests' the *local area* is synonymous with the *study area*.
Magnitude	A combination of the scale, extent and duration of an impact.
Methodology	The specific approach and techniques used for a given study.
Mitigation	Measures, including any process, activity or design to avoid, reduce, remedy or compensate for adverse landscape and visual impacts of a development project.
Option	A concept design alternative developed for consideration.
Perception (of landscape)	The psychology of seeing and possibly attaching a value and/or meaning (to landscape).
Plant	Construction machinery, vehicles or equipment needed to carry out mechanical or construction activities.
Proponent	Goulburn Mulwaree Council (GMC).
Project	Refers to the proposed Highlands Source Project. Broadly, the Project comprises of a proposed pipeline *ca.* 83 km in length to deliver water from the Wingecarribee Reservoir to the City of Goulburn in NSW.

Public open space	Land provided in urban or rural areas for public recreation, though not necessarily publicly owned.
Receptor	Physical landscape resource, special interest or person and/or viewer group that will experience an impact.
Rail corridor	The area of land dedicated to the Australian Rail Track Corporation.
Residual impact	An impact that occurs/persists after mitigation measures have been put in place.
Sense of place	The essential character and spirit (genius loci) of an area.
Site compound	Area enclosing construction machinery, stockpiles and site offices usually adjacent to construction sites.
Spoil	Excess of rock and/or earth material resulting from construction activities.
Study area	The study area for this project is defined as described in Section 1 of this document.
Visual amenity	The value of a particular area or view in terms of what is seen.
Visual catchment	Extent of potential visibility to or from a specific area, feature or proposal.
Visual impact	Changes in the appearance of the landscape or in the composition of available views as a result of development, to people's responses to these changes, and to the overall impacts in regard to visual amenity. This can be positive (i.e. beneficial or an improvement) or negative (i.e. adverse or a detraction).
Zone of visual influence	Area within which a proposed development may have an influence or impact.

Acronyms & Abbreviations

EEC	Endangered Ecological Communities
EP&A Act	*Environment Planning and Assessment Act 1979*.
DoP	Department of Planning
DGR(s)	Director-General's Requirement(s)
GMC	Goulburn Mulwaree Council
HSP	Highlands Source Project
LGA	Local Government Area
LVIA	Landscape and Visual Impact Assessment
NSW	New South Wales
UK	United Kingdom
WSC	Wingecarribee Shire Council
WTP	Water Treatment Plant

Units

km	Kilometres
ha	Hectares
L	Litres
mm	Millimetres
m	Metres
mL	Millilitres
ML	Megalitres
kL	Kilolitres

Executive Summary

The Project consists of the construction of an underground pipeline between the Wingecarribee Reservoir and Goulburn, New South Wales. Along the proposed alignment, the works required to construct the pipeline and associated infrastructure, including a pump station and storage tank, would impact on the visual environment, the extent of which being determined by the nature and location of the works being undertaken and the locations from which views are available.

The objective of this Landscape and Visual Impact Assessment is to assess the potential impact of construction and operation of the Project on landscape character and visual amenity. Landscape and visual values and impacts of the project are assessed separately, although they are closely interrelated. The assessment of the potential landscape impacts of a project is carried out as an impact on an environmental resource (i.e. the landscape) whereas visual impacts are assessed as one of the interrelated impacts of a project on the viewing population.

The majority of landscape and visual impacts as assessed in this report would be a result of activities carried out in the construction phase of the Project. These activities include the clearance of vegetation, the presence of construction machinery and activities in an otherwise rural landscape and the creation of a cleared easement which, until vegetated, would be a visually obvious element in the landscape.

Some potential impacts would occur in the operational phase of the Project. In some locations, vegetation clearance during the construction phase would result in a change to views experienced by residents and travellers. Air, scour and stop valves would be constructed along the pipeline route and, depending on the location of these, they may be the cause of adverse landscape and visual impacts during the operations phase.

Mitigation measures recommended to minimise these issues include avoiding loss of damage to vegetation wherever possible, the sensitive siting of above ground elements and the planting of indigenous screening vegetation at certain locations.

Due to the nature of the project there would be a permanent impact on the visual landscape and amenity of some locations along the Project alignment.

1. Introduction

This Landscape and Visual Impact Assessment has been undertaken by GHD Pty Ltd (GHD) on behalf of the Goulburn Mulwaree Council (GMC) for the Highlands Source Project (referred to as 'the Project'). This report has been prepared to assess the significance of impacts on the visual landscape and outlook as a result of the Project and to identify the extent to which mitigation of impacts would be required.

1.1 Background

Goulburn has faced severe drought and water restrictions since 2002. By mid 2007 Goulburn had less then 12 months' water supply available. GMC, in conjunction with a State Government Task Force, identified an Emergency Pipeline from Wingecarribee Reservoir as the best means of overcoming the emergency and drought proofing Goulburn for the future (GMC & DoC, 2007). Subsequent rains in June 2007 removed the emergency aspect of the project; however the need for improved water security remains.

Since 2007, a range of options for securing Goulburn's water supply have been investigated. GMC has prepared a draft Integrated Water Cycle Management (IWCM) Strategy that will outline actions for improving long term water sustainability. The IWCM Strategy is expected to be finalised towards the end of 2009, and it is anticipated that the Highlands Source Project will be an integral part of this Strategy. Additionally, GMC has undertaken a Goulburn Water Supply Strategy Review, in which the Highlands Source Project was identified as the best solution for improving the city's water security.

1.2 Scope of assessment

1.2.1 Objectives and purpose of this report

The objectives of this Landscape and Visual Impact Assessment are to:

- Assess the potential impact of construction and operation of the Project on the existing landscape character and visual amenity;
- Assess the significance of these potential impacts on sensitive visual receptors and the wider community. The significance of impacts will be assessed as a function of the magnitude of the impact on the landscape and the sensitivity of the viewer, as described in Section 4.4;
- Propose mitigation measures that will help to ameliorate these impacts during both the construction and operation stages of the Project; and
- Address the Director General's Requirements (DGRs) for the Environmental Assessment of the Project.

1.2.2 Content of the report

This report assesses the potential landscape and visual impacts associated with the Project alignment and associated infrastructure. The report includes:

- A description of the project design and its visual components;
- A description of the relevant consultation, legislation, policies and guidelines that have been used to inform the assessment;
- Methodology adopted for the assessment of impacts upon landscape character and visual amenity;
- A description of the limitations and assumptions of this method;
- An evaluation of the baseline landscape and visual context;
- Discussion of visual receptor sensitivity within the study area through the use of representative publicly accessible viewpoints;
- An assessment of the significance of impacts upon landscape character and visual amenity as a direct result of the Project, based upon an evaluation of publicly accessible viewpoints;
- Proposed mitigation strategies;
- Discussion of residual impacts; and
- A summary of the results of the assessment.

1.3 Limitations

There are a number of *limitations* associated with this assessment, as follows.

- There is no guidance on the assessment of landscape and visual impacts specific to Australia. However, the industry typically refers to guidance offered by the British Institute of Landscape Architects in the United Kingdom. This assessment has been conducted in accordance to the Guidance for Landscape and Visual Impact Assessment (2002) published jointly by The Landscape Institute and the Institute for Environmental Management and Assessment (UK).
- For the purpose of this report, general assumptions have been made in order to appraise the impact of the construction works upon landscape resources and visual amenity based upon similar pipeline projects and specialist advice; and
- The assessment process aims to be objective and describe any changes factually. Potential changes as a result of the project have been defined, however, the significance of these changes requires qualitative (subjective) judgements to be made. The conclusions to this assessment therefore combine objective measurement and professional interpretation.

1.4 Assumptions

A number of assumptions have been made for this assessment, as outlined below.

1.4.1 Construction Phase

- Some areas along the pipeline route would be required on a temporary basis to provide construction compounds (equipment storage, site sheds and amenities) and storage areas (pipe lay down, stockpiles and equipment) to support construction. These locations were not confirmed at the time of writing this report;
- Only impacts associated with construction activities occurring (during the construction phase) within the project boundary have been considered, with the exception of site compound and lay down areas outlined above;
- The pipeline corridor would be rehabilitated post construction through vegetation planting appropriate to the local context and all applicable legislation (See Section 2);
- The width of the construction corridor would be up to 20 m for the majority of the alignment length, with variations around creek and road crossings and areas of steep crossfall; and
- The assessment is based on the information provided to GHD at the time of writing.

1.4.2 Operation Phase

- The pipeline infrastructure (during operation) would be primarily underground, with a limited number of above ground elements, however maintenance activities would be carried out periodically during the operation phase, as described in Section 3.9.1. Most landscape and visual impacts relate to the visual appearance of the construction works that would be phased, temporary and restricted to the construction period. Although phased, the type of impact would generally be consistent across the pipeline corridor and are therefore assessed on a site wide basis. Some key areas where the construction activity is likely to be more intense or varied have been identified within the text;
- Baseline conditions have been assessed in November 2009;
- Project mitigation measures are addressed on a site wide basis, with key areas (pump station) addressed separately;
- The pump station would not be lit at night;
- Site specific operational impacts are detailed within the assessment as eight (8) sectors, as described in 3.1.4 and illustrated in Figure 3.1.
- During operation, maintenance and repair works would occur infrequently on restricted sections of the pipeline at any one time, during daylight hours;
- The operational pipeline corridor width (up to 10 m) would remain free of trees and shrubs during operation; and
- The pipeline at creek crossings is assumed to be underground.

2. Planning and statutory requirements

Legislation, policy and guidance with direct relevance to this landscape character and visual impact assessment are outlined below.

2.1 Pipelines Act (1967)

The *Pipelines Act 1967* relates to the construction, operation and maintenance of pipelines, under which this project will apply for a pipeline licence to acquire land and / or easements over which the pipeline and associated infrastructure would be located. This licence must not be refused if the project is approved under Part 3A of the EP&A Act. Conditions of licence (Section 15) include taking measures as the Minister may require for conserving and protecting scenic attractions and other values. This includes the reinstatement, levelling, regressing, re-foresting and contouring of any lands that may be damaged or deleteriously affected by the licensee.

2.2 Goulburn Mulwaree Council Local Environment Plan (LEP) 2009

The Goulburn Mulwaree LEP was developed to make local environmental planning provisions for land in the Goulburn Mulwaree Council. Of direct relevance to this report are the following provisions:

Zone RU1 Primary Production

The stated objectives of this zone include the minimisation of the visual impact of development on the rural landscape. Much of the pipeline within the Goulburn Mulwaree Council is situated in Zone RU1. Mitigation measures proposed in this report will recommend ways to minimise such visual impacts.

Wingecarribee Shire Council Local Environment Plan (LEP) 1989

The Wingecarribee LEP was developed to introduce planning controls that will encourage ecologically sustainable development. The plan includes provisions that require consideration of visual impacts and are of direct relevant to the Project. These provisions are:

Zone 1(a) Rural 'A' Zone

Whilst the pipeline is primarily located in this zone, there is no reference to the preservation of landscape and visual values in the Local Environmental Plan in relation to this zone.

Zone 7(b) Environmental Protection (Landscape Conservation) Zone:

(2) Land within Zone No 7 (a) or 7 (b) shall not be cleared for any purpose except with the consent of the council.

(3) The council shall not grant consent to the clearing of the land referred to in subclause (2) unless it is satisfied that:

- (a) the clearing is essential for the reasonable economic use of the land or the provision of utility services,
- (b) the clearing is proposed to be carried out in a manner which minimises:

(i) visual and scenic impact

2.3 Wingecarribee Shire Council Development Control Plan (DCP) No. 53, 2004

This DCP relates to the 'Siting, Design and Landscaping of Rural Developments' and will be considered in the assessment of impacts relating to the proposed pump station at Wingecarribee Reservoir. The plan has been developed to ensure that development is responsive to the scenic and historic landscapes of the shire and makes reference to the siting, design, colour, materials and screening of built structures.

3. Project description

3.1 Overview

3.1.1 The Project

The Project is to construct and operate a water transfer scheme to transfer water from Wingecarribee Reservoir (*ca.* 9 km east of Moss Vale NSW) to Goulburn's water supply system.

The proposed pipeline would be approximately 83 km in length and would be located within the Council areas of Wingecarribee Shire Council (WSC) and GMC. The necessary ancillary infrastructure would include an offtake and pump station at the Wingecarribee Reservoir site, power supply and controls, and a telemetry system.

The pipeline would deliver a flow of 5 ML/day (over a 22 hour period) with the potential to increase the flow to 7.5 ML/day in the future (15 to 20 years time) to accommodate expected growth in demand. The mode of operation of the system, whether it will be continuous or intermittent, would be subject to detailed design.

The pipeline easement would be constructed predominantly adjacent to existing infrastructure easements. The easement would traverse mostly rural land and would cross various waterways, existing services, and road and rail infrastructure.

There are two water transfer schemes under consideration. The schemes are as follows:

- Raw Water Transfer Scheme, which would transfer raw (untreated) water from the Wingecarribee Reservoir to the Goulburn Water Treatment Plant; and
- Treated Water Transfer Scheme, which would transfer treated water from the Wingecarribee Water Treatment Plant to a reservoir at Governor's Hill (east of Goulburn) or directly into the town water supply system.

The Project, for which GMC is seeking approval to construct and operate, contains both water transfer schemes. Only one transfer scheme however would be constructed.

If the Project is approved, a decision on which scheme to construct would be made once detailed project design has been completed. It is proposed to have the Project operational by June 2011.

The Project would be jointly funded by GMC, the NSW Government and the Australian Government through its Water Smart Australia Program.

3.1.2 Key Project infrastructure

The Project would involve the construction of the following key pieces of infrastructure:

- An 83 km pipeline including scour valves, air valves and divide valves;
- A raw water or a treated water pump station located at the Wingecarribee Reservoir; and

- Connections to the Goulburn Mulwaree water supply at the outlet point.

3.1.3 Key Project activities

Key *construction activities* include:

- Constructing the water intake infrastructure at the Wingecarribee Reservoir site;
- Trench excavations and placement of the pipeline to the off-take point at Goulburn;
- Constructing railway, road, services and river crossings;
- Reinstatement / revegetation of the construction corridor; and
- Commissioning of the water transfer scheme.

Key *operational activities* would include:

- Pumping of water from the Wingecarribee Reservoir to Goulburn;
- Regular maintenance of the pumping station;
- Regular maintenance of the air and scour valves; and
- Less frequent maintenance of the pipeline (*e.g.* pigging to remove blockages, or repairing bursts as required).

3.1.4 Project sectors

For the purposes of describing the proposed route of the pipeline easement, the pipeline route has been divided into sectors. The sectors (from the Wingecarribee Reservoir to Goulburn) are listed in Table 3.1.

Table 3.1 Pipeline easement sectors

Sector	Approximate chainage (m)
Glenquarry	0 – 8 213
Werai- Moss Vale	7 371 – 14 070
Sutton Forest- Exeter	13 794 – 26 602
Paddy's River	25 650 – 40 933
Marulan	39 063 – 53 533
Towrang	51 279 – 68 557
Murrays Flat	68 269 – 72 346
Goulburn	71 252 – 80 721

Figure 3.1 shows the location of the pipeline easement sectors.

3.2 Pipeline

3.2.1 Pipeline route

The proposed pipeline route was determined based on a number of physical factors such as topography, landscape, land use and environmental considerations. The majority of the proposed pipeline route is located adjacent to existing subsurface infrastructure easements (gas, electricity and optical fibre).

As described in Section 3.1.1, there two water transfer schemes under consideration. Each proposed scheme has a different pipeline route at the Goulburn end of the pipeline. However the majority of the pipeline route is common to both schemes.

From the Wingecarribee Reservoir (chainage 0 km) the proposed pipeline route is located through previously cleared rural land. From approximate approximately 9 km to 25 km, the proposed pipeline route is located immediately adjacent to an existing power line easement. From approximately 25 km, it is located immediately adjacent to the existing Moomba to Sydney gas pipeline easement (on the easement's southern side) to approximately 70 km.

From approximately 70 km, the pipeline route differs depending on the proposed water transfer schemes. The pipeline route for the treated water transfer scheme runs south from the 70 km chainage to Governor's Hill. The pipeline route for the raw water transfer scheme continues adjacent to the Moomba – Sydney gas pipeline to chainage 77 km, where it then runs south to the Goulburn Water Treatment Plant.

The raw water transfer scheme pipeline would be approximately 83 km long, while the pipeline for the treated water transfer scheme would be approximately 75 km long.

The proposed pipeline route is shown in Figure 3.1.

3.2.2 Pipeline infrastructure

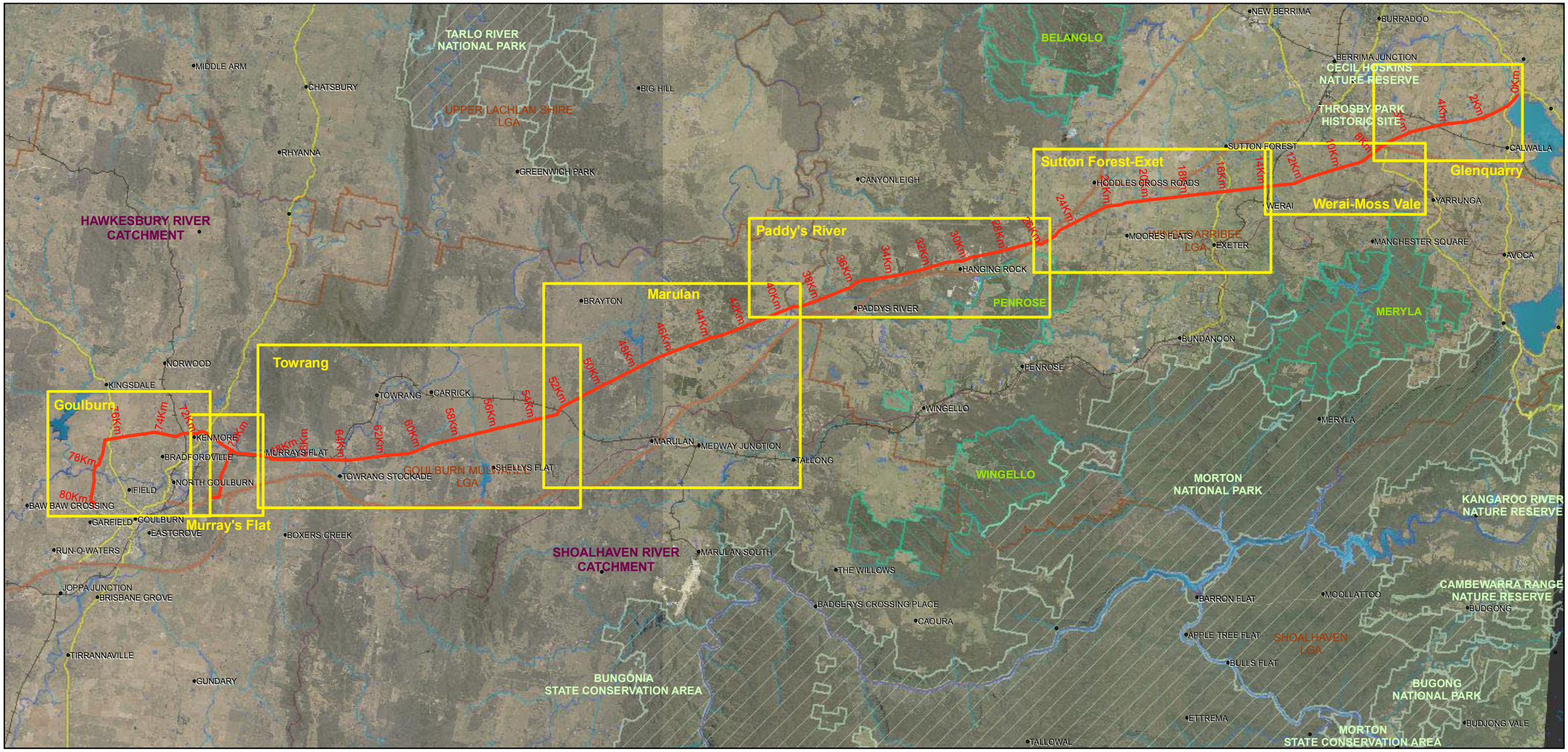
Pipeline

The pipeline would be constructed of ductile iron cement mortar lined (DICL), rubber ring jointed pipes, and would be located approximately 1.2 m below surface level. A number of pipeline materials are currently being considered including both Mild Steel and glass-fibre reinforced polyester (GRP) and a final decision on the pipe material used would not be made until the tender phase. The construction methodology and associated impacts are essentially the same for each material with the use DICL chosen as a scenario for the purposes of this EA.

Air valves, scour valves and divide valves would be located at regular intervals along the pipeline to provide air release and entry, and to allow cleaning. A summary of the key pipeline components in presented in Table 3.2.

Table 3.2 Key pipeline components

Component	Key data
Transfer pipeline	Nominal diameter – 300 mm and 375 mm Total length – approximately 83 km (raw water) and 75 km (treated water) Location – underground Trench depth – 1.5 m to 2 m Material – ductile iron cement lined Coating – corrosion protection and polyethylene sleeving
Air valves, scour valves and other valves	Air valves would be used to exhaust air from the pipeline at high points. Scour valves would be used to release scour water from the pipeline at low points.
Connection/outlet points	The treated pipeline would connect into the existing Goulburn supply network at a new reservoir to be constructed at Governor's Hill. The raw water pipeline would be pumped to an existing tank located behind the Goulburn WTP.
Spoil generation	Approximately 150,000 m^3 of spoil, of which approximately half would be used as backfill material and the remainder to remediate the 20 m wide construction impact zone.
Trucks for supply of pipe	Pipes are expected to be delivered at a rate of approximately 24 pipes lengths per truck, with each pipe length 6 m long. This equates to approximately 510 deliveries over approximately a 6 month period.
Construction – work crews	4 crews (3 pipeline crews, 1 pump station & connections crew) 20 to 30 personnel per crew
Construction corridor	Typically up to 20 m wide construction corridor area directly adjacent to the existing gas pipeline easement. It is likely that this width would be reduced to less than 10 m or less where possible in specific areas where additional constraints exist or more or less width is required).
Pipeline easement	Likely to be a maximum of 10 m wide
EA assessment corridor	100 m wide



Legend

- Proposed Pipeline Alignment
- Proposed_Route_20091129_MR_JC_Edits_polylineM
- Investigation Sectors
- Locality
- PrimaryRoad
- ArterialRoad
- Railway
- Rivers, Creeks
- LGA Boundary
- Lakes, Dams
- Reserve
- State Forest
- Catchment Boundary

1:200,000 (at A3)

0 2 4 6 8 10

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Job Number 23-13312
Revision 0
Date 24 DEC 2009

Preferred pipeline route

Figure 3.1

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Data Source: NSW Lands Dept: Placepoint, roadsegments,railway,hydroarea,hydroline,npwreserve,stateforest - 2007; GMC: aerial imagery - 2008; NSW DECC: rbasin_polygon - 2008. Created by: ccharalambou

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The pipeline would have an outside diameter of 300 mm and 375 mm and a nominal wall thickness of 6 mm to 9 mm. The pipe would be pre-lined with cement mortar and coated in corrosive protection and prior to installation would be wrapped (and taped) in polyethylene sleaving to protect the pipeline from corrosion due to potentially aggressive soils. The pipeline would be laid in a shallow continuous trench to depths of approximately 1.5 m to 2 m below ground level.

The pipeline trench would be constructed within a 10 m wide pipeline easement. The land within this easement would be acquired from landholders and accessed for operational and maintenance purposes. The pipeline easement would be rehabilitated to achieve a stable ground surface and revegetated with an appropriate grass cover.

A 20 m wide (maximum) corridor would be required for construction of the pipeline. The construction corridor would need to be cleared of significant vegetation to allow construction activities to occur. The pipeline easement would lie within the construction corridor. The area of land within the construction corridor but external to the pipeline easement would be rehabilitated to its previous condition.

The pipeline would also include auxiliary infrastructure at various positions along the pipeline route, such as isolation valves, concrete pits, air valves and scour valves. Pipeline marker posts would also be installed at regular intervals (approximately every 200 m) to warn of the location of the underground water pipeline.

Air valves

At high points along the pipeline, air valves would be installed to enable entrained air to be released. Air valves are common pipeline structures in both urban and rural settings designed to assist the water flow and pressure within the pipeline. Air valves would be contained within a concrete circular pit approximately 1200 mm to 1500 mm in diameter, approximately 600 mm above the ground surface and covered in a metal grating (Figure 3.2).

Figure 3.2 Example of a constructed air valve

Nominally, the air valves would be spaced at between 500 m and 800 m centres. A preliminary assessment of the pipeline route grade, using 10 m topographical contour data, has indicated that approximately 45 primary air valves and approximately 20 to 30 secondary air release points would be located along the pipeline. The final number of air valves may vary according to detail survey.

Scour valves

At the low points along the pipeline, scour valves would be installed to enable scouring (cleaning) of the pipeline. Scouring would involve periodically discharging liquid from the pipeline (scour water).

A preliminary assessment of the pipeline route grade, using 10 m topographical contour data, has indicated that approximately 40 primary scour valves and approximately 30 secondary scour points would be located along the pipeline. The final number of air valves may vary according to detail survey.

Scour water would be managed appropriately according to whether raw or treated water is transfer to Goulburn. Scour water management is described in Section 3.9.1.

Divide valves (stop valves)

Divide valves (also known as stop valves) would be installed along the pipeline to allow sections of the pipeline to be isolated. Shutting down water flows in the pipeline would be undertaken during maintenance or repairs. Up to 17 divide valves would be constructed along the alignment at regular 5 km intervals.

3.2.3 Pipeline construction

Pipeline trenching and placement

The pipeline construction corridor would be in the order of 20 m wide while the pipeline is being constructed. Preparation of the construction easement would include clearing of trees and vegetation where present and removal of topsoil and other obstacles such as rocks with a bull dozer (Figure 3.3). The proposed construction easement width would provide sufficient space to construct the trench while providing enough space for excavated material to be placed beside the trench, a trench safety area, pipes to be strung out beside the trench prior to installation and the movement of vehicles such as trucks, cranes and excavators beside the trench. Where specific obstacles such as large trees, endangered ecological communities and large boulders or significant landscapes are identified along the route, the construction corridor would be narrowed to 6 m to 8 m wide.

Pipes would be stockpiled at 5 km to 10 km centres adjacent to an existing road or access that is suitable for a semi-trailer truck. The pipes would then be transported to the cleared construction corridor and would be strung out along the edge of the existing gas pipeline easement, thus acting as a barrier to construction activities entering the gas easement (Figure 3.4).

The pipeline trench would be approximately 1 m wide and excavated to a nominal depth of 1.5 m to 2.0 m below ground surface using either a tracked excavator or a tracked chain trencher. The excavated material would be deposited within the construction easement adjacent to the trench for backfilling or disposal where appropriate. Excavated material that is greater than 20 mm in diameter when it exits the

trenching machine cannot be used for backfilling and alternative material, such as sand would be used to backfill the trench.

The corrosive sleeve protection wrapped pipeline would be lifted into the trench using an excavator or crane (Figure 3.5). The pipeline segments are pushed together (Figure 3.6). Tipper trucks would be used to place backfill sand around the trench and to transport material to and from stockpile areas. Scour valves, air valves and divide valves would be constructed periodically along the pipeline which would involve installing pre-cast concrete components and some concrete pours where required.

Stockpile areas of approximately 10 m by 10 m wide would be located intermittently along the pipeline easement. These stockpile areas would contain sand and other material that would be used for backfill where the natural material is too coarse for use.

Following construction, an easement (of approximately 10 m in width) would be maintained as a cleared landscape to allow access for ongoing maintenance activities.

Figure 3.3 Prepared pipeline construction corridor

Figure 3.4 Stringing pipes along an excavated trench (Stockinbingal to Temora pipeline).

Figure 3.5 Lifting the pipe segments into the excavated trench (Stockinbingal to Temora pipeline)

Figure 3.6 Covered pipe segments joined in the trench prior to replacement of excavated material

Pipeline construction corridor, site compounds and stockpile areas

Site compounds, storage, stockpile and lay down areas would be required at various locations along the pipeline. The proposed locations of the facilities have generally been selected to occupy existing cleared areas or areas that would be cleared for the excavation of the pipeline trench.

Construction corridor

In general, a 20 m wide construction corridor would be required along the pipeline route to allow for trench excavation; equipment storage and movement of construction vehicles along the pipeline corridor; storage of topsoil, backfill and spoil; and bi-directional right of way access.

Clearing and grading would be minimised where practicable to the extent necessary for construction of the pipeline and would not exceed the 20 m construction corridor. The area that would be directly impacted upon by construction activities would range in width from 8 m to 20 m, depending on a range of factors considered that include occurrences of critical habitats for endangered species and communities, vegetation sensitivity and quality, constructability, construction management and safety considerations, land form, slopes and anticipated sub-soil structures. Direct impacts would be reduced as far as practicable with narrower construction corridors proposed where feasible and in areas this may only require a 6 m to 8 m wide corridor (possible only for short stretches). In areas of steep terrain (that impact on construction methodology's available and construction safety) and problematic sub-soil conditions, the impact area would be wider than 10 m, but would always be less than 20 m. The proponent has based the environmental assessment on an indicative corridor width that would be refined

by the construction contractor.

Access to land for the purposes of construction, rehabilitation and operation of the pipeline is the subject of discussions and negotiations between the proponent and the landowners.

Main construction office and site compounds

Primary and secondary site compounds would be required for the construction phase of the Project. Primary compounds would predominately be used for site offices, amenities, storage of major plant and equipment and storage of materials. Primary compounds would be located in close proximity to major construction sites and would provide adequate access and sighting for the Project.

Secondary site compounds would be predominately used for storage of minor plant, equipment and materials. Nominal amenities may also be provided in these locations. Secondary site compounds would also be located in areas close to major construction works. However, the area of secondary site compounds would generally be smaller than primary site compounds.

Each site would be securely fenced with temporary fencing. All necessary signage advising the general public of access restrictions relevant to each site would be provided. These areas would be reinstated at completion of use.

Location of the site offices would be determined and arranged by the nominated Construction Contractor. Marulan is a central location that is likely to be used, with other options including Goulburn, Moss Vale or Exeter. It is likely that some site offices would be established within or adjacent the Wingecarribee Water Treatment Plant area. Being essentially a linear project, plant and equipment will be progressively advancing along the pipeline route; hence it is unlikely that there will be large groups of equipment in one location at any point in time.

Stockpile and spoil areas

Stockpile and spoil areas would be located within the 20 m wide construction impact zone. Excavated material from the trench would be stockpiled adjacent to the trench and used to backfill the area of the trench above the laid pipeline. Generally for this size pipeline – approximately 40 km of 375 mm diameter pipeline and 40 km of 300 mm diameter pipeline – it is found that relative to the disturbed area required for construction that the volume of excess material is relatively small and is generally utilised for reinstating the pipeline corridor. In this case it would equate to an approximate spread depth of less than 50 mm of excess material across the construction impact zone (20 m wide by 83 km long). Additionally, most landholders have erosion areas where they are seeking to have any excess spoil placed.

Imported backfill material (i.e. sand) would be stockpiled in approximate 10 m by 10 m areas at approximate 200 m to 300 m intervals along the impacted zone. It is estimated that approximately 40,000 cubic metres of imported backfill material would be required along the pipeline.

Temporary stockpile areas would be protected by sediment and erosion controls including temporary sediment fences. Stockpiles would be covered or controlled by wetting down where necessary to prevent impacts from dust.

Pipe lay down

Pipes would be delivered by semi-trailers to pipe lay down areas adjacent to existing roads and accesses at approximately 5 km to 10 km intervals nearby to the pipeline route. The pipes removed from the trucks and placed in the lay down areas using mobile cranes. Leases for lay down areas are usually negotiated with landholders and in some areas Council may have adequate areas within existing road reserves which could be used for this purpose.

Pipe lay down areas located within Council road reserves and private land would be fenced and public safety warning erected. Drainage controls would also be constructed where required.

Pipe lay down areas would also be located within the construction impact corridor, in many cases along the boundary of the existing 25 m wide gas pipeline easement. This easement is totally cleared and access may be available on one side of this corridor.

Signage

Water pipeline marker signs would also be installed along the pipeline route at 500 m intervals, horizontal bends, service crossings, either side of road crossings and at fence and gate crossings.

3.3 Pumping station

For both the raw water and treated water options, a new high lift pumping station would be located on the Wingecarribee water treatment plant site. Ultimately both schemes would be designed for a flow of 7.5 ML/d, requiring the installation of a booster pump station in the vicinity of Marulan in approximately 15-20 years time. A schematic of the proposed pumping scheme is presented in Figure 3.7.

A high lift pumping station would be located adjacent to the existing raw water pumping station between the dam and the Wingecarribee WTP. This pumping station would be initially equipped to achieve a flow rate of 5 ML/d and would involve approximately 100 KW of pumping capacity.

The pumping station building is expected to be of a rectangular form to house most likely two duty pumps together with one standby pump. The building footprint would be of the order of 8 m by 15 m which would include the electrical and control equipment. The height of the pumping station would be approximately 5 m in order to provide for a monorail system.

The pumps required are relatively small. The initial preference would be to use single stage split casing pumps. Some consideration to using vertical spindle pumps may be given to overcome some potential flood level immunity requirements.

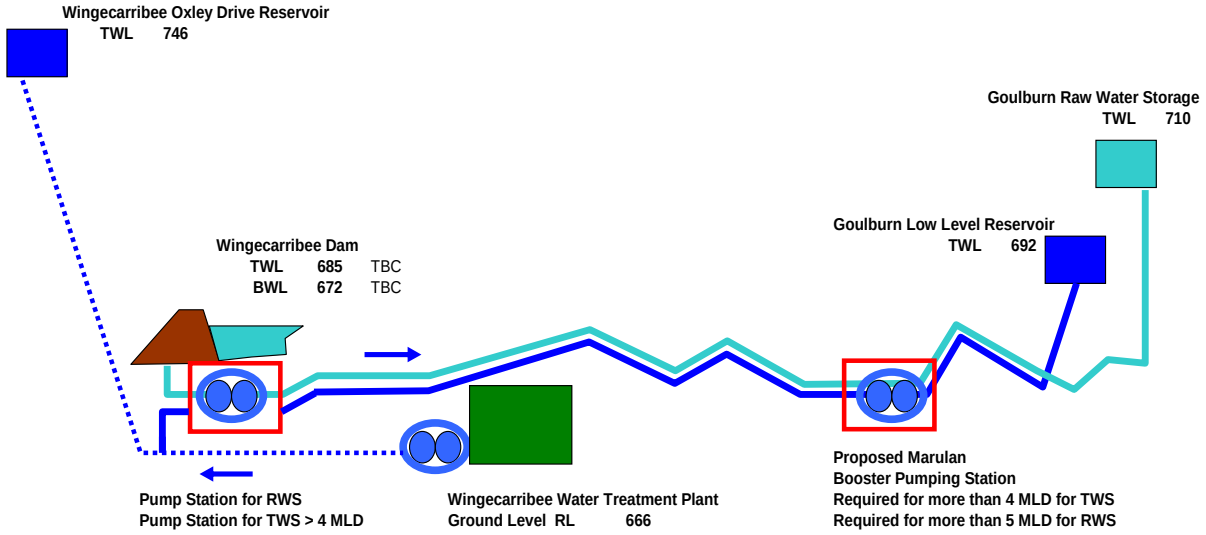


Figure 3.7 Schematic of the proposed water transfer scheme (not to scale)

3.4 Outlet point

3.4.1 Raw water transfer scheme

The pipeline would be constructed to an existing (but currently unused) water balance tank at the Goulburn WTP. Raw water would be discharged into this reservoir. From there, it would be treated at the water treatment plant and released into Goulburn's town water supply.

The Project includes constructing the connections of the pipeline to the outlet point into the reservoir.

3.4.2 Treated water transfer scheme

Two outlet points for the treated water transfer scheme are being considered.

One outlet point would discharge treated water into a proposed new reservoir on Governor's Hill, which is located to the east of Goulburn. The reservoir would be connected to the town water supply system on the eastern side of Goulburn. Planning approval to develop this reservoir is not being sought as part of the Project. An application seeking approval to develop the reservoir and connect it to the town's water supply system would be made in the future.

The other outlet point being considered would be directly connecting the pipeline to the town's water supply system at a point where the water supply system exists east of Goulburn in the vicinity of Governor's Hill.

3.5 Crossings

3.5.1 Overview

The pipeline would cross major roads (*e.g.* the Hume and Illawarra Highways), local roads, railways (including the Moss Vale Unanderra Railway) various waterways (including the Wollondilly River) and a number of services.

Based on a preliminary consideration of technical issues and environmental and geological constraints, a number of common construction methods are proposed to construct the crossings. The methods that would be adopted include:

- Trenching;
- Thrust boring; and
- Horizontal directional drilling (sometimes termed 'under boring').

3.5.2 Ancillary infrastructure

Access roads / tracks

Access to the pipeline easement from existing roads would be required approximately every 3 km to 4 km along the route. Where possible, existing access roads and farm tracks would be used to access the easement and the proposed easement alignment would be the main thoroughfare through the properties. It is envisaged that access to some terrain would be a problem in some areas along the proposed alignment.

Fences and gates

At completion of construction and restoration of the pipeline construction impact area, property fences would be reinstated and gates installed along the pipeline easement between properties. This would allow for ease of access to the pipeline easement for ongoing maintenance and inspections.

3.6 General construction details

3.6.1 Construction timing and hours

Typical hours of construction would be 7:00 am until 7:00 pm Monday to Friday and 8:00 am until 1:00 pm Saturday. Extended working hours would be required on week nights and weekends to ensure the Project is completed within the allocated funding timeframe, particularly for concrete pours and construction material delivery and some road crossings that would need to be completed out of daylight

hours to reduce the potential impact to traffic. Thus construction could ultimately be completed at any time of the day or night. Appropriate measures to mitigate potential impacts to nearby landholders would be implemented in this case, such as identifying work zones away from residences and other sensitive receptors to avoid impacts from light and/or noise.

Some out-of-hours delivery of equipment may also be required. This could occur at any time of the day or night on weekdays and weekends. In this case, delivery areas would be located away from residences to minimise disturbance. The need for extended working hours will be determined during detailed design; however assessments of the potential impacts of night work have been included in this EA.

3.6.2 Construction sequencing

The following sequence of construction activities would generally occur for the construction of the pipeline, pump stations and ancillary equipment:

- Identification of access roads / tracks and maintenance where required;
- Identification, delineation and protection of environmentally sensitive areas, including tagging and fencing;
- Preparation of the pipeline construction easement, including right of way clearing of vegetation and removal of topsoil;
- Advanced trenching work including potentially pre-trenching and blasting in rocky areas if required;
- Delivery and stringing of pipes along proposed route;
- Excavation of an open trench along the pipeline route, with trench spoil mounded to one side;
- Thrust boring and horizontal directional drilling of major roads, significant waterways and rail lines;
- Installation of the pipe, including corrosive sleeve protection and jointing and the installation of scour valves, air valves and divide valves;
- Pipe coating repairs and joint reinstatement;
- Padding and backfilling of trench;
- Progressive hydrostatic testing of the pipeline;
- Reinstatement and rehabilitation of the construction easement;
- Installation of marker posts, signs and gates; and
- Commissioning and completion.

At completion of construction and restoration of the pipeline construction impact area, property fences would be reinstated and gates installed along the pipeline easement between properties. This would allow for ease of access to the pipeline easement for ongoing maintenance and inspections.

3.6.3 Standard construction environmental management

Changes to land uses have the potential to cause disturbance to soils, destroy vegetation, and alter drainage pathways. Construction activities involving groundwater drawdown or deeper excavations have

the potential to degrade the groundwater resource in an area. Such impacts can be minimised or eliminated by adopting recommended sediment and erosion control practices. Erosion and sediment control prevention measures would be implemented as part of all project construction activities. Significant effort and attention would be given to preventing soil erosion and sedimentation of surface water runoff.

Standard controls to prevent erosion and sedimentation would be implemented for each construction activity. The controls that would be implemented are described in Appendix B and are considered to be part of the construction activities for the project. The practices and controls are based on the recommended practices described in the following guidelines:

- *Managing Stormwater: Urban Soils and Construction Vol 1*(Landcom, 2004);
- *Managing Stormwater: Urban Soils and Construction Vol 2A Installation of Services* (DECC, 2008a); and
- *Managing Stormwater: Urban Soils and Construction Vol 2C Unsealed Roads* (DECC, 2008b).

All erosion and sediment control measures would be designed, implemented and maintained in accordance with the above guidelines.

Guiding principles

The guiding principles for effective soil and water management that would be adopted during project construction and post construction periods include:

- Prioritise the prevention of erosion rather than to controlling sediment and capturing sediment laden stormwater;
- Phasing and conducting work within the construction corridor to minimise the area of soil disturbance and vegetation removal;
- Managing topsoil so that it is excavated and temporarily stockpiled separately from sub soils and reused on site during rehabilitation; and
- Agreeing on the rehabilitation outcomes with the landowner prior to commencement of construction. Progressively rehabilitating disturbed areas and maintaining these areas until the agreed rehabilitation outcomes are achieved.

In-stream works

The design and construction of in-stream works would be consistent with the NSW Department of Water and Energy's (now the NSW Office of Water within the Department of Environment, Climate Change and Water) *Guidelines for controlled activities - In-stream works* (Feb 2008) and *Guidelines for controlled activities - Laying pipes and cables in watercourses* (Feb 2008a). The following design principles would be adopted based on these guidelines:

- The full width of the riparian corridor is to be considered when designing and constructing the watercourse crossing;
- The extent of disturbances to soil and vegetation within the watercourse and riparian corridor is to be

minimised;

- All major water courses are to be crossed at points adjacent to existing infrastructure easements;
- The natural hydraulic, hydrologic, geomorphic and ecological function of the watercourses, and the natural geomorphic processes such as natural bed and bank profiles, chains of ponds, surface water pools and riffles are to be maintained;
- Rehabilitation is to occur immediately following the completion of the crossing construction to re-establish the integrity of the riparian zone. Topsoiling, revegetation, mulching, weed control and maintenance are to be undertaken to stabilise disturbed areas;
- Existing channel bed and bank degradation at the crossing points are to be rehabilitate;
- All rehabilitation work is to be monitor and maintain until the riparian zone and channel bed and banks are suitably stabilised.
- Trenches are to remain open for a minimal length of time;
- The channel shape and bed level is to be restored to preconstruction condition;
- Cave-ins or 'frac-outs' are to be avoid by investigating the underlying geology and boring at a appropriate depth;
- Bore entry and exit locations are to be located outside riparian corridors; and
- All drilling mud, construction plant and materials are to be recovered and removed following completion of construction.

3.6.4 Construction workforce

There are expected to be four teams on site concurrently, with each team consisting of approximately 20 – 30 personnel. The teams are likely to be as follows:

Team 1 – Pumping station and external connections team constructing connections to existing Wingecarribee / Sydney Water infrastructure and to existing Goulburn Mulwarree infrastructure;

Team 2 – Pipeline construction (western end) constructing pipeline in generally open terrain with three creek crossings, one rail crossing and possibly two RTA road crossings which would involve special horizontal directional drilling work;

Team 3 – Pipeline construction (eastern end) constructing pipeline in generally open grazing country, working adjacent to power lines, with at least two bored crossings under the Hume Highway and the Illawarra Highway east of Moss Vale; and

Team 4 – Pipeline construction (central section) constructing pipeline in generally more undulating, rocky and stony terrain where some blasting may be required. The alignment is following the southern side of gas pipeline easement.

3.6.5 Construction equipment

An indicative list of construction equipment/plant that would be used during construction is provided in

Table 3.3.

Table 3.3 Indicative construction plant / equipment

Task	Location	Equipment
Trenching and excavations	Pipeline	65T, 45T, 30T and 20T excavators Vermeer tracked trencher Loader Dump trucks and articulated dump trucks Prime mover and pipe trailer Dual cabs Water cart Fuel trailer Mobile cranes Tracked bobcats Backhoe Tipper
	Pump station Booster pump station Outlet tanks / connections	30T, 20T, 8T, 3T excavators Small plant Road trucks Articulated dump trucks
Site preparation	Construction corridor	Grader Dozer Dump trucks Loader
Rock hammer	Pipeline easement - various locations	30T excavator with hammer
Formwork	Construction corridor - various locations	Small tools Generators Trucks Utes
Building works	Pump station	20 – 80 T cranes Concrete boom pump Tool handler

Task	Location	Equipment
Under boring	Major river crossings	Drilling rigs (100 T, 300 T and 500 T)
	RTA roads	Water truck
	Railways	45T, 30T and 20T excavators
	Some services	Utes
		Cranes
		Loader
		Dump truck
		Hand tools

3.6.6 Construction corridor access

Access to the pipeline easement from existing roads would be required approximately every 3 km to 4 km along the route. Where possible, existing access roads and farm tracks would be used to access the easement and the proposed easement alignment would be the main thoroughfare through the properties. It is envisaged that access to some terrain would be a problem in some areas along the proposed alignment.

3.6.7 Required services

Construction power

The pipeline route traverses through largely uninhabited rural land and as such most of the construction areas and work compounds will not be located near existing electrical power supply. It is proposed to use diesel generators in work compounds.

Night works are not planned as part of the construction phase. Task lighting would only be required during unplanned events at night. In winter, some task lighting may be required to assist completion of tasks towards the end of the working day due to less daylight hours. As such, task lighting would be for a short duration within typical working hours.

Security lighting would be used at site compounds for the duration of construction.

3.6.8 Deviations of alignment within the Corridor

Given the assessments undertaken to identify and investigate the Project alignment, including stakeholder consultation and negotiations, it is intended that the construction of the pipeline would occur generally along the alignment exhibited in this EA. In practice, a pipeline is normally constructed 'generally in accordance with' an alignment published during an environmental assessment and approval process, as minor variations generally occur both intentionally and unintentionally as a result of construction contingencies and accordingly the easement would be adjusted. The same will apply to the pipeline.

3.7 Rehabilitation

3.7.1 Approach to rehabilitation

The rehabilitation plan is recognised by the Proponent as the most important part of the post construction environmental process. The Proponent would dedicate the resources needed to rehabilitate to a high standard. The rehabilitation plan would be developed, with specialist input, to describe the rehabilitation management, objectives and activities necessary to assess and rehabilitate areas impacted by construction works.

The majority of rehabilitation would be undertaken after hydrotesting of the pipeline. However, reinstatement of disturbed areas would be undertaken progressively during the construction period where possible, with ongoing discussion with the Project and construction managers to explore the options for early rehabilitation in areas of the construction corridor that may no longer required during the hydrotesting period.

The rehabilitation plan would include recommendations of the terrestrial flora and fauna impact assessment. Outcomes of consultation with landowners would also be included in the rehabilitation plan.

3.7.2 Rehabilitation principles

The rehabilitation principles would guide the preparation of land access agreements and property plans developed for the construction of the pipeline and the maintenance of the easement. All disturbed ground would be rehabilitated in general accordance with the following principals:

- Rehabilitation objectives would be agreed with the landholder prior to construction. The agreed rehabilitation objectives would likely be included in the statutory agreements negotiated with the landholder to access and construct the pipeline;
- The basis of the rehabilitation objectives would be to establish stabilised ground of a nature similar to the pre-construction condition, over approximately 70% of the disturbed area.
- Rehabilitation of the disturbed areas would be undertaken progressively, immediately after a section of pipeline trench has been backfilled or a crossing has been constructed;
- Erosion and sediment controls would remain in place until the rehabilitation objectives are achieved. GMC would remove all controls once the rehabilitation objectives are achieved; and
- Rehabilitated areas would be periodically inspected, reinstated (if required) and maintained by GMC on an on-going basis until the rehabilitation objectives are achieved.

3.8 Commissioning

Commissioning would be undertaken at the completion of the pipeline construction; however progressive testing is likely to be carried out during construction at completion of sections of the pipeline, rather than waiting until the completion of the entire length of pipeline.

Testing will normally involve progressively filling up the pipeline from the supply end and using this to hydrostatically test the pipeline. The precise sectioning of this will depend on the methodology for testing

that is adopted by the successful construction contractor. The final testing is unlikely to be undertaken until the pipeline (apart from the testing limit points) has been completed.

3.9 Operation of the Project

The water transfers will be made by a pump station located at the Wingecarribee Reservoir. The pipeline would be designed to accommodate a flow of approximately 7.5 ML/day (over a 24 hour period). Initially the pipeline will deliver 5 ML/day.

For the raw water transfer option, the water would be delivered from the pipeline into an existing water balance tank upstream of the Goulburn WTP, prior to treatment there.

For the treated water transfer option, the water would be delivered from the pipeline into a proposed new covered balance reservoir at Governor's Hill in East Goulburn. The water would then be piped directly into the eastern zone of the Goulburn water reticulation system.

There are two options in regard to the mode of operation of the water transfer pipeline:

- Continuous operation – where water from the Wingecarribee Reservoir would be delivered daily to Goulburn so as to contribute some set percentage of the overall daily water demand; or
- Intermittent operation – where water from the Wingecarribee Reservoir would be pumped to the Goulburn water supply system only on occasions where the existing water supply resources were measured to be below some trigger level.

3.9.1 Maintenance activities

During the operation phase of the Project, GMC staff will periodically traverse the route to undertake routine maintenance and ensure the pipeline is functioning adequately. The maintenance crews will remain in the cleared pipeline easement at all times and cause minimal disturbance to the natural environment.

Key operational activities would include:

- Regular maintenance of the pumping station;
- Regular visual inspection of the air valves and scour valves; and
- Less frequent maintenance of the pipeline including scouring the pipeline to remove sludge building up. If raw water is selected to be transferred to Goulburn, then it is likely that the water would need to be pumped from the pipe, removed by tanker and handled or discarded in an appropriate manner. If treated water is selected to be transferred, then water may be discharged to an adjacent waterway, farm dam, or pumped and removed by tanker.

Any leakages or ruptures of the pipeline along the section of pipeline located adjacent to the gas easement may be reported to GMC by the APA group during the regular fly-overs by helicopter of the gas easement.

3.10 Project timing

3.10.1 Construction and rehabilitation

The construction of the pipeline, air, scour and divide valves, pump stations, connections and outlet tanks is expected to take between eight and ten months. The length of the pipeline construction would ultimately depend on the number of work teams employed by the successful construction contractor and any unforeseen obstacles that may need to be overcome. Construction would commence in July 2010 and be completed by May 2011.

3.10.2 Commissioning

Progressive hydrostatic testing would be undertaken during the construction of the pipeline as stages are completed. Testing would normally involve progressively filling up the pipeline from the supply end and using this to hydrostatically test the pipeline. The precise sectioning of this would depend on the methodology for testing that is adopted by the successful construction contractor. The final testing is unlikely to be undertaken until the pipeline apart from the testing limit points has been completed. The pipeline is expected to be fully commissioned and operational by the end of June 2011.

3.10.3 Operation and decommissioning

The design life of the main components of the Project is between 50 to 80 years. Mechanical components would need to be replaced at approximately 20 year intervals. The Project would be maintained so that it could be operated for longer if needed, depending on climate conditions and water availability at the time. At the end of its operating life the intake, pump stations and outlet structure would be dismantled and materials recycled, where possible. The pipeline would be left in the ground, access points would be locked off and/or covered over and easements would be removed from property titles.

4. Methodology

4.1 Introduction

The methodology used to undertake baseline environment documentation and assessment of landscape and visual impacts is outlined below. Landscape and visual assessments are presented separately, but are strongly interrelated.

4.2 Baseline environment

A description of the baseline (existing) landscape and visual environment has been undertaken in accordance with the following methodology. This assessment is contained in Section 5 of this report.

4.2.1 Desktop analysis

A desktop analysis of the existing environment was undertaken and included the following tasks:

- Definition of the indicative visual catchment, which is the area from which views of the proposed pipeline corridor and associated infrastructure and works, would be visible. As detailed contour information was not available for the Project corridor, this was done using aerial photography and GIS data interpretation;
- Representative (potentially) publicly accessible and representative viewpoints were identified in a range of locations from aerial photography & topographic maps;
- Identification and grouping of potentially affected receptors (residents, road users, recreation facility users, etc) from aerial photography;
- Identification of potential local landscape character and visual context areas for site assessment purposes from existing mapping information;
- A review of existing information and collation of planning and statutory data; and
- Establishment of LVIA methodology.

4.3 Site evaluation

A site evaluation of the existing environment was undertaken on 12-13 November 2009 during conditions of good visibility. The following activities were carried out:

- Establishment of the baseline visual environment;
- Verification of the desktop study, and provision of more detailed information about the site and likely impacts; and
- Confirming, recording and photographing publicly accessible and representative viewpoints and assessing their visual significance. Photographs of viewpoints within Sections 5.3 and 7.3.3 represent a range of typical views possible from that locality to the project. These viewing situations reflect particular landscape and /or visual features of importance within the visual environment and

local landscape character. Generally, they represent views from key visual receptors (residents and road users) where a potentially significant change in view may occur.

4.4 Assessment of impacts

A qualitative assessment of the significance of potential landscape and visual impacts has been undertaken using a combination of landscape impact and receptor sensitivity. This process of assessment is defined below.

4.4.1 Landscape impact

Landscape impacts refer to the relative capacity of the landscape to accommodate changes to the physical landscape of the type and scale that would occur as a direct result of the Project, through the introduction of new features or loss/modification of existing features. Impacts have been assessed from publicly accessible viewpoints and consider (through professional judgement) the scale, or magnitude, of change including:

- The extent to which the change (modification, removal and / or addition) of landscape features alters the existing landscape character;
- The extent of area within which the effect is evident;
- The duration of the effect (short / medium / long term, permanent/temporary);
- The physical state (or condition) of the landscape and its intactness from a visual, functional, and ecological perspective. This includes consideration of the condition of landscape elements (eg. groups of features within the soft landscape including roadside planting, open space, recreational facilities, creek lines, tree, bush blocks), or features (eg. prominent eye-catching elements such as a distinctive building, significant mature specimen tree, lookout point, etc) and their contribution to landscape character. Individual features and elements make up the character of a place and influence how the landscape is experienced; and
- The likely effectiveness of any proposed mitigation.

Assessment definitions used to describe this assessment are presented below in Table 4.1. Colour codes shown in the 'Landscape Impact' column have also been replicated in Section 6 Environmental Risk Assessment to highlight the magnitude of change for each character area.

Table 4.1 Assessment of Landscape Impact

Landscape Impact	Definition
Large	A substantial / obvious change to the landscape due to total loss of, or change to, elements, features or characteristics of the landscape. Cannot be mitigated.
Moderate	Discernible changes in the landscape due to partial loss of, or change to the elements, features or characteristics of the landscape. May be partly mitigated.
Small	Small / minor changes in the landscape due to minor loss of, or change to the elements, features or characteristics of the landscape. Change may be mitigated.
Negligible (no perceivable impact)	Almost imperceptible or no change in the view as there is little or no loss of / or change to the elements, features or characteristics of the landscape.

4.4.2 Visual impact

Visual impacts arise from changes in views of the landscape that occur as a result of the project. Visual impact is determined through the objective assessment of *sensitivity* of the visual receptors (i.e. residents, transport route users, outdoor recreational users) and the magnitude (scale) of the change in view. Sensitivity is dependent upon receptors': location; the importance of their view; their activity (i.e. working, recreating, passing through) and expectations; available view, and; the extent of screening of this view. Factors that have been considered in assessing the magnitude of change in view/visual amenity of receptors include:

- Interest in the visual environment and their distance/angle of view to the source of the impact.
- The extent of screening / filtering of the view.
- Magnitude of change in the view (i.e. loss/addition of features that change the view's composition).
- Integration of changes within the existing view (form, mass, height, colour and texture).
- Duration of the effect (temporary/ permanent, intermittent/ continuous).
- Effectiveness of proposed mitigation.

Receptor sensitivity definitions used to describe this assessment have been outlined in Table 4.2.

Table 4.2 Assessment of Receptor Sensitivity

Sensitivity	Definition
High	Occupiers of residential properties with long viewing periods, within close proximity, whose interest is focussed upon their surrounding landscape and its amenity, and who value their landscape setting. Users of outdoor recreational facilities including nature reserves, and nature recreation (walking, horse riding trails, water based activities such as swimming and fishing) where their attention is focussed on the landscape and its amenity. These viewers go to such sites specifically for their perceived value of its views and amenity. Communities that place value upon the landscape and enjoyment of views of their landscape setting.
Medium	Workers on farms with a focus on their activity / work, and that may have discontinuous/intermittent views of the study area. Outdoor recreation facility users (i.e. sporting ovals, tennis courts, cricket nets, children's play equipment) where their attention is focussed upon a particular activity (i.e. sport). Occupiers of residential properties with long viewing periods, at a distance from or screened from the study area.
Low	Road users in motor vehicles, trains or on transport routes that are passing through/adjacent to the study area and therefore have short term views and are generally not focussed on the landscape. Viewers indoor at their place of work/volunteering where they are engaged and focussed on a particular activity (e.g. the Bushfire Brigade).

4.5 Significance of impact

For the purposes of this report, predicted impacts as a direct result of the project have been described according to their significance (severity). Significance of impact has been determined in accordance with Table 4.3. Only impacts judged to be of '*major significance (adverse)'* or '*highly significant (adverse)'* have been considered as 'significant' for the purposes of this project. Significance of impact may be beneficial or adverse.

Table 4.3 Significance of Impact

		Landscape Impact			
		Large	**Moderate**	**Small**	**Negligible**
Visual Sensitivity	**High**	Major Significance	High Significance	Moderate Significance	Minor Significance
	Medium	High Significance	Moderate Significance	Minor Significance	Not significant
	Low	Moderate Significance	Minor Significance	Not significant	Not Significant
	Negligible	Minor Significance	Not significant	Not significant	Not significant

4.6 Photomontage visualisation

An indicative photomontage visualisation (in Table 7.8) has been prepared to illustrate potential changes in the existing view as a direct result of the project. This simulation shows the likely visual impact of the pipeline and associated infrastructure during the construction phase.

The image was generated using computer aided design software including digital data (GIS information), 3D modelling (SketchUp) and Adobe Photoshop software.

5. Existing Environment

5.1 Introduction

The existing landscape character and visual context are described both on a regional and local with each of these described in the following sections.

5.2 Regional landscape character

5.2.1 Landscape character and landform

Situated in the Southern Highlands of New South Wales, the Project is proposed to be constructed from Wingecarribee Reservoir, at approximately 670 m AHD to locations at Goulburn, between approximately 640 m and 720 m AHD. The proposed pipeline route is situated in flat to gently undulating terrain for the entirety of its length.

There are limited opportunities for long distance views in the region due to the topography; however these do occur at some locations, including high points on Red Hills Road, Marulan.

The flat terrain surrounding the proposed pipeline corridor is in contrast to the steep valleys of the Shoalhaven and Kangaroo River valleys to the south, the steep escarpments surrounding Wollongong and Shellharbour to the east and the Blue Mountains to the north.

5.2.2 Land use

Over the length of the Project, a variety of land use types are encountered, although the majority of the pipeline is through agricultural grazing land. At the eastern end of the Project, the pipeline would run through smaller rural-residential properties and is located close to the southern outskirts of the town of Moss Vale.

Heavily vegetated bushland areas are encountered around Hanging Rock, Red Hills Road and Carrick, with timber plantations located at several sites in this area, however these plantations are generally not in close proximity to the pipeline alignment.

At the western end of the Project, the pipeline would run in close proximity to residential and rural residential properties on the outskirts of the town of Goulburn.

Much of the pipeline is proposed to be situated within or directly adjacent to existing service easements. In most cases, these easements are currently cleared of trees.

5.2.3 Vegetation

There is significant variation in typical local vegetation along the length of the pipeline, with much of this variation due to land use and topography. Much of the route is located in cleared agricultural land, of primarily grasses and improved pasture. Coverage of trees and shrubs in these areas is typically sparse and scattered.

Windbreak planting is common along property boundaries, particularly in the eastern section of the Project and consists of a variety of native (e.g. eucalypts) and introduced species (e.g. pines).

Where the Project alignment follows existing service easements, these are typically cleared of all vegetation apart from grasses; however in some locations along these easements, regenerating low vegetation is present. In some locations, these cleared easements are flanked by areas of dense indigenous bushland. Pockets of remnant vegetation communities exist, some of which are recognised as endangered ecological communities (EEC).

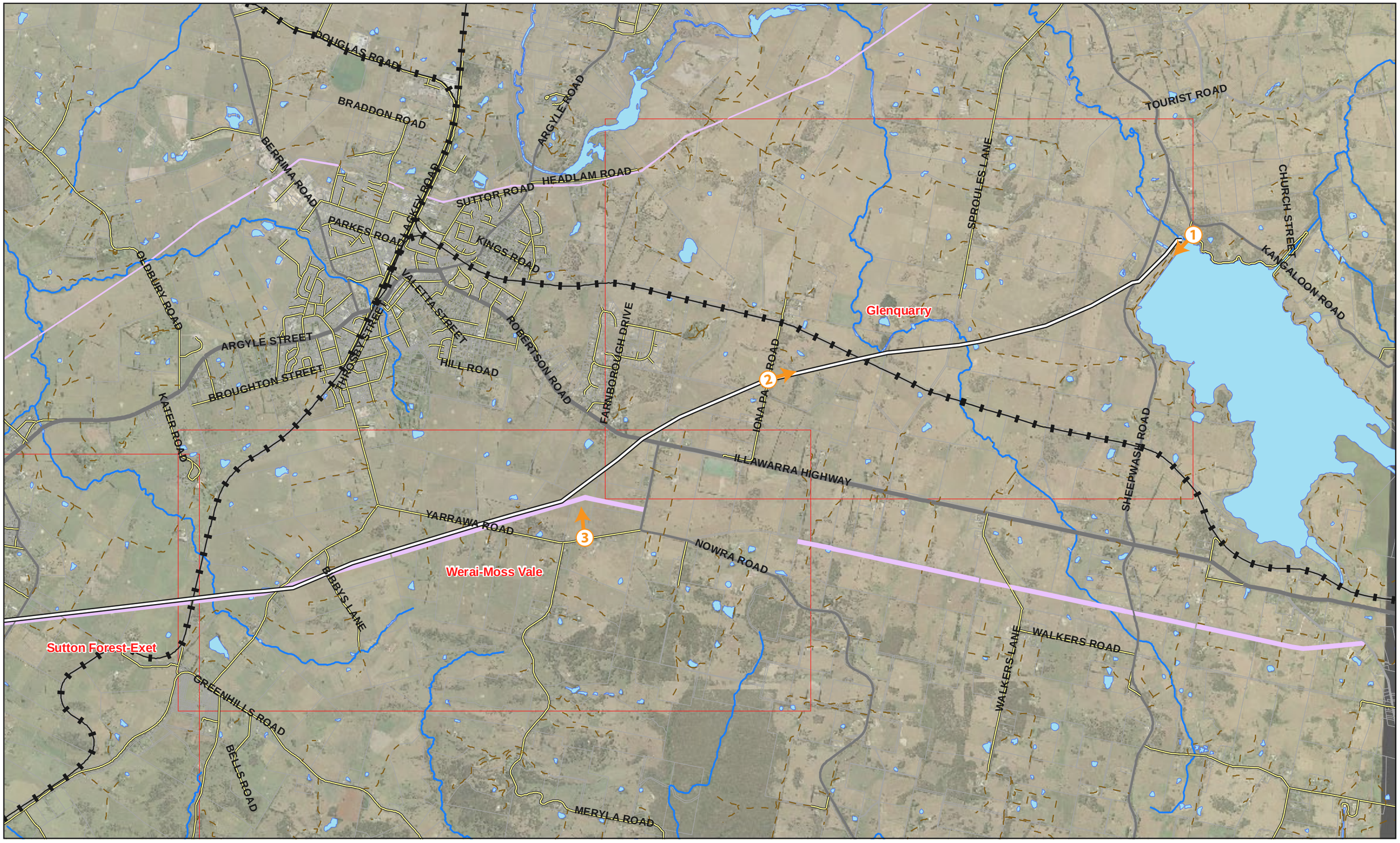
Detailed vegetation assessments have been undertaken as part of the Ecological Assessment the results of which have been included in the EIA report.

5.3 Local landscape character and visual context

A site evaluation was undertaken to determine the baseline condition of the existing environment. For the purposes of this assessment the project has been divided into eight (8) sectors, as illustrated in

Figure 5.1 to Figure 5.6. The corresponding photographs are presented in Table 5.1 to Table 5.8.

The landscape character of the areas surrounding the alignment varies somewhat along the route. A number of viewing locations from each sector have been selected to typify the surrounding landscape character of the sector, as presented in Figure 7.1 to Figure 7.6.



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Proposed Pipeline Route
Glenquarry Investigation Sectors
1 Baseline Condition Photo
Existing easements
Railways
River/Creek

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highland Source Project

Job Number	23-13312
Revision	A
Date	01 DEC 2009

Landscape and Visual Impact Assessment
Baseline Condition Photo Locations

Figure 5.1

G:\31\0103035\NEW LA & UD FOLDER\Projects\Interstate Projects\Highlands Source Project - Goulburn NSW Pipeline\20091112_TimHyland_MelbOC_GISData\23_13312_A3_HSP LVIA viewing locs.mxd

Data Source: DECC: Scivi_sd9 - 2009; NSW Dept of Lands: roadsegments, railways, easments, cadastre - 2007. Created by: ccharalambou, thyland

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Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Proposed Pipeline Route

Glenquarry Investigation Sectors

1 Baseline Condition Photo

Existing easements

Railways

River/Creek

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Goulburn Mulwaree Council
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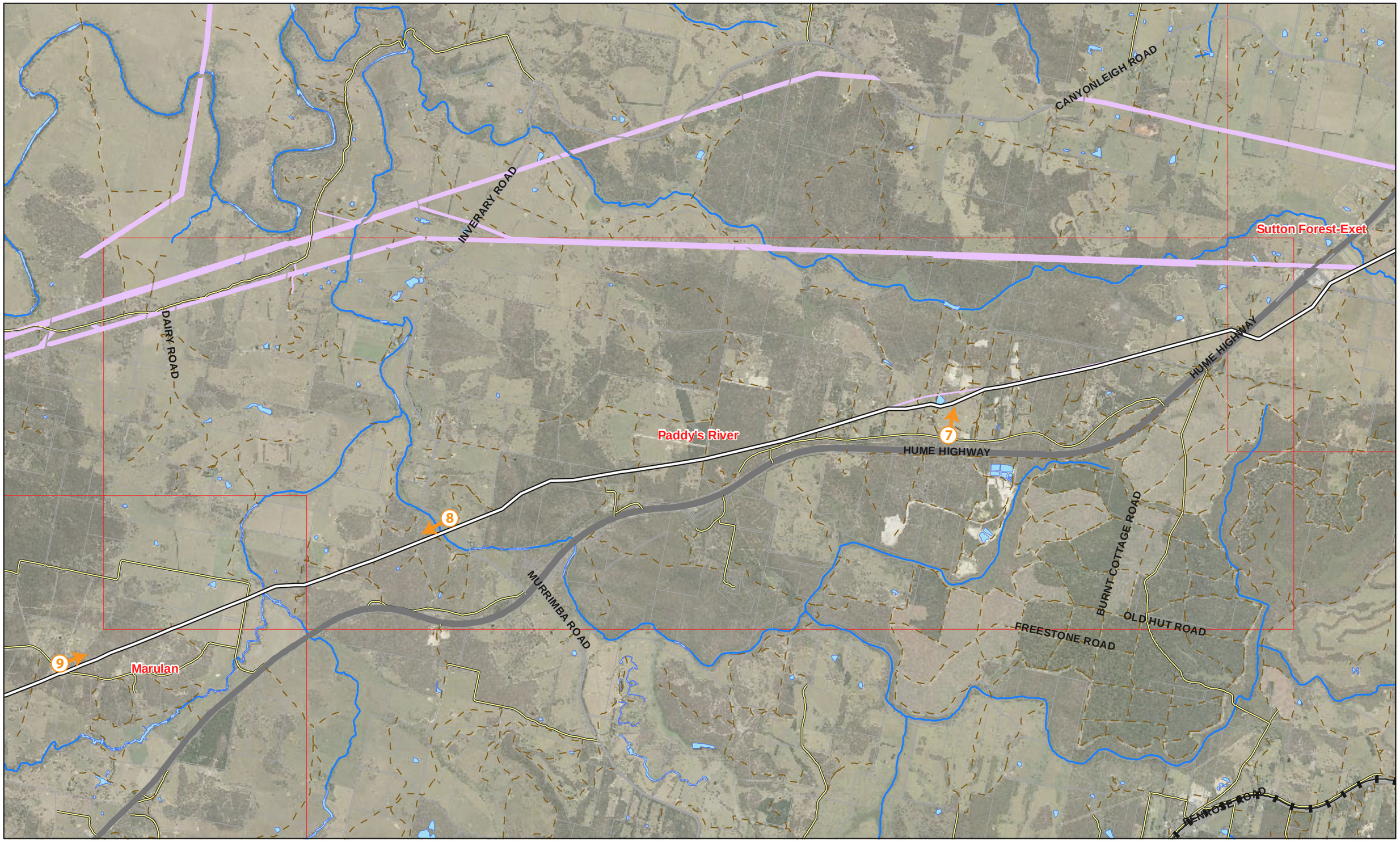
Landscape and Visual Impact Assessment
Baseline Condition Photo Locations

Figure 5.2

G:\31\0103035\NEW LA & UD FOLDER\Projects\Interstate Projects\Highlands Source Project - Goulburn NSW Pipeline\20091112_TimHyland_MelbOC_GISData\23_13312_A3_HSP LVIA viewing locs.mxd

Level 7, 16 Marcus Clarke Street Canberra ACT 2601 **T** 61 2 6113 3200 **F** 61 2 6113 3299 **E** cbrmail@ghd.com.au **W** www.ghd.com.au

Data Source: DECC: Scivi_sd9 - 2009; NSW Dept of Lands: roadsegments, railways, easments, cadastre - 2007. Created by: ccharalambou, thyland



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
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Proposed Pipeline Route

Glenquarry Investigation Sectors

1 Baseline Condition Photo

Existing easements

Railways

River/Creek

GHD

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Landscape and Visual Impact Assessment
Baseline Condition Photo Locations

Figure 5.3

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Data Source: DECC: Scivi_sd9 - 2009; NSW Dept of Lands: roadsegments, railways, easments, cadastre - 2007. Created by: ccharalambou, thyland

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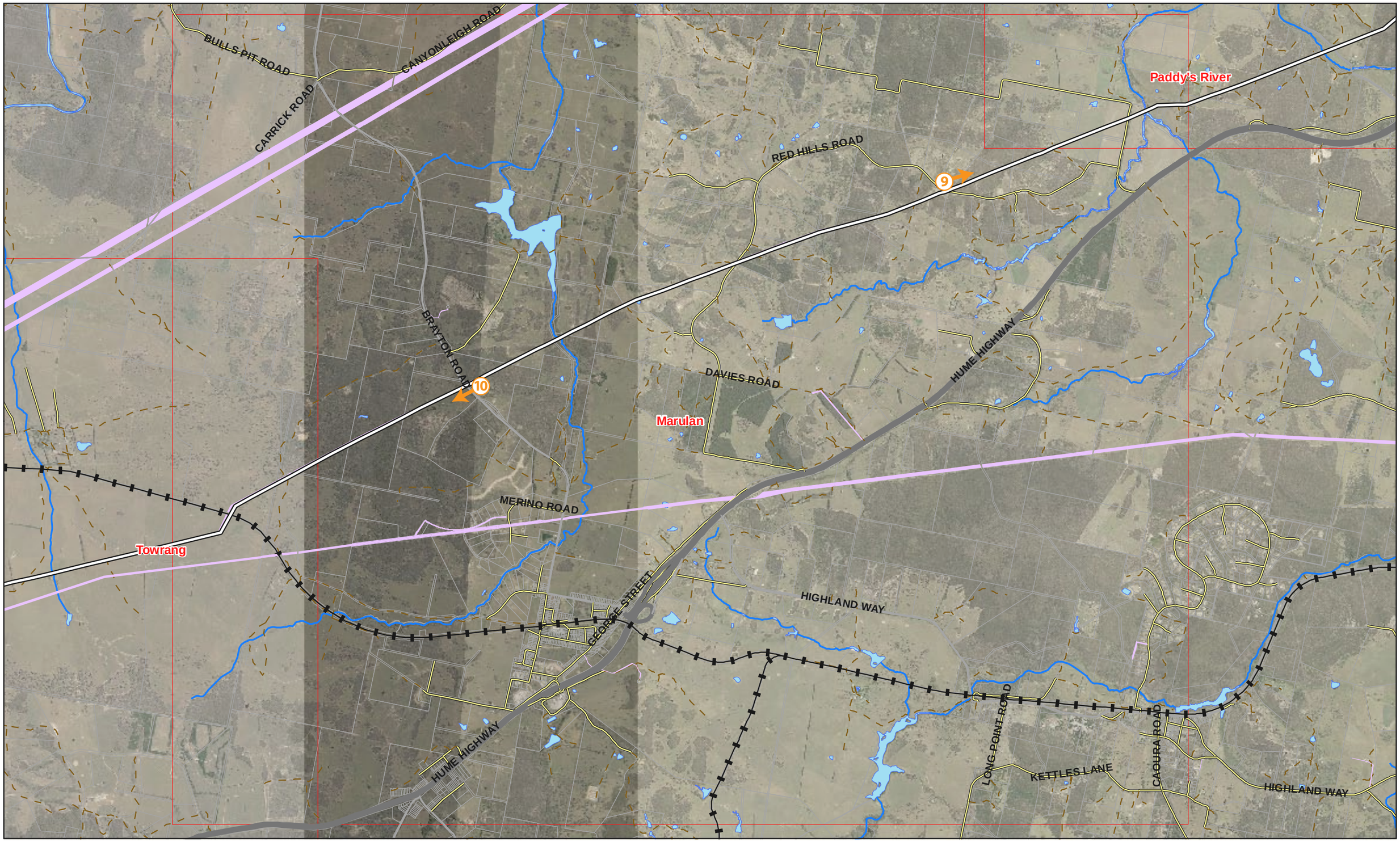

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Proposed Pipeline Route

Glenquarry Investigation Sectors

1 Baseline Condition Photo

Existing easements

Railways

River/Creek

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Goulburn Mulwaree Council
Highland Source Project

Job Number	23-13312
Revision	A
Date	01 DEC 2009

Landscape and Visual Impact Assessment
Baseline Condition Photo Locations

Figure 5.4

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Data Source: DECC: Scivi_sd9 - 2009; NSW Dept of Lands: roadsegments, railways, easments, cadastre - 2007. Created by: ccharalambou, thyland

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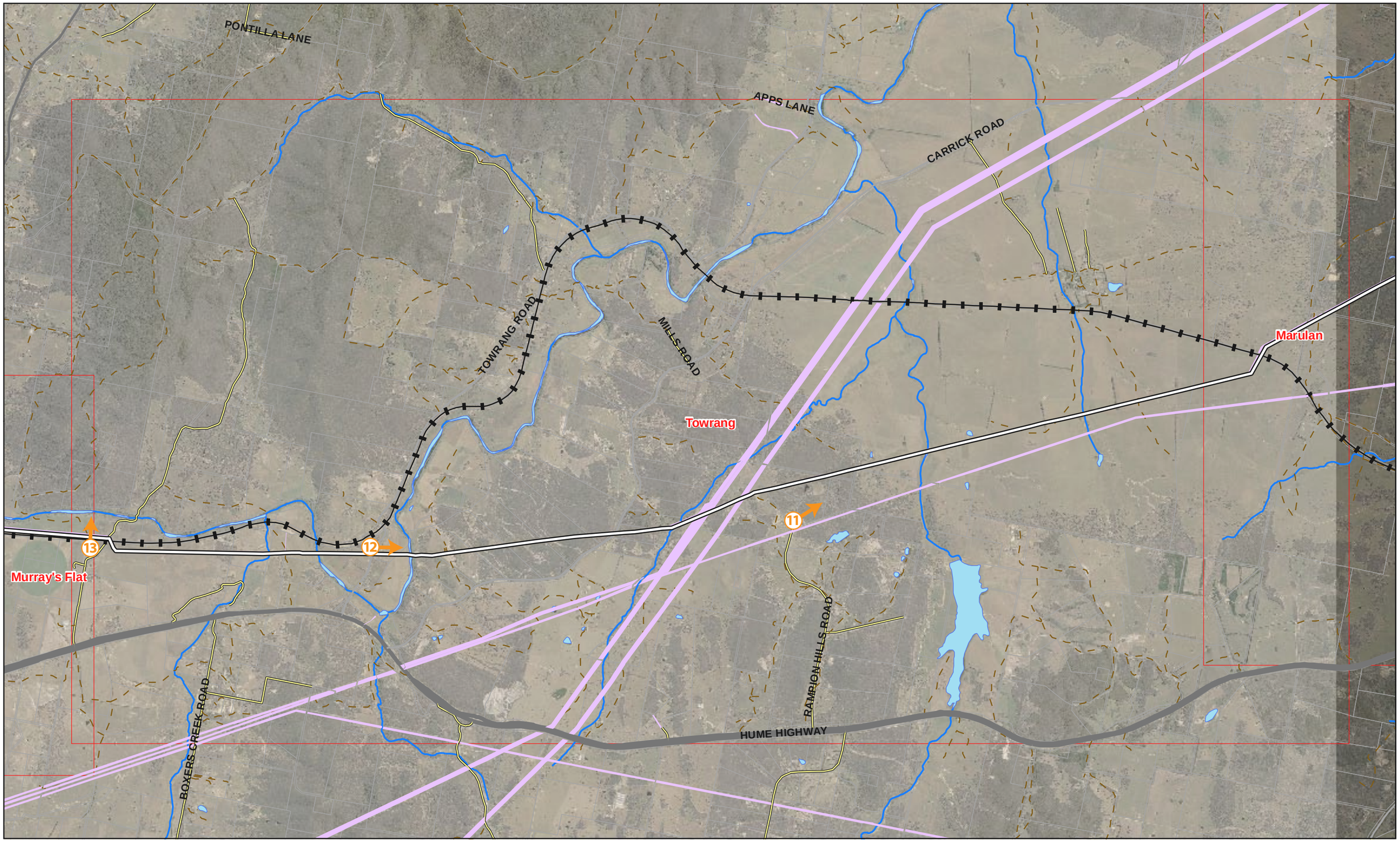

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Proposed Pipeline Route

Glenquarry Investigation Sectors

1 Baseline Condition Photo

Existing easements

Railways

River/Creek

CLIENTS | PEOPLE | PERFORMANCE

Goulburn Mulwaree Council
Highland Source Project

Job Number	23-13312
Revision	A
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Landscape and Visual Impact Assessment
Baseline Condition Photo Locations

Figure 5.5

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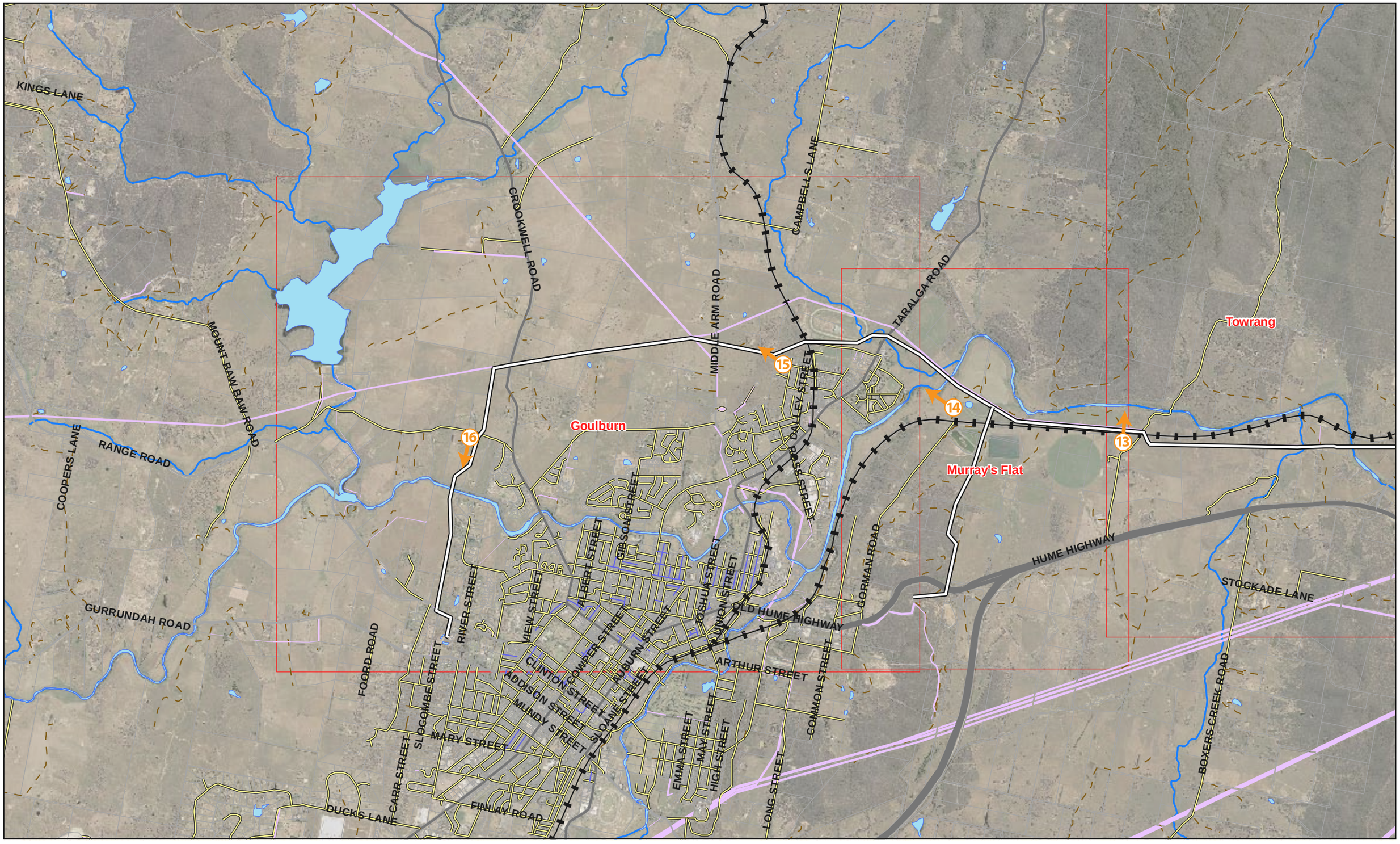
Data Source: DECC: Scivi_sd9 - 2009; NSW Dept of Lands: roadsegments, railways, easments, cadastre - 2007. Created by: ccharalambou, thyland

Level 7, 16 Marcus Clarke Street Canberra ACT 2601 **T** 61 2 6113 3200 **F** 61 2 6113 3299 **E** cbrmail@ghd.com.au **W** www.ghd.com.au



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
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N

Proposed Pipeline Route

Glenquarry Investigation Sectors

1 Baseline Condition Photo

Existing easements

Railways

River/Creek

GHD

CLIENTS | PEOPLE | PERFORMANCE

GOULBURN MULWAREE COUNCIL

Goulburn Mulwaree Council
Highland Source Project

Job Number	23-13312
Revision	A
Date	01 DEC 2009

Landscape and Visual Impact Assessment
Baseline Condition Photo Locations

Figure 5.6

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Data Source: DECC: Scivi_sd9 - 2009; NSW Dept of Lands: roadsegments, railways, easments, cadastre - 2007. Created by: ccharalambou, thyland

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5.3.1 Baseline conditions for Sector 1 – Glenquarry

Table 5.1 Sector 1 – Glenquarry Baseline Conditions

Typical local landscape character (from publicly accessible viewpoints)	 Photo 1 - View south west from publicly accessible carpark at Wingecarribee Reservoir
	 Photo 2 - View north on Iona Park Road.

Landform	The Glenquarry sector, between Moss Vale and the Wingecarribee reservoir is characterised by flat to gently undulating terrain.
Vegetation	Much of the Glenquarry sector is dominated by a rural cleared landscape that is typified by cleared grazing pasture, scattered trees and shrubs. These areas are highly modified through previous clearing of vegetation, and grazing activities. Windbreak planting is common along property / paddock boundaries in this sector, as is roadside vegetation..
Land Use	The Glenquarry sector is comprised of rural-residential and small rural properties on the outskirts of the town of Moss Vale. Rural land use in this area is dominated by agricultural grazing with some agricultural production occurring, including vineyards. The Wingecaribee Reservoir, at the far eastern end of this sector, is a water storage dam that forms a part of the Sydney water supply. This reservoir is the water source for the Project. The Unanderra – Moss Vale railway line runs through this sector.
Visual Context	Views are composed of a modified agricultural landscape, scattered vegetation with views over rolling hills available from some locations within the sector. The views within the Glenquarry sector are experienced by: ◗ Rural residential properties scattered through the study area. The views from these properties are often partly screened by trees, or of open grazing land. These locations have long viewing periods with the visual value being in the rural nature of the landscape; ◗ Residents on the eastern outskirts of Moss Vale; ◗ Activity focussed outdoor farm workers / farmers; ◗ Road users, including those on the Illawarra Highway; and ◗ Railway travellers on the Unanderra – Moss Vale railway line.

5.3.2 Baseline conditions for Sector 2 Werai – Moss Vale

Table 5.2 Sector 2 Werai – Moss Vale Baseline Conditions

Typical local landscape character (from publicly accessible viewpoints)	 Photo 3 - View north from Yarrawa Road, approximately 500 m from proposed pipeline alignment

Photo 4 - View west from Mount Broughton Road. Proposed pipeline alignment follows powerline easement.

Landform	The Werai – Moss Vale sector, south of the town of Moss Vale, is characterised by a flat to gently undulating landscape. The landform becomes more undulating in the southern part of the sector towards the Meryla State Forest.
Vegetation	Much of the Werai – Moss Vale sector is dominated by a rural cleared landscape that is typified by cleared grazing land with scattered trees and shrubs. Areas of dense native vegetation are present on private land and in the Meryla State Forest in the south east of the sector.
Land Use	The Werai – Moss Vale sector is comprised mostly of rural-residential and rural land uses. Rural land uses include agricultural practices such as livestock grazing and pasture improvement. While rural residential properties are largely used for residential purposes. The small township of Werai is located in this sector along with the Southern Highlands railway line. The Meryla State Forest is located in the southern part of this section and is used for nature based recreation activities such as walking.

Visual Context	Views are composed of a modified landscape characterised by agricultural uses, agricultural landscape, scattered vegetation, with the densely vegetated hills of the Meryla State Forest forming background views from some locations within the sector. Views within the Werai – Moss Vale sector are experienced by: ◗ Rural and rural residential properties scattered through the study area. The views from these properties are often partly screened by trees, or of open grazing land. These locations have long viewing periods with the visual value being in the rural nature of the landscape; ◗ Activity focussed outdoor farm workers / farmers; ◗ Road users; and ◗ Railway travellers on the Southern Highlands railway line.

5.3.3 Baseline conditions for Sector 3 Sutton Forest – Exeter

Table 5.3 Sector 3 - Sutton Forest- Exeter Baseline Conditions

Typical local landscape character (from publicly accessible viewpoints)	 Photo 5 - View west from Exeter Road. Proposed pipeline alignment runs parallel to existing powerline easement

Photo 6 - View east from Old Argyle Road. Proposed pipeline alignment runs parallel to existing powerline easement.

Landform	The Sutton Forest - Exeter sector is characterised by flat to gently undulating terrain.
Vegetation	Much of the Sutton Forest – Exeter sector is dominated by a rural cleared landscape that is characterised by cleared grazing pasture, and scattered trees and shrubs. These areas are highly modified through previous clearing of vegetation, and grazing activities. Several properties in the west of the sector contain patches of dense native vegetation, while windbreak planting is common along property boundaries throughout the sector. The town of Exeter, located in the west of the sector, contains a mix of native and introduced vegetation as street planting and in private residential gardens.
Land Use	The Sutton Forest - Exeter sector is comprised mostly of rural residential and rural properties. Rural land uses includes agricultural practices such as livestock grazing and pasture improvement. The town of Exeter is located in this sector and comprises residential properties, a railway station, school and several commercial premises; however this town is not located in close proximity to the proposed pipeline. The Hume Highway and the Southern Highlands Railway line run through this sector.

Visual Context	Views are composed of a modified agricultural landscape, scattered vegetation, the densely vegetated, with some clear felling in the Penrose State Forest and streetscape views in the town of Exeter. Views within the Sutton Forest - Exeter sector are experienced by: ◗ Rural and rural residential properties scattered through the study area. The views from these properties are often partly screened by trees, or of open grazing land. These locations have long viewing periods with the visual value being in the rural nature of the landscape; ◗ Residential properties in the town of Exeter with long viewing periods; ◗ Activity focussed outdoor farm workers / farmers; ◗ Road users, including those on the Hume Highway; and ◗ Railway travellers on the Southern Highlands railway line.

5.3.4 Baseline conditions for Sector 4 – Paddy's River

Table 5.4 Sector 4 - Paddy's River Baseline Conditions

Typical local landscape character (from publicly accessible viewpoints)	 Photo 7 - View north from Hume Highway Service Road, Hanging Rock.

Photo 8 - View south west from Inverary Road, Paddy's River. Proposed pipeline alignment follows existing gas easement. Proposed crossing of Paddy's River seen in foreground.

Landform	The Paddy's River sector is a mix of gently undulating and hilly terrain. Several river valleys run through the sector, including those to the south of the Penrose State Forest, at Paddy's river near the Hume Highway and to the south east of Canyonleigh.
Vegetation	Much of the Paddy's River sector is dominated by densely vegetated, indigenous bushland. A large proportion of the vegetation on the south side of the Hume Highway is used for timber harvesting purposes, with much of this located within the Penrose State Forest. The Penrose State Forest, predominately planted with introduced pine trees and intersected by logging tracks, is a heavily modified landscape. The Hume Highway separates this forest with the area through which the pipeline alignment is located. A rural landscape of cleared grazing land with scattered trees and shrubs comprise the remainder of this sector.

Land Use	The Paddy's River sector is comprised of land used for timber harvesting purposes (including part of the Penrose State Forest), and cleared and uncleared rural properties. A quarry operates to the south of the Hume Highway at Hanging Rock, however due to topography and existing vegetation this is not within visual proximity of the Project. The Penrose State Forest is situated in the south of the sector and is used for timber harvesting. This state forest is also used for nature based recreation activities such as walking and mountain biking. A gas easement runs across the length of this sector, and has been cleared. This easement is largely surrounded by dense bushland. The Hume Highway also runs through this sector.
Visual Context	Views are composed of a modified agricultural landscape, scattered vegetation, heavily vegetated areas (including Penrose State Forest), and timber harvesting areas that have either been clear-felled or have new plantings. The quarry on the southern side of the Hume Highway is screened from view by dense vegetation and topography. Views within the Paddy's River sector are experienced by: ◗ Rural and rural residential properties scattered through the study area. The views from these properties are often partly screened by trees, or of open grazing land. These locations have long viewing periods with the visual value being in the rural nature of the landscape; ◗ Activity focussed outdoor farm workers / farmers / quarry workers; ◗ Those recreating in the Penrose State Forest e.g. walkers, mountain bike riders (however views to the proposed alignment from this location are screened by vegetation); and ◗ Road users, including those on the Hume Highway.

5.3.5 Baseline conditions for Sector 5 – Marulan

Table 5.5 Sector 5 – Marulan Baseline Conditions

Typical local landscape character (from publicly accessible viewpoints)	 Photo 9 - View north east from Red Hills Road, Marulan. Proposed pipeline alignment follows existing gas easement.

Photo 10 - View south west from Brayton Road, Marulan. Proposed pipeline alignment follows existing gas easement.

Landform	The Marulan sector is comprised of a mix of gently undulating and hilly terrain. River valleys in the south of the sector drain towards the steep escarpments of the Shoalhaven River. Ridgelines along Red Hills Road, to the north of the Hume Highway, provide elevated, long distance viewing opportunities.
Vegetation	The Marulan sector comprises a mix of dense native bushland, cleared agricultural rural land, and scattered patches of native vegetation.
Land Use	This sector comprises residential, rural-residential, and rural properties. The town of Marulan, close to the Hume Highway has a population of approximately 540 people and has residential development, a railway station and a number of small commercial buildings. The village of Tallong, in the south east of this sector, has a small cluster of residences and some small commercial buildings. There is a rural residential area to the north of the town that is surrounded by dense vegetation. The proposed alignment would not be visible from the towns of Marulan or Tallong. A cleared gas easement runs for the length of this sector. Much of this easement is surrounded by patches of dense bushland. The Hume Highway and the Southern Highlands railway line also runs through this sector.

Visual Context	Views are composed of a modified agricultural landscape, scattered vegetation, densely vegetated bushland and streetscape views in the towns of Marulan and Tallong (however these towns are not within visual proximity of the Project). Some long distance views are available from elevated ridgelines along Red Hills Road, Views within the Marulan sector are experienced by: ◗ Rural and rural residential properties scattered through the study area. The views from these properties are often partly screened by trees, or of open grazing land. These locations have long viewing periods with the visual value being in the rural nature of the landscape; ◗ Residential properties in the town of Marulan and Tallong with long viewing periods; ◗ Activity focussed outdoor farm workers / farmers; ◗ Road users, including those on the Hume Highway; and ◗ Railway travellers on the Southern Highlands railway line

5.3.6 Baseline conditions for Sector 6 – Towrang

Table 5.6 Sector 6 – Towrang Baseline Conditions

Typical local landscape character (from publicly accessible viewpoints)	 Photo 11 - View north east from end of Rampion Hills Road showing typical landscape character

Photo 12 - View east from Towrang Road. Scattered rural residences and scattered vegetation in agricultural landscape shown.

Landform	The Towrang sector is a mix of flat plains and undulating to hilly terrain. The Brayton Park area, in the north east of the sector is a flat area through which the Wollondilly River runs. A steep ridge line, rising 280m above the river dominates the north west of the sector.
Vegetation	The Towrang sector is a mix of dense native bushland, cleared agricultural rural land, and scattered patches of native vegetation.
Land Use	The Towrang sector comprises rural-residential and rural properties. A cleared gas easement runs for the length of this sector. Much of this easement is surrounded by patches of dense bushland. The Hume Highway and the Southern Highlands railway line also runs through this sector.

Visual Context	Views are composed of a modified agricultural landscape, scattered vegetation, densely vegetated bushland and views to the steep terrain to the north west of the sector. This steep ridgeline (see Photo **13**) provides a dominant backdrop in views to the north west. Views within the Towrang sector are experienced by: ◗ Rural and rural residential properties scattered through the study area. The views from these properties are often partly screened by trees, or of open grazing land. These locations have long viewing periods with the visual value being in the rural nature of the landscape; ◗ Activity focussed outdoor farm workers / farmers; ◗ Road users, including those on the Hume Highway; and ◗ Railway travellers on the Southern Highlands railway line

5.3.7 Sector 7 - Murray's Flat

Table 5.7 Sector 7 – Murray's Flat Baseline Conditions

Typical local landscape character (from publicly accessible viewpoints)	 Photo 13 - View north from end of Murray's Flat Road. Railway line and agricultural land shown with steep, vegetated hillside as backdrop.

Photo 14 - View west from end of Gorman Road showing irrigated agricultural land.

Landform	The Wollondilly River flows through the Murray's Flat sector as it leaves the town of Goulburn. The terrain in the north east of the sector is dominated by a steep ridge line that rises from the Wollondilly River valley to more than 800m AHD and continues northwards. A similar ridgeline is located between the Hume Highway bypass and the town of Goulburn. The remainder of the sector is characterised by flat to gently undulating terrain.
Vegetation	Much of the Murray's Flat sector is characterised by cleared agricultural land, with areas of dense native bushland present in the north east and the south west of the sector.
Land Use	The Murray's Flat sector is predominantly comprised of rural-residential and rural properties. Irrigated agricultural production occurs on several properties near the Wollondilly River. The Murray's Flat sector covers the eastern outskirts of the town of Goulburn, including residences, a sporting oval, Goulburn Speedway and a council-run irrigated farm. The Hume Highway and the Southern Highlands railway line run through this sector.

Visual Context	Views are composed of a modified agricultural landscape, scattered vegetation, densely vegetated bushland and views to and from the steep terrain to the north west of the sector. The steep, densely vegetated ridgeline (see Photo 13) in the north east of the sector provides a dominant backdrop in views to the north east. Views within the Towrang sector are experienced by: ◗ Rural and rural residential properties scattered through the study area. The views from these properties are often partly screened by trees, or of open grazing land. These locations have long viewing periods with the visual value being in the rural nature of the landscape; ◗ Activity focussed outdoor farm workers / farmers; ◗ Road users, including those on the Hume Highway; and ◗ Railway travellers on the Southern Highlands railway line

5.3.8 Sector 8 – Goulburn

Table 5.8 Sector 8 – Goulburn Baseline Conditions

Typical local landscape character (from publicly accessible viewpoints)	 Photo 15 - View north west from Ivy Lea place showing typical new residential street. Proposed pipeline alignment is situated behind these houses.

Photo 16 - View south from Chinamans Lane, Goulburn showing typical landscape character on outskirts of the town. Proposed pipeline alignment runs along fenceline visible at left of image.

Landform	The town of Goulburn is located at the confluence of the Wollondilly and Mulwaree Rivers. The town is situated amongst gently undulating to flat terrain. A ridgeline rises east of the town, around which the Hume Highway runs. There is further hilly terrain to the north west of the town, beyond Lake Sooley, and to the north east, beyond Murray's Flats.
Vegetation	The Goulburn sector comprises the town of Goulburn with urban landscape planting dominating. The area surrounding the town is largely cleared agricultural grazing land. The Goulburn Woodlands Reserve, on the northern outskirts of the town, is also located in this sector. The reserve is accessed from Progress Street and is classified as an Endangered Ecological Community (EEC).
Land Use	The town of Goulburn has a population of approximately 20,000 people. Goulburn is a large regional town with residential areas, a sizeable commercial district, light industry, schools, a hospital, racecourse and correctional centre. The town provides support services to a large rural district and, as one of the largest rural centres on the Hume Highway, which now bypasses the town, it is regularly visited by those travelling between Melbourne and Sydney The Southern Highlands railway line runs through this sector.

Visual Context	Views are composed of township / residential views, a modified agricultural landscape, scattered vegetation, and some patches of densely vegetated bushland. Views within the Goulburn sector are experienced by: ◗ Residents of Goulburn township with residential, suburban streetscape views (however the pipeline alignment would not be visible to the vast majority of Goulburn residents) ◗ Residents of rural residential properties surrounding Goulburn with long viewing periods. The views from these properties are often partly screened by trees, or of open grazing land. These locations have long viewing periods with the visual value being in the rural nature of the landscape; ◗ Activity focussed outdoor farm workers / farmers; ◗ Road users, including those on the Hume Highway and those travelling through the town; ◗ Railway travellers on the Southern Highlands railway line