STATE SIGNIFICANT INFRASTRUCTURE ASSESSMENT:
North West Rail Link – Major Civil Construction Works
Generally between Epping and Rouse Hill (SSI-5100)

Director-General's
Environmental Assessment Report
Section 115ZA of the
Environmental Planning and Assessment Act 1979

September 2012

ABBREVIATIONS

CIV	Capital Investment Value
Department	Department of Planning & Infrastructure
DGRs	Director-General's Requirements
Director-General	Director-General of the Department of Planning & Infrastructure
EIS	Environmental Impact Statement
EMF	Environmental Management Framework
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPI	Environmental Planning Instrument
ESD	Ecologically Sustainable Development
MD SEPP	State Environmental Planning Policy (Major Development) 2005
Minister	Minister for Planning & Infrastructure
NWGC	North West Growth Centre
NWRL	North West Rail Link
PAC	Planning Assessment Commission
PFM	Planning Focus Meeting
PPR	Preferred Project Report
Proponent	Transport for NSW
RtS	Response to Submissions
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
Stage 1 EIS	NWRL Environmental Impact Statement Stage 1-Major Civil Construction Works Incorporating Staged Infrastructure Modification Assessment dated April 2012
Stage 2 EIS	NWRL Environmental Impact Statement Stage 2-Stations, Rail Infrastructure and Systems (in Preparation)

Cover Photograph: Roadheader in operation

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EXECUTIVE SUMMARY

The North West Rail Link (NWRL) project has been identified by the NSW Government as a key priority railway transport infrastructure project. The NWRL project, including alignment and stations, was considered at a concept level during 2006-2008. Since Concept Plan approval, the concept has been optimised to ensure that it appropriately responds to the travel needs of Sydney commuters, and provides a better product outcome for the community. Transport for NSW (the Proponent) has subsequently submitted a request to modify the Concept Plan (staged State significant infrastructure) approval to address refinements to the project, and an application for the NWRL Stage 1: Major Civil Construction Works. Stage 2: Stations, Rail Infrastructure and Systems is to be assessed as a separate application.

The Proponent submitted a request on 14 December 2011, to modify the staged SSI approval (Concept Plan Approval dated 6 May 2008), to address refinements to the project. The existing staged SSI approval provides both in principle approval for a broad rail corridor in North West Sydney, and sets environmental assessment requirements for future applications. The Proponent also requested environmental assessment requirements for both the proposed modification to the staged SSI approval and the SSI application for Stage 1: Major Civil Construction Works. In response to the applications received, supplementary requirements were issued in February 2012 for both the modification and the Stage 1 EIS.

The proposed NWRL is consistent with strategic land use policy for Sydney, and would provide considerable benefits to Sydney's North and North West Subregions, and Sydney as a whole. The provision of heavy rail has been identified as providing significant advantages in comparison to other public transport modes with respect to maximising connectivity and patronage to public transport.

The NWRL alignment will stretch 23km from Epping to Rouse Hill. It will consist of two 15.5km underground rail tunnels generally between Epping and Bella Vista and a 4.2km above ground twin track viaduct generally between Bella Vista and Rouse Hill. It will include eight new stations at Cherrybrook, Castle Hill, Hills Centre, Norwest, Bella Vista, Kellyville, Rouse Hill and Cudgegong Road. The NWRL would join the rail network at the existing tunnel stubs located immediately north of the underground Epping to Chatswood Rail Link, Epping Station Platform.

The proposed modification confirms the project as a heavy rail line integrated with the existing rail network, provides for two new stations, realignment of the NWRL within the North West Growth Centre, and vertical alignment modifications between Bella Vista and Rouse Hill.

A number of changed environmental impacts are associated with the modification of the staged SSI approval. Following an assessment of the Proponent's Environmental Impact Statement (EIS), the Department considers that the modification is supportable.

The Department has also assessed construction issues as part of the Stage 1 application. Supplementary requirements were issued in August 2012 for the Stage 2 application, and include a number of additional requirements specifically related to the stations, rail infrastructure and systems components of the overall project, which must be considered in that EIS.

Stage 1: Major Civil Construction works for the NWRL includes sixteen construction sites along the alignment from which the following will be carried out:

- excavation of tunnels and underground station boxes;
- construction of above ground infrastructure including viaduct spans and bridges; and
- earthworks.

Following a detailed assessment of the Proponent's EIS and Submissions Report, and the submissions received during the exhibition period for the project, the Department identified the project's key issues as:

- Soils, Geotechnical and Groundwater;
- Traffic and Transport;
- Noise and Vibration;
- Local Business Impacts;
- Land use and community facilities;
- Ecology; and
- Surface Water and Hydrology.

These issues were reflected within the 359 submissions received from Government agencies, local councils, and the local community during the exhibition of the EIS.

As a result of the issues raised within submissions, and design refinements, a number of changes to the project have occurred. These include:

- Consolidation of the two construction sites at Epping, the Epping Services Facility and Epping Decline, into one site, an expanded Epping Services Facility. A number of beneficial impacts occur as result of the consolidation of the two construction sites, including shortening of the decline tunnel from approximately 300m to 20m, with resulting reductions in spoil volumes and heavy vehicle movements, and elimination of the Epping Decline site as noise source.
- Cheltenham Services Facility light vehicle access and egress point changes along Castle Howard Road has beneficial impacts for the retention of bushland and reduces the total area of the Cheltenham Services Facility construction site.
- Realignment of the Norwest Station box, previously directly underneath Norwest Boulevard, realigned to the south east to be adjacent to, and outside of, the Norwest Boulevard footprint. This proposed change has the benefit of reducing the interface of construction activities with Norwest Boulevard.

The Submissions Report also provided clarification in relation to the NSW Government's announcement of Sydney's Rail Future in June 2012, which has introduced the concept of a three tier rail transport network. Under the new three tier system, the NWRL would operate as a Tier 1 rapid transit single deck train system, initially operating between the North West and Chatswood. This change would not result in any substantial changes to the environmental impacts described and assessed as part of the Stage 1 EIS process. In line with the NWRL, an upgrade of the Epping to Chatswood Rail Link to a high capacity rapid transit system would be required as a separate project to this application.

Potential impacts have been addressed by the Proponent through a suite of environmental mitigation measures and a construction environmental management framework. Notwithstanding, the Department acknowledges that residual impacts will occur, but considers that these can be managed to an acceptable level. This is reflected within the recommended conditions of approval, including environmental performance requirements, in particular focussing on ecological monitoring and offsetting, soil, water quality and hydrology considerations, and transport and access considerations; community information, reporting and auditing; and construction environmental management requirements including specific air quality, visual amenity, biodiversity, heritage, noise and vibration, property and business impacts, soil, water quality and hydrology, transport and access, landuse and community facilities, and ancillary facilities management measures, as well as specific construction environmental management plans.

Consequently, the Department recommends that the Minister for Planning & Infrastructure approve the modification request and Stage 1: Major Civil Construction Works application, subject to the recommended conditions of approval.

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1. BACKGROUND

The North West Rail Link (NWRL) project has been identified by the NSW Government as a key priority railway transport infrastructure project. The NWRL project, including alignment and stations, was considered at a concept level during 2006-2008.

On 6 May 2008 Concept Plan approval was granted for the western section of the North West Metro (MP 06_0157). This concept plan was assessed and approved under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Concept Plan defines the North West Metro as being the construction and operation of a new electrified passenger rail line between Epping and Rouse Hill, including:

- six new stations at Cherrybrook, Castle Hill, Hills Centre, Norwest, Kellyville and Rouse Hill;
- stabling facilities; and
- associated ancillary infrastructure.

On 1 October 2011, Part 3A of the EP&A Act was repealed. Under clause 5 of Schedule 6A of the EP&A Act, the Concept Plan approval has been transitioned to a State significant infrastructure (SSI) approval under Part 5.1 of the EP&A Act. This approval is to be treated as a staged SSI approval, with the Concept Plan approval forming the initial stage of the staged SSI project. The Concept Plan Approval effectively protected the North West Metro corridor as identified within the Concept Plan.

Since Concept Plan approval, the concept has been optimised to ensure that it appropriately responds to the travel needs of Sydney commuters, and provides a better product outcome for the community.

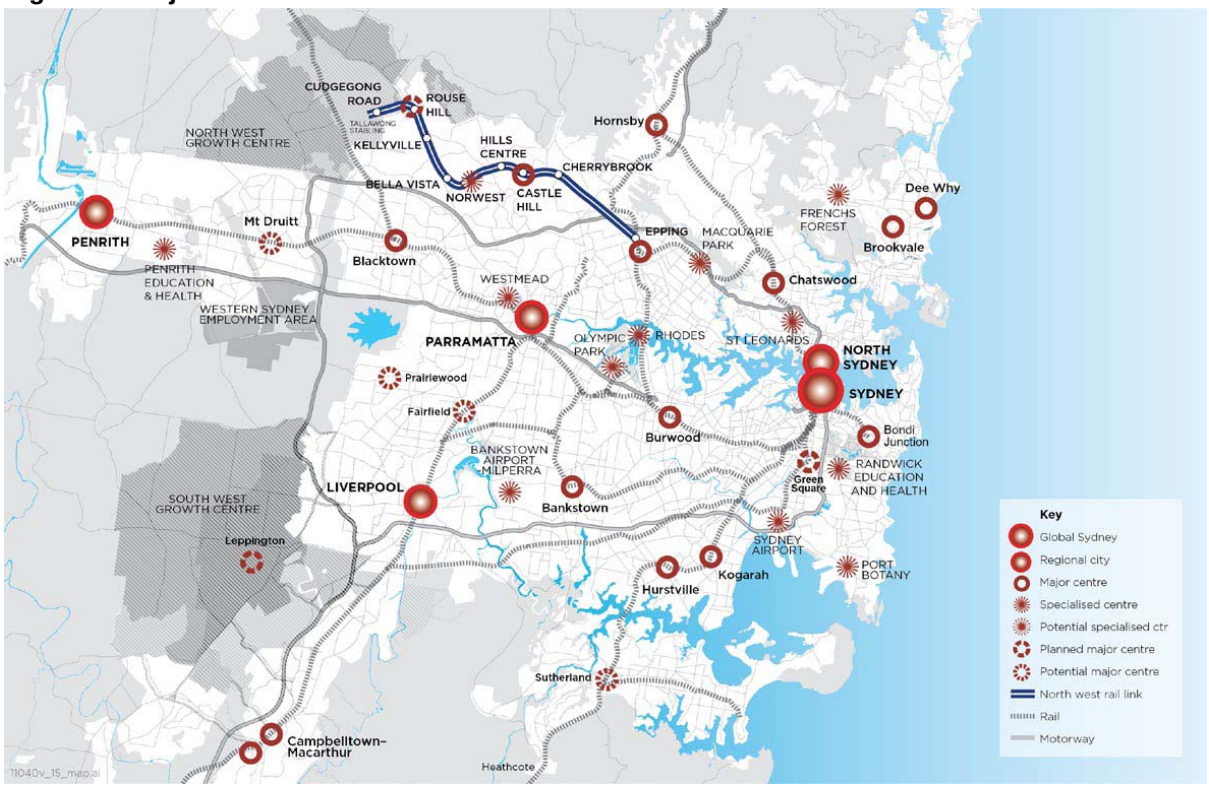
On 14 December 2011, Transport for New South Wales (the Proponent) submitted a request to modify the staged SSI approval to address refinements to the project, and an application for the NWRL Stage 1: Major Civil Construction Works. The project location is shown in Figure 1. The assessment of these two applications is the subject of this report.

The NWRL project will be assessed and delivered through a two stage process with separate applications and approvals. Stage 1 is seeking approval to carry out Major Civil Construction Works, including:

- two 15.5km rail tunnels between Epping and Bella Vista, linking directly into the Epping to Chatswood Rail Line tunnels;
- excavation works for underground railway station construction; and
- above ground construction, including 4.2km Skytrain viaduct structure between Bella Vista and Rouse Hill, and the Tallawong Stabling Facility.

NWRL Stage 2: Stations, Rail Infrastructure and Systems, will address station fit out and design, rail systems and infrastructure, operational systems, transport interchanges, access roads and landscaping in a separate EIS. A parallel master planning and land use integration process is also underway to integrate the NWRL into the surrounding areas, which will be addressed in EIS 2.

Figure 1: Project Location



2. PROPOSED MODIFICATION

2.1. Modification Description

The existing staged SSI approval is for the construction and operation of a new electrified passenger rail line between Epping and Rouse Hill, including:

- six new stations at Cherrybrook, Castle Hill, Hills Centre, Norwest, Kellyville and Rouse Hill;
- stabling facilities; and
- associated ancillary infrastructure.

Following Concept Plan approval of the North West Metro (now transitioned to be staged SSI), further strategic planning and project development has occurred. This has resulted in modifications to the stage SSI approval. These are shown in Figures 6.1 to 6.5 of the EIS, and are summarised as:

- change to the definition of the project from a North West Metro to a NWRL – in February 2010 development of a Metro network for Sydney was deferred, and in April 2011 the NSW Government announced the NWRL would be a heavy rail line that integrates with the existing Sydney rail network;
- railway station modifications – relocate Kellyville Station from Burns Road, Kellyville to Samantha Riley Drive, Kellyville; provide for additional stations at Bella Vista and Cudgegong Road, Rouse Hill; and minor changes to the location of the Hills Centre Station;
- changes to the NWRL alignment within Area 20 to a route parallel to Schofields Road – following additional studies to refine the alignment of the NWRL corridor, it was determined that the best route to service the NWGC is an extended alignment parallel to Schofields Road;
- incorporation of a viaduct (Skytrain) between Bella Vista and Rouse Hill – in response to additional investigations, the vertical alignment has been optimised, so that from Bella Vista the alignment would rise from a cutting to a viaduct following a revised alignment, closer to Old Windsor Road, and continuing to Rouse Hill, for approximately 4.2km (previously approximately 1km on viaduct and 3km in embankment or cutting); and
- location of a permanent train stabling facility in the vicinity of Tallawong Road in the NWGC – previously a temporary stabling facility located adjacent to Windsor Road.

The Proponent's Submissions Report identifies a number of changes to the project as a result of ongoing design development and the public exhibition of the modification request. Three changes are proposed to the project described in the EIS. These are:

- consolidation of the two construction sites at Epping (Epping Services Facility and Epping Decline) into one site (expanded Epping Services Facility);
- the relocation of the light vehicle access and egress point to and from Cheltenham Services Facility; and
- realignment of Norwest Station outside of the Norwest Boulevard footprint.

2.2. Modification Need and Justification

The proposed modification confirms the project as a heavy rail line integrated with the existing rail network, providing existing and future development in north west Sydney with better access to the rail network, and increasing the attractiveness and uptake of the rail service.

The refinement of station locations, addition of two new stations, and realignment of the NWRL within the NWGC, enhances the attractiveness of the NWRL by integrating it with existing and future land uses and other transport services and responding to community requirements.

The vertical alignment modifications between Bella Vista and Rouse Hill would provide better environmental and land use outcomes by:

- limiting the extent of the project on the floodplain and thereby reducing potential flood risks;
- reducing the direct impact on land take and severance of land holding, and more efficient use of land; and
- reducing the length of the alignment in tunnel.

Further description of the project need and justification for Stage 1: Major Civil Construction Works, is included in the following Section 3.2 – Project Need and Justification.

3. PROPOSED PROJECT

3.1. Project Description

The NWRL alignment will stretch 23km from Epping to Rouse Hill. It will consist of two 15.5km underground rail tunnels generally between Epping and Bella Vista and a 4.2km above ground twin track viaduct structure generally between Bella Vista and Rouse Hill. It will include eight new stations at Cherrybrook, Castle Hill, Hills Centre, Norwest, Bella Vista, Kellyville, Rouse Hill and Cudgegong Road. The NWRL would join the rail network at the existing tunnel stubs located immediately north of the underground Epping to Chatswood Rail Link, Epping Station Platform.

Stage 1: Major Civil Construction works for the NWRL includes 16 construction sites along the alignment from which the following will be carried out:

- excavation of tunnels and underground station boxes;
- construction of above ground infrastructure including viaduct spans and bridges; and
- earthworks.

These construction sites are located in the Hornsby Shire, the Hills Shire and Blacktown Local Government Areas (LGA). They are located in contrasting areas of highly urbanised land and rural residential land that have been identified for future residential development.

In general, the areas between Epping and Bella Vista Station along the alignment are urbanised. Surrounding land uses include high and low density residential, commercial, local centre, specialised infrastructure and public open space/conservation zones.

The surroundings from the planned Bella Vista Station to the Cudgegong Road Station and Stabling Facility are undergoing development and currently consist of rural residential lands. Developed densities through this section are lower and surrounding land uses include low density or rural residential, commercial and open space/conservation zones.

Planned future development is anticipated to take place at locations along the alignment and construction compounds. Known initiatives include the continued development of the Epping Town Centre, expansion of Castle Towers Shopping Centre, development of the Balmoral Release Area, development of the Northern Frame of Rouse Hill Town Centre and the development of Area 20.

The project layout is shown in Figure 2. The key components of the project are listed in Table 3.1.

Figure 2: Project Layout

Table 3.1: Key Project Components

Aspect	*Description*
Tunnelling	Two 15.5km tunnels will be constructed generally between Epping Station and the proposed Bella Vista Station. Civil construction works will involve: - the excavation and lining of the tunnels; - cross passages approximately every 240 metres for emergency access; and - two crossover caverns, one at Epping and one at Castle Hill, to allow for trains to switch tracks. The tunnels would generally be between a depth of 20-25 metres. The tunnels would be at their shallowest at the station locations and the northern tunnel entrance near Bella Vista Station. Four Tunnel Boring Machines (TBM) will be used for the tunnelling work. Bella Vista Station and Cherrybrook Stations have been identified as potential TBM launch and support sites, while the Hills Centre Station has been identified as a potential TBM support site only. Up to eight roadheaders will be used and launched from the Epping Decline and the Castle Hill Station. They are likely to be used to excavate connection tunnels with the ECRL, cross passages and connecting tunnels, replacement of stub tunnels for the Parramatta to Epping Rail Link, and rail track crossover caverns.
Viaducts and bridges	The viaduct structure will be approximately 4.2km long, and will be constructed from cast in-situ concrete piles, columns and headstocks with concrete box section girders spanning the columns. Viaduct box sections will typically be 13 metres wide and range between 36-48 metres in length. Longer or shorter spans may be adopted to avoid pillars encroaching on existing infrastructure. Bridges will be constructed where the rail alignment crosses existing infrastructure or watercourses.
Stations	Five stations are proposed along the tunnelled section, two located on the viaduct structure, and one within an area of earthworks to the west of the viaduct. Tunnel stations (CherryBrook to Bella Vista) would be excavated either using an open cut or cut and cover method. Kellyville and Rouse Hill stations will be located on the viaduct structure. Cudgegong Road Station would be located within a shallow earthworks cutting immediately to the west of Cudgegong Road.
Tallawong stabling facility	The stabling facility would be constructed using conventional heavy excavation and earthmoving equipment. It will include provisions for water treatment and stormwater runoff.
Major construction sites	Approximately 16 construction sites are required for the project, with all sites fulfilling a combination of several project needs. Table 2 shows the proposed construction activities to be undertaken at each site. Construction compounds would be established at each location where station excavations are to be undertaken. Acoustic sheds will be erected where precast manufacturing, concrete batching and TBM servicing will be carried out.
Associated rail infrastructure and services	Two service facilities are proposed at Epping and Cheltenham. The Epping service facility would provide tunnel ventilation plant and equipment to ensure NWRL integration into the existing ECRL. The Cheltenham facility would provide emergency access and equipment for the 6km tunnel segment between Epping and Cherrybrook. Several utilities will be adjusted or re-located during construction to continue to provide services without inhibiting project construction. These works are proposed to be undertaken as enabling works prior to construction. High voltage power will be required for TBM, roadheader, pre-cast manufacturing facilities and associated plan operations. Power supplies would likely be brought to each site externally from the project corridor through an underground route. Power supply provision is anticipated to be undertaken as enabling works prior to substantial construction.

Table 3.2: Construction activities by site (TfNSW 2012)

Site	Area (m²)	TBM Launch	TBM Support	TBM Retrieval	Spoil Removal	Roadheader Launch / Support	Station Construction	Services Facility Construction	Viaduct Launch / Support	General Civil Works	Concrete Batch Plant / Pre-cast Facility
Epping Services Facility	3,400			•	•			•			
Epping Decline	4,500				•	•					
Cheltenham Services Facility	12,000				•			•			
Cherrybrook Station	75,000	•	•	•	•		•				
Castle Hill Station	18,000				•	•	•				
Hills Centre Station	65,000		•		•		•				
Norwest Station	21,000				•		•				
Bella Vista Station	63,000	•	•		•		•			•	
Balmoral Road	190,000				•					•	•
Memorial Avenue	120,000								•	•	•
Kellyville Station	100,000						•		•	•	
Samantha Riley Drive to Windsor Road	50,000								•		
Old Windsor Road to White Hart Drive	97,000								•		
Rouse Hill Station	18,000						•		•		
Windsor Road Viaduct	61,000								•		
Windsor Road Viaduct to Cudgegong Road	83,000									•	
Cudgegong Road Station to Tallawong Stabling Facility	590,000				•		•			•	

3.2. Project Need and Justification

The NWRL is located in the North and North West Subregions of Sydney. With Sydney's population expected to increase by 1.7 million, to approximately 6 million people by 2036, these Subregions will play a key role in accommodating Sydney's future residents. It is estimated that an additional 770,000 dwellings are required by 2036 to provide sufficient levels of housing for Sydney's population.

The Department, in its assessment of the North West Metro Concept Plan, found that such a proposal was justified on the following grounds:

- the project is wholly consistent with and builds on the strategic land use and transport objectives for Sydney identified in the *Sydney Metropolitan Strategy (2005)*; *State Infrastructure Strategy (2006)*; *NSW State Plan (2006)* and *Urban Transport Statement (2006)*;

- the project provides significant advantages in terms of the frequency and reliability of service, which is integral to encouraging the shift to more sustainable forms of transit; and
- the project provides significant benefits to existing and developing centres including the NWGC by:
  - providing a viable and efficient transport alternative to car use, with associated personal and wider-social benefits including less fuel costs, congestion relief and air quality benefits; and
  - improving access to employment and social opportunities within existing and planned centres, particularly to the 'Global Arc' which is of significant economic importance to Sydney and to other regional centres previously inaccessible by rail.

Currently, the North and North West Subregions are heavily reliant on private cars and bus services for transport options. The North West has the lowest proportion of trips by public transport and the largest daily distance travelled by motor vehicle per household of the Sydney region. With increased demand on road networks, it is vital that transport networks and services are expanded to the region to support ongoing development and to connect the NWGC to existing centres. Failure to do so will likely see congestion increase on the road network and increased travel times.

The *Metropolitan Plan 2036* sets out the strategic direction for Sydney's growth, including the distribution of future housing. As a proportion of the total new dwellings required, the North Subregion has been nominated to accommodate 29,900 new dwellings by 2036. The North West Subregion has been highlighted to accommodate 169,000 additional dwellings, including 87,000 dwellings in the NWGC. This total dwelling target is the largest proportion across the Sydney Metropolitan area. The NWGC contains sixteen precincts identified to provide housing and employment centres for Sydney's growth. Eleven of these precincts have been released and are at varying stages of development. The NWRL will support development underway in the NWGC.

Up to 760,000 new jobs are needed by 2036 to support Sydney's anticipated growth. The *Metropolitan Plan* sets out employment targets for Sydney's subregions to balance job growth throughout the Sydney basin. The North is forecast to provide 15,000 additional jobs by 2036. The North West is forecast to provide the largest proportion of new employment capacity of the Sydney region, with a target of 145,000 new jobs by 2036. The NWRL will support employment generation by maximising connectivity and patronage numbers utilising public transport in the region. This is a key component in encouraging sustainable transport orientated development along the corridor, stations and surrounding centres.

The *Metropolitan Transport Plan-Connecting the City of Cities 2010*, identifies the NWRL as a key component in delivering essential transport infrastructure and services to the North West and in particular the NWGC. The draft *NSW Long Term Transport Master Plan*, currently being prepared, is also committed to the NWRL, to ensure well-connected and integrated transport to the NWGC.

The NWRL is wholly consistent with the relevant goals of renovating infrastructure and returning quality services in the NSW 2021 State Plan. It will:

- reduce travel times by providing key rail services and facilitating a road to rail modal shift;
- increase public transport patronage by providing an attractive transport alternative in a growing region of Sydney; and
- improve road safety as a result of having fewer cars on the road network.

For the above reasons, the Department considers that the NWRL and by extension, the Stage 1: Major Civil Construction Work is justified on the basis that is represents a vital infrastructure asset which is beneficial to the public interest. The impacts of not proceeding with the project in the long term would prove detrimental to road capacity, air quality, accessibility to housing and jobs and planned land release development of the NWGC and the wider region.

4. STATUTORY CONTEXT

4.1. State Significant Infrastructure

On 6 May 2008, the then Minister for Planning granted Concept Plan Approval for the North West Metro, under Part 3A of the EP&A Act. The Concept Plan Approval protects the North West Metro corridor as identified within the Concept Plan, through the *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP), as land that the Minister has granted approval for under Part 3A for a concept plan for a project comprising development for the purpose of a railway.

Pursuant to section 115U(4) of the EP&A Act, and under the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP), Schedule 4, Part 1, the North West Metro Concept Plan is identified as transitional development, and declared to be SSI.

The Concept Plan approval is therefore now an approval for staged SSI under Part 5.1 of the EP&A Act. The staged approval does not, however, permit the carrying out of works, and a separate detailed environmental assessment and approval is required for the project, or each part of the project, before construction can commence.

The Proponent has subsequently requested to modify the staged SSI approval to address refinements to the project, and submitted an application for the Stage 1: Major Civil Construction Works.

4.2. Critical Infrastructure

Pursuant to section 115V of the EP&A Act, the SRD SEPP, Schedule 5(2), identifies the NWRL as Critical SSI. This listing recognises the importance of the NWRL as a project that is essential to the State for economic, environmental or social reasons.

4.3. Permissibility

The NWRL is defined as a rail infrastructure facility under the Infrastructure SEPP. As a rail infrastructure facility being carried out by a public authority it is identified as development that is permissible without consent under clause 79 of the Infrastructure SEPP.

4.4. Environmental Planning Instruments

With the exception of the Infrastructure SEPP and SRD SEPP, there are no State Environmental Planning Instruments that apply to the carrying out of the NWRL project.

4.5. Objects of the EP&A Act

Decisions made under the EP&A Act must have regard to the objects of the Act, as set out in Section 5 of the Act. The relevant objects are:

(a) to encourage:
- *(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,*
- *(ii) the promotion and co-ordination of the orderly and economic use and development of land,*
- *(iii) the protection, provision and co-ordination of communication and utility services,*
- *(iv) the provision of land for public purposes,*
- *(v) the provision and co-ordination of community services and facilities, and*

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and
(vii) ecologically sustainable development, and
(viii) the provision and maintenance of affordable housing, and

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The objects stipulated under Section 5(a) are significant factors informing determination of the application. The Department, in its assessment, has considered the need to encourage the appropriate management and conservation of natural and artificial resources, including natural water resources, flora and fauna, and towns and centres for the purpose of promoting the social welfare of the community. The Department has also considered the proposed project in relation to the orderly development of land, the protection of communication and utility services, the provision of land for public purposes, the co-ordination of community services and facilities, the maintenance of affordable housing, and the protection of the environment.

Object 5(b) is relevant as the project involves the sharing of responsibility and information for environmental planning to provide key rail infrastructure through key strategic centres and the NWGC. Object 5(c) is also relevant to the project as the issues raised by the community during the exhibition period of the EIS form a part of the assessment of the project and the Departments consideration in Section 7.

4.6. Ecologically Sustainable Development

The EP&A Act adopts the definition of Ecologically Sustainable Development (ESD) found in the *Protection of the Environment Administration Act 1991*. Section 6(2) of that Act states that ESD requires the effective integration of economic and environmental considerations in decision-making processes and that ESD can be achieved through the implementation of:

(a) the precautionary principle,
(b) inter-generational equity,
(c) conservation of biological diversity and ecological integrity,
(d) improved valuation, pricing and incentive mechanisms.

The principles of ESD have been addressed in the EIS prepared by the Proponent. The EIS includes detailed studies in the form of Technical Papers, commissioned by the Proponent in the areas of construction traffic and transport, construction noise and vibration, European heritage, Indigenous heritage, ecology, surface water and hydrology. The results of these studies have been summarised and integrated in the body of the EIS to ensure that the principles of ESD have been adequately addressed as part of the assessment of the project. The Proponent has set out a series of mitigation and management measures that would be implemented during Stage 1 of the project. These measures would be reviewed and augmented where necessary during Stage 1: Major Civil Construction Works and throughout the preparation and assessment of EIS 2 for Stage 2: Stations, Rail Infrastructure and Systems.

On this basis, and the Department's assessment of key issues outlined in Section 7 – Project Assessment of this report, the Department is satisfied that the proposal promotes the principles of ESD.

4.7. Environment Protection and Biodiversity Conservation Act

The Stage 1 Application identified that should the Department for Sustainability, Environment, Water, Population and Communities (DSEWPC) identify the project to be a controlled action

under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), an approval would be required.

There is currently no bilateral agreement in place between the NSW and Commonwealth governments. The Proponent therefore made a referral directly to DSEWPC under the EPBC Act for potential significant impact on Cumberland Plain Woodland and Blue Gum High Forest.

On 21 May 2012, DSEWPC determined that the NWRL is a Controlled Action and therefore requires assessment and approval under the EPBC Act. Whilst agreements are able to be made on a project by project basis in relation to accredited assessment processes, both the Proponent and DSEWPC subsequently considered it appropriate to proceed under a separate assessment and approvals process. The Proponent is currently preparing additional information regarding ecological offsets for Federally listed Endangered Ecological Communities to facilitate the approval under the EPBC Act.

5. CONSULTATION AND SUBMISSIONS

5.1. Exhibition

Under section 115Z(3) of the EP&A Act, the Director-General is required to make the EIS of an application publicly available for at least 30 days. After accepting the EIS, the Department publicly exhibited it from 4 April 2012 until 21 May 2012 (48 days – extended to account for the Easter school holidays) on the Department's website, and at the following exhibition locations:

- Department of Planning and Infrastructure Information Centre;
- Transport for NSW Information Centre;
- Hornsby Shire Council;
- Hornsby Shire Libraries – Pennant Hills, Epping and Hornsby Branches;
- Hills Shire Council;
- Hills Shire Libraries – Castle Hill, Vinegar Hill Memorial and Baulkham Hills Branches;
- Blacktown City Council; and
- Blacktown Council Libraries – Max Webber Library and Denis Johnston Library.

The Department also advertised the public exhibition in the Hills Shire Times on 3 April 2012, and the Sydney Morning Herald, Daily Telegraph, Blacktown Advocate and North Shore Times on 4 April 2012, and notified State and local government authorities directly in writing.

In response to both the Modification and the SSI Stage 1: Major Civil Construction Works application, the Department received 359 submissions during the exhibition of the EIS. This included 12 submissions from public authorities and 347 submissions from the general public and special interest groups.

A summary of the issues raised in submissions is provided below. The Department has considered the issues raised in submissions in its assessment of the project.

5.2. Public Authority Submissions

The key issues raised in public authority submissions are listed in Tables 5.1 and 5.2.

Table 5.1 – Key issues raised by Councils

Council	*Key issues raised*
Blacktown City Council	- construction noise and vibration – monitoring the effectiveness of management measures; - construction traffic management – in particular the management of truck movements at the Tallawong Stabling Facility site; - surface water run-off and flooding – particularly in relation to Second Ponds Creek, and consistency with the Growth Centres Development Code and DCP requirements; - heritage impacts on Old Windsor Road; - visual impacts of the Skytrain viaduct, in particular graffiti and measures to soften the appearance of the viaduct; and - pedestrian access to Bella Vista and Kellyville Stations.
Parramatta City Council	- heritage impacts associated with the Epping Services Facility and the Epping Decline construction sites; - construction traffic impacts along Carlingford Road; and - recommendation that the project includes the widening of Beecroft Road at Carlingford Road, to address capacity constraints.

Council	Key issues raised
Hornsby Shire Council	- construction access – management of construction traffic impacts; - ecology – investigation of threatened species impact at the Cheltenham Services Facility and Cherrybrook sites, and offset requirements to mitigate against the loss of Blue Gum High Forest at the Cherrybrook site and a significant wildlife corridor at Cheltenham; - land use and community facilities – impacts caused by the service centre at Cheltenham Oval; - noise – construction noise impacts at Cherrybrook station; and - visual – impacts of temporary construction structures.
Hills Shire Council	- soils and groundwater – potential risk to land; - construction traffic – road dilapidation reports, access arrangements, street lighting issues, traffic volumes, bus interchange linkages, and heavy vehicle arrangements; - noise and vibration – further investigation into impacts is required, and the provision of acoustic mitigation measures; - historic heritage – view impacts to Mungerie House from Windsor Road resulting from the viaduct and its piers; - local business impacts – support required for small businesses directly affected by construction; - land use and community facilities – further consultation required with stakeholders and nearby residents; - ecology – identification and procurement of offset sites; and - visual – further consideration into mitigation measures to reduce visual impacts.

Table 5.2 – Key issues raised by public authorities

Council	Comments
Office of Environment and Heritage	- Aboriginal cultural heritage – cumulative impacts of the development and surrounding developments on Aboriginal archaeological sites; - biodiversity – identification and procurement of offset sites; - vegetation management plans – should be prepared for identified riparian areas and areas of retained remnant native vegetation within 50m of the construction footprint; - flooding – recommends that flooding mitigation measures are assessed on an overall catchment basis and with regard to surrounding properties; and - salinity – recommends that further soil salinity assessment be undertaken.
Dept of Primary Industries	<u>Fisheries matters</u> - eroded portions of waterways in riparian buffer zones should be rehabilitated and stabilised; and - it is preferred that viaduct structures and footings are not constructed in waterways and preferably outside the riparian buffer zones. <u>Agriculture matters</u> - the Hawkesbury Farmers Market should be able to operate during and post construction at the Castle Hill Showground. <u>Office of Water matters</u> - the design, construction and operation of the project should be undertaken in a manner which minimises harm to water sources; - impacts on riparian areas should be minimised, and the project constructed so as to maintain or improve the hydrologic, geomorphic and ecological integrity of the waterway; - permanent works should be placed outside the riparian buffer; and - Groundwater and Surface Water Management Plans should be developed.

Council	Comments
RailCorp	- RailCorp supports the construction of the NWRL and considers it would provide a beneficial link to the existing Epping to Chatswood Rail Link and the city.
Trade & Investment – Resources & Energy	- It is unclear how the Rouse Hill Shale Quarry will be affected by the project, and whether resource sterilisation at this site has been considered. It appears that the alignment directly intersects the shale quarry.
Roads and Maritime Services	- traffic management – the Proponent shall prepare: a Construction Site Parking Management Plan, a Construction Traffic Management Plan and Haulage Management Plan, and a Traffic Management Plan (Operational); - access – the project shall be designed with the objective of minimising adverse changes to existing access arrangements and services for all transport modes; - provided comments on future road enhancements, hours of construction, construction traffic volumes, T-Way patronage and access, and temporary car parking arrangements for major construction sites and station construction sites; and - specifications – provided specifications for bridgeworks / structures, and pavements / tunnelling / excavations, and outlined urban design issues for the overall project and viaduct.
Environment Protection Authority	- noise – effective communication with, and appropriate management responses for the affected community. Temporary and, where possible, operational noise barriers should be erected as early as possible in construction of the project; - construction hours – there is a need for clear justification and prior approval for individual works packages undertaken outside standard construction hours; - surface water and groundwater – insufficient information regarding groundwater or surface water treatment, in particular with regards to: the amount and quality of water to be discharged to local waterways, location of discharge points, and the method of treating surface water and contaminated groundwater to a standard appropriate for the receiving environment; and - soil contamination – assessment of the contamination status of soils to be disturbed or excavated during the project works should be undertaken prior to works disturbing soils being undertaken in a given area.
Heritage Council	- noted that a number of heritage items listed on Local Environmental Plans and the State register will be affected by the proposed works, and recommended a number of conditions to ensure that heritage issues are satisfactorily addressed.
Dept of Education and Communities	- noted that ongoing discussions are underway with the Department to inform the shape of development surrounding the new stations to facilitate additional capacity at existing schools and potential new schools.

5.3. Public Submissions

The Department received 347 submissions from the public. This included submissions from a number of special interest groups, including businesses, recreation and sporting clubs, schools, community interest groups, resident interest groups, and transport interest groups.

In its consideration of submissions, the Department noted that a number of submissions were made by the same submitter, resulting in more submissions than documented submitters. Where this was the case, the submissions were considered as supplementary to the respective initial submission. Therefore, whilst a total of 347 submissions were received, 343 individual submissions have been counted.

Of the 343 public submissions received, 51 (15%) objected to the project, 28 (8%) supported the project and 264 (77%) provided general comment. Additionally, 125 pro forma submissions were received which provided general comment, equating to approximately 47% of the general comments received, and 36% of all submissions received.

Four submissions also included signed petitions, received from the following groups:

- Bella Vista Waters Estate: 48 signatures - requesting that Bella Vista Station is either relocated to the Circa Shopping Centre area, relocated further along Old Windsor Road, or that the Station is enclosed.
- Bella Vista Railway Station Committee: 54 signatures – suggested alternatives for access and spoil removal, and raised concern over parking for construction vehicles, construction noise and vibration impacts, and safety concerns.
- Oliver Way Residents Group: 16 signatures – objects to the use of Robert Road as a feeder road and potential parking area, and raised concern regarding property impacts, construction dust, noise and vibration impacts, and objects to the clearing of vegetation surrounding the Cherrybrook Station site.
- Robert Road Group: 89 signatures – objects to the use of Robert Road as a feeder road for safety and capacity reasons, and raised concern regarding property devaluation, construction noise, vibration and traffic impacts, and objects to the clearing of vegetation surrounding the Cherrybrook Station site.

The key issues raised in public submissions are listed in Table 5.3.

Table 5.3: Summary of Issues Raised in Public Submissions

Issue	***Issue summary***	***Proportion of submissions***
Ecology *(includes 125 pro formas)*	The majority of submissions raised objection to vegetation clearing in Castle Howard Reserve to allow construction of access roads for the Cheltenham Services Facility.	59%
Construction traffic and access *(includes 125 pro formas)*	Submissions in general raised concern regarding construction traffic around construction sites, with a significant number of submissions raising concern regarding Cherrybrook Station and the use of Robert Road for construction access, and the traffic and access constraints of Kirkham St, Castle Howard Rd, Murray Farm Rd for construction traffic at the Service Facility at Cheltenham.	59%
Operational traffic and access *(includes 125 pro formas)*	Submissions in general raised concern regarding commuter traffic around stations, with a significant number of submissions specifically raising concern regarding Cherrybrook Station and the use of Robert Road as a feeder road, and traffic and access constraints of Kirkham St, Castle Howard Rd, Murray Farm Rd for emergency vehicles at the Service Facility at Cheltenham.	56%
Route alignment	Submissions raised general route alignment comments, including comment on the alignment of the tunnel and viaduct, suggestions for alternative alignment options including station location alternatives, and proposed extensions to the alignment.	16%
Construction noise	Submissions raised general concern regarding construction noise associated with the construction sites, with the community in the vicinity of Cherrybrook Station particular concerned regarding 24/7 construction noise.	15%
Community amenity	Submissions raised general concern regarding the impact to the local community, in particular the removal of the oval and sporting facilities as a result of the Service Facility at Cheltenham.	13%

5.4. Proponent's Response to Submissions

The Proponent provided a response to the issues raised in submissions (see Appendix C). As a result of the public exhibition process and submissions made on the project, and further design refinements, the Proponent has made a number of amendments to the project including the proposed minimisation of impacts where possible. These changes have been summarised below:

Epping Construction Sites

The proposed change to the project consolidates two construction sites at Epping, the Epping Services Facility and Epping Decline, into one site, an expanded Epping Services Facility.

An overview of the potential changes identified the following key environmental aspects:

- *Construction traffic and transport impacts*: Generally no change or minor reduction in impacts, with the exception of the potential loss of 2-3 car parking spaces on Ray Road. There would be an increase in the number of heavy vehicle movements at the Carlingford Road/ Ray Road/ Rawson Street intersection.
- *Construction noise and vibration*: No change or minor reduction in impacts, with the exception of airborne noise (daytime – some locations) and airborne noise (night-time) as well as road traffic noise, with some receivers potentially experiencing an increase in impacts.
- *Local business impacts*: Expansion of the Epping Services Facility to the south east would incorporate the full Epping Office Park site with the acquisition of four commercial premises (18 tenants). This would result in an increase in impacts on business and increased property acquisition. Rawson Street businesses that are reliant on passing trade may be adversely affected; with amenity issues a major factor for businesses located on Rawson Street and Beecroft Road.
- *Visual amenity impacts*: The addition of a larger acoustic shed at the Expanded Epping Services Facility Site.

A number of beneficial impacts occur as result of the consolidation of the two construction sites. The main benefit includes shortening the decline tunnel from approximately 300m to 20m with resulting reductions in spoil volumes and heavy vehicle movements. Other benefits include:

- *Construction traffic and transport*: Elimination of vehicle movements to the former Epping Decline site and reduced impacts to existing cycle path underneath Main North Rail Line. Improved pedestrian movement with the provision of signposted alternative pedestrian route via Ray Road and Kandy Avenue.
- *Noise and vibration*: Elimination of the Epping Decline site as noise source.
- *Local business impacts*: Increased workforce closer to Epping Town Centre and access to businesses along Rawson Street and Beecroft Road may result in an increase in demand for relevant goods and services.
- *Cumulative impacts*: Reduction in impacts to heritage listed bushland resulting from the NWRL and Devlin's Creek with removal of the Epping Decline Site.

Whilst there would be a change in impacts from those presented in EIS 1, these impacts summarised above are anticipated to be minor with the implementation of the revised mitigation measures.

Cheltenham Services Facility light vehicle access and egress

The previously proposed extension of Murray Road from Castle Howard Road through bushland required significant vegetation clearance. The proposed change, in the light vehicle access and egress point to and from the Cheltenham Services Facility, along Castle Howard Road has beneficial impacts for the retention of bushland and reduces the total area of the Cheltenham Services Facility construction site. The amount of Coastal Shale-Sandstone Forest clearance decreases by 2,250m^2 (0.225ha) with total vegetation clearance reduced to 9,750m^2. This also

results in a lesser impact on the existing walking track within the road reserve of Murray Road. There are not anticipated to be additional adverse impacts associated with the proposed change.

Realignment of Norwest Station

The proposed change to the project involves realignment of the Norwest Station box, previously directly underneath Norwest Boulevard, realigned to the south east to be adjacent to, and outside of, the Norwest Boulevard footprint. This proposed change has the benefit of reducing the interface of construction activities with Norwest Boulevard, and therefore reduces the potentially significant disruptions to Norwest Boulevard. To achieve this, an additional area at Brookhollow Avenue would be required during construction.

An overview of the potential changes identified the following key environmental outcomes:

- *Construction traffic and transport*: Generally no change or minor reduction in impacts, with the exception of the potential minor deterioration from level of service A to B at the Norwest Boulevard / Brookhollow Avenue (east) / Colombia Circuit intersection during some periods.
- *Construction noise and vibration*: No change or minor reduction in impacts, with the exception of airborne noise (daytime – some locations), with some receivers potentially experiencing an increase in impacts (receivers to the south) and other receivers experiencing a decrease (receivers to the north).

Apart from reducing significant impacts to Norwest Boulevard, the indented bus bay and bus stop along Norwest Boulevard are retained.

Whilst there would be a change in some traffic and transport and noise impacts from those presented in the Stage 1 EIS, these are anticipated to be minor with the implementation of the revised mitigation measures.

Sydney's Rail Future

The Submissions Report also provided clarification in relation to the NSW Government's announcement of Sydney's Rail Future in June 2012, which has introduced the concept of a three tier rail transport network. Under the new three tier system, the NWRL would operate as a Tier 1 rapid transit single deck train system, initially operating between the North West and Chatswood. This change would not result in any substantial changes to the environmental impacts described and assessed as part of the Stage 1 EIS process. In line with the NWRL, an upgrade of the Epping to Chatswood Rail Link to a high capacity rapid transit system would be required as a separate project to this application.

6. MODIFICATION ASSESSMENT

The Proponent submitted a request in 14 December 2011, to modify the staged SSI approval (Concept Plan Approval dated 6 May 2008), to address refinements to the project. The existing staged SSI approval provides both in principle approval for a broad rail corridor in North West Sydney, and sets environmental assessment requirements for future applications. The Proponent also requested environmental assessment requirements for both the proposed modification to the staged SSI approval and the SSI application for Stage 1: Major Civil Construction Works. In response to the applications received, supplementary requirements were issued in February 2012 for both the modification and the Stage 1 EIS.

Supplementary requirements were also issued in August 2012 for the Stage 2 EIS, and include a number of additional requirements specifically related to the SSI application for Stage 2: Stations, Rail Infrastructure and Systems (Appendix G).

A number of changed environmental impacts are associated with the modification of the staged SSI approval. A comparison of the changed impacts during construction and operation of the project, as a result of the modification at a conceptual level, is included in this section. Detailed impact assessment for the Stage 1: Major Civil Construction Works is provided in Section 7 – Project Assessment.

Table 6.1 identifies changes in environmental impacts associated with the proposed modification, and modifications resulting in a significant change, are discussed below. The changes in the proposed alignment are provided in Figure 6.1 a) to e) below.

Table 6.1: Change in environmental impacts associated with the proposed modifications to the staged SSI approval (TfNSW 2012)

	Environmental Category (Construction / Operation)							
Proposed Modification to the SSI Approval	*Land use, property & infrastructure*	*Traffic, transport, parking & access*	*Noise & vibration*	*Flora & fauna*	*Spoil*	*Hydrology & surface water*	*Visual, landscape & urban design*	*Social & economic*
Relocate Kellyville Station	x / ✓	✓ / ✓	✓ / ✓	x / x	✓ / x	✓ / ✓	x / ✓	✓ / ✓
New Bella Vista Station	✓ / ✓	✓ / ✓	✓ / ✓	x / x	✓ / x	✓ / x	✓ / ✓	✓ / ✓
New Cudgegong Road Station	✓ / ✓	✓ / ✓	✓ / ✓	✓ / x	✓ / x	✓ / ✓	✓ / ✓	✓ / ✓
Minor change to Hills Centre Station	✓ / x	x / x	x / x	✓ / x	x / x	✓ / x	x / x	✓ / x
Area 20 Precinct alignment changes	✓ / ✓	✓ / ✓	✓ / ✓	✓ / x	✓ / x	✓ / ✓	✓ / ✓	✓ / ✓
Vertical alignment changes	✓ / ✓	x / x	x / ✓	x / x	✓ / x	✓ / ✓	✓ / ✓	x / x
Horizontal alignment changes	x / ✓	x / x	x / x	x / x	x / x	x / x	x / x	x / x

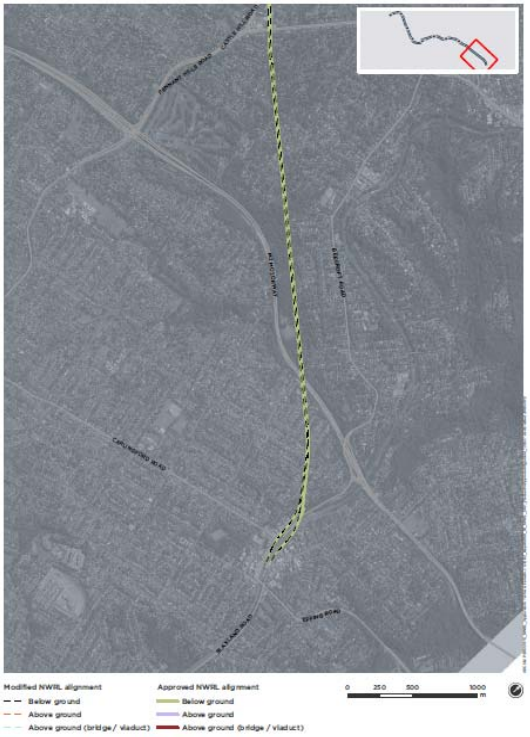
(✓ = significant change, x – no significant change)

The Proponent has advised that the modifications would not give rise to significant changes to Aboriginal and/ or historic heritage, geology, geotechnical and groundwater, utilities, air quality and general waste management issues. The Department considers that the existing staged SSI approval requirements combined with the supplementary requirements issued in February 2012 (for Stage 1, SSI-5100) and August 2012 (for the Stage 2, SSI-5414) adequately provides for the consideration of these issues. These matters are fully assessed in Section 7 of this report.

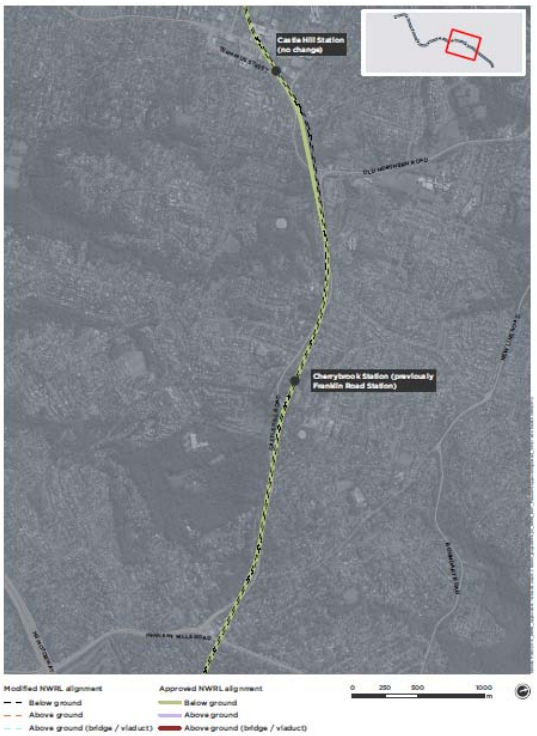
The Department has also prepared supplementary requirements for Stage 2: Stations, Rail Infrastructure and Systems, requiring further consideration of potential visual and cultural landscape impacts on historic heritage items, details of groundwater management during operation, and soil erosion and water course impacts including soil salinity and potential acid sulphate soils.

Figure 6.1 a) to e): Proposed alignment changes

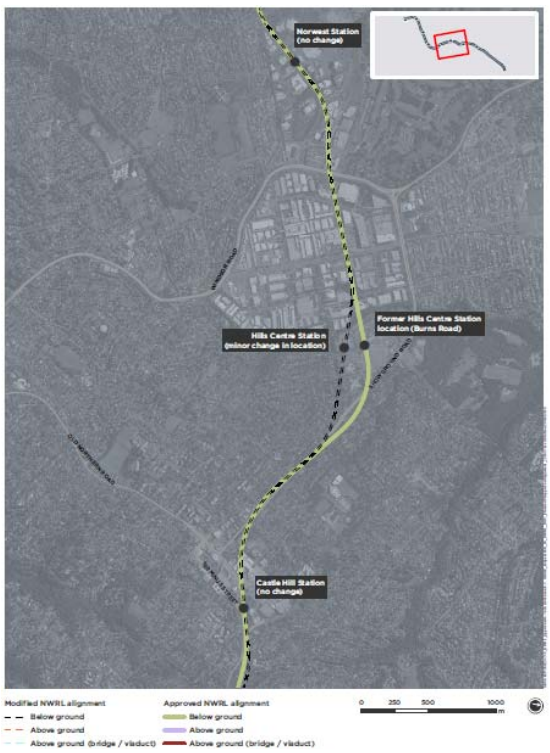
a) Epping Station to Pennant Hills Road



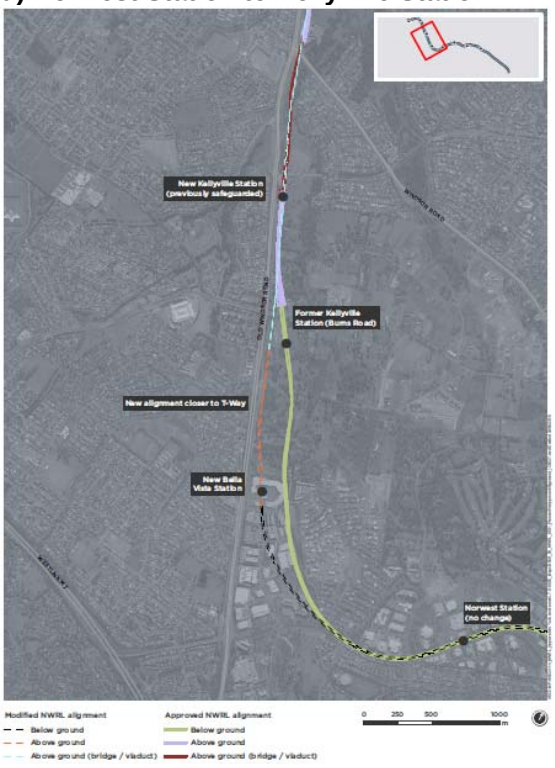
b) Pennant Hills Road to Castle Hill Station



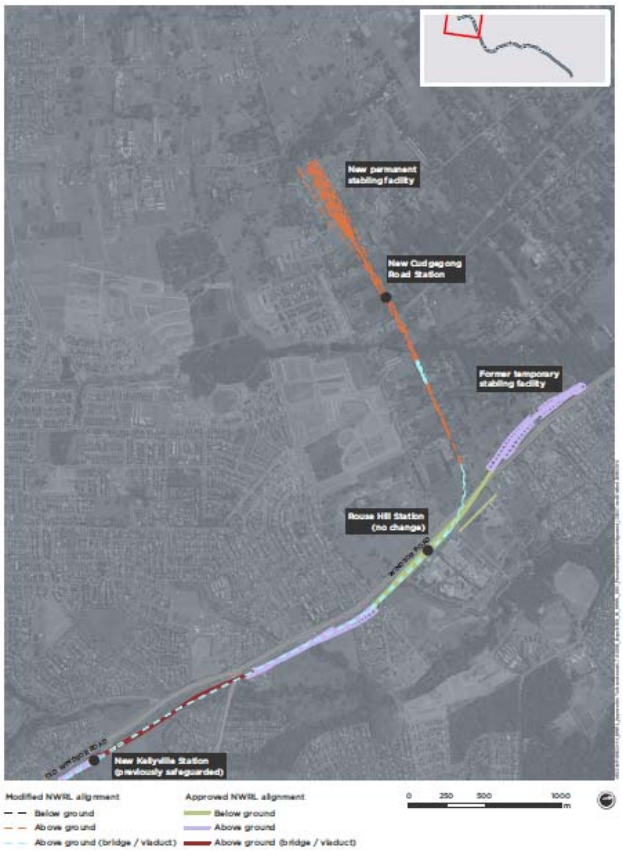
c) Castle Hill Station to Norwest Station



d) Norwest Station to Kellyville Station



e) Kellyville Station to Tallawong Station



6.1. Land use, Property and Infrastructure

The most significant changes to land use impacts during both construction and operation are in relation to the surface components of the project. Key changes as a result of the modification include reduced impact to land uses where the alignment or stations have been moved, and increased impacts in the following areas:

- the construction footprint for the Hills Centre Station site would require the acquisition of a Council depot, car parks associated with the Hills Centre and part of the Castle Hills showground;
- construction of Bella Vista Station would require the demolition of the Totally Home Centre bulky goods and retail complex;
- surface construction sites to accommodate viaduct construction would have an impact on surrounding residential, rural and commercial land uses;
- the horizontal alignment has been moved to abut the eastern side of the North-West T-way in the vicinity of Balmoral Road and Memorial Avenue reducing the construction impacts and enabling the optimisation of government owned land available for residential development within the Balmoral Road precinct;
- construction of the alignment, station and stabling yard through Area 20 would impact on the existing rural and residential land uses and planned future urban residential land uses; and
- the new westerly alignment through the Area 20 precinct, including Cudgegong Road Station, would require additional land take in the vicinity of Schofields Road.

The number of properties permanently or temporarily acquired as a result of the staged SSI approval comprised 92 buildings, approximately 50 less than the estimated 142 properties that were identified as being potentially affected by the project, within the Concept Plan.

The staged SSI approval requirement 3.2 and supplementary requirements issued in February 2012 for Stage 1 (SSI-5100), provided for the consideration of property and land use impacts for the modified project, in particular confirmation of the footprint of the project and land use impacts on existing and planned future use. The Department has assessed these issues against the existing staged SSI approval and supplementary requirements, for the Stage 1 application, in detail in the Section 7.5 – Land use and community facilities, and has provided recommended conditions of approval where required to ensure management of potential impacts.

Significant additional impacts are not anticipated as a direct result of the construction and operation of stations, rail infrastructure and systems. However, indirect land use change impacts around stations and ancillary facilities are anticipated and would be considered further as part of the Stage 2 application. To ensure that changes to land use impacts during operation of the project are specifically considered, the Department has included for Stage 2, the requirement to consider interactions with future land use plans and strategies, in consultation with the Department and relevant Councils.

6.2. Traffic, Transport, Parking and Access

The most significant changes to traffic, transport, parking and access arrangements during construction are focussed around construction sites, and would include the following:

- Hills Centre construction site – approximately 200 off-street parking spaces contained in the Hills Centre car park would be lost during construction;
- Bella Vista construction site – additional construction traffic at the Old Windsor Road / Celebration Drive intersection, and Lexington Drive / Celebration Drive roundabout, and loss of 522 off-street car parking spaces in the Totally Home Centre;
- Kellyville Station construction site – additional construction traffic at Old Windsor Road / Samantha Riley Drive intersection, and a portion of the Riley North-West T-way station car park would need to be relocated;
- Rouse Hill Station construction site – this would require relocation of the North-West T-way interchange for the duration of construction works; and
- Schofields Road construction sites – new construction traffic as a result of new construction sites in Schofield Road.

Overall, potential construction traffic impacts are considered comparable to those described in the staged SSI approval, notwithstanding the changed location of some of the potential impacts. The issue of construction traffic and access was raised in 59% of submissions received during the public exhibition of the EIS. Submissions from Blacktown, Parramatta, Hornsby and The Hills councils and RMS, generally raised concerns regarding construction traffic around construction sites.

These issues have been assessed and considered in detail in Section 7 of this report, and addressed in the related recommended conditions of approval. The Department in its assessment of the impacts is satisfied that with the implementation of construction management plans, that construction traffic impacts can be satisfactorily managed.

The modifications to the project provide for additional stations and additional park and ride facilities, and provide additional opportunities for integration of the project to service existing and future residential and commercial catchments. As a result of operation of the modified rail line, it is expected that there would be a redistribution of traffic as a result of the changed locations of the Hills Centre and Kellyville Stations, and the new Bella Vista and Cudgegong Stations, as well as the provision of park and ride facilities at Cherrybrook, Hills Centre, Bella Vista, Kellyville and Cudgegong stations, compared to that considered for the staged SSI approval. This would have an effect on the regional distribution of traffic and bus networks.

The issue of operational traffic and access was raised in 56% of submissions received during the public exhibition. In particular concerns were raised regarding increased traffic impacts from

station operation and parking stations. A significant number of submissions raised particular concern regarding changed traffic conditions as a result of operation of Cherrybrook Station, in particular the use of Robert Road as a feeder road.

In its assessment of the operational traffic impacts at stations associated with the concept plan approval, the Department noted that station locations have been based on a balance of factors, including patronage potential, land availability, engineering feasibility, and potential for environmental and land use amenity impacts. Specific traffic and transport impacts of stations would be further assessed and designed for during detailed design, and which would be required to be considered in the Stage 2 application. In relation to the proposed modifications, the Department also notes that these factors have informed the proposed station locations and remains satisfied with the approved approach.

In relation to Cherrybrook (Franklin Rd) Station, the Department maintains the position that the site and its associated functions present several significant benefits, which justify its location as proposed, including very high patronage potential, substantial availability of land to address mode of access (park and ride) demand; and good potential connectivity to the arterial road network (although noting that this would require further detailed assessment). As noted, further assessment would be undertaken within the Stage 2 EIS.

Blacktown City Council identified that given both Bella Vista and Kellyville Stations are proposed to be elevated structures, consideration and planning should be directed towards ensuring access is readily available for residents / commuters from the western side of Old Windsor Road. In particular, requesting the provision of further detail in relation to the locations of any future pedestrian overpasses. RMS identified that Traffic Management Plan(s) (Operational) are required for permanent changes on the road network in accordance with the RMS's delegation to Councils.

The Department notes that further assessment of operational impacts will be undertaken as part of Stage 2 and that the existing stage SSI approval requirements 3.3 and 3.4 generally provide for the consideration of operational traffic and transport impacts as a result of the project modifications. However, to address the operational traffic and access impacts as a result of amendments to the rail alignment, the Department has included as a supplementary requirement for Stage 2, the requirement to consider mode-of-access arrangements to specifically address the amended and new station locations, and consideration of connectivity arrangements within the Area 20 Precinct.

6.3. Noise and Vibration

The Proponent has identified that components of the modification could change the noise and vibration impacts identified and assessed under the staged SSI approval. Key components which could impact on noise and vibration include the following:

- relocation of Kellyville Station to the vicinity of Samantha Riley Drive on a viaduct;
- additional stations at Bella Vista and Cudgegong Road;
- new construction sites and stabling facility activities from the realignment and relocation of the Tallawong Stabling facility through Area 20;
- relocation of the Hills Centre Station and excavation sites;
- extension of viaduct between Kellyville Station and Rouse Hill from piling and viaduct placement;
- expansion of the Epping Services Facility by consolidating the Epping Services Facility and Epping Decline into one site; and
- realignment of Norwest Station outside the Norwest Boulevard footprint.

As part of Department's assessment of the Concept Plan, it was recognised that detailed design review of the NWRL project may necessitate refinements to the alignment. Requirements were

therefore included, requiring confirmation of the alignment, station locations and stabling arrangements, and a detailed description of the design and location of ancillary infrastructure. The approval also included requirements detailing environmental standards and design principles, including noise and vibration criteria which would need to inform the future approval and assessment process.

The Department understands that refinement to the approved staged SSI is a result of further investigations undertaken by the Proponent, taking into account of conflicting environmental impacts, engineering requirements and potential amenity impacts to receivers. The Department recognises that movement of the corridor would displace the footprint of the rail corridor under different residential and sensitive land uses. Nonetheless, the Department is satisfied that the proposed changes are not radically different to the staged SSI approval and are justified on balance.

Construction

Under the original staged SSI approval, the Proponent identified the sources of noise impacts from specific construction activities and impacts at specific locations, such as the tunnel works sites. The Proponent identified management and mitigation measures, including standard measures that have been successfully employed at other rail projects. Whilst the Proponent's assessment was location specific, the assessment of noise impacts was focused on potential sensitive receivers and the adequacy of the proposed mitigation and management measures to meet acceptable noise and vibration goals.

Since the approval, new construction noise guidelines have been prepared and adopted. Specifically, the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) is aimed at managing construction noise by setting the noise management levels of a project at sensitive land uses, including residences, places of worship and educational institutions. This Guideline provides a consistent quantitative assessment method of construction noise and the application of feasible and reasonable work practices to minimise construction noise impacts.

Although the Proponent's assessment of the modification request did not specifically compare the total number of properties or receivers which may benefit or be further impacted by the modification, it provided an assessment of noise and vibration impacts at sensitive receivers, taking into account the ICNG. The Department considers that this approach is satisfactory as it reflects current assessment practices.

Whilst some design elements of the project have changed from that approved, the Department considers that construction and vibration impacts are unlikely to be significantly different from the worst case impacts predicted as that approved. This is on the basis that the current assessment remains generally representative of the construction methods and activities assessed, and the project would traverse similar terrain and built environment. It should be noted that the Proponent has re-committed to the implementation of all feasible and reasonable mitigation measures to manage construction noise and vibration impacts, and staged SSI approval requirement 3.6, which requires a review of the noise and vibration impacts of the project and consideration of all feasible and reasonable mitigation options at existing and planned future receivers, remains current. Further assessment of construction noise impacts is outlined in Section 7.3 – Noise and vibration.

Operation

With regards to operational noise and vibration impacts resulting from the modification, the Proponent has undertaken a preliminary assessment, whilst detailed assessment will be included in the Stage 2 EIS, subsequent to further detailed design development.

As the majority of the project remains in tunnel, operational noise impacts are not expected to impact upon significantly larger number of receivers. Key changes of the modification which may lead to new operational noise and vibration impacts are the viaduct where tracks are elevated relative to the majority of existing receivers, and the westerly alignment through Area 20, including the elevated alignment over Windsor Road and the introduction of Cudgegong Road Station and the Tallawong Stabling Facility. Conversely, noise and vibration impacts associated with the

stabling yard in the approved location immediately west of Windsor Road would be eliminated as a result of its relocation.

A number of submissions raised concern regarding operational noise and vibration impacts around changed station locations and the amended alignment. In particular, concerns were raised regarding operational noise as a result of the extended viaduct structure.

In relation to the viaduct, the tracks will be elevated relative to the majority of existing receptors between Kellyville Station and the Rouse Hill area west of Windsor Road. A qualitative assessment of the operational noise and vibration impacts resulting from the viaduct was undertaken. The Department understands that variations in the design of the viaduct will influence the noise impacts associated with the proposal, and that exceedances would be able to be managed through ongoing design refinements and/or source control measures. In this regard, the Department supports the Proponent's recommendation that noise assessment will form an important input into the development process to reduce potential noise impacts. The Proponent has also indicated that the design of the viaduct would enable the construction of noise barriers, if required.

The stabling facility is proposed to be relocated in the newly planned North West Growth Area. The Department's previous assessment of the operational noise impacts of the stabling facility identified that mitigation measures were required to meet acceptable operational noise goals at existing and future sensitive receivers. In order to mitigate and manage operational noise impacts from the train stabling facility, the Department adopted an approach focusing on source mitigation (including consideration of a full enclosure of the facility), coupled with appropriate land use integration. The intent of the land use based mitigation approach is to ensure land adjoining the stabling facility is appropriate (ie development of complementary land use such as commercial/industrial in preference to noise sensitive receivers).

With respect to the stabling facility, the Proponent's assessment indicated that the most significant new operational noise impacts would be generated from the operation of air conditioning units and brake testing. The Proponent's Submissions' Report identified that as a result of the move to single deck rolling stock arising from the incorporation of the NWRL into the recently announced Rapid Transit System, it is not anticipated that horn testing would be required, which represents an improvement in the noise environment. In the absence of horn testing, the predicted noise levels are assessed as exceeding the noise management levels by only 1dB during the night time period, which the Department considers to be minor and acceptable, as such levels are barely perceptible.

Accordingly, the Department remains satisfied that the project as modified can be constructed to address relevant noise criteria and that the future assessment and approvals process for the operational noise and vibration assessment of the project remain adequate.

6.4. Flora and Fauna

The Concept Plan environmental assessment identified that the proposal would clear approximately 21.7 hectares of existing native vegetation. The modified project would clear approximately 30.87 hectares of existing native vegetation. The following tables provide an overview of the total increase and/or decrease in clearance of EECs as a result of the modified project.

Table 6.2: Total Native Vegetation Clearance (under TSC Act)

Vegetation Community	*Clearance under Concept Plan (ha)*	*Clearance under modified project (ha)*
Cumberland Plain Woodland (CEEC)	20.1	25.1
Sydney Turpentine Ironbark Forest (EEC)	0.6	0.32
Riverflat Eucalypt Forest on Coastal Floodplain (EEC)	1	2.33
Blue Gum High Forest (CEEC)	-	1.01

Shale/Sandstone transition Forest (EEC)		-	0.78
Coastal Shale Sandstone Forest		-	1.33
TOTAL	**21.7**	**30.87**	

A number of positive impacts to existing flora and fauna would occur as a result of the modified project, including:

- avoidance of direct impact to Cattai Creek and riparian vegetation as a result of relocation of the Hills Centre Station construction site;
- avoidance of direct impact on areas of vegetation communities and potential threatened species habitat as a result of the amendment to the alignment in the Old Windsor Road area;
- reduced impact on vegetation communities as a result of extension of the viaduct structure beyond the Old Windsor Road / Windsor Road intersection to Rouse Hill; and
- avoidance of impacts on vegetation communities and potential threatened species habitat as a result of the relocation of the Rouse Hill Stabling Facility.

However, additional impacts to other areas of existing flora and fauna would result as a direct consequence of the construction of the modified project, in particular:

- clearing of vegetation communities from the Bella Vista Station, Balmoral Road and Kellyville Station construction sites, including potential impact to riparian and aquatic habitats at Kellyville Station; and
- impacts on vegetation communities and potential threatened species habitat in the North West Growth Centre (affecting Area 20 and Riverstone East) as a result of the amendment to the alignment through the North West Growth Centre, addition of Cudgegong Road Station and Tallawong Road Stabling Facility.

Potential increase in operational impacts would occur as a result of a greater extent of the alignment being located above ground with associated light and noise impacts on the surrounding environment. However, potential impacts on flora and fauna, ecological communities and ecological processes would remain similar to the staged SSI approval.

A number of community submissions raised concerns on flora and fauna impacts associated with the proposed NWRL within the North West Growth Centre lands, particularly in areas not classified as certified vegetation. There was also concern expressed that areas containing certified vegetation had previously been set aside for conservation as offsets for past developments. Agency submissions raised biodiversity offsets and suitable offset sites as a key issue for the proposed loss of native vegetation.

The Proponent, in response to concerns raised, advised that flora and fauna surveys have been undertaken to identify impacts to flora and fauna, with mitigation measures to avoid, manage and mitigate impacts to be included the Construction Environmental Management Framework. The Proponent has noted that native vegetation removed (including areas of non-certified vegetation) would be offset in accordance with the Biodiversity Offset Strategy presented in the EIS. Further to this, Vegetation Management Plans, and Flora and Fauna Management Plans would be prepared for sites where vegetation is proposed to be retained up to 50m adjacent to the construction footprint. Additionally, for vegetation proposed to be cleared, pre-clearance surveys will be conducted. The assessment of these impacts and the adequacy of mitigation measures is further considered in Section 7.6 - Ecology.

In summary, the Department is generally satisfied with the Proponent's assessment and that there will not be significant impact to flora and fauna. Notwithstanding, the Department has recommended a condition strengthening the Proponents commitments in relation to the Biodiversity Offset Strategy to ensure appropriate offset outcomes are achieved.

6.5. Spoil

Overall, the project modification would result in a significant reduction in the overall volume of spoil created, from approximately 3.9 million cubic metres to 2.4 million cubic metres, as a result of the reduced length of tunnelling and the relocation of Kellyville Station to above ground. Notwithstanding, some aspects of the modification would result in spoil being generated at new locations, particularly in the vicinity of Bella Vista Station and within Area 20.

The Department considers that the key impacts associated with spoil generation are the management of spoil related construction heavy vehicle traffic, and noise generated at spoil removal sites. The key impacts associated with spoil generation are therefore generally associated with the Stage 1: Major Civil Construction Works stage of the project.

Taking into account the reduction in spoil generation resulting from the modification, potential construction traffic and noise impacts are considered reduced but generally comparable to those described in the staged SSI approval, notwithstanding the changed location of some of the potential impacts. These matters are further considered in detail in Sections 7.2 - Traffic and Transport and 7.3 – Noise and Vibration. The Department remains satisfied that with the implementation of construction traffic and noise mitigation measures, and implementation of the construction environmental management plan, the construction traffic impacts and construction noise impacts associated with spoil removal can be satisfactorily managed.

6.6. Hydrology and Surface Water

Potential hydrology and surface water impacts of the project would be reduced as a result of the proposed modification. Reduced risk would occur at the following locations:

- Cattai Creek as a result of relocation of station construction activities within the southern section of the Hills Centre Station construction site;
- reduced flood impact as a result of the reduced size of the Balmoral Road construction site and its location closer to Windsor Road, further away from Elizabeth Macarthur Creek;
- the new viaduct section beyond Old Windsor Road / Windsor Road intersection, replacing sections of cut and cover tunnel; and
- the Rouse Hill Stabling Facility.

Additional flood risks identified as a result of the modified project include:

- Bella Vista Station construction site and tunnel portals as a result of being located adjacent to Elizabeth Macarthur Creek;
- the eastern fringe of the Kellyville Station construction site by flooding from Elizabeth Macarthur Creek;
- temporary works such as access roads to facilitate the construction of the viaduct which would have the potential for greater flood impacts in comparison to permanent structures; and
- construction sites at Cudgegong Road Station and Tallawong Stabling Facility including the construction of a crossing over Second Ponds Creek.

The Department acknowledges that the modified project would result in impacts during its construction, which may increase the risk of flooding in some areas. Additional identified risks would be subject to further assessment, would inform the design of temporary works, and be subject to robust mitigation measures.

The issue of hydrology and surface water impacts in relation to the modified project was not raised as a key concern amongst submissions. However, submissions regarding surface water run-off and potential flooding risk during construction activities were received from Blacktown City Council, OEH, DPI – Fisheries, and the EPA, predominantly responding to the detailed surface water and hydrology assessment undertaken for Stage 1.

The Department considers that the staged SSI requirements 3.9 to 3.12 adequately provide for the assessment of hydrology and surface water impacts as a result of construction of the modified project, in particular regarding surface components of the project located on floodplains including temporary construction sites, cut and cover tunnel components which cross creek lines, and impacts to riparian and instream ecology. These requirements also included the identification of flood design criteria in accordance with the *Floodplain Development Manual* (2005), describing risks to existing and planned future receivers and infrastructure based on the modelling of a full range of flood sizes up to and including the probable maximum flood.

The Department has assessed these issues in detail in Section 7.7 – Surface Water and Hydrology, and provided recommended conditions of approval where required to ensure management of any potential adverse impacts.

The Department also considers that the modified project has the potential to reduce the overall long term hydrology and surface water impacts, as a result of station relocations and the extension of the viaduct across the floodplain. Notwithstanding, Blacktown City Council identified that Stage 2 impacts would impact design planning levels for adjoining land development, and considers that water quality and quantity management should be consistent with Growth Centres Development Code and DCP requirements. This would be considered further as part of the Stage 2 EIS.

6.7. Visual Impacts, Landscape and Urban Design

Overall, construction impacts would be required for a significant period of time for major civil construction works (approximately three and a half years), and construction of stations, rail infrastructure and systems. Key changes to visual impacts during construction as a result of the modification include reduced visual impacts where the alignment has been moved, and increased visual impact in the following areas:

- altered visual impact to receivers south of the Hills Centre station as a result of relocating the main construction facility to the southern portion of the site;
- addition of visual impacts from the construction of the new Bella Vista Station and Kellyville Station;
- extension of the viaduct construction beyond the Old Windsor Road / Windsor Road junction to Rouse Hill will result in visual impact on surrounding areas; and
- additional visual impacts from the construction of the relocated rail alignment through Area 20, Cudgegong Road Station, and the stabling yard.

Overall, visual impacts as a result of construction activities are considered comparable to those described in the staged SSI approval, notwithstanding the changed location of some of the potential impacts. New receivers would be impacted as a result of the extension of the viaduct construction, realignment and additional construction sites, and station excavations. Conversely, previous construction sites have been removed or relocated as a result of the realignment and relocation of stations and the stabling facility, thereby removing the impact from previously identified receivers.

The Department acknowledges that the modified project will result in impacts during construction of the project, which may directly affect existing and future land use in the vicinity of the modified project. The Department considers that the staged SSI approval requirement 3.16 adequately provides for the consideration of visual impacts and mitigation requirements for the construction of the project. The Department has also assessed these issues in detail, as part of the Stage 1 Application, in Section 7.8 and provided recommended conditions of approval where required to minimise visual impacts resulting from construction sites and construction of permanent structures, including the viaduct and bridge structures.

Overall, the key additional visual impacts from the modification as a result of operation of the project, are:

- the addition of two new stations and changes to the locations of other stations;
- the permanent establishment of the viaduct structure over an extended length of 4.2 km between Kellyville and Rouse Hill (previously 1 km between Kellyville and Old Windsor Road / Windsor Road intersection), resulting in visual impacts for a number of receptors along this section; and
- relocation of the rail alignment and stabling yard west through Area 20, introducing a new visual impact into this area.

A number of submissions raised concern specifically regarding the visual impact of the extended viaduct, including Blacktown City Council. The Department acknowledges that the erection of a new structure can significantly alter the visual amenity of its surrounding environment.

The design and architectural elements of the viaduct are still being developed by the Proponent. However, to mitigate potential visual impacts, clear design principles would be confirmed as part of the assessment of the stations, rail infrastructure and systems. The Stage 2 EIS will assess the detailed design of the viaduct, and include typical design principles to ensure that the viaduct and stations would be of exceptional architectural and engineering design. Notwithstanding, as part of the viaduct will be constructed as part of Stage 1, consideration of the design of the viaduct structure is required at an early stage in the design to ensure a high quality and sensitive design. The Department has further considered this matter in Section 7.8 of this report.

The Department also considers that the design principles identified within the Stage 1 EIS, and the existing staged SSI approval requirement 3.16, provides an appropriate mechanism to ensure adequate assessment of the altered visual impacts and urban design requirements associated with Stage 2. This requires the Proponent to review the visual and urban design impacts and mitigation requirements for the project, identifying the timing of implementation of urban design and landscaping measures, how the effectiveness of landscaping measures would be monitored, and maintenance responsibilities for relevant urban design and landscape measures.

6.8. Social and Economic

Major civil construction works represent the most significant impact on social and economic impacts due to disruptions to businesses in the vicinity of construction sites. The most significant changes to social and economic impacts as a result of the modification include reduced impacts where the alignment has been moved, and increased impact in the following areas:

- loss of the 'Totally Home' business premises from the construction and operation of the new Bella Vista Station;
- disruptions to local business activities as a result of construction activities associated with the relocated and new stations at Hills Centre Station, Kellyville Station and Bella Vista Station; and
- disruption to the rural residential community in the vicinity of the Cudgegong Road Station construction site.

Overall, and from a regional perspective, potential social and economic impacts are considered comparable to those described in the staged SSI approval, notwithstanding the changed location of some of the impacts. The Department acknowledges that the modified project will result in impacts during construction and operation of the project, which may directly affect the local community and businesses in the vicinity of the modified project. The issue of social and economic impacts in relation to the modified project was not raised as a key concern amongst submissions.

The Department considers that the existing staged SSI approval requirement 3.1(h) provides for the consideration of any additional key issues of relevance to the project, identified during further design development. This would include potential social and economic impacts as a result of construction and/or operation of the modified project. The Department has assessed these issues

for the Stage 1 application, in detail in Sections 7.4 and 7.5, and provided recommended conditions of approval where required, to ensure management of any potential impacts.

6.9. Conclusion

This Department has considered the proposed modification against the existing staged SSI approval and the supplementary requirements issued in February 2012, and has concluded that modification is acceptable in terms of its environmental impacts and in meeting the Government's and project objectives.

Additionally, the Department has reviewed the modification in light of the existing staged SSI requirements and supplementary requirements issued in August 2012, and has concluded that these are sufficient to cover the environmental assessment requirements for the Stage 2: Stations, Rail Infrastructure and Systems application.

7. PROJECT ASSESSMENT

7.1. Geotechnical and Groundwater

The assessment has relied on a number of reports detailing quantitative geotechnical, groundwater, ground movement and tunnel waterproofing studies as part of the Stage 1 EIS. The assessment of soils and groundwater has also based findings on the research conducted for previous NWRL proposals (including the staged SSI approval) and similar, recent tunnelling projects such as the Epping to Chatswood Rail Link projects (undertaken between the late 1990's and 2011).

The assessment has provided a description of existing landform, soil landscapes, regional geology, hydrogeology and existing groundwater levels and quality as a baseline for the environmental impact analysis. Acid Sulfate Soils and contamination have also been considered in the Proponent's assessment.

There are currently three phases of geotechnical investigations; Phase One and Two have been conducted as part of EIS 1 with Phase Three and targeted geotechnical investigations to occur as part of detailed design.

The Phase One and Two geotechnical investigations have included 145 cored boreholes to depths and lengths of between 15m and 75m. Groundwater measures were also taken (or data used from historical measurements) at 74 locations with 36 mechanically excavated pits and a number of insitu and laboratory tests to determine environmental areas of concern and where environmental monitoring may be required.

Ground movement

Ground movement may occur as a result of tunnelling, excavating, groundwater drawdown and tunnel failure. Specific locations of potential impacts in relation to ground movement from construction works are given in Table 7.1.

Table 7.1: Potential impacts

Construction Activity or Element	***Location Affected***	***Ground movement Impacts***
Running Tunnels and cross passages	Epping to Bella Vista Portal.	Stress redistribution, settlement, dewatering
Cross-over's	Castle Hill Station	Existing slope instability affected by tunnel/station construction
ECRL Connection	Epping Station	Stress redistribution causing ground movement
		Temporary dewatering causing ground movement
		Ground heave
Epping Services Facility	Beecroft Road, Epping	Ground movement caused by temporary or permanent wall movements
Intermediate Services Facility	Cheltenham Oval, Castle Howard Road, Cheltenham	Ground movement caused by temporary or permanent wall movements
Underground Stations	Cherrybrook, Castle Hill, Hills Centre, Norwest and Bella Vista	Ground movement caused by temporary or permanent wall movements
Dive Structure	Bella Vista	Ground movement caused by temporary or permanent wall movements
Temporary works	Site wide	Ground movement caused by temporary or permanent wall movements

Measurements of preliminary ground movement indicate potential settlement impacts of between 5mm to 20mm in areas immediately surrounding station locations and above some sections of shallow tunnels during construction. There were no buildings or built structures estimated to sustain ground settlement of greater than 20mm, with the maximum rates of settlement predicted to occur immediately adjacent to station box excavations.

As part of an Existing Buildings and Structures (EBS) risk assessment, damage criteria in relation to potential ground movement has been defined. The identification of potentially affected land parcels is shown in Table 7.2. An update to the EBS, providing a refined medium and high risk land parcels profile, will be undertaken during detailed design and prior to construction.

Table 7.2: Ground movement damage criteria

Maximum settlement	***Degree of damage***	***Risk category***	***Risk Rating***	***Number of potentially affected land parcels***
<10mm	Negligible to slight	0-2 (Aesthetic)	Low	113
10-20mm	Moderate	3 (Functional)	Medium	51
>20mm	Severe to very severe	4-5 (Serviceability / Structural)	High	35

A further EBS risk assessment would be undertaken to refine the medium and high risk land parcels to identify the actual buildings, structures or utilities within the affected land parcels. The Proponent proposes to undertake building condition surveys and assessment of the risks from structural and settlement impacts prior to the commencement of construction. Where settlement predictions exceed the settlement criteria, management measures to minimise potential ground settlement would be implemented.

Groundwater, Soils and Contamination issues

Soil Salinity and the potential for acid sulphate soils have been identified as potential problems, particularly for areas around Caddies Creek, First Ponds Creeks and Second Ponds Creeks. Section 7.7 of this report further details the impacts to surface water quality as a result of these issues.

The EIS identified that the water table within the Hawkesbury Sandstone is affected by low lying and permanently flowing streams in the Beecroft and Castle Hill area. The following table provides an overview of notable potential impacts.

Table 7.3: Potential impacts to regional and local hydrogeology

Potential Impact	***Area of impact***	***Proposed Mitigation measure***
Lowering of water table and long term fall in groundwater levels (resulting from drawdown). Reduced groundwater supply for private water supply bores (drawdown of no more than 15%). Recharge of impacted groundwater sources may take several years to re-establish.	Entire 15km of tunnel from Epping through to Bella Vista (Cherrybrook Station, Castle Hill Station, Hills Centre Station, Norwest Station and Bella Vista Station). Drainage lines where bed cracking or interference with geological features below drainage lines occur (Devlins Creek, Cattai Creek, Strangers Creek). Four private bores along Proposed NWRL tunnel alignment.	Tunnel design and construction methodology (proposed to be drained Stations and either undrained or drained connecting tunnels) to ensure only short term disruption to groundwater levels once permanent tunnel lining is installed. Ground treatments to be completed to minimise groundwater inflows. Consultation with private bore owners/operators once groundwater investigations are completed.

Potential Impact	***Area of impact***	***Proposed Mitigation measure***
Contamination of groundwater (collected within tunnel requiring disposal) Disposal of contaminated groundwater Contaminants during construction leaking into ground surface (e.g. refuelling spills, chemical spills)	There are a number of potential areas of environmental concern (AECs) identified along NWRL alignment due to the potential for moderate to high contamination including: Epping to Cherrybrook (Service Station at Epping, on Beecroft and Carlingford Road). Cheltenham Oval contaminated with asbestos in soil; Castle Hill Station (previous rail station associated fill and former service station at 307-309 Old Northern Road; Hills Centre Station (Council depot); Norwest Station (service station Norwest Boulevard); Localised or near surface soil contamination for existing or previous farm paddocks (fill and pesticides) within selected areas from Kellyville through to Cudgegong Station and Tallawong Stabling.	The nature and extent of contamination at these potential sites would be subject to ongoing investigations prior to construction. Correct procedures for spill management, including site induction and regular inspection and monitoring of construction activities by the Environmental Representative.
Potential increase in water table level (during unusually wet years)	Entire NWRL alignment.	Secondary impacts to be managed via the CEMP Soil and Management Plan.
Groundwater seepage Tunnel inflows of groundwater requiring capture and discharge	Entire 15km of tunnel from Epping through to Bella Vista (Cherrybrook Station, Castle Hill Station, Hills Centre Station, Norwest Station and Bella Vista Station). Tunnels driven beneath (Devlins Creek) or shallow cover areas	Localised treatments to reduce tunnel inflow where required. Tunnel design to consider drained vs. undrained designs incorporating estimated inflows Tunnelling and deep excavations may require localised dewatering and extraction bores, gravity drainage systems and options for discharge into creeks or detention basins
Defects or bed cracking impacts on groundwater on shallow or no soil over competent Hawkesbury Sandstone. Dewatering of surface water and alluvium (caused through under-drainage in rock) may affect paved areas, cause cracking to embankments and other surface features.	Devlins Creek (two locations); Tributary to Devlins Creek (two locations), Cattai Creek and Strangers Creek.	Investigations required to determine whether inflows in construction and operation are expected to exceed pre-set trigger levels within the tunnels Targeted pre-excavation grouting and other treatments

Impacts to mineral resources were considered within EIS 1. It was determined that the potential impacts to existing or proposed mineral or petroleum tenures are low. While the NWRL alignment passes through a petroleum title and mineral allocations for Sydney basin minerals and

geothermal titles, these titles are Sydney basin wide of which the NWRL is a relatively small percentage of area. The Proponent has identified that no mineral titles or resources are affected by the NWRL and similarly, there are no known mine subsidence issues in the area affected by the NWRL.

Consideration

A number of issues were raised by OEH, EPA and Hornsby Shire Council regarding soils and contamination issues. The OEH considers that given the size and extent of the project, additional soil salinity assessment should be undertaken prior to the commencement of construction to enable the development of management and mitigation measures to ensure that saline soils are managed appropriately, and damage to the environment as well as infrastructure is minimised.

The EPA identified a number of concerns regarding potential groundwater treatment during construction, and has recommended further consideration of groundwater to determine appropriate water quality limits and an appropriate treatment method to achieve these limits and options for tunnel inflow reuse prior to the commencement of construction of the project. Additionally, the EPA considers that assessment of the contamination status of soils to be disturbed or excavated during the project works should be undertaken prior to works disturbing soils being undertaken in a given area.

Hornsby Shire Council has also identified that Cheltenham Oval has asbestos contamination. The Proponent notes that, should the oval be utilised then further assessment of the site would be undertaken prior to ground disturbance. The Department also notes that the Proponent has a specific commitment in the event of discovery of previously unidentified areas of potentially contaminated material, that all construction work would cease in the vicinity of the discovery and not recommence until the extent of contamination has been assessed and if necessary, a Remediation Action Plan or similar has been prepared and endorsed by an accredited site auditor.

The Proponent has committed to identifying and assessing structures above tunnelling works to ensure that required ground support is implemented. Impacts to any creeks with highly fractured rock within close proximity would be closely monitored during tunnel excavation. The Proponent has further committed to undertaking supplementary ground treatment (such as stabilisation) where necessary to manage factors such as high stress conditions and depth of weathering existing under the creek. The geotechnical assessment notes that Devlins Creek has the lowest cover to creek bed above tunnel crown and therefore would require ground stabilisation measures prior to excavation to minimise ground movement and manage potential groundwater inflow issues.

The area south of Cherrybrook and Castle Hill Station (immediately south of Castle Hill Road) contains 12 areas of known landslide. Subsequent to the completion of EIS 1, the Proponent undertook further targeted geotechnical assessments in landslide areas and reported this in the Response to Submissions. Based on the current topographic setting (slope profile, distance to the incised watercourses and accumulated debris) and the quality of rock, the assessment concluded that the relative risk of landslides affecting the NWRL alignment is very low and does not require changing the alignment. The assessment stated that the existing landslide debris on the slopes beneath the NWRL alignment from Ch 30700 to Ch 31000 would experience ongoing creep movements and periodically more rapid failures. However, because these landslides are downslope of the NWRL alignment they have been assessed to have no impact on the NWRL tunnels.

The Department acknowledges that the construction and operation (to be assessed in EIS 2) of the NWRL tunnels and Cherrybrook station may potentially alter the groundwater regime beneath the escarpment and therefore have potential impacts on downslope landslide features.. However, it also considers that these impacts can be effectively managed.

To strengthen and clarify the Proponent's commitments to ensure adequate identification, assessment and mitigation of impacts to geology and groundwater is undertaken during the

detailed design, pre-construction, and during construction phases, the Department has recommended a range of conditions including:

- the preparation of a geotechnical model of representative geological and groundwater conditions, prior to excavation and tunnelling in subject area(s) to identify geological structures and groundwater features, to further assess the predicted settlement, ground movement, stress redistribution and horizontal strain profiles caused by excavation and tunnelling on adjacent property and infrastructure;
- the requirement to undertake an assessment of property and infrastructure at risk from damage to determine appropriate settlement criteria to prevent damage;
- the identification and implementation of mitigation measures in consultation with the relevant land and/or infrastructure owners prior to the commencement of construction to ensure where possible that underground services, infrastructure and adjacent buildings will not experience settlements exceeding established criteria;
- the preparation of a water quality monitoring program (including the identification of groundwater monitoring locations and water quality parameters to be monitored); and
- a condition requiring the Proponent to design and construct the project in a manner that minimises impacts to groundwater hydrology including capture, drawdown and quality.

Additionally the Department has recommended conditions to manage potential impacts to third party property and structures including the establishment of an Independent Property Impact Assessment Panel prior to the commencement of construction or demolition works to ensure independent engineering and geotechnical experts verify the Proponent's assessments. The Department is of the opinion that the above measures will appropriately manage and/ or mitigate any geotechnical impacts to property and infrastructure as result of the project and would contribute to ensuring minimal impact to groundwater resources.

In relation to soil salinity, the Department agrees with the OEH that further detailed soil salinity assessment is required to by undertaken to ensure the development and implementation of appropriate mitigation and management measures. Accordingly, the Department has recommended a condition requiring the preparation of a Soil Salinity Report, undertaken in consultation with OEH and NoW, and that the recommendations of the Report be incorporated into the proposed Construction Soil and Water Quality Management Plan.

In relation to groundwater inflow and treatment, the Department notes the Proponent's commitments to minimise groundwater inflows and the treatment of water prior to reuse or disposal, and also accepts that these processes can be adequately addressed through the detailed design and construction management processes. In this respect, the Department has recommended that the management of groundwater and surface water ingress into the station boxes and tunnels, including the design of capture, treatment and discharge methods be undertaken in consultation with the EPA. In relation to groundwater inflows, the Department has recommended that all feasible and reasonable measures be undertaken to limit inflows into tunnels to no greater than 1 litre per second per kilometre..

In relation to land contamination and potential acid sulphate soils, the Department is satisfied with the assessment undertaken, and considers the risk of these issues to the environment to be minimal, subject to the Proponent implementing its commitments. Accordingly, these commitments have been reinforced in the Department's recommended conditions, and in particular, the reporting of Stage 2 contamination investigations and remediation action plans undertaken in accordance with the *Contaminated Land Management Act 1997*.

In summary, the Department is generally satisfied with the assessment undertaken and the proposed mitigation measures presented in EIS 1, as relevant to soils, groundwater, surface water, contamination and waste management. Whilst these management measures are relatively comprehensive, to enhance the commitments the Department has recommended a condition requiring the preparation of a Construction Soil and Water Quality Management Plan. The Plan would address groundwater extraction, use and disposal; management measures to reduce

impacts on groundwater sources potentially impacted by the project; contingency plans for Acid Sulfate Soil management; soil salinity control measures; and the discovery of contaminated materials during construction.

7.2. Traffic and Transport

The construction traffic and transport assessment details the impact of traffic (both heavy and light vehicle movements) on proposed access routes to and from construction sites. These sites will be utilised over various time frames ranging up to 26 months for key construction activities at the Hills Centre Station site. There are sixteen work sites planned for the NWRL (as detailed earlier in Table 3.2 of Section 3.1). Table 7.4 below provides an indication of predicted traffic volumes on the local and arterial road network resulting from additional traffic generated from each of the work sites during the construction phase. It is noted that the majority of construction sites are located within highly developed urban areas.

Table 7.4: Access Routes and Daily Vehicle Movements

Access Routes and Daily Vehicle Movements per Construction Site	***Proposed Access Route***	***Heavy Vehicle Movements***	***Light Vehicle Movements***
Epping Services Facility	- Beecroft Road (left in, left out) - Ray Road (right in, left out)	160	70
Cheltenham Services Facility	- Kirkham Street (left in, right out) - M2 Motorway (left in, left out) (subject to final access arrangements) - Castle Howard Road (light vehicles only)	68	34
Cherrybrook Station	- Castle Hill Road at Glenhope Road (all movements) - Franklin Road (left in, left out, right out) - Robert Road (left in, left out)	550	330
Castle Hill Station	- Old Northern Road and Terminus Street (all movements) - McMullen Avenue (left in, left out) - Crane Road (left out only)	120	34
Hills Centre Station	- Showground Road (all movements) - Carrington Road (all movements)	550	336
Norwest Station	- Norwest Boulevard - Brookhollow Avenue	90	36
Bella Vista Station	- Celebration Drive (all movements) - Balmoral Road (right in, left out)	250	1400
Balmoral Road	- Balmoral Road (left in, right out)	50	0
Memorial Avenue	- Memorial Avenue (all movements)	50	330
Kellyville Station	- Samantha Riley Drive (all movements)	50	300
Samantha Riley Drive to Windsor Road	- Samantha Riley Drive (all movements) - Windsor Road (left in, left out)	50	0
Old Windsor Road to White Hart Drive	- Windsor Road (left in, left out) - Sanctuary Drive south (right in, left out) - Sanctuary Drive north (left in, right out)	50	310
Rouse Hill Station	- White Hart Drive (left in) - Rouse Hill Drive (all movements)	60	92
Windsor Road Viaduct	- Rouse Hill Drive (left in, right out) - Commercial Road (right in,left out)	26	120

Access Routes and Daily Vehicle Movements per Construction Site	*Proposed Access Route*	*Heavy Vehicle Movements*	*Light Vehicle Movements*
	- Windsor Road (left in,left out)		
Windsor Road Viaduct to Cudgegong Road	- Schofields Road at the future Terry Road alignment (all movements) - Cudgegong Road (all movements)	26	120
Cudgegong Road Station and Tallawong Stabling Facility	- Cudgegong Road (all movements) - Tallawong Road (all movements) - Schofields Road (all movements)	700	200
TOTAL		**2850**	**3710**

As identified in Table 7.4, key construction sites with relatively significant construction traffic movements include Cherrybrook Station, Hills Centre Station, Bella Vista Station, and Cudgegong Road Station / Tallawong Stabling Facility. The heavy vehicle route figures for key stations are presented below:

Figure 7.1: Cherrybrook Station Heavy Vehicle Routes (Source: EIS, Volume 2)

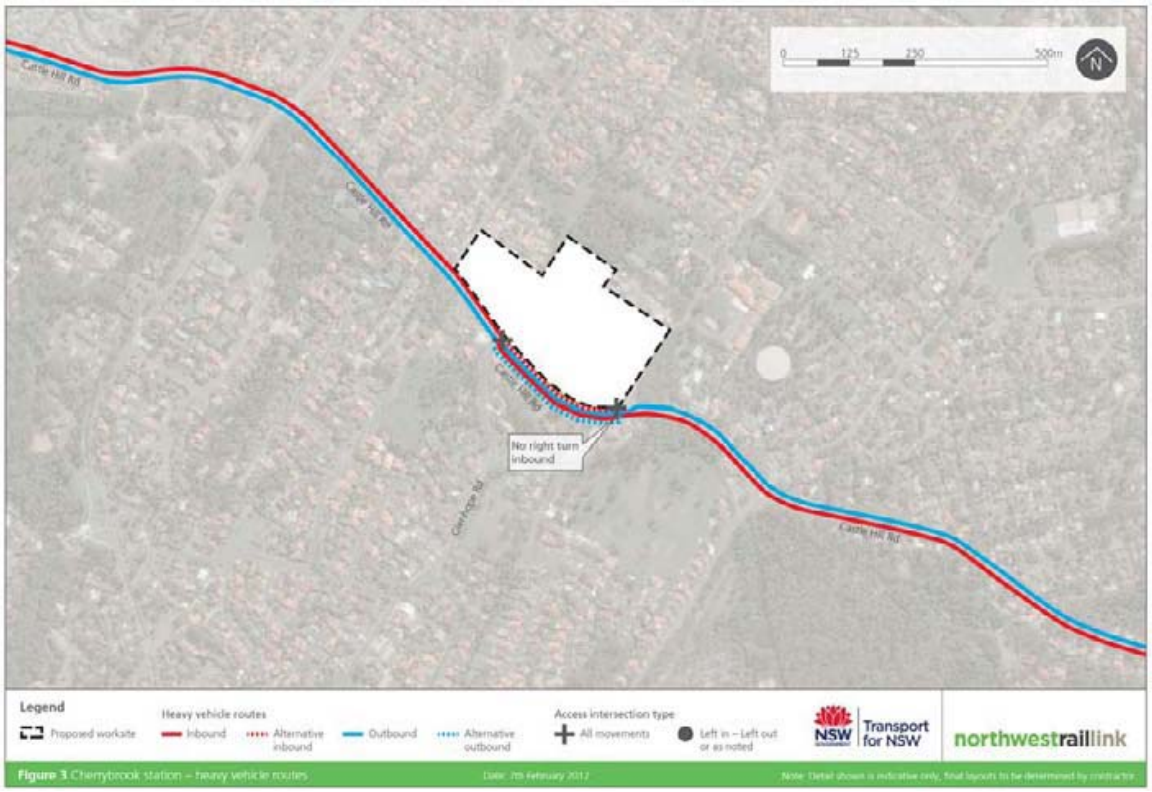
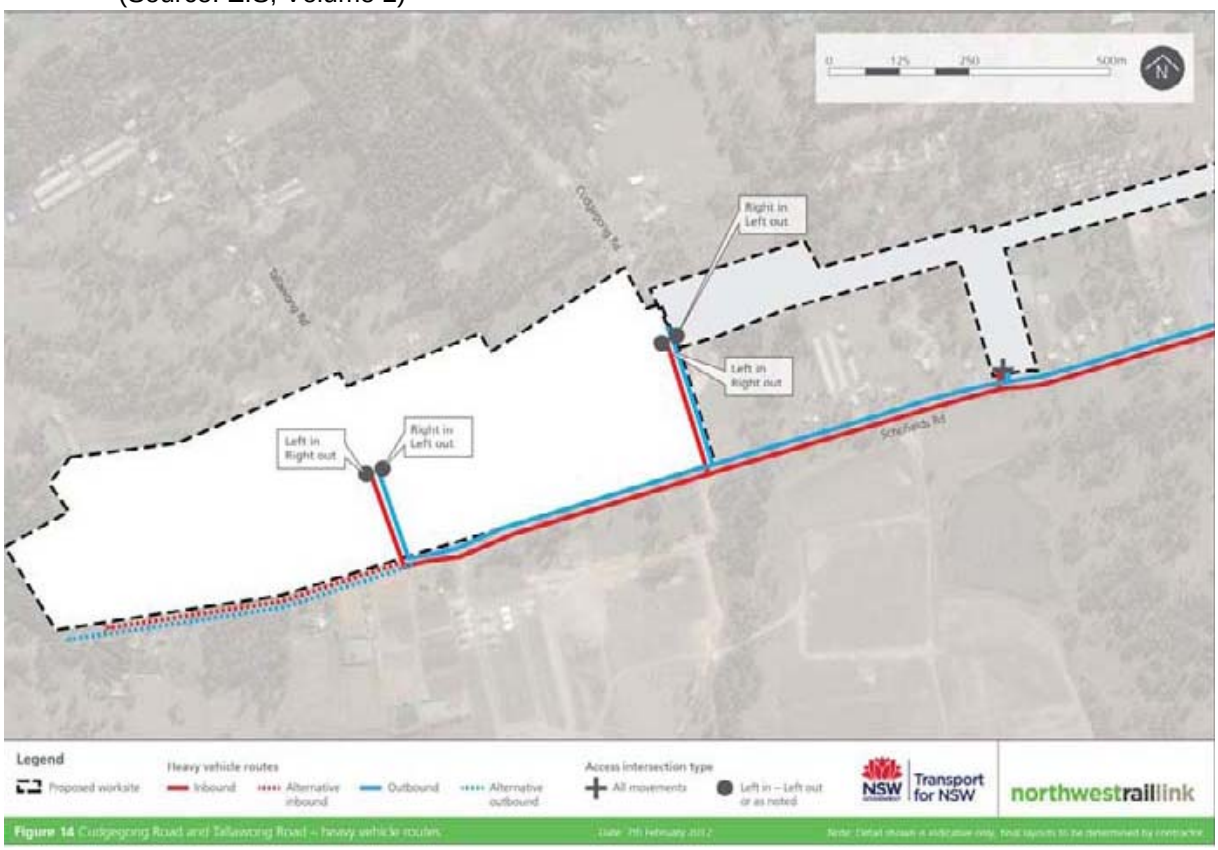


Figure 7.2: Bella Vista Station Heavy Vehicle Routes (Source: EIS, Volume 2)

Figure 7.3: Cudgegong Road Station . Tallawong Stabling Facility Heavy Vehicle Routes (Source: EIS, Volume 2)



The traffic and transport assessment considered intersection modelling and performance of existing local and arterial road networks. Cumulative construction traffic impacts have been addressed; however the Department notes that a lack of available information on future developments has prohibited a full assessment of cumulative impacts.

The key construction impacts are confined generally to the following:

- increased traffic volumes on the local and arterial road network resulting from heavy and light vehicle movements;
- disruption to existing public transport services, specifically buses along existing routes and T-ways;
- loss and/or relocation of car parking; and
- disruption and loss of access for pedestrian and cyclist routes.

Limited and temporary impacts are expected in relation to taxis and kiss-and-ride facilities. In the majority of cases, set-down and pick-up zones would be maintained or relocated.

Construction traffic impacts – traffic volumes

Station and shaft excavation, tunnelling and civil works will generate significant amounts of spoil (approximately 2.4 million cubic metres of spoil) requiring removal and haulage from work sites. The EIS notes that spoil removal activities during tunnelling at Cherrybrook, Hills Centre and Bella Vista Stations would require 24 hour operation as Tunnel Boring machines (TBM) would operate 24 hours, seven days per week, with limited area on-site for stockpiling spoil. These sites would therefore generate the highest numbers of truck movements (in the order of 100,000 one way movements across the proposed construction period, which is up to 26 months at the Hills Centre). Stations and intermediate excavation works would also require a further 42,000 one way truck movements, with Tallawong Stabling Facility and Cudgegong Road Station, together with the previously mentioned stations, generating the majority of truck movements.

Deliveries of construction materials and equipment during construction would also generate truck and vehicle movements, in addition to the construction workforce and associated light vehicle movements accessing worksites at peak and non-peak times.

The operation of construction sites would therefore produce a varying degree of increased traffic volumes resulting from both heavy and light vehicle construction traffic. The increase in traffic is likely to increase congestion and reduce the efficiency of some intersections, particularly around Cherrybrook, Hills Centre and Bella Vista stations work sites and the Tallawong Stabling Facility and Cudgegong Road Station.

The Proponent proposes the use of arterial roads where possible in favour of using the local road network; however at various sites, it would be necessary to utilise local roads during construction as a means for access and egress to selected work sites. This has further impacts on parking, pedestrian and cyclist safety and interaction with other forms of traffic such as the movement of buses.

Impacts to intersection performance

Intersection performance (Level of Service (LoS) and Degree of Saturation (DoS)) has been considered for the key sites. Roads demonstrating a lower level of service and higher degree of saturation as a result of the NWRL project are discussed in Table 7.5.

Table 7.5: Intersection Performance Impacts demonstrating a lower level of service and higher level of saturation as a result of the project

Work site	***Road***	***Local/Regional/ Arterial***	***Impact***
Epping Services Facility (enlarged)	Carlingford Road / Beecroft Road	Arterial	Increase in average delay with intersection operating at capacity in the afternoon peak. LoS D to LoS E in pm peak. No change in DoS.
Cherrybrook Station	Castle Hill Road / Glenhope Road	Arterial/Local	Decreased saturation at this intersection in both morning and afternoon peak. Castle Hill road already experiences high volumes of traffic in morning and afternoon peak, hence truck movements would contribute to traffic congestion during peak times. DoS 1.00 to DoS 0.78 and 0.89, in the am and pm peaks, respectively.
Hills Centre Station	Showground Road / Carrington Road	Arterial/Local collector	Whilst the level of service will remain unchanged at this intersection, the degree of saturation would increase to near capacity, in the pm peak. DoS 0.79 to DoS 0.96 in the pm peak.
Bella Vista Station	Old Windsor Road / Celebration Drive	Arterial/Local collector	Increase in average delay with intersection still operating satisfactorily in the morning peak; however reaching near capacity in afternoon peak. Widening of Celebration Drive would be undertaken to facilitate access from Old Windsor Road. LoS B to C in the am peak, and LoS C to D in pm peak.
Bella Vista Station	Lexington Drive / Celebration Drive	Local collector	Excessive delays to an over capacity scenario in the morning peak and a capacity operation in afternoon peak. The Celebration Drive/Lexington Avenue intersection would be used as an access point during the night and at low traffic times, due to poor performance of intersection. Further treatment at the roundabout is required to accommodate the proposed construction traffic. LoS C to F and DoS 1.02 to 1.32 in am peak. Los B to E and DoS 0.95 to 1.26 in pm peak.
Balmoral Road and Memorial Avenue	Old Windsor Road / Sunnyholt Road / Memorial Avenue	Arterial	Increase in average delay with at capacity intersection moving to just over capacity in afternoon peak. Peak period truck movements would need to be avoided.

Work site	***Road***	***Local/Regional/ Arterial***	***Impact***
			LoS E to F and DoS 1.02 to 1.04 in pm peak.
Kellyville Station	Old Windsor Road / Samantha Riley Drive	Arterial/ Regional	Increase in average delay with intersection operating at capacity in afternoon peak. Cumulative impact to Windsor Road from the construction traffic generated from other NWRL construction sites along Old Windsor Rd. No change in LoS, minor changes in DoS in both am and pm peaks.

In addition to these key intersections that would be impacted as a result of the NWRL project, there are a number of additional roads where submissions from local government, government agencies, business groups and the community raised concerns over the increased volume of construction traffic impacting the existing local road network. These include issues such as pedestrian safety, road condition and general amenity concerns. Traffic impacts from the Cheltenham Services Facility, Cherrybrook, Rouse Hill, Hills Centre, Norwest and Bella Vista Station sites were raised in these submissions.

Construction traffic impacts – impacts to bus movements

There are a number of expected impacts to bus movements as a result of the NWRL project. The main issues affecting buses include:

- *Castle Hill Station and Rouse Hill Station*: Relocating the existing Bus Interchanges increases the potential for conflicts with the movement of buses, pedestrians, cars and construction vehicles.
- *North West Transit way*: Interaction and impact on the North West Transit way (T-Way) operations and access along Windsor Road and Old Windsor Road.
- *Existing Bus Services*: Impacts to existing bus services resulting from construction route conflicts or road works as a result of construction site preparation.

The relocation of the Bus Interchanges has a number of associated issues. Consideration as to the potential layover location for buses is required as a result of the relocated interchanges at Castle Hill and Rouse Hill. It is noted that bus drivers need access to facilities at layover stops and potential delays travelling from layover locations to the interchange facility would affect the timing of services.

The current EIS assessment has not incorporated intersection modelling of the Old Castle Hill Road and Eric Felton Street roundabout to understand the impacts should the bus interchange be relocated to Old Castle Hill Road. The Proponent would need to further investigate this intersection in conjunction with RMS and The Hills Shire Council.

Impacts to the T-way will need to be managed during the construction phase to ensure its ongoing operation. The T-way currently operates adjacent to Old Windsor Road and Windsor Road with services to the city and Parramatta, as well as linkages to Norwest Business park. The Proponent has committed to ensuring any alteration to selected parking stations, including Memorial Avenue (Burn Station), Riley Station and Rouse Hill, would be carried out to ensure that impact on the effective operation of the T-way, is minimised.

There would be minor changes to bus operations at Rouse Hill, including the provision of a short length of 'Bus Only' road at the southern end of the construction site for buses to access the T-way from Tempus Street and to cross White Hart Drive at the existing T-way intersection. Similarly, construction traffic that has the potential to conflict with the T-way and bus services

operation would be detailed and managed in specific Construction Traffic Management Plans associated with each worksite. Additionally, impacts to special services during Olympic Park Special Events would need to be managed, particularly within the Hills Centre worksite vicinity affecting Carrington Road.

Construction traffic impacts – impacts to parking

At a number of worksites, there would be impacts on current parking arrangements, either through the loss of existing car spaces, the need to relocate car parking, or impacts to existing on-street car parking spaces (Table 7.6 summarises the key impacts).

Table 7.6: Main impacts to parking across the project

Worksite	***Streets/ Location***	***Impacts***	***Proponent's commitments/ comments***
Cherrybrook Station	Robert Road, Franklin Road and Glenhope Road	Potentially have on-street car parking spaces reduced as a result of the competing demand for parking from the construction workforce	Construction worker parking will most likely occur on Robert Road, Franklin Road or Glenhope Road
Hills Centre	Within the Castle Hill Showground and Hill Centre car parking facility. Carrington Road on street car parking spaces.	Approximately 200 spaces at Hills Centre would require relocation during construction. There may also be isolated sections of the Castle Hill Showground where car parking spaces would be lost. Existing parking in the vicinity of the Hills Centre, along Carrington Road would also be potentially lost.	Relocation of the Hills Centre car parking spaces within the Castle Hill Showground has been considered. The Proponent has committed to investigating an alternative site for Special Event parking and ongoing discussions with the Showground leasee for alternative parking location.
T-way	T-way parking stations (including informal parking overflow at Rouse Hill Shopping Centre and Riley T-way Station)	T-way parking impacted by the construction works. Loss of commuter parking during construction may occur.	Temporary relocation of parking for Burns T-way Station (159 spaces) and Riley T-way Station (141 spaces) has been committed to by the Proponent The Proponent has also committed to consider the volume of informal car parking at Riley T-way station during construction and will relocate parking where feasible and reasonable
Rouse Hill Station:		Informal parking area which accommodates approximately 240 unrestricted parking spaces (north of Rouse Hill Drive) will be lost during construction. The work sites adjacent to Windsor Road would also displace all existing parking (approximately 160 spaces) between Windsor Road and Rouse Hill Town Centre, including north of Rouse	The Proponent has stated these parking spaces would not be replaced. Whilst these losses are significant in isolation and should be minimised where feasible, the Proponent has advised that some of the affected parking could be relocated to other vacant parts of Rouse Hill Town Centre, and that there is significant below ground car parking available

Worksite	Streets/ Location	Impacts	Proponent's commitments/ comments
		Hill Drive. These parking spaces are generally untimed and used as overflow and staff parking.	under the town centre (timed and is payable after first three hours). The Town Centre is also relatively accessible by the T-Way and local bus services and its accessibility will increase significantly when rail services commence.

Construction traffic impacts – impacts to pedestrian and cyclists

Pedestrian conflicts with buses, construction traffic and arterial and local road network traffic have the highest potential around the worksites, where the number of heavy and light vehicle movements will be high. This generally includes the station works sites of Cherrybrook, Hills Centre and Bella Vista; however will also include the Castle Hill and Rouse Hill shopping precincts, as well as access to the Norwest shopping centre from Norwest Boulevard.

Pedestrian and cyclist movement around Castle Hill, Rouse Hill and (to a lesser extent) Norwest shopping precincts is high and therefore leads to potential safety issues during the construction phase, particularly around key intersections (such as Old Castle Hill Road/Old Northern Road/Castle Street at Castle Hill and Tempus Street/Rouse Hill Drive/ Main Street and Windsor Road). Rouse Hill Town Centre will lose the informal east-west pedestrian route through the existing T-way interchange.

Commuters utilising the T-way parking facilities (subject to relocation) would also be affected during construction with longer walking distances or changed pedestrian conditions; however only minor impacts are anticipated for pedestrian pathways. The pedestrian /cycle path located along the eastern side of Old Windsor Road between Memorial Avenue and Celebration Drive will be closed for the duration of construction works and there may be other discrete impacts to footpaths and cycleways particularly around work sites where a high proportion of pedestrians and cyclists exist (such as Norwest Boulevard).

An underpass would be constructed for pedestrians to cross underneath Norwest Boulevard (east of the site) and the use of barricades has been suggested by the Proponent to effectively direct pedestrians to use this underpass.

Consideration

The Department acknowledges that a major infrastructure project such as the NWRL will have unavoidable traffic and transport impacts during construction. This is particularly true of the NWRL project, given the size and nature of the project, and its location across a number of heavily urbanised environments. The key impacts are centred on construction traffic generation and the implications of increased light and heavy vehicle movements resulting from construction. Notwithstanding, whilst the impacts will be noticeable, the Department considers that these are generally acceptable in noting that the majority of key intersections retain an acceptable level of service and degree of saturation. In the circumstances where this is the case, the Proponent has the capacity to reduce impacts through appropriate design and management measures, including intersection upgrades and the avoidance of pm peak periods.

The impact to existing bus services, the relocation of bus interchanges and necessary potential disturbance to the T-way facilities such as stops, parking and pedestrian pathways would require alternative arrangements. Similarly, impacts to pedestrian and cyclist movement in and around the Castle Towers shopping and Rouse Hill Town Centre precincts will require specific management measures. The loss of parking at particular worksites will cause some significant impacts for local residents and the general public that rely on these car spaces. This is particularly the case for Cherrybrook Station, Hills Centre and the Rouse Hill Town Centre.

The potential conflict with general motorists, pedestrians, cyclists and buses at all work sites require careful management and monitoring during construction, with particular attention to Cherrybrook, Hills Centre, Bella Vista and Cudgegong Road Station and Tallawong Stabling Facility sites.

To ensure the adequate management of these issues, the Department has recommended a comprehensive suite of conditions aimed to focus and strengthen the Proponent's commitments, in relation to the management of traffic impacts, including:

- the establishment of a Traffic and Transport Liaison Group to inform the detailed design of temporary and permanent traffic and transport measures and the ongoing management in relation to construction of the SSI;
- undertaking further supplementary analyses as required by the Traffic and Transport Liaison Group and where relevant undertake modelling of traffic changes;
- ensure the efficient and safe operation of road networks for the construction of permanent road works; and
- requirements around the loss of parking, including minimising the loss or the provision of alternative parking arrangements.

The main tunnel spoil sites at Bella Vista, Hills Centre and Cherrybrook sites require further analysis, particularly the review of heavy vehicle turning paths and the need to increase areas within the work site to enable greater volumes of stockpiling in order to reduce truck movements during peak times and outside of standard construction hours. The Proponent has committed to further analysis of heavy vehicle turning paths and the development of heavy vehicle routes identified for access and egress during the detailed design phase of the project.

The Department has strengthened this commitment with a recommended condition requiring the Proponent to address key traffic and transport impacts and corresponding management measures within the construction environmental management framework, specifically in Construction Traffic Management Plans. These plans will include the detailed traffic control and management measures, including intersection treatments and final access and egress arrangements for each work site. The Construction Traffic Management Plans will be prepared in consultation with the Traffic and Transport Liaison Group which includes the Roads and Maritime Services (RMS), Council(s), transport operators, and other stakeholders such as emergency services.

As part of the Construction Traffic Management Plans, haulage management, including works to facilitate haulage vehicles will be addressed and would be particularly critical for the main tunnel sites, stations and other work sites involving intermediate excavation works and spoil generation works.

Further intersection analysis may be required to account for changes in existing road conditions, particularly at sites where a new access road, intersection signal, changes to road alignment / width or changes to access (on or to that road occur) is required. The Department acknowledges commitments by the Proponent to carry out further analysis as part of detailed design, such as road safety audits and design audit at selected intersections (such as the Castle Hill and Glenhope Road) prior to commencement of works, which have been incorporated in the Department's recommended conditions.

For all other work sites, traffic volumes and associated construction impacts would need to be monitored, with adoption of RMS (or appropriate road authority) recommendations for the design and management of individual intersections such as Balmoral Road, Sanctuary Drive, Windsor Road and Tallawong and Cudgegong Roads. As such, the Proponent has noted that further analysis and specific mitigation measures formulated for work sites will occur as part of the overarching construction traffic management approach, involving the preparation of Construction Traffic Management Plans. The Department considers that this is acceptable based on the expected level of impact identified in the assessment.

Dilapidation reports for heavy vehicle construction routes have also been noted as a means to highlight where construction impacts have negatively impacted the condition of roads. RMS and councils have requested the Proponent commits to ensuring contractors remediate/restore or reinstate roads and other RMS/council infrastructure affected by the NWRL. The Department has strengthened this commitment through the recommendation of a condition requiring the Proponent to provide a Road Dilapidation Report, prior to the construction works commencing and upon completion of construction works.

As identified, the assessment and management of cumulative impacts will be an important aspect of Construction Traffic Management Plans as the NWRL construction program develops. Further assessment and confirmation of cumulative impacts (including future projects) specific to the use of local and regional road networks is required prior to the commencement of the construction phase and construction traffic planning.

The Department acknowledges that the management of buses at key transport interchanges such as Castle Hill and Rouse Hill, in addition to the interaction with the existing T-way and current bus services, would be subject to review and analysis during the development of the detailed construction staging plans and associated traffic management plans. The Department has recommended a condition that requires the detailed design and assessment of related traffic and accessibility impacts to be undertaken in consultation with transport operators.

The EIS details the need for a shuttle bus service to transport construction workers to and from worksites, particularly where there is competing demands or limited access to existing parking spaces. The Department strongly supports this commitment. The loss and alteration of existing parking across the project will be a substantial issue for areas surrounding several worksites. The Hills Centre parking (used predominately during event parking) would require relocation during construction with the alternative parking facility able to cater for the Olympic Park Special Events parking requirements. Similarly, the provision of replacement parking within the Rouse Hill Town Centre precinct is of particular importance for the Rouse Hill worksite. To ensure that the impacts to parking are appropriately managed, the Department has recommended a specific condition requiring the Proponent to minimise impacts to existing parking and, where parking is removed for periods greater than four weeks identify and implement, where feasible and reasonable, either alternate arrangements or identify where the displaced vehicles can be satisfactorily accommodated.

The Proponent identified high-level mitigation measures to avoid pedestrian and cyclist conflicts with construction vehicles and construction-generated traffic. The Department notes that pedestrian management provisions would ensure safe movements during construction and that additional walking distances and modified crossing locations for pedestrians and cyclists are an unavoidable outcome. Where required, particularly near educational facilities, the Proponent has committed to the use of traffic controllers to monitor and regulate pedestrian movements in addition to the use of advance directional signage to guide pedestrians and cyclists to alternative pedestrian/cycle routes.

Submissions from the local community and residents on Robert Road have indicated a number of concerns with the increased rate of potential conflicts between school children and residents during construction compared to the existing low numbers of traffic currently using this road. Accordingly, the Department has recommended a condition requiring the provision of safe pedestrian and cyclist access through or around worksites, or the provision of feasible and reasonable alternate routes where access is restricted.

With the addition of a number of conditions to strengthen the Proponent's commitments during construction of the NWRL, the Department considers unavoidable impacts can be effectively managed to minimise and reduce anticipated negative traffic and transport outcomes during the construction of the SSI.

7.3. Noise and Vibration

The existing noise environment varies along the length of the corridor, and includes a range of commercial, urban, residential, rural-residential and industrial land uses. Sensitive receivers have been identified within 100 metres of the rail corridor and construction sites, and include residential receivers and some commercial buildings, as well as The Hills Centre for Performing Arts and the Hillsong Church and its recording studio.

Construction Noise

The air-borne construction noise impacts have been assessed in accordance with the *Interim Construction Noise Guidelines* (DECC, 2009). For residential receivers, the noise criteria for construction work during standard hours, is a noise management level (NML) ($L_{Aeq(15minutes)}$) of Rating Background Level (RBL) + 10dB, and for construction work outside the standard hours, is a NML ($L_{Aeq(15minutes)}$) of RBL + 5dB.

Spoil removal and product deliveries would result in additional heavy vehicle movements on public roads. Potential noise impacts have been identified using guidance from the *NSW Road Noise Policy* (DECCW, 2011). Construction traffic noise management levels set at 2dB above the existing road traffic noise levels during the daytime and night-time periods are considered appropriate to identify potential noise impacts. Additionally, a sleep disturbance noise management level of 65dBA (external noise level) has been adopted.

During the standard daytime construction period, noise levels are predicted to be highest during the site establishment and excavation phases, and also during the construction of the viaduct. It is predicted that NML's will be exceeded at a number of sites by over 20dB in certain residential areas, including impacts to some child care centres and schools, as well as some commercial receivers. During subsequent construction activities construction site hoardings (at construction work sites) would be erected to act as noise barriers, three metres at each site, and six metres at Cherrybrook.

Night time truck movements for the removal of spoil associated with 24 hour underground tunnelling works are anticipated at all construction sites, except Cheltenham, Cudgegong Road Station and Tallawong Stabling Facility, Rouse Hill and Kellyville Station. The Proponent has proposed to erect acoustic sheds as a noise mitigation measure prior to the commencement of 24 hour per day spoil removal to reduce air-borne noise levels. Notwithstanding, potential NML exceedances of up the 18 dBA are predicted at these work sites at sensitive receivers, primarily as a result of truck movements. The number of truck movements at these sites varies, and range from 2 to 18 truck movements per hour. However, the Proponent has concluded that the risk of sleep awakening as a result of truck movements is generally considered to be low (with the exception of Cherrybrook Station), as the maximum noise levels are within the range of the existing L_{Amax} noise levels at the respective sites.

The Proponent has identified that works in close proximity to Cherrybrook Station are predicted to comply with the sleep disturbance NML, thus unlikely to cause awakening reactions. Nonetheless, the predicted maximum noise levels are above the existing L_{Amax} noise levels by 2dBA, and the risk of sleep disturbance is considered to be moderate. In recognition of this, the Proponent has proposed to increase the height of the perimeter noise walls from three metres to six metres.

Ground-borne noise during construction may be experienced by sensitive receivers located close to the tunnels or other underground excavations. It is generally expected, however, that the potential ground-borne noise impacts at tunnel entrances and station excavation sites, particularly associated with rock breaking activities, are likely to be lower than the airborne noise levels where surface works, in particular rock breaker works, occur in the same area and at the same time. Notwithstanding, for sensitive receivers, including the cinema complex at Castle Hill Station and the Hills Centre for Performing Arts, which are located approximately 50m from station box excavations, during rock breaker works, ground-borne noise levels would be up to $L_{Aeq(15\ minutes)}$ 43dBA, which would be clearly audible within these buildings.

Tunnelling works between Epping and Bella Vista Station may cause ground-borne noise levels of between 30dBA and 40dBA where residential receivers are situated directly above the tunnelling works. This may represent an exceedance of up to 5dBA in some areas. It is anticipated that the worst case ground-borne noise impacts along the majority of the alignment would only be apparent for a relatively short period of time (i.e. several days) whilst the tunnelling works are directly beneath a particular receiver.

The Proponent has identified a threefold approach to managing noise impacts, including:

- site specific mitigation measures developed to avoid, reduce and manage identified potential impacts;
- standard mitigation measures implemented across all NWRL construction sites via the NWRL Construction Noise and Vibration Strategy; and
- additional specific mitigation measures to be implemented where the construction noise levels remain above the construction NMLs.

Construction Vibration

Construction vibration impacts may be experienced by sensitive receivers located close to the tunnels or other underground excavations. The recommended distances from vibration intensive plant, to address both potential building damage and human comfort impacts are derived in accordance with *Assessing Vibration: a technical guideline (*DECCW, 2006*)* and cosmetic impacts are derived in accordance with *British Standards BS 7385: Part 2 – 1993*. A conservative vibration damage screening level of 7.5 mm/s has been adopted for the NWRL project. This level is also generally applicable to heritage structures, unless it is known that the structure is already structurally unsound. No heritage structures have been identified in close proximity to the NWRL alignment which are known to be structurally unsound.

During rock breaking activities, ground-borne vibration levels may be perceptible at the nearest residential and commercial receivers. However, construction related vibration levels from TBM and road headers would be much lower than the 7.5 mm/s screening level, and any vibration felt by receivers would only be apparent for a relatively limited period (ie one or two days) as the TBMs pass beneath a particular location.

In order to minimise the risk of buildings being damaged by the proposed construction activities, the Proponent has proposed the following control measures:

- if there is a risk that vibration levels will be greater than 7.5 mm/s and a building or structure may be damaged, building condition surveys would be undertaken prior to and following construction to identify any change in building condition as a result of the construction activities;
- the safe working distances for cosmetic damage would be complied with at all times, unless otherwise approved by the relevant authority; and
- attended vibration measurements would be required at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.

Consideration

Noise Impacts

Major civil construction works of the project will involve a range of activities, including site establishment, station excavation, tunnel excavation (tunnel boring machine and road header), above ground liner works and viaduct and viaduct stations structural works. The Proponent has identified the construction program of these activities at each construction site, and predicted the potential noise levels resulting from these activities at a range of sensitive receivers. The Department has correlated this information in order to gain an understanding of the noise amenity of sensitive receivers during construction works and the duration of exposure to potential noise level exceedances.

The Department's assessment notes that construction noise impacts are likely to be significant predominately during the daytime, where potential noise levels of more than 85dBA are predicted, and also during the evening period, where noise exposure for some receivers including those in proximity to Cudegegong and Tallawong Roads, Kellyville Station and west of Windsor Road are predicted to be more than 75dBA. In accordance with the Interim Construction Noise Policy, noise levels of 75dB(A) or above represents the point above which there may be strong community reaction to noise.

It is understood that the predicted noise exceedances represent the worst-case maximum impact scenarios, where in actuality the duration of work and intensities of noise will be shorter and less intense. Nonetheless, the Department recognises that the duration of works for the project is extensive, and receivers could be subject to further noise amenity impacts from Stage 2 and other projects in the vicinity, including the Schofields Road Upgrade, Water related services for North West Growth Centre and Castle Towers Shopping Centre upgrade.

The Department recognises that it would be difficult to minimise construction noise to levels that achieve the construction noise objective due to the nature and character of the construction works required, ie linear infrastructure in an urban environment and in close proximity to residential receivers, and notes the Proponent's commitment to minimising noise impacts and developing and implementing feasible and reasonable noise mitigation and management measures to minimise construction noise at sensitive receivers. The Department generally supports the threefold approach proposed by the Proponent. Nonetheless, as some construction activities constitute a continuous (and in some cases stationary noise source) for an extended period of time, the Department notes the concerns of the community and agencies raised in their submissions.

Construction noise was raised in 15% of the submissions received and community feedback raised general concern over the noise impacts associated with construction sites, including truck movements, and in particular the possibility of 24/7 construction timeframe for a number of construction activities. In particular, submissions and petitions identified significant concerns raised by the community in the vicinity of Cherrybrook Station.

Blacktown, Hornsby and The Hills councils noted that the Proponent's noise assessment has identified a number of potential significant exceedances above the noise management levels for the project. In particular, Hornsby Council noted the potential for exceedance of more than 20dB during site establishment and rock excavation at the Cherrybrook Station site. Council recommended that noise monitoring be carried out to ensure that the proposed mitigation measures are effective in reducing noise impacts and further mitigation measures, which reduce noise impacts on residents should be considered, particularly at the detailed design stage where amendments and refinements of the construction methodologies may be undertaken.

Furthermore, the Hills Council noted that night time construction activities and vehicle movements could result in noise exceedances and cause awakening reactions (or sleep disturbance), including residences near The Hills Centre, Castle Hill & Bella Vista, and it was recommended that works be undertaken during daytime only and appropriate evening respite be allowed and truck movements to and from construction site be reduced during the night time period. Lastly, The Hills Council considers that the displacement of residents from homes during period of high noise should be a last resort management option, and recommended that acoustic treatment

including additional acoustic insulation of walls and ceilings, installation of double glazing, installation of air conditioning units be offered.

The EPA noted that the project is predicted to have significant air-borne noise, ground-borne noise and vibration impacts on the surrounding community. Even with the implementation of proposed noise mitigation measures, noise levels are not likely to be able to be reduced to levels to meet the relevant construction noise goals. The EPA recommended that effective communication with, and appropriate management responses to the concerns of the affected community will be of paramount importance. Where possible, the EPA recommended that temporary and operational noise barriers should be erected as early as possible in construction of the project, and that the use of 6 metre high hoardings be implemented at all construction sites, if feasible.

Additionally, the EPA does not generally support more than two consecutive nights of high noise and/or vibration generating work per week, and also considers that truck movements outside standard hours should be minimised, in particular to reduce the potential for sleep disturbance as much as possible.

Based on a review of the Proponent's noise assessment and submissions received, the Department considers the key issues relating to construction noise are the extent of impacts, and works undertaken outside of standard construction hours. These are discussed in detail below.

The Proponent has indicated that Stage 1 of the NWRL project is likely to have a three year construction program. Based on the indicative construction program, the Department recognises that construction activities would be undertaken at various locations concurrently, including high noise impact activities, such as piling works and concreting. Whilst the Department acknowledges that the noisiest activities will not occur for the entire construction period, it notes that the duration and magnitude of impacts on sensitive receivers are long and significant, and residual impacts continue to be well above the noise goals, ie >30dBA above.

However, the Department considers that noise impacts can be minimised through scheduling (including respite periods) and implementation of appropriate mitigation measures, which aim to achieve compliance with the construction noise objectives. On this basis, the Department recommends a condition requiring the Proponent to prepare a Construction Noise and Vibration Management Plan which requires noise mitigation and management measures to be clearly articulated. Specifically, consideration is to be given to key noise generating construction activities, the scheduling of works and respite periods. The objective of the Plan is to minimise noise impacts to the greatest extent practicable.

With regards to noise barriers and noise monitoring, the Proponent has confirmed that noise mitigation measures, including acoustic sheds and noise hoardings will be put in place at each construction site as appropriate and measures for noise and vibration monitoring would be included in the Construction Noise and Vibration Management Plan. The Department has recommended conditions of approval that, as part of the Construction Noise and Vibration Management Plan, the Proponent must identify how the efficiency and efficacy of noise measures employed will be monitored and non compliances rectified.

In addition, the Proponent has committed to undertake further investigation with regard to construction noise. Noise impacts and mitigation measures would be reviewed in the detailed design phase and during development of the site-specific Construction Noise and Vibration Impact Statements.

The Proponent proposes the majority of station construction activities and civil construction works between Bella Vista and the Tallawong train stabling facility to be undertaken within the standard construction hours. Nonetheless, some activities would be undertaken outside these hours, 24/7 days per week, including the following:

- tunnelling works. Rock hammering in the tunnel between 10pm and 7am would however be precluded where it may impact on residential receivers;
- surface works supporting underground construction (eg concrete pumping, truck loading);

- excavation and spoil removal from station entry shafts, non-disruptive preparatory work, repairs or maintenance;
- activities requiring the temporary possession of roads during periods of low traffic; and
- activities requiring rail possessions.

The Department recognises that there are circumstances when flexibility in working hours is warranted, especially where particular construction works cannot be undertaken during standard hours for technical reasons or other unforeseen circumstances, such as the above tunnelling and associated works.

The Department has assessed the Proponent's justification for works to be undertaken at night or other non standard hours, and the proposed management and mitigation measures, and considers the request to be generally justified to ensure the safe and efficient delivery of the project, provided that appropriate management measures are implemented and the affected community is consulted. On this basis, the Department recommends conditions of approval which:

- allow 24 hour tunnelling (and associated activities);
- generally restricts other activities to standard construction hours, being 7:00am to 6:00pm, Monday to Friday, and 8:00am to 1:00apm on Saturdays; and
- activities outside these hours be in accordance with the conditions of an Environmental Protection Licence (EPL) or approved through an out-of-hours work procedure.

The EPA has raised concerns regarding the number of nights where high noise and/or vibration generating work per week are proposed, due to the potential for sleep disturbance. The EPA considers that project impacts on the community in this area should be considered with regard to the fact that some areas affected by the project have already recently been subject to a substantial period of works, and will be subject to further substantial works in the future. The EPA recommended the Proponent commit to working with the proponent's of any construction projects being undertaken concurrently in the vicinity of the project, to coordinate works in order to minimise impacts on, and maximise respite for, the affected sensitive receivers.

The Department notes the EPA's concerns that some receivers may be exposed to extended periods of noise impacts resulting from construction activities undertaken in the vicinity of the project (including the M2 upgrade and Schofields Road upgrade), and also Stage 2. The Department also acknowledges that the Proponent has committed to implement feasible and reasonable mitigation measures to reduce noise emissions, including the erection of acoustic sheds to reduce the impact of noise associated with spoil removal during night time periods, and noise hoardings around the perimeter of construction sites to manage day time and night time noise impacts. The Proponent has also committed to respite periods and additional mitigation measures should noise level goals be exceeded after application of the project specific and standard mitigation measures.

Notwithstanding, the Department has also recommended a condition that clearly identifies that construction shall be consistent and comply with the Environment Protection Licence applying to the project, including in relation to noise mitigation and management measures.

With respect to The Hills Council's suggestion for the provision of at residence acoustic treatments, the Department considers that there would be scope for the Proponent to consider this measure as part of its consideration of noise management measures in the Construction Noise and Vibration Management Plan.

In summary, the Department acknowledges that construction noise is a key concern for the community. However, noise impacts associated with such significant infrastructure projects are unavoidable and are required to be managed, rather than completely mitigated. Accordingly, the Department has recommended conditions consistent with the following actions:

- the preparation of a detailed land use survey to identify potentially critical areas that are sensitive to construction vibration and ground borne noise impacts;
- limit activities resulting in impulsive or tonal noise emissions (such as rock breaking, rock hammering, sheet piling, pile driving) to between 8:00 am to 5:00 pm, Monday to Friday and 8;00 to 1:00pm Saturday, with respite periods;
- minimise the need for blasting, with any blasting requiring trials to determine site specific blast responses, and limited to two single detonations in any one area on any one day;
- consult with potentially affected community, religious, educational institutions and vibration sensitive critical working areas, to ensure that noise generating construction works are not timetabled during sensitive periods, unless appropriate other arrangements are made;
- consult with proponents of other construction works in the vicinity of the project, and that reasonable steps taken to coordinate works to minimise impacts on, and maximise respite for, affected sensitive receivers;
- specify requirements to be included in the Construction Noise and Vibration Management Plan to detail how construction noise and vibration impacts will be minimised and managed, including limiting truck movements during night time periods; and
- a program for monitoring noise levels and evaluating the efficacy of mitigation measures.

Imposition of the above recommended conditions are based on the Department's assessment of the reasonableness of noise impacts on residents, and consideration of the magnitude and duration of the impacts.

Vibration impacts

The Proponent has identified that the majority of existing buildings and structures adjacent to the proposed rail alignment are located more than 50m from the proposed viaduct, and therefore vibration levels are predicted to be below the safe vibration levels associated with minor cosmetic damage. However, there are locations where existing buildings and structures are located closer to the proposed excavation works or above the proposed tunnel alignment where the use of equipments such as TBM and roadheaders may be perceptible at the nearby surface receivers, including the Epping and Castle Hill crossover caverns. Under such circumstances, the Proponent has committed to manage impacts in accordance with the Construction Noise and Vibration Strategy, including the commitment to undertake attended vibration monitoring to ensure vibration levels remain below safe and acceptable limits.

With respect to vibration impacts, the Department is satisfied that the Proponent's assessment has demonstrated that vibration generated during the construction period would have minimal impact on human comfort levels and, is unlikely to result in damage to buildings. On this basis, the Department concludes that the assessment demonstrated that vibration impacts are likely to be minor and could be adequately managed as part of the project. Notwithstanding, the Department has recommended the following conditions:

- best practice vibration and blasting limits to provide performance standards that must be achieved during construction works;
- the Proponent to conduct vibration testing and monitoring to identify site-specific blast response characteristics and allowable blast sizes to meet airblast overpressure and ground vibration limits; and
- implementation of all reasonable and feasible mitigation measures with the aim of achieving the relevant construction vibration goals.

7.4. Local Business Impacts

The Proponent's assessment provided a qualitative assessment of the direct impacts to local businesses resulting from the construction of the NWRL, including an overview of specific and general construction impacts, with proposed mitigation to manage impacts during the construction phase. The assessment of impacts considered the economic profiles of each local government area, conducted a visual business survey (as opposed to using title search) for businesses along the NWRL corridor, identified the positive and negative impacts on businesses and formulated a range of mitigation measures to alleviate potential negative impacts.

Businesses were classified by employment and turnover size, with a focus on the top three industries within each local government area. Businesses were further grouped by business type, with identification of how businesses would be impacted by the project. There was a general separation of businesses that had the potential to either lose or gain trade as a result of the impacts of the project and an increase in construction workforce (such as cafes, eateries); and businesses whose customer base is not influenced by the project impacts or increased workforce population (such as accountants).

The assessment identified positive and negative sources and implications of the project on local businesses during construction. Positive sources and implications include:

- increased trade (increased demand for goods and services resulting from a higher workforce in area);
- increased income (increased value of wages paid to workers as a result of increased demand for labour); and
- increased employment (more demand for workforce).

The negative sources and implications include:

- reduced accessibility (impacts from construction traffic, parking and changes to existing road conditions);
- poorer visibility (considering visual obstruction and access resulting from worksite locations and activities associated with the worksites); and
- reduced quality in operating amenity (due to increased noise, dust, reduced aesthetics and increased construction traffic).

The assessment identified that negative impacts (accessibility, visibility and amenity) would be off-set by increased trade, income and employment, generated through construction workforce patronage.

The permanent acquisition of premises by the Proponent will occur in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. The Proponent's Preferred Infrastructure Report updated the number of businesses impacted by the NWRL from 109 to 164, and included additional properties to be acquired as a result of the expanded Epping Service Facility.

A number of business owners and/or commercial operators provided submissions related to business impacts, particularly for businesses immediately surrounding the Bella Vista worksite, or associated with the Rouse Hill Town Centre and Castle Towers Shopping Precincts. These business owners and/or operators have expressed concern regarding access, parking, movement of pedestrians (relocation of the Bus Interchange and T-way arrangements), potential loss of trade and general reduction in amenity and visibility for patrons accessing retail and commercial premises.

Consideration

The Department's assessment notes that the Proponent's consideration of this matter does not provide an evaluation of indirect impacts resulting from permanent land and property acquisition relating to business users and secondary services reliant on these businesses (local manufacturers, transport companies, real estate services); and that this would be further

assessed by the Stage 2 EIS. Notwithstanding, it is likely that the NWRL would facilitate a range of economic benefits associated with improved accessibility in the short and long term.

The Department acknowledges the potential for impacts on businesses during the construction of the project, however, is generally satisfied that the Proponent's commitment to a Business Management Strategy and ongoing consultation with business owners and operators will address the majority of concerns expressed by businesses and business owners. To reinforce the Proponent's commitment to minimise impacts on businesses during construction of the project and to consult with those affected businesses, the Department has recommended a condition requiring the preparation and implementation of the Business Management Strategy. This condition includes a requirement to undertake further analysis of direct impacts and the identification of potential indirect business impacts. The Proponent will prepare Business Management Plans for affected businesses and detail how the impacts would be managed during construction including the use of associated management strategies such as the employment of place managers.

7.5. Land use and community facilities

The NWRL project spans a variety of land uses, including residential, commercial, industrial and open space/ conservation land uses. The assessment considered the construction of the project on existing land uses, known future land uses and community facilities (with potential future land uses forming part of the consideration of the Stage 2 EIS).

The project will require the temporary and/or permanent acquisition of land for the construction of the NWRL. The acquisition of land will directly and indirectly impact a number of community facilities and could result in impacts ranging from their temporary relocation, short-term suspension of use, render permanent loss of use or change the frequency and type of use through a reduction in amenity (such as increased noise and vibration; traffic impacts; reduced air quality; reduced aesthetic and visual quality). Additionally, temporary or permanent change in land use resulting from the NWRL project may cause land use severance, potential sterilisation and access impacts.

A summary of the key issues and impacts (by work site) is provided in Table 7.7 below.

Table 7.7: Key impacts to land use and community facilities

Work site	*Issues*	*Impacts*
Extended Epping Services Facility (24 - 30 month construction)	- Temporary/ Permanent land acquisition - Conflicts with Epping Town Centre Study recommendations for future land use - Amenity issues	- Acquisition of Emmaus Bible College. - Potential impacts on a further four commercial buildings and the Epping Baptist Church. - Conflicts with the recommendations of the Epping Town Centre Study (July 2011) and land use at this site. Further consultation with Hornsby Shire Council and Parramatta City Council is required.
Cheltenham Services Facility (12 month construction)	- Temporary land acquisition - Access issues	- Temporary acquisition of the netball courts, cricket nets and playground at Cheltenham Oval and parts of Beecroft Reserve (impacting vegetation, walking trails and bike tracks) will limit community and resident use.
Cherrybrook Station (42 month construction)	- Permanent land acquisition - Amenity issues	- Acquisition of 28 residential properties and one commercial property. - Traffic and amenity impacts to sensitive receivers (residential, schools) in close vicinity.
Castle Hill Station (39 month construction)	- Temporary/ Permanent land acquisition	- Construction works would require temporary acquisition and use of Arthur Whitling Park and permanent acquisition of two buildings. Arthur

Work site	Issues	Impacts
	- Access issues	Whitling Park currently contains a war memorial and has European heritage value (these would be removed as part of the project). - Acquisitions of the existing bus interchange on Old Northern Road during construction. - Cumulative impacts associated with extension of Castle Towers Shopping precinct.
Hills Centre Station (36 month construction)	- Temporary/ permanent land acquisition - Access issues	- Acquisition of 11 commercial properties, temporary possession of Castle Hill Showground pavilions and associated infrastructure. Permanent acquisition of The Hills Council Depot. - Parking impacts to existing Hills Centre and Carrington Rd properties.
Norwest Station (24 month construction)	- Permanent land acquisition - Amenity issues	- Permanent acquisition of five commercial properties.
Bella Vista Station (30 month construction)	- Permanent land acquisition - Amenity issues	- Construction works would require the acquisition of the Totally Home Bella Vista Centre (containing over 20 retailers).
Balmoral Road and Memorial Avenue sites (30 month construction for both sites)	- Improved integration of land use planning - Access issues - Permanent land acquisition	- Improved separation of land associated with the Balmoral Road Release Area for residential development. Construction impacts on existing land use are therefore reduced a result of the modification. - Temporary relocation of Burns T-way car park to eastern side of bus station. - Acquisition of four residential properties (Balmoral Road worksite).
Kellyville Station (18 month construction) *Samantha Riley Drive to Windsor Road and Old Windsor Road to White Hart Drive (24 month construction for both sites)*	- Access issues - Permanent land acquisition - Potential land Severance - Amenity issues	- Temporary relocation of T-way commuter parking (Riley T-Way Station). - 10 properties to be acquired including seven commercial, two residential and one other property. - Horizontal realignment of the modified NWRL proposal requires integration with the Balmoral Road Release Area.
Rouse Hill Station (18 month construction)	- Access issues - Amenity issues	- Mixed use development adjacent to the existing Rouse Hill Town Centre would be supported by the NWRL Rouse Hill Station. - Cumulative impacts with the extension of works from the Rouse Hill Town Centre Northern Frame. - Facilities within the Rouse Hill Town Centre precinct (retail and residential) and Castlebrook Lawn Cemetery and Crematorium may experience reduced amenity.
Windsor Road Viaduct (27 month construction)	- Potential land severance and fragmentation	- Elevated station and viaduct as physical barriers have the potential to sever Area 20 land/future communities from Rouse Hill Station and Rouse

Work site	Issues	Impacts
Cudgegong Road (15 month construction)	- Amenity issues	Hill Town Centre. - Reduced amenity for OK Caravan Park and Castlebrook Lawn Cemetery and Crematorium.
Cudgegong Road Station to Tallawong Stabling Facility (24 month construction)	- Permanent land acquisition - Potential land severance and fragmentation	- Potential severance of future Area 20 and Riverstone East communities by viaduct and stabling facility. - Acquisition of 22 residential properties.

Consideration

During the detailed design of the construction sites confirmation of impacts to community and council facilities and associated management/mitigation measures will be required. Where there are unavoidable impacts to community and council facilities, further consultation with key stakeholders is required with regard to the provision of alternative locations and facilities (where feasible and reasonable) to be utilised during the construction period. This would include facilities used for sport, recreational, commemorative, agricultural, health, information and entertainment purposes, including (but not limited to) sites such as Cheltenham Oval and Beecroft Reserve, Castle Hill Showground and Arthur Whitling Park. To ensure clarity, the Department has recommended a condition requiring the identification and implementation of mitigation and management measures, prior to the impacts occurring.

The Department is generally satisfied the Proponent is committed to consulting with key community groups and stakeholders to determine viable and acceptable options for alternative arrangements during construction. To reinforce the Proponent's commitment and ensure the appropriate management is implemented, the Department has recommended a condition requiring the preparation and implementation of a Stakeholder and Community Involvement Plan to provide mechanisms to facilitate communication between the Proponent, the relevant council and community stakeholders (particularly adjoining landowners) on the construction environmental management of the project.

Overall, the Department considers some impacts to community facilities and land use are substantial arising from construction activities, particularly when community land is permanently or temporarily acquired or where there will be a reduction in amenity, access or reduced functionality resulting from the construction phase. The Department has included a specific condition requiring that where community and council facilities are impacted during construction works through temporary or permanent land acquisition, reduced amenity, reduced access, reduced functionality or other impact, the Proponent shall, in consultation with the relevant council, community groups and key stakeholders, address construction impacts and agree on feasible and reasonable mitigation and management measures prior to construction. Where appropriate, the Proponent shall determine viable alternative options for community facilities during construction.

Additionally, the Department recognises that temporary or permanent change in land use resulting from the NWRL project may cause future land use severance and potential sterilisation. Whilst the Department considers these impacts are unavoidable for a large infrastructure project of this scale and nature, further assessment is required, particularly within Area 20 and areas of Riverstone East. Land severance for Area 20 and Riverstone East requires further consultation to ensure current and future communities; land and existing residents are not fragmented as a result of the viaduct parallel to Schofields Road.

Noting the difficulty in defining land use planning impacts at this stage of the project, the Department considers EIS 2 will further the assessment, particularly in relation to station and rail design, operational aspects and how integration with surrounding land use and development will be undertaken.

Similarly, further consultation is required with land owners and developers within the strategic planning context for the Rouse Hill Town Centre Northern Frame works, the Epping Town Centre Study recommendations, Balmoral Road Release Area and the Castle Towers expansion within the Castle Hill Town Centre. As such, the Proponent has committed to continued consultation with key stakeholders such as councils, land owners and developers, the Strategies and Land Release Team within the Department and other relevant agencies regarding Precinct Planning and zoning impacts.

7.6. Ecology

The ecological assessment undertaken for the EIS included quantitative (field surveys for fauna and flora, including ground-truthing as part of vegetation mapping) and qualitative assessment (desk-based database searches; review of previous studies, literature reviews and historical survey results) to identify the potential threatened species, populations and Endangered Ecological Communities (EECs) of flora and fauna (including groundwater dependant ecosystems) within the NWRL study area.

The assessment addressed the following issues:

- direct and indirect impacts to threatened flora occurring within the North West Growth Centre (certified and non-certified) and outside of the North West Growth Centre as part of the NWRL study area, including an assessment of impacts to potential fauna habitat;
- direct impacts to threatened fauna resulting from the NWRL study area;
- indirect impacts to threatened fauna resulting from the NWRL study area such as increased noise and light spill;
- consideration of *State Environmental Planning Policy 19 — Bushland in Urban Areas*;
- specific impacts to riparian, instream and groundwater dependant ecology; and
- mitigation measures and requirements for vegetation management plans, operational measures and offset strategy.

The assessment also considered impacts on Groundwater Dependant Ecological Communities (GDEs) resulting from construction activities, mainly tunnelling, in association with impacts to riparian and instream ecology (such as groundwater drawdown; surface cracking and water flow impacts).

The EIS's ecological assessment concluded that the construction phase (the construction footprint and activities) was likely to represent the fullest extent of ecological impacts for the whole project, considering both construction and operational phases and examined both within the assessment. However, the Department's assessment has focused on construction impacts of the project at this time. Impacts relating to operation will be further considered as part of the Stage 2 EIS.

The assessment includes a Biodiversity Offset strategy, based on the draft Growth Centres Conservation Plan (GCC, 2007) and Guidelines for Biodiversity Certification of Environmental Planning Instruments (DEC, 2007) as a means to achieve the 'Improve or Maintain' principle, in the identification and assessment of the ecological impacts, proposed mitigation measures, and required offsets.

North West Growth Centre

The *Sydney Region Growth Centres State Environmental Planning Policy* (Growth Centres SEPP) has been 'bio-certified' by order of the Minister for the Environment under S126G of the *NSW Threatened Species Conservation Act 1995* (TSC Act). BioCertification negates the requirement for impact assessment in certified areas, as impacts have already been accounted for and offset as part of the Biodiversity Conservation Order.

Non-certified areas of existing native vegetation are able to be utilised for essential infrastructure provided such areas are compensated (additional offset or revegetation). These requirements are addressed in the Offset Strategy.

Flora

Five of the seven native vegetation communities mapped in the study area are listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) and/or the TSC Act as EECs or Critically Endangered Ecological Communities (CEECs). The following tables (Tables 7.8 and 7.9) document the vegetation communities in the study area to be cleared (as identified under the TSC Act and EPBC Act), which exist within and outside of the North West Growth Centre.

The Proponent has made a referral to DSEWPC under the EPBC Act regarding impact on Cumberland Plain Woodland and Blue Gum High Forest. DSEWPC has subsequently determined that the NWRL is a Controlled Action and therefore requires assessment and approval under the EPBC Act. The Proponent is currently seeking a separate approval under the EPBC Act.

The Department notes that Beecroft Reserve will be impacted by the Cheltenham Services Facility. This reserve was declared by Hornsby Shire Council as a Wildlife Protection Area in 2006 and comprises Coastal Shale Sandstone Forest and Sydney Turpentine Ironbark Forest (both listed under the EPBC Act and TSC Act). Hornsby Shire Council has requested that the preparation of Vegetation Management Plans for the Cheltenham site, in addition to Cherrybrook Station, are completed in consultation with the Council. The Proponent has acknowledged this request and will commit to consultation during preparation of these plans.

Table 7.8: Area and status of native vegetation impacted within the North West Growth Centre under the TSC Act and EPBC Act

Vegetation Community	***TSC Act***	***EPBC Act***	***Direct Impacts (ha)***		***Indirect Impacts (ha)***		***Total (Ha)***
			Certified under the Biodiversity Certification Order	Non-certified under the Biodiversity Certification Order	Certified under the Biodiversity Certification Order	Non-certified under the Biodiversity Certification Order	
Cumberland Plain Woodland							
Located within Area 20		CEEC	3.26	-	0.05	-	3.31
	CEEC	-	5.60	0.08	0.85	0.04	6.57
Located within Riverstone East		CEEC	-	-	-	-	
	CEEC		2.28	-	0.13	-	
Total			**11.14**	**0.08**	**1.03**	**0.04**	**12.29**
River Flat Eucalypt Forest							
Located within Area 20	EEC	Not listed	-	0.57	-	0.31	0.88
Located within Riverstone East	EEC	Not listed	0.37	-	0.38		0.75
Total			**0.37**	**0.57**	**0.38**	**0.31**	**1.63**

Vegetation within Area 20 and Riverstone East to be impacted by the project contain areas of both certified and non certified vegetation as classified under the *State Environmental Planning Policy (Sydney Regional Growth Centre) 2006* (SRGC SEPP) biodiversity certification. Developments that result in the clearing of existing native vegetation in areas that are certified do not require threatened species assessments to be undertaken. In non-certified areas however, any clearing

of existing native vegetation (ENV) for essential infrastructure projects must be assessed and offset in accordance with the relevant biodiversity measures of the SRGC SEPP biodiversity certification. The Proponents offset strategy provides for this.

As a result of the ecological assessment's field survey of vegetation, a total of 0.65ha of certified vegetation was identified as being directly impacted by the construction footprint and a further 0.35ha of non-certified vegetation would be directly impacted by the project. Under the biodiversity certification order and associated mapping, only 0.5ha of non-certified ENV requires consideration and the ecological assessment notes that within the North West Growth Centre offsets shall be compensated at a ratio of 1:1; or if revegetation/restoration occurs, at a ratio of 3:1.

Table 7.9: Area and status of native vegetation impacted outside of the North West Growth Centre under the TSC Act and EPBC Act.

Vegetation Community	***Condition***	***Direct Impacts (ha)***		***Indirect Impacts (ha)***	
		TSC Act	**EPBC Act**	**TSC Act**	**EPBC Act**
Blue Gum High Forest	*Status*	*CEEC*	*CEEC*	*CEEC*	*CEEC*
	Good	-	-	0.15	0.15
	Moderate	-	-	-	-
	Poor	1.01	0.91	0.01	0.01
	Total	**1.01**	**0.91**	**0.16**	**0.16**
Sydney Turpentine-Ironbark Forest	*Status*	*CEEC*	*CEEC*	*CEEC*	*CEEC*
	Good	0.01	-	0.09	-
	Moderate	-	-	-	-
	Poor	0.31	0.04	0.34	0.08
	Total	**0.32**	**0.04**	**0.43**	**0.08**
Shale/Sandstone Transition Forest	*Status*	*EEC*	*EEC*	*EEC*	*EEC*
	Good	-	-	-	-
	Moderate	-	-	-	-
	Poor	0.78	0.78	0.38	0.38
	Total	**0.78**	**0.78**	**0.38**	**0.38**
Cumberland Plain Woodland	*Status*	*CEEC*	*CEEC*	*CEEC*	*CEEC*
	Good	0.63	-	-	-
	Moderate	8.32	4.66	0.68	0.39
	Poor	4.93		0.64	-
	Total	**13.88**	**4.66**	**1.32**	**0.39**
River-Flat Eucalypt Forest	*Status*	*EEC*	*Not Listed*	*EEC*	*Not Listed*
	Good	-		-	
	Moderate	0.46		0.8	
	Poor	0.93		0.31	
	Total	1.39		1.11	
Coastal Shale-Sandstone Forest	*Status*	*Not Listed*		*Not Listed*	
	Good	0.655		0.77	
	Moderate	-		-	
	Poor	0.45		0.3	
	Total	1.105		1.07	

Threatened Fauna impacts

The NWRL study area provides a variety of habitat features for a range of threatened fauna species. Twenty-three threatened fauna species listed under the TSC Act have the potential to occur within the study area. These species are shown below in Table 7.10.

Table 7.10: Threatened Fauna within NWRL study area

Class	*Common Name*	*TSC Act Status*	*EPBC Act Status*	*Likelihood of occurrence*
Amphibians	Green and Golden Bell Frog	E	V	Potential
Diurnal Birds	Regent Honeyeater	E	E&M	Potential
	Gang-gang Cockatoo	V,E2		Likely
	Brown Treecreeper (eatern subspecies)	V		Potential
	Varied Sittella	V		Potential
	Swift Parrot	E	E	Likely
	Black-chinned Honeyeater (eastern subspecies	V		Potential
	Turquoise Parrot			Potential
	Scarlet Robin	V		Potential
	Superb Fruit Dove	V		Potential
Nocturnal Birds	Barking Owl	V		Potential
	Powerful Owl	V		Likely
Mammals (excluding bats)	Spotted tailed Quoll (SE Mainland Population)	V	E	Potential
Mammals (bats)	Large-eared Pied Bat	V	V	Potential
	Eastern False Pipistrelle	V		Likely
	Eastern Bent Wing Bat	V		Likely
	East Coast Freetail Bat	V		Likely
	Southern / Large-footed Myotis	V		Potential
	Grey-headed Flying Fox	V	V	Yes
	Yellow-bellied Sheathtail-bat	V		Potential
	Greater Broad-nosed Bat			Potential
Invertebrates	Cumberland Plain Land Snail	E		Potential
Migratory Birds	Fork tailed swift		M	Potential
	White-throated Needltail		M	Potential
	Black-faced Monarch		M	Potential
	Satin Flycatcher		M	Potential
	Rufus Fantail		M	Potential
	Great Egret		M	Potential
	Cattle Egret		M	Yes
	Latham's Snipe		M	Yes

EPBC Act listed fauna species

There is a total of six threatened fauna species listed under the EPBC Act that have the potential to be directly impacted by the project through habitat loss, including the loss of hollow-bearing trees, as well as indirect project impacts such as light spill and increased noise impacts. These species include the Green and Golden Bell Frog; Swift Parrot; Regent Honeyeater; Large-eared Pied Bat; grey-headed Flying fox; and Spotted tail Quoll. In addition, nine migratory fauna (including the Regent Honeyeater) listed under the EPBC Act were identified as occurring or have the potential to occur within the study area.

Species impact assessments were undertaken for the 23 state listed threatened species. The assessments have been grouped where species occupy a similar ecological niche or display common habitat preferences. The assessments note whether the proposal will impact on lifecycles and population, habitat (connectivity and critical habitat), distribution and disturbance

regime. Whilst the NWRL will not affect critical habitat or significantly impact breeding cycles and distribution for the majority of threatened species, the project may fragment and degrade foraging habitats and limit breeding resources, particularly for woodland, parrots and other diurnal and nocturnal birds.

Tree-roosting bats may experience an impact to lifecycles from removal of suitable breeding tree hollows in addition to a fragmentation and degradation of foraging habitats which has the potential to impact breeding resources. Indirect impacts may also occur on prey items. Cave-roosting bats may be impacted indirectly through artificial light and noise sources. The Spotted tailed Quoll is unlikely to be significantly impacted as a result of the NWRL due to its foraging and breeding requirements, making it an unlikely species within the study area. Impacts to EPBC Act listed fauna species will be considered by the Commonwealth.

Potential impacts to threatened species as a result of loss of hollow-bearing trees, and potential breeding habitat, include the Cumberland Plain Land Snail; Green and Golden Bell Frog; Scarlet Robin and Varied Sittela. The following table provides an indication of tree hollows that are directly impacted within each vegetation community.

Table 7.11: Number of size of the tree hollows directly impacted during construction

Vegetation Community	***Direct Impact***		
	Trees with Hollows of Varying Diameter		
	<100mm	***100-300mm***	***>300mm***
Blue Gum High Forest	1	1	0
Coastal Shale-Sandstone Forest	1	6	1
Cumberland Plain Woodland	27	6	1
River Flat Eucalypt Forest	4	1	2
Shale Sandstone Transition Forest	3	5	0
Sydney Turpentine Ironbark Forest	0	0	0
Planted/Exotic	16	21	7
Unmapped species	6	3	0

The loss of hollows will impact upon hollow-dependent fauna including birds and bats that use these hollows for breeding. Two potential breeding hollows for Powerful and Barking Owl will be removed; 58 potential breeding hollows for tree-roosting microbats will be removed; 37 potential breeding hollows for Turquoise Parrott will be removed and 13 potential hollows for the Glossy Black-cockatoo and Gang-gang Cockatoo will be removed. The Proponent has committed to hollow bearing tree surveys for areas not previously surveyed, including the western portion of the Cheltenham Services Facility site.

Some frogs species and other fauna dependant on permanent water may be affected by impacts from tunnel boring on riparian and aquatic environments, which has the potential to cause small rock fractures and reduce the water-holding capacity of watercourses during the construction phase from Epping (Devlins Creek) through to Norwest and Bella Vista Station (tributary to Strangers Creek at Edgewater Drive). Tunnel boring may also impact the discharge of groundwater (under licence) into the creeks affecting water quality and short term changes to stream surface flows.

Key Threatening Processes

There are a number of key threatening processes considered relevant to the project, impacting on both flora and fauna; including:

- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands;
- clearing of native vegetation (TSC Act);

- human-caused climate change (TSC Act);
- infection of native plants by Phyophthora cinnamomoi (TSC Act);
- invasion of native plant communities by exotic perennial grasses (TSC Act);
- loss of hollow-bearing trees (TSC Act); and
- removal of dead wood and dead trees (TSC Act).

These key threatening processes will occur at different sites and during different construction activities. Apart from direct vegetation loss at various sites, open cut construction methodologies occurring from Bella Vista Station and other worksites west of this site would be the potential cause of direct and indirect water runoff and pollution from construction sites; increased runoff velocity; spread of weeds; vegetation clearance at some crossings (Elizabeth Macarthur Creek) and sedimentation resulting from construction works.

In terms of the GDEs, the potential risks associated with the construction activities include loss of fauna habitat resources; loss of aquatic habitat; hydrological and groundwater level changes (affecting tree roots and river base flows); contamination of water quality and altered groundwater discharge.

Consideration

Although avoidance and mitigation measures have been considered in the assessment (for both construction and operational phases), the Department acknowledges impacts on native vegetation (including EECs) and threatened flora and fauna would be unavoidable, and that the project would result in adverse ecological impacts, including negative and temporary effects on riparian zones and upon GDEs during the construction phase.

It is noted in the ecological assessment that vegetation removal (as assessed) resulting from construction worksite footprint and associated works represents the worst-case scenario and that vegetation management plans would be prepared for two sites (Cheltenham and Cherrybrook) which exist outside of the North West Growth Centre.

The Proponent's response to issues raised during exhibition related to this clearance has also been a key component of the Department's consideration, particularly community concern at the loss of bushland associated with the Cheltenham Intermediate Services Facility and loss of vegetation (Blue Gum High Forest) around Cherrybrook Station. In this respect the Department considers it important that the Proponent minimises clearing within Epping, Cheltenham Services Facility and Cherrybrook Station sites where existing stands (in good condition) of Sydney Turpentine-Ironbark Forest, Coastal Shale Sandstone Forest, Blue Gum High Forest may be retained during construction.

Similarly, for areas in the north-western portion of the study area (from Bella Vista Station to Rouse Hill Station as identified outside the North West Growth Centre), the retention of existing stands of Cumberland Plain Woodland or River Flat Eucalypt Forest (in good to moderate condition) during the construction phase should be considered where possible. To ensure this is considered during construction, the Department has recommended a condition requiring the Proponent to minimise the clearing of native vegetation with the objective of reducing impacts to threatened species or EECs and CEECs to the greatest extent practicable.

The Department considers that the biodiversity offsets and vegetation management plans are the key components in ensuring the loss of vegetation and potential habitat loss are adequately managed and mitigated. Depending on the type of offsets selected, the Biodiversity Offset Package would detail future monitoring requirements, relevant maintenance responsibilities and the timing of implementation of offset measures. The Department has recommended a condition of approval requiring the Proponent to provide an offset package in consultation with the Department's Strategies and Land Release team and the NSW Office of Environment and Heritage, within twelve months of the commencement of construction.

Additionally, it is important that consistency with the biodiversity certification is achieved. This will ensure that the part of the proposal within the North West Growth Centre would benefit from the

Growth Centres Strategic Assessment, issued under the Commonwealth's EPBC Act. If the project is not consistent with the Growth Centres Biodiversity Certification then the part of the proposal in the North West Growth Centre will require separate Commonwealth approvals for impacts on matters of National Environmental Significance as it already does for part of the proposal outside the Growth Centres.

The Proponent has committed to an extensive monitoring program including groundwater modelling, pre-clearance search for threatened flora and fauna species and separate reporting. Noting existing knowledge gaps in some areas of assessment, including in relation to the assessment of potential loss of breeding and foraging habitat for the Cumberland Plain Land Snail and Green and Golden Bell Frog; understanding the secondary impacts, such as impacts from light and noise on sensitive species; and the impacts of the proposed tunnel on geological and hydrological regimes, the Department has strengthened this commitment by requiring the Proponent to undertake a monitoring program to determine the effectiveness of the mitigation and management measures undertaken.

Overall, whilst the Department acknowledges that impacts to flora and fauna associated with the clearing required for such significant infrastructure projects are unavoidable, the Department is generally satisfied that the potential impacts of the proposal are acceptable and can be offset with a compensatory offset and mitigation package, prepared in consultation with the key regulatory agencies to complement other specific measures for flora and fauna management during construction of the project.

7.7. Surface Water and Hydrology

The NWRL corridor crosses a number of named and unmanned tributaries of the Parramatta and Hawkesbury River. There are eight main waterway catchments that are located in the vicinity of the project and traversed by construction sites, as outlined in Table 7.12. The surface water and hydrology study carried out as part of the assessment for EIS 1 focused on the potential flooding impacts of the major civil and construction works on these waterways and their associated floodplains and addressed operational impacts of the project as appropriate.

Table 7.12 – Major Waterway Catchments and Construction Sites

Catchment	***Construction Site***
Devlins Creek	1. Epping Services Facility
	2. Cheltenham Services Facility
Pyes Creek	3. Cherrybrook Station
Cattai Creek	4. Castle Hill Station
	5. Hills Centre Station
Strangers Creek	6. Norwest Station
Elizabeth Macarthur Creek	7. Bella Vista Station
	8. Balmoral Road
	9. Memorial Avenue
	10. Kellyville Station
Caddies Creek (including tributaries 3, 4 and 5)	11. Windsor Road/Old Windsor Road
	12. Old Windsor Road/Whitehart Drive
	13. Rouse Hill Station
	14. Windsor Road Viaduct
Second Ponds Creek	15. Windsor Road Viaduct to Cudgegong Road
First Ponds Creek	16. Cudgegong Road and Tallawong Stabling Facility

Construction has the potential to impact on water quality of the receiving environment and the assessment identified that increased erosion and sediment transport resulting from excavation and construction would be the primary risk to water quality, the scale and nature of which would be greater during this stage than the operational stage of the project.

The assessment identified that, given the location of the majority of the project's construction sites were adjacent to water bodies, combined with the various civil construction works occurring at each site, construction would require detailed and careful management and mitigation of potential water quality impacts. The major civil construction works would involve extensive excavation work in many locations resulting in the disturbance and exposure of underlying soils. These works have the potential to lead to increased erosion and sediment transport and sedimentation of downstream waterways. Excavation works include tunnel and station excavation, construction of viaduct columns and bridge piers, stockpiling and handling of spoil, and general civil works. Each construction site would involve one or more of these activities, and pose the greatest risk where they occur in proximity to waterways, on steep slopes or on land subject to flooding or overland flow.

Hydrologic and hydraulic modelling was undertaken in order to map the extent of the 1 in 20 year and 1 in 100 year events of waterways adjacent to, or passing through, each site, as well as to model the impact of indicative temporary construction works such as haul roads and the columns of the viaduct between Balmoral Road and the western end of Windsor Road. Consideration was also given to the full range of flood events up to and including the probable maximum flood (PMF), however, the construction sites and the associated works are not permanent structures and hence have a much lower exposure to extreme flood events.

The hydrology modelling considered existing and future catchment conditions and the results of the assessment were used to:

- define existing flooding behaviour;
- quantify the nature and extent of flood risks to the proposed works and the potential flood impacts from the proposed works on the surrounding environment; and
- identify appropriate mitigation measures to manage risks to the project and minimise flooding impacts on the surrounding environment.

Development within the catchment in the south east portion of the project (including Devlins Creek, Pyes Creek and Cattai Creek) is relatively well established and includes the suburbs of Epping, Cherrybrook and Castle Hill. The catchments within the North West Growth Centre (including Strangers Creeks, Caddies Creek and tributaries, Elizabeth Macarthur Creek, First and Second Ponds Creeks) are less developed, although significant future development has been identified including the Balmoral Release Area, Area 20 Precinct, Alex Avenue, Riverstone, The Ponds and Beaumont Hills. Water management strategies have been incorporated into the planning of these growth areas and include detention basins to managed potential increased runoff.

The hydrology study identified two categories of flooding impacts:

- the risk of inundation at several of the project's construction sites; and
- changes to flood behaviour due to major civil works, specifically the viaduct structure and the bridge crossing of Second Ponds Creek.

The majority of the construction sites are located in or adjacent to the floodplain of local watercourses and therefore there is a risk of inundation during construction. Flooding has the potential to damage project works, cause delays in construction programming, pose a safety risk to construction workers and exacerbate pollution from the transport of sediment laden runoff. In addition, proposed works within the floodplain have the potential to change existing flood behaviour and adversely impact on the surrounding environment.

The various flooding impacts were assessed for each of the construction sites via analysis of the floodplain extents in the proximity of each site and considering the works proposed. The hydrology

assessment identified that construction sites 1, 6, 8 to 13, 16 and 17 had sections that overlapped with the floodplains of adjacent creeks. Of these, sites 1, 6 and 8 involve the construction of tunnel entrances and hence the potential for ingress of floodwaters will require appropriate management on a site-by-site basis. The layout of these sites will need to be developed to take into account the nature and potential risk of flooding. The mitigation measures proposed include placement of the tunnel entrance to minimise the risk and adoption of an appropriate flood standard for each entrance.

Sites 10 to 16 involve the construction of the viaduct and bridge structures and require the construction of haul roads. The assessment found that flooding impacts varied depending on the height of the haul road modelled . To minimise the impact of flooding, it is proposed that the haul roads and other embankments be limited to 0.5 metres above the natural ground level, and to allow controlled overtopping during a flood event.

The area that would be most affected by the proposed haul road at site 12 is around the confluence of Caddies, Elizabeth Macarthur and Tributary 5 as the road would form a barrier and prevent flood waters from the different streams from spreading across the floodplain. The modelling undertaken indicates that with a 0.5 metre thick haul road, localised flooding impacts of up to 0.2 metres would be expected in the 100 year ARI event and within the adjacent residential areas, the flood impacts would be up to 0.1 metres. Under a 2 metre thick haul road the flood impacts on adjacent properties would increase to 0.25 metres. Flows from Elizabeth Macarthur Creek would be confined to the eastern side of the haul road with the potential to increase flooding risk and flows from Caddies Creek would be confined to the western side, leading to potential flood impacts on the Transitway.

Greater impacts are expected at site 13 at Tributary 4 with flood impacts of up to 0.3 metres expected for the 0.5 metre thick haul road and up to 0.7 metres for the 2 metre thick haul road. For the 0.5 metre thick haul road, impacts would be confirned to the area between the Transitway and the NWRL alignment if adequate waterway openings are provided. However, for the 2 metre thick haul road, impacts would extend to Windsor Road and further upstream. At Tributary 3, the haul road would run adjacent to, and immediately downstream of Windsor Road and the Transitway and the extent of flooding would be minimised through the provision of appropriately sized temporary waterway crossings.

The implementation of more localised mitigation strategies would also be necessary, as required. Other mitigation measures include temporary levees or bunds and specific site planning incorporating potential flood impacts.

For the operational phase of the project, the viaduct that spans Elizabeth Macarthur and Caddies Creek floodplain and the bridge crossing of Second Ponds Creek was also assessed. The viaduct has flood impacts in the order of 0.05 to 0.1 metres for the 1 in 100 year event, and up to 0.15 metres in the PMF, which are deemed to be manageable via local mitigation works. The bridge has an impact of 0.48 metres immediately upstream of the structure in the 1 in 100 year event, however, impacts downstream, closer to Schofields Road, are in the order of 0.05 metres (including the PMF). In the PMF the Cudgegong Road Substation would be partially inundated, however, this impact could be managed either by lengthening the bridge or implementing local mitigation works. EIS 2 will include further hydrologic assessment of these structures using a more refined design, as well as the assessment of operational impacts of other components of the project. EIS 2 will also consider flood modelling for the 20 and 100 year average recurrence interval (ARI) and the PMF event in addition to identification of overland flow paths, in order to facilitate further development of the site layouts and construction staging, considering flood risk.

The water generated from tunnel excavation, demolition works and saline and acid sulfate soils would provide additional sources of potential adverse impacts to water quality. Excess water from tunnel excavation would comprise a combination of rainfall runoff, water used in the excavation process and groundwater seepage, and would need to be treated onsite before being discharged. The Proponent has proposed a pump be provided at the tunnel heads to collect water and pump it to water quality collection ponds at the surface. Where there is insufficient space to provide a

water quality pond, a treatment plant would be required. Treated water would be re-used during the construction phase, either within the tunnels or for dust suppression.

The release of potentially harmful chemicals and other substances into the environment may also occur during construction. Potentially contaminating substances include acids and chemicals from washing processes, construction fuels, oils, lubricants, hydraulic fluids and other chemicals. Release of these substances may occur due to spills, as a result of equipment refuelling, failure and maintenance, treatment and curing processes for concrete, as a result of inappropriate storage and handling or from disturbance and inappropriate handling of contaminated soils. Contaminating substances have the potential to be transported in runoff and result in associated water quality and ecological impacts downstream.

Soil salinity has been identified as an issue of concern in Western Sydney and salinity maps (DIPNR 2002) indicate that areas around Caddies Creek, First Ponds Creek and Second Ponds Creek have high salinity potential or known salinity. However, the potential for impacts associated with acid sulphate soils or potential acid sulphate soil is expected to be low as the areas proposed for construction activities are designated as "no known risk" for acid sulphate soils.

A number of mitigation measures and monitoring programs were outlined as part of the assessment, with the overall control of water quality impacts proposed to be defined in a Soil and Water Management Plan, Stormwater and Flooding Management Plan and Erosion and Sedimentation Plan, prepared as part of the overall Construction Environmental Management Plan for the project. The plan would be implemented in accordance with *Landcom's: Managing Urban Stormwater - Soils and Construction Volumes 1 and 2*, *NOW: Guidelines for Controlled Activities, ANZECC: Guidelines for Fresh and Marine Water Quality, ANZECC: Guidelines for Water Quality Monitoring and Reporting*, *Water Management Act 2000* and applicable environment protection licences. The various mitigation options have been categorised as relating to implementation and monitoring, response actions, erosion and sediment control, preliminary sediment basin sizing and works in riparian areas.

Stage 2 EIS would generally address operational impacts of the project, including the potential for pollutant generation and associated impacts on water quality from the rail infrastructure, station precincts and ancillary facilities.

Consideration

The Department has reviewed the assessment, the issues raised in submissions, specifically by agencies and Councils, and the Proponent's Response to Submissions and Preferred Infrastructure Report and considers that the construction of a project of this nature would require careful construction management to prevent flooding and water quality issues such as sedimentation and other pollutants being transported into nearby watercourses.

The assessment identified two categories of flooding impacts: the risk of inundation at several of the project's construction sites and, changes to flood behaviour due to major civil works, specifically the viaduct structure and the bridge crossing of Second Ponds Creek. The study also described a range of mitigation measures aimed at minimising each of the identified impacts.

The OEH noted that the flood assessment was limited to the main stream up to the 100 year ARI flood extent and level instead of being based on a comprehensive understanding of the nature of flood risks. OEH also considered that temporary flood mitigation measures should be assessed in relation to the potential flood affectation on surrounding properties. The safety of construction personnel was also raised and OEH considered that this issue should be addressed through the preparation of an Emergency Response Plan, prepared in consultation with local Councils and State Emergency Services OEH recommended that EIS 2 consider the full range of floods up to the PMF for both the main stream and local overland flow.

As part of the Response to Submissions, the Proponent identified that more detailed hydrologic assessment would be undertaken during the detailed design phase of the project, including:

- Site layout and construction staging would be guided by flood modelling up to the PMF.
- The impact of haul roads, working pads and other temporary works (such as concrete batching facility) would be re-assessed based on more detailed designs becoming available.
- The risk and consequences of the ingress of floodwaters into tunnel entrances would be assessed based on further detailed designs and additional flood modelling becoming available.
- Cumulative impacts of permanent civil works up to the PMF would be assessed as part of EIS 2.
- Flood impacts on major infrastructure such as Windsor Road, Transitway and Schofields Road would be confirmed.
- Flood risk to the rail infrastructure, station precincts and ancillary facilities, such as substations, sectioning huts and tunnel servicing facilities would be assessed as part of EIS 2.
- Flood impacts on the surrounding environment at station precincts and ancillary facilities would be assessed as part of EIS 2.
- Mitigation strategies that reflect the more detailed flood impact assessment work described above would be investigated.

In noting the above and that the works proposed at this stage of the project are generally limited in relation to flooding impacts, the Department is satisfied with the level of assessment undertaken and considers that impacts can be managed. Notwithstanding, the Department considers that the project should be designed in a manner that does not exacerbate the flooding characteristics of the surrounding area and minimises the flood risk to the project. The Department notes the proponent's commitment in its Response to Submissions report that additional detailed hydrological modelling will be required during the detail design stage of the project and the Department expects that refinements to the design of the project would be made, where feasible and reasonable, to ensure that flooding impacts on receivers are manageable and acceptable. The Department also notes that further assessment of flooding would be undertaken as part of EIS 2.

The Department is satisfied that the assessment of the project's construction works can be further refined during the detailed design stage to address agency and Council concerns. However, to ensure that flood impacts from the project are minimised, the Department has recommended that impacts be limited to a maximum increase in flood levels of 20 mm in a 100 year ARI flood event, a maximum increase of 50 mm for the PMF, a maximum increase in time of inundation of one hour in a 100 year ARI flood event and that any increase in flow velocity does not increase the potential for soil erosion and scouring.

The Department notes that the Proponent has committed to developing an Emergency Response Plan as part of the Construction Environment Management Plan. The Department also notes that the Proponent has also committed to preparing a Flood Risk Management Plan for the construction phase, and in accordance with this commitment, the Department has recommended a condition of approval requiring the Proponent to prepare a Stormwater and Flooding Management Plan . The Department has recommended that this Plan be prepared during the detailed design stage of the project and prior to construction in consultation with the Department (Strategies and Land Release), OEH and relevant Councils. Additionally, the Plan should include the design of temporary works and any mitigation measures that do not worsen existing and known future flooding characteristics, the identification of flood risks to the project and adjoining areas, mitigation measures that are proposed to be implemented to protect proposed works and not worsen existing flooding. The Department considers that a flood emergency response management plan should be undertaken as part of the Flood Risk Management Plan instead of the Construction Environmental Management Plan and has outlined this requirement as part of the recommended condition of approval.

The Department notes that the need for construction of cut and cover tunnel components across creek lines proposed in the original concept design has been engineered out of the design

through the construction of a viaduct over Caddies Creek Tributary 3 which would substantially minimise potential impacts on water quality.

In this respect, the Department notes that there are a range of standard and tested management mechanisms available to ensure that watercourse systems are not impacted and would require the Proponent to implement appropriate sediment and erosion control devices to ensure the protection and maintenance of existing downstream water quality.

Given that construction is proposed in an area which is known to be highly saline, the Department has recommended a condition of approval that the Proponent be required to prepare a Soil Salinity Report which details the outcomes of further geotechnical investigations and groundwater monitoring to determine the presence, extent and severity of soils salinity and outlines the potential impacts to groundwater resources and hydrology. The Department considers that such a study should be undertaken in consultation with various agencies, specifically OEH and NOW and be submitted to the Director General prior to the commencement of bulk earth activities and that it detail measures to mitigate impacts on local/regional salinity processes, groundwater systems and receiving environments.

In order to manage water quality impacts during construction, the Department has also recommended that the Proponent undertake a detailed water quality monitoring program and that the program should continue for a three year period following the completion of construction activities or until the affected waterways and /or groundwater resource is certified by an independent expert as being rehabilitated to an acceptable condition. In terms of groundwater or other surface water being discharged from the site, the Department has recommended a condition of approval that requires that this water must be suitable for the receiving environment and that it comply with section 120 of the *Protection of the Environment Operations Act 1997*.

7.8. Other Issues

Historic Heritage

The project passes through a landscape that has heritage values associated with its ability to demonstrate the changing pattern of land use since European settlement. Construction of the project would result in a number of impacts to heritage items (ranging from houses/ properties to vegetation), which could potentially lead to the temporary and/ or permanent loss of heritage items/ significance, including archaeological sites.

Table 7.13 identifies the heritage items and Table 7.14 identifies archaeological sites in the vicinity of each construction site, having the potential to be adversely impacted by the construction of the NWRL (both tables summarise the assessed heritage significance of the item and the nature of the proposed impacts by the project).

Table 7.13: Potentially impacted historic heritage items

Location / Item	*Significance*	*Temporary Impact*	*Permanent Impact*
Epping Services Facility (extended)			
'Woodlands' House	Local		Minor adverse: Construction works mainly separated by development and bushland, some impact on visual setting of the house.
Cheltenham Services Facility			
Street Trees	Local		Minor adverse: Construction works would require removal of some heritage-listed trees.
Beecroft / Cheltenham Heritage Conservation Area	Local		Minor adverse: Loss of vegetation would impact upon the significance of the broader conservation area.

Location / Item	Significance	Temporary Impact	Permanent Impact
Cherrybrook Station			
Glenhope	State	Moderate adverse: - temporary impacts upon the visual setting, including outlook from Glenhope.	
Inala School	Local	Minor adverse: - may require trees to be removed; and - some temporary impacts upon the visual setting of Inala.	
Castle Hill Station			
Arthur Whitling Reserve	Local		Major adverse: Removal of the entire area of the park and various components, impacts on the existing aesthetic character of the space, and the existing historic and social values of the Reserve.
The White House Gallery	Local		Minor adverse: Some impact to visual setting.
Castle Hill Showground	Local	Moderate adverse: Acquisition of portions of the Showground and removal of some heritage items.	Moderate adverse: Acquisition of portions of the Showground and removal of some heritage items.
Bella Vista Station			
Bella Vista	State	Neutral/ adverse: stations site is unlikely to be visible from the property as it is located one kilometre from the construction zone.	
Kellyville Station			
Windsor Rd and Old Windsor Rd Heritage Precincts (Stanhope Farm Alignment)	State		Minor adverse: There may be some impacts upon the historic roadway precinct, however due to recent physical changes to this part of Old Windsor Rd, these would be relatively minor.
Old Windsor Road to White Hart Drive			
Mungerie House	Local		Moderate adverse: The proposed rail corridor cuts across the original entrance driveway and the viaduct structure and would reduce the remnant curtilage of the house, views and interrupt traditional links between the main road and the house.
Windsor Road and Old Windsor Road Heritage Precincts (Caddies Creek Alignment)	State		Minor adverse: There may be some impacts upon the historic roadway precinct, however, due to recent physical changes to this part of Old Windsor Road, these would be relatively minor.

Location / Item	Significance	Temporary Impact	Permanent Impact
Windsor Road Viaduct			
Royal Oak Inn (former) (now Mean Fiddler Hotel)	State		Neutral: Removal of trees, which are a substantial distance from the hotel, could impact on the visual setting of the Inn.
Cudgegong Road Station and Tallawong Stabling Yard			
Rouse Hill House and Farm	State	Neutral: Construction works may be visible from the House and Town Centre.	
Battle of Vinegar Hill (memorial)	Local (potential state)	Neutral: likelihood of construction works impacting upon the Memorial is considered to be remote.	

Two locally significant heritage items, the Arthur Whitling Reserve and Mungrie House, will have moderate to adverse permanent impacts as a result of the project. These impacts cannot be avoided by the project and can only be partially mitigated. One state significant heritage item, Glenhope House, will have moderate adverse visual impacts during the construction of the project. The Department acknowledges these impacts are unavoidable, but notes that impacts to items of State significance have minimised and/ or avoided, and as such are considered acceptable.

To manage and partially mitigate the impacts of the project on historic heritage the Department has recommended a range of conditions (relevant to the impacts proposed) including requiring the Proponent to undertake archival recording including significant views, and archaeological recording of the Mungerie House carriage loop, in consultation with the Department and the Heritage Council of NSW.

Table 7.14: Potentially impacted archaeological sites

Location Item	Listing	Archaeological Remains	Archaeological Potential	Impact (Permanent)
Epping Services Facility and Epping Decline				
Stone causeway over Devlin's Creek	Local	Aligned sandstones	High	Indirect: may be indirectly impacted from erosion and sedimentation.
Cherrybrook Station				
House Site	N/A	Relics including structural remains, postholes, cisterns, refuse dumps, evidence of land-use	Low	Moderate adverse: potential for survival of archaeological evidence. Archaeological research design and excavation required
House Site	N/A	Relics including structural remains, postholes, cisterns, refuse dumps, evidence of land-use	Low	Moderate adverse: potential for survival of archaeological evidence. Archaeological research design and excavation required
Castle Hill Station				
Tramway (associated with Arthur Whitling Reserve)	N/A	Works and relics including tracks and evidence of construction techniques	Low	Moderate adverse: potential for survival of archaeological evidence. Archaeological research design and excavation required

Location	Listing	Archaeological		Impact (Permanent)
Item		Remains	Potential	
Hills Centre				
House Site, Carrington Road	N/A	Relics including structural remains, postholes, cisterns, refuse dumps, evidence of land-use	Medium	Moderate adverse: potential for survival of archaeological evidence. Archaeological research design and excavation required
Kellyville Station				
Archaeological site, south of Samantha Rile Drive	NA	Relics including structural remains, postholes, cisterns, refuse dumps, evidence of land-use	Low - Medium	Major adverse: potential for survival of archaeological evidence. Archaeological research design and excavation required
Potential site/s of the Battle of Vinegar Hill	Local	Potential relics including scattered / lost personal and other artefacts	Low – nil	Minor: potential for survival or archaeological evidence associated with the event within the construction footprint. If encountered - archaeological research design and excavation required
Boundary stone markers	NA	Boundary stone	Medium	Major adverse
Old Windsor Road to White Hart Drive				
Archaeological site, former Swan Inn	Local	Structural remains	Low – medium	Major adverse: potential for survival of archaeological evidence. Archaeological research design and excavation required.
Remains of walking tracks and fences post holes	N/A	Structural remains	Low – medium	Minor adverse: potential for survival of archaeological evidence. Archaeological research design and excavation required.

A number of locally significant archaeological sites are likely to be impacted as a result of the project, the majority are former domestic dwellings, however there is also an inn and a trackway with potential station (associated with the former Parramatta to Castle Hill tramway). Additionally the project may encounter evidence of the Battle of Vinegar Hill. Should archaeological remains exist of the battle they are likely to spread over a wide area and may be of State significance. The Department notes that a number of unsuccessful attempts have been made to locate the site in the past.

To manage and mitigate the archaeological impacts of the project the Department has recommended a condition requiring the Proponent to prepare archaeological research designs for the excavation of the known sites, in consultation with the Heritage Council of NSW and to the satisfaction of the Director General, and includes requirements for final reporting and storage of arartefacts recovered.

The EIS also identified possible indirect impacts during construction to the stone causeway over Devlins Creek (part of the convict built Great North Road – a section of which is located within Dharug and Yengo National Parks and registered on the NSW State Heritage Register). The Department has recommended a condition requiring that the causeway be protected during construction.

Mitigation measures have been developed for all identified heritage items including archaeological sites, to avoid, reduce and manage identified potential impacts. The Proponent has also

committed to the preparation and implementation of a Heritage Management Plan. Heritage specialists would be further involved in the design and construction works, to ensure that the recommended mitigation measures are implemented and impacts on heritage items minimised. Heritage specialists would also be able to assist by identifying opportunities for enhancing the significance of heritage items and archaeological sites.

Following exhibition of the EIS, Blacktown City Council raised specific concerns regarding the impact of the proposal on Old Windsor Road, and the Hills Shire Council raised specific concerns regarding the impact of the proposal on Mungerie House, in particular views from these heritage items. Four public submissions raised concern regarding protection of heritage items during construction.

The Heritage Council of NSW raised no objections to the project and provided a number of recommendations in relation to conditions. The Department notes the Proponent has generally committed to these, and to provide specific parameters and outcomes the Department has strengthened these within its recommended conditions.

As a result of submissions made during the public exhibition process, and further design refinements, the Proponent has relocated the light vehicle access and egress point to and from the Cheltenham Services Facility construction site, eliminating the need for clearing of heritage listed street trees along Castle Howard Road and reduced clearing within Beecroft Reserve. The removal of the Epping decline has removed the need to clear the heritage listed bushland along Beecroft Road. The Proponent has also re-iterated its commitment to implement mitigation measures to reduce the visual impact on heritage items, including re-establishment of vegetation where feasible. It was also identified, by RMS, that a house site in the vicinity of the Bella vista station had been demolished.

The Department acknowledges that the construction of the project would impact on the values of a number of heritage items. However, the Department considers that, generally, the Proponent's mitigation measures provide an appropriate framework to manage impacts during construction. Notwithstanding, the Department has recommended conditions of approval to strengthen and minimise the heritage impacts for the project, including:

- requirements to avoid and/ or minimise impacts to heritage items where reasonable and feasible;
- requirements for archaeological excavations, archival recording and the reporting of these activities to the relevant agencies; and
- preparation of a Construction Heritage Management Plan, in consultation with the Heritage Council of NSW, including:
    - measures to protect the heritage items adjacent to the project, which includes the listed causeway over Devlin's Creek, during construction,
    - procedures for dealing with previously unidentified relics, and
    - heritage training and induction processes for construction personnel.

The Department is satisfied, taking into account the proposed conditions, that the project's direct and indirect impacts on historic heritage items would not significantly affect the overall heritage values of the area and that the majority of impacts can be appropriately managed and/ or mitigated.

Aboriginal Heritage

The assessment focussed on constructions sites along the project alignment. The assessment and surveys were undertaken in consultation with the Aboriginal community, with the consultation process including meetings, provision of reports for comment, and site surveys/ inspections.

While much of the alignment is located on land determined by the Proponent to be disturbed from previous development, field surveys identified 35 Aboriginal sites as being located within or in close proximity to the construction sites, including:

- twenty previously recorded sites (of which only three were re-located in the 2011 survey for the project); and
- seven new Aboriginal sites and eight areas with Potential Archaeological Deposits (PAD) recorded in the 2011 survey.

The sites and PADs are located in the vicinity of Cheltenham Services Facility, Cherrybrook Station, Hills Centre Station, and at a number of locations between Bella Vista Station and the Tallawong Stabling Yard (see Table 7.15). The range of sites include: stone artefact concentrations, isolated finds, open artefact scatters, and PADs, ranging from low to high level archaeological potential. In particular, sites/PADs of moderate to high archaeological potential are located at Balmoral Road, Memorial Avenue, and between the Windsor Road Viaduct and the Tallawong Stabling Yard.

Table 7.15: Aboriginal heritage sites

Location	***No. of Sites/ PADs***	
	within Impact area	***Outside of Impact area***
Cherrybrook Station	1	
Hills Centre Station		1
Norwest Station		2
Generally between Norwest and Bella Vista Stations		9
Generally between Bella Vista and Kellyville Stations	5	9
Generally between Kellyville and Rouse Hill Station	5	10
Rouse Hill Station	3	8
Generally between Rouse Hill and Cudgegong Road Station and Tallawong Stabling Facility	13	7

There is limited opportunity within the construction sites for the avoidance of, impacts to known Aboriginal sites and/or areas with archaeological potential. However, a number of Aboriginal heritage sites extend outside the boundaries of the construction sites, which have the potential to be avoided by impacts. Impacts to seven of the Aboriginal sites (including PADs) could be reduced with the implementation of the appropriate mitigation measures. The degree of impact depends on the size of each Aboriginal site and how far it extends outside each of the construction sites.

Mitigation measures developed to reduce and manage identified potential impacts, include minimising harm, development of an Aboriginal Heritage Management Plan, educating site workers, undertaking archaeological test and salvage excavation, and public interpretation. All areas with Aboriginal sites which are to be conserved would have zero vehicle access across their extent and no earthworks or stockpiling of materials would occur within their boundaries.

The Department acknowledges that the construction of the project would have a significant impact on known Aboriginal sites and areas of archaeological potential. To manage and mitigate the Aboriginal heritage impacts of the project the Department has recommended a condition requiring the Proponent to prepare archaeological research designs for the excavation of the known sites and area's of potential, in consultation with the Aboriginal stakeholders and to the satisfaction of the Director General, and includes requirements for final reporting and storage of any objects recovered.

The Department notes that the OEH raised specific concerns regarding the cumulative impact on Aboriginal heritage from surrounding developments. In particular, proposed management and

mitigation measures for Aboriginal cultural heritage in terms of cumulative impacts. In consideration of this matter, the Department notes the Proponents final reporting on the Aboriginal heritage investigations needs to include a consideration of the regional context and significance of the archaeological sites excavated for the North West rail link, including identification of where similar sites across the area may survive or are conserved.

Overall, the Department considers that the Proponent's mitigation measures provide an appropriate framework to manage potential impacts during construction. Notwithstanding, the Department has recommended conditions of approval to further strengthen this framework, the preparation of a Construction Heritage Management Plan, prepared in consultation with Aboriginal stakeholders and OEH. This Plan would include details of further archaeological investigation and identification of Aboriginal cultural heritage sites, details of management measures, procedures for dealing with previously unidentified Aboriginal objects, procedures for dealing with human remains, heritage training and induction processes, and procedures for ongoing Aboriginal consultation and involvement.

Visual Amenity

The existing visual environment varies along the length of the corridor, but is primarily associated with two distinctive landscapes, the Hills District in the east, and the Cumberland Plain to the west, which includes a more rural setting in the vicinity of Cudgegong. The visual environment and project impacts during construction are summarised in Table 7.16 below.

Table 7.16: Visual Impacts during construction

Area	*Visual Environment*	*Impacts*
Hills District	Includes high density residential and commercial town centre uses around Epping Station, and predominantly low density residential uses with heavily vegetated streetscapes and nature reserves between Epping and the Norwest Business Park. Also within this area is the Castle Hill Towers Shopping Centre, the Hills Centre, and the Norwest Business Park.	The NWRL in this area is completely underground, therefore visual impacts are limited to surface construction sites.
Cumberland Plain landscape	The character of the area is generally low density residential and commercial uses, sitting within open space and rural character landscapes.	In this area the NWRL alignment rises to the surface at Bella Vista Station and runs parallel to Old Windsor Road, which is up to six lanes across in some areas, as well as the North-West T-Way, a dedicated two lane bus way. The alignment crosses the centre of a broad floodplain, with hills on both sides of the line visually enclosing it from surrounding areas. Visual impacts will occur along the alignment as a result of construction of the viaduct between Bella Vista and Rouse Hill, and at station construction sites.
Cudgegong	The landscape character changes to a more rural setting.	The NWRL alignment remains on the surface in this area, however no longer on viaduct, therefore visual impacts would occur along the alignment as a result of construction of the track, and at Cudgegong Road Station, and the Tallawong Stabling Facility.

The construction of the project would cause temporary adverse visual amenity impacts on surrounding land uses, due to vegetation clearing, earthworks, construction compounds, access roads and the like, for a period of up to approximately four years.

The most significant visual impacts are associated with the construction of the Hills Centre Station, the Rouse Hill Station and the Windsor Road viaduct, with highly adverse visual impacts also being identified for views from the Hills Showground and historic Mungerie House (these are also discussed in the heritage section of this report). Impacts would be greatest at locations where residential / sensitive receivers have an unscreened view of the construction sites.

To manage and minimise these impacts the Proponent has committed to enclose construction worksites with plywood hoarding, three metres at all sites except at Cherrybrook where it would be six metres in height. Notwithstanding, some elements of the site compound would be greater than three or six metres in height, including acoustic sheds, cranes, batching plants and storage silos. Light spill from construction sites may also affect the visual amenity of adjacent land uses.

The community raised general concern over the visual impact of construction sites, including the height of the construction noise hoardings, and Hornsby Shire Council and the Hills Shire Council also raised specific concern regarding the visual amenity of the three and six metre high noise hoardings. The community, as well as Blacktown City Council, also raised concern over the visual impact of the viaduct structure, and that consideration should be given to the aesthetic treatment of the viaduct to minimise impacts.

The Proponent has identified the reduction of visual impact of construction on the surrounding community as a key visual management objective. Mitigation measures have been developed, including where possible the retention of existing vegetation around the perimeter of construction sites, to minimise light glare as much as possible, and that the design and finish of acoustic sheds and noise hoardings will blend into the adjoining areas. Visual and landscape management will be implemented as part of the Construction Environmental Management Plan.

The Department considers that the Proponent's commitment to visually screen construction compounds which are visible from surrounding areas is appropriate. The visual amenity impacts associated with the construction of the project will be temporary in nature and will be reduced in the medium to long term through various mitigation measures. Overall, the Department is generally satisfied that the Proponent has provided a suitable suite of mitigation measures to minimise the visual intrusiveness of construction of the project. Notwithstanding, to ensure ongoing consideration of the visual amenity of adjacent land uses, the Department has recommended a condition of approval requiring the project to be constructed in a manner that minimises visual impacts, and which reinforces the Proponent's commitments.

The Department notes that construction of specific project elements would result in permanent visual amenity impacts on surrounding land uses. EIS 1 identifies that it is anticipated that the 4.2 kilometre viaduct structure between Bella Vista and Rouse Hill would be constructed from cast in-situ concrete piles, columns and headstocks with concrete box section girders between the columns. The viaduct would typically be 13 metres in width and have box section spans of between 36 and 48 metres. The viaduct structure and gantry would reach heights of approximately 10 to 15 metres. Several bridges would also be constructed where the alignment crosses key infrastructure or watercourses, generally located in Kellyville and Rouse Hill, including rail bridges as part of the viaduct structure, and road and rail bridges over rail line and over Second Ponds Creek. Figure 7.4 provides an artists impression of the viaduct with the Skytrain arriving at Rouse Hill Station.

Figure 7.4: Artists impression of the Skytrain arriving at Rouse Hill Station
(Source: http://northwestrail.com.au/article/more-trains-more-choice-for-sydneys-north-west)

As a result of construction of the viaduct structure, users of Old Windsor Road, Windsor Road, and the North-West T-way, are likely to experience a considerable change in the visual character of the area, resulting in a moderate adverse visual impact. Gradual erection of the viaduct in an elevated position would also cause highly adverse visual impacts for views from historic Mungerie House, as well as moderate adverse visual impacts for views from John XXIII Catholic School and Church, the Merryville Road Commercial area (including the Ettamogah Pub), and the Castlebrook Lawn Cemetery and Crematorium. Residential areas are expected to experience negligible or minor adverse visual impacts only.

The Proponent has committed to presenting the design of the viaduct as part of EIS 2. The integration of urban design into the overall design of the project is currently occurring as part of the overall design process. EIS 2 will include an urban design framework that builds on principles identified in the staged SSI approval and statement of commitments. Additionally, all permanent features will be subject to a detailed visual impact assessment in EIS 2.

Whilst the Department considers that an appropriate level of detail will be considered for permanent structures as part of EIS 2, the Department considers that as construction of these permanent structures is occurring as part of Stage 1 works, design considerations must occur prior to construction commencement. Design considerations are required prior to construction of permanent structures, to ensure early commitment to aesthetics and sensitive design of the structures within their local environment. The Department has therefore recommended a condition of approval that the Proponent design and construct the SSI in a manner that minimises the visual and heritage setting impacts of the viaduct and bridge structures, and other permanent hard landscaping elements, and that consideration be given to guidance within the *Bridge Aesthetics Design guidelines to improve the appearance of bridges in NSW* (RTA, 2003).

Air Quality

Ambient air quality in the vicinity of the alignment is typical of a primarily developed or developing residential and commercial area, largely affected by motor vehicle emissions, commercial businesses, domestic activities, and ongoing construction emissions.

Construction activities undertaken as part of the major civil construction works have the potential to impact the surrounding air quality in relation to dust generation and vehicular and plant emissions.

Dust impacts would largely be confined to the areas where the proposed alignment is above ground between Bella Vista and the Tallawong Stabling Facility, and in areas where station cavern excavation, spoil movement and service facilities are proposed. The dust generated from these activities would likely result in a minimal impact on local air quality, with the implementation of appropriate mitigation measures.

Other emissions, generated from construction vehicles and construction equipment and plant, would be associated with diesel combustion. These include carbon monoxide, nitrous oxides, sulfur dioxide, particulate matter and hydrocarbon compounds. The quantity of emissions would be dependent on the fuel used and hours of operation of plant and equipment. Higher concentrations of emissions are likely to be generated at above ground construction compounds, where multiple types of vehicle and plant would be required. Ventilation is also required at all construction sites along the route and would have extraction and filtration systems fitted to minimise gas and particle emissions.

Community feedback raised concern regarding dust and other air quality impacts, particularly in relation to impacts on human and animal health. The Proponent considers that dust and exhaust emissions generated during the construction works can largely be controlled through the implementation of mitigation measures, which are routinely adopted during similar construction projects.

The Proponent has identified mitigation measures to avoid, reduce and manage potential impacts. Mitigation measures have been developed to address impacts as a result of construction activities including earthworks, spoil stockpiles, haul roads, demolition, vehicles and equipment, tunnel ventilation, and concrete batch plant and pre-cast facilities. The Proponent has also committed to preparation and implementation of an Air Quality Management Plan. Overall, the Department is generally satisfied that the Proponent has provided a suitable framework, including the commitment to prepare an Air Quality Management Plan, to minimise the dust and exhaust emissions associated with construction of the project.

To reinforce the Proponent's commitments and ensure ongoing management and minimisation of the impact of the project on air quality, the Department has recommended a condition of approval requiring the project to be constructed in a manner that minimises dust emissions from the site, including wind-blown and traffic-generated dust and tracking of material onto public roads.

The Department has also recommended a condition of approval requiring the preparation of a Construction Air Quality Management Plan, to further specify particular requirements to be considered, including identification of potential sources of air pollutants of concern, management objectives, mitigation measures to be implemented, a monitoring program, and mechanisms for monitoring, review and amendment of the Plan.

Waste Generation

Several types of waste are likely to be generated during major civil construction works. Key waste streams include spoil from tunnelling, cuttings and general earthworks activities, and wastewater from tunnel construction operations. Other waste streams anticipated to be generated include demolition waste, green waste, and general construction waste.

The quantity and type of waste material would be site specific, but the majority of waste is expected to consist of general solid waste. Potential waste management impacts associated with the project include:

- large volumes of spoil directed to landfill;
- dust impacts from the incorrect storage, handling and disposal of spoil;
- contamination of soil, surface or groundwater; and
- an increase in vermin from the incorrect storage, handling and disposal of waste.

It is envisaged that the project would generate approximately 2,400,000 m^3 of surplus spoil. The majority of excavated spoil material is expected to be uncontaminated crushed sandstone and shale material, classified as Virgin Excavated Natural Material. Opportunity exists for spoil to be reused at other construction sites within Sydney, the subject of separate planning approval requirements. Any spoil classified as contaminated would be directed to a waste management facility lawfully permitted to accept the waste.

Waste management activities associated with the construction works are not considered to pose a significant risk to the environment given that standard measures are available to address waste generation, storage, disposal and re-use in order to reduce impacts. The Proponent has identified mitigation measures to manage waste in accordance with the principles of resource management hierarchy embodied in the *Waste Avoidance and Resource Recovery Act 2001*.

The Proponent is committed to investigating opportunities for the reuse of usable spoil for onsite purposes where feasible. Potential uses include embankment fill, levees and noise mounds. Details of these potential uses would be pursued in the detailed design phase. Furthermore, the project will also aim to achieve waste management targets of 100% beneficial reuse of usable spoil and 95% beneficial reuse of construction and demolition waste.

The Department also notes that the disposal of spoil to landfill and similar sites would need to meet the approval and/or licencing requirements applicable to these activities, such as traffic, delivery timeframes, and handling requirements.

All feasible and reasonable opportunities for wastewater reuse on site or for construction would be undertaken (such as dust suppression). However, it is expected that generation of wastewater from tunnel construction operations would be greater than the potential for reuse and some discharge to creeks and stormwater systems would be required. Consideration of surface water and hydrology issues are discussed separately in the above Section 7.7 – Surface Water and Hydrology.

Overall, the Department is generally satisfied that the Proponent has provided a suitable framework, including the requirement to prepare a Waste Management and Recycling Plan, to ensure construction of the project is undertaken to avoid, reduce and manage identified potential impacts as much as possible. Standard waste management requirements have also been included by the Department as recommended conditions of approval.

Climate Change and Greenhouse Gases

The climate change risk assessment identifies components of the major civil construction works that are at most risk from climate change impacts. The assessment identified no extreme or high risks to the project and two potential medium (tolerable) risks as a result of climate change. These are flooding damage to infrastructure, and extreme rainfall events that could cause the failure of embankments. The likelihood of these risks occurring is deemed to be rare for flooding and unlikely for extreme rainfall events.

Adaptation options to respond to the climate risks associated with the major civil construction works include the following:

- flooding damage to infrastructure – design the drainage system to take account of increased rainfall events through flood modelling with a climate change margin; and

- extreme rainfall events causing embankment failure – design embankment to take into account a changing climate such as structures to reduce water build up behind and under embankments to prevent lubrication and loss of stability.

The design of the project would be reviewed to ensure due diligence has been applied to address climate risks.

It is estimated that the major civil construction works would generate a total of approximately 2,324,324 tCO_2-e Greenhouse Gas Emissions (GHG), including the following:

- 782,688 tCO_2-e of direct scope 1 emissions – including the use of fuel onsite by construction equipment (approximately 96%);
- 1,087,314 tCO_2-e of indirect scope 2 emissions – including power supply for the operation of road headers and tunnel boring machines and their supporting infrastructure (approximately 74%); and
- 454,323 tCO_2-e of indirect upstream scope 3 emissions – including the use of electricity (approximately 46%), and the use of construction materials (approximately 36%).

The Proponent has identified mitigation measures to avoid, reduce and manage identified potential impacts regarding climate change and GHG emissions. This includes:

- minimising fuel and electricity consumption by construction plant and equipment;
- minimising fuel used in material and spoil transport;
- minimising the embodied carbon of materials used;
- minimising electricity consumption; and
- offsetting a proportion of electricity needs associated with the major civil construction works.

The Proponent has also committed to preparation and implementation of a Carbon and Energy Management Plan.

Overall, the Department is generally satisfied that the Proponent has provided a suitable framework to ensure construction of the project is undertaken to avoid, reduce and manage identified potential impacts as much as possible.

8. RECOMMENDATION

The NWRL is located in the North and North West Subregions of Sydney. With Sydney's population expected to increase by 1.7 million, to approximately 6 million people by 2036, these Subregions will play a key role in accommodating Sydney's future residents.

Currently, the North and North West Subregions are heavily reliant on private cars and bus services for transport options. With increased demand on road networks, it is vital that transport networks and services are expanded to the region to support ongoing development and to connect the subregions to existing centres, services and employment. The provision of an efficient and reliable public transport system is, therefore, key to the sustainable development of the north and north west subregions of Sydney.

The proposed modification confirms the project as a heavy rail line, refines station locations, realigns the NWRL within the North West Growth Centres, and modifies the vertical alignment between Bella Vista and Rouse Hill. The Department considers that the modification is justified on the basis that it provides clarity of the project description, and physical refinements to the project enhances the attractiveness of the NWRL by integrating with existing and future land uses and other transport services and responding to community requirements, and providing better environmental and land use outcomes.

Stage 1: Major Civil Construction works for the NWRL includes sixteen construction sites along the alignment from which excavation of tunnels and underground station boxes, construction of above ground infrastructure including viaduct spans and bridges, and earthworks will be carried out. The Department considers that the Stage 1 Works are justified on the basis that these are activities required for the construction of a vital infrastructure project, and in the public's interest. The adverse consequences of not proceeding with the project would be significant in the long term, in terms of the capacity of the rail network and road network congestion, and poor level of accessibility between homes and jobs.

Following a detailed assessment of the Proponent's EIS and Submissions Report, and the submissions received from agencies, councils and the public during the exhibition period for the project, the Department is satisfied that the impacts of the project can be appropriately mitigated or managed to acceptable levels. The Department therefore recommends that the modification and project be approved subject to the recommended conditions of approval.

The recommended conditions of approval for the project provide for the mitigation and management of key impacts associated with the project. These include specific environmental performance and construction environmental management conditions for ecological impacts, soil, water quality and hydrology impacts, transport and access impacts, visual impact and urban design requirements, heritage impacts, noise and vibration impacts, and property and business impacts. The Department has also recommended conditions of approval for construction environmental management planning, including the requirement for a Construction Compound and Ancillary Facilities Management Plan, a Construction Noise and Vibration Management Plan, a Construction Traffic Management Plan, a Construction Soil and Water Quality Management Plan, a Construction Heritage Management Plan, a Construction Flora and Fauna Management Plan, and a Construction Air Quality Management Plan.

The Department believes that these requirements would provide for the implementation of best management practices during design and construction of the project, and would ensure that the construction impacts of the project on the surrounding environment and the amenity of local residents and rail commuters are managed to acceptable levels.

Consequently, the Department recommends that the Minister for Planning & Infrastructure approve the modification request and Stage 1: Major Civil Construction Works application, subject to the recommended conditions of approval.

24.9.12

Executive Director
Major Projects Assessment

SHaddad

Director-General

25/9/2012.

APPENDIX A ENVIRONMENTAL IMPACT STATEMENT

See the Department's website at http://majorprojects.planning.nsw.gov.au/page/.

APPENDIX B SUBMISSIONS

See the Department's website at http://majorprojects.planning.nsw.gov.au/page/.

APPENDIX C PROPONENT'S RESPONSE TO SUBMISSIONS

See the Department's website at http://majorprojects.planning.nsw.gov.au/page/.

APPENDIX D POLITICAL DONATION DISCLOSURES

See the Department's website at http://majorprojects.planning.nsw.gov.au/page/.

APPENDIX E RECOMMENDED CONDITIONS OF APPROVAL - MODIFICATION

APPENDIX F RECOMMENDED CONDITIONS OF APPROVAL – MAJOR CIVIL CONSTRUCTION WORKS

APPENDIX G SUPPLEMENTARY DIRECTOR-GENERAL'S REQUIREMENTS – SSI APPLICATION FOR STAGE 2: STATIONS, RAIL INFRASTRUCTURE AND SYSTEMS

See the Department's website at http://majorprojects.planning.nsw.gov.au/page/.