Chapter 3. Existing and future environment

3.1 Regional setting

The project is located in Sydney's north west, commencing approximately 16 km from the Sydney CBD at its closest point near Epping Station (see Figure 3.1). The regional environment is relatively diverse in nature, with a variety of environmental, economic and cultural features including:

- Residential areas;
- Commercial centres functioning as local and regional service centres;
- Areas of economic activity, including areas of industrial/light industrial activities and business development;
- Extensive infrastructure facilities including water/sewage infrastructure, energy/electricity works, and road transport infrastructure; and
- Natural features, including areas of open space and parks that provide local and regional amenity, recreation facilities and conservation areas.

According to the Metropolitan Strategy (Department of Planning, 2005), North West Sydney includes the Baulkham Hills, Blacktown, Blue Mountains, Hawkesbury and Penrith local government areas (LGAs). Areas to the east of the project (between Epping and Castle Hill) were mainly developed prior to the 1980s. This area includes the suburbs of Epping, Beecroft, Cheltenham, Pennant Hills, West Pennant Hills, Cherrybrook and Castle Hill.

During the early 1980s forward planning for Sydney's northwest sector (areas to the northwest of Castle Hill) became necessary to cater for Sydney's rapidly growing population and the need for more land for residential development. The outcome of this process was a decision to proceed with development of the Rouse Hill development area. Other areas were identified for future urban expansion.

Sydney Regional Environmental Plan No.19 – Rouse Hill Development Area was gazetted on 1 September 1989 and applies to approximately 9,400 hectares of land in North West Sydney. The general aim of this plan is to accommodate part of the long-term growth of the Sydney region by providing a mechanism for identifying land suitable for urban purposes and by providing for the orderly and economic development of that land. This plan has been a major catalyst in changing land use in this part of Sydney from a predominantly rural environment to an increasingly urban environment.

The rapid pace of development of Rouse Hill during the 1990s created issues in terms of the provision of sufficient public transport, road capacity and other services and infrastructure. Works during the earlier phases of development have involved the development of major infrastructure such as water (both potable and recycled water), sewerage and drainage, on behalf of Sydney Water Corporation, and other services such as electricity, gas and

communications to support urban development. Local Council involvement has occurred through the provision of the local road network and community services and facilities. More recent trunk infrastructure works have included improvements to State roads such as Old Windsor Road and the provision of a regional high speed bus service, the North West Transitway.

The new strategic plan for the development of Sydney (the Metropolitan Strategy) was prepared during 2004/05 and released in December 2005. In June 2005, the document 'Managing Sydney's Growth Centres' was placed on exhibition. The document noted that the growth centres, combined with existing land releases, would provide between 30 and 40 per cent of Sydney's new housing over the next 25 to 30 years. The North West Growth Centre is located at the northern extent of the project.

Whilst the project would mainly traverse established urban areas, the regional environment in the vicinity of the project remains a significant urban development area through ongoing urban consolidation policies within established urban areas, and the continued development of existing land releases in the Rouse Hill Development Area (such as the Balmoral Road Release Area, the Norwest Business Park and the Rouse Hill Regional Centre). The next stage of urban development will involve land within the North West Growth Centre. Further information on future development in the study area is provided in section 3.3.

3.2 Land use and property

3.2.1 Land use

A summary of land uses in the vicinity of the project is provided below and shown in Figures 3.2 to 3.5.

Quadruplication of Northern Line

The main land use in this area is residential, interspersed with recreation/open space and community facilities. Other land uses include commercial centres in the vicinity of Epping, Cheltenham and Beecroft.

Cheltenham Station

Residential housing, station car parking and suburban roads dominate the Cheltenham station area. Large residential properties with established gardens and streetscapes characterise the landscape. Other uses in the vicinity include:

» Cheltenham Girls High School; and

» Tennis courts and croquet club.

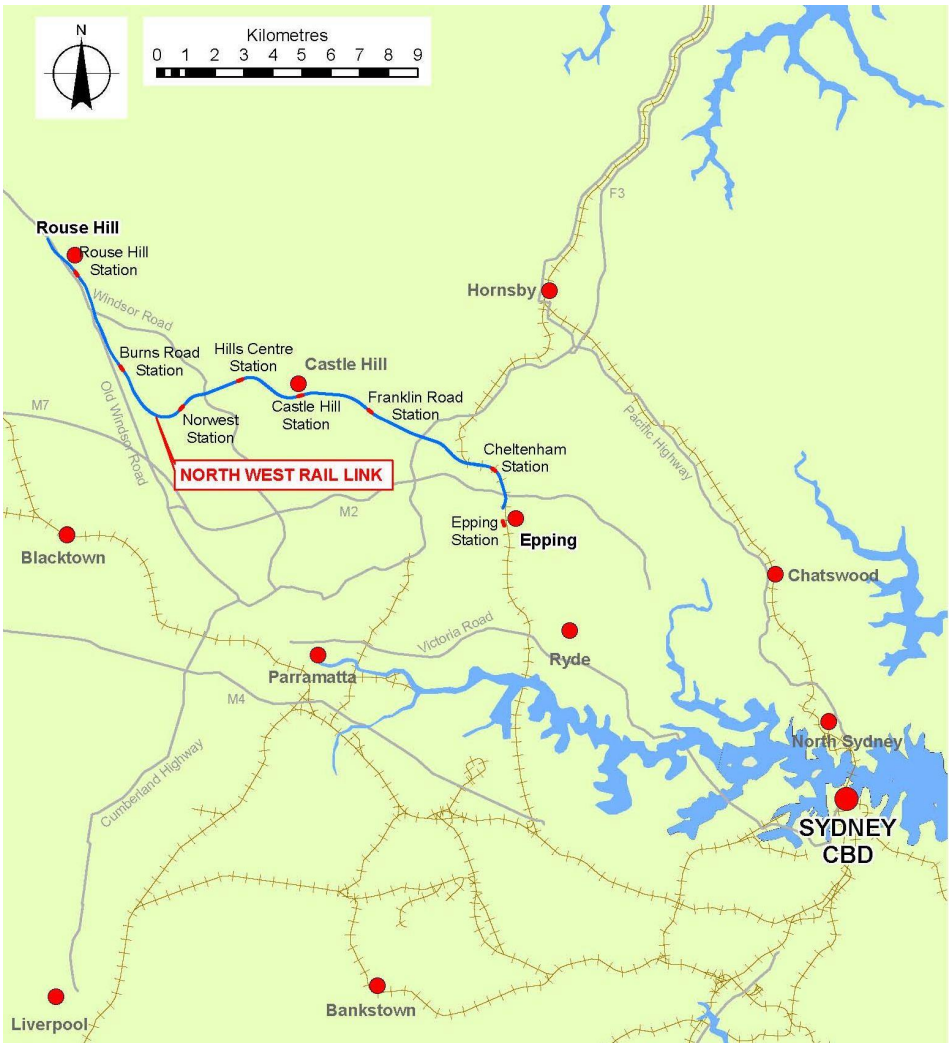

Figure 3.1 Regional location

Quadruplication section

This section traverses (within the existing rail corridor) the suburbs of Epping and Cheltenham within.

This section is dominated by the existing rail reserve for the Northern Line. The existing rail line travels from Epping Station to the bridge over the M2 Motorway and then to Beecroft Station. Remnant vegetation, with exotic trees and a shrub understorey, line either side of the rail corridor.

The land use on either side of the rail reserve is mainly detached residential housing. Suburban roads provide access to residential homes, and local streets are located parallel to the rail reserve on both sides.

Major arterial roads include Beecroft Road (with off ramp and junction from the M2 Motorway) and the M2 Motorway.

Tunnel portal/dive site

The work site for the tunnel portal is expected to be within the existing Northern Line rail reserve.

To the immediate west of the portal are Beecroft Village Green, the Scout and Guide hall, the community centre, Beecroft Public School and Beecroft tennis and lawn bowls green. Beecroft Station is located to the north.

Other land uses include Cheltenham Girls High School, located to the southeast, and Booth Park, located to the northwest. Beecroft Nursing Home and Chesalon Nursing Home are located to the south.

Tunnel portal to Franklin Road Station

This section traverses the suburbs of Beecroft and West Pennant Hills. The main land use above the tunnel is residential housing in the suburbs of Beecroft and West Pennant Hills. Small parks are scattered throughout residential areas. Other land uses in the vicinity include:

» West Pennant Hills Public School;

» Mt Wilberforce lookout reserve;

» Koala Park; and

» Cumberland State Forest.

The main arterial roads in this area are Pennant Hills Road (Cumberland Highway), Castle Hill Road and New Line Road.

Franklin Road Station to Castle Hill Station

Franklin Road Station

Franklin Road Station is located in the suburb of Cherrybrook. Land uses in this area are mainly residential dwellings on large lots and schools. An area of remnant vegetation is located nearby. Tangara School and Inala School are located to the east. The site is located on the Castle Hill Road, a busy arterial road. A 132kV electricity transmission line/easement traverses the site.

Franklin Road Station to Castle Hill Station

This section is mainly located in the suburb of Castle Hill. The main land uses are residential, including the Anglican Retirement Villages (north of Castle Hill Road), and commercial in the vicinity of Castle Towers Shopping Centre. Other land uses in the vicinity include:

» Rogans Hill Reservoir; and

» Council pound.

Major arterial roads include Castle Hill Road, Highs Road, County Drive and Old Northern Road.

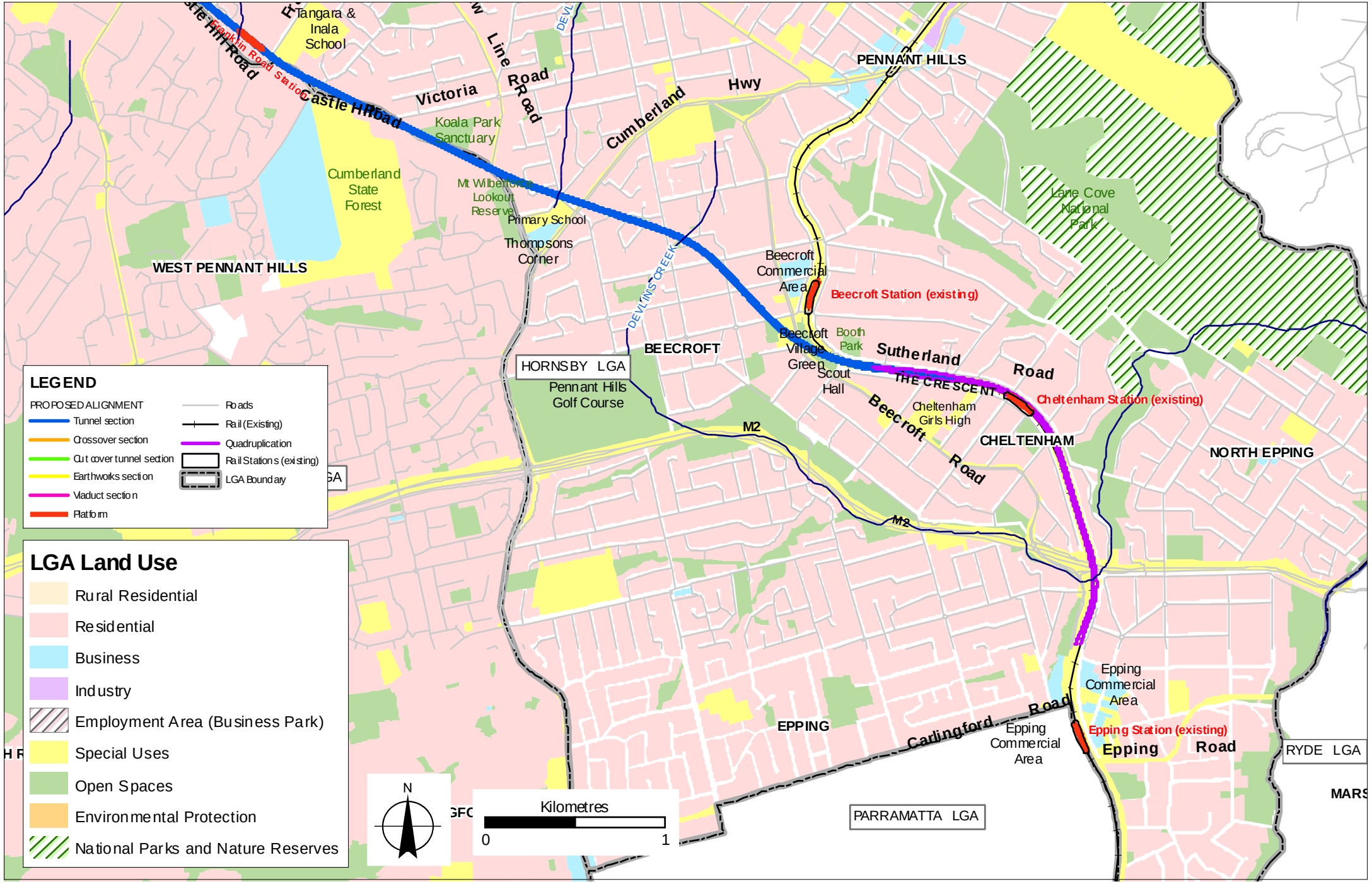

Figure 3.2 Land Use - Epping To Franklin Road Station

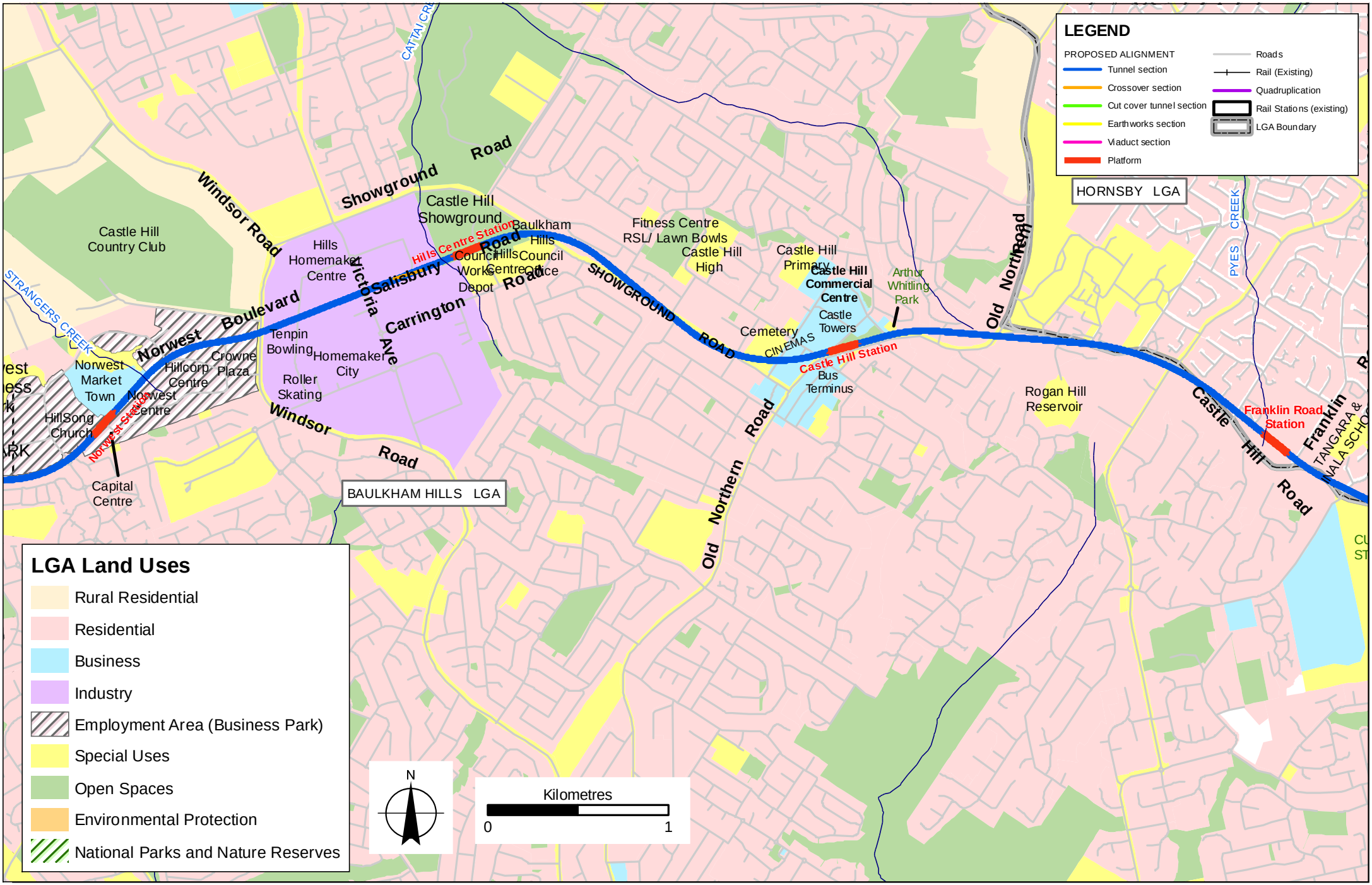

Figure 3.3 Land Use - Franklin Road Station To Norwest Station

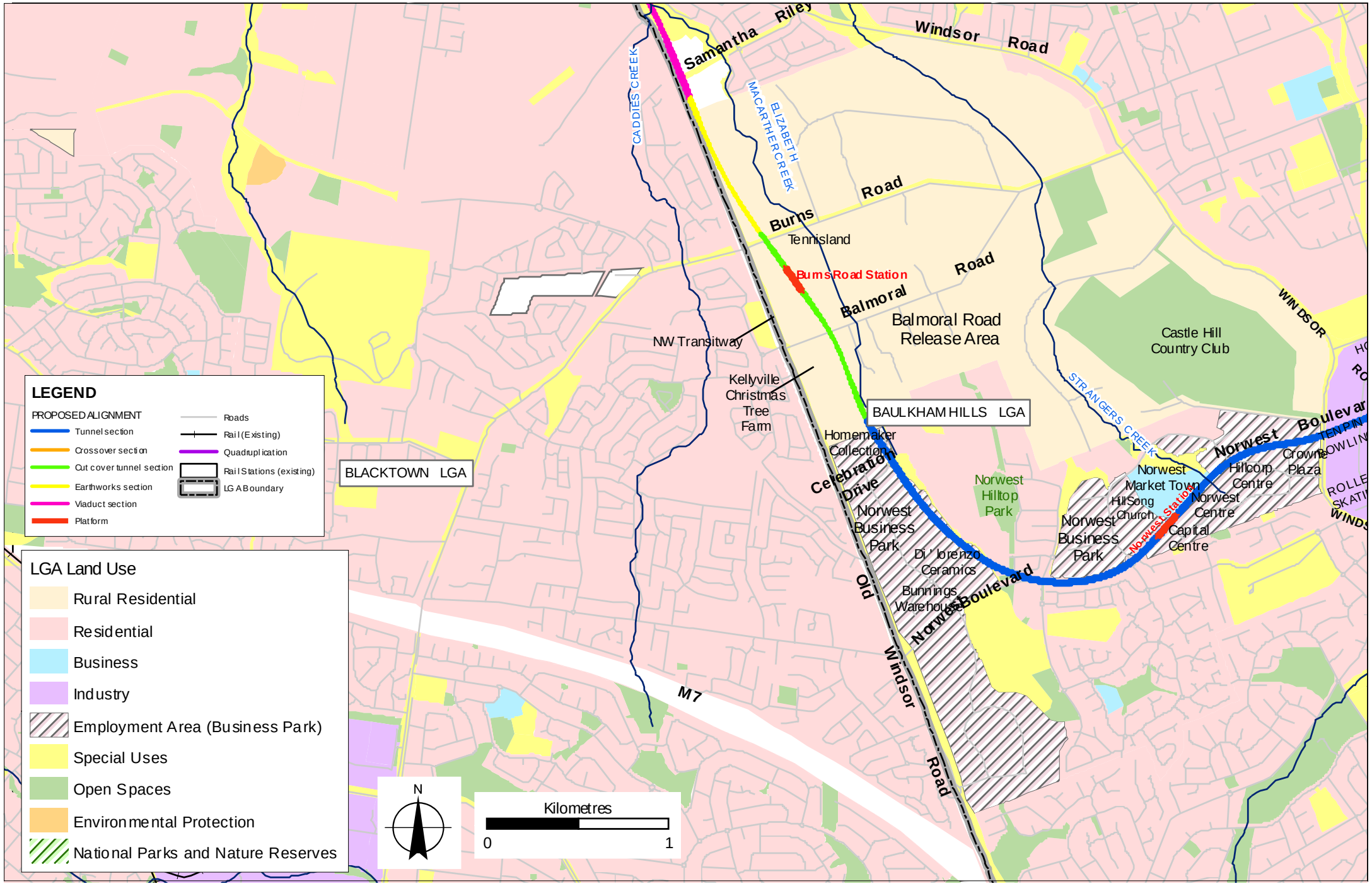

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Figure 3.4 Land Use - Norwest Station To Burns Road Station

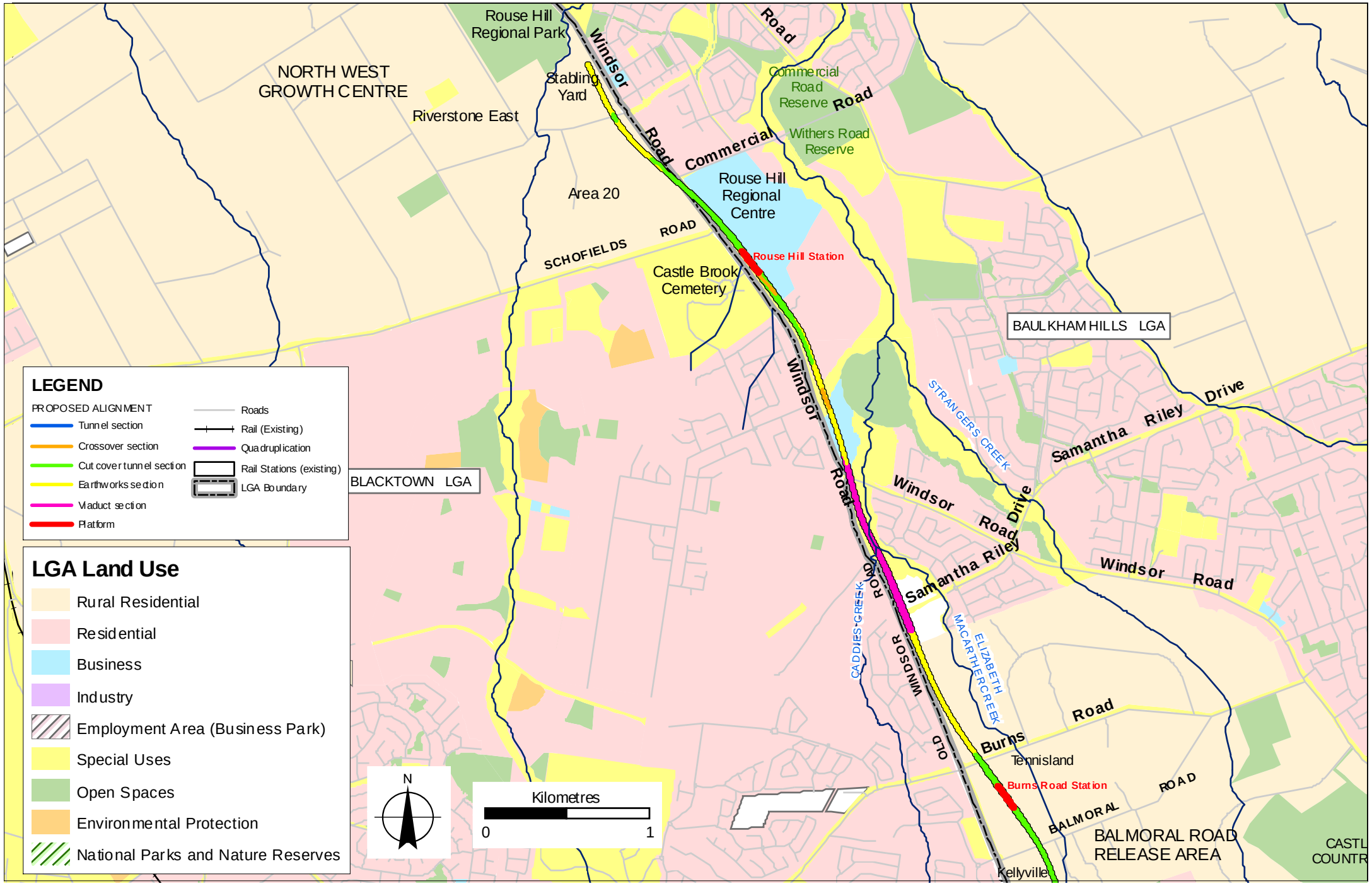

Figure 3.5 Land Use - Burns Road Station To Rouse Hill Stabling Facility

Castle Hill Station to Hills Centre Station

Castle Hill Station

Castle Hill Station area would be located within the commercial and retail hub of the Castle Hill centre, near the junction of Old Northern Road and Old Castle Hill Road adjacent to the Castle Towers Shopping Centre. Land uses include commercial (office blocks), shopping (Castle Towers and strip shopping) and recreation (cinema, and Arthur Whitling Park).

Showground Road and Old Northern Road provide access to and from the centre.

Castle Hill Station to Hills Centre Station

This section is located in Castle Hill. Land uses in the vicinity of the tunnel consist mainly of low-density residential. Recreational uses (fitness centre, lawn bowls green and RSL club) and Castle Hill High School are located to the north.

Hills Centre Station to Norwest Station

Hills Centre Station

Hills Centre Station would be located underground in Castle Hill, adjacent to and north of the Hills Centre, in the vicinity of the Castle Hill Showground and the Baulkham Hills Shire Council buildings. The station would be located within an open space area associated with the showground. Commercial/industrial land uses are located to the west, and recreation/open space to the north and east. Community facilities (Council buildings and Hills Centre) are located to the south.

Arterial roads include Showground Road, Gilbert Road and Windsor Road.

Hills Centre Station to Norwest Station

This section traverses the suburbs of Castle Hill and Baulkham Hills. Land uses vary from community uses and open space in the vicinity of Hills Centre Station to the east, and commercial/industrial uses to the west. Commerical/industrial land uses include large commercial/industrial subdivisions/business parks, with an older industrial subdivision to the east (east of Windsor Road and south of Showground Road) and the more recent Norwest Business Park to the west (west of Windsor Road).

Land uses above in the vicinity of the tunnel include:

- Crown Plaza Norwest;
- Energy Substation;
- Tenpin bowling centre;
- Castle Hill Country Club; and
- Business precincts with companies such as IBM and Woolworths.

Norwest Station to Burns Road Station

Norwest Station

Norwest Station would be located in Baulkham Hills. Land uses in the surrounding area include:

» Hillsong Church;

» Norwest Market Town;

» Hills Corporate Centre;

» Nortech Centre; and

» Capital Centre.

Norwest Station to Burns Road Station

This section traverses the suburbs of Bella Vista and Kellyville. Land uses vary from commercial in the southeast (in the vicinity of the Norwest Business Park), to new residential developments (the suburb of Bella Vista), to land proposed for future residential development (the Balmoral Road Release Area) to the northwest.

As part of the project, a significant construction work site is proposed in the Balmoral Road Release Area (further information on the Balmoral Road Release Area is provided in section 3.3). The main land uses in this area are the Kellyville Christmas Tree Farm and undeveloped (semi-rural) land associated with the Release Area.

Major arterial roads include Norwest Boulevard, Old Windsor Road and Balmoral Road.

Burns Road Station to Rouse Hill Station

Burns Road Station

The station would be located in Kellyville, near Old Windsor Road in the Balmoral Road Release Area. Land uses to the west of Old Windsor Road are mainly residential in recent subdivisions (Stanhope Gardens and Glenwood). To the east of Old Windsor Road are large, previously rural lots, forming the Balmoral Road Release Area. Transport infrastructure (Old Windsor Road and the North West Transitway) is located directly to the west. Tennis Land is located to the north, adjacent to Burns Road. The Kellyville Christmas Tree Farm is located to the south.

Burns Road Station to Rouse Hill Station

The corridor traverses mainly undeveloped land in Kellyville. Residential development in the vicinity includes relatively recent subdivisions to the west of Old Windsor Road, such as Stanhope Gardens (south of the intersection with Samantha Riley Drive) and Kellyville Ridge (north of the intersection with Windsor Road); and to the east of Old Windsor Road (Kellyville, located between the intersections with Samantha Riley Drive and Windsor Road).

The construction of the North West Transitway is underway, and is located to the east of Windsor Road.

Rouse Hill Station to the stabling facility

Rouse Hill Station

Rouse Hill Station is located to the east of Windsor Road, within an area that will be subject to development for the Rouse Hill Regional Centre. This would be a mixed used centre including retail, employment and residential uses as well as community facilities, parklands and urban squares. Higher density housing is planned. Further information is provided in section 3.3.

Existing surrounding land uses include the North West Transitway (to the east of Windsor Road), Castlebrook Cemetery and Crematorium (to the west of Windsor Road), undeveloped land to the northeast, east and southeast, and the Kellyville Country Golf Club further to the north.

Rouse Hill Station to the stabling facility

Land uses in the vicinity of the corridor include the Kellyville Country Golf Club to the east of Windsor Road towards the south of this section, and rural residential to the west of Windsor Road and north of Schofields Road towards the north of this section. The stabling facility would be located within Area 20, one of the precincts within the North West Growth Centre. Further to the east (east of Windsor Road) is a small area of commercial development and residential dwellings in the suburb of Rouse Hill.

Other land uses in the vicinity include a caravan park, a bicycle and walking track, Rouse Hill Cattery and Rouse Hill Regional Park. Rouse Hill Regional Park, which is approximately 115 hectares in size, surrounds the historic Rouse Hill House, built between 1813 and 1818. Rouse Hill Regional Park is managed by the NSW National Parks and Wildlife Service.

Second Ponds Creek meanders in a north-south direction, north of the proposed stabling facility, and through Rouse Hill Regional Park.

3.2.2 Traffic, transport, parking and access

Existing road network characteristics

The following major roads are located in the vicinity of the project:

» The M2 Motorway connects Epping Road at North Ryde with the M7 Motorway at Baulkham Hills. It is a freeway standard divided carriageway with two general travel lanes in each direction and bus lanes between Epping and Windsor Road. In 2006, the average weekday traffic volume reported by Transurban was approximately 93,500 vehicles per day.

» Beecroft Road connects Pennant Hills Road at Pennant Hills with the M2 and Epping Road at Epping. It is an undivided carriageway with two travel lanes in each direction. In 2002, the average annual daily traffic (AADT) at Cheltenham was approximately 34,200 vehicles per day.

» Pennant Hills Road (Cumberland Highway) connects Church Street at North Parramatta with the Pacific Highway at Wahroonga, linking the F3 Sydney-Newcastle Freeway at Wahroonga to the M2 and M7 Motorways at Pennant Hills. It is generally a divided carriageway with three travel lanes in each direction. In 2002, the AADT at West Pennant Hills was approximately 70,500 vehicles per day. Options have been proposed to directly link the F3 to M2, with the preferred option being a road tunnel beneath the existing alignment of Pennant Hills Road.

» Castle Hill Road connects Pennant Hills Road at Pennant Hills with Old Northern Road at Castle Hill. It is an undivided carriageway with two travel lanes in each direction. In 2002, the AADT at Rogans Hill was approximately 47,200 vehicles per day.

» Old Northern Road connects Baulkham Hills to Wisemans Ferry via Castle Hill. It is an undivided carriageway with two travel lanes in each direction. In 2002, the AADT at Rogans Hill was approximately 47,600 vehicles per day.

» Showground Road connects Old Northern Road at Castle Hill with Windsor Road at Kellyville. It includes an undivided carriageway with one travel lane in each direction in the eastern section to Carrington Road, and a divided carriageway with two lanes in each direction west of Carrington Road. In 2002, the AADT at Kellyville was approximately 42,900 vehicles per day.

» Old Windsor Road connects the Cumberland Highway at Old Toongabbie with Windsor Road at Stanhope Gardens. It is a divided carriageway with two or three travel lanes in each direction in the vicinity of the project. In 2002, the AADT at Balmoral Road, Kellyville was approximately 33,900 vehicles per day.

» Windsor Road connects the Cumberland Highway at Northmead with Macquarie Street at Windsor. It is a divided carriageway with two travel lanes in each direction in the vicinity of the project, currently under construction. In 2002, the AADT at Rogans Hill was approximately 47,200 vehicles per day.

Existing B-double routes

Designated B-double routes providing access to and from potential construction work sites are:

» Beecroft Road;

» Castle Hill Road;

» Old Northern Road;

» Showground Road;

» Windsor Road; and

» M7/M2.

3.2.3 Hydrology and drainage

The flooding and surface water management assessment (Appendix E) provides a summary of the existing hydrological environment in the vicinity of the project.

Water courses in the vicinity of the project are shown in Figure 3.6. The project traverses the floodplains of Caddies Creek and its tributaries. Caddies Creeks drains to Cattai Creek, a tributary of the Hawkesbury-Nepean River. In the Caddies Creek Catchment, the project interfaces with a number of tributaries draining to Caddies Creek, namely:

» Elizabeth Macarthur Creek;

» Seconds Pond Creek; and

» A number of smaller tributaries, referred to as Caddies Creek Tributaries 3, 4 and 5.

Elizabeth Macarthur Creek (southeast of Burns Road Station)

The catchment area draining to Elizabeth Macarthur Creek comprises approximately 130 hectares. The width of inundation is likely to be in the order of 50 metres wide during a 1%

annual exceedance probability (AEP) event and 120 metres wide during a probable maximum flood (PMF) event.

Caddies Creek Confluence

The Caddies Creek Confluence marks the confluence of Caddies Creek, a small tributary (Tributary 5) and Elizabeth Macarthur Creek. At this location the project emerges from cut and cover onto the Elizabeth Macarthur Creek floodplain.

The project is located parallel to the Elizabeth Macarthur Creek and traverses approximately 500 metres of the floodplain. Significant development has occurred to the east of Elizabeth Macarthur Creek and flood mapping indicates that these properties are not inundated in a 1% AEP event. However, it is probable that the properties are flood affected during a PMF event.

Caddies Creek passes under Old Windsor Road via a detention basin, which attenuates flood peaks for both existing and future development conditions. Tributary 5 also passes beneath Old Windsor Road and the North West Transitway via a series of box culverts.

The catchment area upstream of this point is approximately 1,019 hectares.

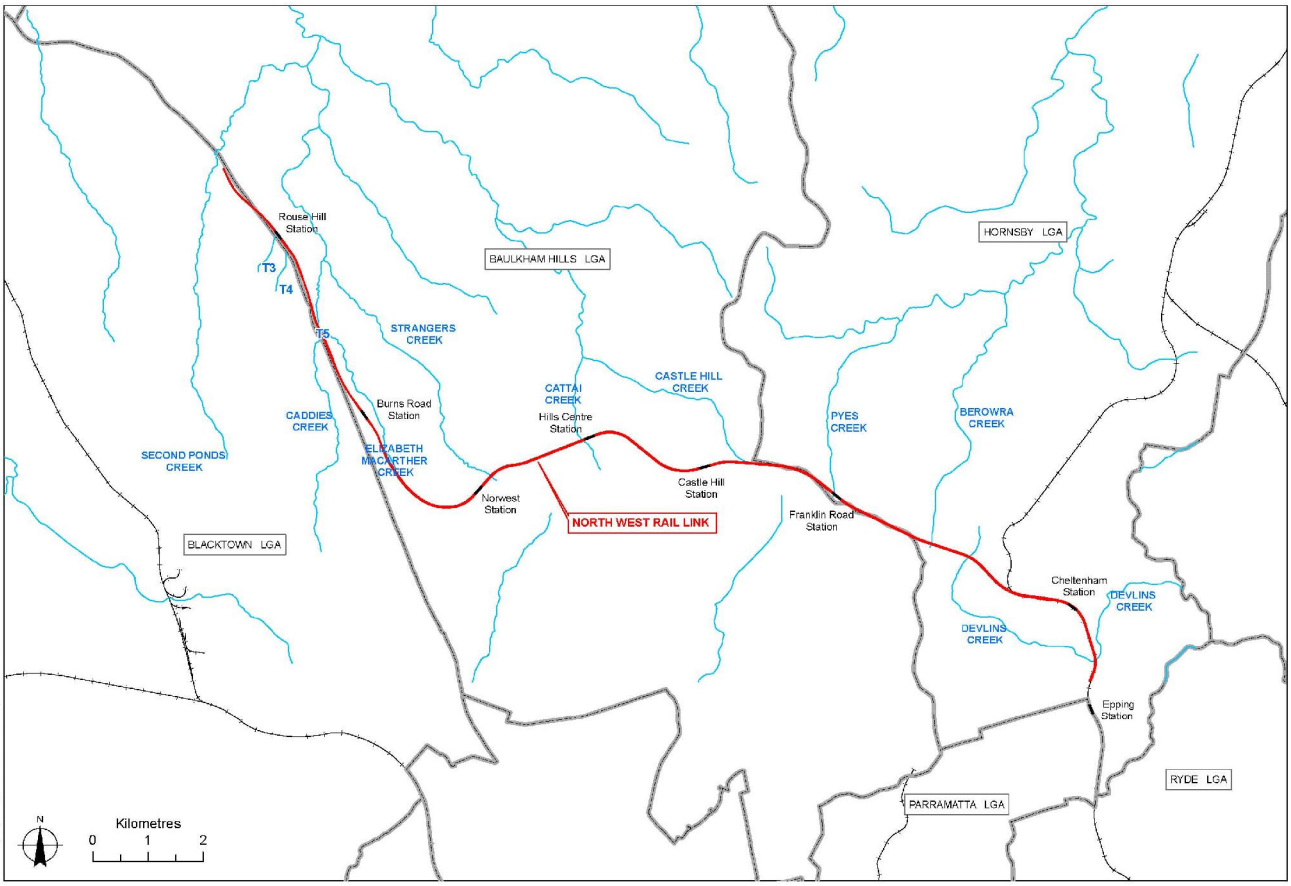

Figure 3.6 Water courses in the vicinity of the project

Tributaries

Where the project crosses Tributary 4, it would be located in a cut and cover tunnel. Tributary 4 passes under Windsor Road via a series of culverts capable of conveying the 1% AEP event. The road is overtopped during a PMF event, the magnitude of which is presently unknown. The extent of inundation at the creek crossing is approximately 60m wide during a 1% AEP event and no existing properties are known to be inundated during a 1% AEP event.

The catchment area of Tributary 4 upstream of the site is approximately 134 hectares.

Where the project crosses Tributary 3, it would be located in a cut and cover tunnel. Rouse Hill Station is located away from the creek centre line. It is unlikely that there would be an aboveground interface of the project with Tributary 3 during the operational phase.

Tributary 3 passes under Windsor Road via a series of culverts. The road is likely to be overtopped during a PMF event, the magnitude of which is presently unknown. The extent of inundation at the creek crossing is approximately 70-100 metres wide during a 1% AEP event and no existing properties are known to be inundated during a 1% AEP event.

The catchment area of Tributary 3 upstream of the proposed rail crossing is approximately 34 hectares.

Second Ponds Creek

The northwestern end of the project (the stabling facility) is located on the eastern edge of the Second Ponds Creek floodplain. The catchment area of Second Ponds Creek upstream of the project is approximately 625 hectares. The width of Second Ponds Creek inundation at the proposed stabling facility is approximately 180 metres during a 1% AEP Event and 350 to 400 metres during a PMF.

Drainage lines in the vicinity of the quadruplication

At the location of the quadruplication of the Northern Line, a number of smaller drainage creek crossings exist. These include the crossing of Devlins Creek at the intersection with the M2 Motorway.

3.2.4 Geology, hydrogeology and groundwater

Geology

The area in which the project is located is characterised by a flat lying stratigraphic sequence. A review of the 1:100,000 series geological maps for Sydney and Penrith reveal that the project is located within geological formations that predominantly include the Ashfield Shale, the Mittagong Formation and underlying Hawkesbury Sandstone.

The Wianamatta Group is the uppermost unit of the Permo – Triasic sediments occupying the central position within the Sydney Basin. Ashfield Shale comprises dark grey to black sideritic claystone and siltstone which grades upward to fine sandstones and siltstone laminate. Ashfield Shale occupies ridgelines and erosional slopes of higher ground along the proposed alignment. A wide variety of weathering profiles exist, from relatively fresh to highly weathered.

The Mittagong Formation is a transitional sequence between the overlying Ashfield Shale and underlying Hawkesbury Sandstone. The Mittagong Formation consists of alternating dark grey-

brown shale and sandstone. Within the corridor, intersections of between 0 to 6 metres are likely to be encountered.

Hawkesbury Sandstone is an orange-yellow-brown medium to coarse grained sandstone with inter bedded shale and siltstone laminate. The unit is estimated to be in the order of 200 metres thick within the vicinity of the corridor.

The northwestern extent of the project includes surface rail sections where the project would cross and incise relatively shallow deposits of unconsolidated Quaternary alluvial sediments, which form narrow floodplains for the northwest trending tributaries of Cattai and Caddies Creeks. These sediments generally comprise silty sands of varying nature.

Hydrogeology

The hydrogeology of the corridor has previously been interpreted by SKM (2002). It was noted that the study area contains four broad hydrogeological units, as summarised below.

Shallow alluvial sediments

The alluvial deposits occur along the narrow floodplains of the northwest flowing tributaries of Caddies and Cattai Creeks. These sediments reflect the character of their catchment geology - fine sandy and silty clay in the shale areas, silty sand in the sandstone areas.

Igneous dykes

Subsurface igneous dykes are a feature of the Sydney Basin and their direction reflects the joint direction in the bedrock. The nearest igneous dyke to the corridor, shown on the published 1:100,000 geological maps, is located approximately 2.5 km north, at Thornleigh. It appears to have intruded along the minor east-southeast trending joint direction in the area (SKM 2002).

Ashfield Shale (weathered and unweathered)

Ashfield Shale is the main geological unit along the corridor. The shale forms an impervious confining bed, however its hydrogeological characteristics vary with the degree of weathering and jointing.

The weathered shale profile is significant because of its lateral extent, covering most of the ground surface within the railway corridor. The weathering profile is typically 3 to 6 metres deep, with the topmost metre or so being residual soil and the remainder extremely to moderately weathered shale.

Hawkesbury sandstone

As reported by SKM (2002) this is the only potential source of groundwater in significant volumes close to the corridor. In some parts of the Sydney Basin, this formation contains aquifers. The Hawkesbury Sandstone is quartz rich sandstone, generally orange to yellow in colour, which is caused by migration of iron rich groundwater.

Groundwater

There seems to be some inconsistency in groundwater levels measured during previous studies. For example, one study showed that the water table could be as shallow as 2 to 6 metres while another suggested that the regional water table is generally at depths of 10 to 30 metres, and sometimes deeper than 50 metres.

However, within the variable weathering profile that exists within the Ashfield Shale unit, localised perched water tables could explain the variable nature of the groundwater level data that has been encountered from the various sources.

Groundwater quality

Only limited data is available on groundwater quality. The salinity of sandstone groundwater east of Castle Hill could be expected to be generally in the range of 1,000 to 3,000 mg/L, and west of Castle Hill it should be less salty, possibly 500 to 1,000 mg/L. It was also noted that sandstone groundwater can tend to be acidic, with pH values of 5.5 or less. The unweathered shale is generally impervious, though small quantities of groundwater may be encountered with salinities in the range 5,000 to 20,000 mg/L, and up to 32,000 mg/L. Unweathered shale is generally overlain by weathered shale to a depth of 3 to 6 metres.

The weathered shale is relatively pervious, and the groundwater within the shale is of fairly low salinity, or the order of 500 to 1000 mg/L total dissolved solids.

The quality of groundwater inflowing into existing tunnels in the Sydney Basin is generally high in iron, and may contain manganese and other contaminants. It also has a relatively high level of total dissolved salts and a low pH.

3.2.5 Soils

Soils

The proposed alignment passes through a variety of soil landscapes, including Gymea, Glenorie, and Luddenham (erosional soil types); Hawkesbury Sandstone and West Pennant Hills (colluvial soils); South Creek (a fluvial soil); and Blacktown (a residual soil).

Salinity/dispersive soils

Salinity is associated with the 'shale' areas. These areas have low permeability, and are prevalent to waterlogging/evaporation in poor drainage areas, which can concentrate salts near the ground surface. In particular, such soils are derived from shale bedrock formed in saline conditions and thus containing trapped (connate) salt as well as a continuing atmospheric salt load due to the proximity of the route to the coast.

According to the Map of Salinity Potential in Western Sydney (published by the Department of Natural Resources in 2002), approximately 90% of the project lies within/below areas of moderate to high salinity potential. Moreover, the majority of the surface sections are in lower landscape areas of high salinity potential and known salinity affectation.

Acid sulphate soils

Acid sulphate soils are associated with marine/estuarine areas, generally below about 10 metres Australian height datum, where sulphate from seawater has combined with iron within sediments (under anaerobic conditions) to form pyrite, which on exposure creates sulphuric acid. These soils and are not expected within the proposed alignment.

Other acid soil/rock considerations that can occur include materials that are potentially acid forming due to their natural mineralogical composition. It is considered unlikely that such materials would be encountered along the route.

3.2.6 Flora and fauna

Flora

Vegetation along the corridor is variable, with the majority of the project passing through developed urban areas. These areas support predominantly planted trees and urban gardens.

The proposed quadruplication area within the rail corridor from Epping to Beecroft varies in vegetation type from areas with a high proportion of invasion by exotic species, and some small areas of remnant native vegetation communities with intact native understorey likely to represent remnant stands of the endangered ecological community Sydney Turpentine - Ironbark Forest.

Some remnant vegetation occurs within parklands and urban environments in the vicinity of the corridor, including an area with structure and canopy species composition characteristic of the endangered Blue Gum High Forest.

North of the Norwest Business Park the corridor passes through a semi-rural area with open areas of remnant trees characteristic of the endangered Cumberland Plain Woodland, terminating in an uncleared area of Cumberland Plain Woodland with a greater diversity of characteristic species. The majority of the above ground portion of the corridor passes through existing development areas, residential properties and grazed pastures with scattered trees. Much of this area is affected by the European Wild Rabbit (*Oryctolagus cuniculus*), considered to be a pest species.

The endangered ecological community, River-flat Eucalypt Forest on Coastal Floodplains, is present along watercourses that run along the corridor at varying distances from the corridor. These riparian areas vary in terms of the level of invasion by exotic species, from high to low.

Vegetation communities recorded along are described below. Four of these (indicated with an asterisk*) are endangered ecological communities listed under the *Threatened Species Conservation Act 1995* (TSC Act). These communities were distributed throughout the study area and were of varying quality.

*Blue Gum High Forest**

One potential stand of Blue Gum High Forest is located at the proposed site of the Franklin Road Station and another isolated stand of Sydney Grey Gum (*E. saligna*) is located within the rail corridor between Epping in Cheltenham on the western side of the corridor amongst a stand of Spotted Gums.

*Cumberland Plain Woodland**

Cumberland Plain Woodland is present north of Norwest Business Park, adjacent to Old Windsor Road within rural properties in this area. This community is patchy in its stands with varying levels of remnant species and transitions in canopy species.

At the northern end of the proposed alignment an uninhabited parcel of land contains uncleared woodland that provides connectivity with woodland to the west and north. This area adjoins vegetation along Second Ponds Creek and contains species characteristic of both River-flat Eucalyptus Forest and Cumberland Plain Woodland. This area is likely to contain species

characteristic of both communities as a transition zone between the two. Extensive grazing by the European Wild Rabbit is evident.

*Sydney Turpentine - Ironbark Forest**

Sydney Turpentine - Ironbark Forest is located within the rail corridor between Cheltenham and Beecroft Stations on the east and west side of the corridor. On the western side, closer to Beecroft Station, a narrow strip occurs along the edge of the rail corridor and represents a disturbed area with access paths and a small amount of weed invasion. On the eastern side of the corridor, this community is located on the edge of a steep embankment of the rail corridor, bordered by a cleared access path along a fence line. There is little weed invasion within this stand.

This community has experienced significant disturbance, with a high level of weed invasion and weed diversity along the creek line. Further up the embankment there is an area of native vegetation with species characteristic of this endangered community. While the understorey is characteristic of this community the canopy species were difficult to identify due to a high scale of dieback of the larger trees.

*River-flat Eucalypt Forest on Coastal Floodplains**

River-flat Eucalypt Forest on Coastal Floodplains is present along Elizabeth Macarthur Creek, Caddies Creek and Strangers Creek. This community exists in the area with varying degrees of disturbance and weed invasion. More intact areas are present further from areas impacted by human access and activities.

Native grassland

Native Grassland is restricted to a small piece of land at the rear of a property off Balmoral Road. Native grasses in this community included Threeawn Speargrass, Kangaroo Grass, *Eragrostis* sp. and Two-colour Panic (*Panicum simile*). A number of exotic species were also present including *Verbena* sp. and Fireweed (*Senecio madagascariensis*). There were scattered Narrow-leaved Ironbarks throughout this grassland which were more densely present adjacent to this area.

Pasture/open grass

Areas of pasture within private properties are scattered regularly throughout the study area along the corridor. These areas are either used as grazing pastures or left as open pastures with varying levels of maintenance. These areas contain predominantly introduced species with occasional native species. Scattered trees occur including Narrow-leaved Ironbark (*Eucalyptus crebra*), Forest Red Gum (*E. tereticornis*) and Grey Box (*E. punctata*).

Planted and garden areas

Planted and landscaped gardens are common as the corridor passes through urban residential areas and landscaped business areas.

Development sites

Development sites where land clearance has occurred were present along Windsor Road. Land clearance has removed all vegetation with the exception of occasional roadside strips of trees such as Grey Box.

Fauna

The majority of the project passes through highly modified urban and commercial environments as described above, and therefore provides limited potential fauna habitat. Areas that exist provide potential habitat for woodland birds, some bat species and arboreal mammals.

Remnant vegetated areas are also isolated from large areas of bushland, with the exception of the northern end of the proposed alignment where the vegetation is linked with a larger intact area of vegetation. This isolation into small remnant areas also limits the suitability and likelihood of an area supporting substantial populations of fauna, threatened or otherwise.

The urbanised and modified nature of much of the area provides habitat for a number of introduced and feral species such as European Red Fox (*Vulpes vulpes*), European Wild Rabbit and Domestic Dog (*Canis familiaris*), all of which were recorded from scats, direct observation or residents' observations (of the Red Fox) during the current field assessments.

Cumberland Plain Woodland in the northern portion of the route provides suitable habitat for the endangered (TSC Act) Cumberland Land Snail (*Meridolum corneovirens*), notably open woodland with leaf litter and other debris. A specimen collected during the current surveys was identified by the Australian Museum as a Cumberland Land Snail, confirming the presence of this species within the study area.

3.2.7 Indigenous heritage

The archaeological assessment of indigenous heritage undertaken for the project (refer Appendix G) identified that the potential for intact archaeological deposits is low for most of the corridor. No areas were identified as being in pristine condition, and the few areas of land with moderate to good potential for archaeological deposits are restricted to small parcels of land with at least some degree of previous land use impact.

The study area falls within the boundaries of the Deerubbin Local Aboriginal Land Council. It is also within an area of interest to the Darug Custodial Aboriginal Corporation, the Darug Tribal Aboriginal Corporation and Darug Aboriginal Cultural Heritage Assessments.

A number of large-scale investigations have been undertaken in the vicinity of the project. As such, a number of sites have been recorded in the local area. A search of the Australian Heritage Information Management System database (July 2006) and a review of the previous studies undertaken within the local area revealed 59 sites previously identified within 1 km of the proposed alignment. Fifteen of these sites occur within 100 metres of the proposed alignment (refer Figure 3.7 of Appendix G for more detail). These are predominantly open camp sites, isolated finds and areas of potential archaeological deposit. Also occurring locally are shelters and axe grinding grooves, though none of these site types are located within close proximity of the project.

The survey undertaken for the environmental assessment (refer Appendix G) resulted in the identification of three previously unrecorded Aboriginal sites: two open lithic scatters with associated potential archaeological deposit (BR01 and CR01) and one open lithic scatter (FR01). Of the 15 previously identified sites and PADs within the corridor, four have had consent to destroy permits (under section 90 of the *National Parks and Wildlife Act 1974*) already issued. Of the remaining 11 sites and PADs, five were relocated. All sites and PADs

are assessed on the basis of their potential for containing intact archaeological deposit founded on the results of the current survey, existing disturbance and landscape parameters.

Archaeological sensitivity mapping was undertaken for the project, based on land-use effects throughout the study area. There are no areas of very high archaeological potential identified, given the high rate of urban and industrial development along the proposed alignment. Some areas of moderate archaeological potential have been identified.

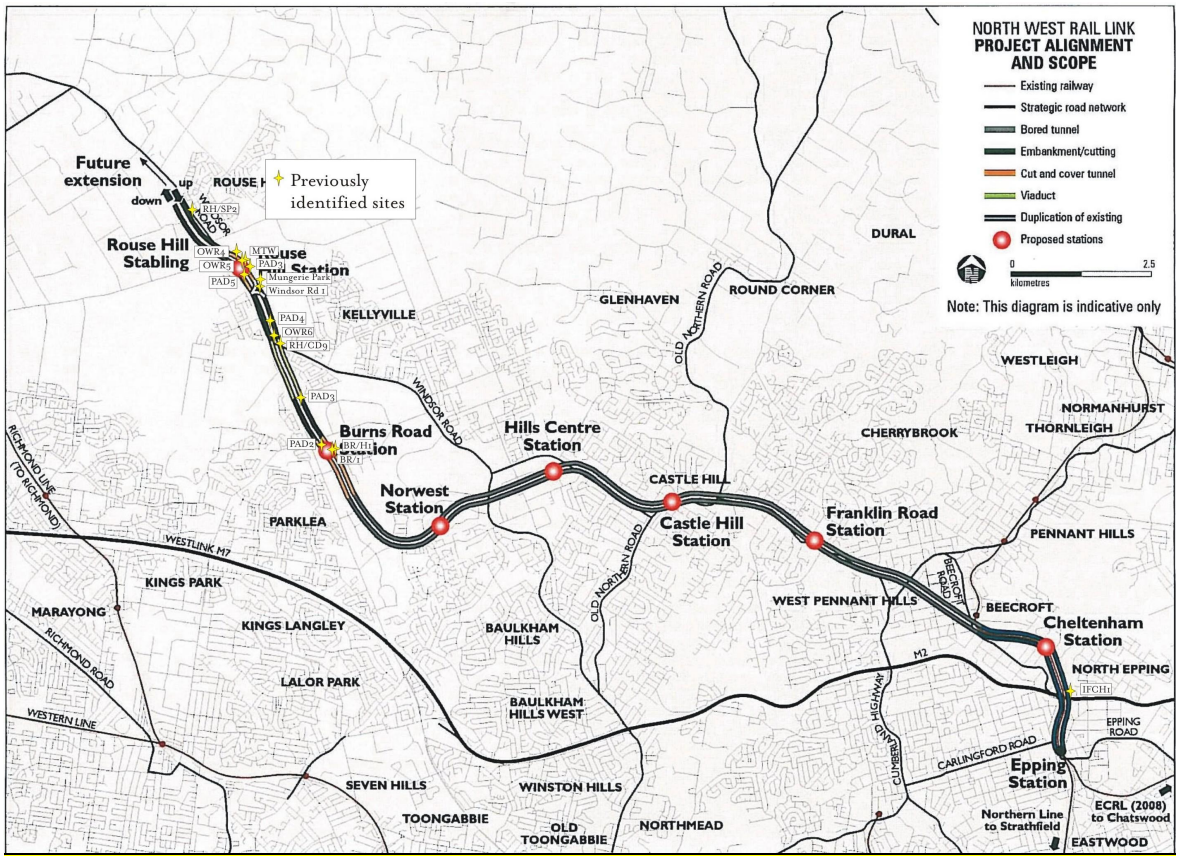

Figure 3.7 Location of previously identified sites within 100 metres of the proposed alignment

3.2.8 Non-indigenous heritage

The heritage review (refer Appendix H) identified that the main identified heritage items in the vicinity of the project are houses listed on heritage instruments, mainly Council Local Environment Plans (LEPs). The majority of identified heritage items are built structures in the Beecroft and Castle Hill areas. The project was divided into six sections for consideration during the heritage review, and the results are described below. A full listing for each of the sites/items identified is provided in Appendix H.

Quadruplication section – North of Epping Station to Beecroft

The area of the quadruplication from the M2 Motorway to and including the tunnel portal area is located within the Beecroft Heritage Conservation Area, however the rail corridor itself is not a listed item.

Vegetation between Carlingford Road and Kandy Avenue is listed as a heritage item by the Hornsby LEP.

Tunnel section – Portal to Franklin Road Station

The portal is partly contained beneath the Beecroft Village Green (identified as item #22 in the heritage review). The listing for the Village Green specifically mentions the 'stand of indigenous remnant forest trees'.

Beecroft Conservation Area

In addition to Beecroft Village Green, there are 13 items listed on Hornsby's LEP located above the tunnel alignment. These comprise individual houses, street trees and other buildings.

Franklin Road Station

Two heritage items have been identified in the vicinity of the proposed Franklin Road Station. Inala School (item #49) is situated on the eastern side of Franklin Road and item #54 is another listed house on the southern side of Castle Hill Road. In addition, two potential archaeological sites are located (items #123 and #124) fronting onto Franklin Road.

Heritage items in the Hornsby Local Government Area

Five heritage items listed on the Hornsby LEP are located above the proposed tunnel alignment. Three items listed on the Hornsby LEP and two unlisted heritage items are less than 50 metres from the tunnel alignment or works area.

Heritage items in the Baulkham Hills Local Government Area

Two heritage items listed on Baulkham Hills LEP are located above the tunnel alignment; one is located less than 50 metres from the tunnel alignment or works area, and one is located 50 to 100 metres from the tunnel alignment or works area.

Tunnel section - Franklin Road Station to Norwest Station

This section is within the Baulkham Hills LGA. Eight listed heritage items are located within the vicinity of the tunnel alignment; four are located less than 50 metres from the tunnel alignment or works area, and one is located 50 to 100 metres from the tunnel alignment or works area.

Castle Hill Station

A 1947 aerial photograph shows a garden area with paths and a large building at either end of the station area (item #129) however, the nature of these buildings is unknown. It is possible that some remains of the Parramatta to Castle Hill tramway are in the vicinity of Castle Hill Station.

Hills Centre Station

There are no listed items of heritage significance in this area. Two potential archaeological sites are located in this area (items #125 and #126).

Norwest Station

There are no known heritage items in the vicinity of the proposed station. Bella Vista homestead (item # 130), listed on the State Heritage Register, is located approximately 1.5 km to the southwest of the proposed station area.

Surface section – Norwest Station to Windsor Road

This section is within the Baulkham Hills LGA. There are no identified items in the vicinity of Burns Road Station, the tunnel portal or cut and cover section.

In the Burns Road to Windsor Road section, the only known heritage site is an archaeological site south of Samantha Riley Drive (item #74).

Other identified heritage items along Old Windsor Road are an original alignment of the roadway (item #73, within 50m of the project), now replaced by the adjacent four-lane roadway. Three items listed on the RTA's section 170 register are also noted as being within 50 metres of the proposed tunnel alignment or works area.

Surface section – Windsor Road to Rouse Hill

This section is within the Baulkham Hills LGA. The Mean Fiddler (The Royal Oak Inn) (item #87) is listed on the Baulkham Hills LEP and also on the State Heritage Register, and is located 50 to 100 metres from the tunnel or works area. The inn (circa 1826) fronts directly onto Windsor Road.

An archaeological site (item #79) thought to be the 1830s site of the Swan Inn, located on Windsor Road (immediately adjacent to the project) is listed on Baulkham Hills LEP.

Mungerie House (item #82) is listed on Baulkham Hills LEP and is less than 50 metres from the project. The house probably dates to the 1890s and contains sites of various outbuildings.

The Battle of Vinegar Hill site is located within Castlebrook Cemetery (over 250 metres from the project) and is listed on Blacktown LEP.

In addition to the abovementioned items, there are four items listed on the RTA's section 170 register and two unlisted items.

Surface section – stabling facility

This section is within the Blacktown LGA. There are no listed heritage items or known archaeological sites in the immediate vicinity of the stabling facility.

The Rouse Hill Estate is located approximately 1.2 km to the northwest of the proposed stabling facility. Rouse Hill House (item #128) is listed on the State Heritage Register. The house is regarded as one of the most substantial and complete houses from the Macquarie period (1810-1822), while the estate generally is regarded as being possibly unique in its chain of occupancy, extensive colonial garden, collection of outbuildings and relationship to the landscape.

3.2.9 Visual and urban design context

The urban design and visual assessment (refer Appendix I) provided the following information on the visual and urban design context of the project.

Topography, vegetation, natural processes and built form inter-relate to create a series of unique visual settings and local identities over the length of the project. Many of the landscapes have been modified during urban development. This includes traditional and well-established suburbs, town centres, and new residential subdivisions. New residential subdivisions are continuing to develop near the project, which will continue to affect the landscape character.

Epping to Beecroft

The area is a residential suburb with a large number of mature trees and stands of vegetation. North of the M2 Motorway the urban fabric is a predominantly a low density built form including detached mixed residential dwellings and schools. South of the M2, the urban form consists of a taller and bulkier built form, including three storey apartment buildings and commercial premises.

Franklin Road Station

The Franklin Road Station area is a small pocket of residential land with large lots, characterised by tall mature trees, large lots and modest buildings and schools. To the north and south of this pocket of land, the landscape is characterised by subdivisions undertaken mainly in the 1970s to 80s.

Castle Hill town centre

This area is dominated by a more intense urban form, including office blocks, large multi-storey shopping complexes such as the Castle Towers Shopping Centre, and strip shopping streets.

Hills Centre

The proposed Hills Centre Station is located in an area of mixed residential, commercial, light industry and open space. The character of the area reflects the mix of uses, which include the rural setting of the showground, the civic setting of the Council buildings, low density residential development on Carrington Street and large industrial factory/warehouse sites to the south.

Norwest Business Park

Norwest Station is located in a business park, which has an industrial/commercial character, bordered to the northwest by open space and to the southeast by recent residential developments.

Norwest to Burns Road Station

This section is located in an open landscape character of rural/pastureland interspersed with semi-rural residential lots. The character is changing rapidly with future subdivision likely to form a landscape of low to medium density residential developments with some commercial/light industrial activities.

Burns Road Station

Built form near the rail line is typically one to two storey detached dwellings on large lots of about two hectares with a number of outbuildings, sheds etc. In the adjoining areas (such as Stanhope Gardens and Parklea) the built form is low density residential, with detached housing on small to medium sized lots.

Burns Road Station to Rouse Hill Station

This area is dominated by the busy transport corridor of Old Windsor Road / Windsor Road running north to south through the landscape. The roads are bordered by a pedestrian/cycleway to the west and the North West Transitway (under construction) to the east, creating a strong linear corridor with a clear transportation character.

The landscape is dominated by the low lying floodplain of Caddies Creek. To the south the precinct has a semi-rural character. Elsewhere there are scattered pockets of new residential development such as the Newbury Estate on the western side of Old Windsor Road. The Balmoral and Rouse Hill Release Areas to the east and Castlebrook Release Area to the west would form the proposed future residential subdivision character of low-density single detached dwellings.

Rouse Hill Station

The site on which the station would be located is currently being developed for the Rouse Hill Regional Centre (see section 3.3).

Stabling facility

The area is currently surrounded by semi-rural residential lots. It is part of the visual catchment of Rouse Hill Regional Park.

3.3 Planned future development

3.3.1 Residential development

To cater for Sydney's future housing requirements, the Metropolitan Strategy has identified a requirement of 445,000 new dwellings in established areas and 195,000 new dwellings in greenfield areas by 2031.

Existing urban areas

According to the Metropolitan Strategy, approximately 60-70% of new dwellings would be located in existing urban areas, focused around centres and corridors. Established residential areas such as Castle Hill and areas located near public transport modes are likely to experience a degree of consolidation through increased housing density and development. For example, there are a number of apartment buildings currently being developed in the vicinity of the Castle Hill centre. Planned development in new release areas in the vicinity of the project includes land at Kellyville (the Balmoral Road Release Area) and the Rouse Hill Regional Centre.

Balmoral Road Release Area

The Balmoral Road Release Area is located in the Baulkham Hills LGA in the vicinity of Balmoral Road and Burns Road. It was originally identified as an urban release area under the State Government's Urban Development Program in 1998.

The Balmoral Road Local Environmental Plan was gazetted on 13 April 2006. This plan rezoned rural land to allow development of the release area. The release area, which has an area of approximately 500 hectares, adjoins the suburbs of Kellyville, Bella Vista and Castle Hill. It is proposed to accommodate approximately 15,000 people and 6,000 dwellings. Other

proposed land uses include a transit interchange/transitway stop in the vicinity of the proposed Burns Road Station, commercial and employment development, public services and facilities such as open space and schools.

The part of the land release area that is partially affected by the project has been identified and zoned as land for railway purposes by the Balmoral Road Local Environmental Plan.

Rouse Hill Regional Centre

Located south of Commercial Road and east of Windsor Road, the site for the Rouse Hill Regional Centre was identified more than 20 years ago by the NSW State Government as a major regional centre.

In October 2003, the Lend Lease Corporation Limited (Lend Lease) and General Property Trust (GPT) joint venture were announced as the successful partner with the (then) Department of Infrastructure, Planning and Natural Resources (now Department of Planning) and Landcom to develop the Rouse Hill Regional Centre on land owned by the NSW Government. It was noted that 'the proposed Rouse Hill Regional Centre will set new benchmarks for environmentally and socially sustainable communities and includes over 1,500 residential lots, a mixed-use town centre, and improved transport infrastructure, to be developed over a 10-year period.'

In March 2006, Lend Lease and GPT Group announced that they had satisfied their conditions to allow development (referred to by the developers as 'The New Rouse Hill') to commence. The project is estimated to have a value of approximately $1.4 billion, comprising approx $1 billion of residential and commercial development by the Lend Lease/GPT Group joint venture and the $470 million Town Centre by GPT Group. The first stage of development will involve the Rouse Hill Town Centre, including:

» The 70,000 m^2 town centre comprising retail, learning and commercial space to be owned and developed by The GPT Group;

» More than 100 apartments within the town centre to be developed by the Lend Lease/GPT joint venture; and

» A new library and community centre committed to by Baulkham Hills Shire Council.

The developers have also submitted a Precinct Plan Development Application for the first residential neighbourhood. This neighbourhood, bordering (the extended) Sanctuary Drive, will be a mixture of land lots and completed homes. Development of this area is expected to occur in 2006/2007.

North West Growth Centre/Area 20

Only a small section of the project is located within the North West Growth Centre, in the southeastern section of the Growth Centre, within Area 20.

In December 2004, the NSW Government announced the new land release plan for the South West and North West Growth Centres as a key part of the Metropolitan Strategy for Sydney. The Growth Centres are defined areas in Sydney's North West and South West. They are proposed to accommodate between 30 and 40 percent of Sydney's long term housing growth, eventually accommodating approximately 181,000 new homes.

The Growth Centres Commission is responsible for managing the future development of housing and infrastructure in the Growth Centres in consultation with local Councils and government agencies. *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (the Growth Centres SEPP) provides the initial environmental planning instrument component of the Metropolitan Strategy for the growth centres.

The North West Growth Centre is approximately 10,000 hectares in area and includes 16 precincts, which will contain approximately 66,000 new homes. The first precincts to be released include Alex Avenue, North Kellyville, Riverstone, Area 20, Colebee, and Riverstone West. The precincts in the North West Growth Centre are shown in Figure 3.8.

Area 20 is proposed to include approximately residential 1,500 lots and precinct planning is expected to commence in 2007/2008 to guide future development of this precinct.

In this area, the project extends from the corner of Schofields Road and Windsor Road for approximately one kilometre, to south of Rouse Hill Regional Park. In the future, the North West Rail Link could be extended further into the North West Growth Centre beyond Rouse Hill, however this does not form part of the current project for which approval is sought.

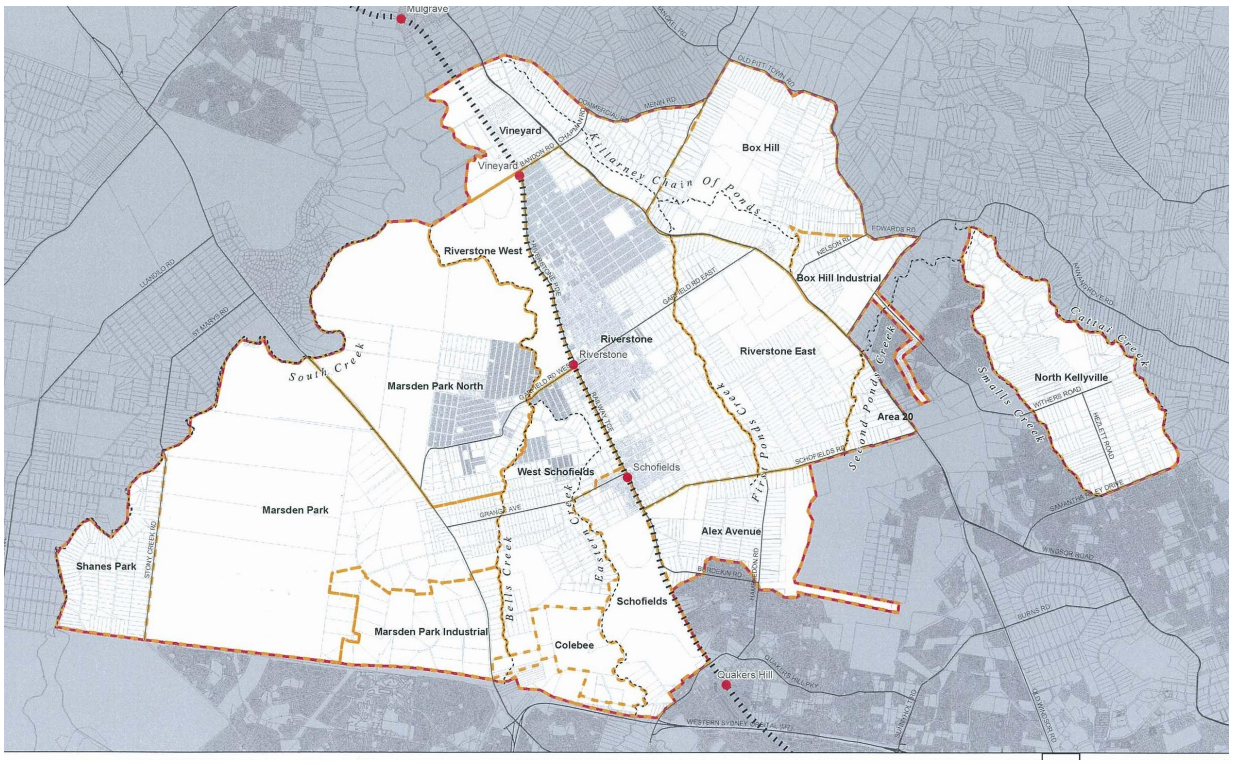

Figure 3.8 North West Growth Centre precincts

Source: Sydney Metropolitan Strategy

3.3.2 Economy/business

Castle Hill

Castle Hill has been identified as a major centre by the Metropolitan Strategy. Major centres are defined by the Metropolitan Strategy as centres that encompass the major shopping and business centre for the surrounding area with a full scale shopping precinct, office buildings, residential buildings and central community facilities.

Accordingly, development/redevelopment is likely to be targeted in Castle Hill and an employment capacity target of 12,000 persons by 2031 has been identified, up 32% from the 2001 employment figures of 9,091.

Norwest Business Park

The Metropolitan Strategy defines specialised centres as areas of high value economic activity. Specialised centres, such as the Norwest Business Park, are targeted to provide industrial premises. As a guide to potential future development, the Norwest Business Park has an employment capacity target of 15,000 by 2031, up 322% from the 2001 employment figures of 4,651.

Rouse Hill Regional Centre

The Rouse Hill Regional Centre has been identified in the Metropolitan Strategy as a planned 'major centre' with a key role in economic and business development. The structure plan for the North West Growth Centre also identifies the Rouse Hill Regional Centre as a major centre.

Development/redevelopment is likely to be targeted in Rouse Hill and an employment capacity target of 9,000 persons by 2031 has been identified, up 861% from the 2001 employment figures of 937. Approximately 150,000m^2 of mixed retail/commercial space is proposed.

3.3.3 Infrastructure

Roads and transport

Plans exist for a potential link between the M2 Motorway and the F3 Freeway. In addition, roads within the vicinity of the project subject to potential upgrading and extensions include:

- Old Windsor Road Upgrade to Schofields Road;
- Schofields Road;
- Garfield Road;
- Burns Road / Memorial Avenue;
- Grade-separation of Burns Road/Sunnyholt/Windsor Road Junction;
- Grade-separation of Schofields Road/Windsor Road Junction; and
- Possible widening of the M2 Motorway.

Bus corridors

The Metropolitan Strategy outlined the NSW Government's plan to establish a network of strategic bus services to connect centres, consistent with the 2004 'Review of Bus Services in NSW.'

A network of 43 strategic bus corridors are progressively being implemented to provide fast, frequent, direct and convenient links to regional centres and major patronage generators. These routes will be supported by bus priority measures including bus-only lanes, queue-jumps, bus signals etc, and the intelligent transport system known as PTIPS.

Strategic bus corridors recommended for North West Sydney include:

» Route 3 – Castle Hill to Blacktown and Wetherill Park (part of in the North West Transitway Network);

» Route 5 – Castle Hill to Hornsby;

» Route 6 – Castle Hill to Epping;

» Route 40 – Castle Hill to Parramatta; and

» Route 42 – Rouse Hill to Parramatta (part of the North West Transitway Network).

These bus services would connect with the project at Castle Hill, Burns Road and Rouse Hill.

The North West Transitway

Construction on the North West Transitway project started in June 2005. This $524 million project will establish bus lanes on some existing local roads and new bus only roadways. Bus services are expected to commence by late 2007.

The North West Transitway includes:

» A 17 km link from Parramatta to Rouse Hill, primarily adjacent to Old Windsor Road and Windsor Road;

» A 7 km link from Blacktown to Parklea, adjacent to Sunnyholt Road; and

» 30 stations.