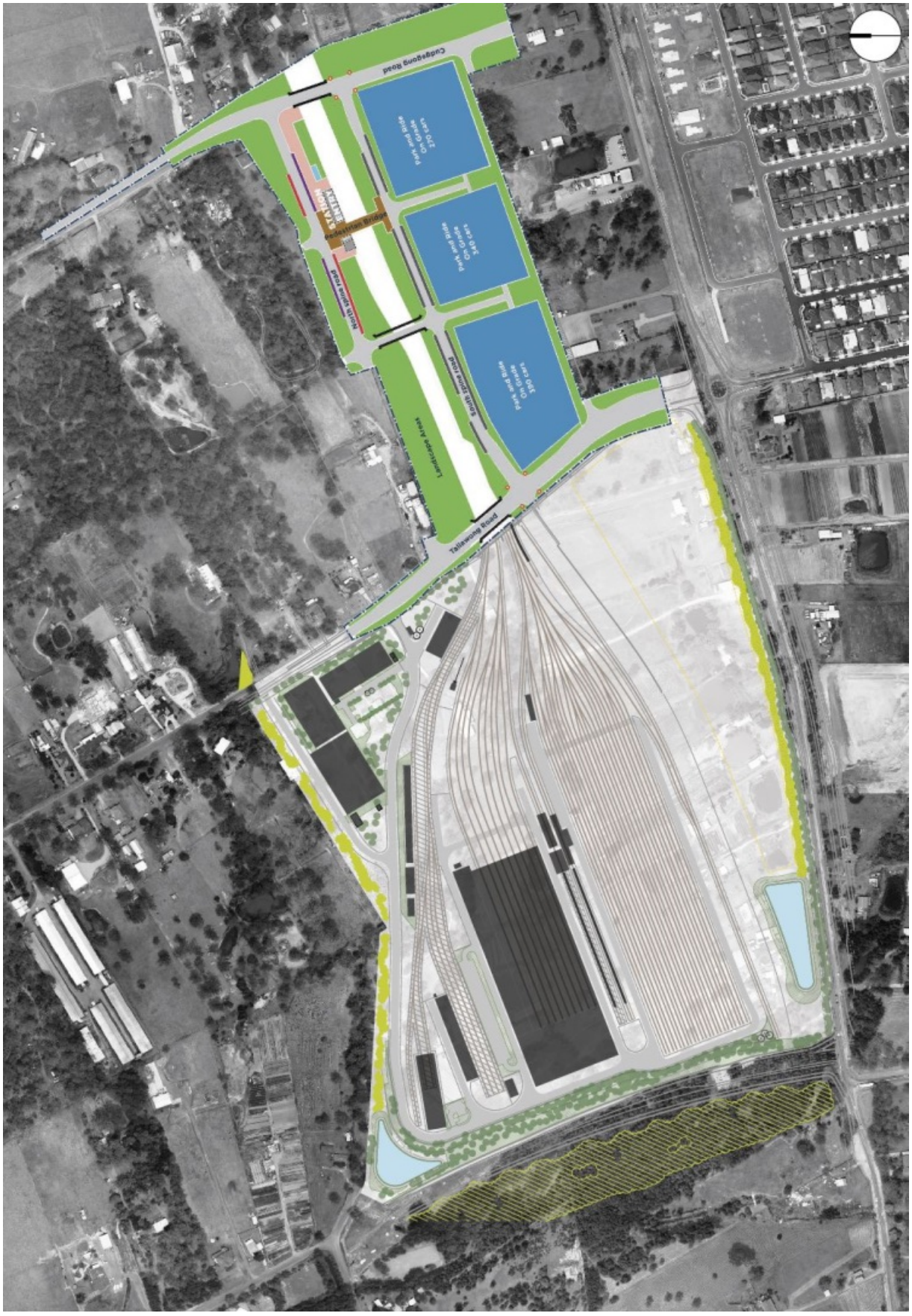

Figure 17 – RTRF and Cudgegong Road Station Precinct

Formal Land Description and Ownership

The legal description of the site is included in **Table 5**. The land is currently owned, or is in the process of being acquired by TfNSW. Particularly, all of the land which is subject of the approved NWRL stabling and maintenance is in the ownership of TfNSW. The remaining land will be subject of property acquisition by TfNSW in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.

In accordance with clause 193 of the *Environmental Planning and Assessment Regulation 2000* the consent of the owner of the land on which State significant infrastructure is to be carried out is not required where the proponent is a public authority. TfNSW has notified the affected land owners in accordance with the requirements of the Regulations.

Table 5 – Land subject to the application and property acquisition

Lot and DP	Street Address	Relationship to NWRL Site	Ownership
27/30186	47 Tallawong Road, Rouse Hill	Expansion	To be acquired by TfNSW
28/30186	51 Tallawong Road, Rouse Hill	Expansion	To be acquired by TfNSW
29/30186	57 Tallawong Road, Rouse Hill	Expansion	To be acquired by TfNSW
28/39341	5 Oak Street, Schofields	Expansion	To be acquired by TfNSW
29/39341	2 Oak Street, Schofields	Expansion	To be acquired by TfNSW
27/39341	68 Gordon Street, Schofields	Expansion	To be acquired by TfNSW
26/30186	31 Tallawong Road, Rouse Hill	Part of NWRL Site Area	TfNSW
16/39303	51 Schofields Road, Schofields	Part of NWRL Site Area	TfNSW
17/39303	53 Schofields Road, Schofields	Part of NWRL Site Area	TfNSW
18/39303	55 Schofields Road, Schofields	Part of NWRL Site Area	TfNSW
19/39303	57 Schofields Road, Schofields	Part of NWRL Site Area	TfNSW
20/39303	59 Schofields Road, Schofields	Part of NWRL Site Area	TfNSW
21/39303	61 Schofields Road, Schofields	Part of NWRL Site Area	TfNSW
25/27220	63 Schofields Road, Schofields	Part of NWRL Site Area	TfNSW
24/27220	65 Schofields Road, Schofields	Part of NWRL Site Area	TfNSW
23/27220	67 Schofields Road, Schofields	Part of NWRL Site Area	TfNSW

Draft Cudgegong Road Structure Plan

The Draft Cudgegong Road Structure Plan includes the RTRF site. The draft structure plan was publicly exhibited between 16 March and 30 April 2013. Employment uses are proposed for the land on which the RTRF is to be located.

5.3 Surrounding Development

Development in the immediate vicinity of the subject site includes a range of low-medium density housing, rural residential, agricultural and market garden uses. Despite the current character of existing development, land use and development patterns within the site's surrounds are expected to change dramatically during the planning, construction and future operational phases of the RTRF.

In particular, the Draft Cudgegong Road Station Structure Plan provides for the land to the north and east of the site (as well as the site itself). Land to the west and south is provided for through the strategic planning, and rezoning, carried out by the Growth Centres Commission as part of the North West Growth Centre, including:

- Alex Avenue Precinct within the North-West Growth Centre to the south of the site.
- Riverstone Precinct within the North-West Growth Centre to the west of the site.

The existing and future development context of the site's surrounds are described below in the context of the above plans. A consolidated plan has been prepared, see **Figure 18**,

which shows the zoning for Alex Avenue and Riverstone Precents under the North West Growth Centre as well as the proposed future land use established in the Draft Cudgegong Road Station Structure Plan.

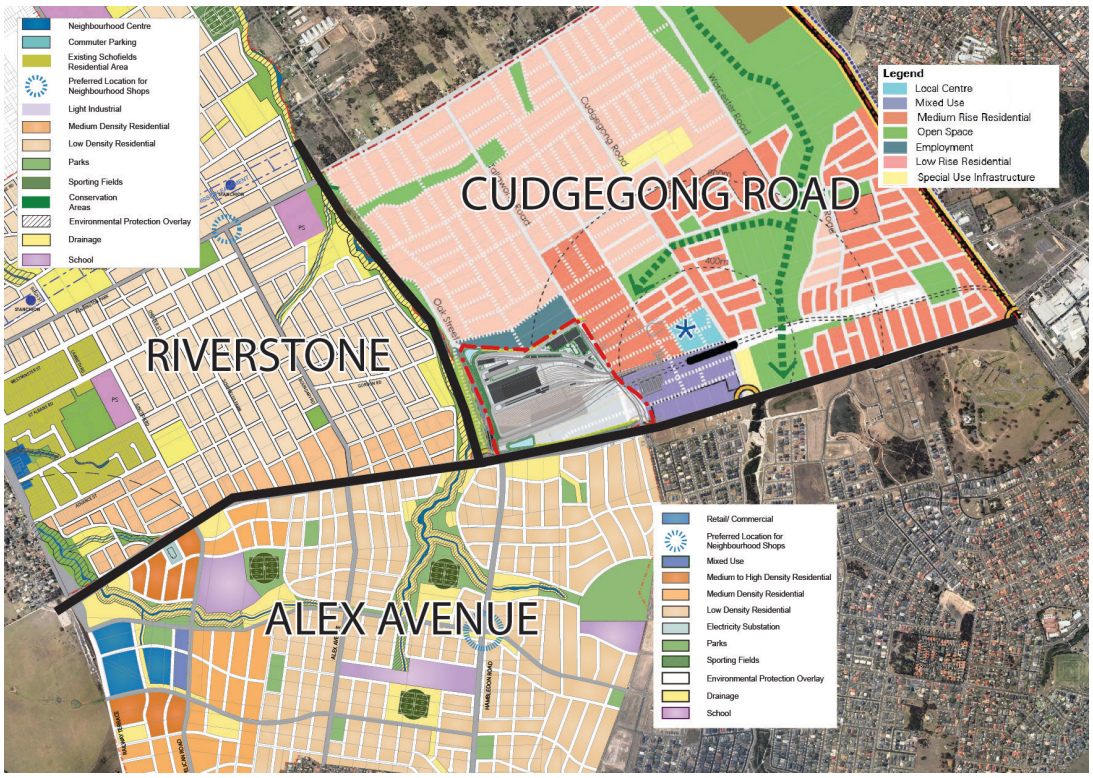

Figure 18 – Indicative Layout Plans for Riverstone and Alex Avenue Precincts (North West Growth Centres) and Structure Plan for Cudgegong Road Station Precinct (NWRL Precincts)

5.3.1 Development to the South

Schofields Road

The site is bounded to the south by Schofields Road, a two-lane road which is currently in the process of being upgraded to a four-lane road by the Roads and Maritime Service (RMS). Stage 1 of the Schofields Road upgrade (Windsor Road to Tallawong Road) was approved under Part 5 of the EP&A Act in 2009 and is currently under construction, with works expected to be completed by late-2014.

Stage 2 includes the upgrade of Schofields Road along the length of the RTRF site's southern boundary, with a major intersection with Hambledon Road immediately adjoining the south-west corner of the subject site necessitating the diversion of First Ponds Creek. This intersection will require filling above natural ground level to raise the level of the intersection. A bridged crossing of the realigned creek will be located approximately 150 metres west of the current culvert under Schofields Road. Plans displayed for Stage 2 in October and November 2012 (which are provided in **Figure 19**) include a northern stub at the Hambledon Road intersection at the south-western site corner of the subject site.

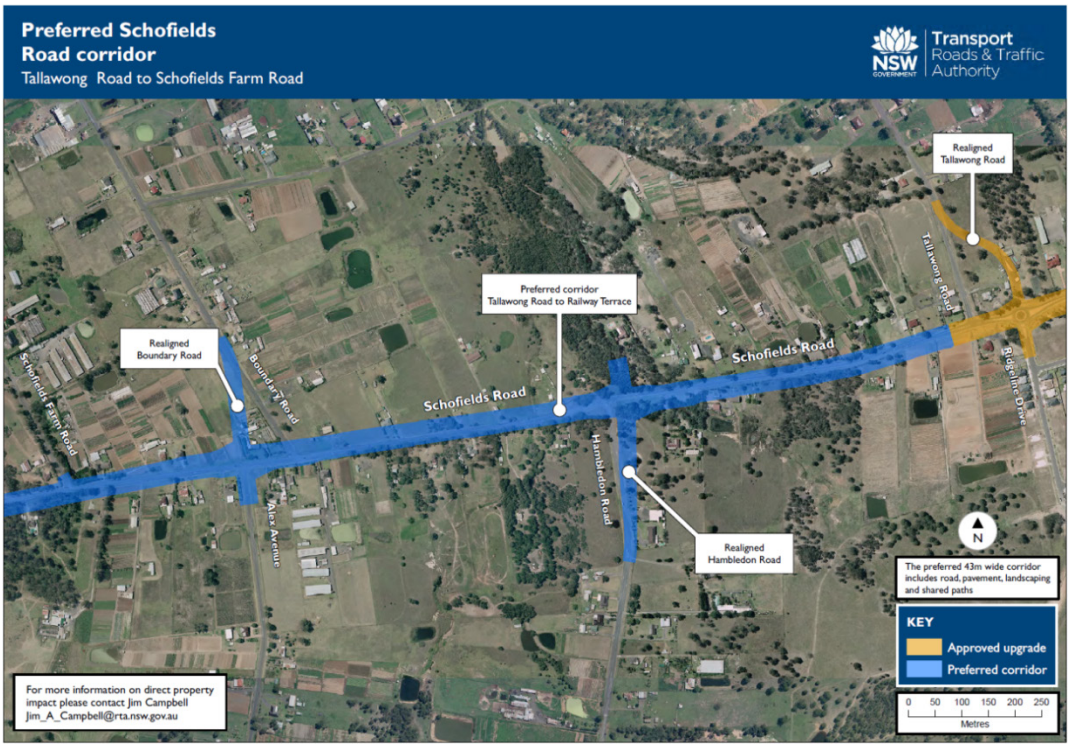

Figure 19 – Plan of Schofields Road Stage 2 Upgrades

Source: *Parsons Brinkerhoff for NSW Roads and Maritime Service*

Figure 20 – (Photograph F) Development to the south of Schofields Rd near Tallawong Road

Figure 21 – (Photograph G) Development to the south of Schofields Rd near Cudgegong Rd

Alex Avenue Growth Centre Precinct

At present, land to the south of Schofields Road opposite the subject site is comprised of a mix of rural-residential properties and market gardens with single and double-storey dwellings.

This area forms the northern extent of the Alex Avenue Precinct within the North-West Growth Centre. Land to the south of Schofields Road in the vicinity of the RTRF is predominately zoned R2 Low Density Residential under *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*.

Hambledon Road currently intersects with Schofields Road and provides access to the south. The Hambledon Road / Schofields Road intersection is proposed to be upgraded, including a new extension to the north.

A north-eastern part of the Alex Avenue Precinct is currently part of the Ponds Masterplan prepared by Urban Growth NSW and Australand. However, land immediately adjoining Schofields Road is generally not currently being developed under that Masterplan. As such, TfNSW are not aware of any immediate plans in place to develop most of the parcels located immediately to the south of Schofields Road, which face the RTRF site.

5.3.2 Development to the East

The RTRF site is bound by Tallawong Road to the east, beyond which is a mix of rural residential properties, market gardens and other agricultural uses. Development opposite the site on the eastern side of Tallawong Road is shown in **Figure 22**.

Stage 1 of the Schofields Road Upgrade (Windsor Road to Tallawong Road) includes the realignment of southern part of Tallawong Road to the east so that it forms a four-way signalised intersection with Schofields Road and Ridgeline Drive. Stage 1 of the Schofields Road Upgrade was approved under Part 5 of the EP&A Act in 2009 and is currently under construction, with works expected to be completed by late-2014. The realigned Tallawong Road, which is also provided for in the NWRL approvals (SSI-5100 and SSI-5414), forms the eastern boundary of the site.

Beyond the realigned Tallawong Road corridor, the NWRL EIS for Stations, Rail Infrastructure and Systems (EIS 2) describes the development of the Cudgegong Road Station precinct between Tallawong Road and Cudgegong Road immediately to the east of the subject site. Cudgegong Road Station is the most north-westerly station on the NWRL and includes the station, at-grade car parking for 1,000 cars and associated access, landscaping and public domain works.

Under the Draft Cudgegong Road Station Structure Plan land to the east of the RTRF site in the vicinity of Cudgegong Road Station will be a range of mixed use commercial and medium density residential development. The Indicative Layout Plan is included at **Figure 18** above.

Figure 22 – (Photograph H) Land to the east of Tallawong Road (looking north)

5.3.3 Development to the North

Land to the north of the subject site is comprised of predominately rural residential properties, market gardens and agricultural uses (such as poultry farming).

A total of five existing dwelling houses are located within 100 metres of the northern site boundary between Oak Street and Tallawong Road. The Lankarama Sri Lankan Buddhist temple is located approximately 200 metres to the north of the site on the western side of Oak Street. Photographs of existing development to the north of the site are included at **Figures 23** and **24.**

This land is currently zoned 1(A) General Rural under the *Blacktown Local Environmental Plan 1988* and is proposed to be zoned RU4 Rural Small Holdings under the recently exhibited *Draft Blacktown Local Environmental Plan 2013*. Land to the north of the site is, however, located within the Riverstone East precinct within the North West Growth Centre, which was released for planning in March 2013, and it is anticipated that this land will be subject to rezoning for urban uses in the future.

Under the *Draft Cudgegong Road Station Structure Plan* land to the north of the site is proposed to be predominately low density residential. The Indicative Layout Plan is included at **Figure 18** above.

Figure 23 – (Photograph I) Dwellings located immediately to the north of the subject site viewed from Oak Street

Figure 24 – (Photograph J) Existing dwellings located on the northern side of Oak Street

5.3.4 Development to the West

The *Draft Cudgegong Road Station Structure Plan* identifies a future northern extension of Hambledon Road connecting through to Oak Street and Gordon Road. The Hambledon Road extension would be located between First Ponds Creek and the RTRF, and has been provided for in plans for the upgrading of Schofields Road and Hambledon Road intersection. A green corridor is proposed along First Ponds Creek.

Land to the west of First Ponds Creek is currently sparsely developed with a small number of rural residential properties and market gardens accessible from Boundary Road, Gordon Road and Oak Street.

This area forms the south-eastern extent of the Riverstone Precinct within the North West Growth Centre. The Riverstone Precinct is zoned for urban development under *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*. Land immediately to the west of the site along the western edge of First Ponds Creek is zoned a mix SP2 Infrastructure (Drainage) and RE1 Public Recreation. Beyond this zone the land north of Schofields Road between First Ponds Creek and Railway Terrace is predominately zoned R3 Medium Density Residential and R2 Low Density Residential.

Figure 18 illustrates the layout plan for the Riverstone Precinct.

6.0 Consultation

This Section provides details of consultation carried out in relation to the RTRF, including a summary of issues raised and how they have been addressed in this EIS.

6.1 Director General Requirements

The following sections address the Director-General's Requirements as they relate to consultation, which are listed in **Table 6**.

Table 6 – Director-General's Requirements: Consultation

Requirement	Where Addressed in EIS
Consultation,	
During the preparation of the EIS, you must consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular, you must consult with:	Section 6.3 and 6.4
▪ local, State or Commonwealth government authorities, including the: - Department of Planning and Infrastructure (Land Release); - Environment Protection Agency; - Department of Primary Industries (including NSW Office of Water, - Agriculture NSW and Fisheries NSW); - Office of Environment and Heritage; - NSW Heritage Office; - NSW Rural Fire Service; and - Blacktown City Council.	Section 6.3
▪ service and infrastructure providers such as: - Roads and Maritime Services.	Section 6.3
▪ specialist interest groups, including Local Aboriginal Land Gouncils; and	Section 6.4 and Section 15.4
▪ the public, including community groups and adjoining and affected landowners.	
The EIS must describe the consultation process and the issues raised, and identify where the design of the project has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.	Section 6.2

6.2 Agency Consultation

The SSI Application documentation was issued by DP&I to relevant agencies in May 2013. Responses to the application documentation were taken into consideration to inform the issue of the DGRs for the RTRF by DP&I on 3 June 2013 (SSI 13_5931).

Initial consultation correspondence to relevant agencies was issued on 13 June 2013, with subsequent meetings being co-ordinated between TfNSW and JBA. Some earlier consultation with agencies was undertaken by specialist sub-consultants to confirm initial scope assumptions and information/data availability for use in the assessment process.

6.2.1 Department of Planning and Infrastructure, November 2012 – May 2013

Consultation with the Department of Planning and Infrastructure (DP&I) commenced with discussions and correspondence between TfNSW and DP&I regarding the proposed RTRF development and SSI Application, continuing periodically through to the issue of DGRs and submission of the EIS for exhibition.

Consultation also occurred with the Land Release section of DP&I in May 2013. Issues raised in this meeting included:

- Consideration of Marsden Park Industrial Area as an option for the site (addressed in **Section 4**).
- Consideration of impacts to surrounding existing and proposed land uses, particularly operational noise (addressed in Sections 10 to 21).

Opportunities for amending proposed land use zoning were identified as being limited given sub-division consents had been issued to Urban Growth.

It was identified that as part of the Riverstone East precinct review there may be opportunities to consider an employment zone buffer to the north of the proposed RTRF. It was recommended that Urban Growth be consulted to identify any opportunities or constraints for revised land use planning to discuss non-structural noise impact mitigation options.

In the absence of being able to rely on land use modifications to minimise potential operational noise impacts, the operational design was amended to consider incorporation of some additional structural and management noise controls. These are discussed further in **Section 11** of the EIS.

The Department of Planning and Infrastructure has released draft structure plans to guide future development around the eight new stations. This *North West Rail Link Corridor Strategy* (the Strategy) provides a vision for how the areas surrounding the train stations could be developed to integrate these new homes and jobs.

The *Strategy* has sought public feedback on areas that include the RTRF study area.

TfNSW will continue to work with the Department of Planning and Infrastructure to align engagement strategies and timeframes to ensure common stakeholders are identified to manage information flows, share stakeholder information where appropriate, and present a coordinated approach for the NSW Government.

6.2.2 UrbanGrowth NSW, May 2013

UrbanGrowth NSW indicated its understanding that the north-west sector would be a construction zone for the next 10 years.

An estimated 800 lots are intended immediately south of Schofields Road, opposite the proposed RTRF. Housing would predominantly be two storey at a minimum six metre distance from the face of the kerb, including a two metre corridor for landscaping and 3 metres for services and utilities. Drainage management through The Ponds and Alex Avenue precincts has been a critical issue for UrbanGrowth NSW. It was identified that 47 Schofields Road would be used by UrbanGrowth NSW as a sewer pump-out point for Alex Avenue with a carrier mains intended to be in place by December 2014.

The discussions confirmed that there are no opportunities to revisit current land use plans for the lands to the south of Schofields Road or to the west of the RTRF boundary. As indicated above, the operational design was amended to consider incorporation of some additional structural and management noise controls. These are discussed further in **Section 11.0**.

6.2.3 Heritage Branch, June 2013

The RTRF was discussed with the Heritage Branch (part of the Office of Environment and Heritage) in June 2013. The main issue for the Heritage Branch was the potential for unexpected heritage items to occur in the northern portion of the site.
The Heritage Branch identified an expectation to see a focus on documenting procedures for unexpected finds in the EIS and their implementation during construction. This expectation has been addressed in **Section 14.6**.

6.2.4 Roads and Maritime Services, May - June 2013

Consultation with RMS has included:

- Discussions with the traffic specialist sub-consultant in May 2013 and
- Discussions with the project team in June 2013.

Discussions in May with the specialist sub-consultants identified the construction timing for completion of Stage 1 of the Schofields Road upgrade and the level of service risks as issues to be addressed within the RTRF EIS. The meeting with RMS identified that main concerns of RMS are the access arrangements for the future development site south of the RTRF and the level of service implications for the Schofields Road / Tallawong Road intersection. As previously noted, the Tallawong Road realignment is included within, and subject to, the RMS approval for the Schofields Road Upgrade (Stage 1) and the NWRL approvals (SSI-5100 and SSI-5414).

RMS have identified that there may be an access constraint to the future development site because of the width of the new bridge to be built over the NWRL tracks. Access arrangements to the future development site may require further consideration in relation to the capacity for a right hand turn into the site from the realigned Tallawong Road when details of the likely land uses are known.

The future development site to the south of the RTRF and north of Schofields Road is not part of the RTRF SSI Application and would be subject to a separate approvals process at some point in the future, once a development option had been identified. Any such proposed development would include design and assessment processes that would take into consideration site access arrangements from the intersection with Tallawong Road. The design and assessment process would include a consultation process with RMS to confirm a satisfactory means of achieving access and egress to the development site during construction and operation. This process would take into consideration any road, bridge and access constraints at the time of the proposed development.

The level of service implications for the Schofields Road / Tallawong Road intersection were discussed at the June meeting with RMS. Stage 1 of the Schofields Road upgrade is expected to be completed by July 2014. In line with TfNSW's commitment to keep trucks off local roads, construction traffic would be utilising the newly upgraded Schofields Road / Tallawong Road intersection. As construction works for the RTRF are anticipated to commence in June 2014 the RMS questioned whether there would be an overlap in commissioning of the intersection (including signals) with the commencement of spoil movements leaving the RTRF construction site.

This concern was addressed through a confirmation of the cut/fill balance on site requiring approximately 74% of the excavated material being retained on site. This retention of spoil in turn defers the traffic impact on the intersection and reduces the risk of the intersection not being fully commissioned at the time of commencement of construction. Construction and operation traffic implications on level of service at the Schofields Road / Tallawong Road intersection have been addressed in **Section 10**.

6.2.5 Blacktown City Council, November 2012 – June 2013

Meetings were held with the General Manager and Council officers and with Council elected representatives in November 2012 to outline the proposal for the RTRF. The primary issue raised in each meeting was with respect to a Council preference for the RTRF to be located at Marsden Park Industrial Precinct. Consideration of the Marsden Park Industrial precinct as an alternative location for the RTRF has been included in **Section 4.0**.

Subsequent meetings in May and June 2013 have presented details of the proposed RTRF and an update of the status of the EIS.

6.2.6 Additional Consultation

Opportunities for consultation beyond the circulation of SSI Application and EIS documentation have also been sought with:

- NSW Environment Protection Authority.
- Office of Environment and Heritage.
- Department of Primary Industries.
  - NSW Fisheries.
  - NSW Office of Water.
  - Agriculture NSW.

Responses from these agencies have indicated that a formal consultation meeting was not considered to be necessary.

Specialist sub-consultants have consulted with the following agencies/authorities to inform their individual assessments:

- Sydney Water
- Endeavour Energy
- RMS

Information from this consultation has been incorporated within the specialist technical reports included as appendices to this EIS.

The proposed development will be placed on public exhibition for 30 days in accordance with clause 194 of the *Environmental Planning and Assessment Regulation 2000*. During the public exhibition period Council and State agencies will have an opportunity to make submissions on the project.

6.3 Public Consultation

TfNSW directly contacted, or attempted to contact, all neighbours affected by the RTRF boundary. Contact methods included phone and/or doorknocking and the provision of information material online via the NWRL project website. Direct communication with neighbours and directly affected land owners/occupiers was made during April and May 2013. Properties which have been contacted are listed below:

- Oak Street – numbers 2, 5, 6, 14, 18, and 34.
- Gordon Road – numbers 51, 57, 59, 62 and 68.
- Tallawong Road – numbers 34, 42A, 42, 47, 50, 51, 57, 58, 67, 72, 74, 77, 83 and 84.

The main issues raised in these consultations were:

- Function of the facility.
- Likely noise impacts.
- Dust.
- Type of rolling stock.
- Traffic impacts.
- Size of the workforce.
- Queries around the next steps in the planning process, and further opportunities for comment/feedback.

Issues related to property acquisition were also discussed where relevant.

The site layout diagrams were presented to people living adjacent to the site to provide an early idea of where they were located in relation to the proposed facility, its roads and access points, and functional areas within the site, eg administration buildings, training facilities and workshops.

Persons contacted were referred to the NWRL website for additional information, and were advised that they would be contacted again in the lead up to the exhibition of the EIS and were asked to contact the NWRL Place Managers if they had any queries at any time.

Broader communication about the project was issued by The Minister for Transport through a media statement issued on 9 April 2013, a copy of which is available at http://www.transport.nsw.gov.au/media-releases/north-west-train-stabling-progresses. Concurrently, an article entitled "*North West Train Stabling Progresses*" was also included on the NWRL website on 9 April 2013 http://northwestrail.com.au/article/north-west-train-stabling-progresses which included a link to the SSI Application.

Further community consultation is planned including a community information session, printed material and website information. An invitation to the information session will be letter box dropped in the area and the team will doorknock the neighbouring properties to advise them of the session. The date, time and venue for the information sessions will also be advertised in the local press.

This EIS will be placed on public exhibition for at least 30 days in accordance with clause 194 of the *Environmental Planning and Assessment Regulation 2000*. During the public exhibition period the public will be invited to participate in the community information session in addition to having an opportunity to make submissions on the project.

Further consultation will follow, including printed material and website information. In addition, a static display will be produced for the NWRL Community Information Centre at Castle Hill. The centre is open and staffed 5 and a-half days a week.

6.4 Consultation with Special Interest Groups

Details of consultation with Aboriginal groups is provided in **Section 15.4** and **Appendix J**. In summary the following groups have been consulted with as part of the process carried out in accordance with the Growth Centres Commission Aboriginal Consultation Protocol and the 2005 DEC Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation:

- Deerubbin Local Aboriginal Land Council (DLALC)
- Darug Aboriginal Cultural Heritage Assessments (DACHA)
- Darug Custodian Aboriginal Corporation (DCAC)
- Darug Tribal Aboriginal Corporation (DTAC)
- Office of the Registrar, Aboriginal Land Rights Act 1983
- National Native Title Tribunal
- NTSCORP
- Metropolitan OEH Planning and Aboriginal Heritage Section
- Blacktown City Council
- Hawkesbury Nepean Catchment Authority

The following Aboriginal stakeholders were identified as persons and organisations who may hold cultural knowledge relevant to the study area and with whom consultation is ongoing:

- DLALC

- DACHA
- DTAC
- DCAC
- Darug Land Observations (DLO)
- Darug Aboriginal Land Care Inc (DALC)
- Gunjee Wong Cultural Heritage Aboriginal Corporation (GWCHAC)
- Scott Franks
- Amanda Hickey Cultural Services (AHCS)
- Tony Williams

7.0 Description of the Infrastructure

This chapter of the report provides a detailed description of the proposed infrastructure. design drawings are included at **Appendix B**.

This application seeks approval for the following infrastructure:

- Site preparation works including bulk earthworks, demolition and tree removal.
- Construction and operation of a RTRF including train stabling, train maintenance, infrastructure maintenance, and operations in support of the rapid transit network, including:
  - Up to approximately 23 rail sidings with stabling capacity for 45 trains.
  - Train wash facility.
  - Wheel lathe.
  - Workshop facilities.
  - Approximately four tracks for infrastructure maintenance trains.
  - Train delivery track.
  - A section of track to test trains for service.
  - Maintenance and infrastructure storage areas.
  - Training area.
  - Administration and staff amenities buildings.
- An Operations Control Centre (within the administration building) to monitor and control operations for the rapid transit network.
- Vehicular access, internal roads and staff car parking.
- Substations.
- Landscaping, lighting and CCTV.
- Communications tower.
- On-site stormwater detention and treatment ponds.

The above project elements are described in the following sections and are identified in the Indicative Site Plan in **Figure 25** below and in the drawings in **Appendix B**. Photomontages of the RTRF provided in **Appendix C** illustrate the project elements.

In total, across all of the operational areas, the site would be expected to support approximately 300 staff.

All works associated with the construction of the RTRF are subject of this application. However, minor site preparation works (such as removal of buildings and structures) may be carried out under SSI-5100 and SSI-5414 approvals until such time as this application is approved.

As described in more detail below, works associated with the diversion and relocation of Talalwong Road, including the over rail bridge, will be carried out under other approvals and are not part of this application.

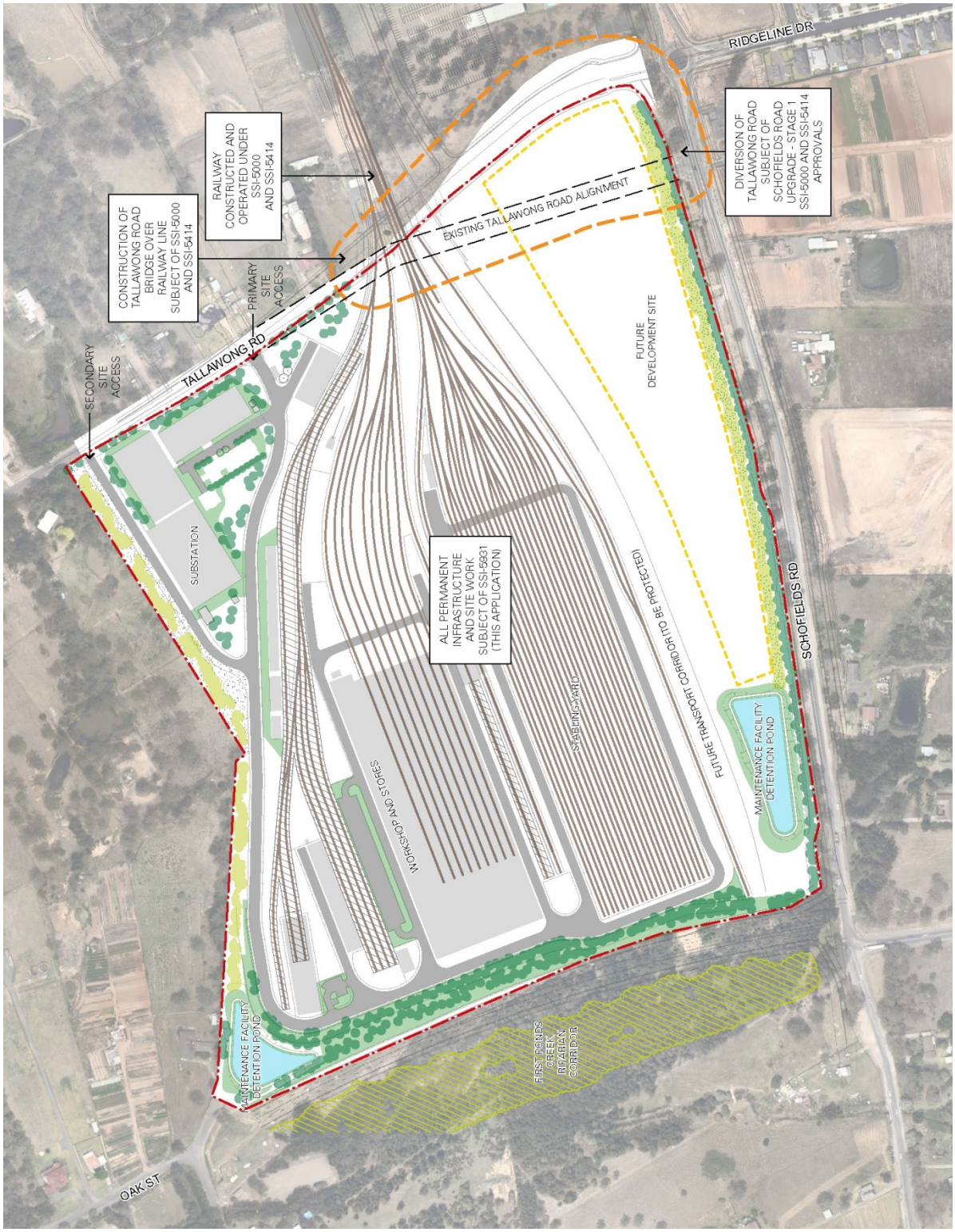

Figure 25 – Indicative Site Layout Plan

7.1 Construction

Construction works for the RTRF will include site preparation activities, earthworks, retaining structures, drainage works, construction of buildings, roads and railway infrastructure systems, including electrical and telecommunications infrastructure.

As previously specified, this SSI Application does not include the works associated with the diversion of Tallawong Road or the bridge over the railway line, which will be carried out under the Schofields Road Upgrade (Stage 1), SSI-5100 and SSI-5414 Approvals.

The southern part of the site would be utilised as a site compound and storage location. Site offices and car parking would likely be located immediately adjacent to Schofields Road with a workshop, storage and laydown to the north. To the west of these facilities would be likely to be a spoil storage and handling area.

Access to and egress from the site would be directly on and off Tallawong Road as shown in **Figure 26**.

7.1.1 Site Preparation

Site preparation includes the removal of existing buildings, structures, infrastructure, utilities and vegetation so that bulk earthworks can commence.

For the land located within Construction Site 17 under the NWRL Major Civil Construction Works approval (SSI-5100) site preparation works may be carried out under that approval. This includes demolition of buildings and structures and the removal of vegetation. In relation to this area of land this RTRF SSI Application is entirely consistent with the approved SSI-5100 SSI Application. The extent of construction works to be carried out under SSI-5100 and the relationship with this SSI Application for the RTRF is shown in **Figure 26** below.

Demolition work would be undertaken by licensed demolition contractors and would be controlled and undertaken in stages where possible. This would involve a hazardous materials analysis prior to stripping buildings and demolition of the main structure. Glass and metal items would be removed prior to the building being demolished using a tracked excavator or other conventional method.

Materials such as bricks and tiles, timber, plastic and metals would be separated where practicable and sent to a waste facility with recycling capabilities. All services into the buildings would be made safe and redundant.

7.1.2 Bulk Earthworks

Due to the undulating nature of the site, cut and fill earthworks are required to provide a flat development surface for the installation of railway maintenance and stabling buildings and infrastructure.

An attempt has been made to balance as much as possible the extent of cut and fill for the RTRF. This has resulted in the proposed development surface level of approximately RL 51m AHD.

A Cut and Fill Plan has been prepared and is provided at **Appendix B** and illustrated at **Figure 27** below. A total of some 570,000 m^3 of cut will be excavated across the site, with areas of cutting concentrated towards Tallawong Road and the train access point for the RTRF. Excavated material will largely be utilised to fill areas towards the north and west of the site to allow the establishment of a generally flat pad for train stabling and maintenance activities. Approximately 430,000 m^3 of material is expected to be able to be used for on-site filling, leaving approximately 140,000 m^3 to be removed and managed as waste spoil.

The earthworks for the stabling facility would be undertaken using conventional heavy excavation and earth moving equipment including bulldozers, scrapers, excavators, rollers, graders and associated equipment.

The facility would include provisions for water treatment to manage stormwater runoff. The earthworks may have steep batters with retaining structures.

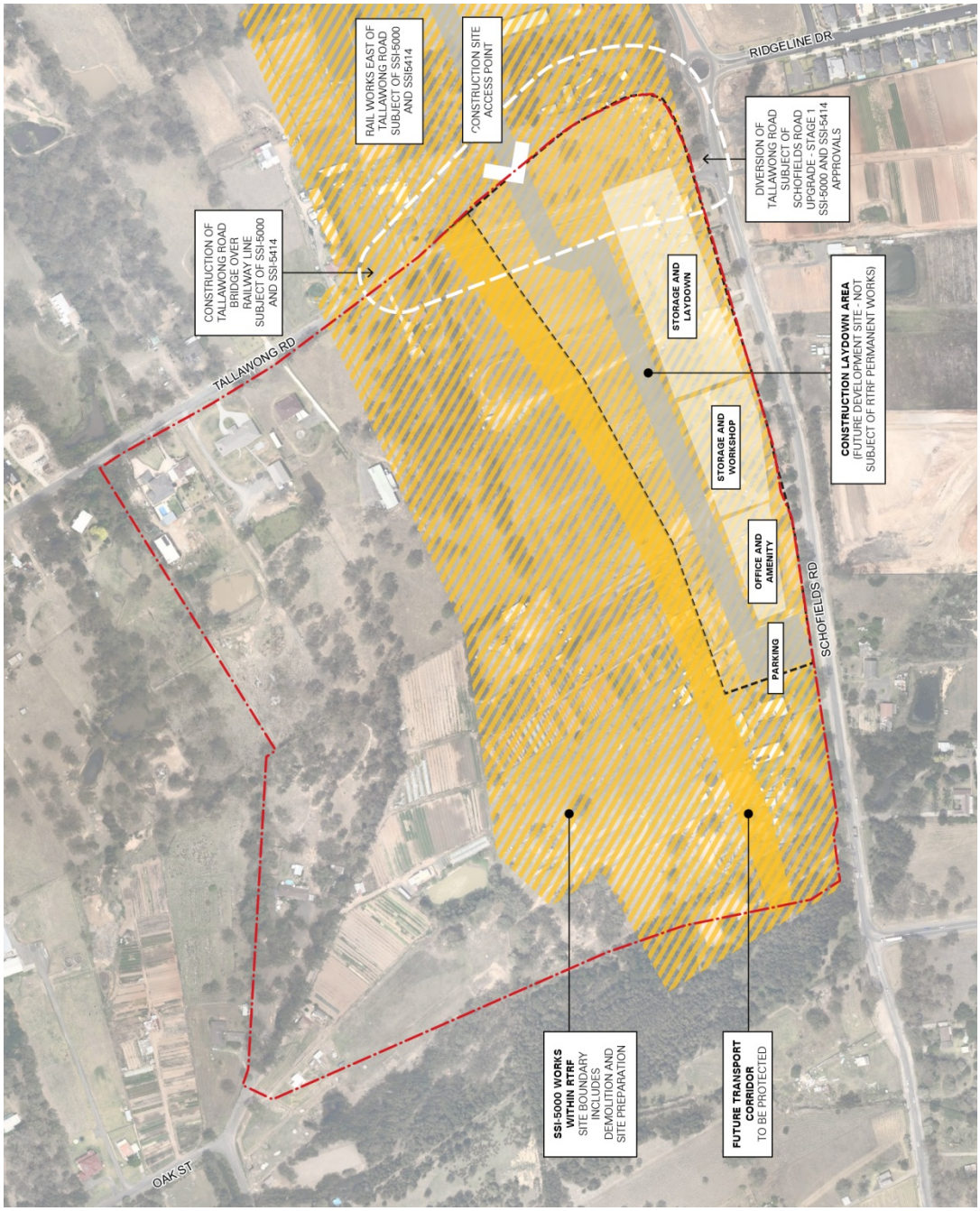

Figure 26 – Construction Plan and relationship to works under SSI-5100

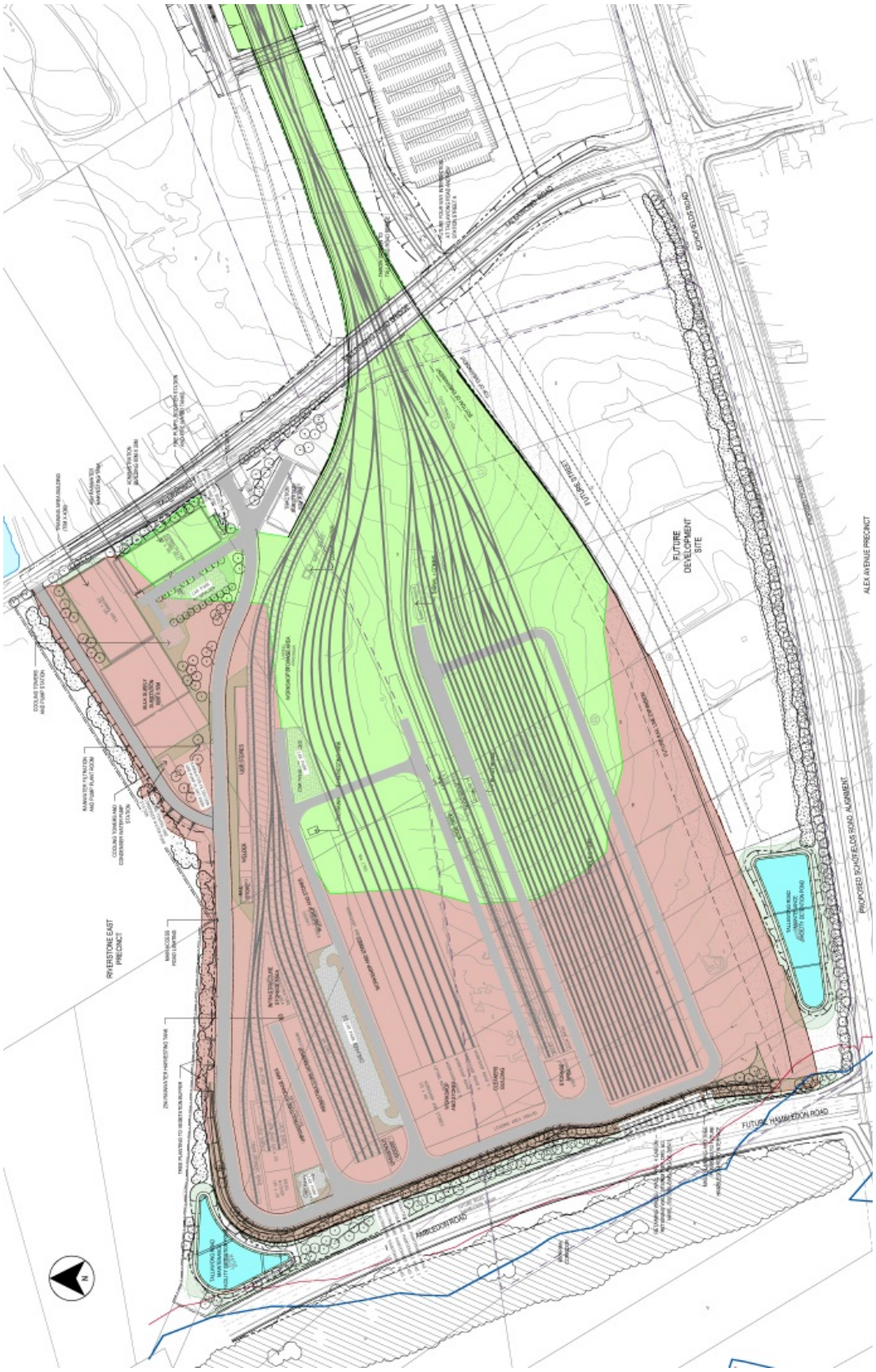

Figure 27 – Cut and Fill Plan (with opening state infrastructure layout shown)

(Note: Area shown in green are cut and areas shown in red are fill)

7.1.3 Buildings and Infrastructure

Buildings located at the RTRF would be likely to be constructed using conventional steel frame methods.

Construction of infrastructure would include laying concrete, track formation, track works and the installation of overhead wire systems and cable supports, as well as the formation of site roads and car parks. Ballast tampers, vibratory rollers, concrete trucks, cranes and trucks would be required to undertake these works.

An indicative layout and sizing for buildings and infrastructure has been provided in the drawings in **Appendix B** and illustrated in the photomontages provided in **Appendix C**. Details of the indicative layout and sizing of buildings are described further in Section 7.2 below. This indicative layout is subject to approval and final design.

7.1.4 Construction Hours

Construction work would generally be limited to the standard hours set out in the Interim Construction Noise Guideline, as follows

- 7am – 6pm Monday to Friday
- 8am – 1pm Saturdays
- No works on Sundays or Public Holidays

Non-disruptive preparatory work, repairs or maintenance may be carried out on Saturday afternoons between 1pm and 5pm or Sundays between 8am and 5pm.

Activities requiring the temporary possession of roads may need to be undertaken outside the standard daytime construction hours during periods of low demand to minimise safety impacts and inconvenience to commuters.

7.2 Description of Infrastructure

7.2.1 Extent of Permanent Works for RTRF

As can be seen in **Figures 1 and 25** (and in **Appendix B**), the preliminary design for the RTRF does not include any permanent development within the south-eastern corner of the site. Further, the design of the RTRF has taken into account the future infrastructure corridor for a potential western extension of the NWRL.

As such, whilst these areas form part of the RTRF site, and will be used during the construction phase as part of the construction site, it is not proposed at this time that any permanent buildings and infrastructure will be located in these areas, and none are proposed as part of this SSI Application.

It is envisaged that the residual land in the south-eastern corner of the site will be used for purposes consistent with the proposed industrial land use set out in the Draft Cudgegong Road Station Structure Plan, which would also be consistent with the adjacent RTRF land use. However, any future development of this land in the south-east corner, as well as any works associated with a possible future western extension of the NWRL, will be subject of future planning applications and approvals and are not part of this SSI Application.

The extent of infrastructure works subject of this EIS is limited to installation of railway track (including systems and other railway infrastructure) west of the bridge over the railway cutting on the re-aligned Tallawong Road. Railway track east of the realigned Tallawong Road will be installed as part of the SSI-5414 Approval.

7.2.2 Train Stabling Area

The area for train stabling would be located on the southern side of the facility towards Schofields Road. The stabling sidings would be approximately 360 metres long and accommodate two eight car train sets on each siding. A service road would enable access around the outside of the stabling area.

The stabling sidings would be installed progressively as demand dictated, with capacity for up to 20 trains at opening, being approximately 10 railway sidings. The ultimate state planned for under this SSI Application would include for approximately 23 railway sidings providing capacity for stabling 45 trains.

The stabling facility requires a large flat area for its operation. Track and crossovers will connect the eastern end of the stabling facility with the main running lines near Cudgegong Road Station. The train stabling area is shown in the north-south section provided in **Figures 28** and **29**.

7.2.3 Train Maintenance Area

Maintenance of rolling stock would occur within a workshop towards the centre of the site. The maintenance workshop would be approximately 260m long, 100m wide and 15m high. All maintenance activities would be conducted within the building. The structure would have operable doors at either end to enclose the space in order to minimise noise.

As with the stabling facility, the sidings for the maintenance workshop would be installed progressively to meet demand over time. Indicatively, four tracks would be provided at opening, which would be increased to approximately eight in the ultimate end state under this SSI Application. The maintenance facility will have an ultimate capacity for maintaining a fleet of 76 eight car train sets.

The maintenance facility is shown (labelled as the Rolling Stock Workshop and Store) in the north-south section (Section 1) and the Western Boundary Detail section (Section 2) in **Figure 28** and **29**.

7.2.4 Infrastructure Maintenance Area

An infrastructure workshop would be provided on the northern side of the maintenance workshop. The infrastructure workshop would include facilities for storing and servicing rail track infrastructure equipment, for the stabling and servicing of maintenance vehicles in addition to fabrication and welding workshops and storage areas for permanent way and heavy infrastructure spares.

An infrastructure workshop building measuring approximately 100m in length by 14m wide would provide a marshalling area for infrastructure operations. The approximate height of the workshop building would be 15m. The infrastructure workshop is shown in the north-south section provided in **Figure 28**.

7.2.5 Train Operation and Management Area

Operations, maintenance and administration for the rapid transit network would be coordinated and managed from the Administration Building to be provided at the site.

The Administration Building would incorporate a rapid transit Operations Control Centre where command, control, system monitoring and communications functions would take place. The building would also include office facilities and amenities for rapid transit staff.

The proposed administration building would be located near the main site entrance from Tallawong Road. The two storey building would have an indicative footprint of 80m by 30m, and a maximum height of 8m. The indicative gross floor area of the administration building would be approximately 2,400m^2. The administration building is shown in the sections provided in **Figure 29**.

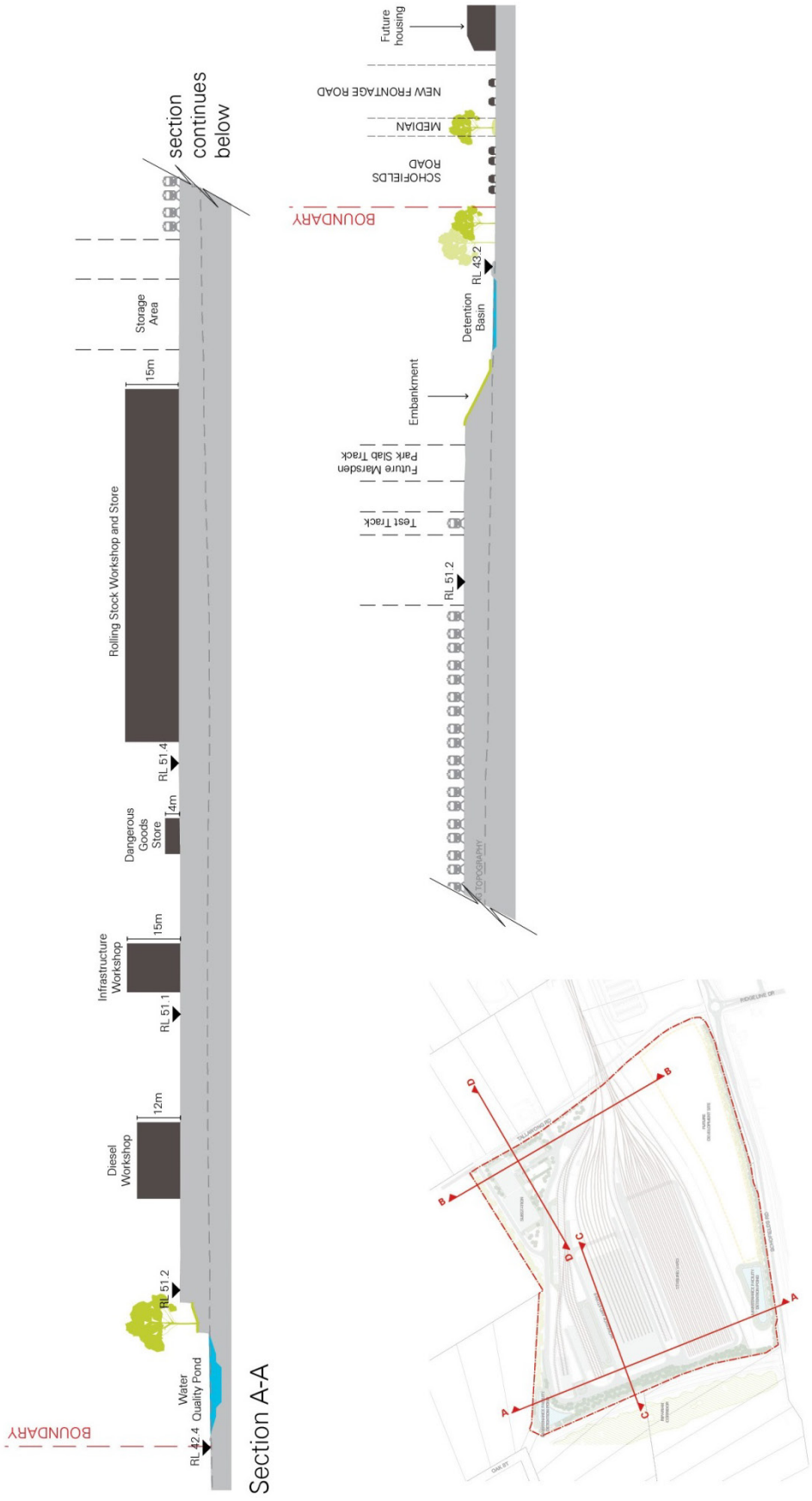

Figure 28 – Sections

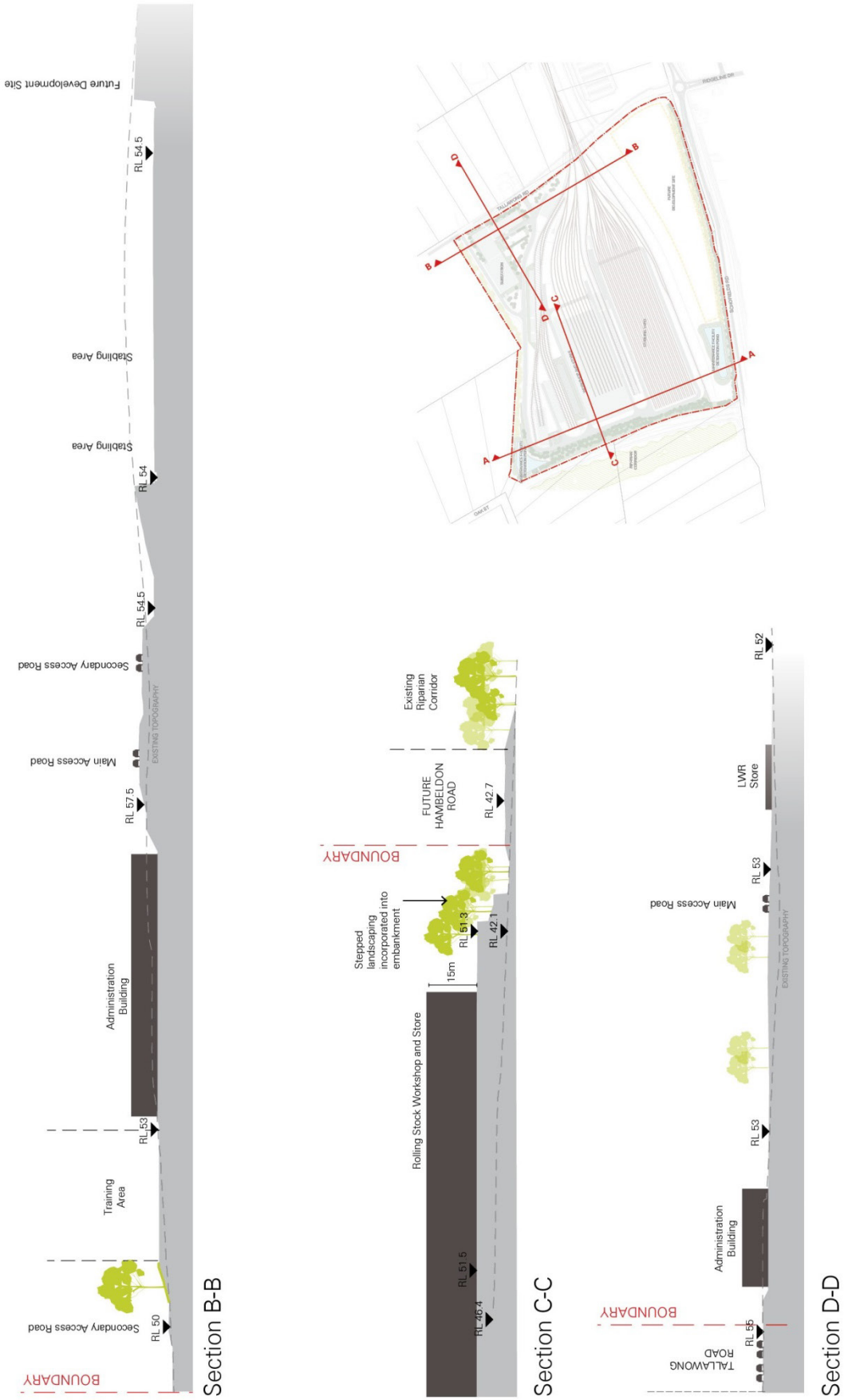

Figure 29 – Sections (east)

Training facilities will include a short section of training track equipped with a turnout, over-head wiring and signalling training equipment, as well as a driving simulator.

7.2.6 Site security

The facility would be a high security site that would be fully self-contained with back-up power supplies and access control/security systems. The site would also accommodate the needs of emergency services. Perimeter fencing and fencing of internal areas will be included with controlled access to the site and restricted areas. Security monitoring will be undertaken by physical security personnel and via CCTV.

7.2.7 Landscaping

The RTRF will include landscape plantings along the northern, western and southern site boundaries. An indicative Landscape Plan is provided in **Figure 30**, and the degree of landscape planting is illustrated in the photomontages in **Appendix C**.

The operational requirements of the RTRF and the presence of substantial in-ground and overhead services precludes the establishment of larger landscape plantings within the site, however smaller shrubs, groundcover plantings and grasses will be provided within the vicinity of the main building, along the frontage to Tallawong Road and where practical along the internal service road.

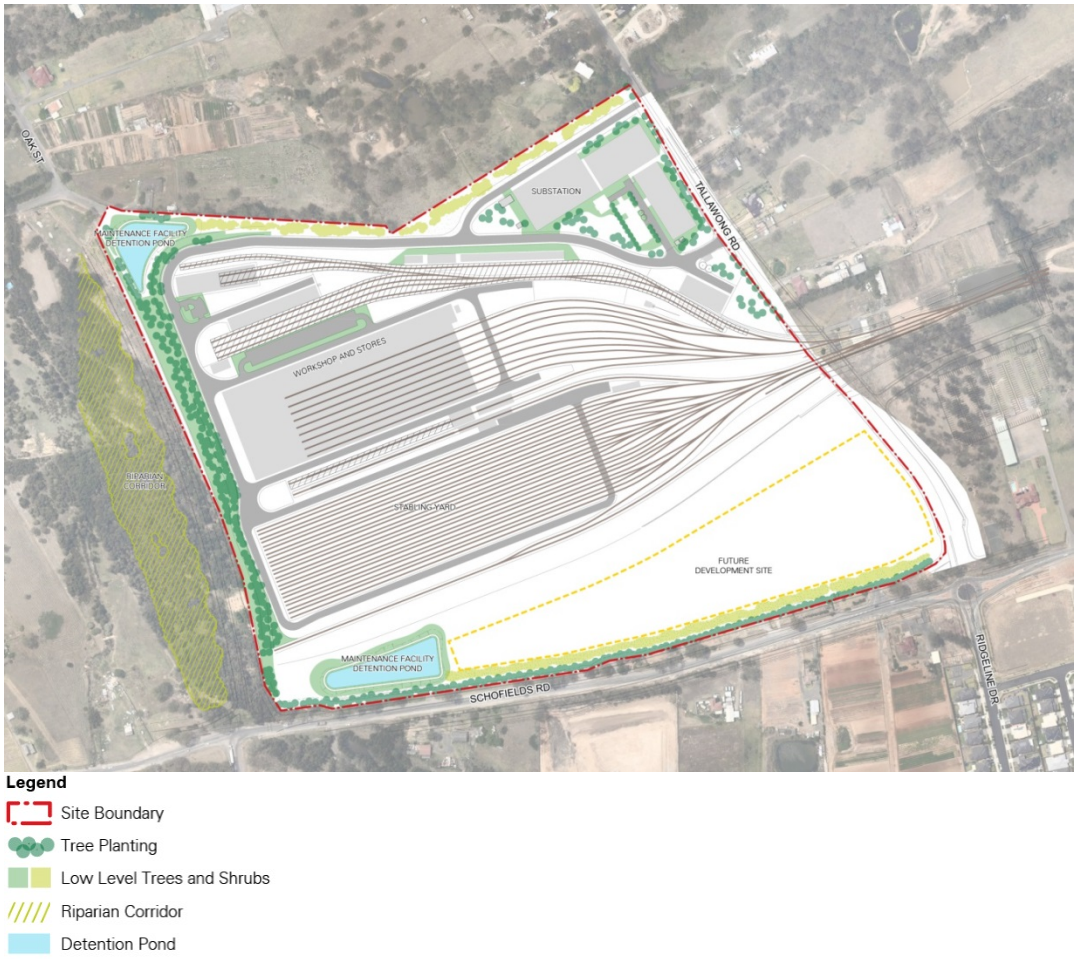

Figure 30 – Indicative Landscape Plan

7.2.8 Vehicular Access and Parking

Site Access

Vehicle access to the site would be from Tallawong Road. The main site entry would be on the northern side of the rail facility tracks, approximately 420 metres north of the intersection with Schofields Road. A secondary site access would be located at the northern end of the Tallawong Road frontage, approximately 150 metres further north of the main site entry. All site access points would be security controlled.

Access Roads

An internal access road would facilitate movements within the site including access for maintenance vehicles to the stabling tracks, wheel lathe, bogie drop, train wash and signalling and communications equipment building and administrative buildings. The internal access road would also allow for emergency vehicle access, and access for heavy vehicles, deliveries and waste collection.

Car Parking

Vehicle parking areas would be provided for staff and visitors. Around 180 parking spaces would be distributed around the site based on estimated staffing within different areas of the facility.

7.2.9 Utilities and Services

The information below has been summarised from the Utility Services Assessment report prepared by Diversi Consulting, which is attached in **Appendix D**. No major service/utilities require relocation as part of the RTRF. Relocation of existing services and utilities within the road reserve of Tallawong Road are outside of the scope of this EIS, and once relocated will not be impacted by the RTRF.

Electricity

There is a need for a Bulk Intake Electricity Sub Station of adequate size to provide all power requirements. There will also be a depot traction sub-station and at least one industrial power substation.

Electricity would be supplied to the on-site substations by a 132kVA extension comprising three cables from the Endeavour Energy substation at Rouse Hill. Apart from the crossings of Cudgegong and Tallawong Roads and the small final extension to the Endeavour Energy Rouse substation, the cables will be entirely laid within the NWRL corridor. The location and position of these cables will comply with the standard conditions of use under TfNSW and will not be placed closer than 2 metres parallel to a private boundary.

The project includes approximately 540 kWp of solar photovoltaics on the roofs of buildings.

Water Supply

The RTRF site and local vicinity is currently serviced by two critical water mains in Tallawong Road and one private service which will become redundant due to the future works. These two major pipes will be adjusted as part of the NWRL Approvals (SSI-5100 and SSI-5414), once when Tallawong Road is being adjusted at the Schofields Road intersection and the second time when the rail bridge over Tallawong Road is being constructed.

Temporary supply to the work site can be achieved utilising the private service that now exists on Tallawong Road (to service private properties that will be resumed), or by extension of the permanent water supply mains. Ultimately, advice on the preferred connection location will be provided by Sydney Water.

Future long term water supply connection will come from an extension of the mains from Schofields Road and supply both the potable water and fire fighting requirements for the site.

Sewerage

The site is not currently serviced by Sydney Water sewerage infrastructure. The area to the south of Schofields Road however is now fully sewered for the new residential development. As part of the on-going development of sewerage infrastructure there is a proposed sewer carrier currently under construction south of Schofields Road which will terminate in a sewerage pump out tank near the north western intersection of Hambledon Road and Schofields Road.

A proposed sewer main carrier will extend further to the north, approximately parallel to the western boundary of the RTRF site. As this carrier is still in the planning phase, the main can be sized to accommodate the flows from the RTRF if required.

Should an early works temporary sewer connection be required, this can be accommodated with a pressure sewer system and temporary rising main from the site connection to the proposed sewerage pump out tank currently being constructed.

Telecommunications

The site will require telephone and internet connection from the time of the early works. There is a current copper cable network available in Tallawong Road however optical fibre cables are not currently available in the vicinity or to the site. If required and for a short period of time, communications services could be provided wirelessly by the exclusive use of mobile services.

Until the Tallawong Road bridge has been completed, the area will have to be serviced via the existing copper service. Service conduits have been allowed for in the bridge for new optic fibre cables to be installed meaning there will be potential for connection to the NBN once the bridge is constructed.

In addition, the site will require the installation of a communications tower, approximately 30 metres in height. The communications tower is most likely to be of hollow steel construction, approximately 1 metre in diameter at the bottom tapering to approximately 200mm at the top. The exact siting of the communications tower will be determined as part of the detailed design, however it is likely to be located near the Tallawong Road frontage.

7.3 Operational Activities

7.3.1 Train Stabling

Trains would need to be stored in the stabling facility outside peak periods and between the last service and the first service commencing the following day. When a train enters the stabling area, the parking brake is applied and the trains would enter cleaning mode with lighting and air-conditioning on for up to an hour while train interiors are cleaned.

Daily internal cleaning of the trains would take place within the stabling area when trains return to the site after the morning and evening peak periods and also at the end of each day. Monthly detailed interior cleaning of trains will also take place in the stabling yard. Washing of the train exterior would take place in the maintenance facility (see **Section 7.3.2** below).

After cleaning they would be stabled with all auxiliary equipment shut down. Trains would need to be powered up approximately 15 minutes prior to their scheduled departure time. Safety checks are undertaken prior to the train entering service the following morning. Prior to the train departing, all auxiliary equipment including air-conditioning, air compressors and static inverters would be switched on.

The stabling area would operate 24 hours per day, seven days per week. Train horn testing would not be required within the stabling facility.

The water used for spot cleaning would be collected and treated onsite for reuse. A rainwater harvesting tank would be installed onsite to enable collection, storage and use of rainwater at the facility.

7.3.2 Train Maintenance

The following activities would be performed in the train maintenance building:

- Train washing.
- Rolling stock inspections and repairs.
- Major train maintenance.
- Wheel maintenance.

To minimise noise impacts, under normal operating conditions the train maintenance activities would be undertaken in an acoustic enclosure.

The exterior of the trains would be washed in an automated train wash a minimum of twice per week. During train washing, the train passes through the train wash at walking pace over a period of a few minutes.

Up to 85% of the wash water used in the automated train wash would be recycled. The residual 5% of wash water would be discharged to sewer.

The tread of train wheels becomes worn during operation. The train wheels would be periodically machined using either an underfloor wheel lathe or milling machine.

7.3.3 Train Commissioning and Testing

A test track will be provided immediately to the south of the stabling area. The test track will be equipped with a virtual station platform to facilitate the testing of on board train systems following maintenance or to assist in detecting faults and for carrying out train driving training.

7.3.4 Infrastructure Maintenance

Infrastructure maintenance activities would predominantly occur during night time periods between the last train service and the first train service the following day as well as selected weekends. Activities within the RTRF to support routine infrastructure maintenance of the rapid transit network would include:

- Operation of maintenance plant and equipment including track maintenance vehicles.
- Delivery and stockpiling of materials.
- Loading of materials for transportation to site.
- Vegetation management.
- Inspections and minor repairs of infrastructure.

Major periodic maintenance activities would be undertaken on an infrequent basis, likely to be on weekends. Activities within the RTRF to support major periodic infrastructure maintenance of the rapid transit network would include:

- Operation of maintenance plant and equipment including track maintenance vehicles.
- Delivery and stockpiling of materials.
- Loading of materials for transportation to site.

- Rail handling and welding of rail into longer lengths.
- Rail replacement and renewal.
- Electrical, signalling and communication systems renewals.
- Maintenance of track maintenance vehicles.
- Maintenance of civil infrastructure; footpaths, internal roads, fences, buildings.
- Maintenance of on-site water systems.

7.3.5 Administration and Training Facilities

The administration building will have the capacity to accommodate the operational personnel and associated space for the provision of administrative and training functions.

The training area immediately adjacent to the administration building is a purpose built external area that provides an example of the track environment for trainees. This would be comprised of sections of track, signalling, over-head wiring (at a reduced height), and communications infrastructure to allow trainees to become accustomed to the track environment safely.

7.3.6 Operating Hours

In order to meet the operational and timetabling requirements of the rapid transit network the RTRF would be required to operate 24 hours per day seven days per week.

7.4 Project Timing

To satisfy the stabling and maintenance requirements of the NWRL the infrastructure will be initially installed to stable and maintain 20 trains. The full extent of the RTRF will provide for stabling of 45 trains and maintenance of a fleet of 76 trains.

In order to meet the initial operational requirements for the NWRL, it is envisaged that approximately 10 railway sidings for stabling would be provided in the initial phase of operations as well as approximately 4 railway sidings for maintenance. Railway sidings for stabling and maintenance would be progressively installed as demand requires in accordance with the medium to long term delivery of the rapid transit network (including the second Sydney Harbour crossing and the conversion of selected lines).

Associated buildings and infrastructure, such as the Administration Building, Training Area Building, and substations would be developed during the main construction phase.

Notwithstanding the progressive installation of railway sidings, it is expected that the bulk earthworks will be largely completed during the main construction phase.

The bulk earthworks are forecast to take up to approximately 15 months, and will be dependent on the timing and programming of works for Cudgegong Road Station and civil works associated with the construction of the Tallawong Road bridge over the railway line. Works associated with the Tallawong Road bridge over the railway line are expected to be carried out concurrently with bulk earthworks for the RTRF, taking approximately 15 months and commencing in mid-2014.

The construction of buildings and infrastructure is expected to commence in late 2015 and will take approximately 18 months. Rail systems installation and testing would be expected to occur for an additional 18 months in 2017 and 2018.

Works associated with the construction of Cudgegong Road Station will take place concurrently with the construction of the RTRF, as was envisaged and assessed in NWRL EIS 1 and EIS 2. It is highlighted that the cumulative construction traffic impact will be less than was forecast in the NWRL EIS 1 due to the balancing of earthworks at the RTRF site, and the resultant substantial reduction in the amount of spoil requiring off-site disposal.

Demolition and other minor site preparation works subject of SSI-5100 have commenced and will continue in accordance with that SSI Approval for part of the RTRF site until this application is approved. Civil works associated with the relocation of Tallawong Road, including the construction of the bridge over the railway line, will be carried out in accordance with the timing set out in the NWRL EISs and that of the RMS as part of the Schofields Road Upgrade (Stage 1), but are expected to be largely complete by mid-2014, when construction of construction for the RTRF is due to commence. Overlapping works are forecast to occur for no more than a couple months. Further, this would not represent worst case construction traffic from either work activity, since the RTRF would be starting up and Schofields Red would be finishing off. The RMS has agreed to this assumption based on their intended completion date of July 2014.

8.0 Sustainability

The RTRF will be delivered within the environmental and sustainability framework established for the NWRL.

8.1 NWRL Sustainability Strategy

The NWRL Sustainability Strategy incorporates the Environment and Sustainability Policy and sets out specific objectives and initiatives/targets to be integrated into the project planning and design, procurement, construction and operations stages of the project.

8.1.1 Environment and Sustainability Policy

The Environment and Sustainability Policy establishes five areas of commitment to maximise the potential sustainability benefits while minimising negative impacts. The commitments are provided in **Table 7**. These commitments provide an overarching framework for the development of more specific sustainability objectives, developed as part of a sustainability strategy, to guide the integration of sustainability into project governance, design, construction and operation for the NWRL.

Table 7 – NWRL Environment and Sustainability Policy Commitments

Commitment Area	Environment and Sustainability Commitments
Leadership	Implement coordinated and transparent decision making, by engaging with stakeholders and suppliers, encouraging innovation and demonstrating sustainability leadership.
	Explore new benchmarks for the transport infrastructure sector by requiring high standards from our designers, contractors and suppliers.
Community and customer:	Provide accessible, safe, pleasurable and convenient access and transport services for all customers.
	Establish positive relationships with community and stakeholders to maximise opportunities to add value to local communities in North West Sydney.
Land use integration and place making:	Create desirable places, promote liveability, cultural heritage, optimise community and economic benefit.
	Balance transport oriented development opportunities with stakeholder expectations.
Embedding sustainability:	Establish robust sustainability objectives and targets.
	Maintain an environmental management system that is integrated into all our project activities.
	Ensure thorough and open environmental assessment processes are developed, deployed and maintained.
	Develop and maintain an environmental management framework to embed best practice environmental and sustainable outcomes during construction.
	Apply effective assurance processes to monitor performance against the project environment and sustainability objectives and identify appropriate reward or corrective action, as required.
	Apply environment and sustainability specific processes to the procurement of delivery activities.
Accountability:	Undertake public sustainability reporting
	Hold employees and contractors to the NWRL project accountable for proactively meeting their environmental and sustainability responsibilities
	Provide appropriate training and resource necessary to meet our responsibilities.'

8.1.2 Sustainability Objectives and Targets

Table 8 lists the fourteen sustainability objectives and specific initiatives/targets which have been identified for the NWRL.

Table 8 – NWRL Project-Wide Sustainability Objectives, Initiatives and Targets

Sustainability Objective		Sustainability Initiatives and Targets		Relevant for RTRF
1	Governance objective Demonstrate sustainability leadership within the rail, transport and land use sectors.	1.1	Target a high level of attainment in the Australian Green Infrastructure Council Infrastructure Sustainability Rating Tool.	Yes
		1.2	Target a high level of attainment in the Transport for NSW's Sustainable Design Guidelines.	Yes
2	Climate change objective Be resilient to potential climate change impacts and reduce infrastructure vulnerability.	2.1	Undertake a climate risk assessment. Identify and implement adaptation measures to address extreme, high or medium level residual climate risks on the project.	Yes
3	Carbon management objective Improve shift towards lower carbon transport. Reduce operational, construction and embodied carbon emissions. Identify low carbon energy generation and procurement options.	3.1	Explore options to offset 100% of the electricity needs for the operational phase of the Project.	Yes
		3.2	Explore options to source 5% of operational demand from onsite renewable or low carbon sources at the stabling yard, stations or car parks.	Yes
		3.3	Offset 20% of the electricity needs for the construction phase of the Project	Yes
4	Energy efficiency objective Promote energy efficient design and construction, including reducing fuel usage.	4.1	Explore options to achieve 20% reduction energy demand on a reference case (including regenerative braking) to be achieved through design.	Yes
		4.2	Zero artificial lighting provided to 95% of the concourse and platform area at elevated stations during the day.	No
		4.3	Targets to be identified for energy efficiency / energy reduction during construction.	Yes
5	Land use integration objective Promote liveability and sustainability benefits of urban renewal and consolidation. Optimise community and economic benefit of residual land development. Promote improved public transport patronage by leveraging connectivity and interchange capabilities.		Targets to be established for:	
		5.1	Electric vehicle charging points provided / safeguarded at all station car parks.	No
		5.2	Distance of cycleways created (metres).	No
		5.3	Number of secure cycle parking to be provided.	No
		5.4	Hectares of landscape/public open space created.	No
		5.5	Kilometres or hectares of creek improvements.	No
6	Community experience objective Promote enhanced urban design and passenger comfort.	6.1	Actively engaging local communities, potential customers and other stakeholders in the development and implementation of the project.	Yes
		6.2	Ensure there are place managers to cover all areas for the project during the planning and construction phases.	Yes
7	Community benefit objective Enhance community benefits through transport amenity and reliability, healthy living, provide for community safety, ensure community engagement and involvement, provision of public art, accessible design and social inclusion.	7.1	Number of community legacy projects provided.	No
		7.2	Demonstration of safety initiatives to deter crime.	Yes
		7.3	Number of community workshops to communicate delivery timeframes and receive input from community members on design development.	Yes
		7.4	Incorporation of public art at all stations.	No
		7.5	All local education facilities (schools, universities, institutes) to have access to project development and benefits for curriculum development.	No

Sustainability Objective		Sustainability Initiatives and Targets		Relevant for RTRF
8	Resource land objective Optimise above and below ground land take requirements	8.1	Identify per cent reduction in efficient use of land (project footprint).	Yes
9	Resource – water efficiency objective Minimise demand for, and use of potable water, as well as maximise opportunities for water re-use from captured stormwater, wastewater and groundwater	9.1	Explore options to achieve 100% of non-potable water demand sourced from non-potable sources during operation.	Yes
		9.2	Explore options to achieve 100% of non-potable water demand sourced from non-potable sources during construction.	Yes
10	Resource – waste and materials objective Reduce materials use and minimise waste through the project life-cycle. Identify materials with lower environmental footprint.	10.1	100% clean spoil to be beneficially reused.	Yes
		10.2	90% of construction and demolition recyclable waste is recycled.	Yes
		10.3	Identify reduction in embodied carbon emissions, compared to a reference design.	Yes
11	Heritage conservation objective Protect and promote local heritage through appropriate design, planning, and management controls	11.1	Identify opportunities to enhance heritage values and show evidence of implementation.	Yes
		11.2	Develop partnerships with relevant stakeholders to utilise heritage places to promote local heritage values.	Yes
12	Biodiversity conservation objective Protect and create biodiversity through appropriate planning, management and financial controls	12.1	Area of biodiversity legacy provided onsite.	Yes
		12.2	Offset biodiversity as determined by the Regulator.	Yes
13	Pollution control objective Reduce sources of pollution and optimise control at source to avoid environmental harm	13.1	Zero major pollution incidents	Yes
14	14: Supply chain objective Influence contractors, subcontractors and materials suppliers to adopt sustainable practices in support of the NWRL Environment and Sustainability Policy	14.1	Develop a workforce strategy, prior to construction commencing including the following aspects: - Local employment. - Training and education. - Health and wellbeing. - Diversity and equal opportunity (including gender, age, minority group membership diversity). - Partnerships with local universities and other educational institutes.	Yes
		14.2	Ensure sustainability and environment performance criteria and the NWRL Environment and Sustainability policy is passed on to all suppliers.	Yes

Sustainability objectives and initiatives/targets would be included in the contract documents for all detailed design, construction, operation and maintenance contracts. Project contractors would be required to clearly identify how they would ensure that specific sustainability objectives and initiatives/targets are met. This approach would encourage industry to develop innovative value for money sustainability solutions.

The initiatives/targets identified in the table are not definitive and are being progressively assessed and developed by the project Sustainability Team.

Implementation of sustainability initiatives/ targets would be monitored and audited in line with the requirements of the Project Sustainability Strategy. The result of this process

would be reported and subject to independent verification as part of an overall sustainability assurance process.

8.1.3 Benchmarking and rating tools

The RTRF would be assessed against the TfNSW Sustainable Design Guidelines. As with the NWRL, the RTRF has also committed to being assessed using the comprehensive Infrastructure Sustainability Council of Australia IS Rating Tool. The IS Rating Tool evaluates sustainability across the design, construction and operation of infrastructure projects. The National Australian Built Environment Rating System (NABERS) and relevant Green Star tools would also be applied to the RTRF as applicable.

8.2 Sustainability in Project Design, Delivery and Operation

The following sustainable design features have been included into the design for the RTRF:

- Rainwater harvesting and reuse; (90% of non-potable water required for operations at the RTRF to be supplied from non-potable sources such as rainwater harvesting and water recycling).
- water recycling at the train wash (85 per cent of the water used in the train wash will be collected, recycled and reused).
- energy efficient ventilation and cooling.
- Minimum provision of 10% of the annual low voltage electricity consumed at the facility from renewable energy sources.
- allowance for inclusion of water sensitive urban design features.

The facility would be designed and operated in accordance with the Transport for NSW - NSW Sustainable Design Guidelines for Rail and Project contractors should aim to achieve a high level of attainment using this tool. In addition to this, the Project contractor would aim to achieve a NABERS rating of 4.5 stars for the office and data centre components, and a Green Star Office Design and Office Interiors rating of 4 stars. The RTRF will also be assessed under the ISCA IS Rating Tool for 'design' and 'as built' ratings, again aiming for a high level of attainment under this rating tool.

The following construction phase initiatives would reduce greenhouse gas emissions:

- Refrigerants and fire suppression systems within the RTRF would have zero ozone depletion potential and low or zero global warming potential.
- Green Travel Plan(s) would be prepared and implemented for the RTRF in order to encourage public transport use.
- Use of materials with lower embodied emissions where appropriate. While these materials are not specified in the Reference Design, they warrant consideration during detailed design and construction, and include:
  - Use of low-carbon concrete (by substituting Portland cement with waste products including ground granulated blast furnace slag and fly ash). Low carbon concrete could potentially be suitable for use for piles, piers and pile caps.
  - Use of geopolymer concrete for non-load bearing applications (for example, noise walls, footpaths).
  - Use of recycled materials (e.g. recycled glass fines instead of sand, recycled ballast, recycled steel in reinforcing).
- Maximising re-use of spoil on the project, to minimise fuel consumed in transportation of spoil.

Other initiatives relevant to the RTRF during delivery and operation are outlined below:

- Workforce development initiatives would be implemented including skilling and training of personnel and subcontractor personnel.
- Opportunities to procure from Australian and New Zealand (ANZ) Small and Medium Enterprises (SMEs) would be maximised.

These measures demonstrate how the RTRF would contribute to the achievement of the NWRL project-wide sustainability objectives.

8.3 The Construction Environmental Management Framework

The Construction Environmental Management Framework (**see Appendix B**) sets out minimum environmental, stakeholder and community management requirements for construction. It acts as a linking document between the initiatives described in environmental assessment documentation and further development and implementation by contractors through individual Construction Environmental Management Plans.

Contractors would be required to implement and adhere to the requirements of the Construction Environmental Management Framework and the NWRL Sustainability Strategy and both documents would be included as a contract document in all design and construction contracts.

8.4 Environmental and Sustainability Management in Project Delivery

The Principal Contractor for the RTRF would be required to develop an environmental and sustainability management system for the project which would link to the Principal's system. All sub-contractors would be required to work under the Principal Contractor's environmental and sustainability management system.

9.0 Soils, Contamination and Groundwater

9.1 Introduction

This chapter describes the physical environment at the RTRF site, and is based on information gathered as part of the investigations of the NWRL corridor in relation to soils and groundwater.

9.2 Director-General's Requirements

Table 9 below sets out the Director-General's Requirements as they related to soils and contamination, and where in the project these have been addressed.

Table 9 – Director-General's Requirements: Soil and Contamination

Issue	Where Addressed in EIS
Soils and Contamination	
Geological and soil characteristics (physical and chemical) including potential constraints such as the presence of acid sulphate soil and soil salinity.	Section 9.4
Land contamination and identification of the need for management or remediation of contaminated land, having regard to ecological and human health risks posed by contamination in the contact of past, existing and future land uses. Where remediation of contaminated land is required presentation of a remediation strategy taking into account relevant OEH (EPA) guidelines and in accordance with the Contaminated Land Management Act 1997.	Section 9.4
Quantification of bulk earthworks and spoil balance and disposal of the excess spoil and waste.	Section 7.1.2 Section 20 (Waste)
A strategy for managing earthworks with particular focus on those works that have the greatest potential to disturb soils that are contaminated, have high erosion and run off hazard.	Section 9.6

9.3 Assessment Methodology

9.3.1 Background information

A number of geotechnical studies and investigations have been undertaken to support the NWRL and predecessor schemes during the period 2002 to 2012. The scope of relevant geotechnical investigations completed to date has been:

- The sinking of 9 boreholes at the RTRF site. Boreholes were drilled up to a 75m depth and representative soil samples were collected at selected/regular intervals in fill and near surface soil where practicable.
- The digging of 8 test pits at the RTRF site. Test pits were excavated up to a 3m depth and representative soil samples collected at selected/regular intervals in fill and near surface soil where practicable.
- A field and laboratory program to assess the identified Areas of Environmental Concern (AEC) and Contaminants of Potential Concern (CoPC) and to provide a general coverage at selected accessible areas, utilising the geotechnical test pits and boreholes as sampling points.
- Laboratory analysis of selected soil samples for CoPC including Total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylenes (BTEX), Polycyclic aromatic hydrocarbons (PAH), Organochlorine pesticides (OCP), Polychlorinated biphenyls (PCBs), heavy metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury,

Nickel, Zinc), total phenolics, asbestos, cations, anions, total dissolved solids (TDS) and sulphate reducing bacteria (SRB)

In addition to the contamination testing program, the samples collected were also utilised for durability testing and the assessment of general groundwater chemistry.

9.3.2 Methodology

The monitoring wells were installed and monitored following installation. Groundwater samples were collected in accordance with industry's accepted standards and protocols. Prior to groundwater sample collection, the monitoring wells were purged and water quality parameters were measured in the field (pH, conductivity and temperature).

Soil samples were collected in accordance with industry accepted standards and protocols with the aid of a decontaminated soil penetration test split spoon sampler, a decontaminated hand auger or from an excavator bucket. Quality assurance and quality control samples were collected, and all samples were dispatched to a NATA accredited laboratory, under chain of custody protocol.

9.4 Existing Environment

9.4.1 Landform

The subject site slopes generally from a high point at the eastern Tallawong Road boundary (RL 64 AHD to RL 49 AHD) to a low point at the western site boundary adjacent to First Ponds Creek (RL 40 AHD to RL 42 AHD).

A small spur runs from west to east within the site from the mid-point of Tallawong Road before falling towards First Ponds Creek. As a result, overland stormwater flows to the north, south and west are in several sub-catchments prior to draining to First Ponds Creek.

9.4.2 Soil landscapes

The published 1:100,000 series Soil Landscape maps for Sydney (sheet 9130) and Penrith (sheet 9030) indicate that the RTRF is underlain by the Blacktown Soil Landscape, defined by the former Department of Land and Water Conservation.

Soils in the Blacktown Landscape occur on low undulating terrain on the Wianamatta Group shales. They are generally moderately deep (1.0 m) red and brown podsols. These soils are moderately reactive, highly plastic and generally poorly drained.

9.4.3 Geology

The proposed RTRF is situated in the north-west of Sydney, in the Sydney Basin, which is characterised by a sub-horizontally lying Permo-Triassic sedimentary sequence. The RTRF site is shown within the Regional Geological Map GSNSW (1991) to be underlain by Bringelly Shale. Bringelly Shale consists of undifferentiated shale, carbonaceous claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff of the Wianamatta group.

The results of test pits indicate that Minchinbury Sandstone underlies the site. The test holes indicate the material is variably weathered across the site with some test holes encountering weathered fine grained sandstone to 5m and 7m depth. Deeper bulk excavations and the detailed excavations for foundations are likely to extend into fresh Mulgoa Laminite.

The boreholes indicate the Mulgoa Formation is sandwiched between the overlying Minchinbury Sandstone and the underlying Regentville Formation. At this location the Mulgoa Laminite is assessed to be 20m thick.

Quaternary and recent alluvial and estuarine sediments occur as channel infills (alluvial deposits <10m thick) within the incised river systems and may be located in the vicinity of First Ponds Creek immediately to the west of the site.

9.4.4 Hydrogeology

The regional water table within the Hawkesbury Sandstone is affected by the beds of low lying permanently flowing streams in the Beecroft / Castle Hill area. The water table rises away from these watercourses, following the topography but in a more subdued fashion deep between ridges, shallow close to streams. The level of the water table may fluctuate by several metres between wet and dry seasons, especially beneath ridges. Recharging water is believed to enter the system along the upper, non-perennial tributaries of these streams, and to ultimately discharge at sea level.

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Groundwater levels measured at the highest part of the site (on the Tallawong Road boundary) were between 13 m and 18 m deep. Groundwater flow at the RTRF site is expected to be north westerly towards First Ponds Creek and Eastern Creek.

Several groundwater bores were identified in the vicinity of the proposed RTRF site. Two of these are located immediately down gradient of the site. The nature and extent of the groundwater bores is unknown and no information was available at the time of searching for groundwater conditions.

9.4.5 Acid Sulfate Soils

Acid sulfate soil (ASS) are associated with marine or estuarine areas in NSW. ASS are naturally occurring soils containing pyrite (iron sulphides) which, on exposure to air, causes oxidisation and creates sulphuric acid. The increased acidity can lead to mobilisation of aluminium, iron and manganese from the soils. Other impacts include the de-oxygenation of water. Potential acid sulfate soils (PASS) are soils containing pyrite that have not yet been exposed to air and oxidised to form sulfuric acid.

ASS risk mapping for the area undertaken by the former Department of Land and Water Conservation (DLWC) in 1998 show that the project lies within areas designated as 'no known risk' of ASS or PASS.

9.4.6 Soil Salinity

Salt occurs naturally within many parts of the Australian landscape. However, urbanisation can increase the movement of water through the soil profile and thus exacerbate salinity. Excess salt levels can affect vegetation and building materials such as concrete and steel. The accumulation of salt can be exacerbated by human practices that increase the rate of water movement in soils. Soil salinity has been identified as a growing problem in the Western Sydney region. Salinity potential maps prepared by the former Department of Infrastructure, Planning and Natural Resources (DIPNR, 2002) identify the potential risk of soil salinity. Based on these maps, areas around First Ponds Creek show moderate salinity potential.

9.4.7 Contamination

A field and laboratory program has been undertaken to assess the identified Areas of Environmental Concern and chemicals of potential concern (COPC) at selected accessible areas, utilising the geotechnical sampling points.

Existing Landuses

The RTRF site comprise predominately market gardens and farm paddocks in semi-rural allotments. Properties which store minor amounts of waste material such as stockpiles of metal and soil and undertake machinery maintenance are Areas of Environmental Concern. Near surface soil impacts, such as fill and pesticides in the market gardens and petroleum hydrocarbon and asbestos in buildings, could be encountered.

Soil

Concentrations of CoPC in the soil samples analysed were generally detected below the LORs or typical of background concentrations indicating that there is no broad scale contamination across the site.

The contamination assessment has not specifically targeted all of the Areas of Environmental Concern i.e. individual above-ground storage tanks (AST), farm dams, and asbestos in buildings. However, contamination, if present, is likely to be in localised areas limited to the near surface soil.

Groundwater

Concentrations of CoPC in groundwater samples analysed were generally typical of background concentrations.

One borehole located immediately adjacent to Tallawong Road showed exceedances of the assessment criteria for Nickel, Zinc and Copper. It is highlighted that concentrations of Nickel and Copper are below the typical values for road run-off, and that concentrations of metals in groundwater meet the Sydney Water's tradewaste acceptance standards.

In the same borehole, concentrations of sodium, chloride and TDS were reported above the adopted criteria but are considered to be representative of slightly saline groundwater conditions typical in the formations in Sydney.

9.4.8 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater. GDEs can occur across both the surface and subsurface landscapes ranging in area from a few metres to many kilometres.

Existing GDEs in the area of the proposed RTRF include surface water environments (as surface water is often linked to groundwater regimes) and forest zones occurring with ground water within close proximity to the ground surface. Details of GDEs in the area are described in Chapter 15.

9.5 Potential Impacts

9.5.1 Groundwater

The groundwater level at the highest point of the site (on the Tallawong Road boundary) was measured at between 13m and 18m deep. The RL at this point is approximately 64m AHD, compared to a finished level of approximately 52m AHD.

As such, there may be a need for some dewatering during site excavations. Dewatering could potentially lower groundwater levels within the local area which could indirectly impact groundwater dependent ecosystems. There are no tunnels or deep excavation works proposed during construction and the majority of the site is likely be filling activities rather than cutting activities. As such, the excavation works are not expected to result in significant amounts of dewatering during construction. Mitigation measures have been proposed to monitor and manage construction dewatering, including investigating opportunities for reuse on-site and providing for treatment prior to discharge.

Once complete the impervious areas associated with the RTRF would reduce local groundwater recharge. Minimal groundwater drawdown is expected, as the stormwater basins will be unlined incorporating an infiltration function, which will provide a reasonable level of groundwater recharge. Landscaped areas will also be provided to encourage infiltration. It is expected that this will reasonably mitigate potential impacts on the local groundwater table. Localised groundwater recharge from the site will continue to drain towards First Ponds Creek.

Due to the low hydraulic conductivity of the underlying soils, the risk of potentially contaminated surface water seeping to ground within permeable surfaces such as the track areas is likely to pose a negligible risk to groundwater quality beneath the RTRF. Therefore the potential risk to receptors such as groundwater dependant ecosystems and First Ponds Creek are likely to be negligible.

9.5.2 Contamination

The site is considered to have a relatively low to moderate likelihood of significant contamination being present. Some localised near surface soil impact associated with fill, market garden activities, AST fuel storages, farm machinery, floors of existing or filled-in farm dams, weathering of building material and localised pesticide and herbicide applications could be present.

The results of soil sampling indicates that the soil would comply with the relevant land use health based investigation levels, and is generally suitable for re-use without remediation. Contamination, if present, is likely to be in localised areas limited to the near surface soil. Near surface excavation for offsite disposal may require further assessment for waste classification and off-site disposal. The nature and extent of contamination at these locations would be subject to ongoing investigations prior to construction to determine the appropriate classification for disposal.

In addition to potential existing land contamination, potential contamination may result from some construction activities proposed as part of the RTRF construction. Activities with potential to cause contamination include:

- Disposal of turbid, saline or contaminated water collected within the excavations from dewatering or seepage.
- Contaminants leaking to the ground surface.
- Accidents or spills involving construction equipment.

9.5.3 Soil Salinity

Areas of soil salinity are known to occur in the vicinity of First Ponds Creek. Construction in areas of known soil salinity can have the following potential environmental impacts:

- Soil and water contamination through leaching of disturbed saline soils.
- Soil and water contamination through modification of groundwater levels.
- Increased salinity of waterways.

It is not expected that construction works would intersect directly with saline soils. However, construction of retaining walls along the western boundary could potentially increase the movement of water through the soil profile and thus exacerbate salinity. Retaining walls will be designed to be free draining to minimise the alteration of groundwater levels and so mitigate the concentration of salinity within soils.

Groundwater recharge at the site is dependent on infiltrating stormwater through the floor of stormwater basins. This represents a concentration of groundwater within potentially saline soils which is known to increase salinity impacts. This is mitigated however due to the infiltration zone being located well below any proposed infrastructure on the RTRF site. The infiltration rate is considered to be consistent with localised infiltration rates within the creek bed and therefore there will be a low risk of salinity impacts at the ground surface the site.

9.6 Mitigation measures

9.6.1 Operation

An OEMP would be developed detailing the processes to manage environmental impacts during the operation of the project. Mitigation measures proposed to avoid, reduce and manage identified potential operational impacts are:

- Procedures to quickly address any contaminant spill or accident would be developed and implemented during operation of the station sites. (OpSG2)

9.6.2 Construction

Mitigation measures developed to address construction impacts would form part of the Construction Environmental Management Framework, provided in **Appendix B** which details the environmental, stakeholder and community management systems and processes for the construction of the NWRL.

These mitigation measures and their application to the construction sites for the NWRL are presented in **Table 10**.

A number of mitigation measures detailed in other chapters would also be relevant to soils and groundwater. These include:

- Mitigation measures relevant to water discharge to surrounding waterways, and the storage and handling of hazardous substances and dangerous goods - refer Chapter 18 (Surface Water and Hydrology).
- Mitigation measures relevant to contaminated spoil - refer Chapter 19 (Non-Key Issues – Waste Management)

Table 10 – Construction Phase Soils and Contamination Mitigation Measures

No.	Mitigation Measure
	Soil Salinity
SG34	Appropriate site specific soil salinity mitigation measures would be adopted in accordance with Draft Salinity Code of Practice (Western Sydney Regional Organisation of Councils, 2004) and the *Guidelines to Accompany Map of Salinity Potential in Western Sydney* (DIPNR 2002). These mitigation measures would be included within Sub-Plans to the CEMP at all sites within areas of known risk of soil salinity.
SG48	Retaining walls will be designed to be free draining.
	Groundwater Management
SG17	A groundwater monitoring plan would be prepared for the duration of the construction period. Parameters to be monitored would include groundwater levels and groundwater quality with field parameters, laboratory parameters and sample frequency to be developed prior to construction.
SG19	Water sampling and testing of groundwater would be undertaken during construction to determine the most suitable treatment processes to meet the required water quality standards
SG26	All feasible and reasonable opportunities for groundwater reuse for construction purposes or recycling nearby would be utilised in the first instance. Should groundwater inflows and required treatment volumes outstrip potential for water reuse for construction purposes, options for discharge would be investigated.
SG27	Where water salinity is found to be too high for discharge to creeks, brackish water reverse osmosis would be undertaken.
SG28	Dissolved iron would typically be removed from discharge water by oxidising the Ferric ion (Fe3+) to Ferrous (Fe2+) which enables precipitation and physical removal.
SG29	Water turbidity would typically be treated by settling / filters.
SG30	Iron reducing bacteria in discharge water would be typically treated by biocide dosing.
	Contamination
SG14	In the event of discovery of previously unidentified area(s) of potentially contaminated material, all work would cease in the vicinity of the discovery and not recommence until the extent of contamination has been assessed and if

No.	Mitigation Measure
	necessary, a Remediation Action Plan or similar has been prepared and endorsed by an accredited Site Auditor.
SG15	A Site Auditor would be required to certify that any contaminated areas have been remediated to a standard consistent with the intended land use prior to operation of the remediated site(s)
SG16	Bunds around fuel depots and stockpile areas would be installed to minimise the risk of contaminants reaching the water table.
SG41	Excavation for offsite disposal will be subject of additional assessments for waste classification with particular focus on Areas of Environmental Concern including above-ground storage tanks, farm dams and asbestos in buildings.

Note: Identifying codes for mitigation measures are taken, where possible, from EIS 1 and EIS 2 for NWRL to maximise consistency. As such, the codes are not always sequential for this EIS.

9.7 Conclusions

There is no evidence of broad contmainationa cross the site. Localised areas limited to the near surface soil potentially impacted by rural residential acitvities may require further assessment for waste classification prior to off-site disposal.

With the application of appropriate mitigiation measures the RTRF is expected to have minimal impacts on groundwater flows and soil salinity issues.

10.0 Traffic and Transport

10.1 Introduction

This chapter includes an assessment of the potential traffic impacts of the construction and operation of the RTRF on the local road network and intersections. The Transport Impact Assessment prepared by GTA Consultants (**Appendix E**) identifies existing road conditions, the potential impacts of the RTRF proposal on these conditions and recommends mitigation measures as appropriate.

10.2 Director General's Requirements

Table 11 reproduces the Director General's Requirement's relevant to traffic and transport, and where in the EIS these have been addressed.

Table 11 – Relevant Director General's Requirements

Key Issues	Where Addressed in EIS	Technical Study
Access to, from and within the site during the construction and operation of the project	Section 7.1, 7.2 and 10.5	**Appendix E**
Interaction and integration with existing and planned transport infrastructure including the North West Rail Link	Section 7.1, 10.5, 10.6 and 21.	**Appendix E**
A traffic impact assessment in the local and regional road network, including a traffic analysis on existing intersections and consideration of existing road constraints	Section 10.4 and 10.5	**Appendix E**
Taking into account the Guide to Traffic Generating Developments (RTA,2002)	Section 10 .3 and 10.5	**Appendix E**

10.3 Assessment Methodology

The methodology for the transport assessment included:

- Traffic count information was previously collected for NWRL EIS1 and EIS2. New traffic count information was collected for key intersections in the vicinity of the RTRF site during the peak periods. This information comprised seven day counts along selected roads in the area
- Intersection modelling was undertaken for the RTRF using the SIDRA Intersection modelling program. Predicted intersection performance was determined as both the degree of saturation (DOS) and the level of service (LOS)
- Review of strategic transport planning for RTRF site surrounds and the North West Growth Centre, including current and planned transport infrastructure upgrades

The traffic and road safety impacts due to the operation of the NWRL were assessed with consideration of the RMS *Guide to Traffic Generating Developments* (RTA, 2002) and other relevant Austroads guidelines. This analysis takes into account the ongoing upgrade of Schofields Road, which includes the future signalisation of the Tallawong Road / Schofields Road intersection. Measures to mitigate these impacts are proposed in order to facilitate access to, and around, the RTRF.

The RTRF site is located within a transitional urban environment. The traffic capacity of the road network immediately adjacent to the site is primarily governed by the operation of the intersections located on the surrounding road network.
The performance of the key intersection, being the Tallawong Road / Schofields Road intersection, has been modelled using the SIDRA modelling software program to assess the effects of the altered vehicle demand on the road network during construction and operation.

The future development site on the southern side of the RTRF site and the realignment of Tallawong Road are outside of the RTRF SSI Application. The Tallawong Road realignment is included within, and subject to, the NWRL EIS1 and EIS2 approvals and the RMS approval for the Schofields Road Upgrade (Stage 1). The future development site would be subject to a separate approvals process at some point in the future, once a development option had been identified. This process would take into consideration the operating conditions and constraints at the time of the proposed development.

For the purposes of this assessment a vehicle movement is defined as a vehicle entering or leaving the site. Therefore each vehicle would generate two movements and the total number of movements reflects the total two-way movement of vehicles generated by the site.

10.3.1 Level of Service

The LoS refers to an overall indication of the operational performance of traffic on any given intersection, traffic lane or roadway. The LoS parameter provides an indication of how well an intersection operates. The SIDRA analysis provides an estimate of intersection performance and then categorises this against the LoS criteria for intersections specified in the RMS *Guide to Traffic Generating Developments* (RTA, 2002) as described in **Table 12** below.

Table 12 – Level of Service criteria for intersections

Level of Service	Average Delay per vehicle (sec/vehicle)	Traffic Signals/Roundabout	Give Way and Stop Sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

10.3.2 Degree of Saturation

The DoS value indicates the ratio of arrival volumes to capacity. Values above 1.0 represent oversaturated conditions, (i.e. arrival volumes exceed capacity) whereas degrees of saturation below 1.0 represent under saturated conditions (i.e. arrival volumes are below capacity). It should be noted that the LoS provides an assessment of the intersection as a whole, whilst the DoS provides an assessment of the worst performing approach to the intersection.

10.4 Existing Conditions

The RTRF site has frontages to two roads, being Tallawong Road to the east and Schofields Road to the south. Tallawong Road is a two-way road with two lanes and a six metre carriageway set within an overall road reserve approximately 25 metres in width. This road operates as a local road and carries approximately 950 vehicles per day.

Schofields Road is a two-way road with two lanes and a six metre carriageway set within an overall road reserve approximately 20 metres in width. Schofields Road is classified as a State Road between Windsor Road and Hambledon Road, including the entire frontage to the RTRF site. This road carries on average 11,600 vehicles daily.

Tallawong Road and Schofields Road intersect adjacent the south-east corner of the RTRF site at a T-intersection. The performance of this intersection is summarised at **Table 13** below. The worst-performing leg of the intersection is the Tallawong Road (north) leg.

Table 13 – Existing operating conditions of Schofields Road/Tallawong Road intersection

Peak	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service
AM	0.304	31	7	C
PM	0.262	39	7	C

Existing AM and PM peak times are provided in NWRL EIS 1, and are summarised as follows:

- Tallawong Road AM Peak – 7am to 9am
- Tallawong Road PM Peak – 4pm to 6pm
- Schofields Road AM Peak – 9am to 10am
- Schofields Road PM Peak – 5pm to 6pm.

Approved Upgrades

Upgrades are currently planned or underway for both Schofields Road and Tallawong Road in the immediate vicinity of the RTRF site. Under the NWRL EIS1 and EIS2 approvals, and the Schofields Road Upgrade (Stage 1) approval, Tallawong Road will be modified and upgraded as required adjacent to the western edge of the Cudgegong Road Station precinct (also the eastern edge of the RTRF site). These works will include the realignment of the southern portion of Tallawong Road to the east (to outside the boundary of the RTRF site), a new four-way intersection to Schofields Road, a new road bridge above the NWRL corridor and intersections to new roads within the station precinct as illustrated at **Figure 31** below.

Stage 1 of the Schofields Road upgrade (Windsor Road to Tallawong Road) was approved under Part 5 of the EP&A Act in 2009 and is currently under construction, with works expected to be completed by late-2014. This stage of works includes realignment of the southern part of Tallawong Road to the east so that it forms a four-way signalised intersection with Schofields Road. Stage 2 includes the upgrade of Schofields Road along the length of the RTRF site's southern boundary, with a major intersection with Hambledon Road immediately adjoining the south-west corner of the subject site necessitating the diversion of First Ponds Creek.

Plans displayed for Stage 2 in October and November 2012 include a northern stub at the Hambledon Road intersection immediately to the west of the south-western site corner of the subject site.

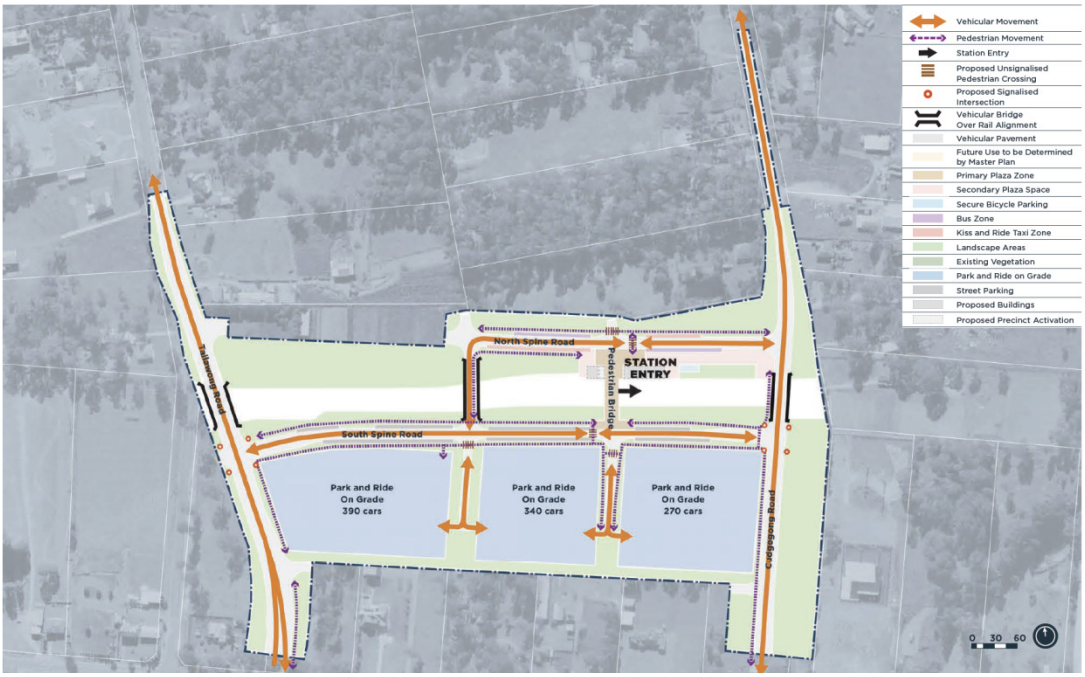

Figure 31 – Vehicular access and road upgrades approved under NWRL EISs

Buses

At present one public bus service (Route T75 Riverstone to Blacktown) operates along Tallawong Road and Schofield Road adjoining the site.

Pedestrians and Cyclists

There are limited pedestrian or cyclist facilities within the vicinity of the site, with no existing footpath on Tallawong Road or Schofields Road adjoining the site. The RMS upgrade and extension of the Schofields Road corridor includes off-road share paths to improve access and safety for cyclists and pedestrians.

10.5 Potential Impacts

10.5.1 Construction

Construction traffic impacts would be related to construction vehicles, site deliveries and construction staff and contractor vehicle movements to and from the site. Construction would occur in two phases, with the major civil works phase occurring over an estimated 13 month period. A three-year timeframe has been assumed for the infrastructure and systems phase based on the construction program for the NWRL, however it is likely that the actual duration of works within the RTRF site will be shorter.

It has been assumed that the Stage 1 Schofields Road upgrade would be completed prior to RTRF construction commencing. This assumption is based on discussions with the RMS. It is further assumed that the Stage 2 Schofields Road upgrade (west of Tallawong Road) would not be carried out until after the RTRF construction works are complete. Intersection modelling has been undertaken based on the RMS designs for the upgraded Schofields Road / Tallawong Road intersection. The modelling assumes that the Schofields Road approaches comprise a single left turn slip lane, two through lanes and a single right turn bay. The Tallawong Road approach is assumed to comprise four lanes comprising two right turn bays, a through lane and a left turn lane.

Vehicle access to the site would be from a single access point on the relocated Tallawong Road, as shown in **Figure 26**. The main heavy vehicle route would be to and from Tallawong Road south and via Schofields Road east of the intersection with Tallawong Road. An alternative heavy vehicle route would be west along Schofields Road, although this route is undesirable due to a lack of connectivity to arterial roads.

During the major civil works phase, a worst-case assessment of construction vehicle traffic generation would result in approximately 100 heavy vehicle movements (two-way) and approximately 100 light vehicle movements (two-way) daily, increasing to approximately 132 heavy vehicle movements (two-way) and 168 light vehicle movements (two-way) daily during the infrastructure and systems works phase.

Heavy vehicle movements during the major civil works phase have been reduced significantly from NWRL EIS1 due to the substantial balancing of cut and fill that has been achieved on the expanded footprint – reducing excess spoil to approximately 145,000 m^3.

Construction is estimated to result in approximately 60 persons being employed on the site daily during the peak of the major civil works phase, with 100 personnel employed on site during the peak of the infrastructure and systems works phase. Considering the nature of the RTRF construction work, it is estimated that no more than half of site personnel would arrive during the AM peak hour (ie. after 7am) or depart during the peak hour (ie. before 6pm). On this basis, a conservative estimate of 50% of the light vehicle traffic generation has been modelled as occurring during the AM and PM peak hours.

Adequate parking for the construction workforce would be provided onsite. On-site parking would be located largely in the construction laydown area in the southern portion of the site, as shown in **Figure 26**.

Table 14 summarises the anticipated worst-case vehicular movements generated by the site during the AM and PM peak periods.

Table 14 – Estimated number of vehicles accessing the site in the AM and PM peak hour

Stage	Peak Hour	Heavy Vehicles		Light Vehicles		Peak Staff Levels
		In	Out	In	Out	
Major Civil Works	AM Peak	5	5	25	0	60
	PM Peak	5	5	0	25	
Infrastructure and Systems Works	AM Peak	6	6	42	0	100
	PM Peak	6	6	0	42	

Consistent with the NWRL EIS1 and EIS2 approvals, construction hours will be restricted to those listed below, with any variations to these hours requiring separate approval:

- Monday to Friday, 7am to 6pm.
- Saturdays, 8am to 1pm.
- Sundays and Public Holidays, no work.

The impact of the worst-case construction impacts on the intersection of Tallawong Road and Schofields Road, has been modelled based on predicted future traffic conditions and the assumptions detailed above, with the results summarised in **Table 15** below. This analysis indicates that construction traffic associated with the RTRF is predicted to have a negligible impact on the signalised Tallawong Road / Schofields Road intersection.

Table 15 – Schofields Road and Tallawong Road Intersection Performance during RTRF construction works

Stage	Peak	Degree of Saturation (DOS)	Average Delay (sec)	Level of Service (LOS)
Base Case (Schofields Road Upgrade Complete)	AM Peak	0.46	33	C
	PM Peak	0.48	32	C
RTRF – Major Civil Works	AM Peak	0.47	35	C
	PM Peak	0.48	32	C
RTRF – Infrastructure and Systems Works	AM Peak	0.47	37	C
	PM Peak	0.48	33	C

Note: DOS is dependent on the worst performing leg of the intersection. In this case the worst performing leg is straight through traffic on Schofields Road, so additional traffic movement into and out of Tallawong Road do not impact on DOS.

Pedestrians and Cyclists

Pedestrian and cyclist facilities in the vicinity of the RTRF construction site would include signalised pedestrian crossings at all legs of the upgraded Tallawong Road / Schofields Road intersection, linking with the new shared path on Schofields Road. Designate pedestrian and cycling routes would remain largely unaffected by RTRF construction activities.

Buses

There is currently one bus route operating along Tallawong Road and Schofields Road (Route T75) which would potentially be impacted during the construction period. Since the Tallawong Road works are to be carried out under separate NWRL approvals it is not likely that the RTRF will require the closure of Tallawong Road. This service could be rerouted via Cudgegong Road should it be required to close Tallawong Road for any length of time.

10.5.2 Operations

Operational traffic impacts would be related to staff and service vehicle movements to and from the site. The main site entry would be located towards the centre of the Tallawong Road frontage, approximately 420 metres north of the Schofields Road intersection. A secondary site access would be located a further 150 metres to the north of the main access gate. These access points would be security controlled. An internal access road would facilitate vehicular movement within the site.

Staff levels have been modelled for the purpose of this assessment based on approximately 300 staff employed on site during the operations of the RTRF. The operational characteristics of the RTRF (ie. train operations on the NWRL will commence at 4am) dictate that a large portion of traffic movements associated with employee commuting will occur during non-peak periods. Conservatively, it has been assumed that all day shift staff would arrive and all night shift staff would depart during the AM peak period. Likewise, it has been conservatively assumed that day shift staff would depart and evening shift staff would arrive during the PM peak period.

Peak hour traffic generation estimates based on the operational characteristics of the RTRF and the distribution of trips based on anticipated destinations are illustrated in **Figure 32** below. It is anticipated that half of RTRF related vehicles will arrive and depart via Schofields Road to the east of the site. **Figure 32** also includes the predicted background traffic for the intersection.

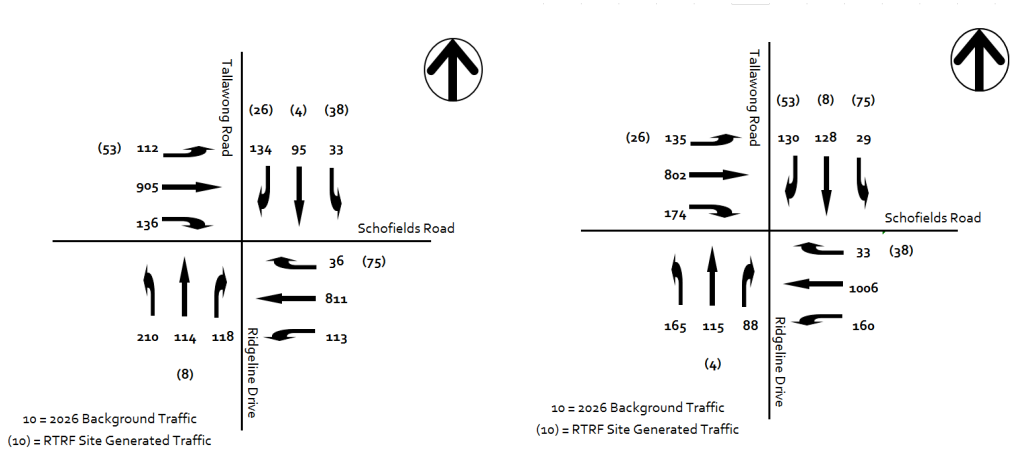

Figure 32 – RTRF generated traffic volumes and distribution to road network – AM (left) and PM (right)

(Note: The RTRF Site Generated Traffic is in addition to the 2026 Background Traffic)

Intersection modelling has been undertaken for the operational phase based on predicted future traffic conditions and the assumptions detailed above.

Background traffic for the year 2026 has been used for the purposes of assessing the traffic impacts of the RTRF operations. This is consistent with the approach taken for the NWRL environmental assessments. The operational traffic assessment compared 2026 traffic levels of service and performance of the Schofields Road/Tallawong Road intersection with and without the RTRF. It was further assumed that the 2026 traffic volumes incorporated traffic generation from the Cudgegong Road Station, and that Stage 2 of the Schofields Road upgrade works has been completed.

The impact of the RTRF-generated traffic on the Schofields Road/ Tallawong Road intersection has been assessed using SIDRA INTERSECTION. **Table 16** presents a summary of the anticipated future (2026) operation of the intersection without and with RTRF operational traffic, for comparative purposes

Table 16 – Schofields Road and Tallawong Road Intersection Performance during RTRF operations

Stage	Peak	Degree of Saturation (DOS)	Average Delay (sec)	Level of Service (LOS)
Without RTRF Operations	AM Peak	0.84	45	D
	PM Peak	0.96	51	D
With RTRF Operations	AM Peak	0.84	45	D
	PM Peak	0.96	51	D

Note: DOS is dependent on the worst performing leg of the intersection. In this case the worst performing leg is straight through traffic on Schofields Road, so additional traffic movement into and out of Tallawong Road do not impact on DOS.

Table 15 indicates that there is no change in average vehicle delay, the degree of saturation, or the level of service for both the AM and PM peaks in 2026 as a result of the RTRF operation. The table shows the modelling results for the worst movement of the intersection – which in this case is the Schofields Road through movement, a movement that would not be expected to be affected by the RTRF operational traffic.

The Tallawong Road approach, which is the most affected approach leg of the intersection, shows no change in LoS (it remains as LoS B during the AM and PM peaks) and a negligible increase in average delay of 0.5 seconds in the AM peak and 1 second in the PM peak.

No impacts to buses, rail services, pedestrians or cyclists are expected as a result of RTRF operations. The introduction of the NWRL and the improvements to public transport services and cycling infrastructure would provide an opportunity for RTRF staff to use public transport for their journeys to and from work.

10.6 Mitigation Strategies

The NWRL Environmental Management Framework, provided in **Appendix L**, details the environmental, stakeholder and community management systems and processes for the construction phase of the RTRF.

The mitigation measures detailed in **Table 17** have been developed to avoid, reduce and manage identified potential impacts.

Table 17 –Mitigation measures for construction and operational traffic

No.	Mitigation Measure
	Construction
T1	Directional signage and line-marking would be used to direct and guide drivers and pedestrians past construction sites and on the surrounding network. This would be supplemented by permanent and portable Variable Message Signs, where reasonable and feasible, to advise drivers of any potential delays, traffic diversions, speed restrictions, or alternative routes.
T2	The public would be notified of proposed traffic changes by newspaper, radio, project web site and other forms of community liaison.
T3	Co-ordination would occur with RMS via the Transport Management Centre's Traffic Operations Manager in the event of incidents or undue congestion.
T4	Management of pedestrian and vehicular access to and past construction sites would occur to ensure safe entry and exit procedures. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modification to existing signals or, on occasions, police presence.
T5	Access to existing properties and buildings would be maintained.
T6	Traffic controllers would manage heavy vehicle movements at worksites, and monitor the need for pedestrian control.
T7	All trucks would enter and exit the worksites in a forward direction, where feasible and reasonable.
T10	The need for, and provision of, alternative remote parking locations and shuttle bus transfers for daytime and night time construction staff would be considered for all construction sites during detailed construction planning.
T12	The Traffic and Transport Liaison Group established for the NWRL would consider individual events and any other special event needs, and make reasonable and feasible short-term adjustment to the construction phase activities and / or review and update detailed Construction Traffic Management Plans.
T34	Shuttle bus services for construction workers, would be provided to service strategic off-site parking areas and public transport facilities, such as Schofields Railway Station.
T35	Scheduling the movements of heavy vehicle haulage and deliveries outside peak periods, where feasible and practicable.
T36	TfNSW would liaise with the RMS and other stakeholders to manage cumulative issues during RTRF construction.
	Operation
OpT6	Consideration of peak period movements in assigning shift hours and changeover patterns for maintenance staff at the RTRF. Ideally these should be undertaken outside identified peak periods, noting that some staff may be constrained by rail operations.

No.	Mitigation Measure
OpT7	Preparation of workplace travel plans for RTRF entities that would provide alternative modes for journeys to/from work. The proximity of the future Cudgegong Road Station provides a significant opportunity to contribute towards a higher public transport mode share for RTRF staff journeys. The potential for RTRF staff shuttle services between the site and Cudgegong Road Station should be considered as part of this workplace travel plan

Note: Identifying codes for mitigation measures are taken, where possible, from EIS 1 and EIS 2 for NWRL to maximise consistency. As such, the codes are not always sequential for this EIS.

10.7 Conclusions

The construction phase of the RTRF proposal would involve an increase in existing traffic volumes entering and exiting the site via Tallawong Road and the Schofields Road intersection. This would result in negligible changes to the predicted future levels of service of this intersection.

The impact of traffic generated during RTRF operations is modelled to have no impact on the local road network.

In light of the above the potential traffic impacts of the RTRF are considered to be acceptable for both the construction and operational phases of the development, subject to the implementation of the mitigation measures listed at **Section 10.6**.

11.0 Noise and Vibration

11.1 Introduction

This chapter provides the noise and vibration impact assessment of the RTRF site. The detailed Noise Assessment Report prepared by SLR Consulting Australia Pty Ltd is included as **Appendix F** of this EIS.

11.2 Director General's Requirements

Table 18 reproduces the Director General's Requirement's relevant to traffic and transport, and where in the EIS these have been addressed.

Table 18 – Relevant Director General's Requirements

Key Issues	Where Addressed in EIS	Technical Study
An assessment of the noise and vibration impacts from construction activities	Section 11.7	**Appendix F**
The nature and sensitivity of, and impact to, potentially affected receivers and structures	Section 11.3.1	**Appendix F**
A strategy for managing construction noise and vibration and out if hours activities with particular focus placed on those activities identified as having the greatest potential for adverse noise or vibration impacts, and a broader, more generic approach developed for lower-risk activities	Section 11.8.1	**Appendix F**
An assessment of noise and vibration impacts from operating the facility	Section 11.7	**Appendix F**
A description of measures to mitigate and manage operational noise and vibration impacts	Section 11.8.2	**Appendix F**
Taking into account the Interim Construction Noise Guidelines (DECC 2009), the NSW Industrial Noise Policy (NSW Government, 2000) and Assessing Vibration: a Technical Guideline (DEC, 2006)	Section 11.4	**Appendix F**

11.3 Existing Environment

11.3.1 Sensitive Receivers

The noise and vibration assessment considers all residential receivers to be of a sensitive nature. Commercial receivers are generally considered to be less sensitive to noise and vibration compared to residential receivers. The nearest existing sensitive receivers to the proposed stabling and maintenance facility are residential.

The nearest noise sensitive receivers to the RTRF site are identified in **Table 19** below.

Table 19 – RTRF Site Nearest Noise Sensitive Receivers

Receiver Area	Location Relative to Works (m)	
	Earthworks	RTRF Operations
North Receiver Catchment - Residences north of the site, between Tallawong Road and Oak Street	20 m	45 m
East Receiver Catchment - Residences east of the site, east of Tallawong Road	25 m	35 m
South Receiver Catchment - Residences south of the site, between Ridgeline Drive and Schofields Road	40 m	130 m
West Receiver Catchment - Residences south and west of the site, west of Ridgeline Drive	95 m	130 m
Other Sensitive Receiver Catchment – Place of Worship to the north of the site, immediately west of Oak Street	150 m	240 m

One other sensitive receiver has been identified north west of the proposed facility boundary, the Lankarama Buddhist Temple. This receiver has been classified as a "Place of Worship". However, this receiver has also been assessed as a residential receiver as it is understood there is some residential accommodation within the temple grounds.

11.3.2 Background Noise Levels

The ambient (background) L_{A90} noise level (or RBL) was measured at three representative locations (BG23, BG24 and BG25) near the proposed facility during the daytime, evening and night-time periods. The location of the sensitive receiver catchments and background monitoring locations are illustrated in **Figure 33**. The existing background noise levels at these three locations are shown in **Table 20**.

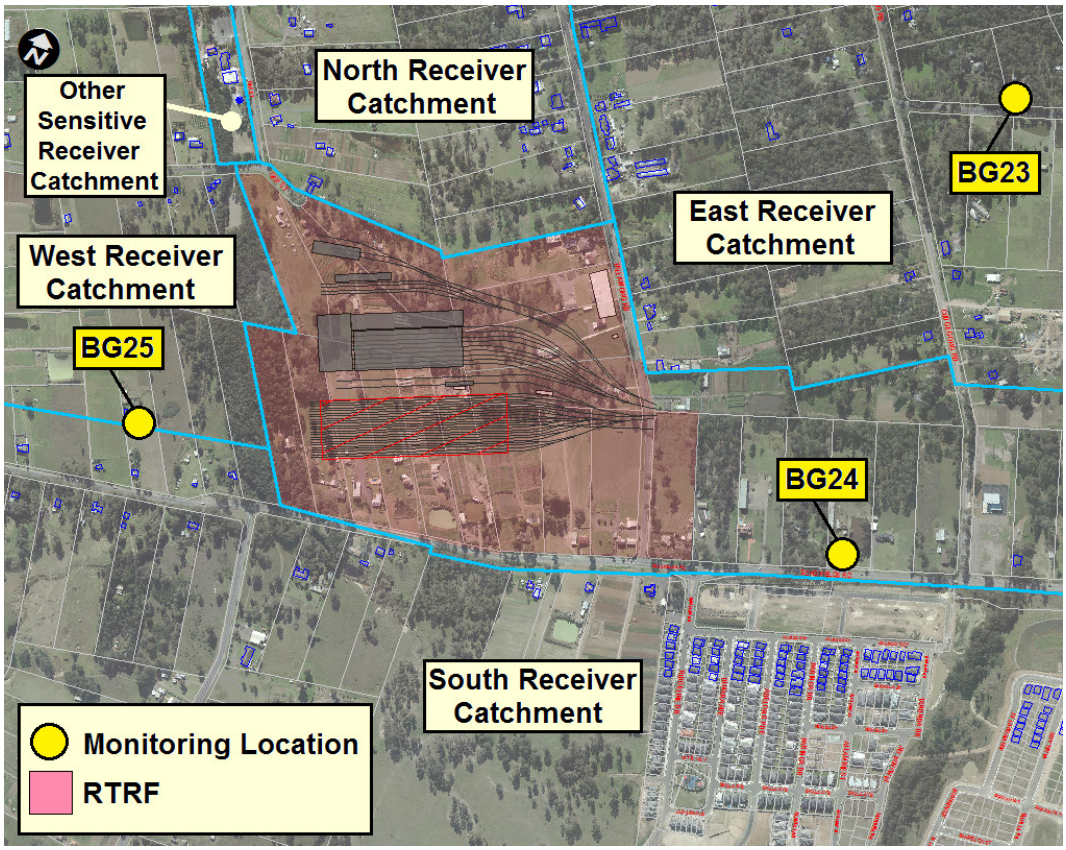

Figure 33 – Location of noise monitoring devices

The variation in RBL between these locations (particularly at night) is indicative of the extent of existing development in the area and proximity to Windsor Road and Schofields Road. BG24, with the highest RBLs, is located close to Schofields Road and The Ponds residential development. BG23 and BG25 are further from major roads and are currently more rural in character.

The attended measurements at these locations describe a noise environment dominated by road traffic and natural sources (eg birds, insects). In the absence of other noise sources, it is likely that the high evening and night-time LAeq noise levels at these locations are controlled by insect noise or other natural noise sources.

Table 20 – Summary of Unattended Noise Logging Near Tallawong RTRF

Location	Noise Level (dBA)[1]						
	Daytime 7.00 am to 6.00 pm		Evening 6.00 pm to 10.00 pm		Night-time 10.00 pm to 7.00 am		
	RBL	L_{Aeq}	RBL	L_{Aeq}	RBL	L_{Aeq}	L_{Amax}[4]
BG23	44	57	43	51	34	48	49-72
BG24 [3]	45	59	49	59	38	55	66-71
BG25 [3]	43	53	44	54	30 [2]	58	61-86

Note 1: The RBL and L_{Aeq} noise levels have been obtained using the calculation procedures documented in the INP

Note 2: In accordance with the INP, where the RBL is found to be less than 30 dBA, then it is set to 30 dBA

Note 3: Where the daytime RBL is lower than the evening RBL, then the daytime RBL has been used to determine the relevant evening noise criteria

Note 4: Maximum noise levels during the night-time period have been determined from the daily noise logging plots where the lower noise level is based on the 25th percentile of the 15-minute L_{Amax} noise levels and the upper range is based on the 75th percentile of the 15-minute L_{Amax} noise levels

The area is undergoing considerable development, including an upgrade of Schofields Road to link Windsor Road to Richmond Road. When the RTRF opens, it is reasonable to expect background noise levels to the west of the facility will have increased.

A night-time background noise level of 35 dBA would correspond to the estimated noise level in *Australian Standard AS 1055.2:2007 Acoustics-Description and measurement of environmental noise Part 2: Application to specific situations*, for areas with low density transportation (Noise Area Category R2) as shown in **Table 21**.

Table 21 – Estimated Background A-Weighted Sound Pressure Levels (AS 1055.2:2007)

Area	Description	RBL Noise Level (dBA)		
		Daytime	Evening	Night-time
R1	Areas with negligible transportation	40	35	30
R2	Areas with low density transportation	45	40	35
R3	Areas with medium density transportation or some commerce or industry	50	45	40
R4	Areas with dense transportation or some commerce or industry	55	50	45
R5	Areas with very dense transportation or in commercial districts or bordering industrial districts	60	55	50
R6	Areas with extremely dense transportation or within predominantly industrial districts	65	60	55

It is noted that the RBLs at all three locations during the daytime and evening periods are already close to or greater than the Noise Area Category R2 noise levels of 45 dBA and 40 dBA. The existing RBLs at locations BG23 and BG24 are already similar to or above the Noise Area Category R2 noise levels during the night-time.

11.4 Assessment Criteria

11.4.1 Construction

A 'Construction Noise and Vibration Strategy' (CNVS) has been developed by the NWRL project team and will be adopted by all contractors to manage construction noise and vibration at the RTRF construction site (refer to Appendix F of the RTRF Noise Assessment in **Appendix F** of the EIS). In preparing this strategy, consideration has been given to

several guideline documents including the 'Interim Construction Noise Guideline' (DECC 1999), TfNSW's 'Construction Noise Strategy', Australian Standard AS 2436-2010 'Guide to noise and vibration control on construction, demolition and maintenance sites' and the 'Road Noise Policy' (DECCW 2011).

The CNVS documents the best-practice techniques specific to the NWRL and RTRF projects for managing construction noise and vibration, and implementing feasible and reasonable mitigation measures.

Noise Management Levels

The *Interim Construction Noise Guideline* (ICNG) contains a quantitative assessment method which is applicable to new infrastructure projects. Guidance levels are given for airborne noise at residences and other sensitive land uses, including commercial and industrial premises. For residences, guidance in relation to ground-borne noise and sleep disturbance is also provided.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the noise management levels (NMLs). The NMLs are average noise levels evaluated over a 15 minute period ($L_{Aeq\ (15\text{-}min)}$). They have been reproduced from the ICNG and are presented in **Table 22**. These NMLs apply to all the construction activities and sites associated with the RTRF. For residences, the NMLs are set with reference to the background noise level (or RBL).

Table 22 – Management Levels for Airborne Construction Noise at Residences

Time of day	Noise Management Level (NML) $L_{Aeq(15minute)}$[1]	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1 Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

The nature of the construction activities for the RTRF site (surface works with minimal screening effects) means that ground-borne noise impacts are expected to be minor in comparison to the airborne noise impacts. For this reason assessment of ground borne construction noise is not warranted.

With reference to the project NMLs and the ambient noise survey results, the site specific construction NMLs are presented in **Table 23.**

Table 23 – RTRF Construction NMLs

Receiver Area	Receiver Type	Relevant Monitoring Location	$L_{Aeq(15minute)}$ Construction NMLs (dBA)	
			Daytime	Evening
North Receiver Catchment	Residential	BG23	54	48
East Receiver Catchment	Residential	BG23	54	48
South Receiver Catchment	Residential	BG25	53	49
West Receiver Catchment	Residential	BG24	55	54
Other Sensitive Receiver Catchment	Other (Place of Worship)[1]	BG23	55	55

Note 1: Corresponding residential NMLs for this receiver are Daytime 54dBA and Evening 48 dBA.

In addition to the NMLs identified for residences, the NML applicable to the Lankarama Buddhist Temple, which has been classified as a "Place of Worship", is $L_{Aeq\ (15\text{-}min)}$ 45 dBA, when in use. This NML is based on internal noise levels. For the purpose of this assessment, it is conservatively assumed that this receiver has openable windows. On the basis that external noise levels are typically 10 dB higher than internal noise levels when windows are open, an external $L_{Aeq(15minute)}$ NML of 55 dBA has been adopted. This receiver has also been assessed against the residential criteria, as it is understood there is some residential accommodation within the temple grounds.

Construction Traffic Noise

When trucks and other vehicles are operating within the boundaries of the construction site, road vehicle noise contributions are included in the construction site noise emissions.

When construction related traffic moves onto the public road network a different noise assessment methodology is appropriate, as vehicle movements would be regarded as "additional road traffic" rather than as part of the construction site. The ICNG does not provide specific guidance in relation to acceptable noise levels associated with construction traffic. For assessment purposes, guidance is taken from the N*SW Road Noise Policy* (RNP).

Construction traffic NMLs in the RNP are set at 2 dBA above the existing road traffic noise levels during the daytime and night-time periods and are considered appropriate to identify the onset of potential noise impacts.

In considering feasible and reasonable mitigation measures where the relevant noise increase is greater than 2 dBA, consideration will also be given to the actual noise levels associated with construction traffic and whether or not these levels comply with the following road traffic noise criteria in the RNP:

- Freeway / arterial / sub-arterial roads: $L_{Aeq(15\text{-}hour)}$ 60 dBA in the day time and $L_{Aeq(9\text{-}hour)}$ 55 dBA night time.
- Existing local roads: $L_{Aeq(1\text{-}hour)}$ 55 dBA in the day time and $L_{Aeq(1\text{-}hour)}$ 50 dBA in the night time.

Sleep Disturbance and Maximum Noise Level Events

There are no specific criteria for sleep disturbance nominated in the ICNG, the INP, or in the RNP. The current approach to identifying potential sleep disturbance impacts is to set a screening criterion 15 dBA above the RBL during the night-time period (10.00 pm to 7.00 am). When the screening criterion is not met, a more detailed analysis may be required which should cover the maximum noise level or L_{Amax}, the extent that the maximum noise level exceeds the background or RBL level and the number of times this occurs during the night-time period.

Some guidance on possible impacts is contained in the RNP which concludes that:

- Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions
- One or two events per night, with maximum internal noise levels of 65 dBA to 70 dBA, are not likely to affect health and wellbeing significantly.

On the basis of the above guidance an internal sleep disturbance NML of L_{Amax} 55 dBA has been adopted, which equates to an external noise level of 65 dBA (assuming open windows).

Construction Vibration

The effects of vibration in buildings can be divided into three main categories;

- Those in which the occupants or users of the building are concerned or possibly disturbed
- Those where the building contents may be affected; and
- Those in which the integrity of the building or the structure itself may be prejudiced.

In relation to human comfort, the vibration management levels are based on guidance contained in the *'Assessing Vibration – a technical guideline'* (DEC, 2006).

Structural damage vibration limits are based on *Australian Standard AS 2187: Part 2-2006 'Explosives - Storage and Use - Part 2: Use of Explosives'* and *British Standard BS 7385 Part 2-1993 'Evaluation and measurement for vibration in buildings Part 2'*. These standards provide frequency-dependent vibration limits related to cosmetic damage, noting that cosmetic damage is very minor and superficial in nature, is readily repairable and does not affect the structural integrity of the building.

A conservative vibration damage screening level of 7.5 mm/s has been adopted for the RTRF project. At locations where the predicted and/or measured vibration levels are greater than 7.5 mm/s, a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would be required to determine the applicable safe vibration level.

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 will be undertaken prior to and following construction to record any change in building condition as a result of the construction activities.

11.4.2 Operation

The RTRF is considered to be a fixed facility and as such, noise emissions emanating from within the facility, including train movements and maintenance, are required to be assessed in accordance with the *NSW Industrial Noise Policy* (INP). Noise modelling has been carried out using the CONCAWE prediction algorithm in SoundPLAN V7.1.

Stabling Facility Noise Criteria

For the proposed RTRF operations, the intrusive, amenity and sleep disturbance noise goals will apply.

- Intrusiveness criteria: To provide for protection against intrusive noise, the INP states that the $L_{Aeq\ (15\text{-}min)}$ noise level of the source should not be more than 5 dB above the RBL during the daytime, evening and night time periods at the nearest sensitive receivers.
- Amenity criteria: To protect against impacts on amenity, the INP identifies recommended acceptable and maximum average noise levels for particular land uses and activities during the daytime, evening and night time periods. The residences in the vicinity of the proposed stabling facility are considered to be 'Suburban' at the time of the project opening.
- Sleep disturbance criteria is described above in Section 11.4.2.

A summary of the relevant operational noise criteria for the facility is provided in **Table 24**. The amenity and intrusiveness criteria are to be met at the most-affected boundary of the receiver property, or if this is more than 30 m from the residence, at the most affected point within 30 m of the residence. The sleep disturbance screening criterion is applicable at the building facade.

In **Table 24**, criteria are specified for residential receiver locations in two categories – those in close proximity to Schofields Road, and those set back from Schofields Road.

- Intrusiveness criteria for receivers close to Schofields Road are based on the measured background levels at BG24. Amenity criteria close to Schofields road in the South Receiver catchment are based on the LAeq period, (traffic) minus 10 dBA.
- Criteria for residences set back from Schofields Road are based on the estimated noise level for Noise Area Category R2 in AS 1055.2:2007 (see **Table 21** above).

Table 24 – Summary of RTRF Operational Noise Criteria

Scenario	Period	Estimated RBL[1] (dBA)	Operational Noise Criteria (dBA)		
			$L_{Aeq(15minute)}$ Intrusive	$L_{Aeq(Period)}$ Amenity	L_{AMax} Sleep Disturbance Screening Level
Residential Receivers – Set back from Schofields Road					
Opening and Future	Early Morning (5am to 7am)[2]	40	45	45	50[3]
	Day (7am to 6pm)	45	50	55	-
	Evening (6pm to 10pm)	45	50	45	-
	Night (10pm to 5am)	35	40	40	50
Residential Receivers – South Catchment Adjacent to Schofields Road					
Opening and Future	Early Morning (5am to 7am)[2]	43	48	49	53[3]
	Day (7am to 6pm)	45	50	55	-
	Evening (6pm to 10pm)	45	50	50	-
	Night (10pm to 5am)	38	43	49	53
Other Sensitive Receivers (Place of Worship)					
Opening and Future	Day (7am to 6pm)	45	n/a	50	n/a
	Evening (6pm to 10pm)	45	n/a	50	n/a

Note1: Daytime and night-time background noise levels away from Schofields Road are estimated from AS1055.2 noise area category R2. Adjacent to Schofields Road RBLS are as measured at BG24 in the relevant time period. Evening levels are taken to be the same as daytime noise levels as no noticeable decrease in the evening period was recorded at any measurement location.

Note 2: The early morning shoulder period applies from 5:00 am to 7:00 am (the period when existing background noise levels are observed to be rising steadily). Noise criteria in this period are taken to be midway between the daytime and night-time criteria.

Note 3: The sleep disturbance screening level is taken to be the same throughout the night-time and early morning shoulder period.

11.5 Noise Generating Activities

11.5.1 Construction

The construction works for the RTRF will comprise a number of noise generating activities.

Earthworks including vegetation clearance, topsoil stripping, and cut and fill. These activities would involve the use of conventional heavy excavation and earth moving equipment including bulldozers, scrapers, excavators, rollers and graders.

Construction of the operational rail infrastructure for the RTRF would involve the use of ballast tampers, vibratory rollers, concrete trucks, cranes and trucks to undertake track formation, track works and the installation of overhead wire systems and cable supports.

Other RTRF construction activities include road and car park formation, and the construction of maintenance workshops and buildings.

11.5.2 Operation

There are several types of single deck trains which could be utilised for the NWRL and the future network. As part of the operational requirements, the contractor will be required to implement best practice measures to minimise environmental noise impacts. The following description of stabling activities is based on the typical requirements for modern single deck trains.

When trains are returning to the train stabling facility, some trains will enter the proposed train wash facility. The train passes through the train wash at walking pace over a period of a few minutes and may operate at any time of the day or night.

When a train enters a stabling area, a number of activities occur. Once the train comes to a standstill, the brakes are applied by exhausting the brake pipe and the parking brake is engaged. Exhausting the brake pipe releases compressed air to atmosphere, causing peak noise levels of short duration.

After the parking brake is applied, the trains would enter cleaning mode with lighting and air-conditioning on for up to an hour while train interiors are cleaned. After cleaning they would be stabled with all auxiliary equipment shut down, as is typical with modern rapid-transit trains.

Safety checks are undertaken prior to the train entering service the following morning. Prior to the train departing, all auxiliary equipment is assumed to operate for up to fifteen minutes. This equipment includes air-conditioning, air compressors and static inverters.

Train horn testing would not be required within the stabling facility.

A non-tonal audio and/or visual warning system would be employed to alert staff of impending train movements in areas of the stabling and maintenance facility. Any such warning system would be significantly less noisy than the use of horns, and would be designed to meet the relevant noise criteria.

Train wheel maintenance undertaken at the wheel lathe workshop and bogie-drop facility is expected to be undertaken during the daytime only.

On-site heavy vehicle movements associated with garbage collection, deliveries, and other activities have to potential to create noise impacts at nearby receivers. On-site heavy vehicle movements are not normally expected to occur during the night-time period.

11.6 Noise Modelling

11.6.1 Construction

The noise modelling used for this assessment are consistent with the noise prediction process recommended in Australian Standard AS 2436-2010 'Guide to noise and vibration control on construction, demolition and maintenance sites'.

L_{Amax} sound power levels for equipment assumed in the modelling are presented in **Table 24**. The sound power levels are maximum noise emission levels of plant that may be used on this project in typical operation.

Table 25 – Maximum Sound Power Levels for Demolition, Excavation and Construction Equipment

Plant Item	L_{Amax} Sound Power Level (dBA)	L_{Amax} Sound Pressure Level at 7 m (dBA)
Dump Truck	108	83
Excavator (approximately 20 tonnes)	105	80
Excavator (approximately 30 tonnes)	110	85
Excavator (approximately 40 tonnes)	115	90
Front End Loader	111	86
Compactor	105	80
Scraper	110	85
Grader	110	85
Water Cart	108	83
Concrete Saw	118	93
Jackhammer	113	88
Mobile Crane	110	85
Generator	104	79
Concrete Pump	109	84
Compressor	105	80
Vibratory Roller	114	89
Hirail Boom Lift	107	76
Water Pump	108	83
Ballast Tamper	121	96

Note 1 The sound power levels presented are based on the CNVS.

Note 2 In accordance with the ICNG *for activities identified as particularly annoying (such as jack hammering, rock breaking and power saw operation), a 5 dB "penalty" is added to the source sound power level when predicting noise using the quantitative method.*

Consistent with the requirements of the ICNG, the construction noise impacts are based on a realistic worst-case assessment.

Residences and other sensitive receivers have been grouped together into receiver areas or 'catchments', which comprise those receivers which will experience a similar level of construction noise. For each receiver area the noise levels are predicted at the most noise-exposed location, which will usually be the closest receiver.

For most construction activities, it is expected that the construction noise levels will frequently be lower than predicted at the most-exposed receiver - as the noise levels presented in this report are based on a realistic worst-case assessment.

11.6.2 Operation

Assumptions

The assumptions that have been made in relation to adverse meteorological conditions, indicative details of timings of train arrivals and departures, and the indicative layout of the RTRF are discussed in detail in the Noise Assessment (**Appendix F**). The indicative details of timings of train arrivals and departures for both the at-opening case and for a future scenario when the capacity of the facility may be increased are outlined in **Table 26**.

Table 26 – Stabling Arrivals, Preparation and Departures for the Purpose of Noise Assessment

Scenario	At Opening				Future Scenario			
	Early Morning	Day	Evening	Night	Early Morning	Day	Evening	Night
Train arrivals	0	8	8	15	0	28	28	13
Train departures	8	13	0	4	24	43	0	3
Maximum trains in preparation for departure	2	2	0	2	8	8	0	2
Maximum trains in cleaning mode	0	6	6	6	0	14	14	14

Note: Early morning is from 5:00 am to 7:00 am, day 7:00 am to 6:00 pm, evening 6:00 pm to 10:00 pm, night 10:00 pm to 5:00 am.

Modelled Noise Sources

Table 27 shows sound power levels used to model the various stabling and maintenance noise sources. The source levels have been derived from attended noise measurements taken by SLR Consulting and other consultants on similar projects, and from recent rolling stock noise specifications on other projects.

Table 27 – Assumed Sound Power Levels for Train Stabling and Maintenance

Noise Source	Sound Power Level	Location of Noise Source
Brake Air Release Noise	95 dBA – L_{Amax}	Under floor, two units per four cars, located at the ends of each four car set
Air Compressor, including brake air release noise	87 dBA – $L_{Aeq(15minute)}$	Under floor, two units per four cars, located at the ends of each four car set
Static Inverter	83 dBA – $L_{Aeq(15minute)}$	Top of train[1], two units per four cars, located at the ends of each four car set
Air-Conditioner	82 dBA – $L_{Aeq(15minute)}$	Top of train, one unit per car, located at the centre of each car
General Workshop Noise	105 dBA – $L_{Aeq(15minute)}$	Inside maintenance building
Train Wash Facility	84 (75)[2] dBA – $L_{Aeq(15minute)}$	Train wash facility facades
Substation – Traction Transformer	77 dB – $L_{Aeq(15minute)}$	Two units in substation operating at 100% capacity
Substation – General Supply Transformer	68 dB – $L_{Aeq(15minute)}$	One unit in substation operating at 100% capacity
Onsite Truck Movements	84 dBA – $L_{Aeq(15minute)}$	One truck on site along main roads per 15 minutes (early morning, daytime and evening only)

Note 1: May be located in the vehicle underframe rather than at the top of the train. Modelled location is assumed worst-case.

Note 2: Sound Power Level in brackets represents the noise emissions through the walls due to the noise sources inside the building. Sound Power Level of 84 dBA represents the noise emission through the end openings of the building.

The majority of train maintenance activities would be undertaken within the proposed maintenance facility building(s). Other noise sources with potential impacts around the stabling and maintenance facility include:

- Infrastructure Maintenance
- Wheel Lathe
- Alarm Systems
- Internal Train Cleaning
- Stabling Facility Staff Car Park and Vehicle Movements
- PA System

Rail grinding and major track maintenance would occur during night time shutdown periods and on selected weekends and would give rise to additional noise sources at the stabling and maintenance facility. These activities (with the exception of routine inspections) are likely to be performed on an infrequent basis. The potential noise impacts associated with infrastructure maintenance will be managed as part of the proposed Operational Noise and Vibration Management Plan (ONVMP) to be prepared prior to commencement of operations.

Noise impacts from the other sources are expected to be minimal as they will be undertaken either on an infrequent basis, within an acoustic enclosure, and/or have appropriate design measures in place.

Noise Modelling Scenarios

The scenarios that have been modelled in the base case are summarised in **Table 28**. The following assumptions have been made about the maintenance building train access doors:

- During the night-time and early morning period, all maintenance building train access doors are assumed to be closed.
- During the evening period, approximately half (four) of the maintenance building train access doors are assumed to be open. The open doors are those closest to the trains undergoing maintenance works inside representing a typical worst-case scenario.
- During the daytime period, all maintenance building train access doors are assumed to be open.

Table 28 – Base Case Modelling Scenarios

Scenario	Parameter	Time Period	Noise Sources
1	$L_{Aeq(15minute)}$	Opening Early Morning	Two trains undergoing preparation with air compressors, air-conditioners, brake air release and static inverters operating Train wash facility Maintenance facility with all doors closed and 1 train inside with all auxiliary equipment operating Substation Onsite heavy vehicles
2	$L_{Aeq(15minute)}$	Opening Daytime Train Departures	Two trains undergoing preparation with air compressors, air-conditioners, brake air release and static inverters operating Train wash facility Maintenance facility with all doors open and 1 train inside with all auxiliary equipment operating Substation Onsite heavy vehicles All workshops operational

Scenario	Parameter	Time Period	Noise Sources
3	$L_{Aeq(15minute)}$	Opening Daytime Train Arrivals	Six trains undergoing cleaning with air-conditioners and static inverters operating Train wash facility Maintenance facility with all doors open and 1 train inside with all auxiliary equipment operating Substation Onsite heavy vehicles All workshops operational
4	$L_{Aeq(15minute)}$	Opening Evening	Six trains undergoing cleaning with air-conditioners and static inverters operating Train wash facility Maintenance facility with four doors open and 1 train inside with all auxiliary equipment operating Substation Onsite heavy vehicles
5	$L_{Aeq(15minute)}$	Opening Night-time Train Departures	Two trains undergoing preparation with air compressors, air-conditioners, brake air release and static inverters operating Train wash facility Maintenance facility with all doors closed and 1 train inside with all auxiliary equipment operating Substation
6	$L_{Aeq(15minute)}$	Opening Night-time Train Arrivals	Six trains undergoing cleaning with air-conditioners and static inverters operating Train wash facility Maintenance facility with all doors closed and 1 train inside with all auxiliary equipment operating Substation
7	$L_{Aeq(15minute)}$	Future Early Morning	Eight trains undergoing preparation with air compressors, air-conditioners, brake air release and static inverters operating Train wash facility Maintenance facility with all doors closed and 2 trains inside with all auxiliary equipment operating Substation Onsite heavy vehicles
8	$L_{Aeq(15minute)}$	Future Daytime Train Departures	Eight trains undergoing preparation with air compressors, air-conditioners, brake air release and static inverters operating Train wash facility Maintenance facility with all doors open and 2 trains inside with all auxiliary equipment operating Substation Onsite heavy vehicles All workshops operational
9	$L_{Aeq(15minute)}$	Future Daytime Train Arrivals	Fourteen trains undergoing cleaning with air-conditioners and static inverters operating Train wash facility Maintenance facility with all doors open and 2 trains inside with all auxiliary equipment operating Substation Onsite heavy vehicles All workshops operational
10	$L_{Aeq(15minute)}$	Future Evening	Fourteen trains undergoing cleaning with air-conditioners and static inverters operating Train wash facility Maintenance facility with four doors open and 2 trains inside with all auxiliary equipment operating Substation Onsite heavy vehicles

Scenario	Parameter	Time Period	Noise Sources
11	$L_{Aeq(15minute)}$	Future Night-time Train Departures	Two trains undergoing preparation with air compressors, air-conditioners, brake air release and static inverters operating Train wash facility Maintenance facility with all doors closed and 2 trains inside with all auxiliary equipment operating Substation
12	$L_{Aeq(15minute)}$	Future Night-time Train Arrivals	Fourteen trains undergoing cleaning with air-conditioners and static inverters operating Train wash facility Maintenance facility with all doors closed and 2 trains inside with all auxiliary equipment operating Substation
13	L_{Amax}	Opening All periods[1]	Brake Air Release
14	L_{Amax}	Future All periods[1]	Brake Air Release

Note 1: All Periods, but potential impacts most significant during night-time period

11.7 Assessment of Noise and Vibration Impacts

11.7.1 Construction Noise

Scenarios were developed to be representative of activities having potentially the greatest noise impact on the surrounding receivers.

The typical $L_{Aeq(15minute)}$ noise levels at the nearest noise sensitive receivers (at ground floor level) are provided in Appendix F of the Noise Assessment Report (see **Appendix F** of the EIS), and the predicted noise level exceedances are summarised in **Table 29**.

Table 29 – Predicted noise level exceedances at Tallawong Stabling Facility

Receiver Area	Noise Modelling Scenario				
	Earthworks		RTRF Construction Works		
	Vegetation clearance and topsoil stripping, cut and fill		Track formation and track works, Installation of overhead wire systems and cable support	Roadworks	Construction of the maintenance buildings
	Daytime	Evening	Daytime	Daytime	Daytime
North Receiver Catchment					
East Receiver Catchment					
South Receiver Catchment					
West Receiver Catchment					
Other Sensitive Receiver Catchment					
Other Sensitive Receiver Catchment[1]					
	Legend				
Compliance 	≤ 10 dB exceedance 		10 dB to ≤ 20 dB exceedance 	> 20 dB exceedance or $L_{Aeq(15minute)}$ > 75 dBA 	

Note 1: Residential use

At the RTRF site, predicted levels for earthworks indicate moderate to high exceedances of the NMLs for the daytime period at surrounding receivers. These are a direct result of the relative close proximity of receivers to the construction activities and the absence of any appreciable shielding between sites and receivers. A lesser level of noise impacts are predicted for the RTRF infrastructure construction works with NML excedances generally below 20 dB.

For most construction activities, it is expected that the construction noise levels will frequently be lower than predicted at the most-exposed receiver – as the noise levels presented in this report are based on a realistic worst-case assessment.

Traffic noise levels have been predicted for residential receivers located on the proposed access routes to the RTRF site. In this instance the access to the site is via Schofields Road which is a sub-arterial road with significant daytime flows. The assessment results in compliance with the 2 dBA allowance.

11.7.2 Construction Vibration

Table 30 provides a summary of the indicative "safe working distances" for the plant items likely to be used for the major civil construction works. The safe working distances are based of the conservative screening level of 7.5 mm/s.

Table 30 – Safe Working Distances - Cosmetic Damage (based on 7.5 mm/s screening level)

Plant Items	Indicative Safe Working Distance
Vibratory Roller - 10 Tonne	6 m
Vibratory Trench Roller - 3 Tonne	1 m

11.7.3 Operation

The highest predicted $L_{Aeq(15minute)}$ noise level at the affected existing receivers within the receiver catchments for each scenario are shown in **Table 31**. These predictions are at the most-affected boundary of the receiver property, or if this is more than 30 m from the residence, at the most affected point within 30 m of the residence.

The noise levels shown in **Table 31** are considered to be representative of worst-case noise impacts at future residential developments in each catchment. It is acknowledged that the catchments to the south and west of the facility are zoned for low density residential development, and that in the at-opening scenarios these currently sparsely populated areas will become built up (to a density similar to that of the adjacent The Ponds development).

Table 31 – Predicted $L_{Aeq(15minute)}$ Noise Levels at Most Affected Receivers – Base Case

Base Case Scenario and Description		Noise Criteria (dBA)			$L_{Aeq(15minute)}$ Sound Pressure Level (dBA)				
		North, East, West	South	Other	North	East	South	West	Other
1	Opening - Early Morning[1]	45	48	n/a	**50**	**53**	**49**	**48**	n/a
2	Opening - Daytime Departures	50	50	50	48	**52**	45	44	43
3	Opening - Daytime Arrivals	50	50	50	48	**52**	47	44	43
4	Opening – Evening	45	50	50	**48**	**52**	47	44	42
5	Opening – Night Departures[1]	40	43	n/a	39	**44**	**46**	**41**	n/a
6	Opening – Night Arrivals[1]	40	43	n/a	**41**	**47**	**49**	**44**	n/a
7	Future - Early Morning[1]	45	48	n/a	**50**	**53**	**53**	**49**	n/a
8	Future – Daytime Departures	50	50	50	48	**52**	49	44	43
9	Future – Daytime Arrivals	50	50	50	48	**52**	50	45	43
10	Future - Evening	45	50	50	**48**	**52**	50	45	42
11	Future - Night Departures[1]	40	43	n/a	40	**44**	**47**	**41**	n/a
12	Future – Night Arrivals[1]	40	43	n/a	**44**	**50**	**54**	**48**	n/a

Note 1: Noise levels for these scenarios have been calculated under adverse weather conditions.
Note 2: Exceedances of the noise criteria are shown in bold text.

The noise levels shown for the night-time period and early morning period scenarios have been calculated under adverse weather conditions. Under neutral weather conditions, the predicted noise levels are typically 4 dB lower at the nearest representative receivers.

It is noted that at this stage a detailed analysis of seasonal weather data (wind and atmospheric stability) has not been undertaken.

Early morning shoulder period (5.00 am to 7.00 am) – Scenarios 1 and 7

For the opening and future scenarios, exceedances of the early morning noise criteria of up to 8 dB are predicted at the nearest residential receivers under adverse weather conditions. The most significant contributing noise source in the opening scenario (Scenario 1) are the onsite heavy vehicle movements. The most significant contributing noise sources in the future scenario (Scenario 7) are those associated with onsite heavy vehicle movements and train stabling operations. Under neutral weather conditions, the predicted noise levels are typically 4 dB lower at the nearest representative receivers.

Daytime period (7.00 am to 6.00 pm) – Scenarios 2, 3, 8 and 9

For the opening and future scenarios, exceedances of the daytime noise criterion (50 dBA LAeq(15minute)) of up to 2 dB are predicted at the east receiver catchment. The most significant contributing noise source is the onsite heavy vehicle movements.

Evening period (6.00 pm to 10.00 pm) – Scenarios 4 and 10

For the opening and future scenarios, exceedances of the evening noise criteria of up to 3 dB are predicted at the east and north residential receiver catchments. The most significant contributing noise source is the onsite heavy vehicle movements.

Night-time period (10.00 pm to 5.00 am) – Scenarios 5, 6, 11 and 12

The most significant contributing noise sources in the opening and future scenarios are those associated with train stabling operations, in particular train arrivals and time in cleaning mode with air-conditioning running. For the opening scenario with adverse weather conditions, exceedances of the night-time noise criteria of up to 7 dB are predicted at the nearest sensitive receivers.

For the future scenario with adverse weather conditions, exceedances of the night-time noise criterion of up to 11 dB are predicted at the nearest sensitive receivers in the south receiver catchment, and up to 10 dB at the nearest sensitive receivers in the east catchment.

Maximum Noise Levels

Source noise levels adopted for the noise modelling assume that silencers are installed in the compressed air lines to minimise the noise levels associated with brake air releases. Noise from brake air releases is also reduced by the under-platform barriers included in the base case scenarios.

With the assumed source levels, and under adverse weather conditions, brake air release noise is predicted to comply with the sleep disturbance screening criterion at all surrounding residential receivers.

There will be some variation in noise level from each of these events since brake air release is a variable source. Noise impacts would also be lower than predicted in the event that the train is shielded by other trains stabled on adjacent tracks, and under neutral weather conditions.

11.8 Mitigation Strategies

11.8.1 Construction

Noise vibration mitigation measures described in the Construction Noise and Vibration Strategy (CNVS) would be implemented (NV1). The CNVS has been developed by TfNSW for adoption by all contractors to manage construction noise and vibration across the various construction sites of the NWRL. The CNVS documents the best practice techniques

for managing construction noise and vibration, and implementing feasible and reasonable mitigation measures. Key elements of the CNVS include:

- The establishment of maximum noise levels.
- Implementation of a noise monitoring program.
- Attended vibration measurements.
- On-site noise control practices and work behaviours.
- Community consultation procedures.

The CNVS includes a standard suite of mitigation measures to be implemented across all NWRL construction sites. It also includes additional mitigation and management measures when construction noise is predicted to exceed the NMLs (such as noise monitoring, individual briefings, respite offers and in some instances at night, alternative accommodation). These measures are primarily aimed at proactive engagement with affected sensitive receivers.

The safe working distances described in **Table 30** are less than those identified in Section 3.3 of the CNVS on the basis of the conservative nature of the 7.5 mm/s screening level.

Construction Hours

Construction hours for the works would generally be restricted to the standard daytime construction hours (7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturdays), except as follows:

- Non-disruptive preparatory work, repairs or maintenance may be carried out on Saturday afternoons or Sundays between 8am and 5pm.
- Activities requiring the temporary possession of roads may need to be undertaken outside the assumed hours during periods of low traffic to minimise safety impacts and inconvenience to commuters.
- Activities requiring rail possessions may need to be undertaken outside the standard construction hours up to 24 hours per day, seven days per week.
- Restrictions would be in place for construction traffic during peak hours and during special events.

Works which would be undertaken outside of standard construction hours without any further approval include:

- Works which are determined to comply with the relevant Noise Management Level (NML) at the nearest sensitive receiver.
- Works required to be undertaken during rail possessions.
- The delivery of materials outside of approved hours as required by the Police or other authorities (including Roads and Maritime Services) for safety reasons.
- Where it is required to avoid the loss of lives, property and/or to prevent environmental harm in an emergency.

With the exception of emergency, activities would not take place outside standard hours without prior discussion with and/or notification of local residents, businesses and the EPA.

11.8.2 Operation – Mitigation Considerations

There are several mitigation options available for consideration in the detailed design stage to meet the operational noise goals for the RTRF.

The first mitigation measure to be considered is strategic land uses, and the opportunity to work with the Planning Authorities regarding future land development to the north, east, and west of the RTRF.

Following on from this the model predictions would be refined during the detailed design, and then verified once the RTRF is operational.

Land Use Considerations

The INP notes that a long-term strategy involving strategic land use decisions is preferable to other strategies such as source, path and receiver controls (INP, Section 7.5 Noise Mitigation Strategies).

To the north, a draft structure plan has been released indicating the potential for residential development adjacent to the stabling facility. TfNSW is having ongoing discussions with DP&I regarding the future zoning of adjoining land to the north. Where possible, it is recommended that the area bordering the stabling facility to the north is re-zoned for commercial or light industrial use. This would provide a buffer (and noise shielding) between the stabling facility and residential land uses. In particular, impacts due to heavy vehicles accessing the RTRF would be minimised.

To the east, future land uses are defined in the Area 20 Precinct Plan. As residential development has not started in this area, there may be scope to develop internal subdivision designs that minimise noise impacts.

The future land use surrounding the proposed stabling facility has already been defined to the south and west, with land already zoned as residential. In these areas it is accepted that land use strategies to mitigate noise are not possible.

Land use considerations will continue to be explored in consultation with the DP&I. For the purpose of this assessment, alternative mitigation measures are also considered.

Design Mitigation

Having considered strategic land use decisions, the investigation of noise mitigation begins with consideration of options to reduce the dominant contributors to noise levels.

Examination of the noise modelling results indicates that the dominant potential noise sources are intermittent noise associated with onsite heavy vehicle movements and steady noise from the train stabling operations (ie, the train auxiliary systems such as static inverters, air-conditioning, and air compressor systems).

The design of the sheds and equipment for the train wash and wheel lathe facilities would include noise mitigation as required in order to comply with the applicable noise criteria at the nearest noise sensitive receivers.

Onsite Heavy Vehicles

Heavy vehicles moving on site have been identified as a potential source of exceedance of the noise goals for the facility. Control of noise impacts caused by onsite heavy vehicle movements such as garbage trucks could be achieved by limiting the time at which heavy vehicle activities are scheduled to occur, for example, during the daytime or evening periods only.

Alternative mitigation measures include requiring loading and unloading of heavy vehicles inside sheds rather than outside, varying access routes around the site, or the construction of localised barriers either near the source or on receiver boundaries.

Train Stabling Operations

When noise from heavy vehicle movements is mitigated, the remaining predicted exceedances of the noise criteria are caused by noise from train stabling operations.

In considering mitigation of train stabling operational noise, the hierarchy of control is to give preference to strategic land use decisions, source control measures, path control measures and finally receiver controls. Strategic land use decisions are discussed above with the following sections discussing other options relating to source, path and receiver controls.

- **Source Mitigation - Train Auxiliary Noise Control**

  The source noise levels of the proposed rolling stock are considered representative of achievable best practice for new rolling stock. It is noted that noise from air-conditioning systems would vary considerably with load, depending on the season and time of day. The load on the system may be higher when starting up than when waiting in the yard on return from service for cleaning.

  Further detailed assessment of the potential LAeq noise impacts, and reasonable and feasible mitigation measures would be required during the detailed design stage when the proposed rolling stock has been identified.

  Potential operational measures to mitigate noise from air-conditioning systems include reducing the time air-conditioning is operational in cleaning mode (or providing alternative ventilation methods).

- **Path Mitigation - Noise Barriers**

  Noise generated at the top of the train (air-conditioning noise and possibly static inverter noise) is difficult to mitigate via noise barriers. A noise barrier would need to be around 6 m high (above rail height) to provide significant attenuation to the south receivers, and would have high cost and visual impacts. The performance of any noise barriers would also be reduced under adverse weather conditions.

  Noise barriers are most effective when they are placed in close proximity to either the noise source or receiver location. In the case of the proposed stabling facility, the trains on all but the outermost tracks would be located away from the barrier, reducing its effectiveness.

  The effectiveness of noise barriers at the RTRF have been assessed and it has been determined that:

  – A 6 m high barrier does not meet the minimum benefit requirement to be considered a cost-effective, viable noise treatment option.

  – Residual exceedances of the noise goals would remain.

  – The proposed terrain, earthworks and footprint of the facility at opening constrain the location of a barrier. Any barrier constructed at opening would later be displaced by the potential future expansion of the facility, which is not considered cost-effective.

  Therefore a noise barrier is unlikely to be considered a reasonable mitigation measure for the RTRF.

- **Path Mitigation – Enclosure or Partial Enclosure**

  The potential benefits of an enclosure or partial enclosure of the stabling area have been considered. This mitigation measure would have significant cost and visual impacts. This mitigation measure is not considered reasonable in the at-opening scenario for the following reasons:

  – At opening, the noise impacts are less than in the future scenario and options for source control measures should be investigated as the first preference.

  – Any enclosure or partial enclosure at opening would later need to be extended to accommodate the future expansion.

An enclosure or partial enclosure remains a potential option for the RTRF in the future scenario, in the event that land-use planning measures and source control measures do not meet the noise goals for the facility.

- **Receiver Mitigation - Building Treatments**

  Whilst source and path controls are generally the preferred means of controlling noise emissions, some situations dictate that receiver controls are the most cost effective option. Unlike source and path controls, receiver controls in the form of air conditioning (or alternative ventilation systems) protect only the internal environment and not the external environment.

  Subject to future land use decisions and the detailed design, property treatments remain an option in particular at receivers to the east as the layout of the facility means that path control options are not effective in this area.

Operation – Modelling of Potential Mitigation Measures

The potential alternative noise mitigation measures include the implementation of best practice in terms of minimising the source noise levels associated with train stabling and maintenance activities. Other potential measures include designing the proposed maintenance buildings to contain noise levels, implementing operational procedures to minimise noise impacts at nearby sensitive receivers, restricting the times in which heavy vehicles such as garbage trucks or delivery vehicles can access the site, and implementing non-tonal alarm systems within the maintenance area (train horn testing will not be required within the stabling facility).

A review of the potential noise impacts and mitigation measures would be undertaken during the detailed design stage, when the rolling stock, proposed maintenance strategies and future land uses are defined in more detail.

To illustrate the potential noise reductions, a number of mitigated scenarios have been assessed as shown in **Table 32**. This table includes two broad mitigation categories to address noise impacts particularly in the night-time and early morning periods.

- Mitigation option M1 – Source / Operational measures to mitigate heavy vehicle noise impacts and train air-conditioning noise impacts. This option is applicable to both the opening and future scenarios.
- Mitigation option M2 – Enclosure or partial enclosure of stabling roads, with mitigation of heavy vehicle noise impacts. This option is considered applicable to the future scenario only.

Table 32 – Mitigated Modelling Scenarios

Scenario[1]	Time Period	Noise Sources
1-M1	Opening Early Morning $L_{Aeq(15minute)}$	Two trains undergoing preparation with air compressors, brake air release and static inverters operating. Mitigated air-conditioning noise. Train wash facility Maintenance facility with all doors closed and 1 train inside with all auxiliary equipment operating Substation Mitigated heavy vehicle noise
5-M1	Opening Night-time Train Departures $L_{Aeq(15minute)}$	Two trains undergoing preparation with air compressors, brake air release and static inverters operating. Mitigated air-conditioning noise. Train wash facility Maintenance facility with all doors closed and 1 train inside with all auxiliary equipment operating Substation

Scenario[1]	Time Period	Noise Sources
6-M1	Opening Night-time Train Arrivals $L_{Aeq(15minute)}$	Six trains undergoing cleaning with static inverters operating. Mitigated air-conditioning noise. Train wash facility Maintenance facility with all doors closed and 1 train inside with all auxiliary equipment operating Substation
7-M1	Future Early Morning $L_{Aeq(15minute)}$	Eight trains undergoing preparation with air compressors, brake air release and static inverters operating. Mitigated air-conditioning noise. Train wash facility Maintenance facility with all doors closed and 2 trains inside with all auxiliary equipment operating Substation Mitigated heavy vehicle noise
11-M1	Future Night-time Train Departures $L_{Aeq(15minute)}$	Two trains undergoing preparation with air compressors, brake air release and static inverters operating. Mitigated air-conditioning noise. Train wash facility Maintenance facility with all doors closed and 2 trains inside with all auxiliary equipment operating Substation
12-M1	Future Night-time Train Arrivals $L_{Aeq(15minute)}$	Fourteen trains undergoing cleaning with static inverters operating. Mitigated air-conditioning noise. Train wash facility Maintenance facility with all doors closed and 2 trains inside with all auxiliary equipment operating Substation
7-M2	Future Early Morning $L_{Aeq(15minute)}$	Stabling area partially enclosed Eight trains undergoing preparation with air compressors, brake air release, air-conditioning and static inverters operating. Train wash facility Maintenance facility with all doors closed and 2 trains inside with all auxiliary equipment operating Substation Mitigated heavy vehicle noise
11-M2	Future Night-time Train Departures $L_{Aeq(15minute)}$	Stabling area partially enclosed Two trains undergoing preparation with air compressors, brake air release, air-conditioning and static inverters operating Train wash facility Maintenance facility with all doors closed and 2 trains inside with all auxiliary equipment operating Substation
12-M2	Future Night-time Train Arrivals $L_{Aeq(15minute)}$	Stabling area partially enclosed Fourteen trains undergoing cleaning with air-conditioning and static inverters operating. Train wash facility Maintenance facility with all doors closed and 2 trains inside with all auxiliary equipment operating Substation

Note 1: Scenario name is the base case scenario plus the mitigation option (M1 or M2)

Predicted Noise Levels with Mitigation

The highest predicted $L_{Aeq(15minute)}$ noise level at the affected receivers within the receiver catchments for each scenario are presented in **Table 33**. The noise levels shown in **Table 33** are considered to be representative of noise impacts at future residential developments in each catchment.

Table 33 – Predicted $L_{Aeq(15minute)}$ Noise Levels at Most Affected Receivers – Mitigated Cases

Mitigated Scenario and Description		Noise Criteria (dBA)			$L_{Aeq(15minute)}$ Sound Pressure Level (dBA)				
		North, East, West	South	Other	North	East	South	West	Other
Option M1 – Source / Operational Mitigation of Heavy Vehicle and Air-Conditioning Noise									
1-M1	Opening - Early Morning[1]	45	48	n/a	38	43	44	38	n/a
5-M1	Opening – Night Departures[1]	40	43	n/a	38	**43**	**44**	38	n/a
6-M1	Opening – Night Arrivals[1]	40	43	n/a	39	**44**	**46**	**41**	n/a
7-M1	Future - Early Morning[1]	45	48	n/a	41	45	**49**	43	n/a
11-M1	Future - Night Departures[1]	40	43	n/a	39	**43**	**44**	39	n/a
12-M1	Future – Night Arrivals[1]	40	43	n/a	**41**	**47**	**50**	**44**	n/a
Option M2 – Stabling Enclosure with Mitigation of Heavy Vehicle Noise									
7-M2	Future - Early Morning[1]	45	48	n/a	41	45	42	37	n/a
11-M2	Future - Night Departures[1]	40	43	n/a	39	**43**	38	35	n/a
12-M2	Future – Night Arrivals[1]	40	43	n/a	**41**	**45**	42	37	n/a

Note 1: Noise levels for these scenarios have been calculated under adverse weather conditions.
Note 2: Exceedances of the noise criteria are shown in bold text.

The noise levels shown for the night-time period and early morning period scenarios in **Table 32** have been calculated under the adverse weather conditions. Under neutral weather conditions, the predicted noise levels are typically 4 dB lower at the nearest representative receivers. It is noted that at this stage a detailed analysis of seasonal weather data (wind and atmospheric stability) has not been undertaken.

The noise levels shown at opening for the night-time period and early morning period scenarios in indicate some residual impacts remain, up to 4 dB under adverse weather conditions. No exceedances would be expected at opening under calm conditions.

In the future scenario the noise levels shown for the night-time period and early morning period scenarios indicate higher residual impacts remain, up to 7 dB under adverse weather conditions. No exceedances would be expected under calm conditions with an enclosure.

11.8.3 Summary of Operational Mitigation Measures

The mitigation measures detailed in **Table 34** have been developed to avoid, reduce and manage identified potential noise impacts.

Table 34 –Mitigation measures for operational noise

No.	Mitigation Measure
OpNV8	The implementation of feasible and reasonable noise and vibration mitigation measures such as: - The design of the sheds and equipment for the train wash and wheel lathe facilities would include noise mitigation as required in order to comply with the applicable noise criteria at the nearest noise sensitive receivers.
OpNV9	The implementation of feasible and reasonable noise and vibration mitigation measures such as: - Investigate the option to incorporate silencers in the compressed air lines of the rolling stock to reduce noise associated with brake air release events.
OpNV10	The implementation of feasible and reasonable noise and vibration mitigation measures such as: - Investigate methods to minimise rolling stock auxiliary noise levels during procurement.
OpNV 14	Liaise with Planning Authorities and land development / delivery organisations to minimise the potential future land use conflict between the RTRF and future residential development in order minimise noise impacts on future residents.

Note: Identifying codes for mitigation measures are taken, where possible, from EIS 1 and EIS 2 for NWRL to maximise consistency. As such, the codes are not always sequential for this EIS.

11.9 Conclusions

11.9.1 Construction

Consistent with the requirements of the ICNG, the construction noise impacts have been assessed based on a realistic worst-case. For most construction activities, it is expected that the construction noise levels would be lower than predicted in this report.

At the RTRF site, predicted levels for earthworks indicate moderate to high exceedances of the NMLs for the daytime period at surrounding receivers. These are a direct result of the relative close proximity of receivers to the construction activities and the absence of any appreciable shielding between sites and receivers. A lesser level of noise impacts are predicted for the RTRF infrastructure construction works with NML excedances generally below 20 dB.

Having considered all reasonable and feasible noise mitigation as part of the design, the RTRF Construction Noise and Vibration Strategy (CNVS) would be implemented to manage the potential noise impacts.

11.9.2 Operation

The worst-case noise impacts of the facility would be concentrated in the night-time and early morning period when trains are arriving or preparing to depart the facility and noise criteria are more stringent than during the daytime and evening.

The noise impact assessment indicates that train auxiliary systems have the potential to result in exceedances of the INP noise goals at some existing and future residential receivers during the night-time and early morning periods. These exceedances are a function of the low ambient noise levels during the night-time and early morning periods in some areas away from Schofields Road, the close proximity of some residential receivers and a typical worst-case noise modelling scenario in terms of the location of trains and adverse weather conditions.

The potential noise mitigation measures include source noise control (quieter trains), designing the proposed maintenance buildings to contain noise levels, implementing operational procedures to minimise noise impacts at nearby sensitive receivers, restricting the times in which heavy vehicles such as garbage trucks or delivery vehicles can access the site, and implementing non-tonal alarm systems within the maintenance area (train horn testing will not be required within the stabling facility). Enclosure or partial enclosure of the stabling area is also an option in the future scenario.

The assessment of mitigation measures in this report indicates that there are several mitigation options available for consideration in the detailed design stage to meet the noise goals for the RTRF.

Importantly TfNSW will continue to liaise with the Planning Authorities to minimise the potential future land use conflict between the RTRF and future residential development in order minimise impacts on future residents.

12.0 Surface Water and Flooding

12.1 Introduction

This chapter provides the hydrological (stormwater quality and quantity) impact assessment of the RTRF site based upon a desktop review of background studies in relation to the NWRL project, review of available floodplain information and field observations.

The detailed Surface Water and Hydrology Impact Assessment prepared by SLR Consulting Australia Pty Ltd is included as **Appendix G** of this EIS.

12.2 Director General's Requirements

Table 35 below sets out the Director-General's Requirements as they related to hydrology and flooding, and where in the project these have been addressed.

Table 35 – Relevant Director General's Requirements

Key Issues	Where Addressed in EIS	Technical Study
Modelling and assessment of the potential impacts of the project on: - The quantity and quality of existing surface and ground water resources - Affected licensed water users and basic landholder rights - Water courses and riparian areas and their associated catchments - Flooding up and including the probable maximum flood	- Section 12.4 (Groundwater is addressed in Section 9.4.4 and Section 9.5.1) - Section 9.4, Section 9.5 and Section 12.5.2 - Groundwater bores are addressed in Section 9.4.4 and Section 9.5.1 Section 12.4 and Section 12.5 Section 12.4 and Section 12.5	**Appendix G**
A description of the water management system for the project (including all infrastructure and storages)	Section 12.6.2	**Appendix G**
A description of measures to minimise water discharges and to mitigate and manage surface and ground water impacts	Section 12.6	**Appendix G**

12.3 Assessment Methodology

The methodology for the Surface Water and Hydrology Impact Assessment included a desktop review of background studies undertaken for the NWRL project, review of online floodplain maps, accompanied by field observations. The assessment considered flooding, water quality and groundwater implications of the RTRF facility.

Relevant guidelines and standards that have been considered in this assessment are outlined below:

- Managing Urban Stormwater: Soils and Construction (Landcom, 2004).
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000).
- Australian Runoff Quality (Institute of Engineers Australia, 2005).
- Blacktown City Council Development Control Plan 2006, Part R Water Sensitive Urban Design and Integrate Water Cycle Management.
- Landcom Water Sensitive Urban Design Book 1, Policy, Draft (2009).
- Controlled Activities - Guidelines for Outlet Structures (NSW Office of Water, 2010).

12.3.1 Flooding

Flood extents produced for NWRL EIS 1 and EIS 2 were plotted over the RTRF indicative site plan to allow the assessment and interpretation of how the proposed facility will impact on existing flood risks during construction and operational phases. This modelling is considered current and adequate for the purposes of the current study as it was developed for the specific purpose of assessing this site.

Conceptual modelling of flood detention basins has been undertaken to assess the impacts of the proposed RTRF site on local hydrology and to assess the impact of the proposed RTRF flood mitigation strategy.

The location of temporary and permanent works within floodplain storage zones has also been assessed for loss of floodplain storage and flood hazard.

12.3.2 Water Quality

The Model for Urban Stormwater Improvement Conceptualisation software (MUSIC) was used to evaluate whether the latest concept designs of the RTRF would provide an adequate footprint for stormwater management basins to meet stormwater quality and stream erosion control objectives.

12.4 Existing Environment

The existing hydrological environment as described in the Surface Water and Hydrology assessment is identified in this section.

12.4.1 Topography

Elevations generally fall from east to west ranging from approximately 64 m AHD at Tallawong Road to approximately 40 m AHD at the western boundary.

There are three distinct ridge lines within the RTRF site forming three surface water sub-catchments. Surface water runoff would tend to flow south westerly in the southern portion of the site, westerly in the centre of the site and north-west of the RTRF site, and north-westerly in the north-east of the RTRF site.

12.4.2 Regional Soils

The RTRF site is representative of the Blacktown soil landscape, characterised as poorly drained soils with low fertility, localised high plasticity and expansive subsoils. These alluvial soils are classified as a high erosion hazard.

The site is within an area designated as 'no known risk' of acid sulphate soil or potential acid sulphate soils.

12.4.3 Rainfall and Evaporation

The RTRF site's climate is characterised by high summer-autumn and low winter-spring rainfall with average monthly rainfall ranges from approximately 70-120 millimetres in the summer-autumn months to approximately 40-110 millimetres in the winter-spring months.

Average monthly evaporation in the region ranges from less than 100 millimetres in the winter months to over 400 millimetres in the summer months.

12.4.4 Local Catchment

The RTRF site is located within the First Ponds Creek catchment, part of the wider Hawkesbury Nepean catchment.

First Ponds Creek flows through a culvert beneath Schofields Road, approximately 300 metres west of the RTRF site, before flowing northerly to its confluence with a tributary of

First Ponds Creek (the tributary) approximately 250 metres to the north of Schofields Road. First Ponds Creek continues to flow north/north-west beyond the RTRF site to Eastern Creek, South Creek and into the Hawkesbury River (Hawkesbury Nepan Catchment Management Authority, 2008).

The south western edge of the RTRF site borders the tributary, which drains a catchment area of approximately 55 hectares up-gradient of Schofields Road. First Ponds Creek drains a catchment area of approximately 300 hectares at the confluence with the tributary. The catchment currently consists of both rural and medium density residential areas. It is estimated that the catchment is currently approximately 11 percent impervious land surface (roads and built up areas) which will increase incrementally with progressive development within the North Western Growth Centre.

The existing hydrological constraints are summarised within **Figure 34**.

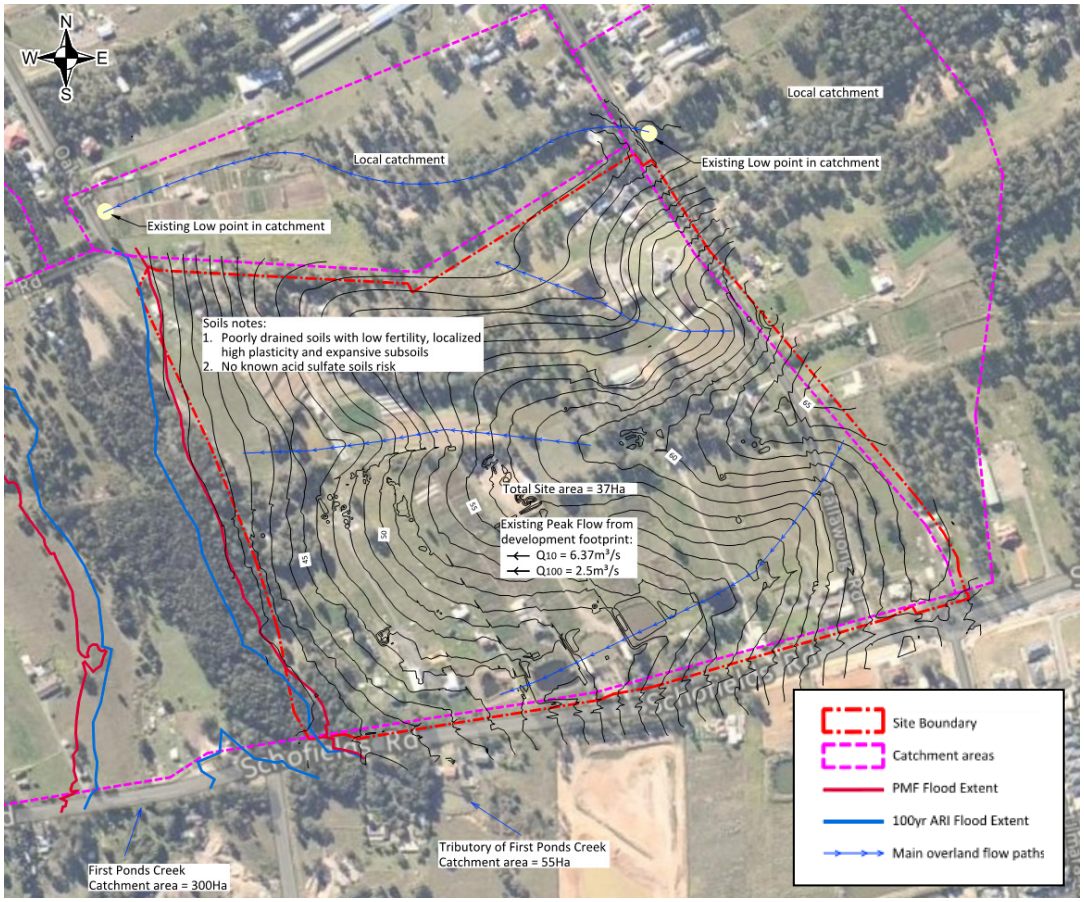

Figure 34 – Hydrological Constraints Plan

12.4.5 Flood Risk

The First Ponds Creek 100 year Average Recurrence Interval (ARI) flood extent is shown to have a variable width of between 140 to 250 metres adjacent to the RTRF site with a typical width of approximately 160 metres. The 100 year ARI flood extents are wider than the riparian corridor but do not encroach into the site as shown in **Figure 35**.

The Probable Maximum Flood (PMF) extent ranges in width between approximately 200 and 300 metres adjacent to the RTRF site with a typical flood width of 210 metres. The PMF has been shown to cross into the RTRF site at the very northern and southern extents of the site as shown in **Figure 35**.

Due to the broad nature of the floodplain relative to magnitude of flow, flood levels are considered to be relatively insensitive to increased rainfall intensities. It is predicted that a 30 percent increase in rainfall intensity as a result of climate change would only lead to an increase of between 0.04 and 0.17 metres in the 100 year ARI peak flood level.

12.4.6 Surface Water Quality

The Hawkesbury-Nepean River Environmental Monitoring Program (DECC 2009) describes current water quality within the wider Hawkesbury-Nepean River System as poor due to sewage treatment plant discharges as well as uncontrolled pollution from urban and agricultural runoff.

Water quality monitoring in First Ponds Creek collected between 2008 and 2011 by Blacktown City Council at the Windsor Road Bridge in Riverstone (approximately 4.2 kilometres north-west and down-gradient of the RTRF site) was compared with ANZECC (2000) water quality investigation trigger values for the protection of fresh water ecosystems in lowland rivers in eastern Australia. The monitoring site is distant and is not reflective of the water quality in First Ponds Creek adjacent to the site, but it is the best available data.

This data is summarised in **Table 36** and is considered to be representative of the water quality in First Ponds Creek at the RTRF site given the consistency of the rural land use within the catchment upstream of the RTRF, and between the RTRF site and sampling location.

Table 36 – Blacktown Council Water Quality Data Summary

Parameter	Units	ANZECC 2000 Trigger Value or Acceptable Limits	Dataset	Mean	Minimum	Maximum
Electrical Conductivity	uS/cm	125 - 2200	Sep 2008 - Sep 2011	1510	**0**	**3349**
Turbidity	NTU	6 - 50	Sep 2008 - Sep 2011	29	**1.1**	**83.2**
Dissoloved Oxygen	%	90 - 110	Sep 2008 - Sep 2011	**78**	**38**	110
pH		6.5 - 8.0	Sep 2008 - Sep 2011	7.3	**5.7**	**8.8**
Total Nitrogen	ug/L	500	Oct 2010 - Sep 2011	**2008**	500	**4900**
Total Phosphorus	ug/L	50	Oct 2010 - Sep 2011	**427**	80	**990**

Notes:

1. *ANZECC 2000 default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems*
2. ***Bold** values indicate data which exceeds adopted trigger values or is outside the adopted acceptable limits*

The water quality data indicates that downstream of the RTRF site, First Ponds Creek is heavily impacted with mean concentrations for Total Nitrogen (TN) over four times the investigative trigger value (500 μg/L) and Total Phosphorus (TP) over eight times the trigger value (50μg/L). Mean concentrations of Dissolved Oxygen (DO) were also outside the acceptable limits.

12.5 Potential Impacts

12.5.1 Construction

Table 37 outlines the potential impacts which can be expected during various construction activities.

Table 37 – Construction Stage Impacts

Construction Activities	Associated Potential Impacts
Vegetation clearing and mulching	Sediment loads in runoff (from cleared areas) entering receiving waterways, impacting on water quality and hence aquatic flora and fauna
	Sediment loads in runoff (from cleared areas) entering receiving waterways and smothering flora and fauna
	Low dissolved oxygen in runoff (from mulch stockpiles) entering waterways and depressing dissolved oxygen levels and stressing aquatic flora and fauna.
	Leaching of tannins from mulch stockpiles entering waterways
	High nutrient runoff (from stockpiles) entering waterways and stimulating algae and aquatic plant growth.
	Exposure of surface or subsurface dispersive soils leading to tunnel erosion, gullying and sediment transport into stream channels with consequential impacts for aquatic ecosystems.
Earthworks, including stockpiling of soils	Exposure of disturbed construction areas resulting in an increased opportunity for erosion and potential sediment transport into adjacent waterways, impacting on water quality and hence aquatic flora and fauna.
	Accidental spills or leaks of chemicals or hydrocarbons, potentially significantly impacting on aquatic ecosystems if the material enters waterways
	If acid sulphate soils are identified within the project area, the potential exists for disturbance of this soil during the construction phase, which can lead to oxidisation of the exposed soil and acidic runoff entering waterways and lowering pH
	Exposure of surface or subsurface dispersive soils leading to tunnel erosion, gullying and sediment transport into waterways with consequential impacts for aquatic ecosystems.
	Inadequate diversion of clean water around and through the site resulting in contamination of waterways
	Exceedence of the design capacity of erosion and sediment control measures (ie. 5 day, 85th %ile) and subsequent sediment transport into adjacent waterways
	Tracking of sediment onto adjacent road surfaces by construction vehicles and subsequent sediment transport into adjacent waterways
Foundation works and installation of culverts, piers and embankments	Accidental spills or leaks of chemicals or hydrocarbons, potentially significantly impacting on aquatic ecosystems if the material enters waterways
	Land disturbing activities within drainage lines and creeks resulting in an increased opportunity for erosion and potential sediment transport into waterways.
	Inappropriate changes to bank and bed forms of channels may lead to geomorphic responses in the channels during rainfall events. This can result in bed and bank erosion and loss of pools and riffle leading to increased sediment loads and reduced dissolved oxygen levels.
	Exposure of surface or subsurface dispersive soils leading to tunnel erosion, gullying and sediment transport into stream channels with consequential impacts for aquatic ecosystems.
	Inadequate diversion of clean water around and through the site resulting in contamination of waterways
	Exceedances of the design capacity of erosion and sediment control measures (ie. 5 day, 85th %ile) and subsequent sediment transport into adjacent waterways

Hydrological Impacts

Construction activities would not significantly alter the existing hydrology of the site. However, there would be an increase in the frequency and intensity of runoff generated within the site and a net increase in the discharge of stormwater to First Ponds Creek. These impacts would be temporary and would not result in significant or lasting impacts on First Ponds Creek.

Flooding Impacts

Construction activities along the western boundary of the RTRF site would encroach into lands affected by the PMF and 100 year ARI flood (**Figure 35**). Given the temporary nature of the works, encroachment being limited to the outer extent of the floodplain there is considered to be negligible impact on upstream or loss of floodplain storage.

Surface Water Quality Impacts

Surface disturbances would generate stormwater borne sediment loads which must be intercepted to prevent sediment discharge to First Ponds Creek. Stockpiling of demolition and excavation materials (including potentially contaminated material), and spoil generated as a result of excavations has the potential for runoff and increased stormwater borne sediment loads discharging to First Ponds Creek.

Soils in the vicinity of First Ponds Creek have been identified as having a high salinity potential. The construction of retaining walls could potentially increase the movement of water through the soil profile and thus exacerbate salinity issues which could potentially affect riparian vegetation and in stream water quality.

There is considered to be no risk of exposure of acid sulphate soils during construction works.

It is expected that small volumes of liquid wastes, fuels and oils would be stored on site associated with construction and earthworks machinery. Potential water quality and ecological impacts could occur in First Ponds Creek as a result of accidental spillage or poor management of these substances during the construction phase.

Riparian and Waterway Impacts

Construction of the proposed stormwater basins will be designed to avoid entry into the non-biodiversity certified lands in the riparian corridor and avoid the need for vegetation removal within this zone.

12.5.2 Operation

Table 38 outlines the potential impacts which can be expected during various activities associated with the operational stage of the project.

Table 38 – Operational stage impacts

Operational Activities	Associated Impacts	Direct or Indirect
Utilisation of site by vehicles	Discharge of polluted stormwater runoff from the roadway into downstream receiving environments (runoff may contain sediments, hydrocarbons, nutrients, litter, heavy metals eg cadmium, chromium, copper, zinc, lead, and nickel from brake lining, tyre wear and settled particulates from exhaust systems. These may be toxic to aquatic biota and fish and also lead to a variety of other waterway impacts.	Indirect
	Accidental spills of chemicals — these can impact aquatic (and terrestrial) ecosystems.	Indirect

Operational Activities	Associated Impacts	Direct or Indirect
	Changes in hydrology due to altered catchment shapes and flowpaths. Changed hydrology can destabilise banks and lead to increased sedimentation and erosion within receiving waterways until streams achieve an equilibrium state.	Indirect
	Impacts of future highway upgrades on downstream wetlands, and long term effects of pollutant buildup in sediments.	Indirect
Maintenance onsite site	Accidental spills of chemicals, eg herbicides, hydrocarbons, — these can impact aquatic and terrestrial ecosystems.	Direct and Indirect

Hydrological Impacts

The RTRF would result in an increase in the frequency and magnitude of stormwater runoff from the site due to an increase in impermeable surface area and a resultant decrease in infiltration. Mitigation measures including stormwater detention, infiltration and harvesting are required to intercept stormwater runoff and prevent creek bank instability and erosion, altered ephemeral hydrology and worsening of downstream flooding.

Assessment of peak flows and detention requirements indicates that the basins would need to provide a combined detention volume of 7,600 m^3 in order to preserve pre-development peak flows to First Ponds Creek up to the 100 year ARI event.

Water balance modelling demonstrates that the project will not reduce volumes of runoff to the downstream creek and therefore will not affect the availability of water to downstream users, including licened water users.

Flooding Impacts

The indicative layout plan for the proposed RTRF shows two stormwater detention basins along the western site boundary with a combined water surface footprint of **5400 m2**. These basins are situated outside the 100 year ARI flood extent but are within the PMF floodplain. The edge of northern basin embankment and toe of the northern basin batter encroach within the PMF floodplain.

Stormwater detention basin embankments are completely outside the 100 year ARI extent, which is the design standard for new development, and will not impact on downstream flooding. The basin embankments encroach on the PMF flood extent but the associated impacts will not affect design standard flooding.

All other development and retaining walls are outside of the floodplain.

Surface Water Quality Impacts

The RTRF would increase impervious areas and introduce site activities that have the potential to increase stormwater pollution loads into the First Ponds Creek catchment, including hydrocarbons, oils, sediments and dust loads associated with cleaning and maintenance of trains.

While there is potential for increased sediment and pollutant loads into First Ponds Creek, this increased load may not be sufficient to adversely affect existing water quality, due to the already degraded in-stream water quality that presently exists.

12.6 Mitigation Strategies

12.6.1 Construction

Surface Water Quality, Erosion and Sedimentation

The control and mitigation of potential surface water quality impacts during the construction phase will be confirmed within a Soil and Water Management Plan (SWMP) prepared as part of the overall CEMP for the RTRF.
The SWMP will be prepared in accordance with the Best Management Practices set out in 'Soils and Construction: Managing Urban Stormwater' (Landcom 2009) and include controls such as:

1. Minimise extent of ground disturbance
2. Control clean water onto and through the site
3. Implement erosion control strategies to prevent on-site damage
4. Implement sediment control strategies to prevent off-site damage
5. Progressive stabilisation following completion
6. Monitoring of controls & strategies

Table 39 identifies the control approaches for the construction stage. These measures are considered sufficient to mitigate any impacts on the water quality of First Ponds Creek.

Table 39 – Control approaches for construction stage impacts

Construction Activities	Associated Impacts	Addressed By
Vegetation clearing and mulching	Sediment laden runoff to waterways	Erosion and Sediment Control: ▪ minimise disturbance (staged clearing) ▪ diversion of run-on water; ▪ installation of sediment controls; ▪ installation of erosion controls; ▪ revegetation (site rehabilitation) ▪ monitoring and evaluation.
	Low dissolved oxygen runoff to waterways	Erosion and Sediment Control
	High nutrient runoff to waterways	Erosion and Sediment Control
Earthworks, including stockpiling of soils	Sediment laden runoff to waterways	Erosion and Sediment Control
	Accidental spills or leaks of chemicals or hydrocarbons	Incidental Spills
Foundation works and installation of culverts, piers and embankments, etc	Accidental spills or leaks of chemicals or hydrocarbons	Incidental Spills
	Sediment laden runoff to waterways	Erosion and Sediment Control
	Inappropriate changes to bank and bed forms of channels leading to erosion and sedimentation	Erosion and Sediment Control

Sediment Control Strategies

Runoff resulting from the construction area will be managed to ensure the highest possible water quality standard can be achieved prior to its exit from the site, within design requirements. Construction Basins form the basis of sediment control. Although essential, it is important to note that sediment basins are considered secondary to erosion control in minimising ground and surface water pollution resulting from construction activities. The main aim is to reduce erosion and trap sediment as high up the catchment as possible, rather than rely on a basin at the end of the 'treatment train'.

Measures to be implemented include basins, traps and flocculation agents. The decision on which measures to use for specific locations is to be based upon a number of factors including design requirements, minimal site disturbance, practicality of construction, effectiveness, ease of maintenance and cost.

In addition to sediment control measures on the construction site, an end of pipe sediment basin, either as a grassed detention basin or a WSUD basin lined with geofabric should be provided as an additional barrier between First Ponds Creek and the construction works. It is likely that multiple basins would be required to control runoff, and swales will be used to convey stormwater runoff to the sediment basin(s).

The sediment basin and swales should be constructed at the commencement of the earthworks program to provide sediment control throughout the construction phase. The exact size and layout of basins would need to be modified to suit the changing form and needs of the construction site as the works progress. The sediment basins installed for the construction phase are expected to be converted to water quality treatment basins for the operation phase.

Basins are to be designed to meet both the sediment control and surface flow retention requirements for the construction stage of the project in addition to water quality requirements for the operational stage. Construction basins are to be designed to ensure containment and treatment of runoff during all stages of construction until the site has been appropriately stabilised.

In sensitive environmental locations (ie First Pond Creek) and where required, sedimentation basins installed for the construction phase may be converted to water quality treatment basins for the operation phase.

Sediment traps are to be used in addition to basins to provide additional filtering and interception of runoff from the site. These sediment traps may include a variety of measures including rock socks, native hardwood mulch, rock checks, sand bags, sediment fence and inlet filters. Mulch is not to be used where there is a risk of mulch tannins entering adjacent watercourses.

While sediment basin and traps are effective at trapping larger sediment particles, the physical soil characteristics indicate there is a high likelihood of fine and/or dispersible soil particles being encountered during construction. This will require flocculation of sediment basins to achieve acceptable water quality standards before release of site runoff.

Incidental Spills

Incidental spills would either be intercepted by active spill management practices in accordance with the CEMP or by sediment control devices. Such devices may include sedimentation basins and/or large capacity gross pollutant traps.

Revegetation

The undeveloped areas of the site would be revegetated/rehabilitated following completion and/or suspension of construction activities. Prior to carrying concentrated flows, drainage lines are to have either adequate vegetation cover, armouring or lining.

Flooding

Any civil works which encroach within the 100 year ARI flood extent would be completed within a short timeframe in order to minimise impacts to the floodplain. Machinery must be moved from the floodplain during rain and overnight.

Construction works would be undertaken progressively to enable diversion channels to be put in place and stabilised to manage external catchment flows around the work site, thereby separating clean and dirty water. All Stockpiles will be located outside the PMF flood extent. Onsite detention basins will also offset the potential increase in surface water flows and progressive release of these waters back into the system in a post flooding environment.

Riparian and Waterway Impacts

Works associated with the construction of stormwater basin discharge points will be carried out in accordance with sediment and erosion management protocols. Flow diversions will be established to bypass creek flows around works areas.

Summary of Mitigation Measures

The mitigation measures detailed in **Table 40** have been developed to avoid, reduce and manage identified potential impacts.

Table 40 –Mitigation measures for construction hydrology and water quality

No	Mitigation Measure
	Flooding
SW3	Construction equipment (or excess material) would be removed from waterway or flood prone areas if wet weather is approaching and at the completion of each day's work activity. The extent of the flood prone area would be defined during detailed construction planning.
	Water Quality and Erosion and Sediment Control
SW14	Water quality mitigation measures would be implemented in accordance with relevant requirements of: - Landcom Managing Urban Stormwater - Soils and Construction Volumes 1 and 2 (2009). - 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. - Applicable Environment Protection Licences.
SW15	Treatment measures would be applied to water collected in sediment basins, including settling of coarse sediments, the use of flocculation for finer sediments and pH correction.
SW16	As a first preference, treated surface water collected in sediment basins would be reused onsite, eg for dust suppression. Additional opportunities for re-using water on site or for construction would be investigated and implemented where feasible and reasonable.
SW17	Exclusion zones would be designated on construction sites to limit disturbance.
SW18	Re-vegetating or stabilising disturbed areas would occur as soon as feasible.
SW20	Appropriate erosion control measures would be installed such as sediment fencing, check dams, temporary ground stabilisation, diversion berms or site regrading.
SW21	Clean water runoff would be diverted away from the works or disturbed areas wherever possible.
SW22	Temporary sediment basins would be installed as appropriate. The exact size and layout of sediment basins would be determined as part of the CEMP in accordance with the requirements of the relevant Environment Protection Licence.
SW26	Surface controls to promote ground stability, limit run-off lengths and reduce run-off velocities within the work sites would be implemented.

No	Mitigation Measure
SW27	Ground stability would be re-established as soon as practicable following the completion of construction.
SW28	Installation of any permanent scour protection measures required for the operational phase would occur as soon as practical.
	Riparian Corridor
SW32	Where water is released into local creeks, outlet scour protection and energy dissipation would be implemented. The discharge point would be at the upstream end of a large pool where feasible and reasonable, to allow for slowing of water.
SW37	Temporary stockpile locations for both site establishment and earthworks operations would be specified prior to the commencement of construction activities. Diversion drains and erosion and sediment control measures would be in place prior to the commencement of any stockpiling activities. Material would only be stockpiled in designated stockpiling areas.
	Contamination and Spills
SW38	Site specific controls would be developed to reduce the potential for environmental releases of potentially harmful chemicals and to reduce the risk of any such releases entering local waterways. Storage of hazardous materials such as oils, chemicals and refuelling activities would occur in bunded areas.
	Monitoring and Implementation
SW40	A qualified environmental officer would be employed to advise on appropriate controls and to monitor the implementation and maintenance of mitigation measures.
SW41	All site staff would be engaged through toolbox talks or similar with appropriate training on soil and water management practices.
SW42	A surface water quality monitoring program for the construction period would be implemented to monitor water quality upstream and downstream of the construction areas. The monitoring programme would commence prior to commencement of any construction works and would build on available water quality data.
SW43	Surface water and water quality monitoring would be carried out periodically and after rainfall events. Monitoring would examine a range of appropriate indicators in accordance with standard guidelines.
SW44	Inspection of water quality mitigation controls (e.g. sediment control fences, sediment basins) would be carried out regularly and following significant rainfall to detect any breach of performance.
SW45	A stormwater management plan that identifies the appropriate design standards for flood mitigation based on the duration of construction, proposed activities and flood risks would be developed for each construction site. The plan would develop procedures to ensure that threats to human safety and damage to infrastructure are not exacerbated during the construction period.

Note: Identifying codes for mitigation measures are taken, where possible, from EIS 1 and EIS 2 for NWRL to maximise consistency. As such, the codes are not always sequential for this EIS.

12.6.2 Operation

General

The following flow management objectives would apply to the site and are adopted from the Interim Reference Guidelines for WSUD practitioners in Sydney and TfNSW - NSW Sustainable Design Guidelines for Rail (Version 2.0):

- Hydrologic objectives for the completed facility will include the following:
  - achieve a Stream Erosion Index (SEI) of 2.
  - maintain 1.5 year ARI peak discharge to pre-development magnitude.
  - preserve predevelopment peak discharges.
- Pollutant reduction compared to untreated stormwater from the same development type, of:
  - 85% of the post development mean annual load of total suspended solids.

  - 65% of the post development mean annual load of total phosphorus.
  - 45% of the post development mean annual load of total nitrogen.
- Non potable water would be incorporated to provide water for flushing toilets, spot cleaning of concourse and platform and water for cooling towers / irrigation.

Proposed Mitigation Scheme

In accordance with TfNSW - NSW Sustainable Design Guidelines for Rail (Version 2.0), the RTRF design incorporates flood management and WSUD measures to address the flow management objectives including:

- Flood detention basins with a total combined volume of approximately 7,600m^3.
- Vegetated swales and water quality treatment within flood detention basins.
- Rainwater harvesting tanks to collect stormwater from the roof of the train maintenance and administration buildings.
- Gross pollutant traps such as litter baskets would also be incorporated into heavily pedestrianised zones.
- Oil and grit separators to control the release of hydrocarbons associated with train maintenance.

These passive treatment systems and flow controls would provide for water diversion, retention and detention across the site. Implementation of this suite of treatment options would avoid or reduce potential water impacts relating to throughflow volumes, water quality, bank and channel stability and flooding impacts.

In addition, the following non potable water measures are to be adopted for the site:

- Potable water is not used as a substitute for non-potable water where on-site or local sources of non potable are available.
- An average of 90 per cent of annual non-potable water demand is to be sourced from non potable sources at the depot.
- 85% of the water used in the train wash is to be collected, recycled and reused; and
- Harvested rainwater must be used for landscape irrigation in the immediate station precinct, cooling towers, flushing toilets, spot cleaning and any other appropriate non potable water uses.

Stormwater Quality

The size of the proposed basins incorporate a notional biofiltration footprint of 3000m^2 which will reduce stormwater pollution loads. MUSIC modelling outputs are summarised in **Table 41**.

Table 41 – Stormwater pollutant loads

Mitigation	Existing Load (kg/yr)	Post Dev Load (no mitigation) (kg/yr)	Post Dev Load (with mitigation) (kg/yr)	Load Reduction (%)	Target Reduction (%)	Target Met
Total Suspended Solids						
Bio-retention	4290	26,500	3990	85	85	Yes
Bio-retention with infiltration through base			3960	85.1	85	Yes
Bio-retention with infiltration through base plus rainwater harvesting			3770	85.7	85	Yes

Mitigation	Existing Load (kg/yr)	Post Dev Load (no mitigation) (kg/yr)	Post Dev Load (with mitigation) (kg/yr)	Load Reduction (%)	Target Reduction (%)	Target Met
Total Phosphorus						
Bio-retention	11.1	54.5	13.4	75.5	65	Yes
Bio-retention with infiltration through base			13	76.2	65	Yes
Bio-retention with infiltration through base plus rainwater harvesting			12.6	77	65	Yes
Total Nitrogen						
Bio-retention	118	408	195	52.2	45	Yes
Bio-retention with infiltration through base			184	55	45	Yes
Bio-retention with infiltration through base plus rainwater harvesting			180	56	45	Yes

This shows that best practice stormwater pollution reduction targets are likely to be met using common place WSUD technologies and acceptable downstream stormwater quality impacts are likely to be provided.

Maintenance activities such as the washdown and general maintenance of trains will be carried out in a covered maintenance building and washdown will be collected in a separate system for treatment and reuse, thus avoiding any potential for such pollutants to enter First Ponds Creek.

Stream Flow

Continuous rainfall and runoff simulations were carried out using MUSIC software to quantify the existing and future annual hydrologic balance for the site. The results of this assessment show that the proposed stormwater basins will reduce the impacts of urban stormwater but will produce a residual impact as follows:

- A net doubling of the annual stormwater runoff to First Ponds Creek
- A small reduction in stormwater infiltration to the groundwater table, which will be significantly reduced without encouraged infiltration to groundwater

The sizes of the proposed basins provide adequate allowance for the inclusion of biofiltration and detention to achieve an SEI in the range of 1 to 1.5, which exceeds Blacktown Council's SEI objective. Despite the increase in runoff from the site, there will be a low risk of creek erosion due to runoff from the RTRF site.

Flooding

The proposed stormwater detention basins have been sized using hydrologic modelling software to preserve pre-development peak flows to First Ponds Creek. These are located out of the 100 year flood extent and will ensure that there is no net increase in flow within the First Ponds Creek up to the 100 year event.

The finished land form for the RTRF will not impact on flood storage or result in an increase in localised or regional flood levels.

Contamination and Spills

Site specific controls around storage facilities will be developed to reduce the potential for environmental releases of potentially harmful chemicals and to reduce the risk of any such releases to First Ponds Creek.

Waste water associated with automated cleaning of rolling stock will be captured and recycled with excess water being discharged to sewer to prevent contaminants reaching First Ponds Creek.

Summary of Mitigation Measures

The mitigation measures detailed in **Table 42** have been developed to avoid, reduce and manage identified potential impacts.

Table 42 –Mitigation measures for hydrology and water quality during operations.

No	Mitigation Measure
OpSW4	Treatment measures would be applied to water collected in on site detention basins, including settling of coarse sediments, the use of flocculation for finer sediments and pH correction.
OpSW6	The stabling facility would be located above the 100 year ARI flood level.
OpSW11	Development within the floodplain would be designed to minimise adverse impacts on adjacent development for flooding up to the 100 year ARI event. And would be designed to maintain the operation of key evacuation routes, minimise impacts on critical infrastructure and flood hazard for flooding up to the PMF.
OpSW14	Water quality treatment measures (including a combination of swales, bioretention systems, water quality basins, gross pollutant traps) would be integrated into the drainage system to mitigate impacts to waterways.
OpSW15	A holistic approach to water quality and stormwater management would be adopted that incorporates Water Sensitive Urban Design principles to minimise impacts on the existing hydrologic regime. Such measures would include: - Managing total runoff volumes through the use of rainwater tanks and measures that promote stormwater infiltration. - Minimising increases in peak flows through the use of detention and retention measures as appropriate. - Preserving and enhancing the amenity of waterways by maintaining or providing natural vegetated measures. - Treating stormwater through a range of at source and end point measures that are integrated with the urban landscape.
OpSW16	A surface water quality monitoring program would be developed post construction to monitor water quality upstream and downstream of the works. Monitoring procedures and performance criteria would be established in consultation with local councils and relevant government agencies.

Note: Identifying codes for mitigation measures are taken, where possible, from EIS 1 and EIS 2 for NWRL to maximise consistency. As such, the codes are not always sequential for this EIS.

12.7 Conclusions

Construction works are generally located outside the floodplain and are outside of the riparian corridor. All construction works would be carried out in accordance with sediment and erosion controls in place consistent with current best practice.

Stormwater impacts during construction are further mitigated by two stormwater detention basins that will have a stormwater quality and flood control function that transitions between construction and operational phases.

The indicative layout plan makes sufficient allocation for soil and water controls to be managed through working controls such as detailed design, normal construction practice and other working controls. Soil and water impact risks associated with construction are therefore categorised as low.

The RTRF will deliver current best practice water cycle management and mitigate potential flooding, water quality, stream erosion and groundwater impacts during operations.

The RTRF includes stormwater basins that will attenuate flood flows and erosive flows from the site, meeting the standards established in the NSW Floodplain Development Manual and local stream flow targets. The proposed basins have capacity to achieve local stormwater pollution reduction targets and will deliver stormwater quality that is consistently better that baseline water quality in First Ponds Creek.

Incorporating an infiltration function into the basins will provide a reasonable level of groundwater recharge and will reasonably mitigate potential impacts on the local groundwater table. Given the proximity of infiltration zones to the riparian corridor, there is a low potential for infiltration to cause salinity impacts on the proposed road and retaining wall infrastructure.

Liquid and waste storage requirements and train wash water capture will prevent contamination of stormwater and receiving waters.

13.0 Ecology

13.1 Introduction

This chapter provides the ecological impact assessment of the RTRF site. The detailed Flora & Fauna Assessment Report prepared by SLR Consulting Australia Pty Ltd is included as **Appendix H** of this EIS.

13.2 Director General's Requirements

Table 43 below sets out the Director-General's Requirements as they related to Ecology, and where in the project these have been addressed.

Table 43 – Relevant Director General's Requirements

Key Issues	Where Addressed in EIS	Technical Study
An assessment of the potential impacts of the project on terrestrial riparian and aquatic areas including critical habitats, threatened species, population or ecological communities and groundwater dependent ecosystems	Sections 13.4, 13.6 and 13.7	**Appendix H**
Consideration of the relevant biodiversity measures of the Biodiversity Certification conferred on the Environmental Planning Policy (Sydney Region Growth Centres 2006)	Section 13.3.2 and 13.5	**Appendix H**
a description of the measures that would be implemented to avoid, mitigate, manage and offset the ecological impacts of the project, noting that any clearing of existing native vegetation proposed within the noncertified areas of the Growth Centre should be offset in accordance with the relevant biodiversity measures of the Biodiversity Certification	Section 13.9	**Appendix H**
taking into account the guidelines for Threatened Species , Assessment (DPI, 2008) and the NSt4/ Safe Groundwater Dependent Ecosystems Policy (D1WC,2002).	Section 13.3.1	**Appendix H**

13.3 Assessment Methodology

13.3.1 Relevant Guidelines

This assessment is based on relevant statutory and planning policies, and agency Guidelines, including:

- State Environmental Planning Policy (Sydney Growth Centres) 2006 (the 'Growth Centres SEPP').
- The OEH Principles for the Use of Biodiversity Offsets in NSW (2011).
- The OEH Threatened Species Survey & Assessment Guidelines (dated 2004).
- OEH documents regarding the Cumberland Plain, including:
  - Cumberland Plain Vegetation Mapping (NPWS 2002).
  - The Cumberland Plain Recovery Plan (DECCW 2011).
  - Recovering Bushland on the Cumberland Plain: Best Practice Guidelines for the Management and Restoration of Bushland (DEC 2005).

13.3.2 Growth Centres SEPP

The extensive investigations undertaken for the Growth Centres SEPP in order to justify the 'Biodiversity Certification' of the North West and South West Growth Centres, pursuant to the Growth Centres State Environmental Planning Policy (SEPP), have been considered as a part of this assessment.

The Growth Centres SEPP enables the 'Biodiversity Certification' of the North West and South West Growth Centres. The result of 'Biodiversity Certification' is that development activities within areas which have been 'certified' (i.e. portions of land that are designated for development activities pursuant to the process) do not require further consideration with respect to "threatened species, populations or ecological communities, or their habitats".

In particular, the 'Biodiversity Certification' process assumes that vegetation within the 'certified land' is to be removed, and has been offset as part of this process. As a consequence, biodiversity certified land that is to be cleared does not require detailed consideration with respect to threatened species, populations or ecological communities, or their habitats. Nor does the clearing require consideration of Section 5A of the EP&A Act with respect to the potential for a "significant effect" to be imposed upon any such biota or their habitat.

13.3.3 EIS Investigations

Investigations undertaken for the Environmental Impact Statements for the North West Rail Link (NWRL) provide a substantial and valid database with which to consider the likely presence of native biota, including "threatened species, populations and ecological communities". Thus the findings of these investigations have been taken into account as part of this assessment.

13.3.4 Current Investigations on the Subject Land

A number of flora and fauna investigations have recently been undertaken on the RTRF site and/or in its immediate vicinity. Investigations were undertaken by EcoLogical Australia for the EISs for the NWRL, including on the Tallawong Road RTRF site. These investigations provide some information regarding the vegetation types and threatened biota recorded in the immediate vicinity and on the southern portion of the RTRF site.

Investigations undertaken by SLR Ecology as a part of this assessment were undertaken to ground truth the previous studies and included:

- walked meanders and surveys of properties within the RTRF site (to which access had been granted), in order:
  - To identify the vegetation types present;
  - To undertake quadrats and transects to identify the condition of vegetation present;
  - To search for fauna habitats and resources of potential relevance;
  - To undertake dedicated searches for threatened flora and fauna species
- nocturnal surveys for native fauna (including microchiropteran bats, terrestrial mammals and arboreal species), including the use of Anabat detectors, infra-red cameras, call playback and spotlighting.

The field investigations undertaken specifically for this assessment were conducted in early May 2013, and involved two ecologists.

13.4 Existing Environment

13.4.1 Locality

Lands in the general vicinity of the RTRF, and in the general locality, have long been substantially modified for a variety of small-scale rural and agricultural activities, with lands to the south and west of the RTRF rapidly being developed for urban purposes.

There are two moderate-sized watercourses in the vicinity of the RTRF site. Second Ponds Creek is located to the east of the site, and First Ponds Creek is located on the western boundary. Both watercourses support bands of modified and disturbed native vegetation, much of which is weed infested and/or substantially modified from its original conditions. Nevertheless, both watercourses support vegetation which has been identified as the River Flat Eucalypt Forest on Coastal Floodplains (REFCF) "endangered ecological community" (EEC).

The RTRF site is located on the southern boundary of the North West Growth Centre, which as discussed in Section 1.1 has received 'Biodiversity Certification', pursuant to Part 7AA of the TSC Act.

Both First Ponds Creek and Second Ponds Creek are identified as 'non-certified' land, whereas the whole of the area proposed for the RTRF has been bio-certified.

13.4.2 The Subject Site

As is the case with the surrounding landscape, the RTRF site is highly modified from its original condition, and consists predominantly of areas of cleared semi-rural and/or agricultural land. The site consists of small rural lots which have been utilised for activities such as low intensity grazing, ponies, small amounts of cropping and other associated semi-rural activities.

Most of the land is cleared of native vegetation, however, there are small moderate areas of native tree canopy, in some instances with a native or partly native groundcover and in others with predominantly introduced weeds and other species.

The vegetation along First Ponds Creek (on the western boundary of the RTRF site), is to be retained and protected from any disturbances associated with the RTRF project in accordance with the North West Growth Centres 'Biodiversity Certification'.

13.4.3 Flora & Vegetation

Existing Vegetation

With respect to the native vegetation present on the subject land, a total of 21 lots were surveyed for this assessment, on the basis of access provided. The assessment includes eleven lots that are to the east the RTRF site.

There is little intact native vegetation present on the RTRF site. Vegetation which is present includes:

- Scatters and patches of Forest Red Gum – Ironbark Woodland on the more elevated parts of the land; and
- Cabbage Gum – Swamp Oak – Paperbark Forest along the lower drainage lines and flats adjacent to watercourses.

Forest Red Gum – Ironbark Woodland vegetation is present as 'derived native grassland' of native and exotic grasses (such as the native Love Grasses, Wallaby Grass, Wire Grass, Windmill Grass and Weeping Grass, and the exotic African Love Grass and Pigeon Grass), with limited to no trees or shrubs and is present on property No. 69 Schofields Road, located in the south eastern corner of the RTRF site (once Tallawong Road is realigned).

The vegetation on property No. 69 Schofields Road has a highly disturbed native groundcover of native Cumberland Plain Woodland (CPW) species and may constitute the Critically Endangered Ecological Community (CEEC).

Property No. 51 Schofields Road contains an area of Cabbage Gum in the southeastern corner, with Swamp Oak along the western boundary. There is a mainly exotic understorey of Privet, Green Cestrum, Wild Tobacco and Japanese Honeysuckle across property No. 51 Schofields Road. The groundcover is sparse within the area of Swamp Oak along the western boundary, and has a more dense cover of native Weeping Grass within the Cabbage Gum in the southeastern corner.

The vegetation on the majority of property No. 51 has a native canopy of species typical of the River-flat Eucalypt Forest on Coastal Floodplain Forest (REFCF) community, with a highly disturbed native groundcover of native REFCF species. This vegetation is considered to constitute the REFCF community, which is listed as an Endangered Ecological Community (EEC) in the TSC Act.

Flora Species

Random Meander and systematic botanical surveys conducted as part of this investigation have recorded a total of 96 plant species from within and adjacent to the RTRF site. Of these, a total of 54 native species were recorded, along with 42 exotic species. A few of the exotic species (including African Olive and Privet) are also listed as noxious species in NSW.

Threatened Species

No "threatened species" of flora were recorded on the subject land during the recent site inspection, or during any of the previous studies.

Given the highly disturbed nature and artificial condition of the vegetation across the subject site and in its vicinity, and the long history of management (including probable use of fertilisers, irrigation and weed control), it is not likely that any of the subject land constitutes suitable habitat for any of the additional threatened plant species known in the locality.

Threatened Populations

No "endangered populations" of any flora species listed in the TSC Act have been recorded from the subject land, and there are none that have been detected in the vicinity.

Endangered Ecological Communities

The vegetation community mapped by NPWS as present on the subject site could constitute the CEEC known as Cumberland Plain Woodland (CPW) and the EEC known as River-flat Eucalypts Forest on Coastal Floodplains (REFCF).

The CPW community is considered to be possibly present within property No. 69 Schofields Road. The REFCF community is considered to be present along the western boundary and in the southeastern corner of property No. 51 Schofields Road.

Vegetation along First Ponds Creek is, in many areas, highly weed-infested, and has been degraded and modified over a long period as a result of the surrounding agricultural activities. Nevertheless, this vegetation has biodiversity conservation value, and would be protected from any construction works or ongoing activities at the RTRF project site.

13.4.4 Fauna

Fauna Habitats

The subject land generally provides only limited habitat opportunities for native fauna, threatened or otherwise, because of the generally high levels of modification and degradation, and the intensity of historical and ongoing human activities.
Most of the land is unlikely to be utilised by native fauna other than highly mobile species and/or habitat generalists (such as some bats and birds), or species tolerant of modified rural landscape and peri-urban environments.

Other features of the RTRF site that demonstrate limited habitat opportunities include the absence of hollow-bearing trees, limited number of hollow logs or notable woodland debris, those present are generally of low quality. There is a high occurrence of dumping and storing of building materials on a number of the properties, which in some instances could provide habitat and shelter for a range of mammals (mostly introduced) and reptiles. The many farm dams which are scattered around the subject land provide potential habitat for an array of amphibian, reptile and waterbird species. However, they are mostly disturbed and are surrounded by exotic pasture, and their value for threatened or significant native fauna is consequently limited.

A few of the farm dams could constitute suitable habitat for the Green & Golden Bell Frog. However, the subject land is not regarded as of relevance for the species. Further, the Plague Minnow Gambusia holbrooki is fairly widespread which would limit amphibian diversity and severely limit any likelihood of the Green & Golden Bell Frog being present.

There are no other habitat features or resources present which are of any significance for any native fauna, threatened or otherwise. The nature, condition and context of the subject land render it of value predominantly only for abundant, widespread, common and/or adaptable species of native fauna, and of only very limited potential relevance for any threatened species.

The RTRF site is not regarded as providing habitat or resources of particular importance or relevance for threatened fauna species which could potentially utilise the subject land. It is not considered likely that the site would be essential or important for the survival of even individuals of any such species in this locality.

Fauna Species

Field investigations within and adjacent to the site during 2013 identified a fauna assemblage of 35 native species (29 birds, 2 reptiles and 3 amphibians) and 6 introduced and/or domestic species.

There is no doubt that additional urban-tolerant and peri-urban fauna species would be likely to utilise the subject land, on occasions at least. In particular, an array of native bird species would be likely to utilise plants on the subject land when flowering, and it is also likely that some microchiropteran bats would fly over the land for foraging purposes. There are no significant natural features on the subject land which would contribute in any relevant or significant manner to the survival of local populations of native biota.

Three common amphibian species were recorded during the survey period at Schofields. Whilst it is possible that a few of the farm dams contain characteristics which could be favourable for the Green & Golden Bell Frog, no individuals of this species have been recorded during any surveys.

Only two reptiles (the Eastern Long-necked Turtle and the Garden Sun-skink) were observed on the subject land, and only common urban and peri-urban reptile species (such as the Common Blue-tongue Lizard or Red-bellied Black Snake) are likely to occur. There are no threatened reptile species known to occur in the locality.

Twenty nine native bird species were recorded on the subject land, all of which occur commonly in semi-rural and peri-urban environments. Whilst the subject land could be utilised on a temporary basis by individuals of some of the more wide-ranging threatened bird species known to occur in the locality, the modified and disturbed nature of the vegetation present indicates that the subject land would not be important for any of these species.

Only three native mammal species were recorded (being three microchiropteran bats), with the remaining four species being introduced. This circumstance is reflective of the highly disturbed and modified nature of the subject land and surrounding environment, and the moderately intensive agricultural activities which have historically and are currently operating. As noted below, two of the three microchiropteran bat species are threatened (the Common Bent-wing Bat and Little Bent-wing Bat). These species are common throughout eastern NSW, and are regularly recorded in the greater Sydney metropolitan area.

Given the large area of the site it is possible that individuals of the more mobile wide-ranging and habitat generalist species (such as the Grey-headed Flying Fox) could utilise it on an infrequent or seasonal basis. However, the disturbed nature, small size and lack of high quality habitat on and/or within the general vicinity of the land indicates that it is highly unlikely to be significant or important for any of these species.

Targeted searches for the Cumberland Plain Land Snail in May 2013 were unsuccessful in locating any individuals or shells on the subject land. The subject land does contain small pockets of vegetation which could provide habitat for the Cumberland Plain Land Snail. However, in most instances, these patches are disturbed, and remain isolated from any intact remnant bushland.

Threatened Species

Only two threatened fauna species have been recorded on the RTRF site, the Common Bent-wing Bat and the Little Bent-wing Bat. It is possible that a number of other (generally widespread and highly mobile species) would occur on the site on occasions. The nature and condition of the habitats and features present does not indicate that significant numbers of other threatened species are likely to be present, even on occasions.

13.5 Potential Impacts

The vegetation present on the RTRF site is not considered to represent a constraint to development of the site as currently proposed due to the following:

- The vegetation is already highly modified and degraded, and consists predominantly of regrowth open woodland vegetation with a variably (generally highly) disturbed and weed-infested understorey.
- The whole of the RTRF site (excluding First Ponds Creek to the west of its western boundary) has been 'bio-certified' under the TSC Act pursuant to the Growth Centre SEPP. This land is identified as "certified" land, and the loss of all vegetation from the RTRF site has therefore been taken into account in the 'Biodiversity Certification' process for the North West Growth Centre.

Where there is native vegetation present on the site, it generally consists of modified and degraded regrowth variants of the CPW community. Notwithstanding that the CPW community is listed as a CEEC in the TSC Act, and as part of a CEEC in the EPBC Act, those degraded patches of CPW present on the site have been identified as appropriate for removal pursuant to the Growth Centre SEPP.

The vegetation present within the RTRF site is highly modified and predominantly highly degraded, as a result of previous and ongoing rural and agricultural activities. Most of the vegetation present is regrowth, and all of it has been substantially modified and degraded as a result of the long-term semi-rural and agricultural activities which have been

undertaken in this location. None of the regrowth CPW or other woodland on the Tallawong Road RTRF site is regarded as of such biodiversity conservation value as to warranty its retention or rehabilitation.

The potential impacts of the project on terrestrial, riparian and aquatic areas are extremely limited because of the degraded nature of most of the vegetation present.
The terrestrial habitats and vegetation, in particular, are extremely highly modified and degraded, and have been addressed within the Biodiversity Certification of the North West Growth Centre.

As discussed above, the riparian vegetation along First Ponds Creek (to the immediate west of the RTRF site) is modified and degraded. The proposed RTRF project would not require removal of any riparian vegetation along First Ponds Creek outside of the RTRF site, and the project will incorporate appropriate environmental management and impact amelioration measures to minimise or avoid impacts upon riparian vegetation along First Ponds Creek.

There is no critical habitat present on or adjoining the RTRF site, and the only aquatic habitat present is contained within the channel of First Ponds Creek and several farm dams on properties within the RTRF site. The farm dams, whilst providing the habitat for native biota (amphibians and wading birds), do not constitute significant habitat or resources for any such species. Further, given the clear intention for the residential development of the North West Growth Centre, the removal of such artificial aquatic habitat is of no consequence or significance.

13.6 Groundwater Dependent Ecosystems

It is unlikely that any of the ecosystems present on the RTRF site are groundwater dependent ecosystems. Whilst there are areas of low-lying vegetation in parts of the subject site, many of those are artificial. Any native vegetation associated with those lowlying areas would be a consequence of moderately long-term drainage into swales and depressions, and is dependent on incipient rainfall and overland flow, rather than groundwater recharge.

The riparian vegetation along First Ponds Creek, similarly, is more dependent upon incipient rainfall and localised overland flow than on any groundwater that may be present at this location.

13.7 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) has little application to the RTRF site because there are no notable watercourses, streams or rivers on the site. The only aquatic habitat present within the RTRF site itself is confined to farm dams, as the drainage swales which are modified and artificial in nature, and are ephemeral in their characteristics.

The only aquatic habitat of relevance in the immediate vicinity is First Ponds Creek, which is located to the immediate west of the RTRF site. The RTRF will not impose any impacts upon any element of any fish habitat or aquatic resources along First Ponds Creek.

The RTRF site will have no impact upon any watercourses of any relevance for the movement of any fish species. The RTRF project will impose no significant impediment to the movement of any fish along any watercourse.

13.8 Matters of National Environmental Significance

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires consideration of the potential for a "significant impact" of an activity on a Matter of National Environmental Significance (MNES). The proposed RTRF has no potential to affect any MNES other than:

- Some listed threatened species and ecological communities.
- Individuals of a few migratory species.

With respect to "migratory species protected under international agreements", the RTRF land is not regarded as of any potential significance or relevance, given:

- Its current disturbed and modified state.
- Its small size with respect to the home ranges of any such species.
- The lack of particular resources of even potential relevance for any migratory species.
- Its context and location.

The only migratory species known or likely to occur at this location are highly mobile common species, such as the Cattle Egret and Masked Lapwing. The RTRF site is not of particular or special value for any such species.

No threatened species listed in the EPBC Act have been recorded on the subject land and there are no resources or habitat features of any particular value or relevance for any of the threatened species listed in the EPBC Act.

The CPW vegetation is part of a critically endangered ecological community listed in the EPBC Act. Importantly, the EPBC Act listing also provides Threshold Criteria for CPW vegetation which requires that:

- The area of the patch of vegetation be larger than one hectare.
- At least 30% of the groundcover species be native plants typical of the CPW community.

Little of the vegetation present on the RTRF or on adjoining lands, would appear to constitute CPW as defined in the EPBC Act. Most of the scattered patches of vegetation do not have a groundcover that is 30% or more native, and the patches are small, degraded and scattered.

13.9 Mitigation Strategies

In addition to its poor condition, the vegetation on the RTRF site has been identified as appropriate for removal on the basis of the strategic assessment undertaken for the Growth Centre SEPP.

This environmental planning instrument identifies the RTRF site as 'bio-certified' land, and consequently the removal of vegetation within that land has been taken into account in determining the overall approach to biodiversity conservation within the North West Growth Centre. There is no requirement for the retention of any of the vegetation on the site, nor is there any further requirement for offsets for the vegetation which is to be removed for the RTRF.

None of the regrowth CPW or other woodland on the RTRF site is regarded as of such biodiversity conservation value as to warranty its retention or rehabilitation. Mitigation measures to minimise impacts on ecological values, would be applied as set out in **Table 44**.

Table 44 –Mitigation measures for hydrology and water quality during operations.

No.	Mitigation Measure
OpE2	Noxious and environmental weeds would be controlled within the site boundary

No.	Mitigation Measure
OpE6 and E15	To reduce disturbance to bats and nocturnal birds where reasonable and feasible, a range of measures would be undertaken, such as: - Artificial lighting would be directed to where it is needed and in a downwards orientation to avoid light spillage, Artificial light would be positioned to face away from areas of native vegetation. - Low-pressure sodium lamps would be used instead of high-pressure sodium or mercury lights. Where mercury lights are used, UV filters would be fitted. - The brightness of lights would be reduced to as low as legally possible, and in conformance with workplace health and safety standards. - Amplified speakers would be directed downwards and away from areas of native vegetation
E1	The ecological component of the site induction would include information on: - Sensitivity of surrounding vegetation (particularly threatened vegetation). - Sensitivity of threatened fauna species (birds and bats). - Site environmental procedures (vegetation management, sediment and erosion control, protective fencing, weed control). - Emergency and incident response/ spill management (chemical spills, fire, injured fauna).
E2	Pre-clearing surveys would be undertaken to identify the presence of: - Hollow bearing trees and other habitat features - Threatened flora and fauna.
E6	Trees containing hollows would be felled using "Slow drop" technique (or similar as agreed with OEH). The slow-drop technique involves nudging and shaking the tree, followed by a controlled lowering of the tree to the ground.
E7	Where feasible and reasonable, topsoil and habitat elements (eg logs and felled trees) from sites that have few weed species would be stored and reused onsite.
E10	Construction sites would be revegetated using endemic native plant species where appropriate.
E12	To prevent establishment or spread of weeds: - Machinery would be cleaned before entering work sites - Weeds would be removed from within the mapped native vegetation areas at least 10m from the edge of the construction footprint (where access allows). - Cleared weed material would be disposed of at a site licensed to receive green waste.
E22	Where native vegetation is to be retained adjacent to or within construction sites, protective fencing and signage would be maintained in accordance with Australian Standard 4970 – 2009 Protection of Trees.

Note: Identifying codes for mitigation measures are taken, where possible, from EIS 1 and EIS 2 for NWRL to maximise consistency. As such, the codes are not always sequential for this EIS.

13.10 Conclusions

There are no threatened or migratory species which are likely to be adversely affected. There is no potential for a significant impact upon any such biota as a consequence of the proposed RTRF.

The removal of the degraded and modified vegetation from the site is not considered to constitute a significant impact upon the CPW community given the nature of the vegetation present and the extent of that vegetation type in this general locality.

In accordance with the Biodiversity Certification of the Growth Centres SEPP the removal of vegetation within that land has already been taken into account in planning for the North West Growth Centre, and there is no requirement for the retention of any of the vegetation on the site, or any further requirement for offsets for the vegetation which is to be removed.

14.0 European Heritage

14.1 Introduction

A non-Indigenous Heritage assessment and Statement of Heritage Impacts has been prepared by Artefact Heritage (refer to **Appendix I**).

The objectives this assessment were to assess the impacts of the RTRF proposal on items of heritage significance, outline opportunities and constraints on the proposed development regarding non-Indigenous heritage, and recommend if further action is required to fulfil statutory heritage obligations.

14.2 Director General's Requirements

Table 45 below sets out the Director-General's Requirements as they related to European Heritage, and where in the project these have been addressed.

Table 45 – Relevant Director General's Requirements

Director General's Requirements	Where Addressed in EIS	Technical Study
impacts to historic heritage (including archaeology, heritage items conservation areas and natural areas). Where impacts to State or locally significant historic heritage items are identified, the assessment shall:		**Appendix I**
- outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures);	Section 14.6	
- include a statement of heritage impact for heritage items (including significance assessment);	Section 14.5.1	
- demonstrate that an appropriate archaeological assessment methodology, including research design, (where relevant) has been undertaken, including results; and	Section 14.3	
- take into account the guidelines in the NSW Heritage Manual(1996) and be undertaken by a suitably qualified heritage consultant.	Section 14.3	

14.3 Assessment Methodology

The methodology for the Non-Indigenous assessment and Statement of Heritage Impacts comprised:

- Review of Heritage reports prepared for the NWRL EIS 1 and EIS 2.
- Review of Statutory Heritage Registers including World Heritage List, National Heritage List, State Heritage Register, Section 170 Registers, Blacktown LEP 1988 and Draft LEP 2013, The Hills LEP 2012, Sydney SEPP (Sydney Region Growth Centres) 2006, Alex Avenue and Riverstone Precinct Plan 2010, and Sydney Regional Environmental Plan No 19.
- Review of Non Statutory Heritage Registers including the Register of National Estate and Register of the National Trust.
- Consideration of the guidelines in the *NSW Heritage Manual (1996)*.
- Site inspection to ground truth desktop assessment and to identify and inspect any visible heritage items. The field investigations were undertaken 6 May 2013. Due to ongoing land acquisition processes, access to the six most northern properties was not available.

14.4 Existing Environment

The non-Indigenous heritage assessment and Statement of Heritage Impacts provides an historical context for the RTRF site, including a brief history of settlement and land use. Assessment of the historical context has included consideration of heritage values beyond the immediate RTRF project footprint. A discussion of local and site heritage values is included within this section.

14.4.1 European Exploration and Government Farms

In 1801, a government farm was established at Castle Hill and in March 1804, convicts at this farm staged an unsuccessful uprising. The main confrontation in this uprising occurred at a site that was afterwards referred to as Vinegar Hill. The Battle of Vinegar Hill memorial has been erected within the Castlebrook Lawn Cemetery 1.6 km to the south-east of the study area to mark the generally accepted location of the battle.

14.4.2 Early Land Grants

A few land grants were made in the vicinity of the study area during the late 1790s, but significant grants in the area were not made until Governor Macquarie's arrival in the colony. In 1813, Richard Rouse was granted 450 acres which he named Rouse Hill.

The western part of the RTRF site was originally a 200 acre grant made to Joseph Bigg by Governor Macquarie. The eastern portion of the RTRF site (east of Oak Street) was originally part of a 600 acre grant made to John Faultless in 1818, which extended to Windsor Road. In 1823, Faultless sold his grant to Richard Rouse.

14.4.3 Twentieth Century Subdivision

A review of an aerial photograph of the RTRF site dating to 1947 (see **Figure 35**) shows that it was partially vegetated (consistent with use for grazing), and no structures were present at this time. A map of the area dating to 1951 also shows no structures within the RTRF site, and by this time the land was largely vegetated.

The Rouse Hill property remained largely intact until 1952. By 1961, most of the property had been sold to Blacktown City Council for subdivision, with the exception of the house and 100 acres of surrounding paddocks. It is expected that the RTRF land would have been sold off during this period. During this period, both Cudgegong and Tallawong Roads were laid out.

Aerial photographs from the 1970's show a large number of small rural allotments within the RTRF site and the surrounding area. Many of these sites appear to have been developed with market gardens or small poultry farms. By this time, the allotments existed on their present-day pattern, and many of the houses within the study area were constructed during the 1970s. An aerial photograph from 1978 is provided in **Figure 36**.

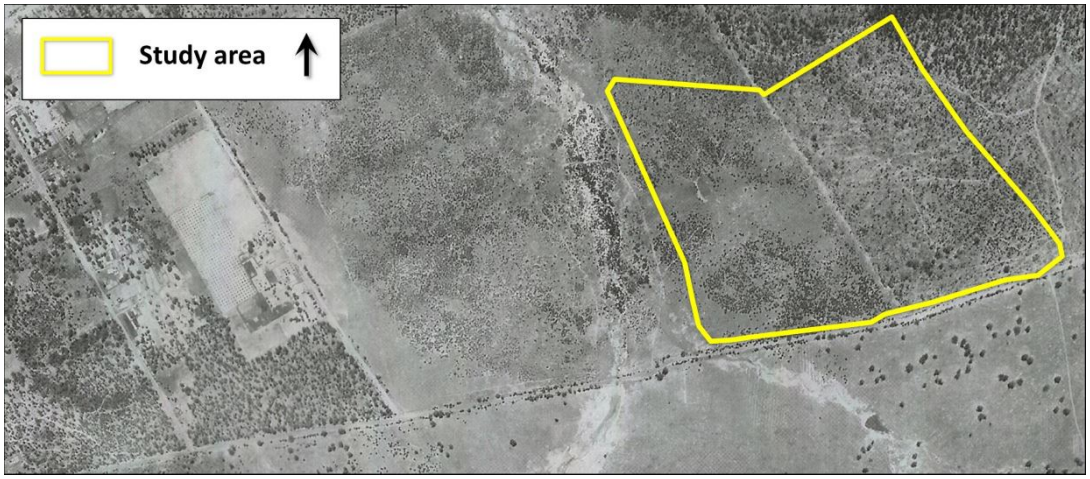

Figure 35 – 1947 aerial photograph of the study area

Source: LPI – Department of Finance and Services

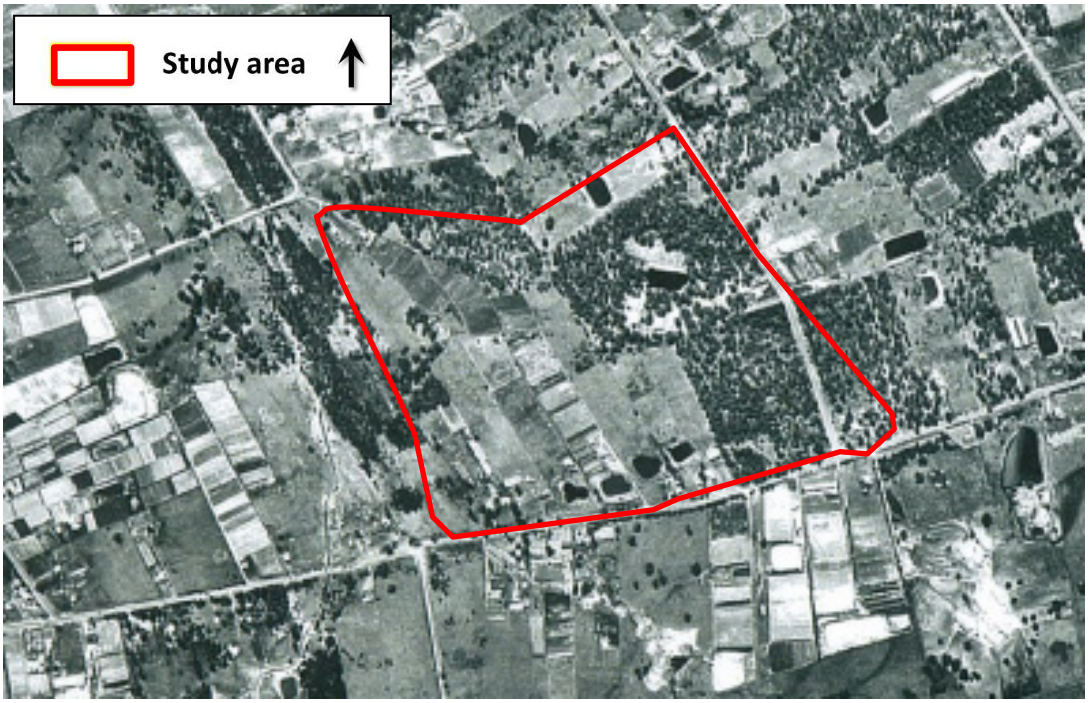

Figure 36 – 1978 aerial photograph of the study area

Source: LPI – Department of Finance and Services

14.5 Potential Impacts

14.5.1 Heritage Items

Non-Indigenous Heritage listed items within a two kilometre radius of the RTRF site that were assessed as having potential to be impacted by the construction and operation of the RTRF, are listed in **Table 46** and identified in **Figure 37**.

The closest listed heritage item to the RTRF site is 1.2 kilometres away, therefore the potential impacts from construction activities on these items are not considered to be dissimilar to the operational activities.

The potential for impacts on these items as assessed in the Non-Indigenous assessment and Statement of Heritage Impacts are presented in **Table 47**.

Table 46 – Potentially Impacted Non-Indigenous Heritage Items

Item Ref #	Item	Address	Distance from RTRF	Listing
1	Rouse Hill House & Farm	Windsor Road Rouse Hill	1.5km	State Heritage Register, Register of the National Trust, Register of the National Estate
2	Royal Oak Inn	2 Commercial Road Rouse Hill	1.8km	State Heritage Register, Register of the National Trust
3	Merriville House & Garden	1 Eire Way (AKA Glenheath Ave, Cavenah Way), Kellyville Ridge	1.3km	State Heritage Register, Register of the National Trust
4	Battle of Vinegar Hill Memorial	712-746 Windsor Road, Kellyville Ridge	1.6km	Blacktown LEP
5	Slab Building - Riverstone High School	Regent Street (71 McCulloch Street) Riverstone	1.7km	Blacktown LEP, Alex Ave & Riverstone Precinct Plan 2010
6	House	122 Regent Street, Riverstone	2km	Blacktown LEP
7	Warrawong	158 Riverstone Road, Riverstone	1.8km	Alex Ave & Riverstone Precinct Plan 2010
8	Schofields Public School	St Albans Road, Schofields	1.6km	Alex Ave & Riverstone Precinct Plan 2010
9	House	128 Westminster Street, Schofields	1.2km	Alex Ave & Riverstone Precinct Plan 2010
10	Windsor Road	Windsor Road from Baulkham Hills to Box Hill	1.9km	The Hills LEP
11	Christchurch	Windsor Road, Rouse Hill	1.8km	The Hills LEP, Sydney Regional Environmental Plan No 19
12	Queen Arms Inn Archaeological Site	1 Resolution Place, Rouse Hill	1.8km	The Hills LEP