3 Description of the proposal

This chapter describes the proposal and provides descriptions of the design parameters and major design features, the construction method and associated infrastructure and activities. The proposal is described from south to north.

3.1 The proposal

The proposal involves the upgrade of about 15 kilometres of The Northern Road between The Old Northern Road, Narellan and Mersey Road, Bringelly. Figure 1-1 shows the location of the proposal, with the figures in Appendix A showing the proposal in more detail.

The main features of the proposal include:

- An upgrade of the existing two-lane road to a four-lane road (two lanes each way) divided by a wide central median. The wide median would cater for a future six-lane configuration on The Northern Road. The median width is up to 16.5 metres at intersections and 15.9 metres between intersections.
- Posted speed limit of 80 km/h.
- Provision of a three metre wide off-road shared pedestrian/cyclist path on the eastern side of the proposal, with space provided on the western side of the proposal for the future construction of a path if required.
- A typical lane width of 3.5 metres (3.3 metre lanes for turning lanes) with two metre outside shoulders and 0.5 metre inside shoulders.
- Bicycle and pedestrian crossing provisions at traffic lights.
- A bus priority lane on the approach and indented bus bay on the departure side of the signalised intersections on The Northern Road.
- Upgrade and/or tie in with 20 local roads including realignment of six local roads:
  - Upgrade and/or tie in with local roads:
    - Porrende Street 90 metres south-west.
    - Fairwater Drive 185 metres north-east.
    - Hillside Drive 110 metres east.
    - Cobbitty Road (west) 350 metres west.
    - Cobbitty Road (east) (Oran Park Drive) 75 metres east.
    - Carrington Road 160 metres east.
    - Robinson Road 75 metres east.
    - Loftus Road 60 metres west.
    - Bringelly Road 225 metres east.
    - Greendale Road 285 metres west.
    - Thames Road 50 metres south.
    - Lea Road 100 metres north-east.
    - Avon Road 85 metres west.
    - Solway Road 60 metres west.
  - Realignment of local roads to align with upgraded existing intersections:
    - Belmore Road 335 metres south-west.
    - Badgerys Creek Road 270 metres north-east.
    - Dart Road 230 metres south-west.
    - Derwent Road 615 metres north-east.
    - Mersey Road 285 metres north-east.
    - Severn Road off Mersey Road 155 metres south-east.
• Upgrade of eight existing unsignalised intersections to seven four-way signalised intersections and a signalised T-intersection:
  – Fairwater Drive/Porrende Street (four-way intersection).
  – Hillside Drive (four-way intersection).
  – Cobbitty Road (west) (T-intersection).
  – Belmore Road (four-way intersection).
  – Bringelly Road/Greendale Road (four-way intersection).
  – Badgerys Creek Road/Dart Road (four-way intersection).
  – Derwent Road (four-way intersection).
  – Mersey Road (four-way intersection).
• A new unsignalised T-intersection at Oran Park Link Road 3.
• Five new signalised intersections with link roads to provide for future connectivity:
  – Oran Park Link Road 2 (four-way intersection).
  – Maryland Link Road 1 (four-way intersection).
  – Maryland Link Road 2 (four-way intersection).
  – Maryland Link Road 3 (four-way intersection).
  – Lowes Creek Link Road (four-way intersection).
• Adjustment to nine unsignalised T-intersections including Cobbitty Road (east) (Oran Park Drive), Carrington Road, Robinson Road, Loftus Road, Thames Road, Solway Road, Lea Road, Avon Road and Severn Road.
• Designated turning lanes at signalised intersections.
• U-turn facilities at Lowes Creek Link Road, Belmore Road, Greendale Road and Derwent Road.
• Tie in with The Northern Road at the start and end of the proposal and the Oran Park Link Road 1 (Peter Brock Drive).
• Retention of the existing bridge over Narellan Creek for the southbound carriageway and provision of a new three span bridge over Narellan Creek for the northbound carriageway.
• Retention of the existing bridge over Thompsons Creek for the southbound carriageway and provision of a new single span bridge over Thompsons Creek for the northbound carriageway.
• Realignment and upgrade of the culverts in Lowes Creek including eight of 2400 millimetres x 2100 millimetres box culverts at the main channel and twenty five of 1800 millimetres x 900 millimetres box culverts over the floodplain.
• Upgrade of cross drainage to meet flood immunity for a 1 in 100 year average recurrence interval (ARI) flood event.
• Scour protection works at Narellan Creek and Thompson Creek bridges and the Lowes Creek culvert.
• Provision of street lighting for the proposal.
• Seven permanent spill basins.
• Batters required for cut and fill areas.
• A major fill location (fill areas greater than five metres deep) near Narellan Creek between chainage 600 and 1250.
• Seven major cut locations (cutting areas greater than five metres to 10 metres deep) near Hillside Drive, Cobbitty Road, North of Oran Park Link Road 1, North of Oran Park Link Road 3, south of Marylands Link Road 2, Dart Road and Avon Road.

The proposal has focused on using the existing road corridor and minimising impacts on residences and commercial premises. The proposal would be undertaken in stages by RMS and others (developers) as the development along The Northern...
Road is released and precincts within the South West Growth Centre are made available (refer to section 3.3.1). The proposal does not include the upgrade of the Oran Park Link Road 1 (Peter Brock Drive) intersection, which is about 450 metres in length. A separate REF (DPS 2012) was undertaken for this intersection (chainage 3350 to chainage 3800) which was determined by RMS in May 2012.

3.2 Design

The following provides a description of the design criteria, and features for the main alignment, intersections and waterways. The description is based on the concept design and would be subject to refinement during the detailed design. A typical cross section for a four-lane divided carriageway is provided in figure 3-1 below.

3.2.1 Design criteria

The following outlines the design criteria that apply to the proposal:

- A signposted speed limit of 80 km/h on The Northern Road, with a 90 km/h through design speed.
- A wide median to cater for a future six lanes configuration on The Northern Road.
- Two 3.5 metre through lanes at all proposed intersection upgrades, northbound and southbound.
- Turning lanes 3.3 metres wide.
- Two metre wide shoulders.
- Intersection controls and facilities for buses, pedestrians and cyclists along The Northern Road including a bus priority lane on the approach and indented bus bay on the departure side of the signalised intersections.
- Capacity for B-double vehicles to turn into and out of The Northern Road at all intersections, including U- turn facilities.
- Provision of a three metre wide off-road shared pedestrian/cyclist path on the eastern side of the proposal, with space provided on the western side of the proposal for the future construction of an off-road shared path if required.
- Local road design criteria of:
  - 60km/h posted speed.
  - 70 km/h design speed.
  - Lanes 3.5 metres wide.
  - Turning lanes 3.3 metres wide.
- A 1 in 100 flood immunity for all roads, bridges and retaining walls.
- Bridge geometric, structural design and traffic load requirements as per Australian Standards AS5100.1-2004, Bridge design.
- Bridges with a 100 year design life.
- Traffic barrier height of 1300 millimetres on bridges.
- Bridge underside to have a minimum 300 millimetres freeboard above the 100 year ARI flood level.
- Provision for landscaping in the median, verges and traffic islands.
- Barriers on the outer edges of the bridge duplications and as required along the road for safety purposes.
- The general maximum embankment batter slope not more than 2:1 but preferably 4:1, unless appropriate batter foundation treatment has been proposed.
- Low fill embankments to be flattened wherever possible.
Figure 3-1 Proposed typical cross section
• Design surcharge load of 20 kPa for retaining walls retaining the roadway and 10 kPa for retaining walls retaining the road embankments not subject to traffic loading.
• Retaining walls to be clear of existing underground utilities.

3.2.2 Major design features

Major design features for the main alignment, waterway crossings and intersections are outlined below. Refer to Appendix A for the location of the proposal relative to the existing road alignment, waterways and intersections.

For the purposes of describing the major design features the proposal has been separated into five sections as follows:

• Section 1 – From the start of the proposal (just north of The Old Northern Road) (chainage 0) to the start of the Oran Park Link Road 1 intersection upgrade (chainage 3350).
• Section 2 – From the end of the Oran Park Link Road 1 intersection upgrade (chainage 3800) to Marylands Link Road 1 (chainage 6100).
• Section 3 – From the northern side of Marylands Link Road 1 (chainage 6100) to Lowes Creek Link Road intersection (chainage 9300).
• Section 4 – From the northern side of Lowes Creek Link Road intersection (chainage 9300) to the Bringelly Road / Greendale Road Intersection (chainage 11600).
• Section 5 – From the northern side of Bringelly Road / Greendale Road Intersection (chainage 11600) to the end of the proposal at Dwyer Road (chainage 15100).

Figure 3-2 below shows the location of each section within the proposal.

Section 1 – Road design chainage 0 to 3350

Main alignment

The proposal ties in to the existing two-lane carriageway on The Northern Road and generally follows the existing road alignment. From the start of the proposal the road consists of a four-lane road (two lanes each way) divided by a wide central median. A three metre wide off-road shared pedestrian/cyclist path has been provided on the eastern side of the proposal. A 4.7 metre allocation has been provided on the western side of the proposal for the future construction of an off-road shared pedestrian/cyclist path if required.

The proposal would widen the western side of the existing alignment from Fairwater Driver / Porrende Street (chainage 600) prior to Cobbitty Road (west) (chainage 2300) and the eastern side of the existing road alignment from Cobbitty Road (west) (chainage 2300) to the Oran Park development (Peter Brock Drive) (chainage 3350).

The major fill location (fill areas greater than five metres deep) would be at Narellan Creek between chainage 600 and 1250. Major cuttings (cutting areas greater than five metres deep) would be located at:

• North of Hillside Drive from chainage 1500 to 2200 (up to seven metres in height).
• Cobbitty Road from chainage 2700 to 2900 (up to five metres in height).
Figure 3.2 Proposal sections

- Section line
- LGA boundary
- South West Growth Centre boundary
The concept design incorporates 4:1 fill batters up to one metre high, 3:1 fill batters from one to three metres high and 2:1 fill batters from three to a maximum height of 10 metres with benching required above a height of 10 metres. No fill areas are currently higher than 10 metres.

The concept design incorporates 3:1 cut batters up to two metres deep, 2:1 cut batters from two to seven metres deep with 4.5 metre benching, with 10:1 slopes required in cuts greater than seven metres. This benching pattern repeats every seven metres until the design interface with the existing surface.

The cross drainage would provide 100 year ARI flood immunity (that is a flood that, on average, would occur once in 100 years) for the proposed roadway and would minimise afflux at adjacent properties. All existing cross drainage structures would be removed and replaced in accordance with the findings of the hydrology assessment. No creek channels would be diverted. Refer to section 6.7 for the hydrology assessment findings. Table 3-1 shows the proposed cross drainage for this section.

### Table 3-1 Section 1 proposed cross drainage

<table>
<thead>
<tr>
<th>Location</th>
<th>Chainage</th>
<th>Type and size (mm)</th>
<th>Length of outlet scour protection (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Fairwater Drive and Hillside Drive</td>
<td>1170</td>
<td>2 x 3000 x 1500 RCBC</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1390</td>
<td>2 x 900 RCP</td>
<td>9</td>
</tr>
<tr>
<td>Between Hillside Drive and Cobbitty Road (west)</td>
<td>1760</td>
<td>Remove existing culvert</td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>2160</td>
<td>4 x 1050 RCP</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>2430</td>
<td>2400 x 900 RCP</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>2650</td>
<td>3 x 1800 x 1200 RCBC #</td>
<td>5</td>
</tr>
<tr>
<td>Between Cobbitty Road (west) and Cobbitty Road (east) (Oran Park Drive)</td>
<td>2970</td>
<td>2 x 600 RCP</td>
<td>3</td>
</tr>
<tr>
<td>Between Cobbitty Road (east) (Oran Park Drive) and Oran Park Link Road 1 (Peter Brock Drive)</td>
<td>3100</td>
<td>600 RCP</td>
<td>9</td>
</tr>
</tbody>
</table>

RCP – reinforced concrete pipe.  
RCBC – reinforced concrete box culvert.  
# bridge size culvert.

A plan view of the cross drainage design near Narellan Creek is provided in figure 3-3.

Scour protection measures to be applied at all cross drainage locations include:

- Rock rip rap at bridges to mitigate local scour at abutments.
- Energy dissipaters at culvert outlets where the discharging flow would be supercritical and receiving waters would be subcritical.
Figure 3-3 Proposed cross drainage at Narellan Creek
• Rock aprons at culvert outlets to transition velocities where dissipaters were not required.

Table 3-1 above provides the length of scour protection at the outlet of the cross drainage. The final location and sizing of cross drainage including scour protection measures would be refined during the detailed design.

Two permanent spill basins would be required to protect water quality at Narellan Creek (chainage 1100). This was identified from a risk assessment that was undertaken as part of the concept drainage design report (SKM 2012b). This assessment considered the risk of spills and the sensitivity of downstream waterways. Refer to section 6.6 for the assessment of potential water quality impacts. Figures 3-3 and 3-4 show the locations of the permanent spill basins relative to Narellan Creek.

Figure 3-4 Proposed permanent spill basin near Narellan Creek

The spill basins were designed to contain spills in dry weather or during small storm events such as the 1 in 1 year ARI. The spill basins have an approximate volume of 60 cubic metres and were designed to capture liquid spills of a maximum 20,000
litres (average tanker size) less dense than water via an under flow baffle arrangement. Following containment, the pollutant would be pumped out and the spill disposed of in an appropriate manner. High fencing would be required around all spill basins for public safety. The final number and locations of permanent spill basins within this section of the proposal would be confirmed during detailed design.

**Fairwater Drive/Porrende Street intersection**

The proposed intersection configuration has been provided in figure 3-5. The footprint of the Fairwater Drive intersection has been minimised as far as practical to minimise property acquisition requirements.

A 220 metre single dedicated right turn bays would be provided from The Northern Road into Fairwater Drive and Porrende Street. A 165 metre left turn slip lane from The Northern Road into Porrende Street and a 140 metre left turn slip lane from The Northern Road into Fairwater Drive would be provided. Traffic islands have been provided at the south-western and north-eastern corners of the intersection.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across Fairwater Drive/Porrende Street intersection on both sides of The Northern Road. These would be located across the north-east slip lane from The Northern Road into Fairwater Drive and the south-west slip lane from The Northern Road into Porrende Street. Porrende Street would be upgraded for a distance of about 90 metres from The Northern Road to the Bunnings Warehouse roundabout. Fairwater Drive would be upgraded for a distance of 185 metres from The Northern Road. The Northern Road upgrade extends for 485 metres south of the intersection where it would tie-in into the existing road.

![Figure 3-5 Proposed Fairwater Drive/Porrende Street intersection](image)
**Narellan Creek bridge**

Narellan Creek Bridge would be duplicated as part of The Northern Road upgrade. The main functional requirement of the new bridge at Narellan Creek was for a 100 year ARI flood. The bridge would consist of a 42 metre long three span bridge constructed on the western side of the existing bridge to cater for northbound traffic on completion of works. The bridge would include two 3.5 metre wide lanes. The deck would be constructed using 1000 millimetre deep precast prestressed concrete beams with a compositely acting 180 millimetre minimum thickness reinforced concrete slab. The road surface level would be raised by about 400 millimetres in order to provide a minimum freeboard of 300 millimetres above the 100 year ARI flood level. Scour protection in the form of rip-rap would also be included on the approach embankments of the creek and at the toe of the embankment where the abutments would be located. This would include scour protection being placed 11 metres upstream of the twin bridge embankments, extending under the twin bridges and finishing 11 metres downstream of the twin bridge embankments. The scour protection has been proposed to avoid the abutments being undermined during a 100 year ARI flood event.

The existing bridge would be retained and cater for southbound traffic. An upgrade of the existing bridge would include removal of the existing concrete barriers and installation of off-structure concrete barriers. These barriers would be a 650 millimetres high, concrete, with twin rails and an overall height of 1300 millimetres. Safety barriers and wire rope transitions would be provided for the off-structure concrete barriers. The upgrade of the bridge would also include widening of the bridge to accommodate a new shared cyclist/pedestrian path.

Fish friendly provisions would be included for Narellan Creek. The waterway crossing design has considered relevant standards and guidelines including *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*, NSW Fisheries (Fairfull. and Witheridge 2003).

The preferred arrangement for the Narellan Creek Bridge has been shown in figure 3-4 above and figure 3-6 below.

**Hillside Drive intersection**

The proposed intersection configuration has been provided in figure 3-7 below. The footprint of the Hillside Drive intersection has been minimised as far as practical to minimise impacts to Orielton (which is a State Heritage Register item) and adjacent residential homes.

A 220 metre single dedicated right turn bays would be provided on The Northern Road for eastbound and westbound movements into Hillside Drive. A 145 metre left turn slip lane from The Northern Road west into Hillside Drive, a 175 metre dedicated left turn bay from The Northern Road east into Hillside Drive and a 120 metre left turn slip lane from Hillside Drive north into The Northern Road would be provided. Traffic islands would be provided at the north-west south-west and north-east corners of the intersection.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided northbound and southbound.
Figure 3-6 Narellan Creek Bridge elevation (top) and Narellan Creek Bridge section (bottom)
Signalised pedestrian crossings would be provided across both sides of The Northern Road and Hillside Drive. The pedestrian crossings across the two left turn slip lanes would be signalised. Hillside Drive east of The Northern Road would be upgraded for a distance of 110 metres. Hillside Drive west of The Northern Road would be a new alignment, 180 metres in length.

**Cobbitty Road (west) intersection**

The proposed intersection configuration has been provided in figure 3-8. The Cobbitty Road (west) alignment has been designed to avoid impacts on the church, located to the north-west of the intersection.

A 100 metre twin dedicated right turn bay would be provided from The Northern Road into Cobbitty Road (west). A 120 metre left turn slip lane from The Northern Road onto Cobbitty Road (west) and a 120 metre left turn slip lane from Cobbitty Road (west) onto The Northern Road would be provided. Traffic islands would be provided at the north-western and south-western corners of the intersection.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided on the northbound carriageway. A bus stop would be provided southbound on the southern side of the intersection.

Signalised pedestrian crossings would be provided across both sides of The Northern Road and across both sides of Cobbitty Road (west). The pedestrian crossings across the two slip lanes would be signalised. Cobbitty Road (west) would be upgraded for a distance of 350 metres from The Northern Road.
Cobbitty Road (east) (Oran Park Drive) intersection

The proposed intersection configuration has been provided in figure 3-9. Access to Cobbitty Road (east) would be from the southbound carriageway only and no turning bays would be provided into or out of the intersection. The pedestrian crossing provided across Cobbitty Road (east) (Oran Park Drive) would not be signalised. Cobbitty Road (east) (Oran Park Drive) would be upgraded for a distance of 75 metres from The Northern Road.
Section 2 – Road design chainage 3800 to 6100

Main alignment

This section consists of a four-lane road (two lanes each way) divided by a wide central median. The proposal generally follows the existing road alignment. A three metre wide off-road shared pedestrian/cyclist path has been provided on the eastern side of the proposal. A 4.7 metre allocation has been provided on the western side of the proposal for the future construction of an off-road shared pedestrian/cyclist path if required.

The proposal would require widening of the western side of the existing road alignment from the Oran Park development (Peter Brock Drive) (chainage 3800) to Marylands Link Road 1 intersection (chainage 6100).

There are no major fill locations within this section of the proposal. Major cuttings (cutting areas greater than five metres deep) would be located at:

- North of Oran Park Link Road 1 from chainage 3900 to 4200 (up to 10 metres in height).
- North of Oran Park Link Road 3 from chainage 5500 to 5700 (up to 7.5 metres in height).

The concept design incorporates 4:1 fill batters up to one metre high, 3:1 fill batters from one to three metres high and 2:1 fill batters from three to a maximum height of 10 metres with benching required above a height of 10 metre. No fill areas are currently higher than 10 metres.
The concept design incorporates 3:1 cut batters up to two metres deep, 2:1 cut batters from two to seven metres deep with 4.5 metre benching, with 10:1 slopes required in cuts greater than seven metres. This benching pattern repeats every seven metres until the design interface with the existing surface.

The cross drainage would provide 100 year ARI flood immunity (that is a flood that, on average, would occur once in 100 years) for the proposed roadway and would minimise afflux to adjacent properties. All existing cross drainage structures would be removed and replaced in accordance with the findings of the hydrology assessment. No creek channels would be diverted. Refer to section 6.7 for the hydrology assessment findings. Table 3-2 shows the proposed cross drainage for this section.

**Table 3-2 Section 2 proposed cross drainage**

<table>
<thead>
<tr>
<th>Location</th>
<th>Chainage</th>
<th>Type and size (mm)</th>
<th>Length of outlet scour protection (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oran Park Link Road 1 (Peter Brock Drive) to Oran Park Link Road 2</td>
<td>4520</td>
<td>3 x 2100 x 900 RCBC #</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>4650</td>
<td>3 x 1800 x 900 RCBC #</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>4870</td>
<td>3 x 2100 x 750 RCBC #</td>
<td>3</td>
</tr>
<tr>
<td>Oran Park Link Road 2</td>
<td>4950</td>
<td>3 x 1500 x 750 RCBC</td>
<td>13</td>
</tr>
<tr>
<td>Between Oran Park Link Road 2 and Oran Park Link Road 3</td>
<td>5200</td>
<td>450 RCP</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5350</td>
<td>3 x 1050 RCP</td>
<td>7</td>
</tr>
<tr>
<td>Between Oran Park Link Road 3 and Marylands Link Road 1</td>
<td>5600</td>
<td>600 RCP</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5820</td>
<td>Remove existing cross culvert</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>6070</td>
<td>600 RCP</td>
<td>3</td>
</tr>
<tr>
<td>Marylands Link Road 1</td>
<td>6100</td>
<td>4 x 1200 RCP</td>
<td>12</td>
</tr>
</tbody>
</table>

RCP – reinforced concrete pipe.  
RCBC – reinforced concrete box culvert.  
# bridge sized culverts.

A plan view of the cross drainage design near Oran Park Link Road 3 is provided in figure 3-10.

Scour protection measures to be applied at all cross drainage locations include:

- Rock rip rap at bridges to mitigate local scour at abutments.
- Energy dissipaters at culvert outlets where the discharging flow would be supercritical and receiving waters would be subcritical.
- Rock aprons at culvert outlets to transition velocities where dissipaters were not required.

Table 3-2 above provides the length of scour protection at the outlet of the cross drainage. The final location and sizing of cross drainage including scour protection measures would be refined during development of the detailed design.
Figure 3-10 Proposed cross drainage near Oran Park Link Road 3
No permanent spill basins would be required to protect water quality at the tributary of South Creek (chainage 4650) based on the assessment of the low risk of spills and the sensitivity of downstream waterway. This was identified from a risk assessment that was undertaken as part of the concept drainage design report (SKM 2012b). Refer to section 6.6 for the assessment of potential water quality impacts.

**Oran Park Link Road 1 (Peter Brock Drive) intersection**

This intersection is not part of the proposal.

**Oran Park Link Road 2 intersection**

The proposed intersection configuration has been provided in figure 3-11. A 150 metre single dedicated right turn bay from The Northern Road east into Oran Park Link Road 2 and a 200 metre twin dedicated right turn lanes west into Oran Park Link Road 2 would be provided. There would be four left turn slip lanes including a 210 metre slip lane from The Northern Road west onto Oran Park Link Road 2, a 165 metre slip lane from The Northern Road east onto Oran Park Link Road 2, a 300 metre slip lane from Oran Park Link Road 2 north onto The Northern Road and a 100 metre slip lane from Oran Park Link Road 2 south onto The Northern Road. Traffic islands would be provided at all four corners of the intersection.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across both sides of The Northern Road, across both sides of Oran Park Link Road 2 and at the north-east and south-east slip lane pedestrian crossings. The north-west and south-west slip lane pedestrian crossings would also be signalised. Oran Park Link Road 2 to the south-east and north-west of The Northern Road would be new alignments, 230 metres and 330 metres in length respectively.

![Figure 3-11 Proposed Oran Park Link Road 2 intersection](image-url)
**Oran Park Link Road 3 intersection**

The proposed intersection configuration has been provided in figure 3-12. Access to Oran Park Link Road 3 would be from the southbound carriageway only. A 125 metre dedicated left turn bay would be provided from The Northern Road into Oran Park Link Road 3. The pedestrian crossing provided across Oran Park Link Road 3 would not be signalised. Oran Park Link Road 3 would be a new alignment, 35 metres in length.

![Figure 3-12 Proposed Oran Park Link Road 3 intersection](image)

**Marylands Link Road 1 intersection**

The proposed intersection configuration has been provided in figure 3-13. There would be two 160 metre single dedicated right turn bays from The Northern Road east and west into Marylands Link Road 1. There would be four left turn slip lanes including a 160 metre slip lane from The Northern Road west into Marylands Link Road 1, a 180 metre slip lane from The Northern Road east into Marylands Link Road 1, a 200 metre slip lane from Marylands Link Road 1 north into The Northern Road and a 120 metre slip lane from Marylands Link Road 1 south into The Northern Road. Traffic islands would be provided at all four corners of the intersection.

A bus priority lane at the approach of the signalised crossing and bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across both sides of The Northern Road, across both sides of Maryland Link Road 1 and at the north-east and south-east slip lane pedestrian crossings. The north-west and south-west slip lane pedestrian crossings would also be signalised. Marylands Link Road 1 to the east and west of The Northern Road are new alignments, 230 metres and 210 metres in length, respectively.
Section 3 – Road design chainage 6100 to 9300

Main alignment

This section consists of a four-lane road (two lanes each way) divided by a wide central median. The proposal generally follows the existing road alignment. A three metre wide off-road shared pedestrian/cyclist path has been provided on the eastern side of the proposal. A 4.7 metre allocation has been provided on the western side of the proposal for the future construction of an off-road shared pedestrian/cyclist path if required. There would also be a U-turn facility provided at the Lowes Creek link road (chainage 9250).

The proposal would require widening of the western side of the existing road alignment from the Marylands Link Road 1 intersection (chainage 6100) to Marylands Link Road 2 intersection (chainage 7200) and Near Lowes Creek Link Road intersection (chainage 8700) to the Lowes Creek Link Road intersection (chainage 9300).
The proposal would require widening of the eastern side of the existing road alignment from the Marylands Link Road 3 intersection (chainage 8100) just prior to Lowes Creek Link Road intersection (chainage 8700).

There would be no major fill locations within this section. There would be a major cut (a cut area greater than five metres deep) south of Marylands Link Road 2 from chainage 6700 to 6900 (up to five metres in height).

The concept design incorporates 4:1 fill batters up to one metre high, 3:1 fill batters from one to three metres high and 2:1 fill batters from three to a maximum height of 10 metres with benching required above a height of 10 metre. No fill areas are currently higher than 10 metre.

The concept design incorporates 3:1 cut batters up to two metres deep, 2:1 cut batters from two to seven metres deep with 4.5 metre benching, with 10:1 slopes required in cuts greater than seven metres. This benching pattern repeats every seven metres until the design interface with the existing surface.

The cross drainage would provide 100 year ARI flood immunity (that is a flood that, on average, would occur once in 100 years) for the proposed roadway and would minimise afflux to adjacent properties. All existing cross drainage structures would be removed and replaced in accordance with the findings of the hydrology assessment. No creek channels would be diverted. Refer to section 6.7 for the hydrology assessment findings. Table 3-3 shows the proposed cross drainage for this section.

**Table 3-3 Section 3 proposed cross drainage**

<table>
<thead>
<tr>
<th>Location</th>
<th>Chainage</th>
<th>Type and size (mm)</th>
<th>Length of outlet scour protection (m)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>6400</td>
<td>5 x 1200 RCP</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>6650</td>
<td>2 x 450 RCP</td>
<td>3</td>
</tr>
<tr>
<td>Marylands Link Road 2</td>
<td>7250</td>
<td>4 x 2400 x 1500</td>
<td>6</td>
</tr>
<tr>
<td>RCBC #</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Marylands Link Road 2 and Marylands Link Road 3</td>
<td>7440</td>
<td>Remove existing cross culvert</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>7750</td>
<td>2 x 750 RCP</td>
<td>3</td>
</tr>
<tr>
<td>Between Marylands Link Road 3 and Lowes Creek Link Road</td>
<td>8900</td>
<td>8 x 2400 x 2100</td>
<td>9</td>
</tr>
<tr>
<td>RCBC #</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9000</td>
<td>25 x 1800 x 900</td>
<td>4</td>
</tr>
<tr>
<td>RCBC #</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9300</td>
<td>5 x 750 RCP</td>
<td>3</td>
</tr>
</tbody>
</table>

RCP – reinforced concrete pipe.
RCBC – reinforced concrete box culvert.
# bridge sized culverts.

A plan view of the cross drainage design near Lowes Creek is provided in figure 3-14.
Figure 3-14 Proposed cross drainage near Lowes Creek
Scour protection measures would be applied at all cross drainage locations and would include:

- Rock rip rap at bridges to mitigate local scour at abutments.
- Energy dissipaters at culvert outlets where the discharging flow would be supercritical and receiving waters would be subcritical.
- Rock aprons at culvert outlets to transition velocities where dissipaters were not required.

Table 3-3 above provides the length of scour protection at the outlet of the cross drainage. The final location and sizing of cross drainage including scour protection measures would be refined during development of the detailed design.

Two permanent spill basins would be required to protect water quality within the proposal at the Lowes Creek (chainage 8800). This was identified from a risk assessment that was undertaken as part of the concept drainage design report (SKM 2012b). This assessment considered the risk of spills and the sensitivity of downstream waterways. Refer to section 6.6 for the assessment of potential water quality impacts. Figure 3-15 shows the location of these basins in relation to Lowes Creek.

The spill basins were designed to contain spills in dry weather or during small storm events such as the 1 in 1 year ARI. The spill basins have an approximate volume of 60 cubic metres and were designed to capture liquid spills of a maximum 20,000 litres (average tanker size) less dense than water via an under flow baffle arrangement. Following containment, the pollutant would be pumped out and the spill disposed of in an appropriate manner. High fencing would be required around all spill basins for public safety. The final number and locations of permanent spill basins within this section of the proposal would be confirmed during development of the detailed design.
**Lowes Creek tributary culvert**

The Lowes Creek tributary culvert (refer to figure 3-16) would be located at chainage 6380 and would include five 1200 millimetre reinforced concrete pipes (RCP). Rock apron scour protection would be provided for a length of three metres downstream of the culvert.

![Figure 3-16 Proposed culverts at Lowes Creek tributary](image)

Marylands Link Road 2 intersection

The proposed intersection configuration is provided in figure 3-17. A 200 metre single dedicated right turn bay from The Northern Road east onto Maryland Link Road 2 and a 200 metre single dedicated right turn bay from The Northern Road west onto Maryland Link Road 2 would be provided. There would be four left turn slip lanes including a 170 metre slip lane from The Northern Road west onto Maryland Link Road 2, a 200 metre slip lane from The Northern Road east onto Maryland Link Road 2, a 150 metre slip lane from Maryland Link Road 2 north onto The Northern Road and a 200 metre slip lane from Maryland Link Road 2 south into The Northern Road. Traffic islands would be provided at all four corners of the intersection.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across both sides of The Northern Road, across both sides of Maryland Link Road 2 and at the north-east and south-east slip lane pedestrian crossings. The north-west and south-west slip lane pedestrian crossings would also be signalised. Maryland Link Road 2 to the east and west of The Northern Road would follow new alignments, 310 metres and 340 metres in length, respectively.
The proposed intersection configuration has been provided in figure 3-18. A 200 metre twin dedicated right turn bay from The Northern Road east onto Marylands Link Road 3 and a 200 metre single dedicated right turn bay from The Northern Road west onto Marylands Link Road 3 would be provided. There would be four left turn slip lanes including a 170 metre slip lane from The Northern Road west onto Marylands Link Road 3, a 180 metre slip lane from The Northern Road east onto Marylands Link Road 3, a 200 metre slip lane from Marylands Link Road 3 north onto The Northern Road and a 200 metre slip lane from Marylands Link Road 3 south onto The Northern Road. Traffic islands would be provided at all four corners of the intersection.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across both sides of The Northern Road, across both sides of Maryland Link Road 3 and at the north-east and south-east slip lane pedestrian crossings. The north-west and south-west slip lane pedestrian crossings would also be signalised. Marylands Link Road 3 to the east and west of The Northern Road would be new alignments, each 240 metres in length.
The Lowes Creek culvert (refer to figure 3-15 above) would be located at chainage 8950 and would include eight 2400 millimetres by 2100 millimetres main channel reinforced concrete box culverts (RCBC). Twenty five 1800 millimetres by 900 millimetres reinforced concrete box culverts (RCBC) would also be constructed to provide flood relief in this area and to provide the new road with the required flood immunity.

The existing main channel of the creek approaches The Northern Road from the west but bends south and runs parallel with the existing carriageway immediately upstream of the existing culvert. Immediately downstream of the road crossing the channel bends north and follows the alignment of the road for a short distance before it bends again and continues in an easterly direction. The meandering nature of the creek at the road crossing suggests it was diverted a short distance to facilitate construction of the existing carriageway (refer to figure 3-15).

The new main channel culvert would be located about 50m north of the existing culvert. The location of the new culvert would reinstate the natural alignment of the creek and improve the flows to and from the new culvert system. The new culvert would also allow for fish passage in accordance with the relevant standards and guidelines including *Why do Fish Need to Cross the Road? Fish Passage...*
Upstream transition works are required to direct flow to the new culvert location. Refer to section 3.3.1 for a description of the construction works to be undertaken in Lowes Creek associated with the culvert upgrade. Rock apron scour protection would be provided for a length of nine metres downstream of the main channel culvert and four metres downstream of the floodplain culverts. Refer to figure 3-19 below for the location of the culverts and scour protection.

**Lowes Creek Link Road intersection**

The proposed intersection configuration has been provided in figure 3-20 below. A 110 metre single right turn bay from The Northern Road east into Lowes Creek Link Road and 115 metre twin right turn bays from The Northern Road west into Lowes Creek Link Road. There would be four left turn slip lanes including a 180 metre slip lane from The Northern Road west into Lowes Creek Link Road, a 165 metre slip lane from The Northern Road east into Lowes Creek Link Road, a 115 metre slip lane from Lowes Creek Link Road north onto The Northern Road and a 60 metre slip lane from Lowes Creek Road south onto The Northern Road. Traffic islands would be provided at all four corners of the intersection.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across both sides of The Northern Road, across both sides of Lowes Creek Link Road and at the north-east, south-east and south-west slip lane pedestrian crossings. The north-west slip lane pedestrian crossing would not be signalised. Lowes Creek Link Road (west) would be a new alignment, 235 metres in length. Lowes Creek Link Road (east) would be a new alignment, 75 metres in length and would contain a U-turn facility.
Section 4 – Road design chainage 9300 to 11600

Main alignment
This section consists of a four-lane road (two lanes each way) divided by a wide central median. The proposal generally follows the existing road alignment. A three metre wide off-road shared pedestrian/cyclist path has been provided on the eastern side of the proposal. A 4.7 metre allocation has been provided on the western side of the proposal for the future construction of an off-road shared pedestrian/cyclist path if required. There would also be U-turn facilities provided at Belmore Road (chainage 10400) and Greendale Road (chainage 11600).

The proposal would require widening of the western side of the existing road alignment from the Lowes Creek Link Road intersection (chainage 9300) to Robinson Road intersection (chainage 10800). The proposal would require widening of the eastern side of the existing road alignment from the Robinson Road intersection (chainage 10800) to the Bringelly Road/Greendale Road Intersection (11600).

There would be no major cut and fill locations within this section of the proposal.
The concept design incorporates 4:1 fill batters up to one metre high, 3:1 fill batters from one to three metres high and 2:1 fill batters from three to a maximum height of 10 metres with benching required above a height of 10 metre. No fill areas are currently higher than 10 metre.

The concept design incorporates 3:1 cut batters up to two metres deep, 2:1 cut batters from two to seven metres deep with 4.5 metre benching, with 10:1 slopes required in cuts greater than seven metres. This benching pattern repeats every seven metres until the design interface with the existing surface.

The cross drainage would provide 100 year ARI flood immunity (that is a flood that, on average, would occur once in 100 years) for the proposed roadway and would minimise afflux to adjacent properties. All existing cross drainage structures would be removed and replaced in accordance with the findings of the hydrology assessment. No creek channels would be diverted. Refer to section 6.7 for the hydrology assessment findings. Table 3-4 shows the proposed cross drainage for this section.

<table>
<thead>
<tr>
<th>Location</th>
<th>Chainage</th>
<th>Type and size (mm)</th>
<th>Length of outlet scour protection (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Lowes Creek Link Road and Carrington Road</td>
<td>9720</td>
<td>3 x 2400 x 900 RCBC #</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>9870</td>
<td>4 x 2100 x 600 RCBC #</td>
<td>9</td>
</tr>
<tr>
<td>Between Carrington Road and Belmore Road</td>
<td>10270</td>
<td>Remove existing culvert</td>
<td>-</td>
</tr>
<tr>
<td>Between Belmore Road and Robinson Road</td>
<td>10380</td>
<td>3 x 600 RCP</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>10390</td>
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<tr>
<td></td>
<td>10610</td>
<td>5 x 2100 x 1500 RCBC #</td>
<td>6</td>
</tr>
<tr>
<td>Between Robinson Road and Loftus Street</td>
<td>10800</td>
<td>5 x 750 RCP</td>
<td>3</td>
</tr>
<tr>
<td>Between Loftus Street and Bringelly Road/Greendale Road</td>
<td>10970</td>
<td>3 x 600 RCP</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>11220</td>
<td>Remove existing culvert</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>11370</td>
<td>3 x 600 RCP</td>
<td>3</td>
</tr>
</tbody>
</table>

RCP – reinforced concrete pipe.
RCBC – reinforced concrete box culvert
# bridge sized culverts.

A plan view of the cross drainage design near Loftus Road is provided in figure 3-21.

Scour protection measures would be applied at all cross drainage locations and would include:

- Rock rip rap at bridges to mitigate constriction and local scour at abutments.
- Energy dissipaters at culvert outlets where the discharging flow would be supercritical and receiving waters would be subcritical.
Rock aprons at culvert outlets to transition velocities where dissipaters were not required.

Table 3-4 above provides the length of scour protection at the outlet of the cross drainage. The final location and sizing of cross drainage including scour protection measures would be refined during development of the detailed design.

One permanent spill basin would be required to protect water quality within the proposal at the South Creek tributary (chainage 10600) (refer to figure 3-22). This was identified from a risk assessment that was undertaken as part of the concept drainage design report (SKM 2012b). This assessment considered the risk of spills and the sensitivity of downstream waterways. Refer to section 6.6 for the assessment of potential water quality impacts.

Figure 3-21 Proposed permanent spill basin near Belmore Road
Figure 3-22 Proposed cross drainage near Loftus Road
The spill basin was designed to contain spills in dry weather or during small storm events such as the 1 in 1 year ARI. The spill basin has an approximate volume of 60 cubic metres and was designed to capture liquid spills of a maximum 20,000 litres (average tanker size) via an under flow baffle arrangement. Following containment, the pollutant would be pumped out and the spill disposed of in an appropriate manner. High fencing would be required around the spill basin for public safety. The final number and location of permanent spill basins within this section of the proposal would be confirmed during development of the detailed design.

**Carrington Road intersection**

The proposed intersection configuration has been provided in figure 3-23. Access to Carrington Road would be from the southbound carriageway only and no turning bays would be provided into or out of the intersection. The pedestrian crossing provided across Carrington Road would not be signalised. Carrington Road would be a new alignment, 160 metres in length.

![Figure 3-23 Proposed Carrington Road T-intersection](image)

**Belmore Road intersection**

The proposed intersection configuration has been provided in figure 3-22 above. A 165 metre single dedicated right turn bay from The Northern Road east onto Belmore Road and a 160 metre dedicated right turn bay from The Northern Road west onto Belmore Road would be provided. There would be four left turn slip lanes including a 170 metre slip lane from The Northern Road west into Belmore Road, a 165 metre slip lane from The Northern Road east onto Belmore Road, a 110 metre slip lane from Belmore Road north onto The Northern Road and a 120 metre slip lane from
Belmore Road south onto The Northern Road. Traffic islands would be provided at all four corners of the intersection.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided on the northbound and southbound carriageways. Signalised pedestrian crossings would be provided across both sides of The Northern Road, across both sides of Belmore Road and at the north-east and south-east slip lane pedestrian crossings. The north-west and south-west slip lane pedestrian crossings would not be signalised. Belmore Road (north-east) and Belmore Road (south-west) would be new alignments, 240 metres and 335 metres in length, respectively. A U-turn facility would be provided on Belmore Road, 100 metres west of The Northern Road.

**Robinson Road intersection**

The proposed intersection configuration has been provided in figure 3-24. Access to Robinson Road would be from the southbound carriageway only and no turning bays would be provided into or out of the intersection. A traffic island would be provided in the median of Robinson Road. The pedestrian crossing provided across Robinson Road would not be signalised. Robinson Road would be upgraded for a distance of 75 metres from The Northern Road.

**Loftus Road intersection**

The proposed intersection configuration has been provided in figure 3-25. Access to Loftus Road would be from the northbound carriageway only and no turning bays would be provided into or out of the intersection.

The pedestrian crossing provided across Loftus Road would not be signalised. Loftus Road would be upgraded for a distance of 60 metres from The Northern Road.
The Bringelly Road / Greendale Road intersection is the only intersection that is currently signalised. The proposed intersection configuration is provided in figure 3-26. The main alignment and Greendale Road was designed to avoid impacts to the heritage-listed Bringelly Public School and the shops.

A 210 metre twin dedicated right turn bay from The Northern Road east onto Bringelly Road and a 220 metre dedicated right turn bay from The Northern Road west onto Greendale Road would be provided. Two 220 metre dedicated left turn bays would be provided from The Northern Road onto Greendale Road and Bringelly Road.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across both sides of The Northern Road, across Bringelly Road and across Greendale Road. Bringelly Road would be upgraded for a distance of 225 metres from The Northern Road. Greendale Road would be upgraded for a distance of 285 metres. A pick up/drop off bay would be provided for Bringelly Public School on Greendale Road, 165 metres from The Northern Road.
Section 5 – Road design chainage 11600 to 15100

Main alignment

This section consists of a four-lane road (two lanes each way) divided by a wide central median. The proposal generally follows the existing road alignment. A three metre wide off-road shared pedestrian/cyclist path has been provided on the eastern side of the proposal. A 4.7 metre allocation has been provided on the western side of the proposal for the future construction of an off-road shared pedestrian/cyclist path if required.

The proposal would require widening of the western side of the existing road alignment from the Bringelly Road/Greendale Road intersection (chainage 11600) to the end of the proposal (chainage 15100). The proposal would require widening of the eastern side of the existing road alignment from the Robinson Road intersection (chainage 10800) to the Bringelly Road / Greendale Road Intersection (11600).

There would be no major fill locations within this section of the proposal. Major cuttings (cutting areas greater than five metres deep) would be located at:

- Dart Road from chainage 12700 to 12900 (up to five metres in height).
- Avon Road from chainage 13950 to 14200 (up to five metres in height).

The concept design incorporates 4:1 fill batters up to one metre high, 3:1 fill batters from one to three metres high and 2:1 fill batters from three metres to a maximum
height of 10 metres with benching required above a height of 10 metre. No fill areas are currently higher than 10 metre.

The concept design incorporates 3:1 cut batters up to two metres deep, 2:1 cut batters from two to seven metres deep with 4.5 metre benching, with 10:1 slopes required in cuts greater than seven metres. This pattern repeats every seven metres until the design interface with the existing surface.

The cross drainage would provide 100 year ARI flood immunity (that is a flood that, on average, would occur once in 100 years) for the proposed roadway and would minimise afflux to adjacent properties. All existing cross drainage structures would be removed and replaced in accordance with the findings of the hydrology assessment. No creek channels would be diverted. Refer to section 6.7 for the hydrology assessment findings. Table 3-5 shows the proposed cross drainage for this section.

Table 3-5 Section 5 proposed cross drainage

<table>
<thead>
<tr>
<th>Location</th>
<th>Chainage</th>
<th>Type and size (mm)</th>
<th>Length of outlet scour protection (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Thames Road and Lee Street/Solway Road</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12050</td>
<td>3 x 450 RCP</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>12120</td>
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<td>-</td>
</tr>
<tr>
<td>12350</td>
<td>4 x 900 RCP</td>
<td></td>
<td>Refer to figure 3-31 below</td>
</tr>
<tr>
<td>Between Lee Street/Solway Road and Dart Road/Badgerys Creek Road</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12610</td>
<td>3 x 900 RCP</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>12620A</td>
<td>Remove existing culvert</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>12620B</td>
<td>Remove existing culvert</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Between Dart Road/Badgerys Creek Road and Derwent Road</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12680</td>
<td>2 x 750 RCP</td>
<td></td>
<td>-</td>
</tr>
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<td>12950</td>
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</tr>
<tr>
<td>13780</td>
<td>4 x 750 RCP</td>
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</tr>
<tr>
<td>Between Derwent Road and Avon Road</td>
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<td></td>
</tr>
<tr>
<td>13800</td>
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<td>13920</td>
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<td>Between Avon Road and Mersey Road</td>
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<td></td>
</tr>
<tr>
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<td></td>
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</tr>
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<td>3 x 1500 x 600 RCBC</td>
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</tr>
<tr>
<td>14520</td>
<td>600 RCP</td>
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<td>3</td>
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</table>
A plan view of the cross drainage design near Thompsons Creek is provided in figure 3-27.

Scour protection measures would be applied at all cross drainage locations and would include:

- Rock rip rap at bridges to mitigate local scour at abutments.
- Energy dissipaters at culvert outlets where the discharging flow would be supercritical and receiving waters would be subcritical.
- Rock aprons at culvert outlets to transition velocities where dissipaters were not required.

Table 3-5 above provides the length of scour protection at the outlet of the cross drainage. The final location and sizing of cross drainage including scour protection measures would be refined during development of the detailed design.

Two permanent spill basins would be required to protect water quality within the proposal at the Thompsons Creek (chainage 12300). This was identified from a risk assessment that was undertaken as part of the concept drainage design report (SKM 2012b). This assessment considered the risk of spills and the sensitivity of downstream waterways. Refer to section 6.6 for the assessment of potential water quality impacts. Figure 3-28 shows the location of these basins near the Thompsons Creek bridge.
Figure 3-27 Proposed cross drainage near Thompsons Creek
The spill basins were designed to contain spills in dry weather or during small storm events such as the 1 in 1 year ARI. The spill basins have an approximate volume of 60 cubic metres and were designed to capture liquid spills of a maximum 20,000 litres (average tanker size) less dense than water via an under flow baffle arrangement. Following containment, the pollutant would be pumped out and the spill disposed of in an appropriate manner. High fencing would be required around all spill basins for public safety. The final number and locations of permanent spill basins within this section of the proposal would be confirmed during development of the detailed design.

**Thames Road intersection**

The proposed intersection configuration has been provided in figure 3-29. Access to Thames Road would be from the northbound carriageway only and no turning bays
would be provided into or out of the intersection. The pedestrian crossing provided across Thames Road would not be signalised. Thames Road would be upgraded for a distance of about 50 metres from The Northern Road.

![Figure 3-29 Proposed Thames Road intersection](image)

**Thompsons Creek bridge**

Thompson Creek bridge would be duplicated as part of The Northern Road upgrade. The main functional requirement of the new bridge at Thompsons Creek was to provide for a 100 year ARI flood. The bridge would consist of a 25.5 metre long single span bridge constructed on the western side of the existing bridge which would cater for northbound traffic on completion of works. The bridge would include two 3.5 metre wide lanes. The deck would be constructed using 1000 millimetre deep precast prestressed concrete beams with a compositely acting 200 millimetre minimum thickness reinforced concrete slab. The road surface level would be raised by about 400 millimetres in order to provide a minimum freeboard of 300 millimetres above the 100 year ARI flood level. Scour protection in the form of dumped rip-rap would also be included on the approach embankments of the creek and at the toe of the embankment where the abutments would be located. This would include scour protection being placed three metres upstream of the twin bridge embankments, extending under the twin bridges and finishing three metres downstream of the twin bridge embankments. The scour protection has been proposed to avoid the abutments being undermined during a 100 year ARI flood event.

The existing bridge would be retained and cater for southbound traffic. An upgrade of the existing bridge would include removal of the existing concrete barriers and installation of off structure concrete barriers which would be a 650 millimetre high
concrete barrier with twin rail and an overall height of 1300 millimetres. Safety barriers and wire rope transitions would be provided for the off structure concrete barriers. The upgrade of the bridge would also include widening of the bridge to accommodate a new shared cyclist/pedestrian path.

Fish friendly provisions would be included for Thompsons Creek. As such, the waterway crossing design has considered relevant standards and guidelines including *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*, NSW Fisheries (Fairfull and Witheridge 2003). The duplication of the bridge would include some minor excavation works in the creek channel in order to maintain the bridge waterway area.

The preferred arrangement for the Thompson Creek bridge has been shown in figure 3-28 above and figure 3-30.

**Lea Road/Solway Road intersection**

The proposed intersection configuration has been provided in figure 3-28. Access to Lea Road would be from the southbound carriageway only and there no turning bays would be provided into or out of the intersection.

The pedestrian crossing provided across Lea Road would not be signalised. Lea Road would be upgraded for a distance of about 100 metres from The Northern Road. Access to Solway Road would be from the northbound carriageway only and no turning bays would be provided into or out of the intersection. The pedestrian crossing provided across Solway Road would not be signalised. Solway Road would be upgraded for a distance of 60 metres from The Northern Road.

**Dart Road/Badgerys Creek Road intersection**

The proposed intersection configuration has been provided in figure 3-31. A 210 metre single dedicated right turn bay from The Northern Road east onto Badgerys Creek Road and a 140 metre dedicated right turn bay from The Northern Road west onto Dart Road would be provided. There would be three left turn slip lanes including a 200 metre slip lane from The Northern Road west onto Dart Road, a 170 metre slip lane from The Northern Road east onto Badgerys Creek Road and a 70 metre slip lane from Dart Road north onto The Northern Road. Traffic islands would be provided at three corners of intersection, at the north-east, north-west and south-west corners.

A bus priority lane at the approach of the signalised crossing and a bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across both sides of The Northern Road, across Dart Road, across Badgerys Creek Road and across the north-east slip lane pedestrian crossings. The north-west and south-west pedestrian crossings would not be signalised. Dart Road would be realigned for 230 metres from The Northern Road and Badgerys Creek Road would be realigned for 270 metres from the Northern Road.
Figure 3-30 Thompsons Creek Bridge elevation (top) and Thompsons Creek Bridge section (bottom)
Figure 3-31 Proposed Dart Road / Badgerys Creek Road intersection

**Derwent Road intersection**

The proposed intersection configuration has been provided in figure 3-32 below. A 165 metre single dedicated right turn bay from The Northern Road east onto Derwent Road and a 130 metre dedicated right turn bay from The Northern Road west onto Derwent Road would be provided. There would be four left turn slip lanes including a 175 metre slip lane from The Northern Road west onto Derwent Road, a 165 metre slip lane from The Northern Road east onto Derwent Road, a 75 metre slip lane from Derwent Road north onto The Northern Road and a 120 metre slip lane from Derwent Road south onto The Northern Road. Traffic islands would be provided at all four corners of the intersection.

A bus priority lane at the approach of the signalised crossing and bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across both sides of The Northern Road, across both sides of Derwent Road and at the north east and south east slip lane pedestrian crossings. The north-west and south-west slip lane
pedestrian crossings would not be signalised. Derwent Road to the north-east and south-west of The Northern Road would be new alignments, 615 metres and 75 metres in length, respectively. A U-turn facility would be provided on Derwent Road, 120 metres west of The Northern Road.

**Figure 3-32 Proposed Derwent Road intersection**

**Avon Road intersection**

The proposed intersection configuration has been provided in figure 3-33. Access to Avon Road would be from the northbound carriageway only and no turning bays would be provided into or out of the intersection.

The pedestrian crossing provided across Avon Road would not be signalised. Avon Road would be upgraded for a distance of about 85 metres from The Northern Road.

**Figure 3-33 Proposed Avon Road T-intersection**
**Mersey Road intersection**

The proposed intersection configuration has been provided in figure 3-34. A 230 metre single dedicated right turn bay from The Northern Road east onto Mersey Road and a 150 metre dedicated right turn bay from The Northern Road west onto Mersey Road would be provided. There would be four left turn slip lanes including a 170 metre slip lane from The Northern Road west into Mersey Road, a 155 metre slip lane from The Northern Road east into Mersey Road, a 110 metre slip lane from Mersey Road north onto The Northern Road and a 110 metre slip lane from Mersey Road south onto The Northern Road. Traffic islands would be provided at all four corners of the intersection.

A bus priority lane at the approach of the signalised crossing and bus bay on the departure side would be provided on the northbound and southbound carriageways.

Signalised pedestrian crossings would be provided across both sides of The Northern Road, across both sides of Mersey Road and at the north-east and south-east slip lane pedestrian crossings. The north-west and south-west slip lane pedestrian crossings would not be signalised.

Mersey Road (south-west) would be a new alignment, 160 metres in length. Mersey Road (north-east) would be realigned for 285 metres from The Northern Road. Severn Road, which is located off Mersey Road, would be realigned to the south-east for a distance of 155 metres. The Northern Road would be upgraded for 305 metres north of the intersection where it would tie-in onto the existing road.

![Figure 3-34 Proposed Mersey Road intersection and Severn Road T-intersection](image)
3.2.3 Engineering constraints

A number of engineering constraints that required engineering and design responses to avoid and/or minimise are listed below:

- Bunnings car park: A batter with a 2:1 slope was incorporated into the design to avoid impacts on the Bunnings car park between chainage 200 and 350.
- Harrington Grove West precinct: A batter with a 2:1 slope was incorporated into the design to reduce impacts on the adjacent future Harrington Grove West precinct between chainage 1600 and 1700.
- Retention of trees: Localised narrowing of the median was incorporated into the proposed road corridor on the eastern side of the proposal between chainage 2300 and 2400 to reduce the impact to native vegetation.
- Non-Aboriginal cultural heritage items: The proposal was modified to minimise the impact on non-Aboriginal cultural heritage items, in particular at:
  - Orielton (listed on the State Heritage Register and Camden LEP) – chainage 110 to 1850.
  - Narellan Camp – chainage 2150 to 3650.
  - Maryland Garden and Setting including heritage gateposts (listed on Register of the National Estate, State Heritage Register and Camden LEP) – chainage 7250 to 8350.
  - Bringelly Public School (listed on Liverpool LEP) – chainage 11650.
- Aboriginal cultural heritage items: To avoid and minimise impacts to Aboriginal cultural heritage items including those items listed on the Aboriginal cultural heritage Information Management System (AHIMS) and identified during field inspections, the proposal was adjusted to minimise and/avoid impacts. For instance, the design was modified to avoid impact to a scarred tree near Lowes Creek.
- Threatened Ecological Communities: Where possible, the extent of the proposed road corridor was minimised in areas where Threatened Ecological Communities (TECs) under the NSW Threatened Species and Conservation Act 1995 and/or Commonwealth Environment Protection and Biodiversity Conservation Act 1999 were identified. This includes the Cumberland Plain Woodland (critically endangered) and River-flat Eucalypt Forest (endangered).
- Threatened flora and fauna: Where possible, the proposed road corridor was minimised in areas which provided habitat for the Native Pear, the Cumberland Plain Land Snail, microbats and woodland birds.
- Property impacts: Where possible, intersection footprints were minimised to minimise property acquisition requirements.

3.3 Construction activities

3.3.1 Work methodology

The work methodology for the proposal would be refined during the detailed designed phase. Construction activities would be guided by a construction environmental management plan (CEMP) to ensure that works would be located within the specified works area and completed to incorporate all safeguards as described in this REF and any subsequent measures included as a result of submissions to the REF. The proposal would involve the following general work methodology:

- Pre-construction identification and marking of sensitive areas as identified in this REF, the construction environmental management plan and relevant sub plans (as required).
- Installation of temporary erosion, sediment and water quality controls, including sediment retention basins and traffic management controls.
- Establishment of permanent and temporary fencing, construction compound sites and access.
- Installation of traffic controls.
- Marking of trees that require clearing.
- Vegetation clearing and grubbing, and processing (including recycling) of various materials for use in landscaping activities.
- Stripping, stockpiling and management of topsoil.
- Property adjustments.
- Removal of existing pavement and road structures.
- Utility adjustments.
- Earthworks including cuttings and fills.
- Cross drainage works.
- Foundation works for bridges, including pile boring.
- Bridge construction over Narellan Creek and Thompsons Creek.
- Sub-grade preparation and pavement works.
- Installation of traffic signals.
- Topsoil rehabilitation and revegetation of batters and berms.
- Rehabilitation of temporary stockpiles.
- Landscaping.
- Line-marking and signposting.
- Installation of lighting.
- Finishing works including installation of safety barriers, fencing, pavement marking, signposting, street lighting and traffic control signals and opening to traffic.

The detailed work methodology for the proposal would be refined during detailed design and the development of the construction methodology by the construction contractor.

General culvert works
The general construction methodology for the culverts would be as follows:

- Clearing of vegetation for construction access tracks. All access tracks would be within the proposal as identified in Appendix A.
- Construction of access tracks, including placement of a layer of clean fill to create a stabilised surface and installation of sediment and erosion controls.
- New culverts would be provided for the new carriageway and widened road and all existing cross drainage culverts would be replaced.
- Construct half of the new culvert under the new carriageway while maintaining the existing flow path.
- Provide a temporary channel between the new and existing culverts to maintain a flow path while constructing the other half of the new culvert.
- Direct flow through the new culvert and remove the existing culvert and temporary channel.
- On completion of the culvert works the inlet and outlet would be lined as appropriate to protect the bed from scour and shaped according to the existing channel.
**Lowes Creek culvert works**

The general construction methodology for the Lowes Creek main channel culverts would be as follows:

- Clearing of vegetation and construction of an access track as per the general culvert works methodology above.
- Construct the western half of the new culvert under the northbound carriageway while maintaining the existing flow path.
- Construct the upstream channel realignment to direct flow to the new culvert inlet.
- Backfill the segment of existing creek channel adjacent the upstream realignment works and grade towards the new channel location.
- Provide a temporary channel from the new culvert under the northbound carriageway to the existing culvert.
- Construct the eastern half of the new culvert, including the scour protection while maintaining flow through the western half of the new culvert, temporary channel and existing culvert. Scour protection for an area of 25 metres by nine metres would be required at the outlet of the main channel culverts.
- Direct flow through the new culvert, remove the existing culvert, and locally backfill the existing and temporary channel adjacent the new culvert outlet.

**Bridge works**

The following construction methodology would be followed for the bridges over Narellan Creek and Thompsons Creek:

- Construct a new bridge for the northbound carriageway.
  - Construct cast-in-place piles at abutments and piers.
  - Construct reinforced concrete abutments, column extensions and pier headstocks.
  - Install super-T girders and construct reinforced concrete deck including end diaphragms.
  - Place precast barriers and complete in-situ stitch pour.
  - Construct reinforced concrete approach slabs.
  - Install expansion joints and steel traffic barrier railing.
  - Install waterproof membrane and asphalt.
- Once this new bridge has been constructed direct both northbound and southbound traffic onto the new bridge to undertaken works required on the existing bridge for the proposal. This would include the following:
  - Removal of the existing traffic barrier and kerb on the western side of the existing bridge.
  - Construct footings for the off-structure barriers at either end of the existing bridge.
  - Construct new in-situ concrete barriers on the existing bridge and approaches with safety barriers and wire rope transitions for the off-structure concrete barriers.
  - Removal of the existing footpath, traffic barrier and kerb on the eastern side of the existing bridge.
  - Construct a new slab (comprising precast prestressed planks and an in-situ reinforced concrete deck) on the western side of the existing bridge to accommodate the new shared pedestrian/cyclist path.
Once the existing bridge has been modified move the southbound traffic back onto the existing bridge and provide for northbound traffic only on the new bridge.

**Temporary sedimentation basins**

Temporary sedimentation basins would be required during construction to control run off. Basins would collect water from disturbed areas minimising discharge into surrounding areas. A preliminary drainage assessment identified the potential number and location for temporary sediment basins. The proposed location and sizing requirements for the temporary basins would be based on the guidelines and procedures set out in the publication entitled *Soils and Construction – Managing Urban Stormwater Volume 1*. Therefore the design criteria for the temporary sedimentation basins used during the construction phase were aimed at meeting the performance objectives and requirements of the Blue Book (Landcom 2004 and DECC 2008).

In total 17 temporary sedimentation basins may be required during the construction of the proposal. Locations are shown on the figures in Appendix A. Ten temporary sedimentation basins were identified for the northbound section of the proposal, with seven identified for the southbound section (refer to table 3-6). Two of these basins would be reduced in size and retained during operation of the proposal as permanent spill basins. Refer to table 3-7 for permanent spill basin locations (chainage 8775 and chainage 12250). An additional five permanent spill basins would be constructed for the proposal (refer to table 3-7). Refer to section  and Appendix A for the location of these basins.

**Table 3-6 Temporary sedimentation basins for the proposal**

<table>
<thead>
<tr>
<th>Location description</th>
<th>Location (chainage)</th>
<th>Northbound/southbound</th>
<th>Catchment area (hectares)</th>
<th>Basin volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fairwater Drive/Oran Park Drive to Hillside Drive</td>
<td>800</td>
<td>N</td>
<td>3.2</td>
<td>1018</td>
</tr>
<tr>
<td>Cobbitty Road (east) to Oran Park Link Road 2</td>
<td>3700</td>
<td>N</td>
<td>3.7</td>
<td>1310</td>
</tr>
<tr>
<td>Oran Park Link Road 3</td>
<td>4500</td>
<td>S</td>
<td>0.9</td>
<td>285</td>
</tr>
<tr>
<td>Oran Park Link Road 3</td>
<td>4900</td>
<td>N</td>
<td>1.5</td>
<td>400</td>
</tr>
<tr>
<td>Oran Park Link Road 3</td>
<td>5400</td>
<td>N</td>
<td>1.6</td>
<td>425</td>
</tr>
<tr>
<td>Marylands Link Road 1 to Marylands Link Road 2</td>
<td>6325</td>
<td>S</td>
<td>4.3</td>
<td>1350</td>
</tr>
<tr>
<td>Marylands Link Road 2 to Marylands Link Road 3</td>
<td>6660</td>
<td>N</td>
<td>1.4</td>
<td>350</td>
</tr>
<tr>
<td>Marylands Link Road 2 to Marylands Link Road 3</td>
<td>7275</td>
<td>N</td>
<td>2.2</td>
<td>685</td>
</tr>
<tr>
<td>Marylands Link Road 3 to Marylands Link Road 3</td>
<td>7725</td>
<td>N</td>
<td>0.9</td>
<td>245</td>
</tr>
<tr>
<td>Marylands Link Road 3 to Lowes Creek Road</td>
<td>8775*</td>
<td>S</td>
<td>2.2</td>
<td>680</td>
</tr>
<tr>
<td>Carrington Road</td>
<td>9100</td>
<td>N</td>
<td>2.1</td>
<td>670</td>
</tr>
<tr>
<td>Belmore Road to Robinson Road</td>
<td>9950</td>
<td>N</td>
<td>1.6</td>
<td>505</td>
</tr>
<tr>
<td>Thames Road to Lea Road</td>
<td>10575</td>
<td>N</td>
<td>1.6</td>
<td>570</td>
</tr>
<tr>
<td>Thames Road to Lea Road</td>
<td>10650</td>
<td>S</td>
<td>1.6</td>
<td>520</td>
</tr>
<tr>
<td>Derwent Road</td>
<td>12250*</td>
<td>S</td>
<td>4.0</td>
<td>1180</td>
</tr>
<tr>
<td>Derwent Road</td>
<td>13800</td>
<td>S</td>
<td>1.2</td>
<td>385</td>
</tr>
<tr>
<td>Mersey Road to the end of the proposal</td>
<td>14975</td>
<td>S</td>
<td>1.5</td>
<td>450</td>
</tr>
</tbody>
</table>

* These basins would be reduced in size and retained during operation of the proposal.
Table 3-7 Permanent spill basins for the proposal

<table>
<thead>
<tr>
<th>Location description</th>
<th>Location (chainage)</th>
<th>Northbound/southbound</th>
<th>Receiving waterway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fairwater Drive/Porrende Street to Hillside Drive</td>
<td>1050 N</td>
<td>N</td>
<td>Narellan Creek</td>
</tr>
<tr>
<td></td>
<td>1200 N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maryland's Link Road 3 to Lowes Creek Road</td>
<td>8775* S</td>
<td>S</td>
<td>Lowes Creek</td>
</tr>
<tr>
<td></td>
<td>9025 S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belmore Road to Robinson Road</td>
<td>10600 S</td>
<td>S</td>
<td>South Creek tributary</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thames Road to Lea Road</td>
<td>12250* S</td>
<td>S</td>
<td>Thompson Creek</td>
</tr>
<tr>
<td></td>
<td>12350 S</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* These permanent spill basins would be converted from temporary sedimentation basins.

The final location, number and size of temporary sediment basins and permanent spill basins would be confirmed during the detailed design. Should the location of these be outside the current impact area assessed in this REF, further environmental impact assessment would be required.

**Staging**

Construction and delivery of the proposal would be undertaken as precincts within the South West Growth Centre are released and developments along The Northern Road are approved. Therefore, the proposal would be constructed in staged sections that are currently unknown. Construction of the proposal would be undertaken by RMS and/or others (developers). At the time of writing the REF the stage sections were not known.

Within each staged section construction is anticipated to be undertaken in two main phases:

- The first phase would involve construction of the new carriageway with traffic to be carried on the existing carriageway.
- The second phase would involve upgrading works on the existing carriageway with traffic to be carried on the new carriageway.

**3.3.2 Plant and equipment**

Typical plant and equipment likely to be used during construction are listed in table 3-8. Plant and equipment requirements would be refined during the construction planning phase by the construction contractor.

Table 3-8 Construction plant and equipment

<table>
<thead>
<tr>
<th>Construction phase</th>
<th>Plant and equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Cranes</td>
</tr>
<tr>
<td></td>
<td>Excavators</td>
</tr>
<tr>
<td></td>
<td>Bulldozers</td>
</tr>
<tr>
<td></td>
<td>Road sweepers</td>
</tr>
<tr>
<td></td>
<td>Water carts</td>
</tr>
<tr>
<td></td>
<td>Semi-trailers and large delivery trucks</td>
</tr>
<tr>
<td></td>
<td>Air compressors</td>
</tr>
<tr>
<td></td>
<td>Light commercial and passenger vehicles</td>
</tr>
</tbody>
</table>
### 3.3.3 Earthworks

Cut and fill batters would be provided where the outer extremities of the upgrade and/or the local access road are respectively below or above the natural ground level. Where the proposal would be below the existing ground level, a cut batter would be established in earthworks to meet desired pavement and sub-grade levels. Where the proposal would be on embankment (or fill), the earth formation would be initially wider and then progressively reduced as it is raised to meet the required level of the road surface.

As detailed in section 3.2.2, the major fill location (fill areas greater than five metres deep) would be at Narellan Creek between chainage 600 and 1250. The major cuttings (cutting areas greater than five metres deep) would be located near Hillside Drive, Cobbitty Road, North of Oran Park Link Road 1, North of Oran Park Link Road 3, South of Marylands Link Road 2, Dart Road and Avon Road.

About 216,000 cubic metres of topsoil would be removed, of which 123,000 would be reused, and 93,000 would be in excess. Further work during the detailed design would be carried out to balance this excess or the need to be disposed of off-site to an approved licensed facility.

About 234,000 cubic metres of material would be excavated, of which 191,000 cubic metres would be used as fill, and 43,000 cubic metres would be in excess. About 590,000 cubic metres of material would be imported to site, with an additional
127,130 cubic metres of selected material imported. Surplus material that cannot be used on site would be reused or disposed of in the following order of priority:

- Transfer to other RMS projects for reuse in accordance with the EPA’s excavated public road resource recovery exemption.
- Transfer to an approved RMS stockpile site for reuse on a future project only if a specific project has been identified prior to stockpiling and Protection of the Environment Operations Act 1997 waste regulatory requirements are met. If a project cannot be identified the material would not be stockpiled.
- Transported off site for reuse by a third party in accordance with relevant EPA resource recovery exemption or to an EPA licensed waste recovery facility
- Disposal at an accredited materials recycling or waste disposal facility

The estimated quantities of materials for import, re-use and disposal would be refined during detailed design and the development of the construction methodology by the construction contractor.

Should groundwater be encountered during earthworks, it would be managed in accordance with the management measures provided in section 6.6.

### 3.3.4 Materials and water

Materials would be imported and sourced from the Sydney region, where possible. The approximate quantities of particular materials that would be required by the proposal are identified in table 3-9.

<table>
<thead>
<tr>
<th>Material</th>
<th>Estimated quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt</td>
<td></td>
</tr>
<tr>
<td>Tack coat</td>
<td>73,400 litres</td>
</tr>
<tr>
<td>Asphaltic concrete</td>
<td>283,338 tonnes</td>
</tr>
<tr>
<td>Road base</td>
<td>173,209 cubic metres</td>
</tr>
<tr>
<td>Steel</td>
<td>1022 tonnes</td>
</tr>
<tr>
<td>Concrete</td>
<td>8365 tonnes</td>
</tr>
</tbody>
</table>

Water for construction would be sourced from sediment basins and available hydrants in the area, mostly from Sydney Water.

The required quantities of water are not yet known, and would be confirmed during detailed design. Water would be required for compaction of earthworks associated with pavement layers, such as select layers to adjust the moisture content and dust suppression. A review of the water requirements for the proposal would be undertaken during detailed design and prior to the construction of stage sections.

### 3.3.5 Traffic management and access

It is anticipated that a maximum of 100 truck movements per day would be required during construction. The trucks would be used for the delivery of construction material to the site, and the removal of material from the site to temporary stockpile sites or to a licensed waste facility. The number of truck movements may increase
during the early phases of construction when the bulk earthworks would be carried out. Traffic movements would again increase after the traffic is switched to newly constructed carriageway and the removal of the existing pavement and sub-grade preparation commences.

Up to 200 additional light vehicle on-site movements per day are estimated. An estimated 20 to 30 light vehicles of construction site workers would arrive at the site each working day and park in the site compound and other temporary car parks.

The estimated maximum number of truck and vehicle movements per day, were based on construction of the full proposal. As construction of the proposal is dependent on the rate of development in the South West Growth Centre the proposal would be constructed in staged sections, which are currently unknown. Therefore actual truck and vehicle movements required for these staged sections are currently unknown. The construction traffic volumes, scheduled arrival and departure of workers and trucks transporting materials and spoil would be reviewed during detailed design for the construction of the full proposal and reviewed prior to the construction.

Designated access routes for construction vehicles would be along the arterial road network where practicable. Details of all routes used for access and haulage during construction would be developed in consultation with the relevant council. Roads likely to be used for access and haulage include:

- Narellan Road.
- Camden Valley Way.
- Hume Highway.
- Bringelly Road.
- Elizabeth Drive.
- Western Motorway.
- Great Western Highway.
- Badgerys Creek Road.

Designated access routes for vehicles would be developed in consultation with Liverpool City Council and Camden Council.

During construction, access would be maintained for residents, businesses and through-traffic. Alternative access provisions would be undertaken in consultation with the relevant councils, and affected property and business owners. In the case of properties adjoining the road corridor, temporary driveways would be provided as required. Final driveway configuration would be installed as part of the pavement construction.

A Traffic Management Plan would be prepared in accordance with the then RTA Traffic Control at Work Sites Manual Version 4 (RTA 2010), and approved by RMS prior to implementation. The Traffic Management Plan would also need to consider other developments that may also be under construction close to Bringelly Road (such as construction activities associated with the South West Rail Link, South West Growth Centre and other road upgrades such as Bringelly Road). This plan would also consider the safety and potential impacts to pedestrians, cyclists, public transport and emergency services.
3.3.6 Work force and working hours

It has been estimated that 30 to 40 construction and site management personnel would be required for each of the construction stages, along the 15 kilometre length of the proposal.

It has been anticipated that work for the proposal would be undertaken during standard working hours as follows:

- Monday to Friday: 7am to 6pm.
- Saturday: 8am to 1pm.
- Sundays and public holidays: no work.

However, should work be undertaken outside of the standard working hours it would be to minimise traffic impacts, including:

- Construction and utility adjustment works requiring road occupancy.
- Construction of tie-ins with adjoining sections.
- Placement of asphalt wearing course.
- Intersection construction activities.

The procedures contained in the *Environmental Noise Management Manual* (RTA 2001), “Practice Note vii – Roadworks Outside of Normal Working Hours”, the *Interim Construction Noise Guidelines* (DECCW 2010) and the safeguards contained in the REF would be followed for work outside of the standard working hours. This would include notifying the local community of any works planned to be undertaken outside standard construction hours.

The timing of construction would largely be dependent on the rate of future land releases and the allocation of funding by the Government. The detailed approach to and program for staging, including the construction activities and timetable are therefore currently unknown.

3.4 Ancillary facilities

A number of ancillary facilities would need to be established during construction. These facilities would include construction compound sites and stockpile sites. The location of ancillary facilities has not been confirmed. This is because the construction staging is currently unknown and due to the difficulties of anticipating how the South West Growth Centre will be developed near the proposal and how that development will influence the availability of land that is suitable for ancillary facilities.

The locations of the ancillary facilities must allow for efficient and cost-effective construction of the proposal while minimising environmental and social impacts. The location of ancillary facilities would be identified during the detailed design.

Construction compound and stockpile sites would be subject to the site location criteria set out in the then RTA’s *Stockpile Site Management Procedures* (RTA 2011). The locations for construction compound or stockpile sites would be selected using the following criteria wherever practicable:

- Located away from residential dwellings where possible.
- Located in areas not prone to flash flooding and more than 40 metres from a watercourse.
- Located in certified areas of the South West Growth Centre.
Located in plain view of the public to deter theft and illegal dumping.
Stockpiles sites would be located outside the drip line of trees and be on level ground wherever possible.
No impacts on sensitive environmental areas such as heritage sites.

Once the construction contractor has finalised the location of the ancillary facilities, consultation with the RMS regional environment officer would be undertaken to identify if any additional environmental impact assessment would be required for the ancillary facilities. It would be unlikely that batching plants would be required for the proposal.

3.4.1 Construction compound sites

The main construction compound site would include portable buildings with amenities (such as lunch rooms and toilets), secure and bunded storage areas for site materials, including fuel and chemicals, office space for on-site personnel and associated parking. A number of additional minor compound areas may also be required along the length of the proposal for workshops or crib sheds.

Liquid and solid waste would be removed by tanker or truck and disposed of off-site at a suitably licensed facility able to accept those wastes for storage, reuse or disposal. Fuel and chemical storage areas would be bunded and protected in accordance with the specifications set out by the NSW Office of Environment and Heritage (OEH) and WorkCover.

Each site would be securely fenced with temporary fencing. All necessary signage advising the general public of access restrictions would be provided. Upon completion of the construction works, the temporary construction compound sites and work areas would be removed, the sites would be cleared of all rubbish and materials and rehabilitated.

3.4.2 Stockpile sites

A number of temporary stockpile sites and laydown areas would also need to be established for the construction period. These sites would be used to store, prepare and distribute aggregate and other bulk materials such as topsoil, unsuitable sands, pre-cast culverts, drainage pipes and drainage pits. Materials such as topsoil, mulched timber and any unsuitable cut material would need to be stockpiled during construction prior to being re-used in the final landscaping.

Upon completion of the construction works, the stockpile sites would be removed. All stockpile sites would be cleared of all rubbish and any excess materials, and then the area would be rehabilitated.

3.5 Public utility adjustment

Consultation with public utilities has been undertaken as part of the development of the concept design to identify and locate existing utilities and incorporate utility authority requirements for relocations or adjustments. Chapter 5 provides a summary of the consultation undertaken for the proposal.

Service investigations indicated that water mains, sewer mains, gas, telecommunications and electrical transmission lines would require relocation or adjustment as part of the proposal. Side streets were accounted for in the utilities design. Connection into the existing utilities on the side streets would be undertaken.
If necessary side street utilities would be adjusted where the proposed side street alignment has changed to allow for connection with the existing side street utilities.

Where possible utilities would be relocated under the proposed footpath in allocations as set out in the *NSW Street Opening Conference Guidelines*. Underboring may be required at creek crossings. This would be reviewed and confirmed in the detailed design.

**Water mains**

Three water mains currently exist and four water mains have been proposed within the proposal and are described below.

Existing mains include:

- 375/400 millimetre diameter, south of Fairwater Drive to Hillside Drive (chainage 240 to chainage 1500).
- 200/150/100 millimetre diameter, from the start of the proposal to 400 metres north of Hillside Drive (chainage 0 to chainage 1800).
- 200/150/100 millimetre diameter, from the Bringelly Road/Greendale Road intersection to Thames Road (chainage 11600 to chainage 12100).

Proposed Sydney Water Corporation (SWC) mains include:

- 450 millimetre diameter, from Hillside Drive to Oran Park Link Road 1 (Peter Brock Drive) Intersection (chainage 1500 to chainage 3500).
- 750/600 millimetre diameter, from Fairwater Drive/Porrende Street intersection to Oran Park Link Road 2 intersection (chainage 600 to chainage 4500).
- 750/600 millimetre diameter, from the start of the proposal to Fairwater Drive/Porrende Street intersection (chainage 0 to chainage 600).

**Proposed relocations/re-alignments**

The alignment of the proposed water mains was taken into account in the access strategy as they generally run either outside the proposal or within the shared path.

Minor realignment of the existing 200/150/100 millimetre diameter water main at the start of the proposal (chainage 200), and the existing 375/450 millimetre diameter water main at the Fairwater Drive/Porrende Street intersection (chainage 600) would be relocated away from the proposed alignment.

Relocation of the existing 200/150/100 millimetre diameter water main between Fairwater Drive/Porrende Street intersection and Hillside Drive (chainage 800 to chainage 1400), and Bringelly Road/Greendale Road intersection and Thames Road (chainage 11600 to chainage 12100) would be necessary. The existing 375/450 millimetre diameter water main between Fairwater Drive/Porrende Street intersection and Narellan Creek Bridge (chainage 800 to chainage 1050) would require relocation to the eastern shared cyclist/pedestrian path to allow continued maintenance and access.

Consultation with SWC regarding the proposed changes to the proposed water mains was undertaken as summarised in chapter 5. The concept design has considered the location of the proposed mains and any relocations necessary would be assessed in the detailed design.
**Sewer mains**

There are sewer mains located within the proposal. An existing sewer main crosses the proposal at chainage 8650. Based on the preliminary investigations, no proposed adjustments or relocations of the existing or proposed sewer mains have been anticipated. Sewer mains also run along both sides of the existing road from chainage 0 to 650 with no anticipated adjustments would be necessary.

**Gas**

An existing 75 millimetre gas main is located from the start of the proposal to Fairwater Drive/Porrende Street intersection (between chainage 0 and chainage 600) and crosses the proposal between chainage 350 and chainage 400. A 200 millimetre high pressure gas main crosses the proposal at the Bringelly Road/Greendale Road intersection (chainage 11500). It has not been anticipated that relocation of any low/medium/high pressure gas mains would be required as there would be sufficient cover over the mains. Consultation with the gas supplier (Jemena) at detailed design would be required to confirm that adjustment or relocation of the gas mains would not be required.

**Telecommunications**

Relocation of Telstra above-ground and underground telecommunications would be required for assets within the proposal. It has been proposed to move the telecommunications into shared paths either side of the road (preferably on the same side of the road as existing assets to maintain supply without creating any additional road crossings).

A proposed optic fibre cable is to be located 500 metres north of the proposed Marylands Link Road 1 intersection and Lowes Creek (chainage 6650 to chainage 8800), and an Inter Exchange Network (IEN) is located from the proposed Oran Park Link Road 3 intersection and Dart Road/Badgerys Creek Road intersection (chainage 5300 to chainage 12700). Consultation with Telstra would be required during detailed design to assess the extent of relocation.

**Transmission lines**

There are numerous above-ground transmission lines and underground electrical conduits located within the proposal. It has been proposed that the above-ground electrical transmission lines be relocated into the shared path or adjacent to property boundary as per the allocation in the Streets Opening Conference guide. Relocation of proposed transmission line poles would be required for a 132 kV above-ground electrical transmission line at the intersections of The Northern Road with Marylands Link Road 2, Maryland Link Road 3 and Lowes Creek Link intersections. Adjustment of proposed transmission line poles may also be required with regards to vertical clearance at intersections with Oran Park Link Road 2 and Oran Park Link Road 3. No relocations of the proposed 132 kV underground transmission line have been anticipated.

**Lighting**

New street lighting or adjustments to existing street lighting would also be required at the signalised intersections. Street lighting would also be provided along the full length of the proposal to light the carriageway and shared path/cycleway. Intelligent Transport System ducting has been also proposed along the eastern shared cyclist/pedestrian path.
The relocation of utilities would be undertaken in consultation with the utility authorities during detailed design. Should it be identified during detailed design that relocation outside of the proposal is required, consultation with the RMS regional environmental officer would be undertaken to identify if any additional environmental assessment would be required.

3.6 Property acquisition and lease

The proposal would require full and partial property acquisition which are summarised and shown in Appendix C. This would be refined during the detailed design which may also affect the extent of property acquisition required. Three properties would need to be fully acquired and 148 properties would require partial acquisitions. The final required acquisitions would be confirmed during the detailed design phase in consultation with the landowners.

All land acquisitions would be conducted in accordance with the RMS Land Acquisition Policy and compensation would be identified in accordance with the Land Acquisition (Just Terms) Compensation Act 1991.

It is anticipated that land for the temporary construction compound sites, stockpile sites and temporary sedimentation basins would be leased for the duration of the construction activities and would not require acquisition. These locations would be confirmed during the detailed design.

Negotiations with landowners for the lease of land would occur during detailed design. Upon completion of the construction works, the ancillary facilities and temporary sediment basins would be removed, and the sites cleared of all rubbish and materials and rehabilitated.