Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
						from time to time, but unlikely to be resident.	eucalypts. Most breeding records come from the western slopes.
Grantiella picta	Painted Honeyeater	VU	V	#	Negligible	Suitable habitat not present in study area and no recent records.	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. It is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, and prefers mistletoes of the genus *Amyema*.
Hieraaetus morphnoides	Little Eagle		V	2011	Low	Marginal habitat present in study area (low quality and extent).	The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species. It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests.
Lathamus discolor	Swift Parrot	EN	E1	2011#	Low	Marginal habitat present in study area (low quality and extent).	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon* and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
Neophema pulchella	Turquoise Parrot		V	2012	Low	Marginal habitat present in study area (low quality and extent).	Occurs in open woodlands and eucalypt forests with a ground cover of grasses and understorey of low shrubs. Generally found in the foothills of the Great Divide, including steep rocky ridges and gullies. Nest in hollow-bearing trees, either dead or alive; also in hollows in tree stumps. Prefer to breed in open grassy forests and woodlands, and gullies that are moist.
Pandion cristatus	Osprey	M	V	#	Negligible	Suitable habitat not present in study area and no recent records.	Found in coastal waters, inlets, estuaries and offshore islands. Occasionally found 100 kilometres inland along larger rivers. It is water-dependent, hunting for fish in clear, open water. The Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within 1 kilometre of the sea.
Petroica boodang	Scarlet Robin		V	2008	Low	Marginal habitat present in study area (low quality and extent).	During the breeding season the Scarlet Robin is found in eucalypt forests and temperate woodlands, often on ridges and slopes. During autumn and winter it moves to more open and cleared areas. It has dispersive or locally migratory seasonal movements. The Scarlet Robin forages amongst logs and woody debris for insects which make up the majority of its diet.
Rostratula australis	Australian Painted Snipe	EN	E1	#	Negligible	Suitable habitat not present in study area and no recent records.	The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Prefers fringes of

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
							swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.
Stictonetta naevosa	Freckled Duck		V	2006	Negligible	Suitable habitat not present in study area.	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs and farm dams.
Reptiles							
Hoplocephalus bungaroides	Broad-headed Snake	VU	E1	#	Negligible	Suitable habitat not present in study area and no recent records.	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer.
Frogs							
Heleioporus australiacus	Giant Burrowing Frog	VU	V	#	Negligible	Suitable habitat not present in study area and no recent records.	Prefers hanging swamps on sandstone shelves adjacent to perennial non-flooding creeks. Can also occur within shale outcrops within sandstone formations. Known from wet and dry forests and montane woodland in the southern part range. Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water. Spends the majority of its time in non-breeding habitat 20-250 metres from breeding sites.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
Litoria aurea	Green and Golden Bell Frog	VU	E1	2015#	Low	Marginal habitat present in study area (low quality and extent).	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC. The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks, although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land.
Fish							
Macquaria australasica	Macquarie perch	EN		#	Negligible	Suitable habitat not present in study area and no recent records.	Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries
Prototroctes maraena	Australian Grayling	VU		#	Negligible	Suitable habitat not present in study area and no recent records.	The Australian Grayling occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range from Sydney southwards to the Otway Ranges in Victoria, and Tasmania. Australian grayling do not occur in the inland Murray–Darling Basin system. Grayling is a diadromous species; migrating between freshwater streams and the ocean. This species has been found in clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops, and also in muddy-bottomed, heavily silted habitats.

Scientific name	Common name	Conservation status		Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	TSC				
Invertebrates							
Meridolum corneovirens	Cumberland Plain Land Snail		E1	2015	Moderate	Potential habitat present in study area. Habitat limited in its capacity to support the species due to extent, quality and isolation.	Most likely restricted to Cumberland Plain, Castlereagh Woodlands and boundaries between River-flat Forest and Cumberland Plain Woodland. It is normally found beneath logs, debris and amongst accumulated leaf and bark at the base of trees. May also use soil cracks for refuge.

* - habitat descriptions have been adapted by qualified ecologists from the DEE Species Profile and Threats (SPRAT) Database, OEH Threatened Species online profiles and the NSW Scientific Committee final determinations for listed species, references within the above table are provided within the report reference list.

A3.3 Migratory species (EPBC Act listed)

Includes records from the following sources:

- NSW OEH BioNet Wildlife Atlas (refer to Section 2.1).
- DPI database (accessed on 30/11/2015).
- Current survey.

Table A.5 Migratory fauna species recorded, or predicted to occur, within 5 kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record
		EPBC	TSC	
Apus pacificus	Fork-tailed Swift	M	-	#
Ardea ibis	Cattle Egret	M	-	2011#
Ardea modesta	Eastern Great Egret	M	-	2013#
Cuculus optatus	Oriental Cuckoo	M	-	#
Gallinago hardwickii	Latham's Snipe	M	-	2013#
Hirundapus caudacutus	White-throated Needletail	M	-	2000#
Merops ornatus	Rainbow Bee-eater	M	-	2010#
Monarcha melanopsis	Black-faced Monarch	M	-	2011#
Motacilla flava	Yellow Wagtail	M	-	#
Myiagra cyanoleuca	Satin Flycatcher	M	-	#
Pandion cristatus	Osprey	M	V	#
Rhipidura rufifrons	Rufous Fantail	M	-	2012#
Symposiachrus trivirgatus	Spectacled Monarch	M	-	#

Appendix 4 Assessments of Significance

The following section provides for Assessments of Significance according to the seven factors outlined in Section 5A of the EP&A Act for all species listed as a medium likelihood or greater in Appendix 2 and Appendix 3.

Cumberland Plain Woodland

This assessment has determined that the vegetation within the study area (Cumberland Plain Woodland, Cumberland Plain Woodland – Derived Shrubland and Cumberland Plain Woodland – Derived Grassland as mapped in Figure 2) is consistent with Cumberland Plain Woodland in the Sydney Basin Bioregion, a TSC Act CEEC as described by the NSW Scientific Committee (2011). Although the Derived Shrubland and Derived Grassland sub-communities do not have canopy strata, as a result of historic clearing, these communities meet the listing criteria under the TSC Act for this community.

Cumberland Plain Woodland occurs in the driest parts of the Sydney Basin, typically on heavy clay soils derived from Wianamatta Shale (OEH 2014b). In Western Sydney, this community historically covered an extensive area of the Cumberland Plain, but has since European settlement been degraded and removed. Today, only 9 per cent of the original extent remains (OEH 2014b), often occurring in small patches with limited connectivity to other extant remnant vegetation.

Cardno are in the process of preparing a rezoning application for a subdivision that will see the removal of 1.38 hectares of TSC Act listed isolated and edge impacted Cumberland Plain Woodland (including the Derived Shrubland and Derived Grassland communities) rezoned as *R1 – General residential* (Figure 5). It should be noted that Figure 5 includes a small area of land that have previously been approved as part of the broader rezoning application.

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The TSC Act defines a 'threatened species' as 'a species specified in Part 1 and Part 4 of Schedule 1, Part 1 of Schedule 1A and Part 1 of Schedule 2' of the Act. Cumberland Plain Woodland is not a threatened species, as defined under the TSC Act.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

The TSC Act defines an 'endangered population' as 'an endangered population specified in Part 2 of Schedule 1' of the Act. Cumberland Plain Woodland is not an endangered population, as defined under the TSC Act.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

1.38 hectares of Cumberland Plain Woodland (including the derived communities) will undergo clearance in the proposed R1 zone. The surrounding area is heavily modified consisting mostly of cleared agricultural land and residential housing with scattered patches of modified bushland in between. Given that 7.95 hectares will be retained and preserved as E2 in the study area, the area to be removed constitutes approximately 20 per cent of this CEEC within the study area. Establishment and maintenance of APZs may result in potential indirect impacts such as increased edge effects, altered fire regime, altered species composition and altered structural integrity which can be avoided or mitigated by following recommendations within Table 8.These

impacts are limited to patch boundaries only and will not extend into patch interiors. In such a highly modified context, retention of the largest patches of Cumberland Plain Woodland in conjunction with revegetation and restoration works to be conducted by Cardno is a good strategy to preserve and improve the most resilient parts of Cumberland Plain Woodland in the study area. Therefore, the Project is not likely to have an adverse effect on the extent of the ecological community, nor is it likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality.

The rezoning application would result in 1.38 hectares of Cumberland Plain Woodland (including derived communities) cleared for residential development which makes up approximately 15 per cent of the community recorded in the study area.

The small patches of Cumberland Plain Woodland to be removed are currently isolated or on the fringe of larger patches. The surrounding area is heavily modified consisting mostly of cleared agricultural land and residential housing. Overall there is poor to no connectivity with low condition patches of Cumberland Plain Woodland in the broader landscape. The 7.95 hectares of Cumberland Plain Woodland (including derived communities) that will be retained and preserved for environmental conservation are the largest most intact patches of this community in the study area. Establishment and maintenance of APZs may result in the potential indirect impacts listed above, however, these impacts will not result in fragmentation or isolation and can be avoided or mitigated by following recommendations within Table 8. Hence, Cumberland Plain Woodland is not likely to become fragmented or isolated from other areas of habitat as a result of the Project.

While Cumberland Plain Woodland provides important habitat for threatened flora and fauna species, such as the Cumberland Plain Land Snail and Spiked Rice-flower, the area to be removed (1.38 hectares) is small and largely isolated from large intact patches in the landscape. Therefore, the Project is not likely to impact the long-term survival of Cumberland Plain Woodland in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitats are areas of land that are crucial to the survival of particular threatened biota. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for Cumberland Plain Woodland.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Cumberland Plain Woodland is included in the Cumberland Plain Recovery Plan which was developed by DECCW (2010). The recovery objectives are as follows:

- *To build a protected area network, comprising public and private lands, focused on the priority conservation lands.*

- *To deliver best practice management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatible with biodiversity conservation.*
- *To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the recovery program.*
- *To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner.*

The study area is not located within the priority conservation lands identified within the recovery plan. Considering the condition, small patch size and presence of larger, higher quality remnants that will be retained in the study area, the proposal will not interfere with a recovery actions set out within DECCW (2010). Some of the recovery objectives can be met through revegetation and restoration works to be conducted by Cardno in the areas of Cumberland Plain Woodland to be retained under E2.

In addition OEH lists activities to assist threatened biota in their recovery within NSW. Those listed for Cumberland Plain Woodland that are relevant to the Project include:

- *Promote public involvement in restoration activities.*
- *Protect habitat by minimising further clearing. This requires recognition of the values of all remnants.*
- *Promote regeneration by avoiding mowing or prolonged or heavy grazing.*
- *Protect habitat by controlling run-off entering the site, where it would change water, nutrient or sediment levels or cause erosion.*
- *Weed control.*
- *Undertake restoration including bush regeneration and revegetation.*

Several management objectives are listed under the OEH *saving our species* program. The key objective listed for Cumberland Plain Woodland that is relevant to the Project is the:

- Support and promote the adoption of best practice standards for bushland management and restoration (as specified in Appendix 2 of the Cumberland Plain Recovery Plan) on public and private lands within the Cumberland Plain.

To date, no threat abatement plan relevant to Cumberland Plain Woodland has been developed.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key Threatening Processes (KTP) are listed under Schedule 3 of the TSC Act 1995. Clearing of Cumberland Plain Woodland in the R1 zone would constitute the following KTP:

- *Clearing of native vegetation.*

Given that a small area (1.38) consisting of mostly isolated patches of Cumberland Plain Woodland will be removed and patch boundaries potentially indirectly impacted via APZ maintenance and establishment, it is unlikely that the operation of this KTP will have a significant impact on the community.

The Project also has the potential to increase the operation of the following KTPs relevant to Cumberland Plain Woodland:

- *Invasion, establishment and spread of Lantana Lantana camara.*
- *Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata.*
- *Invasion of native plant communities by exotic perennial grasses.*
- *Invasion and establishment of exotic vines and scramblers.*
- *Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.*

Recommendations have been made to limit the spread of weeds (including noxious weeds) in the study area and conduct revegetation works in E2 areas of Cumberland Plain Woodland. With these actions and based on the current weed dominance it is unlikely that the Project will exacerbate these KTPs such that there is a significant impact to Cumberland Plain Woodland.

Conclusion

In light of the consideration of the above seven factors, the Project is not likely to result in a significant impact on Cumberland Plain Woodland due to:

- The Project will not adversely affect the extent or composition of the ecological community to the point where it becomes locally extinct.
- The Project will not further fragment or isolate the community or affect its long term survival in the locality.
- The Project is consistent with recovery actions for this community.

Consequently, given that a significant impact on Cumberland Plain Woodland is not likely, a Species Impact Statement is not required for the Project.

Spiked Rice-flower *Pimelea spicata*

Spiked Rice-flower *Pimelea spicata* is listed as Endangered on the TSC Act. The species is an erect to spreading shrub that grows 50 centimetres in height. The leaves are opposite and elliptical, and usually held outwards from the stem, and the tubular flowers are white with a pink tinge and four spreading petals (OEH 2015c). The Spiked Rice-flower is dependent upon seed production for recruitment and flowers sporadically throughout the year, with flowering likely to depend on climatic variables such as rainfall (DEC 2005; OEH 2015c).

Historically, the Spiked Rice-flower occurred extensively across the Cumberland Plain. Today, the species is restricted to two separate areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama) (OEH 2015c).

In the Cumberland Plain, the Spiked Rice-flower occurs in Cumberland Plain Woodland (Cumberland Plain Woodland and variants) and Moist Shale Woodland (OEH 2015c).

Spiked Rice-flower was not recorded during the field investigation, but potential habitat for this species exists within the Cumberland Plain Woodland in the study area. This species has been recorded 449 times within the locality, the closest being 1.28 kilometres from the study area (OEH 2015a). Cardno are in the process of preparing a rezoning application for a subdivision that proposes 0.89 hectares of Cumberland Plain Woodland (potential habitat for the Spiked Rice-flower) rezoned as *R1 – General residential* and cleared for residential development (Figure 5). 7.95 hectares would be rezoned *E2 – Environmental conservation* and retained within the study area with significant revegetation works to be conducted to conserve this area of potential habitat.

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

A viable local population of the Spiked Rice-flower does not occur within the study area, but based on records from OEH (2015a) may occur in the locality. A total of 8.85 hectares of potential habitat for this species occurs in the Cumberland Plain Woodland of the study area and it is considered to be in moderate to good condition. Although 0.89 hectares of potential habitat for the Spiked Rice-flower would be rezoned R1 and cleared for residential development this constitutes only 10 per cent of Cumberland Plain Woodland occurring in the study area and these patches are small and mostly isolated. A large amount of potential habitat (7.96 hectares) will be retained within the study area in the E2 zone, in larger intact patches of Cumberland Plain Woodland that also have greater connectivity to patches that occur in the broader landscape. Establishment and maintenance of APZs may result in potential indirect impacts such as increased edge effects, altered fire regime, altered species composition and altered structural integrity which can be avoided or mitigated by following recommendations within Table 8. These impacts are not expected to extend into the patch interior. Furthermore, revegetation and restoration works to be conducted by Cardno will limit the spread of weeds, including noxious weeds (manual control preferred over chemical), that have been noted to pose an increasing threat to the Spiked Rice-flower (OEH 2015c). Based on these points, it is considered unlikely that the Project will have a significant impact on the lifecycle of the Spiked Rice-flower such that it is placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

The TSC Act defines an 'endangered population' as 'an endangered population specified in Part 2 of Schedule 1' of the Act. Spiked Rice-flower is not an endangered population, as defined under the TSC Act.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The TSC Act defines an 'endangered ecological community' as 'an endangered ecological community specified in Part 3 of Schedule 1' of the Act. Spiked Rice-flower is not an endangered ecological community, as defined under the TSC Act.

In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality.

The Project will require the removal of 0.89 hectares and risk of indirect impacts to potential habitat which makes up 10 per cent of potential habitat in the study area.

The vegetation to be removed is made up of several small patches that are largely isolated in the study area and are vulnerable to further degradation through increased edge effects. The remaining 7.96 hectares of potential habitat in the study area will be conserved in the E2 zone and its condition improved through revegetation and restoration works. Establishment and maintenance of APZs may result in potential indirect impacts to patch boundaries, however, these impacts can be avoided or mitigated by following recommendations within Table 8 and are not expected to extend into the patch interior. Therefore, potential habitat for the Spiked Rice-flower is not likely to become fragmented or isolated from other areas of habitat as a result of the Project.

Potential habitat for the Spiked Rice-flower that is being removed from the study area (0.89 hectares) is small and while it is considered to be in moderate to good condition, due to its patchy and isolated nature it is not considered an important piece of habitat for this species. With the restoration works to be conducted in the larger patches of potential habitat to be retained in the E2 zone (7.96 hectares), this conserved area is likely to provide better quality habitat for the Spiked Rice-flower than the areas to be removed, and as such, the Project is not likely to impact the long-term survival of the Spiked Rice-flower in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan for the Spiked Rice-flower has been developed (DEC 2005) and includes several recovery objectives, of which two are relevant to the Project.

- *Provide the community with information that assists in conserving the species.*
- *Raise awareness of the species and involve the community in the recovery program.*

OEH (2015c) lists a number of practical *Activities to assist this species*, of which one is relevant to the Project, namely:

- *Control threatening weeds where necessary. Avoid herbicide use close to Spiked Rice-flower plants to ensure they are not impacted by poison.*

This can be ensured by following recommendations provided in this report to minimise disturbance to the retained E2 zone areas of Cumberland Plain Woodland and reduce the spread of weeds in the study area, using manual control over chemical control where possible.

Two management sites for the Spiked Rice-flower have been established are listed under the OEH *saving our species* program. The study area does not fall within the boundary of either management site though it should be noted it is in close proximity to the Narellan site. The management objective under this program is not relevant to the Project.

To date, no threat abatement plan relevant to the Spiked Rice-flower has been developed.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key Threatening Processes (KTP) are listed under Schedule 3 of the TSC Act 1995. Clearing of Cumberland Plain Woodland, potential habitat for the Spiked Rice-flower, in the R1 zone would trigger the following KTP:

- *Clearing of native vegetation.*

Given that a small area (0.89 hectares) consisting of mostly isolated patches of potential habitat will be removed, it is unlikely that the operation of this KTP will have a significant impact on the Spiked Rice-flower.

The Project also has the potential to increase the operation of the following KTPs relevant to the Spiked Rice-flower:

- Invasion, establishment and spread of Lantana *Lantana camara*.
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*.
- Invasion of native plant communities by exotic perennial grasses.
- Invasion and establishment of exotic vines and scramblers.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

Recommendations have been made to limit the spread of weeds (including noxious weeds) in the study area and conduct revegetation and restoration works in retained E2 areas of potential habitat. With these actions and based on the current weed dominance it is unlikely that the Project will exacerbate these KTPs such that there is a significant impact to potential habitat for the Spiked Rice-flower.

Conclusion

In light of the consideration of the above seven factors, it is unlikely that the Project will impose a significant impact on the Spiked Rice-flower or its habitat as:

- The Project will not adversely affect the lifecycle of the species such that its local occurrence is placed at risk of extinction.
- The Project will not further fragment or isolate habitat for the species or affect its long term survival in the study area or in the locality.
- The Project is not likely to adversely affect the recovery of the species.

Consequently, given that a significant impact on the Spiked Rice-flower is not likely, a Species Impact Statement is not required for the Project.

Cumberland Plain Land Snail *Meridolum corneovirens*

Cumberland Plain Land Snail *Meridolum corneovirens* is listed as Endangered on the TSC Act. This species has a thin, fragile, uniform brown shell with a diameter of 25-30 millimetres (OEH 2013). The underside of the shell is often transparent, providing view of the snail colour some internal organs, whereas the upper side of the shell is coarse and wrinkly (OEH 2013). Shell features also vary between different age classes in this species.

The Cumberland Plain Land Snail is primarily found in Cumberland Plain Woodland, but also occurs in Shale Gravel Transition Forest, Castlereagh Swamp Woodland and at the margins of River-flat Eucalypt Forest – all of which are listed as threatened ecological communities under the TSC Act (OEH 2013). Within these communities, this species lives and shelters in piles of shed bark and detritus, under leaves and logs, in loose soil around grass clumps and occasionally under rubbish (OEH 2013). The Cumberland Plain Land Snail is hermaphroditic, eats fungus and is mostly active at night.

Threats to the Cumberland Plain Land Snail identified by OEH (2013) include:

- *Clearing and degradation of Cumberland Plain Woodland remnants.*
- *Weeds, by altering the composition of the litter that grows the fungi on which the species feeds.*
- *Inappropriate fire regimes.*
- *Heavy grazing by domestic stock.*
- *Removal of logs.*
- *Predation by carnivorous snails.*
- *Changes to vegetation structure and composition that result from weed invasion and seral shift.*

Cumberland Plain Land Snail was not recorded during the field investigation, but potential shed bark habitat for this species exists within the Cumberland Plain Woodland (including the Derived Shrubland and Derived Grassland communities) in the study area. This species has been recorded 16 times within the locality, the closest being 755 metres from the study area (OEH 2015a). Cardno are in the process of preparing a rezoning application for a subdivision that proposes 1.38 hectares of Cumberland Plain Woodland (potential habitat for the Cumberland Plain Land Snail) rezoned as *R1 – General residential* and cleared for residential development (Figure 5). 7.95 hectares would be rezoned *E2 – Environmental conservation* and retained within the study area with significant revegetation works to be conducted to conserve this area of potential habitat.

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

A viable local population of the Cumberland Plain Land Snail does not occur in the study area, but based on records from OEH (2015a) may occur in the locality. Although 1.38 hectares of potential breeding, foraging, sheltering and/or dispersal habitat for the Cumberland Plain Land Snail would be rezoned R1 and cleared for residential development, this constitutes only 25 per cent of Cumberland Plain Woodland (including derived communities) occurring in the study area and these patches are small and mostly isolated, ranging from poor to good condition. Larger intact patches of potential habitat (7.95 hectares) will be retained within the study area in the E2 zone and revegetation and restoration works will be conducted by Cardno to limit the spread of weeds and improve the condition of the potential habitat for this species in the study area. Establishment and

maintenance of APZs may result in potential indirect impacts such as increased edge effects, altered fire regime, altered species composition and altered structural integrity which can be avoided or mitigated by following recommendations within Table 8. These impacts are not expected to extend into the patch interior. Based on these points, it is considered unlikely that the Project will have a significant impact on the lifecycle of the Cumberland Plain Land Snail such that it is placed at risk of extinction

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

The TSC Act defines an 'endangered population' as 'an endangered population specified in Part 2 of Schedule 1' of the Act. Cumberland Plain Land Snail is not an endangered population, as defined under the TSC Act.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The TSC Act defines an 'endangered ecological community' as an endangered ecological community specified in Part 3 of Schedule 1' of the Act. Cumberland Plain Land Snail is not an endangered ecological community, as defined under the TSC Act.

In relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality.

The Project will require the removal of 1.38 hectares which makes up approximately 15 per cent of potential habitat recorded in the study area.

Potential habitat to be removed is made up of several small patches that are largely isolated in the study area and are vulnerable to further degradation through increased edge effects. The remaining 7.95 hectares of potential habitat in the study area will be conserved in the E2 zone and its longevity ensured through revegetation and restoration works. Establishment and maintenance of APZs may result in potential indirect impacts, albeit they are limited to patch boundaries, are not expected to impact the patch interior and can be avoided or mitigated by following recommendations within Table 8. These impacts will not further fragment or isolate patches of potential Cumberland Plain Land Snail habitat or extend into the patch interior. Therefore, potential habitat for the Cumberland Plain Land Snail is not likely to become fragmented or isolated from other areas of habitat as a result of the Project.

Although Cumberland Plain Woodland (including derived communities) is one of the few community types in which the Cumberland Plain Land Snail occurs, the potential habitat that would be removed (1.38 hectares) is small, some areas of which are in poor condition and other areas are patchy and isolated. As such, it is not considered an important piece of habitat for this species. Restoration works to be conducted in the larger

patches of potential habitat to be retained in the E2 zone are likely to provide better quality habitat for the Cumberland Plain Land Snail than the areas to be removed, and as such, the Project is not likely to impact the long-term survival of the Cumberland Plain Land Snail in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

To date, no recovery plan for the Cumberland Plain Land Snail has been developed.

OEH (2013) lists a number of practical *Activities to assist this species*, of which the following are relevant to the Project, namely:

- *Preserve remaining pockets of habitat from further urban development.*
- *Controlling weed invasion of habitat is considered an important activity in managing the species at the sites it occupies.*
- *Identify high priority lands for the conservation of the species within the known habitat distribution areas or within high conservation lands.*

This can be ensured by following recommendations provided in this report to minimise disturbance to the retained E2 zone areas of Cumberland Plain Woodland (including derived communities) and reduce the spread of weeds in the study area.

The management objective under the OEH *saving our species* program is not relevant to the Project. Critical actions listed that are relevant to the Project include:

- *Retain large woody debris and other material (stones) on the ground that provides habitat. Ensure it is dispersed across occupied sites to allow movement of individuals.*
- *Manage weed presence, density and diversity at occupied sites, maintaining low density of weeds that are identified as habitat engineers (e.g. dense shrubs) or otherwise strongly affect structure and composition of the Grassy Woodland habitat. Where possible, also manage adjacent source areas for weed seeds and propagules.*
- *Implement 'open structure design' when designing structures such as roads which may isolate patches of habitat. Use of bridges rather than culverts and minimising channelisation of waterways allows migration to occur.*
- *Reduce or exclude slashing from areas that are or may be occupied by snails such as around woody debris and near the trunks of trees to ensure habitat and cover are retained.*

To date, no threat abatement plan relevant to the Cumberland Plain Land Snail has been developed.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key Threatening Processes (KTP) are listed under Schedule 3 of the TSC Act 1995. Clearing of Cumberland Plain Woodland (including derived communities), potential habitat for the Cumberland Plain Land Snail, in the R1 zone would constitute the following KTP:

- *Clearing of native vegetation.*

Given that a small area (1.38 hectares) consisting of mostly isolated patches of potential habitat will be removed, it is unlikely that the operation of this KTP will have a significant impact on the species.

The Project also has the potential to increase the operation of the following KTPs relevant to the Cumberland Plain Land Snail:

- *Invasion, establishment and spread of Lantana Lantana camara.*
- *Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata.*
- *Invasion of native plant communities by exotic perennial grasses.*
- *Invasion and establishment of exotic vines and scramblers.*
- *Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants*

Recommendations have been made to limit the spread of weeds (including noxious weeds) in the study area and conduct revegetation and restoration works in retained E2 areas of potential habitat. With these actions and based on the current weed dominance it is unlikely that the Project will exacerbate these KTPs such that there is a significant impact to the Cumberland Plain Land Snail.

Conclusion

In light of the consideration of the above seven factors, it is unlikely that the Project will impose a significant impact on the Cumberland Plain Land Snail or its habitat as:

- The Project will not adversely affect the lifecycle of the species such that its local occurrence is placed at risk of extinction.
- The Project will not further fragment or isolate habitat for the species or affect its long term survival in the study area or in the locality.
- The Project is not likely to adversely affect the recovery of the species.
- The Project will not significantly contribute to any KTP that is either currently in operation within the study area or that has the potential to come into operation.

Consequently, given that a significant impact on the Cumberland Plain Land Snail is not likely, a Species Impact Statement is not required for the Project.

Appendix 5 Significant Impact Criteria assessments

The following section provides for Significant Impact Criteria in accordance with *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DoE 2013) for all species listed as a medium likelihood or greater in Appendix 2 and Appendix 3.

Cumberland Plain Woodland

This assessment has determined that the vegetation within the study area is consistent with *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest*, an EPBC Act CEEC as described by the Threatened Species Scientific Committee (TSSC 2008a). The nationally-listed ecological community groups two separately listed state ecological communities on the basis of similarities in their vegetation (DEWHA 2010). *Cumberland Plain Shale Woodland* is equivalent to *Cumberland Plain Woodland in the Sydney Basin Bioregion* (TSC Act listed name) and is hereon referred to as Cumberland Plain Woodland.

Cumberland Plain Woodland occurs in the driest parts of the Cumberland Plain, typically on flat to undulating terrain on heavy clay soils derived from Wianamatta Shale (DEWHA 2010). In Western Sydney, Cumberland Plain Woodland historically covered an extensive area of the Cumberland Plain, but has since European settlement been degraded and removed. Today, only 9 percent of the original extent remains (OEH 2014b), often occurring in small patches with limited connectivity to other extant remnant vegetation.

Cardno are in the process of preparing a rezoning application for a subdivision that will proposes 0.89 hectares of Cumberland Plain Woodland rezoned as *R1 – General residential* and cleared for residential development (Figure 5). 7.95 hectares would be rezoned *E2 – Environmental conservation* and retained within the study area with significant revegetation works to be conducted to promote the survival of this community.

Is there a real chance or a possibility that the action will reduce the extent of an ecological community?

0.89 hectares of Cumberland Plain Woodland would be cleared for residential development in the R1 zone. This constitutes 10 per cent of this CEEC within the study area. The vegetation to be cleared consists of several small patches, which are largely isolated in the study area and are vulnerable to further degradation through increased edge effects.

Larger, more intact patches of Cumberland Plain Woodland (7.95 hectares) will be retained and preserved as E2 in the study area. Establishment and maintenance of APZs may result in potential indirect impacts such as increased edge effects, altered fire regime, altered species composition and altered structural integrity which can be avoided or mitigated by following recommendations within Table 8. These impacts are not expected to extend into the patch interior and will not reduce the extent of Cumberland Plain Woodland retained within the study area. These patches will also be subject to revegetation and restoration works to be conducted by Cardno.

Is there a real chance or a possibility that the action will fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?

The small patches of Cumberland Plain Woodland to be removed are currently isolated or occur on the fringe of larger patches. The surrounding area is heavily modified consisting mostly of cleared agricultural land and residential housing. Overall there is poor to no connectivity with low condition patches of Cumberland Plain Woodland in the broader landscape. Therefore the action is not likely to increase fragment of this ecological community.

Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of an ecological community?

The Cumberland Plain Woodland to be removed (0.89 hectares) within the study area is not considered to be critical to the survival of the CEEC because it is very small and a much larger area will be retained within the study area. Establishment and maintenance of APZs may result in potential indirect impacts which can be avoided or mitigated by following recommendations within Table 8. These impacts are not expected to affect habitat critical to the survival of Cumberland Plain Woodland retained in the study area. Additionally the

revegetation and restoration works to be carried out by Cardno will preserve and improve the most resilient parts of Cumberland Plain Woodland in the study area. Therefore the Project is considered unlikely to adversely affect habitat critical to the survival of this ecological community.

Is there a real chance or a possibility that the action will modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?

The clearing of Cumberland Plain Woodland is not expected to modify or destroy abiotic factors necessary for the survival of this community as long as the recommendations made to install sediment and erosion controls are carried out.

Is there a real chance or a possibility that the action will cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?

Cumberland Plain Woodland provides important habitat for threatened flora and fauna species, including the Cumberland Plain Land Snail and Spiked Rice-flower. However the area to be removed (0.89 hectares) is small and largely isolated from large intact patches in the landscape. Establishment and maintenance of APZs may result in potential indirect impacts such as increased edge effects, altered fire regime, altered species composition and altered structural integrity which will be limited to patch boundaries only and can be avoided or mitigated by following recommendations within Table 8. Therefore, the Project is not likely to cause a substantial change in the species composition of the Cumberland Plain Woodland in the locality.

Is there a real chance or a possibility that the action will cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

– assisting invasive species, that are harmful to the listed ecological community, to become established, or

– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?

Several exotic species are already well-established in the study area, and based on the current weed dominance, the Project is not expected to cause a substantial reduction in the quality or integrity of this ecological community by assisting invasive species to become established or causing regular mobilisation of chemicals or pollutants. Recommendations have been made to use manual control over chemical when conducting weed removal and reduce the amount of herbicides used in the study area.

Is there a real chance or a possibility that the action will interfere with the recovery of an ecological community?

The Project is consistent with the Conservation Advice for this CEEC (TSSC 2008b), and it is recommended efforts are made to address these priority actions:

- *Develop and implement best practice standards for management of remnants on private and public lands.*
- *Manage any changes to hydrology that may result in changes to water table levels. In addition, develop and implement urban stormwater management guidelines that address risks of urban run-off to the ecological community.*
- *Ensure chemicals or other mechanisms used to manage weeds do not have a significant adverse impact on Cumberland Plain Woodland.*

- *Manage sites to prevent introduction or further spread of invasive weeds, which become a threat to the Cumberland Plain Woodland, using appropriate methods.*
- *Raise awareness of the Cumberland Plain Woodland ecological community within the local community e.g. through active Conservation Management Networks, Landcare groups and other groups.*
- *Investigate options to maintain and improve connectivity of remnants, including the protection of paddock trees and replanting of key canopy tree species in derived grasslands and shrublands, where possible.*

Cumberland Plain Woodland is included in the Cumberland Plain Recovery Plan which was developed by DECCW (2010). The recovery objectives are as follows:

- *To build a protected area network, comprising public and private lands, focused on the priority conservation lands.*
- *To deliver best practice management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatible with biodiversity conservation.*
- *To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the recovery program.*
- *To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner.*

The study area is not located within the priority conservation lands identified within the recovery plan. Considering the condition, small patch size and presence of larger, higher quality remnants that will be retained in the study area, the proposal will not interfere with a recovery actions set out within DECCW (2010). Some of the above objectives can be met through revegetation and restoration works to be conducted by Cardno in the areas of Cumberland Plain Woodland to be retained under E2. The Project is therefore considered unlikely to interfere with the recovery of this ecological community.

Several management objectives are listed under the OEH *saving our species* program. Those listed for Cumberland Plain Woodland that are relevant to the Project include:

- *Support and promote the adoption of best practice standards for bushland management and restoration (as specified in Appendix 2 of the Cumberland Plain Recovery Plan) on public and private lands within the Cumberland Plain.*

The Project is consistent with this recovery action.

Conclusion

Based on the above assessment Cumberland Plain Woodland is not likely to be significantly impacted by the Project for the following reasons:

- The Project will not significantly reduce the extent of Cumberland Plain Woodland (only 0.89 hectares is required to be removed).
- The Project will not significantly further fragment or isolate a patch of Cumberland Plain Woodland.

- The Project is considered unlikely to introduce weeds or pathogens or modify the composition of the existing Cumberland Plain Woodland.
- The Project is considered unlikely to interfere with the recovery of Cumberland Plain Woodland at a local or regional level.

As such, a Referral under the provisions of the EPBC Act is not recommended for this community.

Spiked Rice-flower *Pimelea spicata*

Spiked Rice-flower *Pimelea spicata* is listed as Endangered on the EPBC Act.

Spiked Rice-flower was not recorded during the field investigation, but potential habitat for this species exists within the Cumberland Plain Woodland in the study area. This species has been recorded 449 times within the locality, the closest being 1.28 kilometres from the study area (OEH 2015a). Cardno are in the process of preparing a rezoning application for a subdivision that proposes 0.89 hectares of Cumberland Plain Woodland (potential habitat for the Spiked Rice-flower) rezoned as *R1 – General residential* and cleared for residential development (Figure 5). 7.95 hectares would be rezoned *E2 – Environmental conservation* and retained within the study area with significant revegetation works to be conducted to conserve this area of potential habitat.

Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of a population?

Spiked Rice-flower has been recorded at closest 1.28 kilometres from the study area (OEH 2015a), but was not recorded in the study area during the field investigation. Therefore, the Project is considered unlikely to lead to a long-term decrease in the size of a population of the Spiked Rice-flower.

Is there a real chance or a possibility that the action will reduce the area of occupancy of the species?

Spiked Rice-flower was not recorded in the study area during the field investigation, and therefore the Project is not expected to reduce the area of occupancy of the Spiked Rice-flower.

Is there a real chance or a possibility that the action will fragment an existing population into two or more populations?

Spiked Rice-flower was not recorded in the study area during the field investigation, and therefore the Project is not expected to fragment an existing population into two or more populations.

Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?

Potential habitat to be removed (0.89 hectares) from the study area is not considered to be critical to the survival of the Spiked Rice-flower because it is small, patchy and mostly isolated, and a much larger area (7.95 hectares) will be retained in the E2 zone and conserved through revegetation and restoration works. Establishment and maintenance of APZs may result in potential indirect impacts such as increased edge effects, altered fire regime, altered species composition and altered structural integrity which are limited to the patch boundaries only and can be avoided or mitigated by following recommendations within Table 8. Therefore the Project is considered unlikely to adversely affect habitat critical to the survival of the Spiked Rice-flower.

Is there a real chance or a possibility that the action will disrupt the breeding cycle of a population?

Spiked Rice-flower was not recorded in the study area during the field investigation, and therefore the Project is not expected to disrupt the breeding cycle of a population of the Spiked Rice-flower.

Is there a real chance or a possibility that the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Potential habitat for the Spiked Rice-flower that is being removed (0.89 hectares) from the study area is small and while it is considered to be in moderate to good condition, due to its patchy and isolated nature it is not considered an important piece of habitat for this species. Larger, more intact areas (7.95 hectares) of

potential habitat will be retained within the study area and conserved in the E2 zone. Establishment and maintenance of APZs may result in potential indirect impacts which are limited to patch boundaries only and will not result in destruction, removal, isolation or high levels of modification to Spiked Rice-flower habitat within the study area.

With the recommended weed removal and ecological restoration works to be conducted in the retained patches, this conserved area is likely to provide better quality habitat for the Spiked Rice-flower than the areas to be removed. Therefore, potential habitat in the study area is not expected to be modified or decreased in availability or quality to the extent that the Spiked Rice-flower is likely to decline.

Is there a real chance or a possibility that the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

As long as the recommended actions regarding weed control and restoration are carried out, based on the current weed dominance it is unlikely that the Project will result in invasive species that are harmful to the Spiked Rice-flower becoming established in its potential habitat any more than actions that already occur in the area (such as seed dispersal through natural means, vehicles, people and animals) currently do.

Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?

Pathogens known to affect native plant species such as *Phytophthora* were not observed in the study area during the current survey and it is unlikely that the Project will introduce diseases that may cause the Spiked Rice-flower to decline. Nonetheless, recommendations have been made to minimise soil transportation within, into or out of the study area to reduce the spread of weeds and introduction of pathogens within the study area.

Is there a real chance or a possibility that the action will interfere with the recovery of the species?

A recovery plan for the Spiked Rice-flower has been developed (DEC 2005) and includes several recovery objectives, of which two are relevant to the Project.

- *Provide the community with information that assists in conserving the species.*
- *Raise awareness of the species and involve the community in the recovery program.*

Spiked Rice-flower was not recorded in the study area during the field investigation and the Project is not expected to interfere with the recovery of the species.

Conclusion

Based on the above assessment the Spiked Rice-flower is not likely to be significantly impacted by the Project and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

- The Project will only reduce the extent of potential habitat for the Spiked Rice-flower by a small amount.
- The Project will not further fragment or isolate the patch of Spiked Rice-flower, or its habitat.
- The Project is considered unlikely to introduce exotic species that will deteriorate habitat for Spiked Rice-flower.

- The Project is considered unlikely to interfere with the recovery of Spiked Rice-flower at a local or regional level.

As such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Manooka Valley Stage 3, Lot 627 DP 1163903

APPENDIX I

VISUAL IMPACT ASSESSMENT

Cardno
Shaping the Future

Visual Impact Assessment (VIA) Manooka Valley

Lot 622 DP 11 63903 Planning proposal to amend Camden Local Environmental Plan 2010

Prepared for Wolin Investments and Landco Pty Ltd

Feburary 2017

Cardno
Shaping the Future

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0	00/00/00	Insert description	Initials		Initials	

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Shaping the Future

Contents

1) INTRODUCTION

1.1 Project Description

Cardno (NSW/ACT) Pty Ltd has been commissioned by Wolin Investments and Landco Pty Ltd to prepare a Visual Impact Assessment (VIA) to accompany a Planning Proposal at Lot 627 DP 1163903, Manooka Valley in Currans Hill to rezone the Site from:

- E2 – Environmental Conservation zone;
- E4 – Environmental Living zone; and
- RU2 – Rural Landscape.

To the following landuse zones:

- E2 – Environmental Conservation zone; and
- R1 –General Residential.

This VIA has been carried out via the following process:

- Assessment of the visual character and quality of the local area, including a review of relevant planning constraints
- Identification of the visual catchment (view shed) of the proposed development
- Identification of critical view points within the visual catchment
- Assessment of the likely impact of the proposal on the quality of views from each of the identified critical viewpoints and recommendations for measures to address any identified impacts.

1.2 Methodology

The methodology for the VIA involves the following process:

- Review of background planning controls and policies of relevance to the visual quality of the area.
- Use of Geographical Information Systems (GIS) datasets and aerial photography to generate a visual catchment map identifying the areas within the locality that would potentially have views of the subject land.
- Identification of key or critical viewing points within the identified visual catchment and assessment of the sensitivity of these viewing points to changes in the landscape using aerial photography, Site visits and on Site photography;
- Development of indicative images to provide an impression of the likely changes to the visual environment resulting from the proposed development; and
- Conclusions and recommendations for mitigation of impacts.

2) SITE AND SURROUNDS

2.1 Site Location

The subject Site (the Site) is located at 207B Turner Road, Currans Hill, and covers an area of approximately 34.15 ha (DP&E). The Site has a legal description of Lot 627 Deposited Plan 1163903. The suburb of Currans Hill is located approximately 60 km South-West of the Sydney CBD, 44 km from the Parramatta CBD, 42 km from Penrith, 26 km from Liverpool, 20 km South of the Site of the proposed Western Sydney Airport at Badgerys Creek, and 6 km North-West of Campbelltown City.

2.2 Physical Description of the Site and Locality

The Site adjoins the Eastern suburban fringe of low-density residential development at Currans Hill. This area typically comprises one and two storey detached dwellings and two storey townhouses. To the North of the Site is low density residential development identified as Gregory Hills, currently under construction. To the North West of the Site is St. Gregory's College, Campbelltown. To the East of the Site is open plains, identified, as the area of Blairmont and to the South of the Site, Mount Annan Christian College, Currans Hill. Low-density suburban residential homes, educational uses and open plains surround the area.

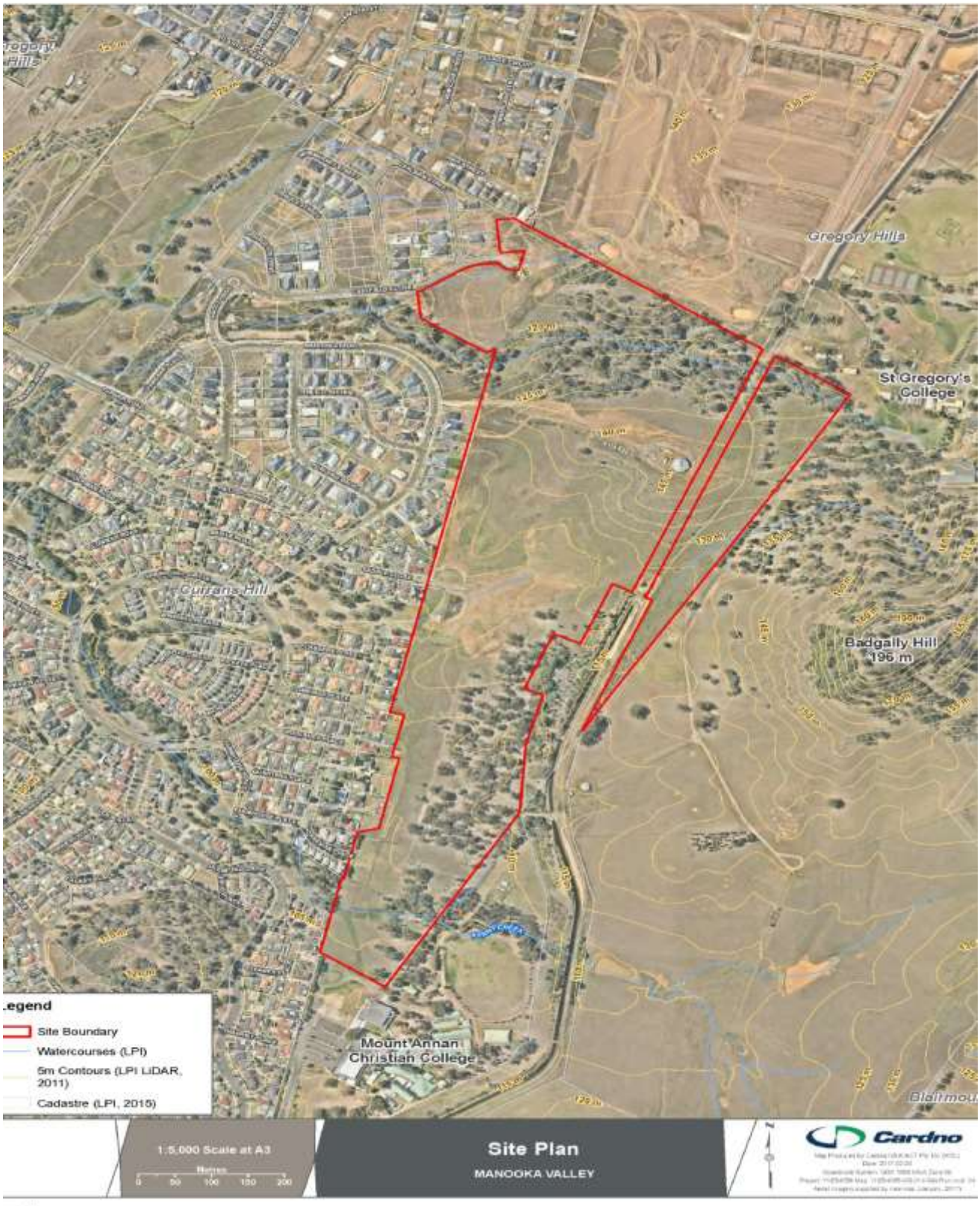
The Site can only be accessed from Currans Hill. There is no access from the North, being Gregory Hills or the East being the Blairmont area. At a regional level, access is typically via the Hume Motorway and Narellan Road. Local buses service the area.

In terms of visual character , the Site comprises a small Hill which lies at the Northern end of the lot. This Hill currently accommodates a Sydney Water Reservoir. For the most part, the land gently rises from a low point of 105 metres above sea level at the South of the Site to a high point of 145 metres at the North of the Site. The Site comprises open plains, which had previously been used for agricultural purposes that is cattle grazing. The Site also contains two ephemeral creeks, one unnamed creek in the North-East and the other, Kenny Creek to the South West of the study area. The Site also contains Cumberland Plan Woodlands located to the North and East of the Site.

Currently, the Site contains no physical development. Refer to Site Plan in Figure 1 overleaf. Figure 2 identifies the key visual features of the Site and Figure 3 highlights the topography of the Site and surrounding area.

The Site is situated on gentle undulating terrain with ground surface sloping down in a general direction to the South. Ground surface within the site generally slopes at angles of about 3 to 4 degrees. (From Jan 2015 Geotech Report)

2) SITE AND SURROUNDS



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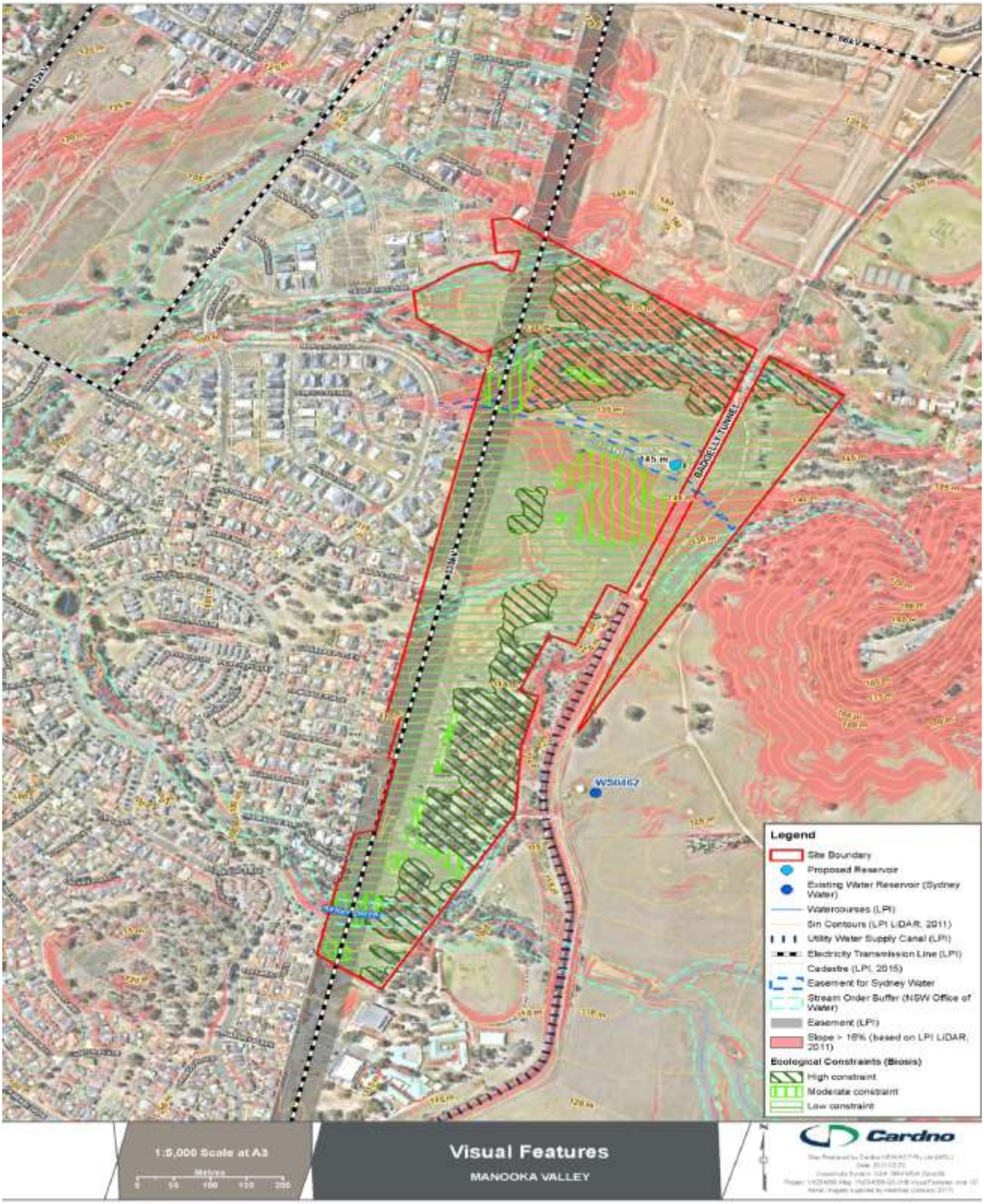
Attachment 3

2) SITE AND SURROUNDS



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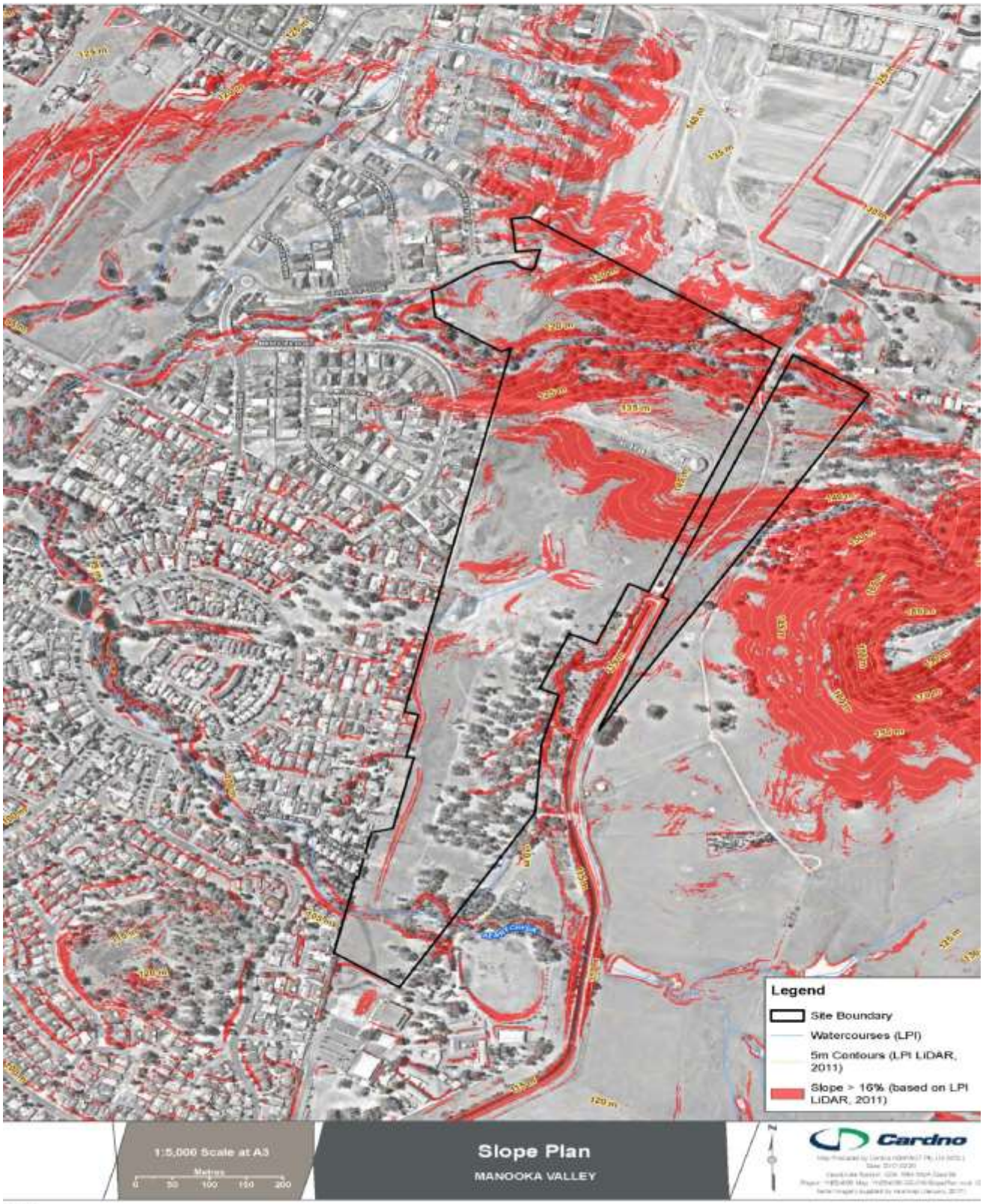
2) SITE AND SURROUNDS



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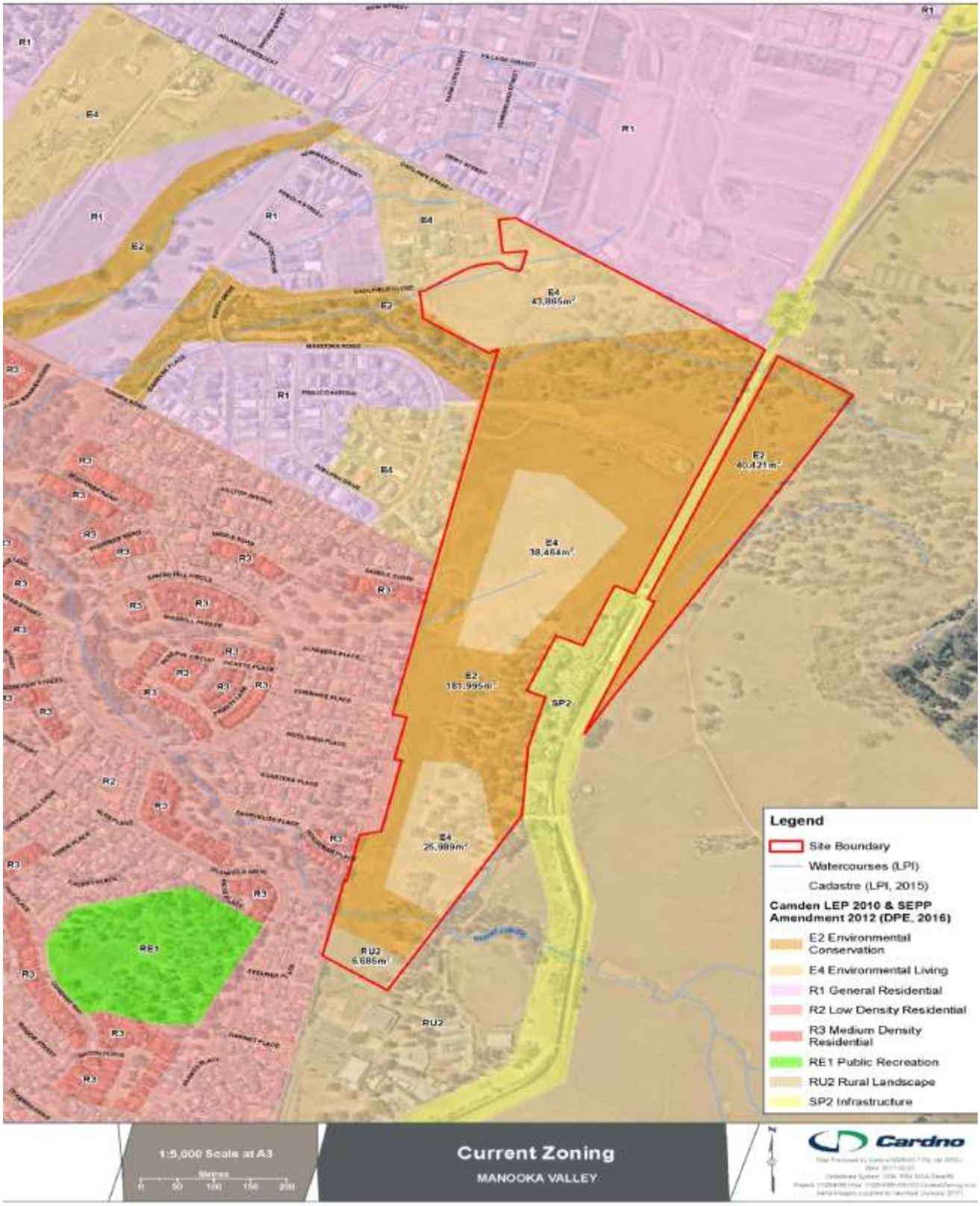
3) VISUAL PLANNING CONTEXT

The visual planning context is determined by the existing and proposed land uses, and policy documents, which provide guidance on the existing and future character of the Site. A review of zoning information within Camden and Campbelltown Local Government areas identifies that the Site is surrounded by a mix of residential land zones being R1 – General Residential, R2 – Low Density Residential and R3 – Medium Density Residential located to the West and North of the Site. To the South and East of the Site, the primary zoning is RU2 – Rural Landscape. The Site is located at the interface of Camden and Campbelltown Local government areas and the identified zonings reference both Council areas.

3.1 Zoning Information

Figure 4 identifies the existing zones for the Site. It should be noted that the existing zoning acknowledges the use of portions of the Site for residential purposes by providing for "Environmental Living" therefore the use of the Site for residential purposes has been established, the remainder of the Site is currently identified for use as areas of environmental protection.

3) VISUAL PLANNING CONTEXT



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3) PLANNING CONTEXT

3.2 Manooka Valley Plan of Management

In 2003, a Plan of Management (PoM) was prepared by Conacher Travers, for the Manooka Valley Release Area Currans Hill, which includes the Site. This is the most recent policy document from Camden Council, which references the landscape and visual quality of the area. Although the document is outdated, the objectives of the PoM are acknowledged and addressed. The stated aim of the PoM is *"to protect, restore and enhance the native vegetation and habitat, specifically targeting the protection of the endangered ecological communities Cumberland Plain Woodland and Sydney Coastal River Flat Forest"*. The document notes that the existence of remnant bushland located in Manooka Valley is of environmental importance to the area based on the value that it provides. These values have been identified as including, natural heritage values, nature conservation values, recreational values, and rich scenic values. The PoM developed three Environmental Protection Zones as a mechanism to manage the area. The plan acknowledges residential land use in Manooka Valley and identifies the issue of bushfire management, weeding and ecologically significant areas as being of key importance. All these issues are addressed in detail in the Planning Proposal. The Objectives are addressed below.

Conacher Travers Plans of Management Identified Objectives	Demonstrated compliance with Objectives.
Achieves an ecologically sustainable use and management of the Environmental Protection Zones.	The Site has been fully investigated by independent ecologists, Biosis who conducted a Flora and Fauna Assessment of the Site. The recommendations of the Biosis study have been incorporated into the proposed zoning of the Site and a copy of the Report is enclosed with the Planning Proposal.
Conserve and regenerate native vegetation.	All vegetation of ecological value has been retained as per the Recommendations of the Biosis Flora and Fauna Report.
Establish a buffer from adjoining land uses that could potentially cause adverse environmental impacts.	To the North and East, there is established vegetation, which is to be retained and provides a buffer. To the South, there is open space and to the West, there is a 60m electrical transmission easement.
Protect habitat for Cumberland Plain Woodland.	The Cumberland Plain Woodlands are retained as per the Recommendations of the Biosis Flora and Fauna Report.
Prevent soil erosion in the middle catchment areas of the Environmental Protection Zones.	Soil erosion is currently being managed and will continue to be managed.
Exclude water pollution from entering the Environmental Protection Zones from the adjoining urban development.	The areas of environmental sensitivity on the Site are currently managed and will continue to be managed in accordance with the regulatory regime.
Manage the Environmental Protection Zones to reduce the bushfire threat to the built environment.	Travers Bushfire and Ecology have prepared a Bushfire Assessment Report and a buffer zone is provided surrounding the environmentally sensitive areas.
Maintain the aesthetic quality of the area. The current zoning of the site encourages a transitional zone between suburban Currans Hill and pastoral lands to the East. The proposal maintains that transitional function through protection of its open and forested character and containment of residential development to narrow, generally low lying lands within a semi -rural context.	The aesthetic quality of the area is maintained by ensuring that areas of topographical interest, streams and environmentally sensitive areas are retained. In addition, the electrical transmission easement provides a 60m open space area, which is similarly retained.
Provide opportunities for scenic research and monitoring.	Opportunities for research and monitoring are unchanged..

3) PLANNING CONTEXT

3.3 Scenic Hills (Badgally Road to Narellan Road)

Campbelltown Council has produced a document entitled, *"The Visual Analysis of Campbelltown's Scenic Hills and East Edge Scenic Protection Lands (Badgally Road to Narellan Road), October 2011 Section 4.3 "Scenic Hills – Landscape Unit 3"*. This section of the Report identifies the visual landscape that is immediately East of the Site.

The "Scenic Hills" comprise a number of Hills connected by ridgelines, which are considered to have a unique visual and landscape quality. The portion of the scenic Hills that is most relevant extends from Badgally Road to the North in Campbelltown Local Government Area to Narellan Road to the South in Camden Local Government Area, bordered by the Hume Highway to the East. The three most visually pronounced and significant Hills located within the landscape include Badgally Hill at 196m in height, Kenny Hill at 160m and an unnamed Hill located between them at 150m.

The "Scenic Hills" and connecting ridges play an important role in providing high quality rural views for the community of Camden. Badgally and Kenny Hills provide valuable panoramic views that extend to Mount Annan to the South, to Mount Universe to the North, from the valley floor to the Georges River Plateau and beyond. Views are accessible from several locations throughout Camden toward Badgally and Kenny Hills providing outstanding intrinsic aesthetic quality. The "Scenic Hills" are visible from the Site. The Hill from which it would be possible to view the Site is Badgally Hill, however there is restricted access as it is surrounded by private land.

The landscape associated with the "Scenic Hills" has a strong pastoral character and includes working dairy farms, which demonstrates the historic rural activities that characterise this area. The distinctive rural profile and spatial arrangements are expressed through vegetated open slopes and overlapping ridges that dominate the character of the Scenic Hills. The land containing the Scenic Hills is zoned E3 – Environmental Management under the *Campbelltown Local Environmental Plan*. It has been left relatively undeveloped with the exception of a limited number of traditional and modest dwellings that sympathise with the rural surrounds as is demonstrated in the Blairmont area. The location of the ridgeline to the East of the Site effectively ensures that views of the scenic Hills will remain unaffected by the proposed development of the Site. The proposed development has considered the environmental, cultural and historic value of the "Scenic Hills" by preserving views for the continued enjoyment and enrichment of the community.

The proposed development of Manooka Valley will protect rather than encroach on the existing view to Badgally Hill and does not impact on any other Hills or ridgelines. Therefore, the character and visual quality of the "Scenic Hills" is preserved.

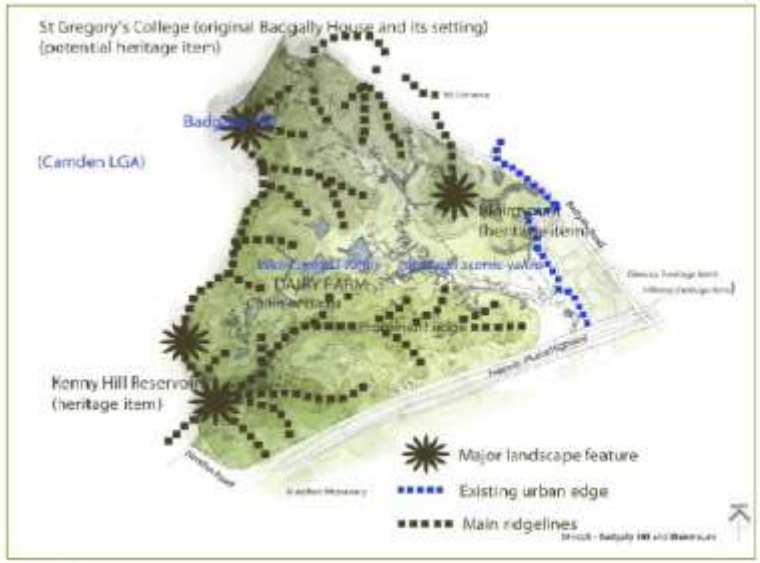


Figure 5

3) PLANNING CONTEXT

3.4 Draft South West District Plan

The Draft South West District Plan, was released by the Greater Sydney Commission in October 2016. The plan acknowledges that the social and economic milieu has changed (specifically since the 2013, Plan of Management was developed) and that the South West region now faces a critical shortage of housing. Given this, the SW District Plan outlines strategies to meet the local housing targets for both 5 and 20 year timeframes. It also identifies a need for Councils to determine additional capacity to accommodate housing and provide incentives to deliver a number of housing options including larger group homes, smaller homes for singles, the elderly, disabled, couples without children, intergenerational homes and medium density housing options. The overarching intention of the Plan is to provide greater housing choice to meet the changing socio-economic and demographic needs of the growing community.

The document notes that to increase housing supply and choice, Councils are required to implement a list of actions. Specifically, Camden Council are to:

> "Monitor the delivery of Camden's five-year housing target of 11,800 dwellings. (Growth areas have been identified in Oran Park, Gregory Hills, Catherine Hills and other Greenfield areas).
>
> Continue to work on the South West Priority Growth Area with adjoining council's and the Department to create housing strategies.
> Should the need for additional housing capacity be identified, investigate opportunities for additional housing capacity. "

The Five year housing target for Camden is 11,800 dwellings, which is proposed to be delivered in the areas below:

> Elderslie
> Harrington Grove
> Manooka Valley
> Spring Farm
> Camden Park

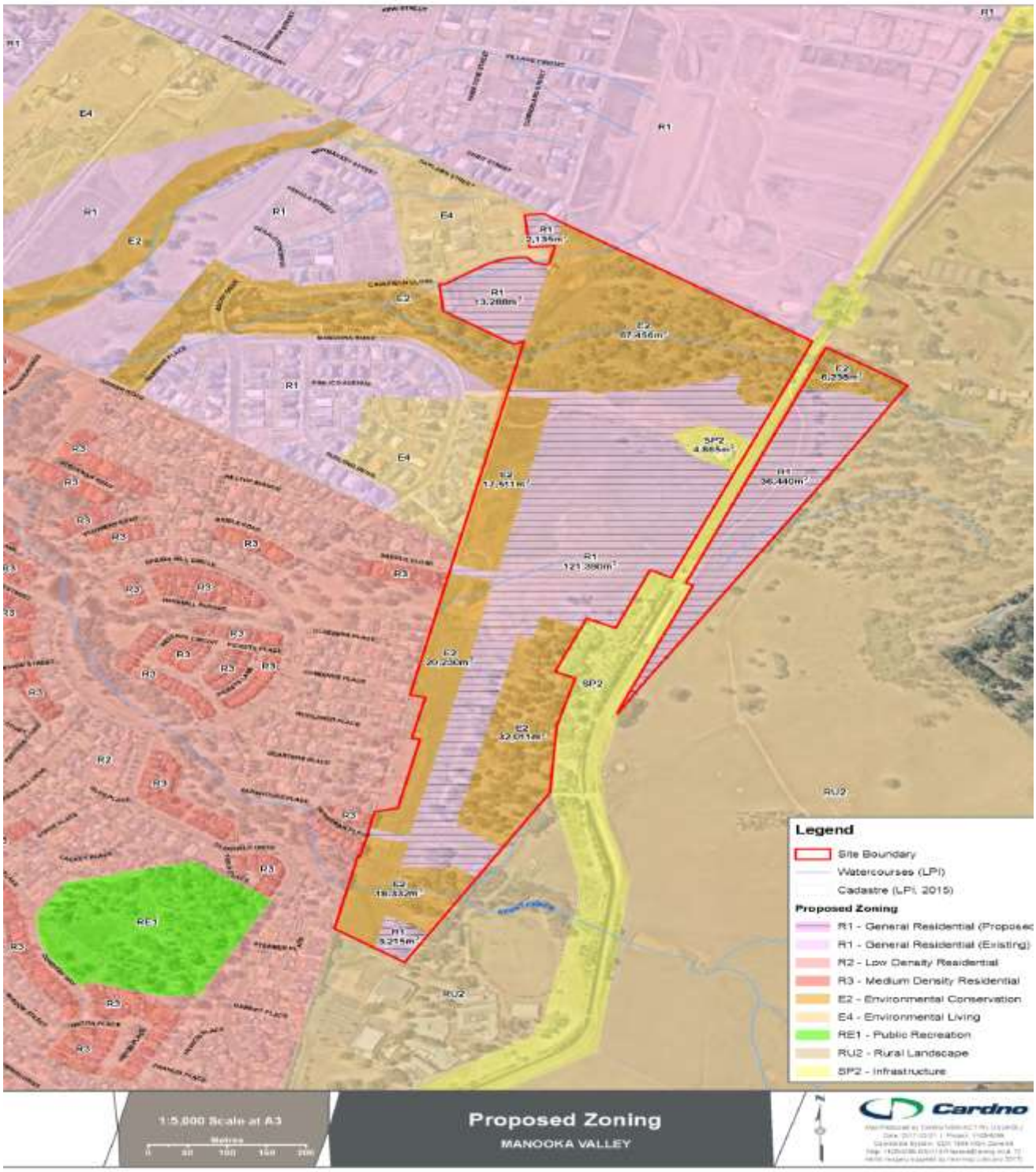
It is noted that increasing new housing in these areas will assist in delivering the minimum 20-year strategic housing target (Pg 103). The document also notes that Councils are to be proactive in providing housing choice and affordable housing.

The key issue is that there is an acknowledgement that there is a need for more housing in the area. Within this context, the purpose of this VIA is to determine whether additional housing can be provided on the subject land with an acceptable impact on the identified visual qualities of the locality.

The visual planning context is informed by the current character of the area which is characterised by a combination of suburban and rural /pastural visual quality, and the visual features of the Site. The ecological values of the area are acknowledged and carried through into the proposed land use layout. Refer to Figure 6 below.

4) THE PROPOSAL

Planning Proposal is intended to amend the land use of the Site to include Environmental Protection and R1 – General Residential zones as onstrated on this map.



gure 6

ORD05

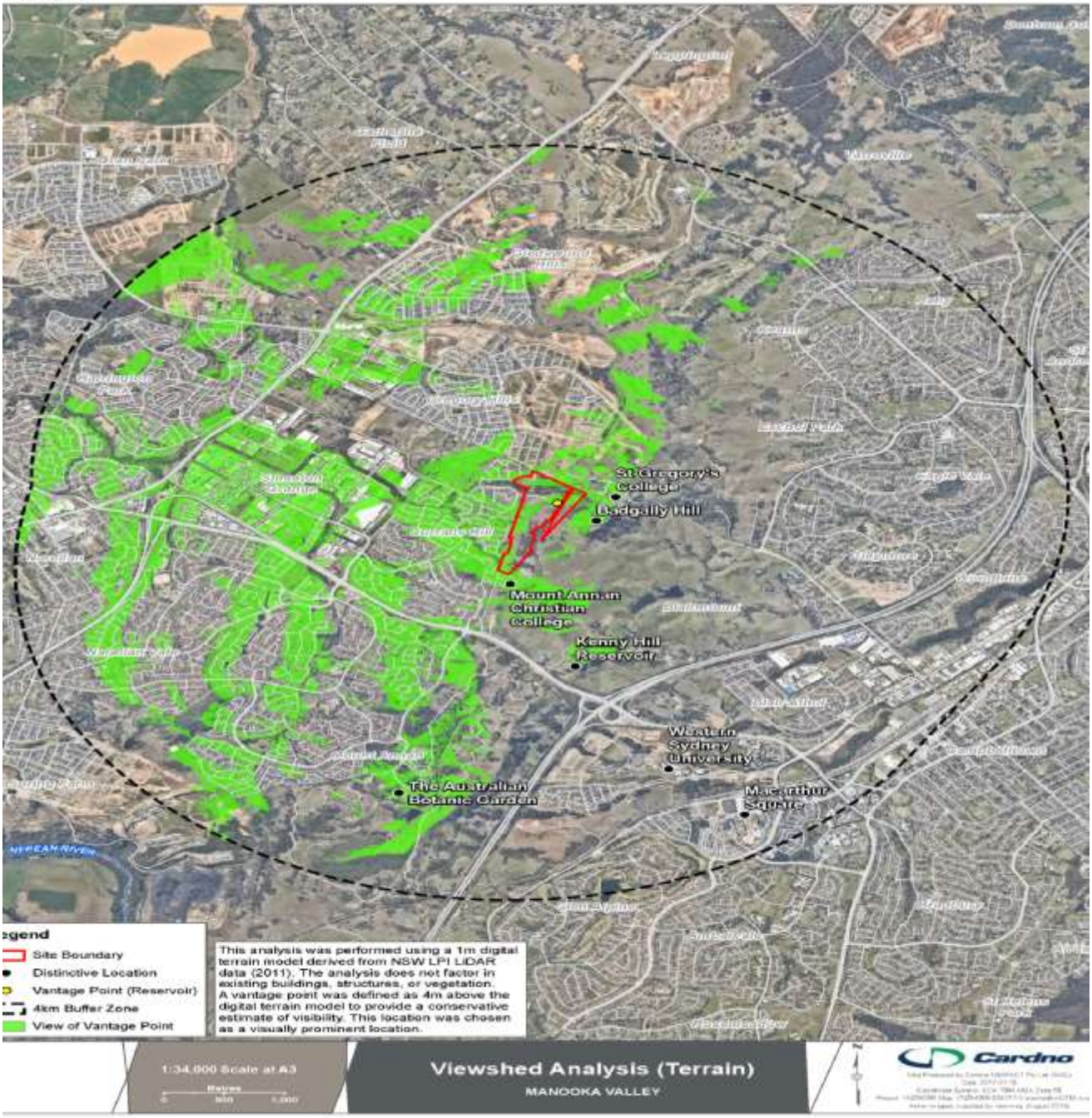
Attachment 3

5) VISUAL ASSESSMENT

Visual Catchment of the Proposed Development

/isual catchment of the proposed development is reviewed in terms of a 4 km radius from the Site. In accordance with conventions a 4km is is nominated as views are generally considered to be not discernible at distances greater than 4kms.

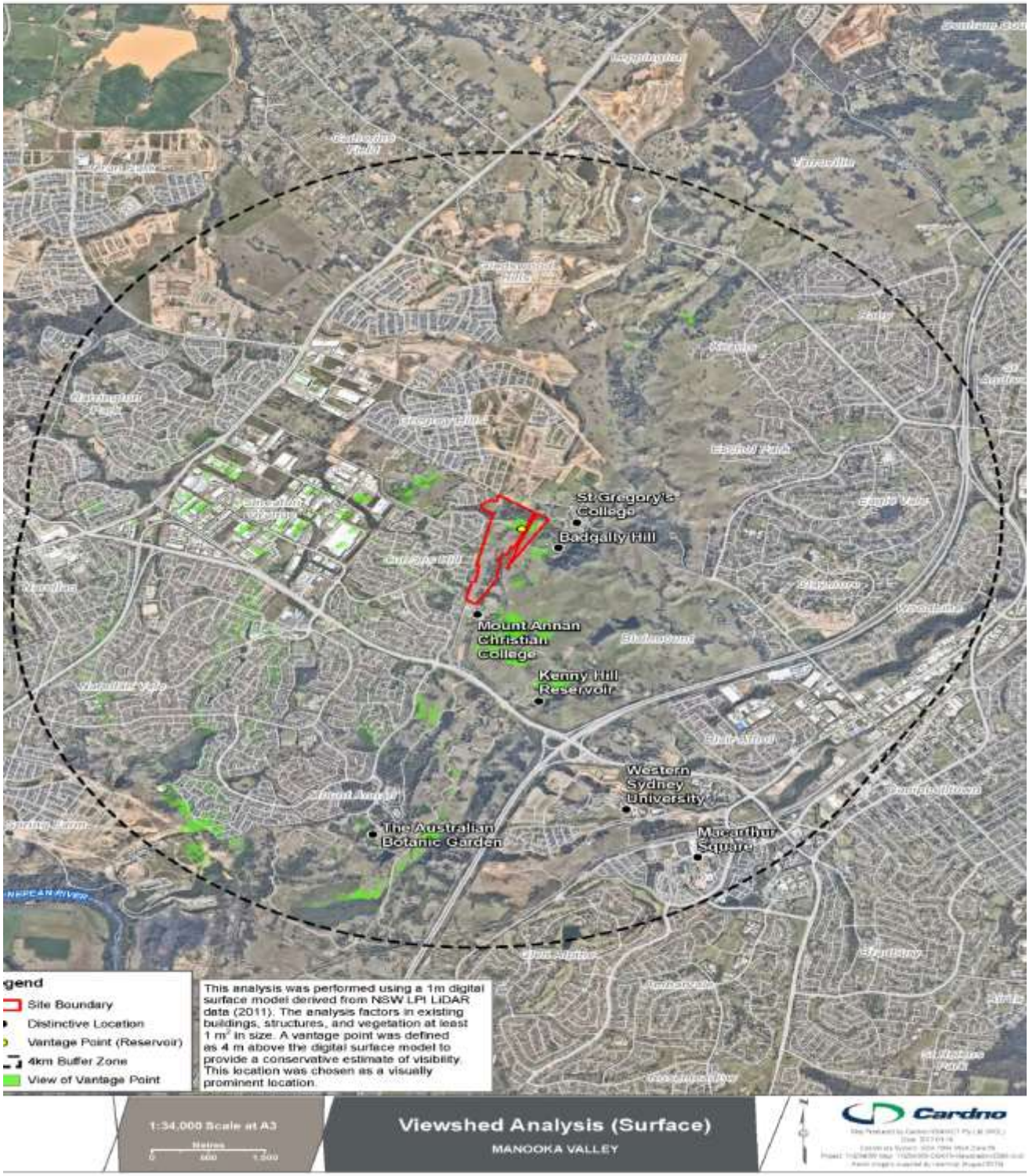
e 7: 4k Catchment Viewshed Analysis area. The areas identified as green are areas that are topographically 4m above the terrain model. that it does not include existing buildings, structures or vegetation. This Viewshed Analysis effectively identifies the topography within the nment area.



ure 7

5) VISUAL ASSESSMENT

e 8: is a more realistic assessment of the impact of the proposed develoment as it includes buildings, trees etc. There is a noticeable shift ibility with a greatly reduced viewshed.



ure 8

5) VISUAL ASSESSMENT

Following is a defined analysis of the visual character and visibility of the site and its locality presented with the aid of a photographic survey.

5.2 Views towards the Site

To the North of the Site is the suburb of Gregory Hills and St. Gregory's High School, neither of which are able to view the Site. Gregory Hills ranges from 125m to 140m ASL which is lower that the average gradient of the Site. It also screened by dense vegetation, which ensures that there are no views to the Site.

The suburb of Currans Hill in the West ranges in ground levels 105m to 125m, which is similar to the levels within the majority of the Site. Generally, views from Currans Hill towards the Site are obscured by dwellings and rooftops. It is however possible to view Badgally Hill at 195m ASL, on approach of the Site. This is considered an important view. Further East is the industrial estate of Smeaton Grange. It is possible to view Badgally Hill in the distance from this location, although the proposed development of the Site will not be visible given that it is at a lower height than Smeaton Grange and that the industrial area is planted with street trees, which provide a visual canopy obscuring any view of the proposed development.

Views from the South towards the site are restricted by the adjacent location of Mount Annan Christian College and Narellan Road. The school completely screens the Site as it is set out within a campus parklands location and it is not possible to view the Site from the Narellan Drive or from the front of the school. It is only possible to view the Site from the rear of the school Site. The school is a private school and only teachers and students of the school will be able to view the Site if they drive to the rear of the school. Similarly, the Site is not visible further South as it is screened by vegetation. The Site is not visible from The Australian Botanic Gardens, which is located approximately 3.3m from the Site.
The Site is not generally visible from the East as it is screened by Badgally Hill and associated ridge lines.

5.3 Views from the Site

From the far North of the Site at the Sydney Water Reservoir the views are obscured by dense vegetation. It is possible to gain glimpses of the residential suburb of Gregory Hills, however they are very much obscured by the existing vegetation. There are no views to St. Gregory's School Hills as it is located below the ridge line.

From the Site towards Currans Hills in the West, the only views are the rear of existing residential dwellings. If located at the Sydney Water Reservoir Site it is possible to view the roof tops across Currans Hill, and the street trees of Smeaton Grange. The suburb of Currans Hill ranges in ground levels 105m to 125m, which is similar to the levels within the majority of the Site. There are no outstanding topographic or visual features in this direction. Views are typically of residential premises including rooftops and trees. Smeaton Grange the industrial area is visible in the far distance if viewed from the Hill.

From the South of the Site the only view is towards the rear of St. Annan's Christian College.

The outstanding topographic feature of Badgally Hill located at 195m screens the East of the Site. This Hill is visible from the Site and provides the Western backdrop to the Site. The Hill is a natural feature, which is undeveloped. To the far South of the Site is Kenny Hill at 160m in extent and between the two is an unnamed Hill at 150m Between the Hills the area typified by pastoral lands identified as the Blairmont area. To the Far East is the Hume Highway and Campbelltown City Council/City Centre. Refer to photographs in Section 4.3.

5.4 Photographs of the Site

5.4.1 Photographs toward the site

Refer to the following pages.

Views towards the Site

Site Photo 1

View from the rear of St Annan Christian College towards the site. This view clearly identifies the natural slope of the Site. To the West is the rear of yards of existing dwellings and to the East of the image are the Cumberland Woodlands, which are to be retained. In addition, the 60m easement is visible which creates an open space and connection North South along the Site.

Site Photo 2

View from the rear of St Annan Christian College towards the site. This view is slightly closer than View No. 6 and clearly identifies the natural slope of the Site with a small hill to the north. To the West is the rear of yards of existing dwellings and to the East of the image is Cumberland Woodlands. This image provides a closer view of the vegetation on Site, which is to be retained. In addition, the 60m easement is visible which creates an open space and connection North South along the Site.

Site Photo 3

This image is from the gate of a private property, located off the Narellan Road. The key feature is the rolling hill that effectively screens any views to or from the Site in an Easterly direction. The location within the area of Blairmont, and characterises the rolling pastural hills of the area to the west of the site.

Site Photo 4

View of the interface between the suburb of Currans Hill and the site, noting the rear of dwellings. The existing concrete road forms part of the 60m electrical easement. The vegetation is Cumberland Woodland and is be retained. In the distance are rolling hills all of which are unaffected by the proposed development.

Site Photo 5

View from the rear of St. Gregory's School towards the site. The Site is not visible at this point as it is located beyond and below the horizon.

Site Photo 6

View from the Windmill Close reserve towards the Site. Note the tower on Badgally Hill on the horizon.

Site Photo 7

View from Pickets Place in Currans Hill, which identifies the electrical infrastructure in the distance. The Site is not visible from this location.

Site Photo 8

View from Smeaton Grange overlooking Magdalene Catholic High School. Smeaton Grange is an industrial Estate from Camden Valley Way towards Manooka Valley. The Site is not visible from this location.

Site Photo 9

View from Blairmont, which typifies the rural character of the area. The Site is not visible to or from this area and development on the Site would not impact on the character of the broader area.

Site Photo 10

View from Blairmont, which typifies the rural landscape associated with the area and, that is rolling hills and pastoral lands. The subject is located to the far East of the Hill and is not visible to or from this view. Any development on the Site would not impact on the character of the broader area. The existing quality of these hills is maintained.

Site Photo 11

View from the Australian Botanic Gardens.
The proposed development would not impact on panoramic views to the north, and is heavily screened by trees.

Site Photo 12

View from the Australian Botanic Gardens.
A closer view towards the site. The concrete path is visible and a development on the site would blend into the landscape, complementing the residential dwellings to the west.

View from the Site

Site Photo 13

View from Sydney Water Reservoir Site in a North Easterly direction. Note tree screening to the North. The access road will act as a 'track' which leads to the Reservoir and will provide an outlook over the Site.

Site Photo 14

View immediately North towards Gregory Hills, which is currently under construction for suburban development. Note, tree screening which obscures any potential for overlooking from Gregory Hills and vis versa. Trees are of ecological significance and will be retained.

Site Photo 15

View orientated NW, which focuses on a pocket of land that is part of the broader Site. The Site is bordered by existing suburban lots and a significant wall, which provides a clear physical barrier to Gregory Hills and is well suited for in-fill residential development.

Site Photo 16 (17.02.2017)

Mid View from the Site towards the Sydney Water Reservoir. The reservoir (currently under construction) will be a significant ridge top built element in the view on the existing Hill.

Site Photo 17 T (17.01.2017)

Mid view from the Site identifying the Northern Hill, which accommodates the Sydney Water Reservoir. The sheds associated with the construction are visible, as is the vegetation on the horizon. This vegetation is protected and is to be retained.

Site Photo 18

This view is from the Sydney Water Reservoir Site in a Southerly direction. To the West is the base of Badgally Hill and Scenic Hills. This landscape area forms part of the "Scenic Hills" and falls within the jurisdiction of Campbelltown Council.

Site Photo 19

This view is from the Sydney Water Reservoir Site in a Southerly direction and includes the Site to the South. The Hills to the far West form part of the "Scenic Hills" which falls within Campbelltown Council. This outlook provides panoramic views to the south, including towards the Australian Botanic Gardens.

Site Photo 20

This view is from the Sydney Water Reservoir Site in a South Westerly direction and includes the edge of the Currans Hill suburb. In the distance is Smeaton Grange the Industrial Estate.

Site Photo 21

View of concrete road (within the site) and rear of existing dwellings in Currans Hill. Most dwellings are secured with a colorbond fence of approximately 1.5 to 2m in height to provide privacy and security to the residents. The access to the Sites is via Manooka Road, therefore, there will be minimal overlooking.

Site Photo 22

View of Badgally Hill from the middle of the Site.

6) VISUAL SENSITIVITY

Typically, locations within the visual catchment which are considered to have significant sensitivity to changes to visual quality include the following:

- Residential areas;
- Recognised lookouts or recreational facilities such as walking tracks or scenic drives;
- Major regional roads; and
- Institutions such as schools or other places of learning.

The following sensitive view lines have been identified.

Views towards the Site:

- A key view is that from Saddle Close towards Badgally Hill in an easterly direction, which is the main entrance to the Site. Identified on the Viewing Map as View Line 1.
- From Windmill Parade, Currans Hill in an easterly direction towards the Site, with Badgally Hill in the distance. This area is open recreational reserve. Identified on the Viewing Map as View Line 4.
- The view from the rear of the existing residences towards the Site is also important. Although these residences are orientated with their rear yards to the Site the current use of the Site provides visual, acoustic and scenic amenity to these residences. View Line 2 identifies the interface between the existing and proposed residential dwellings.
- Views in a Southerly direction from the Hill are important as they provide visual and scenic amenity over the Site towards the "Scenic Hills", Campbelltown Town Centre in the distance and Currans Hill. This Hill is a view outlook, which is proposed to contain a walking trail. This view line is also the view that will be seen from the existing residences in a Northerly direction towards the Hill within the Site. The existence of the Sydney Water Reservoir, which is approximately 21m in height, provides a major visual impediment to the area.

6.1 Impacts of the Proposal on Visual Quality

Factors that are considered in assessing the response of receptors to changes in the visual amenity include the following:

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

(Adapted from Department of Queensland VIA Guidelines)

The critical views as identified above are analysed in detail below.

6.2 Prefer to Visual Impressions Overleaf

6) VISUAL SENSITIVITY

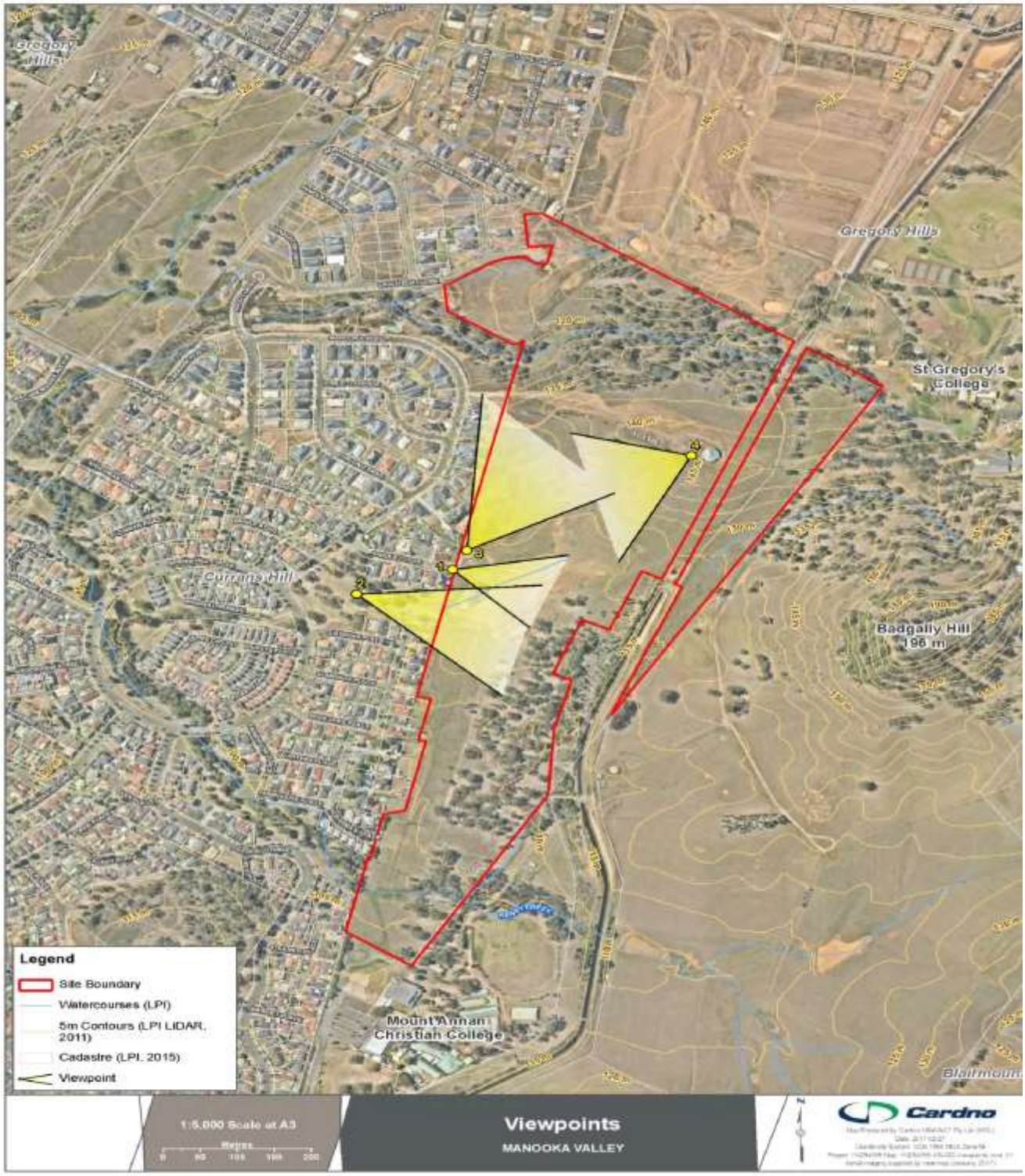


Figure 9

6) VISUAL SENSITIVITY

6.1 View from Saddle Close towards Badgally Hill

Existing View

Impression of view with potential development in place

6) VISUAL SENSITIVITY

erest in the visual vironment and their tance/angle to the urce of the impact.	Badgally Hill is a key landmark in the area and should be retained to ensure the longevity of the pastoral character of the area. It forms a critical part of the "Scenic Hills". The distance from Saddle Close to the Badgally Hill is approximately 500m. It is important that this view line is retained.
e extent of screening/ ering of the view;	Proposed dwellings will be located at the base of the extension of the Hill. The existing Sydney Cumberland Woodlands will continue to provide screening to the rear of the proposed dwellings, which will soften the view and ensure that the additional tree planting will also contribute to the softening of this view.
agnitude of change the view (i.e. loss/ dition of features at change the view's mposition).	The magnitude of the change is minor and the key feature being the Hill top and mid area is unaffected by the proposed development. Therefore there is no change to the overall view. At the base of the Hill, the vegetation and tree lines will continue to provide a visual context of pastoral open plains.
egration of changes thin the existing view rm, mass, height, lour and texture).	The proposed low density residential development will be readily absorbed into the locality. While a strip of dwellings will be visible from Saddle Close there is sufficient distance from the entrance of the Site at Saddle Close to the strip of residential dwellings to ensure the view to Badgally Hill is not compromised.
ration of the effect mporary/permanent, ermittent/continuous).	The effect will be permanent.
ectiveness of the posed mitigation.	Given the retention of the existing Cumberland Plain Woodlands and the location of the residential development, the trees will continue to provide an authentic pastoral rural quality to the Site.

6) VISUAL SENSITIVITY

6.2 View from Windmill Close toward the Site

Existing View

Impression of Proposed View

6) VISUAL SENSITIVITY

nterest in the visual nvironment and their istance/angle to the ource of the impact.	This view is from the recreational area of Windmill Close towards the Site and in particular the view towards Badgally Hill.
he extent of screening/ ltering of the view.	The proposed development will have a minor impact on the existing view, as it is located some 300m from the centre of the Reserve. Therefore, it is a long distance view, which is largely maintained.
Magnitude of change n the view (i.e. loss/ ddition of features hat change the view's omposition.	There is a minor change in view from open landscape to residential use along a strip of the Site. The green foreground & natural ridgetop are both retained and protected.
ntegration of changes vithin the existing view orm, mass, height, olour and texture).	The proposed development will be comfortably absorbed into the view in terms of providing a bulk and scale that is compatible to the surrounding development. The proposed development will be tucked into the low-lying areas of the Site and, given the distance from the Reserve to the proposed development, the impact will be negligible.
uration of the effect emporary/permanent, ntermittent/continuous).	The effect will be permanent and minor.
ffectiveness of the roposed mitigation.	Mitigation is built into this view given the long range distance views. Further, the critical view associated with Badgally Hill is retained in its entirety.

6) VISUAL SENSITIVITY

6.3 View from Saddle Close towards the site

Existing View

Impression of Proposed View

6) VISUAL SENSITIVITY

erest in the visual vironment and their tance/angle to the urce of the impact.	This view is of significance in terms of the impact it may have on the existing residences. While it is acknowledged that it is the rear of the existing residences that will be impacted, it is their key private recreational space for the existing residences.
e extent of screening/ ering of the view.	The existing rear boundary walls screen the current dwellings. In addition, they are likely to interface with the rear of the proposed development, rather than a street frontage. There is therefore no overlooking anticipated. The screening will be in terms boundary fences and low vegetation.
gnitude of change the view (i.e. loss/ dition of features t change the view's nposition).	There is a change in view from open landscape to an open corridor with an edge of residential development. Notably, however the existing tree lined horizon would be generally maintained.
egration of changes thin the existing view rm, mass, height, our and texture).	The proposed development will be absorbed into the Site in terms of the scale and bulk as it will have a height restriction and is likely to interface with the rear of buildings, which will limit the level of activity. While it will be visible there is sufficient distance in terms of the Electrical Easement (that is 60m) to ensure the impact is reduced by the retention of horizon level trees.
ration of the effect mporary/permanent, ermittent/continuous).	The effect will be permanent.
ectiveness of the posed mitigation.	It is proposed to provide a walking path within the 60m Electrical Easement, which will ensure that the sense of open space is retained between the existing and proposed residential developments. In addition, the pathway will activate an area that is currently inaccessible and improve the safety and use of this area. The pathway will provide a viable link to existing pathways North of the Site. This additional activity within a parkland setting is likely to be welcomed by the surrounding community.

6) VISUAL SENSITIVITY

6.4 View from Sydney Reservoir Southwards

Existing View

Impression of Proposed View

6) VISUAL SENSITIVITY

erest in the visual vironment and their tance/angle to the urce of the impact.	This view is of interest as it is part of a proposed walking trail and lookout point over the Site towards the 'scenic Hills' in the East, Campbelltown Centre and Mount Annan in the far South and Currans Hill and Smeaton Grange to the West. It provides a panoramic view.
e extent of screening/ ering of the view.	The view will be filtered by ensuring that the height of the proposed development does not impede into the skyline of the view.
agnitude of change the view (i.e. loss/ dition of features at change the view's mposition).	There is a significant change in view from open landscape to a partially residentially view interspersed with open space and vegetation.
egration of changes thin the existing view rm, mass, height, our and texture).	The proposed development will be absorbed into the Site in terms of the scale and bulk. A key element will be to ensure that the rooftops of proposed residences do not extend above the horizon. Given the natural topography of the Site, the land drops away significantly from the Hill in a Southerly direction; therefore, it is feasible that the visual impact will be reduced, as the development will be viewed below natural eye level.
ration of the effect mporary/permanent, ermittent/continuous).	The effect will be permanent.
ectiveness of the posed mitigation.	It is proposed to ensure the proposed development respects the natural contours of the Site and is placed into the landscape with respect to the existing configuration of the Site. Specifically that refers to retaining the existing areas of ecological significance and streams that traverse the Site. In addition, the height of the buildings will be limited to ensure there is no intrusion into the panoramic skyline. Further, it is recommended to undertake extensive street planting to soften the impact of the built form. These measures will mitigate the impact of the proposed development on the view and ensure that the panoramic outlook is retained.

6) VISUAL SENSITIVITY

6.3 Significance of Impact

Predicated impacts have been described according to their significance, which is a function of the magnitude of the impact and the sensitivity of the receptor. Only impacts considered being of major or high significance are considered as significant for the purposes of this assessment. Of the photographed views, four views were considered of high significance and of the four views investigated further, only one view is considered critical. The most significant view is that from the Hill accommodating the Sydney Water Reservoir over the Site in a Southerly direction. The significance of this view is its panoramic views over the Site, which captures the pastoral landscape quality of the "Scenic Hills" to the West, which remain intact, and views to Campbelltown, Mount Annan to Australia Botanic Gardens and Curran's Hill with distance Hills on the horizon. Again, this view line remains unimpeded.

A secondary element associated with this view is that it is proposed to be part of a walking trail and viewpoint.

It is possible that local residents will walk to this viewpoint and then meander along the newly created walking and cycle path within the Electrical Transmission lines. The lookout point does not connect to any paths beyond it. It is a destination in its own right and remains intact.

7) CONCLUSIONS AND RECOMMENDATIONS

The outcome of the VIA is that the broader landscape is of a high visual quality which is worthy of protection from negative visual impacts. Accordingly, the proposed development has been respectfully crafted into the landscape. It has taken full consideration of the history of the Site, the surrounding land uses, the ecological values of the existing fauna and the future housing needs of the local area. In order to ensure that the Site continues to provide a transition/interface land use between the low-density suburban development characterised by Currans Hill to the East and the open plains of Blairmont to the West, the following recommendations are proposed:

- Areas of ecological value be retained and managed to ensure the long term survival of the flora and fauna, in accordance with the Fauna and Flora Study by Biosis, 2016;
- That a walking and cycle path be constructed within the 60m Electrical Transmission easement to activate the area and provide a North South link for the community to access and enjoy. Such activity will provide greater visual integration between the existing and proposed residential uses;
- That the height of the future built form be restricted to ensure that it does not impede into panoramic views from the Northern Hill across the Site.
- That a landscape strategy be prepared to ensure that the new residential environment is substantially vegetated with forest scale trees within its streetscapes and public spaces. Develop that additional planting and spines of vegetation be introduced, as a subdivision plan evolves for the Site. With these measures in place, it is our opinion that the proposed amendment to the zoning of the site that is the subject of this VIA would result in development with an acceptable impact on the visual quality of the site and its locality.
- That a Landscape Plan consistent with the landscape strategy be prepared to accompany any future Development Application.

About Cardno

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange (ASX: CDD).

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Attachment 4

Manooka Valley Stage 3, Lot 627 DP 1163903

APPENDIX H

TRAFFIC IMPACT ASSESSMENT

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Attachment 4

Traffic Impact Assessment

Manooka Stage 3 Planning Proposal

YN294099

Prepared for
Landco/Wolin JV

11 July 2017

Cardno
Shaping the Future

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C	30/06/2017	Final – Revised following Council's Comments	AP / RK	IP
D	11/07/2017	Final – Revised following client comments	KW	HC

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1 Introduction

1.1 Background

Cardno has been commissioned by Landco/Wolin JV to produce a Traffic Impact Assessment (TIA) to accompany a planning proposal seeking consent for the rezoning of Lot 627 DP 1163903 located at 207B Turner Road, Currans Hill.

1.1.1 Strategic Directives

The proposed rezoning aims to increase the housing and population in Sydney's south-west aligning with strategic directives such as:

1.1.1.1 Draft South West District Plan (Nov 2016)

The Draft South West District Plan (District Plan) was prepared by the Greater Sydney Commission and released for exhibition in November 2016. The Greater Sydney Commission is aiming to connect local planning with longer-term planning for Greater Sydney to better coordinate State and local government planning. Six Greater Sydney Districts were created following consultation with local Councils. Camden Council LGA is located within the 'South West' Sydney District, which also includes Campbelltown, Fairfield, Liverpool and Wollondilly Local Government Areas (LGAs).

The Greater Sydney Commission's Fact Sheet for Sydney's South West District states the following:

> *"The South West District is a mix of productive rural areas, precious bushland and historic towns, interspersed with growing urban centres. It's the fastest growing district in Sydney. For some years, the South West Priority Growth Centre – new land releases around Oran Park, Leppington and Bringelly – has brought new housing to the market. The South West Rail Link now connects Leppington to the Sydney rail network, and a new town centre is emerging at Oran Park."*

The District Plan anticipates that the population in the region will increase from the 2016 estimate of 715,200 to 1,088,000 in 2036 (p.83). Camden LGA in particular is expected to experience the most significant growth, with a projected population increase of 143,700 people over that 20-year period (p.84). To accommodate this population influx, a significant increase in dwellings is required across Camden. The District Plan provides a target of 11,800 new dwellings over the 5 years to 2021, and notes that Manooka Valley is one of the precincts identified by the Department of Planning & Environment as able to generate significant capacity for housing supply (p.97).

The Planning Proposal responds directly to the projections and targets that have been identified by the Greater Sydney Commission. The proposal aims to increase the residential zoned area of Camden Council, thus facilitating an increase in the potential developable land in the area.

Further to this, the confirmed location and future development of the proposed Western Sydney Airport at Badgerys Creek is anticipated to be the most significant driver of economic change in Sydney over the coming decades, a "game changer" for Greater Sydney (p.25). The new airport will create a hub for between 29,000 and 34,000 jobs while also spurring on construction and major new transport infrastructure (p.54). Manooka Valley is located approximately 20 minutes south of the proposed Western Sydney Airport site by car, and will therefore be seen as a suitable residential location for potential airport employees.

1.1.1.2 *NSW State Priorities – Making It Happen (Sep 2015)*

NSW: Making it Happen is the most recent strategic vision released for NSW, outlining 30 key reforms for the State, as identified below:

> Relevant strategic priorities:

- Creating Jobs

  The NSW Government aims to create 150,000 new jobs by 2019. New housing options are necessary in regions of job creation to accommodate and support workers.

- Infrastructure

  Increasing housing supply across NSW is a major goal of the State Government. Their aim is to deliver more than 50,000 approvals every year to allow for the creation of 664,000 new homes over the next 20 years. In the 12 months to July 2015, there were 61,057 building approvals in NSW, the highest result in more than 41 years and 64.5% above the decade average. The Government is supporting future growth by establishing housing targets across NSW, and providing record allocations to the Housing Acceleration Fund to build the infrastructure to support this growth.

  The proposed additional housing at the Manooka Valley site will allow for significant residential development that will help to achieve the long-term housing goals set by the NSW Government.

1.1.1.3 *A Plan for Growing Sydney (Dec 2014)*

Goal 2 – A city of housing choice, with homes that meet our needs and lifestyles

Direction 2.1 – Accelerate housing supply across Sydney

Direction 2.2 – Accelerate urban renewal across Sydney to ensure more jobs closer to home

Direction 2.3 – Improve housing choice to suit different needs and lifestyles

Direction 2.4 – Deliver timely and well planned greenfield precincts and housing.

'A Plan for Growing Sydney' is the State Government's proposed strategy to ensure Sydney remains Australia's premier city and is able to respond appropriately to the growth it will experience over the next 20 years. The plan predicts that the South West subregion of Sydney is to grow by 325,850 people between 2011 and 2031. This is a rate of 2.1% per year as opposed to the Sydney average of 1.6% population growth per year, equating to an increase of 121,200 households in the region over that period. Combined with a decreased average household size, it is expected that approximately 126,900 new homes will be needed by 2031.

The NSW Government's 2016 population projections suggest that the Camden LGA population is to grow from 80,900 residents in 2016 to 224,550 residents in 2036, a population increase of 143,650 residents. This signifies a 177.6% increase on 2016 population levels, the highest of any LGA in NSW by a significant distance. Similarly, the number of households in Camden LGA is expected to increase from 27,050 households in 2016 to 77,300 in 2036, an increase of 185.8%, in part due to the decreasing average household size.

The population and household data necessitates the utilisation of additional land in Camden LGA to allow for an increase in residential development. The proposed provision of additional housing within Manooka Valley responds directly to both this data and the directions discussed in the strategy. It will allow for the region to more easily accommodate the high number of people moving to the area while promoting the delivery of a range of housing types in a well-connected and desirable region of Sydney.

1.1.1.4 South West Priority Growth Area

The South West Growth Centre is approximately 17,000 hectares in size and includes parts of the Liverpool, Camden and Campbelltown local government areas. It is divided into 18 Precincts that are being progressively released for planning and rezoned for sustainable urban development. The South West Priority Growth Area will be supported by a Major Centre at Leppington and be serviced by the new South West Rail Link. It will contain about 110,000 new dwellings for some 300,000 residents.

To date, seven Precincts -- Oran Park, Turner Road, Edmondson Park, Austral, Leppington North, Catherine Field (partial) and East Leppington -- have been rezoned to allow urban development.

The Manooka Valley Subject Site borders the southern boundary of the suburb of Gregory Hills. Gregory Hills forms part of the South West Growth Centre Turner Road Precinct, as illustrated in the South West Growth Centre Structure Plan Explanatory Notes. This is part of the southernmost boundary of the South West Growth Centre. As such, although the Subject Site does not fall under the legislation governing the South West Growth Centre, its proximity to the Turner Road Precinct and to Campbelltown City Centre allows it to cater to development based on similar principles.

1.1.1.5 Camden 2040

Camden Council's endorsed local strategic plan is 'Camden 2040 – Working Together to Achieve the Community's Vision for the Future' (Camden 2040). Camden 2040 has a vision to effectively manage its growth whilst promoting a prosperous local economy, with thriving local businesses and local employment. Part of successfully managing growth is to overcome a key challenge of "Achieving a balance between large population increases and keeping the valued characteristics of Camden as it is now will be an ongoing tension and challenge over the coming decades."

The specific key challenges for growing the Camden Area which relate to the Proposal include:

> Creating good quality, liveable urban environments with a greater density than is currently available in the Camden area, including providing a range of efficient, affordable and innovative housing styles and public urban and open spaces.

> The importance of building and maintaining certainty and investment confidence within the area through efficient and stable strategic planning and development control processes.

The key strategies to meet the above challenges include:

> Learning from and improving the urban planning process over time so that lessons learned from each precinct planning process, as well as industry best practice, are used in subsequent precincts to ensure improved outcomes over time

> Prioritising environmental outcomes through the planning and development process to maximise improvement and restoration opportunities and to minimise the ecological impacts of increased urban form, economic activity, and people and lifestyles.

> Ensuring greater choice and diversity in housing to meet a range of existing and future community needs.

The provision of additional housing will fulfil these key strategies through ensuring that there is certainty and consistency in the delivery of urban growth areas within Camden and delivering further choice in housing diversity.

1.2 Scope of Works

The following scope of works has been undertaken as part of this study:

- Review background information of the proposed site
- Review existing road network
- Desktop study of public transport, pedestrian and cycling provisions
- Modal shift assessment
- Site access and layout assessment
- Review parking provision
- Estimate traffic generation and prepare spreadsheet models
- Extract and process EMME traffic volumes
- Undertake SIDRA assessment and provide mitigations measures, as required.

1.3 Reference Documents

In preparing this report, reference has been made to a number of background documents, including:

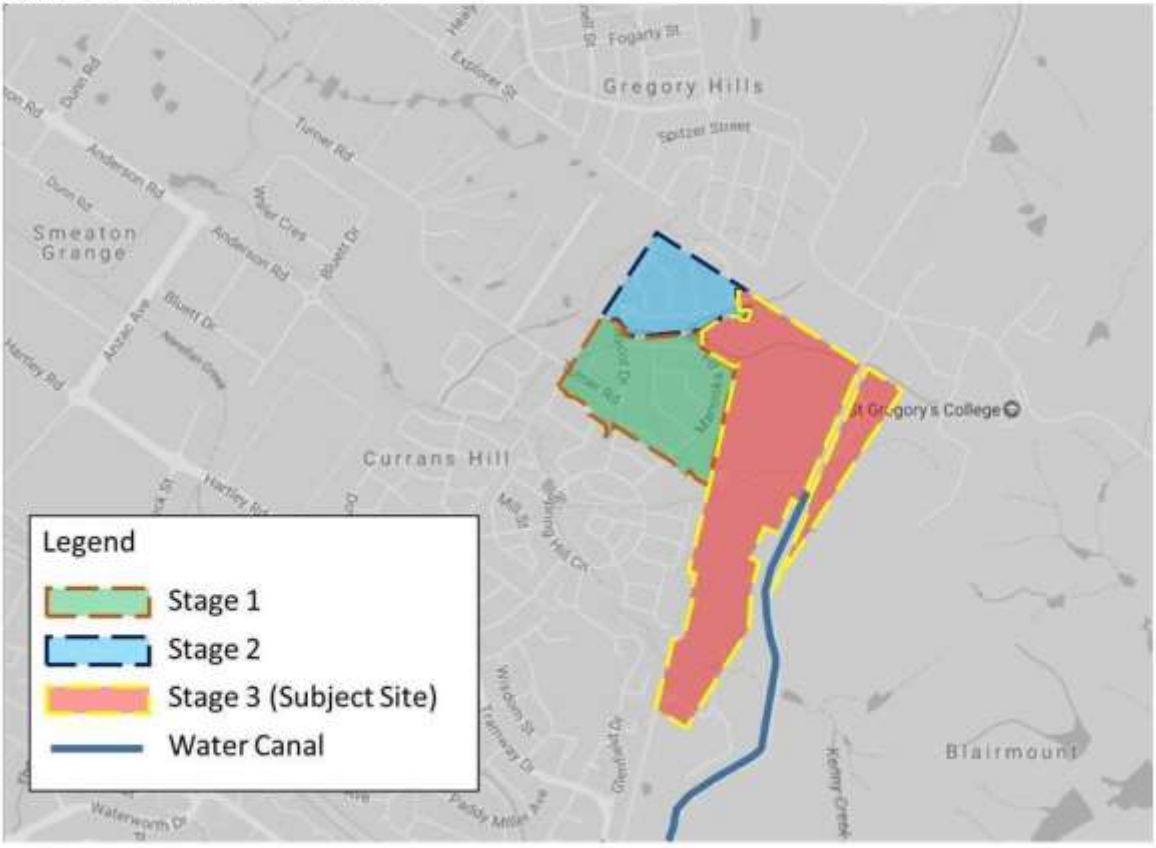
- Roads and Maritime Schedule of Classified Roads and Unclassified Regional Roads (2014)
- Camden Council DCP Part B: General Land Use Controls (2011)
- Narellan Road Upgrade – Camden Valley Way to Blaxland Road / Gilchrist Drive report, AECOM (2013)
- Roads and Maritime Guide to Traffic Generating Developments (2002)
- Roads and Maritime Technical Direction (TDT 2013/04a).
- Walking, Riding and Access to Public Transport (Department of Infrastructure and Transport, 2013)

2 Existing Conditions

2.1 Subject Site

The proposed subject site is located to the east of Turner Road Precinct and south of Gregory Hills as shown in **Figure 2-1**.

Figure 2-1 Subject Site Location

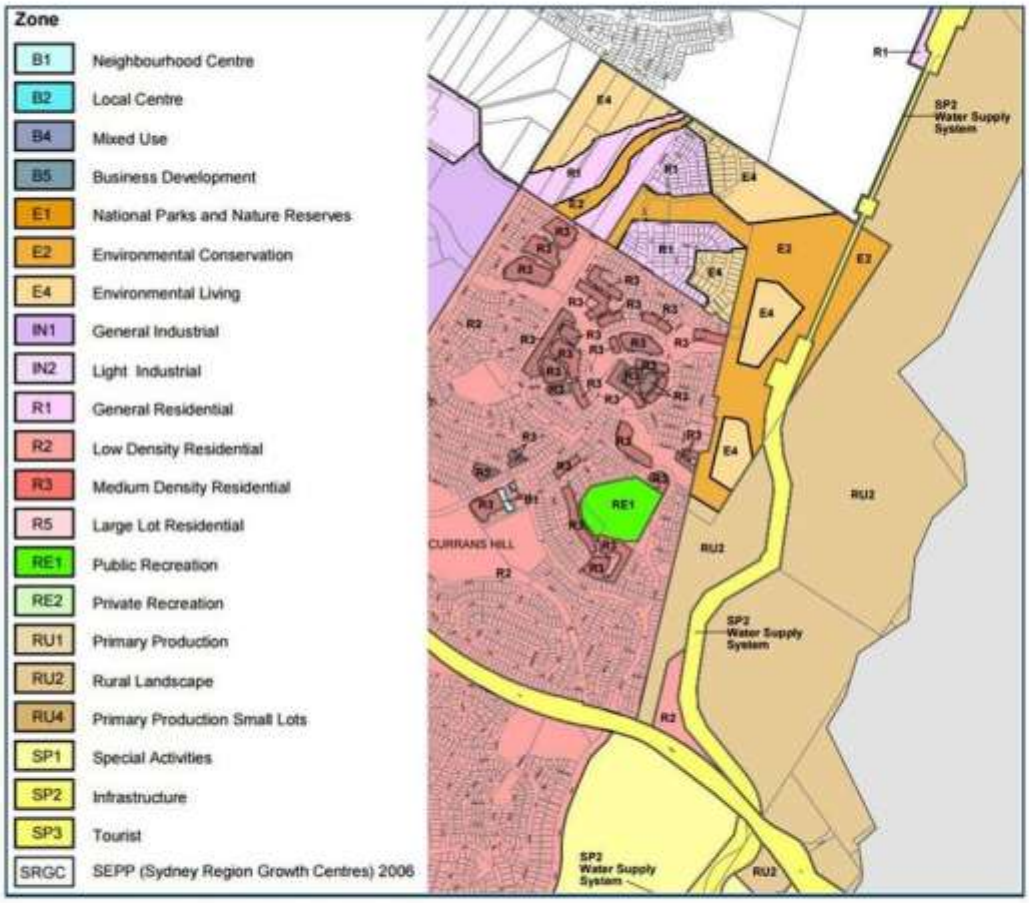


Source: NearMap, 2017

The existing site is currently zoned as E2 – Environmental Conservation, E4 – Environmental Living and RU2 – Rural Landscape. There is a water canal that runs through the proposed site zoned as SP2 – Infrastructure owned by Sydney Water.

A map of the existing zoning in the surrounding area is illustrated in **Figure 2-2**.

Figure 2-2 Current zoning map



Source: Camden Local Environmental Plan 2010

2.2 Existing Road Network

2.2.1 Schedule of Road Classification

Roads and Maritime in partnership with local government established an administrative framework of State, Regional, and Local Road categories to assist managing the extensive network of roads.

State roads are managed and financed by Roads and Maritime, and Regional / Local Roads are managed and financed by councils. Notwithstanding, Regional Roads perform an intermediate function between the main arterial network of State Roads and council controlled Local Roads and therefore receives financial assistance from Roads and Maritime.

2.2.2 Narellan Road

Narellan Road is classified as a State Road under the care and maintenance of Roads and Maritime, connecting Campbelltown at Appin Road to Narellan at The Northern Road.

Narellan Road is a major arterial road signposted with a speed limit between 60km/h - 80km/h along various sections of the road.

2.2.3 Hartley Road

Hartley Road is a local road under the care and maintenance of Camden Council. The road is not signposted with a speed limit and parking is generally allowed on both sides of the road.

2.2.4 Tramway Drive

Tramway Drive is a local road under the care and maintenance of Camden Council. The road is signposted with a speed limit of 50km/h. A 40km/h school zone exists between Moore Place and Lackey Place. Parking is generally allowed on both sides of Tramway Drive.

2.2.5 Currans Hill Drive

Currans Hill Drive is a local road under the care and maintenance of Camden Council. The road is signposted with a speed limit of 50km/h. A 40km/h school zone exists between Hodges Place and William Mannix Avenue. Parking is generally allowed on both sides of Currans Hill Drive.

2.2.6 Spring Hill Circle

Spring Hill Circle is a local road under the care and maintenance of Camden Council. The road is signposted with a speed limit of 50km/h.

2.2.7 Manooka Road

Manooka Road is a local road under the care and maintenance of Camden Council. The road is not signposted with a speed limit and parking is generally allowed on both sides of the road.

2.2.8 Saddle Close

Saddle Close is a closed cul-de-sac local road under the care and maintenance of Camden Council. The road is not signposted with a speed limit and parking is generally allowed on both sides of the road.

Saddle Close is proposed to be one of the access for the proposed rezoning development site.

2.2.9 Glenfield Drive

Glenfield Drive is a local road under the care and maintenance of Camden Council. The road is signposted with a speed limit of 50km/h and parking is generally allowed on both sides of the road.

2.2.10 Horseman Place

Horseman Place is a closed cul-de-sac local road under the care and maintenance of Camden Council. The road is not signposted with a speed limit and parking is generally allowed on both sides of the road.

Horseman Place is proposed to be one of the access for the proposed rezoning development site.

2.2.11 Caulfield Close

Caulfield Close is a cul-de-sac local road under the care and maintenance of Camden Council.

Caulfield Close is proposed to be one of the access for the proposed rezoning development site.

2.3 Current Road Upgrades

2.3.1 Narellan Road

Narellan Road is currently being upgraded by Roads and Maritime, which are expected to be completed in mid-2018 (weather permitting). The upgrades are to be undertaken in two stages:

> Stage 1 – 1.6km corridor between the M31 Hume Motorway and the access road to the TAFE / Western Sydney University. Stage 1 of the Narellan Road Upgrade is complete. Key features of Stage 1 included:
  - Narellan Road has been upgraded to a six lane divided road with three lanes in each direction and a central median from the M31 Hume Motorway to the TAFE/Western Sydney University campus;
  - New traffic lights at the Narellan Road and M31 Hume Motorway interchange;
  - Widened southbound exit and loop ramp from one lane to three;
  - A shared pedestrian and cyclist path on the southern side of Narellan Road (will connect to new pedestrian bridge as part of the Narellan Road Upgrade Stage 2);

- An extra right turn lane into the TAFE/Western Sydney University campus for eastbound traffic and extension of the right turn bay by about 180 metres;
- Upgraded TAFE/Western Sydney University roundabout from a single lane to dual lanes;
- Two left turn lanes and an extra right turn lane onto Narellan Road from the TAFE/ Western Sydney University;
- New Incident Response Facility at the south east corner of the M31 Hume Motorway interchange. This facility will provide immediate response to any accidents on the M31 Hume Motorway and surrounding areas;
- New bus bays to improve safety and access for commuters.

> Stage 2 – 5.2km corridor from the M31 Hume Motorway to Camden Valley Way and from the TAFE / Western Sydney University access road to Blaxland Road, Campbelltown. Stage 2 of the Narellan Road Upgrade is expected to be complete in mid-2018. Key Features of Stage 2 include:

- Widening Narellan Road to a six lane divided road, generally three lanes in each direction with a central median;
- Upgrading the M31 Hume Motorway interchange and widening the northern bridge over the motorway for additional lanes;
- Building a pedestrian bridge to provide a shared path over the M31 Hume Motorway on the southern side of Narellan Road;
- Installing new traffic lights with pedestrian crossings at Kenny Hill Road;
- Installing a three metre wide off-road share pedestrian/cyclists path;
- Extending the southbound merge lane onto the M31 Hume Motorway by about 500 metres;
- Constructing a Heavy Vehicle Inspection Bay on the westbound carriageway between Botanical Gardens and Hume Motorway Interchange;
- Ten intersection improvements between Camden Valley Way, Camden and Blaxland Road, Campbelltown.

2.4 Existing Traffic Volumes

An indication of the existing traffic volumes in the vicinity of the subject site is provided by peak hour traffic surveys undertaken on 8 December 2016 between 7am-9am and 4pm-6pm at the following intersections:

> Narellan Road / Hartley Road / Waterworth Drive

> Hartley Road / Currans Hill Road / McPherson Road

> Narellan Road / Mount Annan Drive / Tramway Drive

> Currans Hill Drive / Tramway Drive

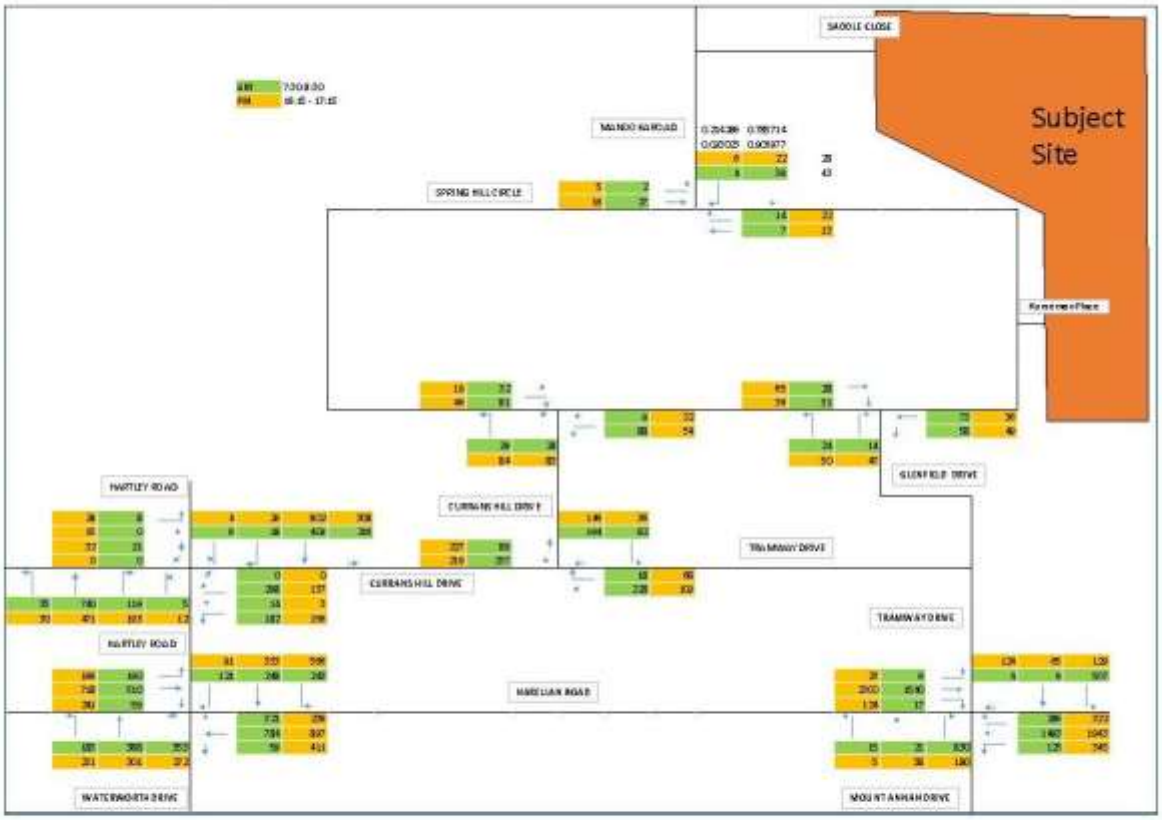
> Currans Hill Drive / Spring Hill Circle

> Spring Hill Circle / Glenfield Drive

> Spring Hill Circle / Manooka Road.

The survey data is summarised in **Figure 2-3.** Full results of the traffic survey can be found in **Appendix A**.

Figure 2-3 Existing Traffic Volumes



2.5 Existing Public Transport Services

2.5.1 Buses

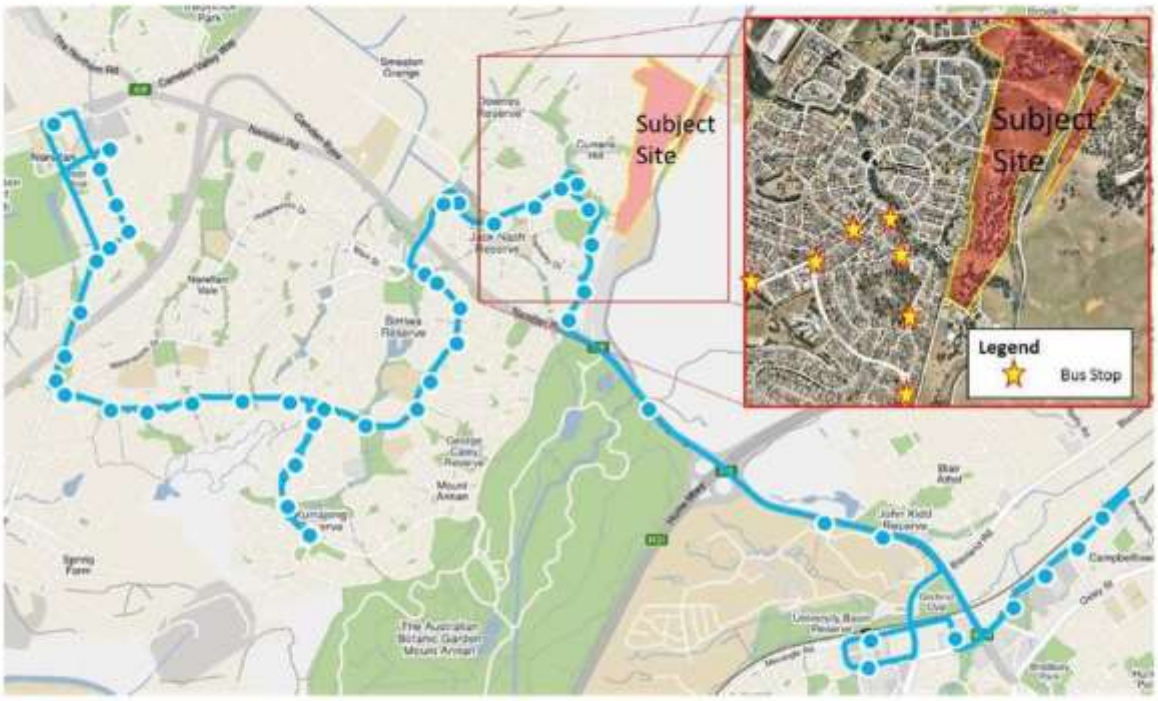
There are several bus services that operate along Narellan Drive. These bus routes (890, 890C, 892, 893, 894, 894X, 896, 898 and 900) services run frequently providing a connection to Campbelltown and Campbelltown Station. Narellan Road however is 950m south of Horseman Place entrance. Within the Currans Hill there is currently one (1) bus service operating within an accessible walking catchment of 400m from the south-western entrance to the subject site on Horseman Place. The closest bus stops are located on Glenfield Drive, 40m west of the intersection with Field Place. To access these stops from the Horseman Place entrance, commuters can walk west along Farmhouse Place and use the footpath through Broughton Reserve to Glenfield Drive. Currently, there are no shelters or signage provided at the bus stops.

The bus stops are shown in **Figure 2-4** and the service and its frequency is summarised in Error! Reference source not found.. No other bus routes operate within a 400m walking catchment of the other entrances to the subject site. Additional bus services and alternative bus routes should be considered to provide an alternative travel option for residents other than private vehicles.

Table 2-1 Weekday Bus Service Frequency

Route	Direction	Frequency	
		AM Peak	PM Peak
891	Mount Annan to Campbelltown via Currans Hill	30 minutes	30 minutes
	Campbelltown to Mount Annan via Currans Hill	30 minutes	30 minutes

Figure 2-4 Bus Route Map (891)



Source: Transport for NSW

2.5.2 Trains

Campbelltown Station and Macarthur Station are both located within 6kms south-east of the subject site. These stations are not within an accessible walking distance of 400m from the subject site, or an accessible cycling distance of 2 to 3 km. The stations provide connection to Greater Sydney and regional NSW via the following services:

- T2 Airport, Inner West and South Line, comprising three varying routes connecting Sydney CBD to Macarthur, Edmondson Park and Leppington;
- T5 Cumberland Line connecting to Schofields through the Western Suburbs of Sydney including Parramatta and Blacktown; and
- Southern Highland Line, connecting Campbelltown with rural regional centres such as Bowral and Goulbourn.

Commuters can access both of these stations by the 891 bus route from the subject site. Rail journeys to major centres within Sydney are generally under an hour; train journeys from Campbelltown Station to Sydney CBD, Parramatta CBD and Sydney Airport can each be completed in less than an hour, whilst a journey to Liverpool Station is under 30 minutes.

Campbelltown train station has both kiss and ride and park and ride facilities on the western side of the station for commuters. This provides approximately 1130 spaces with an additional 20 spaces of on street parking.

2.6 Existing Pedestrian and Cyclist Facilities in the sorrounding area

2.6.1 Cycling facilities

A shared path joining to the site entrance at Saddle Close connects to the northern part of Currans Hill, however it is disconnected from the shared paths and on-road facilities to the south, indicated in **Figure 2-5**. No other entrance to the subject site has an existing cycling connection. Cyclists can access Campbelltown and other areas in Sydney's south-west via the on-road shoulder facilities on Narellan Road.

Figure 2-5 Cycleway Map of Currans Hill

Source: Road's and Maritime Services CyclewayFinder, 2017. http://www.rms.nsw.gov.au/roads/bicycles/cycleway-finder.html

2.6.2 Pedestrian facilities

Footpaths connect Currans Hill to Narellan Road, however many roads have footpaths that are disconnected or are only on one side such as at the subject site entrances at Horseman Place and Saddle Close. A footpath is also provided on the un-named road running south from the south-western corner of the site to Narellan Road.

3 Development Proposal

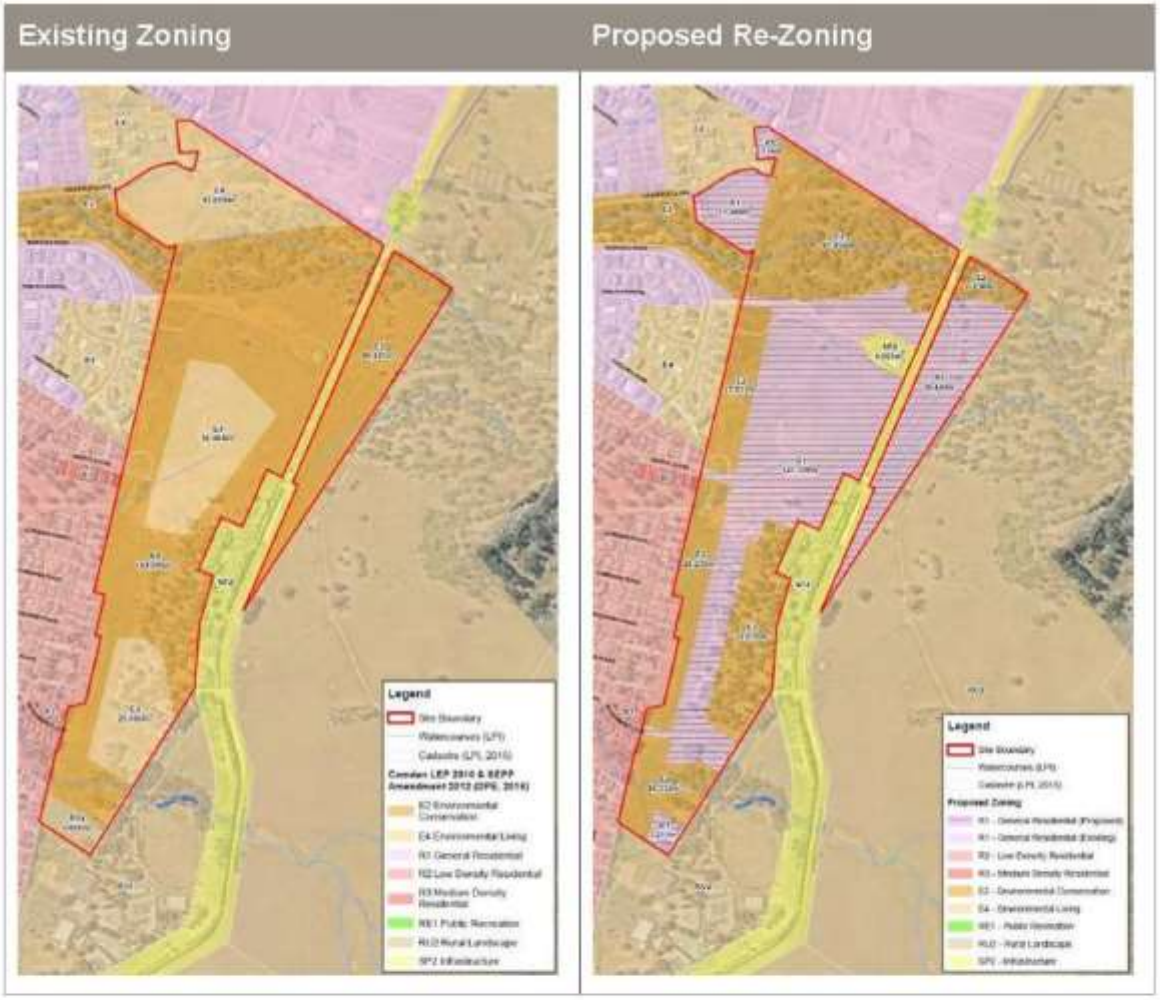
3.1 Proposed Development

This planning proposal aims to rezone existing E4 – Environmental Living and E2 – Environmental Conservation land to R2 – Low Density Residential. The proposed development will comprise the following:

- Up to 200 residential allotments
- Parklands
- Internal road networks

The existing zoning and the proposed re-zoning are summarised in **Figure 3-1**.

Figure 3-1 Existing and Proposed Zoning Maps



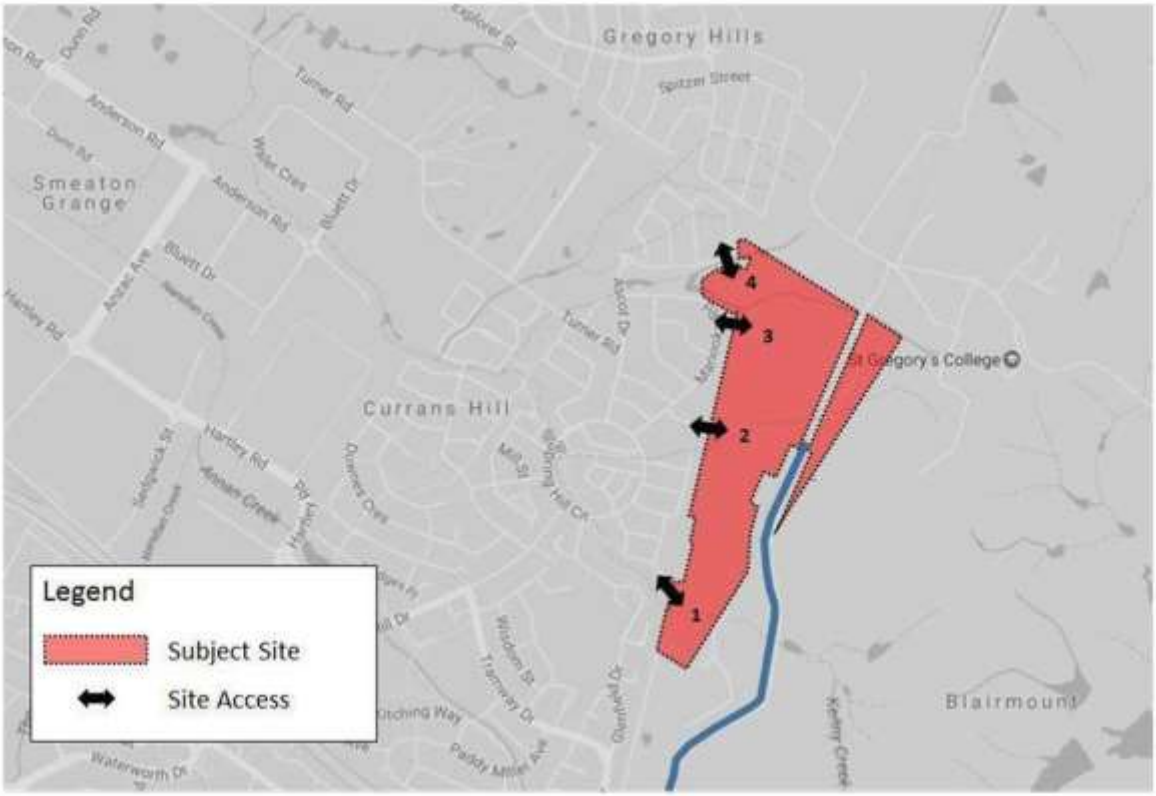
It is important to note that the site currently has an approval for 21 residential sites and that while this assessment conservatively evaluates the impact of an indicative yield of 200 lots, the actual yield is more likely to be in the order of 180 lots (subject to further investigations / design). As such, the proposed scheme would result in circa 160 lots in addition to those already approved. As explained, the assessment conservatively assumes 200 lots for the purposes of the trip generation calculations.

3.2 Access Arrangement

While the lot layout and distribution across the precinct hasn't been defined yet, vehicular access into and out of the proposed Manooka Valley Stage 3 development is envisaged to consist of the following:

1. Horseman Place – access anticipated to be restricted to an extension of the existing cul-de-sac for a small number of dwellings;
2. Saddle Close - to provide access to a limited number of dwellings at the central part of the site (not to function as the main access point to the overall development);
3. New access off Manooka Road (just north of Pimlico Ave), anticipated to provide access to a substantial proportion of the total number of dwellings.
4. Caulfield Close – anticipated to consist of converting the Oaklawn Street / Caulfield T intersection to a four-way intersection to allow access to small number of lots (cul-de sac)

Figure 3-2 Proposed Access Arrangement



It must be noted that Saddle Close and Horseman Place are currently minor roads with cul-de-sacs. To reduce a significant increase in traffic on the minor roads, a minor extension to the cul-de-sacs at Saddle Close and Horseman Place should be considered instead. This would force most vehicles to travel up north to use the new access directly off Manooka Road, reducing the impact on the minor road network in the adjacent development.

4 Traffic Impact Assessment

4.1 Traffic Generation

An indication of the traffic generation potential of the proposed Manooka Valley Stage 3 is sourced from the Roads and Maritime's Technical Direction (TDT 2013/04a), which nominates the following traffic generation rates applicable to the proposed development:

Low Density Residential Dwellings (Sydney)

> AM Peak: 0.95 peak hour vehicle trips per dwelling

> PM Peak: 0.99 peak hour vehicle trips per dwelling

Accordingly, the proposed 200 residential lots within Stage 3 of the Manooka Valley Development is estimated to generate approximately 190 trips during the AM peak hour and 198 during the PM peak hour as summarised in **Table 4-1**.

Table 4-1 Traffic Generation Summary

Land Use	RMS Guide Definition	Quantum	Traffic Generation	
			AM Peak	PM Peak
Residential	Low-Density	200 lots	190 trips	198 trips

4.2 Trip Distribution and Assignment

4.2.1 Directional Distribution

The directional distribution and assignment of traffic generated by the proposed development would be influenced by a number of factors:

> Configuration of the adjoining local road network in the vicinity of the site

> Accessibility and suitability of the local road network to cater for additional traffic

> Existing operation of intersections providing access around the adjoining road network

> Development of a residential lots layout within the subject area

> Surroundings employment centres, retails centres and schools in relation to the site

> Likely distribution of employee's residences in relation to the site

> Configuration of the access arrangement to the site.

Having considered all of the above and Census Journey to Work (JTW) data, the directional distribution of development generated traffic is established in **Figure 4-1**.

Figure 4-1 Directional Traffic Distribution

The above figure indicates 70% of generated trips will head east towards Campbelltown and Sydney CBD and 30 % of generated trips will head west towards Camden.

Notwithstanding the above, there will be a proportion of vehicles generated from the proposed precinct that may not contribute to a peak hour car trip to or from the Narellan Road and Tramway Drive intersection. Areas west and northwest of the proposed precinct have a range of land uses which will attract vehicle trips and have local employment opportunities. This includes a supermarket, recreational facilities, educational facilities and an industrial area in Smeaton Grange. Gregory Hills and Oran Park have mixed land uses including small retail and education facilities. Connections to Camden Valley Way from the proposed precinct may support trips made to these areas west and reduce the dependence on Narellan Road.

Improved public transport infrastructure (such as additional bus services and alternative bus routes) and improved walking and cycling facilities would help reduce reliance on private vehicle usage.

In summary, the traffic impact assessment described in this report consists of a conservative scenario which does not take in consideration the above factors.

4.2.2 Inbound/Outbound Distribution

The ratio of the inbound and outbound traffic movements is assumed to be 20:80 in the AM peak hour (i.e. 20% inbound and 80% outbound) and 80:20 in the PM peak hour (i.e. 80% inbound and 20% outbound).

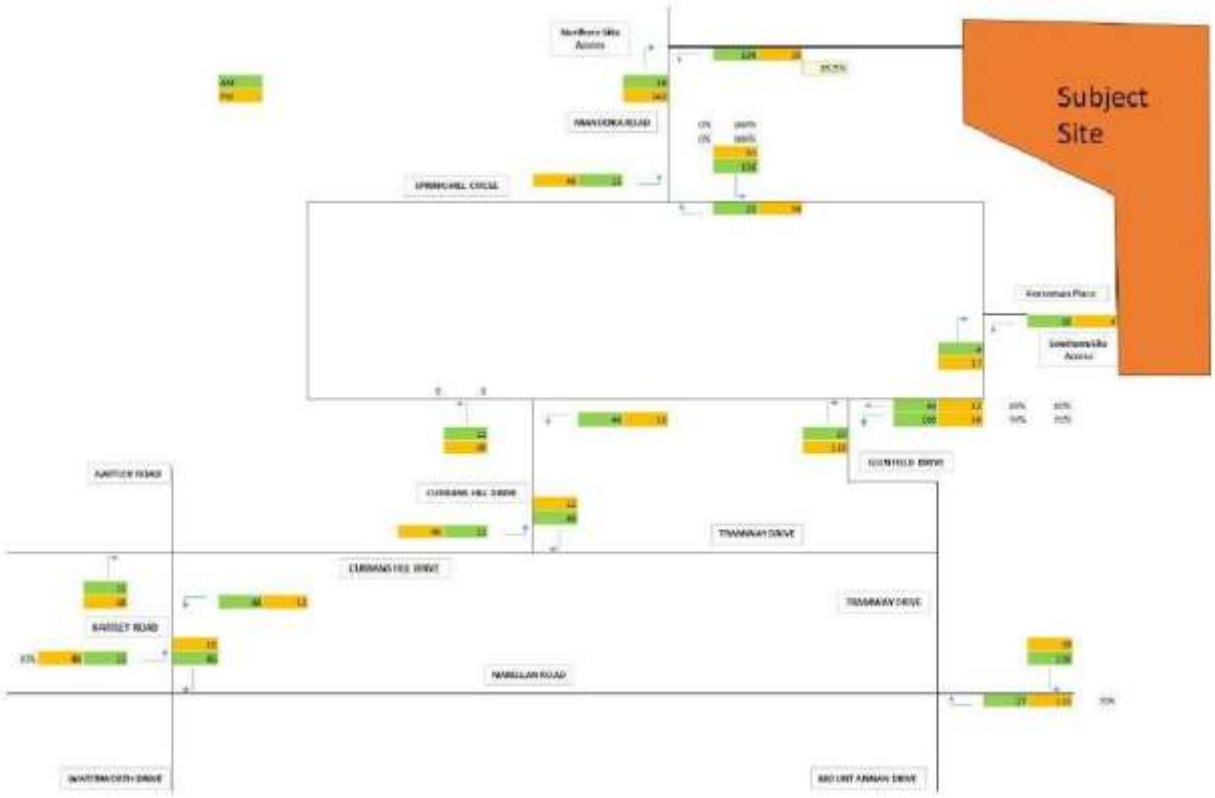
4.2.3 Access Distribution

The envisaged access arrangements are described in Section 3.2.

For the purpose of the traffic assessment, it was assumed that 10.5% of trips will access the site via the southern access at Horseman Place and 89.5% of trips will access the site via the other access points.

Figure 4-2 incorporates the aforementioned trip generation and directional split of Manooka Valley Stage 3.

Figure 4-2 Traffic Generation of Manooka Valley Stage 3



4.3 Assessment Scenarios

The proposed developments are assumed to be completed in 2021. For a robust assessment on the impacts the development will have on the surrounding road network, a 10 design year horizon will also be assessed. The following summarises the assessment scenarios:

- 2016 Existing – Upgrade works are still being undertaken on Narellan Road. No development has occurred.
- 2021 Base – Upgrades to Narellan Road will be completed. Five year growth rate is applied to background traffic on Hartley Road, Narellan Road and Waterworth Drive. Only future background traffic is assessed.
- 2021 Base + Development – Upgrades to Narellan Road will be completed. Five year growth rate is applied to background traffic on Hartley Road, Narellan Road and Waterworth Drive. Development traffic is added to future background traffic to be assessed.
- 2031 Base – Upgrades to Narellan Road will be completed. Fifteen year growth rate is applied to background traffic on Hartley Road, Narellan Road and Waterworth Drive. Only future background traffic is assessed.
- 2031 Base + Development – Upgrades to Narellan Road will be completed. Fifteen year growth rate is applied to background traffic on Hartley Road, Narellan Road and Waterworth Drive. Development traffic is added to future background traffic to be assessed.

4.4 Historic Background Traffic Growth

Roads and Maritime have permanent traffic counters in various key locations in NSW. The closest three (3) permanent counters are:

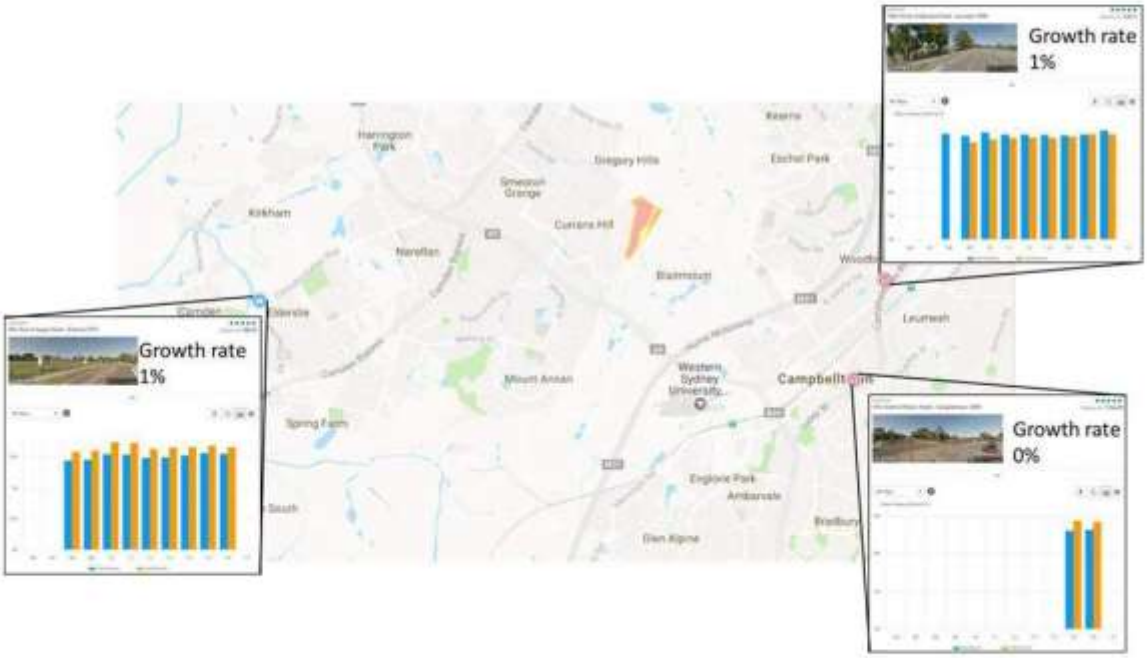
Camden Valley Way – 80m East of Argyle Street, Elderslie

Broughton Street – 10m North of Moore Street, Campbelltown

Campbelltown Road – 190m North of Blaxland Road, Leumeah

The location, daily traffic and annual growth rate is summarised in **Figure 4-3**.

Figure 4-3 Roads and Maritime Permanent Counter Location and Daily Traffic



Considering the expected growth found in Sydney's south-west, the historic growth rates shown in the figure above will be considered insufficient in accurately describing the future growth in the Camden region.

For the purposes of this assessment, a conservative growth rate approach was undertaken. STFM data was obtained from Roads and Maritime. Section 4.5 of this report describes the conservative growth rate approach used for this assessment.

4.5 Future Background Traffic Growth

The future background traffic growth for future design year 2021 and 2031 was estimated by using the 2031 STFM model outputs provided by Roads and Maritime.

Figure 4-4 2031 AM STFM Data

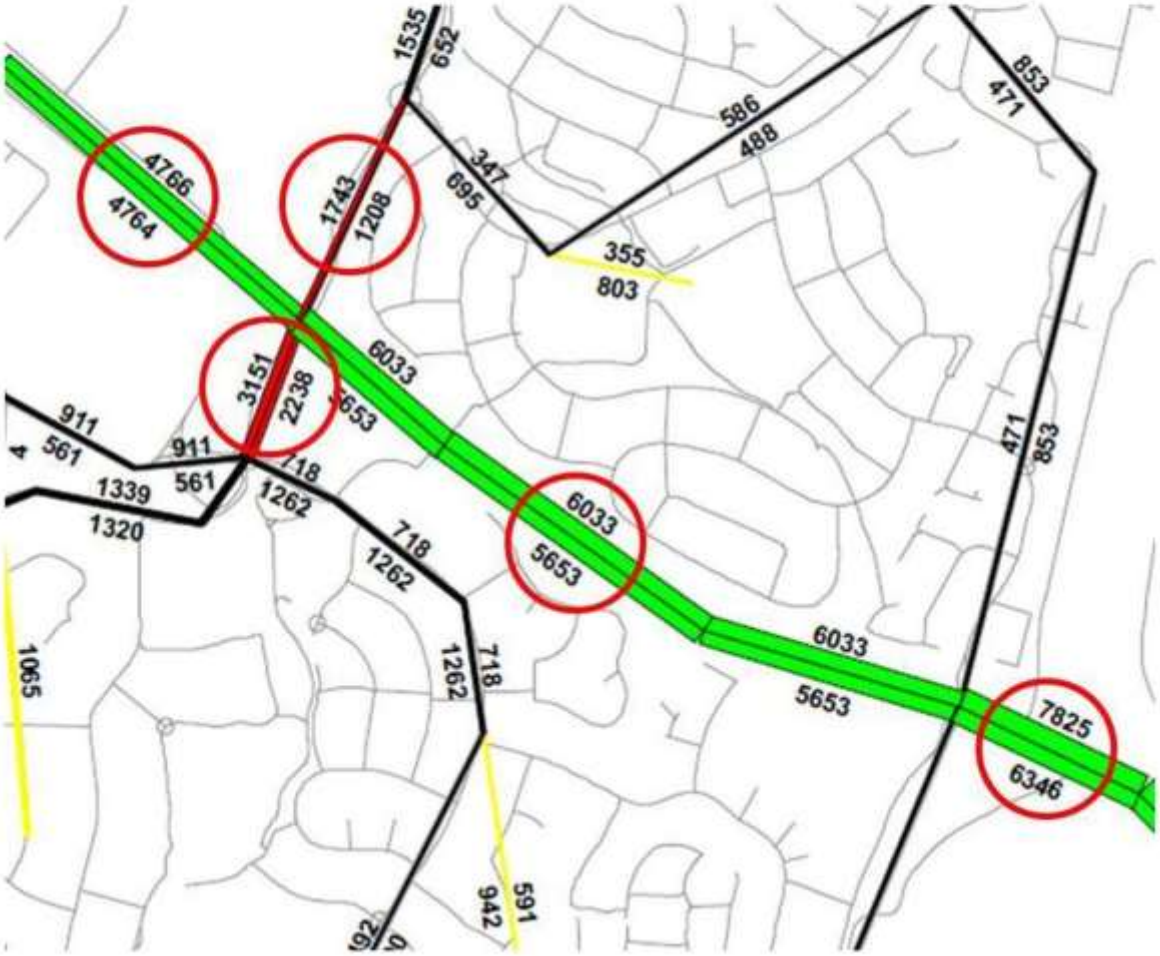
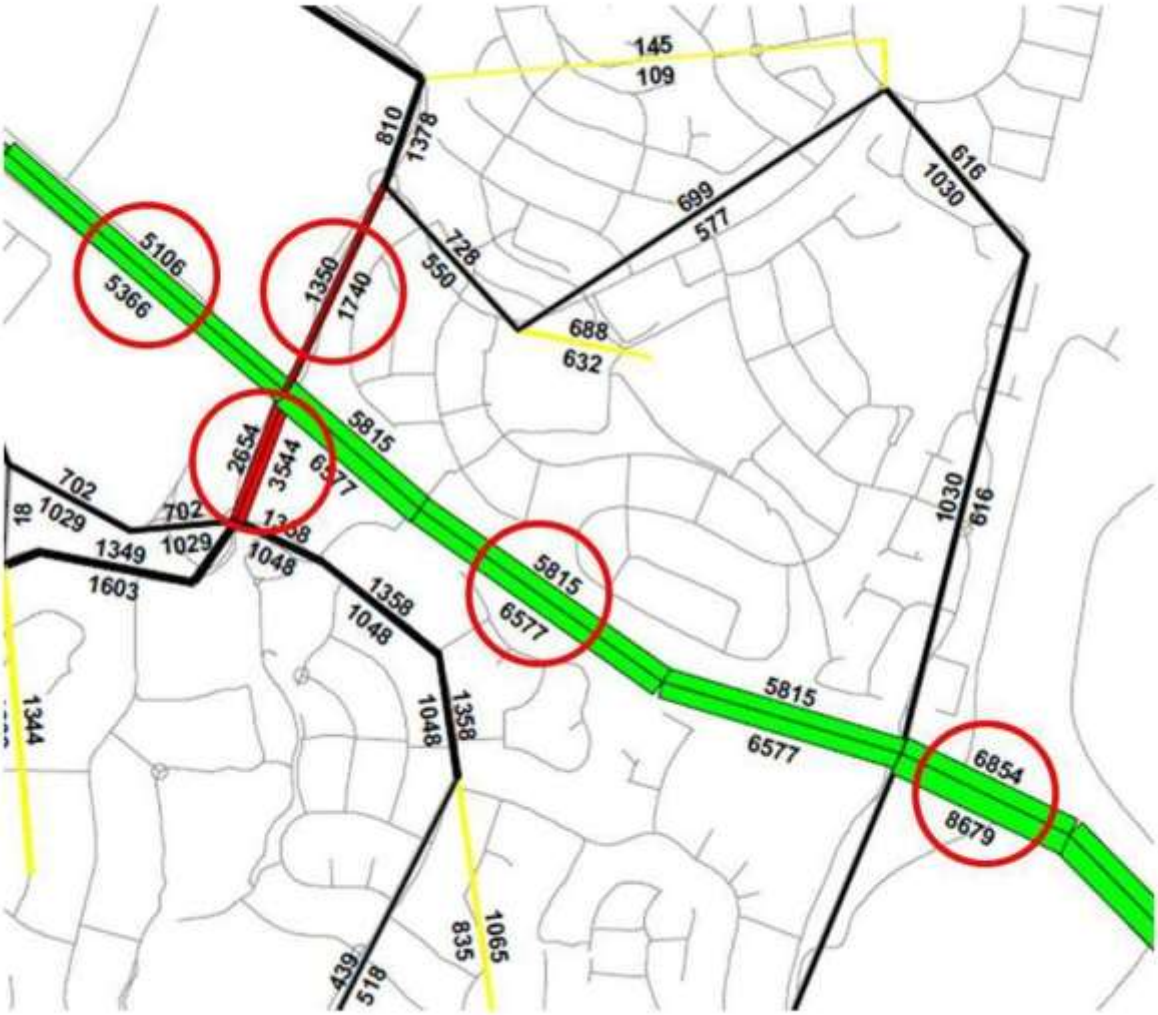


Figure 4-5 2031 PM STFM Data



The following methodology was adopted:

> Convert 2031 STFM model output 2hr peak volumes to 1hr peak volumes using a factor of 0.55

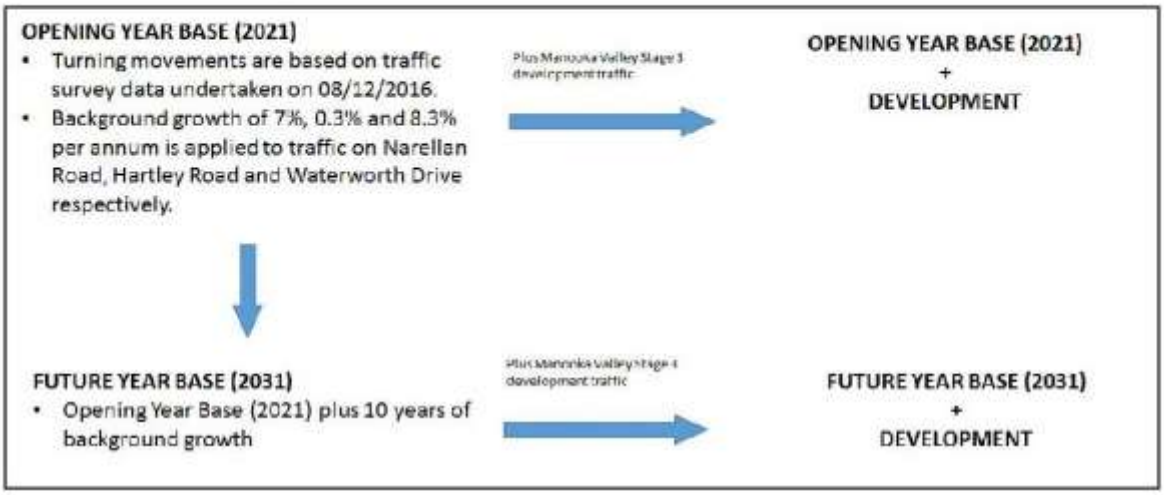
> Calculate the average annual growth by comparing 2031 STFM model 1hr peak volumes to 2016 existing 1hr peak volumes on three major roads:

- Narellan Road 7% per annum
- Hartley Road 0.3% per annum
- Waterworth Drive 8.3% per annum.

> Apply the above average annual growth rates to the existing survey data to estimate future background traffic volumes for 2021 and 2031.

Figure 4-6 illustrates the background traffic growth approach methodology.

Figure 4-6 Future Background Traffic Growth Methodology



The methodology assumes that Narellan Road will experience the majority of traffic growth in the area. The traffic growth is attributable to the significant population growth anticipated in the Camden LGA to the west of the study area. It is assumed that the greater Manooka Valley development area is fully developed and therefore no significant growth will occur to the local access roads.

4.6 Level of Service Criteria for intersections

In an urban area, the capacity of a road network can be largely determined by the capacity of the controlling intersections. The existing intersection operating performance was assessed using the SIDRA software package to determine the Degree of Saturation (DOS), Average Delay (AVD in seconds) and Level of Service (LoS) at each intersection. The key indicator of intersection performance is Level of Service, where results are placed on a continuum from 'A' to 'F', as shown in **Table 4-2**.

Table 4-2 Intersection Level of Service

LoS	Traffic Signal / Roundabout	Give Way / Stop Sign / T-Junction Control
A	Good operation	Good operation
B	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	Satisfactory	Satisfactory, but crash study required
D	Operating near capacity	Near capacity and crash study required
E	At capacity at signals, incidents will cause excessive delays	At capacity and requires alternative control model
F	Unsatisfactory and requires additional capacity Roundabout requires alternative control mode	Exceeds capacity and requires alternative control mode

The Average Vehicle Delay (AVD) provides a measure of the operational performance of an intersection as indicated in **Table 4-3** which relates AVD to LoS. The AVDs should be taken as a guide only as longer delays could be tolerated in some locations (i.e. inner city conditions) and on some roads (i.e. minor side street intersection with major arterial route). For traffic signals, the average delay over all movements should be taken. For roundabouts and priority control intersections (sign control) the critical movement for level of service assessment should be that movement with the highest average delay.

Table 4-3 Intersection Average Vehicle Delay

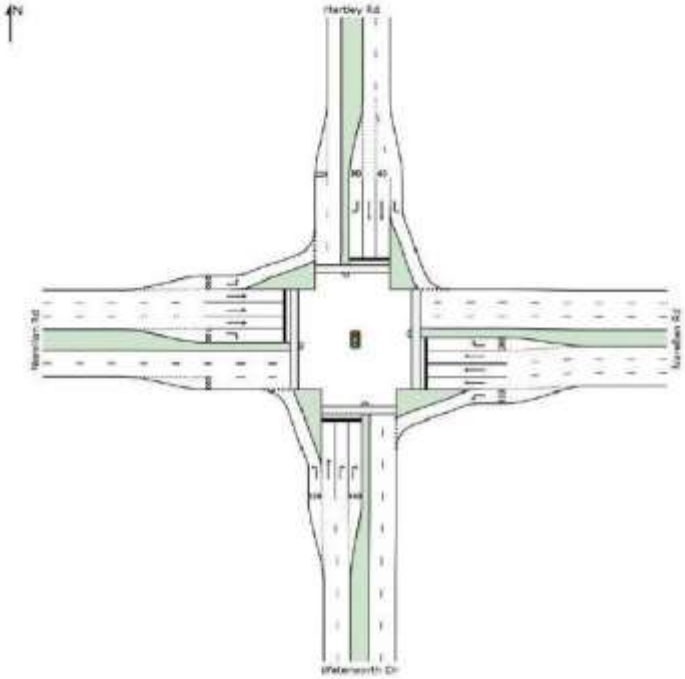
LoS	Average Delay per Vehicle (seconds)
A	Less than 14
B	15 to 28
C	29 to 42
D	43 to 56
E	57 to 70
F	More than 70

The degree of saturation (DOS) is another measure of the operational performance of individual intersections. For intersections controlled by traffic signals both queue length and delay increase rapidly as DOS approaches 1.000. It is usual to attempt to keep DOS to less than 0.9. DOS in the order of 0.7 generally represent satisfactory intersection operation, when DOS exceed 0.9 vehicle queues can be expected.

4.6.2 Narellan Road / Hartley Road / Waterworth Drive

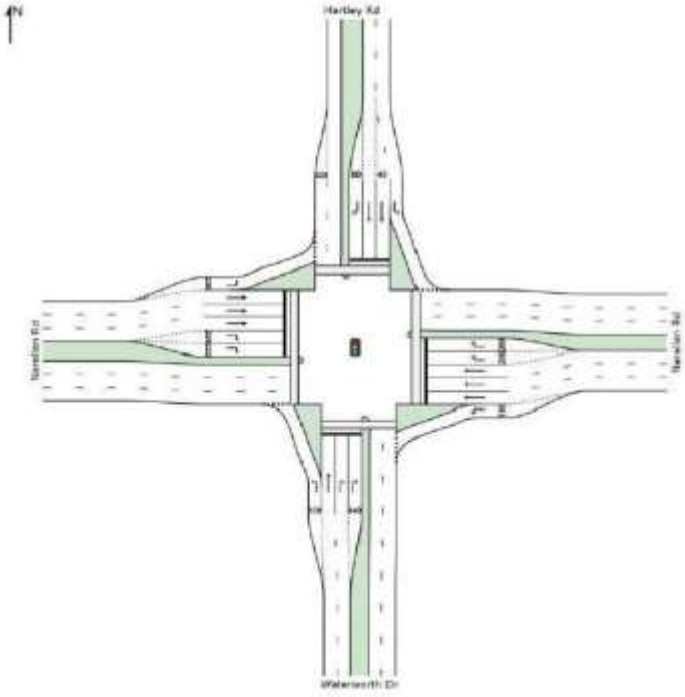
The existing layout of Narellan Road / Hartley Road / Waterworth Drive is illustrated in **Figure 4-7**.

Figure 4-7 Existing Narellan Road / Hartley Road / Waterworth Drive Intersection Layout



The ultimate layout of Narellan Road / Hartley Road / Waterworth Drive after the current upgrades is illustrated in **Figure 4-8**.

Figure 4-8 Future Narellan Road / Hartley Road / Waterworth Drive Intersection Layout



The SIDRA assessment of Narellan Road / Hartley Road / Waterworth Drive intersection for all assessment scenarios are summarised in **Table 4-4**. By 2021, the intersection will be upgraded according to the layout provided from Roads and Maritime (**Appendix B**). The 2021 and 2031 assessment scenarios have included these committed upgrades.

Table 4-4 Narellan Road / Hartley Road / Waterworth Drive Intersection SIDRA Results

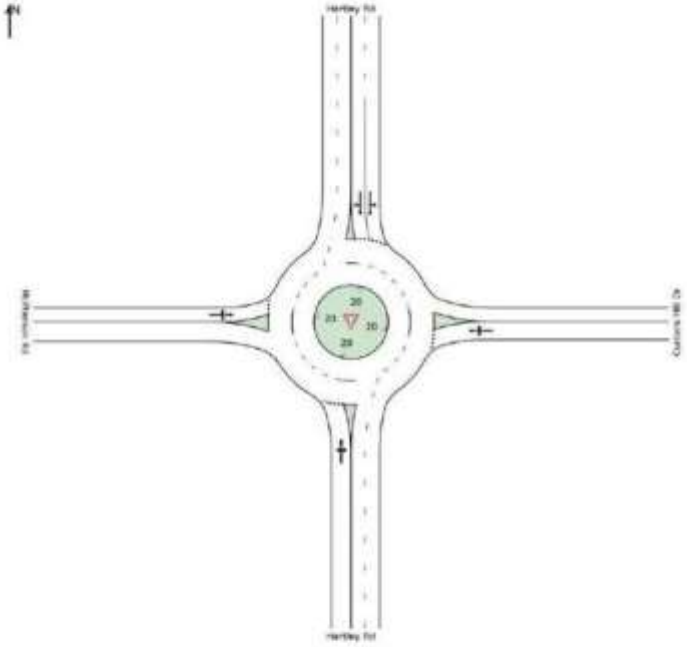
Scenario	AM Peak			PM Peak		
	DOS	Delay (s)	LoS	DOS	Delay (s)	LoS
2016 Existing	0.877	38.4	C	1.001	30.5	C
2021 Base	0.893	36.6	C	0.848	32.5	C
2021 Base + Development	0.893	37.3	C	0.848	32.4	C
2031 Base	0.885	55.8	D	1.038	77.6	F
2031 Base + Development	0.885	56.5	E	1.038	77.3	F

The above SIDRA results indicate that the intersection is expected to operate unsatisfactorily in both the AM and PM peak hour by 2031 with a LoS F regardless of proposed development. These results are consistent with Narellan Road Upgrade – Camden Valley Way to Blaxland Road / Gilchrist Drive report by AECOM (2013). The SIDRA movement summarised are found in **Appendix C**.

4.6.3 Hartley Road / Currans Hill Road / McPherson Road

The layout of Hartley Road / Currans Hill Road / McPherson Road is illustrated in **Figure 4-9**.

Figure 4-9 Hartley Road / Currans Hill Road / McPherson Road Intersection Layout



The SIDRA assessment of Hartley Road / Currans Hill Road / McPherson Road intersection for all assessment scenarios are summarised in **Table 4-5**.

Table 4-5 Hartley Road / Currans Hill Road / McPherson Road Intersection SIDRA Results

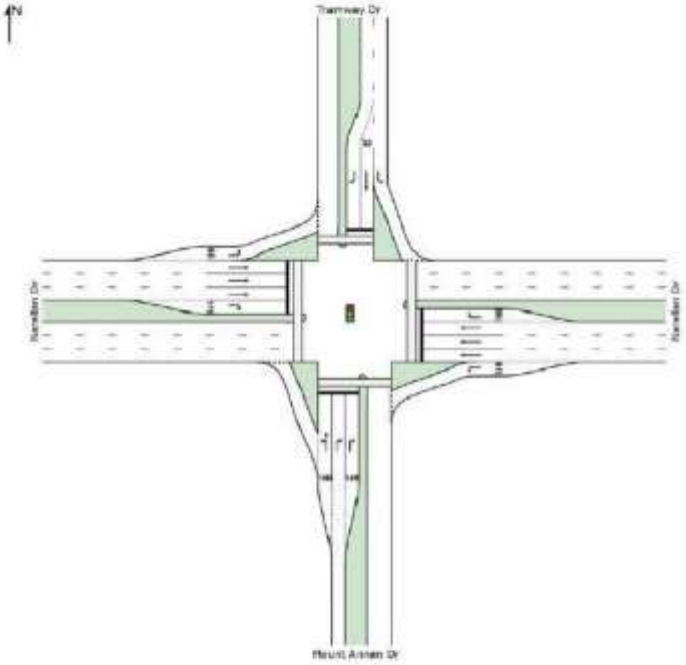
Scenario	AM Peak			PM Peak		
	DOS	Delay (s)	LoS	DOS	Delay (s)	LoS
2016 Existing	0.169	25.8	B	0.142	13.2	A
2021 Base	0.176	26.4	B	0.144	13.3	A
2021 Base + Development	0.181	27.0	B	0.154	14.0	A
2031 Base	0.185	27.7	B	0.146	13.5	A
2031 Base + Development	0.190	28.4	B	0.157	14.2	A

The above SIDRA results indicate that the intersection is expected to operate satisfactorily in both the AM and PM peak hour for all assessment scenarios with a LoS B or better. The SIDRA movement summarised are found in **Appendix C**.

4.6.4 Narellan Road / Mount Annan Drive / Tramway Drive

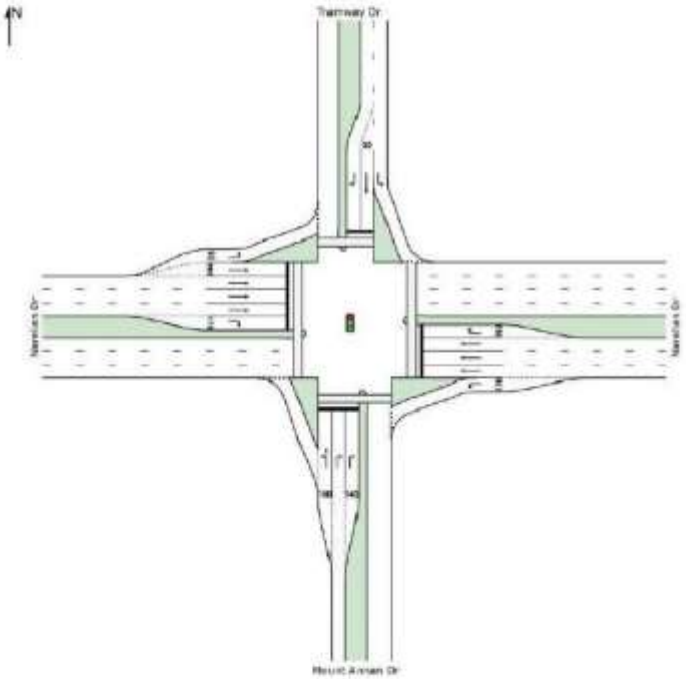
The existing layout of Narellan Road / Mount Annan Drive / Tramway Drive is illustrated in **Figure 4-10**.

Figure 4-10 Existing Narellan Road / Mount Annan Drive / Tramway Drive Intersection Layout



The ultimate layout of Narellan Road / Mount Annan Drive / Tramway Drive after the current upgrades is illustrated in **Figure 4-11**.

Figure 4-11 Future Narellan Road / Mount Annan Drive / Tramway Drive Intersection Layout



The SIDRA assessment of Narellan Road / Mount Annan Drive / Tramway Drive intersection for all assessment scenarios are summarised in **Table 4-6**. By 2021, the intersection will be upgraded according to

the layout provided from Roads and Maritime (**Appendix B**). The 2021 and 2031 assessment scenarios have included these committed upgrades.

Table 4-6 Narellan Road / Mount Annan Drive / Tramway Drive Intersection SIDRA Results

Scenario	AM Peak			PM Peak		
	DOS	Delay (s)	LoS	DOS	Delay (s)	LoS
2016 Existing	1.028	86.5	F	1.030	74.2	F
2021 Base	1.063	125.3	F	1.099	131.8	F
2021 Base + Development	1.079	126.8	F	1.170	164.0	F
2031 Base	1.371	351.1	F	1.463	428.8	F
2031 Base + Development	1.375	357.6	F	1.532	470.2	F

The above SIDRA results indicate that the intersection is expected to operate unsatisfactorily in both the AM and PM peak hour by 2021 with a LoS F regardless of proposed development. These results are consistent with Narellan Road Upgrade – Camden Valley Way to Blaxland Road / Gilchrist Drive report by AECOM (2013). The SIDRA movement summarised are found in **Appendix C**.

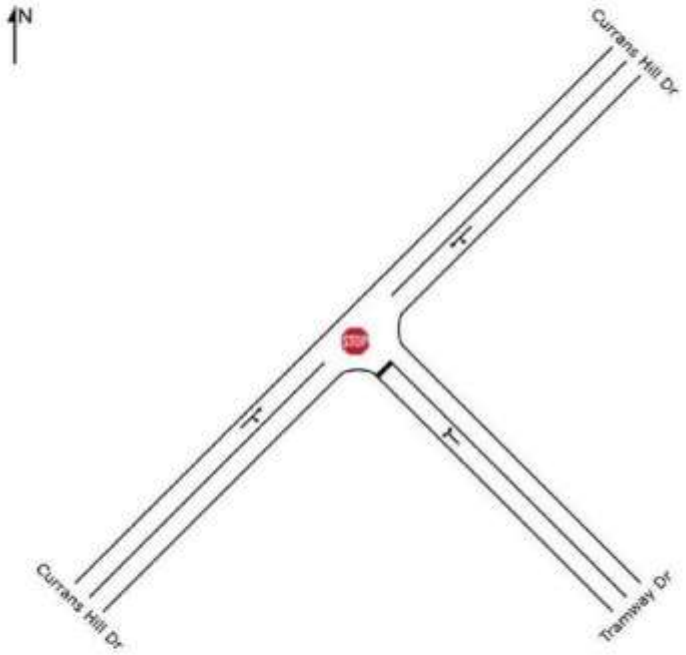
Further to the above, it should be noted that the increase in traffic volumes is relatively small in comparison with the expected future year volumes utilising the intersection.

Based on the outcomes of the SIDRA assessment, Cardno believes further investigation with the input of RMS should be considered. The methods adopted to calculate the forecasted future year volumes is considered overly conservative and further liaison with RMS would allow a less conservative yet more accurate estimate of the future year volumes.

4.6.5 Currans Hill Drive / Tramway Drive

The layout of Currans Hill Drive / Tramway Drive is illustrated in **Figure 4-12**.

Figure 4-12 Currans Hill Drive / Tramway Drive Intersection Layout



The SIDRA assessment of Currans Hill Drive / Tramway Drive intersection for all assessment scenarios are summarised in **Table 4-7**.

Table 4-7 Currans Hill Drive / Tramway Drive Intersection SIDRA Results

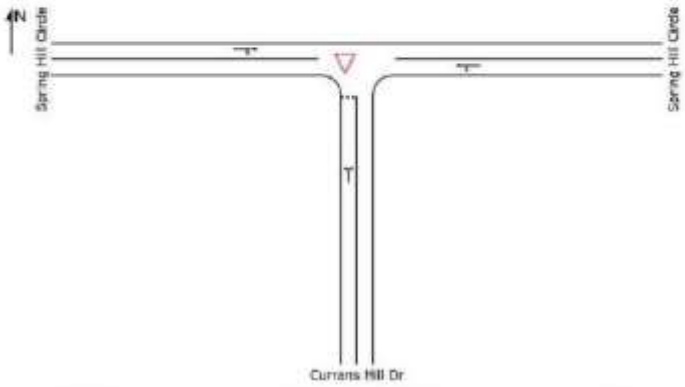
Scenario	AM Peak			PM Peak		
	DOS	Delay (s)	LoS	DOS	Delay (s)	LoS
2016 Existing	0.242	12.0	A	0.226	12.1	A
2021 Base	0.242	12.0	A	0.226	12.1	A
2021 Base + Development	0.256	12.7	A	0.241	13.0	A
2031 Base	0.242	12.0	A	0.226	12.1	A
2031 Base + Development	0.256	12.7	A	0.241	13.0	A

The above SIDRA results indicate that the intersection is expected to operate satisfactorily in both the AM and PM peak hour for all assessment scenarios with a LoS A or better. The SIDRA movement summarised are found in **Appendix C**.

4.6.6 Currans Hill Drive / Spring Hill Circle

The layout of Currans Hill Drive / Spring Hill Circle is illustrated in **Figure 4-13**.

Figure 4-13 Currans Hill Drive / Spring Hill Circle Intersection Layout



The SIDRA assessment of Currans Hill Drive / Spring Hill Circle intersection for all assessment scenarios are summarised in **Table 4-8**.

Table 4-8 Currans Hill Drive / Spring Hill Circle Intersection SIDRA Results

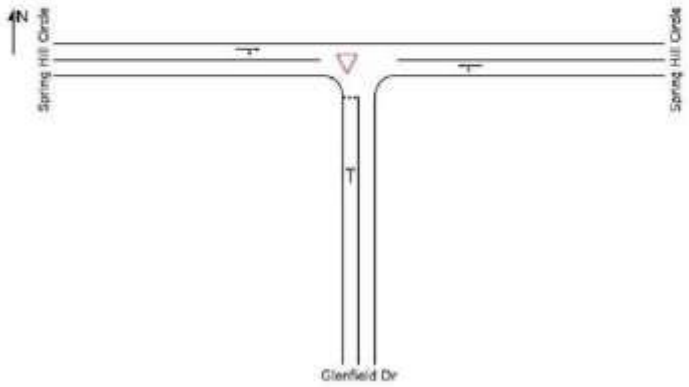
Scenario	AM Peak			PM Peak		
	DOS	Delay (s)	LoS	DOS	Delay (s)	LoS
2016 Existing	0.049	5.5	A	0.133	5.1	A
2021 Base	0.049	5.5	A	0.133	5.1	A
2021 Base + Development	0.056	5.6	A	0.165	5.2	A
2031 Base	0.049	5.5	A	0.133	5.1	A
2031 Base + Development	0.056	5.6	A	0.165	5.2	A

The above SIDRA results indicate that the intersection is expected to operate satisfactorily in both the AM and PM peak hour for all assessment scenarios with a LoS A or better. The SIDRA movement summarised are found in **Appendix C**.

4.6.7 Spring Hill Circle / Glenfield Drive

The layout of Spring Hill Circle / Glenfield Drive is illustrated in **Figure 4-14**.

Figure 4-14 Spring Hill Circle / Glenfield Drive Intersection Layout



The SIDRA assessment of Spring Hill Circle / Glenfield Drive intersection for all assessment scenarios are summarised in **Table 4-9**.

Table 4-9 Spring Hill Circle / Glenfield Drive Intersection SIDRA Results

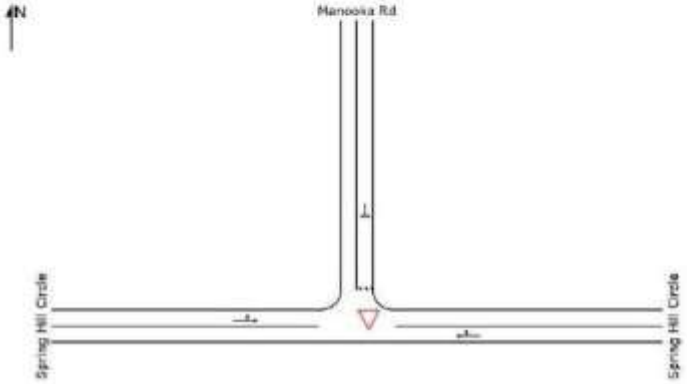
Scenario	AM Peak			PM Peak		
	DOS	Delay (s)	LoS	DOS	Delay (s)	LoS
2016 Existing	0.032	5.4	A	0.078	5.2	A
2021 Base	0.032	5.4	A	0.078	5.2	A
2021 Base + Development	0.043	5.9	A	0.188	5.4	A
2031 Base	0.032	5.4	A	0.078	5.2	A
2031 Base + Development	0.043	5.9	A	0.188	5.4	A

The above SIDRA results indicate that the intersection is expected to operate satisfactorily in both the AM and PM peak hour for all assessment scenarios with a LoS A or better. The SIDRA movement summarised are found in **Appendix C**.

4.6.8 Spring Hill Circle / Manooka Road

The layout of Spring Hill Circle / Manooka Road is illustrated in **Figure 4-15**.

Figure 4-15 Spring Hill Circle / Manooka Road Intersection Layout



The SIDRA assessment of Spring Hill Circle / Manooka Road intersection for all assessment scenarios are summarised in **Table 4-10**.

Table 4-10 Spring Hill Circle / Manooka Road Intersection SIDRA Results

Scenario	AM Peak			PM Peak		
	DOS	Delay (s)	LoS	DOS	Delay (s)	LoS
2016 Existing	0.030	5.0	A	0.020	4.7	A
2021 Base	0.030	5.0	A	0.020	4.7	A
2021 Base + Development	0.119	5.2	A	0.043	5.2	A
2031 Base	0.030	5.0	A	0.020	4.7	A
2031 Base + Development	0.119	5.2	A	0.043	5.2	A

The above SIDRA results indicate that the intersection is expected to operate satisfactorily in both the AM and PM peak hour for all assessment scenarios with a LoS A or better. The SIDRA movement summarised are found in **Appendix C**.

4.7 SIDRA Intersection Assessment Summary

The modelling assessment outcomes are summarised below:

- In 2021 without development, the model results indicate that the intersections in the vicinity of the proposed development will operate satisfactorily at LoS B or better, except the intersection at Narellan Road / Mount Annan Drive / Tramway Drive. This intersection would operate at LoS F during peak hours.
- In 2031 without development, the model results indicate that the intersections in the vicinity of the proposed development will operate satisfactorily at LoS B or better, except the intersection at Narellan Road / Hartley Road / Waterworth Drive and Narellan Road / Mount Annan Drive / Tramway Drive. These intersections would operate at LoS E and F during the peak hours.
- The model results are consistent with the findings of the Narellan Road Upgrade – Camden Valley Way to Blaxland Road / Gilchrist Drive report by AECOM (2013), which found that even with the committed intersection upgrades, the Narellan Road / Hartley Road / Waterworth Drive and Narellan Road / Mount Annan Drive / Tramway Drive intersections would fail to operate satisfactorily during peak hours in the 2011 (+20% additional traffic) scenario
- The proposed development is expected to generate a total (including inbound/outbound) of 190 trips during the AM peak hour and 198 trips during the PM peak hour (based on a total development yield conservatively assumed to be 200 lots for trip generation calculation purposes)

The future year traffic forecasts along Narellan Road are based on the interpretation of strategic modelling data, which is believed to be the most suitable methodology to estimate future year volumes using publicly available data (provided by RMS). However, as explained, the results indicate that the upgrades currently under construction will still result in unsatisfactory operation of the Narellan Road / Mount Annan Drive / Tramway Drive.

It is possible that RMS holds more detailed traffic modelling data for this corridor and/or this intersection which could show a different range of traffic volumes and therefore different results for the intersection operation.

5 Parking

The statutory car parking requirements are set out in the Camden Council's Development Control Plan (DCP) 2011.

Minimum car parking space for dwellings with 1 to 2 bedrooms is 1 parking space.

Minimum car parking space requirement for dwellings with more than 2 bedrooms is 2 parking spaces

In both instances, at least one car parking space behind the building line.

The parking provisions of each lot must comply with Council's DCP and will be addressed in a future development application.

6 Conclusions

Cardno has been commissioned by Landco/Wolin JV to produce a Traffic Impact Assessment (TIA) to accompany a planning proposal seeking consent for the rezoning of Lot 627 DP 1163903 located at 207B Turner Road, Currans Hill.

The following conclusion outlines the analysis and discussions presented within this report:

6.1 Traffic Assessment / Traffic Generation

- The model results are consistent with the findings of the Narellan Road Upgrade – Camden Valley Way to Blaxland Road / Gilchrist Drive report by AECOM (2013)
- Model results for 2021 without development indicate the intersections in the vicinity of the subject site will operate satisfactorily at LoS B or better, except Narellan Road / Hartley Road / Waterworth Drive which will operate at LoS F.
- Model results for 2031 without development indicate the intersections in the vicinity of the subject site will operate satisfactorily at LoS B or better, except Narellan Road / Hartley Road / Waterworth Drive and Narellan Road / Mount Annan Drive / Tramway Drive which will operate at LoS E and LoS F.
- The model results indicate that the proposed development will have an insignificant impact to the average delay of the assessed intersections in the vicinity of the development during peak hour periods in opening year 2021 and future horizon year 2031
- The proposed development is expected to generate 190 trips in the AM peak hour and 198 trips in the PM peak hour
- Journey to Work data indicate 30% of trips are west-bound and 70% of trips are east-bound

6.2 Accessibility / Connectivity

- The nearest public transport provision is located approximately 400m from the access of the subject site
- Internal road layout to comply with Council's DCP
- The parking provisions of each lot must comply with Council's DCP and will be addressed in a future development application

6.3 Further Work

- A conceptual residential lots master plan to be developed is required detailing the traffic implications connecting the subject area to the adjacent local road network
- Consultation with public transport authorities may be required to confirm potential extension of the existing bus routes
- Consultation with RMS to confirm if more detailed traffic modelling data for the Narellan Road corridor is available (which could show a different range of traffic volumes and therefore different results for the intersection operation)

Manooka Stage 3 Planning Proposal

APPENDIX A

TRAFFIC SURVEY DATA

Cardno
Shaping the Future

BVY TRAFFIC SURVEY

QUALITY ENDORSED COMPANY BY AS/NZS ISO 9001:2008

OH&S SYSTEM CERTIFIED TO AS/NZS ISO 4801:2001

TURNING MOVEMENT SURVEY

Intersection of Glenfield Dr and Spring Hill Cl, Manooka

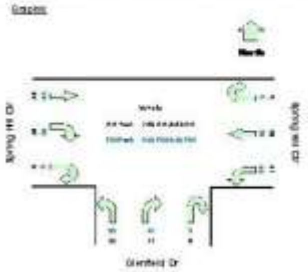
Date:	Thu 09/12/16	North:	N/A	Survey Start	AM: 7:00 PM: 16:00
Weather:	Overcast	East:	Spring Hill Cl	Vehicles per Peak hour	
Suburban:	Manooka	South:	Glenfield Dr	AM: 7:45 AM-8:45 AM	PM: 4:15 PM-5:15 PM
Customer:	Cardno	West:	Spring Hill Cl		

All Vehicles

Time		East Approach Spring Hill Cl			South Approach Glenfield Dr			West Approach Spring Hill Cl			Hourly Total	
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	Hour	Peak
7:00	7:15	0	10	6	0	4	6	0	3	2	188	
7:15	7:30	0	16	9	0	2	8	0	8	1	216	
7:30	7:45	0	17	17	0	8	4	0	8	9	228	
7:45	8:00	0	20	16	0	5	7	0	11	9	237	Peak
8:00	8:15	0	16	17	0	1	7	0	6	9	217	
8:15	8:30	0	17	12	0	3	6	0	8	8		
8:30	8:45	0	14	16	0	8	13	0	2	8		
8:45	9:00	0	16	12	0	1	8	0	7	7		
16:00	16:15	0	6	12	0	8	8	0	8	16	279	
16:15	16:30	0	11	11	0	13	12	0	13	17	283	Peak
16:30	16:45	0	8	11	0	13	13	0	7	16	278	
16:45	17:00	0	6	18	0	12	13	0	8	18	273	
17:00	17:15	0	8	8	0	8	12	0	7	15	248	
17:15	17:30	0	8	12	0	17	8	0	16	20		
17:30	17:45	0	6	8	0	12	7	0	13	16		
17:45	18:00	0	4	12	0	7	8	0	8	13		

Peak Time		East Approach Spring Hill Cl			South Approach Glenfield Dr			West Approach Spring Hill Cl			Peak
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	total
7:45	8:45	0	69	61	0	17	33	0	28	25	237
16:15	17:15	0	36	48	0	47	50	0	36	66	283

Graphs



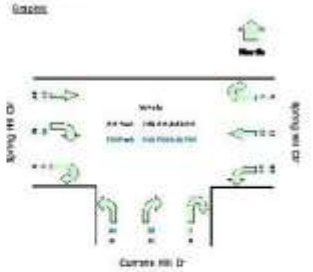
Light Vehicles

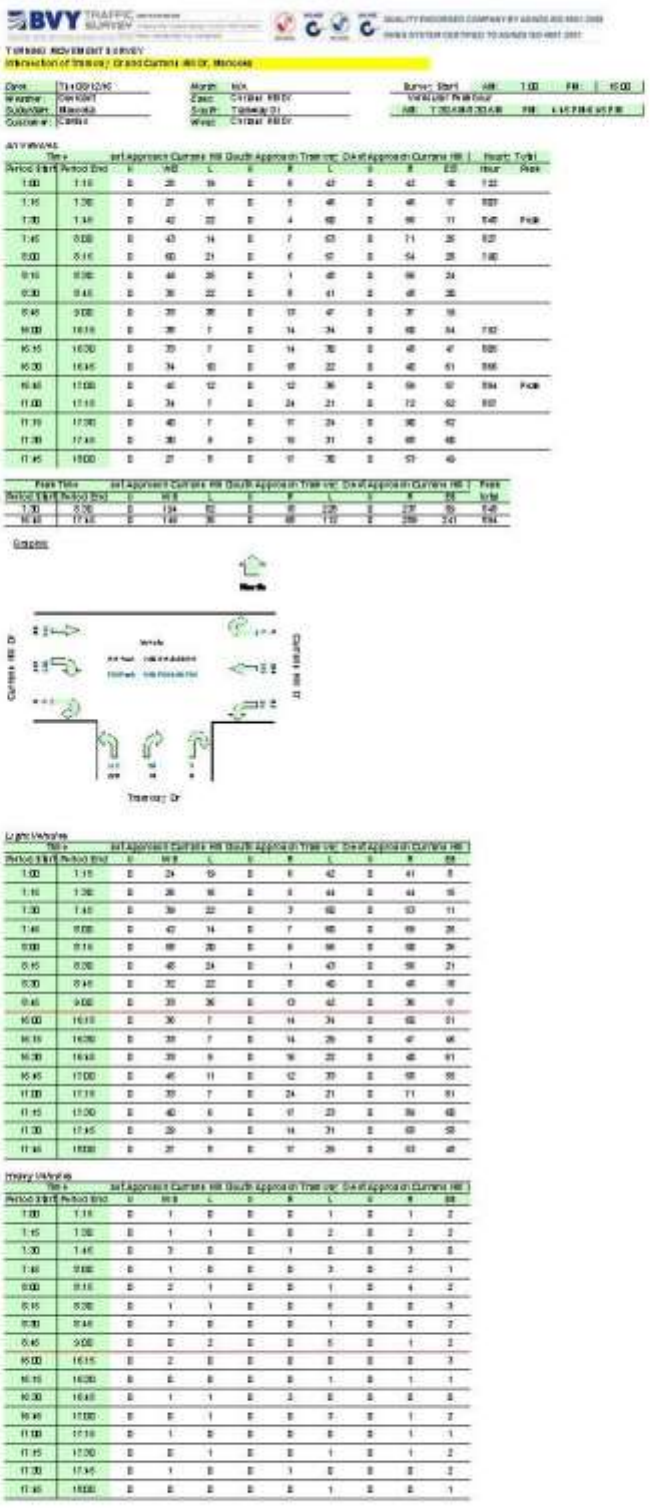
Time		East Approach Spring Hill Cl			South Approach Glenfield Dr			West Approach Spring Hill Cl		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
7:00	7:15	0	10	6	0	4	4	0	3	2
7:15	7:30	0	16	8	0	2	3	0	8	1
7:30	7:45	0	16	13	0	5	3	0	8	5
7:45	8:00	0	19	16	0	8	7	0	10	9
8:00	8:15	0	16	17	0	8	4	0	8	9
8:15	8:30	0	17	11	0	2	6	0	6	5
8:30	8:45	0	14	16	0	7	11	0	2	8
8:45	9:00	0	16	12	0	1	6	0	6	7
16:00	16:15	0	5	12	0	8	7	0	4	15
16:15	16:30	0	10	10	0	13	12	0	12	17
16:30	16:45	0	8	11	0	13	13	0	7	16
16:45	17:00	0	8	18	0	12	12	0	8	18
17:00	17:15	0	5	9	0	9	12	0	8	15
17:15	17:30	0	8	11	0	13	8	0	8	19
17:30	17:45	0	6	9	0	12	6	0	11	16
17:45	18:00	0	4	12	0	7	8	0	8	13

Heavy Vehicles

Time		East Approach Spring Hill Cl			South Approach Glenfield Dr			West Approach Spring Hill Cl		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
7:00	7:15	0	0	0	0	0	1	0	0	0
7:15	7:30	0	0	1	0	0	3	0	1	0
7:30	7:45	0	0	0	0	0	1	0	0	0
7:45	8:00	0	1	0	0	0	0	0	1	0
8:00	8:15	0	0	0	0	1	3	0	1	0
8:15	8:30	0	0	1	0	1	0	0	3	0
8:30	8:45	0	0	0	0	1	2	0	0	0
8:45	9:00	0	0	0	0	0	0	0	2	0
16:00	16:15	0	0	0	0	1	1	0	2	0
16:15	16:30	0	1	1	0	0	0	0	1	0
16:30	16:45	0	0	0	0	0	1	0	0	0
16:45	17:00	0	0	0	0	0	1	0	0	0
17:00	17:15	0	0	0	0	0	0	0	1	0
17:15	17:30	0	0	1	0	0	0	0	1	1
17:30	17:45	0	0	0	0	0	1	0	2	0
17:45	18:00	0	0	0	0	0	0	0	1	0

RATIO CONSULTANTS PTY LTD





BVY TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

Intersection of Harley Rd and Cumins Hill Dr, Manooka

Date:	Thr 09/12/16	Weather:	Overcast	Suburb:	Manooka	Customer:	Client

North:	Harley Rd	East:	Cumins Hill Dr
South:	Harley Rd	West:	Mt Pleasure Rd

Survey Start	AM	7:00	PM	16:00

Vehicular Peak Hour

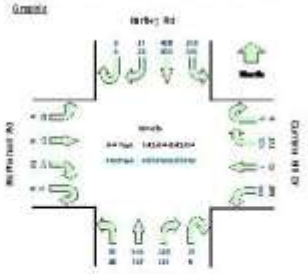
AM: 7:45 AM to 8:45 AM PM: 16:00 PM to 17:00 PM

All Vehicles

Time		North Approach Harley Rd				East Approach Cumins Hill Dr				South Approach Harley Rd				West Approach Mt Pleasure Rd				Hourly Totals	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
7:00	7:15	0	2	61	30	2	53	3	29	0	13	104	13	0	3	0	1	1141	
7:15	7:30	2	2	73	41	0	61	2	26	2	21	102	8	0	0	0	1	1306	
7:30	7:45	1	3	82	34	0	70	3	34	0	19	122	6	0	3	0	3	2071	
7:45	8:00	0	4	102	62	0	89	2	39	2	33	136	8	0	7	0	2	2096	Peak
8:00	8:15	3	6	100	71	0	74	5	59	2	30	200	12	0	6	0	0	2011	
8:15	8:30	0	6	119	69	0	93	4	93	1	31	112	10	0	9	0	3		
8:30	8:45	0	6	71	31	0	69	4	52	1	31	106	8	0	1	0	1		
8:45	9:00	2	4	100	33	0	40	0	61	3	24	111	11	0	3	0	4		
16:00	16:15	1	9	200	99	0	59	4	39	0	34	166	11	0	9	3	1	2265	Peak
16:15	16:30	0	7	159	80	0	26	0	62	5	57	124	8	0	1	5	9	2217	
16:30	16:45	4	6	209	92	0	24	2	61	1	47	115	4	0	9	3	4	2230	
16:45	17:00	0	1	159	60	0	62	1	66	4	51	102	7	0	6	2	3	2156	
17:00	17:15	0	6	200	76	0	36	0	21	2	30	120	11	0	10	0	12	2096	
17:15	17:30	3	8	220	71	0	36	0	32	1	44	163	4	0	1	6	1		
17:30	17:45	0	3	156	86	0	46	0	30	4	60	122	1	0	2	0	2		
17:45	18:00	0	3	111	71	0	44	0	52	2	57	106	1	0	3	0	1		

Peak Times		North Approach Harley Rd				East Approach Cumins Hill Dr				South Approach Harley Rd				West Approach Mt Pleasure Rd				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Total
7:45	8:45	3	21	429	213	0	212	15	200	6	124	578	36	0	26	0	6	2096
16:00	17:00	9	29	668	336	0	131	7	166	10	186	616	36	0	21	13	23	2265

Graphic



Light Vehicles

Time		North Approach Harley Rd				East Approach Cumins Hill Dr				South Approach Harley Rd				West Approach Mt Pleasure Rd			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	2	61	29	2	52	3	28	0	11	125	13	0	1	0	0
7:15	7:30	2	2	69	39	0	60	2	26	2	21	139	1	0	0	0	1
7:30	7:45	1	3	31	31	0	73	3	34	0	19	163	0	0	1	0	2
7:45	8:00	0	4	77	60	0	81	2	31	2	33	161	7	0	2	0	0
8:00	8:15	3	6	100	69	0	71	5	58	2	29	111	12	0	3	0	0
8:15	8:30	0	5	95	49	0	55	4	45	1	35	145	9	0	3	0	2
8:30	8:45	0	5	93	30	0	49	3	45	1	29	145	7	0	1	0	0
8:45	9:00	2	3	82	33	0	36	0	60	3	22	128	11	0	3	0	3
16:00	16:15	1	9	134	90	0	59	4	33	0	33	140	10	0	4	3	1
16:15	16:30	0	4	152	79	0	24	0	62	5	56	116	7	0	7	4	4
16:30	16:45	3	4	196	90	0	23	2	60	1	47	102	3	0	9	3	4
16:45	17:00	0	6	158	92	0	50	1	65	4	50	81	5	0	6	2	3
17:00	17:15	0	6	159	76	0	35	0	26	1	36	106	10	0	9	6	11
17:15	17:30	3	8	200	71	0	34	0	32	1	43	143	4	0	1	4	1
17:30	17:45	0	3	150	86	0	46	0	29	4	49	103	1	0	2	0	2
17:45	18:00	0	3	102	71	0	43	0	52	2	56	96	1	0	3	0	1

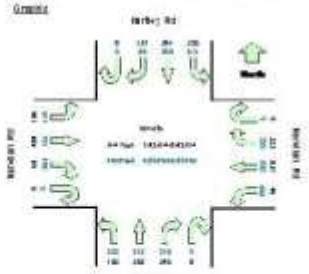
Heavy Vehicles

Time		North Approach Harley Rd				East Approach Cumins Hill Dr				South Approach Harley Rd				West Approach Mt Pleasure Rd			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	36	1	0	1	0	1	0	2	29	0	0	2	0	1
7:15	7:30	0	0	10	3	0	1	0	2	0	0	23	1	0	0	0	0
7:30	7:45	2	0	21	3	0	2	0	0	0	1	9	0	0	2	0	1
7:45	8:00	0	0	20	2	0	2	0	2	0	0	29	1	0	0	0	2
8:00	8:15	0	0	29	3	0	3	0	0	0	0	29	0	0	0	0	0
8:15	8:30	0	0	33	0	0	2	0	2	0	2	24	1	0	2	0	1
8:30	8:45	0	1	21	1	0	0	1	4	0	2	24	1	0	2	0	1
8:45	9:00	0	1	14	0	0	5	0	1	0	2	34	0	0	0	0	1
16:00	16:15	0	0	12	1	0	0	0	2	0	1	25	1	0	1	0	0
16:15	16:30	0	3	11	1	0	2	0	0	0	1	10	1	0	0	1	1
16:30	16:45	1	2	16	2	0	1	0	1	0	0	11	1	0	0	0	0
16:45	17:00	0	1	21	1	0	2	0	1	0	1	19	2	0	1	0	0
17:00	17:15	0	0	16	0	0	0	0	1	1	2	14	1	0	1	0	1
17:15	17:30	0	0	11	0	0	1	0	0	0	1	16	0	0	0	2	0
17:30	17:45	0	0	13	0	0	0	0	1	0	1	15	0	0	0	0	0
17:45	18:00	0	1	9	0	0	1	0	0	0	1	9	0	0	0	0	0

RATIO CONSULTANTS PTY LTD

ORD05

Attachment 4



BVY TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

Intersection of Tramway Dr and Nicholas Rd, Manooka

Date:	Thr 09/12/16		Weather:	Overcast		Suburb:	Manooka
Location:	Casino		North:	Tramway Dr		East:	Nicholas Rd
South:	Tramway Dr		West:	Nicholas Rd			

Survey Start	AM	7:00	PM	16:00

Vehicular Peak Hour

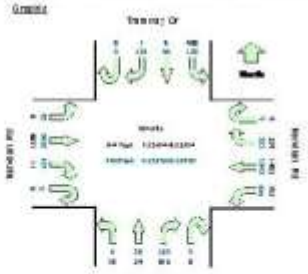
AM	7:15 AM to 8:15 AM	PM	16:30 PM to 17:30 PM

All Vehicles

Time		North Approach Tramway Dr				East Approach Nicholas Rd				South Approach Tramway Dr				West Approach Nicholas Rd				Hourly Total	
Period Start	Period End	U	R	HB	L	U	R	HB	L	U	R	HB	L	U	R	CB	L	Hour	Peak
7:00	7:15	0	2	1	113	0	83	329	21	0	225	8	2	0	2	113	4	4868	
7:15	7:30	0	0	1	108	0	91	353	20	0	227	4	1	0	1	145	2	4965	Peak
7:30	7:45	0	0	3	129	0	83	361	28	0	234	6	1	0	3	206	0	4954	
7:45	8:00	0	0	0	147	0	81	403	22	0	189	7	1	0	4	183	3	4930	
8:00	8:15	0	1	2	115	0	53	365	33	0	212	1	1	0	3	269	3	4354	
8:15	8:30	0	3	4	116	0	63	356	43	0	136	1	6	0	1	266	3		
8:30	8:45	0	4	2	86	0	84	343	23	0	136	10	4	0	11	266	3		
8:45	9:00	0	2	6	70	0	29	361	11	0	95	1	3	0	8	260	4		
16:00	16:15	0	9	4	83	0	48	436	19	0	86	1	2	0	9	169	12	6678	
16:15	16:30	0	5	11	66	0	55	508	15	0	36	1	0	0	8	191	7	6590	Peak
16:30	16:45	0	5	15	43	0	31	412	51	0	30	3	1	0	21	549	9	5427	
16:45	17:00	0	66	19	8	0	69	462	109	0	42	11	4	0	34	564	2	6381	
17:00	17:15	0	69	21	12	0	116	421	100	0	62	11	0	0	61	460	6	6012	
17:15	17:30	0	61	30	6	0	96	496	115	0	84	10	2	0	39	529	2		
17:30	17:45	0	60	26	11	0	74	360	100	0	66	8	0	0	26	461	6		
17:45	18:00	0	50	22	9	0	83	336	95	0	66	6	2	0	53	409	15		

Peak Time		North Approach Tramway Dr				East Approach Nicholas Rd				South Approach Tramway Dr				West Approach Nicholas Rd				Peak
Period Start	Period End	U	R	HB	L	U	R	HB	L	U	R	HB	L	U	R	CB	L	Total
7:15	8:15	0	1	5	439	0	328	1452	109	0	815	24	10	0	11	1529	0	4965
16:15	17:15	0	126	85	129	0	322	1843	345	0	180	36	5	0	124	2483	23	6698

Graphic



Light Vehicles

Time		North Approach Tramway Dr				East Approach Nicholas Rd				South Approach Tramway Dr				West Approach Nicholas Rd			
Period Start	Period End	U	R	HB	L	U	R	HB	L	U	R	HB	L	U	R	CB	L
7:00	7:15	0	2	1	113	0	81	268	26	0	216	8	2	0	2	268	3
7:15	7:30	0	0	1	108	0	92	288	19	0	222	4	1	0	1	286	1
7:30	7:45	0	0	3	126	0	82	309	28	0	230	6	1	0	3	282	0
7:45	8:00	0	0	0	141	0	80	340	22	0	187	7	1	0	2	318	1
8:00	8:15	0	1	0	108	0	53	314	32	0	212	1	6	0	3	343	1
8:15	8:30	0	3	4	111	0	60	312	39	0	136	1	6	0	6	324	2
8:30	8:45	0	4	2	83	0	62	309	22	0	136	10	4	0	10	330	2
8:45	9:00	0	2	5	67	0	24	286	16	0	90	1	2	0	8	342	4
16:00	16:15	0	7	4	61	0	46	458	61	0	83	1	2	0	8	474	12
16:15	16:30	0	5	11	66	0	55	503	74	0	36	1	0	0	8	661	6
16:30	16:45	0	5	15	43	0	31	428	69	0	30	3	1	0	21	536	9
16:45	17:00	0	66	11	8	0	66	474	109	0	41	10	4	0	34	565	2
17:00	17:15	0	66	20	9	0	116	403	99	0	60	11	0	0	61	436	4
17:15	17:30	0	61	19	6	0	96	429	113	0	83	9	2	0	39	503	2
17:30	17:45	0	59	25	6	0	74	360	99	0	59	7	0	0	26	436	6
17:45	18:00	0	50	21	7	0	81	329	91	0	64	6	1	0	53	388	13

Heavy Vehicles

Time		North Approach Tramway Dr				East Approach Nicholas Rd				South Approach Tramway Dr				West Approach Nicholas Rd			
Period Start	Period End	U	R	HB	L	U	R	HB	L	U	R	HB	L	U	R	CB	L
7:00	7:15	0	0	0	0	0	3	69	1	0	6	0	0	0	0	68	1
7:15	7:30	0	0	0	3	0	6	65	1	0	1	0	0	0	0	69	1
7:30	7:45	0	0	0	3	0	1	52	0	0	1	0	0	0	0	63	0
7:45	8:00	0	0	0	6	0	2	63	0	0	2	0	0	0	2	48	2
8:00	8:15	0	0	2	1	0	0	51	1	0	0	0	1	0	0	46	2
8:15	8:30	0	0	0	6	0	3	62	1	0	2	0	0	0	1	62	1
8:30	8:45	0	0	0	3	0	5	64	1	0	0	0	0	0	1	58	1
8:45	9:00	0	0	1	3	0	5	62	1	0	0	0	1	0	1	63	0
16:00	16:15	0	2	0	2	0	2	40	3	0	2	0	0	0	0	29	0
16:15	16:30	0	0	0	1	0	0	39	1	0	0	0	0	0	0	36	1
16:30	16:45	0	0	0	0	0	4	36	3	0	3	0	0	0	0	33	0
16:45	17:00	0	0	1	0	0	3	29	0	0	1	1	0	0	0	29	0
17:00	17:15	0	1	1	3	0	0	18	1	0	2	0	0	0	0	22	1
17:15	17:30	0	0	1	2	0	1	35	0	0	1	1	0	0	0	26	0
17:30	17:45	0	1	0	3	0	0	22	1	0	0	1	0	0	1	19	0
17:45	18:00	0	0	1	2	0	2	11	1	0	2	0	1	0	0	12	0

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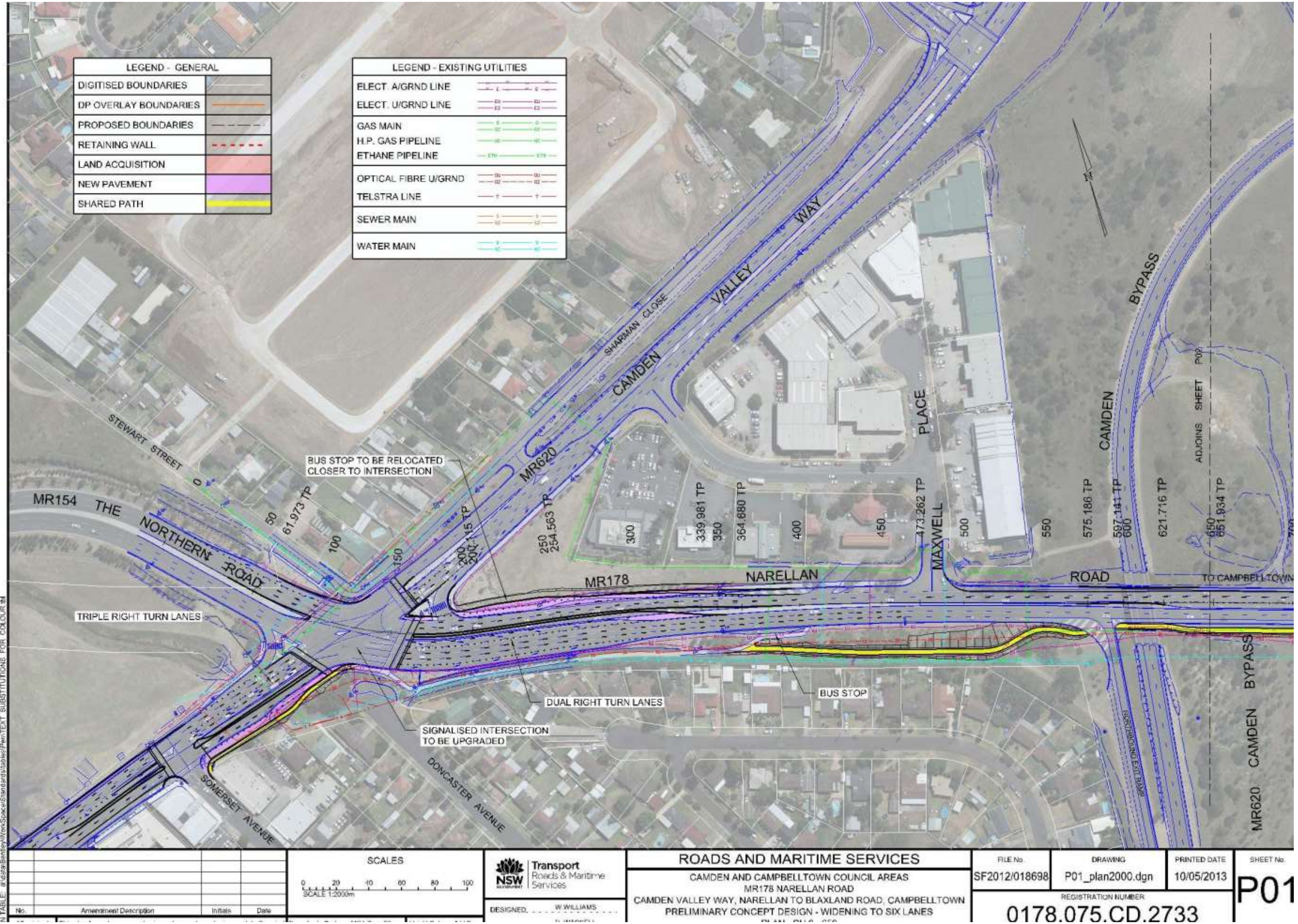
Manooka Stage 3 Planning Proposal

APPENDIX B

NARELLAN ROAD UPGRADE PLANS

Cardno
Shaping the Future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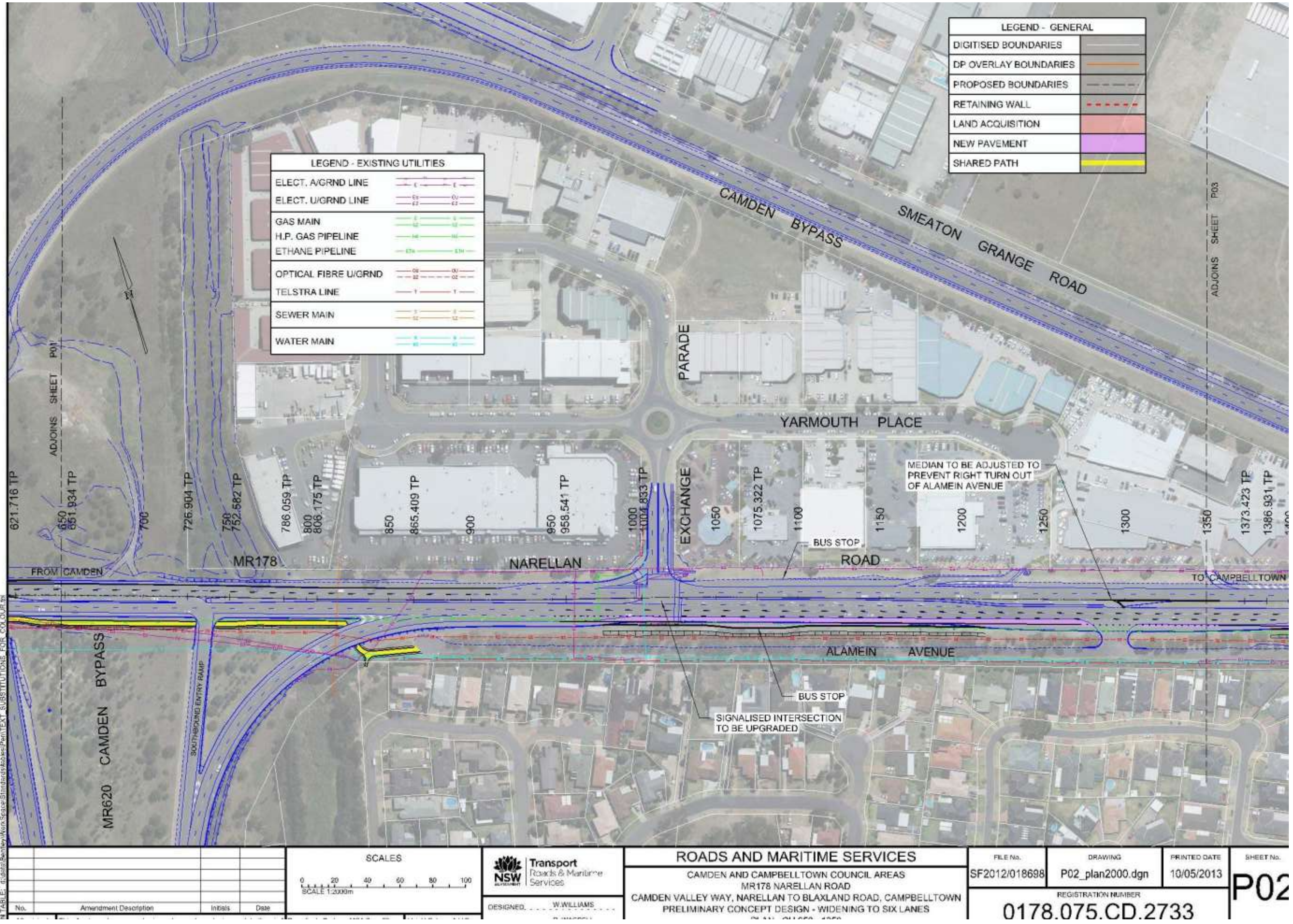
DIGITISED BOUNDARIES
DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
BUS STOP TO BE RELOCATED CLOSER TO INTERSECTION
TRIPLE RIGHT TURN LANES
DUAL RIGHT TURN LANES
SIGNALISED INTERSECTION TO BE UPGRADED
BUS STOP
MR154 THE NORTHERN ROAD
MR178 NARELLAN ROAD
MR620 CAMDEN BYPASS
CAMDEN VALLEY WAY
SHARMAN CLOSE
MAXWELL PLACE
STEWART STREET
SOMERSET AVENUE
DONCASTER AVENUE
TO CAMPBELLTOWN
ADJOINS SHEET P02
SCALES
SCALE 1:2000m
Transport Roads & Maritime Services
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
PRELIMINARY CONCEPT DESIGN - WIDENING TO SIX LANES
FILE No. SF2012/018698
DRAWING P01_plan2000.dgn
PRINTED DATE 10/05/2013
SHEET No. P01
REGISTRATION NUMBER 0178.075.CD.2733
No. Amendment Description Initials Date
DESIGNED W WILLIAMS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DIGITISED BOUNDARIES
DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
CAMDEN BYPASS
SMEATON GRANGE ROAD
PARADE
YARMOUTH PLACE
EXCHANGE
NARELLAN ROAD
MR178
MR620 CAMDEN BYPASS
ALAMEIN AVENUE
FROM CAMDEN
TO CAMPBELLTOWN
BUS STOP
BUS STOP
MEDIAN TO BE ADJUSTED TO PREVENT RIGHT TURN OUT OF ALAMEIN AVENUE
SIGNALISED INTERSECTION TO BE UPGRADED
SOUTHBOUND ENTRY RAMP
ADJOINS SHEET P01
ADJOINS SHEET P03
621.716 TP
650
651.934 TP
700
726.904 TP
750
752.582 TP
786.059 TP
800
806.175 TP
850
865.409 TP
900
950
958.541 TP
1000
1004.833 TP
1050
1075.322 TP
1100
1150
1200
1250
1300
1350
1373.423 TP
1386.931 TP
SCALES
0 20 40 60 80 100
SCALE 1:2000m
Transport Roads & Maritime Services
NSW GOVERNMENT
DESIGNED W.WILLIAMS
No. Amendment Description Initials Date
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
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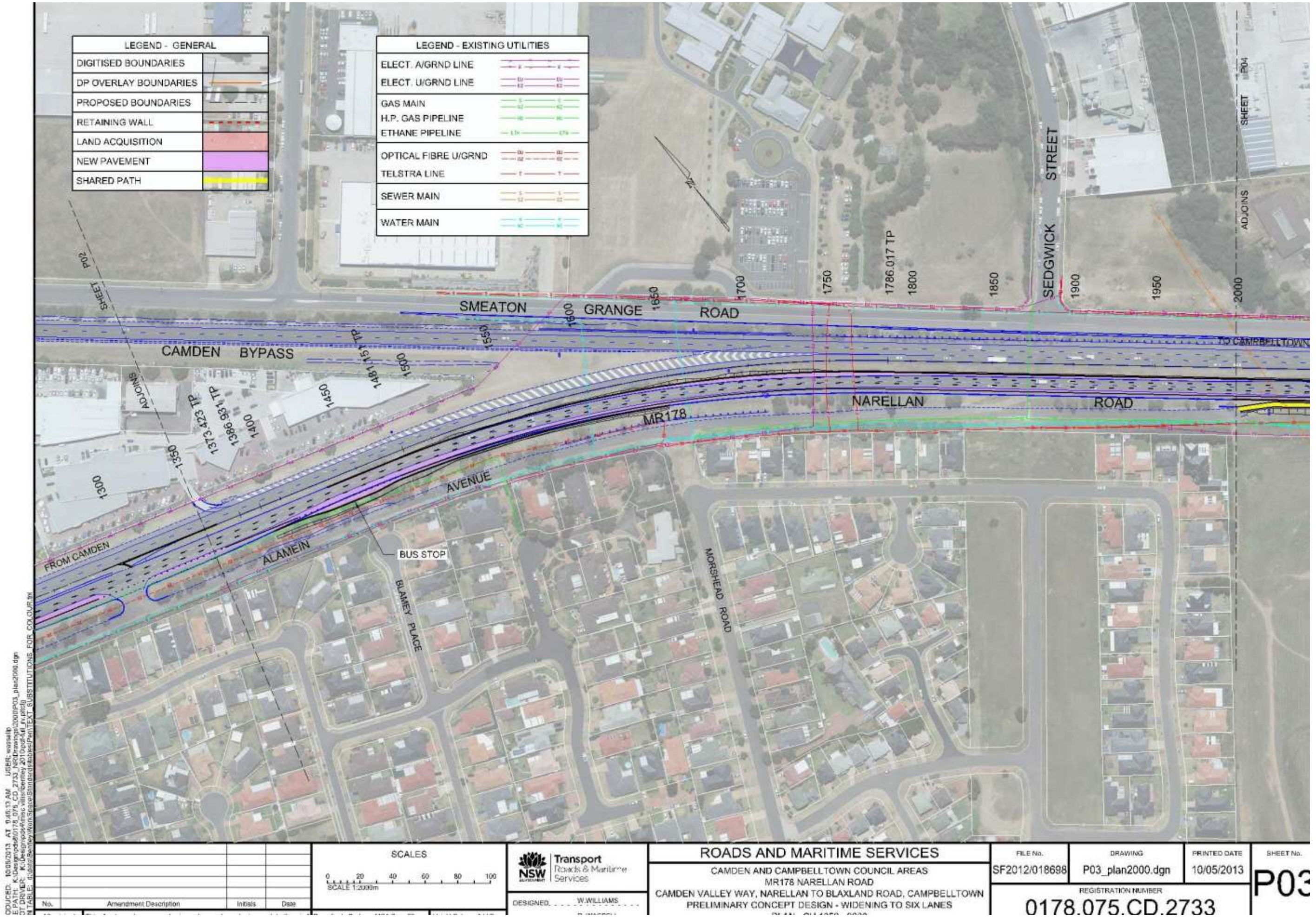
SHEET No. P02
REGISTRATION NUMBER 0178.075.CD.2733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DIGITISED BOUNDARIES
DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
SMEATON GRANGE ROAD
CAMDEN BYPASS
SEDGWICK STREET
NARELLAN ROAD
MR178
AVENUE
ALAMEIN
BLAMEY PLACE
MORSHEAD ROAD
BUS STOP
FROM CAMDEN
TO CAMPBELLTOWN
ADJOINS
SHEET P04
SHEET P02
1786.017 TP
1481.154 TP
1373.423 TP
1386.931 TP
SCALES
SCALE 1:2000m
Transport Roads & Maritime Services
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
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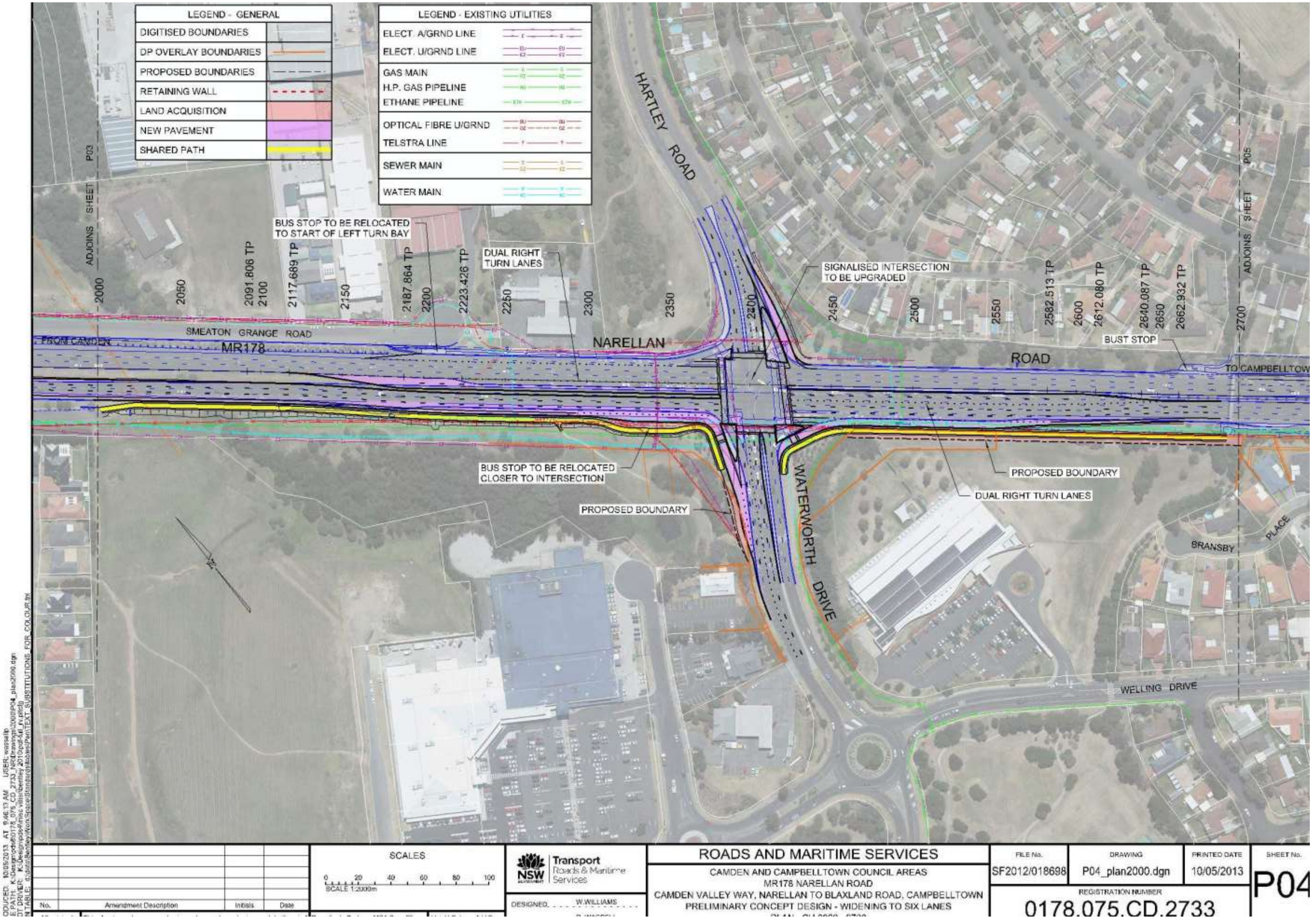
DRAWING P03_plan2000.dgn
PRINTED DATE 10/05/2013
SHEET No. P03
REGISTRATION NUMBER 0178.075.CD.2733
No. Amendment Description Initials Date
DESIGNED W.WILLIAMS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DIGITISED BOUNDARIES
DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
HARTLEY ROAD
ADJOINS SHEET P03
ADJOINS SHEET P05
BUS STOP TO BE RELOCATED TO START OF LEFT TURN BAY
DUAL RIGHT TURN LANES
SIGNALISED INTERSECTION TO BE UPGRADED
BUST STOP
TO CAMPBELLTOW
SMEATON GRANGE ROAD
FROM CAMDEN
MR178
NARELLAN
ROAD
BUS STOP TO BE RELOCATED CLOSER TO INTERSECTION
PROPOSED BOUNDARY
DUAL RIGHT TURN LANES
WATERWORTH DRIVE
BRANSBY PLACE
WELLING DRIVE
2000
2050
2091.806 TP
2100
2117.689 TP
2150
2187.864 TP
2200
2223.426 TP
2250
2300
2350
2400
2450
2500
2550
2582.513 TP
2600
2612.080 TP
2640.087 TP
2650
2662.932 TP
2700
SCALES
SCALE 1:2000m
Transport Roads & Maritime Services
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
PRELIMINARY CONCEPT DESIGN - WIDENING TO SIX LANES
DESIGNED W.WILLIAMS
No. Amendment Description Initials Date
FILE No. SF2012/018698
DRAWING P04_plan2000.dgn
PRINTED DATE 10/05/2013
SHEET No. P04
REGISTRATION NUMBER 0178.075.CD.2733

LEGEND - GENERAL
DIGITISED BOUNDARIES
DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH

LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN

MEDIAN PEDESTRIAN FENCE TO BE EXTENDED TO START OF WIRE ROPE SAFETY BARRIER

ADJOINS SHEET P04

ADJOINS SHEET P06

2640.087 TP

2662.932 TP

2870.448 TP

3419.350 TP

2700 2750 2800 2850 2900 2950 3000 3050 3100 3150 3200 3250 3300 3350 3400

FROM CAMDEN

TO CAMPBELLTOWN

BUS STOP

MR178 NARELLAN ROAD

BRANSBY PLACE

WATSON ROAD

SCALES

0 20 40 60 80 100

SCALE 1:2000m

Transport Roads & Maritime Services NSW GOVERNMENT

DESIGNED W.WILLIAMS

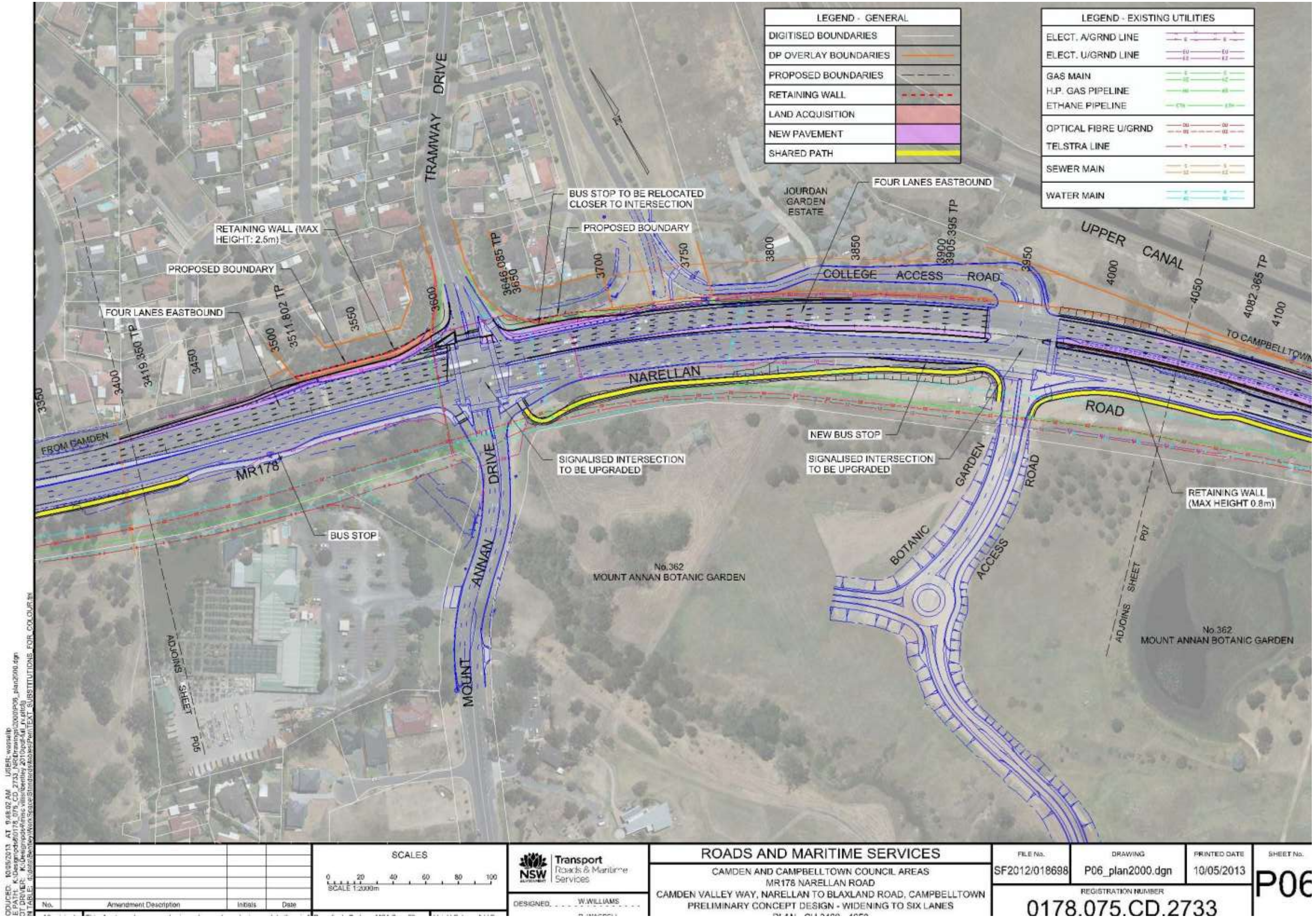
No.	Amendment Description	Initials	Date

ROADS AND MARITIME SERVICES

CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
PRELIMINARY CONCEPT DESIGN - WIDENING TO SIX LANES

FILE No.	DRAWING	PRINTED DATE	SHEET No.
SF2012/018698	P05_plan2000.dgn	10/05/2013	P05

REGISTRATION NUMBER
0178.075.CD.2733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DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
TRAMWAY DRIVE
BUS STOP TO BE RELOCATED CLOSER TO INTERSECTION
PROPOSED BOUNDARY
RETAINING WALL (MAX HEIGHT: 2.5m)
PROPOSED BOUNDARY
FOUR LANES EASTBOUND
FOUR LANES EASTBOUND
JOURDAN GARDEN ESTATE
COLLEGE ACCESS ROAD
UPPER CANAL
TO CAMPBELLTOWN
NARELLAN ROAD
FROM CAMDEN
MR178
BUS STOP
SIGNALISED INTERSECTION TO BE UPGRADED
SIGNALISED INTERSECTION TO BE UPGRADED
NEW BUS STOP
MOUNT ANNAN DRIVE
GARDEN ROAD
BOTANIC GARDEN ACCESS
RETAINING WALL (MAX HEIGHT 0.8m)
No.362 MOUNT ANNAN BOTANIC GARDEN
No.362 MOUNT ANNAN BOTANIC GARDEN
ADJOINS SHEET P05
ADJOINS SHEET P07
3646.085 TP
3511.802 TP
3419.350 TP
3905.395 TP
4082.365 TP
SCALES
SCALE 1:2000m
Transport Roads & Maritime Services
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
PRELIMINARY CONCEPT DESIGN - WIDENING TO SIX LANES
DESIGNED W.WILLIAMS
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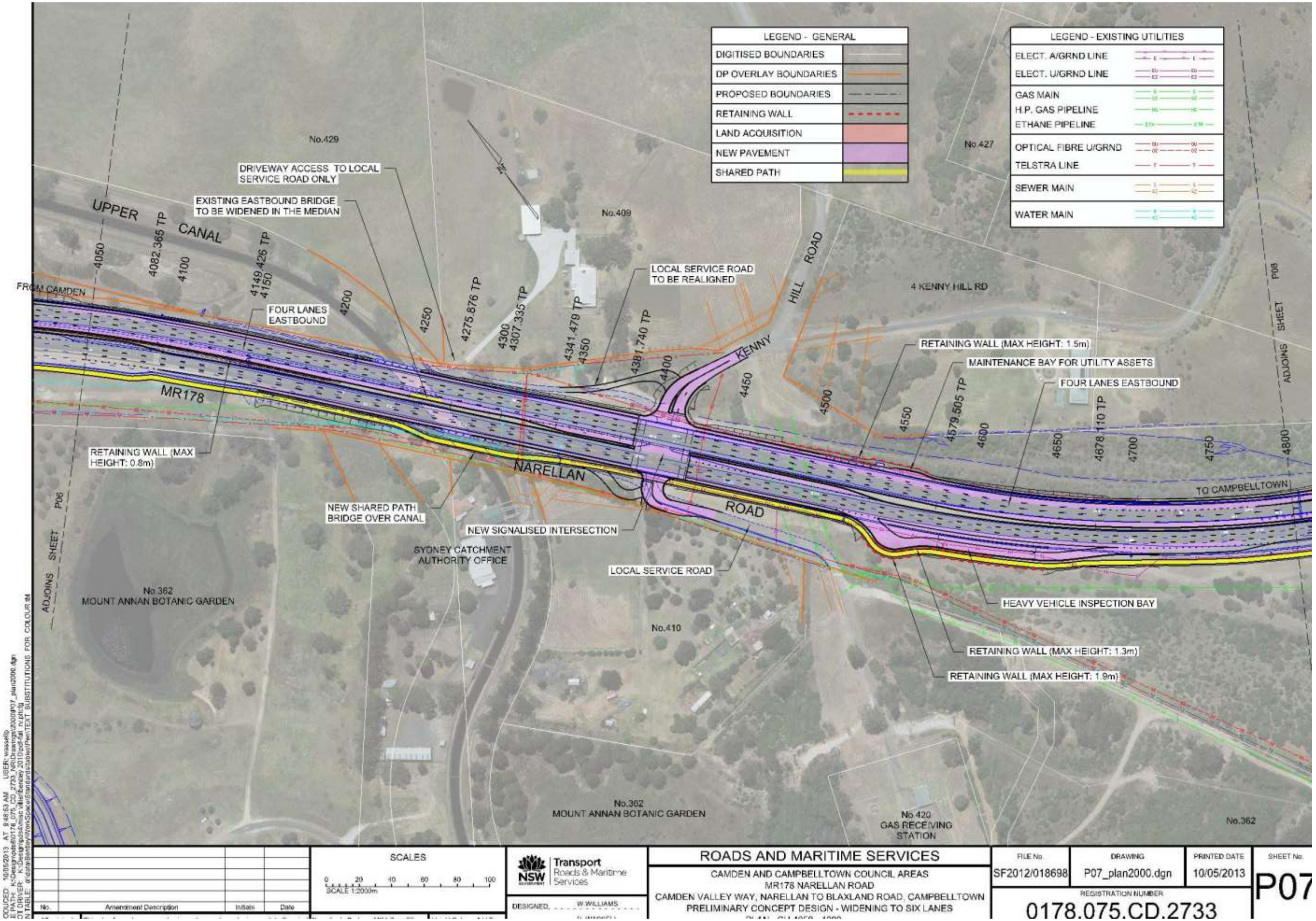
PRINTED DATE 10/05/2013
SHEET No. P06
REGISTRATION NUMBER 0178.075.CD.2733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DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
No.429
No.427
No.409
No.410
No.362
MOUNT ANNAN BOTANIC GARDEN
No.420
GAS RECEIVING STATION
4 KENNY HILL RD
DRIVEWAY ACCESS TO LOCAL SERVICE ROAD ONLY
EXISTING EASTBOUND BRIDGE TO BE WIDENED IN THE MEDIAN
LOCAL SERVICE ROAD TO BE REALIGNED
FOUR LANES EASTBOUND
RETAINING WALL (MAX HEIGHT: 0.8m)
NEW SHARED PATH BRIDGE OVER CANAL
NEW SIGNALISED INTERSECTION
SYDNEY CATCHMENT AUTHORITY OFFICE
LOCAL SERVICE ROAD
RETAINING WALL (MAX HEIGHT: 1.5m)
MAINTENANCE BAY FOR UTILITY ASSETS
FOUR LANES EASTBOUND
HEAVY VEHICLE INSPECTION BAY
RETAINING WALL (MAX HEIGHT: 1.3m)
RETAINING WALL (MAX HEIGHT: 1.9m)
UPPER CANAL
MR178
NARELLAN ROAD
KENNY HILL ROAD
FROM CAMDEN
TO CAMPBELLTOWN
ADJOINS SHEET P06
ADJOINS SHEET P08
4050
4082.365 TP
4100
4149.426 TP
4150
4200
4250
4275.876 TP
4300
4307.335 TP
4341.479 TP
4350
4381.740 TP
4400
4450
4500
4550
4579.505 TP
4600
4650
4678.110 TP
4700
4750
4800
SCALES
SCALE 1:2000m
Transport Roads & Maritime Services
DESIGNED W.WILLIAMS
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
PRELIMINARY CONCEPT DESIGN - WIDENING TO SIX LANES
FILE No. SF2012/018698
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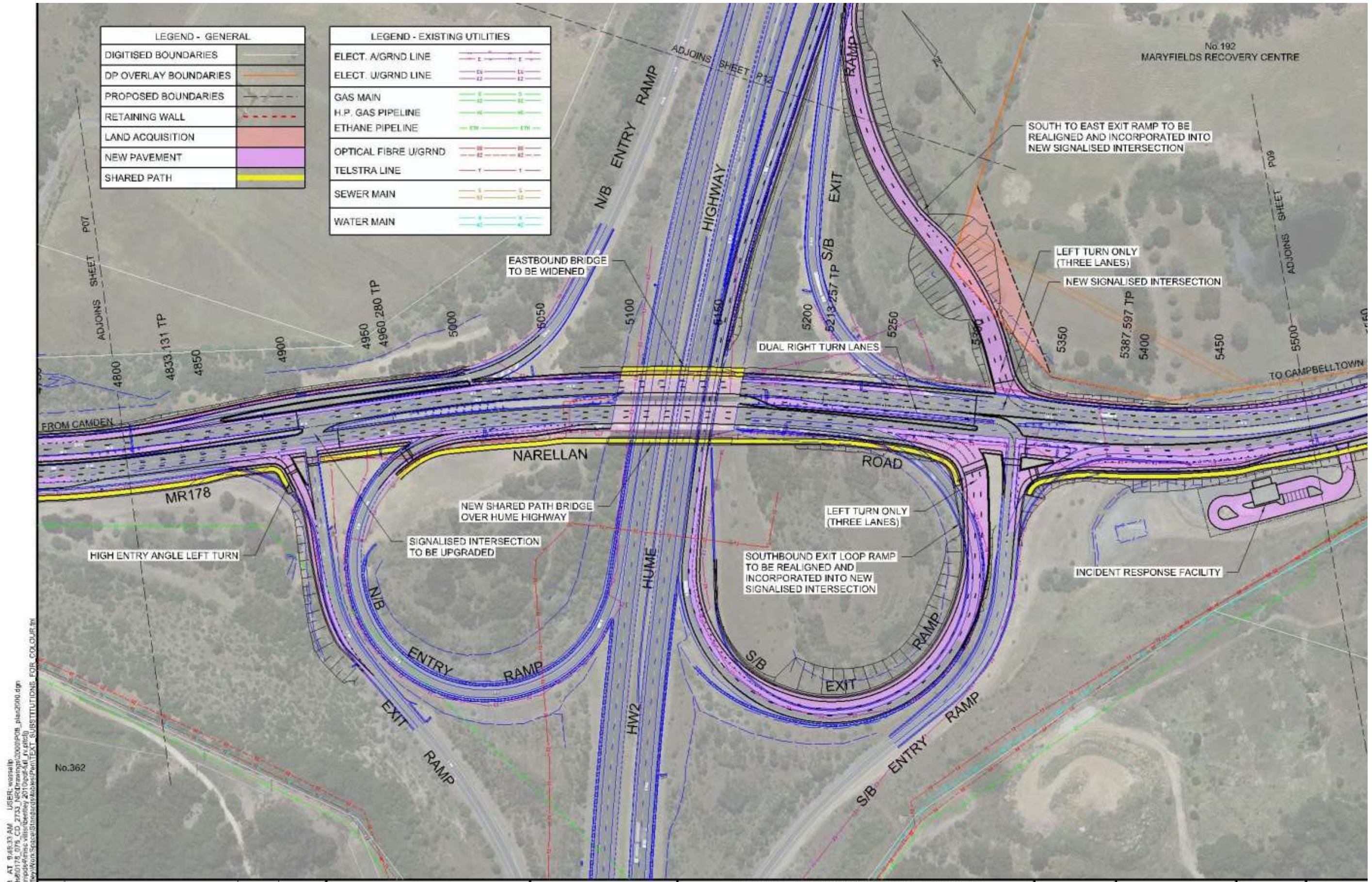
REGISTRATION NUMBER 0178.075.CD.2733
No. Amendment Description Initials Date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DIGITISED BOUNDARIES
DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
No.192
MARYFIELDS RECOVERY CENTRE
SOUTH TO EAST EXIT RAMP TO BE REALIGNED AND INCORPORATED INTO NEW SIGNALISED INTERSECTION
LEFT TURN ONLY (THREE LANES)
NEW SIGNALISED INTERSECTION
DUAL RIGHT TURN LANES
EASTBOUND BRIDGE TO BE WIDENED
NEW SHARED PATH BRIDGE OVER HUME HIGHWAY
SIGNALISED INTERSECTION TO BE UPGRADED
HIGH ENTRY ANGLE LEFT TURN
LEFT TURN ONLY (THREE LANES)
SOUTHBOUND EXIT LOOP RAMP TO BE REALIGNED AND INCORPORATED INTO NEW SIGNALISED INTERSECTION
INCIDENT RESPONSE FACILITY
No.362
N/B ENTRY RAMP
HIGHWAY
S/B EXIT RAMP
N/B ENTRY RAMP
EXIT RAMP
HUME HW2
S/B ENTRY RAMP
S/B EXIT RAMP
NARELLAN ROAD
MR178
FROM CAMDEN
TO CAMPBELLTOWN
ADJOINS SHEET P07
ADJOINS SHEET P09
ADJOINS SHEET P33
4833.131 TP
4960.280 TP
5213.257 TP
5387.597 TP
SCALES
SCALE 1:2000m
Transport Roads & Maritime Services
DESIGNED W.WILLIAMS
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
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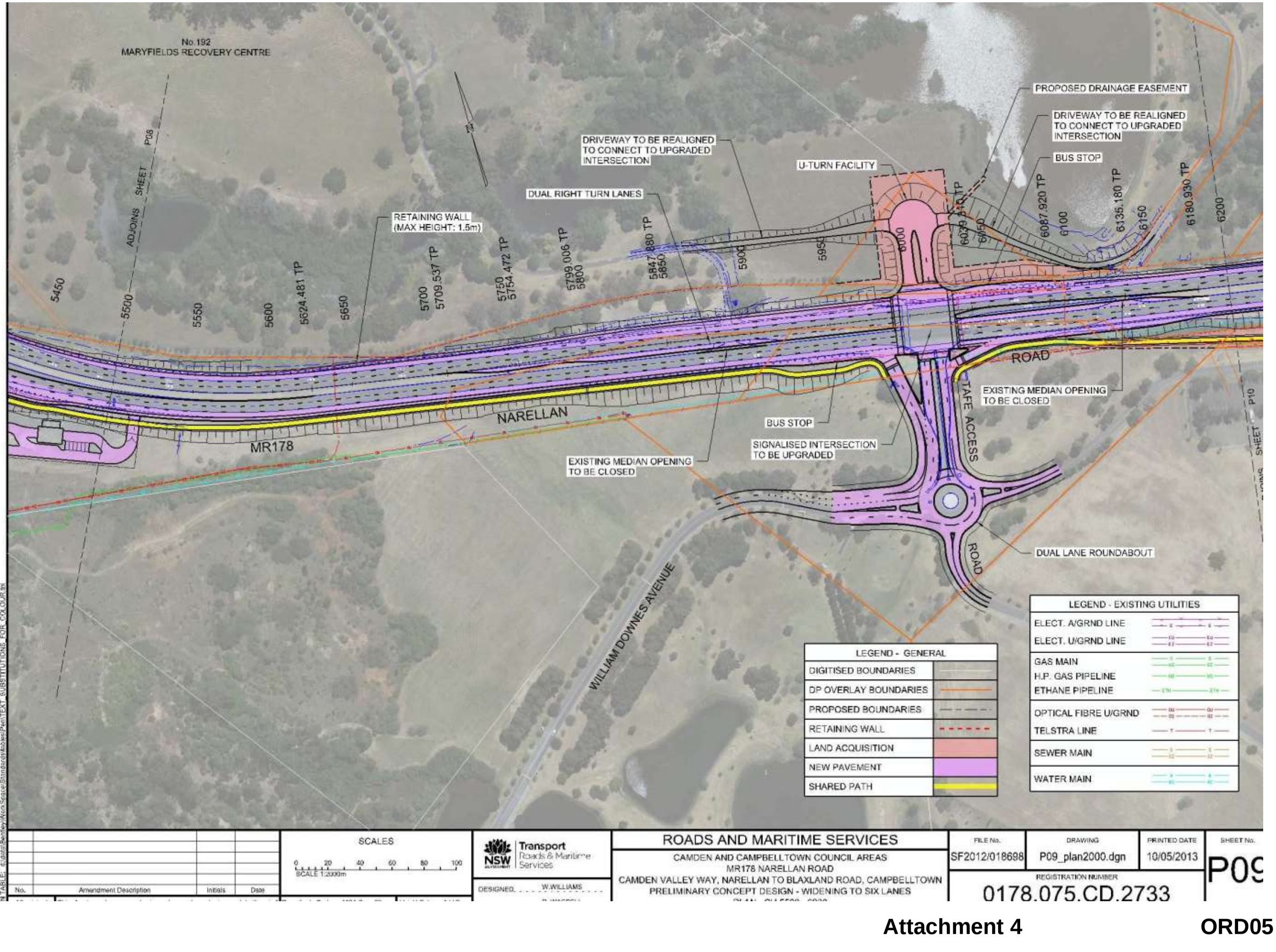
REGISTRATION NUMBER 0178.075.CD.2733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MARYFIELDS RECOVERY CENTRE
ADJOINS SHEET P08
RETAINING WALL (MAX HEIGHT: 1.5m)
DRIVEWAY TO BE REALIGNED TO CONNECT TO UPGRADED INTERSECTION
DUAL RIGHT TURN LANES
U-TURN FACILITY
PROPOSED DRAINAGE EASEMENT
DRIVEWAY TO BE REALIGNED TO CONNECT TO UPGRADED INTERSECTION
BUS STOP
5450
5500
5550
5600
5624.481 TP
5650
5700
5709.537 TP
5750
5754.472 TP
5799.006 TP
5800
5847.880 TP
5850
5900
5950
6000
6039.610 TP
6050
6087.920 TP
6100
6135.180 TP
6150
6180.930 TP
6200
NARELLAN
MR178
ROAD
TAFE ACCESS
EXISTING MEDIAN OPENING TO BE CLOSED
BUS STOP
SIGNALISED INTERSECTION TO BE UPGRADED
EXISTING MEDIAN OPENING TO BE CLOSED
ADJOINS SHEET P10
WILLIAM DOWNES AVENUE
ROAD
DUAL LANE ROUNDABOUT
LEGEND - GENERAL
DIGITISED BOUNDARIES
DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
SCALES
0 20 40 60 80 100
SCALE 1:2000m
Transport Roads & Maritime Services
DESIGNED W.WILLIAMS
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
PRELIMINARY CONCEPT DESIGN - WIDENING TO SIX LANES
FILE No. SF2012/018698
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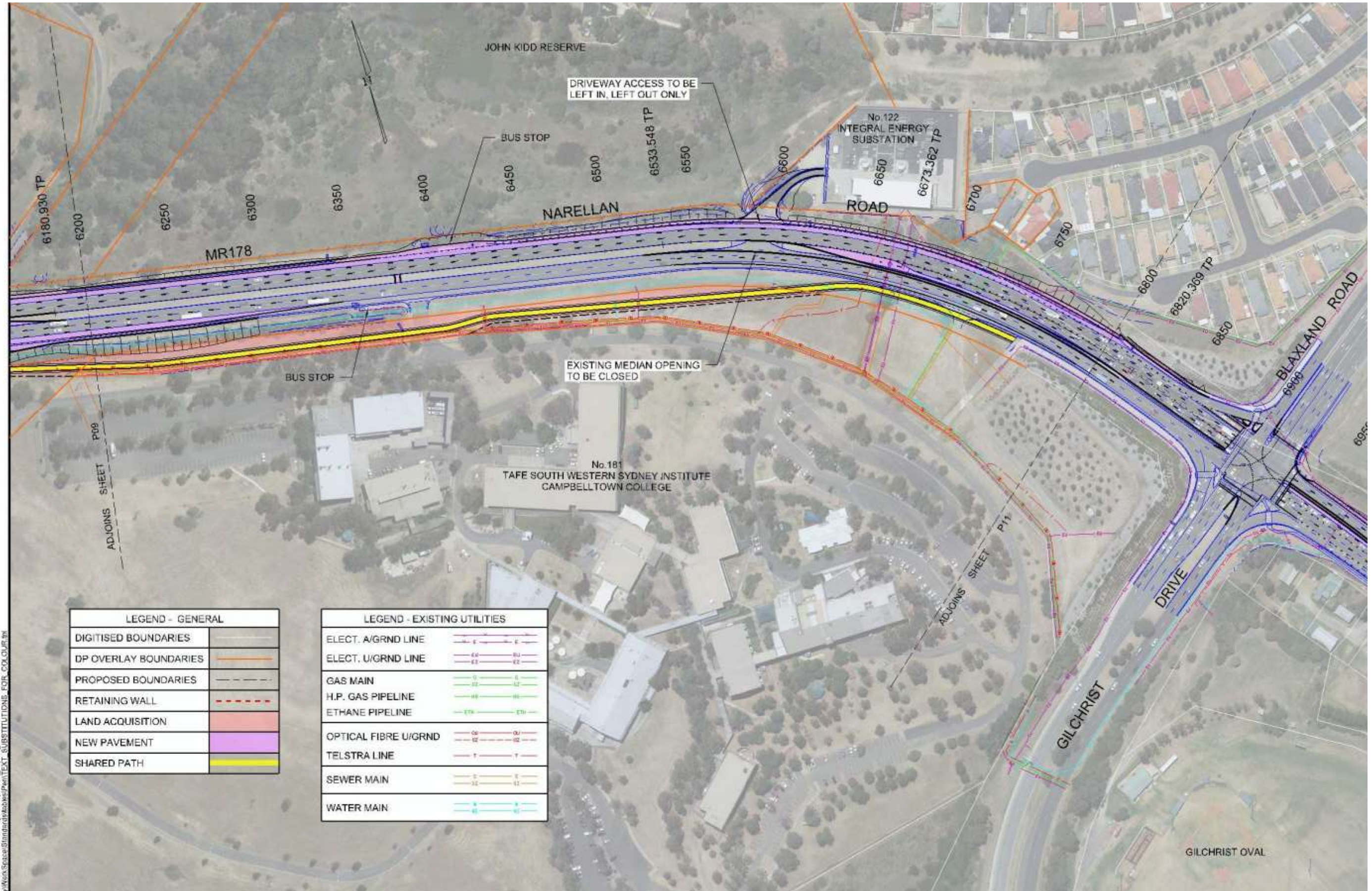
REGISTRATION NUMBER 0178.075.CD.2733
No. Amendment Description Initials Date


JOHN KIDD RESERVE
DRIVEWAY ACCESS TO BE LEFT IN, LEFT OUT ONLY
BUS STOP
No.122
INTEGRAL ENERGY SUBSTATION
NARELLAN ROAD
MR178
BUS STOP
EXISTING MEDIAN OPENING TO BE CLOSED
No.181
TAFE SOUTH WESTERN SYDNEY INSTITUTE
CAMPBELLTOWN COLLEGE
ADJOINS SHEET P09
ADJOINS SHEET P11
BLAXLAND ROAD
DRIVE
GILCHRIST
GILCHRIST OVAL
6180.930 TP
6533.548 TP
6673.362 TP
6820.369 TP
LEGEND - GENERAL
DIGITISED BOUNDARIES
DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
SCALES
SCALE 1:2000m
Transport Roads & Maritime Services
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
PRELIMINARY CONCEPT DESIGN - WIDENING TO SIX LANES
DESIGNED W.WILLIAMS
FILE No. SF2012/018698
DRAWING P10_plan2000.dgn
PRINTED DATE 10/05/2013
SHEET No. P10
REGISTRATION NUMBER 0178.075.CD.2733
No. Amendment Description Initials Date

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DIGITISED BOUNDARIES	
DP OVERLAY BOUNDARIES	
PROPOSED BOUNDARIES	
RETAINING WALL	
LAND ACQUISITION	
NEW PAVEMENT	
SHARED PATH	

LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN

BLAXLAND ROAD

RAILWAY

NARELLAN ROAD

MR178

DRIVEWAY ACCESS TO BE LEFT IN, LEFT OUT ONLY

No.122
INTEGRAL ENERGY SUBSTATION

6673.362 TP

6533.548 TP

6820.369 TP

6965.145 TP

7030.000 TP

7087.142

SIGNALISED INTERSECTION TO BE UPGRADED

EXISTING MEDIAN OPENING TO BE CLOSED

ADJOINS SHEET P10

GILCHRIST DRIVE

GILCHRIST OVAL

SOUTHERN

No.181
TAFE SOUTH WESTERN SYDNEY INSTITUTE
CAMPBELLTOWN COLLEGE

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No.	Amendment Description	Initials	Date

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Transport for NSW
Roads & Maritime Services

DESIGNED W.WILLIAMS

ROADS AND MARITIME SERVICES

CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
PRELIMINARY CONCEPT DESIGN - WIDENING TO SIX LANES

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REGISTRATION NUMBER
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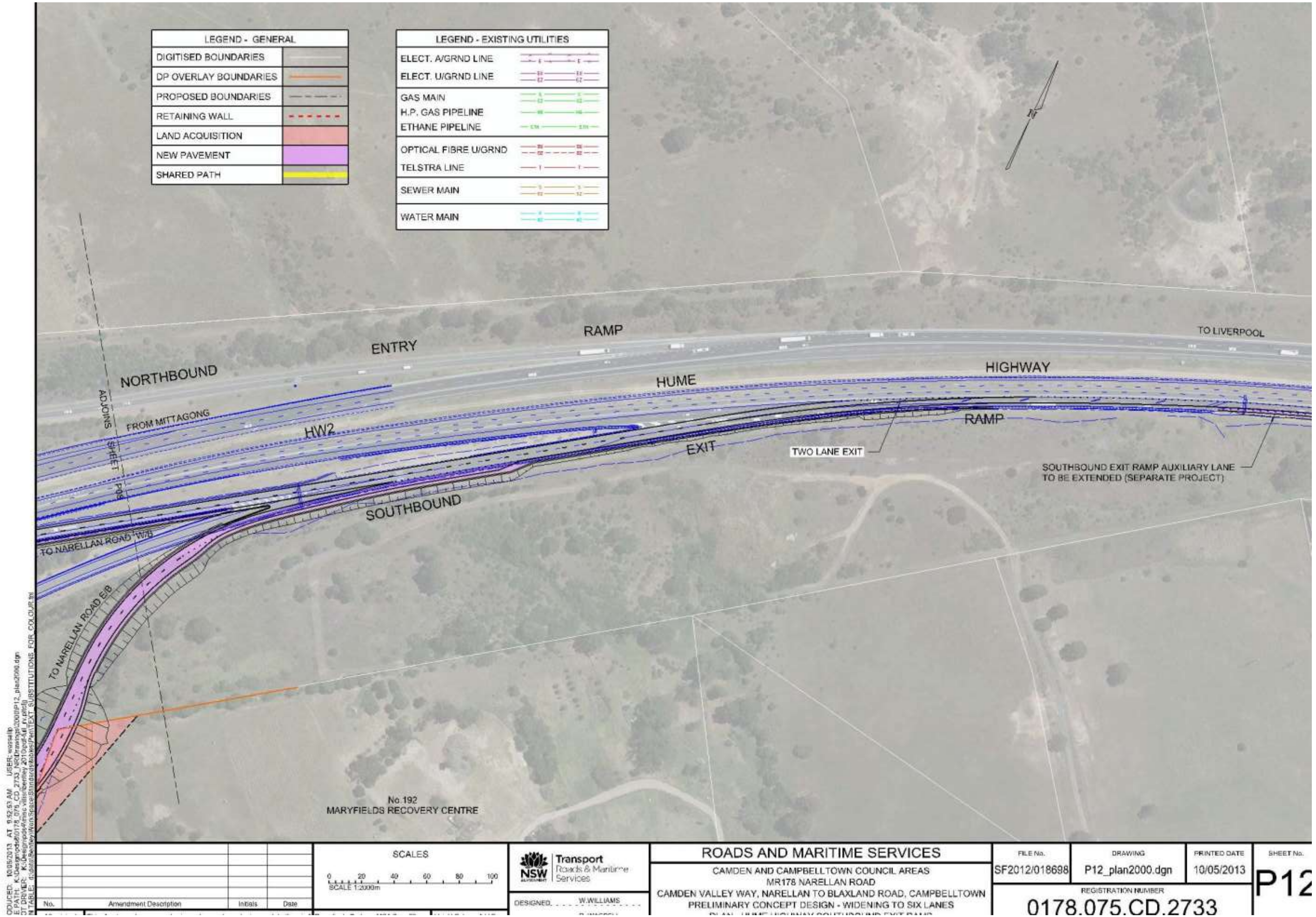
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DIGITISED BOUNDARIES
DP OVERLAY BOUNDARIES
PROPOSED BOUNDARIES
RETAINING WALL
LAND ACQUISITION
NEW PAVEMENT
SHARED PATH
LEGEND - EXISTING UTILITIES
ELECT. A/GRND LINE
ELECT. U/GRND LINE
GAS MAIN
H.P. GAS PIPELINE
ETHANE PIPELINE
OPTICAL FIBRE U/GRND
TELSTRA LINE
SEWER MAIN
WATER MAIN
NORTHBOUND
ENTRY
RAMP
HUME
HIGHWAY
TO LIVERPOOL
ADJOINS SHEET P08
FROM MITTAGONG
HW2
EXIT
RAMP
TWO LANE EXIT
SOUTHBOUND EXIT RAMP AUXILIARY LANE
TO BE EXTENDED (SEPARATE PROJECT)
SOUTHBOUND
TO NARELLAN ROAD W/B
TO NARELLAN ROAD E/B
No.192
MARYFIELDS RECOVERY CENTRE
SCALES
SCALE 1:2000m
Transport Roads & Maritime Services
ROADS AND MARITIME SERVICES
CAMDEN AND CAMPBELLTOWN COUNCIL AREAS
MR178 NARELLAN ROAD
CAMDEN VALLEY WAY, NARELLAN TO BLAXLAND ROAD, CAMPBELLTOWN
PRELIMINARY CONCEPT DESIGN - WIDENING TO SIX LANES
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10/05/2013
SHEET No.
P12
REGISTRATION NUMBER
0178.075.CD.2733

Manooka Stage 3 Planning Proposal

APPENDIX C

SIDRA MOVEMENT SUMMARIES

Cardno
Shaping the Future

MOVEMENT SUMMARY

Site: [2016 AM Narellan Rd x Waterworth Rd x Hartley Rd]

Existing Year 2016
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	193	5.5	0.168	10.2	LOS A	2.7	19.8	0.41	0.66	51.7
2	T1	408	3.6	0.877	45.6	LOS D	20.5	147.7	1.00	1.05	26.0
3	R2	372	3.4	0.838	54.9	LOS D	9.1	65.7	1.00	0.97	27.6
Approach		973	3.9	0.877	42.1	LOS C	20.5	147.7	0.88	0.94	29.9
East: Narellan Rd											
4	L2	62	22.0	0.052	9.1	LOS A	0.4	3.6	0.24	0.65	54.5
5	T1	825	13.9	0.769	40.6	LOS C	12.4	97.3	1.00	0.91	42.5
6	R2	338	22.4	0.863	53.1	LOS D	16.9	141.2	1.00	0.97	31.7
Approach		1225	16.7	0.863	42.5	LOS C	16.9	141.2	0.96	0.91	39.5
North: Hartley Rd											
7	L2	256	36.6	0.264	10.5	LOS A	3.8	35.2	0.42	0.67	46.1
8	T1	261	6.5	0.330	33.0	LOS C	5.0	36.6	0.89	0.72	30.8
9	R2	127	14.9	0.853	58.5	LOS E	6.4	50.7	1.00	0.98	28.6
Approach		644	20.1	0.853	29.1	LOS C	6.4	50.7	0.73	0.75	35.6
West: Narellan Rd											
10	L2	200	7.9	0.251	20.3	LOS B	4.9	36.7	0.64	0.75	47.6
11	T1	537	21.0	0.670	41.1	LOS C	7.9	65.0	0.99	0.84	42.3
12	R2	62	8.5	0.266	29.0	LOS C	1.6	12.3	0.93	0.74	39.3
Approach		799	16.7	0.670	34.9	LOS C	7.9	65.0	0.90	0.81	43.2
All Vehicles		3641	13.9	0.877	38.4	LOS C	20.5	147.7	0.89	0.87	37.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P2	East Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		211	39.3	LOS D			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Monday, 23 January 2017 3:45:10 PM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2016_Existing.sip7

MOVEMENT SUMMARY

Site: [2016 PM Narellan Rd x Waterworth Rd x Hartley Rd]

Existing Year 2016
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	264	2.0	0.233	9.8	LOS A	3.2	22.8	0.46	0.68	53.1
2	T1	317	2.0	0.823	34.8	LOS C	11.9	84.8	1.00	0.98	30.0
3	R2	286	5.1	0.799	44.8	LOS D	5.5	40.1	1.00	0.93	30.8
Approach		867	3.0	0.823	30.5	LOS C	11.9	84.8	0.84	0.88	35.4
East: Narellan Rd											
4	L2	433	1.9	0.391	12.4	LOS A	6.2	43.8	0.54	0.75	53.0
5	T1	944	6.0	0.839	35.9	LOS C	12.1	88.9	1.00	0.97	44.9
6	R2	252	22.6	1.001	82.7	LOS F	14.5	120.7	1.00	1.25	24.4
Approach		1628	7.5	1.001	36.9	LOS C	14.5	120.7	0.88	0.96	41.2
North: Hartley Rd											
7	L2	596	10.1	0.565	11.5	LOS A	10.2	77.2	0.64	0.75	50.7
8	T1	351	3.6	0.460	27.5	LOS B	5.5	39.5	0.93	0.75	33.5
9	R2	96	4.4	0.532	40.4	LOS C	3.4	24.4	0.99	0.78	35.3
Approach		1042	7.4	0.565	19.6	LOS B	10.2	77.2	0.77	0.76	43.1
West: Narellan Rd											
10	L2	175	6.6	0.185	14.7	LOS B	2.8	20.5	0.56	0.72	52.0
11	T1	756	5.6	0.669	29.7	LOS C	8.4	61.9	0.98	0.84	48.6
12	R2	254	1.2	0.877	48.3	LOS D	10.3	73.0	1.00	1.00	30.7
Approach		1184	4.8	0.877	31.5	LOS C	10.3	73.0	0.92	0.85	44.7
All Vehicles		4722	6.0	1.001	30.5	LOS C	14.5	120.7	0.86	0.87	41.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P3	North Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		211	29.3	LOS C			0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2016 AM Hartley Rd x Currans Hill Dr x McPherson Rd]

Existing Year 2016
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	37	5.7	0.917	12.7	LOS A	16.2	124.5	0.98	1.10	41.2
2	T1	779	12.3	0.917	13.1	LOS A	16.2	124.5	0.98	1.10	47.7
3	R2	125	6.7	0.917	17.6	LOS B	16.2	124.5	0.98	1.10	44.6
Approach		941	11.3	0.917	13.7	LOS A	16.2	124.5	0.98	1.10	47.1
East: Currans Hill Dr											
4	L2	192	2.2	0.544	5.4	LOS A	2.9	20.6	0.56	0.82	46.0
5	T1	15	0.0	0.544	5.2	LOS A	2.9	20.6	0.56	0.82	45.4
6	R2	314	3.0	0.544	9.8	LOS A	2.9	20.6	0.56	0.82	49.2
Approach		520	2.6	0.544	8.1	LOS A	2.9	20.6	0.56	0.82	48.0
North: Hartley Rd											
7	L2	227	3.7	0.297	4.8	LOS A	1.8	13.8	0.38	0.51	50.1
8	T1	431	26.2	0.297	5.2	LOS A	1.8	13.8	0.39	0.51	53.3
9	R2	19	0.0	0.297	9.5	LOS A	1.7	14.6	0.40	0.51	51.8
Approach		677	17.9	0.297	5.2	LOS A	1.8	14.6	0.39	0.51	52.0
West: McPherson Rd											
10	L2	8	50.0	0.169	20.6	LOS B	1.0	9.9	0.92	0.96	37.3
11	T1	2	50.0	0.169	20.5	LOS B	1.0	9.9	0.92	0.96	36.5
12	R2	22	57.1	0.169	25.8	LOS B	1.0	9.9	0.92	0.96	30.3
Approach		33	54.8	0.169	24.2	LOS B	1.0	9.9	0.92	0.96	32.6
All Vehicles		2171	11.9	0.917	9.9	LOS A	16.2	124.5	0.69	0.84	48.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2016 PM Hartley Rd x Currans Hill Dr x McPherson Rd]

Existing Year 2016
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	32	16.7	0.621	5.0	LOS A	3.7	27.8	0.41	0.56	46.2
2	T1	496	13.0	0.621	5.1	LOS A	3.7	27.8	0.41	0.56	52.7
3	R2	203	2.1	0.621	9.6	LOS A	3.7	27.8	0.41	0.56	49.0
Approach		731	10.1	0.621	6.3	LOS A	3.7	27.8	0.41	0.56	51.4
East: Currans Hill Dr											
4	L2	164	1.9	0.404	5.9	LOS A	1.9	13.4	0.64	0.85	46.0
5	T1	3	0.0	0.404	5.8	LOS A	1.9	13.4	0.64	0.85	45.4
6	R2	144	3.6	0.404	10.4	LOS A	1.9	13.4	0.64	0.85	49.2
Approach		312	2.7	0.404	8.0	LOS A	1.9	13.4	0.64	0.85	47.6
North: Hartley Rd											
7	L2	324	1.3	0.518	5.6	LOS A	3.5	25.7	0.53	0.58	49.6
8	T1	844	8.5	0.518	5.8	LOS A	3.5	25.7	0.54	0.58	53.0
9	R2	27	23.1	0.518	10.9	LOS A	3.4	26.0	0.54	0.58	50.7
Approach		1196	6.9	0.518	5.9	LOS A	3.5	26.0	0.53	0.58	51.9
West: McPherson Rd											
10	L2	29	21.4	0.142	9.3	LOS A	0.8	5.9	0.74	0.81	45.1
11	T1	16	6.7	0.142	8.7	LOS A	0.8	5.9	0.74	0.81	43.5
12	R2	34	6.3	0.142	13.2	LOS A	0.8	5.9	0.74	0.81	42.8
Approach		79	12.0	0.142	10.8	LOS A	0.8	5.9	0.74	0.81	43.9
All Vehicles		2317	7.5	0.621	6.5	LOS A	3.7	27.8	0.52	0.62	50.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2016 AM Narellan Rd x Mount Annan Dr x Tramway Dr]

Existing Year 2016
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	16	6.7	0.055	23.3	LOS B	1.3	9.0	0.67	0.57	43.2
2	T1	22	0.0	0.055	18.7	LOS B	1.3	9.0	0.67	0.57	37.8
3	R2	874	0.6	1.012	123.1	LOS F	45.5	320.4	1.00	1.17	16.8
Approach		912	0.7	1.012	118.8	LOS F	45.5	320.4	0.99	1.15	17.3
East: Narellan Dr											
4	L2	129	1.6	0.080	7.7	LOS A	0.5	3.9	0.11	0.64	51.0
5	T1	1572	14.6	0.712	38.9	LOS C	31.5	248.1	0.90	0.80	38.9
6	R2	301	2.1	1.028	139.7	LOS F	32.2	229.1	1.00	1.09	13.6
Approach		2002	11.9	1.028	52.1	LOS D	32.2	248.1	0.86	0.83	31.8
North: Tramway Dr											
7	L2	534	4.1	0.728	46.5	LOS D	25.8	187.1	0.90	1.05	27.0
8	T1	9	22.2	0.036	58.0	LOS E	0.6	4.9	0.88	0.61	26.2
9	R2	4	0.0	0.057	82.3	LOS F	0.3	2.2	0.98	0.64	23.6
Approach		547	4.4	0.728	47.0	LOS D	25.8	187.1	0.90	1.04	27.0
West: Narellan Dr											
10	L2	9	55.6	0.010	11.5	LOS A	0.1	1.4	0.25	0.63	52.1
11	T1	1621	12.7	1.027	124.7	LOS F	59.1	459.1	1.00	1.28	18.3
12	R2	18	17.6	0.271	88.2	LOS F	1.4	11.0	1.00	0.70	24.9
Approach		1648	13.0	1.027	123.7	LOS F	59.1	459.1	1.00	1.27	18.4
All Vehicles		5109	9.5	1.028	86.5	LOS F	59.1	459.1	0.93	1.05	22.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	34.8	LOS D	0.2	0.2	0.68	0.68
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	45.0	LOS E	0.2	0.2	0.78	0.78
P4	West Full Crossing	53	46.5	LOS E	0.2	0.2	0.79	0.79
All Pedestrians		211	48.9	LOS E			0.80	0.80

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2016 PM Narellan Rd x Mount Annan Dr x Tramway Dr]

Existing Year 2016
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	5	0.0	0.151	73.1	LOS F	2.8	20.3	0.90	0.73	28.0
2	T1	40	2.6	0.151	68.6	LOS E	2.8	20.3	0.90	0.73	24.0
3	R2	189	3.3	0.653	80.2	LOS F	7.1	50.9	1.00	0.81	22.1
Approach		235	3.1	0.653	78.1	LOS F	7.1	50.9	0.98	0.80	22.5
East: Narellan Dr											
4	L2	363	1.4	0.245	9.4	LOS A	4.6	32.8	0.24	0.67	49.6
5	T1	2045	6.1	0.747	29.7	LOS C	40.8	300.7	0.83	0.76	44.3
6	R2	339	2.2	1.030	139.8	LOS F	36.5	260.2	1.00	1.09	13.6
Approach		2747	5.0	1.030	40.6	LOS C	40.8	300.7	0.77	0.79	36.3
North: Tramway Dr											
7	L2	136	3.1	0.166	28.6	LOS C	5.7	41.2	0.62	0.68	33.7
8	T1	68	3.1	0.233	60.3	LOS E	4.4	31.8	0.92	0.71	25.7
9	R2	131	0.8	0.986	115.6	LOS F	12.3	86.4	1.00	1.15	18.9
Approach		335	2.2	0.986	69.0	LOS E	12.3	86.4	0.83	0.87	24.0
West: Narellan Dr											
10	L2	24	8.7	0.019	12.0	LOS A	0.4	3.2	0.29	0.65	51.8
11	T1	2421	5.2	1.024	112.9	LOS F	89.4	653.6	1.00	1.29	19.7
12	R2	131	0.0	0.753	83.4	LOS F	9.9	69.2	1.00	0.85	25.8
Approach		2576	5.0	1.024	110.4	LOS F	89.4	653.6	0.99	1.26	20.1
All Vehicles		5893	4.8	1.030	74.2	LOS F	89.4	653.6	0.88	1.00	25.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	25.3	LOS C	0.1	0.1	0.58	0.58
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	30.8	LOS D	0.1	0.1	0.64	0.64
P4	West Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	48.7	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2016 AM Currans Hill Dr x Tramway Dr]

Existing Year 2016
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	240	3.9	0.242	8.6	LOS A	1.1	7.8	0.37	0.89	44.6
6	R2	19	5.6	0.242	12.0	LOS A	1.1	7.8	0.37	0.89	43.5
Approach		259	4.1	0.242	8.9	LOS A	1.1	7.8	0.37	0.89	44.6
NorthEast: Currans Hill Dr											
7	L2	86	2.4	0.154	4.6	LOS A	0.0	0.0	0.00	0.16	48.4
8	T1	204	3.6	0.154	0.0	LOS A	0.0	0.0	0.00	0.16	48.9
Approach		291	3.3	0.154	1.4	NA	0.0	0.0	0.00	0.16	48.8
SouthWest: Currans Hill Dr											
2	T1	94	6.7	0.238	1.2	LOS A	1.3	9.3	0.43	0.46	46.4
3	R2	249	3.8	0.238	5.9	LOS A	1.3	9.3	0.43	0.46	45.9
Approach		343	4.6	0.238	4.6	NA	1.3	9.3	0.43	0.46	46.0
All Vehicles		893	4.0	0.242	4.8	NA	1.3	9.3	0.27	0.49	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2016 PM Currans Hill Dr x Tramway Dr]

Existing Year 2016
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	115	3.7	0.226	8.3	LOS A	0.9	6.3	0.34	0.92	44.1
6	R2	72	2.9	0.226	12.1	LOS A	0.9	6.3	0.34	0.92	43.0
Approach		186	3.4	0.226	9.8	LOS A	0.9	6.3	0.34	0.92	43.7
NorthEast: Currans Hill Dr											
7	L2	38	5.6	0.101	4.6	LOS A	0.0	0.0	0.00	0.11	48.7
8	T1	154	1.4	0.101	0.0	LOS A	0.0	0.0	0.00	0.11	49.3
Approach		192	2.2	0.101	0.9	NA	0.0	0.0	0.00	0.11	49.2
SouthWest: Currans Hill Dr											
2	T1	239	1.8	0.280	0.6	LOS A	1.5	10.6	0.32	0.28	47.4
3	R2	231	1.4	0.280	5.4	LOS A	1.5	10.6	0.32	0.28	46.8
Approach		469	1.6	0.280	3.0	NA	1.5	10.6	0.32	0.28	47.1
All Vehicles		847	2.1	0.280	4.0	NA	1.5	10.6	0.25	0.38	46.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2016 AM Currans Hill Dr x Spring Hill Circle]

Existing Year 2016
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	31	3.4	0.049	4.6	LOS A	0.2	1.3	0.04	0.54	45.9
3	R2	29	17.9	0.049	5.5	LOS A	0.2	1.3	0.04	0.54	45.2
Approach		60	10.5	0.049	5.0	LOS A	0.2	1.3	0.04	0.54	45.5
East: Spring Hill Circle											
4	L2	93	5.7	0.057	4.6	LOS A	0.0	0.0	0.00	0.48	46.4
5	T1	9	0.0	0.057	0.0	LOS A	0.0	0.0	0.00	0.48	47.3
Approach		102	5.2	0.057	4.2	NA	0.0	0.0	0.00	0.48	46.5
West: Spring Hill Circle											
11	T1	34	3.1	0.071	0.3	LOS A	0.3	2.4	0.21	0.38	47.4
12	R2	85	2.5	0.071	4.9	LOS A	0.3	2.4	0.21	0.38	46.0
Approach		119	2.7	0.071	3.6	NA	0.3	2.4	0.21	0.38	46.4
All Vehicles		281	5.2	0.071	4.1	NA	0.3	2.4	0.10	0.45	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2016 PM Currans Hill Dr x Spring Hill Circle]

Existing Year 2016
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	88	1.2	0.133	4.7	LOS A	0.5	3.7	0.11	0.53	45.9
3	R2	87	3.6	0.133	5.1	LOS A	0.5	3.7	0.11	0.53	45.4
Approach		176	2.4	0.133	4.9	LOS A	0.5	3.7	0.11	0.53	45.6
East: Spring Hill Circle											
4	L2	57	5.6	0.049	4.6	LOS A	0.0	0.0	0.00	0.34	47.3
5	T1	34	0.0	0.049	0.0	LOS A	0.0	0.0	0.00	0.34	48.1
Approach		91	3.5	0.049	2.9	NA	0.0	0.0	0.00	0.34	47.6
West: Spring Hill Circle											
11	T1	20	0.0	0.040	0.2	LOS A	0.2	1.3	0.19	0.37	47.4
12	R2	48	2.2	0.040	4.8	LOS A	0.2	1.3	0.19	0.37	46.1
Approach		68	1.5	0.040	3.5	NA	0.2	1.3	0.19	0.37	46.5
All Vehicles		335	2.5	0.133	4.1	NA	0.5	3.7	0.10	0.44	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2016 AM Glenfield Dr x Spring Hill Circle]

Existing Year 2016
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	25	16.7	0.032	5.0	LOS A	0.1	0.9	0.18	0.52	46.0
3	R2	15	14.3	0.032	5.4	LOS A	0.1	0.9	0.18	0.52	45.6
Approach		40	15.8	0.032	5.1	LOS A	0.1	0.9	0.18	0.52	45.8
East: Spring Hill Circle											
4	L2	61	1.7	0.073	4.6	LOS A	0.0	0.0	0.00	0.24	48.2
5	T1	77	1.4	0.073	0.0	LOS A	0.0	0.0	0.00	0.24	48.6
Approach		138	1.5	0.073	2.0	NA	0.0	0.0	0.00	0.24	48.4
West: Spring Hill Circle											
11	T1	29	0.0	0.039	0.4	LOS A	0.2	1.3	0.23	0.28	48.0
12	R2	33	16.1	0.039	5.2	LOS A	0.2	1.3	0.23	0.28	46.8
Approach		62	8.5	0.039	2.9	NA	0.2	1.3	0.23	0.28	47.3
All Vehicles		240	5.7	0.073	2.8	NA	0.2	1.3	0.09	0.30	47.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2016 PM Glenfield Dr x Spring Hill Circle]

Existing Year 2016
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	53	4.0	0.078	4.7	LOS A	0.3	2.1	0.12	0.53	46.3
3	R2	49	0.0	0.078	5.2	LOS A	0.3	2.1	0.12	0.53	45.9
Approach		102	2.1	0.078	4.9	LOS A	0.3	2.1	0.12	0.53	46.1
East: Spring Hill Circle											
4	L2	52	2.0	0.048	4.6	LOS A	0.0	0.0	0.00	0.31	47.8
5	T1	36	2.8	0.048	0.0	LOS A	0.0	0.0	0.00	0.31	48.2
Approach		89	2.4	0.048	2.6	NA	0.0	0.0	0.00	0.31	48.0
West: Spring Hill Circle											
11	T1	68	0.0	0.060	0.2	LOS A	0.2	1.5	0.14	0.19	48.6
12	R2	38	5.6	0.060	4.9	LOS A	0.2	1.5	0.14	0.19	47.6
Approach		106	2.0	0.060	1.8	NA	0.2	1.5	0.14	0.19	48.2
All Vehicles		298	2.1	0.078	3.1	NA	0.3	2.1	0.09	0.34	47.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2016 AM Manooka Rd x Spring Hill Circle]

Existing Year 2016
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	7	14.3	0.012	0.1	LOS A	0.1	0.4	0.10	0.35	47.7
12	R2	15	0.0	0.012	4.6	LOS A	0.1	0.4	0.10	0.35	46.8
Approach		22	4.8	0.012	3.1	NA	0.1	0.4	0.10	0.35	47.1
North: Manooka Rd											
1	L2	41	0.0	0.030	4.6	LOS A	0.1	0.8	0.09	0.50	46.4
3	R2	4	25.0	0.030	5.0	LOS A	0.1	0.8	0.09	0.50	45.6
Approach		45	2.3	0.030	4.7	LOS A	0.1	0.8	0.09	0.50	46.3
West: Spring Hill Circle											
4	L2	2	50.0	0.016	5.0	LOS A	0.0	0.0	0.00	0.04	48.6
5	T1	28	3.7	0.016	0.0	LOS A	0.0	0.0	0.00	0.04	49.9
Approach		31	6.9	0.016	0.3	NA	0.0	0.0	0.00	0.04	49.8
All Vehicles		98	4.3	0.030	3.0	NA	0.1	0.8	0.06	0.32	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2016 PM Manooka Rd x Spring Hill Circle]

Existing Year 2016
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	14	0.0	0.020	0.1	LOS A	0.1	0.6	0.08	0.34	47.9
12	R2	23	0.0	0.020	4.6	LOS A	0.1	0.6	0.08	0.34	47.0
Approach		37	0.0	0.020	2.9	NA	0.1	0.6	0.08	0.34	47.3
North: Manooka Rd											
1	L2	23	4.5	0.020	4.7	LOS A	0.1	0.5	0.07	0.51	46.4
3	R2	6	0.0	0.020	4.7	LOS A	0.1	0.5	0.07	0.51	46.0
Approach		29	3.6	0.020	4.7	LOS A	0.1	0.5	0.07	0.51	46.3
West: Spring Hill Circle											
4	L2	5	0.0	0.013	4.6	LOS A	0.0	0.0	0.00	0.11	48.9
5	T1	20	0.0	0.013	0.0	LOS A	0.0	0.0	0.00	0.11	49.4
Approach		25	0.0	0.013	1.0	NA	0.0	0.0	0.00	0.11	49.3
All Vehicles		92	1.1	0.020	2.9	NA	0.1	0.6	0.06	0.33	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2021 AM Narellan Rd x Waterworth Rd x Hartley Rd]

Opening Year Base 2021
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	273	5.5	0.264	12.2	LOS A	4.6	33.4	0.52	0.70	49.7
2	T1	415	3.6	0.757	30.6	LOS C	15.8	113.9	0.97	0.89	32.0
3	R2	526	3.4	0.893	53.2	LOS D	12.4	89.0	1.00	1.06	28.3
Approach		1214	3.9	0.893	36.2	LOS C	15.8	113.9	0.88	0.92	32.8
East: Narellan Rd											
4	L2	84	22.0	0.069	9.0	LOS A	0.5	4.4	0.25	0.65	54.6
5	T1	1114	13.9	0.874	42.1	LOS C	16.9	132.2	1.00	1.02	41.8
6	R2	343	22.4	0.779	49.1	LOS D	7.3	60.8	1.00	0.91	33.0
Approach		1541	16.2	0.874	41.8	LOS C	16.9	132.2	0.96	0.98	40.1
North: Hartley Rd											
7	L2	259	36.6	0.307	13.2	LOS A	4.6	42.6	0.55	0.70	44.3
8	T1	265	6.5	0.315	28.5	LOS B	4.4	32.6	0.88	0.70	33.1
9	R2	129	14.9	0.771	49.1	LOS D	5.6	43.9	1.00	0.91	31.4
Approach		654	20.1	0.771	26.5	LOS B	5.6	43.9	0.77	0.74	36.9
West: Narellan Rd											
10	L2	203	7.9	0.210	14.8	LOS B	3.5	26.1	0.54	0.73	51.9
11	T1	725	21.0	0.805	40.0	LOS C	10.3	84.7	1.00	0.94	42.8
12	R2	84	8.5	0.321	48.2	LOS D	1.7	12.6	0.98	0.73	30.5
Approach		1013	17.3	0.805	35.6	LOS C	10.3	84.7	0.91	0.88	43.1
All Vehicles		4421	13.7	0.893	36.6	LOS C	16.9	132.2	0.90	0.90	38.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P2	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P3	North Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		211	34.3	LOS D			0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2021 PM Narellan Rd x Waterworth Rd x Hartley Rd]

Opening Year Base 2021
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	374	2.0	0.351	12.9	LOS A	7.4	52.4	0.54	0.72	49.9
2	T1	321	2.0	0.653	32.8	LOS C	12.8	91.3	0.95	0.81	31.0
3	R2	405	5.1	0.848	55.0	LOS D	10.0	73.2	1.00	0.99	27.6
Approach		1100	3.2	0.848	34.2	LOS C	12.8	91.3	0.83	0.84	34.0
East: Narellan Rd											
4	L2	584	1.9	0.464	11.8	LOS A	9.4	66.6	0.48	0.74	53.7
5	T1	1275	6.0	0.815	37.8	LOS C	19.3	142.0	1.00	0.94	43.9
6	R2	255	22.6	0.717	53.7	LOS D	5.9	49.5	1.00	0.86	31.5
Approach		2114	6.9	0.815	32.5	LOS C	19.3	142.0	0.85	0.88	43.7
North: Hartley Rd											
7	L2	604	10.1	0.660	19.0	LOS B	15.5	117.6	0.78	0.88	45.3
8	T1	356	3.6	0.442	34.0	LOS C	6.9	50.1	0.92	0.75	30.4
9	R2	97	4.4	0.605	51.4	LOS D	4.4	32.0	1.00	0.80	31.6
Approach		1057	7.4	0.660	27.0	LOS B	15.5	117.6	0.85	0.83	38.8
West: Narellan Rd											
10	L2	177	6.6	0.157	12.3	LOS A	2.6	19.0	0.42	0.70	54.2
11	T1	1020	5.6	0.650	31.3	LOS C	13.4	98.0	0.94	0.80	47.6
12	R2	342	1.2	0.836	57.1	LOS E	8.4	59.4	1.00	0.93	27.8
Approach		1539	4.7	0.836	34.9	LOS C	13.4	98.0	0.89	0.82	42.9
All Vehicles		5809	5.7	0.848	32.5	LOS C	19.3	142.0	0.86	0.85	40.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P2	East Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		211	37.5	LOS D			0.91	0.91

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2021 AM Hartley Rd x Currans Hill Dr x McPherson Rd]

Opening Year Base 2021
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	35	5.7	0.869	9.9	LOS A	12.1	92.8	0.86	0.95	43.5
2	T1	751	12.3	0.869	10.3	LOS A	12.1	92.8	0.86	0.95	49.9
3	R2	119	6.7	0.869	14.8	LOS B	12.1	92.8	0.86	0.95	46.6
Approach		905	11.3	0.869	10.9	LOS A	12.1	92.8	0.86	0.95	49.3
East: Currans Hill Dr											
4	L2	182	2.2	0.511	5.1	LOS A	2.5	18.2	0.53	0.79	46.1
5	T1	14	0.0	0.511	5.0	LOS A	2.5	18.2	0.53	0.79	45.6
6	R2	298	3.0	0.511	9.6	LOS A	2.5	18.2	0.53	0.79	49.3
Approach		494	2.6	0.511	7.8	LOS A	2.5	18.2	0.53	0.79	48.2
North: Hartley Rd											
7	L2	216	3.7	0.282	4.8	LOS A	1.6	12.6	0.36	0.50	50.2
8	T1	415	26.2	0.282	5.2	LOS A	1.6	12.6	0.37	0.50	53.4
9	R2	18	0.0	0.282	9.5	LOS A	1.6	13.4	0.37	0.50	51.9
Approach		649	18.0	0.282	5.2	LOS A	1.6	13.4	0.37	0.50	52.1
West: McPherson Rd											
10	L2	8	50.0	0.138	18.4	LOS B	0.8	7.8	0.89	0.95	38.4
11	T1	2	50.0	0.138	18.3	LOS B	0.8	7.8	0.89	0.95	37.6
12	R2	21	57.1	0.138	23.5	LOS B	0.8	7.8	0.89	0.95	31.2
Approach		31	54.8	0.138	21.9	LOS B	0.8	7.8	0.89	0.95	33.6
All Vehicles		2079	12.0	0.869	8.5	LOS A	12.1	92.8	0.63	0.77	49.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2021 PM Hartley Rd x Currans Hill Dr x McPherson Rd]

Opening Year Base 2021
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	32	16.7	0.627	5.0	LOS A	3.7	28.5	0.42	0.56	46.2
2	T1	503	13.0	0.627	5.1	LOS A	3.7	28.5	0.42	0.56	52.7
3	R2	203	2.1	0.627	9.6	LOS A	3.7	28.5	0.42	0.56	49.0
Approach		738	10.1	0.627	6.3	LOS A	3.7	28.5	0.42	0.56	51.4
East: Currans Hill Dr											
4	L2	164	1.9	0.407	6.0	LOS A	1.9	13.6	0.65	0.85	46.0
5	T1	3	0.0	0.407	5.9	LOS A	1.9	13.6	0.65	0.85	45.4
6	R2	144	3.6	0.407	10.5	LOS A	1.9	13.6	0.65	0.85	49.2
Approach		312	2.7	0.407	8.1	LOS A	1.9	13.6	0.65	0.85	47.6
North: Hartley Rd											
7	L2	324	1.3	0.523	5.6	LOS A	3.6	26.2	0.53	0.58	49.6
8	T1	856	8.5	0.523	5.8	LOS A	3.6	26.2	0.54	0.58	53.0
9	R2	27	23.1	0.523	10.9	LOS A	3.5	26.4	0.55	0.58	50.7
Approach		1207	6.9	0.523	5.9	LOS A	3.6	26.4	0.54	0.58	51.9
West: McPherson Rd											
10	L2	29	21.4	0.144	9.4	LOS A	0.8	6.0	0.74	0.81	45.0
11	T1	16	6.7	0.144	8.8	LOS A	0.8	6.0	0.74	0.81	43.4
12	R2	34	6.3	0.144	13.3	LOS A	0.8	6.0	0.74	0.81	42.8
Approach		79	12.0	0.144	10.9	LOS A	0.8	6.0	0.74	0.81	43.8
All Vehicles		2336	7.5	0.627	6.5	LOS A	3.7	28.5	0.52	0.62	50.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2021 AM Narellan Rd x Mount Annan Dr x Tramway Dr]

Opening Year Base 2021
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	16	6.7	0.072	31.2	LOS C	1.6	11.3	0.76	0.61	39.6
2	T1	22	0.0	0.072	26.6	LOS B	1.6	11.3	0.76	0.61	34.6
3	R2	874	0.6	1.042	143.0	LOS F	48.9	343.8	1.00	1.23	15.1
Approach		912	0.7	1.042	138.3	LOS F	48.9	343.8	0.99	1.21	15.5
East: Narellan Dr											
4	L2	129	1.6	0.080	7.7	LOS A	0.5	3.9	0.11	0.64	51.0
5	T1	2122	14.6	1.027	120.3	LOS F	81.9	645.0	1.00	1.31	18.8
6	R2	301	2.1	1.028	139.8	LOS F	32.2	229.1	1.00	1.10	13.7
Approach		2553	12.5	1.028	116.9	LOS F	81.9	645.0	0.95	1.25	18.7
North: Tramway Dr											
7	L2	534	4.1	0.705	44.6	LOS D	25.3	183.0	0.88	1.04	27.6
8	T1	9	22.2	0.033	56.0	LOS D	0.6	4.8	0.86	0.60	26.7
9	R2	4	0.0	0.028	42.1	LOS C	0.2	1.3	0.94	0.63	33.7
Approach		547	4.4	0.705	44.8	LOS D	25.3	183.0	0.88	1.03	27.7
West: Narellan Dr											
10	L2	9	55.6	0.009	11.5	LOS A	0.1	1.4	0.25	0.63	52.1
11	T1	2188	12.7	1.063	150.6	LOS F	65.1	505.6	1.00	1.37	15.7
12	R2	18	17.6	0.271	88.2	LOS F	1.4	11.0	1.00	0.70	24.9
Approach		2216	13.0	1.063	149.5	LOS F	65.1	505.6	1.00	1.36	15.8
All Vehicles		6227	10.2	1.063	125.3	LOS F	81.9	645.0	0.97	1.26	17.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	35.4	LOS D	0.2	0.2	0.69	0.69
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	45.7	LOS E	0.2	0.2	0.78	0.78
P4	West Full Crossing	53	58.2	LOS E	0.2	0.2	0.88	0.88
All Pedestrians		211	52.2	LOS E			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2021 PM Narellan Rd x Mount Annan Dr x Tramway Dr]

Opening Year Base 2021
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	5	0.0	0.139	86.8	LOS F	4.0	28.3	0.88	0.75	25.4
2	T1	40	2.6	0.139	82.3	LOS F	4.0	28.3	0.88	0.75	21.8
3	R2	189	3.3	0.712	82.5	LOS F	7.2	51.9	1.00	0.84	21.7
Approach		235	3.1	0.712	82.5	LOS F	7.2	51.9	0.98	0.83	21.8
East: Narellan Dr											
4	L2	363	1.4	0.243	9.3	LOS A	4.6	32.6	0.23	0.67	49.6
5	T1	2761	6.1	1.014	102.3	LOS F	107.1	788.7	1.00	1.25	21.2
6	R2	339	2.2	1.069	168.3	LOS F	40.0	285.4	1.00	1.15	11.8
Approach		3463	5.2	1.069	99.0	LOS F	107.1	788.7	0.92	1.18	21.1
North: Tramway Dr											
7	L2	136	3.1	0.165	28.7	LOS C	5.8	41.4	0.62	0.68	33.7
8	T1	68	3.1	0.215	58.3	LOS E	4.3	31.2	0.90	0.70	26.2
9	R2	131	0.8	1.051	161.7	LOS F	14.3	101.1	1.00	1.26	14.9
Approach		335	2.2	1.051	86.6	LOS F	14.3	101.1	0.83	0.91	21.0
West: Narellan Dr											
10	L2	24	8.7	0.019	11.8	LOS A	0.4	3.1	0.28	0.65	52.0
11	T1	3268	5.2	1.099	174.5	LOS F	115.1	841.6	1.00	1.53	14.0
12	R2	131	0.0	1.054	159.3	LOS F	14.4	100.9	1.00	1.11	16.8
Approach		3423	5.0	1.099	172.8	LOS F	115.1	841.6	0.99	1.51	14.1
All Vehicles		7456	5.0	1.099	131.8	LOS F	115.1	841.6	0.95	1.31	17.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	23.6	LOS C	0.1	0.1	0.56	0.56
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	30.8	LOS D	0.1	0.1	0.64	0.64
P4	West Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	48.2	LOS E			0.78	0.78

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2021 AM Currans Hill Dr x Tramway Dr]

Opening Year Base 2021
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	240	3.9	0.242	8.6	LOS A	1.1	7.8	0.37	0.89	44.6
6	R2	19	5.6	0.242	12.0	LOS A	1.1	7.8	0.37	0.89	43.5
Approach		259	4.1	0.242	8.9	LOS A	1.1	7.8	0.37	0.89	44.6
NorthEast: Currans Hill Dr											
7	L2	86	2.4	0.154	4.6	LOS A	0.0	0.0	0.00	0.16	48.4
8	T1	204	3.6	0.154	0.0	LOS A	0.0	0.0	0.00	0.16	48.9
Approach		291	3.3	0.154	1.4	NA	0.0	0.0	0.00	0.16	48.8
SouthWest: Currans Hill Dr											
2	T1	94	6.7	0.238	1.2	LOS A	1.3	9.3	0.43	0.46	46.4
3	R2	249	3.8	0.238	5.9	LOS A	1.3	9.3	0.43	0.46	45.9
Approach		343	4.6	0.238	4.6	NA	1.3	9.3	0.43	0.46	46.0
All Vehicles		893	4.0	0.242	4.8	NA	1.3	9.3	0.27	0.49	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 4:23:31 PM
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MOVEMENT SUMMARY

Site: [2021 PM Currans Hill Dr x Tramway Dr]

Opening Year Base 2021
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	115	3.7	0.226	8.3	LOS A	0.9	6.3	0.34	0.92	44.1
6	R2	72	2.9	0.226	12.1	LOS A	0.9	6.3	0.34	0.92	43.0
Approach		186	3.4	0.226	9.8	LOS A	0.9	6.3	0.34	0.92	43.7
NorthEast: Currans Hill Dr											
7	L2	38	5.6	0.101	4.6	LOS A	0.0	0.0	0.00	0.11	48.7
8	T1	154	1.4	0.101	0.0	LOS A	0.0	0.0	0.00	0.11	49.3
Approach		192	2.2	0.101	0.9	NA	0.0	0.0	0.00	0.11	49.2
SouthWest: Currans Hill Dr											
2	T1	239	1.8	0.280	0.6	LOS A	1.5	10.6	0.32	0.28	47.4
3	R2	231	1.4	0.280	5.4	LOS A	1.5	10.6	0.32	0.28	46.8
Approach		469	1.6	0.280	3.0	NA	1.5	10.6	0.32	0.28	47.1
All Vehicles		847	2.1	0.280	4.0	NA	1.5	10.6	0.25	0.38	46.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2021 AM Currans Hill Dr x Spring Hill Circle]

Opening Year Base 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	31	3.4	0.049	4.6	LOS A	0.2	1.3	0.04	0.54	45.9
3	R2	29	17.9	0.049	5.5	LOS A	0.2	1.3	0.04	0.54	45.2
Approach		60	10.5	0.049	5.0	LOS A	0.2	1.3	0.04	0.54	45.5
East: Spring Hill Circle											
4	L2	93	5.7	0.057	4.6	LOS A	0.0	0.0	0.00	0.48	46.4
5	T1	9	0.0	0.057	0.0	LOS A	0.0	0.0	0.00	0.48	47.3
Approach		102	5.2	0.057	4.2	NA	0.0	0.0	0.00	0.48	46.5
West: Spring Hill Circle											
11	T1	34	3.1	0.071	0.3	LOS A	0.3	2.4	0.21	0.38	47.4
12	R2	85	2.5	0.071	4.9	LOS A	0.3	2.4	0.21	0.38	46.0
Approach		119	2.7	0.071	3.6	NA	0.3	2.4	0.21	0.38	46.4
All Vehicles		281	5.2	0.071	4.1	NA	0.3	2.4	0.10	0.45	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2021 PM Currans Hill Dr x Spring Hill Circle]

Opening Year Base 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	88	1.2	0.133	4.7	LOS A	0.5	3.7	0.11	0.53	45.9
3	R2	87	3.6	0.133	5.1	LOS A	0.5	3.7	0.11	0.53	45.4
Approach		176	2.4	0.133	4.9	LOS A	0.5	3.7	0.11	0.53	45.6
East: Spring Hill Circle											
4	L2	57	5.6	0.049	4.6	LOS A	0.0	0.0	0.00	0.34	47.3
5	T1	34	0.0	0.049	0.0	LOS A	0.0	0.0	0.00	0.34	48.1
Approach		91	3.5	0.049	2.9	NA	0.0	0.0	0.00	0.34	47.6
West: Spring Hill Circle											
11	T1	20	0.0	0.040	0.2	LOS A	0.2	1.3	0.19	0.37	47.4
12	R2	48	2.2	0.040	4.8	LOS A	0.2	1.3	0.19	0.37	46.1
Approach		68	1.5	0.040	3.5	NA	0.2	1.3	0.19	0.37	46.5
All Vehicles		335	2.5	0.133	4.1	NA	0.5	3.7	0.10	0.44	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2021 AM Glenfield Dr x Spring Hill Circle]

Opening Year Base 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	25	16.7	0.032	5.0	LOS A	0.1	0.9	0.18	0.52	46.0
3	R2	15	14.3	0.032	5.4	LOS A	0.1	0.9	0.18	0.52	45.6
Approach		40	15.8	0.032	5.1	LOS A	0.1	0.9	0.18	0.52	45.8
East: Spring Hill Circle											
4	L2	61	1.7	0.073	4.6	LOS A	0.0	0.0	0.00	0.24	48.2
5	T1	77	1.4	0.073	0.0	LOS A	0.0	0.0	0.00	0.24	48.6
Approach		138	1.5	0.073	2.0	NA	0.0	0.0	0.00	0.24	48.4
West: Spring Hill Circle											
11	T1	29	0.0	0.039	0.4	LOS A	0.2	1.3	0.23	0.28	48.0
12	R2	33	16.1	0.039	5.2	LOS A	0.2	1.3	0.23	0.28	46.8
Approach		62	8.5	0.039	2.9	NA	0.2	1.3	0.23	0.28	47.3
All Vehicles		240	5.7	0.073	2.8	NA	0.2	1.3	0.09	0.30	47.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 4:23:33 PM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2021_Base.sip7

MOVEMENT SUMMARY

▽ Site: [2021 PM Glenfield Dr x Spring Hill Circle]

Opening Year Base 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	53	4.0	0.078	4.7	LOS A	0.3	2.1	0.12	0.53	46.3
3	R2	49	0.0	0.078	5.2	LOS A	0.3	2.1	0.12	0.53	45.9
Approach		102	2.1	0.078	4.9	LOS A	0.3	2.1	0.12	0.53	46.1
East: Spring Hill Circle											
4	L2	52	2.0	0.048	4.6	LOS A	0.0	0.0	0.00	0.31	47.8
5	T1	36	2.8	0.048	0.0	LOS A	0.0	0.0	0.00	0.31	48.2
Approach		89	2.4	0.048	2.6	NA	0.0	0.0	0.00	0.31	48.0
West: Spring Hill Circle											
11	T1	68	0.0	0.060	0.2	LOS A	0.2	1.5	0.14	0.19	48.6
12	R2	38	5.6	0.060	4.9	LOS A	0.2	1.5	0.14	0.19	47.6
Approach		106	2.0	0.060	1.8	NA	0.2	1.5	0.14	0.19	48.2
All Vehicles		298	2.1	0.078	3.1	NA	0.3	2.1	0.09	0.34	47.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 4:23:34 PM
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MOVEMENT SUMMARY

▽ Site: [2021 AM Manooka Rd x Spring Hill Circle]

Opening Year Base 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	7	14.3	0.012	0.1	LOS A	0.1	0.4	0.10	0.35	47.7
12	R2	15	0.0	0.012	4.6	LOS A	0.1	0.4	0.10	0.35	46.8
Approach		22	4.8	0.012	3.1	NA	0.1	0.4	0.10	0.35	47.1
North: Manooka Rd											
1	L2	41	0.0	0.030	4.6	LOS A	0.1	0.8	0.09	0.50	46.4
3	R2	4	25.0	0.030	5.0	LOS A	0.1	0.8	0.09	0.50	45.6
Approach		45	2.3	0.030	4.7	LOS A	0.1	0.8	0.09	0.50	46.3
West: Spring Hill Circle											
4	L2	2	50.0	0.016	5.0	LOS A	0.0	0.0	0.00	0.04	48.6
5	T1	28	3.7	0.016	0.0	LOS A	0.0	0.0	0.00	0.04	49.9
Approach		31	6.9	0.016	0.3	NA	0.0	0.0	0.00	0.04	49.8
All Vehicles		98	4.3	0.030	3.0	NA	0.1	0.8	0.06	0.32	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 4:23:34 PM
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MOVEMENT SUMMARY

▽ Site: [2021 PM Manooka Rd x Spring Hill Circle]

Opening Year Base 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	14	0.0	0.020	0.1	LOS A	0.1	0.6	0.08	0.34	47.9
12	R2	23	0.0	0.020	4.6	LOS A	0.1	0.6	0.08	0.34	47.0
Approach		37	0.0	0.020	2.9	NA	0.1	0.6	0.08	0.34	47.3
North: Manooka Rd											
1	L2	23	4.5	0.020	4.7	LOS A	0.1	0.5	0.07	0.51	46.4
3	R2	6	0.0	0.020	4.7	LOS A	0.1	0.5	0.07	0.51	46.0
Approach		29	3.6	0.020	4.7	LOS A	0.1	0.5	0.07	0.51	46.3
West: Spring Hill Circle											
4	L2	5	0.0	0.013	4.6	LOS A	0.0	0.0	0.00	0.11	48.9
5	T1	20	0.0	0.013	0.0	LOS A	0.0	0.0	0.00	0.11	49.4
Approach		25	0.0	0.013	1.0	NA	0.0	0.0	0.00	0.11	49.3
All Vehicles		92	1.1	0.020	2.9	NA	0.1	0.6	0.06	0.33	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2021 AM Narellan Rd x Waterworth Rd x Hartley Rd]

Opening Year Base + Development 2021
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	273	5.5	0.276	13.1	LOS A	4.9	35.9	0.55	0.71	48.8
2	T1	415	3.6	0.829	36.1	LOS C	17.4	125.4	1.00	0.99	29.5
3	R2	526	3.4	0.893	53.2	LOS D	12.4	89.0	1.00	1.06	28.3
Approach		1214	3.9	0.893	38.3	LOS C	17.4	125.4	0.90	0.96	31.9
East: Narellan Rd											
4	L2	84	22.0	0.069	9.0	LOS A	0.5	4.4	0.25	0.65	54.6
5	T1	1114	13.9	0.874	42.1	LOS C	16.9	132.2	1.00	1.02	41.8
6	R2	343	22.4	0.779	49.1	LOS D	7.3	60.8	1.00	0.91	33.0
Approach		1541	16.2	0.874	41.8	LOS C	16.9	132.2	0.96	0.98	40.1
North: Hartley Rd											
7	L2	259	36.6	0.307	13.2	LOS A	4.6	42.6	0.55	0.70	44.3
8	T1	265	6.5	0.315	28.5	LOS B	4.4	32.6	0.88	0.70	33.1
9	R2	177	10.9	0.821	49.4	LOS D	7.7	59.1	1.00	0.96	31.7
Approach		701	18.7	0.821	28.1	LOS B	7.7	59.1	0.79	0.77	36.5
West: Narellan Rd											
10	L2	215	7.5	0.222	14.9	LOS B	3.7	27.9	0.54	0.73	51.8
11	T1	725	21.0	0.805	40.0	LOS C	10.3	84.7	1.00	0.94	42.8
12	R2	84	8.5	0.321	48.2	LOS D	1.7	12.6	0.98	0.73	30.5
Approach		1024	17.1	0.805	35.4	LOS C	10.3	84.7	0.90	0.88	43.2
All Vehicles		4480	13.5	0.893	37.3	LOS C	17.4	132.2	0.90	0.92	38.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P2	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P3	North Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
P4	West Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		211	34.3	LOS D			0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2021 PM Narellan Rd x Waterworth Rd x Hartley Rd]

Opening Year Base + Development 2021
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	374	2.0	0.354	13.3	LOS A	7.6	53.9	0.55	0.72	49.5
2	T1	321	2.0	0.653	32.8	LOS C	12.8	91.3	0.95	0.81	31.0
3	R2	405	5.1	0.848	55.0	LOS D	10.0	73.2	1.00	0.99	27.6
Approach		1100	3.2	0.848	34.4	LOS C	12.8	91.3	0.83	0.84	33.9
East: Narellan Rd											
4	L2	584	1.9	0.464	11.8	LOS A	9.4	66.6	0.48	0.74	53.7
5	T1	1275	6.0	0.815	37.8	LOS C	19.3	142.0	1.00	0.94	43.9
6	R2	255	22.6	0.717	53.7	LOS D	5.9	49.5	1.00	0.86	31.5
Approach		2114	6.9	0.815	32.5	LOS C	19.3	142.0	0.85	0.88	43.7
North: Hartley Rd											
7	L2	604	10.1	0.660	19.0	LOS B	15.5	117.6	0.78	0.88	45.3
8	T1	356	3.6	0.442	34.0	LOS C	6.9	50.1	0.92	0.75	30.4
9	R2	109	3.9	0.682	52.4	LOS D	5.1	36.7	1.00	0.84	31.3
Approach		1069	7.3	0.682	27.4	LOS B	15.5	117.6	0.85	0.84	38.6
West: Narellan Rd											
10	L2	227	5.2	0.200	12.4	LOS A	3.4	25.0	0.43	0.71	54.1
11	T1	1020	5.6	0.650	31.3	LOS C	13.4	98.0	0.94	0.80	47.6
12	R2	342	1.2	0.836	57.1	LOS E	8.4	59.4	1.00	0.93	27.8
Approach		1589	4.6	0.836	34.2	LOS C	13.4	98.0	0.88	0.82	43.2
All Vehicles		5873	5.6	0.848	32.4	LOS C	19.3	142.0	0.86	0.85	40.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P2	East Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P3	North Full Crossing	53	35.6	LOS D	0.1	0.1	0.89	0.89
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		211	37.5	LOS D			0.91	0.91

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2021 AM Hartley Rd x Currans Hill Dr x McPherson Rd]

Opening Year Base + Development 2021
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	37	5.7	0.940	14.9	LOS B	19.4	148.9	1.00	1.18	39.6
2	T1	791	12.3	0.940	15.3	LOS B	19.4	148.9	1.00	1.18	46.1
3	R2	137	6.2	0.940	19.8	LOS B	19.4	148.9	1.00	1.18	43.2
Approach		964	11.2	0.940	15.9	LOS B	19.4	148.9	1.00	1.18	45.4
East: Currans Hill Dr											
4	L2	240	1.8	0.597	5.7	LOS A	3.5	24.9	0.60	0.85	45.9
5	T1	15	0.0	0.597	5.6	LOS A	3.5	24.9	0.60	0.85	45.3
6	R2	314	3.0	0.597	10.2	LOS A	3.5	24.9	0.60	0.85	49.1
Approach		568	2.4	0.597	8.2	LOS A	3.5	24.9	0.60	0.85	47.8
North: Hartley Rd											
7	L2	227	3.7	0.305	4.9	LOS A	1.9	14.3	0.40	0.51	50.1
8	T1	437	26.2	0.305	5.3	LOS A	1.9	14.3	0.41	0.51	53.2
9	R2	19	0.0	0.305	9.6	LOS A	1.8	15.1	0.42	0.51	51.7
Approach		683	18.0	0.305	5.3	LOS A	1.9	15.1	0.41	0.51	51.9
West: McPherson Rd											
10	L2	8	50.0	0.181	21.8	LOS B	1.0	10.6	0.93	0.97	36.7
11	T1	2	50.0	0.181	21.7	LOS B	1.0	10.6	0.93	0.97	36.0
12	R2	22	57.1	0.181	27.0	LOS B	1.0	10.6	0.93	0.97	29.8
Approach		33	54.8	0.181	25.3	LOS B	1.0	10.6	0.93	0.97	32.1
All Vehicles		2248	11.7	0.940	10.9	LOS A	19.4	148.9	0.72	0.89	47.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2021 PM Hartley Rd x Currans Hill Dr x McPherson Rd]

Opening Year Base + Development 2021
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	32	16.7	0.665	5.1	LOS A	4.3	32.6	0.45	0.57	45.9
2	T1	503	13.0	0.665	5.2	LOS A	4.3	32.6	0.45	0.57	52.4
3	R2	254	1.7	0.665	9.7	LOS A	4.3	32.6	0.45	0.57	48.8
Approach		788	9.5	0.665	6.6	LOS A	4.3	32.6	0.45	0.57	50.9
East: Currans Hill Dr											
4	L2	177	1.8	0.431	6.1	LOS A	2.1	15.0	0.67	0.87	45.9
5	T1	3	0.0	0.431	6.0	LOS A	2.1	15.0	0.67	0.87	45.4
6	R2	144	3.6	0.431	10.6	LOS A	2.1	15.0	0.67	0.87	49.1
Approach		324	2.6	0.431	8.1	LOS A	2.1	15.0	0.67	0.87	47.5
North: Hartley Rd											
7	L2	324	1.3	0.548	5.9	LOS A	3.9	28.2	0.59	0.62	49.4
8	T1	856	8.5	0.548	6.3	LOS A	3.9	29.3	0.60	0.63	52.7
9	R2	27	23.1	0.548	11.5	LOS A	3.9	29.3	0.61	0.64	50.3
Approach		1207	6.9	0.548	6.3	LOS A	3.9	29.3	0.60	0.63	51.6
West: McPherson Rd											
10	L2	29	21.4	0.154	10.2	LOS A	0.9	6.6	0.77	0.84	44.5
11	T1	16	6.7	0.154	9.5	LOS A	0.9	6.6	0.77	0.84	42.9
12	R2	34	6.3	0.154	14.0	LOS A	0.9	6.6	0.77	0.84	42.2
Approach		79	12.0	0.154	11.7	LOS A	0.9	6.6	0.77	0.84	43.3
All Vehicles		2399	7.3	0.665	6.8	LOS A	4.3	32.6	0.57	0.65	50.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 3:52:37 PM
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MOVEMENT SUMMARY

Site: [2021 AM Narellan Rd x Mount Annan Dr x Tramway Dr]

Opening Year Base + Development 2021
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	16	6.7	0.073	32.1	LOS C	1.6	11.5	0.77	0.62	39.2
2	T1	22	0.0	0.073	27.5	LOS B	1.6	11.5	0.77	0.62	34.3
3	R2	874	0.6	1.074	166.6	LOS F	52.6	369.9	1.00	1.30	13.5
Approach		912	0.7	1.074	160.9	LOS F	52.6	369.9	0.99	1.27	13.9
East: Narellan Dr											
4	L2	129	1.6	0.080	7.7	LOS A	0.5	3.9	0.11	0.64	51.0
5	T1	2122	14.6	1.014	111.9	LOS F	79.7	628.1	1.00	1.27	19.8
6	R2	329	1.9	1.079	176.0	LOS F	39.7	282.7	1.00	1.17	11.4
Approach		2581	12.3	1.079	114.8	LOS F	79.7	628.1	0.96	1.23	18.9
North: Tramway Dr											
7	L2	645	3.4	0.835	49.9	LOS D	36.2	261.0	0.96	1.11	26.1
8	T1	9	22.2	0.033	56.0	LOS D	0.6	4.8	0.86	0.60	26.7
9	R2	4	0.0	0.028	42.4	LOS C	0.2	1.3	0.94	0.63	33.6
Approach		659	3.7	0.835	49.9	LOS D	36.2	261.0	0.96	1.10	26.2
West: Narellan Dr											
10	L2	9	55.6	0.010	11.7	LOS A	0.1	1.5	0.26	0.63	51.9
11	T1	2188	12.7	1.063	150.6	LOS F	65.1	505.6	1.00	1.37	15.7
12	R2	18	17.6	0.271	88.2	LOS F	1.4	11.0	1.00	0.70	24.9
Approach		2216	13.0	1.063	149.5	LOS F	65.1	505.6	1.00	1.36	15.8
All Vehicles		6367	10.0	1.079	126.8	LOS F	79.7	628.1	0.97	1.27	17.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	34.8	LOS D	0.2	0.2	0.68	0.68
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	45.7	LOS E	0.2	0.2	0.78	0.78
P4	West Full Crossing	53	59.1	LOS E	0.2	0.2	0.89	0.89
All Pedestrians		211	52.2	LOS E			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2021 PM Narellan Rd x Mount Annan Dr x Tramway Dr]

Opening Year Base + Development 2021
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	5	0.0	0.139	86.8	LOS F	4.0	28.3	0.88	0.75	25.4
2	T1	40	2.6	0.139	82.3	LOS F	4.0	28.3	0.88	0.75	21.8
3	R2	189	3.3	0.783	85.6	LOS F	7.4	53.2	1.00	0.89	21.2
Approach		235	3.1	0.783	85.1	LOS F	7.4	53.2	0.98	0.86	21.4
East: Narellan Dr											
4	L2	363	1.4	0.243	9.3	LOS A	4.6	32.6	0.23	0.67	49.6
5	T1	2761	6.1	1.015	103.3	LOS F	108.8	801.5	1.00	1.26	21.0
6	R2	456	1.6	1.164	243.5	LOS F	66.1	468.9	1.00	1.30	8.7
Approach		3580	5.1	1.164	111.6	LOS F	108.8	801.5	0.92	1.20	19.2
North: Tramway Dr											
7	L2	165	2.5	0.186	26.1	LOS B	6.7	47.9	0.60	0.68	35.0
8	T1	68	3.1	0.215	58.3	LOS E	4.3	31.2	0.90	0.70	26.2
9	R2	131	0.8	1.125	217.6	LOS F	17.1	120.2	1.00	1.38	11.8
Approach		364	2.0	1.125	100.8	LOS F	17.1	120.2	0.80	0.93	18.9
West: Narellan Dr											
10	L2	24	8.7	0.020	13.4	LOS A	0.5	3.6	0.32	0.65	50.7
11	T1	3268	5.2	1.170	235.3	LOS F	129.8	948.9	1.00	1.74	10.8
12	R2	131	0.0	1.054	159.3	LOS F	14.4	100.9	1.00	1.11	16.8
Approach		3423	5.0	1.170	230.8	LOS F	129.8	948.9	1.00	1.71	11.1
All Vehicles		7602	4.9	1.170	164.0	LOS F	129.8	948.9	0.95	1.41	14.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	23.0	LOS C	0.1	0.1	0.55	0.55
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	34.1	LOS D	0.2	0.2	0.67	0.67
P4	West Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	48.9	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2021 AM Currans Hill Dr x Tramway Dr]

Opening Year Base + Development 2021
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	240	3.9	0.256	9.0	LOS A	1.1	8.2	0.41	0.90	44.5
6	R2	19	5.6	0.256	12.7	LOS A	1.1	8.2	0.41	0.90	43.4
Approach		259	4.1	0.256	9.2	LOS A	1.1	8.2	0.41	0.90	44.4
NorthEast: Currans Hill Dr											
7	L2	86	2.4	0.179	4.6	LOS A	0.0	0.0	0.00	0.14	48.5
8	T1	253	2.9	0.179	0.0	LOS A	0.0	0.0	0.00	0.14	49.1
Approach		339	2.8	0.179	1.2	NA	0.0	0.0	0.00	0.14	48.9
SouthWest: Currans Hill Dr											
2	T1	105	6.0	0.255	1.5	LOS A	1.4	10.1	0.47	0.46	46.4
3	R2	249	3.8	0.255	6.1	LOS A	1.4	10.1	0.47	0.46	45.9
Approach		355	4.5	0.255	4.8	NA	1.4	10.1	0.47	0.46	46.0
All Vehicles		953	3.8	0.256	4.7	NA	1.4	10.1	0.29	0.47	46.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 3:52:43 PM
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MOVEMENT SUMMARY

Site: [2021 PM Currans Hill Dr x Tramway Dr]

Opening Year Base + Development 2021
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	115	3.7	0.241	8.4	LOS A	0.9	6.7	0.36	0.92	43.9
6	R2	72	2.9	0.241	13.0	LOS A	0.9	6.7	0.36	0.92	42.8
Approach		186	3.4	0.241	10.2	LOS A	0.9	6.7	0.36	0.92	43.5
NorthEast: Currans Hill Dr											
7	L2	38	5.6	0.107	4.6	LOS A	0.0	0.0	0.00	0.10	48.7
8	T1	166	1.3	0.107	0.0	LOS A	0.0	0.0	0.00	0.10	49.4
Approach		204	2.1	0.107	0.9	NA	0.0	0.0	0.00	0.10	49.2
SouthWest: Currans Hill Dr											
2	T1	289	1.5	0.309	0.6	LOS A	1.6	11.6	0.32	0.26	47.6
3	R2	231	1.4	0.309	5.5	LOS A	1.6	11.6	0.32	0.26	46.9
Approach		520	1.4	0.309	2.8	NA	1.6	11.6	0.32	0.26	47.3
All Vehicles		911	2.0	0.309	3.9	NA	1.6	11.6	0.26	0.36	46.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 3:52:43 PM
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MOVEMENT SUMMARY

▽ Site: [2021 AM Currans Hill Dr x Spring Hill Circle]

Opening Year Base + Development 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	42	2.5	0.056	4.6	LOS A	0.2	1.6	0.03	0.53	45.9
3	R2	29	17.9	0.056	5.6	LOS A	0.2	1.6	0.03	0.53	45.2
Approach		72	8.8	0.056	5.0	LOS A	0.2	1.6	0.03	0.53	45.6
East: Spring Hill Circle											
4	L2	141	3.7	0.083	4.6	LOS A	0.0	0.0	0.00	0.50	46.3
5	T1	9	0.0	0.083	0.0	LOS A	0.0	0.0	0.00	0.50	47.2
Approach		151	3.5	0.083	4.3	NA	0.0	0.0	0.00	0.50	46.4
West: Spring Hill Circle											
11	T1	34	3.1	0.073	0.5	LOS A	0.3	2.5	0.26	0.39	47.2
12	R2	85	2.5	0.073	5.1	LOS A	0.3	2.5	0.26	0.39	45.9
Approach		119	2.7	0.073	3.8	NA	0.3	2.5	0.26	0.39	46.3
All Vehicles		341	4.3	0.083	4.3	NA	0.3	2.5	0.10	0.47	46.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 3:52:44 PM
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MOVEMENT SUMMARY

Site: [2021 PM Currans Hill Dr x Spring Hill Circle]

Opening Year Base + Development 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	139	0.8	0.165	4.7	LOS A	0.7	4.8	0.11	0.52	45.9
3	R2	87	3.6	0.165	5.2	LOS A	0.7	4.8	0.11	0.52	45.4
Approach		226	1.9	0.165	4.9	LOS A	0.7	4.8	0.11	0.52	45.7
East: Spring Hill Circle											
4	L2	69	4.5	0.056	4.6	LOS A	0.0	0.0	0.00	0.36	47.2
5	T1	34	0.0	0.056	0.0	LOS A	0.0	0.0	0.00	0.36	48.0
Approach		103	3.1	0.056	3.1	NA	0.0	0.0	0.00	0.36	47.5
West: Spring Hill Circle											
11	T1	20	0.0	0.041	0.3	LOS A	0.2	1.3	0.21	0.37	47.4
12	R2	48	2.2	0.041	4.9	LOS A	0.2	1.3	0.21	0.37	46.1
Approach		68	1.5	0.041	3.5	NA	0.2	1.3	0.21	0.37	46.5
All Vehicles		398	2.1	0.165	4.2	NA	0.7	4.8	0.10	0.46	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 3:52:44 PM
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MOVEMENT SUMMARY

▽ Site: [2021 AM Glenfield Dr x Spring Hill Circle]

Opening Year Base + Development 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	25	16.7	0.063	5.2	LOS A	0.2	1.7	0.26	0.56	45.8
3	R2	43	4.9	0.063	5.7	LOS A	0.2	1.7	0.26	0.56	45.5
Approach		68	9.2	0.063	5.5	LOS A	0.2	1.7	0.26	0.56	45.6
East: Spring Hill Circle											
4	L2	173	0.6	0.158	4.6	LOS A	0.0	0.0	0.00	0.31	47.8
5	T1	125	0.8	0.158	0.0	LOS A	0.0	0.0	0.00	0.31	48.2
Approach		298	0.7	0.158	2.7	NA	0.0	0.0	0.00	0.31	48.0
West: Spring Hill Circle											
11	T1	29	0.0	0.043	0.9	LOS A	0.2	1.5	0.36	0.30	47.6
12	R2	33	16.1	0.043	5.9	LOS A	0.2	1.5	0.36	0.30	46.5
Approach		62	8.5	0.043	3.5	NA	0.2	1.5	0.36	0.30	47.0
All Vehicles		428	3.2	0.158	3.2	NA	0.2	1.7	0.09	0.35	47.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 3:52:45 PM
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MOVEMENT SUMMARY

Site: [2021 PM Glenfield Dr x Spring Hill Circle]

Opening Year Base + Development 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	53	4.0	0.188	4.8	LOS A	0.7	5.0	0.20	0.56	46.1
3	R2	166	0.0	0.188	5.4	LOS A	0.7	5.0	0.20	0.56	45.8
Approach		219	1.0	0.188	5.2	LOS A	0.7	5.0	0.20	0.56	45.8
East: Spring Hill Circle											
4	L2	81	1.3	0.070	4.6	LOS A	0.0	0.0	0.00	0.33	47.7
5	T1	51	2.1	0.070	0.0	LOS A	0.0	0.0	0.00	0.33	48.1
Approach		132	1.6	0.070	2.8	NA	0.0	0.0	0.00	0.33	47.8
West: Spring Hill Circle											
11	T1	68	0.0	0.061	0.2	LOS A	0.2	1.6	0.18	0.19	48.5
12	R2	38	5.6	0.061	5.0	LOS A	0.2	1.6	0.18	0.19	47.5
Approach		106	2.0	0.061	1.9	NA	0.2	1.6	0.18	0.19	48.1
All Vehicles		457	1.4	0.188	3.8	NA	0.7	5.0	0.14	0.41	46.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2021 AM Manooka Rd x Spring Hill Circle]

Opening Year Base + Development 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	7	14.3	0.026	0.1	LOS A	0.1	0.9	0.12	0.44	47.2
12	R2	39	0.0	0.026	4.7	LOS A	0.1	0.9	0.12	0.44	46.3
Approach		46	2.3	0.026	4.0	NA	0.1	0.9	0.12	0.44	46.4
North: Manooka Rd											
1	L2	184	0.0	0.119	4.7	LOS A	0.5	3.6	0.10	0.50	46.4
3	R2	4	25.0	0.119	5.2	LOS A	0.5	3.6	0.10	0.50	45.6
Approach		188	0.6	0.119	4.7	LOS A	0.5	3.6	0.10	0.50	46.4
West: Spring Hill Circle											
4	L2	14	7.7	0.023	4.6	LOS A	0.0	0.0	0.00	0.18	48.4
5	T1	28	3.7	0.023	0.0	LOS A	0.0	0.0	0.00	0.18	49.0
Approach		42	5.0	0.023	1.5	NA	0.0	0.0	0.00	0.18	48.8
All Vehicles		277	1.5	0.119	4.1	NA	0.5	3.6	0.09	0.44	46.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 3:52:46 PM
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MOVEMENT SUMMARY

▽ Site: [2021 PM Manooka Rd x Spring Hill Circle]

Opening Year Base + Development 2021
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	14	0.0	0.080	0.2	LOS A	0.4	2.7	0.18	0.47	46.9
12	R2	122	0.0	0.080	4.8	LOS A	0.4	2.7	0.18	0.47	46.1
Approach		136	0.0	0.080	4.3	NA	0.4	2.7	0.18	0.47	46.2
North: Manooka Rd											
1	L2	60	1.8	0.043	4.6	LOS A	0.2	1.2	0.06	0.51	46.5
3	R2	6	0.0	0.043	5.2	LOS A	0.2	1.2	0.06	0.51	46.1
Approach		66	1.6	0.043	4.7	LOS A	0.2	1.2	0.06	0.51	46.4
West: Spring Hill Circle											
4	L2	56	0.0	0.040	4.6	LOS A	0.0	0.0	0.00	0.39	47.4
5	T1	20	0.0	0.040	0.0	LOS A	0.0	0.0	0.00	0.39	47.8
Approach		76	0.0	0.040	3.4	NA	0.0	0.0	0.00	0.39	47.5
All Vehicles		278	0.4	0.080	4.1	NA	0.4	2.7	0.10	0.46	46.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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ORD05

Attachment 4

MOVEMENT SUMMARY

Site: [2031 AM Narellan Rd x Waterworth Rd x Hartley Rd]

Future Year Base 2031
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	433	5.5	0.485	26.1	LOS B	18.9	138.7	0.69	0.78	39.3
2	T1	426	3.6	0.781	54.0	LOS D	29.1	209.7	0.98	0.88	23.6
3	R2	835	3.4	0.885	74.5	LOS F	33.0	237.8	1.00	0.96	23.0
Approach		1694	4.0	0.885	57.0	LOS E	33.0	237.8	0.92	0.89	26.0
East: Narellan Rd											
4	L2	127	22.0	0.097	9.6	LOS A	1.4	12.0	0.21	0.65	54.0
5	T1	1692	13.9	0.884	57.5	LOS E	44.2	346.2	0.99	0.98	35.6
6	R2	353	22.4	0.787	80.4	LOS F	13.3	111.4	1.00	0.88	24.8
Approach		2172	15.8	0.884	58.4	LOS E	44.2	346.2	0.95	0.95	34.0
North: Hartley Rd											
7	L2	266	36.6	0.418	33.6	LOS C	12.8	118.1	0.74	0.85	34.5
8	T1	273	6.5	0.437	61.0	LOS E	9.0	66.8	0.95	0.77	21.9
9	R2	133	14.9	0.790	49.2	LOS D	6.4	50.4	1.00	0.87	31.4
Approach		672	20.1	0.790	47.8	LOS D	12.8	118.1	0.87	0.82	28.7
West: Narellan Rd											
10	L2	208	7.9	0.199	18.7	LOS B	6.1	45.5	0.47	0.72	48.8
11	T1	1101	21.0	0.782	56.5	LOS D	25.6	211.3	0.99	0.89	35.9
12	R2	127	8.5	0.779	91.8	LOS F	5.1	38.1	1.00	0.84	20.2
Approach		1437	18.0	0.782	54.1	LOS D	25.6	211.3	0.91	0.86	35.3
All Vehicles		5974	13.4	0.885	55.8	LOS D	44.2	346.2	0.92	0.90	31.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	40.4	LOS E	0.2	0.2	0.73	0.73
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	51.4	LOS E	0.2	0.2	0.83	0.83
P4	West Full Crossing	53	56.5	LOS E	0.2	0.2	0.87	0.87
All Pedestrians		211	54.4	LOS E			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2031 PM Narellan Rd x Waterworth Rd x Hartley Rd]

Future Year Base 2031
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	594	2.0	0.651	30.7	LOS C	29.6	210.7	0.80	0.82	37.2
2	T1	331	2.0	0.805	64.0	LOS E	24.1	171.3	1.00	0.92	21.2
3	R2	643	5.1	1.036	142.8	LOS F	35.1	256.8	1.00	1.18	14.3
Approach		1567	3.3	1.036	83.8	LOS F	35.1	256.8	0.92	0.99	20.5
East: Narellan Rd											
4	L2	887	1.9	0.700	20.9	LOS B	26.2	186.6	0.65	0.86	45.3
5	T1	1936	6.0	1.038	133.1	LOS F	78.8	580.3	1.00	1.32	20.6
6	R2	262	22.6	0.768	48.8	LOS D	5.5	46.1	1.00	0.85	33.1
Approach		3085	6.3	1.038	93.7	LOS F	78.8	580.3	0.90	1.15	24.3
North: Hartley Rd											
7	L2	621	10.1	0.851	48.7	LOS D	36.0	273.4	0.97	1.04	31.7
8	T1	365	3.6	0.707	63.8	LOS E	12.6	91.2	0.97	0.83	21.3
9	R2	100	4.4	0.641	49.6	LOS D	5.2	37.9	1.00	0.79	32.2
Approach		1086	7.4	0.851	53.9	LOS D	36.0	273.4	0.98	0.94	28.3
West: Narellan Rd											
10	L2	182	6.6	0.153	14.6	LOS B	4.1	30.6	0.38	0.70	52.2
11	T1	1549	5.6	0.777	46.1	LOS D	33.4	244.9	0.96	0.85	40.0
12	R2	520	1.2	1.009	128.5	LOS F	26.4	186.5	1.00	1.06	15.8
Approach		2252	4.7	1.009	62.6	LOS E	33.4	244.9	0.92	0.89	31.9
All Vehicles		7991	5.4	1.038	77.6	LOS F	78.8	580.3	0.92	1.02	25.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	41.2	LOS E	0.2	0.2	0.74	0.74
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	41.9	LOS E	0.2	0.2	0.75	0.75
P4	West Full Crossing	53	66.4	LOS F	0.2	0.2	0.94	0.94
All Pedestrians		211	54.7	LOS E			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2031 AM Hartley Rd x Currans Hill Dr x McPherson Rd]

Future Year Base 2031
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	37	5.7	0.949	16.0	LOS B	20.8	159.7	1.00	1.21	38.9
2	T1	813	12.3	0.949	16.4	LOS B	20.8	159.7	1.00	1.21	45.4
3	R2	125	6.7	0.949	20.9	LOS B	20.8	159.7	1.00	1.21	42.6
Approach		975	11.3	0.949	16.9	LOS B	20.8	159.7	1.00	1.21	44.8
East: Currans Hill Dr											
4	L2	192	2.2	0.548	5.5	LOS A	2.9	21.0	0.57	0.83	45.9
5	T1	15	0.0	0.548	5.3	LOS A	2.9	21.0	0.57	0.83	45.4
6	R2	314	3.0	0.548	9.9	LOS A	2.9	21.0	0.57	0.83	49.1
Approach		520	2.6	0.548	8.1	LOS A	2.9	21.0	0.57	0.83	48.0
North: Hartley Rd											
7	L2	227	3.7	0.306	4.9	LOS A	1.9	14.4	0.39	0.51	50.1
8	T1	448	26.2	0.306	5.2	LOS A	1.9	14.4	0.40	0.51	53.2
9	R2	19	0.0	0.306	9.5	LOS A	1.8	15.2	0.40	0.51	51.8
Approach		695	18.1	0.306	5.2	LOS A	1.9	15.2	0.39	0.51	52.0
West: McPherson Rd											
10	L2	8	50.0	0.185	22.4	LOS B	1.1	10.9	0.93	0.97	36.4
11	T1	2	50.0	0.185	22.3	LOS B	1.1	10.9	0.93	0.97	35.7
12	R2	22	57.1	0.185	27.7	LOS B	1.1	10.9	0.93	0.97	29.5
Approach		33	54.8	0.185	26.0	LOS B	1.1	10.9	0.93	0.97	31.8
All Vehicles		2222	12.1	0.949	11.4	LOS A	20.8	159.7	0.71	0.90	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2031 PM Hartley Rd x Currans Hill Dr x McPherson Rd]

Future Year Base 2031
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	32	16.7	0.638	5.0	LOS A	3.9	29.7	0.43	0.56	46.2
2	T1	517	13.0	0.638	5.1	LOS A	3.9	29.7	0.43	0.56	52.7
3	R2	203	2.1	0.638	9.6	LOS A	3.9	29.7	0.43	0.56	49.0
Approach		752	10.2	0.638	6.3	LOS A	3.9	29.7	0.43	0.56	51.4
East: Currans Hill Dr											
4	L2	164	1.9	0.414	6.1	LOS A	2.0	14.0	0.66	0.86	45.9
5	T1	3	0.0	0.414	6.0	LOS A	2.0	14.0	0.66	0.86	45.3
6	R2	144	3.6	0.414	10.6	LOS A	2.0	14.0	0.66	0.86	49.1
Approach		312	2.7	0.414	8.2	LOS A	2.0	14.0	0.66	0.86	47.5
North: Hartley Rd											
7	L2	324	1.3	0.534	5.6	LOS A	3.7	27.1	0.54	0.58	49.6
8	T1	880	8.5	0.534	5.9	LOS A	3.7	27.1	0.55	0.58	53.0
9	R2	27	23.1	0.534	11.0	LOS A	3.6	27.3	0.55	0.58	50.6
Approach		1232	6.9	0.534	5.9	LOS A	3.7	27.3	0.55	0.58	51.8
West: McPherson Rd											
10	L2	29	21.4	0.146	9.6	LOS A	0.8	6.1	0.75	0.82	44.9
11	T1	16	6.7	0.146	9.0	LOS A	0.8	6.1	0.75	0.82	43.3
12	R2	34	6.3	0.146	13.5	LOS A	0.8	6.1	0.75	0.82	42.6
Approach		79	12.0	0.146	11.1	LOS A	0.8	6.1	0.75	0.82	43.7
All Vehicles		2374	7.6	0.638	6.5	LOS A	3.9	29.7	0.53	0.62	50.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2031 AM Narellan Rd x Mount Annan Dr x Tramway Dr]

Future Year Base 2031
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	16	6.7	0.088	38.7	LOS C	1.8	12.6	0.82	0.65	36.6
2	T1	22	0.0	0.088	34.2	LOS C	1.8	12.6	0.82	0.65	32.0
3	R2	874	0.6	1.363	417.1	LOS F	83.7	589.2	1.00	1.86	6.3
Approach		912	0.7	1.363	401.3	LOS F	83.7	589.2	0.99	1.81	6.6
East: Narellan Dr											
4	L2	129	1.6	0.080	7.7	LOS A	0.5	3.9	0.11	0.64	51.0
5	T1	3222	14.6	1.371	409.9	LOS F	223.3	1759.0	1.00	2.34	6.6
6	R2	301	2.1	1.299	365.0	LOS F	53.2	379.3	1.00	1.46	6.1
Approach		3653	13.1	1.371	391.9	LOS F	223.3	1759.0	0.97	2.21	6.8
North: Tramway Dr											
7	L2	534	4.1	0.766	49.5	LOS D	26.9	195.1	0.93	1.07	26.2
8	T1	9	22.2	0.033	56.0	LOS D	0.6	4.8	0.86	0.60	26.7
9	R2	4	0.0	0.028	44.5	LOS D	0.2	1.4	0.94	0.63	32.9
Approach		547	4.4	0.766	49.6	LOS D	26.9	195.1	0.93	1.06	26.3
West: Narellan Dr											
10	L2	9	55.6	0.009	10.6	LOS A	0.1	1.2	0.22	0.62	52.9
11	T1	3324	12.7	1.293	344.5	LOS F	156.7	1216.6	1.00	2.07	7.7
12	R2	18	17.6	0.271	88.2	LOS F	1.4	11.0	1.00	0.70	24.9
Approach		3352	12.9	1.293	342.1	LOS F	156.7	1216.6	1.00	2.06	7.8
All Vehicles		8463	11.1	1.371	351.1	LOS F	223.3	1759.0	0.98	2.03	7.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	30.1	LOS D	0.1	0.1	0.63	0.63
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	36.1	LOS D	0.2	0.2	0.69	0.69
P4	West Full Crossing	53	65.5	LOS F	0.2	0.2	0.94	0.94
All Pedestrians		211	50.3	LOS E			0.81	0.81

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2031 PM Narellan Rd x Mount Annan Dr x Tramway Dr]

Future Year Base 2031
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	5	0.0	0.139	86.8	LOS F	4.0	28.3	0.88	0.75	25.4
2	T1	40	2.6	0.139	82.3	LOS F	4.0	28.3	0.88	0.75	21.8
3	R2	189	3.3	0.979	112.9	LOS F	8.7	62.9	1.00	1.10	17.8
Approach		235	3.1	0.979	107.1	LOS F	8.7	62.9	0.98	1.03	18.5
East: Narellan Dr											
4	L2	363	1.4	0.239	9.0	LOS A	4.1	29.3	0.22	0.67	49.9
5	T1	4194	6.1	1.417	445.5	LOS F	314.9	2319.8	1.00	2.46	6.1
6	R2	339	2.2	1.463	511.7	LOS F	71.4	509.3	1.00	1.64	4.5
Approach		4896	5.5	1.463	417.7	LOS F	314.9	2319.8	0.94	2.27	6.4
North: Tramway Dr											
7	L2	136	3.1	0.193	35.7	LOS C	6.6	47.4	0.69	0.70	30.7
8	T1	68	3.1	0.215	58.3	LOS E	4.3	31.2	0.90	0.70	26.2
9	R2	131	0.8	1.325	388.4	LOS F	23.8	167.7	1.00	1.65	7.2
Approach		335	2.2	1.325	177.9	LOS F	23.8	167.7	0.86	1.07	12.6
West: Narellan Dr											
10	L2	24	8.7	0.018	10.2	LOS A	0.3	2.4	0.23	0.64	53.4
11	T1	4964	5.2	1.445	475.1	LOS F	286.7	2096.9	1.00	2.51	5.8
12	R2	131	0.0	1.318	384.5	LOS F	23.6	164.9	1.00	1.38	8.3
Approach		5119	5.1	1.445	470.6	LOS F	286.7	2096.9	1.00	2.48	5.8
All Vehicles		10584	5.2	1.463	428.8	LOS F	314.9	2319.8	0.97	2.30	6.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	20.8	LOS C	0.1	0.1	0.53	0.53
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	24.7	LOS C	0.1	0.1	0.57	0.57
P4	West Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	46.0	LOS E			0.76	0.76

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: [2031 AM Currans Hill Dr x Tramway Dr]

Future Year Base 2031
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	240	3.9	0.242	8.6	LOS A	1.1	7.8	0.37	0.89	44.6
6	R2	19	5.6	0.242	12.0	LOS A	1.1	7.8	0.37	0.89	43.5
Approach		259	4.1	0.242	8.9	LOS A	1.1	7.8	0.37	0.89	44.6
NorthEast: Currans Hill Dr											
7	L2	86	2.4	0.154	4.6	LOS A	0.0	0.0	0.00	0.16	48.4
8	T1	204	3.6	0.154	0.0	LOS A	0.0	0.0	0.00	0.16	48.9
Approach		291	3.3	0.154	1.4	NA	0.0	0.0	0.00	0.16	48.8
SouthWest: Currans Hill Dr											
2	T1	94	6.7	0.238	1.2	LOS A	1.3	9.3	0.43	0.46	46.4
3	R2	249	3.8	0.238	5.9	LOS A	1.3	9.3	0.43	0.46	45.9
Approach		343	4.6	0.238	4.6	NA	1.3	9.3	0.43	0.46	46.0
All Vehicles		893	4.0	0.242	4.8	NA	1.3	9.3	0.27	0.49	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 1:40:21 PM
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MOVEMENT SUMMARY

Site: [2031 PM Currans Hill Dr x Tramway Dr]

Future Year Base 2031
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	115	3.7	0.226	8.3	LOS A	0.9	6.3	0.34	0.92	44.1
6	R2	72	2.9	0.226	12.1	LOS A	0.9	6.3	0.34	0.92	43.0
Approach		186	3.4	0.226	9.8	LOS A	0.9	6.3	0.34	0.92	43.7
NorthEast: Currans Hill Dr											
7	L2	38	5.6	0.101	4.6	LOS A	0.0	0.0	0.00	0.11	48.7
8	T1	154	1.4	0.101	0.0	LOS A	0.0	0.0	0.00	0.11	49.3
Approach		192	2.2	0.101	0.9	NA	0.0	0.0	0.00	0.11	49.2
SouthWest: Currans Hill Dr											
2	T1	239	1.8	0.280	0.6	LOS A	1.5	10.6	0.32	0.28	47.4
3	R2	231	1.4	0.280	5.4	LOS A	1.5	10.6	0.32	0.28	46.8
Approach		469	1.6	0.280	3.0	NA	1.5	10.6	0.32	0.28	47.1
All Vehicles		847	2.1	0.280	4.0	NA	1.5	10.6	0.25	0.38	46.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2031 AM Currans Hill Dr x Spring Hill Circle]

Future Year Base 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	31	3.4	0.049	4.6	LOS A	0.2	1.3	0.04	0.54	45.9
3	R2	29	17.9	0.049	5.5	LOS A	0.2	1.3	0.04	0.54	45.2
Approach		60	10.5	0.049	5.0	LOS A	0.2	1.3	0.04	0.54	45.5
East: Spring Hill Circle											
4	L2	93	5.7	0.057	4.6	LOS A	0.0	0.0	0.00	0.48	46.4
5	T1	9	0.0	0.057	0.0	LOS A	0.0	0.0	0.00	0.48	47.3
Approach		102	5.2	0.057	4.2	NA	0.0	0.0	0.00	0.48	46.5
West: Spring Hill Circle											
11	T1	34	3.1	0.071	0.3	LOS A	0.3	2.4	0.21	0.38	47.4
12	R2	85	2.5	0.071	4.9	LOS A	0.3	2.4	0.21	0.38	46.0
Approach		119	2.7	0.071	3.6	NA	0.3	2.4	0.21	0.38	46.4
All Vehicles		281	5.2	0.071	4.1	NA	0.3	2.4	0.10	0.45	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2031 PM Currans Hill Dr x Spring Hill Circle]

Future Year Base 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	88	1.2	0.133	4.7	LOS A	0.5	3.7	0.11	0.53	45.9
3	R2	87	3.6	0.133	5.1	LOS A	0.5	3.7	0.11	0.53	45.4
Approach		176	2.4	0.133	4.9	LOS A	0.5	3.7	0.11	0.53	45.6
East: Spring Hill Circle											
4	L2	57	5.6	0.049	4.6	LOS A	0.0	0.0	0.00	0.34	47.3
5	T1	34	0.0	0.049	0.0	LOS A	0.0	0.0	0.00	0.34	48.1
Approach		91	3.5	0.049	2.9	NA	0.0	0.0	0.00	0.34	47.6
West: Spring Hill Circle											
11	T1	20	0.0	0.040	0.2	LOS A	0.2	1.3	0.19	0.37	47.4
12	R2	48	2.2	0.040	4.8	LOS A	0.2	1.3	0.19	0.37	46.1
Approach		68	1.5	0.040	3.5	NA	0.2	1.3	0.19	0.37	46.5
All Vehicles		335	2.5	0.133	4.1	NA	0.5	3.7	0.10	0.44	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2031 AM Glenfield Dr x Spring Hill Circle]

Future Year Base 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	25	16.7	0.032	5.0	LOS A	0.1	0.9	0.18	0.52	46.0
3	R2	15	14.3	0.032	5.4	LOS A	0.1	0.9	0.18	0.52	45.6
Approach		40	15.8	0.032	5.1	LOS A	0.1	0.9	0.18	0.52	45.8
East: Spring Hill Circle											
4	L2	61	1.7	0.073	4.6	LOS A	0.0	0.0	0.00	0.24	48.2
5	T1	77	1.4	0.073	0.0	LOS A	0.0	0.0	0.00	0.24	48.6
Approach		138	1.5	0.073	2.0	NA	0.0	0.0	0.00	0.24	48.4
West: Spring Hill Circle											
11	T1	29	0.0	0.039	0.4	LOS A	0.2	1.3	0.23	0.28	48.0
12	R2	33	16.1	0.039	5.2	LOS A	0.2	1.3	0.23	0.28	46.8
Approach		62	8.5	0.039	2.9	NA	0.2	1.3	0.23	0.28	47.3
All Vehicles		240	5.7	0.073	2.8	NA	0.2	1.3	0.09	0.30	47.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: [2031 PM Glenfield Dr x Spring Hill Circle]

Future Year Base 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	53	4.0	0.078	4.7	LOS A	0.3	2.1	0.12	0.53	46.3
3	R2	49	0.0	0.078	5.2	LOS A	0.3	2.1	0.12	0.53	45.9
Approach		102	2.1	0.078	4.9	LOS A	0.3	2.1	0.12	0.53	46.1
East: Spring Hill Circle											
4	L2	52	2.0	0.048	4.6	LOS A	0.0	0.0	0.00	0.31	47.8
5	T1	36	2.8	0.048	0.0	LOS A	0.0	0.0	0.00	0.31	48.2
Approach		89	2.4	0.048	2.6	NA	0.0	0.0	0.00	0.31	48.0
West: Spring Hill Circle											
11	T1	68	0.0	0.060	0.2	LOS A	0.2	1.5	0.14	0.19	48.6
12	R2	38	5.6	0.060	4.9	LOS A	0.2	1.5	0.14	0.19	47.6
Approach		106	2.0	0.060	1.8	NA	0.2	1.5	0.14	0.19	48.2
All Vehicles		298	2.1	0.078	3.1	NA	0.3	2.1	0.09	0.34	47.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2031 AM Manooka Rd x Spring Hill Circle]

Future Year Base 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	7	14.3	0.012	0.1	LOS A	0.1	0.4	0.10	0.35	47.7
12	R2	15	0.0	0.012	4.6	LOS A	0.1	0.4	0.10	0.35	46.8
Approach		22	4.8	0.012	3.1	NA	0.1	0.4	0.10	0.35	47.1
North: Manooka Rd											
1	L2	41	0.0	0.030	4.6	LOS A	0.1	0.8	0.09	0.50	46.4
3	R2	4	25.0	0.030	5.0	LOS A	0.1	0.8	0.09	0.50	45.6
Approach		45	2.3	0.030	4.7	LOS A	0.1	0.8	0.09	0.50	46.3
West: Spring Hill Circle											
4	L2	2	50.0	0.016	5.0	LOS A	0.0	0.0	0.00	0.04	48.6
5	T1	28	3.7	0.016	0.0	LOS A	0.0	0.0	0.00	0.04	49.9
Approach		31	6.9	0.016	0.3	NA	0.0	0.0	0.00	0.04	49.8
All Vehicles		98	4.3	0.030	3.0	NA	0.1	0.8	0.06	0.32	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2031 PM Manooka Rd x Spring Hill Circle]

Future Year Base 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	14	0.0	0.020	0.1	LOS A	0.1	0.6	0.08	0.34	47.9
12	R2	23	0.0	0.020	4.6	LOS A	0.1	0.6	0.08	0.34	47.0
Approach		37	0.0	0.020	2.9	NA	0.1	0.6	0.08	0.34	47.3
North: Manooka Rd											
1	L2	23	4.5	0.020	4.7	LOS A	0.1	0.5	0.07	0.51	46.4
3	R2	6	0.0	0.020	4.7	LOS A	0.1	0.5	0.07	0.51	46.0
Approach		29	3.6	0.020	4.7	LOS A	0.1	0.5	0.07	0.51	46.3
West: Spring Hill Circle											
4	L2	5	0.0	0.013	4.6	LOS A	0.0	0.0	0.00	0.11	48.9
5	T1	20	0.0	0.013	0.0	LOS A	0.0	0.0	0.00	0.11	49.4
Approach		25	0.0	0.013	1.0	NA	0.0	0.0	0.00	0.11	49.3
All Vehicles		92	1.1	0.020	2.9	NA	0.1	0.6	0.06	0.33	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 24 January 2017 1:40:26 PM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2031_Base.sip7

MOVEMENT SUMMARY

Site: [2031 AM Narellan Rd x Waterworth Rd x Hartley Rd]

Future Year Base + Development 2031
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	433	5.5	0.510	28.7	LOS C	20.1	147.2	0.73	0.79	37.8
2	T1	426	3.6	0.839	61.1	LOS E	31.3	226.1	1.00	0.95	21.8
3	R2	835	3.4	0.885	74.5	LOS F	33.0	237.8	1.00	0.96	23.0
Approach		1694	4.0	0.885	59.4	LOS E	33.0	237.8	0.93	0.91	25.4
East: Narellan Rd											
4	L2	127	22.0	0.097	9.6	LOS A	1.4	12.0	0.21	0.65	54.0
5	T1	1692	13.9	0.884	57.5	LOS E	44.2	346.2	0.99	0.98	35.6
6	R2	353	22.4	0.787	80.4	LOS F	13.3	111.4	1.00	0.88	24.8
Approach		2172	15.8	0.884	58.4	LOS E	44.2	346.2	0.95	0.95	34.0
North: Hartley Rd											
7	L2	266	36.6	0.418	33.6	LOS C	12.8	118.1	0.74	0.85	34.5
8	T1	273	6.5	0.437	61.0	LOS E	9.0	66.8	0.95	0.77	21.9
9	R2	181	10.9	0.876	54.4	LOS D	9.6	73.4	1.00	0.94	30.1
Approach		720	18.7	0.876	49.2	LOS D	12.8	118.1	0.88	0.84	28.5
West: Narellan Rd											
10	L2	220	7.5	0.210	19.3	LOS B	6.6	49.1	0.48	0.72	48.4
11	T1	1101	21.0	0.782	56.5	LOS D	25.6	211.3	0.99	0.89	35.9
12	R2	127	8.5	0.779	91.8	LOS F	5.1	38.1	1.00	0.84	20.2
Approach		1448	17.8	0.782	53.9	LOS D	25.6	211.3	0.91	0.86	35.4
All Vehicles		6034	13.3	0.885	56.5	LOS E	44.2	346.2	0.93	0.90	31.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	40.4	LOS E	0.2	0.2	0.73	0.73
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	51.4	LOS E	0.2	0.2	0.83	0.83
P4	West Full Crossing	53	59.1	LOS E	0.2	0.2	0.89	0.89
All Pedestrians		211	55.0	LOS E			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:15:56 AM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2031_Base + Development.sip7

MOVEMENT SUMMARY

Site: [2031 PM Narellan Rd x Waterworth Rd x Hartley Rd]

Future Year Base + Development 2031
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Waterworth Dr											
1	L2	594	2.0	0.660	31.5	LOS C	30.0	213.8	0.81	0.83	36.8
2	T1	331	2.0	0.831	66.9	LOS E	24.7	175.9	1.00	0.94	20.6
3	R2	643	5.1	1.036	142.8	LOS F	35.1	256.8	1.00	1.18	14.3
Approach		1567	3.3	1.036	84.6	LOS F	35.1	256.8	0.93	1.00	20.3
East: Narellan Rd											
4	L2	887	1.9	0.700	20.9	LOS B	26.2	186.6	0.65	0.86	45.3
5	T1	1936	6.0	1.038	133.1	LOS F	78.8	580.3	1.00	1.32	20.6
6	R2	262	22.6	0.768	48.8	LOS D	5.5	46.1	1.00	0.85	33.1
Approach		3085	6.3	1.038	93.7	LOS F	78.8	580.3	0.90	1.15	24.3
North: Hartley Rd											
7	L2	621	10.1	0.851	48.7	LOS D	36.0	273.4	0.97	1.04	31.7
8	T1	365	3.6	0.707	63.8	LOS E	12.6	91.2	0.97	0.83	21.3
9	R2	113	3.9	0.668	49.5	LOS D	5.9	42.7	1.00	0.80	32.2
Approach		1099	7.3	0.851	53.8	LOS D	36.0	273.4	0.98	0.94	28.3
West: Narellan Rd											
10	L2	233	5.2	0.194	14.8	LOS B	5.5	39.9	0.39	0.71	52.0
11	T1	1549	5.6	0.777	46.1	LOS D	33.4	244.9	0.96	0.85	40.0
12	R2	520	1.2	1.009	128.5	LOS F	26.4	186.5	1.00	1.06	15.8
Approach		2302	4.6	1.009	61.6	LOS E	33.4	244.9	0.91	0.89	32.1
All Vehicles		8054	5.3	1.038	77.3	LOS F	78.8	580.3	0.92	1.02	25.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	41.2	LOS E	0.2	0.2	0.74	0.74
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	41.9	LOS E	0.2	0.2	0.75	0.75
P4	West Full Crossing	53	87.4	LOS F	0.2	0.2	0.95	0.95
All Pedestrians		211	54.9	LOS E			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:15:58 AM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2031_Base + Development.sip7

MOVEMENT SUMMARY

Site: [2031 AM Hartley Rd x Currans Hill Dr x McPherson Rd]

Future Year Base + Development 2031
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	37	5.7	0.961	18.1	LOS B	23.4	179.2	1.00	1.27	37.5
2	T1	813	12.3	0.961	18.5	LOS B	23.4	179.2	1.00	1.27	44.0
3	R2	137	6.2	0.961	22.9	LOS B	23.4	179.2	1.00	1.27	41.3
Approach		986	11.2	0.961	19.1	LOS B	23.4	179.2	1.00	1.27	43.4
East: Currans Hill Dr											
4	L2	240	1.8	0.600	5.6	LOS A	3.5	25.2	0.60	0.86	45.8
5	T1	15	0.0	0.600	5.7	LOS A	3.5	25.2	0.60	0.86	45.3
6	R2	314	3.0	0.600	10.3	LOS A	3.5	25.2	0.60	0.86	49.1
Approach		568	2.4	0.600	8.3	LOS A	3.5	25.2	0.60	0.86	47.7
North: Hartley Rd											
7	L2	227	3.7	0.310	4.9	LOS A	1.9	14.7	0.40	0.51	50.1
8	T1	448	26.2	0.310	5.3	LOS A	1.9	14.7	0.41	0.51	53.2
9	R2	19	0.0	0.310	9.6	LOS A	1.8	15.5	0.42	0.51	51.7
Approach		695	18.1	0.310	5.3	LOS A	1.9	15.5	0.41	0.51	51.9
West: McPherson Rd											
10	L2	8	50.0	0.190	23.1	LOS B	1.1	11.3	0.94	0.97	36.1
11	T1	2	50.0	0.190	23.0	LOS B	1.1	11.3	0.94	0.97	35.4
12	R2	22	57.1	0.190	28.4	LOS B	1.1	11.3	0.94	0.97	29.3
Approach		33	54.8	0.190	26.6	LOS B	1.1	11.3	0.94	0.97	31.6
All Vehicles		2282	11.7	0.961	12.3	LOS A	23.4	179.2	0.72	0.93	46.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:15:59 AM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2031_Base + Development.sip7

MOVEMENT SUMMARY

Site: [2031 PM Hartley Rd x Currans Hill Dr x McPherson Rd]

Future Year Base + Development 2031
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hartley Rd											
1	L2	32	16.7	0.676	5.1	LOS A	4.5	34.4	0.46	0.57	45.9
2	T1	517	13.0	0.676	5.2	LOS A	4.5	34.4	0.46	0.57	52.3
3	R2	254	1.7	0.676	9.7	LOS A	4.5	34.4	0.46	0.57	48.8
Approach		802	9.5	0.676	6.7	LOS A	4.5	34.4	0.46	0.57	50.9
East: Currans Hill Dr											
4	L2	177	1.8	0.438	6.2	LOS A	2.2	15.4	0.68	0.88	45.8
5	T1	3	0.0	0.438	6.1	LOS A	2.2	15.4	0.68	0.88	45.3
6	R2	144	3.6	0.438	10.7	LOS A	2.2	15.4	0.68	0.88	49.1
Approach		324	2.6	0.438	8.2	LOS A	2.2	15.4	0.68	0.88	47.4
North: Hartley Rd											
7	L2	324	1.3	0.559	6.0	LOS A	4.1	29.6	0.60	0.62	49.4
8	T1	880	8.5	0.559	6.4	LOS A	4.1	30.7	0.61	0.64	52.6
9	R2	27	23.1	0.559	11.6	LOS A	4.1	30.7	0.62	0.65	50.3
Approach		1232	6.9	0.559	6.4	LOS A	4.1	30.7	0.61	0.64	51.5
West: McPherson Rd											
10	L2	29	21.4	0.157	10.4	LOS A	0.9	6.8	0.78	0.85	44.4
11	T1	16	6.7	0.157	9.7	LOS A	0.9	6.8	0.78	0.85	42.8
12	R2	34	6.3	0.157	14.2	LOS A	0.9	6.8	0.78	0.85	42.0
Approach		79	12.0	0.157	11.9	LOS A	0.9	6.8	0.78	0.85	43.1
All Vehicles		2437	7.4	0.676	6.9	LOS A	4.5	34.4	0.57	0.66	50.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:16:00 AM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2031_Base + Development.sip7

MOVEMENT SUMMARY

Site: [2031 AM Narellan Rd x Mount Annan Dr x Tramway Dr]

Future Year Base + Development 2031
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	16	6.7	0.088	38.7	LOS C	1.8	12.6	0.82	0.65	36.6
2	T1	22	0.0	0.088	34.2	LOS C	1.8	12.6	0.82	0.65	32.0
3	R2	874	0.6	1.363	417.1	LOS F	83.7	589.2	1.00	1.86	6.3
Approach		912	0.7	1.363	401.3	LOS F	83.7	589.2	0.99	1.81	6.6
East: Narellan Dr											
4	L2	129	1.6	0.080	7.7	LOS A	0.5	3.9	0.11	0.64	51.0
5	T1	3222	14.6	1.375	412.9	LOS F	224.6	1769.0	1.00	2.35	6.6
6	R2	329	1.9	1.349	409.1	LOS F	61.9	440.7	1.00	1.52	5.5
Approach		3681	13.0	1.375	398.3	LOS F	224.6	1769.0	0.97	2.22	6.7
North: Tramway Dr											
7	L2	645	3.4	0.906	65.9	LOS E	44.0	316.7	1.00	1.20	22.3
8	T1	9	22.2	0.033	56.0	LOS D	0.6	4.8	0.86	0.60	26.7
9	R2	4	0.0	0.028	44.5	LOS D	0.2	1.4	0.94	0.63	32.9
Approach		659	3.7	0.906	65.6	LOS E	44.0	316.7	1.00	1.19	22.4
West: Narellan Dr											
10	L2	9	55.6	0.009	10.7	LOS A	0.1	1.2	0.22	0.62	52.8
11	T1	3324	12.7	1.311	360.8	LOS F	159.6	1238.8	1.00	2.11	7.4
12	R2	18	17.6	0.271	88.2	LOS F	1.4	11.0	1.00	0.70	24.9
Approach		3352	12.9	1.311	358.4	LOS F	159.6	1238.8	1.00	2.10	7.5
All Vehicles		8603	10.9	1.375	357.6	LOS F	224.6	1769.0	0.98	2.05	7.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	30.1	LOS D	0.1	0.1	0.63	0.63
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	36.8	LOS D	0.2	0.2	0.70	0.70
P4	West Full Crossing	53	65.5	LOS F	0.2	0.2	0.94	0.94
All Pedestrians		211	50.4	LOS E			0.81	0.81

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:16:02 AM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2031_Base + Development.sip7

MOVEMENT SUMMARY

Site: [2031 PM Narellan Rd x Mount Annan Dr x Tramway Dr]

Future Year Base + Development 2031
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Mount Annan Dr											
1	L2	5	0.0	0.139	86.8	LOS F	4.0	28.3	0.88	0.75	25.4
2	T1	40	2.6	0.139	82.3	LOS F	4.0	28.3	0.88	0.75	21.8
3	R2	189	3.3	1.119	208.5	LOS F	12.2	87.9	1.00	1.30	11.3
Approach		235	3.1	1.119	184.3	LOS F	12.2	87.9	0.98	1.19	12.6
East: Narellan Dr											
4	L2	363	1.4	0.239	9.0	LOS A	4.1	29.3	0.22	0.67	49.9
5	T1	4194	6.1	1.416	444.9	LOS F	318.2	2344.5	1.00	2.45	6.1
6	R2	456	1.6	1.490	533.8	LOS F	98.5	699.2	1.00	1.68	4.3
Approach		5013	5.4	1.490	421.4	LOS F	318.2	2344.5	0.94	2.25	6.3
North: Tramway Dr											
7	L2	165	2.5	0.213	32.4	LOS C	7.6	54.4	0.66	0.69	32.1
8	T1	68	3.1	0.215	58.3	LOS E	4.3	31.2	0.90	0.70	26.2
9	R2	131	0.8	1.515	558.4	LOS F	28.7	202.5	1.00	1.83	5.2
Approach		364	2.0	1.515	225.8	LOS F	28.7	202.5	0.83	1.10	10.3
West: Narellan Dr											
10	L2	24	8.7	0.019	11.5	LOS A	0.4	3.0	0.27	0.65	52.2
11	T1	4964	5.2	1.532	555.3	LOS F	303.5	2219.6	1.00	2.69	5.0
12	R2	131	0.0	1.318	384.5	LOS F	23.6	164.9	1.00	1.38	8.3
Approach		5119	5.1	1.532	548.4	LOS F	303.5	2219.6	1.00	2.64	5.1
All Vehicles		10731	5.1	1.532	470.2	LOS F	318.2	2344.5	0.97	2.38	5.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	20.3	LOS C	0.1	0.1	0.52	0.52
P2	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	27.7	LOS C	0.1	0.1	0.61	0.61
P4	West Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	46.6	LOS E			0.76	0.76

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:16:04 AM
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MOVEMENT SUMMARY

Site: [2031 AM Currans Hill Dr x Tramway Dr]

Future Year Base + Development 2031
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	240	3.9	0.256	9.0	LOS A	1.1	8.2	0.41	0.90	44.5
6	R2	19	5.6	0.256	12.7	LOS A	1.1	8.2	0.41	0.90	43.4
Approach		259	4.1	0.256	9.2	LOS A	1.1	8.2	0.41	0.90	44.4
NorthEast: Currans Hill Dr											
7	L2	86	2.4	0.179	4.6	LOS A	0.0	0.0	0.00	0.14	48.5
8	T1	253	2.9	0.179	0.0	LOS A	0.0	0.0	0.00	0.14	49.1
Approach		339	2.8	0.179	1.2	NA	0.0	0.0	0.00	0.14	48.9
SouthWest: Currans Hill Dr											
2	T1	105	6.0	0.255	1.5	LOS A	1.4	10.1	0.47	0.46	46.4
3	R2	249	3.8	0.255	6.1	LOS A	1.4	10.1	0.47	0.46	45.9
Approach		355	4.5	0.255	4.8	NA	1.4	10.1	0.47	0.46	46.0
All Vehicles		953	3.8	0.256	4.7	NA	1.4	10.1	0.29	0.47	46.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:16:05 AM
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MOVEMENT SUMMARY

Site: [2031 PM Currans Hill Dr x Tramway Dr]

Future Year Base + Development 2031
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Tramway Dr											
4	L2	115	3.7	0.241	8.4	LOS A	0.9	6.7	0.36	0.92	43.9
6	R2	72	2.9	0.241	13.0	LOS A	0.9	6.7	0.36	0.92	42.8
Approach		186	3.4	0.241	10.2	LOS A	0.9	6.7	0.36	0.92	43.5
NorthEast: Currans Hill Dr											
7	L2	38	5.6	0.107	4.6	LOS A	0.0	0.0	0.00	0.10	48.7
8	T1	166	1.3	0.107	0.0	LOS A	0.0	0.0	0.00	0.10	49.4
Approach		204	2.1	0.107	0.9	NA	0.0	0.0	0.00	0.10	49.2
SouthWest: Currans Hill Dr											
2	T1	289	1.5	0.309	0.6	LOS A	1.6	11.6	0.32	0.26	47.6
3	R2	231	1.4	0.309	5.5	LOS A	1.6	11.6	0.32	0.26	46.9
Approach		520	1.4	0.309	2.8	NA	1.6	11.6	0.32	0.26	47.3
All Vehicles		911	2.0	0.309	3.9	NA	1.6	11.6	0.26	0.36	46.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2031 AM Currans Hill Dr x Spring Hill Circle]

Future Year Base + Development 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	42	2.5	0.056	4.6	LOS A	0.2	1.6	0.03	0.53	45.9
3	R2	29	17.9	0.056	5.6	LOS A	0.2	1.6	0.03	0.53	45.2
Approach		72	8.8	0.056	5.0	LOS A	0.2	1.6	0.03	0.53	45.6
East: Spring Hill Circle											
4	L2	141	3.7	0.083	4.6	LOS A	0.0	0.0	0.00	0.50	46.3
5	T1	9	0.0	0.083	0.0	LOS A	0.0	0.0	0.00	0.50	47.2
Approach		151	3.5	0.083	4.3	NA	0.0	0.0	0.00	0.50	46.4
West: Spring Hill Circle											
11	T1	34	3.1	0.073	0.5	LOS A	0.3	2.5	0.26	0.39	47.2
12	R2	85	2.5	0.073	5.1	LOS A	0.3	2.5	0.26	0.39	45.9
Approach		119	2.7	0.073	3.8	NA	0.3	2.5	0.26	0.39	46.3
All Vehicles		341	4.3	0.083	4.3	NA	0.3	2.5	0.10	0.47	46.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:16:06 AM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2031_Base + Development.sip7

MOVEMENT SUMMARY

Site: [2031 PM Currans Hill Dr x Spring Hill Circle]

Future Year Base + Development 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Currans Hill Dr											
1	L2	139	0.8	0.165	4.7	LOS A	0.7	4.8	0.11	0.52	45.9
3	R2	87	3.6	0.165	5.2	LOS A	0.7	4.8	0.11	0.52	45.4
Approach		226	1.9	0.165	4.9	LOS A	0.7	4.8	0.11	0.52	45.7
East: Spring Hill Circle											
4	L2	69	4.5	0.056	4.6	LOS A	0.0	0.0	0.00	0.36	47.2
5	T1	34	0.0	0.056	0.0	LOS A	0.0	0.0	0.00	0.36	48.0
Approach		103	3.1	0.056	3.1	NA	0.0	0.0	0.00	0.36	47.5
West: Spring Hill Circle											
11	T1	20	0.0	0.041	0.3	LOS A	0.2	1.3	0.21	0.37	47.4
12	R2	48	2.2	0.041	4.9	LOS A	0.2	1.3	0.21	0.37	46.1
Approach		68	1.5	0.041	3.5	NA	0.2	1.3	0.21	0.37	46.5
All Vehicles		398	2.1	0.165	4.2	NA	0.7	4.8	0.10	0.46	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2031 AM Glenfield Dr x Spring Hill Circle]

Future Year Base + Development 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	25	16.7	0.063	5.2	LOS A	0.2	1.7	0.26	0.56	45.8
3	R2	43	4.9	0.063	5.7	LOS A	0.2	1.7	0.26	0.56	45.5
Approach		68	9.2	0.063	5.5	LOS A	0.2	1.7	0.26	0.56	45.6
East: Spring Hill Circle											
4	L2	173	0.6	0.158	4.6	LOS A	0.0	0.0	0.00	0.31	47.8
5	T1	125	0.8	0.158	0.0	LOS A	0.0	0.0	0.00	0.31	48.2
Approach		298	0.7	0.158	2.7	NA	0.0	0.0	0.00	0.31	48.0
West: Spring Hill Circle											
11	T1	29	0.0	0.043	0.9	LOS A	0.2	1.5	0.36	0.30	47.6
12	R2	33	16.1	0.043	5.9	LOS A	0.2	1.5	0.36	0.30	46.5
Approach		62	8.5	0.043	3.5	NA	0.2	1.5	0.36	0.30	47.0
All Vehicles		428	3.2	0.158	3.2	NA	0.2	1.7	0.09	0.35	47.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:16:08 AM
Project: \\AUSYDCFS02\CID-Data\294099 - Manooka Valley Stages 1, 2 & 3\Traffic\Report\20170127\Appendix\SIDRA\2031_Base + Development.sip7

MOVEMENT SUMMARY

Site: [2031 PM Glenfield Dr x Spring Hill Circle]

Future Year Base + Development 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Glenfield Dr											
1	L2	53	4.0	0.188	4.8	LOS A	0.7	5.0	0.20	0.56	46.1
3	R2	166	0.0	0.188	5.4	LOS A	0.7	5.0	0.20	0.56	45.8
Approach		219	1.0	0.188	5.2	LOS A	0.7	5.0	0.20	0.56	45.8
East: Spring Hill Circle											
4	L2	81	1.3	0.070	4.6	LOS A	0.0	0.0	0.00	0.33	47.7
5	T1	51	2.1	0.070	0.0	LOS A	0.0	0.0	0.00	0.33	48.1
Approach		132	1.6	0.070	2.8	NA	0.0	0.0	0.00	0.33	47.8
West: Spring Hill Circle											
11	T1	68	0.0	0.061	0.2	LOS A	0.2	1.6	0.18	0.19	48.5
12	R2	38	5.6	0.061	5.0	LOS A	0.2	1.6	0.18	0.19	47.5
Approach		106	2.0	0.061	1.9	NA	0.2	1.6	0.18	0.19	48.1
All Vehicles		457	1.4	0.188	3.8	NA	0.7	5.0	0.14	0.41	46.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: [2031 AM Manooka Rd x Spring Hill Circle]

Future Year Base + Development 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	7	14.3	0.026	0.1	LOS A	0.1	0.9	0.12	0.44	47.2
12	R2	39	0.0	0.026	4.7	LOS A	0.1	0.9	0.12	0.44	46.3
Approach		46	2.3	0.026	4.0	NA	0.1	0.9	0.12	0.44	46.4
North: Manooka Rd											
1	L2	184	0.0	0.119	4.7	LOS A	0.5	3.6	0.10	0.50	46.4
3	R2	4	25.0	0.119	5.2	LOS A	0.5	3.6	0.10	0.50	45.6
Approach		188	0.6	0.119	4.7	LOS A	0.5	3.6	0.10	0.50	46.4
West: Spring Hill Circle											
4	L2	14	7.7	0.023	4.6	LOS A	0.0	0.0	0.00	0.18	48.4
5	T1	28	3.7	0.023	0.0	LOS A	0.0	0.0	0.00	0.18	49.0
Approach		42	5.0	0.023	1.5	NA	0.0	0.0	0.00	0.18	48.8
All Vehicles		277	1.5	0.119	4.1	NA	0.5	3.6	0.09	0.44	46.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:16:09 AM
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MOVEMENT SUMMARY

▽ Site: [2031 PM Manooka Rd x Spring Hill Circle]

Future Year Base + Development 2031
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Spring Hill Circle											
11	T1	14	0.0	0.080	0.2	LOS A	0.4	2.7	0.18	0.47	46.9
12	R2	122	0.0	0.080	4.8	LOS A	0.4	2.7	0.18	0.47	46.1
Approach		136	0.0	0.080	4.3	NA	0.4	2.7	0.18	0.47	46.2
North: Manooka Rd											
1	L2	60	1.8	0.043	4.6	LOS A	0.2	1.2	0.06	0.51	46.5
3	R2	6	0.0	0.043	5.2	LOS A	0.2	1.2	0.06	0.51	46.1
Approach		66	1.6	0.043	4.7	LOS A	0.2	1.2	0.06	0.51	46.4
West: Spring Hill Circle											
4	L2	56	0.0	0.040	4.6	LOS A	0.0	0.0	0.00	0.39	47.4
5	T1	20	0.0	0.040	0.0	LOS A	0.0	0.0	0.00	0.39	47.8
Approach		76	0.0	0.040	3.4	NA	0.0	0.0	0.00	0.39	47.5
All Vehicles		278	0.4	0.080	4.1	NA	0.4	2.7	0.10	0.46	46.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Friday, 27 January 2017 10:16:09 AM
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Manooka Valley Stage 3, Lot 627 DP 1163903

APPENDIX G

BUSHFIRE PROTECTION ASSESSMENT

Cardno
Shaping the Future

ORD05

Attachment 5

Travers

bushfire & ecology

bushfire protection assessment

Rezoning Application
Stage 3 - Manooka Valley
Lot 627 DP 1163903,
Caulfield Close, Currans Hill

Under Section 117(2) Direction No 4.4 of the *EP&A Act*

MARCH 2017
(amended July 2017)
(REF: A16187)

ORD05

Attachment 5

Travers

bushfire & ecology

Bushfire Protection Assessment

Rezoning Application
Stage 3 – Manooka Valley
Lot 627 DP 1163903
Caulfield Close, Currans Hill

Report Authors:	Nicole van Dorst BPAD Level 2 23610
Plans prepared:	Kelly Tucker
Checked by:	John Travers BPAD-L3 15195
Date:	6 March 2017 (amended 3 July 2017)
File:	A16187

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be relied upon as meaning it reflects any advice by this firm. The report does not suggest or guarantee that a bush or grass fire will not occur and or impact the development. This report advises on matters published by the *NSW Rural Fire Service* in their guideline *Planning for Bush Fire Protection 2006* and other advice available from that organisation.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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EXECUTIVE SUMMARY

A bushfire protection assessment has been undertaken for the proposed Stage 3 rezoning located at Lot 627 DP 1163903, Caulfield Close, Currans Hill. This updated report has been prepared to incorporate Camden Council comments from a second pre-lodgement meeting for the planning proposal (letter dated 26 April 2017) – refer Appendix 3.

The site is currently zoned E2 – Environmental Conservation, RU2 – Rural Landscape and E4 – Environmental Living in the Camden Local Environmental Plan (LEP) 2010. The proposed rezoning seeks to amend the zoning to replace the existing E4 & E2 zoning with R1 – General Residential and SP2 - Infrastructure within the cleared portions of the site.

This report identifies matters for consideration for the planning proposal and highlights the required bushfire protection measures, including asset protection zones (APZs), for future development under the *Environmental Planning and Assessment Act 1979 (EP&A Act), Section 117 Direction 4.4 and* in accordance *Planning for Bush Fire Protection 2006* (*PBP*) and *Community Resilience Practice Note 2/12 Planning Instruments and Policies*.

The key principle for the proposal is to ensure that future development is capable of complying with *PBP*. Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, specifying minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments in hazardous areas and placement of combustible material in APZs.

Our assessment found that bushfire can potentially affect the site from the woodland vegetation located both within (i.e. vegetated portions of E2 zoned land) and external to the sites north-eastern and south-eastern boundaries. Bushfire risk also exists from the riparian corridor in the north-west.

The bushfire risk posed to the rezoning proposal however can be mitigated if appropriate bushfire protection measures (including APZs) are put in place and managed in perpetuity.

The assessment has concluded that future development on site is capable of providing compliance with the planning principles of *PBP* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies*.

A pre-DA meeting was held with the NSW Rural Fire Service (RFS) to discuss landscaping and management requirements standards within the electrical easement and to seek approval for future access requirements to support the narrow single-lot deep R1 zoned land (confined to the southern portion of the site). Whilst future access will not meet the acceptable solutions the RFS have provided agreement (refer Appendix 2 attached) that the performance criteria can be met based on the low risk nature of the bushfire hazard and the provision of through access.

A pre-lodgement meeting was held between the client and Council officers on the 31st March, 2017. A summary of the key issues (relating to bushfire) discussed at the meeting and our response is provided in the table below (refer Appendix 3 for pre-lodgement notes).

Table E1 – Summary of key issues raised by Camden Council.

Council Comment	TBE response
The BPA does not provide details on the width of the proposed roads and whether the roads will be accommodated within the proposed R1 General Residential (proposed) Zone. This information will be required, particularly in relation to the narrow width of the proposed R1 zone, which adjoins the transmission line in the southern part of the site. These comments are made noting that it may be difficult to accommodate residential lots and a parallel perimeter connector road, within this narrow area (to comply with the Planning for Bushfire Protection Guidelines 2006), within then having to further remove CPW in the adjoining E2 zone.	TBE can confirm that the roads will be confined to the proposed R1 zoned land. The width of the southern portion of R1 zone land is 50m. This can incorporate the required 8m wide carriageway width (perimeter road) as well as a single row of houses backing onto the electrical easement. A concept plan is not included within the rezoning submission. Any future subdivision plan (at DA stage) is to ensure a perimeter road of 8m (adjacent to E2 zone land) as discussed with the NSW RFS in the pre-DA meeting (refer Appendix 2).
The BPA identifies an asset protection zone width of 16 metres on the northern side of the 'assumed restoration to a woodland structure' land in the Kenny Creek Riparian Corridor. Recent dealing with the RFS have confirmed that revegetation works in riparian corridors have been assessed by the RFS to create a 'forested wetlands' vegetation formation as per the PFBP Guidelines. As such, this vegetation category will required a much wider APZ, with may then decrease the area of land suitable for residential development in this locality. Accordingly, the proposal should clearly identify the requirements for the Kenny Creek Riparian Corridor as per 'The guidelines for Riparian Corridors on Waterfront Land'.	*TBE* undertook a site inspection of the property in October 2016 to identify the vegetation formations and topographic features of the site. The vegetation (refer Section 2.1) associated with the creek line is a mixture of grassland and woodland. The Flora and Fauna Report prepared by Biosis identifies the vegetation within the creek line as Cumberland Plain Woodland, native sedge land and derived shrub land. *TBE* in our assessment adopted a worst case scenario using a 'woodland' structure to recommend minimum 16-21m APZ. The final APZ (subject to a subdivision DA) will also include a review of any future vegetation management plan (VMP) which is expected to be prepared at DA stage. If the VMP recommends a different vegetation community the APZ's will be reassessed taking into consideration planting density's and species types. The Kenny Creek Riparian corridor (within the E2 zoned land) has been identified within the northern and southern portions of the site. These creek lines are considered a First order and Second order stream.

GLOSSARY OF TERMS

AHIMS	Aboriginal Heritage Information System
APZ	Asset protection zone
AS1596	*Australian Standard – The storage and handling of LP Gas*
AS2419	*Australian Standard – Fire hydrant installations*
AS3745	*Australian Standard – Planning for emergencies in facilities*
AS3959	*Australian Standard – Construction of buildings in bushfire-prone areas 2009*
BAL	*Bushfire attack level*
BCA	*Building Code of Australia*
BSA	Bushfire safety authority
EEC	Endangered ecological community
FDI	Fire danger index
IPA	Inner protection area
LEP	*Local environmental plan*
OPA	Outer protection area
PBP	*Planning for bush fire protection 2006*
RFS	NSW Rural Fire Service
SFPP	Special fire protection purpose

TABLE OF CONTENTS

Introduction 1

Travers bushfire & ecology has been requested by *Cardno* to undertake a bushfire protection assessment for the proposed rezoning located at Lot 627 DP 1163903, Caulfield Close, Currans Hill

The proposal is located on land mapped by *Camden Council* as being bushfire prone. *Direction 4.4, Planning for Bush Fire Protection 2006 (PBP)* identifies matters for consideration for planning proposals that will affect, or are in proximity to land mapped as bushfire prone.

As such, the proposal is subject to the requirements of Section 117(2) of *the Environmental Planning and Assessment Act 1979 (EP&A Act)* which requires Council to consult with the Commissioner of the NSW Rural Fire Service (RFS) and to take into account any comments by the Commissioner.

1.1 Aims of the assessment

The aims of the bushfire protection assessment are to:

- Review the bushfire threat to the landscape
- Undertake a bushfire attack assessment in accordance with *PBP*
- Provide advice on planning principles, including the provision of perimeter roads, asset protection zones (APZs) and other specific fire management issues
- Review the potential to carry out hazard management over the landscape, taking into consideration the proposed retention of trees within the final development plans.

1.2 Project synopsis

The site is currently zoned E2 – Environmental Conservation, RU2 – Rural Landscape and E4 – Environmental Living in the Camden Local Environmental Plan (LEP) 2010 (refer Figure 1.1).

The proposed rezoning seeks to amend the zoning to replace the existing E4 & E2 zoning with R1 – General Residential and SP2 - Infrastructure within the cleared portions of the site (refer Figure 1.2).

Bushfire constraints have been highlighted and minimum APZs have been recommended from the boundary of the R1 zoned land (adjacent to unmanaged vegetation). The final subdivision design should ensure that APZ's are either contained within the perimeter road or within the individual lot boundaries to ensure ongoing maintenance. Alternatively ongoing maintenance of an APZ (outside of lot boundaries) can be assured through a 'community title' subdivision which would be subject to a fuel management plan. Ongoing maintenance of the 60m wide electrical easement will be subject to plan of management.

Recommendations have also been made for future road design, building construction, water supply and utilities.

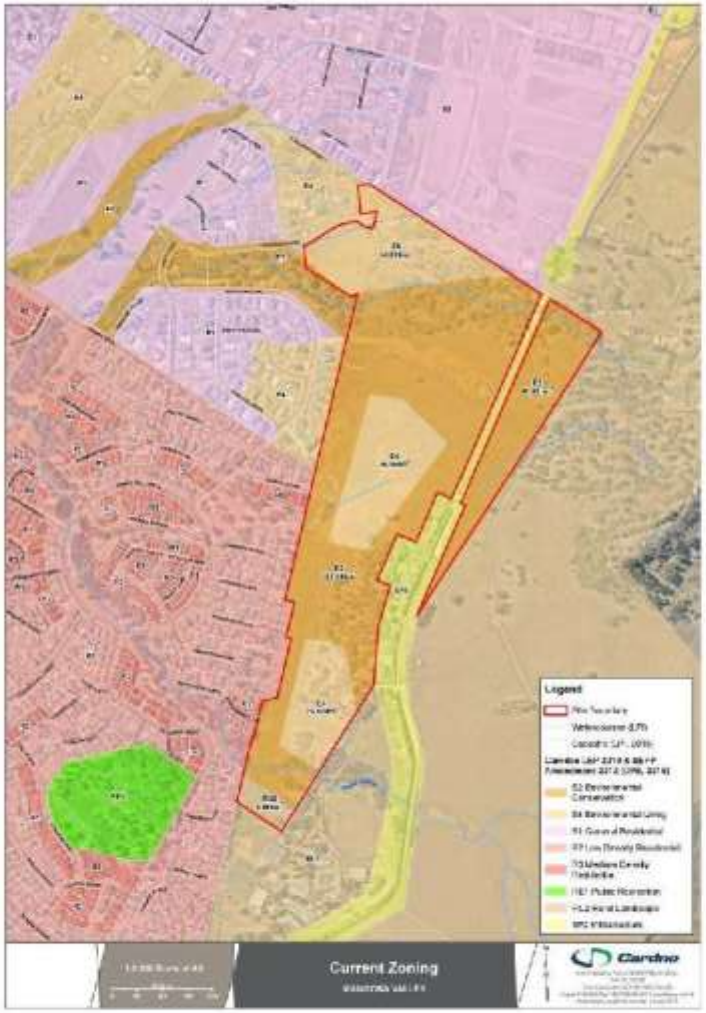


Figure 1.1. – Current Zoning

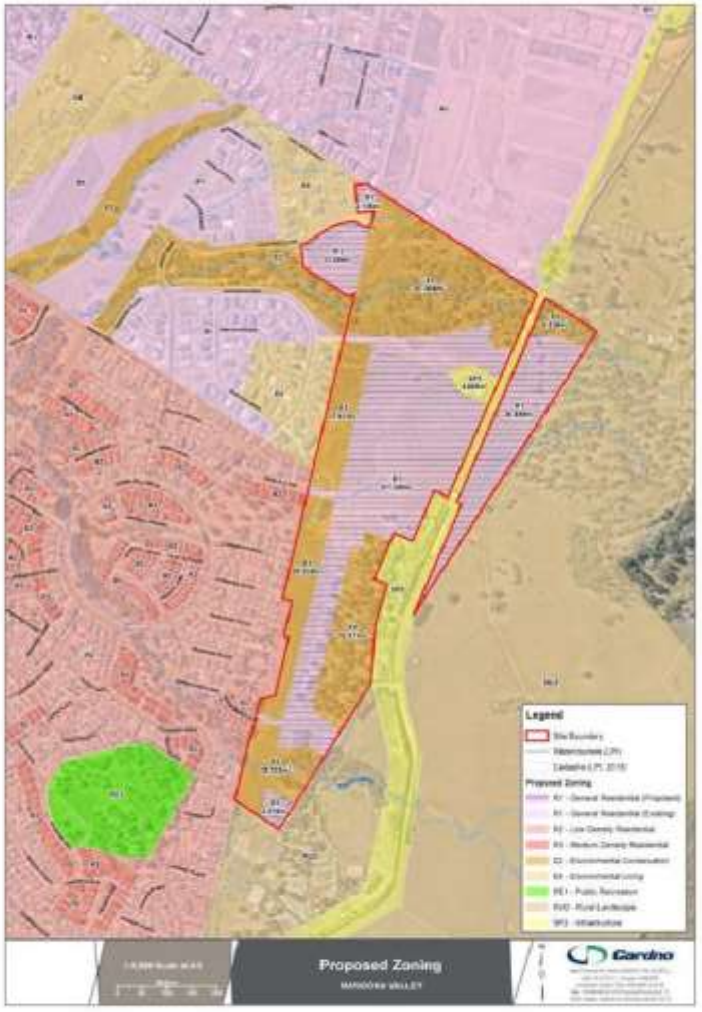


Figure 1.2. – Proposed Zoning

1.3 Information collation

To achieve the aims of this report, a review of the information relevant to the property was undertaken prior to the initiation of field surveys. Information sources reviewed include the following:

- Current and proposed rezoning plans produced by *Cardno* dated 21/02/2017
- Manooka Stage 3 Rezoning: Flora and Fauna Assessment – final report (version 2) prepared by *Biosis* dated 27th February 2017.
- Camden Local Environmental Plan 2010
- Camden Development Control Plan 2011
- NearMap aerial photography
- Topographical maps *DLPI of NSW* 1:25,000
- *Australian Standard 3959 Construction of buildings in bushfire-prone areas*
- *Planning for Bush Fire Protection 2006 (PBP)*
- *Community Resilience Practice Notes 2/12 Planning Instruments and Policies*.

An inspection of the proposed development site and surrounds was undertaken by Nicole van Dorst on 10 October 2016 to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bushfire measures and a visual appraisal of bushfire hazard and risk were also undertaken.

A pre-DA meeting was held with the NSW Rural Fire Service (RFS) on the 10th February 2017 to discuss landscaping and management requirements standards within the electrical easement and to seek approval for future access requirements to support the narrow single-lot deep R1 zoned land (confined to the southern portion of the site). The minutes from this meeting are provided in Appendix 2.

This updated report has also been prepared to incorporate Camden Council comments from a second pre-lodgement meeting for the planning proposal (letter dated 26 April 2017) – refer Appendix 3 and the executive summary for a response to Council comments.

1.4 Site description

The site is located at 627 DP 1163903, Caulfield Close, Currans Hill (refer Figure 1.3).

The property is adjoined to the north by St Gregory Hills residential development (currently under construction) and to the north-east and east by St Gregory's College. Mount Annan Christian College adjoins the site to the south and south-east with extensive urban development located to the west.

Figure 1.3 – Aerial appraisal

1.5 Legislation and planning instruments

1.5.1 Environmental Planning and Assessment Act 1979 (EP&A Act) and bushfire prone land

The *EP&A Act* governs environmental and land use planning and assessment within New South Wales. It provides for the establishment of environmental planning instruments, development controls and the operation of construction controls through the *Building Code of Australia (BCA)*. The identification of bushfire prone land is required under Section 146 of the *EP&A Act*.

Bushfire prone land maps provide a trigger for the development assessment provisions. The property is located on land that is mapped by *Camden Council* as being bushfire prone – Category 2 open woodland vegetation (depicted yellow) and its associated buffer (depicted red) (refer Figure 1.4). This figure was endorsed by the NSW RFS in October 2013 and is indicative only of the bushfire risk. It does not take into account the clearing that has occurred by Sydney Water for the construction of a water tank within the site, nor the clearing that has occurred to the west and north due to recent subdivision approval.

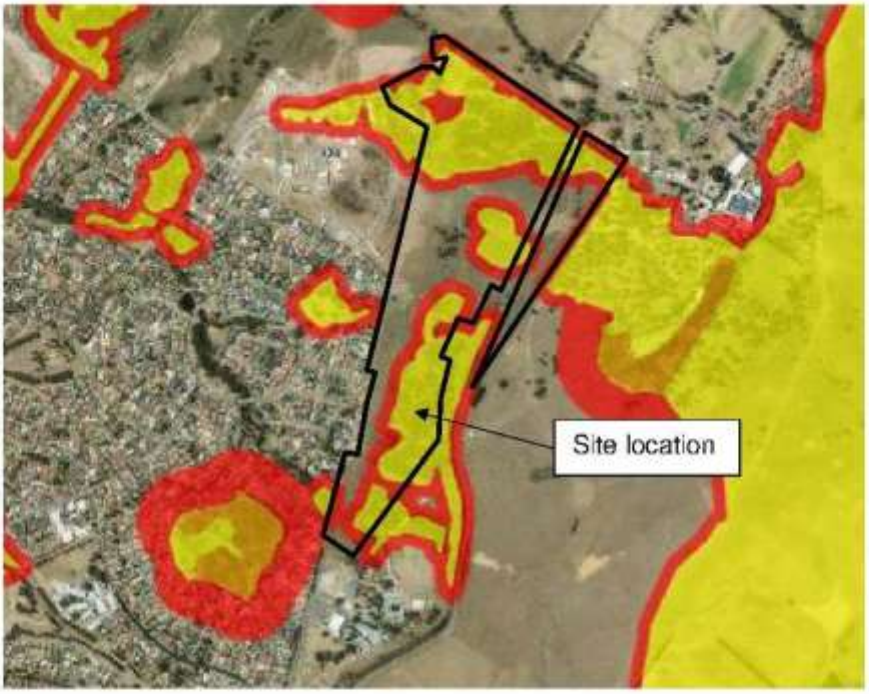


Figure 1.4 – Bushfire prone land map (11th October 2013)
(Source: Camden Council)

PBP (pg 4) stipulates that if a proposed amendment to land use zoning or land use affects a designated bushfire prone area then Section 117(2) Direction No 4.4 of the *EP&A Act* must be applied. This requires Council to consult with the Commissioner of the RFS and to take into account any comments by the Commissioner and to have regard to the planning principles of *PBP* (detailed within Section 1.5.3).

1.5.2 Local Environmental Plan (LEP)

A LEP provides for a range of zonings which list development that is permissible or not permissible, as well as the objectives for development within a zone.

The proposal is to proceed as an amendment to the current *Camden LEP 2010* as depicted in Figure 1.1 and 1.2.

The proposal, including the provision of APZs, would seek to comply with the objectives of the proposed rezoning with APZ's excluded from the E2 zoned land.

1.5.3 Planning for Bush Fire Protection 2006 (PBP)

Bushfire protection planning requires the consideration of the RFS planning document entitled *PBP*. *PBP* provides planning principles for rezoning to residential land as well as guidance on effective bushfire protection measures.

The policy aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property and the environment from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment.

PBP outlines the following planning principles that must be achieved for all rezoning proposals:

1. Provision of a perimeter road with two way access which delineates the extent of the intended development.
2. Provision, at the urban interface, for the establishment of adequate APZs for future housing.
3. Specifying minimum residential lot depths to accommodate APZs for lots on perimeter roads.
4. Minimising the perimeter of the area of land interfacing the hazard, which may be developed.
5. Introduction of controls which avoid placing inappropriate developments in hazardous areas, and
6. Introduction of controls on the placement of combustible materials in APZs.

In addition to the above, *PBP* outlines the bushfire protection measures required to be assessed for new development in bushfire prone areas.

The proposed rezoning has been assessed in compliance with the following measures to ensure that future development is capable of complying with *PBP*:

- asset protection zones
- building construction and design
- access arrangements
- water supply and utilities
- landscaping
- emergency arrangements

1.5.4 Building Code of Australia (BCA) and the Australian Standard AS3959 Construction in bushfire-prone areas 2009 (AS3959)

The *BCA* is given effect through the *EP&A Act* and forms part of the regulatory environment of construction standards and building controls. The *BCA* outlines objectives, functional statements, performance requirements and deemed to satisfy provisions. For residential dwellings these include Classes 1, 2 and 3 buildings. The construction manual for the deemed to satisfy requirements is *AS3959*.

Although consideration of *AS3959* is not specifically required in a rezoning proposal, this report (Section 3.2) provides the indicative setbacks for each dwelling construction level and can be used in future planning for master plans and / or subdivision proposals.

1.6 Environmental and cultural constraints

1.6.1 Environmental constraints

A review of the Flora and Fauna Assessment prepared by Biosis (dated 27st February 2017) has been undertaken. The assessment identified one listed Critically Endangered Ecological Community (CEEC) and one Endangered Ecological Community (EEC) within the study area:

- Cumberland Plain Woodlands on shale of the southern Cumberland Plain, Sydney Basin Bioregion (synonymous with Cumberland Plain Shale Woodlands and Shale - Gravel Transition Forest

- River-flat Eucalypt Forest on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (synonymous with River - Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered, TSC Act).

Other key ecological values identified in the report were:

- Native sedgeland
- A population of Pink Bindweed *Convolvulus erubescens*, a Rare or Threatened Australian Plant (RoTAP) species.
- Two ephemeral creeks, one unnamed creek in the north-east and the other, Kenny Creek to the southwest of the study area.

The Kenny Creek Riparian corridor has been identified within the northern and southern portions of the site. A preliminary assessment in accordance with the 'Guidelines for riparian corridors on waterfront land' prepared by the *Department of Primary Industries – Office of Water* indicates that these creek lines are considered a first order and second order stream (refer Schedule 1 attached). The recommended riparian corridor widths are as follows:

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1st Order	10 metres	20m + channel width
2nd Order	20 metres	40m + channel width

It is recommended that the final APZ (subject to a subdivision DA) will include a review of any future riparian assessment and comments from the Office of Water which is expected to be prepared at DA stage.

1.6.2 Cultural constraints

A basic search was conducted on the Aboriginal Heritage Information System (AHIMS). The results show that there are four (4) identified Aboriginal sites of significance within Lot 627 DP 1163903 or within 50m of the site.

Bushfire Threat Assessment 2

To assess the bushfire threat and to determine the required width of an APZ for a development, a review of the elements that comprise the overall threat needs to be completed.

PBP provides a methodology to determine the size of any APZ that may be required to offset possible bushfire attack. These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation.

2.1 Hazardous fuels

PBP guidelines require the identification of the predominant vegetation formation in accordance with David Keith (2004) to determine APZ distances for subdivision developments. However, when determining construction standards in accordance with *AS3959 – Construction in bushfire-prone areas*, AUSLIG Pictorial Analysis is used to determine the vegetation and hence building construction standards (refer Section 3.2 of this report).

The hazardous vegetation is calculated for a distance of at least 140m from a proposed site / development boundary. The vegetation within 140m of the proposed residential zoned land has been identified as:

Table 2.1 – Vegetation communities

Aspect	Vegetation community (refer Figure 2.1)	David Keith	AUSLIG Pictorial Analysis / Fuel Load
Proposed E2 zoned land and external to north-eastern and north-western boundary of site	Cumberland Plain Woodland (refer Photo 1)	Coastal Valley Grassy Woodland	Woodland 15/25t/ha
Adjoining creek line in northern portion of site	River-flat Eucalypt Forest	Coastal Swamp Forest	Forest
Within adjoining SP2 zoned land to the east	Remnant Forest (refer Note 1)	N/A	Rainforest

Note 1: *PBP* describes remnant vegetation as a parcel of vegetation with a size of less than 1ha or a shape that provides a potential fire run directly towards a building not exceeding 50m. The vegetation within the SP2 zoned land to the east exhibits these qualities and therefore the threat posed is considered low and APZ setbacks for this aspect are the same as for the rainforest category outlined in *PBP*.

Photo 1 – Existing Cumberland Woodland vegetation associated with the southern creek line.

The vegetation associated with the creek line is a mixture of grassland and woodland. The Flora and Fauna Report prepared by Biosis identifies the vegetation within the creek line as Cumberland Plain Woodland, native sedge land and derived shrub land (refer Figure 2.1). The following bushfire assessment has adopted a worst case scenario using a 'woodland' structure to determine APZ distances.

It is recommended that the final APZ (subject to a subdivision DA) will also include a review of any future vegetation management plan (VMP) which is expected to be prepared at DA stage.

If the VMP recommends a different vegetation community the APZ's will be reassessed taking into consideration planting density's and species types.

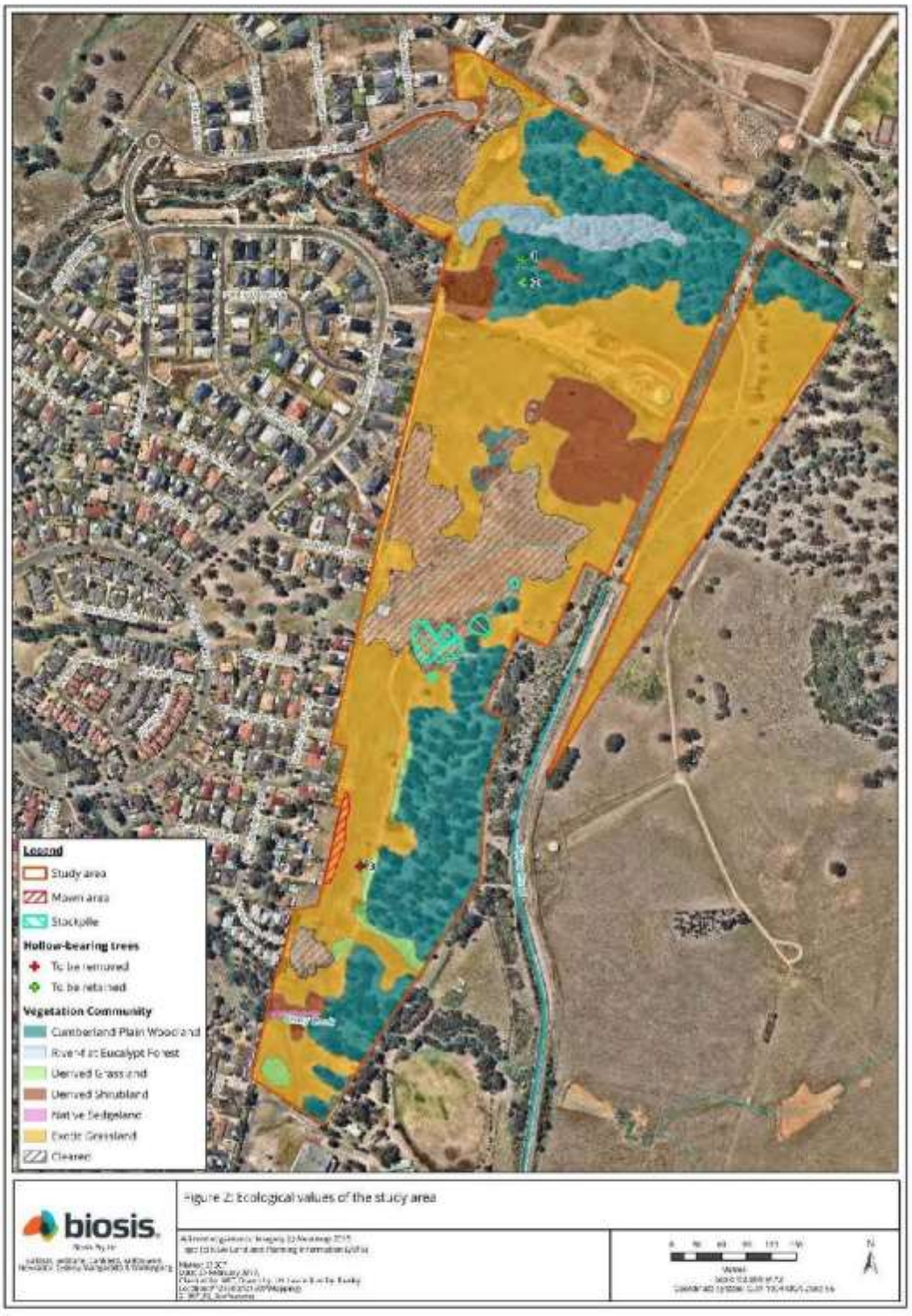


Figure 2.1 – Vegetation Community (Biosis, 2017)

A TransGrid easement runs parallel and within the western portion of the site. This easement will be dedicated to Council as parkland and will be maintained by Council under a similar agreement as the Gregory Hills Development located directly to the north (within the same easement). Photos of the current management are provided below. This grassland easement will not pose a bushfire threat to the planning proposal. Landscaping and management of the electrical easement (along the entire western boundary) will be outlined in a plan of management.

Photo 2 & 3: Managed grassland easement

2.2 Effective slope

The effective slope is assessed for a distance of up to 100m. Effective slope refers to that slope which provides the most effect upon likely fire behaviour. A mean average slope may not in all cases provide sufficient information such that an appropriate assessment can be determined.

The effective slope within the hazardous vegetation is provided in detail within Table 2.1 but is generally summarised as:

- 5-10 degree downslope within the E2 zoned land to the north
- Level to upslope within the woodland vegetation external to the eastern boundary
- Level to 5 degrees downslope within the E2 zoned land to the south and east.

2.3 Bushfire attack assessment

It is important that the developer understands that there are different methods in determining APZ and BAL levels to ensure that there is a clear understanding of the implications for future dwelling construction (i.e. costs and processes associated with dwelling approval).

Subdivision Approval – PBP 2006 Appendix 2 is used to determine APZ distances to achieve approval for subdivision development applications. This approach does not conform to the construction code AS3959 *Construction of buildings in bushfire prone areas* in all cases and therefore can pose significant implications for future dwelling approval.

In order to avoid potential future complications the assessment in the following Table 2.1 has been undertaken using a deemed to satisfy (in most cases). There are two (2) situations in which an alternate solution approach was undertaken.

- ***Deemed to satisfy approach*** (DS) – The deemed to satisfy approach is undertaken in compliance with AS3959 and is used by future lots owners to obtain approval for a construction certificate under complying development.

  The assessment uses Method 1 Table 2.4.2 of AS3959. This will allow future purchasers of each allotment to submit their application for building construction in accordance with the Code's SEPP (i.e. complying development). This is a simplified process and results in a cheaper bushfire assessment at building construction stage (refer Column 6 of Table 2.1).

- ***Alternate solution approach*** (AS) – The alternative solution approach is undertaken in compliance with AS3959 Appendix B Method 2 to obtain an accurate BAL rating approval using accurate slopes.

  This method maximises the developable area and can provide future lots owners with the best way to achieve cheaper building construction costs. However future purchasers will be required to lodge their dwelling application under Section 79BA of the *EP&A Act*, which will require a further bushfire protection assessment report (i.e. increased cost for report) to support the lower BAL level. Referral of the report to the RFS is also required from when using an alternative solution (refer Column 3 & 5 of Table 2.1).

Please note that the APZs depicted in Schedule 1 attached are based on a BAL 29 construction.

Table 2.1 – Bushfire attack assessment

Lots Vegetation formation within 140m of development (refer Note 1)	Effective slope of land	Minimum APZ required (Alternative solution approach)	APZ provided (meters)	Building construction standards (Alternative solution approach)	Building construction standards (Deemed to satisfy approach) (refer Note 2)
North-west (Lots adjacent to Caulfield Close)					
Woodland within riparian corridor to the south (DS - 15/25t)	0 - 5° ▯	N/A	21	N/A	BAL 29 (21-<29) BAL 19 (29 - <41) BAL 12.5 (41-<100)
Managed grassland within the electrical easement (60m) then woodland to the east	0 - 5° ▯	N/A	60 (electrical easement)	N/A	BAL 12.5 (41-<100)
North (within E2 zoned land)					
Woodland (DS - 15/25t)	5-10° ▯	N/A	26	N/A	BAL 29 (26-<37) BAL 19 (37 - <50) BAL 12.5 (50-<100)
	13° ▯	32 **(refer Note 3)**	32	BAL 29 (32-<43) BAL 19 (43-<58) BAL 12.5 (58-<100)	BAL 40 (25-<33) BAL 29 (33-<45) BAL 19 (45 - <60) BAL 12.5 (60-<100)
	0 - 5° ▯	N/A	21	N/A	BAL 29 (21-<29) BAL 19 (29 - <41) BAL 12.5 (41-<100)
East (external to site boundary)					
Woodland (DS - 15/25t)	Level to upslope	N/A	16	N/A	BAL 29 (16-<24) BAL 19 (24 - <33) BAL 12.5 (33-<100)
	5-10° ▯	N/A	26	N/A	BAL 29 (26-<37) BAL 19 (37 - <50) BAL 12.5 (50-<100)
Grassland (DS-15t)	Level to upslope	N/A	9	N/A	BAL 29 (9-<13) BAL 19 (13 - <19) BAL 12.5 (19-<50)

Lots Vegetation formation within 140m of development (refer Note 1)	Effective slope of land	Minimum APZ required (Alternative solution approach)	APZ provided (meters)	Building construction standards (Alternative solution approach)	Building construction standards (Deemed to satisfy approach) (refer Note 2)
Remnant vegetation within SP2 zoned land (Sydney water pipe line)	0 - 5° D	N/A	14	N/A	BAL 29 (14-<20) BAL 19 (20 - <29) BAL 12.5 (29-<100)
Eastern Aspect (within E2 zoned land)					
Woodland (DS - 15/25t)	Level to upslope	N/A	16	N/A	BAL 29 (16-<24) BAL 19 (24 - <33) BAL 12.5 (33-<100)
	2° D	19 **(refer Note 3)**	19	BAL 29 (19-<27) BAL 19 (27-<37) BAL 12.5 (37-<100)	BAL 40 (15-<21m) BAL 29 (21-<29) BAL 19 (29 - <41) BAL 12.5 (41-<100)
Western Aspect (Transgrid electrical easement)					
Managed grassland within the electrical easement (60m) then residential development	0 - 5° D	N/A	<100	N/A	N/A
Riparian corridor (southern portion of site)					
Woodland (DS - 15/25t) (refer Note 4)	0 - 5° D	N/A	21	N/A	BAL 29 (21-<29) BAL 19 (29 - <41) BAL 12.5 (41-<100)
	0 - 5° D	N/A	21	N/A	BAL 29 (21-<29) BAL 19 (29 - <41) BAL 12.5 (41-<100)

*Notes: * Slope is either 'U' meaning up slope 'D' meaning down slope. Fuel loads utilised for each method is provided in brackets DS – Deemed to satisfy.*

Note 1: This assessment has assumed the restoration of the E2 zoned land in the north, east and south to a woodland structure (i.e. Cumberland Plain Woodland). This area currently consists of canopy trees and a grassland understorey (devoid of shrub layer). It is recommended that APZ's are reassessed following the preparation / review of any vegetation management plan which will stipulate areas to be revegetated and/or managed.

Note 2: Under clauses 3.36B and 3A.37 of the Codes SEPP the construction of dwellings on some bush fire prone land may be considered as complying development. For complying development to occur on future allotments, the land must be certified as being below a BAL 29 risk rating and be provided a minimum setback as outlined in Column 6. A BAL Certificate must be obtained from the council or a person who is recognised by the RFS as a suitably qualified consultant in bush fire risk assessment prior to lodging an application for a CDC. Buildings assessed as BAL 40 or BAL FZ are not considered complying and must lodge their application under section 79BA and a full bushfire protection assessment must be prepared for submission to NSW RFS.

Note 3: A performance based assessment using Appendix B of *AS3959* was undertaken to determine the required APZ (equivalent to BAL 29 construction) based on woodland vegetation (fuel load 15/25) on a downslope of 13° and 2°.The results of the assessment, provided below, were prepared using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting*.

NBC Bushfire Attack Assessment Report V2.1

Printed: 24/10/2016 **Assessment Date:** 24/10/2016

Site Street Address: Manooka Valley, Currans Hill

Assessor: Mr Admin, admin

Local Government Area: Camden **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: AFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2002; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description:	A North		
Vegetation Information			
Vegetation Type:	Woodland	Vegetation Group:	Forest and Woodland
Vegetation Slope:	13 Degrees	Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	15	Overall Fuel Load(t/ha):	25
Site Information			
Site Slope	4 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m):	Default	APZ/Separation(m):	32
Fire Inputs			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
Calculation Parameters			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
Program Outputs			
Category of Attack:	HIGH	Peak Elevation of Receiver(m):	11.62
Level of Construction:	BAL 29	Fire Intensity(kW/m):	37614
Radiant Heat(kW/m2):	28.68	Flame Angle (degrees):	51
Flame Length(m):	31.69	Maximum View Factor:	0.46
Rate Of Spread (km/h):	4.41	Inner Protection Area(m):	32
Transmissivity:	0.919	Outer Protection Area(m):	0

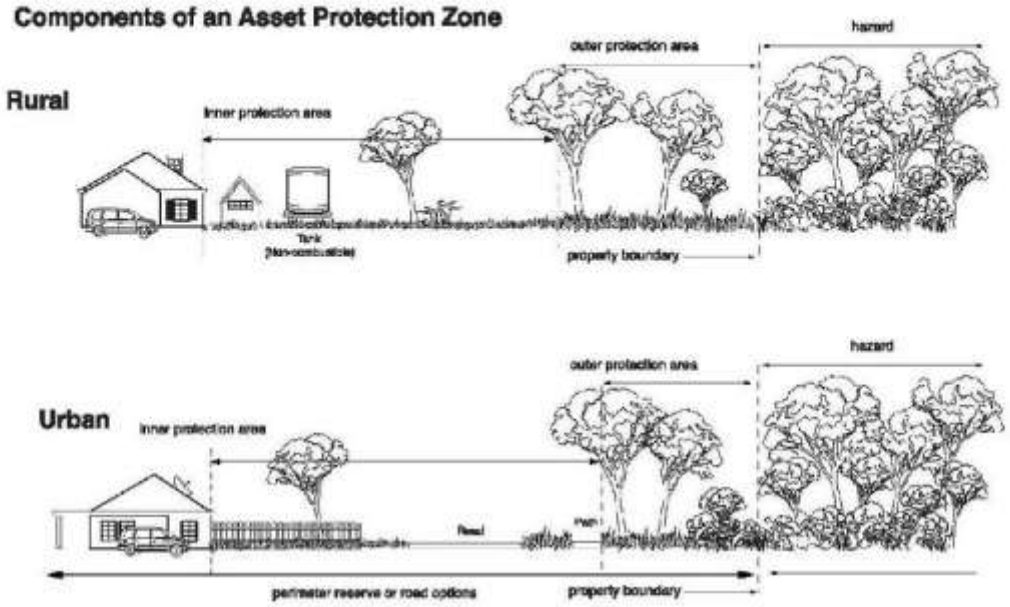
Run Description:	B East (woodland)		
Vegetation Information			
Vegetation Type:	Woodland	Vegetation Group:	Forest and Woodland
Vegetation Slope:	2 Degrees	Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	15	Overall Fuel Load(t/ha):	25
Site Information			
Site Slope	0 Degrees	Site Slope Type:	Level
Elevation of Receiver(m):	Default	APZ/Separation(m):	19
Fire Inputs			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
Calculation Parameters			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
Program Outputs			
Category of Attack:	HIGH	Peak Elevation of Receiver(m):	7.92
Level of Construction:	BAL 29	Fire Intensity(kW/m):	29680
Radiant Heat(kW/m2):	27.43	Flame Angle (degrees):	60
Flame Length(m):	18.43	Maximum View Factor:	0.427
Rate Of Spread (km/h):	2.07	Inner Protection Area(m):	19
Transmissivity:	0.949	Outer Protection Area(m):	0

Note 4: The vegetation associated with the creek line is a mixture of grassland and woodland. The Flora and Fauna Report prepared by Biosis identifies the vegetation within the creek line as Cumberland Plain Woodland, native sedge land and derived shrub land. This assessment has adopted a worst case scenario using a 'woodland' structure to determine APZ distances. It is recommended that the final APZ (subject to a subdivision DA) is determined following a review of any future vegetation management plan (VMP) which is expected to be prepared at DA stage. If the VMP recommends a different vegetation community the APZ's will be reassessed taking into consideration planting density's and species types.

Specific Protection Issues 3

3.1 Asset protection zones (APZs)

APZs are areas of defendable space separating hazardous vegetation from buildings. The APZ generally consists of two subordinate areas, an inner protection area (IPA) and an outer protection area (OPA). The OPA is closest to the bush and the IPA is closest to the dwellings. The IPA cannot be used for habitable dwellings but can be used for all external non-habitable structures such as pools, sheds, non-attached garages, cabanas, etc. A typical APZ and therefore defendable space is graphically represented below:



APZs and progressive reduction in fuel loads (Source: RFS, 2006)

Note: Vegetation management as shown is for illustrative purposes only. Specific advice is to be sought in regard to vegetation removal and retention from a qualified and experienced expert to ensure APZs comply with the *RFS* performance criteria.

PBP dictates that the subsequent extent of bushfire attack that can potentially emanate from a bushfire must not exceed a radiant heat flux of $29kW/m^2$ for residential subdivision developments. This rating assists in determining the size of the APZ in compliance with *PBP* to provide the necessary defendable space between hazardous vegetation and a building. Table 3.1 outlines the proposals compliance with the performance criteria for APZs.

Table 3.1 – Performance criteria for asset protection zones (*PBP* guidelines pg. 19)

Performance criteria	Acceptable solutions	Complies
Radiant heat levels at any point on a proposed building will not exceed 29kW/m².	APZs are provided in accordance with Appendix 2. APZs are wholly within the boundary of the development site.	Yes - refer Table 2.1. APZ's have been provided in compliance with AS3959 to ensure dwelling applications (for the most part) can proceed as complying development. Final APZ's are to be provided within lot boundaries (can incorporate perimeter roads).
APZs are managed and maintained to prevent the spread of fire towards the building.	In accordance with the requirements of *Standards for Asset Protection Zones* (*NSW RFS* 2005).	Yes - to be made a condition of consent.
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is negated.	The APZ is located on lands with a slope of less than 18°.	Yes - Slopes are less than 18°.

3.2 Building protection

In terms of future subdivision approval, the minimum APZ must be provided in accordance with Appendix 2 of *PBP*. The APZs provided in Table 2.1 (Section 2.3) of this report comply with these requirements, whilst also considering the final building setbacks as per *AS3959*.

Although not required in terms of rezoning, the following advice in relation to building construction levels can be used for future planning and subdivision design.

The construction classification system is based on five (5) bushfire attack levels (BAL). These are BAL – Flame Zone (FZ), BAL 40, BAL 29, BAL 19 and BAL 12.5 AS3959 – *Construction of buildings in bushfire-prone areas*. The lowest level, BAL 12.5, has the longest APZ distance while BAL – FZ has the shortest APZ distance. These allow for varying levels of building design and use of appropriate materials.

Table 2.1 provides an indication of the BAL setbacks that are likely to apply for future building construction. These BAL levels are for planning purposes only and will be assessed / confirmed prior to building construction stage. The APZ depicted in Schedule 1 attached is based on BAL 29 building construction for those lots fronting the bushfire hazard.

3.3 Hazard management

In terms of implementing and / or maintaining APZs, there is no physical reason that would constrain hazard management from being successfully carried out by normal means (e.g. mowing / slashing).

The APZs are to be managed in accordance with the RFS guidelines *Standards for Asset Protection Zones (RFS, 2005)*, with landscaping to comply with Appendix 5 of *PBP*.

A summary of the guidelines for managing APZs is attached as Appendix 1 to this report.

Minimum APZs have been recommended from the boundary of the R1 zoned land. The final subdivision design should ensure that APZ's are either contained within a perimeter road or within individual lot boundaries to ensure ongoing maintenance. Alternatively ongoing maintenance of an APZ (outside of lot boundaries) can be assured through a 'community title' subdivision.

The 60m wide TransGrid easement currently consists of grassland vegetation (for the most part). The proposed ongoing use will be managed parkland with cycleway. As a result it is recommended this zoning is changed from E2 to an R1 (or similar) to reflect its current and ongoing use. The easement will be dedicated to Council as parkland and will be maintained by Council under a similar agreement as the Gregory Hills Development located directly to the north. This grassland easement will not pose a bushfire threat to the planning proposal. Landscaping and management of the electrical easement will be outlined in a plan of management.

3.4 Access for fire fighting operations

Future residential development within the site will access Caulfield Close in the north-west, Saddle Close in the west and Horseman Place in the south-west.

The internal road network has not been finalised however future design should comply with the performance criteria and acceptable solutions for public roads as outlined in Table 3.2 & 3.3. Perimeter roads (fronting the bushfire hazard) are to have a carriageway width of 8m. Internal roads are to have a carriageway width of 6.5m)

It appears that the majority of these solutions can be achieved, however any future road within the narrow proposed R1 zoned land in southern portion of the site (whilst having a width of 8m) would be approximately 560m long (i.e. greater than 500m).

A pre-DA meeting was held with the NSW Rural Fire Service (RFS) to seek approval for the proposed future access within the narrow single-lot deep R1 zoned land (confined to the southern portion of the site). Whilst future access will not meet the acceptable solutions the RFS have provided agreement (refer Appendix 2 attached) that the performance criteria can be met.

The performance criteria states '*Public road widths and design that allow safe access for fire fighters while residents are evacuating an area*'. A future perimeter road in the southern portion of the site will allow safe access for firefighters via the;

- Provision of through road access between Saddle Close in the north and Horseman Place in the south
- Low risk nature of the bushfire hazard adjacent to the proposed access which consists of woodland vegetation (grassy understorey) and short fire run potential of less than 130m.
- Short travel distance (i.e. <350m) adjacent to the hazard which will provide fire fighters with safe egress opportunities to the north-west and south-west (away from the direct threat of bushfire).

Table 3.2– Performance criteria for public roads (*PBP* guidelines pg. 20)

Performance criteria	Acceptable solutions
Fire fighters are provided with safe all weather access to structures (thus allowing more efficient use of fire fighting resources).	Public roads are two-wheel drive, all weather roads.
Public road widths and design that allow safe access for fire fighters while residents are evacuating an area.	Urban perimeter roads are two way, that is, at least two traffic lane widths (carriageway 8m minimum kerb to kerb) allowing traffic to pass in opposite directions. Non perimeter roads comply with Table 3.3 below. Perimeter road is linked with the internal road system at an interval of no greater than 500m in urban areas. Traffic management devices are constructed to facilitate access by emergency services. Public roads have a cross fall not exceeding 3°. All roads are through roads. If unavoidable, dead end roads are not more than 200m in length, incorporate a minimum 12m outer radius turning circle, sign posted dead end and direct traffic away from the hazard. Curves of roads (other than perimeter) have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress. The minimum distance between inner and outer curves is 6m. Maximum grades for sealed roads do not exceed 15° and an average grade of not more than 10°. Minimum vertical clearance of 4m above the road at all times.
The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles	The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles (15 tonnes for reticulated water and 28 tonnes for all other areas). Bridges clearly indicate load rating.
Roads that are clearly sign posted (with easily distinguishable names) and buildings / properties that are clearly numbered.	Public roads >6.5m wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water. Public roads 6.5-8m wide are No Parking on one side with the hydrant located on this side to ensure accessibility to reticulated water. Public roads <6.5m wide provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water. One way only public access are no less than 3.5m wide and provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water.
There is clear access to reticulated water supply. Parking does not obstruct the minimum paved width	Parking bays are a minimum of 2.6m wide from kerb edge to road pavement. No services or hydrants are located within parking bays. Public roads directly interfacing the bushfire hazard are to provide roll top kerbing to the hazard side of the road.

Table 3.3 – Minimum widths for public roads that are not perimeter roads

Curve radius (inside edge) (metres width)	Swept path (metres width)	Single lane (metres width)	Two way (metres width)
<40	3.5	4.5	8.0
40-69	3.0	3.9	7.5
70-100	2.7	3.6	6.9
>100	2.5	3.5	6.5

3.5 Water supplies

Town reticulated water supply is available to the property in the form of an underground reticulated water system. Table 3.4 outlines the performance criteria and acceptable solutions for reticulated water supply.

Table 3.4 – Performance criteria for reticulated water supplies (*PBP* guidelines pg. 27)

Performance criteria	Acceptable solutions
Water supplies are easily accessible and located at regular intervals.	Reticulated water supply to urban subdivision uses a ring main system for areas with perimeter roads. Fire hydrant spacing, sizing and pressures comply with AS2419.1 - 2005. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. Hydrants are not placed within any road carriageway. All above ground water and gas pipes external to the building are metal, including and up to taps. The provisions of parking on public roads are met.

3.6 Gas

Table 3.5 outlines the required performance criteria for the gas supply.

Table 3.5 – Performance criteria for gas supplies (*PBP* guidelines pg. 27)

Performance criteria	Acceptable solutions
Location of gas services will not lead to the ignition of surrounding bushland land or the fabric of buildings	Reticulated or bottled gas bottles are to be installed and maintained in accordance with AS1596 (2002) and the requirements of relevant authorities. Metal piping is to be used. All fixed gas cylinders are to be kept clear of flammable materials to a distance of 10m and shielded on the hazard side of the installation. If gas cylinders are to be kept close to the building the release valves must be directed away from the building and at least 2m away from any combustible material, so that they do not act as a catalyst to combustion. Connections to and from gas cylinders are metal. Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used.

3.7 Electricity

Table 3.6 outlines the required performance criteria for electricity supply.

Table 3.6 – Performance criteria for electricity services (*PBP* guidelines pg. 27)

Performance criteria	Acceptable solutions
Location of electricity services limit the possibility of ignition of surrounding bushland or the fabric of buildings Regular inspection of lines in undertaken to ensure they are not fouled by branches.	Where practicable, electrical transmission lines are underground Where overhead electrical transmission lines are proposed: • Lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas: and • No part of a tree is closer to a power line than the distance set out in accordance with the specification in *Vegetation Safety Clearances* issued by *Energy Australia* (NS179, April 2002).

Conclusion & Recommendations 4

4.1 Conclusion

A bushfire protection assessment has been undertaken for the proposed rezoning located at Lot 627 DP 1163903, Caulfield Close, Currans Hill.

Our assessment found that bushfire can potentially affect the site from the woodland vegetation located both within (i.e. E2 zoned land) and external to the sites north-eastern and south-eastern boundaries. Bushfire risk also exists from the riparian corridor in the north-west.

The bushfire risk posed to the rezoning proposal however can be mitigated if appropriate bushfire protection measures (including APZs) are put in place and managed in perpetuity.

The assessment has concluded that future development on site is capable of complying with the planning principles of *PBP*, *Community Resilience Practice Note 2/12 – Planning Instruments and Policies* and the performance criteria for public roads.

Future development on site is to comply with the following planning principles.

Table 4.1 – Planning principles

Planning principles	Recommendations
Provision of a perimeter road with two way access which delineates the extent of the intended development.	A perimeter road (8m carriageway width) is to be provided adjacent to all bushland areas.
Provision, at the urban interface, for the establishment of adequate APZs for future housing.	APZs have been recommended in compliance with BAL 29 (AS3959, 2009).
Specifying minimum residential lot depths to accommodate APZs for lots on perimeter roads.	Future subdivision design is to allow for the minimum APZs as recommended within Table 2.1 and as depicted within Schedule 1 attached.
Minimising the perimeter of the area of land interfacing the hazard, which may be developed.	Future residential development is confined to the cleared portion of the property. Whilst future access within the southern portion of the ste will not meet the acceptable solutions the RFS have provided agreement (refer Appendix 2 attached) that the performance criteria can be met based on the through access available, and low risk nature of the bushfire hazard.
Introduction of controls which avoid placing inappropriate developments in hazardous areas.	Future development consists of residential dwellings and is appropriate for the level of bushfire risk.
Introduction of controls on the placement of combustible materials in APZs.	Compliant – can be made a condition of consent.

The following recommendations are provided to ensure that future residential development is in accordance with, or greater than, the requirements of *PBP*.

4.2 Recommendations

Recommendation 1 - The zoning of the 60m wide TransGrid easement (located parallel and within the western boundary) is changed from E2 to an R1 (or similar) to reflect its current and ongoing use. The easement will be dedicated to Council as parkland and will be maintained by Council under a similar agreement as the Gregory Hills Development located directly to the north. Landscaping and management of the electrical easement is to be outlined in a plan of management.

Recommendation 2 - APZs are to be provided to the future residential development. APZs are to be measured from the exposed wall of any dwelling toward the hazardous vegetation. The minimum APZ must be achievable within all lots fronting the bushfire hazard as nominated in Table 2.1 and also as generally depicted in Schedule 1.

Recommendation 3 – This assessment has assumed the restoration of E2 zoned land in the north, east and south to a woodland structure (i.e. Cumberland Plain Woodland). It is recommended that APZ's are reassessed following the preparation / review of any vegetation management plan which will stipulate areas to be revegetated and/or managed. APZ's should also be reassessed after the completion of a riparian study and comments from the Office of Water.

Recommendation 4 - Fuel management within the APZs is to be maintained by regular maintenance of the landscaped areas, mowing of lawns in accordance with the guidelines provided in Appendix 1, and as advised by the RFS in their publications.

Minimum APZs have been recommended from the boundary of the R1 zoned land. The final subdivision design should ensure that APZ's are either contained within a perimeter road or within individual lot boundaries to ensure ongoing maintenance. Alternatively ongoing maintenance of an APZ (outside of lot boundaries) can be assured through a 'community title' subdivision which will be subject to a fuel management plan.

Recommendation 5 - Building construction standards are to be applied for future residential dwellings in accordance with *Australian Standard AS3959 Construction of buildings in bushfire-prone areas (2009)* with additional construction requirements as listed within Section A3.7 of Addendum Appendix 3 of *PBP*.

Recommendation 6 – Public access roads are to comply with the performance criteria provided within Section 4.1.3 of *PBP* (refer Section 3.4 of this report). Whilst future access within the southern portion of the site (narrow (single lot deep) R1 zoned area) will not meet the acceptable solutions of PBP (in terms of road length) the RFS have provided agreement (refer Appendix 2 attached) that the performance criteria can be met based on the through access available, and low risk nature of the bushfire hazard.

Recommendation 7 – Water, electricity and gas supply is to comply with the acceptable solutions as provided within Section 4.1.3 of *PBP* (refer Sections 3.5, 3.6 and 3.7 of this report).

REFERENCES

Australian Building Codes Board (2010) – *Building Code of Australia*, Class 1 and Class 10 Buildings Housing Provisions Volume 2.

Chan, K.W. (2001) – *The suitability of the use of various treated timbers for building constructions in bushfire prone areas*. Warrington Fire Research.

Councils of Standards Australia AS3959 (2009) – *Australian Standard Construction of buildings in bush fire-prone areas.*

Hon Brad Hazzard (7 June 2012) – *Planning proposal to rezone land at Boundary Road, Medowie from 1 (c1) Rural Small Holdings Zone to 1(c5) Rural Small Holdings, 1(c4) Rural Small Holdings and 7(a) Environmental Protection.*

Keith, David (2004) – *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change.

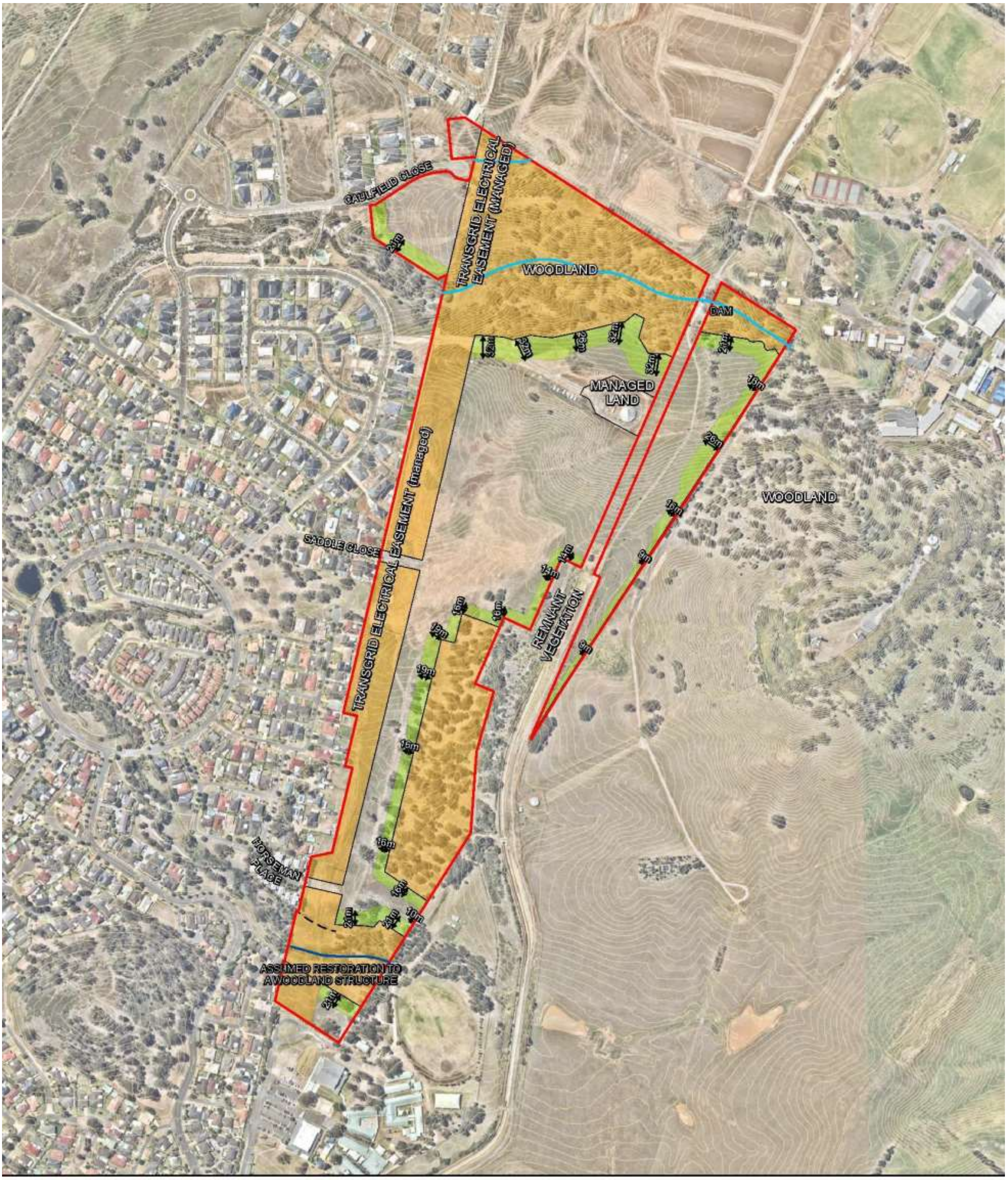
Rural Fire Service (2006) - *Planning for bushfire protection– a guide for councils, planners, fire authorities and developers*. NSW Rural Fire Service.

Rural Fire Service (2006) - Bushfire Attack Software on RFS Web site.

Tan, B., Midgley, S., Douglas, G. and Short (2004) - *A methodology for assessing bushfire attack*. RFS Development Control Service.

Travers, J. (2003) *The Ecological Management of Asset Protection Zones at Wallarah Peninsula – A Case Study.*


Plan of Bushfire
Protection Measures
S1


GAULFIELD CLOSE
TRANSGRID ELECTRICAL EASEMENT (MANAGED)
WOODLAND
DAM
MANAGED LAND
WOODLAND
SADDLE CLOSE
TRANSGRID ELECTRICAL EASEMENT (managed)
REMNANT VEGETATION
HORSEMAN PLACE
ASSUMED RESTORATION TO A WOODLAND STRUCTURE
Legend
Site boundary (source: LPI)
Proposed rezoning - E2 Environmental Management
Contours - 1m (source: LiDAR)
Minimum Asset Protection Zone (APZ) (based on BAL29 construction)
Water course order (Strahler classification)
1st order (20m + channel width)
2nd order (40m +channel width)
Travers bushfire & ecology
PROJECT & MAP REFERENCE
Stage 3, Manooka Valley
A16187_BF001
DATE & ISSUE NUMBER
5/07/2017
Issue 1
SCALE & COORDINATE SYSTEM
1:5,000 @ A3
GDA 1994 MGA Zone 56
0
100
200 m
TITLE
Schedule 1 - Bushfire Protection Measures
Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features

Management of Asset Protection Zones A1

The RFS advises that when living in a bushfire prone environment APZs are required to be provided between hazardous fuels and a dwelling.

The RFS provides basic advice in respect of managing APZs in several documents namely *Planning for Bush Fire Protection 2006 (PBP)* and *Standards for Asset Protection Zones* (undated but circa 2006).

APZs provide a level of defendable space between the hazard and a habitable dwelling or similar structure. These zones are usually shown on plans adjacent to either cultural or natural assets (e.g. dwelling). They act to significantly lessen the impact of intense fire. The major mitigating factor that limits the effects of wildfire is the amount of fuel available to burn. By reducing the amount of fuel there will be a reduction in the intensity of the fire.

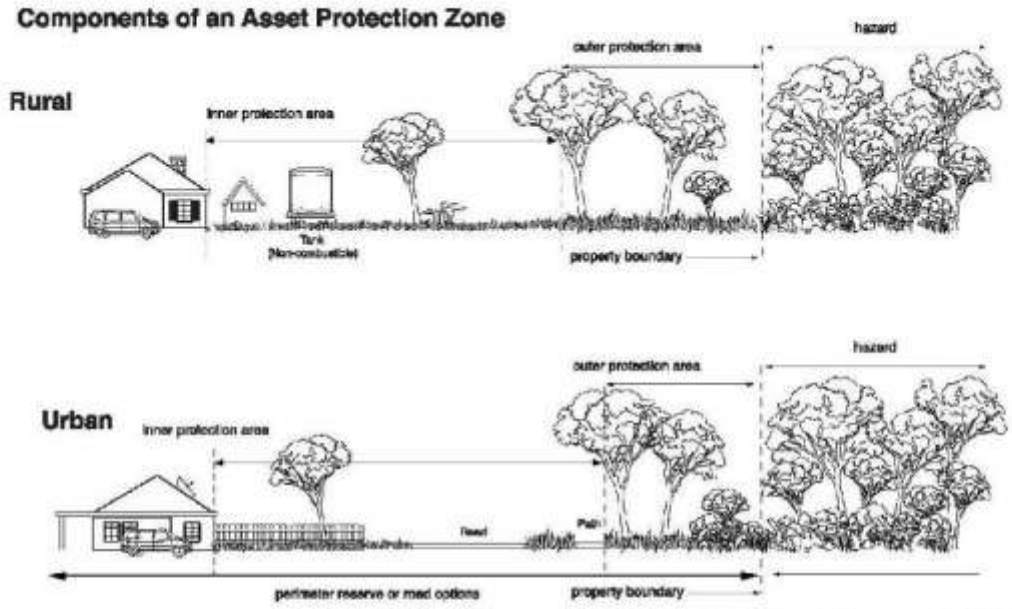
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

Table 1 – Fuel layers

Fuel layer name	Location of layer in vertical column	Type of fuel
Ground fuels	Below ground level	Peatmoss (always below the surface)
Surface fuels	0-200mm	Litter layer (leaves & twigs)
Aerial fuels	200-3,000mm	Shrubs and grasses
Canopy fuels	>3,000mm	Tree canopy

The APZ can be further classified into two sub-zones with each having a specific role. These sub-zone areas are called the inner protection area (IPA) and the outer protection area (OPA) – see figure below.

The IPA is managed as a fuel free zone while the OPA is managed as a fuel reduced zone. This means that the fuel free zone has little fuel available to be consumed in the event of a fire whilst the fuel reduced zones has less than normal fuel levels that could be consumed in the event of a fire.



APZs and progressive reduction in fuel loads (Source: RFS, 2006)

Inner protection area (IPA)

This area is almost free of all fuels and usually takes the form of grassy areas, car parks, roads, concrete areas, tracks or trails. It does not imply or require the wholesale removal of every tree and or shrub.

This zone is intended to stop the transmission of flame and reduce the transmission of radiant heat by the elimination of available fuel. This area also allows airborne embers to fall safely without igniting further outbreaks.

This zone also provides a safe fire fighting position and is operationally important for implementation of clear fire control lines.

Grasses may occur within an IPA if they are generally no higher than 50-75mm. Above this height, fuel weights tend to increase exponentially and consequentially cause greater flame heights and therefore fire intensity

Shrubs may occur within an IPA in the form of clumping amidst open grassy areas. The design of the clumping will be dependent on species selection and spatial density. For example, the larger the shrubs the less clumping may occur in a given area.

As a general rule, trees are allowed within an IPA but only where those trees are at least 5m away from a dwelling.

A recommended performance standard for the fuel load of an IPA is between 0-4t/ha. Shrubs may occur within an IPA commensurate with a spatial distribution of 15-20%. For example an area of 100m^2 (10mx10m) can have up to 20% of this area composed of shrubs.

If a shrub layer is present the following table shows the additional fuel weights that should be added to the calculated surface fuels.

Shrub cover	Fuel weight
10-30%	2.5 tonnes / ha
35-50%	5.0 tonnes / ha
55-75%	7.5 tonnes / ha

Presence of trees within an inner protection area

A tree may occur within an IPA if the canopy does not form a link with shrubs. The reason is to lessen any chance for vegetation linking and the capability for fire to extend into the canopy.

It is a basic premise in fire behaviour understanding that fire cannot occur in the canopy unless surface fuels such as grasses or shrubs are burning. This merging creates opportunity for fire to link with the canopy and therefore increase fire intensity by some significant amount.

Trees that have a canopy beginning near the ground (such as Forest Oaks *Allocasuarina*) form a continuous link with the tree canopy and shrubs. A forest canopy cannot therefore burn without fuel to feed that fire. In a tall open forest, where the trees are generally above 20m in height the canopy is separated from the land surface by some distance. In an open woodland the low canopy height (usually <5m) merges with the shrubland layer.

Knowing the relationship between the shrub layer and the tree canopy allows fire managers to design safer areas in the APZs. It is for this reason that vegetation such as Forest Oaks are usually excluded from an IPA.

Similarly, in open forests the height of the forest is sufficiently removed from the shrub layer. As a general rule, trees are allowed within an IPA where the density of those trees is commensurate with Table 2 below and located on slopes up to 20% with a westerly aspect.

In respect of trees that can be located in an IPA Table 2 provides guidelines.

Table 2 – Tree density in inner protection area

Distance from dwelling wall	Trees permitted on the exposed side of a dwelling	Trees permitted on the non exposed side of a dwelling
Within 5m	No trees	No trees
Between 5-10m	One tree per 100m^2	2 trees per 100m^2
Between 10-20m	<10 tree per 400m^2	<10 trees per 400m^2

Outer protection area (OPA)

This zone is designed to stop the development of intense fires and the transmission of severe radiated heat.

The OPA assumes all trees will remain but with either a modified shrub / grass layer or regular removal of the litter layer. In some sparse vegetation communities the shrub layer may not require modification.

The fire fighting advantage will manifest in reduced fire intensity. It achieves this by denying fire a significant proportion of the fuel to feed upon. Fuels containing small (or fine) leaves such as Forest Oaks (or similar) are targeted for removal due to the capacity to burn quickly and therefore feed fire up into adjacent trees.

In most cases, the removal of 85% of the litter layer will achieve a satisfactory OPA. A recommended performance standard for the fuel load of an OPA is between 4-6t/ha.

Managing the APZ

Fuel management within the APZs should be maintained by regular maintenance such as:

- Mowing grasses regularly - grass needs to be kept short and, where possible, green.

- Raking or manual removal of fine fuels - ground fuels such as fallen leaves, twigs (less than 6mm diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.

- Removal or pruning of trees, shrubs and understorey - the control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by 2-5m. A canopy should not overhang within 2-5m of a dwelling. Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.
- Trees or tall shrubs may require pruning upon dwelling completion in line with *PBP*. Notwithstanding this, the presence of shrubs and trees close to a dwelling in a bushfire prone landscape requires specific attention to day to day management and owners and or occupier should be made aware that whilst landscaping can contribute to a way of life and environmental amenity the accumulated.

In addition, the following general APZ planning advice should be followed:

- Ensure that vegetation does not provide a continuous path to the house.

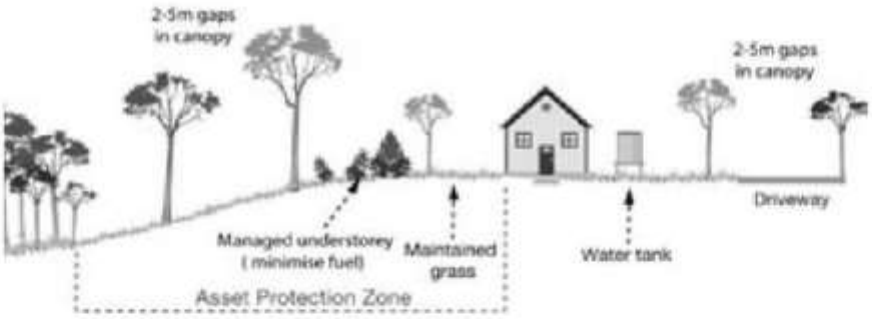
- Plant or clear vegetation into clumps rather than continuous rows.

- Prune low branches 2m from the ground to prevent a ground fire from spreading into trees.

- Locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission.

- Ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low flammability plants and non flammable ground cover such as pebbles and crushed tile; and

- The following RFS illustrative diagram depicts one version of an ideal situation. Specific advice is to be sought from qualified experts to ensure that the implemented APZs meet the performance criteria of APZs.



Figures courtesy of NSW RFS 2006.

NSW RFS Pre-DA meeting summary A2

NSW RURAL FIRE SERVICE

PRE-DA ADVICE MEETING SUMMARY

Attendees: Nicole Van Dorst & John Travers, Travers Bushfire & Ecology
Jason Masten, Team Leader Development Assessment and Planning
Nika Fomin, Manager Planning and Environment Services

Subject: Caulfield Close, Currans Hill
RFS Ref. DOC17/13445

Time and date: 13:30 10/2/2017 **Location:** Planning and Environment East
42 Lamb Street, Glendenning

Details of the proposal

☑ Residential subdivision — Proposed rezoning to allow residential subdivision

Bush fire protection issues discussed

☑ Hazard Assessment
☑ Asset Protection Zones

- 60 metre wide high voltage electricity transmission line easement to the east of the site to be landscaped to form passive or active recreation space;
- Future residential subdivision will be connected to the existing residential area to the east of the easement via two street connections at the southern end of the site. A narrow single-lot deep residential area will be located between the easement and a north-south road connecting the two east-west connections. This will provide through access as required by *Planning for Bush Fire Protection 2006* but will have a distance of approximately 560 metres between connecting roads which slightly exceeds the 500 metre network road requirements of *Planning for Bush Fire Protection 2006*. It is proposed that it this is acceptable given the minor deviation, through-access available, low risk nature of the adjoining bush fire hazard and short travel distance required to escape from the hazard.

☑ Access

Documentation / plans referenced

Final Draft Bushfire Protection Assessment, January 2017

Advice Provided

- Landscaping and management of the electricity easement should be set out in plans of management for the site which prescribe appropriate management standards;
- The bush fire report prepared in support of the planning proposal / future residential development should acknowledge that the proposed road network design does not meet the acceptable solutions given the existing constraints and set out how the performance criteria is met with reference to the abovementioned factors.

Disclaimer

RFS advice is based on information provided and policy and legislative requirements applicable at the time. The advice should be copied into, or referenced in, any subsequent development application.

All efforts are made to identify issues of relevance and likely concern with the preliminary proposal. However, the comments and views in this document are based only on the plans and information submitted for preliminary assessment and discussion at the pre-DA meeting. You are advised that: -

- The views expressed may vary once detailed plans and information are submitted and formally assessed in the development application process, or as a result of issues contained in submissions by interested parties;
- Given the complexity of issues often involved and the limited time for full assessment, no guarantee is given that every issue of relevance will be identified;
- Amending one aspect of the proposal could result in changes which would create a different set of impacts from the original plans and therefore require further assessment and advice; and,
- The Pre-DA advice given does not bind Council officers, the elected Council members, or other parties to the DA process.

Signed:

Jason Maslen
Team Leader
Development Assessment and Planning Officer

Nika Fomin
Manager Planning and Environment Services East

Date: 28/2/2017


Pre-lodgement meeting
for planning proposal
A3

ORD05

Attachment 5

Camden Council
70 Central Avenue, Oran Park NSW 2570 DX 25807
PO Box 183, Camden 2570 ABN: 31 117 341 764
Telephone: 02 4654 7777 Fax: 02 4654 7829
Email: mail@camden.nsw.gov.au

SC 3524
17/115807

26 April 2017

Cardno
PO Box 19,
St Leonards
NSW 1590

Attn: Cassie Lowry

Re: Second Pre-lodgement Meeting for Planning Proposal
Property: Lot 627 DP 1163903 at 207B Turner Road, Currans Hill

Dear Cassie,

I refer to the second pre-lodgement meeting for the subject site held in Council's Offices on 31 March, 2017 attended by the following Council Officers, Heath James (Team Leader - Land Use and Planning), Ilyas Karaman (Strategic Planner) and Rob Corby (Sustainability Officer.)

Attendance from Cardno included the following, John O'Grady – Manager, Urban Planning, Cassie Lowry –Senior Project Manager and co-land owner, Josip Zivko.

Please refer to the following as a summary of the key issues discussed at this meeting and Council's advice regarding the subject Planning Proposal to be submitted for the land at 207B Turner Road, Currans Hill.

Planning Proposal

The Planning Proposal provided at the second pre-lodgement meeting is considered to be the same proposal as per the previous pre-lodgement meeting with the exception of the additional supporting studies. The proposal predominantly aims to rezone E2 Environmental Conservation zone and E4 Environmental Living zone to an R1 General Residential zone.

The proposed zoning map shows the subject site of 341,245 m^2 in area rezoned to the following:

- Total: 176,468 m^2 - R1 General Residential zone;
- Total: 161,778 m^2 - E2 Environmental Conservation zone;
- Total: 4,865 m^2 - SP2 Infrastructure zone.

The proposed minimum lot size for the R1 General Residential zone is not provided, whilst the Traffic Impact Assessment indicates approximately 200 new lots resulting from the proposal.

Council advised in the meeting, the proposed rezoning map provided in each of the supporting studies are inconsistent. Cardno confirmed during the meeting, the correct proposed rezoning map is titled "Proposed Zoning Manooka Valley" prepared by Cardno and dated 21 February 2017.

Supporting Studies

Council acknowledged four studies have been undertaken on the subject site to support the Planning Proposal. These studies include the following:

- Visual Impact Assessment (VIA) prepared by Cardno dated February 2017;
- Flora and Fauna Assessment prepared by Biosis dated 27 February 2017;
- Bushfire Assessment Protection prepared by Travers Bushfire & Ecology dated March 2017; and
- Traffic Impact Assessment prepared by Cardno dated 27 February 2017.

Council's preliminary comments were provided on these supporting studies in the meeting and as per this letter. A further detailed assessment on these studies will be undertaken by Council officers following the lodgement of the Planning Proposal.

Key Planning Issues

Visual Impact Assessment

The VIA prepared by Cardno advises that the proposal is not visible from prominent surrounding focal points and the proposal will not impact upon the views to and from the Scenic Hills.

Council will undertake a detailed assessment of the VIA following lodgement of the Planning Proposal. Council officers advise that adequate consideration must be given to minimise the potential visual impacts of the development on the overall landscape setting of Manooka Valley as emphasised in Camden Development Control Plan (DCP) 2011.

In addition, the Planning Proposal must provide justification for any departures or inconsistencies with Camden Development Control Plan (DCP) 2011.

Flora & Fauna Assessment

The Flora and Fauna Assessment has identified 1.38 ha of Cumberland Plain Woodland (CPW) will be removed as result of the proposed development, which includes 0.89 ha of isolated patches of CPW, 0.17 ha of CPW derived shrub land and 0.32 ha of CPW derived native grassland.

Council officers have advised that where there is a loss of CPW from the Planning Proposal that additional consideration be given to offset the loss of CPW via an on-site Biobank and/or Biodiversity certification agreement.

Council officers acknowledged efforts made by the Proponent to contact and liaise with the NSW Office of Environment and Heritage (OEH) for their initial comments on the Planning Proposal. Council will refer the Planning Proposal to OEH at the lodgement stage for their formal comments.

The above ecological matters can be further discussed with Council's Sustainability Officer, Rob Corby on 4645 5048.

Traffic

Council officers advised during the meeting that based on the supporting Traffic Impact Assessment, the traffic modelling results indicate that the signalised intersections are operating at Level of Service, F, in the Narellan Road / Mount Annan Drive / Tramway Drive Intersection. Further that the additional traffic from the proposal would only add to the existing delays.

As such, Council officers do not support the proposal in its current form with the primary access via Narellan Road.

Site Access

Other traffic comments include that the majority of surrounding local streets including Saddle Close (which is proposed as a primary access to the site) are relatively narrow and have unrestricted parking on both sides. The roadway connecting the southern section of the site, Horseman Place, is 5.5m in width and has no parking restrictions.

Council officers advised that the above traffic matters must be addressed prior to the lodgement of the Planning Proposal. Further information on the above traffic issues can be provided via contacting Council's Team Leader - Traffic and Transport, Tom Allen on 4645 5005.

Bushfire Protection Assessment

Council officers have reviewed the Bushfire Protection Assessment (BPA) and have provided the following comments:

- The BPA does not provide details on the width of the proposed roads and whether the roads will be accommodated within the proposed R1General Residential (Proposed) Zone. This information will be required, particularly in relation to the narrow width of the proposed R1 zone, which adjoins the transmission line in the southern part of the site. These comments are made noting that it may be difficult to accommodate residential lots and a parallel perimeter connector road, within this narrow area (to comply with the Planning for Bushfire Protection Guidelines 2006), without then having to further remove CPW in the adjoining E2 zone.

- The BPA identifies an Asset Protection Zone width of 16 metres on the northern side of the "Assumed Restoration to a Woodland Structure" land in the Kenny Creek Riparian Corridor. Recent dealings with the NSW Rural Fire Services (RFS) have confirmed that revegetation works in riparian corridors have been assessed by the RFS to create a "Forested Wetlands" Vegetation Formation as per the PFBP Guidelines.
  As such, this vegetation category will require a much wider APZ, which may then decrease the area of land suitable for residential development in this locality.
  Accordingly, the proposal should clearly identify the requirements for the Kenny Creek Riparian Corridor as per "*The Guidelines for Riparian Corridors on Waterfront Land.*"

The above bushfire protection related matters can be further discussed with Council's Sustainability Officer, Rob Corby on ph.4645 5048.

Other Planning Issues

Council has concerns that the proposed increase in residential areas and density on the site may result in excessive cut and fill, particularly on the steeper sections of the site.

Council advises that the current zone of E4 Environmental Living with larger lot sizes on 900 m^2/ 1500 m^2 is specifically confined to parts of the site that are less steep. As such, Council advises that further residential development is to be discouraged from the steeper portions of the site or where additional cut and fill will result in adverse impacts to the natural topography of the land.

Draft South West District Plan

The Greater Sydney Commission has recently released the Draft District Plan. Council advises that the Planning Proposal will be required to address all the requirements of the "Draft South West District Plan" as applicable to Camden LGA.

Lodgement Process

In summary, Council advises that the above issues as raised in this letter, be adequately addressed in the Planning Proposal and supporting documents to be lodged with Council.

Prior to the lodgement of the Planning Proposal, it is requested that an appointment be made for the proposal to be signed in with Council's Strategic Planner regarding the checking of all required documentation. The first stage of fees as shown below will be required to be paid at lodgement.

- Request to Council and Initial Report (not subject to refund): $3,160.00
- Processing Major Planning Proposal following initial Council decision: $22,840.00

Note: The Planning Proposal category appears to be "major" and will be determined at the time of submission.

For more information please see Camden Council's Schedule of Fees and Charges.

At the time of Lodgement you will also need to provide the following forms to Council, these are included for your use.

- Planning Proposal Lodgement Checklist
- Application Form (includes owners consent)
- Declaration of Interest.

Should you have any questions regarding this information or wish to set up a lodgement meeting please contact Mr Ilyas Karaman of Council's Strategic Planning Branch on 4654 7798.

Yours sincerely,

Ilyas Karaman,
Strategic Planner

ORD07

Attachment 1

HERITAGE ADVISORY COMMITTEE – TERMS OF REFERENCE

HERITAGE ADVISORY COMMITTEE – TERMS OF REFERENCE

PART 1 - INTRODUCTION

1. BACKGROUND

1.1 The Camden Community Strategic Plan identifies caring for the natural environment inclusive of heritage sites as a key objective for Council. The Community Strategic Plan also values Strong Local Leadership as a key direction for Council, with a key objective under this direction being the maintenance of strong partnerships and shared responsibilities with key stakeholders.

1.2 The establishment of a Heritage Advisory Committee will help inform strategic heritage directions and community education around the importance of Camden's heritage to our unique identity.

2. PURPOSE OF THE COMMITTEE

2.1 To support Council by providing informed recommendations on heritage matters;

2.2 To promote heritage and community education by:

a) Generating a wider appreciation of heritage through public displays, seminars, participation in the annual National Trust Heritage festival & history week;
b) Promoting and coordination of heritage open days;
c) Generating a greater understanding and appreciation of Aboriginal heritage in Camden Local Government Area;
d) Actively encouraging conservation and maintenance of heritage items and heritage conservation areas to owners and the general public;
e) Investigating grant opportunities;
f) Investigating opportunities for Council run awards/recognition in response to good heritage work;
g) Developing a register of local heritage professionals and tradespeople; and
h) Assisting in developing education packages for information, school education, and best heritage practices.

2.3 To provide general advice and assistance by sourcing heritage information and historic photos to aid in replacing materials and carrying out work.

2.4 To provide policy input by:

a) Contributing to the review of heritage listings, and reviewing potential new heritage items; and
b) Providing feedback to Council staff on key local and state strategic planning policies with heritage implications.

3. SCOPE

3.1 These terms of reference apply to all activities of the heritage advisory Committee.

4. DEFINITIONS

4.1 **Council** means Camden Council.
4.2 **Committee** means Council's Heritage Advisory Committee.
4.3 **Chairperson** means the person appointed under section 9.1 or, in the absence of that person, the other Councillor member or, in the absence of the other Councillor member, the alternate Councillor member.

PART 1 – TERMS OF REFERENCE

5. TITLE AND DELEGATIONS

5.1 The Committee shall be referred to as the 'Camden Council Heritage Advisory Committee'.

5.2 The Committee functions as an advisory committee without delegations.

6. MEMBERSHIP

6.1 Only members have voting rights.

6.2 The Committee shall consist of the following members:

a) Two Councillors (and one alternate Councillor);
b) One representative of the Camden Historical Society;
c) Two community representatives from Camden's Aboriginal and Torres Strait Islander community;
d) Three community representatives, one resident in each of the North, Central and South wards of the Camden Local Government Area;
e) Two heritage experts or other experts as Council determines.

6.3 Council staff, as determined by the General Manager, will attend meetings to act as the secretary and to provide technical advice and support and respond to enquiries. Council staff are not members and hold no formal voting rights.

6.4 Councillors appointed to the Committee hold office until the next ordinary Council election provided that they remain Councillors under the provisions of the *Local Government Act 1993*.

6.5 Community representatives and experts appointed to the Committee

hold office until the next ordinary Council election.

6.6 Members may re-nominate for further terms.

6.7 Membership of the Committee for those appointed is voluntary and no payment of expenses applies in relation to attending activities or meetings of the Committee.

7. APPOINTMENT OF MEMBERS

7.1 Council appoints the Councillor members.

7.2 The Camden Historical Society may nominate one of its members as its representative member from time to time. The appointment of the nominee is subject to Council's approval.

7.3 Organisations representing Camden's local Aboriginal and Torres Strait Islander community, such as the Tharawal Local Aboriginal Land Council and the Cubbitch Barta Native Title Claimants Aboriginal Corporation, will be consulted and may nominate Aboriginal and Torres Strait Islander community members from time to time. The appointment of the nominees is subject to Council's approval.

7.4 For other community representative members, written nominations will be invited by advertisement in local media and Council's website. Initial assessments are undertaken by appropriate Council staff.

7.5 A report to Council will be prepared recommending suitable community and expert nominees for appointment. Council then appoints members accordingly.

7.6 Nominations will be assessed according to the following criteria:

a) Ability and commitment to meet the objectives of the Committee and these terms of reference;
b) For representatives of the Camden Historical Society – written nomination by the Society;
c) For Aboriginal and Torres Strait Islander community representatives – written nomination by an organisation representing Camden's Aboriginal and Torres Strait Islander community;
d) For other community representatives – residence in the Camden Local Government Area with only one from each ward;
e) For experts – demonstrated expertise and experience in heritage or related matters in the Camden Local Government Area.

8. MEMBER VACANCY

8.1 A member's position becomes vacant:

a) If the member dies;
b) If the member resigns membership by notice in writing to the Committee or Council;
c) If the member is absent for more than three consecutive meetings without the leave of the chairperson and Council resolves to remove the member;

d) If the member misuses information or breaches confidentiality and Council resolves to remove the member;
e) If they were nominated by the Camden Historical Society or an organisation representing Camden's Aboriginal and Torres Strait Islander community and the nomination is revoked by written notice to Council;
f) If they are an other community representative and no longer reside in the Ward for which they were appointed;
g) If Council otherwise resolves to remove the member.

8.2 If a vacancy occurs within the term of the member caused by the resignation, removal or death of the member, or the revocation of the member's nomination, the position may be filled through the following process:

a) When a vacancy occurs, the chairperson will report it to the Committee at its next meeting.
b) If the member was nominated by the Camden Historical Society or an organisation representing Camden's Aboriginal and Torres Strait Islander community, Council staff will request the relevant body to nominate a replacement.
c) Council staff will prepare a report to the next available Council meeting on the following matters:
   - If the member was an expert, the proposed replacement;
   - If the member was nominated by the Camden Historical Society or an organisation representing Camden's Aboriginal and Torres Strait Islander community, the replacement nominee;
   - If the member was nominated as an other community representative, Council officers will review the original expressions of interest received and will confirm if any of those persons are suitable and available to be considered as a member of the Committee;
   - Where, due to no other previous nominations, or nominations not being suitable, an expression of interest will be called for in replacing member/s appointed by Council.
d) Where a vacancy occurs within eight months of the end of the term of the members, the vacancy will not be filled.
e) Once appointed by Council, the new member will be a member of the Committee for the remainder of the original member's term.
f) If Council does not endorse the recommendation, an expression of interest will be called for further nominations.

9. CHAIRPERSON AND SECRETARY

9.1 Council appoints the chairperson from the Councillor members, and may resolve to remove or replace the chairperson.

9.2 The chairperson presides over all meetings of the Committee.

9.3 If there is a tied vote, the chairperson shall have a casting vote.

9.4 The General Manager will determine a staff member to perform the role of secretary.

10. ADVISORY ROLE

10.1 The Committee provides advice to Council and makes recommendations only.

10.2 The Committee's views can be made available through the minutes, a regular Councillor update or in writing from the Chairperson to the General Manager.

10.3 The Committee may make decisions about its internal process provided that there is no conflict with these terms of reference.

10.4 The Committee does not have a decision-making role concerning development applications or planning proposals. However, Council or Council officers may notify development applications to the Committee in their discretion for comment.

11. RESPONSIBILITY OF MEMBERS

11.1 Members are responsible to:

a) Respond to matters referred to the Committee by Council;
b) Give advice to the best of their knowledge and ability that will help achieve the objectives of the Committee;
c) Facilitate tasks allocated to them;
d) Behave in a manner that respects the interests and viewpoints of other members;
e) Declare any potential or actual conflicts of interests on matters that are brought before the Committee before consideration of those matters;
f) Abide by Council's Code of Conduct and these terms of reference.

12. RESPONSIBILITIES OF COUNCIL

12.1 Council will:

a) Provide meeting facilities for the Committee and ensure that support is available for minute taking and professional officer advice as appropriate;
b) Consider whether to notify the Committee about various issues for comment and duly consider the Committee's views;
c) Review the Committee's role and may re-organise or disband the Committee.

13. FREQUENCY OF MEETINGS

13.1 The Committee shall meet at least once each quarter or more frequently if considered necessary by the chairperson.

13.2 The chairperson, or the secretary with the consent of the chairperson, is responsible for calling meetings and may call special meetings for urgent matters in their discretion.

14. QUORUM

14.1 The quorum for a meeting of the Committee is a majority of the members but this number must include at least one Councillor member.

14.2 If there is no quorum within 15 minutes of the scheduled start of the meeting or at any time during the meeting, the meeting must be adjourned by the chairperson or, in their absence, by the majority of members present. If neither the chairperson nor the majority adjourns the meeting, the meeting will be deemed to have been adjourned to the next meeting called by the chairperson or the secretary.

15. MEETING PROCEDURES

15.1 Notice of the time, place and agenda of all meetings is to be given by the secretary to each member of the Committee not less than seven days prior to the meeting, except where the chairperson, or the secretary with the consent of the chairperson, calls a special meeting for an urgent matter, in which case notice will be given as soon as practicable.

15.2 Members of the Committee are required to advise the chairperson or the secretary prior to the meeting if they are unable to attend any meeting.

15.3 Minutes of all meetings shall be made accessible to the public (except to the extent that Council considers that the information should be considered in closed Council or as a confidential attachment to a report).

15.4 Minutes of all meetings shall be kept electronically and forwarded to Council for noting if Council so requests.

15.5 Minutes of all meetings shall record the meeting attendees, including any invitees.

15.6 Meetings are not open to the public but persons may be invited to attend the meetings at the request of the chairperson on behalf of the Committee. Invitees cannot vote and may be requested to leave the meeting at any time by the Chairperson.

15.7 At all meetings of the Committee, each voting member present (including the chairperson) shall have one vote.

15.8 Pursuant to Section 10(2) of the *Local Government Act 1993*, Council authorises the chairperson to expel persons from a meeting for misconduct or if neither a member nor an invitee.

15.9 Recordings of meetings are not permitted except with the authority of Council, other than recordings made by the secretary only for verifying the accuracy of minutes, and recordings are not made available or disclosed to any person, except as required by law.

15.10 Pursuant to Section 10(2) of the *Local Government Act 1993*, Council authorises the chairperson to expel persons from a meeting for using or having used a recorder in contravention of this clause.

15.11 In this clause 15, 'recorder' includes a video camera, still camera and any electronic device capable of recording speech, moving images or still images. In this clause, 'recording' means making a temporary or permanent record in any medium, or engaging in or facilitating internet or local streaming of, or otherwise capturing, speech or images.

* * *

RELEVANT LEGISLATIVE INSTRUMENTS:	*Local Government Act 1993* *Local Government (General) Regulation 2005*
RELATED POLICIES, PLANS AND PROCEDURES:	Code of Conduct
RESPONSIBLE DIRECTOR:	Planning and Environment
APPROVAL:	Council

HISTORY:

Version	Approved by	Changes made	Date	TRIM Number
1	*Approved by Council*	*Nil*	*Insert date*	*Insert TRIM number*