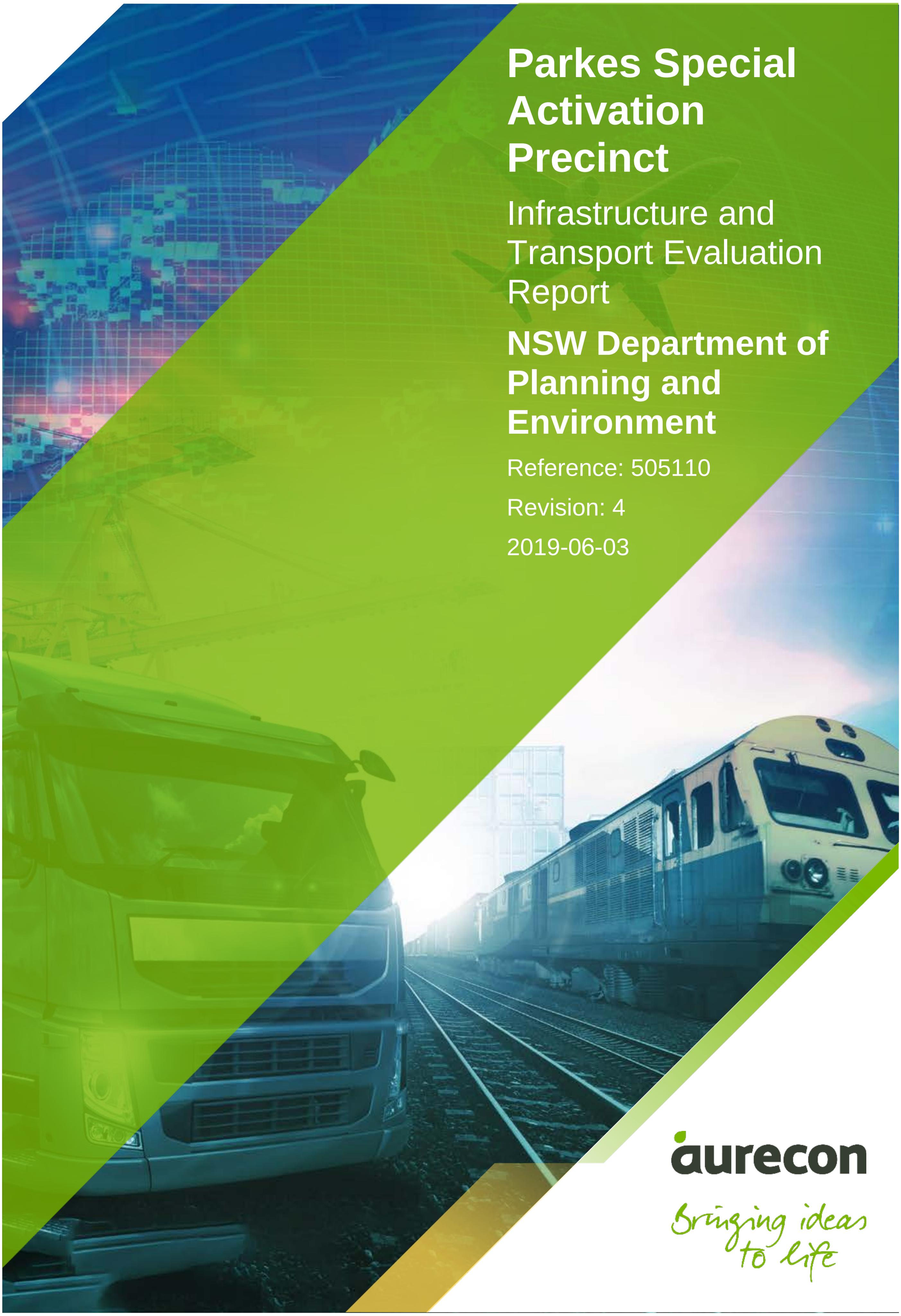

Parkes Special Activation Precinct

Infrastructure and Transport Evaluation Report

NSW Department of Planning and Environment

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1. INTRODUCTION

The Parkes Special Activation Precinct (the SAP) is a joint Government Agency initiative, announced by the Deputy Premier, the Hon John Barilaro MP, to create a 20-year vision for job creation and regional development. The Department of Premier and Cabinet and the Department of Planning and Environment are leading the creation of the Parkes SAP.

Parkes is a location of State and Regional significance and the SAP is an economic enabler that will address market failures and leverage catalyst opportunities. The SAPs are a place-based approach to 'activate' this strategic location.

The Parkes SAP was selected because of the economic opportunities associated with the construction of an Inland Rail from Brisbane to Melbourne and the existing east-west Sydney to Perth/Adelaide Rail corridor which cross at Parkes creating an opportunity for an Inland Port.

The Parkes SAP will lead to investment in common-use infrastructure, including roads infrastructure, water, electricity, telecommunication, gas systems and services, high speed internet and data connections and facilities, and other possible infrastructure or services.

A SAP contains five core components and this plan (government led studies) will inform fast track planning for the SAP and potential future infrastructure investment and government led development.

Figure 1 Parkes Special Activation Precinct Overview

Source: DPE

1.1 Regional and local context

Parkes local government area (LGA) is located approximately 350 kilometres west of Sydney, in the Central West and Orana Region. The main townships and settlements in the LGA include Alectown, Bogan Gate, Cookamidgera, Parkes, Peak Hill, Trundle and Tullamore. Other major centres in the region include Condobolin, Cowra, Dubbo, Forbes and Orange.

Parkes has a stable population of approximately 11,500 people (ABS, 2016), with around 5,000 dwellings. An industrial estate (zoned IN1 - General Industrial) is located south of the town, adjoining the Newell Highway. The town is serviced by an existing local centre, mixed use areas that contain both commercial, business and retail use. A new hospital and associated health precinct is located towards the southern end of the town. The Parkes Regional Airport is located east of town, with the Parkes National Logistics Hub located to the west.

The Central West and Orana Regional Plan 2036 identifies the following key features about Parkes:

- Development and settlement is clustered around key corridors, including the twin centres of Parkes and Forbes;
- Parkes, along with Dubbo, is a major freight hub particularly in the selling, processing, manufacturing and transporting of livestock and agricultural produce;
- TransGrid's NSW Connection Opportunities identifies Parkes as having capacity for renewable energy generation; and
- Existing regional mining operations (Northparkes Mines and Tomingley) near Parkes.

The establishment of a Parkes SAP is consistent with Parkes Shire Council's vision and strategic planning for the locality.

Figure 2 Indicative Location of Parkes SAP

Source: Aurecon, DPE, LPI (2019)

1.2 Parkes Special Activation Precinct

The Parkes SAP is strategically located to the west of the Parkes (see Figure 2) at the intersection of:

- the Brisbane to Melbourne Inland Rail;
- the Sydney to Perth/Adelaide Rail corridor; and
- is in close proximity to the junction of the Henry Parkes Way and Newell Highway.

The Inland Rail project has received $9.3 billion in funding from the Commonwealth Government to support the upgrade to the freight network from Brisbane the Melbourne. It is projected that the first train will run between the two capital cities in 2025. Parkes is an important connection for the Inland Rail project, as it is the epicentre of inland freight.

The Parkes SAP area is predominantly occupied by agricultural land, with a solar energy facility located in the north-western corner and an existing quarry operation located in the south-eastern area of the SAP.

The existing primary industries in Parkes are focused around freight and logistics, agribusiness and mining. Parkes strategic location within Regional NSW provides the opportunity to capitalise on these industries, along with the potential to expand into warehousing, advanced food manufacturing and renewable energy uses.

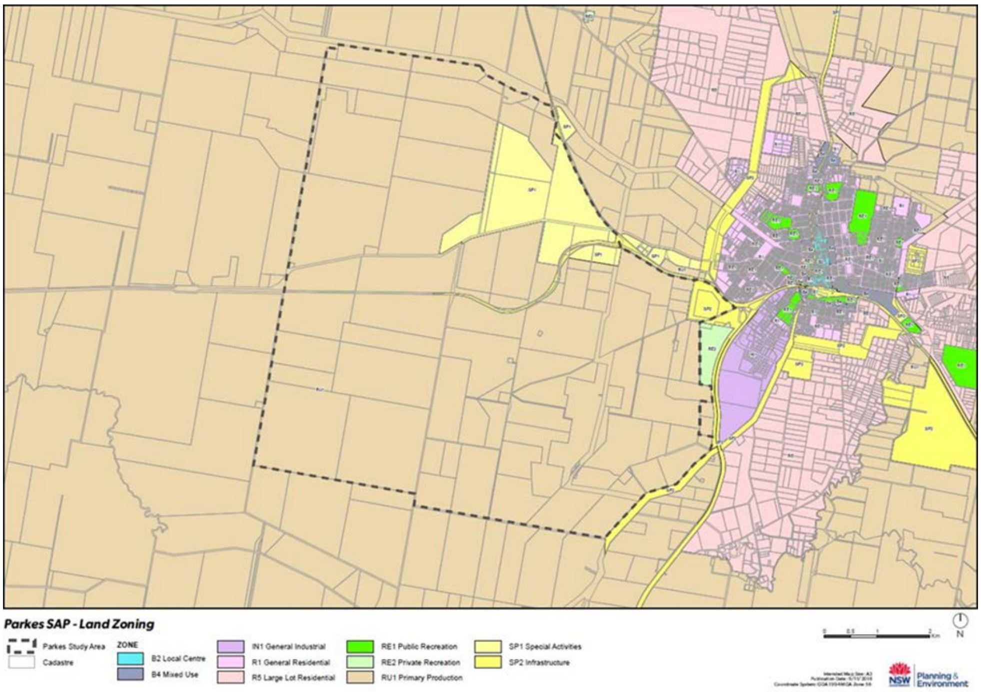
1.3 Planning Framework

Currently under the Parkes Local Environmental Plan (LEP) 2013, the Parkes SAP area is zoned (see Figure 3):

- RU1 – Primary Production;
- SP1 – Special Activities; and
- SP2 – Infrastructure.

The land zoned SP1 – Special Activities has been identified as the Parkes National Logistics Hub. The Parkes National Logistics Hub covers approximately 600 hectares. The land includes the Pacific National, Linfox and SCT Logistics sites among other landholdings. The locality provides the opportunity to create an intermodal site serviced by rail and road connections.

Figure 3 Zoning Map



1.4 Existing logistic sites

1.4.1 Pacific National

Pacific National (PN) is the largest interstate rail freight carrier in the country. Once fully operational, PN's Parkes Logistics terminal would have capacity to process approximately 450,000 cargo containers each year. The Parkes site is 300ha in size and will include an extensive rail terminal, intermodal operations, container storage centre and national logistics and distribution facilities.

1.4.2 SCT

SCT is Australia's largest privately owned rail freight operating business in Austrralia today. SCT logistics has been on site in Parkes since 2006 and currently houses a transit warehouse/rail; canopy covering 9,693 m^2, 6 kilometres of rail infrastructure and a container park covering 3,000 m^2. SCT runs some of the largest most efficient freight trains in Australia and currently run 2 trains a week from Parkes to Perth.

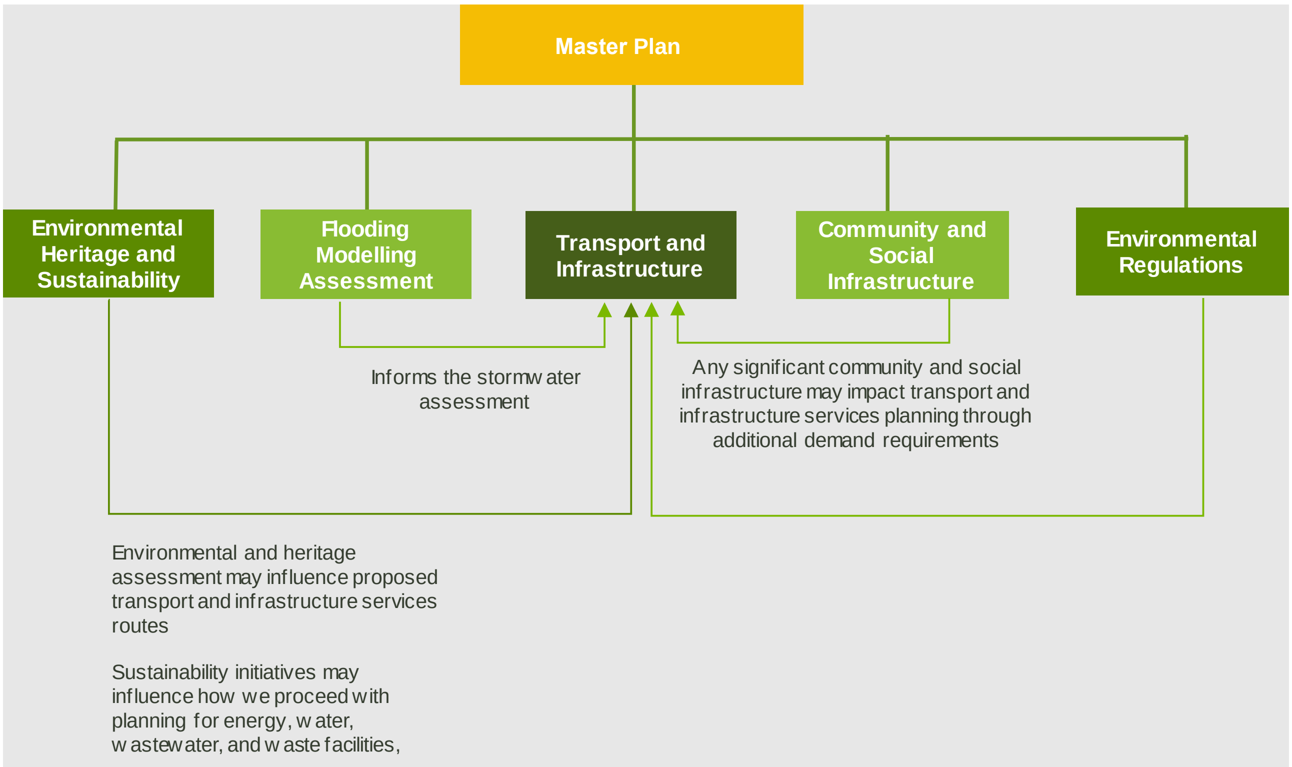
1.4.3 Linfox

Linfox is Australia's largest privately-owned logistics company. Linfox intermodal has maintained a significant presence at the strategically located, multi-modal Parkes Logistics Hub since 1998. The site has multiple warehouses, rail siding and a dangerous goods facility. Linfox have regular rail services to Perth, Adelaide and Brisbane with over-dimensional rail capability to and from Western Australia and South Australia.

1.5 Purpose

The purpose of this Study is to develop a plan that follows the strategic design of the SAP and assesses precinct and regional linkages in the context of transport and infrastructure networks. Figure 4 below shows the relationship between this study, the other technical studies and, feeding into the overall Master Plan.

Figure 4 Relationships between the technical studies and Master Plan



2. STRATEGIC CONTEXT

NSW is a large and populous state with a range of strategic and planning policies of relevance to Parkes SAP. A review of national, state, regional and local plans suggests there are commonalities across all levels, particularly when it comes to planning for growth in the Parkes area.

A summary of these policies and strategies is provided below, outlining how the documents support the policy justifications and implementation strategy for the Parkes SAP along with highlighting any specific requests or uses.

Infrastructure NSW, State Plan – Premier's priorities and State Infrastructure Strategy 2018-2038

The strategy sets out independent advice on the current state of NSW's infrastructure and the needs and priorities over the next 20 years. The strategy sets six cross-sectional strategic directions, each designed to achieve 'more with less' across Regional NSW and Greater Sydney and outer metro.

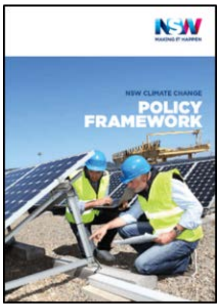
The strategy outlines specific strategic objectives including;

- Transport – ensuring the transport system creates opportunities for people and business to access services and support they need,
- Energy – encourage private sector investment to deliver reliable and affordable low emissions energy,
- Water – supporting the growth, productivity and liveability of communities by ensuring water security, quality and waste water services protect public health and the environment.

Alignment to Parkes SAP Infrastructure and Transport

This strategy outlines the importance of growth areas and planned precinct in the Integrated Land Use and Infrastructure Planning chapter. INSW *Recommendation 3*, recommends that NSW Government agencies integrate infrastructure priorities to support planned precincts and growth infrastructure compacts into capital infrastructure plans and asset management plan.

This strategy is consistent with the policy direction and recommendations of INSW, by contributing to an overall Master Plan for Parkes SAP.



NSW Climate Change Policy Framework

The NSW Climate Change Policy Framework outlines the long-term objectives to achieve net-zero emissions by 2050 and to make NSW more resilient to a changing climate. The policy framework guides NSW Government's policy and programs.

The policy framework identifies seven policy directions to guide government action.

Alignment to Parkes SAP Infrastructure and Transport

In relation to the Parkes SAP, the aligned policy directions include investment opportunities in emerging industries (e.g. transport, energy), boosting energy productivity (putting downward pressure on energy bills), and taking advantage of opportunities to grow new industries in NSW.

This Report is at the high-level stage of evaluation; however, the initiatives and assessment will seek to incorporate key climate change policy directions, particularly around emerging industries and transport.

Future Transport 2056

This strategy feeds into the Building Momentum State Infrastructure Strategy 2056.

Future Transport 2056 highlights NSW will aim to shift towards the 'hub and spoke' network of services in regional areas to increase connectivity between regional centres and Sydney and provide greater NSW with safer and more reliable travel options. The move to the 'hub and spoke' network aims to capitalise on the growing role of regional cities and centres such as Parkes as hubs of employment and services including retail, health, education and cultural services. Currently, the network is largely focused on connecting regions to Sydney.

Alignment to Parkes SAP Infrastructure and Transport

The SAP, in combination with Inland Rail and the Newell Highway Upgrade would further promote this vision by creating a regional centre in realising the visions of Future Transport 2056.

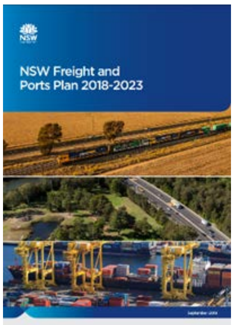
NSW Road Safety Plan, Towards Zero, 2021

The NSW Road Safety Plan 2021 sets priority areas for the NSW Government to improve road safety, setting priority targets to reduce road fatalities by 30 per cent by 2021 (from 2008-10 levels) and towards the aspirational long-term goal of zero trauma on the NSW road network.

The plan identifies a host of actions to be implemented within NSW in order to meet the set priorities. In general, smarter road and intersection design, and infrastructure safety upgrades on country roads are key actions that need to be implemented by this plan to support the reduction in fatalities on NSW roads.

Alignment to Parkes SAP Infrastructure and Transport

This plan acknowledges road safety on regional and country roads is a growing problem. In 2017, 70% of road fatalities occurred on country roads. Any road upgrades to support the Parkes SAP will incorporate the priority areas within this policy around saving lives on country roads, using new and proven vehicle technology and building a safer future.



NSW Ports and Freight Plan 2018-2023 (2018)

The NSW Freight and Ports Plan 2018-2023 is a call to action for government and industry to work together to make our freight system more efficient, more accessible, safer and more sustainable for the benefit of producers, operators, customers and communities across NSW.

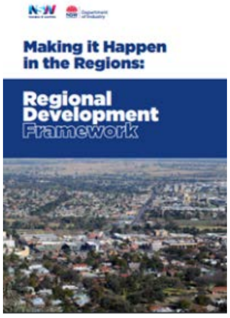
The Plan recognises there is significant NSW support for the Inland Rail project. In May 2018, the NSW and Australian Governments signed a bilateral agreement to progress the Inland Rail project in NSW.

Alignment to Parkes SAP Infrastructure and Transport

NSW freight volumes are expected to grow significantly between 2016 and 2036. The Parkes SAP is located in an ideal location to bring regional suppliers together to local, regional and international markets.

A key NSW focus is on improving east-west rail freight networks and connectivity to NSW ports and to support the development of intermodal terminals along the route including at Parkes. Inland Rail is expected to greatly improve freight connections between regional NSW, Brisbane and Melbourne.

The policy directions in this Plan, relating to investing and delivering new, and improvements to, regional transport infrastructure, and moving more with less by identifying intermodal terminals will protect land needed for vital freight and logistics operations. This policy directions will guide the evaluation and further development for transport to and from the SAP.



NSW Regional Development Framework (2017)

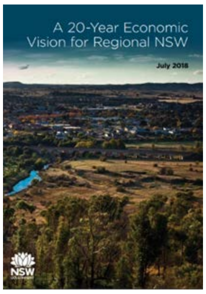
This framework outlines a three-tiered program of investment to provide quality services and infrastructure, to support growing regional centres, and assist with identifying and activating economic potential.

The NSW Government is committed to providing all communities in regional NSW with essential services and infrastructure. For inland areas, such as the Central West, agribusiness is identified as a key industry sector that could drive regional development but will require investment in infrastructure to create efficient freight networks that will increase the sector's competitiveness.

Alignment to Parkes SAP Infrastructure and Transport

The framework sets out the focus to *'do more if we focus our efforts' and* is based around a model of investment in regional NSW that will provide quality services and infrastructure, aligns effort to support the growing regions and identifies and activates economic potential. The framework contains the mechanisms to implement the NSW Government's regional development agendum building on existing work to enable a more coordinated and focused effort in the future.

This framework is consistent with this policy direction, by taking a coordinated and stakeholder focused approach to infrastructure and transport evaluation for the SAP.



A 20 Year Economic Vision for Regional NSW (2018)

The Regional Economic Development Framework aims deliver the 20 Year Economic Vision for NSW.

The 20-Year Vision plans to accelerate economic growth in key sectors or ‘engine industries’, such as agribusiness, tertiary education, health care, resources and mining, freight and logistics, advanced manufacturing, renewable energy, and technology enabled primary industries.

Furthering this, is the drive to improve connectivity across inland regional areas to capital cities to help boost business activity, deepen labour force pools and improve the overall pull of inland regions as a destination for people and business. The regions should specialise in key sectors based on their competitive advantages and operate in a business-friendly regulatory environment.

Alignment to Parkes SAP Infrastructure and Transport

The vision outlines that for regional areas to flourish they depend on Government working together, along with collaboration with industries, communities and Aboriginal economic participation.

The Parkes SAP Infrastructure and Transport Report aligns to four of the seven key principles that will be used when making decisions on regional economic development; Infrastructure (improving travel times between regional centres and the rest of NSW, improve freight networks to increase competitiveness of key sectors and reliable accessible water and energy) and Advocacy and Promotion (recognise each region’s strengths and underlying endowments).

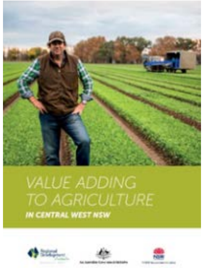
Investment Attraction Package for Regional NSW (2018)

The fund contains $20 million in grants and interest free loans targeted at offsetting government levies and duties to eligible businesses that want to invest and grow in regional NSW, which will contribute to new jobs. The Special Activation Precincts or business hubs in these areas will offer infrastructure and streamlined planning processes for the industries and sectors responsible for driving significant growth in regions.

Alignment to Parkes SAP Infrastructure and Transport

The investment packages outlines Parkes as the state’s first SAP, taking advantage of its unique location at the intersection of the Inland Rail line, the east–west rail line and the north–south Newell Highway.

The grants allow for businesses and industry to request more information regarding growing the Parkes SAP and apply for grants. This Report will provide the foundations for integrated infrastructure and transport evaluation in the SAP, the outcomes of this planning will help to facilitate further growth and attract industry.



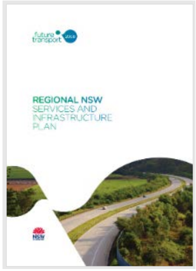
Value Adding to Agriculture in Central West NSW (2016)

This study was born of a mutual recognition across key stakeholders and government bodies in the region that a food and fibre strategy was needed to ensure a sustainable, diverse agricultural economy reflecting the changing global landscape.

Trade agreements will create significant opportunities for Central West agricultural products. The ability to transport produce by air from Canberra to Asian markets is a potential game changer for agricultural exports from Central West. Freight and logistics connectivity to market is a key challenge and opportunity for the Central West region.

Alignment to Parkes SAP Infrastructure and Transport

The analysis of agriculture trends and markets along with potential trade agreements is an important quantitative assessment of the supply of produce that could benefit from the SAP. The transport and infrastructure provisions for the SAP will enable greater access for regional producers.



Regional NSW Services and Infrastructure Plan, Transport for NSW, 2056

The Regional NSW Services and Infrastructure Plan is the NSW Government's blueprint for transport in regional NSW to the year 2056. The plan supports a 40-year vision to support liveable communities and productive economies in regional NSW.

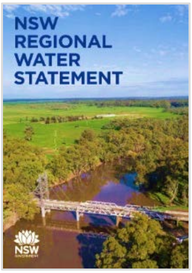
The Plan draws on the customer and network outcomes identified in the Future Transport 2056 plan considering these outcomes further from a regional perspective for a diverse range of customers. Integrating transport and land use planning to separate freight and passenger traffic on major freight corridors and efficiently plan collection points in centres and at network interchanges.

Alignment to Parkes SAP Infrastructure and Transport

The Plan outlines specific policy and project initiatives for the Central West and Orana region, including Parkes.

The Plan acknowledges that the development of the Melbourne to Brisbane Inland Rail has the potential to transform the Central West and Orana region into one of the key freight and logistics destinations in Australia. With associated transport infrastructure upgrades, there is potential to unlock further economic potential within the Central West and Orana region.

The plan identifies a committed initiative for the Newell Highway Parkes Bypass as well as other short to long term (20 years+) initiative and visions for the wider region.



NSW Department of Industry, NSW Regional Water Statement, February 2019

This water statement sets out the status today and plans to support vibrant regional communicates with secure access to water resources for the future. This statement provides an overarching update on progress for regional water security, including the Lachlan catchment.

An outcome of the regional statement is also the Lachlan Long Term Water Plan (2018) which provides an important step to describing the flow regimes that are required to maintain or improve environmental outcomes in the Lachlan. Community consultant has now closed on this Plan.

Alignment to Parkes SAP Infrastructure and Transport

The NSW Department of Industry has set out long term solutions for Lachlan regional water strategy and specific initiatives for the Murray Darling Basin. This policy direction will advise the evaluations in this Report, including outlining the different roles and responsibilities in regional water management from water policy and resource allocation through to distribution, water pricing and compliance.

Central West and Orana Regional Plan 2036

The Central West and Orana Regional Plan (CWORP) 2036 is a 20-year blueprint for the future of the Central West and Orana region preparing for future population needs for housing, jobs, infrastructure and a healthy environment. The CWORP was made in collaboration with representatives from joint organisations, regional organisations of Councils and state agencies in 2017.

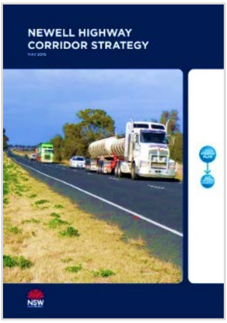
The potential for the region to transform into one of the key freight and logistics destinations in Australia is a key focus of the CWORP.

Alignment to Parkes SAP Infrastructure and Transport

Improved connections with Sydney, Canberra and Newcastle, together with the proposed Melbourne to Brisbane Inland Rail, have been recognised to provide the capacity and connectivity for agribusiness, manufacturing, tourism and mining.

Developing the Parkes National Logistics Hub is recognised as a priority for Parkes.

This Plan sets out the regional priorities to support the SAP.



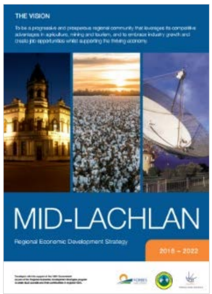
Transport for NSW, Newell Highway Corridor Strategy 2015

The Newell Highway is the longest highway in NSW, running south to north through the State and providing an essential road connection for central western NSW, including Parkes. This Strategy outlines how the NSW Government will manage road transport along the highway.

Alignment to Parkes SAP Infrastructure and Transport

In 2015, the Newell Highway Corridor Strategy outlined strategic plans to address the PBS3a (performance-based standard) constraints through Parkes, including a bypass for Parkes and railway level crossing issues.

This Report will focus on road connection to the SAP and region, and will incorporate the strategic directions in this strategy, along with liaising with key stakeholders such as the Roads and Maritime. Road access to the SAP for local and regional freight is an important factor to support inland rail.



Mid-Lachlan Regional Economic Development Strategy 2018-2022

The NSW Government has worked with local councils and their communities to develop 37 Regional Economic Development Strategies across regional NSW. This Strategy is formed in collaboration between Forbes, Lachlan and Parkes Shire Councils.

The Strategy identifies economic development opportunities to capitalise on the existing endowments of its functional economic region.

The SAP aligns with the strategy as it will improve access to markets for agriculture, mining and manufacturing by investing in intermodal network resilience and reliability.

There is specific local response to some of the strategies and policies around regional transport, inland rail and activation precincts, for example the case for the Parkes National Logistics Hub:

Parkes Shire Council Community Strategic Plan (2017)

The Community Strategic Plan (CSP) sits above all other Parkes Shire Council plans and policies in the community planning hierarchy (Parkes Shire Council, 2017). The plan identifies the community's main priorities and aspirations for the future and incorporates plans to achieve them.

Alignment to Parkes SAP Infrastructure and Transport

The Parkes SAP is directly in line with the vision and future direction of the CSP. The CSP identifies Parkes as the transport crossroad of the nation, and states that development should be promoted to make Parkes the national logistics hub. Both skills development and infrastructure, such as a direct highway access route for heavy vehicle traffic, will support and complement the Parkes National Logistics Hub.

Access to and from Sydney, as well as the development of freight through Parkes Regional Airport, is believed to further strengthen the strategic location of the Parkes Shire.

The directions within this Plan will help guide the local planning and community aspects of the SAP.

Parkes Shire Council Delivery Program 2017/18-2020/21

The Delivery Program is the point where the community's strategic goals are systematically translated into actions. The Delivery Program identifies and passes down the deliverables required annually in Parkes Shire Council's Operational Plan to achieve goals set.

Alignment to Parkes SAP Infrastructure and Transport

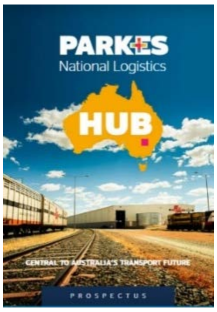
The Parkes National Logistics Hub (Parkes SAP) is identified as a key economic program stream within the delivery program.

To continue developing the Parkes National Logistics Hub, this delivery program is relying significantly on the assistance of other levels of government and will continue to advocate, plan and lobby for the hub's development.

Parkes Operational Plan 2018-2019

The Operational Plan identifies the projects, programs and activities that Parkes Shire Council will undertake within the next financial year. It will contribute to the goals contained within the Parkes Plus Delivery Program. The plan commits to delivering the communities vision being that by 2030 the Parkes Shire will be a “progressive and smart regional centre, embracing a national logistics hub, with vibrant communities, diverse opportunities, learning and healthy lifestyles”.

The Parkes SAP specifically aligns with Parkes Shire Council’s deliverable in advocating for the transport and logistics hub industry including transport and infrastructure. The Parkes SAP will also support a number of deliverables of the Council including; supporting and promoting growth opportunities for business and maintaining Parkes Shire Council’s regional road network.



Parkes National Logistics Hub Prospectus (2017)

This prospectus outlines the case for the inland rail project and the critical role of the Parkes National Logistics Hub as the sole connection for the inland rail to the east and west.

The prospectus contains testimonials from key stakeholders, industries and investors including SCT, Pacific National, Linfox and others.

This Report incorporates the themes and testimonials within the prospectus, into the evaluation of transport for Parkes SAP.

3. EXISTING NETWORKS

3.1 Infrastructure – Regional and Precinct Analysis

This desktop analysis seeks to understand the capacity and availability of utilities both within the Parkes SAP and its adjacent wider regions, depending on the supply of services. It has been based on information and spatial data received from the Department of Planning and Environment (DPE), Parkes Shire Council and utility providers. The utilities assessed include:

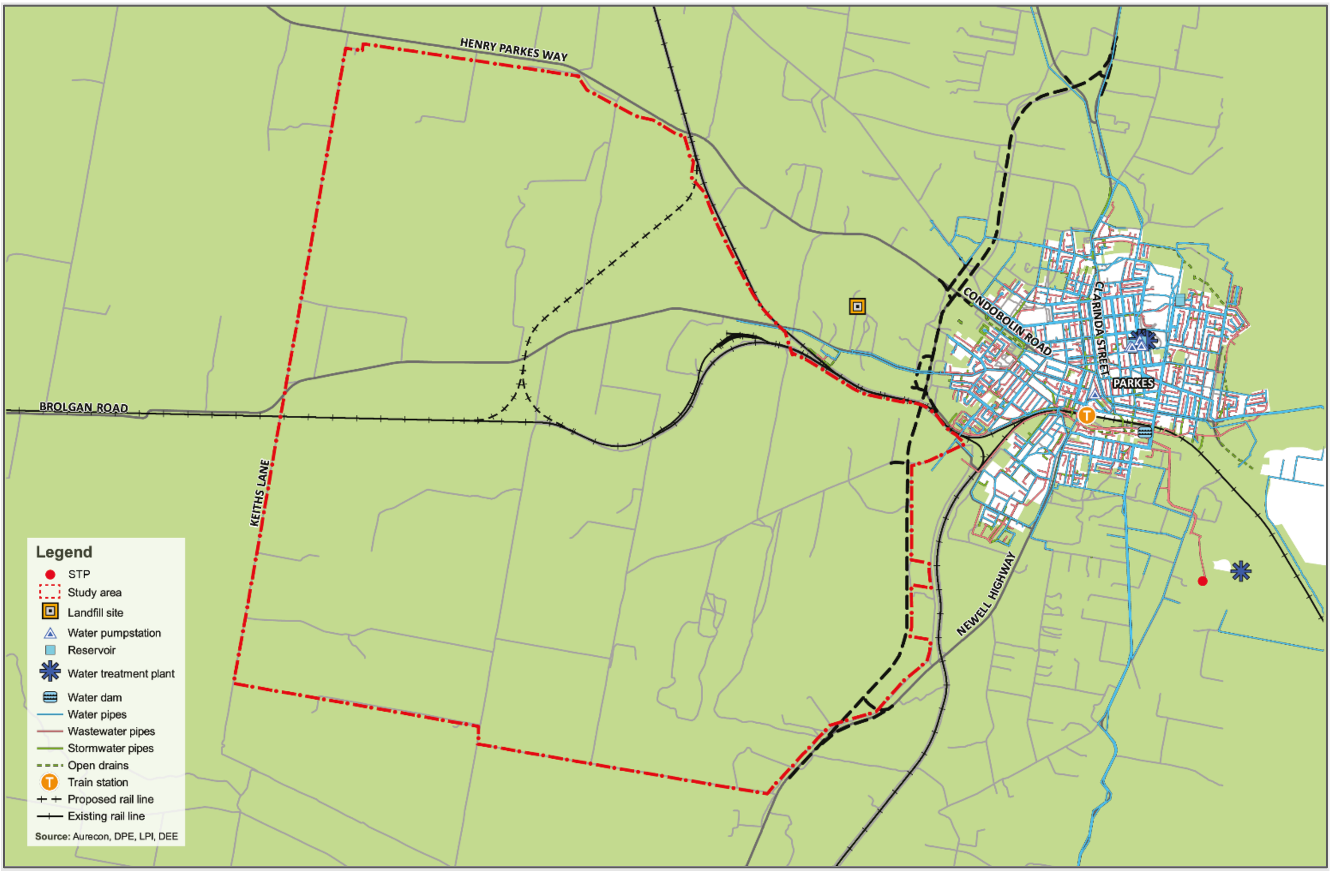
- Water, wastewater and stormwater;
- Electricity and gas;
- Telecommunications and internet services; and
- Waste and resources recovery.

These are discussed in further detail over the following sections, along with any risks, issues and opportunities identified. Full sized maps presented are available in the Appendix.

3.1.1 Water, Wastewater and Stormwater

The Parkes SAP investigation area is largely a greenfield site with no water, wastewater, and stormwater infrastructure. This analysis focuses on assessing the remaining available capacity of existing water related infrastructure located within Parkes town. Figure 5 highlights the extent of water networks within the town (shown as blue lines in Figure 5), and a small extension of the network along Brolgan Road.

Figure 5 Existing water, wastewater and stormwater infrastructure



Source: Aurecon, DPE, LPI, DEE (2019)

Water

Existing infrastructure

The investigation area is a greenfield site and contains minimal, newly constructed water infrastructure along Brolgan Road currently servicing SCT and all the business to the east. Augmentation of the existing Parkes' water network will be required to service the entire Parkes SAP following an assessment of available capacity at the existing Parkes water treatment plant (WTP) and analysis of the raw water supply and demand. The latter points are discussed below.

Water treatment plant

The WTP is located on Webb Street to the north of Parkes and is designed to produce up to 16 ML of water per day (5,840 ML/ year) to supply potable water to communities of Parkes, Peak Hill, Alectown and Cookamidgera. A 30-year projection of the water demand for these townships indicated that the average annual demand is expected to rise from 2,500 ML/ year in 2016 to 2,702 ML/ year in 2046 based on a population growth rate of 0.4%, overall utilising less than 50% of the WTP design capacity[1]. Note that this projection has not included offset from potential potable water savings due to implementation of the recycled water scheme and the active water leak detection program, and peak day demands, available network storage and peak delivery capacities should be considered in confirming augmentation needs to existing systems.

Raw Water Demand & Supply

Currently, the two main users of water include Parkes WTP (to service the town), and Northparkes Mine (NPM), who are both serviced under the Parkes Water Supply Scheme managed by Parkes Shire Council. Together, these two users collectively demand an average of 5,000 ML/year. The NPM is a major employer and contributor to the economy of Parkes Shire, and has licence to extract up to 12,800 ML/ year of water from the Lachlan River and the bore fields[2]. NPM has used approximately 2,500 ML/year in the recent years. The basis of strategic planning for bulk water supply to NPM assumes no significant increase in demand till 2046[3].

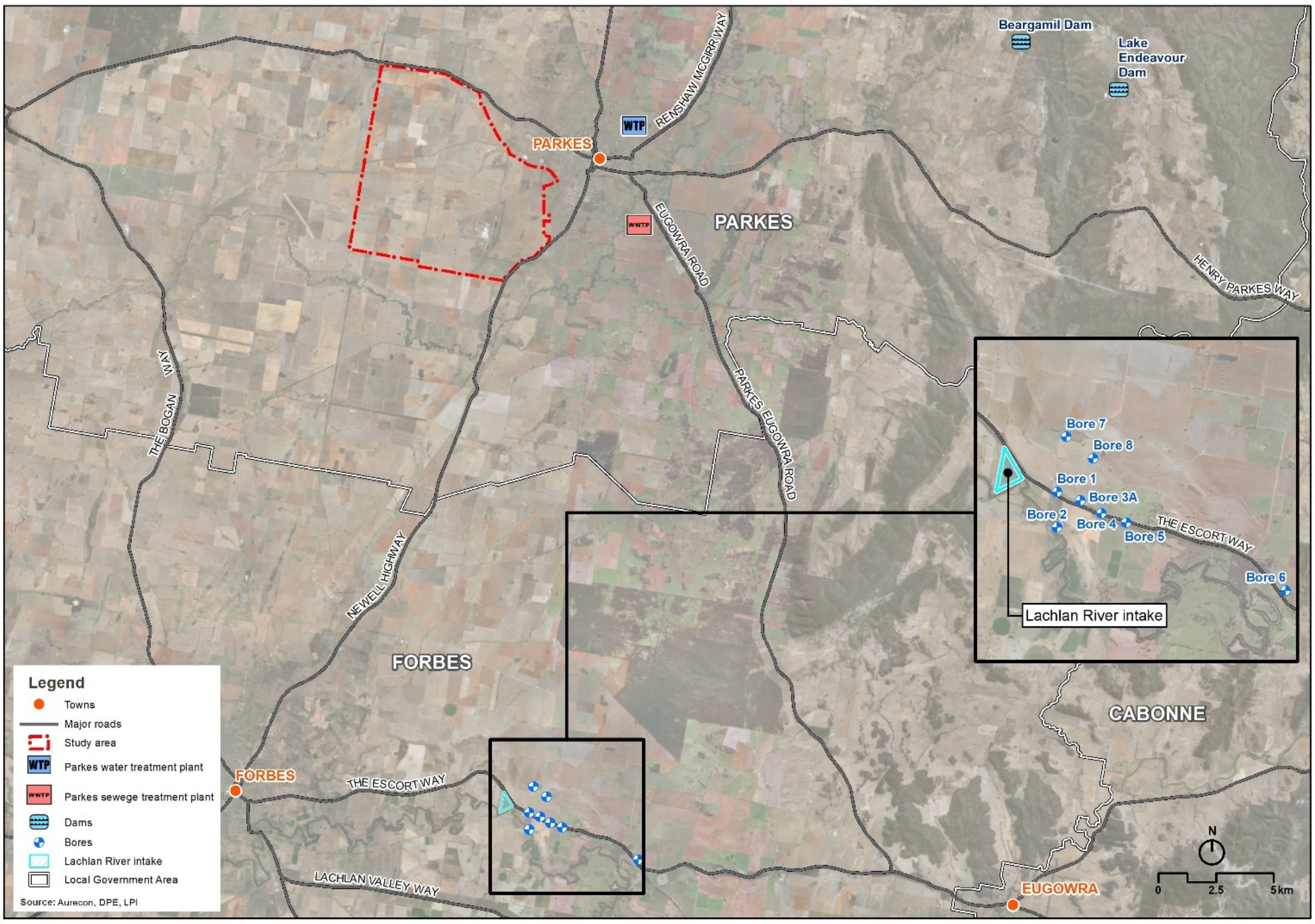
Under the scheme, raw water is supplied from a combination of the following sources:

- Surface water from Lake Endeavour dam, completed in 1940 by Parkes Shire Council and has a water storage capacity of 2,400 ML however estimated capacity is 1,900 ML due to siltation. Parkes Shire Council has advised that the long run sustainable yield, based on climate correction model, is currently 900 ML/year.
- Surface water from Beargamil dam, constructed in 1924 and has a capacity of 480 ML.
- Surface water off-take from Lachlan River downstream of Wyangla Dam. The Lachlan River is a regulated water source, and when full, Wyangla Dam holds more than 1,200 GL. State Water operates this dam and gives priority to urban water and high security licences over irrigation and general security licences.
- Eight production bores from the Upper Lachlan Alluvium that extract water from up to 100m below ground level. Ground water has been used to supplement the water supply since 1967. Prior to installation of a number of the existing bores and additional licenses being purchased, there have been instances (around 2001) where Parkes Shire Council has exceeded its draw limit to meet NPM operational needs.

BY 2046, THE EXISTING WTP WILL HAVE ~50% AVAILABLE CAPACITY PER YEAR TO SUPPLY POTABLE WATER TO PARKES TOWN OR THE FUTURE SAP.

[1] Integrated Water Cycle Management Strategy (Parkes Shire Council, 2015)
[2] CMOC- 2018 Annual Review (Northparkes Mines, 2018)
[3] Integrated Water Cycle Management Strategy (Parkes Shire Council, 2015)

Figure 6 Location of raw water resources for Parkes/Peak Hill/ NPM Water Supply Scheme.



Source: Aurecon, DPE, LPI (2019)

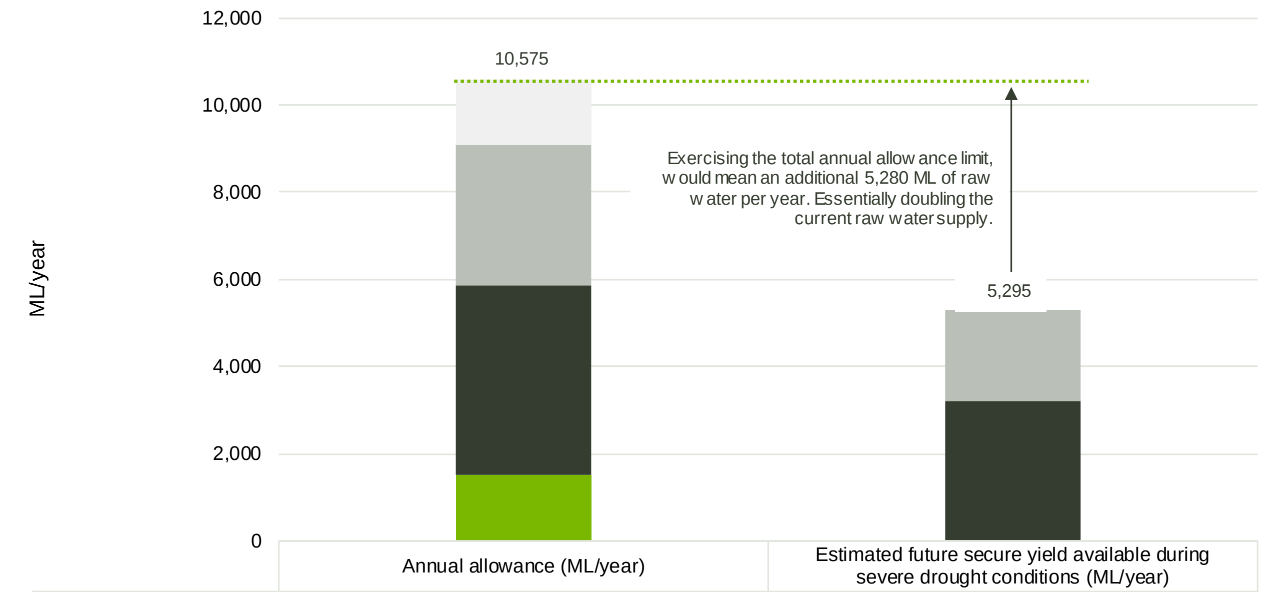
Parkes Shire Council's preference is to draw water from the dams to avoid pumping from Lachlan River and bore fields, which are about 30km south of Parkes. Bore water generally offers the most reliable water quality, and it is generally preferred over river water to supplement supply from the dams. When the quality of water permits, the Lachlan River typically supplies the NPM due to limitations to bore drawdown.

Under the current supply scheme, each water source listed above is subject to annual allowance limits. The median global climate model (GCM) indicates water availability will reduce from 2016 to 2046 on all sources relied by Parkes Shire. These reductions are already built into Parkes Shire Council's long-run sustainable yield and annual extraction regime scenarios, and Parkes Shire Council has advised would be reviewed as part of the upcoming revision to the IWCM.

Previously, the dams have been unable to supply raw water during periods of extreme drought (up to 18 months at a time). A secure yield has been determined based on the following assumptions:

- 65% of the High Security Lachlan River allowance will be available
- 0% of the General Security allowance will be available
- Lake Endeavor and Beargamil dams may be empty
- The groundwater bores continue to supply 1,200 ML/year, and for short to medium terms (2 to 5 years) can supply up to 3,200 ML/ year

Figure 7 Comparison of annual allowance limits and estimated future yield



	Annual allowance (ML/year)	Estimated future secure yield available during severe drought conditions (ML/year)
Lachlan General Security	1,500	0
Lachlan High Security	3,225	2,095
Borefield 1 to 6	4,350	3200
Dams	1,500	0

Source: Aurecon analysis, based on information from Integrated Water Cycle Management Strategy (Parkes Shire Council, 2015).

Figure 7 indicates the secure yield (of ~5,300 ML/year, which is just above the forecast water demands for the Parkes/Peak Hill/NPM to 2046) based on the above assumptions and does not include the yield from newly refurbished Bores 7 and 8. Any increase in forecasted water demand is anticipated to be able to be met through Parkes Shire Council negotiating to utilise its full annual allowance limits, and further supplementing these with bore water supply. Through exercising these measures, the total raw water supply could amount to just over 10,000 ML/year (see Figure 7). With refurbishment of bore 7 and 8 completed in 2018, the total raw water supply has since increased to 13,000 ML/year[4], which is 5 times the existing Parkes town water demand and could meet Parkes SAP's future water needs (depending on the proposed land uses and the degree of water intensity). In addition, Parkes Shire Council's recycled water scheme, which, at the time of writing, is expected to come on-line in June 2019, would be expected to supplement non-potable water demands.

As part of Parkes Shire Council's *Servicing the Parkes Logistics Hub – Infrastructure Extension*, Parkes Shire Council has delivered initial water infrastructure to service developments within PN and SCT land, comprising extension of the existing 300mm diameter pipe located at the railway crossing at Brolgan Road to Coopers Lane (~3km total length), delivering potable water to these sites.

Future opportunities

As mentioned before, any additional raw water demand that cannot be readily met under the current annual allowance limits (with the assumptions overlaid), Parkes Shire Council could negotiate these limits and utilise its bore water supply. Alternate raw water supply may be sought to supplement secure water supply to Parkes SAP. WSP (2019) has recently undertaken a groundwater desktop study and has identified two water sharing plans that are currently operating within the investigation area:

- NSW Murray-Darling Basin Fractured Rock, commenced 16 January 2012
- Lachlan Unregulated and Alluvial, commenced 14th September 2012

Table 1 outlines the total number of Water Access Licenses (WALs) per license category within the corresponding water sharing plan.

Table 1 Total numbers of WALS per water sharing plan for the 2018 to 2019 Financial Year

Water sharing plan	Access license category	No. WALS	Available water (ML)	Usage Year to Date (ML)

[4] *Integrated Water Cycle Management Strategy (Parkes Shire Council, 2015).*

NSW Murray-Darling Basin Fractured Rock – Lachlan Fold Belt	Aquifer	1024	66,927	704
	Aquifer (Town Water supply)	6	467	2
	Local Water Utility	35	2371	0.1
	Local Water Utility (Domestic and Commercial)	1	50	0
	Salinity and Water Table Management	1	236	0
Lachlan Unregulated and Alluvial Sources – Upper Lachlan Alluvial Groundwater source	Aquifer	375	166,519	50,188
	Local Water Utility	9	7848	181

Source: The NSW Water Register maintained by the NSW Land Registry Services (Water NSW, 2019)

The WSP study identified 19 registered bores within the investigation area and additional 33 bores within 2 km of the investigation area. The majority of the bores are used for monitoring purposes with the remaining used for household water supply, stock, manufacturing and industry and mining. Parkes Shire Council has advised that preliminary investigations and anecdotal evidence suggests that these bores are not high yielding.

If these alternate water sources were to be considered to supply the Parkes SAP, further studies, including field investigations, would be required to identify groundwater levels and yields, refine groundwater quality and identify potential project impacts on neighbouring bores. It is also recommended an assessment of available water access licenses be undertaken. Parkes Shire Council currently has a license acquisition strategy and will be revising the Integrated Water Cycle Management Strategy (Parkes Shire Council, 2015) in the year 2019/20.

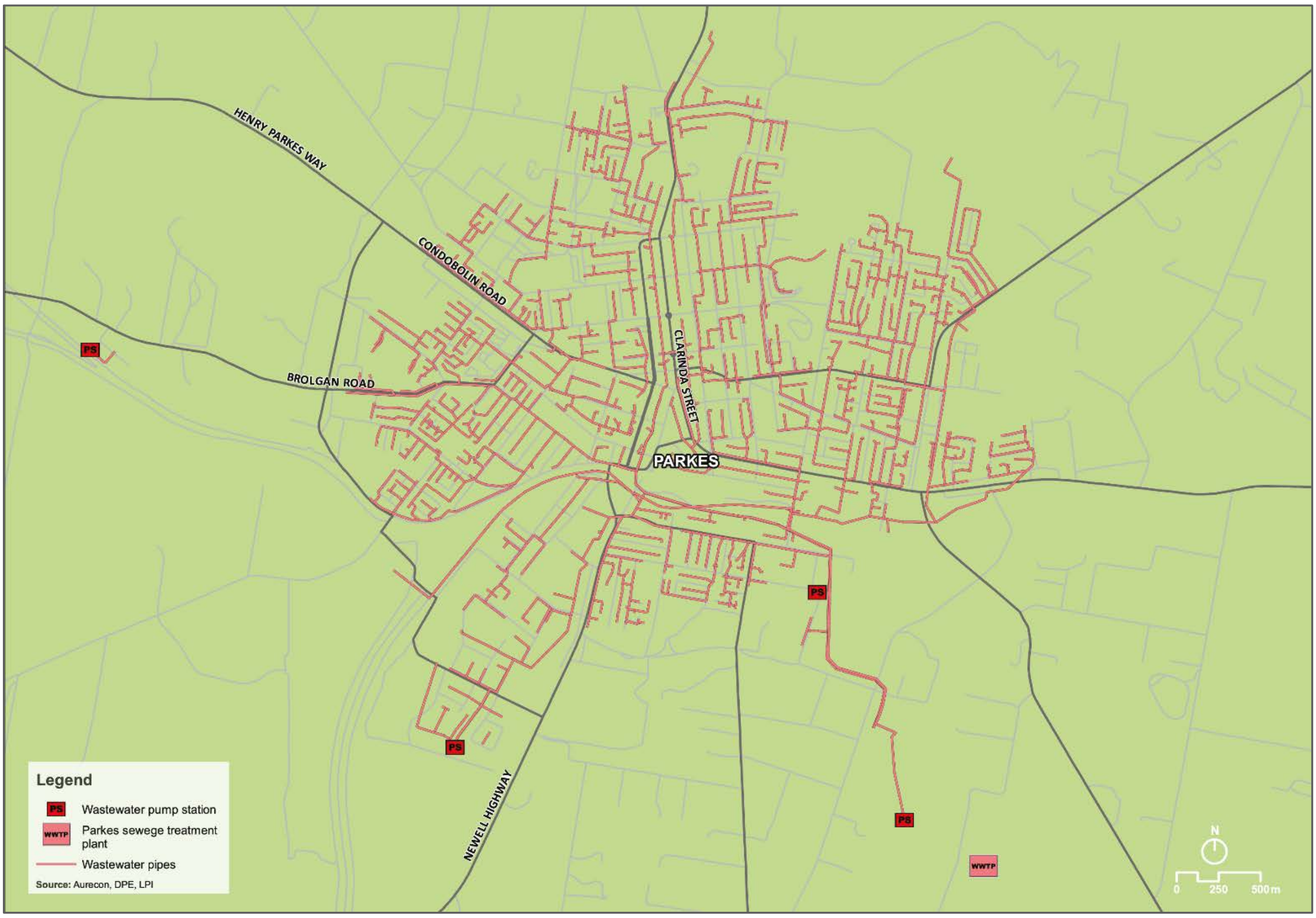
Wastewater

There is currently no wastewater infrastructure servicing the Parkes SAP, however, wastewater network and a treatment plant are available within Parkes town centre.

Existing infrastructure

Parkes is served by a conventional gravity sewage collection and transport system, as illustrated in Figure 8. Raw sewage gravitates towards a pump station and rising main on Nash Street (South-West of Parkes) to transfer to the Parkes Sewage Treatment Plant (STP).

Figure 8 Parkes sewage network, pump stations and sewage treatment plant.



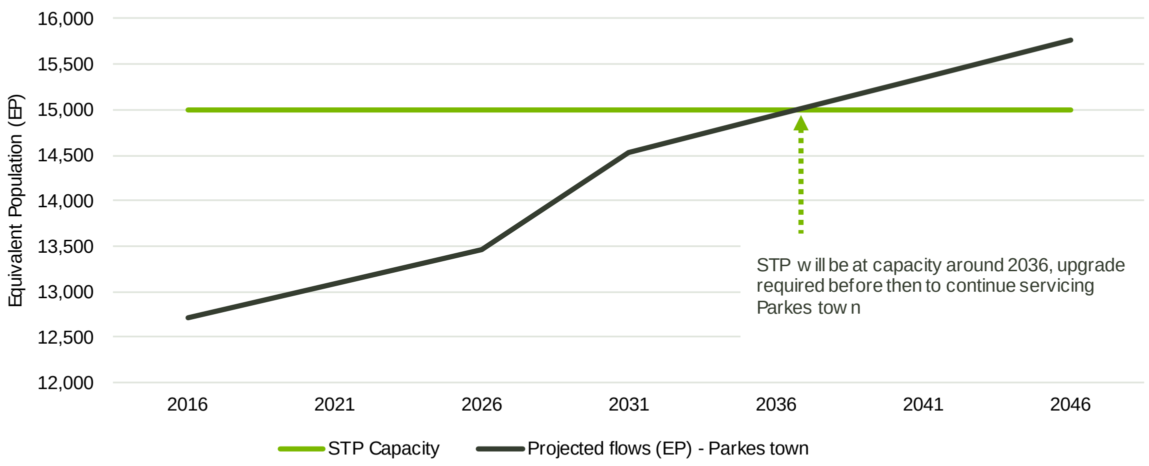
Source: Aurecon, DPE, LPI (2019)

The STP is located on Akuna Road, south of Parkes. The STP commissioned in July 2017 currently has treatment capacity for up to 15,000 Equivalent Population (EP), with the ability to be expanded to 20,000 EP in the future to accommodate population growth. The STP has an Advanced Water Recycling Facility to reduce environmental wastewater discharges and provide high value, beneficial re-use. Parkes Shire Council is currently installing a recycled water rising main (purple pipe) network within Parkes, enabling the STP to maximise resource re-use by supplying recycled water for irrigation of the town's sporting fields and open spaces as well as Parkes Golf Course and Parkes Racecourse.

For the STP to accept any trade waste generated from the SAP, pre-treatment onsite may be required to process wastewater to meet STP treatment envelope and comply with the environmental protection license (EPL). To assess the existing STP capacity, a population growth rate of 0.4% with design flow of 200 L/EP/day has been adopted[5]; these values are consistent with design criteria previously used for the STP. A design flow value of 200 L/EP/day is conservative and is used for strategic planning purposes. The current and projected flows to the Parkes STP are summarised in Figure 9.

[5] Integrated Water Cycle Management Strategy (Parkes Shire Council, 2015)

Figure 9 Projected flows to Parkes STP



Source: Integrated Water Cycle Management Study (Parkes Shire Council, 2015)

As shown in Figure 10, the existing STP would require capacity augmentation of 5,000 EP to be online before 2036 to meet the projected population growth of Parkes town.

Post business case cost review, Parkes Shire Council has advised that the STP treatment capacity is 16,000 EP and could be expanded to 24,000 EP to accommodate population growth. This update is not expected to alter the final Master Plan but will be used to cost the final solution.

Planned / committed infrastructure

Significant infiltration and inflow (I/I) program has been in place since 2013, which would reduce baseline flows to the STP overtime and reduce the peak impacts of significant rainfall events

Future opportunities

The existing STP can be duplicated and this could double its design capacity to service 40,000 EPs. The future wastewater generated by Parkes SAP could be serviced in one of three ways:

- Treated by the existing STP (after duplication)
- **A dedicated Parkes SAP STP**. An alternative to the option above is to a wastewater treatment facility dedicated to the SAP. To confirm the feasibility of an on-site STP, consideration should be given to factors such as wastewater loading, wastewater qualities, licensing and regulation, effluent management (i.e. industrial recycling, crop/pasture irrigation, river discharge, storage and pumping requirements), siting and buffer zones, treatment technology, servicing (power, telecommunications, water), and ongoing operation and maintenance requirements. An on-site STP offers opportunities for improved environmental and economic outcomes for wastewater treatment, by promoting a circular economy and exploring possible opportunities for resource recovery. This could include biogas generation to supply heat and electricity on-site, or production of valuable products through nutrient recovery from organics within the wastewater.
- **Decentralised STPs**. If not discharging to the Parkes STP or an SAP STP, intensive industries, such as abattoir, dairy and agribusiness, would typically require an on-site wastewater treatment facility installed. Each individual industry would be responsible for appropriate management of the treated effluent from its treatment facility and may be regulated with an operational licence. Investigations would be required of allowable treated effluent disposal options (industrial recycling, land disposal, discharge to surface waters).

The decision to either centralise or decentralise works should be viewed with reference to risk and opportunity to the environment and public health amongst other considerations.

Stormwater

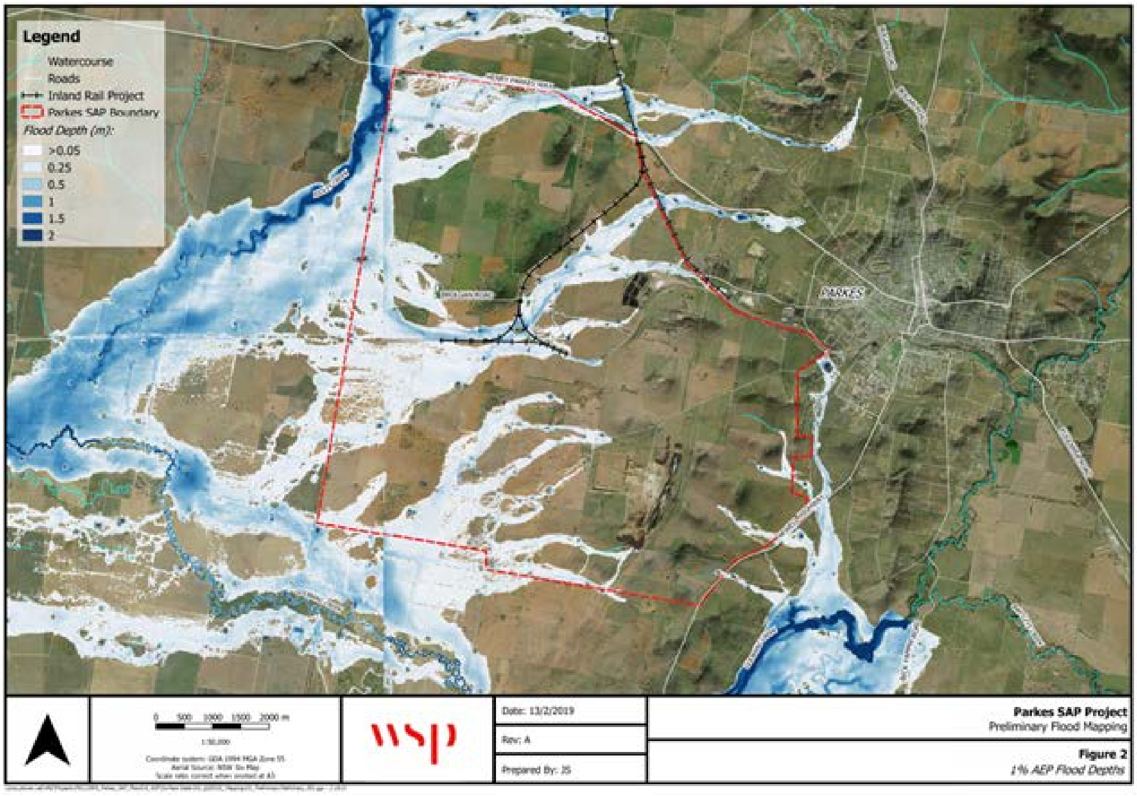
Existing infrastructure

The SAP is undeveloped with some isolated buildings, activities and minor stormwater infrastructure. The topography predominantly slopes towards the south west into Goobang Creek, away from Parkes. Any stormwater infrastructure within Parkes is therefore not expected to convey any significant amount of runoff to or through the development site under existing conditions.

Key drainage features that currently exist within the development site include:

- Grass or naturally lined table drains along unsealed roads. The depths and slopes of these drains vary in size. A small number of culverts, predominately concrete, are also present at intersections between sealed and unsealed roads and privately-owned driveways.
- Grass or naturally lined table drains for the sealed roads; Henry Parkes Way, Brolgan Road. Most of which are trapezoidal shape.
- Various cross drainage structures along the existing rail alignments within the eastern areas of the development site.
- Numerous farm dams exist which will capture localised concentration of sheet flow runoff from small lower order streams and gullies. This will have an influence on the accumulation and timing of runoff during local storms.
- The major overland/concentrated flow paths within the Parkes SAP area have been identified as part of flood modelling of the broader area, for the 1% Annual Exceedance Probability (AEP) flood event. The various identified overland flow paths drain to Goobang Creek, along the following alignments:
  - East to west adjacent to the northern extent of the development site near Henry Parkes Way;
  - North east to south west, approximately following the alignment of the railway and Brolgan Road;
  - A braided configuration of flow paths towards the south west, in the south western portion of the development area; and
  - Three gullies flowing to the south east across the south eastern boundary of the development area traversing the Newell Highway.

Figure 10 Existing case scenario - overland flow paths and 1% AEP flood extents and depths



Source: WSP. Parkes SAP Preliminary Flood Mapping (February 2019)

Planned / committed infrastructure

None.

Future opportunities

Developed conditions and compliance standards

The proposed development condition is still in conceptual design stage and it is therefore not possible to accurately predict the nature of changes to total runoff, sub catchment delineation, runoff directions and runoff timing. It is however assumed that the proposed changes will consist of significant and various land use changes and a high likelihood that the imperviousness of the overall area will be significantly increased.

An increase in imperviousness typically equates to an increase in stormwater runoff (stormwater quantity), where mitigation measures are not implemented, and land use changes can introduce various sources of pollutants to stormwater runoff (stormwater quality).

An increase in runoff is likely to trigger local council compliance standards where the typical requirement for the quality of stormwater discharge from the development site is to not be of poorer quality than the pre-development case. Additionally, compliance with stormwater quality standards typically require minimum pollutant reduction targets be met for various types of stormwater pollutants, again from the existing case scenario compared to the developed case.

Sensitivity to stormwater quantity increases and stormwater quality impacts

A desktop review of aerial imagery and flood mapping suggests a low risk profile for adverse impacts from an increase in stormwater quantity/discharge perspective, as no major infrastructure, buildings or densely populated areas currently exist immediately downstream of the Parkes SAP boundaries (see Figure 10). However, potential for future surrounding developments in combination with the Parkes SAP development could create significant cumulative impacts including increased flood levels, flood hazards, frequency and duration of flooding, and scouring/destabilisation of watercourses.

The SAP may also cause a deterioration in stormwater quality due to land use changes to activities that may include those that introduce various types of pollutant runoff. The majority of the stormwater will drain into Goobang Creek.

Stormwater quantity and quality management

A new stormwater drainage network will be required for the development of Parkes SAP. This will minimise the risk of adverse impacts onsite and downstream, provide the opportunity for onsite re-use and recycling, and ensure compliance with stormwater run-off quality standards.

According to the identified existing major overland flow paths, there will likely be multiple stormwater discharge locations from the development site (as shown in Figure 10). It is therefore not likely that the most efficient and cost-effective management of stormwater runoff from the developed site will be a centralised detention system. It is more likely that a system of decentralised and at source detention measures be used in combination to manage stormwater runoff, and likely also create opportunities from stormwater quality improvement, harvesting and re-use within the new stormwater drainage network.

Existing stormwater reuse opportunities

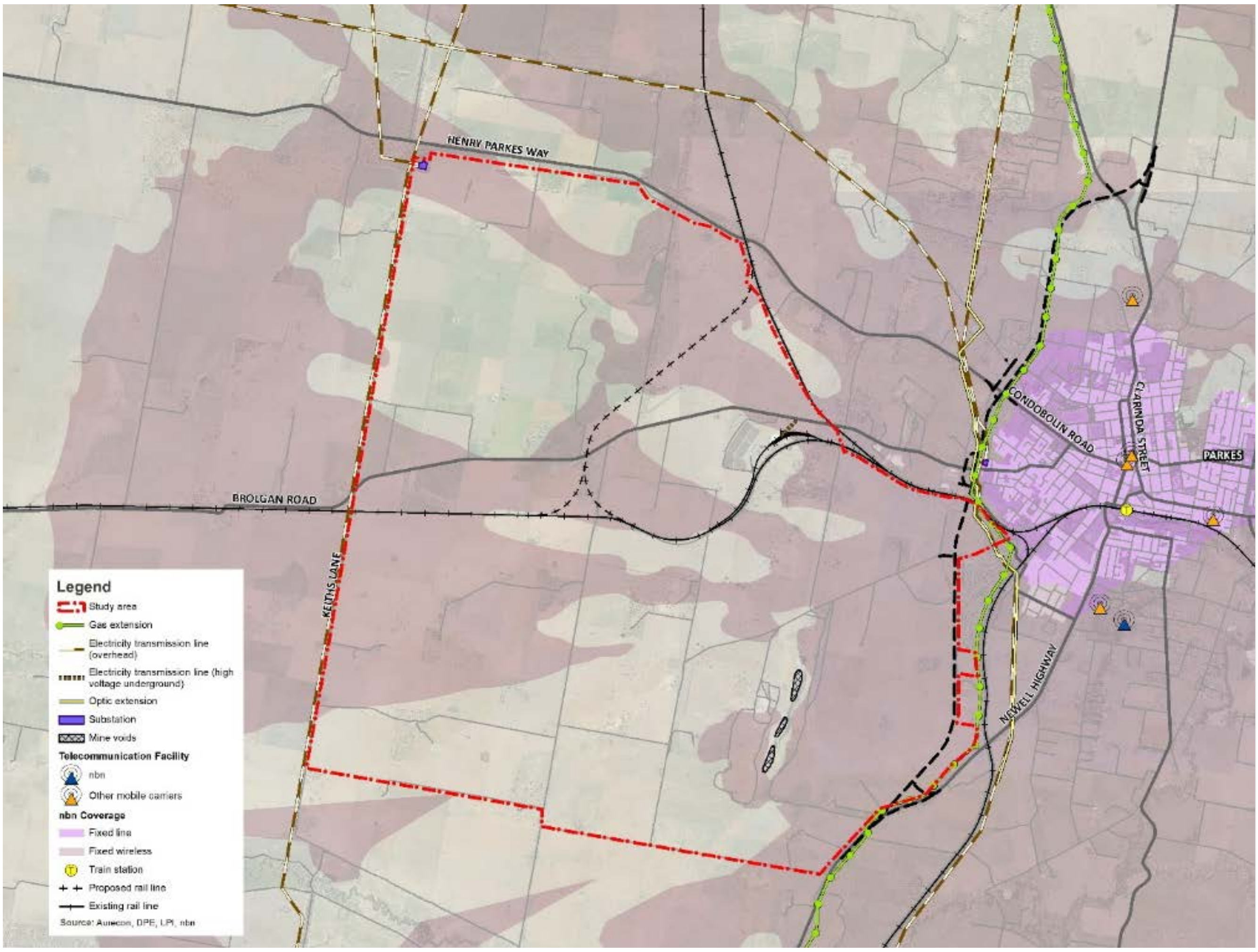
A number of small existing farm dams exist on the development site. However, these dams and stormwater infrastructure are relatively minor and could potentially be removed, or at least their behaviour altered with development. The feasibility for using existing surface water storages (e.g. farm dams) to supplement water demand may be limited. Additionally, access to these sources may require the introduction of significant extra infrastructure, e.g. additional pipeline and pump infrastructure, etc.

Given that increased imperviousness in the catchment will likely require detention systems to manage stormwater runoff, these introduced systems are opportunities for capturing stormwater runoff for re-use. These systems may be as detention basins and be at neighbourhood-catchment scale and/or at a lot scale as roof capture with rainwater tanks or capture from roofs and hardstand with detention tanks.

3.1.2 Electricity, Gas, and Telecommunications

This preliminary analysis draws from publicly available information, as well as team knowledge of the assets within the area. Figure 11 highlights how the SAP currently experiences 'patchy' National Broadband Network (NBN) fixed wireless coverage, has no gas infrastructure (although a major pipeline exists just outside the boundary near the town), and some electricity supply.

Figure 11 Existing Electricity, Gas, Telecommunications and Waste Infrastructure



Source: Aurecon, DPE, LPI, nbn (2019)

3.1.2.1 Electricity/Solar

Existing infrastructure

Electricity could be supplied to Parkes SAP from two existing substations: Essential Energy’s Parkes Town Zone Substation, and TransGrid's Parkes Substation.

Table 2 shows the available electrical capacity at these substations, based on the electricity utilities’ 2018 network planning reports.

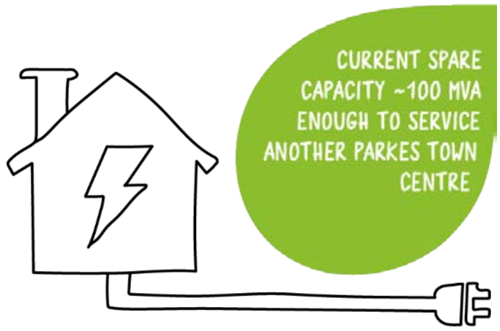


Table 2 Summary of Capacity from Two Nearby Utility Substations

Substation	Owner	Currently installed capacity	Current Max Demand		Current Spare Capacity	Future Maximum Capacity after Augmentation to These Substations
			Winter	Summer		
Parkes Town Zone Substation (33°8’12.5’’S, 148°9’13.00’’E)	Essential Energy	60 MVA	16.5 MVA	20.8 MVA	39.2 MVA	46 MVA
Parkes Substation (33° 6'9.86"S, 148° 4'30.18"E)	TransGrid	120 MVA	56 MVA	59 MVA	61 MVA	121 MVA

As summarised in Table 2, the maximum available spare capacity is 39.2 MVA at Parkes Town substation, and 61 MVA at Parkes substation. If more capacity is required, future augmentation projects such as transformer and/or switchyard upgrades could be implemented and will result in the available capacity of 46 MVA and 121 MVA at Parkes Town and Parkes Substations respectively. This implies that there is enough capacity for Parkes SAP to consume approximately twice as much power as the 2018 Parkes Town electricity demand (estimated at 20.8 MVA). Typically, an augmentation would consist of a transformer replacement or transmission line upgrades. The current capacity of the Substations should be sufficient for the estimated SAP demand without any augmentations.

Although connecting to both substations is an option, it will be more costly than a single connection. There is a trade-off to be made between cost and redundancy. The advantage of utilising two supplies would be the ability to limit outages to a portion of the SAP, although outages should not be a regular occurrence. Connecting to the two substations also introduces an additional layer of complexity in the connection process and eventual billing, because it is owned by different network operators.

The trade-off between connecting to Essential Energy’s Parkes Town Zone Substation or TransGrid’s Parkes Substation is summarised in Table 3.

Table 3 Trade Off Between Connecting to Parkes Town Zone Substation and Parkes Substation

Substation	Advantage	Disadvantage/Risk
Essential Energy - Parkes Town Zone Substation	• Lower augmentation (if required) cost due to lower voltage level.	• Less spare capacity in comparison to TransGrid Parkes Substation. • Risk that the existing substation’s footprint could not be extended to accommodate necessary augmentation. • As the substation is close to urban area, it could be difficult to obtain easement (safety clearance zone) normally required by the utility.
TransGrid - Parkes Substation	• Location is relatively close to Parkes SAP. • More spare capacity available in comparison to Essential Energy Parkes Town Zone Substation, without augmentation. • Easier to obtain easement as the substation is located outside of urban area.	• More expensive augmentation than Parkes Town Zone Substation (if required) cost due to higher voltage level requiring more expensive high voltage equipment.

Based on the final preferred land use scenario, the forecast demand for the site reaches 80MW. This is much larger than the current capacity of Essential Energy Zone Substation. Therefore, it is recommended for SAP to connect to the 132kV bus at Transgrid Parkes Substation.

The northern portion of Parkes SAP is currently occupied by a privately owned 55MW solar farm connected to TransGrid's Parkes Substation.

Planned / committed infrastructure

Solar

A development approval currently exists for a new privately owned solar farm directly adjacent to the existing solar farm, with construction expected to commence in the near future. The new privately owned solar farm is expected to have 70MW of total capacity and will be connecting to TransGrid's Parkes Substation. This means that the total solar capacity connected to this substation could exceed 120MW. This generation is significant and TransGrid will likely impose stringent connection requirements for any future solar farm. This is foreseen as a challenge if Parkes SAP were to construct their own solar farm. Other challenges include acquisition of a new area for the solar farm and application of a new development approval. Connection of a solar farm should have a minimum impact on the available network capacity to supply the SAP.

There is a potential for the SAP to leverage the existing and planned solar farms, for their generation capacity and technical capabilities to potentially enhance SAP sustainability and reduce power price uncertainty. The solar farm might be interested in a cooperative agreement with the SAP for these following benefits:

- **Financial benefit:** the solar farm might consider financial benefit if the SAP commits to a higher price than the National Electricity Market (NEM) ruling price, such as through a corporate Power Purchase Agreement (PPA) contract. PPAs are designed to deliver financial benefit to both the buyer and the seller, by protecting the buyer (e.g. the SAP) from high electricity market pricing or retail contract pricing, and by guaranteeing the seller (e.g. the solar farm) a higher revenue than they might typically experience from trading in the electricity market.
- **Marginal loss factor (MLF):** the MLF is a measure of the loss of electricity as it flows through the transmission network, due to resistive heating of transmission lines. MLFs are calculated and fixed annually to facilitate efficient market scheduling and settlement processes in the NEM. Typically, the further a generator is from a major load centre, the worse the MLF will be, reflecting high power losses through transmission networks. The increasing demand stimulated by the development of SAP will likely improve the MLF as the electricity generated by the solar farm could be consumed locally.

Several possible cooperative arrangements that the SAP could pursue with the solar farms are outlined below:

- Engage the solar farm owners to enter into a PPA contract. In this arrangement, the SAP could purchase power directly from the solar farm even if they are connected to different substations in the network.
- Connecting both the solar farms and the SAP behind the TransGrid meter via a new switching substation. Note that the new solar farm is currently in its preconstruction stage and likely to finish before SAP construction commences. Any changes to the connection of the solar farms would have to be performed as retrofit.
- The SAP could install new solar panels and batteries and enter into agreement with the solar farm owners where they operate and optimise the solar generation and battery storage onsite.

To determine which arrangement to pursue, it is recommended that the following be performed in the next stage of the project i.e. either during Final Business Case or afterwards:

- Producing daily load demand profile for the whole year.
- Understanding the optimum size of solar panel and storage that could be installed on site to meet either the whole or part of the demand.
- Performing financial assessment to compare the cost of various supply arrangements above against connecting and purchasing power directly from the utility.

Future opportunities

Waste to Resource (W2R), a privately-owned waste management company, have previously expressed interest in the prospect of establishing a new waste to energy facility in the Parkes. A waste to energy facility aims to process solid municipal waste and produce gas via the gasification of waste, generating electricity which could be used power homes and businesses in NSW.

The SAP could potentially leverage a W2R facility by connecting the W2R plant directly 'behind the meter' into SAP intake substation. The W2R facility could then connect to Essential Energy or TransGrid as an embedded generator. Under this arrangement, the Parkes SAP could directly purchase electricity from W2R via a retailer without paying network fee and associated charges.

Alternatively, connecting the waste to energy facility would require a dedicated connection point (i.e. directly to either Parkes or Parkes Town substations). This will therefore not directly impact the SAP and will have to be addressed by the generator developers separately.

At this time, it is not clear what stage this opportunity has progressed to.

3.1.2.2 Gas

Existing infrastructure

The Parkes LGA is supplied with natural gas by a 255 km long, DN150, 4000 kPa (inlet pressure) pipeline, known as the Central West Pipeline (CWP), running immediately to the west of Parkes, from the Moomba Sydney Pipeline at Marsden to Dubbo. This pipeline is owned by APA group and forms part of the Jemena Gas Networks (Jemena) NSW Country distribution area. The Jemena-owned distribution network that runs off the high-pressure cross-country line has an operating pressure of 210 kPa. The APA-owned transmission pipeline has a maximum delivery capacity of 10.1 TJ/d and supplies gas to Forbes, Parkes, Narromine and Dubbo with minimum delivery pressures of 1750 kPa, before continuing on to the Central Ranges Pipeline. In the 2017 calendar year the Parkes LGA consumed approximately 69 TJ of natural gas with the customer breakdown summarised in Table 4.

Table 4 Natural Gas consumption in the Parkes LGA for 2017

Customer Type	Number of Customers	Average Consumption per Customer (GJ/year)	Total Consumption for Customer Type (GJ/year)
Residential	2,261	19.39	43,840
Business	108	234.8	25,360

Source: Jemena

In the same time, the total usage of the 4 LGAs was approximately 411 TJ (51 TJ upstream of Parkes, 291 TJ downstream). In January 2018, APA group identified that the CWP possessed spare capacity of 3 TJ/d. This indicates that the transmission pipeline has significant capacity that can be utilised by the SAP. To take advantage of this, the SAP has two main options to access the gas supply. These are: to tie-in to the transmission line if a very high capacity or supply pressure are required, or to tie-in to the existing Jemena distribution network in Parkes if required capacity or supply pressure are low.

If tying in to the Jemena distribution network, the impact on the existing network must be considered. As shown in Table 4, approximately 63% of the natural gas usage in the Parkes LGA was by residential customers while the remaining 37% was from business customers. Additionally, the average business customer uses approximately 10 times more gas than a residential customer. Thus, the network will be far more sensitive to the addition of businesses in the SAP than residential infrastructure. However, if the SAP is predicted to significantly increase the need for population in the Parkes LGA then the further impact of this on the gas demand of the area will need to be considered. Jemena defines both residential and business customers as 'volume market' as they consume less than 10 TJ/year (per customer). For industrial customers consuming more than 10 TJ/year, Jemena defines these as 'demand market' and will work with these industries to provide the required capacity.

The current gas supply is sufficient to meet the needs of Parkes and Central West Region. At present, there is only one industrial use in the Parkes SAP locality, a limestone mine (formerly London-Victoria Gold Mine) run by Westlime; additionally, there is an SCT logistics hub containing an advanced manufacturing facility which is also likely to require considerable natural gas supply. There are currently no residential customers in the Parkes SAP.

Planned / committed infrastructure

The current Jemena gas supply is sufficient to meet the needs of the Parkes and surrounding area. Jemena has expressed interest, in their Draft Plan 2020, to upgrade current infrastructure as well as connect new customers, although no specific reference is made to the Parkes area or particularly the SAP. Their desire to invest for the long-term is conducive to them being able to provide infrastructure for the SAP. For servicing the future SAP, it could be expected of Jemena to monitor the developments within the SAP and provide additional supply and gas infrastructure as necessary. Early coordination between Jemena and the other road or utilities upgrade works in the SAP would be beneficial to take advantage of any possible construction efficiencies.

There is funding committed towards a Jemena-owned gas take-off from the main Parkes pipeline that runs down Brolgan Road in the SAP towards Lot 55. This 3.5 km long, 110 mm diameter, 210 kPa pipeline with a nominal capacity of 1 TJ/d is likely to be able to assist in the provision of gas to the SAP.

The degree to which Jemena's distribution network needs to be upgraded will be impacted by the required supply pressure of the gas purchaser as well as the location of the connection to the gas main. Typically, industrial customers will require gas to be supplied at a pressure of around 100 kPa which may require increased upstream gas pressure in the pipeline as the operating pressure range of the Jemena gas pipeline in the area is 70-200 kPa; the addition of residential customers is unlikely to require an increase in gas supply pressure. In any case, Jemena will be able to provide the required supply as this will prove economically viable for them and the transmission pipeline has additional capacity.

Future opportunities

Jemena is currently implementing a Power to Gas trial in western Sydney, known as Project H2GO. The trial uses electricity generated from renewable sources to produce hydrogen gas from water, in a process known as electrolysis, which enables energy from renewables to be stored for longer periods of time than by batteries. The hydrogen gas will be sent to Jemena gas networks in Sydney where it will supplement the gas supply to 250 homes and power a hydrogen refuelling station. This trial will show whether the existing natural gas network infrastructure can contribute in a zero-carbon future, by demonstrating the extent to which hydrogen gas can be successfully injected into the gas network. Assuming trial success, a third party could also produce hydrogen gas and sell this to Jemena for injection into their gas network. One such party is the proposed waste to energy facility in the Parkes SAP which could export energy or gas from the treatment of municipal waste to local utility networks.

3.1.2.3 Telecommunications and Internet Services

Existing infrastructure

Parkes and the SAP area are serviced by all mobile carriers with both 3G and 4G services. Parkes also has 5G capability although this has not yet been implemented.

The nbn^{tm} is present in the area, servicing the residential/commercial core of Parkes with Fixed-line broadband. The surrounds are generally well serviced by the nbn^{tm} Fixed Wireless broadband service. Due to the undulating terrain, some areas to the north of the town centre have a reduced level of coverage. NBN Co announced that at the completion of the rollout in Parkes as of February 2017, 5,100 homes and businesses in Parkes were able to connect to the nbn^{tm}, of these, 745 premises on the outskirts of Parkes would have access to the Fixed Wireless service. The connection uptake as of January 2019, has over 3000 premises connected to the nbn^{tm} and between 1800-2000 yet to connect. Less than 50 premises were not able to obtain any connection.

Parkes SAP is serviced by the nbn^{TM} Fixed Wireless network, which is partially available across the investigation area, with the southern and north western corner of the SAP receiving little to no coverage. The nature of the terrain within the investigation area has also resulted in a reduced level of mobile coverage in the north west corner, as indicated by publicly available carrier coverage maps. A Fixed-line connection is present on the eastern perimeter of the SAP. Extension of this service type to the wider SAP area would likely be considered cost prohibitive.

A private entity, BitWave Networks, also operates a Fixed Wireless network as an alternative to the nbn^{tm}, in the Parkes area. The coverage footprint for this service includes the SAP and provides services to business, government and domestic clients. This service would be available to businesses within the SAP.

There is also a VOCUS Communications regional fibre network line that runs north-south through Parkes that connects Brisbane to Sydney via an inland route. An additional TPG line is also present to the west of Parkes, which ties into the VOCUS fibre. The location of this infrastructure is not readily available, and more detail is required from the infrastructure owners to locate and determine suitability for use in the SAP.

Planned / committed infrastructure

An increase in demand for data and call services in the SAP will place additional loading on the existing mobile communications infrastructure in and around Parkes. Generally, it will fall to the individual carriers to accommodate an increased demand for services by either upgrading existing facilities or by building new base stations should they be required. This is typically a reactive process on the carrier's behalf, with increased demand being placed on facilities triggering a process of either upgrade or infill to accommodate the new load. The upgrading of existing facilities in the area would depend on a range of factors including tenure, structural capacity, coverage objective of a particular carrier and the level of demand being placed on the network at the time.

Full coverage of the investigation area is achieved by mobile telecommunications providers (Telstra, Optus, Vodafone.) To achieve full nbn™ Fixed Wireless coverage across the investigation area several options are available including the following.

- The existing NBN Co facility located on Back Yamma Road could be upgraded to provide coverage to the SAP area, which would likely involve a height extension to the facility (pending a structural assessment);
- The construction of a new rooftop facility at an elevated point within the SAP once an appropriate candidate is built and identified
- The construction of a new greenfield facility within the SAP upon NBN Co reaching an agreement with a willing landowner
- Proactive engagement with the nbn™ Local team

The committed funding to provide fixed wireless connections, including two to three towers, to the SAP as detailed in the Growing Local Economies Business Case 2018, would allow for Parkes Shire Council to encourage the deployment of network infrastructure through the provision of purpose built, ready to use facilities.

Future opportunities.

The rollout of 5G mobile coverage has begun in regional NSW, with Telstra and Optus committing to the technology becoming increasingly available from 2019 onwards. The demand for this service will likely push other service providers to follow with customers and business users expecting stable and super-fast mobile internet connections. The capacity of this service to handle large amounts of data will mean some users may rely solely on a mobile data connection for certain aspects of business. The provision of a purpose-built facility (monopole or lattice tower) within the SAP, would allow for carriers wishing to provide 5G coverage to the area, a simple option upon which to locate equipment. Connection into a fibre network would be made possible through the nearby fibre networks.

The early engagement between Parkes Shire Council and the nbn™ local team on the provisioning of fibre to the SAP, will also allow for business and industry to take advantage of the fixed line network. nbn will ultimately review the business case for the provisioning however support indicated by Parkes Shire Council and committed funding to assist in the deployment of services should expedite and support this.

The introduction of a Long Range Wide Area Network (LoRaWAN) in the SAP, will help enable Internet of Things (IoT) connectivity for land uses within the Intensive Livestock Agriculture zone. This type of network could take advantage of the previously mentioned tower facility allow business owners a low-cost sensor connection option.

3.1.3 Waste and Resources Recovery

Existing infrastructure

Parkes Shire Council operates seven waste management facilities within the Parkes LGA, including the Parkes Waste Facility and others located in Alectown, Bogan Gate, Gunningbland, Peak Hill, Trundle and Tullamore.

The Parkes Waste Facility landfill site is estimated to have a 115 year remaining life. This is based on ~11 tonnes/year of w aste landfilled at the site, and an estimated landfill capacity of 1,329,000 tonnes.

The Parkes Waste Facility, an EPA licensed landfill (No. 6016), is located at 104 Brolgan Road, just outside the Parkes SAP to the east and on the western border of Parkes Town. It is the largest of the waste management facilities operated by the Parkes Shire Council and receives the majority of domestic and commercial waste servicing approximately 11,000 people.

Several of the smaller waste management facilities in the region are nearing the end of their operational life, or are near capacity, and it is understood waste transfer stations will be established in these rural areas to divert waste to the Parkes Waste Facility when those facilities close. The existing waste management facility servicing Parkes Shire Council has airspace to last up to 115 years based on current filling rates and has an additional 70 hectares of land not yet developed. (PSC, 2016). A summary of the existing waste management facilities within a 75km radius of Parkes is provided in the table below (75km is assumed to be the maximum economical distance to transport waste by road).

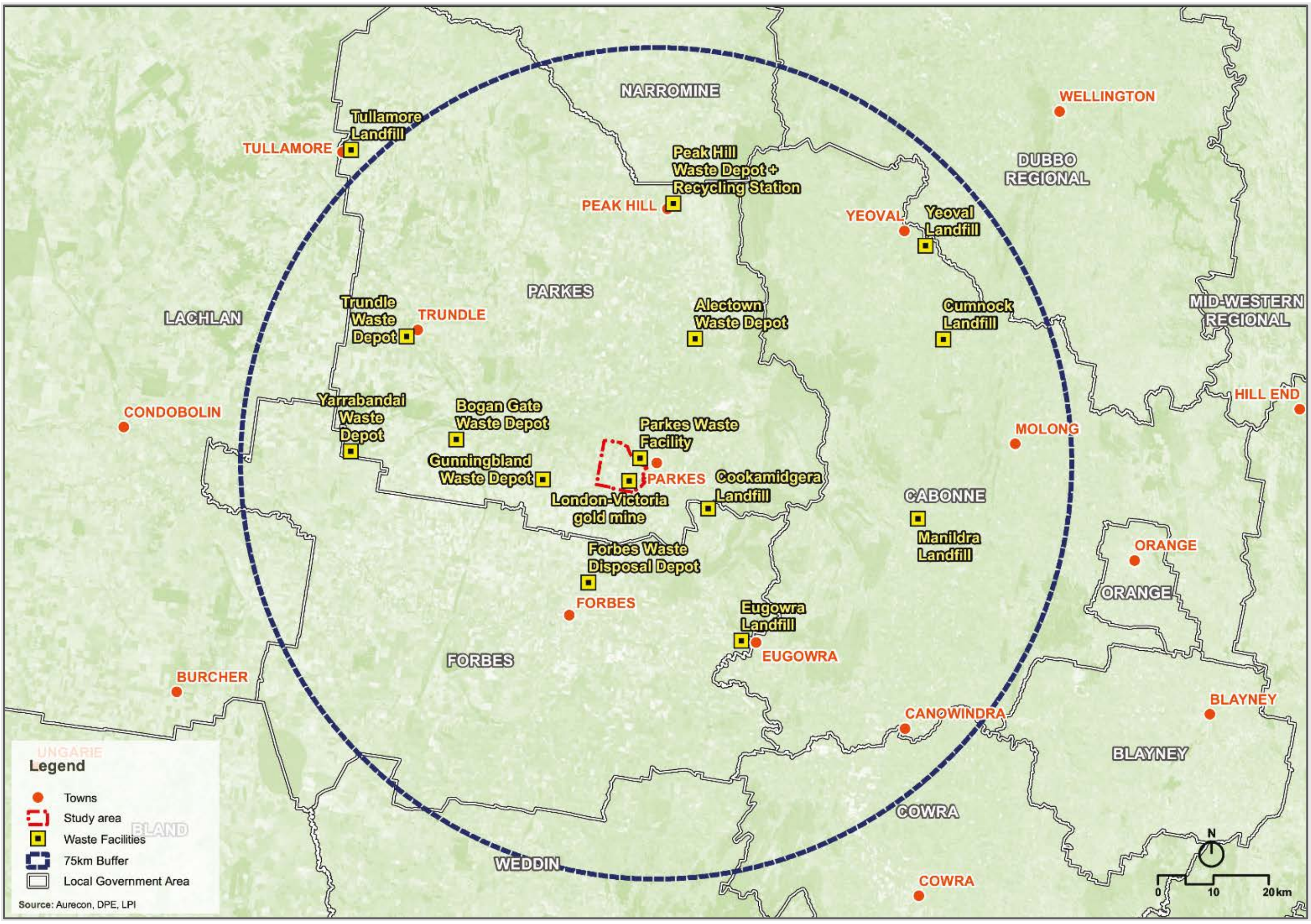
Table 5 Summary of waste management facilities surrounding Parkes SAP

Facility	LGA	Distance from Parkes (km by road)	Population Served	Remaining Lifetime (years)
Parkes Waste Facility	Parkes Shire Council	3.5	11,000	110+
Bogan Gate Waste Depot	Parkes Shire Council	41	150	10+
Forbes Waste Depot	Forbes Shire Council	28	N/A	N/A
Trundle Waste Depot	Parkes Shire Council	54	400	10+
Peak Hill Waste Transfer Station	Parkes Shire Council	50	1100	N/A*
Cumnock Landfill	Cabonne Shire Council	62	N/A	N/A
Manildra Landfill	Cabonne Shire Council	63	N/A	N/A
Eugowra Landfill	Forbes Shire Council	41	N/A	N/A
Tullamore Landfill	Parkes Shire Council	90	200	10+
Yeoval Landfill	Cabonne Shire Council	76	N/A	N/A
Alectown Waste Depot	Parkes Shire Council	25	200	2-5
Gunningbland Waste Depot	Parkes Shire Council	35	50	2-5
Yarrabandi Waste Depot	Parkes Shire Council	55	50	2

Source: Parkes Shire Council
** Remaining lifetime is not applicable for the Peak Hill Waste Transfer Station.*

Figure 12 provides an overview of the locations of nearby waste management facilities in relation to Parkes, including the London Victoria gold mine.

Figure 12 Waste facility locations – 75 km radius from Parkes



Source: Aurecon, DPE, LPI (2019)

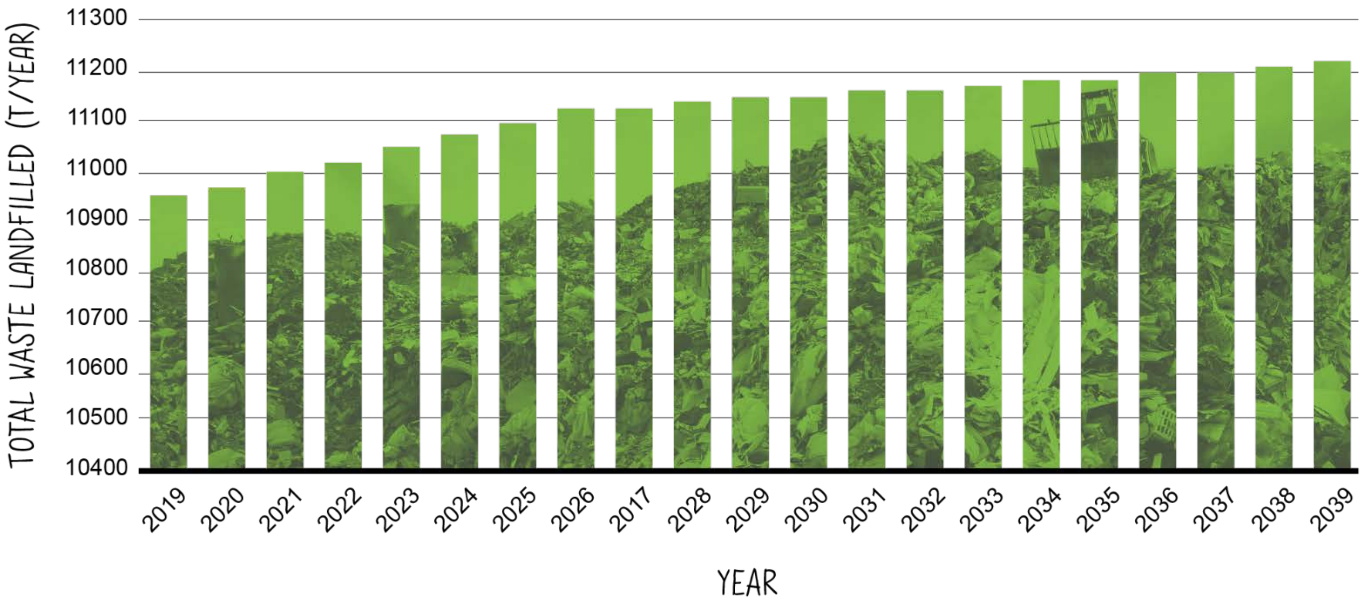
An assessment of the existing waste streams from municipal, commercial/industrial and construction/demolition sources processed at the Parkes Waste Facility, along with recycling activities was undertaken as well as high level projections and forecasts.

Kerbside collection of domestic waste and organic waste is undertaken, under contract, by JR Richards & Sons. Overall 46% of waste is diverted from landfill, of this 12% is recycled. All green waste is mulched and used on site as a soil additive for capping works, while construction & demolition waste is crushed and used as daily cover. Recyclate is sent to Sydney for processing.

From the NSW EPA waste stream report and summary of recycling activities, during 2017-2018 the mass of waste and capping material landfilled at the Parkes Waste Facility was estimated at 10,873 t/year. Based on the current population within the Parkes LGA, this equates to approximately 0.71 t/person/year.

Figure 13 provides a twenty-year projection of the waste mass being generated, accounting for the slight population increase anticipated in Parkes LGA (SGS, 2019).

Figure 13 Waste to Landfill – 20-year projection (Parkes LGA, without SAP).



Source: SGS 2019

The estimated remaining lifetime of the Parkes Waste Facility is 115 years[6]. A cumulative projection of the landfilling rate over 115 years provides an estimate of the remaining landfill capacity at Parkes Waste Facility at 1,329,000 t. It can be concluded that the existing waste management facilities servicing Parkes and its surrounds are sufficient for the LGA's need for the foreseeable future.

Planned / committed infrastructure

PSC is not considering the provision of specialised landfilling services for the SAP for the disposal of non-municipal waste streams, and could not, without a significant upgrade of its landfill. The landfill accepts low level domestic waste and is unlikely to be suitable for the disposal of industrial wastes. If there are special wastes from the SAP that require higher level facilities, then these wastes should be identified and cost-efficient disposal options considered. Most likely a new facility will have to be constructed in a different location to handle special waste streams that could be generated within the SAP.

The neighbouring LGA's within the 75km radius of Parkes have no plans to upgrade or expand their facilities. The large waste disposal facility at Cabonne Shire Council also has strict operating restrictions imposed on it by its Consent by the Land and Environment Court; therefore, it can be seen that none of the neighbouring LGA's waste management facilities are viable alternatives to accept PSC's waste.

Future opportunities

Studies have been undertaken by Parkes/Forbes in the past to develop a regional waste disposal facility at the London-Victoria gold mine, which falls within the borders of the SAP. At this time, neither Parkes or Forbes are progressing further with this study, although it must be mentioned that it is a potentially viable future waste management facility location and the owner has expressed interest. However, there would be a long lead time for the development of this as a waste management facility as it is still an operating mine and the site would require substantial rehabilitation before it could be developed; careful consideration would have to be undertaken to compare this against the option of purchasing less disturbed land adjacent to the site to develop. There have been suggestions that the site could be developed by the private sector and operated as a hazardous landfill, run in parallel with existing Parkes Shire Council facilities.

Waste to Resource (W2R), a privately-owned waste management company, have previously expressed interest in the prospect of establishing a new waste to energy facility in the Parkes SAP. Such a development would aim to mitigate the issue of landfill waste by conversion to energy through environmentally friendly advanced gasification methods and could be used to power homes and businesses in NSW. The facility could process household waste and sewage through combustion to produce pure hydrogen. Waste maybe transported from Sydney, Melbourne,

[6] Parkes Shire Council, 2016

and Brisbane via rail in accordance with NSW EPS's Energy from Waste Policy Statement (2015). Waste to energy is considered a complementary adjacent business possibility using the intermodal transport facility.

At this time, no specific proposal has been lodged or is known for a particular development

3.2 Transport – National, State, Regional and Precinct Analysis

Parkes is strategically located at the intersection of several key roads and rail lines serving regional NSW, with critical transport infrastructure to be delivered in the coming years. Development of the Parkes SAP has the potential to increase the road freight mode share to rail, in alignment with actions identified in the *NSW Freight and Ports Plan 2018-2023* to increase productivity of the network.

This report section sets out the existing transport provisions surrounding the Parkes SAP and identifies the risks, issues and opportunities associated with current and future transport networks.

3.2.1 Road

3.2.1.1 Road hierarchy

Parkes is situated at the intersection of national, state and regional roads that facilitate connectivity between local communities and also serve as key links between origin and destination locations of various commodities transported by freight (see Figure 14). Analysis of freight forecasts at a Statistical Area Level 3 (SA3) indicates that agricultural commodities such as grain and livestock make up a large majority of the imports and exports within and external to the Lachlan Valley area.

Figure 14: State and Regional Road Networks

Source: Aurecon, DPE, LPI (2019)

3.2.1.2 Key roads

Table 7 highlights six key roads that interact with the Parkes SAP precinct area, how they interact on a regional basis, and constraints based on their existing design. Parkes Shire Council has received committed funding to upgrade a section of Brolgan Road to enable heavy vehicle access.

Table 6 Summary of key roads that interact with the Parkes SAP

Road	Region	Scale	Approximate AADT Volumes	Function	Access	Constraints
Newell Highway	National Land Transport Network (A39) and State	Two-lane, two-way with overtaking bays Speed limit varies 80-110km/hr Approved for use by PBS Level 2 vehicles	4000 vehicles (25% HVs)	Key freight link between Queensland and Victoria, main spine through regional NSW	Passes through Parkes town centre (north-south), with a proposed (north-south) bypass branching off to the west of the highway to provide more direct access to the SAP and access for 36.5m PBS Level 3A vehicles, closing an access gap from Forbes to Dubbo	Speed limit reduction to 50km/hr through the town centre, coupled with unsignalised intersections may cause congestion
Henry Parkes Way	State	Two-lane, two-way 80-100km/hr speed limit	1500 vehicles (16% HVs)	Key connector between Parkes and Sydney via Orange (main freight corridor) as well as several townships east and west of Parkes	Passes through Parkes town centre (east-west), and will be the northern edge of the Parkes SAP	The Condoblin Road and Dalton Street section is not approved for PBS Level 2 and Level 3A vehicles. Access is allowed on Westlime Road and Hartigan Avenue.
Brolgan Road	Local	Two-lane, two-way, changing to two-way unmarked road west of Westlime Road 80km/hr speed limit (50km/hr east of Westlime Road)	785 vehicles (19% HVs)	Local road which is the main connector to the town waste facility, agricultural areas and is the key spine road for the Parkes National Logistics Hub	Starts at intersection of Middleton Street and Hooley Street in Parkes town, branching westwards. Will be east-west spine through middle of Parkes SAP	Not approved for use by PBS Level 2 and Level 3A vehicles on majority of roadway (the only section is between SCT Logistics and Hartigan Avenue intersection).
Westlime Road	Local	Two-lane, two-way 80km/hr speed limit		Local road connecting Henry Parkes Way and Brolgan Road, leading to Hartigan Avenue		
Hartigan Avenue	State	Two-lane, two-way 80km/hr speed limit (50km/hr when it joins Westlime)	650 vehicles (35% HVs)	Key road utilised by road freight to access the south and east	Connects Newell Highway and Brolgan Road, allowing freight vehicles to bypass residential areas	The section between London Road and Newell Highway is not approved for PBS Level 3A vehicles

		Approved for use by PBS Level 2 vehicles				
London Road	Local	Two-lane, two-way 80km/hr speed limit	No AADT information available	Small local road connecting largely agricultural areas and several landmarks (Westlime Quarry, Parkes Golf Course) to Parkes town centre	Access off Hartigan Avenue via traffic signals to control the level crossing safety for Road Trains accessing the Westlime Quarry	London Road is accessible to PBS Level 2 and 3A vehicles until the unsealed section of London Road (3.3km from Hartigan Avenue intersection)

3.2.1.3 Travelling Stock Routes

Travelling Stock Routes (TSRs) are an extensive network of public land that was established for the transport of cattle and sheep to market and have come to serve a broader function for biodiversity conservation, indigenous culture and recreation. TSRs are roads along which livestock can be legally driven, and usually have wide verges on which cattle can graze (shown in Figure 15).

Figure 15: Travelling Stock Routes

Source: Aurecon, DPE, LPI (2019)

Across the state, 75% of TSRs are classified as Category 2, meaning they are used for both travelling stock and other purposes. A further 24% fall into Category 3, meaning that they are rarely used for travelling stock or to support emergencies but serve important functions for conservation, cultural heritage or recreation. More information on the TSR state classification system can be found below in Table 6.

Table 7 Travelling Stock Route State Classifications

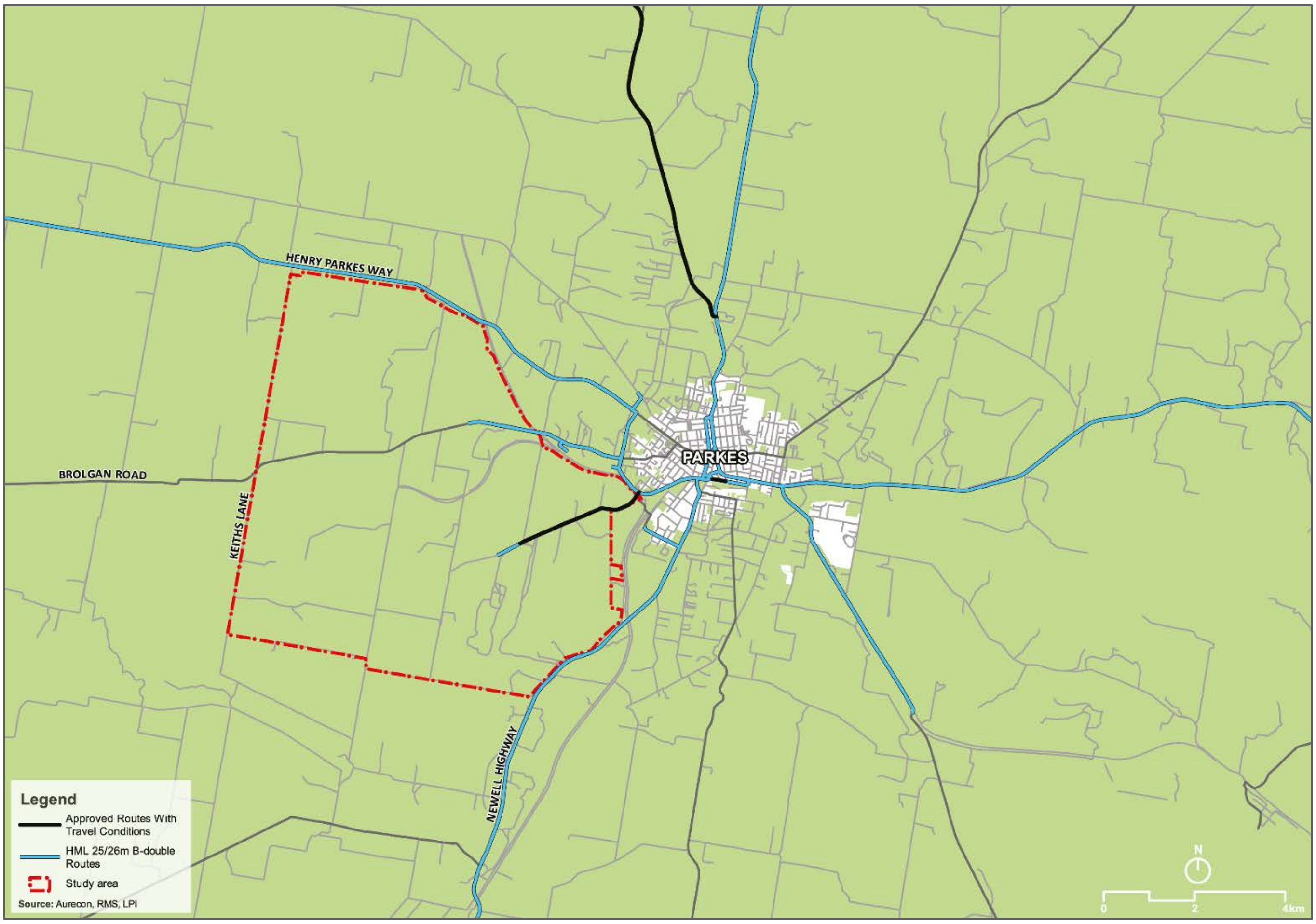
Category	Description
Category 1	TSRs that are only used for travelling stock or emergency management and biosecurity purposes. These sites have no other important uses or values.
Category 2	TSRs that are used for travelling stock, emergency management or biosecurity purposes, but they are also important and used for other reasons (i.e. biodiversity conservation, Aboriginal cultural heritage or recreational purposes).
Category 3	TSRs that are rarely if ever used for travelling stock or emergency management, but are important, valued and used for other reasons (i.e. biodiversity conservation, Aboriginal cultural heritage or recreational purposes).
Category 4	TSRs that are no longer used or valued for any of the above reasons.

3.2.1.4 Regional road constraints and growing demand

Figure 16 shows the road network surrounding Parkes, accessible to Performance Based Standards (PBS) Level 2 vehicles. Figure 17 is a similar map showing PBS Level 3A (Road Train Type I) vehicle access. The following maps consider PBS Level 2 and 3A to be operating on Higher Mass Limit (HML). Road train access on Henry Parkes Way, Brolgan Road, Westlime Road and Hartigan Avenue is constrained due to the restriction of road train access on the Newell Highway (turn path constraints and level crossing conflicts) and further East of Parkes.

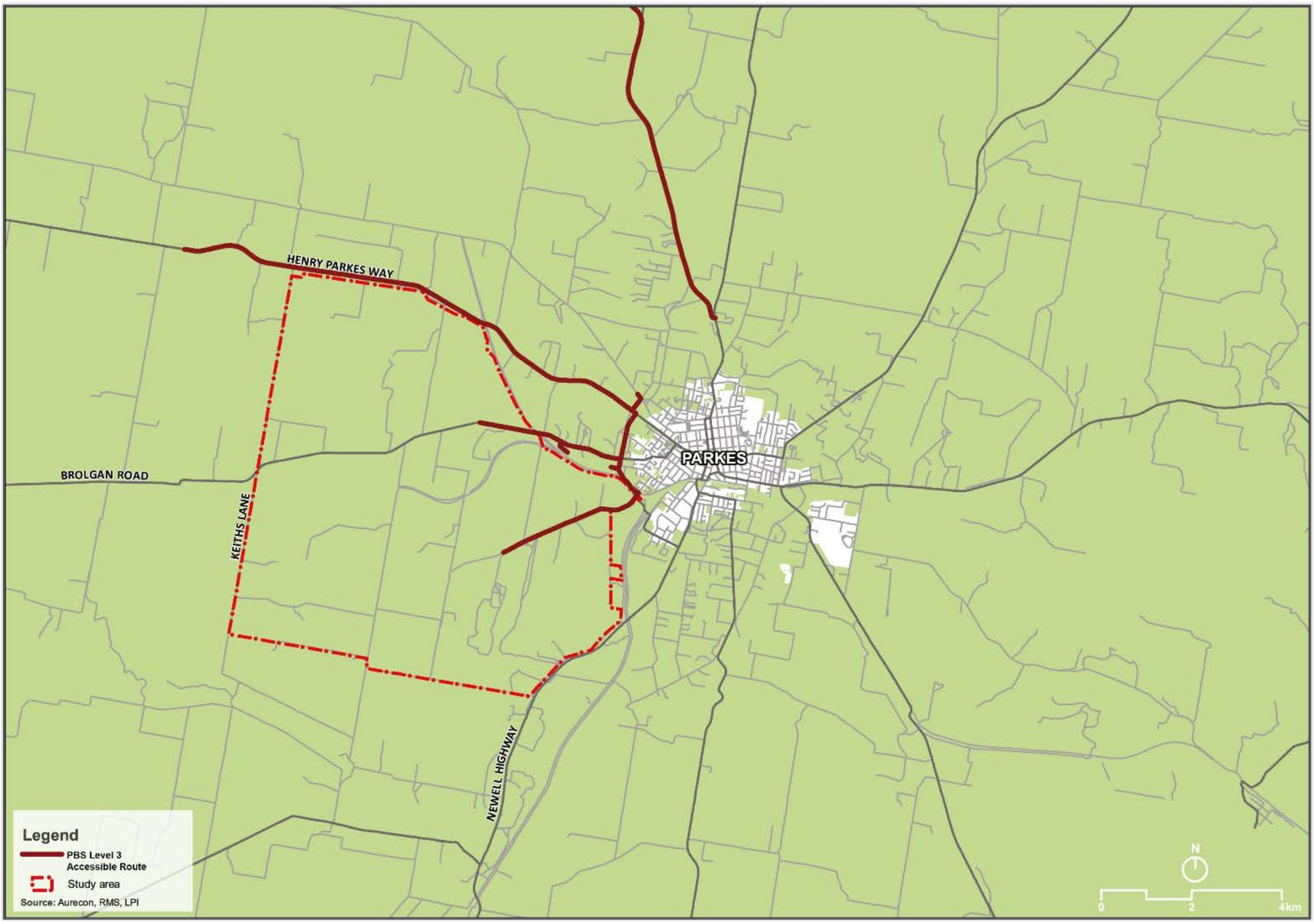
There are signalised rail level crossings (4 in total) on Henry Parkes Way, Brolgan Road, London Road and Coopers Road due to the alignment of the Main West and Parkes to Goonumbla rail freight lines interfacing with the SAP. This could lead to extended wait times on each road to allow passage of freight trains entering and leaving the SAP.

Figure 16 Parkes PBS Level 2 Access Road Network



Source: Aurecon, RMS, LPI (2019)

Figure 17 PBS Level 3 (Road Train Type 1) Access Map



Source: RMS Higher Mass Limit and Road Train Interactive Map

The freight task of regional NSW is forecast to grow by approximately 12% by 2036 (from 255 million tonnes to 286 million tonnes)[7] with the majority of regional imports and exports currently transported by road.

Roads and Maritime Services permanent vehicle classifier on the Newell Highway, 5km south of Forbes town centre (near Greens Road), collects data on the northbound and southbound traffic demand along the highway. Heavy Vehicles (HVs) make up approximately 36% of the average daily vehicular traffic passing through the area (a total of approximately 2,560 vehicles per day). A second classifier located 50km north of Parkes on Newell Highway indicates similar traffic volumes and HV percentages.

The results of origin-destination (OD) surveys done by Roads and Maritime in 2014 indicate that 58% of all vehicles captured by the different OD pairs analysed in the *Parkes Bypass Traffic and Transport Assessment Report* travel through the town centre, between Newell Highway/Bogan Road intersection (north) and Newell Highway/Sale yards Road intersection (south). East-West OD pair data was not available, however daily traffic volumes on Henry Parkes Way indicate the importance of the road as a key connector to the SAP (approximately 3,000 vehicles on Henry Parkes Way east of the town and 1,500 vehicles on Henry Parkes Way west of the town).

Daily traffic count data from the report also shows that approximately 10,000 vehicles utilise Newell Highway/Bogan Street to travel northbound and southbound through Parkes. Coupled with the percentage of HVs (36% of traffic) traversing the Parkes town centre to access the SAP, which may pose a road safety risk to vulnerable users (pedestrians and cyclists) around the town centre and increase congestion within the Parkes township. There is an opportunity to divert northbound and southbound HVs via the proposed Parkes bypass to reduce the volume of HVs operating in proximity to residential or retail areas. For eastbound and westbound traffic, there is potential for a future East-West bypass to the north or south of Parkes, connecting to the Parkes bypass. This is further discussed in Section 4.4.

[7] NSW Freight and Ports Plan 2018-2023, Transport for NSW

Indeed, the vision for the SAP as a leading freight and logistics hub may be compromised by productivity costs due to local traffic congestion, accessibility, safety and amenity issues on the local transport network. An improved understanding and assessment of the future transport impacts and congestion generated by the SAP should be considered at the master planning stage.

A more detailed transport assessment, including modelling, may also be required at a later stage to inform the effects on increased traffic movements through key intersections, the potential for a southern bypass of Parkes, and any associated costs. This would facilitate an improved understanding of connections in to the SAP so that the local and regional road networks are appropriately managed. To mitigate potential liabilities, the masterplan process will need to resolve funding, ownership and maintenance responsibilities for new infrastructure across the various jurisdictions, including intersects with the Regional NSW road network, several rail crossings/bridges, and interfaces with the local road network.

Key intersections in Parkes affected by the growth in east-west freight movements should be evaluated with basic SIDRA modelling in future stages, including:

- Forbes Road and Hartigan Avenue
- Grenfell Street and Bogan Street
- Bogan Street and Bushman Street
- Clarinda Street and Short Street

As part of the planning approvals process, the development authority should consider the traffic impacts of the specific developments against the broader traffic assumptions used in this Transport Plan to ensure they are aligned and accurate as the assumptions may need further assessment. Furthermore, the application of exempt and complying pathways for development necessitates the adoption of guidelines and standards that should be used to inform the process, including (but not limited to):

- National standards for HV movements
- Road corridor design standards
- Active transport infrastructure
- Construction and traffic management for developments
- Truck turning facilities
- Vehicle layover/trailer storage

3.2.1.5 Newell Highway Parkes Bypass

The Newell Highway corridor has developed as a series of links between regional towns and centres, providing improved access for local trips and regional travel. However, as local traffic volumes have increased alongside growth in town centres, there is increasing interaction with inter-regional traffic that has impacts on the efficiency and safety of the road network.

The Newell Highway Corridor Strategy (2015) identified Parkes as a key site for a bypass due to its position on the highway as an essential freight route to be maintained for industry growth. Justification for the Parkes bypass centred around avoidance of HV constraints within Parkes town centre (level crossings, dangerous interactions with local traffic and pedestrians, and narrow road widths that do not allow sufficient space for HVs turns) and improvements in interstate movement of freight between Victoria and Queensland.

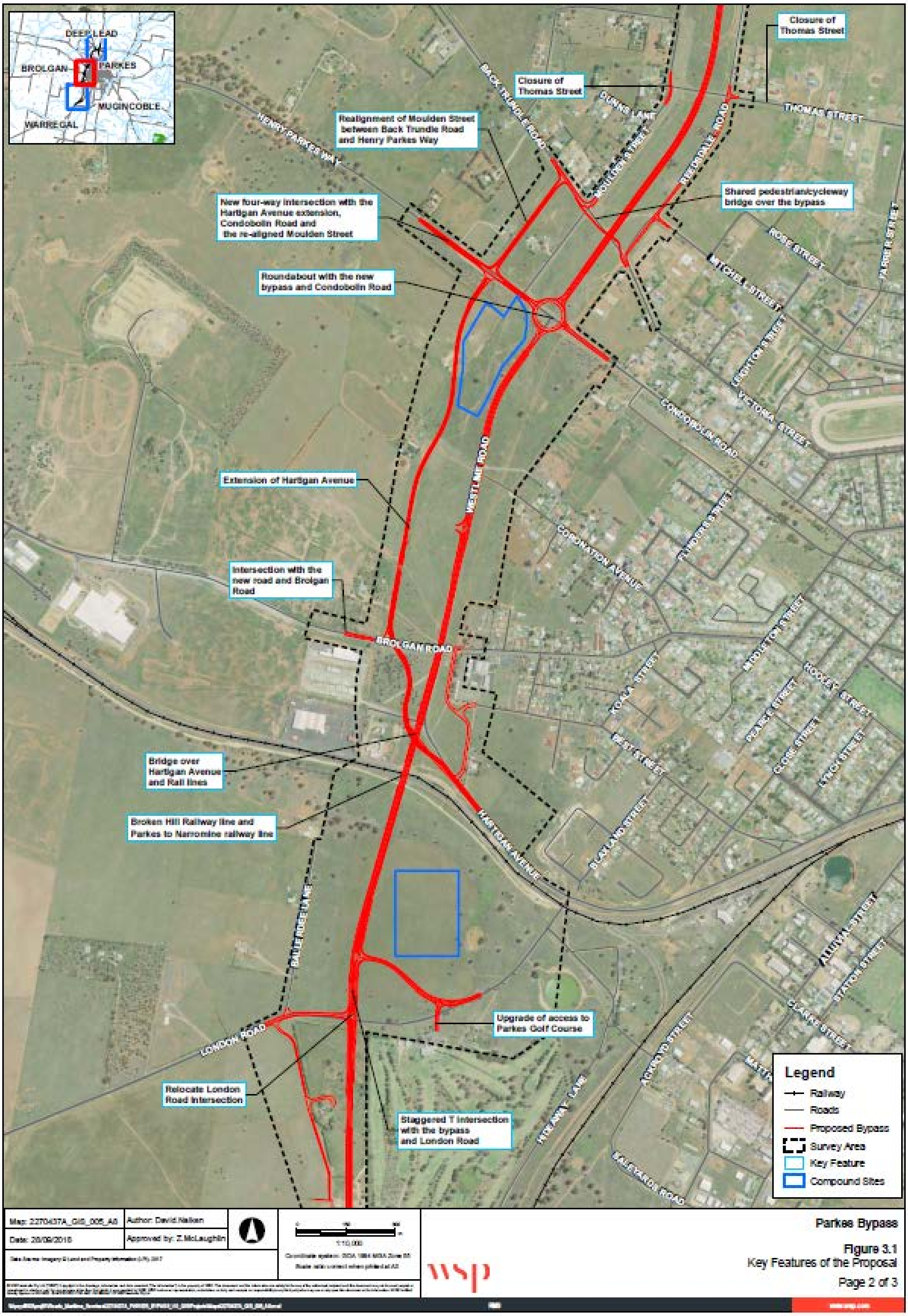
With Parkes' strategic freight transportation location at the intersection of the Newell Highway and interstate rail lines, the proposed bypass would enable safe access for large freight vehicles, improve safety of railways level crossings, facilitate future connectivity to the SAP, and improve the amenity and pedestrian access within the town centre.

As detailed in the Newell Highway REF (2018) the proposed 10.5 kilometre Parkes bypass of the Newell Highway would be located about 1.5 to 2 kilometres west of the existing Newell Highway alignment in Parkes. The features of the proposed bypass include:

- A new two-lane bypass (one lane in each direction) with four key intersections A bridge over the Broken Hill and Parkes to Narromine rail lines and Hartigan Avenue, as well as a shared pedestrian/cycleway bridge over the Parkes bypass connecting Victoria Street and Back Trundle Road
- An extension of Hartigan Avenue that would connect to Brolgan Road (west of the bypass) and Condobolin Road (Henry Parkes Way)
- Changes to local roads to tie in with the new bypass

It is anticipated that construction would start in 2020 and would take approximately three years to complete. This is subject to funding, weather and access considerations. The proposed alignment for the bypass around Parkes is shown below in Figure 18, which also highlights the key intersections that will interact with the SAP.

Figure 18 Proposed alignment of Parkes bypass



Source: Newell Highway Parkes Bypass, WSP (September 2018)

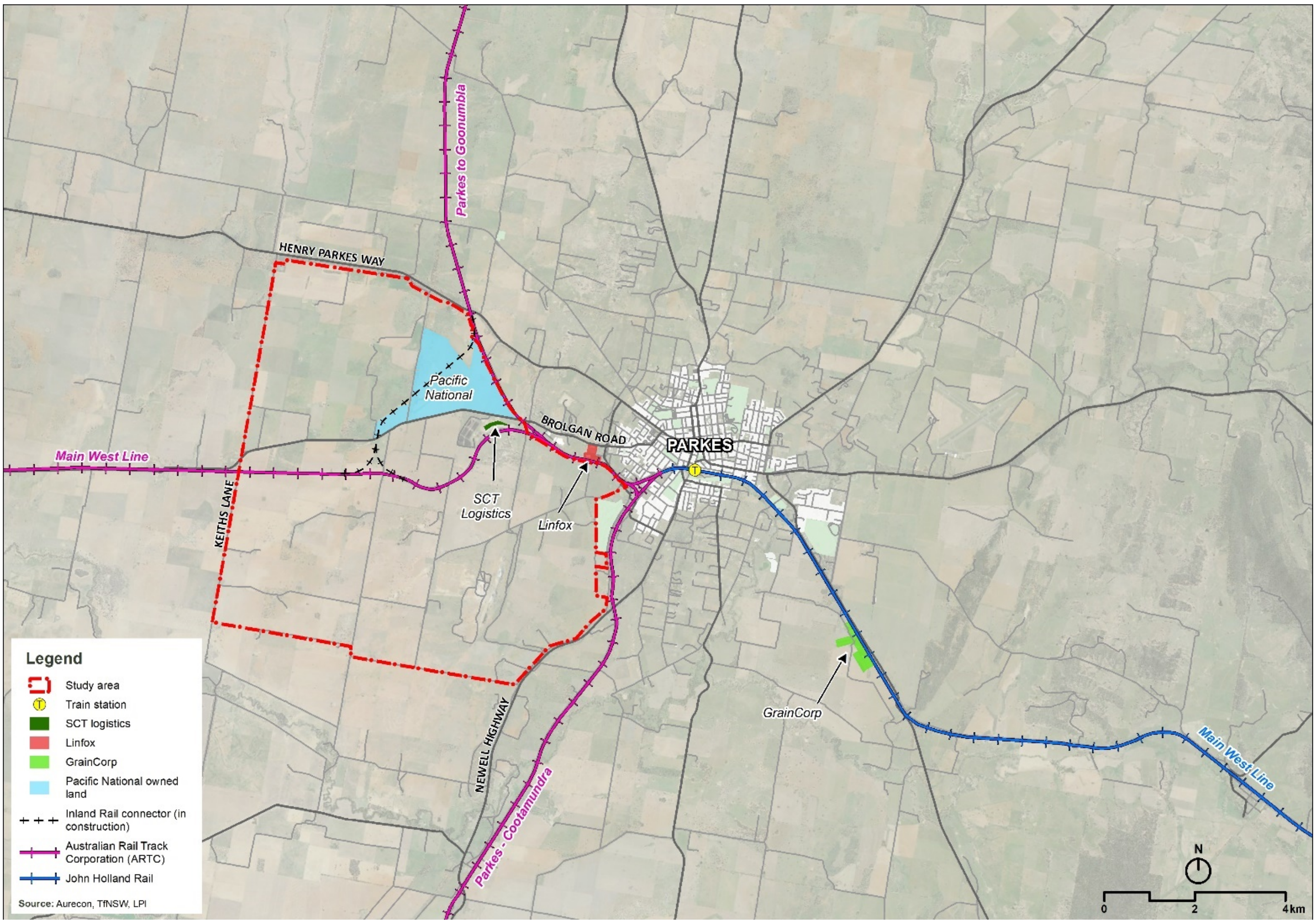
3.2.2 Rail

The Parkes SAP will be well serviced by rail infrastructure, benefitting from the major investment ($9.3 billion worth of Government investment) slated as part of the Inland Rail project scheduled to begin service in 2025. The Inland Rail Programme Business Case was submitted to the Inland Rail Implementation Group for endorsement in 2015, with ARTC developing a 10-year delivery programme subject to the timing of Government decision to proceed with the project.

The following key freight lines pass through Parkes, as shown in Figure 19:

- Main West Line: Extending from Sydney to Adelaide via Parkes and Broken Hill. The line continues to Perth from Adelaide
- Parkes to Cootamundra Line: Extending to Sydney, Melbourne and the Riverina
- Parkes to Goonumbla Line: Extending to Port Kembla. The line is currently being upgraded to the Parkes to Narromine link of the Inland Rail project.

Figure 19: Parkes connection to Key Rail Freight Lines



Source: Aurecon, TfNSW, LPI (2019)

3.2.2.1 Frequency of services

Daily freight rail traffic is predominantly comprised of grain and mineral trains. Existing freight rail services on the network include:

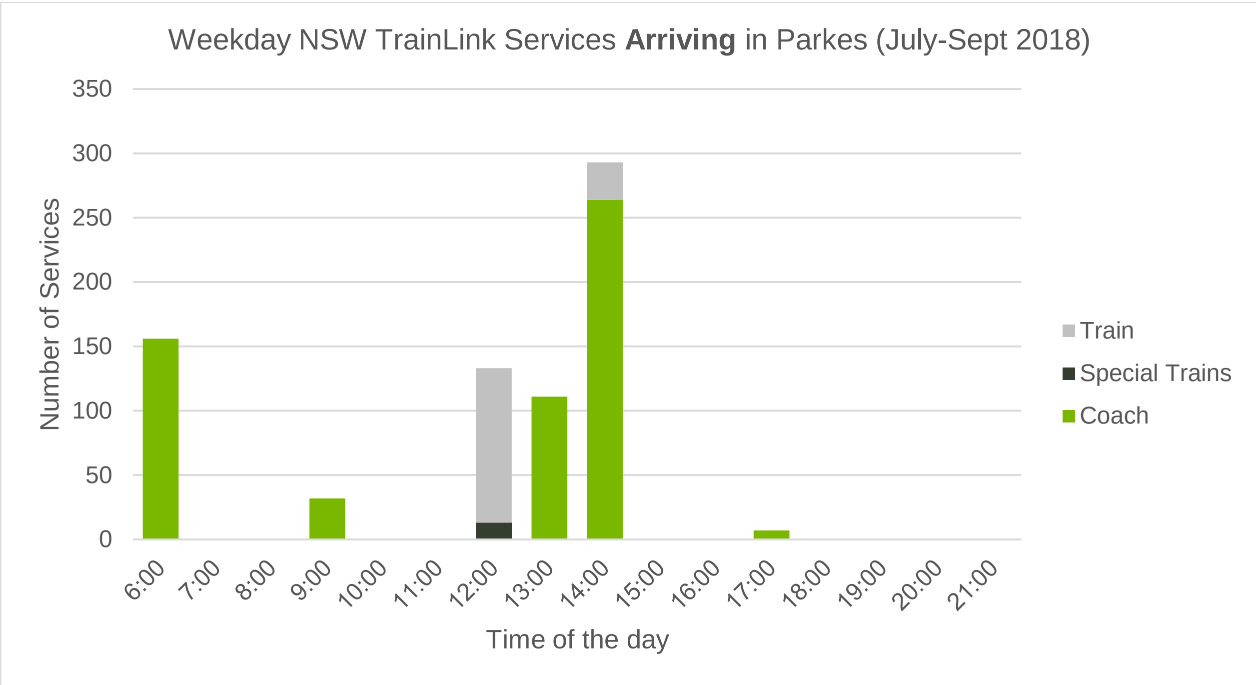
- More than 15 intermodal trains a week travelling east to west, from Melbourne/Sydney to Perth via the Main West Line
- Around 30 trains a week travelling south to north, via the Parkes to Cootamundra and Parkes to Goonumbla freight lines

Results presented in the Inland Rail Business Case suggest that be approximately 123 freight trains utilising the Inland Rail network per week (round trips).

Based on information provided by local businesses, current freight trains travelling east-west are 1800m long, with 80 wagons with a total weight of 3000 tonnes, equating to approximately 100 PBS Level 2 vehicles. Operations are currently at 80% capacity, justifying the need for future rail infrastructure upgrades.

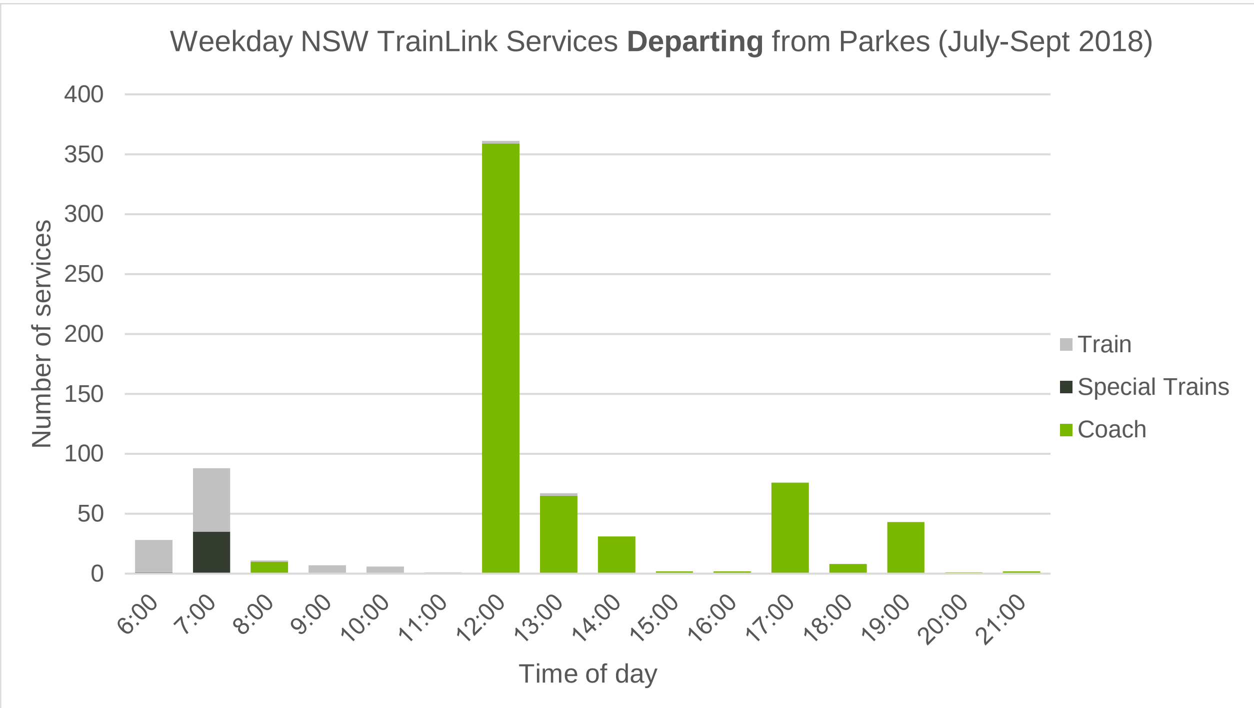
There are two passenger train services which stop in Parkes weekly: one service arriving and departing towards Broken Hill and the other towards Sydney. The remaining passenger travel is done through coach services. NSW Trainlink data taken over the course of a two months (July-September) in 2018 give an approximate number of coach and train trips arriving and departing from Parkes on a typical weekday and weekend. In total, there was an average of 733 trips arriving and departing Parkes on weekdays and an average of 155 trips arriving and departing Parkes on weekends. These numbers reflect low utilisation of intrastate public transport to and from Parkes, potentially attributes to the infrequency of services.

Figure 20 Weekday NSW TrainLink Services Arriving in Parkes between July – September 2018



Source: NSW Trainlink ticketing data (TfNSW)

Figure 21 Weekday NSW TrainLink Services Departing from Parkes between July – September 2018



Source: NSW Trainlink ticketing data (TfNSW)

This study has assumed that there is unconstrained capacity on the local rail network to accommodate future freight movements. Further studies and modelling would need to be undertaken to understand the impacts of network constraints for freight movements on the rail network that may affect the rate of growth, particularly on the routes to and from Sydney, in addition to developing an understanding of the levels of investment needed to accommodate projected freight volumes into and out of the SAP. Consideration of capacity on the network would also need to ensure that the impacts on passenger services to Parkes are not compromised.

3.2.3 Airport

Parkes Regional Airport, located 5 kilometres east of Parkes town centre, operates 18 flights weekly between Sydney and Parkes, serving 35,000 passengers annually utilising two runways. The primary runway (Runway 04/22) is 1,684 metres long and 45 metres wide with a sealed surface. The runway sits within a 150 metres wide strip and has recently had a lighting upgrade. The secondary runway (Runway 11/29) is 1,623 metres long and 30 metres wide with a sealed surface.

Parkes Regional Airport precinct has recently undergone a $3 million redevelopment, including:

- Installation of new runway lighting
- Upgraded new airport terminal
- NBN broadband installation at terminal
- Connection of potable water
- Additional car parking
- Upgrades to Parkes Aero Club
- New entry treatment and widening of entry road

Extensions to the primary runway would be required to accommodate international services (i.e. wide-body operations to south-east Asia destinations) to a maximum length of 2,564 metres, which is limited by adjacent roadways and the airport boundary.

Stage 2 ($1.56 million) of the Airport Business Park project is currently underway, which will facilitate investment in the airport industrial precinct and includes an airside apron, taxiways, and fire and medical emergencies infrastructure to improve airport operations for passengers. Future development opportunities include the leasing and development of a further five sites for commercial investment.

As a result of the airport upgrades, private investment could be encouraged to support the development of an air freight facility, aircraft maintenance facility, pilot training facility, as well as retail, commercial and hospitality. Not only would these investments increase the air freight capacity of the airport but would also be integral to the success of the SAP.

Currently, air freight at Parkes is collected upon flight arrival, as there are no storage facilities within the existing airport site. Information regarding the import and export of air freight is limited, although it is unlikely a large volume of freight will be transported by air. Growth in the current freight business operations of the airport highlights the increasing importance of freight and logistics to the Parkes area and the opportunity to expand this capability, providing a truly intermodal freight and logistics hub for the region.

Future assessment should be undertaken on the capacity needs of air services between the Parkes Regional Airport and the SAP, with consideration of any current or future fly-in-fly-out workforce. As the SAP develops, consideration could be given to developing a new airport and associated road connections within or near the SAP, as necessary.

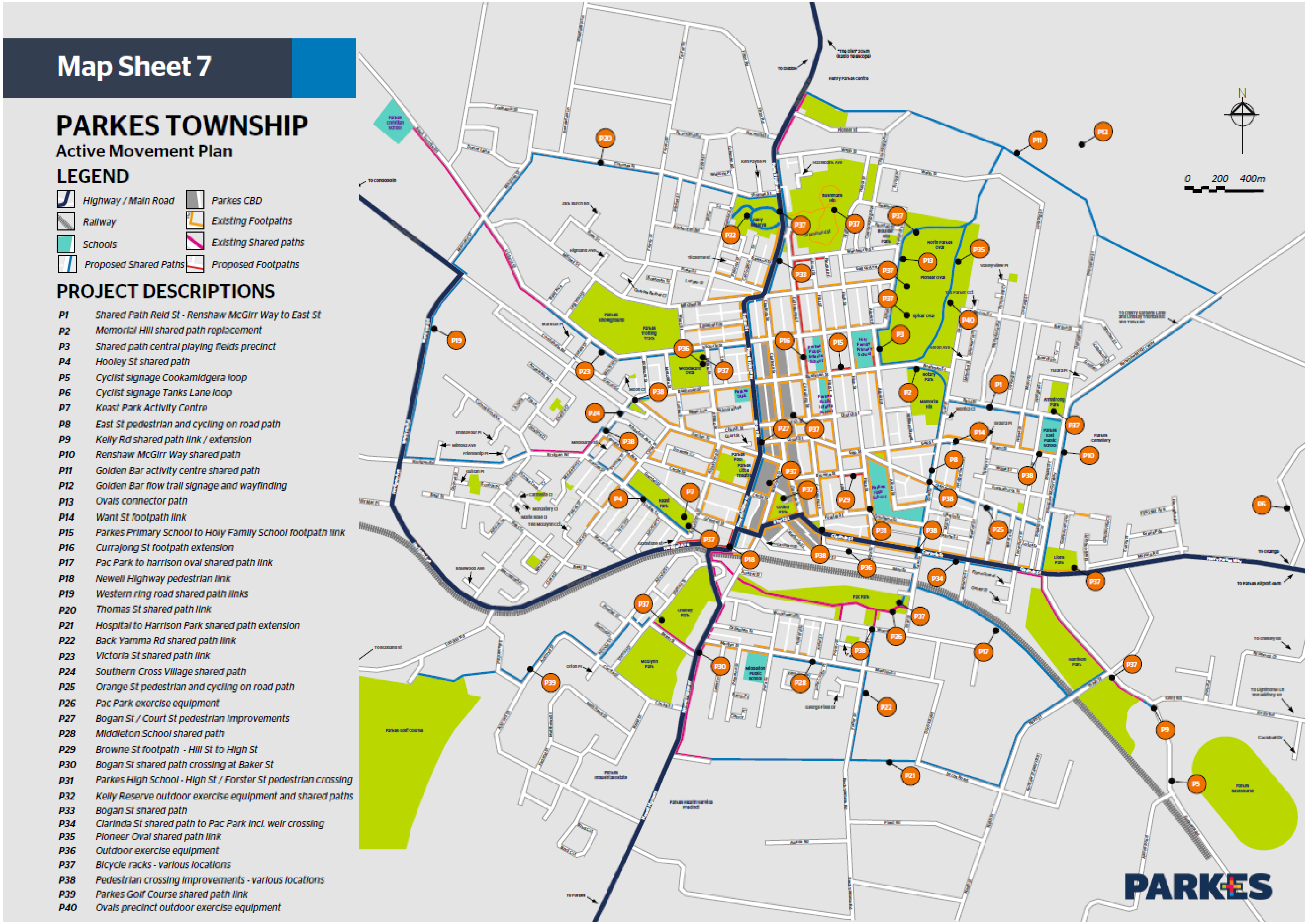
3.2.4 Public Transport

3.2.4.1 Pedestrian and cycling

According to journey to work (JtW) data for local workers in Parkes Shire (idcommunity, 2016) the majority of local workers travelling to Parkes for work (71%) rely on private motor vehicles (64.9% as driver, 6.1% as passenger) for their journey to work, with only 5.9% choosing to walk to work. 'Working from home' (8.3%) and 'did not go to work' (9.9%) rate relatively high in comparison to other mode choices, with the remaining 10.8% splitting their journey to work between other modes such as train (0.1%), bus (0.2%), truck (1.1%), motorbike (0.4%) and bicycle (0.3%), or even multiple methods (1.4%).

Current cycleways are not well connected from the town centre to the SAP. The *Parkes Pedestrian and Cycling Plan 2016* sets out the vision and objectives for enhancing pedestrian and cycling infrastructure, with forty proposed upgrades identified within the town centre (see Figure 22).

Figure 22 Parkes Pedestrian Cycling Plan



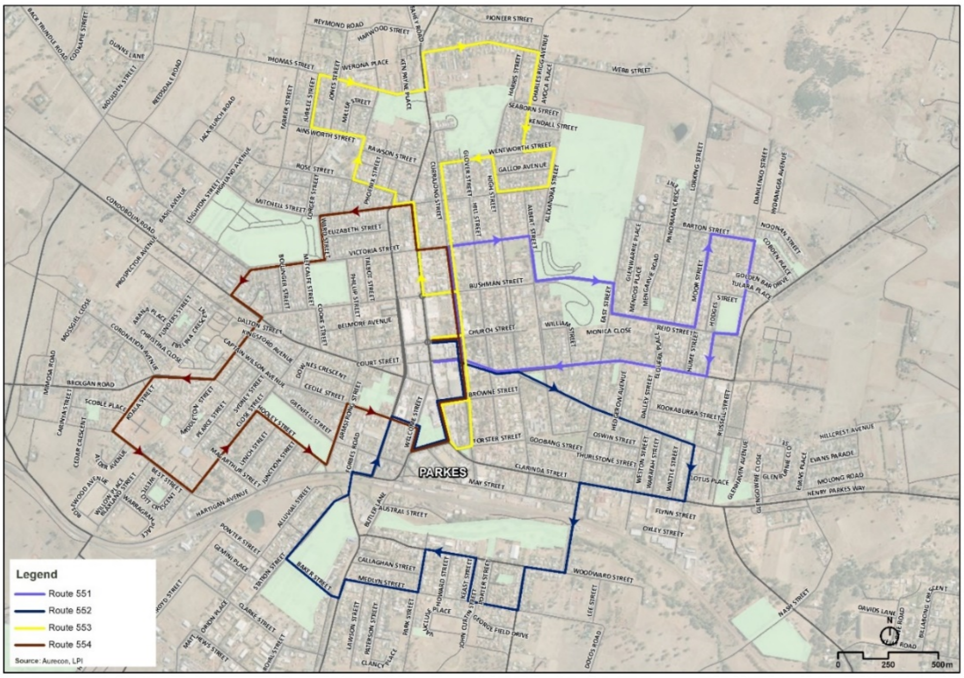
However, there are limited opportunities identified outside the town centre for pedestrian and cycling infrastructure improvements. Proposed improvements include, among others, the provision of:

- On-road bicycle lanes
- Pedestrian refuge islands and marked crossings
- Vehicle restriction/diversion and traffic calming measures
- Signalised crossings with improved signage

3.2.4.2 Bus

Western Road Liners offers four town bus services that run Monday to Friday (except public holidays) within the Parkes town centre, as shown below. These bus services are infrequent, with most of the routes operating between 9:30am and 3:00pm only. Additionally, there are no existing bus services that extend past the town centre that currently service the SAP.

Figure 23 Western Road Liners Parkes Bus Services



Source: Aurecon, LPI

Data on patronage for the above local bus services is currently unavailable, but it is understood through discussions with key stakeholders from Roads and Maritime Services and TfNSW that they are underutilised and have significant spare capacity.

Parkes is also serviced by a regional bus network, operated by NSW TrainLink, there are a range of regional routes starting or terminating in Parkes, including:

- Route 520 that runs from Orange, through Cudal, Eugowra and Forbes to Parkes
- Route 521 that travels from Orange to Parkes via Manildra (available both directions)
- Route 595 that travels from Parkes to Condobolin via Bogan Gate, Yarrabandai, Ootha, and Derriwang

Additionally, there are several school bus routes that provide a service for students who live within the towns and in the surrounding agricultural areas.

The Parkes SAP presents significant opportunity to improve public transport service provision and connectivity to the Central West Region, particularly in the context of addressing congestion and safety issues associated with workforce access to the SAP. This should be considered in more detail in future stages.

In addition, the contribution of public transport to the productivity outcomes of the SAP has not been explored. Facilitation of public transport access to the SAP may result in improved transport service connections as part of the development, which will impact on the costs and thresholds for implementation. The *Guidelines for Public Transport Capable Infrastructure in Greenfield Sites* could provide guidance at future stages to determine the most appropriate way of integrating direct and convenient bus services from Parkes and surrounding centres to service the SAP.

4. FUTURE NETWORKS

4.1 Outcomes of Scenario Testing

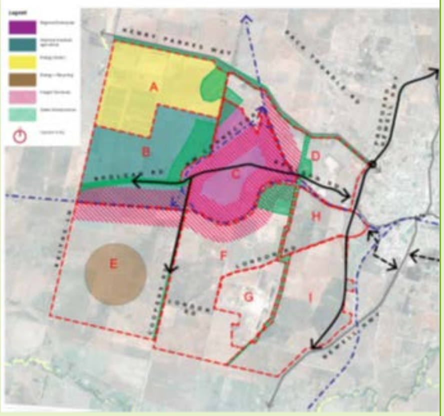
The three development scenarios were tested against a list of general infrastructure and transport elements common across all three; as well as specific infrastructure elements unique to each development scenario.

As the land uses in each development scenario are presented at a precinct level, some assumptions were made based on SAP sub-precinct Master Planning outcomes in order to facilitate calculating the likely infrastructure demands and requirements. For the sake of future proofing the SAP and providing a level of infrastructure sufficient for a variety of SAP sub-precinct Master Planning scenarios, the largest infrastructure demand was used.

Schematic infrastructure and transport plans to service the SAP for each Scenario are included in Appendix D, Appendix E and Appendix F. Demand and infrastructure/transport requirements resulting from each scenario are detailed in Appendix I. Water and wastewater demand estimation criteria are summarised in Appendix J.

4.1.1 Scenario 1

Table 8 Summary of Scenario 1 outcomes

<table>
<tr><th>Infrastructure/Transport</th><th>Outcomes</th></tr>
<tr><td></td><td>

Land Use Quantum	
Freight Terminals	306 ha
Regional Enterprise	1064 ha
Intensive livestock agriculture	803 ha
Energy (Solar)	690 ha
Energy + Recycling	250 ha
Protected cropping	0 ha
(Green infrastructure)	231 ha
Airport	0 ha
Total project area	3113 ha
Total developable area	2882 ha

</td></tr>
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Water –

Demand

Water demand is highly dependent on the type of businesses in the SAP. An upper bound estimate has been assumed.

The ultimate total water demand is estimated to be 8,800 ML/yr based on the following assumptions:

- This includes demand for potable and non-potable uses, including irrigation of green infrastructure.
- Average annual demand in Parkes and surrounding townships is expected to rise from 2,500 ML/ year in 2016 to 2,702 ML/year in 2046 based on a population growth rate of 0.4%.
- Latest best practice ESD for the built environment will be used (e.g., low flow taps, leak detection, etc)

It is noted that the 2017 Integrated Water Cycle Management Strategy report considered Northparkes Mine water use in the raw water demand estimation. Parkes Shire Council has since confirmed that Northparkes Mine has their own water access licences. Therefore, this water demand estimate excludes the mine's water allocation.

</td></tr>
</table>

Supply

The total current raw water supply allowance available is around 13,000 ML/year, including dams, groundwater and river water access licences. This is insufficient to meet total potable and non-potable water demand.

However, there would be sufficient recycled water to meet non-potable (green infrastructure) demand.

Water availability is likely to be significantly reduced during extreme drought. and future climate change will exacerbate this. Therefore, it is recommended, to improve resilience of water supply, that climate change risks are considered during the development of future water supply strategies. These strategies may include changes to water management practices and sourcing of alternative water supplies, including acquisition of additional water access licenses.

There may be up to 6,000 ML/year of alternative water supply generated within the SAP, including rainwater, harvested stormwater and recycled water.

The existing water treatment plant in Parkes is likely to have sufficient capacity to supply potable water for early development in the SAP, although the existing transfer network will require augmentation to supply the SAP. New water networks are required in the SAP, including water reservoirs.

Additional treatment capacity at the existing WTP, or a new WTP in the SAP supplied directly by bore water or river water, will be required when demand in the SAP exceeds around 6,100 ML/year. Refer Appendix D for further detail on water infrastructure requirement.

Wastewater –

Wastewater generation is highly dependent on the types of businesses in the SAP. An upper bound estimate has been assumed.

The ultimate wastewater flow generated from the SAP under Scenario 1 is estimated to be 3,000 ML/yr. This equates to approximately 57,000 EP. It was assumed the best practise ESD that reduced intensive livestock contribution to wastewater flows by 50% and reduced flows from energy and recycling by 75%.

The existing sewage treatment plant servicing Parkes has been designed to allow for duplication of its capacity from 20,000 EP to 40,000 EP. This capacity may be utilised to service early development and defer the need for a new STP to service the SAP. However, the SAP naturally drains to the south west. Therefore, a pipeline of 5 to 10 km (crossing the railway and Newell Highway) and possibly sewage pumping station would be required to transfer wastewater to Parkes STP.

Wastewater infrastructure for the SAP might be staged for cost efficiencies, such as use of tankers and on-site wastewater systems in the early stages of development until there is sufficient wastewater load to support construction of a sewerage system and new STP for the SAP.

In addition, a recycled water system would be required to meet non-potable water demands. This might include a third pipe system throughout the Regional Enterprise land use area. Refer Appendix D for further detail on wastewater infrastructure requirement.

	Stormwater – Key proposed measures of stormwater management approach include: • Workability (i.e., liveability) and drainage corridors to convey stormwater flows and improve amenity for workers. • 9 cross drainage infrastructure locations where concentrated overland flow paths intersect with proposed infrastructure (road and rail) alignments. • 3 stormwater detentions basins as a minimum to manage stormwater quality and quantity, although there are many more potential locations depending on development design. It is also recommended that the principles of water sensitive urban design (WSUD) are integrated into the detailed development design, including bioretention systems, swales, raingardens, to optimise stormwater management. Rain water and stormwater harvesting may provide alternative water supplies of up to 1,000 and 3,000 ML/yr respectively. However, further detailed water balance modelling is required to confirm this once development typologies are further defined.
	Electricity – Estimated energy demand is 60 MVA. This is approximately 3 times the current Parkes town energy demand. The current TransGrid Parkes Substation will have enough capacity without requiring augmentation.
	Gas – Estimated demand is 0.22 TJ/d, equivalent to 17% of nominal capacity of Brolgan Road Pipeline. Only additional infrastructure required is the proposed main pipeline extension and a localised gas distribution network within the land parcels.
	Telecommunications – Deployment of a fibre spine along Brolgan Road will allow for a staged branched deployment as the SAP grows west. Indicative land uses associated with Scenario 1, being primarily logistics focused, are likely to require access to a 10-gigabit fibre connection for normal business operation going forward. Supporting the peripheral connections such as autonomous vehicles and IoT connections within the SAP would be supported by a 5G wireless network.
	Waste and Resource Recovery – Estimated solid waste generation rate of 966 t/year. If this waste is of a type able to be handled by the Parkes Waste Facility (PWF), it will consume roughly 7% of the life of the PWF, reducing the projected life by 8 years, (from 115 years to 107 years) However, PWF is not considering the provision of specialised landfilling services for the SAP. If there are special wastes from the SAP that require higher level facilities, then these wastes will need to be disposed of at; 1) either a new facility licensed to handle these wastes, located in land parcel G, or, 2) transported to a facility elsewhere.

	Road – *Brolgan Road* The main spine road servicing the SAP is Brolgan Road. Brolgan Road is currently being upgraded until Coopers Road as the road network needs to be suitable for PBS Level 3A vehicles. Sufficient corridor width (50m wide reserve) will be provided to future-proof for potential implementation of new technologies or future road upgrade requirements. Road upgrades will be required at various trigger points, according the volume of light and heavy vehicle traffic generated. A 'first stage' north-south connection along the western end of the SAP, parallel to Keiths Lane is to be developed. Several new intersections will be required on Brolgan Road and Henry Parkes Way as development of the SAP progresses. Grade separation of road and rail will be required, with the eastern separation on Brolgan Road required from day one and the western separation required as the develops westwards. *London Road* Upgrades to London Road (currently a sealed road, one lane in each direction) will be required to enable heavy vehicle access all the way through to the energy and recycling facility. The road alignment should be modified to provide direct access to the energy and recycling facility, removing the number of 90 degree turns that currently exist along London Road. Sufficient corridor width will be provided to accommodate for future road capacity increases (see Appendix I for details). *Newell Highway Parkes Bypass* Given the scale of development proposed, the most appropriate intersection solutions will need to be considered. For example, the provision for a future roundabout at London Road to facilitate more efficient access to the proposed east-west Parkes bypass to the south of the town centre. T-intersection treatment, as proposed in existing bypass design, would be sufficient to cater for movements associated with early SAP development.
	Rail – North-west rail connection is currently in construction and the Parkes-Narromine line is being upgraded, as part of the Inland Rail project. No further upgrades have been proposed and any new rail line will require investigation of grade separation from Brolgan Road (road over rail). See Appendix I for details. Development of the SAP is not likely to significantly impact current and future passenger rail operations.
	Airport – No airport proposed in this scenario. Scenario has no impact on the existing airport. There is a potential for an east-west bypass to the north of the town centre which could connect to the existing airport.

Public transport –

Provision of public transport to and from the SAP would provide an efficient alternate access for employees. This would reduce the impact of light vehicle traffic on roads within both the SAP and the town and would extend the lifespan of this infrastructure.

Road corridor widths should accommodate for the provision of a shared path to provide the option for active travel to and from the SAP (see Appendix I for details) and will enable future public transport infrastructure such as bus stops to be implemented at different stages of development of the SAP, as necessary.

As employment numbers increase, there are opportunities to have a consolidated parking facility with associated shuttle service to businesses in the SAP, as outlined in the ESD report.

4.1.2 Scenario 3

Table 9 Summary of Scenario 3 outcomes

Infrastructure/Transport	Outcomes
	see Land Use Quantum table below

Land Use Quantum	
Freight Terminals	436 ha
Regional Enterprise	1442 ha
Intensive livestock agriculture	1532 ha
Energy (Solar)	690 ha
Energy + Recycling	900 ha
Protected cropping	0 ha
(Green infrastructure)	1240 ha
Airport	O ha
Total project area	6240 ha
Total developable area	5000 ha

Water –

Demand

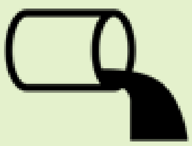
Water demand is highly dependent on the type of businesses in the SAP. An upper bound estimate has been assumed.

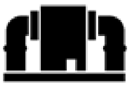
The ultimate total water demand is estimated to be 17,450 ML/yr based on the following assumptions:

- This includes demand for potable and non-potable uses, including irrigation of green infrastructure.
- Average annual demand in Parkes and surrounding townships is expected to rise from 2,500 ML/ year in 2016 to 2,702 ML/year in 2046 based on a population growth rate of 0.4%.
- Latest best practice ESD for the built environment will be used (e.g., low flow taps, leak detection, etc)

It is noted that the 2017 Integrated Water Cycle Management Strategy report considered Northparkes Mine water use in the raw water demand estimation. Parkes Shire Council has since confirmed that Northparkes Mine has their own water access licences. Therefore, this water demand estimate excludes the mine's water allocation.

Supply:

	The total current raw water supply allowance available is around 13,000 ML/year, including dams, groundwater and river water access licences. This is insufficient to meet total potable and non-potable water demand. Water availability is likely to be significantly reduced during extreme drought. and future climate change will exacerbate this. Therefore, it is recommended, to improve resilience of water supply, that climate change risks are considered during the development of future water supply strategies. These strategies may include changes to water management practices and sourcing of alternative water supplies, including acquisition of additional water access licenses. There may be up to 7,500 ML/year of alternative water supply generated within the SAP, including rainwater, harvested stormwater and recycled water. Combined with current raw water supplies, this is 20,500 ML/year just above demand. Additional groundwater and surface water allocations will be required to ensure water security under Scenario 3. The volume of additional allocations required will depend on the extent to which alternative water supplies are utilised. The existing water treatment plant in Parkes is likely to have sufficient capacity to supply potable water for early development in the SAP, although the existing transfer network will require augmentation to supply the SAP. New water networks are required in the SAP, including water reservoirs. Additional treatment capacity at the existing WTP, or a new WTP in the SAP supplied directly by bore water or river water, will be required when demand in the SAP exceeds around 5,840 ML/year. Refer Appendix E for further detail on water infrastructure requirement.
	**Wastewater –** Wastewater generation is highly dependent on the types of businesses in the SAP. An upper bound estimate has been assumed. The ultimate wastewater flow generated from the SAP under Scenario 3 is estimated to be 4,600 ML/yr. This equates to approximately 87,000 EP. It was assumed the best practise ESD that reduced intensive livestock contribution to wastewater flows by 50% and reduced flows from energy and recycling by 75%. The existing sewage treatment plant servicing Parkes has been designed to allow for duplication of its capacity from 20,000 EP to 40,000 EP. This capacity may be utilised to service early development and defer the need for a new STP to service the SAP. However, the SAP naturally drains to the south west. Therefore, a pipeline of 5 to 10 km (crossing the railway and Newell Highway) and possibly sewage pumping station would be required to transfer wastewater to Parkes STP. Wastewater infrastructure for the SAP might be staged for cost efficiencies, such as use of tankers and on-site wastewater systems in the early stages of development until there is sufficient wastewater load to support construction of a sewerage system and new STP for the SAP.

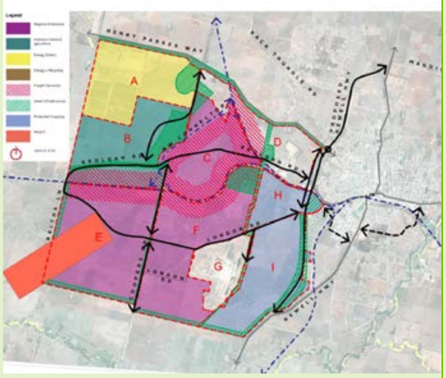
	In addition, a recycled water system would be required to meet non-potable water demands. This might include a third pipe system throughout the Regional Enterprise land use area. Refer to Appendix E for further details on wastewater infrastructure required.
	**Stormwater –** Key proposed measures of stormwater management approach include • Workability (i.e., liveability) and drainage corridors to convey stormwater flows and improve amenity for workers. • 13 cross drainage infrastructure locations where concentrated overland flow paths intersect with proposed infrastructure (road and rail) alignments. • 11 stormwater detentions basins as a minimum to manage stormwater quality and quantity, although there are many more potential locations depending on development design. It is also recommended that the principles of water sensitive urban design (WSUD) are integrated into the detailed development design, including bioretention systems, swales, raingardens, to optimise stormwater management. Rain water and stormwater harvesting may provide alternative water supplies of up to 1,300 and 4,500 ML/yr respectively. However, further detailed water balance modelling is required to confirm this once development typologies are known.
	**Electricity –** Estimated energy demand is 82.5 MVA. High energy consumption is driven by large regional enterprise area. This is approximately 4 times the current Parkes town energy demand.
	**Gas –** Estimated demand is 0.41 TJ/d, equivalent to 31% of nominal capacity of Brolgan Road Pipeline. Only additional infrastructure required is the proposed main pipeline extension and a localised gas distribution network within the land parcels.
	**Telecommunications –** Fibre deployment length extended to the western boundary of the SAP. 10-gigabit necessary to remain competitive with future data requirements of the logistics and transportation industry expectations.
	**Waste and Resource Recovery –** Estimated solid waste generation rate of 1,686 t/year. If this waste is of a type able to be handled by the Parkes Waste Facility (PWF), it will consume roughly 11% of the life of the PWF, reducing the projected life by 13 years, (from 115 years to 102 years) However, PWF is not considering the provision of specialised landfilling services for the SAP. If there are special wastes from the SAP that require higher level facilities, then these wastes will need to be

	disposed of at; 1) either a new facility licensed to handle these wastes, located in land parcel G, or, 2) transported to a facility elsewhere.
	Road – *Brolgan Road* Increased area for regional enterprise developments may require consolidated access points onto Brolgan Road and grade separation for road/rail crossings to ensure intersections allow safe manoeuvres for all vehicles. Completion of the north-south connection to link Henry Parkes Way and London Road, branching off from Coopers Road. This will require a grade separated rail crossing with a minimum height clearance of 8m. *London Road* Upgrades to London Road (currently a sealed road, one lane in each direction) will be required to enable heavy vehicle access all the way through to the energy and recycling facility. The road alignment should be modified to provide direct access to the energy and recycling facility, removing the number of 90 degree turns that currently exist along London Road. Sufficient corridor width (50m wide reserve) will be provided to accommodate for future road capacity upgrades. *Newell Highway Parkes Bypass* Given the scale of development proposed, the most appropriate intersection solutions will need to be considered. For example, the provision for a future roundabout at London Road to facilitate more efficient access to the proposed east-west Parkes bypass to the south of the town centre. T-intersection treatment, as proposed in existing bypass design, would be sufficient to cater for movements associated with early SAP development.
	Rail – North-west rail connection is currently in construction and the Parkes-Narromine line is being upgraded, as part of the Inland Rail project. No further upgrades have been proposed and any new rail line will require investigation of grade separation from Brolgan Road (road over rail). Development of the SAP is not likely to significantly impact current and future passenger rail operations.
	Airport – No airport proposed in this scenario. Scenario has no impact on existing airport. There is a potential for an east-west bypass to the north of the town centre which could connect to the existing airport.

	Public transport – Provision of public transport to and from the SAP would provide an efficient alternate access for employees. This would reduce the impact of light vehicle traffic on roads within both the SAP and the town and would extend the lifespan of this infrastructure. Road corridor widths should accommodate for the provision of a shared path to provide the option for active travel to and from the SAP (see Appendix I for details) and will enable future public transport infrastructure such as bus stops to be implemented at different stages of development of the SAP, as necessary. As employment numbers increase, there are opportunities to have a consolidated parking facility with associated shuttle service to businesses in the SAP, as outlined in the ESD report.

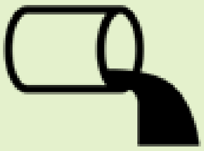
4.1.3 Scenario 6

Table 10 Summary of Scenario 6 outcomes

Infrastructure/Transport	Outcomes
	See land use quantum table below

Land Use Quantum	
Freight Terminals	542 ha
Regional Enterprise	1929 ha
Intensive livestock agriculture	803 ha
Energy (Solar)	690 ha
Energy + Recycling	0 ha
Protected cropping	949 ha
(Green infrastructure)	334 ha
Airport	350 ha
Total project area	5263 ha
Total developable area	4929 ha

	Water – *Demand* Water demand is highly dependent on the type of businesses in the SAP. An upper bound estimate has been assumed. The ultimate total water demand is estimated to be 30,418 ML/yr based on the following assumptions: • This includes demand for potable and non-potable uses, including irrigation of green infrastructure. • Average annual demand in Parkes and surrounding townships is expected to rise from 2,500 ML/ year in 2016 to 2,702 ML/year in 2046 based on a population growth rate of 0.4%. • Latest best practice ESD for the built environment will be used (e.g., low flow taps, leak detection, etc) It is noted that the 2017 Integrated Water Cycle Management Strategy report considered Northparkes Mine water use in the raw water demand estimation. Parkes Shire Council has since confirmed that Northparkes Mine has their own water access licences. Therefore, this water demand estimate excludes the mine's water allocation.

	Supply: The total current raw water supply allowance available is around 13,000 ML/year, including dams, groundwater and river water access licences. This is insufficient to meet total potable and non-potable water demand. Water availability is likely to be significantly reduced during extreme drought. and future climate change will exacerbate this. Therefore, it is recommended, to improve resilience of water supply, that climate change risks are considered during the development of future water supply strategies. These strategies may include changes to water management practices and sourcing of alternative water supplies, including acquisition of additional water access licenses. There may be up to 12,300 ML/year of alternative water supply generated within the SAP, including rainwater, harvested stormwater and recycled water. Combined with current raw water supplies, this is 22,800 ML/year which is insufficient to meet demand. Therefore, additional groundwater and surface water allocations will be required to meet demand under Scenario 6. The volume of additional allocations required will depend on the extent to which alternative water supplies are utilised. The existing water treatment plant in Parkes is likely to have sufficient capacity to supply potable water for early development in the SAP, although the existing transfer network will require augmentation to supply the SAP. New water networks are required in the SAP, including water reservoirs. Additional treatment capacity at the existing WTP, or a new WTP in the SAP supplied directly by bore water or river water, will be required when demand in the SAP exceeds around 5,840 ML/year. Refer Appendix F for further detail on water infrastructure requirement.
	**Wastewater –** Wastewater generation is highly dependent on the types of businesses in the SAP. An upper bound estimate has been assumed. The ultimate wastewater flow generated from the SAP under scenario 6 is estimated to be 5,000 ML/yr. This equates to approximately 95,000 EP. It was assumed the best practise ESD that reduced intensive livestock contribution to wastewater flows by 50% and reduced flows from energy and recycling by 75%. The existing sewage treatment plant servicing Parkes has been designed to allow for duplication of its capacity from 20,000 EP to 40,000 EP. This capacity may be utilised to service early development and defer the need for a new STP to service the SAP. However, the SAP naturally drains to the south west. Therefore, a pipeline of 5 to 10 km (crossing the railway and Newell Highway) and possibly sewage pumping station would be required to transfer wastewater to Parkes STP. Wastewater infrastructure for the SAP might be staged for cost efficiencies, such as use of tankers and on-site wastewater systems in the early stages of development until there is sufficient wastewater

	load to support construction of a sewerage system and new STP for the SAP. In addition, a recycled water system would be required to meet non-potable water demands. This might include a third pipe system throughout the Regional Enterprise land use area. Refer Appendix F for further detail on wastewater infrastructure requirement.
	Stormwater – Key proposed measures of stormwater management approach include • Workability (i.e., liveability) and drainage corridors to convey stormwater flows and improve amenity for workers. • 13 cross drainage infrastructure locations where concentrated overland flow paths intersect with proposed infrastructure (road and rail) alignments. • Stormwater detentions basins as a minimum to manage stormwater quality and quantity, although there are many more potential locations depending on development design. It is also recommended that the principles of water sensitive urban design (WSUD) are integrated into the detailed development design, including bioretention systems, swales, raingardens to optimise stormwater management. Rain water and stormwater harvesting may provide alternative water supplies of up to 2,500 and 8,200 ML/yr respectively. However, further detailed water balance modelling is required to confirm this once development typologies are known
	Electricity – Estimated energy demand is 94.5 MVA. High energy consumption is driven by large intermodal terminal, large regional enterprise area and the international airport. This is approximately 5 times the current Parkes town energy demand.
	Gas – 0.26 TJ/d, equivalent to 20% of nominal capacity of Brolgan Road Pipeline. Only additional infrastructure required is the proposed main pipeline extension and a localised gas distribution network within the land parcels
	Telecommunications – Fibre extended to connect the wider Regional Enterprise land use will significantly increase cost. The spread of businesses under this scenario will increase the need for 5G/small cell and fixed wireless technology across a wider area. Fibre backbone down Brolgan Road should be extended north south along any proposed underground utility routes.

	Waste and Resource Recovery – Estimated solid waste generation rate of 1,331 t/year. If this waste is of a type able to be handled by the Parkes Waste Facility (PWF), it will consume roughly 9% of the life of the PWF, reducing the projected life by 10 years, (from 115 years to 105 years) However, PWF is not considering the provision of specialised landfilling services for the SAP. If there are special wastes from the SAP that require higher level facilities, then these wastes will need to be transported to a facility elsewhere.
	Road – *Brolgan Road* Increased area for regional enterprise developments may require consolidated access points onto Brolgan Road and to ensure intersections allow safe manoeuvres for all vehicles. Completion of the North-South connection to link Henry Parkes Way and London Road, branching off from Coopers Road. This will require a grade separated rail crossing with a minimum height clearance of 8m. *London Road* Upgrades to London Road (currently a sealed road, one lane in each direction) will be required to enable heavy vehicle access all the way through to the energy and recycling facility. The road alignment should be modified to provide direct access to the energy and recycling facility, removing the number of 90 degree turns that currently exist along London Road. Sufficient corridor width (50m wide reserve) will be provided to accommodate for future road capacity upgrades. *Newell Highway Parkes Bypass* Given the scale of development proposed, the most appropriate intersection solutions will need to be considered. For example, the provision for a future roundabout at London Road to facilitate more efficient access to the proposed east-west Parkes bypass to the south of the town centre. T-intersection treatment, as proposed in existing bypass design, would be sufficient to cater for movements associated with early SAP development.
	Rail – North-West rail connection is currently in construction and the Parkes-Narromine line is being upgraded, as part of the Inland Rail project. No further upgrades have been proposed and any new rail line will require investigation of grade separation from Brolgan Road (road over rail). See Appendix I for details. Development of the SAP is not likely to significantly impact current and future passenger rail operations.

	**Airport –** An international airport at Parkes would cost hundreds of millions of dollars (based on Brisbane West Wellcamp Airport). International air freight is therefore likely to be sent to Sydney rather than loaded onto direct international flights departing Parkes. Low volumes of freight and international passengers will not warrant investment in a new international airport at Parkes. The existing Parkes airport is likely to be cheaper to extend if warranted, rather than a new airport in the SAP. The proposed location of airport in Scenario 6 plan does not improve the efficiency of aircraft movements, compared to the current location. Height and noise restrictions may limit other activities within the SAP.
	**Public Transport –** Provision of public transport to and from the SAP would provide an efficient alternate access for employees. This would reduce the impact of light vehicle traffic on roads within both the SAP and the town and would extend the lifespan of this infrastructure. Road corridor widths should accommodate for the provision of a shared path to provide the option for active travel to and from the SAP (see Appendix I for details) and will enable future public transport infrastructure such as bus stops to be implemented at different stages of development of the SAP, as necessary. As employment numbers increase, there are opportunities to have a consolidated parking facility with associated shuttle service to businesses in the SAP, as outlined in the ESD report.

Elements to take forward to the final Master plan from scenario testing

- Water – New water infrastructure will be required to supply water to the SAP. This will include a new water supply network, water storage reservoir and augmentation of water treatment capacity (either through a new water treatment plant or augmentation of the existing plant) when demand exceeds 3,100 ML/year. A road easement up to 2 metres should be allowed for the water main and land should be set aside for a water storage reservoir and a new water treatment plant. This requires land acquisition, property agreements and/or easements with key landholders. Refer Appendix D, Appendix E, and Appendix F for further details on water infrastructure required.
- Water – it is recommended that the SAP develop a water supply management strategy that takes into consideration the expected economic benefits of the SAP and allows for long-term variabilities in water supply (including the proposed raising of Wyangala Dam, which would improve long term water security without increasing total license share) and future competing water uses.
- Water – the raising of Wyangala Dam might prompt a review of the current ratio of High Security water licenses within the Lachlan Valley reflecting improvement in overall water security.
- Wastewater – New sewerage infrastructure will be required to service the SAP. This will include a new wastewater collection network, a new sewage pumping station and a new sewage treatment plant once sufficient sewage is generated. A road easement up to 2 metre should be allowed for sewers and rising mains, and land should be reserved at low points within the development for a sewage pumping station and new sewage treatment plant. Provision for recycled water storage should also be considered. This might be in the form of tanks (which might not be aesthetically pleasing but pose less risk to human exposure) or ponds (which might be aesthetically pleasing but creates a risk to human exposure). Refer Appendix D, Appendix E, Appendix F for further detail on wastewater infrastructure required.

- Stormwater – New stormwater infrastructure will be required to manage runoff from the development. Drainage corridors will need to be reserved and will perform multiple functions including stormwater conveyance and improved workability/amenity. Cross drainage infrastructure will be required where flow paths intersect road and rail alignments. Stormwater detention basins and distributed water sensitive design features will be required to manage stormwater quality and quantity to acceptable levels and should be allowed for in the land use planning. These stormwater detention basins might be managed in parallel with recycled water storage ponds, but not shandied (as recycled water has stricter restrictions to human exposure than stormwater).
- Electricity - Based on the forecast estimated load (82.5 MVA), the most realistic point of supply would be the TransGrid Parkes Substation, since the Essential Energy Parkes Town substation would not have sufficient capacity. One or more main intake substations can be constructed, potentially located at the north and south end of the SAP to create some redundancy and limit internal reticulation losses.
- Electricity - Internal electricity reticulation for each facility can be installed as a ring supply arrangement coming from the main intake substation. This increases the redundancy of the system, eliminates the cost of building a dedicated substation for each facility and can easily be extended.
- Electricity – Should an energy intensive business, for example a data centre, be considered as part of the SAP, particular attention would need to be paid to the demand of the SAP as a single large load would potentially require additional augmentation of the supply points to ensure enough capacity is available.
- Gas - Waste to energy or some other hydrogen generator (e.g. solar power to gas) is a vital part of this plan in order to provide a circular economy on the gas infrastructure side. The hydrogen produced from the waste to energy process can be injected back into the gas network, provided the final gas composition is <10% hydrogen. Also, coordination with the waste to energy provider would need to be undertaken to ensure W2E can provide hydrogen at pressures between 100-210 kPa so that they can inject into the network reliably.
- Telecommunications – Deployment of fibre optic cable within the SAP under this scenario should be extended to the local high point, located in the north west quadrant. This will allow for the placement of a purpose-built tower designed to host 5G/small cell antenna. Backhaul to this facility would be through the fibre network and will mean the western quadrant of the SAP will have access to high speed data connect, prior to the future provisioning of fibre, as the SAP builds out over time. Coverage areas for 5G/small cell facilities ranges from 500m to 2.5km depending on terrain and environmental clutter.
- Telecommunications – Deployment of fibre alongside other utilities where possible is recommended to reduce cost and delays in connection. Provision of a telecommunications facility at the local high point recommended with another further to the south west to increase coverage area.
- Telecommunications – Fibre connections between businesses will allow for uninterrupted data transfer. Co-location of land uses/ business such as logistics and warehousing should be pursued where possible to reduce any dark fibre network lengths.
- Telecommunications – Scenario 6 sees the introduction of an airport in the south west corner of the SAP. Airspace control surfaces will have a limiting influence on the height of tower facilities, especially on the local high point, given the indicative alignment of the airport land use. An Obstacle Limitation Surface should be taken into account when developing a Master Plan for this scenario.
- Waste – Considering the relatively small volume of waste generated within the SAP (between 966 to 1,686 tons per year) and the volumes of waste required to economically sustain large W2E plants (mass burn typically required 300,000+ tons per year; Anaerobic digestion typically requires 60,000+ tons per year; Refuse derived fuel typically requires 150,000+ tons per year) it can be assumed that any W2E facility will mainly cater for waste generated outside of PSC, be it regional, metropolitan or interstate. Be that as it may, consideration should still be made to choose a technology that can treat all the waste generated with the SAP; otherwise there is a risk of Parkes becoming a dumping ground for everyone else's waste but their own. Once a technology is chosen, the expected emissions plume should be modelled as the prevailing afternoon winds are towards Parkes.
- Waste – Rail access as well as heavy vehicle road access are vital for the transport of feedstock to the W2E facility, as well as transportation of any output. A dedicated rail siding is required to serve the facility to offload containers from trains carrying waste from regional, metropolitan or interstate, onto either trucks or

conveyors for local transport to the facility. Should a small, bespoke W2E plant be constructed to only service the waste generated within the SAP, a rail siding will not be required. Irrespective of the W2E technology chosen, consideration needs to be made for the disposal of residual waste generated (ash, biosolids, digestate, etc), either on site or offsite.

- Waste – Depending on the W2E technology chosen, the facility with require a large environmental buffer (ranging from just 50m up to 1km), consideration should be made to co-locate a complementary industry within this buffer if environmental issues and concerns can be mitigated (solar farm, industry, etc)
- Waste – Where land is set aside for recycling, synergies should be sought with complementary business that use recycled products to manufacture new products to promote circular economy principles.
- Transport - All State and local roads within the SAP should cater for the movement of PBS Level 3 vehicles up to 42m. For all proposed transport requirements, the road layout and cross-sections will be provided in a future interactive GIS map. Further details, indicative maps can be found in Appendix D, Appendix E, and Appendix F with associated 'fact sheets' in Appendix I.
- Transport – Provision of sufficient corridor width (50m wide reserve is proposed) to ensure the roads are capable of accommodating future technologies or future road upgrades required as the SAP develops. This could include demand-responsive bus services, which may align to changing customer needs than traditional bus services. The feasibility and appropriateness of such services would need to be considered as the SAP develops. Several new intersections will be required on Brolgan Road and Henry Parkes Way as development of the SAP progresses. Existing rail level crossings on Brolgan Road should be considered for investigation for future grade separation.
- Transport - A 'first stage' north-south connection parallel to Coopers Road is to be developed, creating an internal loop. This will require a grade separated road above the rail corridor with a minimum height clearance of 8m to allow for double-stacked freight trains. A 'second stage' north-south connection is proposed further west of the SAP cutting through the solar farm, connecting Henry Parkes Way and Brolgan Road.
- Transport – Given the scale of development proposed, the Henry Parkes Way and London Road intersections along the Newell Highway Parkes Bypass will require upgrades to ensure safe manoeuvre of heavy vehicles. It is anticipated that the proposed intersections will eventually require upgrade to roundabouts to accommodate for the increase in heavy vehicle traffic.
- Transport – On opening day, westbound heavy vehicle traffic will continue to utilise the current Hartigan Avenue route through the town centre as there is capacity along this section of road and it is an existing approved route for PBS Level 2 vehicles. As heavy vehicle traffic increases with the development of the SAP, it may be necessary to investigate a future East-West town bypass. A future roundabout at the London Road / Newell Highway Parkes Bypass intersection (as mentioned in the previous dot point) would provide opportunity for connection to Parkes Shire Council's proposed bypass south of Parkes town centre (see figure below). A northern bypass between the Newell Highway and Henry Parkes Way, along the alignment of Maguire Road and Kamandra Lane could also be considered, which would facilitate connection to the existing Parkes airport. These bypass options should be investigated according to Parkes Shire Council plans and priorities.

(Source: Parkes Shire Council Strategic Plan – Transport)

- Transport – It is recommended that property access points on Brolgan Road be consolidated as the SAP develops, to avoid an increase in the number of intersections interfacing with main roads surrounding the SAP to maximise safety and efficiency along the spine road.
- Transport – London Road to be upgraded to accommodate for an increase in heavy vehicle movements due to increased intensive livestock agriculture land uses to the south of the SAP. The current alignment could be modified to provide direct access to the energy and recycling facility.

4.2 Business Case Capital Cost Review for Scenario Testing

Capital cost estimates were developed based on industry knowledge and best practices and serve to provide high-level estimates of capital costs associated with the infrastructure fitout of the Parkes SAP under the three scenarios. The estimates assume planning and approvals process to take up to one year, and similarly, design and construction estimated up to one year. Note there are time and cost savings associated with planning and delivering all infrastructure assets type together, as in most instances they require the same alignment. For example, upgrading Brolgan Road may mean excavating the existing road and at the same time it would be possible to locate services such as optic fibre cable alongside it. These capital costs relate to the following infrastructure categories:

- Roads
- Rail
- Gas
- Energy
- Water
- Telecommunications
- Wastewater
- Airport
- Customs Port

The costs in this section are preliminary and may be subject to change.

4.2.1 Roads

Capital costs for the road infrastructure required under each scenario of the Parkes SAP were estimated with the following key cost items:

- road pavement works
  - Brolgan Road
  - Coopers Road
  - Western Road (Keiths Lane)
  - New Central Road (North and South)
  - Mine Link Road Upgrade
  - New Mine Access Road
  - New Southern Road
- new intersections
- truck rest areas and turning facilities
- grade separations
  - obliquely across rail line
  - perpendicular to rail line

Estimated capital costs for this infrastructure are set out in the table below. At this stage, road costs for Scenario Six are assumed to be the same as for Scenario Three, which will be confirmed later.

Table 11. Road infrastructure capital costs, undiscounted, $ million, 2018

Road Infrastructure Capital Costs	Scenario One	Scenario Three	Scenario Six
Base Cost	55.7	121.4	121.4
Contingency @ 25%	13.9	29.3	29.3
Base Cost + Contingency	**69.7**	**150.6**	**150.6**

4.2.2 Rail

Capital costs for the rail infrastructure required under each scenario of the Parkes SAP were estimated with the following key cost items:

- waste rail / truck transfer
- waste rail siding

Estimated capital costs for this infrastructure are set out in the table below. At this stage, rail costs for Scenario Six are assumed to be the same as for Scenario Three, which will be confirmed later. No cost allowance has been included for third rail terminal.

Table 12. Rail infrastructure capital costs, undiscounted, $ million, 2018

Rail Infrastructure Capital Costs	Scenario One	Scenario Three	Scenario Six
Base Cost	0.0	10.8	10.8
Contingency @ 25%	0.0	2.7	2.7
Base Cost + Contingency	**0.0**	**13.5**	**13.5**

4.2.3 Gas

The largest cost is likely to be the provision of the 210 kPa pipeline extension along Brolgan Road from the existing pipeline. This has been estimated as costing $1.2m. This pipeline has been estimated as being able to provide the capacity required for the whole SAP, provided the input pressure is 210 kPa as quoted by Jemena. If this is not the input pressure, then Jemena will need to increase to this value to ensure operability and delivery pressures of 100 kPa to businesses in the westernmost land parcels. Secondary, but non-negligible, costs come from the construction of a gas distribution network in the SAP. This network should be constructed wholly at the initial stages of the SAP construction to ensure good coordination with other infrastructure to prevent excess costs in earthmoving etc. For example, while only the land parcels north of the trainline may form the initial rollout, the distribution network should extend south of the trainline for future-proofing capacity.

Capital costs for the gas infrastructure required under each scenario of the Parkes SAP were estimated with the following key cost items:

- installation of gas lines
- connection terminals

Estimated capital costs for this infrastructure are set out in the table below.

Table 13. Gas infrastructure capital costs, undiscounted, $ million, 2018

Gas Infrastructure Capital Costs	Scenario One	Scenario Three	Scenario Six
Base Cost	9.1	13.1	12.7
Contingency @ 25%	2.3	3.3	3.2
Base Cost + Contingency	**11.4**	**16.4**	**15.9**

4.2.4 Electricity

Capital costs for the electricity infrastructure required under each scenario of the Parkes SAP were estimated with the following key cost items:

- substations and transmission lines
- transmission switch-bays

Estimated energy costs for this infrastructure are set out in the table below. At this stage, electricity costs for Scenario Six are assumed to be the same as for Scenario Three, which will be confirmed later.

Table 14. Energy infrastructure capital costs, undiscounted, $ million, 2018

Energy Infrastructure Capital Costs	Scenario One	Scenario Three	Scenario Six
Base Cost	12.0	16.0	16.0
Contingency @ 25%	3.0	4.0	4.0
Base Cost + Contingency	**15.0**	**20.0**	**20.0**

4.2.5 Water

Capital costs for the water infrastructure required under each scenario of the Parkes SAP were estimated with the following key cost items:

- installation of water distribution network
- water reservoirs
- provision of water supply to site

Estimated water costs for this infrastructure are set out in the table below.

Table 15. Water infrastructure capital costs, undiscounted, $ million, 2018

Water Infrastructure Capital Costs	Scenario One	Scenario Three	Scenario Six
Base Cost	63.2	81.0	97.0
Contingency @ 25%	15.8	20.2	24.2
Base Cost + Contingency	**79.1**	**101.3**	**121.3**

4.2.6 Telecommunications

Costs associated with the provisioning of the fibre are directly linked to the length of deployment. Brolgan Road will act as the backbone line through the SAP with extensions running north south as the land uses extend west. The Brolgan Road trunk is estimated to cost approximate $1.2m with over 9km of buried optic fibre. The Regional Enterprise zone is considered to accommodate the businesses with the highest data requirements into the future. Additional costs not included in the business case is the provision of tower facilities, located within the SAP, that can provide 5G and fixed wireless coverage. Cost of the construction can range between $170k and $500k depending on complexity of access, terrain and structure type. Given the assumption that most uses within the SAP will not need to solely rely on high capacity 10 gigabit fibre connection, then the provisioning of tower facilities to provide alternative connection types is considered a likely requirement, across all scenarios. Under Scenario One, a single telecommunications tower located on the local high point, backhauled into the proposed fibre trunk out Brolgan Road will provide wireless coverage to businesses and land uses that do not require a fibre connection. Under Scenario Two, the fibre to run out Brolgan Road would act as the main trunk with north/south extensions running from it into the Regional Enterprise zones. This extent of coverage for 5G and fixed wireless services under this scenario would likely see the need for 2 tower facilities strategically located to provided coverage. Each facility can cover and area between 0.5km – 2.5km. Scenario Three would entail a high cost of fibre deployment across the SAP, extending to the airport location in the south-west corner. Multiple tower facilities will be necessary under this scenario to provide broader coverage to businesses. The impact of the airport's OLD will restrict the location and height of these facilities.

Capital costs for the telecommunications infrastructure required under each scenario of the Parkes SAP were estimated with the following key cost items:

- installation of buried fibre optic cable
- provision of telecommunications to site

Estimated telecommunications costs for this infrastructure are set out in the table below. At this stage, telecommunications costs for Scenario Six are assumed to be the same as for Scenario Three, which will be confirmed later.

Table 16. Telecommunications infrastructure capital costs, undiscounted, $ million, 2018

Telecom Infrastructure Capital Costs	Scenario One	Scenario Three	Scenario Six
Base Cost	1.8	3.0	3.0
Contingency @ 25%	0.5	0.8	0.8
Base Cost + Contingency	**2.3**	**3.8**	**3.8**

4.2.7 Wastewater

Capital costs for the wastewater infrastructure required under each scenario of the Parkes SAP were estimated with the following key cost items:

- construction of sewerage network
- new sewage treatment plant
- augmentation to existing sewage treatment plant
- connection terminals

Estimated wastewater costs for this infrastructure are set out in the table below. At this stage, wastewater costs for Scenario Six are assumed to be the same as for Scenario Three, which will be confirmed later.

Table 17. Wastewater infrastructure capital costs, undiscounted, $ million, 2018

Wastewater Infrastructure Capital Costs	Scenario One	Scenario Three	Scenario Six
Base Cost	58.4	108.2	108.2
Contingency @ 25%	14.6	27.0	27.0
Base Cost + Contingency	**73.0**	**135.3**	**135.3**

4.2.8 Airport

Capital costs for the airport required under Scenario Six of the Parkes SAP were estimated with the following key cost items:

- Airport construction

Estimated airport costs for this infrastructure are set out in the table below.

Table 18. Airport infrastructure capital costs, undiscounted, $ million, 2018

Airport Infrastructure Capital Costs	Scenario One	Scenario Three	Scenario Six
Base Cost	0.0	0.0	207.0
Contingency @ 25%	0.0	0.0	51.8
Base Cost + Contingency	**0.0**	**0.0**	**258.8**

4.2.9 Customs Port

Capital costs for the customs port infrastructure required under each scenario of the Parkes SAP were estimated with the following key cost items:

- building structures
- security fencing
- cantilever sliding gate
- security access system
- CCTV system

Estimated customs port costs for this infrastructure are set out in the table below. At this stage, costs for Customs Port are assumed to be the same across all scenarios, which will be confirmed later.

Table 19. Customs Port infrastructure capital costs, undiscounted, $ million, 2018

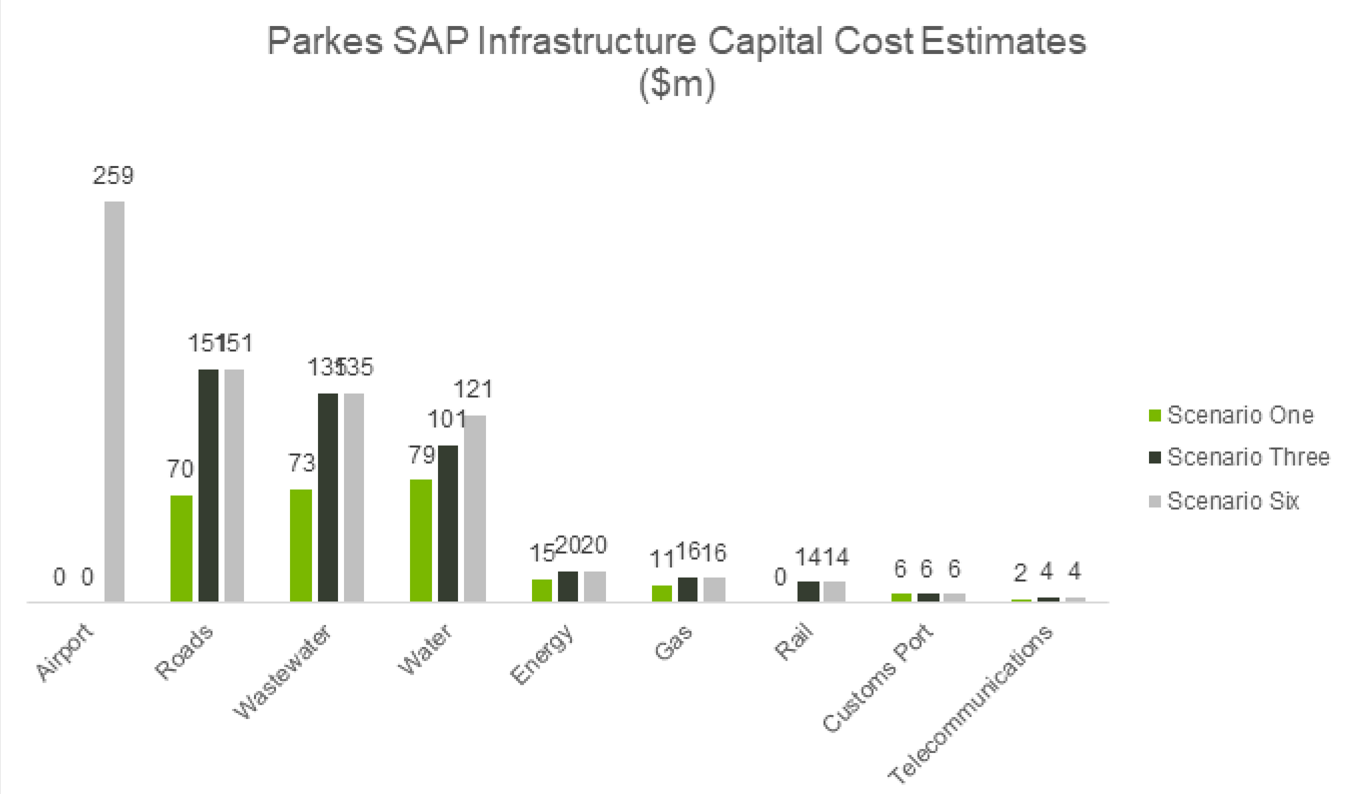
Customs Port Infrastructure Capital Costs	Scenario One	Scenario Three	Scenario Six
Base Cost	4.5	4.5	4.5
Contingency @ 25%	1.2	1.2	1.2
Base Cost + Contingency	**5.8**	**5.8**	**5.8**

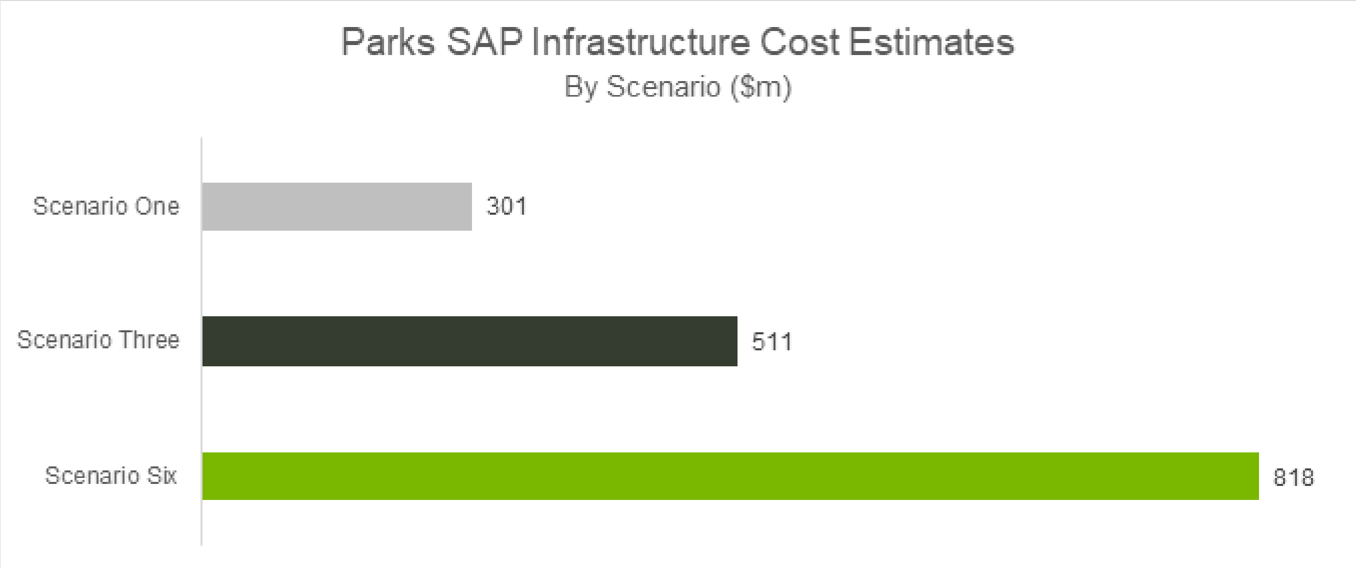
It is noted that the current scenarios do not include a Customs Port for the SAP. However, given the Strategic Business Case has considered a customs port facility, costings have been provided which may be considered further during the master planning workshop. It is not foreseen that the customs port would have a significant impact on infrastructure requirements beyond its capital cost.

4.2.10 Summarised Capital Cost Review

Table 20. Total infrastructure capital costs, undiscounted, $ million, 2018

Capital Cost Item	Base Case	Scenario One	Scenario Three	Scenario Six
Road Infrastructure	0.0	69.7	150.6	150.6
Rail Infrastructure	0.0	0.0	13.5	13.5
Gas Infrastructure	0.0	11.4	16.4	15.9
Energy Infrastructure	0.0	15.0	20.0	20.0
Water Infrastructure	0.0	79.1	101.3	121.3
Telecom Infrastructure	0.0	2.3	3.8	3.8
Wastewater Infrastructure	0.0	73.0	135.3	135.3
Airport Infrastructure	0.0	0.0	0.0	258.8
Customs Port Infrastructure	0.0	5.8	5.8	5.8
Subtotal for Infrastructure	**0.0**	**256.1**	**446.7**	**724.9**
Design @ 5%	0.0	12.8	22.3	36.2
Subtotal for Design	**0.0**	**268.9**	**469.0**	**761.2**
Approvals @ 5%	0.0	6.0	6.0	6.0
Offsets @ 5%	0.0	6.0	10.0	10.0
Appeals @ 5%	0.0	10.0	2.0	2.0
Subtotal for approvals, offsets and appeals	**0.0**	**286.9**	**487.0**	**779.2**
Owners costs @ 5%	0.0	14.3	24.4	39.0
Grand total	**0.0**	**301.3**	**511.4**	**818.2**


Parkes SAP Infrastructure Capital Cost Estimates ($m)
259
151 151
135 135
121
101
79
73
70
15 20 20
11 16 16
0 14 14
6 6 6
2 4 4
0 0
Airport
Roads
Wastewater
Water
Energy
Gas
Rail
Customs Port
Telecommunications
Scenario One
Scenario Three
Scenario Six


Parks SAP Infrastructure Cost Estimates By Scenario ($m)
Scenario One
301
Scenario Three
511
Scenario Six
818

4.3 Innovations, Efficiencies and the Circular Economy

While testing the scenarios, the following innovations and infrastructure efficiencies were identified that could contribute to achieving the principles of the circular economy for land uses identified within the three SAP scenarios. Case studies of where these have been successfully applied are also presented.

4.3.1 Innovation and Case Studies

Microgrid - Siemens Brookfield MicroGrid, Huntlee	
	**What is the innovation?** Creating an independent microgrid based on an array of rooftop solar panels, gas fuelled generators and battery storage. Note that this microgrid is not connected to the utility network at all. The microgrid services 7,500 dwellings and a commercial precinct.
	Where is it being used? Huntlee, a new precinct, 2.5 hours north of Sydney or 50 minutes north west of Newcastle, NSW
	What could its possible application be to Parkes? We could recreate a similar arrangement utilising embedded generation on site (solar panels on warehouse roofs and potentially W2E). SAP could appoint or act as utility retailer. This allows the SAP to facilitate behind the meter electricity generation within the site and regulate electricity billing for each tenant in the area. Full independence from the grid requires a microgrid, where all generation is performed on site from renewables and W2E, to a high level of reliability.
	Incremental improvement to business / business unusual / aspirational? With this arrangement, we could aim for zero net energy consumption with respect to utility connection. A connection to the grid could still be made to ensure security of supply.

Hydrogen production for injection into gas network – Jemena trial

What is the innovation?

Hydrogen produced from renewable/clean energy injected into the natural gas network (with concentration of up to 10%). Australian Gas Infrastructure Group believes that injections of up to 15% could be achieved with no modification to existing network infrastructure. Several studies suggest this could be increased to 20% with minimal issues.

Where is it being used?

Broader Jemena NSW network – e.g. Sydney

What could its possible application be to Parkes?

Reduces the reliance of Parkes and the SAP on Natural Gas, a fossil fuel, and assists in heading towards future-proof technologies. Helps bring Parkes towards a circular economy in the gas space.

Incremental improvement to business / business unusual / aspirational?

Business unusual – increases efficiency of gas network while improving energy cleanliness. Pushes towards circular economy.

10 Gigabit – City of Adelaide

What is the innovation?

Future proof dark fibre deployment to the Adelaide CBD, allowing high volume data transfer between businesses.

Where is it being used?

Adelaide CBD, SA

What could its possible application be to Parkes?

Could allow for highly efficient business to business secure data connections. A network of this capacity would allow for the use of blockchain authentication procedures to be used to providence proof digital and physical goods between locations, for example.

Incremental improvement to business / business unusual / aspirational?

A fibre network deployed to service business to business needs removes the roadblocks of congestions on normal internet networks. This opens the door to the use of blockchain authentication technologies and high volumes of IoT connections, data processing and distribution.

Automated freight handling – Moorebank Logistics Park, Sydney

What is the innovation?

Automated freight handling technology

Where is it being used?

Moorebank Logistics Park, Sydney NSW

What could its possible application be to Parkes?

This technology could be implemented in the freight terminals to increase efficiency of the transfer of freight between rail and adjacent distribution centres or warehouses. However, it would have adverse impacts on employment.

Incremental improvement to business / business unusual / aspirational?

This would provide efficiencies to the freight terminal operator. However, circulation of automated freight vehicles on the internal and external road network is unlikely in the near future.

4.3.2 Efficiencies

4.3.2.1 Stormwater efficiency applications

Potential efficiency initiatives for future development:

- Stormwater harvesting on an individual enterprise scale
- Design riparian throughout development to drain toward main workability water corridors with wide buffer zones. Within these zones construct wetlands to assist with water treatment and assist with stormwater management.
- Natural features for storm water treatment and storage (i.e. dams or wetlands) can be placed near banks of workability water corridors
- Water management through creating flow channels through crops to ensure efficient distribution of storm water.
- Detention features may be positioned above known areas of existing underground aquifers.
- Self- releasing water tanks incorporated into each building structure in all land uses to capture water from the roof and to self-release when rain is detected.
- Business clusters, for example
    - chicken farm to fertilizer plant
- cereal + abattoir = pet food
- Co-location opportunities such as solar farm and agricultural
- Solar farm around W2E in buffer zone (possibly owned by the SAP) as on days with temperatures near 40 degrees when solar farm cannot capture energy from the sun. Good efficiency to be co-located.
- Connection of embedded generation and SAP owned solar farm could be 'behind the meter' and any generation shall be only used within SAP. This removes the burden of a generator connection application process.
- Potential for hydrogen production to offset any excess generation, especially when the grid is constrained, and renewable generators have to be curtailed.
- Solar farm floating on recycled water or stormwater storage pond for dual purpose use of land and keep solar cells cool to maintain efficiency.
- Future proof land zoning by not “boxing” land uses into discrete area; allow for co-location of uses which can co-exist but which may not be similar uses/traditional zones.

4.3.3 Parkes SAP Circular Economy Blueprint

The SAP circular economy blueprint has been based on the following Guiding Principles:

Table 21 Guiding Principles of the Circular Economy

Guiding Principles	
A	Minimise material inputs into the SAP
B	Minimise end of life waste output from the SAP
C	Shared value with partners (one business's waste is another's 'treasure')
D	Highest and best use of resources

Table 9 below lists the incentives and interconnecting synergies between infrastructure that can lead to a more holistic development of the SAP.

Table 22 Incentives and Interconnecting synergies

Principle	Synergy	Infrastructure element						
		Water	**Wastewater**	**Stormwater**	**Power**	**Gas**	**Waste**	**Telco**
AB	Using W2E to form synchronised electricity generation helping to improve the stability and security of electricity supply within SAP and also to the wider network.				■		■	
A	Utilising extensive rooftop area from regional enterprise and terminal to install large capacity solar panels to help reduce net electricity supply of SAP.				■			
C	Co-location of solar farms with agricultural industry.				■			
AD	Storing electricity generation produced by either excessive embedded generation or certain mechanical operation (e.g. gantry cranes regenerative braking when dropping container).				■	■		
CD	SAP to appoint or act as utility retailer for electricity, water and gas. In this position, SAP will be able to distribution in-house embedded electricity generation within the site and regulate electricity billing for each tenant in the area.	■	■		■	■		
AC	Excess solar energy used for Hydrogen production				■	■		
AC	Stormwater harvesting for irrigation of parks and open spaces			■				
ABC	Recycled water for non-potable industrial uses (i.e. wash down)		■					
BCD	Supply biosolids to resource recovery/energy recycling facility							
BD	Recharge aquifer from stormwater detention basins	■		■				
AD	Rainwater tanks - Rainwater for internal uses (i.e. warehouse toilet flushing and hot water systems)	■		■				
D	Rainwater tanks - Connect rainwater to weather forecasts to release before rainfall to minimise flooding and peak stormwater flows			■				
C	Smart pressure sewer system that balances and schedules flows - Minimise treatment capacity		■					
A	Smart pressure sewer system that balances and schedules flows - Minimise pipe sizes and depth		■					
A	Smart pressure sewer system that balances and schedules flows - Energy efficiency		■		■			

Principle	Synergy	Infrastructure element						
BCD	Produce custom recycled water that is fit for purpose - Provide nutrient rich recycled water for cropping/horticulture and irrigation on green spaces							
ABCD	Produce custom recycled water that is fit for purpose - High quality, low salt water for high tech greenhouses							
ABCD	Produce custom recycled water that is fit for purpose - Very consistent, high quality water for sensitive industrial uses							
ABCD	Produce custom recycled water that is fit for purpose - Class A recycled water for non-potable uses							
ABCD	Produce custom recycled water that is fit for purpose - Shandy and dispose of excess recycled water and diluted process by-product water via irrigation to land within the development boundary							
ABCD	Produce custom recycled water that is fit for purpose - Recycled water and rainwater to cooling towers							
CD	Import excess recycled water from Parkes STP for recycling and reuse within the SAP							
BCD	Import groundwater and export recycled water for use in mines							
B	Passive stormwater treatment to minimise nutrient & pollutant discharges from study area							
ABC	Waste to Energy – Gas - Hydrogen to main gas network							
ABC	Waste to Energy – Gas - Methane gas export							
ABC	Waste to Energy – Gas - Carbon dioxide export							
ABC	Waste to Energy – Electricity – Direct to customer (behind the meter)							
ABC	Waste to Energy – Electricity – Input into the grid							
ABCD	Waste to Energy – Heat – Used as a direct fuel source to produce heat for a manufacturing process							

4.4 Final Master Plan Solution – Enquiry by Design Workshop

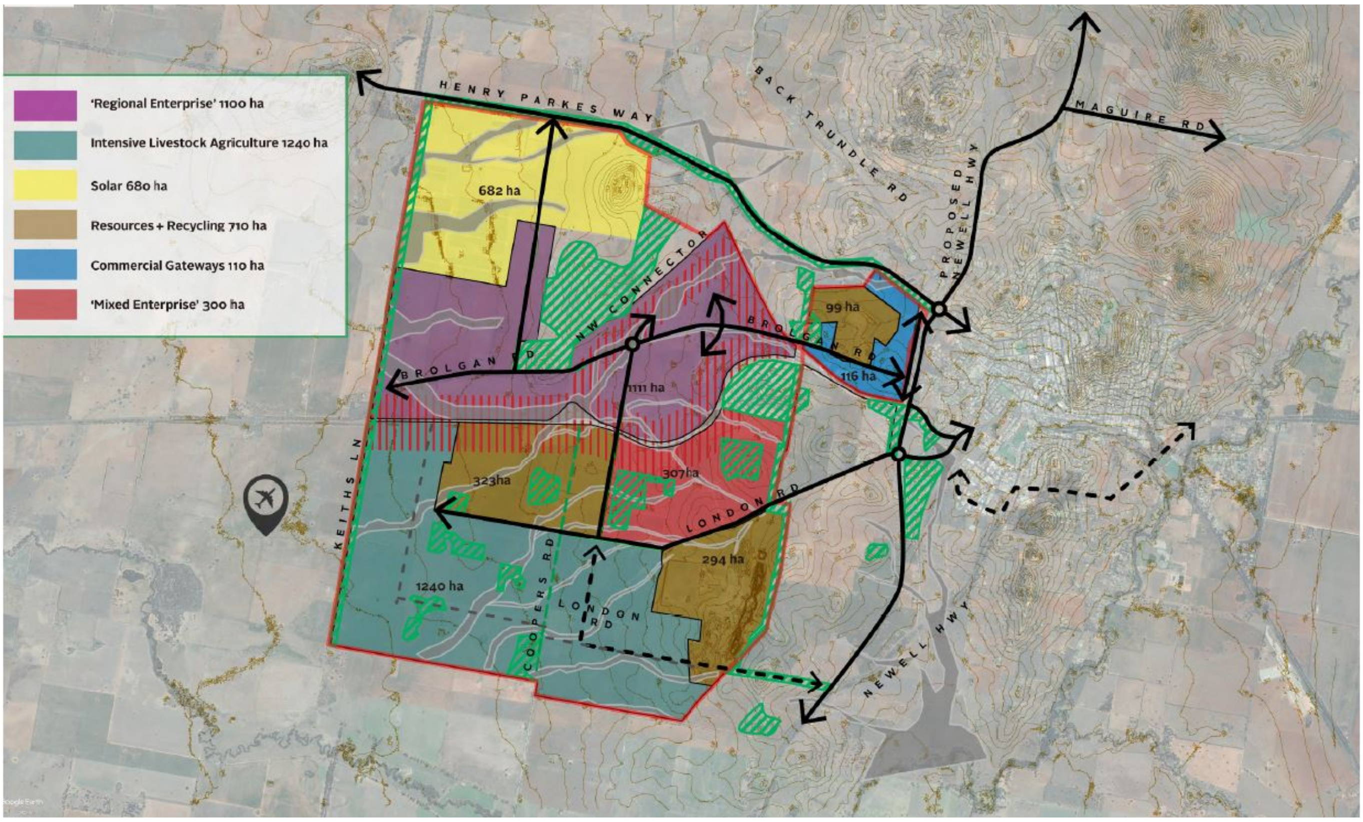
4.4.1 Introduction

The Parkes SAP Enquiry by Design workshop was held in Parkes, NSW from Monday 6th to Friday 10th May 2019. The workshop was the primary master planning workshop for the project and involved more than 40 participants from the project team, state agencies, Parkes Shire Council and local stakeholders.

In completing the Enquiry by Design workshop, a final Master Plan solution was developed which is identified in Figure 24. As a result, a refined infrastructure and transport strategy has been prepared for the final Master Plan including modelling, costing and staging of the infrastructure. The following section summarises the final solution for each infrastructure and transport technical areas. Water and wastewater demand estimation criteria for the final Master Plan are summarised in Appendix J.

Figure 25, Figure 26 and Figure 27 illustrate the strategic infrastructure and transport plan for the final Master Plan solution.

Figure 24: Final Master Plan



Water

Demand

Water demand is highly dependent on the type of businesses of each land-use in the SAP. An upper bound estimate has been assumed.

The ultimate total water demand is estimated to be 7,000 ML/yr based on the following assumptions:

- Non-potable supply to green infrastructure and potable supply to the remaining land-use.
- Average annual demand in Parkes and surrounding townships is expected to rise from 2,500 ML/ year in 2016 to 2,702 ML/year in 2046 based on a population growth rate of 0.4%.
- Latest best practice ESD for the built environment will be used (e.g. low flow taps, leak detection, etc)

Water use for Northparkes Mines has been excluded from raw water demand as Parkes Shire Council has since confirmed that Northparkes Mine has their own water access licences.

It is noted that land-use quantum for green infrastructure is not available. Green infrastructure demand for non-potable water has therefore not been determined and it is assumed there will be surplus recycled water to irrigate green infrastructure if required.

Supply:

The total current raw water supply allowance available is around 13,000 ML/year, including dams, groundwater and river water access licences. This is sufficient to meet total potable and non-potable water demand.

Water availability is likely to be significantly reduced during extreme drought and future climate change will exacerbate this. To improve resilience of water supply, it is recommended that climate change risks are considered during the development of future water supply strategies. These strategies may include changes to water management practices and sourcing of alternative water supplies, including acquisition of additional water access licenses.

There may be up to 8,000 ML/year of alternative water supply generated within the SAP, including rainwater, harvested stormwater and recycled water. Combined with current raw water supplies, this is 21,000 ML/year.

A new airport is not planned as part of the SAP under the final scenario, however, a water supply service maybe extended to service an airport if required.

Staging consideration

The existing water treatment plant in Parkes is likely to have sufficient capacity to supply potable water for early development in the SAP, although the existing transfer network will require augmentation. New water networks are required in the SAP, including water reservoirs.

Additional treatment capacity at the existing WTP, or a new WTP in the SAP will be required when demand in the SAP exceeds around 3,000 ML/year.

Estimated Water Infrastructure Capital Costs

Base Cost: $71.5m

Contingency @ 25%: 17.9m

Base Cost + Contingency: $89.4m

Wastewater

Wastewater –

Wastewater generation is highly dependent on the types of businesses that occur in each land-use in the SAP. An upper bound estimate has been assumed.

The ultimate wastewater flow generated from the SAP is estimated to be 2,400 ML/yr. This equates to approximately 37,000 EP. It was assumed:

- Best practice ESD within the energy and recycling land uses will include water recycling and therefore reduce wastewater flows by 75%;
- Intensive livestock industry land uses will be serviced by localised wastewater treatment facilities and therefore will not transfer wastewater flows to the new sewage treatment facility servicing the SAP;
- No wastewater generation from green-infrastructure as water will be used for irrigation.
- Minimal wastewater generation from mixed enterprise (commercial cropping).

A centralised STP dedicated to servicing Parkes SAP is proposed. The SAP naturally drains to the south west; locating a new STP towards the west of the SAP will enable sewage to flow via gravity towards the STP and minimize the need for pump stations and pressure rising mains.

A recycled water system will be required to meet non-potable demand. This might include a third pipe system throughout the regional enterprise, green infrastructure and intensive livestock land use areas, which could join the existing purple pipe loop around the town.

A new airport is not planned as part of the SAP under the final scenario, however, if a new airport is required to support the SAP it was assumed that it will be serviced by an onsite sewage management system given the indicative location of an airport west of the SAP. If an airport is to be serviced by the centralised Sewage Treatment Plant with the SAP, a sewage pumping station and long rising main would be required to transfer flows northeast to the new STP.

Staging Considerations

Wastewater infrastructure for the SAP should be staged for cost efficiency as full development on the SAP is unlikely to occur for many years. Tankers and temporary on-site wastewater systems may be required in the early stages of development. A new centralised STP with a total of 40,000 EP capacity is required. The design of the STP should allow for stage augmentation as SAP development progresses and certainty around sewage generation improves. The sewage network should be constructed with the new STP. Staging of sewer mains may be required to avoid septicity and odour issues in the early development stages and may also defer some investment.

Estimated Waste Water Infrastructure Capital Costs

Base Cost: $68.8

Contingency @ 25%: $17.2m

Base Cost + Contingency: $86.0m

Stormwater

Drainage Methodology

The proposed stormwater drainage philosophy for the estimation of infrastructure requirements and opportunities for innovation and the management of stormwater quality and quantity utilises the natural contours of the land (low areas), which were found favourable for drainage corridors, adopting a minimisation of disturbance approach where possible.

The study area was initially divided into 3 sub-catchments, in which drainage corridors were designed to approximately follow preliminary modelled flood extents for the 1% AEP and the natural lay of the land. These are shown in the plan and provide the basis for the stormwater management plan.

Key Proposed Measures of Stormwater Management Philosophy

Workability / drainage corridors, which:

- constitute a primary method of conveying stormwater runoff;
- storing quality water wherever feasible
- these are loosely based on the 1% AEP flood extent and follow the natural overland flow paths
- are an alternative to conveying flows through pipes, which reduces demand for traditional drainage infrastructure
- create wide riparian buffer zones, which provide opportunity for management measures such as detention (e.g. basins) or water quality improvement (e.g. bioretention swales) features and further public amenity and environmental values.
- Provide green spaces and opportunities for social interaction which improve workability, or the liveability of workers.

Cross drainage infrastructure:

- Locations for cross drainage have been identified where concentrated overland flow paths intersect with proposed infrastructure (road and rail) alignments. Locations for storage not yet identified.

Water Quantity measures:

- Designation of floodwater storage areas
- Manage both stormwater quality and quantity – avoiding cumulative effects that would increase flow and pollution – allow the water to pass through infiltration and detention system upstream
- Location and size based on contributing catchment and land use (i.e. high risk / high impact land use will need to have water treated at / close to source)
- Having the detention basins upstream decreases flood risk downstream (which has been increased by impervious land uses)

Water Quality Measures:

- Application of the principles of water sensitive urban design (WSUD), e.g. bioretention systems, swales, and raingardens.

Site Characteristics and Constraints for Stormwater Management

Drought consideration

- As the site is in a drought prone area, stormwater storage is very important. Determining realistic water quantities and the frequency of rainfall will guide the method of stormwater management

Downstream effects outside the property boundary

- Using storage to manage extra flow running off the property as a result of development is important. Maintaining the natural course of water, avoiding increase of flooding downstream, and avoiding scour downstream to maintain natural course of water must be considered.

Recommended Infrastructure

Table 24 Core Infrastructure Requirements

Features	Final Master Plan
Workability Corridor	Applicable
Cross Drainage Locations	13
Detention Basins	27

Note: There are more potential locations for detention basins based on development detailed designs

Table 25 Opportunities for Innovation and stormwater management

Features	Final Master Plan
Regional Enterprise	Opportunity for high density development that can incorporate drainage easements to avoid cumulative effects increasing peak flow downstream. Traditional piped stormwater drainage measures likely required at a lot and block scale where high intensity development is implemented. End of pipe into drainage easements for stormwater quantity (detention) and quality measures at a neighbourhood scale recommended.
Intensive Livestock Agriculture	Natural detention features or dams may be placed at multiple locations.
Solar	It is assumed that the implementation of solar farm infrastructure will not significantly increase the imperviousness of these land use areas. However, where isolated areas of imperviousness are created. It is recommended that any creation concentrated stormwater flow paths are detained or distributed to minimise risk erosion and land degradation.
Green Infrastructure	Connectivity with drainage easements at downstream extents of large areas set aside as “Green Infrastructure” areas is recommended.
Resources and Recycling	Potential for varied industrial activities may require specific/bespoke stormwater quality treatment measures to deal with a range of potential stormwater pollutants. Large roof areas to be potentially introduced with large scale industrial activity where potential opportunity for lot scale rainwater capture and stormwater harvesting.
Commercial Gateways	Requirement for implementation of a combination of natural drainage corridors and tradition pipe drainage solutions where intensive (high impervious) developments are constructed. A high level of connectivity (roof to drain) is likely with these development, therefore block and neighbourhood scale drainage networks with local detention, harvesting and water quality features are recommended.
Mixed Enterprise	Assumed that a range of potential developments could be included in these areas. Therefore, a mix of recommended stormwater management measures from all other land use types may be required. The implementation of these measures to be strategically considered with the rollout of detailed design development in this land use area.

Staging Considerations

A decentralised system of detention features, constructed on an as needs basis is preferred as the number and extent of detention features implemented will ultimately reflect the infrastructure needed, to match the extent of development that actually occurs. This is thought to optimise the cost associated with construction and ongoing management of these features.

A centralised system for dealing with increases to stormwater quantity runoff form the Parkes SAP development area was not favoured for the final Master Plan due to the significant up-front capital cost for implementation, and the difficulty in sizing and configuring an appropriate design. This is where the exact nature/intensity of the development and hence increased runoff is not accurately known before, and if, development occurs. Additionally, large dams have a higher operational complexity and carry a failure risk profile with higher consequences than smaller decentralised detention features.

Estimated Stormwater Infrastructure Capital Costs

Base Cost: $8.1m

Contingency @ 25%: $2.0m

Base Cost + Contingency: $10.1m

Electricity

The estimated electricity demand is 80 MVA for the preferred land usage as agreed in the Enquiry by Design Workshop. The high energy estimate is driven by the extensive area of regional enterprise and intensive livestock agriculture. There is currently not enough capacity in the TransGrid Parkes Substation for this demand if the SAP is to connect at 66kV bus, nor at the 66kV Essential Energy Parkes Town Zone Substation. It is therefore recommended that the SAP connects to the 132kV bus to avoid triggering the installation of an additional 132/66kV transformer in Parkes Substation.

One or more main intake substations can be constructed, potentially located at the north and south end of the SAP to create some redundancy and limit internal reticulation losses.

Internal electricity reticulation for each facility can be installed as a ring supply arrangement coming from the main intake substation. This increases the redundancy of the system, eliminates the cost of building a dedicated substation for each facility and can easily be extended.

Staging Considerations

In terms of staging, the following sequence is proposed for electrical installations:

1. Apply for connection application as a load from the relevant NSP
2. Apply for connection application as an embedded generator, pending finalisation of the generation options. If power is to be exported, a generator application should be made as a registered market participant in the National Electricity Market (NEM), although generator may be less than 30 MW export.
3. Installation of 132kV incoming feeder cables and construction of Main intake substations. Both main intake substations shall be completed before 132kV cables can be terminated and commissioned.
4. Installation of ring main unit, kiosk transformers and internal reticulation cables feeding each facility will be performed during the construction period of respective facilities.

Estimated Electricity Infrastructure Capital Costs

Base Cost: $27.0m

Contingency @ 25%: $6.8m

Base Cost + Contingency: $33.8m

Gas

No upgrades to existing infrastructure are required to support the chosen Master Plan. The planned extension of the Brolgan Rd 210 kPa pipeline will be required to support the SAP but will not require a capacity upgrade. Provided the input to this pipeline is 210 kPa, the pressure will not need to be increased to support the SAP. In addition to the existing and planned infrastructure, this Master Plan will require a gas distribution network to be installed to connect businesses to the gas pipeline. It would be prudent to ensure coordination between road and water infrastructure works to minimise earthmoving costs for the installation of these gas pipelines.

Staging Considerations

Conducting the rollout of the whole gas distribution at the initiation of the project is more economically favourable as it can coordinate with other industries (i.e. roads and water) to ensure gas pipeline locations are easily accessible and convenient. Also, providing additional capacity in the distribution network for the expected maximum SAP demand would be economical, as replacing pipelines at a later stage would pose further complexities.

Estimated Gas Infrastructure Capital Costs

Base Cost: $9.6m

Contingency @ 25%: $2.4m

Base Cost + Contingency: $12.0m

Telecommunications and Internet Services

The committed fibre deployment along Brolgan Road as part of the Growing Local Economies initiative will provide sufficient data connection resource to the SAP. Overtime, the provision of north/south running connections from this primary trunk should be considered, especially as users of the regional enterprise zone of identified and confirmed. Where ever possible, new underground utilities should include fibre connection to future proof parts of the SAP.

The opportunity to locate a telecommunication tower at the local high point, back-haul into the fibre network should be considered and could provide 5G or fixed wireless connections to those businesses and land uses not necessarily dependant on a fibre connection. The introduction of the tower into this area will also present an opportunity for mobile carriers to install equipment when customer demand reaches a certain point within the SAP.

Staging Considerations

Fibre deployment along Brolgan Road to a tower facility providing a wireless connection to the wider area will allow for business not reliant on fibre to establish themselves within the SAP. Fibre provisioning should occur wherever possible with other buried services, with unused line connected as demand grows. The small scale of optic fibres means their deployment with other utilities is relatively low impact and can normally be accommodated in underground power supply conduits for example.

Estimated Telecommunications and Inter Services Infrastructure Capital Costs

Base Cost: $3.0m

Contingency @ 25%: $0.8m

Base Cost + Contingency: $3.8m

Waste and Resource Recovery

The estimated solid waste generation rate is 1,418 t/year. If this waste is of a type able to be handled by the Parkes, Waste Facility (PWF), it will consume roughly 9.5% of the life of the PWF, reducing the projected life by 11 years, (from 115 years to 104 years).

No additional general waste specific infrastructure is required to support the final Master Plan as there is sufficient capacity at the Parkes Waste Disposal Facility. Should the SAP generate any special wastes, it is recommended that a special waste disposal facility be constructed by a private developer in the Resources and Recycling land uses or the waste must be transported off site to another facility licensed to handle the waste type.

The roads, rail and other infrastructure proposed for this SAP is sufficient to support the internal transportation of waste generated within the SAP as well as any waste imported from outside Parkes Shire Council to the W2E facility. The only specific infrastructure for W2E is the development of a new rail siding to serve the W2E facility and it is assumed that this will be undertaken by a private developer, however may be undertaken by NSW Government. Its cost has been included in the final Master Plan to enable economic analysis.

Staging Considerations

General waste disposed of at the Parkes Waste Disposal Facility. The disposal of special wastes will either be outside the SAP or when volumes become economically viable, to an internal waste facility constructed in the Resources and Recycling land uses, by a private developer.

Estimated Waste and Resource Recovery Infrastructure Capital Costs

No upfront capital costs. Refer to transport section below for rail siding cost estimate.

Transport

Road

The initial stage of SAP development will require upgrades to Brolgan Road (Road (currently being upgraded between SCT Logistics Centre and Coopers Road), including new intersections providing site specific access to SCT Logistics and Pacific National. The eastern rail crossing along Brolgan Road as well as the rail crossing on Coopers Road will need to be grade separated from the outset to provide unobstructed access for both road and rail to service the SAP. Upgrades to London Road will be required to ensure access for heavy vehicles, and the north-south connector along Coopers Road between Brolgan Road and London Road will also be required to facilitate movement across the central and eastern parts of the SAP as part of the first stage of development. As part of the Newell Highway Parkes Bypass development and construction, a new connector road should be integrated into the SAP from day one, enabling seamless access from the Newell Highway into the SAP. Intersections with the bypass (at Henry Parkes Way and London Road) should be monitored for performance to provide necessary upgrades at suitable trigger points as outlined in Appendix I.

As the SAP progresses to the next stage of development, an additional north-south connection between Brolgan Road and Henry Parkes Way will be required to support development at the northern end of the SAP. A further extension of both Brolgan Road and London Road to the west may be required to facilitate development in the western and southern ends of the SAP. There is also contingency for extending the north-south connector along Coopers Road further to the south and then east to link back up with the proposed Parkes Bypass.

Estimated Road Infrastructure Capital Cost

Base Cost: $102.4m

Contingency @ 25%: $22.6m

Base Cost + Contingency: $125.0m

Rail

The North-West rail connection is currently under construction and the Parkes-Narromine line is being upgraded as part of the Inland Rail project. The rail siding to service any future waste infrastructure may be privately funded however costs have been included in the final Master Plan to enable economic analysis.

Development of the SAP is not likely to significantly impact current and future passenger rail operations.

Estimated Rail Infrastructure Capital Cost

Base Cost: $10.8m

Contingency @ 25%: $2.7m

Base Cost + Contingency: $13.5m

Airport

A new airport is not planned as part of the SAP under the final scenario, but contingency has been made (indicatively) for a new airport to the west of the SAP, should it be needed as the SAP develops.

Estimated Airport Infrastructure Capital Cost

None.

Public Transport

Provision of public transport to and from the SAP would provide an efficient alternate access for employees. This would reduce the impact of light vehicle traffic on roads within both the SAP and the town and would extend the lifespan of the infrastructure.

Road corridor widths should accommodate for the provision of a shared path to provide the option for active travel to and from the SAP. The corridor width will enable future public transport infrastructure (e.g. bus stops) to be implemented at different stages of development within the SAP, as necessary.

As employment numbers increase, there are opportunities to have a consolidated parking facility with associated shuttle service to businesses in the SAP, as outlined in the ESD report.

Estimated Public Transport Costs

None.

4.4.2 Final Master Plan Solution Cost Summary

Table 23. Total infrastructure capital costs, undiscounted, $ million, 2018

Capital Cost Item	Final Master Plan Solution
Road Infrastructure	125.0
Rail Infrastructure	13.5
Gas Infrastructure	12.0
Energy Infrastructure	33.8
Water Infrastructure	89.4
Telecom Infrastructure	3.8
Wastewater Infrastructure	86.0
Stormwater Infrastructure	10.1
Customs Port Infrastructure	5.8
Subtotal for Infrastructure	**379.4**
Design @ 5%	19.0
Subtotal for Design	**398.4**
Approvals	6.0
Offsets @ 5%	10.0
Appeals	2.0
Subtotal for approvals, offsets and appeals	**416.4**
Owners costs @ 5%	20.8
Grand total	**437.2**

Figure 25: SAP Master Plan: Water, Wastewater and Stormwater Infrastructure

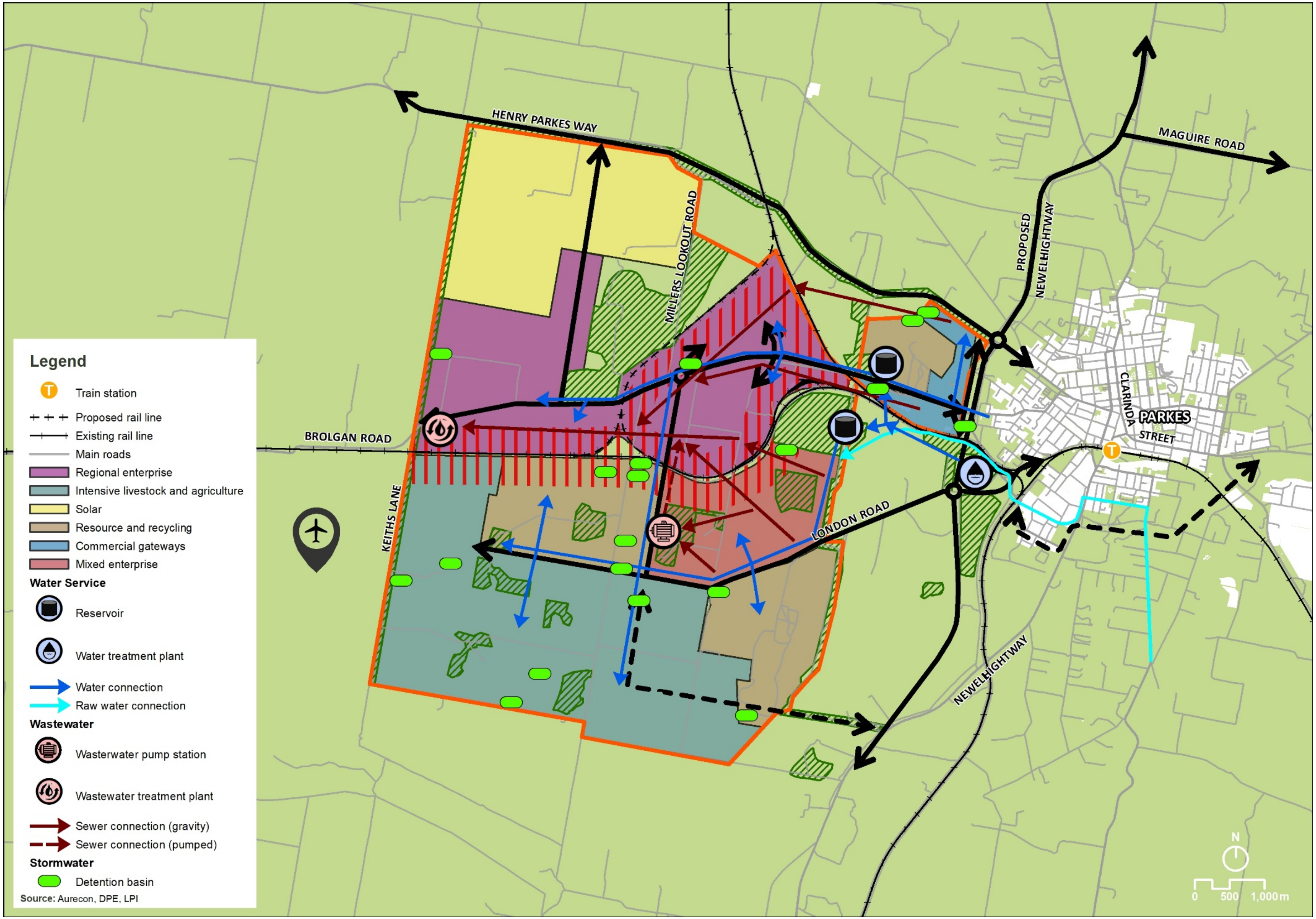


Figure 26: SAP Master Plan: Electricity, Gas, Telecommunications and Waste Resources Infrastructure

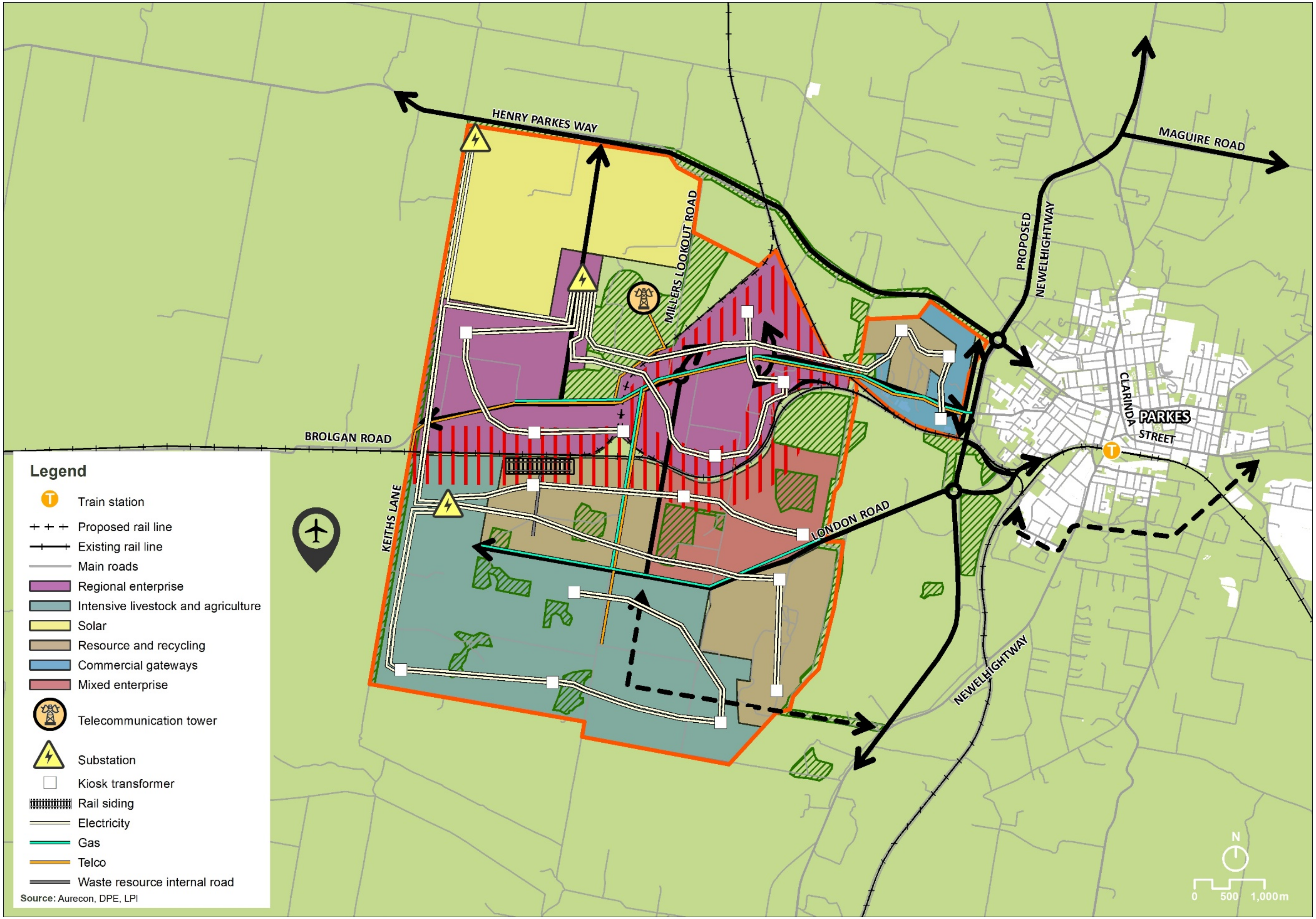
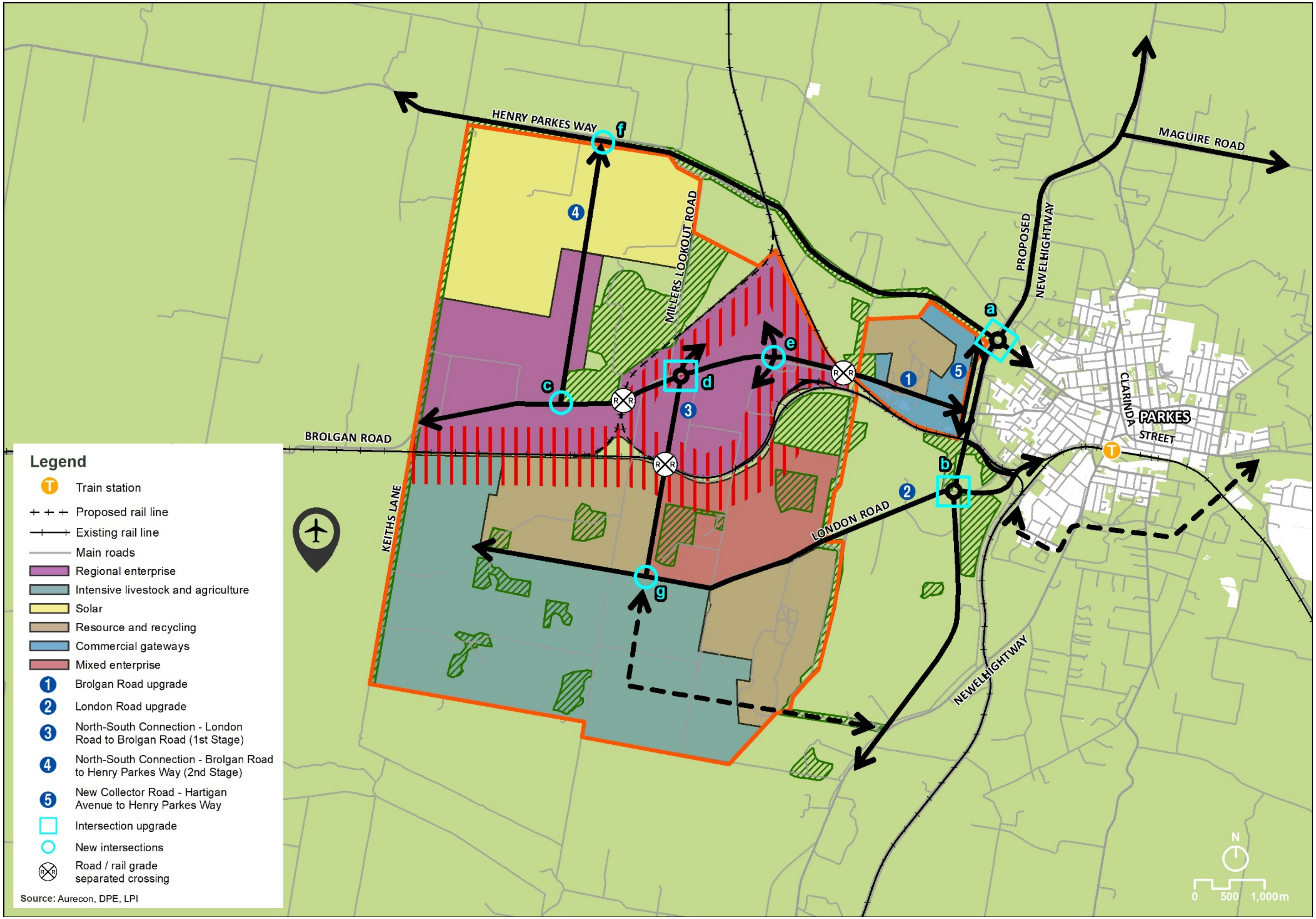
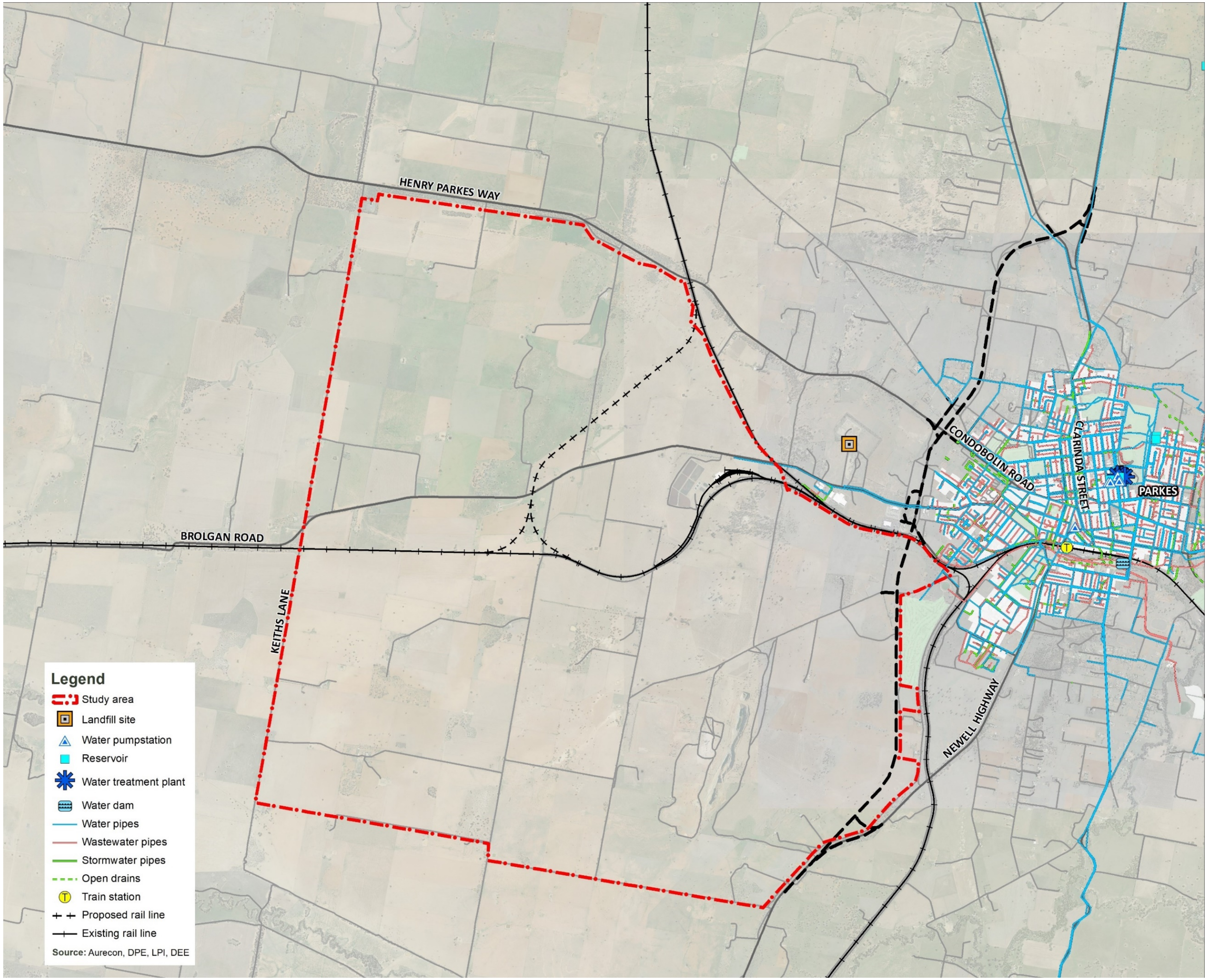


Figure 27: SAP Master Plan: Transport Infrastructure

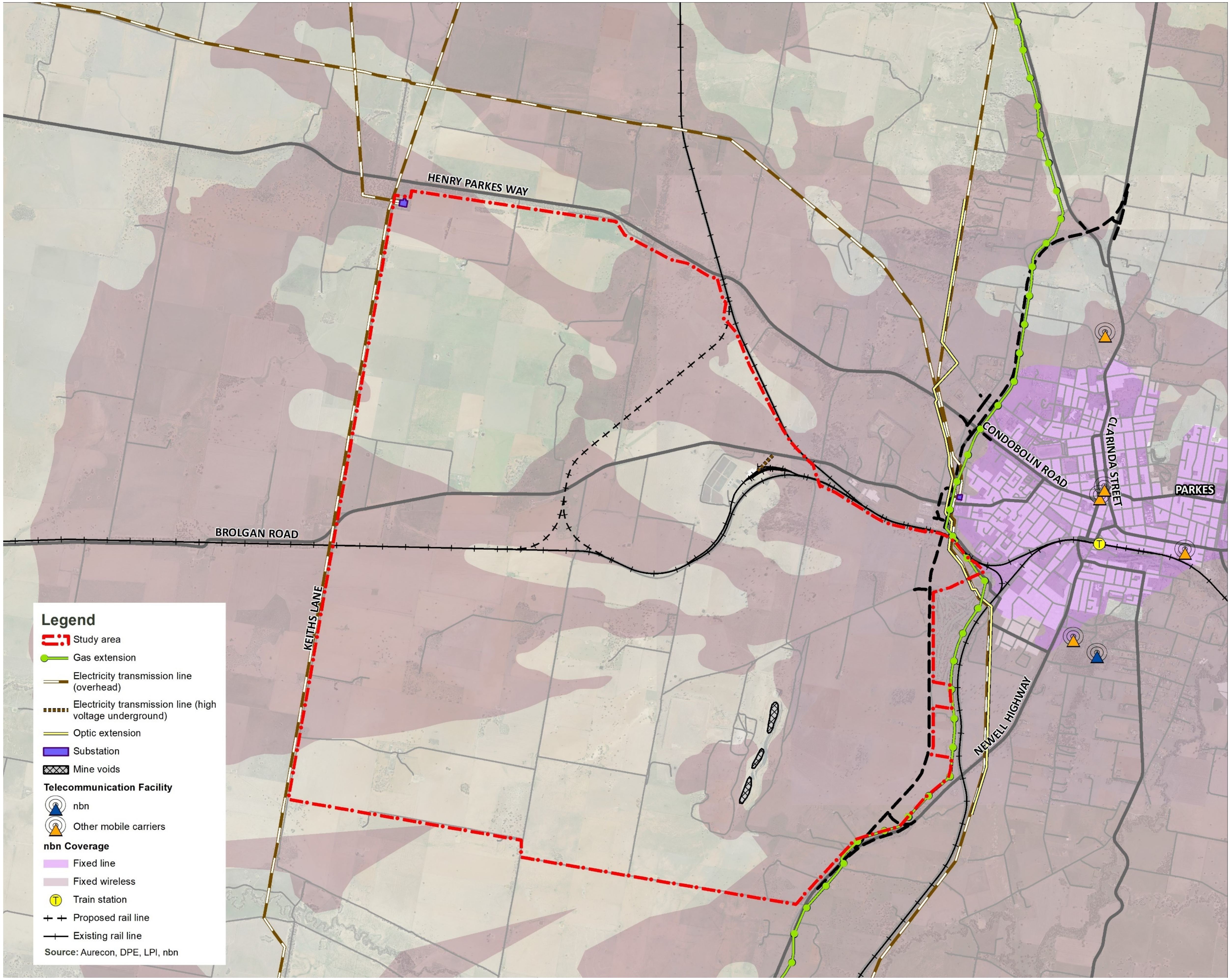


Appendices

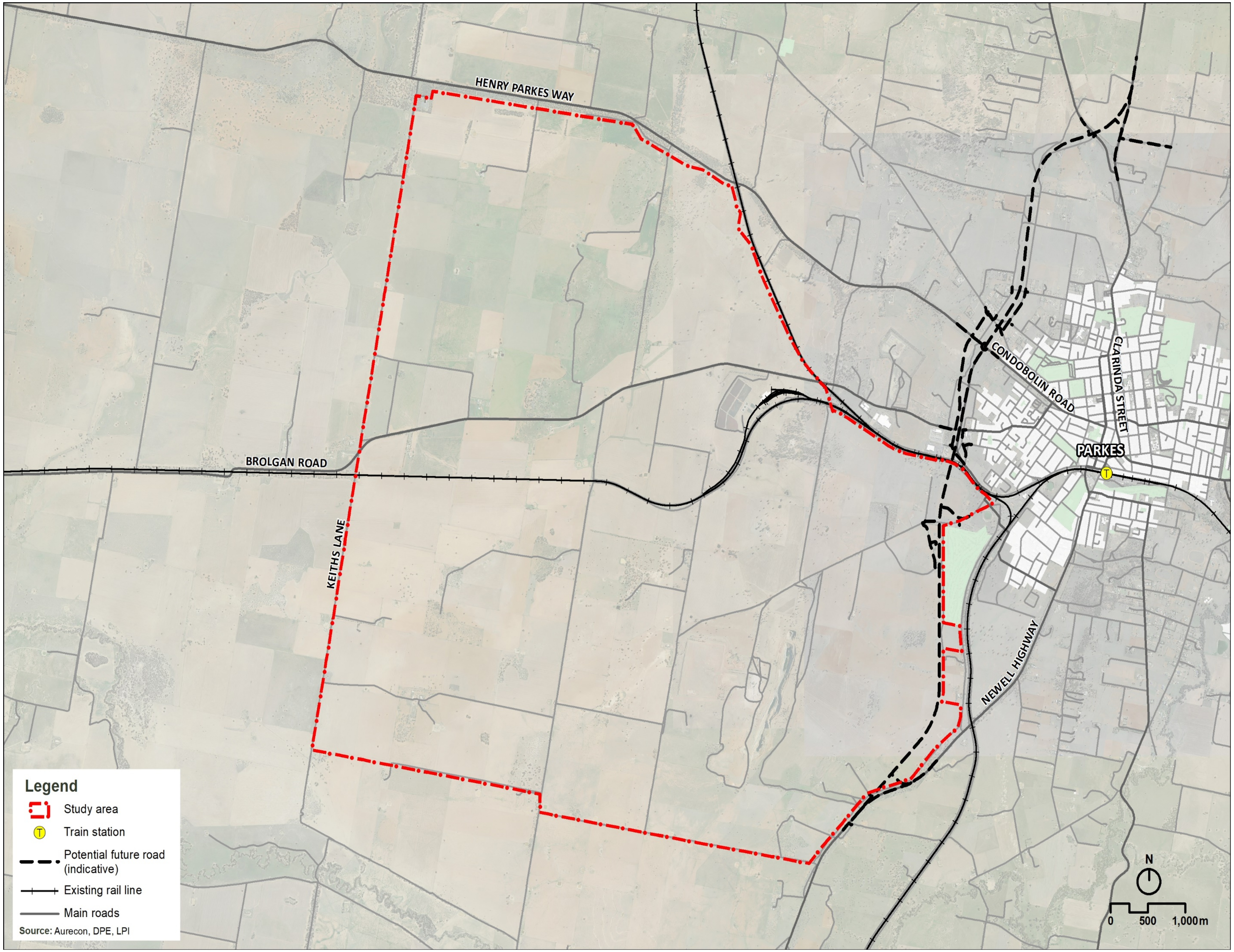
Appendix A - Existing Water, Wastewater and Stormwater Map


HENRY PARKES WAY
BROLGAN ROAD
KEITHS LANE
CONDOBOLIN ROAD
CLARINDA STREET
PARKES
NEWELL HIGHWAY
Legend
Study area
Landfill site
Water pumpstation
Reservoir
Water treatment plant
Water dam
Water pipes
Wastewater pipes
Stormwater pipes
Open drains
Train station
Proposed rail line
Existing rail line
Source: Aurecon, DPE, LPI, DEE

Appendix B -
Existing Electricity, Gas, and Telecommunications Map


HENRY PARKES WAY
BROLGAN ROAD
KEITHS LANE
CONDOBOLIN ROAD
CLARINDA STREET
PARKES
NEWELL HIGHWAY
Legend
Study area
Gas extension
Electricity transmission line (overhead)
Electricity transmission line (high voltage underground)
Optic extension
Substation
Mine voids
Telecommunication Facility
nbn
Other mobile carriers
nbn Coverage
Fixed line
Fixed wireless
Train station
Proposed rail line
Existing rail line
Source: Aurecon, DPE, LPI, nbn

Appendix C - Existing Transport Infrastructure Map


HENRY PARKES WAY
BROLGAN ROAD
KEITHS LANE
CONDOBOLIN ROAD
CLARINDA STREET
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NEWELL HIGHWAY
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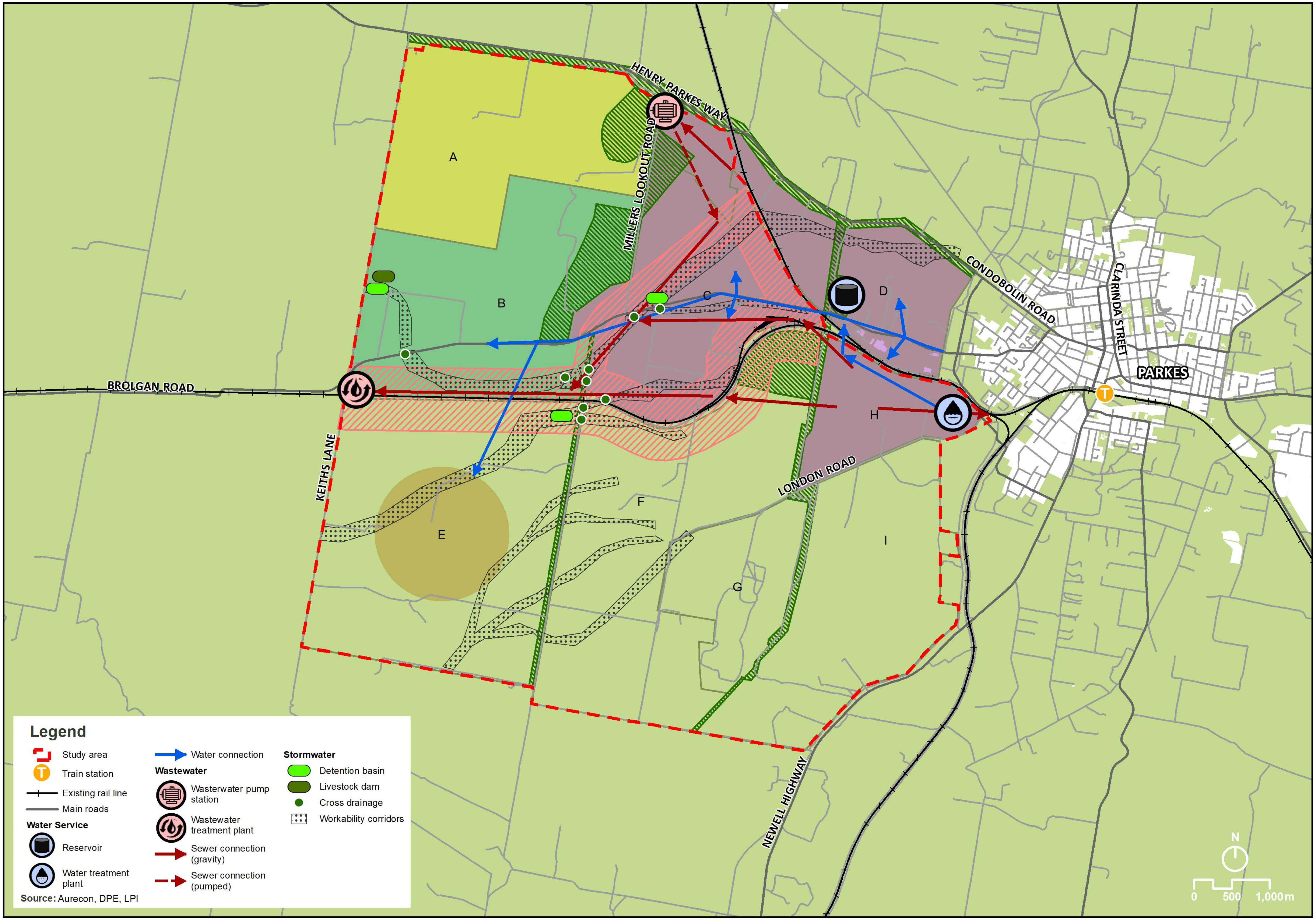
1,000m
Legend
Study area
Train station
Potential future road (indicative)
Existing rail line
Main roads
Source: Aurecon, DPE, LPI

Appendix D -
Scenario 1 Infrastructure and transport plans



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MILLERS LOOKOUT ROAD
CONDOBOLIN ROAD
CLARINDA STREET
PARKES
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
Legend
Study area
Train station
Existing rail line
Main roads
Water Service
Reservoir
Water treatment plant
Water connection
Wastewater
Wasterwater pump station
Wastewater treatment plant
Sewer connection (gravity)
Sewer connection (pumped)
Stormwater
Detention basin
Livestock dam
Cross drainage
Workability corridors
Source: Aurecon, DPE, LPI
N
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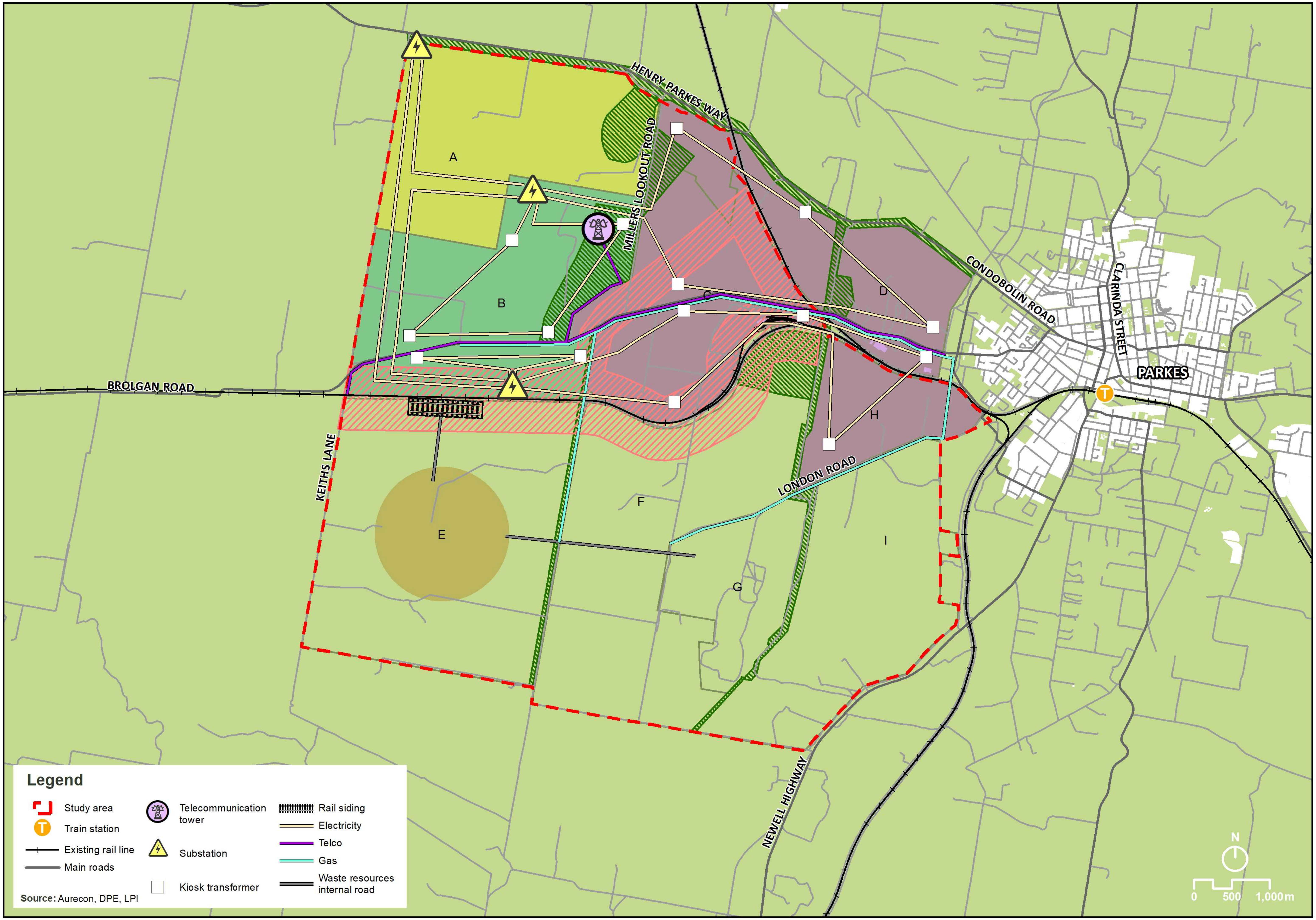
1,000 m



HENRY PARKES WAY
MILLERS LOOKOUT ROAD
CONDOBOLIN ROAD
CLARINDA STREET
PARKES
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
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Legend
Study area
Train station
Existing rail line
Main roads
Telecommunication tower
Substation
Kiosk transformer
Rail siding
Electricity
Telco
Gas
Waste resources internal road
Source: Aurecon, DPE, LPI
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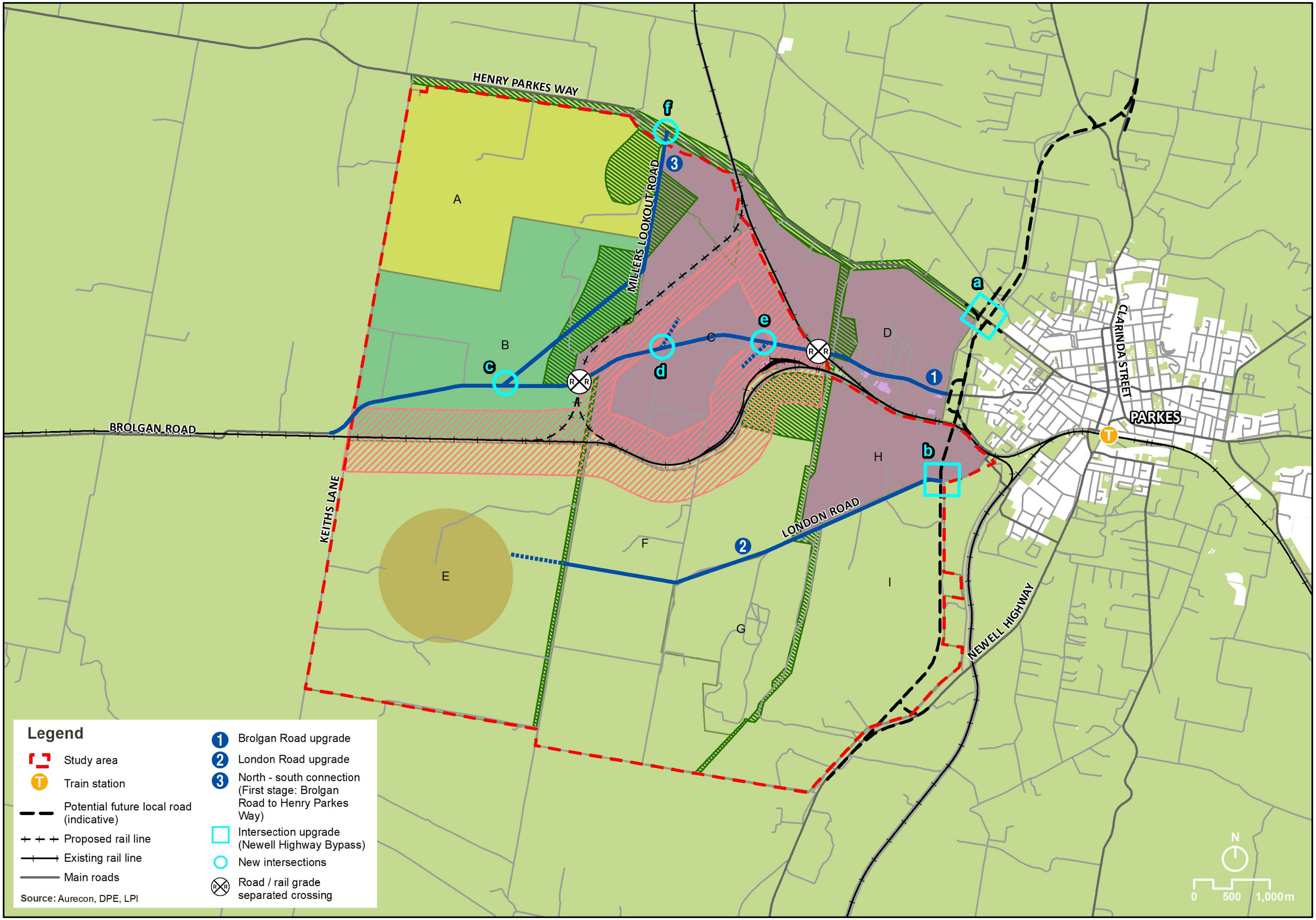
1,000 m


HENRY PARKES WAY
MILLERS LOOKOUT ROAD
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
CLARINDA STREET
PARKES
A
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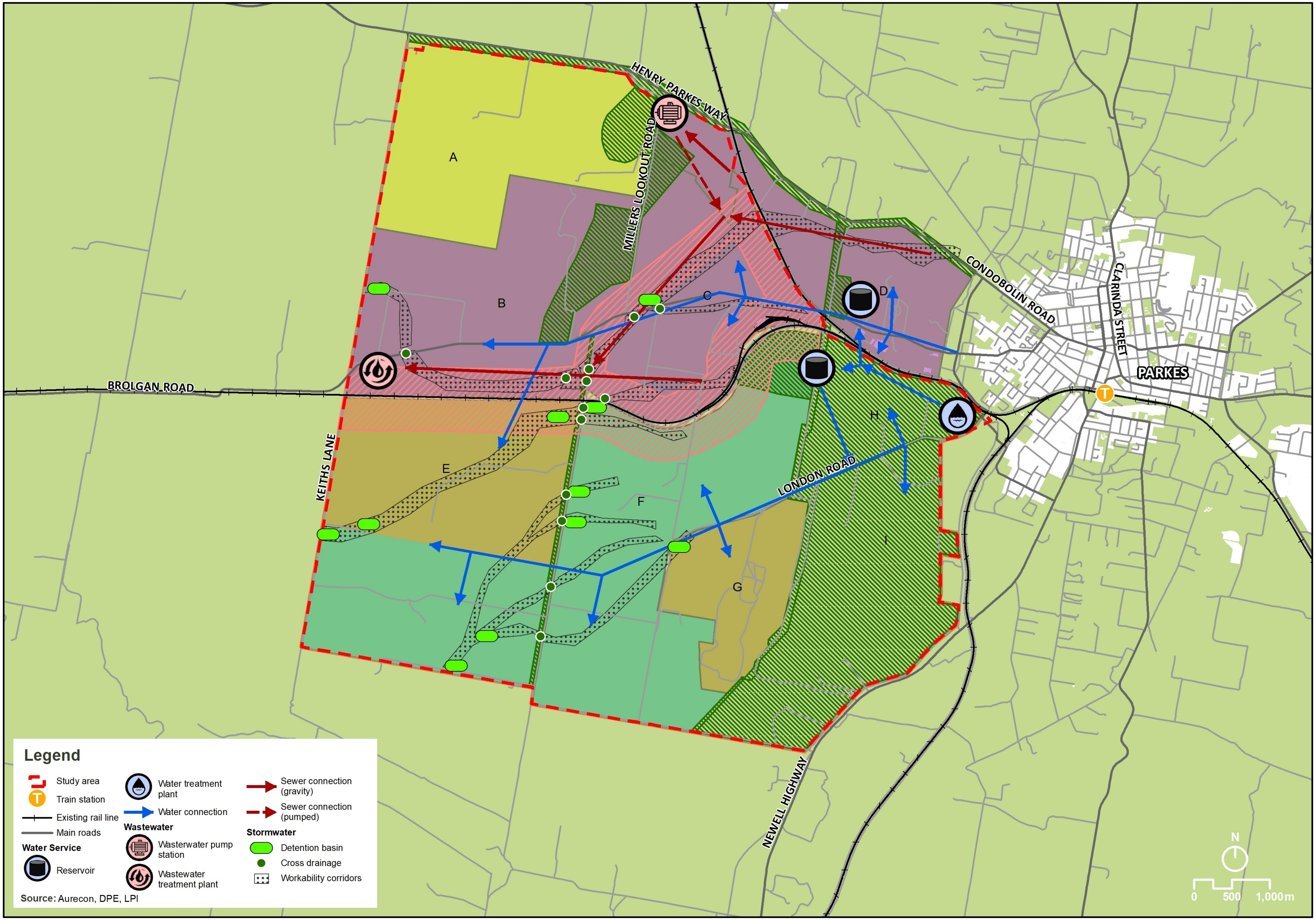
Legend
Study area
Train station
Potential future local road (indicative)
Proposed rail line
Existing rail line
Main roads
1 Brolgan Road upgrade
2 London Road upgrade
3 North - south connection (First stage: Brolgan Road to Henry Parkes Way)
Intersection upgrade (Newell Highway Bypass)
New intersections
Road / rail grade separated crossing
Source: Aurecon, DPE, LPI
N
0 500 1,000 m

Appendix E -
Scenario 3 Infrastructure and transport plans



HENRY PARKES WAY
MILLERS LOOKOUT ROAD
CONDOBOLIN ROAD
CLARINDA STREET
PARKES
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
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Legend
Study area
Train station
Existing rail line
Main roads
Water Service
Reservoir
Water treatment plant
Water connection
Wastewater
Wasterwater pump station
Wastewater treatment plant
Sewer connection (gravity)
Sewer connection (pumped)
Stormwater
Detention basin
Cross drainage
Workability corridors
Source: Aurecon, DPE, LPI
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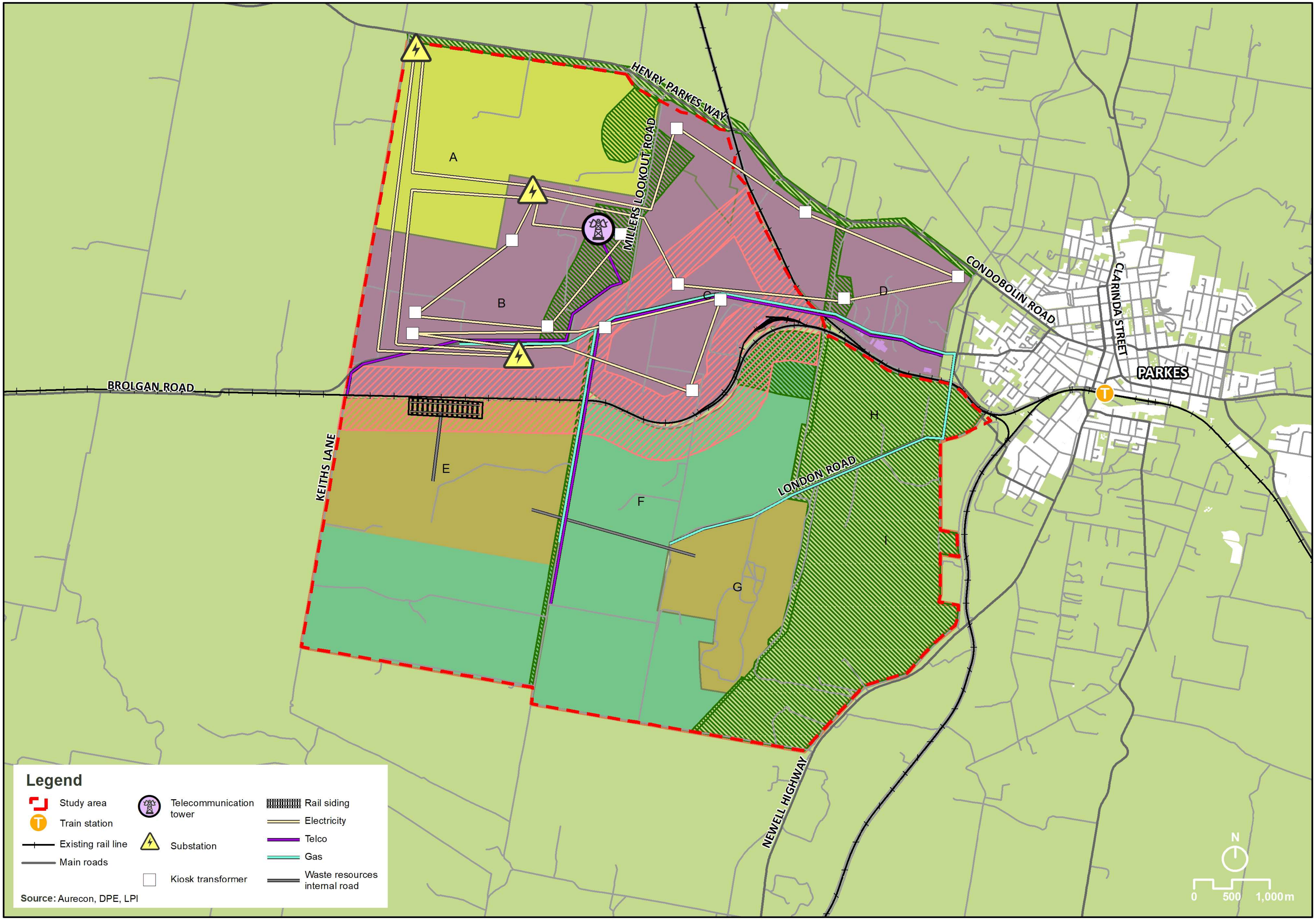
1,000 m



HENRY PARKES WAY
MILLERS LOOKOUT ROAD
CONDOBOLIN ROAD
CLARINDA STREET
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BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
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Legend
Study area
Train station
Existing rail line
Main roads
Telecommunication tower
Substation
Kiosk transformer
Rail siding
Electricity
Telco
Gas
Waste resources internal road
Source: Aurecon, DPE, LPI
N
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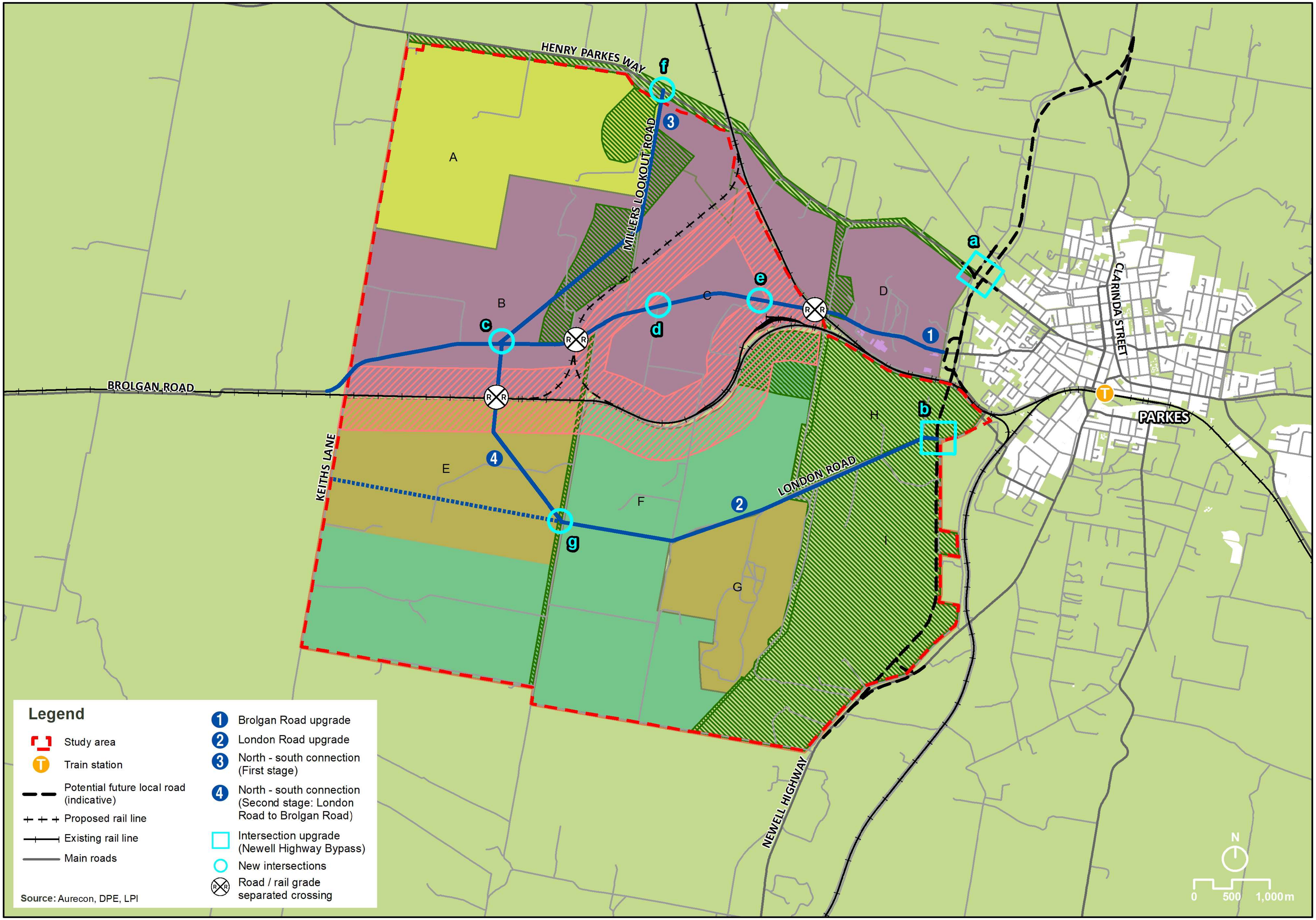
500
1,000 m


HENRY PARKES WAY
MILLERS LOOKOUT ROAD
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
CLARINDA STREET
PARKES
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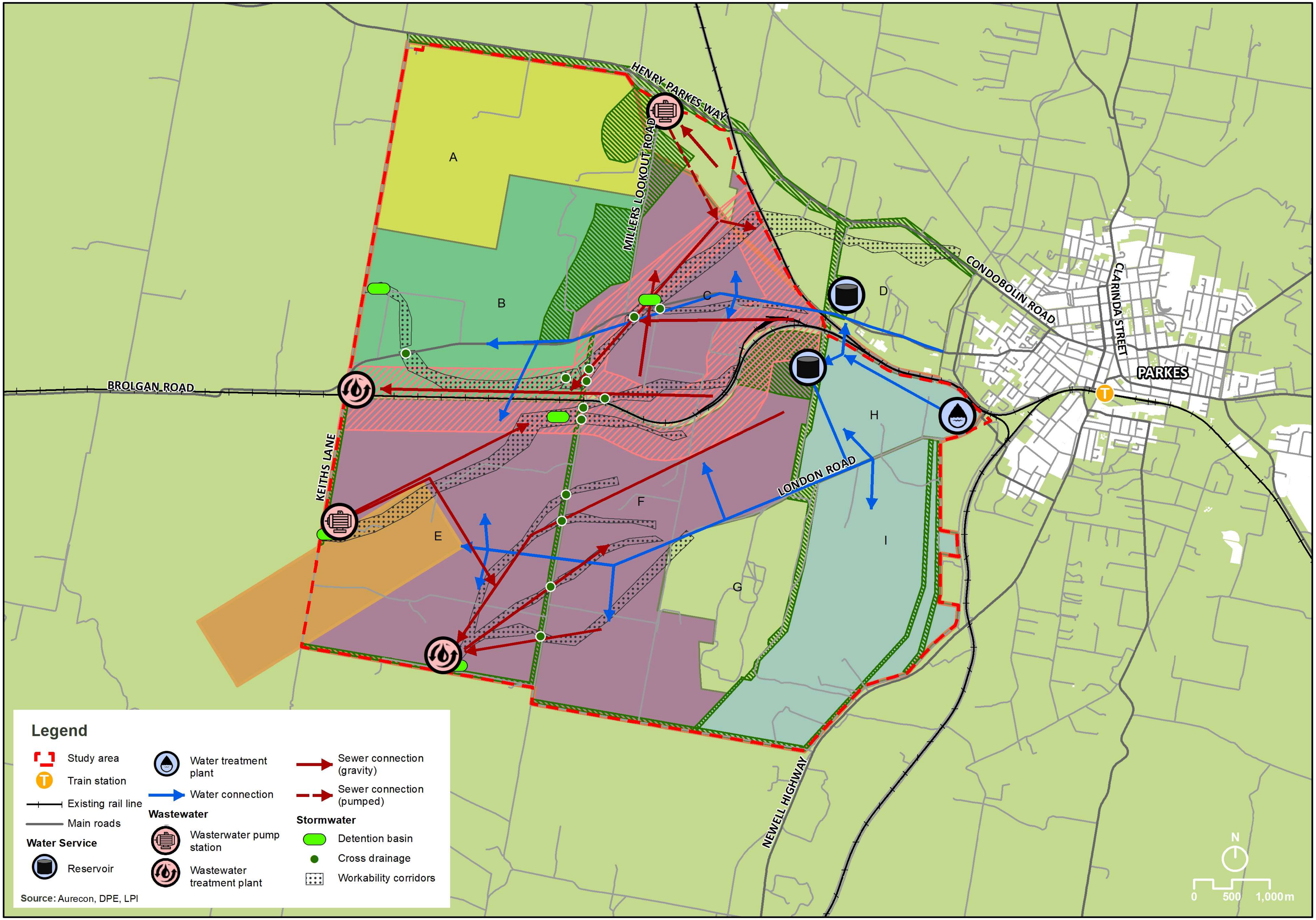
Legend
Study area
Train station
Potential future local road (indicative)
Proposed rail line
Existing rail line
Main roads
1 Brolgan Road upgrade
2 London Road upgrade
3 North - south connection (First stage)
4 North - south connection (Second stage: London Road to Brolgan Road)
Intersection upgrade (Newell Highway Bypass)
New intersections
Road / rail grade separated crossing
Source: Aurecon, DPE, LPI
N
0
500
1,000 m

Appendix F -
Scenario 6 Infrastructure and transport plans



HENRY PARKES WAY
MILLERS LOOKOUT ROAD
CONDOBOLIN ROAD
CLARINDA STREET
PARKES
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
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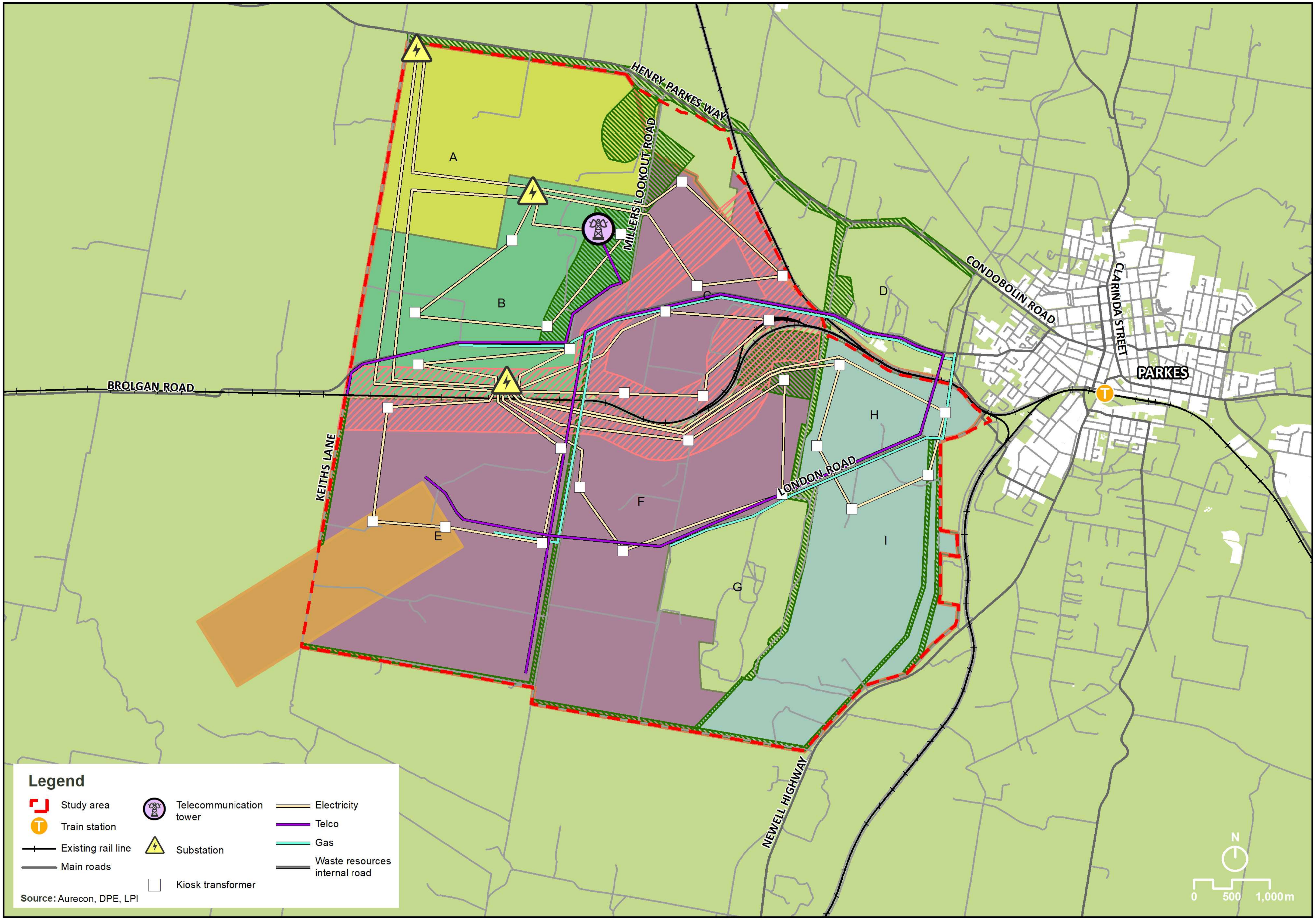
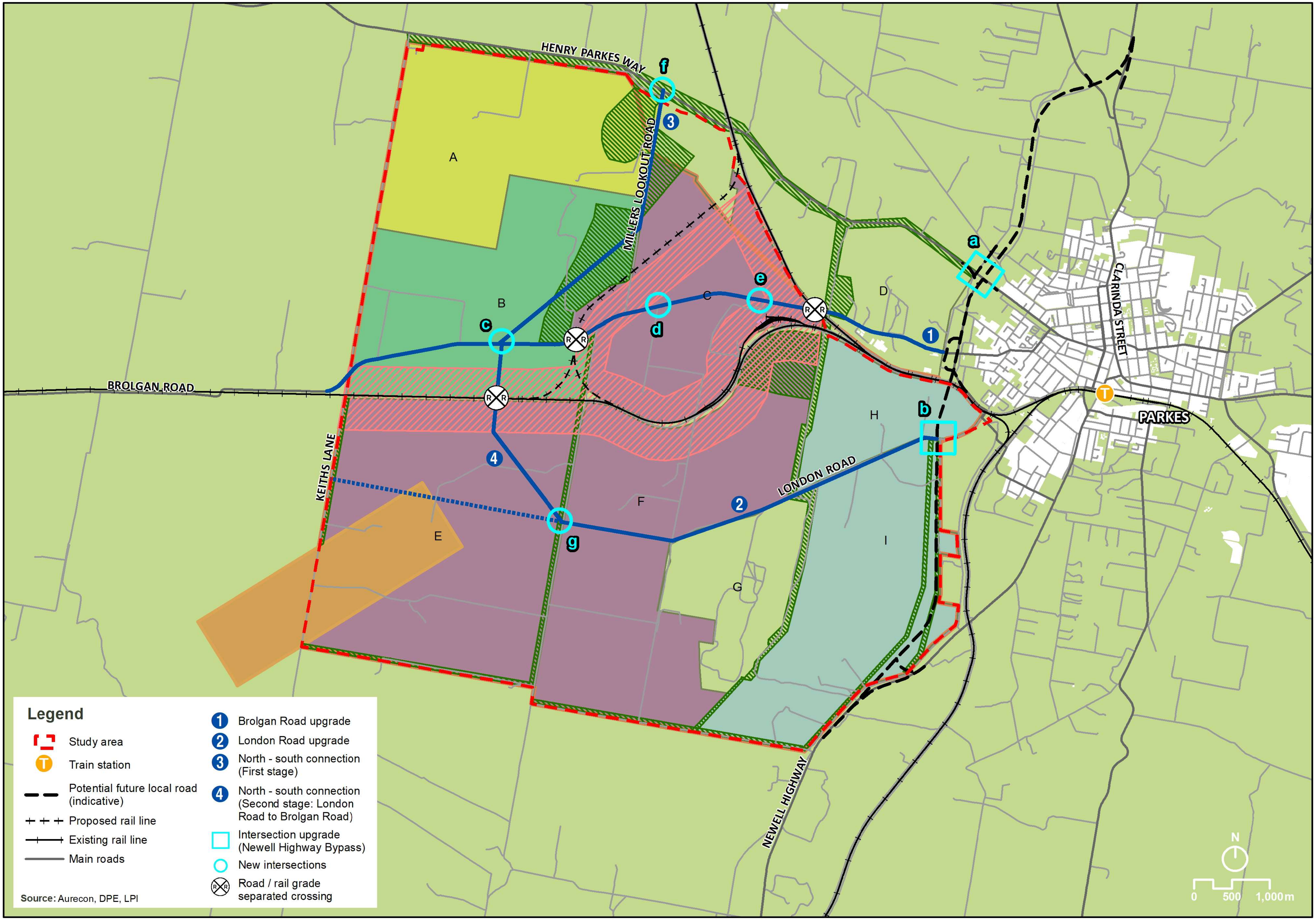
Legend
Study area
Train station
Existing rail line
Main roads
Water Service
Reservoir
Water treatment plant
Water connection
Wastewater
Wasterwater pump station
Wastewater treatment plant
Sewer connection (gravity)
Sewer connection (pumped)
Stormwater
Detention basin
Cross drainage
Workability corridors
Source: Aurecon, DPE, LPI
N
0
500
1,000 m

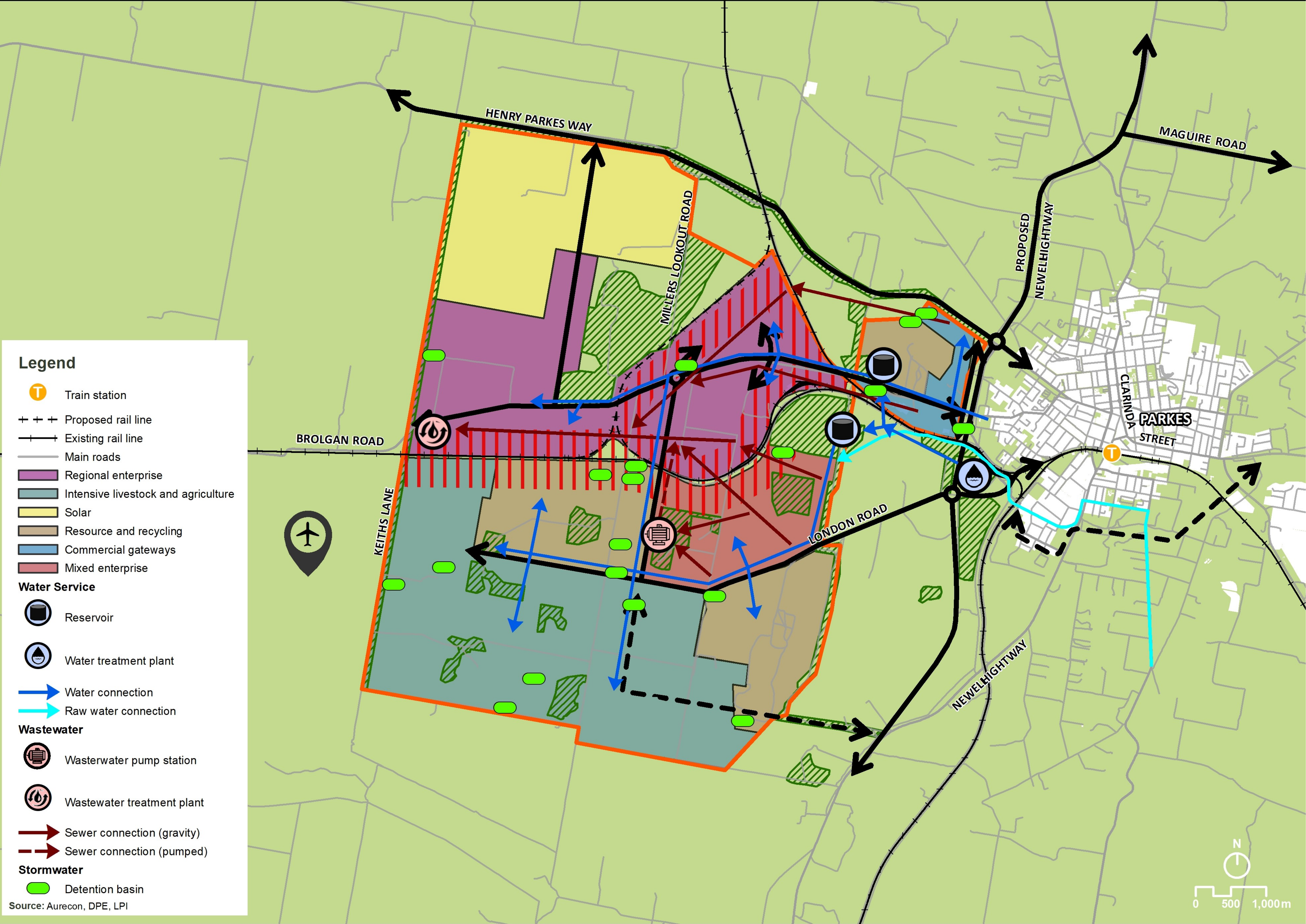


HENRY PARKES WAY
MILLERS LOOKOUT ROAD
CONDOBOLIN ROAD
CLARINDA STREET
PARKES
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
A
B
C
D
E
F
G
H
I
Legend
Study area
Train station
Existing rail line
Main roads
Telecommunication tower
Substation
Kiosk transformer
Electricity
Telco
Gas
Waste resources internal road
Source: Aurecon, DPE, LPI
N
0
500
1,000 m

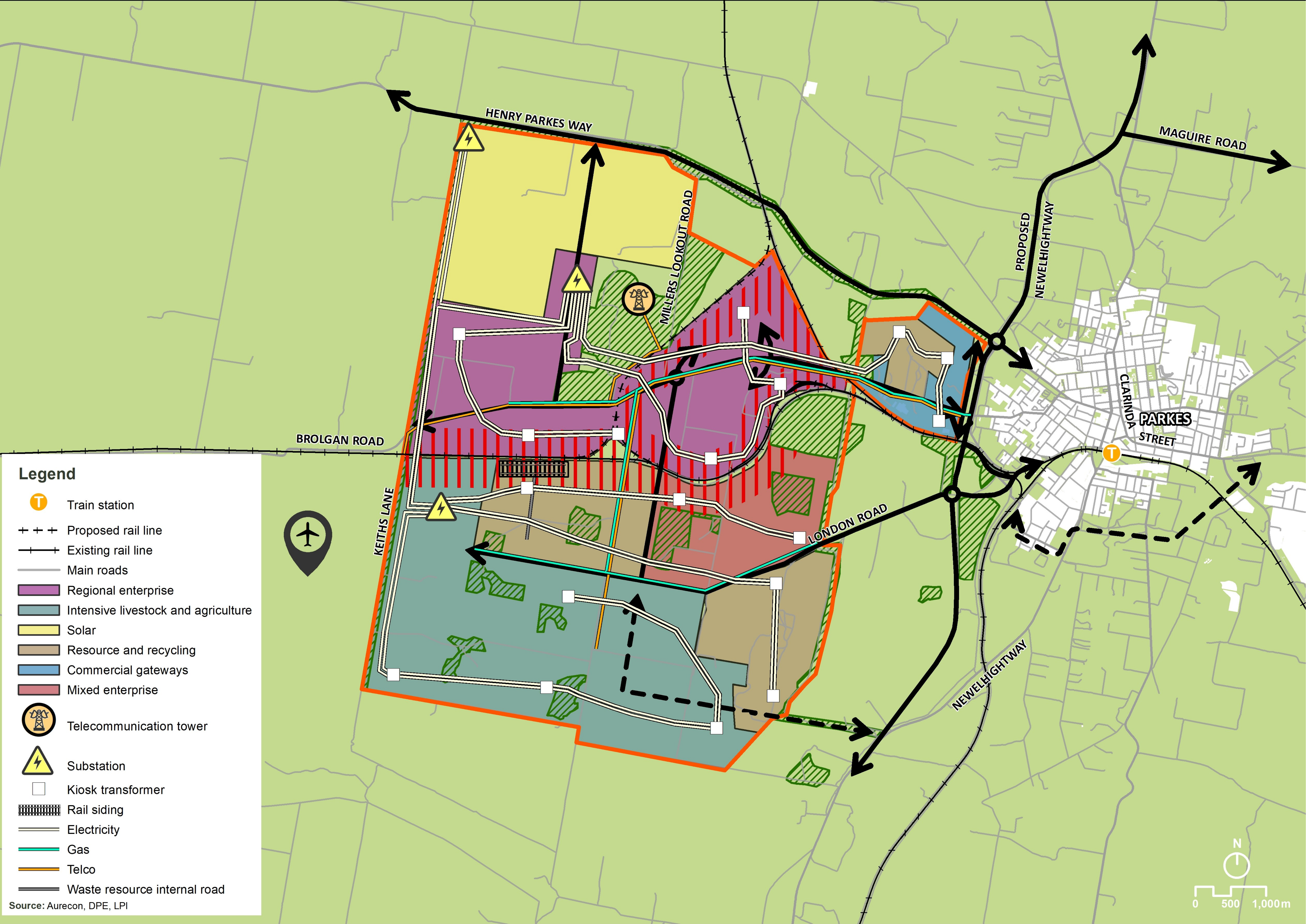

HENRY PARKES WAY
MILLERS LOOKOUT ROAD
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
CLARINDA STREET
PARKES
A
B
C
D
E
F
G
H
I
a
b
c
d
e
f
g
1
2
3
4
Legend
Study area
Train station
Potential future local road (indicative)
Proposed rail line
Existing rail line
Main roads
1 Brolgan Road upgrade
2 London Road upgrade
3 North - south connection (First stage)
4 North - south connection (Second stage: London Road to Brolgan Road)
Intersection upgrade (Newell Highway Bypass)
New intersections
Road / rail grade separated crossing
Source: Aurecon, DPE, LPI
N
0
500
1,000 m

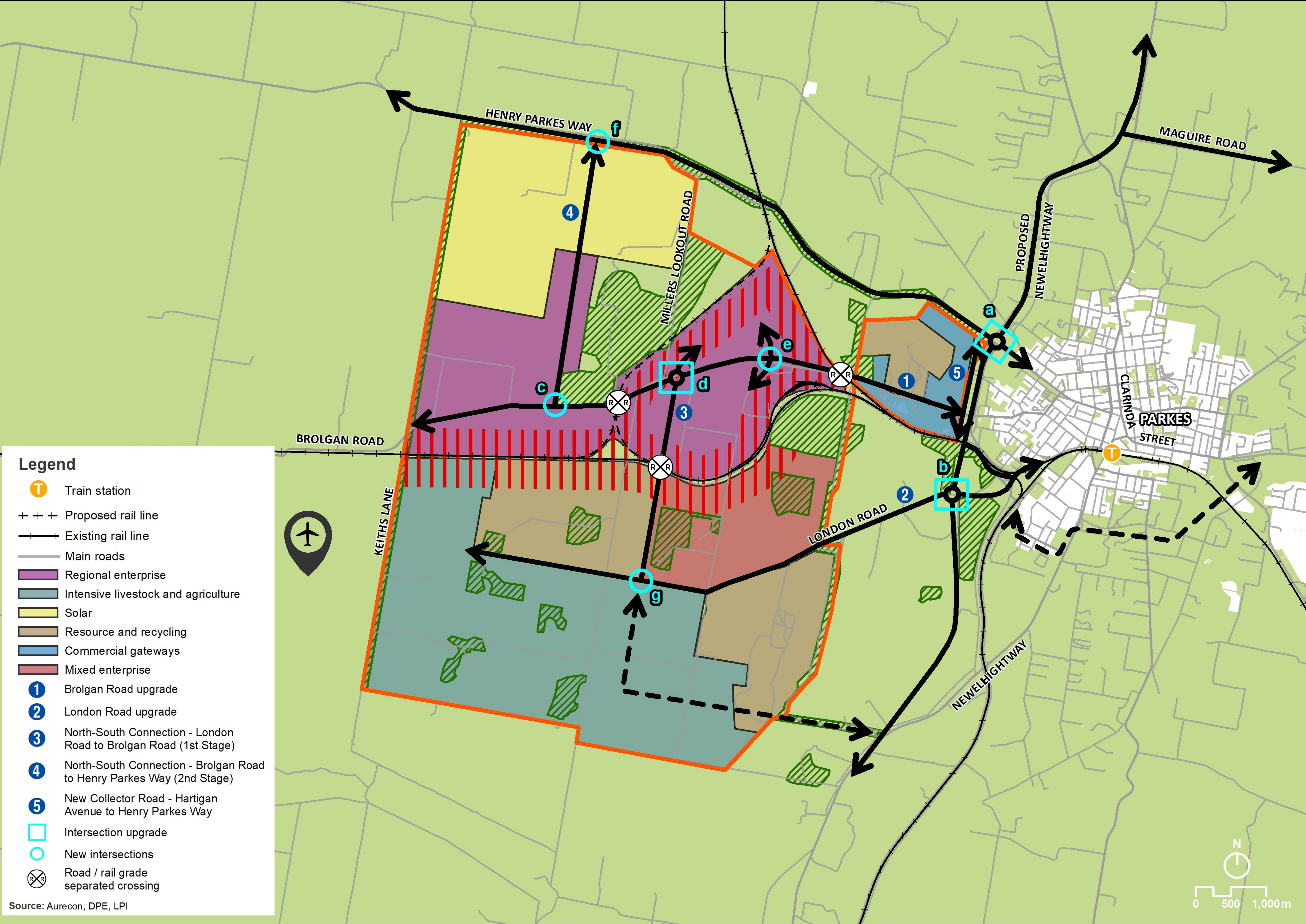
Appendix G -

Master Plan - Infrastructure and Transport Plans



HENRY PARKES WAY
MAGUIRE ROAD
MILLERS LOOKOUT ROAD
PROPOSED NEWELL HIGHWAY
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
CLARINDA STREET
PARKES
NEWELL HIGHWAY
Legend
Train station
Proposed rail line
Existing rail line
Main roads
Regional enterprise
Intensive livestock and agriculture
Solar
Resource and recycling
Commercial gateways
Mixed enterprise
Water Service
Reservoir
Water treatment plant
Water connection
Raw water connection
Wastewater
Wasterwater pump station
Wastewater treatment plant
Sewer connection (gravity)
Sewer connection (pumped)
Stormwater
Detention basin
Source: Aurecon, DPE, LPI
N
0 500 1,000m


HENRY PARKES WAY
MAGUIRE ROAD
PROPOSED NEWELL HIGHWAY
MILLERS LOOKOUT ROAD
BROLGAN ROAD
CLARINDA STREET
PARKES
LONDON ROAD
KEITHS LANE
NEWELL HIGHWAY
Legend
Train station
Proposed rail line
Existing rail line
Main roads
Regional enterprise
Intensive livestock and agriculture
Solar
Resource and recycling
Commercial gateways
Mixed enterprise
Telecommunication tower
Substation
Kiosk transformer
Rail siding
Electricity
Gas
Telco
Waste resource internal road
Source: Aurecon, DPE, LPI
N
0 500 1,000m



HENRY PARKES WAY
MAGUIRE ROAD
PROPOSED NEWELL HIGHWAY
MILLERS LOOKOUT ROAD
BROLGAN ROAD
KEITHS LANE
LONDON ROAD
NEWELL HIGHWAY
CLARINDA STREET
PARKES
a
b
c
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e
f
g
1
2
3
4
5
Legend
Train station
Proposed rail line
Existing rail line
Main roads
Regional enterprise
Intensive livestock and agriculture
Solar
Resource and recycling
Commercial gateways
Mixed enterprise
1 Brolgan Road upgrade
2 London Road upgrade
3 North-South Connection - London Road to Brolgan Road (1st Stage)
4 North-South Connection - Brolgan Road to Henry Parkes Way (2nd Stage)
5 New Collector Road - Hartigan Avenue to Henry Parkes Way
Intersection upgrade
New intersections
Road / rail grade separated crossing
Source: Aurecon, DPE, LPI
N
0 500 1,000m

Appendix H -
Scenarios – infrastructure capacity and infrastructure requirements

Scenario 1

Discipline	What Capacity is required for the Scenario?	What Infrastructure and size is required?	Alternative Infrastructure/Transport options
Water	Water demand is highly dependent on the type of businesses in the SAP. An upper bound estimate has been assumed.The ultimate total water demand for Parkes SAP is estimated to be 6,057 ML/yr, based on the assumption that potable water is supplied to all land users in Parkes SAP with the exception of green infrastructure, which will irrigate with an alternative water supply such as recycled water (non-potable).	The existing water treatment plant in Parkes is likely to have sufficient capacity to supply potable water to the SAP during early development, although augmentation of the existing water networks may be required. New water networks and reservoirs are required in the SAP precinct: - main potable water pipeline - 2 x 375 mm ID - main non-potable water pipeline - 1 x 375 mm ID - 10 Megalitre water reservoir - branch potable and nonpotable connection - 1 x 180 mm ID	
Wastewater	The ultimate wastewater flow generated from the SAP under scenario 1 is estimated to be 3,000 ML/yr. This equates to approximately 57,000 EP. It was assumed that reduced intensive livestock contribution to wastewater flows by 50% and reduced flows from energy and recycling by 75%.	The existing sewage treatment plant servicing Parkes has been designed to allow for duplication of its capacity from 20,000 EP to 40,000 EP. This capacity may be utilised to service early development and defer the need for a new STP to service the SAP. It may be more economical to service early development using tankers and on-site wastewater systems until sufficient flow if generated to support a new STP servicing the SAP. A new sewage treatment facility and sewage network dedicated to the SAP are required in the long-term. New main sewer network (2 x 375mm ID pipeline) is required in the SAP precinct.Branch sewer connection from main is assumed to be 180 mm ID. If recycled water is adopted as an alternate supply to green space, a recycled water pipeline would be required. If recycled water is to be supplied to the Regional Enterprise land uses, a third pipe recycled water network would be required throughout the regional enterprise land use area.	
Stormwater	9 cross drainage infrastructure locations , 3 Stormwater detentions (requires more detailed assessment), Workability corridors for stormwater conveyance	9 cross drainage infrastructure locations where concentrated overland flow paths intersect with proposed infrastructure (road and rail) alignments.3 stormwater detentions basins as a minimum to manage stormwater quality and quantity, although there are many more potential locations depending on development design. It is also recommended that the principles of water sensitive urban design (WSUD) are integrated into the detailed development design, including bioretention systems, swales, raingardens. Rain water and stormwater harvesting may provide alternative water supplies of up to 1,000 and 3,000 ML/yr respectively. However, further detailed water balance modelling is required to confirm this once development typologies are known. The sizes and capacity of this infrastructure will require more investigation using PC drains software. Further to assess size with regards to quality of water in detention basins there would need to be an assessment in MUSIC modelling software.	
Electricity/Energy	Estimated energy demand is 60 MVA. This is approximately 3 times the current Parkes town energy demand.	Based on the forecast estimated load the most realistic point of supply would be the Transgrid Parkes Substation, since the Essential Energy Parkes Town substation would not have sufficient capacity. One or more main intake substations can be constructed, potentially located at the north and south end of the precinct to create some redundancy, and limit internal reticulation losses	Internal electricity reticulation for each facility can be installed as a ring supply arrangement coming from the main intake substation. This increases the redundancy of the system, eliminates the cost of building a dedicated substation for each facility and can easily be extended
Gas	0.22 TJ/day (17% of available from Brolgan Rd pipeline)	Require extension of pipeline down Brolgan Rd (planned as part of GLE business case) and distribution network from this pipeline by Jemena.	Could take gas from main pipeline but not recommended due to low supply requirement and associated high costs
Telecommunications	Indicative land uses associated with Scenario 1, being primarily logistics focused, are likely to require access to a 10-gigabit fibre connection for normal business operation going forward.	Deployment of a fibre spine along Brolgan road will allow for a staged branched deployment as the precinct grows west. Deployment of fibre optic cable within the precinct under this scenario should be extended to the local high point, located in the north west quadrant. This will allow for the placement of a purpose-built tower designed to host 5G/small cell antenna. Backhaul to this facility would be through the fibre network and will mean the western quandrant of the precinct will have access to high speed data connect, prior to the future provisioning of fibre, as the precinct builds out over time. Coverage areas for 5G/small cell facilities ranges from 500m to 2.5km depending on terrain and environmental clutter	Supporting the peripheral connections such as autonomous vehicles and IoT connections within the precinct would be supported by a 5G wireless network. Fibre connections between businesses will allow for uninterrupted data transfer. Colocation of land uses/business such as logistics and warehousing should be pursued where possible to reduce any dark fibre network lengths
Waste Resources	Estimated solid waste generation rate of 966 t/year.	Parkes Waste Facility already in place, required to meet waste generation load from SAP - estimated remaining lifetime of 107 years with current load + SAP Scenario 1 waste generation. However, PSC is not considering the provision of specialised landfilling services for the SAP. If there are special wastes from the SAP that require higher level facilities, then these wastes need to be identified and disposal options considered. It is likely that a new facility will need to be constructed to handle waste specific waste streams that could be generated by the SAP.	Development of an additional waste disposal facility to handle specific waste streams generated by the SAP at the London-Victoria gold mine or less disturbed adjacent land.
Road		One lane in each direction as a minimum on each road, with main roadways reserving extra width to accommodate turning lanes, traffic circles, and/or future width expansion based on demand. Brolgan Road upgrades to be complete by Council. Limited upgrades to London Road needed as south side of precinct is less land-use intensive. Connection needed between Brolgan Road and HPW to provide north-south connectivity across precinct. Roads need to be able to accommodate PBS 3A vehicles throughout the precinct. Newell Bypass connectivity to Brolgan Road needs to accommodate predicted traffic flows (unknown at this point)	Investment in high quality and frequent public transport services both within the precinct and between the precinct and Parkes could be considered for local employees. However, freight (ie. trucks) will still require signficant investment in road infrastructure
Rail		Rail lines are already in place, being upgraded, or in planning stages. No additional rail lines need to be considered at this point, as three lines will be converging in the SAP providing significant capacity in all directions. Ensure grade separated crossings with rail and road.	No need for alternative options to be considered?
Airport			Parkes Regional Airport is already in operation. Plans to expand the airport site to include a freight storage facility and business park are in consideration (or being planned for in future phases)

Land Use Quantums	
Freight Terminals	306 ha
Regional Enterprise	1064 ha
Intensive livestock agriculture	803 ha
Energy (Solar)	690 ha
Energy + Recycling	250 ha
Protected cropping	0 ha
(Green infrastructure)	231 ha
Airport	0 ha
Total project area	3113 ha
Total developable area	2882 ha

Scenario 3

Discipline	What Capacity is required for the Scenario?	What Infrastructure is required?	Alternative Infrastructure/Transport options
Water	Estimated water demand is 56,000 ML/yr is required with minimal water re-use. The ultimate total water demand in Parkes SAP is estimated to be 14,750 ML/yr, based on the assumption that potable water is supplied to all land users in Parkes SAP with the exception of green infrastructure, which will irrigate with an alternative water supply such as recycled water (non-potable)	The existing water treatment plant in Parkes is likely to have sufficient capacity to supply potable water to the SAP during early development, although augmentation of the existing water networks may be required. New water networks and reservoirs are required in the SAP precinct: - main potable water pipeline - 2 x 525 mm ID - main non-potable water pipeline - 2 x 450 mm ID - 10 Megalitre water reservoir - branch potable and nonpotable connection - 1 x 180 mm ID Additional treatment capacity at the existing WTP, or a new WTP in the SAP supplied directly by bore water or river water, will be required when demand exceeds around 5,840 ML/year.	
Wastewater	The ultimate wastewater flow generated from the SAP under scenario 3 is estimated to be 4,600 ML/yr. This equates to approximately 87,000 EP. It was assumed that reduced intensive livestock contribution to wastewater flows by 50% and reduced flows from energy and recycling by 75%.	The existing sewage treatment plant servicing Parkes has been designed to allow for duplication of its capacity from 20,000 EP to 40,000 EP. This capacity may be utilised to service early development and defer the need for a new STP to service the SAP. It may be more economical to service early development using tankers and on-site wastewater systems until sufficient flow if generated to support a new STP servicing the SAP. A new sewage treatment facility and sewage network dedicated to the SAP are required in the long-term. New main sewer network (2 x 375mm ID pipeline) is required in the SAP precinct; Branch sewer connection is assumed to be 180 mm ID. If recycled water is adopted as an alternate supply to green space, a recycled water pipeline would be required. If recycled water is to be supplied to the Regional Enterprise land uses, a third pipe recycled water network would be required throughout the regional enterprise land use area.	
Stormwater	13 cross drainage infrastructure locations , 11 Stormwater detentions (requires more detailed assessment), Workability corridors for stormwater conveyance	13 cross drainage infrastructure locations where concentrated overland flow paths intersect with proposed infrastructure (road and rail) alignments.11 stormwater detentions basins as a minimum to manage stormwater quality and quantity, although there are many more potential locations depending on development design. It is also recommended that the principles of water sensitive urban design (WSUD) are integrated into the detailed development design, including bioretention systems, swales, raingardens. Rain water and stormwater harvesting may provide alternative water supplies of up to 1,300 and 4,500 ML/yr respectively. However, further detailed water balance modelling is required to confirm this once development typologies are known. The sizes and capacity of this infrastructure will require more investigation using PC drains software. Further to assess size with regards to quality of water in detention basins there would need to be an assessment in MUSIC modelling software.	
Electricity/Energy	Estimated energy demand is 82.5 MVA. High energy consumption is driven by large regional enterprise area. This is approximately 4 times the current Parkes town energy demand.	Based on the forecast estimated load the most realistic point of supply would be the Transgrid Parkes Substation, since the Essential Energy Parkes Town substation would not have sufficient capacity. There is currently not enough capacity in the utility Transgrid Parkes Substation for this demand if the SAP is to connect at 66kV bus. It is therefore recommended for SAP to connect to the 132kV bus to avoid triggering the installation of an additional 132/66kV transformer in Parkes SubstationOne or more main intake substations can be constructed, potentially located at the north and south end of the precinct to create some redundancy, and limit internal reticulation losses	Internal electricity reticulation for each facility can be installed as a ring supply arrangement coming from the main intake substation. This increases the redundancy of the system, eliminates the cost of building a dedicated substation for each facility and can easily be extended
Gas	0.41 TJ/day (31% of available from Brolgan Rd pipeline)	Require extension of pipeline down Brolgan Rd (planned as part of GLE business case) and distribution network from this pipeline by Jemena.	Could take gas from main pipeline but not recommended due to low supply requirement and associated high costs
Telecommunications	10-gigabit necessary to remain competitive with future data requirements of the logistics and transportation industry expectations.	Fibre deployment length extended to the western boundary of the precinct. Deployment of fibre alongside other utilities where possible is recommended to reduce cost and delays in connection. Provision of a telecommunications facility at the local high point recommended with another further to the south west to increase coverage area. The fibre to run out Brolgan Road would act as the main trunk with north/south extensions running from it into the Regional Enterprise zones. This extent of coverage for 5G and fixed wireless services under this scenario would likely see the need for 2 tower facilities strategically located to provided coverage. Each facility can cover and area between 0.5km – 2.5km.	
Waste Resources	Estimated solid waste generation rate of 1,686 t/year	Parkes Waste Facility already in place, required to meet waste generation load from SAP - estimated remaining lifetime of 102 years with current load + SAP Scenario 3 waste generation. However, PSC is not considering the provision of specialised landfilling services for the SAP. If there are special wastes from the SAP that require higher level facilities, then these wastes need to be identified and disposal options considered. It is likely that a new facility will need to be constructed to handle waste specific waste streams that could be generated by the SAP.	Development of an additional regional waste disposal facility at the London-Victoria gold mine or less disturbed adjacent land.
Road		One lane in each direction as a minimum on each road, with main roadways reserving extra width to accommodate turning lanes, traffic circles, and/or future width expansion based on demand. Brolgan Road upgrades to be complete by Council. Significant upgrades to London Road needed. Connection needed between Brolgan Road and HPW to provide north-south connectivity across precinct. Connection needed from Brolgan Road down Coopers Road to provide north-south connectivity across precinct. Roads need to be able to accommodate PBS 3A vehicles throughout the precinct. Newell Bypass connectivity to Brolgan Road needs to accommodate predicted traffic flows (unknown at this point)	Investment in high quality and frequent public transport services both within the precinct and between the precinct and Parkes could be considered for local employees. However, freight (ie. trucks) will still require signficant investment in road infrastructure
Rail		Rail lines are already in place, being upgraded, or in planning stages. No additional rail lines need to be considered at this point, as three lines will be converging in the SAP providing significant capacity in all directions. Ensure grade separated crossings with rail and road.	No need for alternative options to be considered?
Airport			Parkes Regional Airport is already in operation. Plans to expand the airport site to include a freight storage facility and business park are in consideration (or being planned for in future phases)

Land Use Quantums	
Freight Terminals	436 ha
Regional Enterprise	1442 ha
Intensive livestock agriculture	1532 ha
Energy (Solar)	690 ha
Energy + Recycling	900 ha
Protected cropping	0 ha
(Green infrastructure)	1240 ha
Airport	0 ha
Total project area	6240 ha
Total developable area	5000 ha

Scenario 3

Discipline	What Capacity is required for the Scenario?	What Infrastructure is required?	Alternative Infrastructure/Transport options
Water	Estimated water demand is 56,000 ML/yr is required with minimal water re-use. The ultimate total water demand in Parkes SAP is estimated to be 14,750 ML/yr, based on the assumption that potable water is supplied to all land users in Parkes SAP with the exception of green infrastructure, which will irrigate with an alternative water supply such as recycled water (non-potable)	The existing water treatment plant in Parkes is likely to have sufficient capacity to supply potable water to the SAP during early development, although augmentation of the existing water networks may be required. New water networks and reservoirs are required in the SAP precinct: - main potable water pipeline - 2 x 525 mm ID - main non-potable water pipeline - 2 x 450 mm ID - 10 Megalitre water reservoir - branch potable and nonpotable connection - 1 x 180 mm ID Additional treatment capacity at the existing WTP, or a new WTP in the SAP supplied directly by bore water or river water, will be required when demand exceeds around 5,840 ML/year.	
Wastewater	The ultimate wastewater flow generated from the SAP under scenario 3 is estimated to be 4,600 ML/yr. This equates to approximately 87,000 EP. It was assumed that reduced intensive livestock contribution to wastewater flows by 50% and reduced flows from energy and recycling by 75%.	The existing sewage treatment plant servicing Parkes has been designed to allow for duplication of its capacity from 20,000 EP to 40,000 EP. This capacity may be utilised to service early development and defer the need for a new STP to service the SAP. It may be more economical to service early development using tankers and on-site wastewater systems until sufficient flow if generated to support a new STP servicing the SAP. A new sewage treatment facility and sewage network dedicated to the SAP are required in the long-term. New main sewer network (2 x 375mm ID pipeline) is required in the SAP precinct; Branch sewer connection is assumed to be 180 mm ID. If recycled water is adopted as an alternate supply to green space, a recycled water pipeline would be required. If recycled water is to be supplied to the Regional Enterprise land uses, a third pipe recycled water network would be required throughout the regional enterprise land use area.	
Stormwater	13 cross drainage infrastructure locations , 5 Stormwater detentions (requires more detailed assessment), Workability corridors for stormwater conveyance	13 cross drainage infrastructure locations where concentrated overland flow paths intersect with proposed infrastructure (road and rail) alignments.5 stormwater detentions basins as a minimum to manage stormwater quality and quantity, although there are many more potential locations depending on development design. It is also recommended that the principles of water sensitive urban design (WSUD) are integrated into the detailed development design, including bioretention systems, swales, raingardens. Rain water and stormwater harvesting may provide alternative water supplies of up to 2,500 and 8,200 ML/yr respectively. However, further detailed water balance modelling is required to confirm this once development typologies are known. The sizes and capacity of this infrastructure will require more investigation using PC drains software. Further to assess size with regards to quality of water in detention basins there would need to be an assessment in MUSIC modelling software.	
Electricity/Energy	Estimated energy demand is 94.5 MVA. High energy consumption is driven by large intermodal terminal, large regional enterprise area and the international airport. This is approximately 5 times the current Parkes town energy demand.	Based on the forecast estimated load the most realistic point of supply would be the Transgrid Parkes Substation, since the Essential Energy Parkes Town substation would not have sufficient capacity. One or more main intake substations can be constructed, potentially located at the north and south end of the precinct to create some redundancy, and limit internal reticulation losses	Internal electricity reticulation for each facility can be installed as a ring supply arrangement coming from the main intake substation. This increases the redundancy of the system, eliminates the cost of building a dedicated substation for each facility and can easily be extended
Gas	0.26 TJ/day (20% of available from Brolgan Rd pipeline)	Require extension of pipeline down Brolgan Rd (planned as part of GLE business case) and distribution network from this pipeline by Jemena.	Could take gas from main pipeline but not recommended due to low supply requirement and
Telecommunications	The spread of businesses under this scenario will increase the need for 5G/small cell and fixed wireless technology across a wider area. Fibre backbone down Brolgan road should be extended north south along any proposed underground utility routes	Fibre extended to connect the wider Regional Enterprise land use will significantly increase cost. This scenario sees the introduction of an airport in the south west corner of the precinct. Airspace control surfaces will have a limiting influence on the height of tower facilities, especially on the local high point, given the indicative alignment of the airport land use. An Obstacle Limitation Surface should be taken into account when developing a structure plan for this scenario.	
Waste Resources	Estimated solid waste generation rate of 1,331 t/year	Parkes Waste Facility already in place, required to meet waste generation load from SAP - estimated remaining lifetime of 105 years with current load + SAP Scenario 6 waste generation. However, PSC is not considering the provision of specialised landfilling services for the SAP. If there are special wastes from the SAP that require higher level facilities, then these wastes need to be identified and disposal options considered. It is likely that a new facility will need to be constructed to handle waste specific waste streams that could be generated by the SAP.	Development of an additional regional waste disposal facility at the London-Victoria gold mine or less disturbed adjacent land.
Road		One lane in each direction as a minimum on each road, with main roadways reserving extra width to accommodate turning lanes, traffic circles, and/or future width expansion based on demand. Brolgan Road upgrades to be complete by Council. Significant upgrades to London Road needed. Connection needed between Brolgan Road and HPW to provide north-south connectivity across precinct. Connection needed from Brolgan Road down Coopers Road to provide north-south connectivity across precinct. Roads need to be able to accommodate PBS 3A vehicles throughout the precinct. Newell Bypass connectivity to Brolgan Road needs to accommodate predicted traffic flows (unknown at this point)	Investment in high quality and frequent public transport services both within the precinct and between the precinct and Parkes could be considered for local employees. However, freight (ie. trucks) will still require signficant investment in road infrastructure
Rail		Rail lines are already in place, being upgraded, or in planning stages. No additional rail lines need to be considered at this point, as three lines will be converging in the SAP providing significant capacity in all directions. Ensure grade separated crossings with rail and road.	No need for alternative options to be considered?
Airport		Airport (Scenario 6 only) would require runway that could accommodate all airplane types to enable for future growth and expansion as well as heavy air freight. Freight storage facilities should be included in any airport development.	Parkes Regional Airport is already in operation. Plans to expand the airport site to include a freight storage facility and business park are in consideration (or being planned for in future phases)

Land Use Quantums	
Freight Terminals	542 ha
Regional Enterprise	1929 ha
Intensive livestock agriculture	803 ha
Energy (Solar)	690 ha
Energy + Recycling	0 ha
Protected cropping	949 ha
(Green infrastructure)	334 ha
Airport	350 ha
Total project area	5263 ha
Total developable area	4929 ha

Appendix I -
Transport Fact Sheets

Proposed Road Upgrades

1. Brolgan Road Upgrade

Location

Brolgan Road upgrade
Intersection upgrade (Newell Highway Bypass)
New intersections
Road / rail grade separated crossing

Description & Function

- Brolgan Road is the main spine road through the precinct with several access points to existing logistic centres
- Currently accessible to PBS Level 2 and 3 vehicles up to SCT Logistics. It is intended for the entire length of Brolgan Road to be designed for PBS Level 3 vehicles

Issues & Constraints

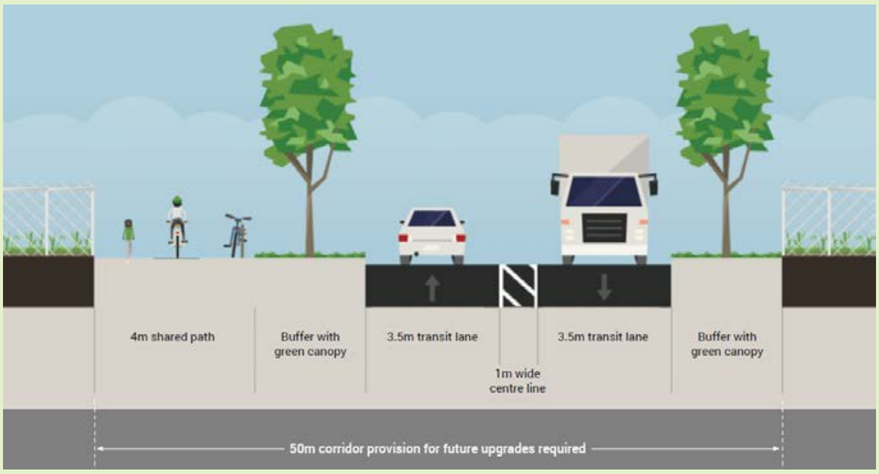
- Not fully accessible to PBS Level 3 vehicles and lack of available connection to the wider region due to travel restrictions on Newell Highway and Henry Parkes Way (East of Parkes)
- Several rail level crossings will require upgrades to allow for PBS Level 3 vehicles and new crossings must be considered for grade separation above the rail corridor
- Staged road upgrades will require construction under live traffic conditions at all times since the precinct will operate 24/7

Proposed Interfacing Treatments

- Provision of a 50-metre wide corridor, with the inclusion of a shared path (minimum 2.5m, ideally 4m) and urban canopy improvements to promote active travel. This will allow for future road widening required to accommodate for long-term precinct development and future technologies
- Road/rail grade separation (minimum height clearance of the overhead structure is 8m above rail)
- Additional intersections to support the development of the precinct

Proposed Cross Section

Stage 1:



Stage 2:

Similar as above, with an additional travel lane in each direction (4 travel lanes, 1 shared path)

Staging

Trigger points:

Stage 1: Required from opening day

Stage 2: When traffic demand exceeds 1200 PCU/hour

Staging requirements for each scenario:

Scenario	Stage 1	Stage 2
1	Yes	No
3	Yes	Yes
6	Yes	Yes
Final	Yes	Yes

Future innovations

Designated kerbside areas for on-demand vehicles

Dedicated lanes for autonomous bus services

2. London Road Upgrade

Location

Description & Function	**Issues & Constraints**
- London Road is currently a small local road (sealed, unmarked, one lane in each direction until Westlime mine) which will serve the southern end of the precinct as secondary access route - Currently accessible to PBS Level 2 (subject to speed restrictions) and 3 vehicles up to the Westlime access point	- Not fully accessible to PBS Level 3 vehicles and lack of available connection to the wider region

Proposed Interfacing Treatments

- Realignment/extension of London Road to provide straight-forward access to the south and west of the precinct and proposed waste to energy facility and livestock agriculture areas
- Additional intersection to support the development of the precinct

Staging

Trigger points:

Stage 1: Required from opening day

Stage 2: As W2E facility and intensive livestock agriculture development increases, necessitating direct connectivity through the precinct towards Keiths Lane

Staging requirements for each scenario:

Scenario	Stage 1	Stage 2
1	Yes	No
3	Yes	Yes
6	Yes	Yes
Final	Yes	Yes

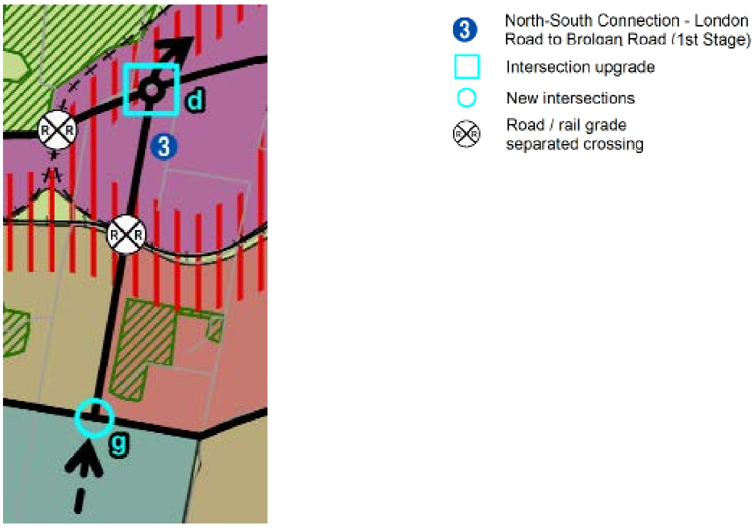
Future innovations

Designated kerbside areas for on-demand vehicles

Dedicated lanes for autonomous bus services

3. North-South Connection – Brolgan Road to London Road (1st Stage)

Location



Description & Function

A north-south internal connection will be required from opening day to connect Brolgan Road and the upgraded London Road. This will facilitate the development in the central and eastern part of the precinct that are identified as part of the initial stage of development of the SAP (and comprising the existing SCT Logistics and Pacific National sites).

Issues & Constraints

- This section of road will require a grade separated carriageway over the rail corridor
- The allowance for double-stacked freight trains means that the minimum height clearance of the structure would be 8 metres

Proposed Interfacing Treatments

- New road/rail grade separated crossing over the current rail corridor
- Roundabout at Brolgan Road intersection

Staging

Trigger points:

Stage 1: Required from opening day

Stage 2: Implementation will be required to support development of the northern end of the precinct

Staging requirements for each scenario:

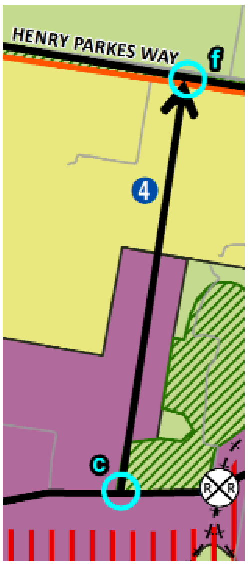
Scenario	Stage 1	Stage 2
1	Yes	No
3	Yes	Yes
6	Yes	Yes
Final	Yes	Yes

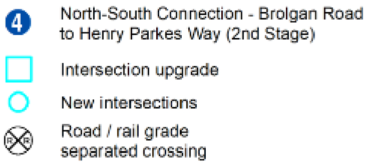
Future innovations

Automated freight technology to be implemented on the roadway within freight terminals

4. North-South Connection – Brolgan Road to Henry Parkes Way (2nd Stage)

Location





Description & Function

Building on the first stage of the internal north-south connection, a second section further west will be required to improve efficiency of vehicle movements between the various proposed land uses and to facilitate a circular economy within the precinct. As the northern and western side of the precinct develops, this second stage north-south connection will complete the internal connection between Henry Parkes Way, Brolgan Road and London Road.

Issues & Constraints

- Two new intersections will be built on Henry Parkes Way and Brolgan Road under live traffic conditions to facilitate this new connection. The intersections must ensure safe turning circles for heavy vehicles up to PBS Level 3
- The alignment of the north-south connection must consider environmental constraints such as flooding, and will cut through the existing and future phases of the solar park development

Proposed Interfacing Treatments

- New internal north-south road between Henry Parkes Way and Brolgan Road, passing through the existing and future phases of the solar park

Staging

Stage 1: Required from opening day

Stage 2: Implementation will be required to support development of the northern end of the precinct

Staging requirements for each scenario:

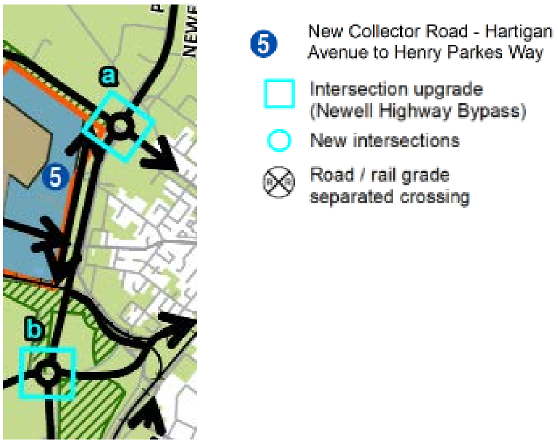
Scenario	Stage 1	Stage 2
1	Yes	No
3	Yes	Yes
6	Yes	Yes
Final	Yes	Yes

Future innovations

Automated freight technology to be implemented on the roadway within freight terminals

5. New Collector Road – Hartigan Avenue to Henry Parkes Way

Location



Description & Function

The proposed Newell Highway bypass will play an important role for the region, providing a safe and efficient connection from north to south that allows vehicles (particularly heavy freight vehicles) to avoid having to traverse the Parkes town centre. Along with the proposed connector road, it will provide uninterrupted connectivity into the SAP.

Issues & Constraints

- New intersections will be built on Henry Parkes Way, Brolgan Road (and Hartigan Avenue in the future) under live traffic conditions to facilitate this new connection. The intersections must ensure safe turning circles for heavy vehicles up to PBS Level 3

Proposed Interfacing Treatments

- A new collector road is proposed to provide uninterrupted connectivity between the Newell Highway bypass and the SAP. The collector road will run from Henry Parkes Way down to Hartigan Avenue, connecting to the east-west routes through Parkes township just south of Brolgan Road.
- A roundabout is proposed at the Henry Parkes Way intersection

Staging

Trigger points: Required as part of the construction/development of the Newell Highway bypass

Staging requirements for each scenario:

Scenario	Stage 1
1	Yes
3	Yes
6	Yes
Final	Yes

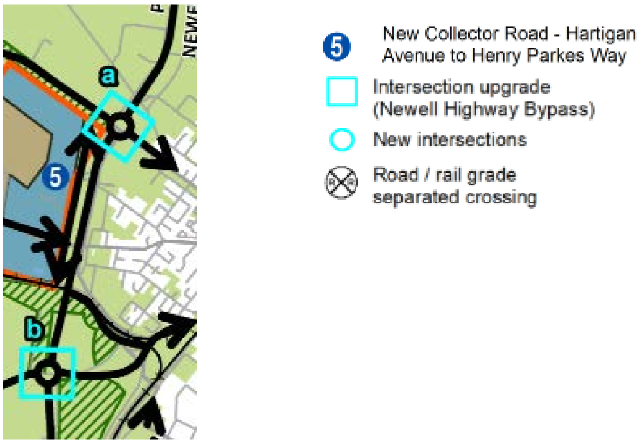
Future innovations

Automated freight technology to be implemented on the roadway within freight terminals

Proposed Intersection Upgrades

a. Intersection Upgrade: Henry Parkes Way/Newell Highway Bypass

Location



Description & Function	**Issues & Constraints**
- Currently, all northbound traffic travelling on Henry Parkes Way is required to traverse the town centre to continue on to the Newell Highway - A Newell Highway bypass is proposed to improve safety and efficiency of heavy vehicles in the area. The bypass intersects with Henry Parkes Way and other precinct roads - Henry Parkes Way is accessible to PBS Level 2 and Level 3A vehicles up to Condoblin Road	- The placement of both roundabouts next to each other needs to ensure safe manoeuvre and sufficient turning circles for PBS Level 2 and Level 3A vehicles

Proposed Interfacing Treatments

- The road configuration proposed for the Henry Parkes Way/Newell Highway bypass is a roundabout alongside a second roundabout providing access to the parallel bypass collector road at Henry Parkes Way

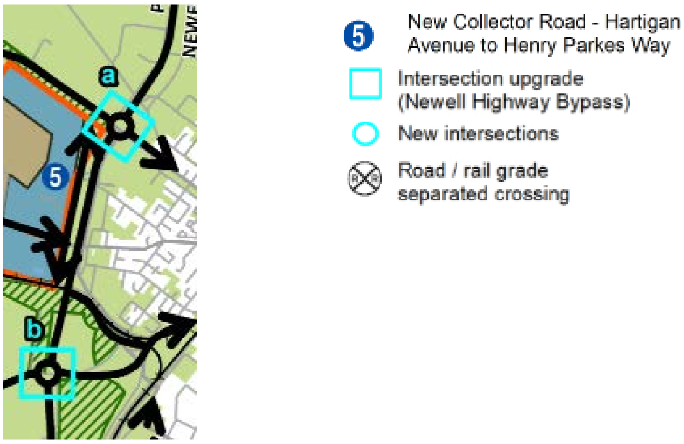
Staging

Trigger points:

Monitor intersection performance, and when LoS falls below C, upgrade to roundabout may be required

b. Intersection Upgrade: London Road/Newell Highway Bypass

Location



Description & Function

- Currently, all northbound traffic travelling on London Road is required to traverse the town centre via Hartigan Avenue to continue on to the Newell Highway
- A Newell Highway bypass is proposed to improve safety and efficiency of heavy vehicles in the area. The bypass intersects with London Road and other precinct roads

Issues & Constraints

- New proposed roundabout will be built on the Newell Highway bypass under live traffic conditions.
- The intersections must ensure safe turning circles for heavy vehicles up to PBS Level 3A

Proposed Interfacing Treatments

- Roundabout on London Road and Newell Highway bypass which will provide opportunity for future east-west town bypass connection

Staging

Trigger points:

Monitor intersection performance, and when LoS falls below C, upgrade to roundabout may be required

c. d. e. New Intersection(s): Brolgan Road

Location

Description & Function	**Issues & Constraints**
- Brolgan Road is the main spine road through the precinct with several access points to existing logistic centres - Currently accessible to PBS Level 2 and Level 3A vehicles up to SCT Logistics site. Proposed upgrades will ensure the entire length of Brolgan Road is designed for PBS Level 3A vehicles - New intersections as indicated will provide enhanced connectivity as the precinct grows to enable site specific access as well as precinct-wide access with connecting roads, as needed	- Not fully accessible to PBS Level 3A vehicles - No existing intersections at proposed locations - New intersections will require construction under live traffic conditions at all times since the precinct will operate 24/7

Proposed Interfacing Treatments

- Road/rail grade separation (minimum height clearance of the overhead structure is 8m above rail) is preferred for all new intersections
- Limit signalisation of new intersections through roundabout or 4-way intersection design

Staging

Trigger points:

New intersections required as surrounding land-uses are developed

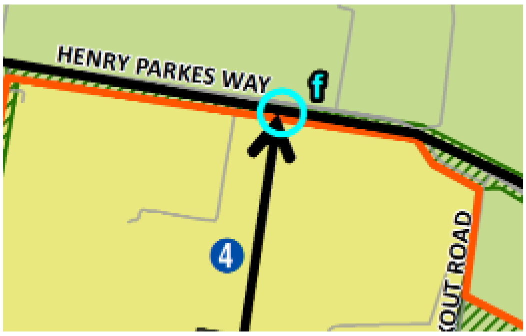
Staging requirements:

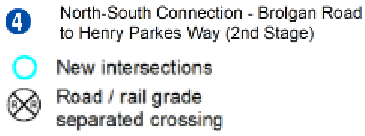
Stage 1: Intersections d and e required from day one, providing access to existing SCT Logistics and Pacific National sites

Stage 2: Intersection c will be required as precinct develops

f. New Intersection: Henry Parkes Way

Location





Description & Function

- Henry Parkes Way serves as a key access route for the north of the precinct, and will provide direct connectivity to the Newell Highway Bypass further east of the proposed intersection location
- Henry Parkes Way is accessible to PBS Level 2 and Level 3A vehicles up to Condoblin Road
- New intersection as indicated will provide enhanced connectivity as the precinct grows to enable site specific access as well as precinct-wide access with connecting roads, as needed

Issues & Constraints

- Not fully accessible to PBS Level 3A vehicles (only to Condoblin Road)
- No existing intersection at proposed locations
- New intersection will require construction under live traffic conditions at all times since the precinct will operate 24/7

Proposed Interfacing Treatments

- Road/rail grade separation (minimum height clearance of the overhead structure is 8m above rail) is preferred for all new intersections
- Limit signalisation of new intersections through T-intersection design or 4-way intersection design

Staging

Trigger points:

New intersection required as surrounding land-uses are developed

g. New Intersection: London Road

Location

2 London Road upgrade

New intersections

Description & Function

- London Road is currently a small local road (sealed, unmarked, one lane in each direction until Westlime mine) which will serve the southern end of the precinct as secondary access route
- Currently accessible to PBS Level 2 (subject to speed restrictions) and Level 3A vehicles up to the Westlime access point
- New intersection as indicated will provide enhanced connectivity as the precinct grows to enable site specific access as well as precinct-wide access with connecting roads, as needed

Issues & Constraints

- Not fully accessible to PBS Level 3A vehicles
- No existing intersection at proposed locations
- New intersection will require construction under live traffic conditions at all times since the precinct will operate 24/7

Proposed Interfacing Treatments

- Road/rail grade separation (minimum height clearance of the overhead structure is 8m above rail) is preferred for all new intersections
- Limit signalisation of new intersections through T-intersection, roundabout or 4-way intersection design

Staging

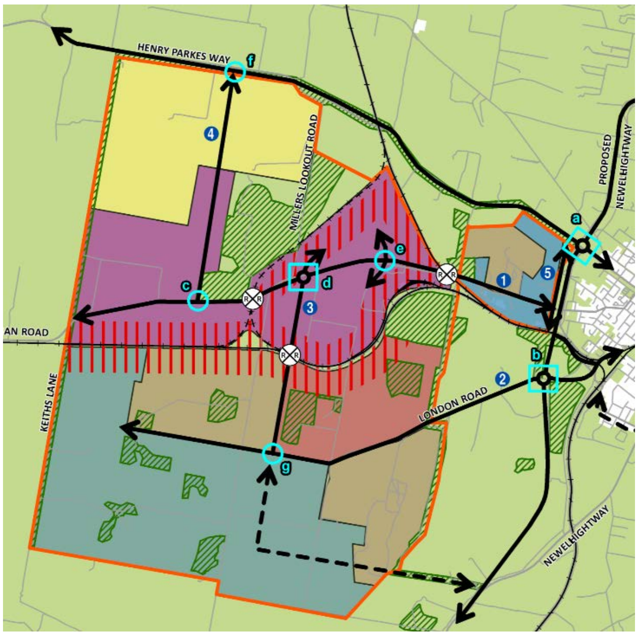
Trigger points:

New intersection required as surrounding land-uses are developed

Grade Separated Rail Crossings (Road Over Rail)

Road / Rail Grade Separated Crossing

Location



Description & Function

- Several rail level crossings currently exist within the precinct
- Traffic is stopped for a considerable amount of time at these level crossings. This may lead to reduced efficiency of heavy vehicle movements and increased congestion along Brolgan Road, which is the main access road to and from the precinct

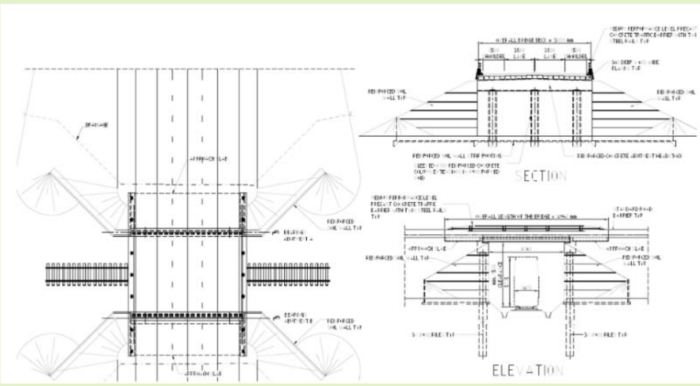
Issues & Constraints

- Government priorities aim to reduce the implementation of level crossings. As such, any new rail crossing must be grade-separated (road over rail). Any future road upgrades will also require upgrades to the existing rail crossings
- In order for the freight rail lines to achieve double-stacked capability, the overhead structure will require significant elevation from ground level (minimum 8m)

Proposed Interfacing Treatments

- Grade-separated road over the rail corridor

Proposed Design



(Sample engineering drawing)

Staging

Trigger points:

All rail crossings will be required along with road upgrades and construction of new roads. Grade separation of road and rail will be required, with the eastern separation on Brolgan Road and the Coopers Road separation required from day one, and the western separation on Brolgan Road required as the precinct develops westwards.

Appendix J– Water and Wastewater Demand Estimation Criteria

- Estimates of equivalent population (EP) for different land-uses is summarised in table below.

LAND USE	DEMAND ESTIMATION CRITERIA		
	EP/Ha[1]	ML/Ha/yr	L/passenger/d
Freight terminal and logistic	24		
Regional enterprises	30		
Commercial gateway	40		
Intensive livestock agriculture	30		
Energy (solar)	5		
Energy + recycling - waste facility	30		
Protected cropping/ mixed enterprise		20[2]	
Airport			11[3]
Green Infrastructure		5[3]	

Note:

1. SEQ design criteria Brisbane City Planning - **http://www.seqcode.com.au/standards/**; Adopt 5 EP/ha for solar farm due to minimal water usage.
2. Estimate based on average crop water use in NSW DPI national report. (https://www.dpi.nsw.gov.au/agriculture/irrigation/irrigation/crops/maximising-returns-from-water)
3. Typical irrigation rate of 5 ML/Ha/year in MEDLI modelling for green infrastructure.
4. Metcalf and Eddy 5th Edition (page 190, assume 120,000 passenger).

- Water demand:
  - Only recycled water is supplied to the green infrastructure.
  - All other land uses are supplied with potable water.
  - Design demand of 180 L/EP/day applies to all land uses.
- Wastewater generation:
  - No wastewater generation from green infrastructure and mixed enterprise (commercial cropping).
  - Assume 75% water reuse internally for the recycling + energy land use and therefore wastewater generation is 25% of water demand
  - Intensive livestock industry has internal wastewater treatment; no wastewater transferred to the centralised STP
  - Excluding internal water-reuse above, wastewater generation is assumed to be 80% of water demand

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