Jemena Gas Networks (NSW) Ltd

Western Sydney Aerotropolis Projects

Options Analysis

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Authorisation

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1. EXECUTIVE SUMMARY

1.1 KEY DRIVERS AND PROJECT SCOPE

The largest development for gas infrastructure over the next 20 years and beyond is to cater for the Western Sydney Aerotropolis (Aerotropolis). The airport is scheduled to fully operational by 2026[1], and will be surrounded by industrial, agricultural, commercial and residential developments, which are planned to developed prior to the airport completion. The overall proposed Aerotropolis footprint covers an extensive area, with the initial precincts including; the Aerotropolis Core, Western Sydney Airport (Airport) and the Northern Gateway (Sydney Science Park). Within the Aerotropolis region we have also received a request to supply gas to a Water processing facility (Water Factory).

Construction on the Airport began in September 2018 and since then the Greater Sydney Commission has launched the Growth Infrastructure Compact (GIC) process, which is to assess the nature, level and timing in infrastructure required to service the area. Regular workshops have enabled us to work closely with other utilities to assess the options of supplying the Western Sydney Aerotropolis and determine possible utility synergies.

In recent months a number of new road and asset relocations and upgrades have commenced around the Airport and a number of planning documents have been released by the NSW Government.

Working with other utilities and government authorities, we have identified synergies which will deliver customer benefits by lowering costs and reducing construction inconvenience. We are only able to share utility synergies with specific utilities as the other electrical assets need to be kept separate to maintain the integrity of our secondary steel mains.

The principal drivers for undertaking the project expansion is to connect customers to gas, providing new customers access to gas and lower bills for our existing customers (as connecting more customers allows us to spread our largely fixed costs across more customers).

1.2 CREDIBLE OPTIONS

The options that were assessed for the Aerotropolis projects are listed in Table 1. To develop the credible options the route, timing and pipe sizes were evaluated. It was found there is optionality on the timing and utility synergies of the Airport and the Science Park only. For the other supply points (Aerotropolis Core and the Water Factory), there are only two credible options: base case (maintain status quo and do not supply) or install mains along the shortest route.

It is not possible to align utility synergies for all locations as they are either not taking the same route as us or the timing in which they lay their assets does not meet our requirements. This is relevant for supply to the Science Park where customers are connecting in December 2021 and for us to supply gas we must lay mains along Elizabeth Drive ahead of other utilities.

Considering the above, all options (1 to 4) include the common project configurations with no additional identified variables:

[1] https://buildingourfuture.gov.au/projects/featured/western-sydney-airport?gclid=Cj0KCQiAiZPvBRDZARIsAORkq7eiYLEobR2ldXCPl37cT2_iLAICTXiIGkdTh0TYhjZJ1mQfIGIWxVcaAgHQEALw_wcB

1. Aerotropolis Core: Lay 4000m of 250mm ST with utility synergies[2]
2. Water Factory: Lay 2500m of 150mmST in a Jemena trench[3]

Table 1: Options Summary for Aerotropolis

Option	Option Name	Description	Gas delivered	NPV ($M, 2018)	Augmentation capex ($M, 2018)
Base case	Maintain Status Quo	No investment in the Aerotropolis	N/A	0	0
1	Defer investment until 2026	Investment is delayed until 2026 for all Aerotropolis projects	RY26	-4.46	18.7
2	Gas available for first dwellings/businesses	Supply airport by December 2024, Sydney Science Park by December 2021, Aerotropolis Core by 2022 and Water Factory by December 2024. Construct main to Sydney Science Park, via airport, by 2022: 2.5km of 250 mm ST to airport then 5.5km of 150mm ST to Sydney Science Park. Synergies achieved in airport to Sydney Science Park section. Lay 4km of 250mm ST to Aerotropolis Core by 2022 (timing to achieve construction synergies). Lay 2.5km of 150mm ST to Water factory by December 2024.	AP: RY25 SP: RY23	9.92	13.7
3	Delay gas to Sydney Science park	Supply timeframes as in option 2 – except delay supply to Sydney Science park to December 2024. Construct main to Sydney Science Park, via airport, by December 2024: 2.5km of 250 mm ST to airport then 5.5km of 150mm ST to Sydney Science Park. Synergies realised in the section to the airport. Aerotropolis Core and Water Factory consistent with Option 2.	AP: RY25 SP: RY25	7.28	14.4

[2] Utility synergies are defined where we can share with another utility construction activities such as trenching and restoration .

[3] A Jemena trench assumes we have to perform our own trenching and restorations of the roads or road reserve. There are no cost savings as there is not an opportunity to share construction activities with other utilities

Option	Option Name	Description	Gas delivered	NPV ($M, 2018)	Augmentation capex ($M, 2018)
4	Alternative supply route (supply the Science Park from the north)	Supply timeframes as in option 2 Construct 8km 150mm ST main to Sydney Science Park from north rather than via Airport by December 2021 (no construction synergies) Construct separate 2.5 km 250mm ST main to airport by December 2024 (with construction synergies). Aerotropolis Core and Water Factory consistent with Option 2.	AP: RY25 SP: RY23	4.23	17.5

NB: All estimates above include the extensions to supply Aerotropolis Core and Water Factory with no variables.

1.3 RECOMMENDATION

It is recommended to implement Option 2 for the Aerotropolis as the benefits of connecting the Science Park (NPV of $9.92M) for when they first have gas are greater than the potential cost and utility synergies you would receive in aligning our mains to the Airport with synergies (NPV of $7.28, Option 3) and delivering gas to Science Park at a later time. The principal driver is that if gas is not available for the first set of connections, homes and businesses will choose alternative sources of energy. A reduced number of connections will mean higher bills for our existing customers.

Other utility groups are laying water mains along Badgerys Creek Rd to supply the Aerotropolis Core, we intend to lay alongside their mains and gain the utility synergy benefits.

The Water Factory will be supplied by laying mains in a Jemena trench through green field areas as there are currently no other utility plans along the same route.

Our preferred option maximises the potential synergies by aligning to other utility infrastructure where possible, such as along Luddenham Road to the Science Park and Badgerys Creek Road to the Aerotropolis Core. This ensures the lowest cost option to the customer and is the option which will deliver the lowest customer bills.

1.4 CONSUMER ENGAGEMENT

In considering the pipe diameters and the amount of capacity we plan for, we directly consulted customers on our approach to supply the Aerotropolis i.e. planning for the medium or long term (more or less capacity). We had initially engaged customers at a conceptual level to identify whether we should invest in the medium or longer term.

At a high level, customers told us to invest for the long term but they were concerned about affordability. To balance this feedback we considered a mixed approach for our augmentation investments driven by connections.

This means where the likelihood of further development is high and the costs of providing additional capacity now is low, we would adopt a long term approach. Otherwise we would adopt a medium term approach to lower costs.

For the Aerotropolis, we selected a mixed approach where we install a mix of medium and long term capacity pipes depending on the future outlook for each area[4]. Most customers (53%) supported our mixed approach. Of the remaining customers, most (34%) preferred that we always invested for the long term while 13% preferred the medium term. Given that the majority of customers endorsed our mixed approach we recommend a mixture of 150mm and 250mm ST diameter pipes.

1.5 NATIONAL GAS RULES

These projects conform with The National Gas Rules (**NGR**) (r. 79) which sets out the new capital expenditure criteria. The selected option complies with Rule 79(1)(a) as it delivers the greatest bill reduction and is therefore what would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services. Moreover, the selected option is justified as it complies with Rule 79(2)(a) and 79(2)(b) as it delivers economic value to JGN's current and future customers and the overall incremental revenue to be generated exceeds the present value of the capital expenditure.

[4] Attachment 2.2 of the 2020 Plan – JGN's Customer Engagement, RPS.

2. PROJECT BACKGROUND AND KEY DRIVERS

2.1 PROJECT BACKGROUND

The Western Sydney International (Nancy-Bird Walton) Airport is the site named for the second Sydney airport, located within Badgerys Creek and is set to be completed by 2026.

The Airport is planned to be a catalyst for new infrastructure that will bring an economic hub delivering 200,000 new jobs, 28 000 - 34 000 homes, infrastructure and services to the heart of Western Sydney. It forms part of the NSW government's plan for an Aerotropolis city that will make a significant contribution to new jobs for Western Sydney. It will do this by developing land and establishing growth for jobs in aerospace and defence, manufacturing, healthcare, freight and logistics, agribusiness, education and research industries[5].

The construction of the Airport and development of the surrounding land is one of the largest State planning projects of the decade. The project offers an exciting opportunity to work with governmental planning bodies, other utilities and developers to deliver affordable and reliable energy to customers of Western Sydney Aerotropolis.

2.2 IDENTIFIED NEED

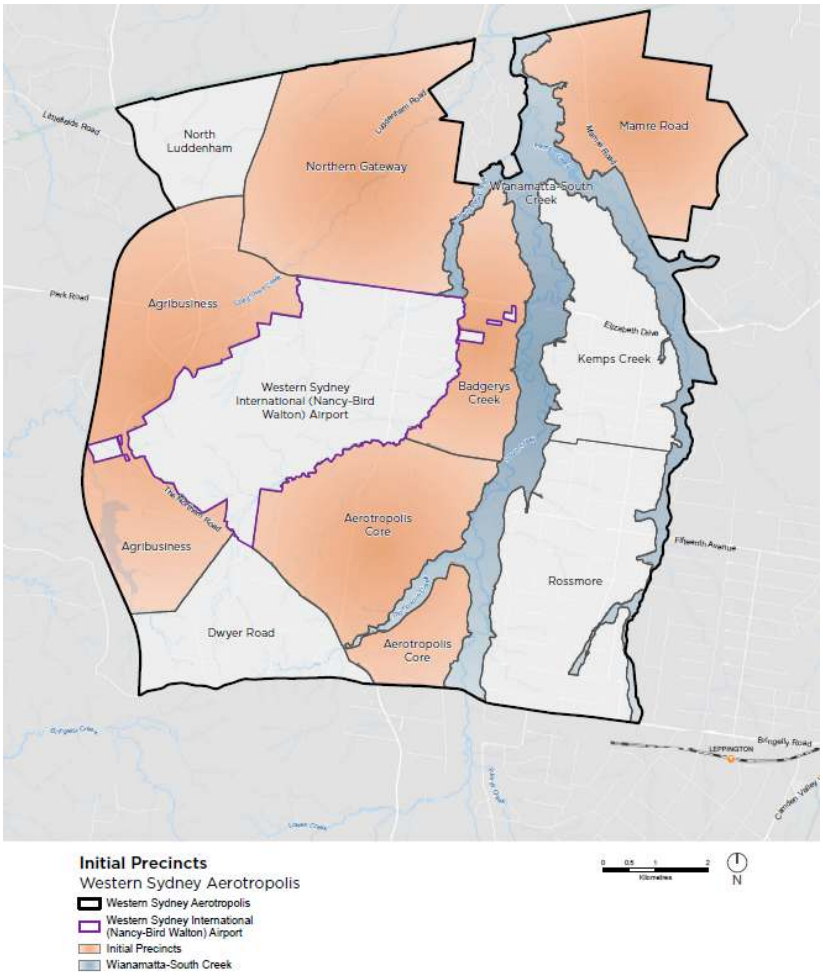
In December 2019, the NSW State Government published the Western Sydney Aerotropolis Plan[6] detailing a vision for the Western Sydney Aerotropolis as Australia's next global gateway, built around the world-class Western Sydney International (Nancy-Bird Walton) Airport.

The plan describes the largest development for gas infrastructure over the next 20 years and beyond will be to cater for the Western Sydney Aerotropolis. Figure 1 shows the overall proposed Aerotropolis footprint, with the initial precincts of the Aerotropolis Core, Western Sydney Airport and the Northern Gateway (Sydney Science Park) being the main focus. The plan states the initial precincts will be rezoned by mid-2020.

5 https://www.planning.nsw.gov.au/Plans-for-your-area/Priority-Growth-Areas-and-Precincts/Western-Sydney-Aerotropolis

6 https://shared-drupal-s3fs.s3-ap-southeast-2.amazonaws.com/master-test/fapub_pdf/A+Aerotropolis/WesternSydneyAerotropolis_Plan_DraftForComment_WEB.pdf

Figure 1: The Western Sydney Aerotropolis Plan with indications of initial precinct developments [7]



2.2.1 WESTERN SYDNEY AIRPORT

The Western Sydney Airport will be in operation from 2026 with commissioning and operational testing from the end of 2024. The Airport will also feature an airport freight and logistics precinct, an airport commercial precinct and the passenger terminal precinct. The passenger terminal will be catering for up to 10 million annual passengers as part of Stage 1 and the expansion of the terminal and commercial facilities where a second parallel runway is estimated to be required by 2050. The commercial precinct will include hotels, retail and light industrial premises.

To adhere to the timeframes of the Airport, we need to ensure gas supply is available by the end of 2024.

2.2.2 AEROTROPOLIS CORE

The Aerotropolis Core will be a 24 hour global centre to provide a variety of commercial and dwelling options for the workers, residents and visitors coming to and from the Airport. The current forecasts for the area include 8,000 new dwellings and a mix of commercial uses such as offices, entertainment facilities, cafes, restaurants, education centres and defence and aerospace technologies.

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7 NSW Department of Planning and Environment

The Aerotropolis Core is classified in the Western Sydney Aerotropolis Plan[8] as a Metropolitan Cluster where a high concentration of jobs and residents are planned to be located. The total area includes 1,382 hectares of land with potentially 50,000 to 60,000 jobs and 20,000 to 24,000 residents.

The current timing for the initial development of the area is 2022.

2.2.3 SYDNEY SCIENCE PARK

The Sydney Science Park is part of the Northern Gateway precinct of the Aerotropolis and will include a technology centre that includes education and research facilities, food production and processing, 30,000m^2 of retail space allocated and approximately 3,400 residential dwellings.

A letter was received from Sydney Science Park Pty Limited[9] on the 12th December 2019 stating:-

The current timing to supply commercial/industrial customers in the Science Park is December 2021.

2.2.4 WATER FACTORY

Sydney Water have approached JGN[10] with a request for gas at their newly proposed water recycling facility in the Aerotropolis region. The plant is to be constructed in time to supply the new Airport with water in mid-2024.

The facility will be situated in the Kemps Creek precinct, north of the newly proposed M12. Gas supply is required prior to December 2024.

8 https://shared-drupal-s3fs.s3-ap-southeast-2.amazonaws.com/master-test/fapub_pdf/A+Aerotropolis/WesternSydneyAerotropolis_Plan_DraftForComment_WEB.pdf

9 JGN-RP-Aerotropolis-Sydney Science Park-Letter-20191212-confidential

10 JGN-RP-Aerotropolis-Sydney Water-Letter of support-20191219-confidential

2.3 STAKEHOLDERS DRIVING COLLABORATION

2.3.1 GREATER SYDNEY COMMISSION

The Greater Sydney Commission (**GSC**) is a government organisation aimed at assisting metropolitan planning to make Greater Sydney more productive, sustainable and liveable. They play a role in coordinating and aligning the plans that will shape the future of Greater Sydney.

More specifically to the Aerotropolis the GSC released in March 2018 the Greater Sydney Regional Plan outlining a vision of three cities: the Western Parkland City, Central River City and the Eastern Harbour City[11]. The Western Parkland City encompassed the Western Sydney Airport, Greater Penrith and Campbelltown and detailed plans on how these areas will transform and be serviced by infrastructure and transport.

One of the initiatives to come out of the plan was to develop a mechanism to better align growth with infrastructure through a Growth Infrastructure Compact (**GIC**) which would assess the nature, level and timing of infrastructure required for an area in light of its forecast housing and employment growth. The GIC was formed to provide utilities, councils and government agencies the platform to collaborate and consider the sequencing, optimising and adaptability of infrastructure as part of managing infrastructure delivery with growth. In order to support the collaboration group a memorandum of understanding was signed by each utility and stakeholder group.

The GIC collaborative group has meet many times over 2019 including the recent workshops detailing the current and proposed infrastructure requirements of all energy, water and transport services to meet the projected growth of the Aerotropolis. One of the main items to come out of the collaborative group was a group utilities map detailing each utilities current infrastructure, the proposed infrastructure and timings.

Memorandum of Understanding (**MoU**)

An MoU was signed by all participating utility businesses with an agreement date starting from 4 October 2019[12]. The agreement details the expectations of working together in order to support the City Deal by coordinating planning, design, delivery, maintenance and operation of utility related infrastructure.

The purpose of the agreement is to assist the utilities stakeholder group to achieve a group wide approach to planning, design and delivery of the utilities infrastructure in the Western Parkland City to ensure that the right infrastructure and services are provided in the right place at the right time.

The group meets regularly to ensure a coordinated approach to installing the infrastructure required for the area.

Jemena has a track record of working effectively with other utilities and government authorities. In order to meet the time requirements and build infrastructure concurrently we must be flexible and be able to mobilise quickly to take advantage of the short windows typically provided.

An example of this is our recent secondary extension project in Edmondson Park. To take advantage of a small construction window that opened up we obtained internal approvals and mobilised in two weeks. The secondary extension has since been completed.

Group utilities map

The latest outcome of the Utilities Collaboration Group (**UCG**) is the creation of a utilities map with the current and future requirements of all utilities to service the new area. This map has been created to allow for easy identification of synergy areas and a shared vision on how each utility is going to service the area.

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11 https://www.greater.sydney/metropolis-of-three-cities/introduction

12 JGN-RP-Aerotropolis-MOU-signed-20191211-confidential

The map details emerging staging for land use and the proposed infrastructure of Sydney Water, TransGrid Endeavour Energy and JGN. The map identifies which synergies are possible for instance between some utilities (like water mains and JGN's steel gas mains) and where utilities need to keep their assets separate (electricity lines and cables need to be kept separate to our secondary steel mains).

The map also identifies elements which will increase costs. For instance future transport corridors with the M12 being built to the north of Elizabeth Drive and indication for the new Sydney Metro Greater West Stage 1 both proposed for operation in 2026 (in coincidence for the Airport opening) as well as natural barriers such as creeks.

As part of the overall Aerotropolis utility plans, Sydney Water have proposed a Water Factory (called South Creek Water Recycling Plant). The plant will treat wastewater and has requested to be a JGN customer. As the request has come through the Aerotropolis working groups the Water Factory designs are discussed in this Options Analysis.

2.3.2 STAKEHOLDERS INVOLVED

The below stakeholders are involved in collaborating with GSC for construction of network utility services:

- Sydney Water
- Endeavour Energy
- TransGrid
- Department of Planning Industry and Environment
- Roads and Maritime Services
- Transport for NSW
- Sydney Metro
- Caltex

2.4 ASSUMPTIONS

The following are a list of assumptions taken into consideration while undertaking the options analysis.

Table 2: List of Assumptions and Constraints

	Assumption / Constraint
1.	Construction synergies can be shared with another utility. We assume shared costs for common trenching, restoration and other synergies
2.	JGN is able to access and complete the augmentation at specified construction times
3.	There will be no objections from other utilities and local councils and all approvals will be granted in a timely manner.
4.	The proposed route does not have other pre-existing utilities in the way which require relocation
5.	Jemena steel mains must be kept separate from electrical infrastructure and telecommunication lines, as electrical currents may interfere with cathodic protection
6.	Ability to cross future M12 and Metro lines even before their construction

2.5 METHODOLOGY

When investigating new developments and the project design for gas supply we take the following approach:

(1) **Review current infrastructure**: Analysis of current infrastructure allows us to determine whether JGN already has the capabilities to service the new development. The location, timing and magnitude of gas demand of the new developments will determine the future planning requirements.

(2) **Route**: Once a potential customer has been identified we look at the shortest route from our assets to the customer. The route must be along roads unless an easement can be acquired. In most cases we cannot lay as the crow flies as you have to traverse through private property or park lands. We must also take into consideration obstacles that may be in our way such as creeks, motorways, railway corridors and Jemena infrastructure such as the Trunk pipeline. An initial route is determined using desktop analysis, geospatial imagery system (**GIS**), up-to-date satellite imagery and street view.

(3) **Timing**: Timing is critical as we must ensure the gas main is commissioned (gas-on) in time for the first gas customers and where possible enable utility synergies by aligning construction activities with other utilities or councils.

a. Gas-on: For these types of developments we adopt a "just-in-time" approach to ensure customers are provided gas just when they need it. If gas is not available customers will install electricity appliances and not connect to our network, leading to higher bills for our existing customers.

b. Synergies: For new development areas, all utility groups are faced with the same challenges to service the new areas as generally there is no existing infrastructure. In these situations we look for commonality with other utilities or council works to align work and enable synergies. This can provide the opportunity to lower cost and bring more convenience to customers and the public.

(4) **Pipe sizes**: Once the route and timing has been determined, we use Synergi modelling and simulation software to determine the pipe sizes required to service the load. Consideration is given to service the requested load and the future requirements of the area. Modelling is completed on a range of pipe sizes and the optimal solution is picked based on the new demand loads and our minimum design pressures (525 kPa for secondary pressure).

a. Medium vs Long term approach: It is important to consider the medium and long term approaches for new augmentation projects when modelling pipe sizes. Previous project designs for augmentation projects consisted of a mix of both medium term and long term depending on factors such as dwellings forecast, sensitivity of gas load and penetration and potential for more commercial gas usage, etc. This was discussed in the Capacity Augmentation Plan[13] as well as our collaboration findings with our customers on their preferred approach. Given that the majority of customer preferred a mixed approach (53%)[14] we must consider this heavily when looking at pipe sizes for the Aerotropolis region.

[13] JGN-2-3.15-2-Capacity Augmentation Development Plan-20190630-public

[14] Attachment 2.2 of the 2020 Plan – JGN's Customer Engagement, RPS.

3. FINDINGS

3.1 CURRENT INFRASTRUCTURE

The Western Sydney growth area, includes the JGN Central Trunk, Trunk Regulating Stations (**TRS**), Primary mains network, Primary Regulating Stations (**PRS**), Secondary mains network, Secondary Regulating Sets (**SRS**) and Medium pressure mains network. There are two TRS facilities supplying gas to the western area (Figure 2, circled below):

1. Horsley Park TRS facility
2. West Hoxton TRS facility

These facilities reduce the pressure from the JGN Trunk pressure (6895 kPa) into the primary mains network (3500kPa). At these facilities, there are also PRS stations, which reduce the primary main pressure down to secondary mains network (1050kPa) which feeds to the proposed Aerotropolis region.

The secondary mains network includes:

- Maximum Allowable Operating Pressure (**MAOP**): 1050 kPa
- Material: Steel
- Supply gas mostly to large industrial customers
- Supplies gas to the medium pressure network through SRS

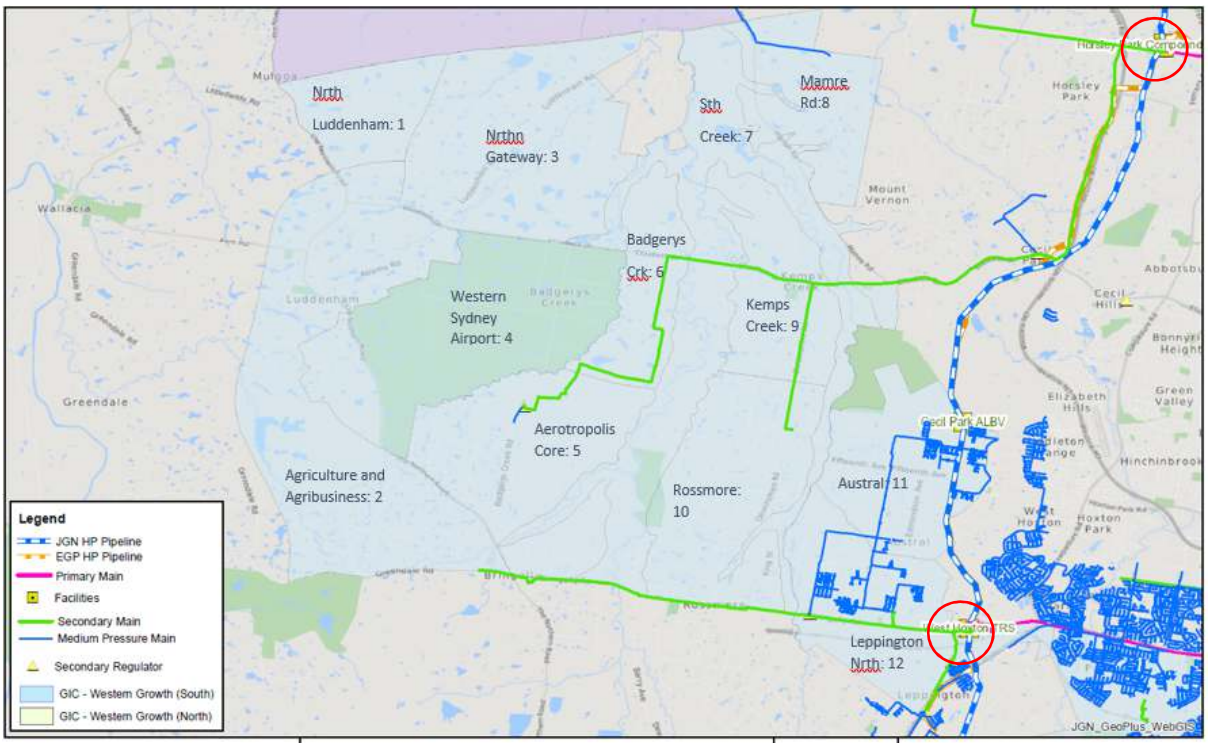
Medium pressure mains network includes:

- MAOP : 210 kPa, 300kPa
- Material: Polyethene, Nylon
- Supply gas to residential and light commercial customers

There are two SRSs installed in the Aerotropolis region which reduce the pressure from the secondary mains network to the medium pressure network and supply existing customers and new residential developments in Austral.

The existing infrastructure is sufficient to supply gas to new estate developments in the Austral precinct. However, the secondary mains will have to be extended to reach the new major growth locations such as the Western Sydney Airport, Aerotropolis, Sydney Science Park and the Water Factory.

Figure 2: Sydney gas mains network and the Aerotropolis region in Western Sydney



3.2 ROUTE

Figure 3 shows the JGN trunk, primary and secondary mains across all of Sydney. Looking at the Aerotropolis area (highlighted blue) there are not many feasible options for where gas supply can easily be brought into the area. The red circles indicate possible secondary main extension points to the area.

To determine which options should be carried into the credible options analysis we must first determine the distances required to be laid.

Figure 3: JGN Sydney network with Aerotropolis outline and possible secondary main extension points (circled) to service the Aerotropolis area

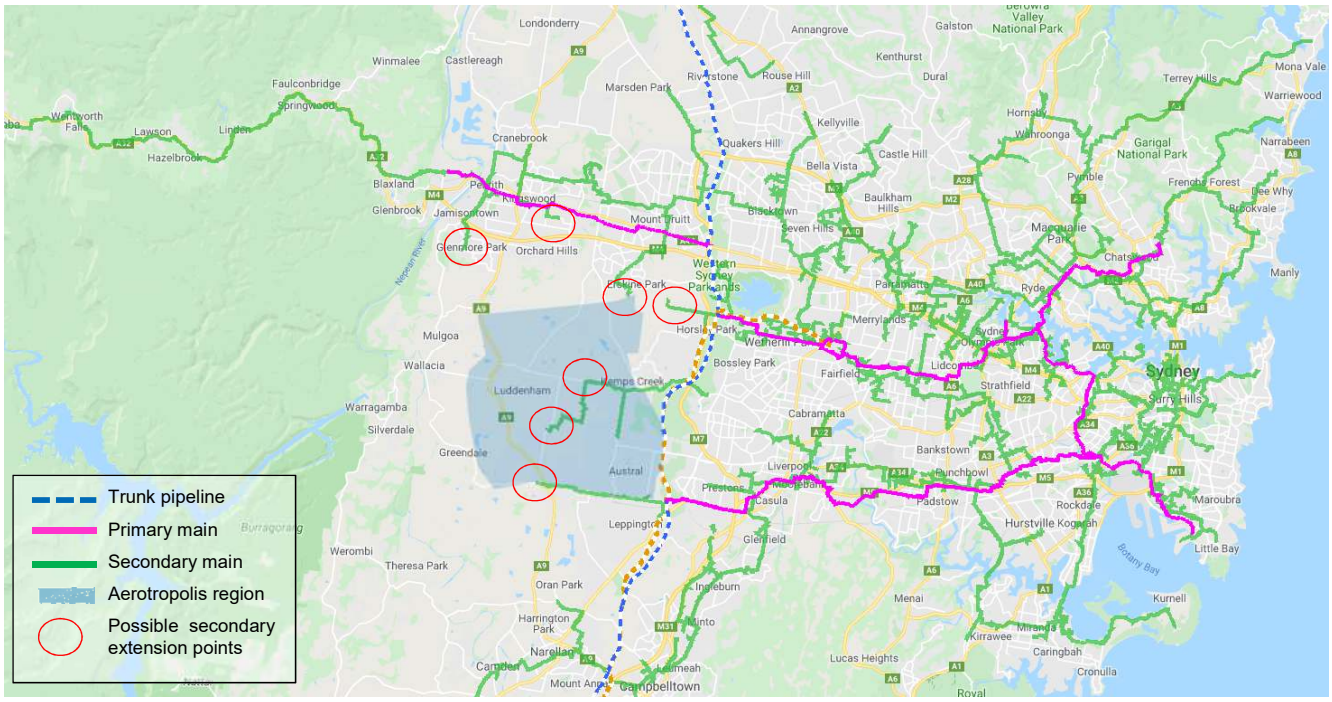


Figure 4 shows the possible mains extension routes required to service the project locations. To formulate credible options we assessed each individual project with the following route considerations:

1. **Western Sydney Airport**: The shortest route to the Airport is by extending the secondary along Elizabeth drive for 2.5km (solid light blue line), this is much shorter than providing gas from the South along Badgerys Creek Road for 4km (dotted light blue line). Only the shortest route of 2.5km is deemed credible and carried forward.

2. **Sydney Science Park**: The shortest route to the Science Park is to continue the main from the Airport along Elizabeth Drive to Luddenham Road and north to the Park, 5.5km (solid red line) which would include the Metro and M12 crossing. Alternatively, supply can be provided from the north with 8km of secondary mains (dotted red line).

   There are other options for mains extension as indicated by the red circles, extending the mains from these locations requires over 10km and not deemed credible options. The two route options drawn (extending from the south and extending from the north) are deemed credible and included in the options analysis. Two routes are considered as the shorter route is time dependant on the gas supply to the Airport, while supplying from the north does not rely on other project time factors.

3. **Aerotropolis Core**: Preliminary assessments of the Aerotropolis Core shows that to support the required gas demand the secondary mains have to be interconnected. This can be achieved by either extending the main along Badgerys Creek Rd (solid dark blue line), 4km to Bringelly Rd or two varying interconnections further east which are both 5km or 6.5km each (dotted dark blue line). Only the shortest route of 4km is deemed credible and carried into the Options Analysis.

4. **Water Factory:** There are only two different roads extending to Water Factory. The shortest route being 2.5km (solid yellow line) through back streets is deemed credible and is assessed further.

Therefore, the routes are:

Airport: 2.5km along Elizabeth Drive

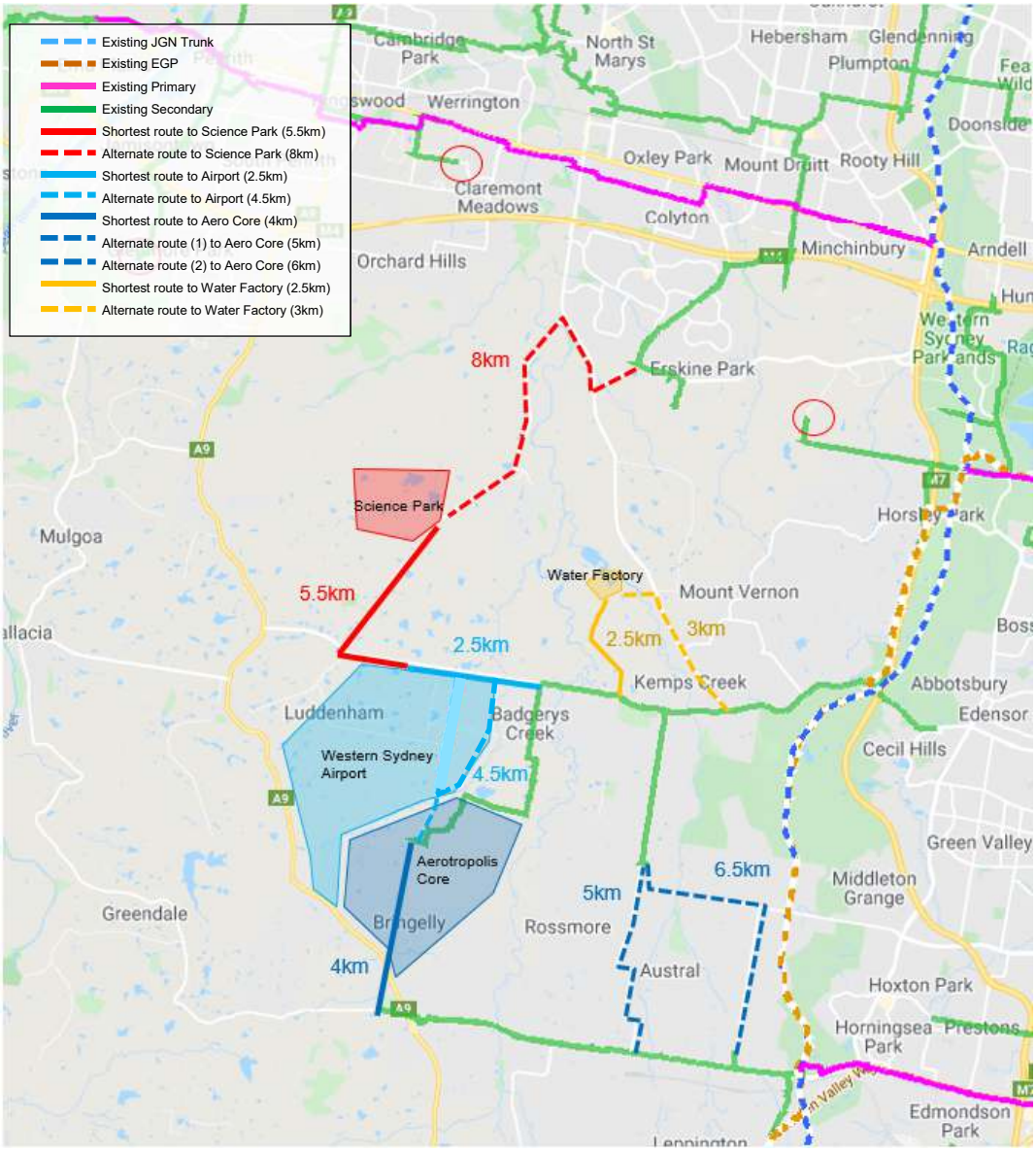
Aerotropolis Core: 4km along Badgerys Creek

Water Factory: 2.5km along back streets

There are two credible route options for the Science Park:

1. Science Park from the south: 5.5km along Luddenham Road (assuming main to Airport is in place)
2. Science Park from the north: 8km from Erskine Park

Figure 4: Route options for the Aerotropolis projects.



3.3 TIMING

As identified earlier, there is an opportunity to collaborate within the UCG and incorporate synergies such as shared trenching and restoration costs (this will be called 'utility synergies').

Table 3 shows when gas is required and the corresponding UCG timings for each project. Ideally, for all projects we would deliver our projects at the same time to ensure the lowest cost to the customer, however, it is not possible to incorporate synergies for the Airport and Science Park collectively. This is because our shortest route to the Science Park requires the gas mains along Elizabeth Drive (passing the Airport) to be completed before connecting to the Science Park

Another option to connect the Science Park at the required time and incorporate utility synergies with the Airport is to lay secondary mains from the north (as shown in Figure 4) and is considered credible.

We are able to incorporate utility synergies for the Aerotropolis Core, as others are augmenting along Badgerys Creek Rd which aligns to our route and timing. This is the lowest cost option for supplying gas to the Aerotropolis Core and remains unchanged in the options analysis.

To supply gas to the Water Factory there are no utility synergies at this stage and the shortest distance from JGN's secondary mains to Water Factory is 2.5km. This option remains unchanged in Section 4. Credible Options.

Table 3: Gas demand requirements and UCG utility service timings

Project	Requires gas	UCG timing
Western Sydney Airport	2024 – Commissioning Dec 2024[15]	2022-24 –Elizabeth Drive
Sydney Science Park	Dec 2021 – first gas on	2021-22 – Luddenham Rd to the Science Park
Aerotropolis Core	2022	2020-22 – Extending along Badgerys Creek Rd
Water Factory	Dec 2024 –Operational for Airport.	No other infrastructure proposed along the same route as JGN.

There are three credible timing and utility synergy options for the Airport and Science Park:

1. Jemena trench for the Airport section, utility synergies to Science Park section
2. Utility synergies for the Airport section, Jemena trench to the Science Park section from the south.
3. Utility synergies for the Airport section, Jemena trench to the Science Park section from the north

and

Aerotropolis Core: Utility synergies, RY22

Water Factory: Jemena trench, RY24

[15] Passengers being transported from 2026

3.4 PIPE SIZES

3.4.1 PIPE SIZE EVALUATION

The pipe diameter is a critical element in the project design as it determines the quantity of gas travelling through the pipeline and determines whether we are planning for the medium or long term. There are a number of different diameter secondary mains that can extended into the area and a primary main. These include;

1. 150mm ST, MAOP 1,050kPa
2. 200mm ST, MAOP 1,050kPa
3. 250mm ST, MAOP 1,050kPa
4. Primary, 150-450mm ST, MAOP 3,500kPa

As discussed in Section 3.1 the JGN Central trunk runs alongside the boundary of the development area, which provides us the option of supplying primary into the new growth area. A primary pipeline laid in green field areas would cost ~$2,000/m, with a new TRS and PRS costing approximately $10M and $5M respectively. The primary pipeline would be taken from the closest trunk main near Cecil Park, 8km to the Airport supply point. The total cost for laying primary main would be ~$31M. This cost compared to laying secondary of ~$10-15M is significantly more.

Laying a primary has not been selected due to the cost, timing and constructability. The existing secondary network has sufficient capacity to supply the required loads. Constructing two additional facilities, and laying a primary network along Elizabeth Drive is unnecessary.

Only the differing secondary main sizes were modelled in Synergi.

3.4.2 SYNERGI MODELLING OF LOADS

To determine which secondary pipe diameter (150, 200 and 250 mm ST) should be taken into the Section 4. Credible Options, Synergi modelling was carried out on all secondary diameter scenarios.

The analysis found the optimal pipe size configuration to be: –

- Sydney Airport: 250mm ST
- Sydney Science Park from the south: 150mm ST
- Sydney Science Park from the north: 150mm ST
- Aerotropolis Core: 250mm ST
- Water Factory: 150mm ST

Further information on the analysis can be found in Appendix B.

4. CREDIBLE OPTIONS

From Section 3 the following credible options were identified:

- Base Case: Maintain Status Quo
- Option 1: Defer investment until 2026
- Option 2: Gas available for first dwellings/businesses
- Option 3: Delay gas to Sydney Science park
- Option 4: Alternative supply route (supply Science Park from the North)

The credible options are explained in detail below.

Table 4: Credible Options

	Option Name	Description
Base case	Maintain Status Quo	No investment in the Aerotropolis
1	Defer investment until 2026	Investment is delayed until 2026 for all Aerotropolis projects
2	Gas available for first dwellings/businesses	Supply airport by December 2024, Sydney Science Park by December 2021, Aerotropolis Core by 2022 and Water Factory by December 2024. Construct main to Sydney Science Park, via airport, by 2022: 2.5km of 250 mm ST to airport then 5.5km of 150mm ST to Sydney Science Park. Synergies achieved in airport to Sydney Science Park section. Lay 4km of 250mm ST to Aerotropolis Core by 2022 (timing to achieve construction synergies). Lay 2.5km of 150mm ST to Water factory by December 2024.
3	Delay gas to Sydney Science park	Supply timeframes as in option 2 – except delay supply to Sydney Science park to December 2024. Construct main to Sydney Science Park, via airport, by December 2024: 2.5km of 250 mm ST to airport then 5.5km of 150mm ST to Sydney Science Park. Synergies realised in the section to the airport. Aerotropolis Core and Water Factory consistent with Option 2.
4	Alternative supply route (supply the Science Park from the north)	Supply timeframes as in option 2 Construct 8km 150mm ST main to Sydney Science Park from north rather than via Airport by December 2021 (no construction synergies) Construct separate 2.5 km 250mm ST main to airport by December 2024 (with construction synergies). Aerotropolis Core and Water Factory consistent with Option 2.

4.1 BASE CASE – MAINTAIN STATUS QUO

We do not extend our secondary mains to supply gas to the Aerotropolis Core, Western Sydney Airport, Sydney Science Park and Water Factory

Benefits

1. No capital or operational expenditure required.

2. Simpler planning for the Aerotropolis collaboration group as gas feeder mains and services do not need to be considered.

Drawbacks

1. Higher customer bills (as we lose the opportunity to spread our largely fixed costs across more customers).

2. Dwellings and businesses in the Aerotropolis region would not have access to gas, a fuel our customers tell us they value.

3. We would be going against the recommendations of our customers in the forums of our Customer Engagement series, where customers told us they value gas and want JGN to invest in the network for future gas usage[16]. We also consulted customers on the level of future planning and whether we should invest in the medium or long term. Most customers (53%) preferred the mixed approach where we only invested in the long term where the gas loads were more certain.

4.2 OPTION 1: DEFER INVESTMENT UNTIL 2026

We do not invest until all of the customers and gas loads have eventuated. This would mean investment would not occur until post 2025. It is assumed the optimal solution is to augment in the same configuration as option 2 (Section 4.3).

Benefits

1. No capital or operational expenditure required by JGN until 2026.

Drawbacks

1. Higher customer bills. We lose the opportunity to spread our largely fixed costs across more customers as the homes and business that were built over the 2020-25 period would have installed electricity appliances as gas was not available.

2. Construction costs will be greater if we connect to the Aerotropolis post 2025 due to added trenching costs, restoration costs, movement of other utilities, disruption to the community and lost revenue from not connecting customers earlier.

3. Risks of not being able to supply to the Aerotropolis at all. Government authorities and other utilities may not grant permission to disrupt newly built infrastructure.

[16] Jemena Customer Engagement Report, Straight Talk, October 2018, p.24

4. We would be going against the recommendations of our customers in the forums of our Customer Engagement series, where customers told us they do not want rework and want minimal disruption to the community.

5. There would be a significant disruption to community and reputational damage from not coordinating timing of construction of infrastructure.

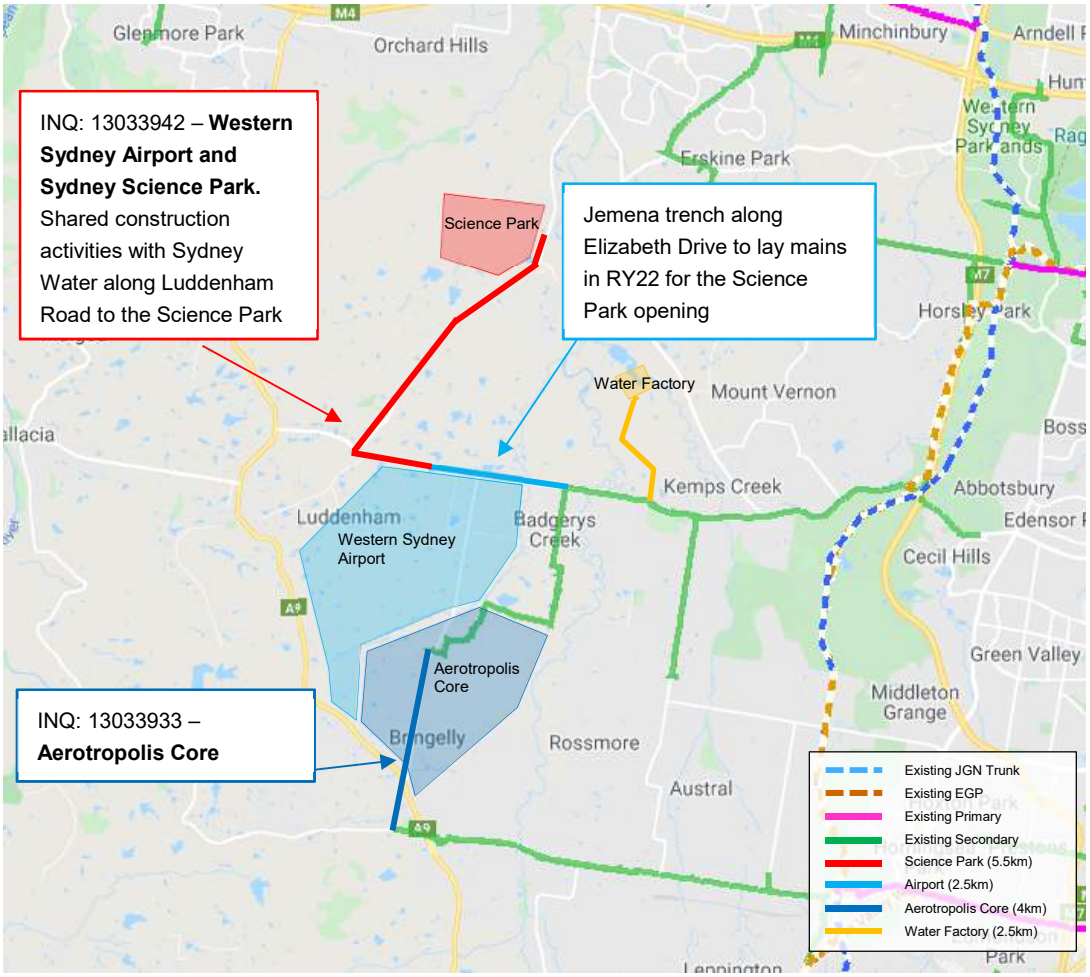
4.3 OPTION 2: GAS AVAILABLE FOR FIRST DWELLINGS / BUSINESSES

In this option the Airport is laid in a Jemena trench and the Sydney Science Park has utility synergies so that we can supply gas to the Science Park for first gas-on in December 2021.

Scope for Option 2:

Western Sydney Airport and Sydney Science Park:	Airport: Lay 2500m of 250mm ST along in a Jemena trench in RY22. Science Park: Lay 5500m of 150mm ST with utility synergies in RY22
Aerotropolis Core:	Lay 4000m of 250mm ST with utility synergies in RY22
Water Factory:	Lay 2500m of 150mm ST in a Jemena trench in RY24

Figure 5: Option 2, Jemena trench to the Airport and utility synergies to the Science Park



Benefits

1. Construction synergies in aligning our project timing to UCG in supplying gas to the Science Park. This will allow us to share a trench in the road reserve and the restoration works associated to laying new mains thereby lowering costs for customers.

2. Working with the UCG will have less disruption to the community with the construction works being completed in one block instead of a few years later another utility coming back to cause more disruption.

3. The net benefits to JGN customers are greatest compared to other options with an NPV of $9.92M, as customers are able to get the benefits of synergising with UCG with the largest section and gain the benefits of adding those customers to the network from RY23.

4. Future customer connections will be a lower cost as the mains cover a large section of the current and proposed redevelopment areas. These mains will form part of a solid backbone for future connections to branch off it.

Drawbacks

1. The RMS have plan for a northern motorway (M12) that traverses parallel to Elizabeth Drive and crosses over Luddenham Road. The Roads and Maritime Services (**RMS**) do not have plans to have this

operational until 2026. Our main to the Sydney Science Park will be commissioned by December 2021. Although we are completing our works before the construction of the M12 there is a risk they will prevent us from laying or an agreement will be required on the depth and location of main. Details on alignment are not available at time of writing

2. Crossing of the future Metro will be required and an alignment is not available at this stage,

3. There are drawbacks to collaborating with UCG as there will be added costs for stakeholder management, project management and risk of having to schedule multiple construction crews to the same location due to meeting other stakeholder requirements.

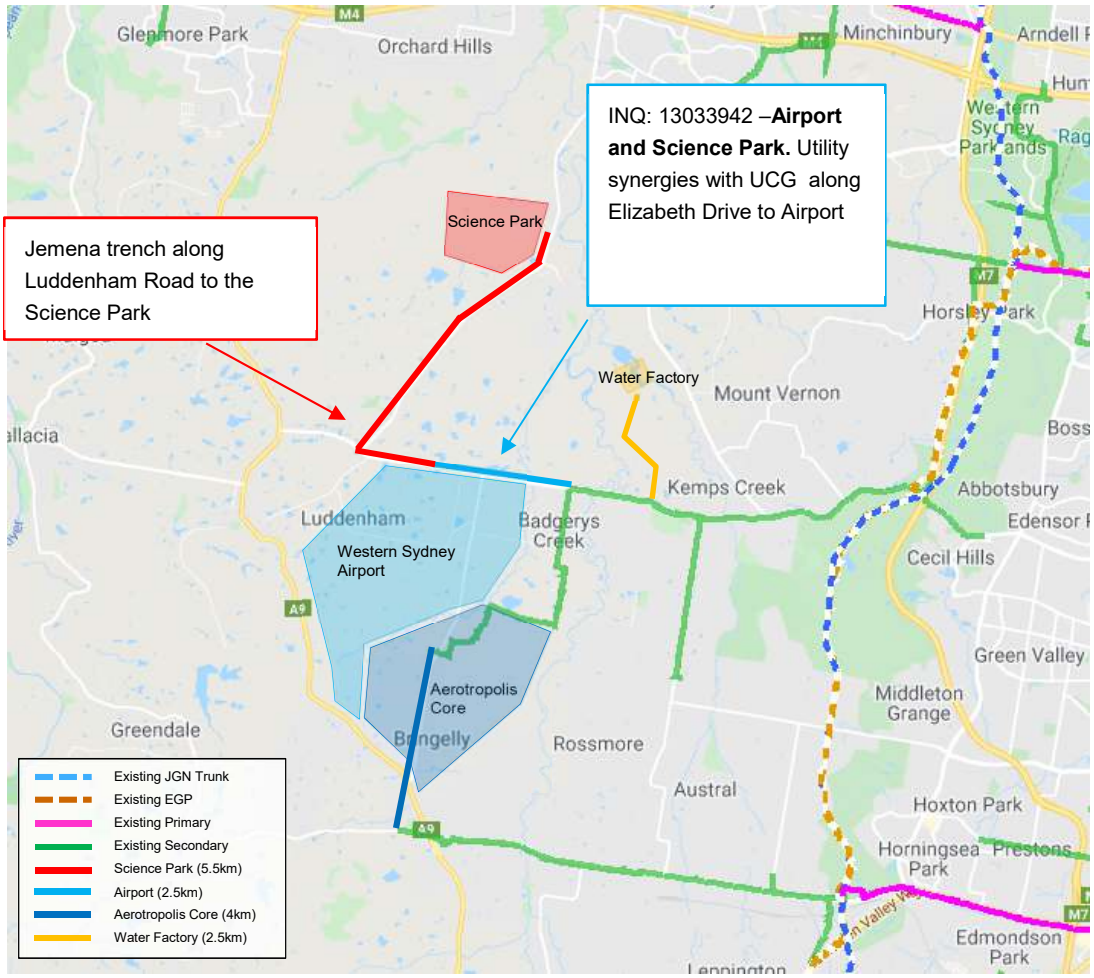
4.4 OPTION 3: DELAY GAS TO SYDNEY SCIENCE PARK

In this option the Airport and the Science Park will be completed as one project. Information provided by UCG shows they will be supplying the Airport by laying mains along Elizabeth Drive in 2022-24. Aligning our design to UCG will enable us to lay mains in an utilities corridor along Elizabeth Drive and continue the connection in our own Jemena trench to the Science Park in 2024.

Scope for Option 3:

Western Sydney Airport and Sydney Science Park:	Airport: Lay 2500m of 250mmST with utility synergies in RY24 Science Park: Lay 5500m of 150mmST in a Jemena trench in RY24
Aerotropolis Core:	Lay 4000m of 250mm ST with utility synergies in RY22
Water Factory:	Lay 2500m of 150mm ST in a Jemena trench in RY24

Figure 6: Option 3 utility synergies for the Airport and Jemena trench for the Science Park



Benefits

1. Construction synergies in aligning our project timing to UCG in supplying gas to the Airport and Aerotropolis Core. This will allow us to share a trench in the road reserve and the restoration works associated to laying new mains.

2. JGN internal project synergies by laying both projects at the same time. Savings will be made through the project life cycle with reduction in time, costs and construction activities.

3. Working together with UCG will have less disruption to the community with the construction works being completed in one block instead of a few years later another utility coming back to cause more disruption.

4. The net benefits to JGN customers are second highest compared to other options with an NPV of $7.28M.

5. Future customer connections will be a lower cost as the mains cover a large section of the current and proposed redevelopment areas. These mains will form part of a solid backbone for future connections to branch off it.

Drawbacks

1. Gas supply to the Sydney Science Park is required by December 2021 as stated by the letter received in December 2019[17], and this option will have gas available to the Science Park by 2024. There will be no customer connections made prior to commissioning the steel main in RY24 as homes and businesses will install electricity appliances if gas is not available on time. This will lead to lost connections and higher bills for our existing customers.

2. The Roads and Maritime Services (**RMS**) have planned for a northern motorway (M12) that traverses parallel to Elizabeth Drive and crosses over Luddenham Road. RMS do not have plans to have this operational until 2026. Our main to the Sydney Science Park will be commissioned by June 2024. Although we are completing our works before the construction of the M12 there is a high risk they will prevent us from laying or an agreement will be required on the depth and location of main.

3. There may be some drawbacks to collaborating with UCG as there may be added costs for stakeholder management, project management and risk of having to schedule multiple construction crews to the same location due to meeting other stakeholder requirements.

4.5 OPTION 4: ALTERNATIVE SUPPLY STRATEGY (SUPPLY SCIENCE PARK FROM THE NORTH)

To avoid the complications of connecting the Science Park from the south such as crossing the M12, completing the whole section (Airport and Science Park) as one project and laying mains early along Elizabeth Drive to connect the first customers, we can connect the Science Park from the north.

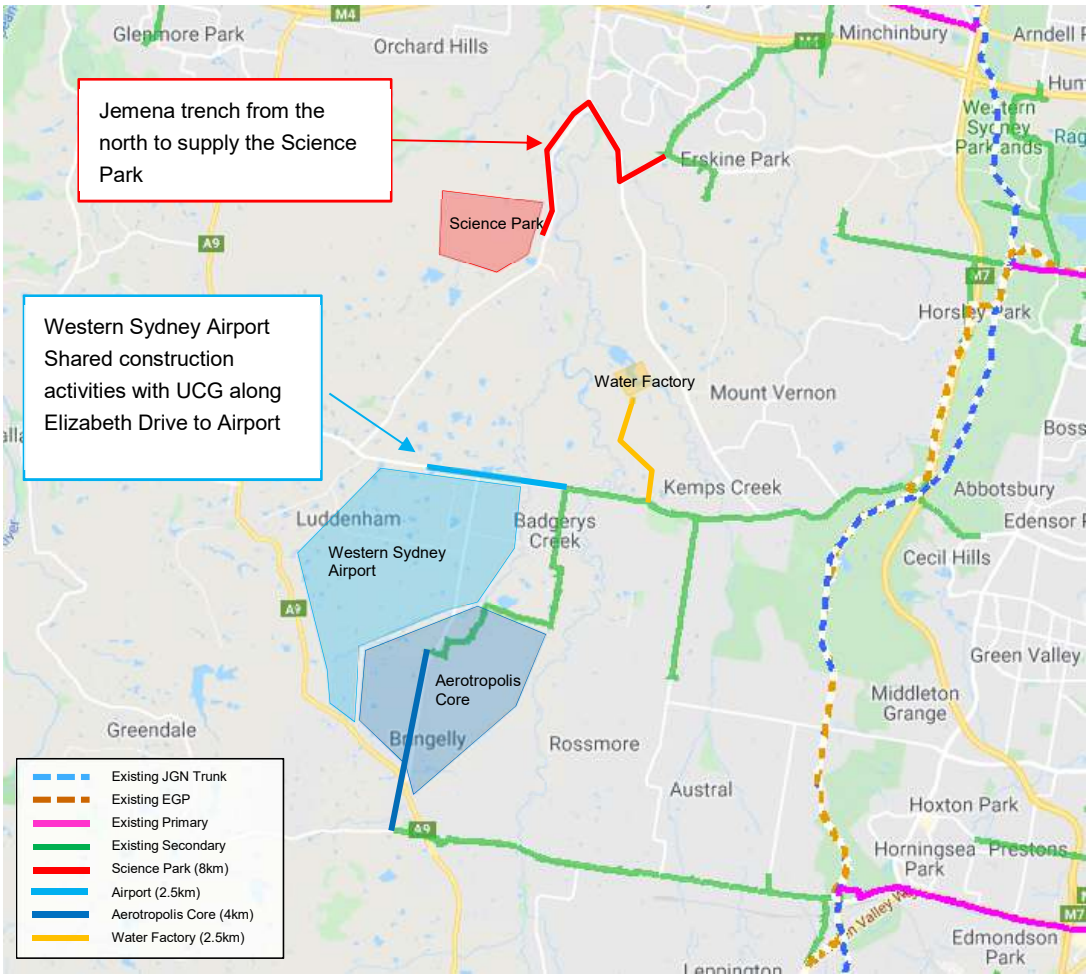
In this option connection to the Science Park does not rely on the mains along Elizabeth Drive. The Airport connection can be constructed in line with UCG timings and utility synergies can be incorporated.

Scope for option 4:

Western Sydney Airport:	Lay 2500m of 250mmST with utility synergies, RY24
Sydney Science Park	Lay 8000m of 150mmST in a Jemena trench, supply from the north, RY22
Aerotropolis Core:	Lay 4000m of 250mm ST with utility synergies, RY22
Water Factory:	Lay 2500m of 150mm ST in a Jemena trench, RY24

[17] JGN-RP-Aerotropolis-Sydney Science Park-Letter of support-20191212-confidential.pdf

Figure 7: Option 4 utility synergies for the Airport and Jemena trench for the Science Park



Benefits

1. Construction of the airport with trucks travelling along Elizabeth road can continue unhindered as the mains along Elizabeth Drive do not have to be laid early.

2. The Science Park connections do not rely on the construction of the main along Elizabeth Drive. Customers can be connected in December 2021.

3. Utility synergies can be incorporated along Elizabeth Drive.

4. Mobilisation to construct the Science Park mains will be smoother as additional stakeholder management is not required for M12.

Drawbacks:

1. It is a longer and more costly route to the Science Park. An additional 2.5km are constructed compared to options 2 and 3.

2. No utility synergies are identified at this stage to the Science Park contributing to an increase in cost.

3. There may be drawbacks to collaborating with UCG for construction around the Airport as there will be added costs for stakeholder management, project management and risk of having to schedule multiple construction crews to the same location due to meeting other stakeholder requirements.

4.6 COMPARISON OF OPTIONS

Table 5: Options summary including risk, benefits and cost. For risk assessment see, Appendix A

Criteria	Base Case	Option 1	Option 2	Option 3	Option 4
Option description	**Do not connect**	**No investment until 2026**	**Utility synergies with Science Park**	**Utility synergies with Airport**	**Alternative supply strategy (Supply Science Park from the North)**
Customer benefits	- None	- None	- Largest customer benefits $9.9M	- Customer benefits of $7.3M	- Customer benefits of $4.2M
Efficiency of costs	- No capacity or operational expenditure required	- N/A	- Utility synergies with UCG along Luddenham Rd to the Science Park.	- Utility synergies with UCG along Elizabeth Drive to the Airport.	- Utility synergies with UCG along Elizabeth Drive to the Airport.
Strategic benefits			- Connecting the Science Park customers from first gas on - Construction past the M12 prior to RMS development - Carrying out the project as one (i.e. shared project manager and construction crew for both mains to the Airport and Science Park	- Working with UCG to deliver services to the Airport - Carrying out the project as one (i.e. shared project manager and construction crew for both mains to the Airport and Science Park	- Connect customers at the Science Park from December 2021. - Do not have to rely on the connection along Elizabeth or supply gas to the Science Park - Avoid M12 crossing
Delivery constraints	- N/A	- High traffic control due to increase in activity in the area - RMS construction of M12 by 2026	- Working with UCG may result in more project management hours and multiple mobilisations	- Working with UCG may result in more project management hours and multiple mobilisations - M12 construction likely to be in place	- Proposed metro rail to traverse over secondary main from the north
Treated Risk Ranking	Significant	Moderate	Low	Low	Low
NPV of customer benefits[18]	$0	$-4.5 M	$9.9 M	$ 7.3M	$4.2 M
Augmentation cost (2019)	$0	$19.0 M	$14.0 M	$14.6 M	$17.8 M
Option Analysis	○ Does not address the issue	○ Does not address the issue	● Fully addresses the issue	◕ Mostly addresses the issue	◑ Partly addresses the issue
Recommendation	Not Recommended	Not Recommended	Recommended	Not Recommended	Not Recommended

[18] JGN-RP-Aerotropolis-NPV Model-20191220-public

5. RECOMMENDATION

5.1 RECOMMENDED SOLUTION

Based on the analysis above the below solution was selected. For more details on the project scope see, Appendix C: Project Scopes

Table 6: Recommeded Options Summary

Project	Description	Timing	Cost ($2019)
Western Sydney Airport and Sydney Science Park	Airport section: Lay 2500m of 250mmST in a Jemena trench Science Park section: Lay 5500m of 150mmST with utility synergies	RY22	$7.97M[19]
Aerotropolis Core	Lay 4000m of 250mm ST with utility synergies	RY22	$3.9M
Water Factory	Lay 2500m of 150mm ST in a Jemena trench	RY24	$2.2M[20]
		TOTAL	$14.07

5.2 COST DETAILS

5.2.1 COST METHODOLOGY

The cost estimate was built using our Project Estimation Methodology and based on similar projects delivered by Jemena.

5.2.2 COST ESTIMATION

Details of the cost estimation can be found in the below attachments:

1. JGN-RP-13033942-Western Sydney Airport and Sydney Science Park-PEM-20191211-public
2. JGN-RP-13033933-Aerotropolis Core-PEM-20191211-public
3. JGN-RP-10049740-Water Factory-PEM-20191216-public

[19] Since carrying out the Options Analysis, UCG have considered the potential to align their water main along Elizabeth Drive to JGN's timing. This would mean utility synergies could be made for construction to the Airport as documented in their letter *JGN-RP-Aerotropolis-Sydney Water-Letter of support-20191220-confidential.* However, costs such as the required SRS at the Sydney Science Park and one at Aerotropolis Core have not been included (approximately $400 k). Additional synergies to with the Airport would be in the order of $180 k n potential savings.

[20] [redacted]

6. REFERENCES

1. Jemena Group Risk Management Manual
2. Gas Supply Act 1996
3. Gas Supply (Safety and Network Management) Regulation 2013
4. 2020 Plan
5. JGN-2-3.15-2-Capacity Augmentation Development Plan-20190630-public
6. Attachment 2.2 of the 2020 Plan – JGN's Customer Engagement, RPS.
7. JGN-RP-Aerotropolis-MOU-signed-20191211-confidential
8. JGN-RP-13033942-Western Sydney Airport and Sydney Science Park-PEM-20191211-public
9. JGN-RP-13033933-Aerotropolis Core-PEM-20191211-public
10. JGN-RP-10049740-Water Factory-PEM-20191216-public

Appendix A Risk Assessment Summary

A risk assessment was conducted to determine the level of risk severity of the untreated risk. The table below shows the summary of results and then the treated risk summary for each option. The risk assessment was undertaken in accordance with the Jemena Group Risk Management Manual Revision 8.

UNTREATED IMPACT/CONSEQUENCES								UNTREATED RISK SUMMARY		
Contributing Factors	**Strategic**	**Financial**	**Safety**	**Operational**	**Reg & Compl**	**Reputation**	**Comments**	**Consequence**	**Likelihood**	**Risk Level**
Do not connect new customers in the Aerotropolis	Serious	Serious	N/A	N/A	Serious	N/A	○ **Strategic –** Dwellings and businesses in the Aerotropolis region would not have access to gas, a fuel our customers tell us they value ○ **Financial** – The customer revenue from the new connections will be lost. ○ **Reg & Compliance** - The NGR states that conforming capex is when the revenue is higher than the capex to connect, this is the case for projects: Airport, Science Park and Aerotropolis Core.	Serious	Likely	Significant

PREFERRED OPTION – Risk assessment summary				TREATED RISK SUMMARY		
Preferred Option	Augmentation Cost	Benefit	Key Mitigations	Consequence	Likelihood	Risk Level
Option 1 – Investment in 2026	$19.0M	- Investment would not occur until the customer and new load requirements have been realised. - Opportunity to work closely with RMS on the M12 crossing and reach an agreement on the solution	○ Connect customers post 2025 ○ Avoid construction activities around the Airport and Science Park	Serious	Possible	Moderate
Option 2 – Utility synergies with the Science Park	$14.0M	- Utility synergies with UCG along Luddenham Rd to the Science Park. - Carrying out the project as one (i.e. shared project manager and construction crew for both mains to the Airport and Science Park	○ Increased revenue of connecting customers ○ Cost reduction by working with UCG to deliver the project with shared trenching and restoration costs	Minor	Unlikely	Low
Option 3 – Utility synergies with the Airport	$14.6M	- Utility synergies with UCG along Elizabeth Drive to the Airport. - Carrying out the project as one (i.e. shared project manager and construction crew for both mains to the Airport and Science Park	○ Increased revenue of connecting customers (however, the first 2-3 years of connections to the Science Park will be lost) ○ Cost reduction by working with UCG to deliver the project with shared trenching and restoration costs	Minor	Unlikely	Low
Option 4 – Alternative supply strategy	$17.8M	- Utility synergies with UCG along Elizabeth Drive to the Airport. - Connect customers at the Science Park from December 2021.	○ Do not have to rely on the connection along Elizabeth for connection to the Science Park ○ Cost reduction by working with UCG to the Airport to deliver the project with shared trenching and restoration costs	Minor	Unlikely	Low

Appendix B Synergi modelling analysis

B1. MODELLING ANALYSIS

Modelling was completed on each of the pipe diameter scenarios to determine the optimum pipe size. The analysis and pressure modelling results are provided below –

Initial analysis showed it was sufficient to supply the Water Factory and the Sydney Science Park (from the south) with 150mm ST. Based on these finding and in order to determine the optimal configuration of the Airport and the Aerotropolis Core we maintained the pipe diameters of 150mm ST to the Water Factory and Science Park for all scenarios.

Table 7 shows the minimum pressure results for varying years and pipe diameters for the Airport and Aerotropolis Core. Laying 150mmST secondary mains is considered the medium term approach. This is because the pipe diameter only provides enough capacity for the immediate loads. This can be seen in the table below where in 2029 the pressure drops below the minimum secondary design pressure of 525 kPa with 451 kPa and reinforcement is required.

Laying 200mm ST secondary mains may provide adequate capacity with 598 kPa in 2029 if the network was not going to grow much further. Laying 250mmST secondary mains is considered the long term approach. The Airport extension will be a critical feeder main into the new Aerotropolis region. A minimum pressure at 631 kPa provides a good foundation for future gas customers.

Further analysis of the pipe sizes with loads at 2029 are provided in Table 8.

Table 7: Minimum pressure recorded at the Science Park[21]

Year	150mm ST	200mm ST	250mm ST
2022	895kPa	912kPa	917kPa
2024	821kPa	852kPa	860kPa
2029	451kPa[22] 543kPa (with added reinforcement)	598kPa	631kPa

[21] See appendix B4. Other Synergi Snapshots for corresponding pressure models

[22] Pressure is below our minimum pressure threshold and reinforcement is required.

Table 8: Synergi modelling snapshot for 150mm ST in year 2029

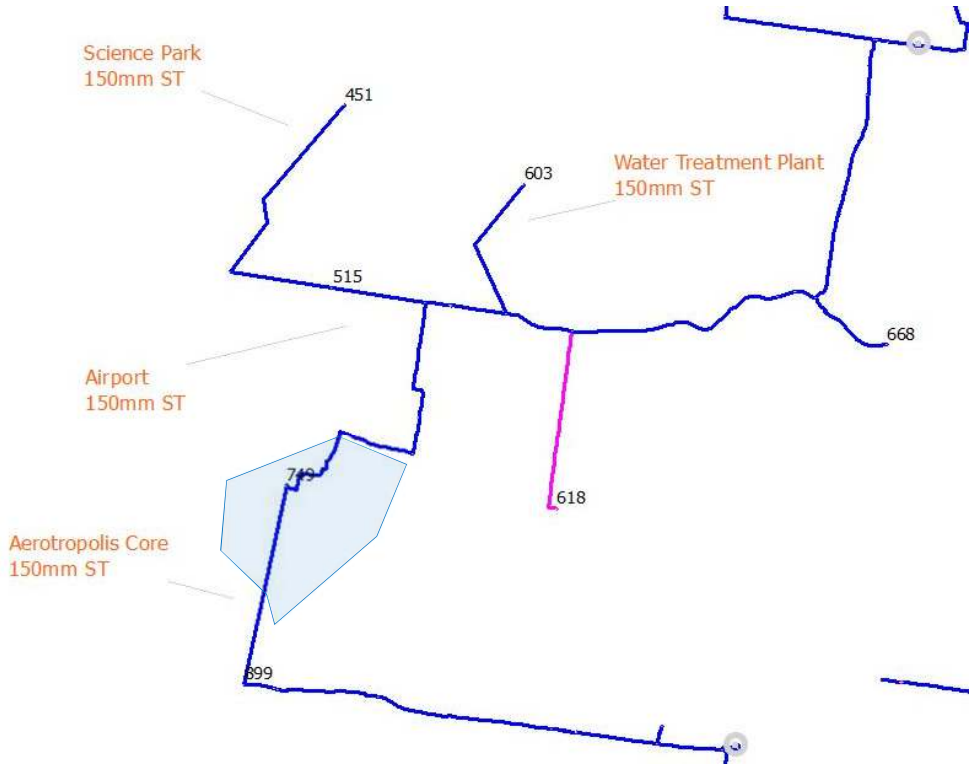
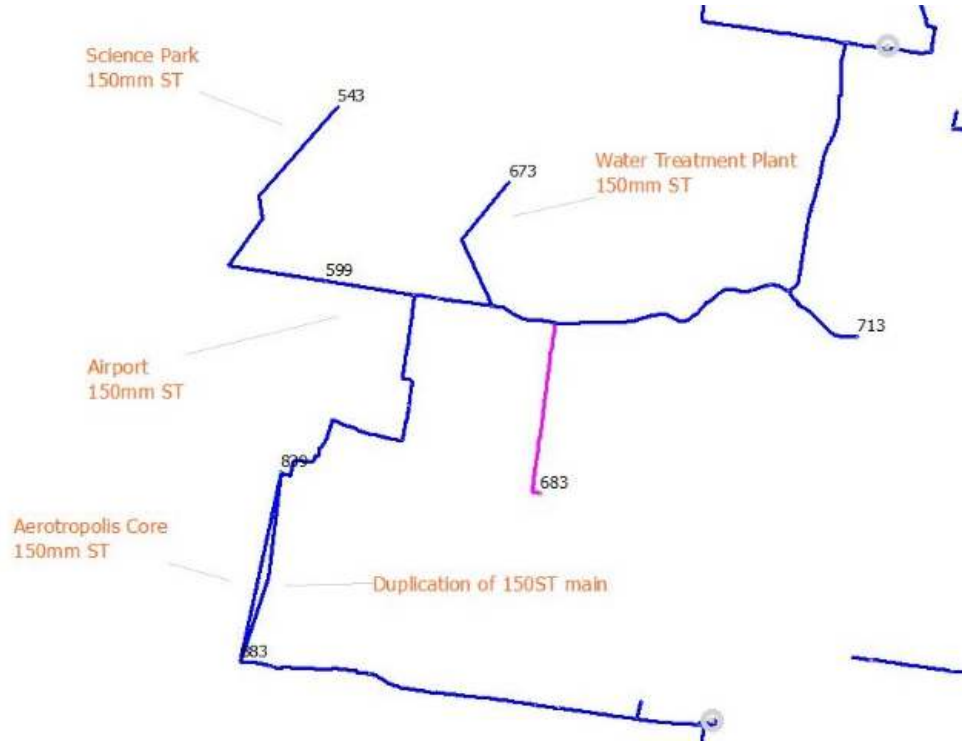
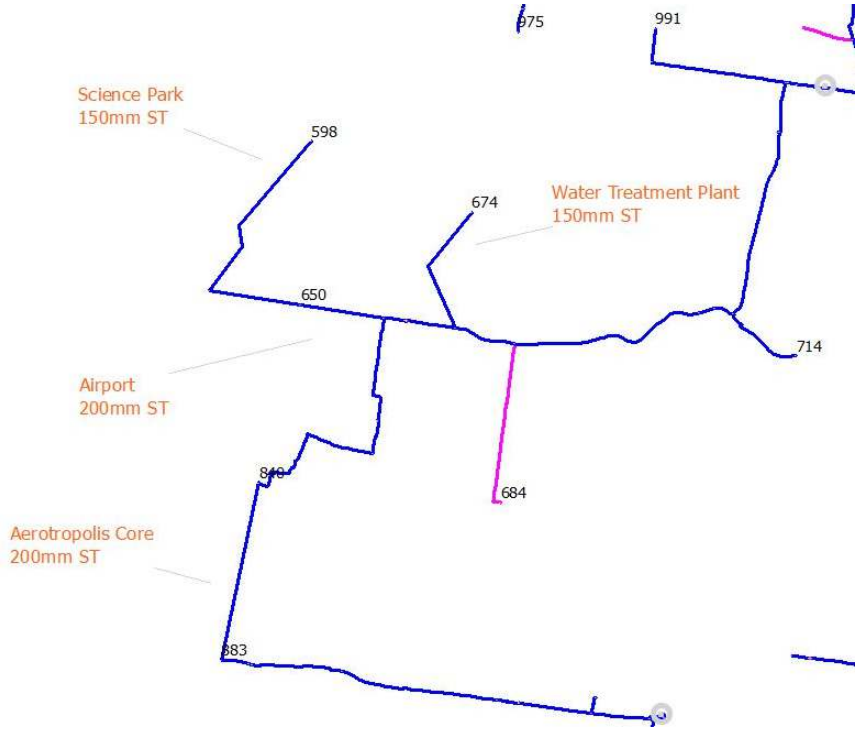
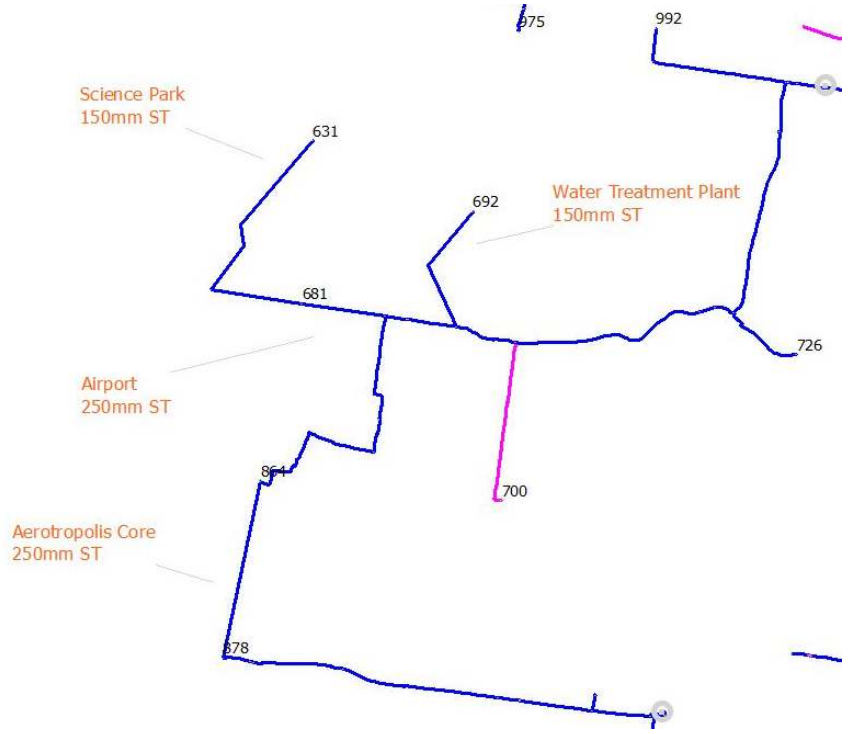
Synergi modelling snapshots	
	There is insufficient capacity with 150mm ST in 2029, where the pressure for the Science Park drops below the minimum secondary design pressure of 525 kPa with 451 kPa and the Airport is 515 kPa. The Aerotropolis Core shows a significant pressure drop between the interconnects with a difference of 150kPa shows there is limited benefit in interconnecting the secondary mains with 150mmST.
	If we were to proceed with laying 150mm ST for the Airport and the Aerotropolis Core we would have to duplicate the main along Badgerys Creek Rd in 2030 to supply the required load.

Table 9: Synergi modelling snapshot for 200 and 250mm ST in year 2029

Synergi modelling snapshots	
	The Airport pressure of 650 kPa may be adequate capacity for a new area if the network was not going to extend much further than this point. We know the Science Park will be taking gas and it is likely other customers will connect using the Airport as a feeder main. This suggests the 200mm ST is not adequate to service the future demand.
	Extending the Airport main with 250mm ST provides a pressure of 681 kPa. The interconnection of the two secondary sub systems at the Aerotropolis Core is important in the overall capacity plan and design for the Aerotropolis secondary network as we are connecting two separate secondary networks (the north network is feed from Horsley Park PRS and the south from West Hoxton PRS). Connecting these systems ensures security of supply and future capacity.

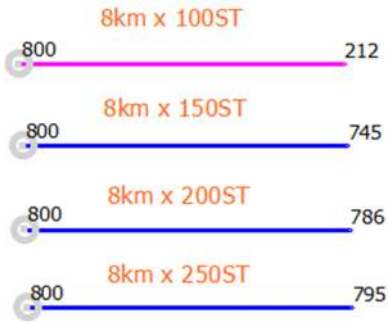
B2. SUPPLY SYDNEY SCIENCE PARK FROM THE NORTH

One of the other route options is to supply the Sydney Science Park from the north. This route includes 8km of secondary steel along Mamre Rd to the Science Park. To determine the optimal pipe size required for the Options Analysis, different scenarios were run for supplying from the north.

Table 10, shows the pressure difference ($P_1 – P_2$) when the varying pipe sizes are added to Synergi with Sydney Science Park load (forecasted at 2029). It demonstrates that the 100mm ST pipe does not have sufficient capacity to meet the Science Park loads while pipe sizes > 150mmST can meet the required demand.

The 150mmST diameter is optimal and should be used to supply the Science Park from the north as the addition capacity from larger pipe diameters (200 and 250mm ST) are not necessary to service the area.

Table 10: Pressure drop results for 8km of different pipe sizes with 2029 Science Park loads

Pipe size (mm ST)	Synergi modelling	Pressure difference (kPa)
100		588
150		55
200		14
250		5

B3. OPTIMAL CONFIGURATION

To ensure maximum benefits are provided to the customer we assessed the capacity against the likelihood of the customer demand. These considerations included:

- The Airport will form the major feeder main into the new development area with the potential for many new customers to come off this main. It supports the growth of the Science Park by enabling sufficient capacity.
- The interconnection of the two secondary sub systems at the Aerotropolis Core is important in the overall capacity plan and design for the Aerotropolis secondary network as we are connecting two separate secondary networks (the north network is fed from Horsley Park PRS and the south from West Hoxton PRS). Connecting these systems ensures security of supply and future capacity.

- The Aerotropolis Core will form the backbone of the whole Aerotropolis development and secure the gas supply to thousands of new customers.
- The Science Park is at the end of the network and the potential for new loads to grow further north is not known at this point in time.

Based on the considerations above the recommendations for the pipe diameters going into the next sections are:

1. Sydney Airport: 250mm ST
2. Sydney Science Park from the south: 150mm ST
3. Sydney Science Park from the north: 150mm ST
4. Aerotropolis Core: 250mm ST
5. Water Factory: 150mm ST

Appendix C Project Scopes

C1. WESTERN SYDNEY AIRPORT AND SCIENCE PARK

The Western Sydney Airport will be supplied by installing 2.5km of 250mm ST secondary mains. The route design involves the following steps:

1. Lay main starting on the corner of Martin Road and Elizabeth Drive
2. Install 250mm ST valve for commissioning purposes
3. Lay 800m of 250mm ST along Elizabeth Drive in a Jemena trench, including Lawson Rd crossing
4. Horizontal directional drilling (**HDD**) 150m of 250mm ST across Badgerys Creek
5. Lay 1700m of 250mm ST along Elizabeth Drive, including the new airport road and Badgerys Creek Rd.
6. Install 250mm ST valve
7. Lay 1500m of 150mm ST along Elizabeth Drive to the corner of Luddenham Rd
8. Lay 4000m of 150mm ST in a shared utilities trench along Luddenham Road to the entrance of the Sydney Science Park

Figure 8: Proposed location of the Western Sydney Airport/Science Park secondary main

Project Delivery Timeline:

CY20: Assign project manager and continue discussions with UCG.

CY21: Begin construction along Elizabeth Drive and work with UCG's to realise synergies along Luddenham Rd.

Approvals

Approval must be obtained from major governing authorities. Below is a list of third party authorities that may potentially be impacted by the excavation. This list is indicative only; it is the Works Delivery Group's responsibility to identify impacted stakeholders:

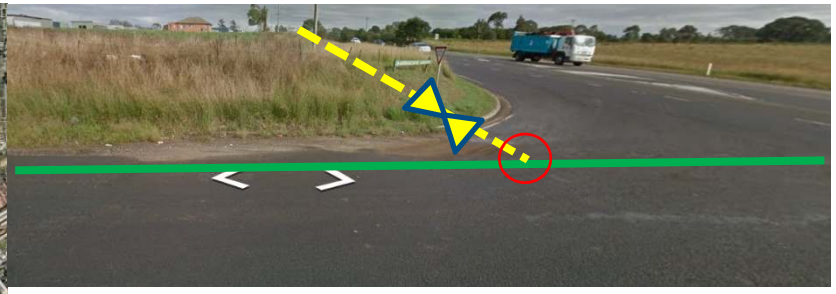
- Council – Land access notification, construction access confirmed
- Other Utilities and pipelines – Notification and/or approval of integrity dig works
- Road Authority – Traffic Management
- RMS - Notification and/or approval of integrity dig works in road corridor
- Transport for New South Wales

Other project considerations

The external contractor shall manage the site and stakeholders:

- Traffic Management – Check the setback distances from the worksite to the main road. Determine access to the site so that traffic flow can be managed during the works.
- Pipelines and/or other Utilities – Check if there are any parallel or crossing pipelines and/or utilities in vicinity of the work. Coordinate with other utilities.
- Stakeholder Management – Liaison with the local community, residents, Rail Corporation (Sydney Trains), Transport New South Wales, Council and Roads & Maritime Services.

Conceptualised design for the Western Sydney Airport and Science Park



Proposed secondary main to tie into existing secondary main on the corner of Martin road and Elizabeth Drive. Secondary valve would be installed for commissioning purposes

Ground view on the corner of Elizabeth Drive and Martin Rd

Ground view of Elizabeth Drive with Badgerys Creek crossing requiring either HDD or bridge crossing

Elizabeth Drive and the second road crossing at the new airport road

Ground view of Elizabeth Drive with road reserve space and the third road crossing at Badgerys Creek Rd

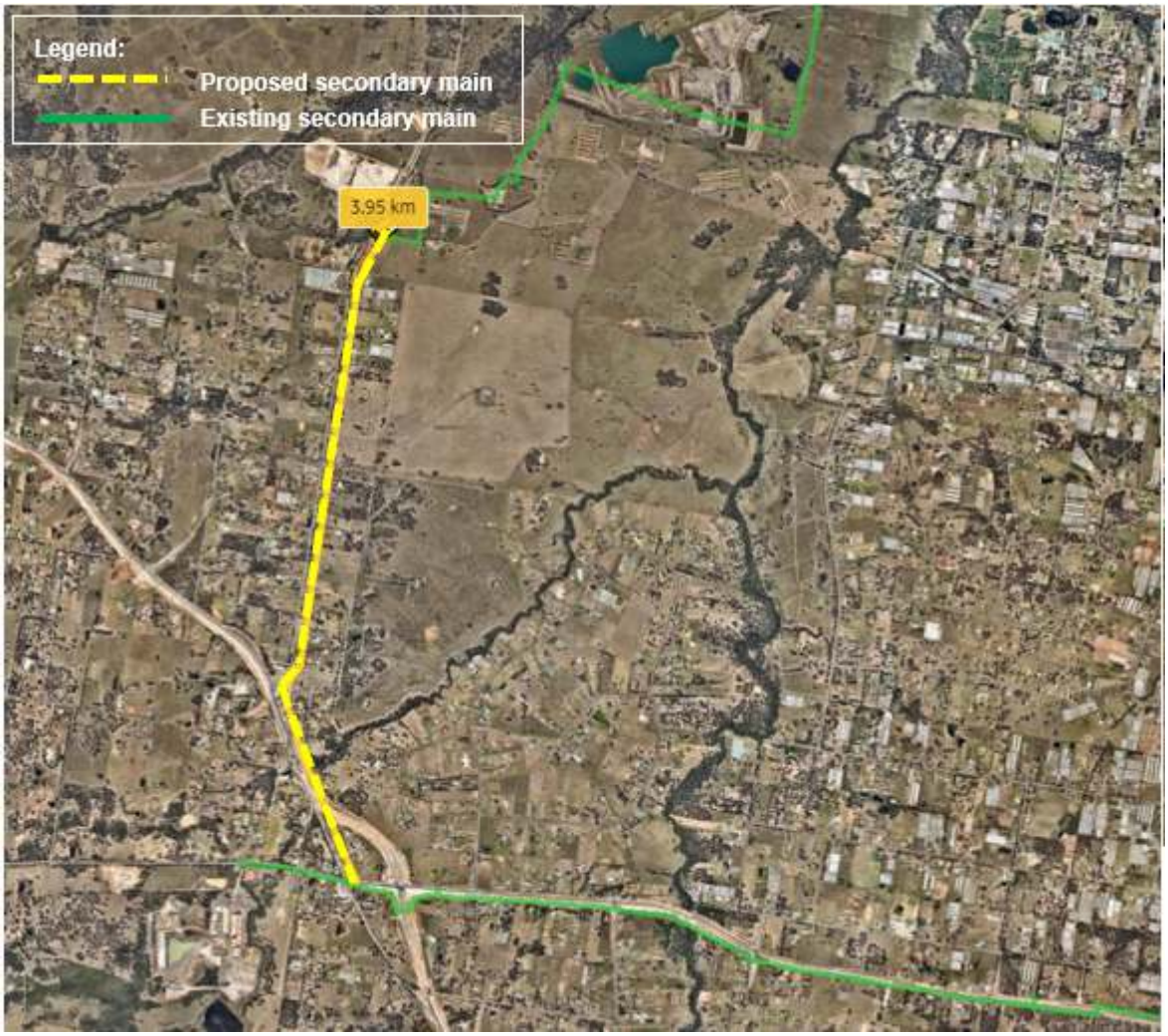
Luddenham Rd from the entrance to Sydney Science Park

C2. AEROTROPOLIS CORE

The Aerotropolis Core will be supplied with gas by installing 4km of 250mm ST secondary interconnecting the existing secondary mains. The route involves the following steps:

1. One hot tap on the corner of Bringelly Rd and The Northern Road
2. Horizontal directional drilling (**HDD**) across Bringelly Rd
3. Installation of 250mm ST valve for commissioning purposes
4. Lay 380m of 250mm ST along Northern Road to the base of new road upgrade
5. 150m of HDD along across the Northern Road
6. Lay 500m of 250mm ST along Northern Road to Badgerys Creek Rd
7. Lay 3150m of 250mm ST along Badgerys Creek Rd, install 250mm ST valve and hot tap secondary main to join existing secondary

Figure 9: Proposed location of the Aerotropolis Core secondary main



Project Delivery Timeline

CY20: Assign project manager and continue discussions with UCG.

CY21: Begin construction along Badgerys Creek Rd and work with UCG's to ensure synergies.

Approvals

Approval must be obtained for major governing authorities. Below is a list of authorities that may need consultation for construction. This list is indicative only; it is the Works Delivery Group's responsibility to identify impacted stakeholders:

- Council – Land access notification, construction access confirmed
- Other Utilities and pipelines – Notification and/or approval of integrity dig works
- Road Authority – Traffic Management
- RMS - Notification and/or approval of integrity dig works in road corridor
- Transport for New South Wales

Other project considerations

The external contractor shall manage the site and stakeholders:

- Traffic Management – Check the setback distances from the worksite to the main road. Determine access to the site so that traffic flow can be managed during the works.
- Pipelines and/or other Utilities – Check if there are any parallel or crossing pipelines and/or utilities in vicinity of the work. Coordinate with other utilities.
- Stakeholder Management – Liaison with the local community, residents, Rail Corporation (Sydney Trains), Transport New South Wales, Council and Roads & Maritime Services.

Aerotropolis Core - Figure 10:

Proposed secondary main to tie into existing secondary main on the corner of The Northern road and Bringelly Road. The main then extends north along Northern Road

HDD across the new The Northern Rd upgrade

The secondary main is proposed to continue along The Northern Road before going up Badgerys Creek Road

Secondary mains continue along Badgerys Creek Road and tie into secondary mains

C3. WATER FACTORY

The Water Factory will be supplied with gas by installing 2.5km of 150mm ST secondary. The route involves the following steps:

1. One hot tap on Elizabeth Road
2. HDD or direct lay across Elizabeth Road
3. Lay 2.5km of 150mm ST along the proposed route.

Figure 11: Water Factory route from Elizabeth Drive to the new water processing facility