Final Business Case Evaluation Summary

Sydney Metro - Western Sydney Airport

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Infrastructure
New South Wales

About this report

Sydney Metro - Western Sydney Airport (Sydney Metro WSA) is proposed as a transformational integrated land use and transport project. The purpose of the project is to underpin development of the Western Parkland City by connecting rail to the Western Sydney International (Nancy-Bird Walton) Airport and Western Sydney Aerotropolis, by delivering a new 23-kilometre driverless metro rail service stopping at six new stations between St Mary's and the Aerotropolis Core at Bringelly North.

Sydney Metro WSA is driven by a need to meet the longer-term transformational vision for Western Sydney by:

- Providing a turn-up-and go service between the Aerotropolis Core and the T1 Western Line at St Marys.
- Enabling land use rezoning to occur.
- Attracting an additional 39,000 jobs and 27,000 dwellings to high-amenity precincts around stations by 2056.
- Placing an additional 229,000 jobs and 417,000 people within a 30-minute commute of the project corridor by 2056.
- Supporting the long-term growth of Western Sydney International.

The key benefits that Sydney Metro WSA will generate includes:

- Significant city-shaping and transformative urban development.
- Long-term quality transport outcomes.
- Social and sustainability improvements.
- Facilitation of productivity improvements.

The Project scope includes the construction of new tunnels, viaducts, bridges, retained cuttings and at-grade track infrastructure; new rolling stock; stations and immediate station precinct upgrades; fully-automated rail systems; tunnel and station support systems; and a stabling and maintenance facility.

The Business Case for Sydney Metro WSA was developed by Sydney Metro (Transport for NSW) in conjunction with the Australian Government Department of Infrastructure, Transport, Regional Development and Communications, and Western Sydney City Deal Partners including local governments of Western Sydney.

This Business Case Evaluation Summary has been prepared by Infrastructure NSW, the NSW Government's independent infrastructure advisory agency. The summary reflects the state of the project as included in the Business Case. As with any large-scale project, elements of scope will continue to be refined as the project is further developed.

Strategic context

The Western Sydney City Deal

As part of the *Western Sydney City Deal*, the Australian and NSW Governments have jointly committed to deliver Sydney Metro WSA (formerly Sydney Metro Greater West), connecting St Marys, Western Sydney International (Nancy-Bird Walton) Airport and the Western Sydney Aerotropolis. The two governments have a shared objective of connecting rail to the airport when the airport opens for passenger services. The Australian and NSW Governments will be joint partners in funding Sydney Metro WSA.

The Australian and NSW Governments will work with the eight local governments of the Western Sydney City Deal and Blacktown City Council to deliver transformative change to the region over the next 20 years[1].

The Western Parkland City draws on its parkland setting and the strength of Western Sydney International and the Aerotropolis investments that will contribute to 200,000 new jobs across the Western Parkland City by 2036[2]. The City will also capitalise on the established centres of Greater Penrith, Liverpool and Campbelltown-Macarthur[3]. In this context, Sydney Metro WSA captures a rare opportunity for mass transit to lead and mould the enduring shape of the Western Parkland City and is critical to unlocking the strategic vision.

Provision of rail infrastructure in advance of full development of the corridor provides a rare opportunity to shape development of the new Western Parkland City as a modern, compact, landscape-oriented, transit-focused city. This will facilitate more sustainable travel choices, improve transport access, reducing reliance on private vehicles, and discourage a car-based low-density sprawl typical of outer-urban areas of Australian cities. This is key to realising the vision of a liveable, productive and sustainable Western Parkland City, as supported by the Greater Sydney Commission.

Greater Sydney Regional Plan

Greater Sydney is currently disadvantaged by geographical, demographic, social and environmental imbalances. This is due to economic opportunities being concentrated around the Eastern Economic Corridor[4] and the emerging Parramatta CBD. The Western Parkland City, as defined by the Greater Sydney Commission, currently has poorer access to jobs and economic activity. This structural imbalance increases incidences of social disadvantage and inequality. This in turn leads to the risk of higher unemployment, lower incomes, and poorer environmental and health outcomes.

To enhance economic and social opportunities the NSW Government co-developed a shared vision with the Australian Government and local governments, including integrated land use and transport. The *Greater Sydney Region Plan* outlines a 40-year vision for a more productive, liveable and sustainable Greater Sydney. This will be achieved by improved coordination and investment in infrastructure and land use planning across the established Eastern Harbour City

[1] *The eight local governments include Blue Mountains, Camden, Campbelltown, Fairfield, Hawkesbury, Liverpool, Penrith and Wollondilly*

[2] *Department of Planning and Environment (August 2018), Western Sydney Aerotropolis Land Use and Infrastructure Implementation Plan Stage 1: Initial Precincts, p8.*

[3] *Greater Sydney Commission (March 2018), Greater Sydney Region Plan, p16.*

[4] *From Macquarie Park to Sydney Airport*

(Sydney CBD), the growing Central River City (Parramatta CBD) and the emerging Western Parkland City[5].

Future Transport 2056 strategy and State Infrastructure Strategy 2018 - 2038

Along with the *Greater Sydney Region Plan,* the *Future Transport 2056* strategy and the *State Infrastructure Strategy 2018-2038* set out a 40-year vision for Greater Sydney, where residents across Greater Sydney are able to access employment, schools, shopping, services and recreational facilities within a 30 minute travel time by active and public transport.

These three NSW Government strategies guide the strategic planning framework that focuses on productivity, liveability and sustainability. The three plans create a clear and linked hierarchy that cascades across all levels of government to integrate investment in infrastructure with land use planning[6].

[5] *Greater Sydney Commission (2018), Greater Sydney Region Plan: A Metropolis of Three Cities, p8.*

[6] *Greater Sydney Commission (March 2018), Greater Sydney Region Plan, p8.*

Project need

Investment in a mass transport project in the Western Parkland City is necessary to improve liveability, productivity and sustainability outcomes across Greater Sydney. This vision will enable a 30-minute commute by public and active transport users providing greater access to jobs and services. This investment will also revitalise existing key centres, support the development of new ones and induce more activity in the region that will ease pressure on the existing road and rail network servicing Greater Sydney.

The core transport problem in the Western Parkland City is limited connectivity between its people, places and businesses. Reliance on roads and private vehicles compromises place outcomes and hinders development of a more accessible and walkable city, as described in the strategic plans and infrastructure strategies.

As of 2016, there was a deficit of 130,000 jobs in the Western Parkland City. As a result, residents need to commute up to four hours per day to access jobs. The lack of economic-enabling infrastructure in the Western Parkland City means that residents need to commute to access most services, education, health centres and leisure activities. Due to limited transport alternatives, cars currently make up 90 per cent of all trips, increasing community, environmental, health and safety costs.

Planned growth in the Western Parkland City

The population growth of the Western Parkland City is forecast to double from 740,000 in 2016 to 1.5 million in 2056 (an additional 760,000) by leveraging off its parkland setting, a new metropolitan cluster, and the significant investments in Western Sydney International and the Aerotropolis[7]. This planned population growth is also premised on successful investment in mass transit infrastructure that will be necessary to support the development of Western Sydney International and the future employment centres planned across the Western Parkland City.

Need for city-shaping infrastructure

Planning and development of the new Western Parkland City to cater for an additional 760,000 people by 2056, will be a significant undertaking. The business case estimated that additional infrastructure required across the Western Parkland City will include additional schools, university campuses and hospitals[8]. In addition to major infrastructure, other infrastructure requirements would include the development of utility connections such as water, sewage, electricity, gas and telecommunications, as well as a range of complementary transport investments to support population growth across the wider area.

The Australian Government's investment in Western Sydney International provides a unique opportunity to leverage the significant land use change and outcomes underway in the Western Parkland City. This opportunity is further strengthened by the 'Greenfield' nature of the infrastructure development because the cost, risk and ease of construction would be less compared to a similar scale of investment in established areas.

The new city build will allow development of the Western Parkland City to be staged in a coordinated manner, so as to concentrate early development along the mass transit corridor and optimise its delivery over time as growth disperses geographically. The ability to concentrate

[7] *Greater Sydney Commission (March 2018), Greater Sydney Region Plan, p16.*

[8] *Based on benchmarks of current provision of infrastructure across Greater Sydney and the additional population forecast for the Western Parkland City.*

density and land use change along the transport corridor will reduce the geographical footprint of new development and create economies of scale (that is, a larger scale of infrastructure in fewer locations, with delivery optimised over time).

The city-shaping benefits of mass transit are aligned with the infrastructure delivery, liveability, productivity and sustainability themes in the *Greater Sydney Region Plan*, and include:

- Providing an enduring structure and long-term certainty for decision-makers, enabling governments to lead growth, respond early and coordinate across agencies.
- Facilitating the development of high-amenity, vibrant and accessible local centres around stations.
- Providing fast and reliable connections between employment, residential and key service centres.

Western Sydney International

Construction of Western Sydney International is underway. The full-service, curfew-free, domestic and international airport will generate economic activity and is expected to provide 28,000 jobs within five years of opening for the people of Western Sydney. The Australian Government is investing up to $5.3 billion in equity to deliver the airport through a government business enterprise, 'Western Sydney Airport'.

Western Sydney International will help meet Sydney's growing aviation needs and, within a decade of opening, is expected to handle around 10 million passengers annually, similar to the volume of Adelaide Airport today. By around 2063, the airport is expected to have the capacity to serve 82 million annual passengers after a second runway, additional aviation infrastructure and support precincts are developed.

Sydney Metro WSA will service two stations at Western Sydney International, at the Airport Terminal and Airport Business Park.

Role of mass transit in successful airports

A mass transit connection provides a major accessible option to Western Sydney International by delivering reliability, convenience and transport capacity that will be needed to support it as an international airport. Mass transit will also support growth in patronage and manage local congestion over time. The increased reliability, network resilience and travel choice that a rail connection provides, as well as the improved amenity that can be created by including luggage space and other services to airport passengers, incentivises public transport usage for both airport passengers and the local work force.

Mass transit will be important to supporting the long-term growth of Western Sydney International, and ensuring that the airport can grow to its full potential as demand for aviation increases. Over time, not delivering the right mass transit options may delay the significant local economic and productivity benefits to the Western Parkland City that a thriving international airport would provide.

The objective of having rail connected to Western Sydney International in time for the start of passenger services is part of the *Western Sydney City Deal*. The airport is currently being planned concurrently with mass transit to fully integrate the designs of the two projects to deliver a seamless customer experience between metro rail and the airport. It is important to coordinate both the mass transit and airport delivery, because constructing mass transit at a later date when in an operating airport environment, a number of additional complexities would arise such as: the

significant disruption to airport passengers and local communities; higher interface risks; and increased congestion in the vicinity of the projects.

Need to address structural imbalances impacting Greater Sydney

The vision for Greater Sydney seeks to address a series of underlying social, demographic and economic imbalances that can result in social disadvantage. The region's current concentration of economic opportunity, enabling infrastructure and housing typology reflects the current character of Western Sydney, with smaller population and lower densities compared to a mature Eastern Harbour City and Central River City. Without planned land use outcomes and infrastructure, social disadvantage will not be addressed.

Land use growth without investment in mass transit

Mass transit investment is required to facilitate the outcome of a concentrated higher density development around the new Metro stations and surrounding high-amenity precincts.

Without mass transit as a catalyst:

- Growth that occurs in the Western Parkland City will be geographically dispersed, with lower densities in detached dwellings and fewer knowledge-intensive jobs in high productivity precincts, increasing costs for population-supporting infrastructure.
- The Central River and Eastern Harbour Cities will need to accommodate more residents and workers, over and above business-as-usual targets of an additional 2.4 million people by 2056. This will place increased pressure on existing communities and infrastructure networks.
- The Western Parkland City, and Greater Sydney as a result, will become a less attractive destination for investment and a less attractive place to live, making it harder to attract and retain high-value knowledge workers and international businesses, where:
    - Failure to achieve planned growth in the Western Parkland City, including attracting knowledge-intensive jobs, will have flow-on effects for the other two cities.
    - The Central River and Eastern Harbour Cities will need to accommodate more jobs and population growth, increasing the strain on already congested and crowded transport networks.
    - Congestion and crowding will reduce liveability and productivity of Greater Sydney as a whole, reducing its attractiveness as a place to invest or work.

Combined, this would have a significant negative impact on the productivity, sustainability and liveability of Greater Sydney.

Insufficient transport capacity to support planned growth

Congestion will worsen on existing rail services without investment in additional transport solutions. Over the medium to long term, increasing customer demand on the existing network will result in Western Sydney's rail lines reaching peak capacity by the mid-2020s, particularly the T1 Western Line, T1 Richmond Line and T8 Airport and South Line.

A number of Sydney's existing Sydney Trains suburban rail lines are shared by passenger and freight customers and there is an ever-increasing difficulty in balancing both customer needs, contributing to longer travel times. The Sydney Trains suburban rail network has a number of

constraints, including: its lineside signaling system; its reliance on at-grade junctions; and lines that combine express services, all-stop services and freight services.

Notwithstanding the NSW Government's continued investment in public transport infrastructure, an increasing number of residents continue to rely on the road network for travelling to work and other key destinations. Cars and buses face congestion on shared roads, making commutes longer and more unreliable.

There is significant planned investment to address these issues, such as the More Trains, More Services Program, Western Sydney Freight Line, M12 Motorway, and Western Sydney Roads Infrastructure program. These investments will be enhanced by a mass transit solution that addresses the broader challenges of public transport access, along with driving the additional benefits that mass transit provides.

Project objectives and design

Six project objectives have been used to inform project development activities

Aspirations to successfully develop the Western Parkland City by anchoring off Western Sydney International and the Aerotropolis as the driver of shaping significant land use change in the region has led to six objectives for the Project to achieve during project development activities.

These objectives have reflected a need to provide more jobs closer to where people live and optimise the significant investment that the Australian and NSW Governments are making by building Western Sydney International and the Aerotropolis.

The six project objectives are:

1. Safe and customer-focused transport service.
2. Successful airport and Western Parkland City.
3. Attracting knowledge and internationally competitive jobs.
4. Realising the 30-minute city.
5. Great places with an increased housing supply.
6. Delivering a value for money solution.

Key decisions have been informed by these objectives, including station location and orientation options, metro product alternatives, station typology, vertical alignment and interface options. The following sections will outline other key factors considered during the development of the project.

Customer Experience Framework

Sydney Metro's customer experience framework aims to design an 'easy' door-to-door-to-door experience. An easy experience can be defined as the absence of unnecessary physical or cognitive effort.

Sydney Metro WSA will service a range of destinations and customer trip purposes, including customers who are travelling through Western Sydney International. A key consideration for Sydney Metro WSA is to support an 'easy' journey through Western Sydney International by responding to the following specific customer needs:

- An airport journey – Requiring both a higher physical effort in dealing with luggage and a higher cognitive effort due to the unfamiliarity of the journey and the stress of a flight deadline.
- Customers travelling with luggage – Increased spatial requirements caused by luggage result in an increase to a customer's spatial envelope; such as consideration of up to 50 per cent larger envelope per person.
- First-timers – A proportion of international or irregular domestic travelers will be accessing the line as a first-time experience. This results in an increased unfamiliarity with structure and process, social norms and language barriers.
- Increased fatigue – Customers who have undertaken long journeys across different time zones and temperatures will be exhibiting both cognitive and physical fatigue.
- Curfew-free airport – The impact of the curfew-free airport and how the Sydney Metro service synchronises with all other modes of transport to meet customer travel requirements.

The door-to-door-to-door design model is the whole integrated journey, and to succeed, design consideration has been given to the whole extended customer journey. An example door-to-door-to-door journey featuring customer design and technology to the airport is detailed below.

1. Tailored trip planning could provide customers with real-time information. Customers will be able to see seat availability and lift status so that they can choose the transport mode that best meets their needs.
2. Key pedestrian access routes to each station have been identified, with guidance toward infrastructure to support active travel. Encouraging and efficient pedestrian movement is prioritised, and cyclists can either use metro bike storage or take their bike on the train.
3. Customers that use buses or on-demand public transport for their first or last mile will benefit from co-located services where changing mode is easy.
4. All stations have accessible gradients without steps so that customers with strollers, luggage or mobility scooters have equal independent access. Station entrance plazas provide generous safe pedestrian zones and are sheltered from the weather so customers can get to their destination comfortably, even on extreme weather days.
5. A carry-on piece of luggage could be placed underneath the metro train seats so that customers can travel without worrying about their luggage rolling around the carriage. Multipurpose areas for strollers, luggage and bicycles are also available so customers can store their belongings comfortably as they travel.
6. Level access between the platform and train will help customers with strollers, luggage and mobility scooters board the service smoothly without assistance. Platform screen doors keep people and objects safely away from the edge of the platform and door numbers help customers orientate themselves to meet friends and family. Wheelchair signs show customers where to board to be close to the designated area for travel.
7. Escalators, multiple lifts on platforms and wider gates at Airport Terminal Station help customers with strollers, luggage or mobility scooters to exit the station easily. Customers could be supported by personal technology, such as wayfinding applications and customer help points.

Environmental considerations in design

Key environmental considerations during the development of the definition design include:

- Avoiding or minimising impacts to known structures, such as buildings, basements, utilities and infrastructure (including other rail and road infrastructure).
- Avoiding known or potential areas of contamination.
- Avoiding sensitive land designations, such as national parks, flood zones, and priority conservation areas.
- Minimising the potential for direct and indirect impacts to Aboriginal and non-Aboriginal heritage items, or areas of potential Aboriginal archaeological potential (particularly areas adjacent to creek lines).
- Minimising direct impact on property, particularly residential property and other sensitive receivers such as schools and universities.
- Avoiding areas of, or minimising direct impacts to areas of high biodiversity value, particularly areas of critically endangered or endangered ecological communities and vegetation along riparian corridors that contribute to habitat connectivity.

- Considering noise and vibration issues, both during construction and operation, when determining the locations of tunnel boring and support sites, construction sites and maintenance facilities.

Business requirements specifications

The business requirements specification encapsulates the Australian and NSW Government's strategic goals and objectives for delivering travel improvements, and captures the high-level stakeholder needs for Sydney Metro WSA.

The business requirements were used as the basis of the design as it was developed from scoping design to definition design during the development of the Final Business Case. All requirements were captured, tracked and traced across the Project's system lifecycle.

Business requirements have been considered and defined across the following key areas:

- Customer experience.
- Operations.
- Safety and assurance.
- Sustainability and environment.
- Transport and precinct integration.
- Asset management.

Definition design

The definition design was developed during the preparation of the Final Business Case, to determine the technical feasibility of the Project and generate documentation that supported the costing and scheduling activities. The definition design developed included six stations and used demand data derived from transport modelling. During the definition design, the data was updated as per required to reflect revised transport demand and land use modelling assumptions.

Alignment and station localities

Product, alignment and station options have been developed collaboratively with a range of partners across multiple agencies and projects, including the Department of Infrastructure, Transport, Regional Development and Communications, Western Sydney Airport, the Western Sydney City Deal partners including local governments, and NSW Government Transport and Planning agencies.

Twenty-one station options between the T1 Western Line and Aerotropolis Core were assessed against the city-shaping, productivity, transport and value-for-money objectives of the Project. The recommended station locations are:

1. St Marys.
2. Orchard Hills.
3. Luddenham.
4. Airport Business Park.
5. Airport Terminal.
6. Aerotropolis.

Station design

The station designs have considered the following requirements:

- Customer experience.
- Operations and system requirements.
- Safety and security.
- Accessibility.
- Sustainability and environment.
- Place making and activation.
- Transport integration.
- Station typology and configuration.
- Integrated station development.

Tunnels, viaducts, bridges and at-grade structures

The business case proposes tunnels for Sydney Metro WSA from St Marys to Orchard Hills and in the airport precinct. The proposed tunnel alignment was guided primarily by the general location of metro stations. The alignment was also refined by the functional requirements of train operations.

Bridges and viaducts will be required to accommodate creek and road crossings and to ensure that the railway remains above flood levels at certain locations. Where appropriate, the approach spans to bridges and viaducts will include passageways to allow fauna to cross from one side of the railway to the other. Standardised designs will be used for bridge and viaduct structures and will consist of concrete structures.

Major retaining wall structures will be provided at Orchard Hills and through Western Sydney International. The retaining walls at Orchard Hills will form a tunnel dive structure that will also contain Orchard Hills Station.

Rolling stock

A fleet of fully-accessible, single-deck automated trains will be used to operate Sydney Metro WSA. The rolling stock will have a minimum of three doors per carriage. This will provide for fast boarding and alighting of services, allow short dwell time at stations, and facilitate the service frequencies that will be required to meet the passenger demands, particularly during peak hours.

Sydney Metro WSA trains will be designed to ensure high levels of reliability and customer amenity. This will provide a line capacity of at least 7,740 passengers per hour per direction utilising three-car trains (at 12 trains per hour) on Day One of operations.

Stabling and maintenance

A stabling and maintenance facility is required for the operation and maintenance of rolling stock for Sydney Metro WSA. The current design is for the facility to be located in the rail corridor at Orchard Hills.

Operations

Peak-hour services are planned to initially operate every five minutes (12 trains per hour) in each direction between 06:00am and 10:00am, and between 3:00pm and 7:00pm Monday to Friday. Off peak services will operate every ten minutes (six trains per hour) per direction.

Sydney Metro WSA will support the 24-hour operation of Western Sydney International and the Aerotropolis.

Options identification and assessment

The purpose of an alternative options assessment is to enable a comparison of different potential investment solutions against a set of criteria.

An options assessment relies on supporting evidence that is strategic in nature, and its purpose is to assist with selecting between options rather than delivering a specific solution. The evidence is focused on outlining the most significant costs, risks and benefits of all different options.

Key features of the alternative options assessment process include:

- Development of a broad range of alternative transport options (the long list) that address some or all of the project objectives, including service reform and new capital investment options, in addition to demand management strategies.
- Transparent assessment of the long list against the project objectives, including cost considerations, to iteratively narrow down the options and identify a preferred option. This included a three-step process consisting of a:
    - Strategic merit test.
    - Multi-criteria assessment.
    - Rapid economic appraisal.
- Progressing preferred option(s) to more detailed design and assessment, including full economic and financial appraisals.

Stakeholder input into the assessment process

Stakeholder input into the alternative options assessment was embedded in three key areas:

- Defining the evaluation criteria and setting up appropriate scoring systems.
- Identifying and assessing options within the strategic merit test and multi-criteria assessment against the agreed evaluation criteria.
- The endorsement of outcomes by Sydney Metro WSA project governance arrangements, including the Joint Steering Committee, Project Control Group, and the Project Definition Working Group.

A number of different stakeholders were involved across the different steps of the alternative options assessment process. Key participants throughout the process included representatives from Sydney Metro, Department of Infrastructure, Transport, Regional Development and Communications, and Transport for NSW.

No-project case

Before developing a long list of project options that could address the problems identified in the need for investment, a no-project case was defined. Each intervention option identified through the long list was assessed incrementally against the no-project case.

The no-project case was defined as a ‘do-minimum’ scenario without Sydney Metro WSA but included a number of committed, funded and planned investments in Greater Sydney including in the Western Parkland City. The no-project case was used consistently during the development of the Final Business Case.

Key planned investments in the no-project case include:

- The Western Sydney Infrastructure Plan, a $4.1 billion investment over 10 years that will deliver new and upgraded roads in Western Sydney.
- Bus network investments.
- Rail network infrastructure.
- Parramatta Light Rail Stage 1.

Identifying the long list of options

A range of transport alternatives were identified for inclusion on the long list, to be examined as part of the alternative options assessment process. The long list consists of nine options across multiple modes that could potentially address the integrated city-shaping, productivity, transport, and value for money objectives of the Project. The long list of alternative options includes capital and non-capital investments across a diverse range of modes and are described in Table 1 below.

Table 1: Description of the long list of transport options

Option Type	Option	Description
Service reform	Increased frequency of on-road buses	This option would increase the service frequencies of the no-project case bus network in the project corridor, and would not involve major capital expenditure apart from additional fleet, layover and depot capacity to support increased services). This option would reduce the average wait time between services.
Demand management	Road pricing policy	A road pricing policy is a travel demand management strategy that charges private users for the use of road infrastructure. This strategy is often used as a tool to encourage change in vehicle use and reconsideration of the need for travel to certain locations or travel during certain periods. Charges are assumed to be levied on major highways or roads but not local roads. This would therefore make car travel on major highways less attractive, and may encourage mode shift to public transport or increased use of local roads, depending on the relative attractiveness of these alternatives.
Better use	Bus priority (on road)	This option involves a new bus service operating on roads shared with other traffic, such as cars and trucks, with priority given to the bus service over other road users. This could include bus priority lanes and signal upgrades for intersection priority. This option is designed to be a lower cost alternative to a bus transitway and makes better use of existing (and committed future) infrastructure and fleet.
Capital investment (rail)	Dedicated airport rail	The dedicated airport rail service is a premium airport travel service that would predominantly be point-to-point, with no or limited intermediate stations, and may not share characteristics with NSW rail products (such as integrated ticketing and fares). This would tend to improve travel times for airport passengers relative to other mass transit products, with speeds up to 160 kilometers per hour.
	Mass transit rail (or a metro rail product)	Mass transit rail is a fast, reliable transport option operating on dedicated infrastructure for reliable service to activity centres for a larger number of passengers. Flexibility in the delivery characteristics of mass transit rail, including rolling stock, performance and corridor design, allows for attractive travel times over relatively large distances and speeds of up to 110 kilometres per hour.
	Light rail	A light rail product is a medium-capacity and operating speed option (8,000 passengers per direction per hour and 60 kilometres per hour respectively), which operates in a dedicated or shared corridor at surface level, with relatively short distances between stops (around one kilometre).

Option Type	Option	Description
Capital investment (non-rail)	Bus priority (transitway)	This option involves new bus services operating on a fully-segregated transitway, removed from general traffic for improved reliability, and potentially including a specialised fleet of larger buses. This contributes to relatively high capacity and maximum speeds (12,000 passengers per direction per hour and 90 kilometres per hour respectively).
	Road infrastructure investment	Road infrastructure investments would expand the significant commitments in the no-project case, with additional lanes on existing roads or new road investments (for example, additional motorways). Additional road capacity could benefit cars and freight vehicles, with reduced congestion and improved travel times and reliability; but would also make car use more attractive relative to public transport.
	Active transport investment	Investment in active transport involves the development of priority walking and cycling links along the corridor. Attracting people away from cars by increasing opportunities for walking and cycling can have positive impacts on amenity, health costs and productivity.

Metro as the preferred form of mass transit rail

For the alternative options assessment, the mass transit rail option was assessed as a metro rail product. This is consistent with outcomes from the *Western Sydney Rail Needs* Study and the *Western Sydney Airport Integrated Transport North South Link Strategic Business Case (2018)*[9], which identified that a single-deck, high-frequency metro product with full automation would suit the transport needs of the Project. This style of metro has been identified as the preferred mass transit rail product over heavy rail (which is assumed to share similar characteristics to the existing Sydney Trains suburban trains network) as it provides the ability to offer higher frequency and reliability, but at the same time can be less expensive to operate.

Single-deck metro trains also provide benefits for airport passengers. It is easier for customers with baggage to move in and out of the train, due to more doors, single-deck and wider aisles.

[9] *The Western Parkland City Integrated Transport Strategic Business Case looked at the broader multi-modal transport network needed to support the vision for the Western Parkland City and the optimisation of other major project investments. It confirmed Sydney Metro - Western Sydney Airport as the first stage of the north south rail line and determined the best approach for developing the remaining stages, which include other rail alignments considered in the Western Sydney Rail Needs Scoping Study extending from Schofields to Macarthur.*

Economic evaluation

The economic appraisal takes into consideration the broad range of benefits expected to be generated by the Project, including city shaping urban development, transport, social and community and productivity benefits.

Benefit Cost Ratio (BCR)

The following table outlines the estimated benefits for the project:

Table 2: Economic appraisal summary ($millions, 7 per cent discount rate)

	$ millions
Urban Development	3,566
Transport	1,597
Road	*617*
Public transport	*980*
Social and Community	384
Productivity	546
Total benefits (excluding wider economic benefits(WEBs))	**5,545**
Total benefits (including WEBs)	**6,091**
Net Present Value *excluding WEBs*	**-1,839**
Net Present Value *including WEBs*	**-1,294**

Benefit cost ratio (BCR) *excluding WEBs*	**0.75**
Benefit cost ratio (BCR) *including WEBs*	**0.82**

A benefit cost ratio (BCR) is the ratio of a Project's benefits relative to its costs. The BCR for the Project is 0.75 (excluding WEBs), or 0.82 (including WEBs). This BCR should be considered in the context of the project being a long-term city-shaping initiative with benefits taking a long lead time to become manifest following the opening of Western Sydney International and the Western Sydney Aerotropolis. At the time of preparing this summary, the NSW Government is in the process of either procuring or preparing to procure various packages of works which form part of the overall rolling delivery program for Sydney Metro WSA. As such, NSW Government has requested that the estimated cost of the program is not published in this summary. Infrastructure NSW understands that the program cost will be released by the NSW Government at a commercially appropriate time.

Deliverability

Procurement

A baseline delivery strategy has been developed and currently includes procurement of the following key packages:

- Advanced and enabling works.
- Advanced and enabling civil works within Western Sydney International potentially to be undertaken by Western Sydney Airport.
- Design and Construct (D&C) packages for tunnels and station excavations, surface and civil alignment works.
- Design, build, operate and maintain contract for stations, systems, trains, operations and maintenance.
- Finalisation auxiliary works comprising of a series of contracts for non-rail works best defined later and delivered by smaller contractors, including precinct activation.

The business case assessed an alternative Public Private Partnership (PPP) contract model for the stations, systems, trains, operations and maintenance package.

Timeframe

The Project is currently engaged in key procurement planning activities. The commencement of construction is expected in 2020. The Australian and NSW Governments have a shared objective of having the commencement of services when passenger airline services begin.

Key risks and mitigation

The Project Team has identified foreseeable sources of risks and key material risks through dedicated risk management practices, and has developed optimal treatment strategies to address these risks. The key material risks can be further qualified by common driving factors, as grouped into the following themes:

- Interfaces and interdependencies.
- Scope, design and construction.
- Planning approvals.
- Commercial.
- Community and stakeholder management.

The Infrastructure NSW view

Consistent with the NSW Government's Infrastructure Investor Assurance Framework[10], Infrastructure NSW has undertaken all required Gateway Reviews to date, project reporting and project monitoring activities on Sydney Metro - Western Sydney Airport (Sydney Metro WSA).

The overall case for the six-station configuration (St Mary's to the Aerotropolis Core) is considered comprehensive and presents a strong case for investment based on the Project's enabling role in facilitating the city-shaping development and realisation of the future Western Parkland City, Western Sydney International (Nancy-Bird Walton) Airport, and the Aerotropolis. It was also recognised that the project does not meet a current short to medium term transport need.

The Final Business Case, demonstrated strategic merit and achieved a benefit-cost-ratio (BCR) of 0.75 (or 0.82 when including wider economic benefits). This BCR should be considered in the context of the project being a long-term city-shaping initiative, with benefits taking a long lead time to become manifest. The Project will receive significant funding from the Australian Government under the *Western Sydney City Deal* commitments. This funding contributes significantly to supporting the project as a value for money investment for the NSW Government.

Interface and scope impacts between procurement packages need to be carefully considered and accounted for commercially. Escalating land costs, due to rezoning of the Western Parkland City, presents an ongoing cost risk for all projects in the area and will require careful consideration during the risk management process and should be addressed in a timely manner.

Given the existing market conditions, significant scale of the project, complexity of the scope and activity in the Australian construction sector, any planned opening to passenger service date is likely to be impacted by the market response to procurement packaging.

Delivery timeframes are driven by the objective of having passenger services commence when Western Sydney International Airport opens to passengers. However, it should be recognised that this could present a challenge to the delivery teams. Timeframes should not be artificially compressed by governments, and delivery partners should be permitted to bid their delivery programs, interface arrangements and timings on a value-for-money and best for project basis.

[10] Infrastructure NSW (2016), *Infrastructure Investor Assurance Framework.*