PART EIGHT

OPTIONS TO DEVELOP NEW INFRASTRUCTURE TO GAIN CAPACITY TO MEET FORECAST DEMAND

P8

Key points

- Initially, all parts of the Sydney region were considered to find a site suitable for either:
  - a 'Type 1' airport – a full service airport serving all market segments capable of handling a future parallel runway layout; or
  - a 'Type 3' airport – a single runway airport serving all market segments.
- Eighteen localities were identified for further assessment, from which five were shortlisted. A small number of specific sites were identified within these five localities as offering the best potential for a new airport.
- Key issues in the shortlisting and site assessment included proximity to demand (within 90 minutes travel time of Sydney's population centre); site suitability; aviation development capacity; airspace conflicts with existing airports and flight paths; environment impacts; and proximity to growth centres.
- The sites listed below are assessed as the more suitable sites in each locality.

Table 40 Sites identified as more suitable (on technical analysis), by locality

	Localities				
	Central Coast	Hawkesbury	Nepean	Burragorang	Cordeaux-Cataract
More suitable Type 3 Airport(s) sites	Wallarah	Wilberforce	Badgerys Creek Luddenham Bringelly Greendale	Silverdale Mowbray Park	Wilton Wallandoola
More suitable Type 1 Airport(s) sites	Wallarah	Wilberforce	Badgerys Creek Luddenham Bringelly Greendale	Mowbray Park	Wilton

Source: *Australian Department of Infrastructure and Transport.*

- A quantitative assessment was made against the criteria that could be monetised, to arrive at Relative Cost Benefit Ratios for these sites. An additional qualitative analysis was made of the sites against the criteria that cannot be monetised.
- The sites in the Nepean locality were assessed as clearly superior against most criteria compared with the sites in any other locality. The key advantage of these sites is their relative proximity to the sources of potential demand and the associated benefits that would accrue to airport users. Site development costs were also estimated to be relatively lower than for compared with most of the sites in other localities.
- The next best ranking site in the quantitative assessment was Wilberforce in the Hawkesbury locality. Its main advantage was also proximity to potential demand including nearby commercial growth opportunities. Its main disadvantages were noise impacts on communities and sensitive uses as well as the potential social impacts of land acquisition. Furthermore, a Type 3 site located at Wilberforce would require its runway alignment to be parallel or near parallel to RAAF Base Richmond with coordinated control between the two airports in order to operate both facilities. A Type 1 airport located at Wilberforce is likely to require closure of RAAF Base Richmond or relocation of RAAF activities to the Wilberforce site.
- Following the four Nepean sites and Wilberforce, the next best ranking site in the quantitative analysis was Somersby in the Central Coast, which had relatively high development costs but also reasonable levels of economic benefits. It also received a

relatively mid-range ranking against the qualitative criteria. However, Somersby would be constrained in operational capacity terms due to airspace interaction with Sydney (Kingsford-Smith) Airport.

- Wilton in the Cordeaux-Cataract locality rates just behind the Nepean and Hawkesbury sites and level with Somersby on BCR (although with a slightly lower NPV) in the quantitative assessment for a Type 1 airport. It has the best ranking in terms of noise impacts on existing communities. Its capacity would not be constrained through airspace interaction with Sydney (Kingsford-Smith) Airport.
  - Wilton is located further from the potential market under existing planning instruments but would be well located if Sydney's longer-term growth is to the south-west.
- Mowbray Park in the Burragorang locality rated mid-range in the quantitative analysis and had mixed ratings on the qualitative analysis. It has a relatively lower noise impact on local communities compared to most other sites but is not well located in terms of potential demand.
- The Relative Cost Benefit Ratios were higher for Type 1 airport developments than for Type 3 developments, reflecting the high economic value that a major airport would provide in the long term.
- Sites that enable initial development as a Type 3 airport with the capacity to be extended to a full Type 1 airport in the future would best allow for the medium- and long-term growth in the Sydney market.
- Given the analysis of capacity pressures on Sydney (Kingsford-Smith) Airport, the supplementary airport would need to be available for initial use between 2025 and 2030.
- To finalise a decision on the best location for a supplementary airport, additional work will be required on detailed site studies and environmental assessment.
- Indicative costs of land acquisition for the shortlisted sites range from $40,000 to $70,000 per hectare for sites in the Central Coast, Nepean and Cordeaux-Cataract localities; to $140,000 to $215,000 per hectare for sites in the Hawkesbury and Burragorang localities. Including an allowance for risk and contingency suggests costs per site between $30 million and $600 million, dependent on airport type and location.
- Based on high-level, strategic cost estimates, indicative generic construction costs of airport infrastructure would be in the order of $1.7 billion for a limited service Type 3 airport and $5.3 billion for a maximum Type 1 airport with parallel runways.
- A large additional cost in most locations would be the earthworks costs to prepare sites for airport infrastructure owing to the undulating nature of the land. For example, land preparation costs for the development at a location such as Wilton could range from $350 million for a Type 3 airport development to $810 million for the ultimate Type 1 airport site preparation. For the range of shortlisted localities and airport types, and factoring in an allowance for risk and contingency, indicative earthworks costs are between $140 million and $1.2 billion.
- Supporting infrastructure such as road, rail and utilities costs would be additional to the above high-level costs. These could comprise significant cost elements of up to $950 million for a Type 3 airport and up to $3.6 billion for a Type 1 airport (assuming inclusion of a rail connection and incorporating an allowance for risk and contingency) in a suitable site.
- Totalling these key cost elements, the capital investment to develop an airport and supporting infrastructure could total between $7 billion and $11 billion for a Type 1 airport and between $2 billion and $4 billion for a Type 3 airport.

The options considered in Parts Six and Seven of this Report for making best use of existing airports, provide enough additional capacity for only the short or medium term. The cost, community impacts or aviation impacts associated with a number of these options may make them unsuitable, either individually or in combination, in the judgement of governments. It is important to look for new options that will provide additional capacity for the long term.

Numerous cities around the world are served by multiple Regular Public Transport (RPT) airports, providing a range of aviation services and serving broad economic areas. This is the case especially as Low Cost Carriers (LCCs) have emerged with the deregulation of aviation in Europe and North America. The Steering Committee has therefore also considered options for additional greenfield airport sites which could be appropriately developed for the forecast levels and types of traffic.

An alternative which has not been considered, is planning for a replacement airport to Sydney (Kingsford-Smith) Airport. This is in recognition of the economic and access benefits Sydney (Kingsford-Smith) Airport provides to Sydney, NSW and Australia as a whole, given its location next to the Sydney CBD, and its proximity to the market catchment for business, freight and leisure travel. Taking into account the existing sunk and programmed investment in infrastructure, it is expected the airport will continue to be the focus of demand particularly for peak business and high value air freight.

8.1 Factors affecting decisions to use a new airport

The extent to which new options will meet the unmet demand will depend on whether they can attract airlines, passengers and other users.

The evolution of airline structures, coupled with the growth in LCCs and alliances, are influencing the patterns of airline activity, the airports they use and whether primary or non-primary airports are preferred.

The categories of airlines could be considered to include:

- full service (predominantly long established or legacy) carriers;
- LCCs;
- ‘hybrid’ LCCs (with some full service/legacy characteristics); and
- freight airlines.

The line between these airline types has become increasingly blurred and new models are emerging. These developments reflect the drive by airlines to lower operating costs, increase revenue and become more competitive.

The role and diversity of airports is changing as a consequence of this restructuring and, with it, the distinction between usages of a primary or non-primary airport is becoming less clearly defined. LCCs and legacy airlines alike now often operate out of either airport type depending on the market requirements.

Airlines choose to operate to airports based on a wide range of criteria. The criteria vary but decisions are largely based on strategic, commercial and operational objectives.

Table 41 presents key criteria for each airline model in considering non-primary airport relative to primary airport usage.[183]

183 Further information can be found in Technical Paper C10.

Table 41 Key criteria for airlines considering non-primary airport usage

Criteria	New entrant to a market				Established operator			
	Legacy	LCC	Hybrid LCC	Freight	Legacy	LCC	Hybrid LCC	Freight
Network connectivity	H	L	M	H	H	H	M	H
Alliance requirements	H	L	M	M	L	L	M	L
Access (24-hour, turnaround/ utilisation opportunities)	L	H	M	H	H	H	H	H
Operational constraints/ congestion at primary airport	L	H	H	M	H	H	H	H
Proximity to market	H	H	M	H	H	H	M	H
Size/viability of catchment (including passenger mix, yield)	H	H	H	L	H	M	H	L
Good transport linkages (road/rail)	H	M	M	H	H	M	H	H
Airport owner/government incentives	L	H	M	L	L	M	M	L
Competitive advantage	M	H	M	L	H	H	H	L
Strategic and market development opportunities	M	M	M	L	H	H	H	M

Note: Ratings of High, Medium and Low have been applied to the above criteria to indicate the level of importance for each (High=Most important; Medium=Reasonably Important; and Low=Less important).

Source: CAPA Consulting.

While this assessment is high-level and is therefore unlikely to capture the nuances of commercial decisions, it highlights that, across all airline types, proximity to market and the size of the market are important, while legacy airlines in particular will also be highly sensitive to network connectivity, alliance linkages and the availability of land transport in choosing an airport. The assessment also shows variations in relative priorities between an airline already established in a market and a new market entrant. Congestion at the primary airport, or strategic and/or competitive issues, may influence an established airline to move from a primary to non-primary airport or to co-locate operations.

Overall, considering the range of airline models, short-haul LCC airlines typically gravitate to secondary airports while legacy airlines generally remain at primary airports. Hybrid LCCs are more likely to use primary airports which perform as business hubs. Freight operators tend to remain at primary airports, as the duplication of freight handling and surface transport facilities may be excessive to operate at separate locations, but they can also operate out of secondary airports where there is adequate freight demand.

Network connectivity and alliance requirements

Legacy / full service carrier airlines tend to be hub airlines, operating a model that allows them to fill aircraft with both local and connecting passengers, thus increasing load factors and reducing the cost per seat. This can occur in terms of funnelling domestic traffic onto international services (examples include Sydney (Kingsford-Smith) Airport and Chicago (O Hare) in the United States) or alternatively through consolidating different international traffic at the one airport to feed into services for multiple onward destinations (for example in the case of Singapore, Kuala Lumpur, Dubai or Abu Dhabi airports). Concentration of traffic at a hub airport also allows airlines to increase frequencies, particularly on high-yielding business routes, where passengers tend to be time-sensitive and value schedule flexibility. An airline's own connectivity requirements will extend to the group operations where, for example, a parent airline has a subsidiary offering regional services, as is the case for Qantas and its QantasLink subsidiary.

Further considerations are the alliance and code-sharing arrangements entered into by an airline, which require not only connectivity but also similar standards and product offerings, such as lounges, across the airlines. Members of the global alliances such as Star Alliance, oneworld and SkyTeam usually gravitate to the same airport to provide for seamless connections, group branding and a sharing of check-in areas and marketing and sales facilities. Alliances often aggregate around hubs in a particular market, enabling passenger and freight transfers between member airlines, coordinated scheduling and expanded service coverage. Recent announcement by Qantas and Virgin Australia have seen renewed emphasis on alliances to ensure more competitive services at a lower cost.

By contrast, point-to-point services optimise operational efficiency through:

- no passenger hubbing processes or structures;
- aircraft, pilots and cabin crew generally returning to home base each day; and
- avoiding interlining and code-shares as they add cost and complexity to operations.

Point-to-point services are generally offered by LCCs where connectivity is less of an issue, as they advertise the fact that they do not provide any services relating to flight connections such as baggage transfer. However, this may change with the increase in alliances and offshore ventures among LCC airlines as well.

Regional airlines are less likely to use non-primary airports for connectivity reasons. They generally provide links between smaller population areas and major cities or between regional towns and cities. In Australia, regional airlines focus on capital city airports and maintain alliance or interline relationships with interstate and international operators (such as Regional Express / Virgin Australia and SkyWest / Qantas).

Interlining and alliances will put greater pressure on appropriate transport links between airports. While the cost incurred through using primary airports is higher (in some cases much higher) than at non-primary airports, this is outweighed by the need for convenient transfers and the revenue benefits generated in accessing connecting traffic.

Competitive advantage / strategic and market development opportunities

Non-primary airports are a more likely option for new entrants (especially LCCs) than market incumbents, and their attractiveness is derived from their relative accessibility and pricing, compared with the primary airport.

Non-primary airports have an important role to play in delivering a market advantage over a competitor operating from a primary airport with its more convenient location and connectivity advantages. A non-primary airport offering a strong incentive regime and short turnaround times can reduce airline unit costs. Price is usually the main tool available to an LCC and it becomes a strong advantage when combined with easy airport access and on-time performance.

The opportunity to be the first operator at a new non-primary airport also potentially provides a strategic opportunity for an airline to develop a hub in the long term. Other airlines seeking to enter the market may face barriers to entry under this scenario.

Freight operators have particular requirements which may be met at either a primary or a non-primary airport. Express freight, for example, has characteristics which may support the development of dedicated distribution hubs separate to mainstream airports. These could operate in isolation to a scheduled gateway.

These factors can operate together: for example, Frankfurt-Hahn Airport in Germany developed initially as a specialist freight gateway, and has now seen the entry of LCCs Ryanair and Wizz Air.

Cost and duplication issues

Airlines face high establishment costs at each airport. As such, there are a number of benefits for an airline to concentrate operations at one airport. Use of multiple airports within a catchment is likely to lead to a duplication of assets and supporting resources.

The major cost duplication relates to infrastructure finance, upkeep and upgrade. However, there may also be operating costs that either are duplicated or have a higher unit cost at a non-primary airport. Airlines may not be able to achieve the economies of scale or cost efficiencies available when operating from one location.

For full service airlines, the priority is likely to be on primary airports where possible. Full service airlines also rely on the availability of flexible schedules with high frequencies and connectivity to provide a competitive advantage in the important business travel market. Duplication costs are likely to act as disincentives to the use of non-primary airports.

However, once these airlines reach a critical mass and it becomes difficult to further expand services, the option of relocating some services to a less congested access point to accommodate market growth becomes more attractive.

CAPA Consulting's analysis suggests that the scale of investment by Qantas Group and the Virgin Group at Sydney (Kingsford-Smith) Airport, and the competitive and cost advantages and revenue generation as a result of their major role at the airport make it highly unlikely the groups, as a whole, would relocate to a secondary facility. However, this would not preclude the deployment of some services at such an airport. For example, the Qantas Group's strategy for the Melbourne region suggests a similar structure could be adopted for the Sydney region if a second airport facility were available. In Melbourne, Jetstar was established at Avalon Airport as a means of strengthening the group's position in the market in tandem with the presence of the mainline brand and its LCC subsidiary at Melbourne Tullamarine Airport.

As a result of this, CAPA Consulting advised the Steering Committee that the prospect of LCC usage for a secondary facility in Sydney is feasible, especially in relation to Tiger Airways and Jetstar. However, it considers Virgin Australia may prefer to maintain services at Sydney (Kingsford-Smith) Airport, subject to the availability of appropriate capacity to meet growth requirements.

Proximity to market and size/viability of catchment

Airlines require proximity to markets with development potential to absorb the capacity introduced by commencing or expanding operations.

- **Outbound routes:** if an airline's route(s) from a non-primary airport are outbound then there needs to be a sizeable population base in close proximity to the airport and GDP growth forecasts need to be at least promising. This is because the propensity to travel broadly tracks GDP growth and, if the market is outbound, then the success of the route would be determined by the population in the airport's catchment area.
- **Inbound routes:** if the market is inbound then there should be one or more key reasons passengers have to travel to the airport, including: tourism, easy access to a major city, materially lower relative real estate prices than their origin market, or greater employment opportunities than in their origin market. This requirement was emphasised by the impact of the downturn in incoming tourism from Japan on operations at Cairns Airport.

- **Balanced markets:** balanced markets require elements of both to be successful. While other criteria are important, however, their importance quickly declines if there is no market development potential, either inherently or based purely on stimulation of demand through low fares.

Even with significant incentives, airlines generally will not commence operations from a non-primary airport unless they can penetrate a greater share of their target market.

In the case of LCCs, there needs to be a sufficient potential market of price-sensitive outbound travellers in the airport's catchment. GDP growth forecasts also need to be at least promising or no amount of price stimulation will create a market.

Airlines apply different benchmarks to what they may consider to be a 'viable' market size. Table 42 presents an indication of the number of passengers required to achieve 80 per cent loads at varying weekly frequencies by aircraft type and by basic LCCs, hybrid LCCs and full service airlines.

Table 42 Indicative passenger market requirements for various service frequencies and airline and aircraft types (annual passengers)

				Number of return flights			
Airline	Service	Aircraft type	Seats	1/week	3/week	5/week	Daily
Basic LCC	Domestic/International	A320	180	14,980	44,930	74,880	104,830
Hybrid LCC	Domestic	B737NG	180	14,980	44,930	74,880	104,830
	International	B777-300ER	363	30,200	90,600	151,010	211,410
Full service airlines	Domestic	B737NG	168	13,980	41,935	69,890	97,845
	International	A380	450	37,440	112,320	187,200	262,080

Note: Assumes 80 per cent passenger loads for each aircraft type.

Source: CAPA Consulting.

On this basis, a traditional LCC or a hybrid LCC could potentially require 104,000 passengers per year for a daily domestic service with an A320 or B737NG, while a market of 211,000 passengers could be needed for a daily B777-300ER. The requirement to operate a daily A380 service at an 80 per cent load would be 262,000 passengers per year.

As discussed in Parts Two and Four, the Sydney region is home to approximately six million people and more than 4.2 million live in the Sydney Metropolitan Area. Forecasts show Sydney's population is expected to reach 6.2 million by 2036, with estimates reaching between seven and 7.5 million by 2056 (with over half living in Western Sydney). It is projected that by 2060 approximately 260,000 aircraft movements per year and 54 million passengers per year will be unable to be accommodated at Sydney (Kingsford-Smith) Airport.

The analysis by CAPA Consulting is based in part on overseas experience. It can only provide broad indications of the likely use of any new greenfield airport in the Sydney region, as outcomes will be affected by the particular circumstances of the local market. However, the analysis does suggest that, with continued growth in gross domestic product (GDP) and increasing constraints at Sydney (Kingsford-Smith) Airport, the Sydney region will provide an attractive and large market for both new entrants and legacy airlines. While LCCs and new entrants are likely to be the first to operate at a new airport, with increasing constraints at Sydney (Kingsford-Smith) Airport, the new airport is likely to become attractive to existing operators for growth services and potentially a transfer of some services from the airport.

8.2 Identifying viable options

Over recent decades, a range of alternative and innovative greenfield options has been proposed to provide aviation capacity in the region.

A strategic assessment of a broad spectrum of these options was undertaken for the Steering Committee, which included consideration of some of the options previously raised by stakeholders or considered in past government studies.

The assessment considered past proposals to develop new sites outside the Sydney region. However, all such options were such a distance from Sydney that they would not provide significant relief to capacity constraints, given that the location would still either require flights to connect to Sydney or may not attract Sydney region users due to the significant land transport travel time required.

Other options, such as offshore airports along the NSW coast, raised engineering and access issues and would incur significant expenditure. Significant capital outlay would be required not only to develop the offshore platform but also to provide appropriate land transport linkages for passengers and freight. Passenger access would be expensive to establish and operate, with difficult and costly linkages to the existing networks. Offshore airports would also create a range of environmental impacts and security of infrastructure is now also a key consideration for such a development.

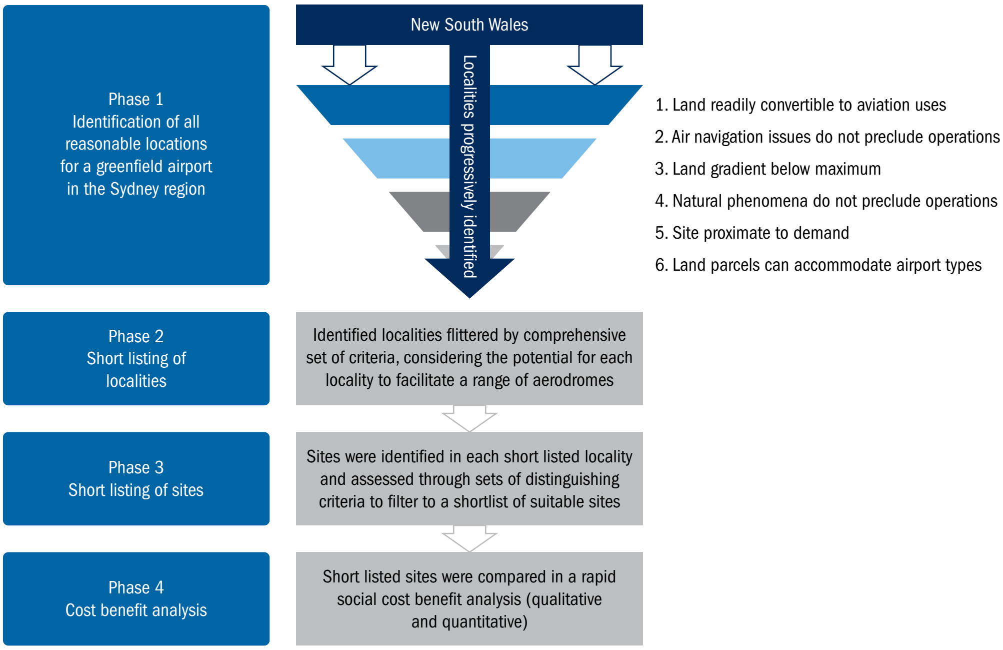
As a result of this assessment, analysis was refined to focus on land in the Sydney region capable of accommodating development of a new airport. Detailed information can be found in Appendix F and Technical Papers C11, C12 and C13.

8.3 Methodology to identify and assess greenfield airport sites

Four-phase methodology

In order to identify a comprehensive range of potential greenfield airport sites, a four-phase process was applied, commencing with all land in the broader Sydney region. Filters were then applied to locations that were identified as being conceivably able to accommodate a greenfield airport to progressively identify the sites which might best accommodate an additional airport. An outline of the process is shown in Figure 135.

Figure 135 Methodology for greenfield airport identification and assessment



It includes:

- **Phase 1 – Identification of all potential locations:** involved the identification of all possible areas in the region that could conceivably accommodate large-scale domestic and international operations on a minimum land parcel size, as well as a limited service airport on a reduced land parcel size.[184]
- **Phase 2 – Shortlisting of localities:** these geographic areas ('localities') were compared against a comprehensive set of criteria, considering the potential for each locality to support a range of airports, from a small-scale airport serving mainly General Aviation (GA) and limited RPT to a large-scale international airport serving all market segments. Criteria that more clearly distinguished each locality's suitability for an airport were used, along with a preliminary rapid cost benefit analysis (CBA), to filter the number of localities.
- **Phase 3 – Identification of sites:** in each shortlisted locality, sites that were suitable to accommodate either a full-sized international airport serving all market segments or a limited service airport aimed primarily at the LCC and regional markets were identified.
- **Phase 4 – Assessment of sites:** the identified sites were assessed further in order to select the sites considered most suitable in each locality. This involved assessment against a set of technical criteria, and evaluation through a rapid CBA.

Distinguishing criteria

A complex range of factors were identified and applied in the four-phase identification and assessment process as criteria to filter and prioritise options. These were developed by PwC and WorleyParsons/AMPC from sources spanning four decades including Australian and international aviation studies and reports documenting previous aviation upgrades and international standards. Specifically for the greenfield identification and assessment process, a comprehensive set of 30 criteria were developed to allow analysis across a range of factors.

184 It should be noted that, for the purpose of describing the greenfield site assessment process, four airport types have been developed and have been used throughout the Report. More information on the process and findings can be found in Technical Papers C11 and C13.

8.4 Phase 1: Identification of potential locations

The aviation sector accommodates a range of demand types regular public transport (RPT, including international, domestic and regional), GA, military and freight. A new greenfield site could be developed to serve just one or multiple segments of aviation demand. The parameters that directly influence the ability of a site to support aviation activities will vary considerably dependent on the segment of demand (for example, the length of runway required).

To guide the identification and assessment of greenfield airport sites, consideration was given to four possible airport types that could respond to a range of potential aviation demand segments:

- **Type 1:** full service airport with runway length up to 4,000 metres, serving all RPT segments, capable of accommodating a future parallel runway layout;
- **Type 2:** land constrained full-service airport serving all RPT segments, capable of accommodating one runway;
- **Type 3:** limited service airport serving all RPT segments, accommodating a single shorter runway of up to 2,600 metres; and
- **Type 4:** minimum service airport serving GA and limited RPT.

Before assessing the relative merits of any particular site, it was necessary to identify the areas where a new airport could realistically be located.

WorleyParsons/AMPC undertook this work by applying a set of six criteria across the broader Sydney region to exclude areas that could not conceivably accommodate a greenfield airport. The criteria enabled identification of a number of areas where it will not realistically be feasible to locate a new airport.

Localities within the Sydney region that did not satisfy the criteria below were not assessed further.

- **Land at the location must be readily convertible to aviation uses and not already urbanised:** noting almost any land parcel is likely to have some pre-existing use (such as residential, employment, recreational or agricultural use). Dense residential and business areas of NSW, such as existing suburbs, were excluded from further assessment.
- **Air navigation issues should not preclude major civilian aviation operations at the location:** while any potential greenfield airport sites in the Sydney region may involve changes to accommodate existing use of airspace, some airspace use is more readily adapted. Areas with existing airspace classifications and aircraft operations were identified as being more challenging to adapt. Areas were excluded if the operation of any new airport located there would present a danger to existing aviation activity.
- **The site should be proximate to demand:** one of the key success factors for a new airport is its proximity to sources of demand. This criterion sets a generous initial threshold of two hours along each major existing road system out of Sydney, from the centre of the Sydney region's population (Ermington),[185] to reflect a travel time beyond which an airport is likely to be unattractive to use for the largely Sydney-based population whose needs it is aiming to meet. Current travel times were used given the uncertainty projecting all factors that could affect future travel times over the Joint Study period, including certainty of future road and rail improvements being implemented, and the level of population and employment growth relative to targets and projections.
- **The locality should not be subject to natural phenomena (for example, wind shear) which would preclude major civilian aviation operations at the location:** throughout the world airports operate within a range of climatic conditions and experience natural phenomena

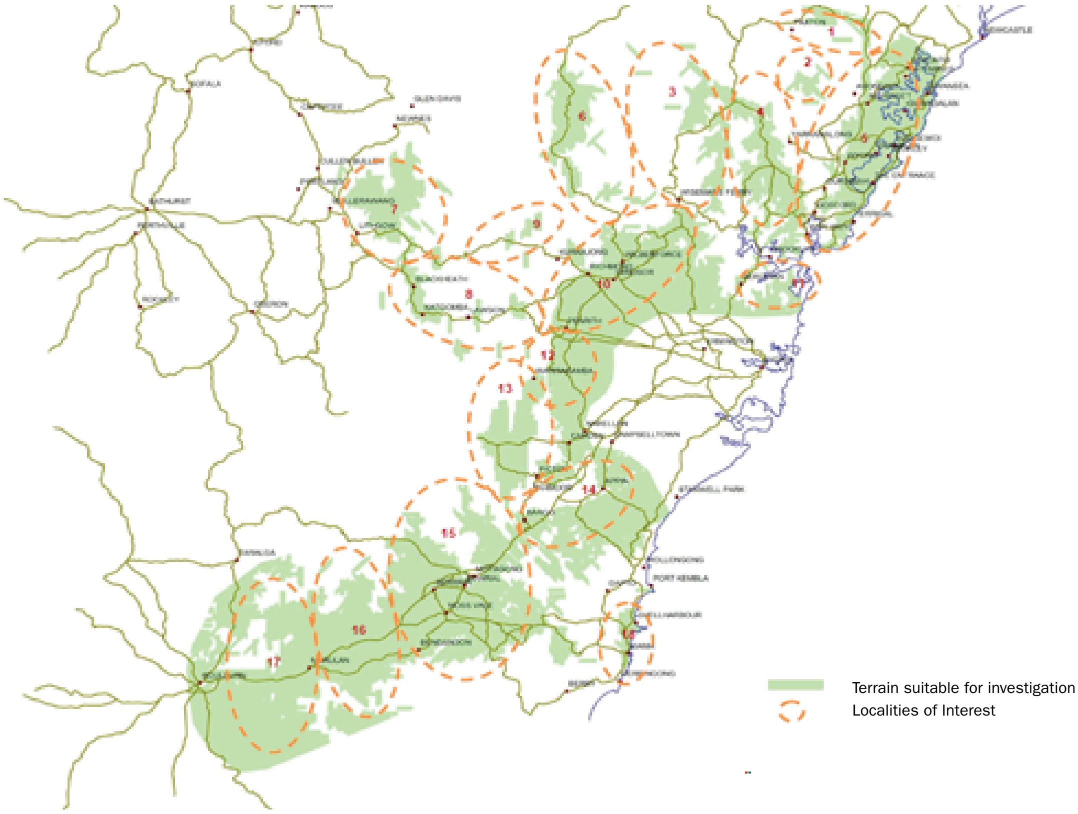
185 ABS, 3218.0 *Regional Population Growth, Australia, 2009–10,* centre of population of the Sydney Statistical Division, 2010.

that can be accommodated by means such as instrument landing systems. Consequently, factors such as fog, wind and hail were not considered to exclude land areas. However, areas not considered suitable for aviation purposes due to potential wind shear were excluded, as this phenomenon has significant safety implications.

- **Land at the location is (or can reasonably be adapted to be) within the minimum acceptable land gradient for aircraft operations:** for safety reasons there are International Civil Aviation Organisation (ICAO) standards and Civil Aviation Safety Authority (CASA) regulations setting out maximum longitudinal slopes and specifications for obstacle limitation surfaces (OLS) for airport runways. While any site is likely to require some cut and fill earthworks to suitably level or grade the land for use as an airport, this criterion excluded areas where the terrain and surrounding landscape may either limit earthworks or make them prohibitively costly to accommodate safety requirements.
- **The land parcels must be able to accommodate a set number of runways, minimum runway lengths, minimum separation of runways and minimum airside and landside requirements:** earlier criteria may identify a range of land parcels of differing sizes, but some may be shaped such that it is not feasible to locate an airport on a given parcel. This criterion sought to ensure the land areas identified could feasibly site one or more runways. A broad range of potential airport localities were sought by considering the land parcel size and a potential runway length required to accommodate a Type 4 airport.

By applying the six criteria above, Phase 1 identified a range of possible areas that could reasonably locate a greenfield airport. These areas were grouped into 18 localities, where areas of land were reasonably contiguous, as shown in Figure 136.

Figure 136 Indicative greenfield airport localities



Note: Green areas within the ellipses represent the land areas identified. The ellipses shown are indicative only and generally enclose the green shaded areas intended for further investigation.

Source: WorleyParsons.

Table 43 summarises the region and principal Local Government Areas (LGAs) of each locality and also provides a descriptor of each geographic location. A mix of localities within the Sydney basin and beyond was identified.

Table 43 Greenfield airport localities identified in Phase 1

Region	Locality number	Locality	Principal LGAs
Northern localities	1	Ellalong	Cessnock
	2	Watagan Mountains	Cessnock, Lake Macquarie, Wyong
	3	Yengo National Park and Macpherson State Forest	Cessnock, Gosford, Hawkesbury
	4	Central Mangrove-Kulnura	Gosford, Wyong
	5	Central Coast	Lake Macquarie, Wyong
Western and north-west localities	6	Putty Road	Hawkesbury, Lithgow, Singleton
	7	Newnes State Forest and Plateau	Blue Mountains, Lithgow
	8	Great Western Highway	Blue Mountains, Lithgow
	9	Bell's Line of Road, Bilpin	Blue Mountains, Hawkesbury
Sydney basin localities	10	Hawkesbury[1]	Baulkham Hills, Blacktown, Hawkesbury, Hornsby, Penrith
	11	Ku-ring-gai National Park and surrounds	Hornsby, Gosford, Pittwater, Warringah
	12	Nepean[2]	Blue Mountains, Liverpool, Penrith, Wollondilly
South-west localities	13	Burragorang[3]	Camden, Wollondilly
	14	Cordeaux-Cataract[4]	Campbelltown, Wingecarribee, Wollondilly, Wollongong
	15	Southern Highlands[5]	Wingecarribee
	16	Goulburn to Marulan[6]	Goulburn-Mulwaree, Upper Lachlan, Wingecarribee
	17	Marulan to Illawarra Highway junction[7]	Goulburn-Mulwaree, Upper Lachlan
Southern localities	18	West of Kiama Bypass	Shellharbour

Notes: 1. Northern Hawkesbury River valley and slopes.
2. Nepean River valley and slopes.
3. The Oaks and surrounds.
4. Wilton-Appin and surrounds.
5. Mittagong, Moss Vale, Berrima and surrounds.
6. North and south of the F5 between Goulburn and Marulan.
7. North and south of the F5 between Marulan and Illawarra Highway junction.

Source: WorleyParsons/AMPC analysis.

8.5 Phase 2: Shortlisting of localities

In Phase 2, information was gathered on the 18 identified localities and compared against a comprehensive set of criteria to allow assessment of the relative merits of each to facilitate aerodromes ranging in scale from a Type 1 full land-sized international airport, serving all market segments, to a Type 4 minimum service GA airport. [186]

186 Further information can be found in Appendix F (Matrix 1).

The following 10 primary criteria were applied to assess and compare localities:

- capacity created and/or unlocked in the network;
- accessibility to the Sydney land transport network;
- scope for commercial opportunities near or on the airport site;
- proximity to the landside origins and destinations of likely users;
- restrictions due to nature of sites, considering air traffic management arrangements and potential OLS restrictions;
- noise impacts on residents (with impacts on other noise-sensitive land uses considered in the next phase);
- impact on national/state parks;
- flora and fauna impacts;
- impact on state significant sites; and
- unexploded ordnance risks.

Extensive data was collected for each locality against each of the primary criteria. In addition, key performance indicators were developed to measure each criterion. These were applied to facilitate further differentiation between localities.

Some localities encompassed large areas and gathering detailed information on the entire area would have been time and cost-prohibitive. Therefore, to assist in the comparison of the 18 localities, representative airport sites were identified in each of the localities. These representative sites were identified principally to enable further testing of each locality and were not chosen as an indication of the optimal airport site or sites in each locality. The same set of criteria already developed was used to identify the most representative site.

To compare the representative sites in each locality, a comprehensive set of 30 criteria were applied to allow analysis across a range of factors. These encompassed the initial 10 primary criteria, supplemented with criteria including factors such as frequency of meteorological conditions, the number of properties and population located within the site, occurrence of heritage items, flood risk and bushfire risk.

The results of this analysis were incorporated into a comprehensive matrix documenting the performance of each locality. The full matrix of information, collated for Phase 2 providing details for each locality against all the criteria, is set out in Appendix E.

The collated data for each locality in the matrix provided an overview of the locality's potential to provide additional aviation capacity for the Sydney region, as well as the implications of developing and operating an airport in that locality.

While all of the factors developed had relevance, there were some criteria that more clearly distinguished each locality's suitability to provide a site for an airport, and these were used to filter the number of localities. These distinguishing criteria are discussed below.

Proximity to demand

As identified earlier in this Part, proximity to market and the size of that market will be key considerations for airlines when considering whether to operate to a non-primary airport.

A number of localities identified in Phase 1 were situated close to the two-hour travel time from Sydney's population centre threshold applied in the locality identification process. On a number of measures, a locality (or site) situated closer to demand will be more suitable, as, in addition to the attraction for airlines, it is likely to be more attractive to airport users on time and cost grounds and involve lower costs to provide transport links from key demand areas.

The supplementary information collected in Phase 2 showed that these more distant localities were not consistently stronger on other criteria than localities closer to Sydney. This held true regardless whether localities were located north, south-west or south of Sydney.

For example, the Ellalong, Watagan Mountains and Yengo National Park/Macpherson State Forest localities all lie to the north of Sydney and between an estimated 111 and 116 minutes travel time from Sydney. Furthermore, none of these localities were considered able to support the development of a full service Type 1 international airport. In contrast, the Central Mangrove–Kulnura and Central Coast localities also lie to the north of Sydney but at an estimated 64 to 76 minutes travel time to Sydney. These two sites were considered capable of supporting the development of any of the four airport types considered in the Joint Study. Therefore, there was no advantage in retaining the Ellalong, Watagan Mountains and Yengo National Park / Macpherson State Forest localities relative to the more proximate Central Mangrove–Kulnura and Central Coast localities.

As a result of this finding across a number of the more distant localities, the travel time threshold was revised to 1.5 hours.

Seven of the 18 identified localities were located beyond the 1.5 hour travel time threshold and were not taken forward for further assessment. These seven localities were:

- Ellalong;
- Watagan Mountains;
- Yengo National Park and Macpherson State Forest;
- Newnes State Forest and Plateau;
- Goulburn to Marulan;
- Marulan to Illawarra Highway junction; and
- west of Kiama Bypass.

Potential impact on protected areas

In Phase 1, dense urban residential and business areas were not considered suitable for development of a greenfield airport given the level of existing activity that would be impacted or need to be relocated. However, land occupied by national parks and other preserved land was considered to be technically feasible to convert to an airport. In Phase 2 it was identified that such areas were not consistently stronger on other criteria relative to other localities, and clearly were less desirable sites on environmental grounds.

For example, the Great Western Highway and the Bell's Line of Road, Bilpin localities fall within the Greater Blue Mountains world heritage area. Furthermore, these localities are only suitable for the development of single runway airports given the dissected mountain plateau nature of the terrain. There was, therefore, no advantage in retaining these localities in comparison to other localities closer to Sydney with more potential to provide greater aviation capacity for the Sydney region.

As a result of this broad comparative assessment, areas within, or partially within, a national park or a state conservation area were not taken forward for further assessment.

Of the 11 localities or partial localities remaining after the 1.5 hour travel time threshold was applied, four had no viable airport site outside of a national park or state conservation area and were not taken forward for further assessment. The four localities were:

- Putty Road;
- Great Western Highway;
- Bell's Line of Road, Bilpin; and
- Ku-ring-gai National Park and surrounds.

This resulted in seven localities being prioritised for further assessment:

- Central Mangrove–Kulnura;
- Central Coast;
- Hawkesbury;
- Nepean;
- Burragorang;
- Cordeaux-Cataract; and
- Southern Highlands.

Preliminary economic appraisal

In order to further compare these seven localities, a preliminary rapid CBA was undertaken by Ernst & Young.[187] This incorporated key monetised as well as non-monetised impacts, and viewed benefits from a national perspective.

The locality specific factors that were monetised and included in the analysis were:

- airport capital and operating costs;
- supporting infrastructure capital and operating costs;
- land acquisition costs and earthworks platform costs;
- value of aviation movements, including:
  - consumer surplus realised by Australian residents who will be able to fly if new capacity is added but whose demand will be suppressed in the base case;
  - tourism spend of non-Australian residents who would otherwise not visit Australia; and
  - value of freight that is able to be transported to and from Sydney that will have otherwise not been transported;
- reduction in aviation movement costs:
  - reduction in delay of passengers that would have flown in the base case;
  - reduction in delays to aircraft operators; and
  - reduction in the percentage of passengers that have to alter their preferred flight times due to supply constraints; and

187 Further information can be found in Technical Papaer C13.

- increased externality costs on the wider community and society:
  - additional landside transport costs (including congestion/delays on the land transport network, realised by additional passenger vehicle movements and additional freight vehicle movements that can now be accommodated);
  - environmental impact of additional flights; and
  - cost to mitigate noise impacts on local areas.

The results of the rapid CBA of the monetised impacts are shown in Table 44, with the five highest economic results for each of the airport types shaded.[188]

Table 44 Rapid CBA results (relative benefit cost ratios) – monetised impacts

Airport type	Central Mangrove–Kulnura	Central Coast	Hawkesbury	Nepean	Burragorang	Cordeaux-Cataract	Southern Highlands
1	1.37	2.25	1.67	2.82	1.80	2.00	0.81
2	1.23	1.64	1.30	1.92	1.28	1.33	0.35
3	0.68	0.95	0.74	1.22	0.72	0.76	0.02
4	-0.09	0.05	0.23	0.38	0.00	0.18	-0.50

Note: Shaded areas represent the five localities that return a higher ratio of benefits to costs. Results presented are comparative benefit cost ratios based on discounted costs and benefits (seven per cent discount rate). Some of the variation between airport type results is due to the assumption of when each airport type will commence operation (assumed to be 2035 for Types 1 and 2, and 2025 for Types 3 and 4 considering potential development and construction time required).

Source: Ernst & Young.

These Relative Benefit Cost Ratios (RBCRs) were developed by Ernst & Young to provide a relative comparison between localities. Given the rapid nature of the economic appraisal, a RBCR of less than 1.0 was not considered to definitively suggest a locality would be unviable; likewise, a high RBCR was not considered to definitively suggest economic viability.

The RBCRs suggested two of the localities would deliver significantly lower RBCRs than the other five. These two localities were:

- Central Mangrove–Kulnura; and
- Southern Highlands.

The lower economic results were principally attributed to the higher travel time to airport user origins and destinations due to the lack of connectivity (Southern Highlands), and a combination of higher travel times and relative site development costs (Central Mangrove Kulnura).

The quantitative analysis suggested that Type 1 airports are more economically viable than other airport types. However, the Steering Committee considered that there was merit in continuing to assess Type 3 airport sites, as such sites could reasonably represent the first stage of development for a greenfield airport.

188 While cost benefit ratios of 1.5 or greater would normally be the preferred choice from a CBA, in a rapid CBA, a ratio greater than 1.0 is considered reasonable for shortlisting purposes. As the results are presented as relative benefit cost ratios due to the rapid nature of the appraisal, however, a CBR of less than 1.0 was not considered to definitively suggest a locality/site would be unviable.

To highlight any further significant differences between the localities, a qualitative analysis was also undertaken based on the following eight criteria:

- proximity of aviation capacity to NSW commercial growth centres;
- commercial opportunities near or on-site;
- potential impact on existing residents and other land users as a result of land acquisition;
- Indigenous cultural heritage items;
- national and state parks;
- flora/fauna species within the representative site;
- noise impacts on residents; and
- noise impacts on sensitive areas.

There was a wide variation in the results of the qualitative analysis. The best performing localities are outlined below.

- Strategic growth alignment: Nepean and Hawkesbury are located relatively close to existing growth centres.
- Social and cultural: Cordeaux-Cataract has the fewest number of people living in the airport footprint and the most compatible current land use.
- Environmental: Southern Highlands has the lowest impact on national and state parks and/or flora and fauna species.
- Noise: Cordeaux-Cataract and Nepean have the lowest number of residents or 'sensitive' users exposed to noise impacts.

As a result of this process, the five localities identified in Figure 137, being those with the highest RBCRs, were taken forward for further analysis.

Figure 137 **Greenfield airport localities to be assessed in Phase 3**

Note: Green areas within the ellipses represent the land areas identified. The ellipses shown are indicative only and generally enclose the green shaded areas intended for further investigation.

Source: WorleyParsons/AMPC.

Table 45 summarises the shortlisted localities and identifies the regions and the LGAs where the localities are situated.

Table 45 **Greenfield airport localities to be assessed in Phase 3**

Region	Locality number	Locality	Principal LGAs
Northern localities	5	Central Coast	Lake Macquarie, Wyong
Sydney basin localities	10	Hawkesbury	Baulkham Hills, Blacktown, Hawkesbury, Hornsby, Penrith
	12	Nepean	Blue Mountains, Liverpool, Penrith, Wollondilly
South-west localities	13	Burragorang	Camden, Wollondilly
	14	Cordeaux-Cataract	Campbelltown, Wingecarribee, Wollondilly, Wollongong

Source: WorleyParsons, AMPC and Ernst & Young analysis.

8.6 Phase 3: Identification of sites

The assessment process through Phase 1 and 2 focused on identifying and assessing broader, geographic localities. While a broad area was considered appropriate in the initial identification and analysis phases, the sheer scale of some localities required that specific sites were identified to further progress the process. In this phase, analysis was undertaken to identify the more suitable site/s within each locality. This involved application of a set of filters to identify and assess sites within each of the five localities.[189]

A focus was placed on identifying Type 1 and Type 3 airport sites in this phase.

Reflecting the findings in Part Four of this Report that in the short to medium term, key capacity issues at Sydney (Kingsford-Smith) Airport arise principally for new international and LCC operator demand, Type 4 airport sites were no longer considered as they are not able to accommodate these demand segments. While a Type 2 airport can accommodate these segments, it represents a land-constrained alternative to a Type 1, which was considered less relevant for long-term planning at this stage.

Identify broadly suitable lands

The first filter involved screening each locality in order to exclude land considered unsuitable for airport development and identify broadly suitable lands. It focused on factors that could make areas in a locality particularly challenging to adapt, or could make operations relatively unsafe. These factors are listed below.

- **Site terrain:** airports require large areas of land, which, while not necessarily needing to be completely level, must be able to accommodate linear infrastructure to closely defined geometrical standards and tolerances, including runways, taxiways and OLS requirements. Land that is near level, or able to be modified to the required shape at the lowest cost, is preferred for airport development. While it will always be preferable to choose a site which is as level as possible, the scale of earthworks required to transform a non-level site into an airport can be significantly reduced by fitting the airport's geometry as closely as possible to the terrain. This refinement would typically occur during the detailed design stage.

  However, for the purposes of this phase of site analysis, terrain requiring earthworks of more than 150,000 cubic metres of cut plus fill per hectare (derived from international and Australian benchmark data) was considered to preclude airport development due to the significant cost. In past studies, 10,000 to 25,000 cubic metres per hectare was the level considered in previous Badgerys Creek and Wilton assessments, while 100,000 to 150,000 cubic metres per hectare, while difficult in terms of earthworks volumes, would be characteristic of one of the previously considered Holsworthy options (OptionB).[190]
- **Air navigation:** several aspects of air navigation requirements for safe airport operation, when applied to an area under investigation for new airport development, effectively act as absolute excluding criteria for airport operations. These include airspace management, OLS, and approach surfaces for an instrument runway approach.
- **Wind shear:** wind shear is a well-known causal factor in a proportion of aircraft accidents. It is also the only weather-related factor that can be readily incorporated into an airport site suitability assessment because of its specific association with particular terrain formations, especially large-scale escarpments.
- **Protected ecosystems:** protected ecosystems were mapped and excluded from further investigation for airport sites; these included National Parks, State Conservation Areas, State Forests and Ramsar wetlands.

189 Further information can be found in Appendix F (Matrix 2) and Technical Paper C11.
190 Airport Planning Pty Ltd, *Second Sydney Airport (SSA) Planning and Design Summary Report,* 1997.

- **Urban areas and rural settlements:** existing urban areas and more populous rural settlements were considered absolute excluding areas because of the potential high cost of wide-scale acquisition of property. It is also preferable to locate airports away from urban areas to avoid adverse levels of aircraft noise impact.

Findings: broadly suitable land

After applying these criteria to the five localities, each locality still had land remaining after exclusion of land considered unsuitable for airport purposes. These lands were essentially similar in their location and shape for either a Type 1 full service international airport or a Type 3 limited service RPT airport.

In general terms, larger areas of broadly suitable land were identified in the Nepean and Hawkesbury localities, with smaller areas identified in the Cordeaux-Cataract, Burragorang and Central Coast localities, as listed below.

- **Central Coast:** three main areas were identified – in the vicinity of Wallarah, Somersby and Peats Ridge. These areas are discrete and discontinuous with each other.
- **Hawkesbury:** a large overall area was identified comprising some substantial and continuous parcels of land lying between the Western Motorway and Windsor Road, with other smaller discrete parcels to the north of Windsor Road and along the Old Northern Road.
- **Nepean:** the largest continuous area of any locality was identified lying mostly between the Western Motorway and Camden Valley Way and to the west of the M7 motorway and east of the Nepean River.
- **Burragorang:** a series of smaller, discrete parcels of land were identified lying west of the Nepean River, south of the Warragamba River and along the generally north-south alignment of Silverdale and Montpellier Roads, in the vicinity of the Oaks township.
- **Cordeaux-Cataract:** a set of six discrete, discontinuous areas of land were identified in the vicinity of Appin, Wilton and the Cordeaux-Cataract water catchment areas and lying to the east of the M5 South Western motorway and to the west of the F6 Southern freeway and the Illawarra escarpment.

These areas of land in each of the five localities formed the input to the next stage of the assessment process.

Identify the most suitable land

The second filter involved assessment of the broadly suitable land within each locality to identify areas most suitable for aviation uses. This involved relative, scaled assessments of the broadly suitable land based on the following criteria:

- **Earthwork volumes:** earthwork volumes to create a level site were assessed in terms of a range of bands; for example, zero cubic metres to 10,000 cubic metres per hectare, 10,000 cubic metres to 25,000 cubic metres per hectare and so on, up to 125,000 cubic metres to 150,000 cubic metres per hectare. These bands were mapped for the broadly suitable land in the five localities so that areas which required greater or lesser volumes of earthworks for a notionally level site could be identified.
- **Population density:** the total population within the 20 ANEC contour was determined for a range of possible runway orientations. The smallest total population that was produced by the different orientations was recorded and mapped to the following scale: 101 to 500 persons, 501 to 1,000 persons and so on, up to a category of 20,001+ persons inside the contour. Land having the lowest count of population within the associated

20 ANEC contour was considered to represent the more suitable land in relation to this criterion.

- **Mine subsidence:** designated mine subsidence districts were mapped to identify those areas which could be potentially affected by mine subsidence and long-wall mining activity. Such areas were not considered suitable for airport development.
- **Distance to land transport network:** transport accessibility was assessed in terms of the direct distance to the Sydney land transport network, and specifically to the designated freeway and motorway system. The distance from existing freeways and motorways was mapped based on the following bands: less than 2 kilometres, 2 to 5 kilometres, 5 to 10 kilometres and so on.

Findings: most suitable land

In terms of earthwork volumes, the greatest continuous extent of easy and moderate terrain for creating a platform for a Type 1 airport lies within the Hawkesbury and Nepean localities. There are smaller parcels of such land in other localities, which are generally characterised by terrain which is more difficult, in terms of the extent of earthworks, to create a level site suitable for airport development.

The Hawkesbury and Nepean localities were found to contain continuous areas of terrain where earthworks below 75,000 cubic metres per hectare, and even below 25,000 cubic metres per hectare, would be required to prepare an airport site platform to meet prescribed standards. By comparison, the Burragorang and Central Coast localities were found to largely comprise terrain requiring earthworks of 75,000 to 125,000 cubic metres per hectare, with some areas in the localities between 125,000 to 150,000 cubic metres per hectare.

As would be expected, lands with the lowest populations in the 20 ANEC contour are those more distant from existing urban areas. Additionally, some lands, though relatively proximate to urban areas, may enable a runway to be oriented such that aircraft noise would not occur over more heavily populated areas. All localities contain some lands which are at the lowest levels of population exposure to aircraft noise, with the Cordeaux-Cataract locality having the greatest extent of potential sites with options to minimise population within the ANEC noise contours.

Known mine subsidence areas are exclusively concentrated in two localities – Central Coast, to the north of Wyong, and Cordeaux-Cataract, mostly around Appin. No other localities are known to be affected by designated mine subsidence districts.

With the exception of the Burragorang locality, all other localities have significant extents of land less than five kilometres from the major transport network, which is generally the road network, and the majority of the locality within 10 kilometres. In several cases, there are tracts of land adjoining or less than two kilometres from the road network.

The results of this process identified land considered suitable within each locality and enabled the search for suitable sites to be focused on a smaller footprint of land.

Identify suitable sites within the suitable land

In the land areas identified as being most suitable to locate a Type 1 or 3 airport within each locality, a third filter was applied in order to identify potentially suitable sites. This was undertaken using airport site and airport planning principles, and involved a manual review of specific runway alignments in the suitable land areas, with application of airport planning principles.

The four criteria from the previous phase, as well as the following seven additional criteria, were applied:

- Avoiding flight paths over urban areas;
- Orienting runway for greatest compatibility with Sydney (Kingsford-Smith) Airport's runways;
- Minimising site- and runway-specific OLS issues;
- Avoiding adverse effects on major infrastructure where possible;
- Ensuring airspace management compatibility;
- Assessing suitability of local topography for airport facilities; and
- Determining ability to incorporate a cross-runway.

In order to identify suitable airport sites, an 8 x 8 kilometre square grid, as shown in Figure 138 and Figure 139, was superimposed on a map covering all five localities. For the most suitable lands identified earlier, each grid cell was reviewed against the 11 criteria described above. The desired outcome of the filter, and for the phase overall, was the definition of one or more suitable sites for each airport type, within each of the five localities.

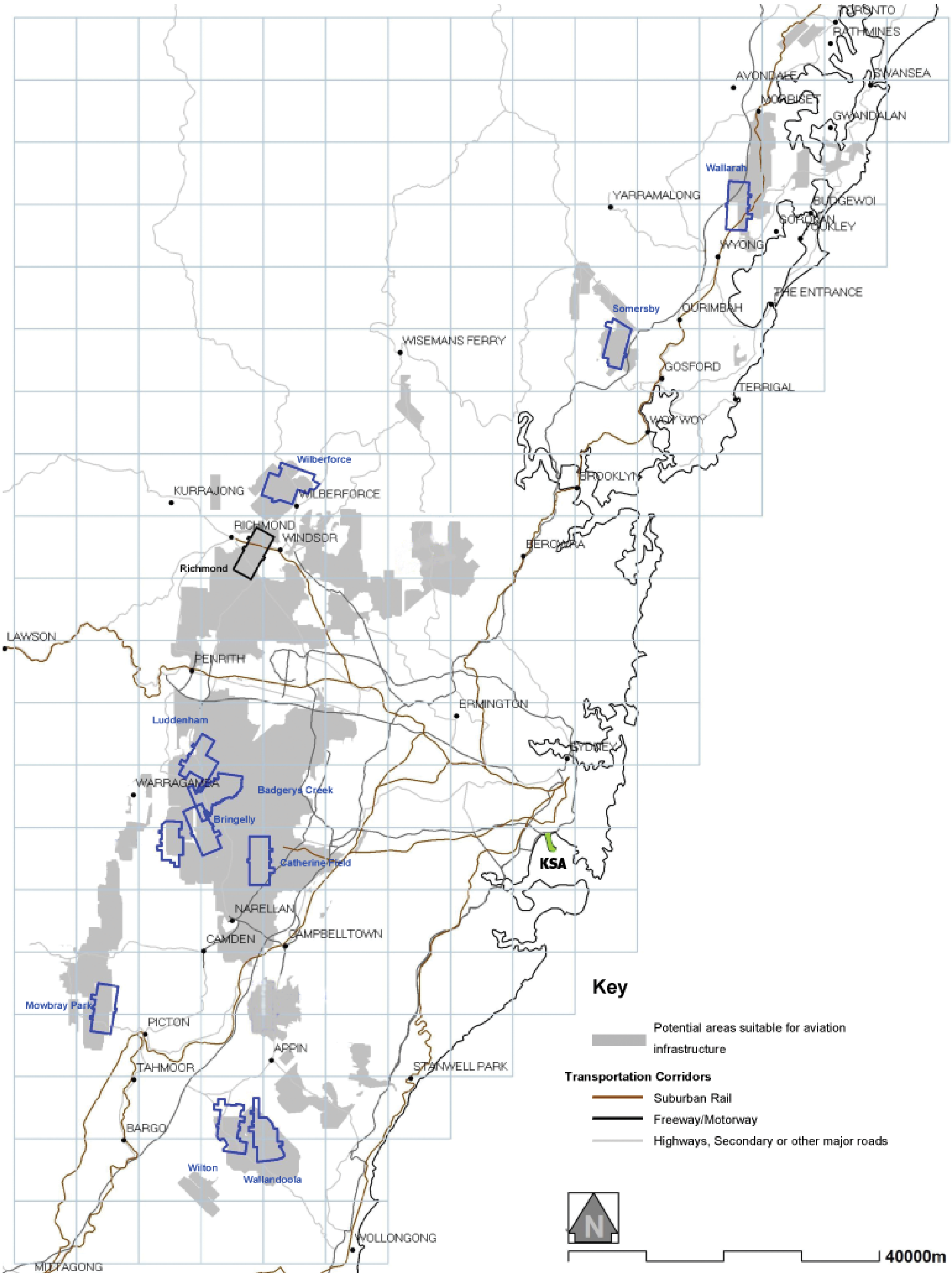
Table 46 presents the 13 sites identified as suitable to accommodate a large Type 1 full service international airport at each of the localities, and Figure 140 presents the sites graphically.

Table 46 Suitable Type 1 airport sites by locality

Region	Locality number	Locality	Shortlisted sites
Northern localities	5	Central Coast	Wallarah
			Somersby
Hawkesbury	10	Hawkesbury	Wilberforce
			Glenorie
Sydney basin localities	12	Nepean	Luddenham
			Badgerys Creek
			Bringelly
			Greendale
			Catherine Field
South-west localities	13	Burragorang	Mowbray Park
	14	Cordeaux-Cataract	North Appin
			Wilton
			Wallandoola

Source: WorleyParsons/AMPC analysis.

Figure 138 **Suitable Type 1 airport sites identified**



Note: The Richmond site in the figure represents the RAAF Base Richmond north-south runway option discussed in Part Six of this Report. It has been included in this figure to illustrate its general location relative to the greenfield suitable sites.

Source: WorleyParsons/AMPC.

Table 47 presents the sites identified as suitable for a limited service Type 3 RPT airport at each of the localities. Given that this type of airport requires significantly less land than a Type 1 airport, there were more opportunities to locate suitable sites for these airports. In this case, 21 sites were identified as suitable for possible airport development.

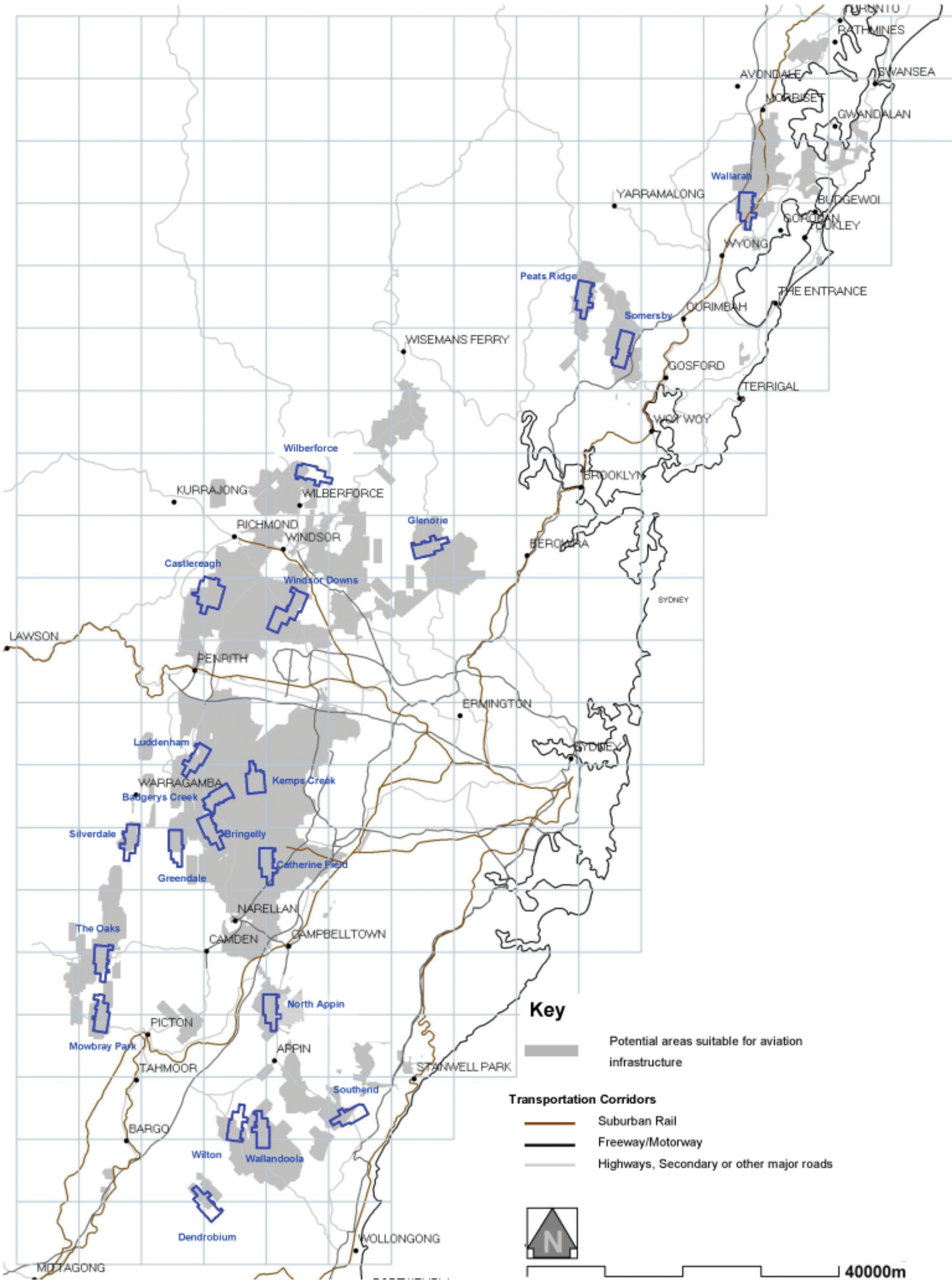
Table 47 **Suitable Type 3 airport sites by locality**

Region	Locality number	Locality	Shortlisted sites
Northern localities	5	Central Coast	Wallarah
			Peats Ridge
			Somersby
Hawkesbury	10	Hawkesbury	Wilberforce
			Castlereagh
			Windsor Downs
			Glenorie
Sydney basin localities	12	Nepean	Luddenham
			Kemps Creek
			Badgerys Creek
			Bringelly
			Greendale
			Catherine Field
South-west localities	13	Burragorang	Silverdale
			The Oaks
			Mowbray Park
	14	Cordeaux-Cataract	North Appin
			Southend
			Wilton
			Wallandoola
			Dendrobium

Source: WorleyParsons/AMPC analysis.

Figure 139 presents the more suitable Type 3 airport sites graphically.

Figure 139 Suitable Type 3 airport sites identified



Source: WorleyParsons/AMPC.

Specific limitations for some sites

Prior to proceeding to the Phase 4 assessment of more suitable sites, the implications of three factors were considered:

1. **Safety implications of mine subsidence:** when undertaking the process of identifying suitable lands, areas which could be potentially affected by mine subsidence and long-wall mining activity were still considered suitable for location of a greenfield airport. This was principally on the basis that despite high cost implications this may be overcome if the site had other

advantages. As the North Appin site was located within a designated mine subsidence district underlain by old mine workings, it was excluded at this point in the analysis for safety reasons.

2. **Future land use and growth centre plans:** in the greenfield identification and analysis undertaken to this point, criteria applied to identify suitable lands had principally considered current land use in determining lands not suitable for conversion to an airport. Given the recent actions by the NSW Government to accelerate development of precincts in the South West Growth Centre and the North West Growth Centre, it was considered that planned development in these areas would significantly change the suitability of such sites against assessment criteria such as the presence of urban areas and the scale of population likely to be impacted by noise. Therefore, prior to proceeding to the Phase 4 assessment of more suitable sites, the Catherine Field and Windsor Downs sites were excluded on the basis that their footprints were entirely located within these planned growth centres.
3. **Airspace management:** In addition, Airservices Australia further considered airspace in relation to the identified suitable sites. From this assessment, Airservices Australia advised sites generally became less constrained by airspace and route structures from north to south across the Sydney region. Furthermore, it was broadly inferred that Glenorie, in the Hawkesbury locality, was unviable operationally for both Type 1 and Type 3 airports. Therefore, it was not considered further for the purposes of identifying suitable sites. All other suitable sites were considered able to be operated.

8.7 Phase 4: Assessment of sites

The outcome of Phase 3 was a list of suitable sites in each of the shortlisted localities. In Phase 4, assessment was undertaken to identify the sites considered more suitable in each geographic area.

The following assessment was undertaken:

- a set of technical criteria were applied in order to identify the sites considered most suitable within each locality; and
- a rapid CBA featuring both a quantitative and qualitative assessment was undertaken to assist comparing the RBCRs of each site.[191]

Technical assessment of suitable sites

Firstly, a set of technical criteria was applied to the suitable sites in order to identify the sites considered more suitable in each geographic area. The information gathered in this step also formed one of a number of data inputs for the rapid CBA undertaken on the suitable sites. This analysis, together with the rapid CBA, enabled assessment of the more suitable Type 3 and maximum Type 1 airport sites from the range of suitable sites within each locality.

The criteria applied were those best able to be measured and costed, and which would best distinguish the relative merits of identified sites. The criteria were:

- general site attributes (encompassing factors such as site zoning, estimated population within and immediately surrounding the site, potential site footprint, and terrain);
- accessibility of the Sydney land transport network (rail and state roads);
- proximity to urban growth centres and commercial opportunities;
- comparative earthworks estimates;

191 Further information can be found in Appendix F (Matrix 3), and Technical Papers C11, C12 and C13.

- noise impacts on residents – measured by estimating the Person-Events Index (PEI) over an average day based on an estimate of the number of instances where an individual may be exposed to noise levels;[192]
- designated mine subsidence zone partially present within or adjacent to the site;
- number of lots which would require acquisition;
- airspace interaction;
- capacity for future expansion to a maximum Type 1 Airport;
- topographic constraints and risks at the site such as being flood prone; and
- potential infrastructure dislocations, relocations and other items likely to involve cost outlays.

For the Burragorang locality, there was only one suitable maximum Type 1 identified as part of Phase 3 (Mowbray Park) and, as such, that site was determined to be the more suitable site in this locality. However, Phase 3 had identified more than one suitable site in all other localities for either a maximum Type 1 or Type 3 airport.

A further qualitative process was applied to these localities in order to identify sites considered more suitable. The rating scale shown in Table 48 was adopted as an indicator of the general and relative suitability of the sites based on distinguishing differences between them.

Table 48 Rating scale for comparison of sites

More suitable	Suitable	Less suitable
✓✓	✓✗	✗✗
Adverse issues are those considered capable of being readily remedied through normal planning and design processes and/or some additional capital cost.	Adverse issues should be capable of being remedied through normal planning and design but with possible additional capital cost.	Adverse issues would be difficult to remedy through normal planning and design and/or expensive to remedy with likely additional capital cost implications.

Source: WorleyParsons/AMPC.

In the application of these ratings, no attempt was made to rank the criterion. However, the approach adopted did enable major differentiators to be identified. This enabled assessment to focus on what was different between the sites rather than what was reasonably the same.

Central Coast locality

Table 49 provides a summary comparison and qualitative assessment of the Central Coast locality suitable sites.

192 The PEI allows the total noise load generated by an airport to be computed by calculating the potentially exposed population and the total number of instances where an individual is exposed to an aircraft noise event above a specified noise level over a given time period.For the purposes of this assessment, WorleyParsons/AMPC has used an average daytime period and a specified noise level of 70 dB(A). A-weighted decibels, or dB(a), are an expression of the relative loudness of sounds in air as perceived by the human ear.70 dB(A) is considered the external noise level threshold for an average residence with doors and windows closed.

Table 49 **Central Coast locality suitable sites**

Criterion	Type 3 Airport Sites			Maximum Type 1 Airport Sites	
	Peats Ridge	Somersby	Wallarah	Somersby	Wallarah
1 –Comparative transport upgrade costs ($ millions)[1]	✓✗ $260	✓✓ $80	✓✓ $70	✓✗ $80 (road) $2,190 (rail)	✓✓ $110 (road) $740 (rail)
2 – Proximity to growth centres	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected
3 – Earthworks platform comparative cost ($ millions)	✓✗ $410	✓✗ $430	✓✓ $180	✓✗ $530	✓✓ $280
4 – Noise impacts (PEI: N70, person-events)	✓✓ 45,500	✓✗ 236,600	✗✗ 1,048,700	✓✗ 670,600	✗✗ 2,534,200
5 – Mine subsidence areas (MSAs)	✓✓ n/a	✓✓ n/a	✓✓ n/a	✓✓ n/a	✓✗ Surrounded by MSAs
6 – Property acquisition (number of lots)	✓✗ 110	✓✗ 140	✓✗ 200	✓✗ 190	✓✗ 500
7 – Airspace interaction capacity (movements per hour)	✗✗ [2]	✗✗ [3]	✓✗	✗✗ [4]	✓✗
8 – Potential to expand to a maximum Type 1 airport	✗✗ No	✓✓ Yes	✓✓ Yes	✓✓ n/a	✓✓ n/a
9 – Major flood risk	Non Major	Non Major	Non Major	Non Major	Non Major
10 – Other major costs	No major items	No major items Closure of Somersby Airfield	Freeway, rail and major power realignment Closure of Somersby, Mangrove Mountain Airfields	No major items	Freeway, rail and major power realignment Closure of Somersby, Mangrove Mountain Airfields

Notes: 1. *For Type 3 – road upgrade cost only.*
2. *Must be integrated with Sydney (Kingsford-Smith) Airport airspace management and may be unable to operate for periods of time due to close connection with Sydney (Kingsford-Smith) Airport, such as during major wind shifts, which requires change of runway at Sydney (Kingsford-Smith) Airport.It may also be further constrained by military airspace associated with RAAF Base Richmond and RAAF Base Williamtown.*
3. *As per comment above.*
4. *As per comment above.*

Source: WorleyParsons/AMPC and Airservices Australia.

It can be observed that two of the three Type 3 airport sites are capable of expansion to a maximum Type 1 airport (Somersby and Wallarah) while the Peats Ridge site does not have that potential. The Type 3 airport sites are distinguished principally by the criteria listed below.

- **Noise impacts on surrounding community:** with Peats Ridge having a significantly lower impact than either Somersby or Wallarah.
- **Number of properties to be acquired:** with Peats Ridge having the lowest number.
- **Construction issues:** with Wallarah having lower costs to construct an airport platform and to connect to both road and rail transport systems.
- **Additional capital costs:** with Wallarah having much greater possible additional costs to relocate or make alignment adjustments to major infrastructure.

The key factor overall which distinguishes between Central Coast Type 3 suitable sites is airspace management. Both the Peats Ridge and Somersby sites are considered to be operationally connected to Sydney (Kingsford-Smith) Airport and, as a result, their actual day-to-day capacity in terms of aircraft movements is likely to be seriously affected by the necessary interaction with Sydney (Kingsford-Smith) Airport.

This capacity may be worsened in specific circumstances. For example, a southerly front passing through Sydney which causes a change of runway from, for instance, Runway 34 to Runway 16 at Sydney (Kingsford-Smith) Airport may take more than an hour to reach Peats Ridge or Somersby. An airport at either the Peats Ridge or Somersby site could be still operating under a wind direction from the north (for example, in the opposite direction to Sydney (Kingsford-Smith) Airport). During this time, until the southerly passed through these sites, these airports would have to be restricted in capacity or even closed because the identified runway orientation would not allow aircraft movements. While this condition applies, these sites would be severely operationally compromised. On this basis alone, neither site can be considered to be more suitable than Wallarah within the Central Coast locality.

Wallarah, while not subject to such a limitation in regard to Sydney (Kingsford-Smith) Airport, is operationally affected by other airspace issues such as RAAF Base Williamtown and would still require detailed consideration of a number of airspace management issues in order for it to be able to operate at 100 per cent of theoretical runway capacity. This may entail reorientation of the runway(s) and this may have adverse consequences for effects on infrastructure and for aircraft noise on residents. It may also be difficult to achieve while continuing to keep the airport site’s footprint outside lands designated as mine subsidence areas.

Although Wallarah has some major shortcomings which would need to be addressed, of the Central Coast sites, it is considered to be more suitable for both a Type 3 and a maximum Type 1 airport. As noted, this assessment would only change if the Somersby and Peats Ridge sites could be operationally decoupled from airspace arrangements for Sydney (Kingsford-Smith) Airport, which on current advice from Airservices Australia appears unlikely.

Hawkesbury locality

The key issue in respect of any site in this locality is the presence of RAAF Base Richmond and the interaction that any new airport would have with that operation. For RAAF to continue operations in the area, runway orientations have to be compatible with ongoing operation at RAAF Base Richmond, or provision would need to be made for a RAAF precinct on any new airfield. Table 50 provides a summary comparison and qualitative assessment of the Hawkesbury locality suitable sites.

Table 50 **Hawkesbury locality suitable sites**

Criterion	Type 3 airport sites		Maximum Type 1 airport sites
	Castlereagh (including RAAF)	Wilberforce (09/27 Runway)	Wilberforce with RAAF precinct on new airfield (01/19 Runway(s))
1 – Comparative transport upgrade costs ($ millions)[1]	✓✗ $210 (road)	✓✗ $260 (road)	✓✗ $260 (road) $1,320 (rail)
2 – Proximity to growth centres	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected
3 – Earthworks platform comparative cost ($ millions)	✓✓ $130	✓✓ $200	✓✓ $340
4 – Noise impacts (PEI: N70, person-events)	✗✗ 1,085,400	✓✗ 172,800	✗✗ 2,020,800[2]
5 – Mine subsidence areas (MSAs)	✓✓ n/a	✓✓ n/a	✓✓ n/a
6 – Property acquisition (number of lots)	✓✗ 180	✓✗ 100	✓✗ 380
7 – Airspace interaction capacity (movements per hour)	✓✗	✗✗	✓✗
8 – Potential to expand to a maximum Type 1 airport	✗✗ No	✓✓ Yes	✓✓ n/a
9 – Major flood risk	✓✗ Partial 1:100 and Probable Maximum Flood (PMF) events	✓✗ Partial 1:100 and PMF events	✓✗ Partial 1:100 and PMF events
10 – Other major costs	✗✗ Relocation of RAAF Base Richmond Possible relocation of Orchard Hills Bankstown flying areas may close Severe impacts on aircraft lane entry	✓✓ No major items	✗✗ Relocation of RAAF Base Richmond

Notes: 1. For Type 3 – road upgrade cost only.
2. Note the runway orientation changes from Wilberforce Type 3 to Wilberforce Maximum which is more north-south.

Source: WorleyParsons/AMPC and Airservices Australia.

Two Type 3 airports and one maximum Type 1 airport site were identified for the Hawkesbury locality. However, it should be noted that while not specifically analysed as a separate option for a Type 3 airport at Wilberforce, possible first stages to develop from a Type 3 to a Maximum airport could be a Type 3 Wilberforce runway with a 10/28 alignment (to be later used as a cross-runway). This alignment would have greater compatibility with RAAF Base Richmond, while the preferred 01/19 orientation would have greater compatibility with Sydney (Kingsford-Smith) Airport.

The major factors which provide differentiation between the Wilberforce and Castlereagh sites are:

- noise effects with a Type 3 at Wilberforce 09/27 predicted to generate only 172,800 N70 person-events while a Type 3 at Castlereagh would generate more than five times that amount at 1.085 million person-events;
- the ability to expand Wilberforce into a Type 1 airport, should this be required in the future (as discussed 09/27 could form a cross-runway; or alternatively the Type 3 Wilberforce could be developed with a 01/19 orientation); and
- the relatively easier connection of a Castlereagh Type 3 airport to the major road system by virtue of its position east of the Hawkesbury River.

While Wilberforce would generally be a more suitable site than Castlereagh for a Type 3 airport, advice from Airservices Australia is that, due to interaction with Sydney (Kingsford-Smith) Airport's approaches and circuits, capacity is likely to be constrained below the theoretical runway capacity. If, on closer examination, this makes the Wilberforce 09/27 (or 10/28) Type 3 site effectively unviable then, to develop the other sites, there would be a need to relocate RAAF Base Richmond – either to the Castlereagh site or a Wilberforce 01/19 site. In this case, Castlereagh would merit further consideration, as its primary orientation is more compatible with overall aircraft movements in the Sydney Control Zone[193], though not without adverse interactions with current Sydney (Kingsford-Smith) Airport airspace management.

Only one site in the Hawkesbury locality – Wilberforce 01/19 – was identified as capable of accommodating a maximum Type 1 airport and, accordingly, it is nominated as a more suitable site in the Hawkesbury locality. As has been noted, this situation would force the closure of RAAF Base Richmond, necessitating the inclusion of a precinct on this site for RAAF's activities and operations. Another key issue for a maximum Type 1 airport at Wilberforce would be the relatively high effects on people, with more than two million N70 person-events being predicted, as well some 380 property lots having to be acquired.

193 The Sydney Control Zone is controlled airspace approximately 10 nautical miles radius around Sydney (Kingsford-Smith) Airport.

Nepean locality

Table 51 provides a summary comparison and qualitative assessment of the Nepean locality suitable sites for a Type 3 airport.

Table 51 Nepean locality suitable sites – Type 3 airport

	Type 3 Airport Sites				
Criterion	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale
1 –Comparative transport upgrade costs ($ millions)[1]	✓✗ $350 (road)	✓✓ $130 (road)	✓✗ $190 (road)	✓✗ $270 (road)	✓✗ $370 (road)
2 – Proximity to growth centres	✓✓ Not affected	✗✗ Partial direct footprint	✓✗ Partially acoustic footprint	✗✗ Partially acoustic footprint	✓✓ Not affected
3 – Earthworks platform comparative cost ($ millions)	✓✓ $130	✓✓ $100	✓✓ $160	✓✓ $310	✓✓ $230
4 – Noise impacts (PEI: N70, person-events)	✓✗ 206,300	✓✗ 330,300	✓✗ 200,700	✓✗ 179,200	✓✗ 104,800
5 – Mine subsidence areas (MSAs)	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected
6 – Property acquisition (number of lots)	✓✓ 80	✓✗ 200	✓✓ 10	✓✗ 150	✓✓ 40
7 – Airspace interaction capacity (movements per hour)	✓✓	✓✓	✓✓	✓✓	✓✓
8 – Potential to expand to a maximum Type 1 airport	✓✓ Yes	✗✗ No	✓✓ Yes	✓✓ Yes	✓✓ Yes
9 – Major flood risk	✓✓ Non Major	✓✗ Flood prone	✓✓ Non Major	✓✓ Non Major	✓✗ Partial, 1:20, 1:100 and PMF events
10 – Other major costs	✗✗ RAAF Orchard Hills closure Major power lines Sydney water supply Camden and Bankstown flying training areas and Wilton Parachute Centre may close	✗✗ RAAF Orchard Hills closure Flying training areas and Wilton Parachute Centre closures Operations at Holsworthy, Camden and Bankstown affected: new GA airport may be needed Severe impacts on aircraft lane of entry Major power lines	✓✗ Camden Airport closure Flying training areas and Wilton Parachute Centre may close Major power lines	✓✗ Camden Airport closure RAAF Orchard Hills and Wilton Parachute Centre closure Operations at Holsworthy and Bankstown severely affected Major power lines	✓✗ RAAF Orchard Hills may require a buffer zone Operations at Bankstown affected Camden and The Oaks airport, Wilton Parachute Centre closure Major power lines

Note: 1. For Type 3 – road upgrade cost only.

Source: WorleyParsons/AMPC and Airservices Australia.

Kemps Creek is one of the easier sites on which to create a platform in terms of earthworks. It also has the lowest cost for upgrading road access. On the other hand, a Kemps Creek site would result in a greater effect on people, with the highest number of N70 person-events, the highest number of property lots needing to be acquired and a partial footprint on the land designated for the South West Growth Centre. Finally, Kemps Creek is considered only capable of providing a site for a Type 3 airport which could not be expanded to a maximum Type 1 airport.

All of the remaining sites are considered capable of expansion to a maximum Type 1 airport. All sites are also reasonably equivalent[194] in terms of operational capability as Type 3 airports, though this is not necessarily the case if they were to be expanded to maximum Type 1 airports.

In terms of effect on people, Greendale generates the lowest impact with N70 person-events at 104,800 while the other three sites are predicted to generate N70s between 179,000 to 210,000 based on the current distribution of population. Proximity to the land designated for the South West Growth Centre would result in an overlap of the acoustic footprint of airports at Kemps Creek, Bringelly, and a site at Badgerys Creek. This may not be an issue depending on the land use proposed for that overlap. However, the Greendale and Luddenham sites would not have such an overlap. A site at Badgerys Creek obviously has the least amount of property needed to be acquired with the majority, if not all, of the site already owned by the Commonwealth Government. If expansion capability is not required at the site, there is potential, subject to runway orientation, for a Type 3 airport to be located wholly on the existing Commonwealth Government land. Kemps Creek would require the highest number of lots estimated at 200 lots.

All sites would require adjustment to some forms of major infrastructure, notably power transmission lines and existing airports, but the Luddenham site would require the closure of the RAAF Orchard Hills facility and possibly a relocation of the Warragamba water supply pipelines. Greendale, on the other hand, is more liable to major flooding by its position lower in the Nepean River valley.

While there are variations in terms of all criteria between the all of the Type 3 sites, those at Luddenham, Badgerys Creek, Bringelly and Greendale are sufficiently similar to be retained as sites considered more suitable in the Nepean locality, notwithstanding that changes to the concepts shown may be required to suit airspace operations. By being virtually contiguous sites, this retains the possibility of a yet better site being identified in the future, which could incorporate some or all of these sites.

Kemps Creek should only be considered further if there is no requirement for the site to ever be expanded to a maximum Type 1 airport and, even then, the interaction with the South West Growth Centre lands would need to be resolved to enable even a Type 3 airport at that site to operate efficiently.

Table 52 provides a summary comparison and qualitative assessment of the Nepean locality suitable sites for a Type 1 airport.

194 All sites interact with existing airspace constraints that influence capacity in some way or another as outlined in Technical Papers C11 and C12.

Table 52 **Nepean locality suitable sites – Type 1 airport**

Criterion	Maximum type 1 airport sites: Luddenham	Badgerys Creek	Bringelly	Greendale
1 –Comparative transport upgrade costs ($ millions)[1]	✓✗ $350 (road) $1,130 (rail)	✓✗ $190 (road) $1,130 (rail)	✓✗ $270 (road) $1,130 (rail)	✓✗ $370 (road) $1,130 (rail)
2 – Proximity to growth centres	✓✓ Not affected	✓✗ Partially acoustic footprint	✗✗ Partially acoustic footprint	✓✓ Not affected
3 – Earthworks platform comparative cost ($ millions)	✓✓ $280	✓✓ $360	✓✗ $410	✓✓ $300
4 – Noise impacts (PEI: N70, person-events)	✗✗ 1,545,200	✗✗ 1,668,800	✗✗ 1,284,600	✓✗ 499,200
5 – Mine subsidence areas (MSAs)	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected
6 – Property acquisition (number of lots)	✓✗ 140	✓✓ 40	✓✗ 180	✓✓ 70
7 – Airspace interaction capacity (movements per hour)	✓✓	✓✗	✓✗	✓✓
8 – Potential to expand to a maximum Type 1 airport	✓✓ n/a	✓✓ n/a	✓✓ n/a	✓✓ n/a
9 – Major flood risk	✓✓ Non major	✓✓ Non major	✓✓ Non major	✓✗ Partial, 1:20, 1:100 and PMF events
10 – Other major costs	✗✗ RAAF Orchard Hills closure May close Camden/ Bankstown flying training areas Wilton Parachute Centre closure Major power lines Sydney water supply	✓✗ Camden and Wilton Parachute Centre closure may severely impact Camden/ Bankstown flying training areas Major power lines	✓✗ Camden Airport closure Severe impacts on Bankstown Closure of RAAF Orchard Hills Limitations on operations at Holsworthy Possible need to relocate some facilities/activities Wilton Parachute Centre closure Major power lines	✓✗ Impacts on Bankstown Airport Closure of Camden and The Oaks Airports and Wilton Parachute Centre Buffer to RAAF Orchard Hills Major power lines

Note: *1. For Type 3 – road upgrade cost only.*

Source: *WorleyParsons/AMPC and Airservices Australia.*

The key distinguishing factors for maximum Type 1 airport sites are, firstly, the possible effects on people with the Greendale site assessed to generate an N70 of 499,200 person-events based on current population distributions, which are about three times less than predicted for the sites at Luddenham, Bringelly and a site at Badgerys Creek. Greendale and Luddenham would not cause either direct, partial or indirect effects on the South West Growth Centre lands whereas both Badgerys Creek and Bringelly, if configured as currently shown, would have acoustic footprints which do overlap with the designated Growth Centre lands. However, while the land uses in this area are in the planning stage, the eventual end land use in such areas of overlap is not yet known and may or may not require changes either to growth centre land uses or to airport runway orientation in order to increase compatibility between the airport and the Growth Centres. As with the Type 3 airports, the Badgerys Creek site can be distinguished from sites which would require between 70 and 180 lots to be acquired to achieve a similar aggregated land area to that at Badgerys Creek. While an airport could be constructed on the current Commonwealth-owned site at Badgerys Creek, the acquisition of 40 additional properties would better accommodate a cross-runway and items such as a public safety area, glide path and runway end safety area.

The second key distinguishing factor is in terms of airspace and operational compatibility with Sydney (Kingsford-Smith) Airport, which, based on currently proposed runway allocations and orientations, the Luddenham and Greendale sites would yield greater movement capacity at, or about, the theoretical maximum capacity of the airport. However, more intensive airspace modelling and realignment of runways may achieve better results at all of these sites.

Like the Type 3 sites, all the maximum Type 1 airport sites would require adjustment of some forms of major infrastructure, notably power transmission lines. The Luddenham site would require the closure of the RAAF Orchard Hills facility and possibly a relocation of the Warragamba Dam water supply pipelines. Greendale on the other hand is more liable to major flooding because of its position at a lower level in the Nepean River valley.

Burragorang locality

Table 53 provides a summary comparison and qualitative assessment of the Burragorang locality suitable sites.

Table 53 Burragorang locality suitable sites

	Type 3 airport sites			Maximum Type 1 airport sites
Criterion	Silverdale	The Oaks	Mowbray Park	Mowbray Park
1 –Comparative transport upgrade costs ($ millions)[1]	✓✗ $430 (road)	✓✗ $320 (road)	✓✗ $400(road)	✓✗ $400 (road) $930 (rail)
2 – Proximity to growth centres	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected
3 – Earthworks platform comparative cost ($ millions)	✓✗ $460	✓✗ $490	✓✓ $370	✓✗ $680
4 – Noise impacts (PEI: N70, person-events)	✓✓ 42,100	✓✗ 194,600	✓✗ 159,600	✓✗ 799,400
5 – Mine subsidence areas (MSAs)	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected
6 – Property acquisition (number of lots)	✓✓ 40	✓✓ 70	✓✓ 40	✓✓ 100
7 – Airspace interaction capacity (movements per hour)	✓✓	✓✓	✓✓	✓✓[2]
8 – Potential to expand to a maximum Type 1 airport	✗✗ No	✗✗ No	✓✓ Yes	✓✓ Yes
9 – Major flood risk	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected
10 – Other major costs	✓✗ RAAF Orchard Hills, The Oaks Airfield, Camden Airport, Wilton Parachute Centre closures Operations at Bankstown affected Major power lines	✓✗ The Oaks Airfield, Camden Airport, Wilton Parachute Centre closures	✓✗ The Oaks Airfield, Wilton Parachute Centre closures Camden Airport operations affected Major power lines	✓✗ The Oaks Airfield, Wilton Parachute Centre closures Camden Airport operations affected Major power lines

Notes: 1. For Type 3 – road upgrade cost only.
2. Based on advice provided by Airservices Australia, assuming Mowbray Park is similar to Greendale.

Source: WorleyParsons/AMPC and Airservices Australia.

Three Type 3 sites have been identified in the Burragorang locality. On most criteria, while there are some differences, these are not great and do not distinguish between sites. The areas where there is some degree of differentiation are that:

- the Silverdale site is predicted to have a much lower effect on the current distribution of population, with an N70 of 42,500 person-events, compared to 195,000 person-events at the Oaks site and 160,000 person-events for the Mowbray Park site;

- the comparative cost of creating an airport platform has been assessed to be lower at the Mowbray Park site than the other sites;
- only the Mowbray Park site has been assessed as being capable of expansion to a maximum Type 1 airport;
- construction of an upgraded access road to The Oaks site has been assessed as being lower in cost than to either of the other two sites; and
- the Mowbray Park site would require closure of The Oaks Airfield while the sites at Silverdale and the Oaks would require closure of not just the Oaks Airfield but Camden Airport.

On the basis of these differentiations, Mowbray Park is deemed to be the more suitable of these sites, most notably because of its ability to be upgraded to a maximum Type 1 airport. However, if only a Type 3 airport is sought then, given its much lower effect on people, Silverdale may be regarded as a more suitable suite. However, the site would still have issues to be addressed in terms of links to the existing road network and impacts on various forms of existing infrastructure.

Only one maximum Type 1 airport site could be found in the Burragorang locality – at Mowbray Park – and therefore becomes the more suitable site in this category in this locality. This site is not capacity constrained in relation to Sydney (Kingsford-Smith) Airport and could operate at or near its theoretical capacity. The site's relatively more remote location would require greater investment in transport infrastructure. The site is in relatively more difficult terrain so airport platform costs would be higher. However, while relatively remote, it would still result in a level of N70 events at about 800,000 person-events if it was to be a large Type 1 airport.

Cordeaux-Cataract Locality

Table 54 provides a summary comparison and qualitative assessment of the Cordeaux-Cataract suitable sites.

Table 54 **Cordeaux-Cataract locality suitable sites – Type 3 airport**

Criterion	Type 3 airport sites			
	Southend	Wilton	Wallandoola	Dendrobium
1 –Comparative transport upgrade costs ($ millions)[1]	✓✗ $450 (road)	✓✗ $460 (road)	✓✗ $460 (road)	✗✗ $370 (road)
2 – Proximity to growth centres	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected
3 – Earthworks platform comparative cost ($ millions)	✓✓ $500	✓✗ $350	✓✓ $350	✓✓ $250
4 – Noise impacts (PEI: N70, person-events)	✓✓ 27,200	✓✓ 19,800	✓✓ 29,400	✓✓ 26,100
5 – Mine subsidence areas (MSAs)	✓✗ Not directly affected	✗✗ Partially affected	✓✗ Not directly affected	✓✗ Not directly affected
6 – Property acquisition (number of lots)	✓✓ 10	✓✓ 10	✓✓ 5	✓✓ 5
7 – Airspace interaction capacity (movements per hour)	✓✓	✓✓	✓✓	✓✓
8 – Potential to expand to a maximum Type 1 airport	✗✗ No	✓✓ Yes	✓✓ Yes	✗✗ No
9 – Major flood risk	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected	✓✓ Not affected
10 – Other major costs	✓✗ Wilton Parachute Centre to close Holsworthy, Camden operations affected Water catchment areas Major power lines	✗✗ Wilton Parachute Centre to close Holsworthy, Camden and Bankstown operations and Wedderburn Airfields affected Water catchment areas Major power lines	✓✗ Wilton Parachute Centre to close Holsworthy, Camden operations and Wedderburn Airfields affected Water catchment areas	✓✗ Wilton Parachute Centre to close Camden operations affected Illawarra Regional Airport affected Water catchment areas Major power lines

Note: 1. For Type 3 – road upgrade cost only.

Source: WorleyParsons/AMPC and Airservices Australia.

Airservices Australia has indicated a Type 3 airport at Southend would likely be constrained by interaction with operations at Sydney (Kingsford-Smith) Airport. The extent of any constraints was not specified.

The only other areas of differentiation for the Type 3 sites are that:

- no form of public road access currently exists to the Dendrobium site, which is wholly within a water catchment area (other sites adjoin water catchment areas);
- airport platform costs are assessed as likely to be higher at the Wilton site than the other sites;

- the Wilton site, as currently defined, appears to have a partial overlap with a designated Mine Subsidence District and all these sites are underlain by coal measures which are actively being mined, albeit not necessarily located directly under these sites at present;
- neither the Dendrobium site nor the Southend site is considered capable of being expanded to a maximum Type 1 airport, due to their limited site areas; and
- airports at the Wilton and Wallandoola sites would require closure of the Wilton Parachute Centre and the Wedderburn Airfield.

Notwithstanding these latter considerations, Wilton and Wallandoola are assessed as being the more suitable Type 3 airport sites in the Cordeaux-Cataract locality.

Table 55 provides a summary comparison and qualitative assessment of the Cordeaux-Cataract suitable sites for a maximum Type 1 airport.

Table 55 Cordeaux-Cataract locality suitable sites – Maximum Type 1 airport

	Type 1 airport sites	
Criterion	Wilton	Wallandoola
1 –Comparative transport upgrade costs ($ millions)	✓✗ $460 (road) $1,100 (rail)	✓✗ $460 (road) $1,630 (rail)
2 – Proximity to growth centres	✓✓ Not affected	✓✓ Not affected
3 – Earthworks platform comparative cost ($ millions)	✓✗ $810	✓✗ $560
4 – Noise impacts (PEI: N70, person-events)	✓✓ 81,500	✓✗ 324,800
5 – Mine subsidence areas (MSAs)	✗✗ Partially affected	✓✗ Not directly affected
6 – Property acquisition (number of lots)	✓✓ 40	✓✓ 10
7 – Airspace interaction capacity (movements per hour)	✓✓	✓✓
8 – Potential to expand to maximum Type 1 airport	✓✓ n/a	✓✓ n/a
9 – Major flood risk	✓✓ Not affected	✓✓ Not affected
10 – Other major costs	✗✗ Water catchment areas Wilton and Wedderburn Airfields closure Holsworthy, Camden and Bankstown operations affected Major power lines	✓✗ Water catchment areas Wilton and Wedderburn Airfields closure Holsworthy, Camden and Bankstown operations affected

Source: WorleyParsons/AMPC and Airservices Australia.

There are two sites within the Cordeaux-Cataract locality capable of accommodating a Type 1 airport – Wilton and Wallandoola. Neither site is capacity constrained through interaction with Sydney (Kingsford-Smith) Airport. In the maximum Type 1 airport configuration, these sites were assessed as suitable with little differentiation between them in all aspects other than that:

- Wilton is close to the M5 freeway, although Wallandoola is located an equal distance between the M5 motorway and the M6 freeway;
- earthworks platform costs have been assessed to be higher at Wilton than at Wallandoola;
- rail access cost would be higher for Wallandoola than for Wilton;
- as with its Type 3 form, the maximum Type 1 airport site at Wilton has an overlap with a designated Mine Subsidence District; and
- there are major transmission lines to be relocated at Wilton, in addition to the need to close both the Wilton Parachute Centre and the Wedderburn Airfield.

The major point of differentiation, however, is in terms of N70 effects, with Wilton generating about a quarter of N70 person-events compared to Wallandoola, based on current population distributions and runway orientations. The suitability of Wilton as a maximum Type 1 airport site would be subject to further detailed checking on the occurrence and effects of mining.

Summary of progressive assessment of the more suitable sites by locality

Table 56 summarises the progressive assessment of the suitable Type 3 and maximum Type 1 airport sites and those sites which have been assessed to be more suitable than others in the same locality.

Table 56 Sites identified as more suitable by locality

	Central Coast	Hawkesbury	Nepean	Burragorang	Cordeaux-Cataract
Type 3 airport					
Suitable sites	Peats Ridge Somersby Wallarah	Wilberforce 09/27 Castlereagh (including RAAF)	Badgerys Creek Luddenham Kemps Creek Bringelly Greendale	The Oaks Silverdale Mowbray Park	Wilton Southend Wallandoola Dendrobium
Sites considered more suitable	Wallarah	Wilberforce 09/27[1]	Badgerys Creek Luddenham Bringelly Greendale	Silverdale (a) Mowbray Park (b)	Wilton Wallandoola
Key reason(s) for being considered more suitable	Airspace relationship to Sydney (Kingsford-Smith) Airport	Compatibility with RAAF Base Richmond	Ability to expand to Type 1 airport with parallel runways	(a) Least noise impact (b) Ability to expand to Type 1 airport with parallel runways	Ability to expand to Type 1 airport with parallel runways
Maximum Type 1 airport					
Suitable airport Sites	Somersby Wallarah	Wilberforce 01/19 with RAAF precinct on new airfield	Badgerys Creek Luddenham Bringelly Greendale	Mowbray Park	Wilton Wallandoola
Sites considered more suitable	Wallarah	Wilberforce 01/19 with RAAF precinct on new airfield	Badgerys Creek Luddenham Bringelly Greendale	Mowbray Park	Wilton
Key reason(s) for being considered more suitable	Airspace Relationship to Sydney (Kingsford-Smith) Airport	Only available suitable site for a maximum Type 1 airport with parallel runways	Differences may be able to be resolved through design refinements and/or identification of a site that comprises parts of some or all these sites	Only available suitable site for Type 1 airport with parallel runways	Much lower noise impact

Note: 1. Two Type 3 airports and one maximum Type 1 airport site were identified for the Hawkesbury locality. However, it should be noted that while not specifically analysed as a separate option for a Type 3 airport at Wilberforce, possible first stages to develop from a Type 3 to a Maximum airport could be a Type 3 Wilberforce runway with a 10/28 alignment (to be later used as a cross-runway). This alignment would have greater compatibility with RAAF Base Richmond, while the preferred 01/19 orientation would have greater compatibility with Sydney (Kingsford-Smith) Airport.
Source: WorleyParsons/AMPC.

Economic assessment of suitable sites

Drawing on the information collected on each site as described above, an economic appraisal was undertaken in a rapid (or high-level) CBA framework. Reflecting the challenges monetising some of the key aspects of an airport operation at the sites an analysis, featuring both quantitative and qualitative assessment, was undertaken.

As with the rapid CBA undertaken in Phase 3, the purpose of the appraisal undertaken of suitable sites was to provide a relative comparison between localities. Given the rapid nature of the economic appraisal, a RBCR of less than 1.0 is not considered to definitively suggest a site would be unviable; likewise a high RBCR was not considered to definitively suggest economic viability.

The methodology for the monetised analysis took account of the following costs and benefits.

Costs

- Capital cost of constructing a generic airport.
- Ongoing operation and maintenance of a generic airport.
- Renewal cost of generic airport.
- Land acquisition.
- Earthworks costs to develop a platform.
- Supporting infrastructure capital cost.
- Supporting infrastructure operation and maintenance.
- Supporting infrastructure renewal.

Benefits

- Value of aviation movements, including:
  - consumer surplus realised by Australian residents who will be able to fly if new capacity is added, but whose demand will be suppressed in the base case;
  - tourism spend of non-Australian residents who will otherwise not visit Australia; and
  - value of freight that is able to be transported to and from Sydney which will have otherwise not been transported.
- Reduction in aviation movement costs:
  - reduction in delay of passengers that would have flown in the base case;
  - reduction in delays to aircraft operators; and
  - reduction in the percentage of passengers that have to alter their preferred flight times due to supply constraints.
- Increased externality costs on the wider community and society:
  - additional landside transport costs (including congestion or delays on the land transport network, realised by additional passenger vehicle movements and additional freight vehicle movements that can now be accommodated);
  - environmental impact of additional flights; and
  - cost to mitigate noise impacts on local areas.

While generally the methodology and inputs applied in the economic appraisal were in line with those incorporated in the Phase 2 rapid CBA of localities, a greater level of detail was incorporated into some elements in order to assess the suitable sites. This included the application of specific land footprint sizes identified by WorleyParsons/AMPC for each suitable site in order to develop costs. In addition, some costs were developed specifically for the suitable sites; in particular, road and rail connecting infrastructure and earthworks. The benefit methodology applied was the same as that applied in Phase 2, though greater detail was incorporated on the inputs and assumptions used to estimate noise mitigation and land transport impacts.

The methodology for the qualitative assessment was the same as that used for the rapid CBA of localities, with a focus to enable comparison of the sites. The criteria used are listed below.

- **Strategic growth alignment:** considering site proximity to aviation capacity to NSW commercial growth centres.
- **Social and cultural:** assessing the potential impact on existing residents and other land users as a result of land acquisition.
- **Noise:** noise impacts on residents or sensitive uses.

Interpreting rapid appraisal results

Full service international airport (maximum Type 1 airport) sites

The rapid CBA assessed suitable sites identified as possible locations for maximum Type 1 airports. These are located within the five previously identified priority localities (Cordeaux-Cataract, Burragorang, Nepean, Hawkesbury and Central Coast). Table 57 summarises the RBCR and the Net Present Values (NPVs) derived from assessment of each of the suitable Type 1 airport sites (capable of accommodating parallel runways).

Table 57 Summary outcomes of quantitative analysis (Type 1)

Locality	Site	RBCR	NPV ($ billions)
Nepean	Luddenham	2.7	4.9
Nepean	Badgerys Creek	2.7	4.8
Nepean	Bringelly	2.6	4.9
Hawkesbury	Wilberforce	2.6	4.7
Nepean	Greendale	2.4	4.3
Central Coast	Somersby	2.0	3.3
Cordeaux-Cataract	Wilton	2.0	3.0
Burragorang	Mowbray Park	1.9	2.7
Cordeaux-Cataract	Wallandoola	1.9	2.8
Central Coast	Wallarah	1.6	1.5

Note: Based on unconstrained analysis, which assumed all sites can provide the same passenger access and capacity with no operating, planning or engineering restrictions. Results presented are discounted costs and benefits (seven per cent discount rate). To allow for comparison across sites on a like basis, land acquisition costs were included in the appraisal of Badgerys Creek so these results do not reflect that acquisition has already occurred. Results are in order of the RBCRs. In some instances NPV results do not result in the same ranking of sites.

Source: Ernst & Young.

This quantitative economic assessment shows that three of the four suitable sites in the Nepean locality have the highest RBCRs as well as the highest NPVs. These sites are Luddenham, Badgerys Creek and Bringelly.

The next best ranking site in the quantitative CBA was in the Hawkesbury locality, where the Wilberforce site had a higher RBCR and NPV than Greendale in the Nepean and sites in the other localities.

While Wilberforce performed well relative to other sites in terms of the strategic growth alignment criteria (which considers factors such as proximity to NSW commercial growth and commercial opportunities nearby), it was the lowest-ranking site against both the qualitative criteria considering noise impacts on residents and sensitive uses, as well as the social and cultural criteria considering potential impacts due to land acquisition.

The four Nepean sites, along with Wilberforce in the Hawkesbury, ranked higher than the other sites in terms of proximity of potential aviation capacity to NSW growth centres, one element of the qualitative assessment. However, these sites generally rated mid-range against the other qualitative criteria. It should be noted that no adjustment in the quantitative assessment was made for the fact that the land required at the Badgerys Creek site has already been acquired. Any such adjustment would increase the relative suitability of this site, compared to others assessed.

Following the four Nepean sites and Wilberforce, the next best ranking sites in the quantitative CBA were Somersby in the Central Coast locality, and Wilton in the Cordeaux-Cataract locality. While Wallarah and Wallandoola are in the same respective localities, both of these sites have lower RBCRs and NPVs. Somersby had a relatively mid-range ranking against the qualitative criteria, performing lower than Wilton in terms of the social and cultural and noise criteria. Wilton was the highest-ranking site for the qualitative CBA criteria related to noise impacts on residents, had a relatively mid-range ranking for the social and cultural criteria, but was the lowest-ranking site against the strategic growth alignment criteria.

Mowbray Park, as the only suitable site in the Burragorang locality, along with Wallandoola and Wallarah, were the lowest-ranked sites in terms of both RBCR and NPV. In terms of the qualitative criteria, Mowbray Park had a relatively mid-range ranking for the strategic growth alignment criteria but quite high ranking against the noise and social and cultural criteria. Wallandoola had similar qualitative rankings as Wilton but resulted in lower quantitative results due to the higher costs to connect supporting rail infrastructure and reduced benefits for potential airport users. Like Somersby, Wallarah had a relatively mid-range ranking against the qualitative criteria, though was highest ranking in terms of the social and cultural criteria. However, relative to Somersby it resulted in lower quantitative CBA results due to its more distant location.

Limited service RPT airport (Type 3) sites

The smaller land area required for a Type 3 airport relative to a Type 1 full service, parallel runway airport means there are more opportunities to locate such airports in the Sydney region. Table 58 summarises the RBCR and NPV for each of the suitable Type 3 airport sites resulting from the unconstrained quantitative assessment.

Table 58 Summary outcomes of quantitative analysis (Type 3)

Locality	Site	RBCR	NPV ($ billions)
Nepean	Kemps Creek	1.4	0.7
Nepean	Badgerys Creek	1.2	0.3
Hawkesbury	Wilberforce	1.2	0.3
Nepean	Luddenham	1.2	0.3
Nepean	Bringelly	1.1	0.2
Hawkesbury	Castlereagh	1.1	0.2
Cordeaux-Cataract	Southend	1.0	-0.1
Nepean	Greendale	1.0	-0.1
Central Coast	Somersby	0.9	-0.1
Burragorang	Silverdale	0.8	-0.4
Burragorang	The Oaks	0.7	-0.6
Cordeaux-Cataract	Wilton	0.7	-0.6
Cordeaux-Cataract	Wallandoola	0.7	-0.6
Cordeaux-Cataract	Dendrobium	0.7	-0.6
Central Coast	Peats Ridge	0.7	-0.7
Burragorang	Mowbray Park	0.6	-0.7
Central Coast	Wallarah	0.5	-0.8

Note: Based on unconstrained analysis, which assumed all sites can provide the same passenger access and capacity with no operating, planning or engineering restrictions. Results presented are discounted costs and benefits (seven per cent discount rate). To allow for comparison across sites on a like basis, land acquisition costs were included in the appraisal of Badgerys Creek so these results do not reflect that acquisition has already occurred. Results are in order of the RBCRs. In some instances NPV results do not result in the same ranking of sites.

Source: Ernst & Young.

As with the maximum Type 1 airport sites, the Type 3 sites in the Nepean locality were generally the highest ranking in terms of RBCR. However, the highest-ranking site of Kemps Creek does not have the potential for expansion beyond a Type 3 airport.

Sites in the Hawkesbury locality were the next highest rating in terms of the quantitative CBA results. Unlike Castlereagh, Wilberforce is the only site in this locality capable of further expansion.

In the Cordeaux-Cataract locality, Southend ranked much higher than Wilton, Wallandoola and Dendrobium. However, unlike the Wilton site, it is not capable of further expansion beyond a Type 3 airport.

In the Central Coast locality, the best site was Somersby.

The Silverdale and The Oaks sites in the Burragorang locality were better-ranked sites compared to Mowbray Park, though Mowbray Park is the only site capable of expansion to a maximum Type 1 airport.

8.8 The role and size of a new airport

CAPA Consulting analysis suggests that it is less likely a secondary facility would quickly become either a dedicated international gateway or a mixed long-haul-international/domestic airport because of the relatively high establishment costs for infrastructure (such as longer runways, more taxiways and complex terminals as well as Customs, Immigration and Quarantine, and security).

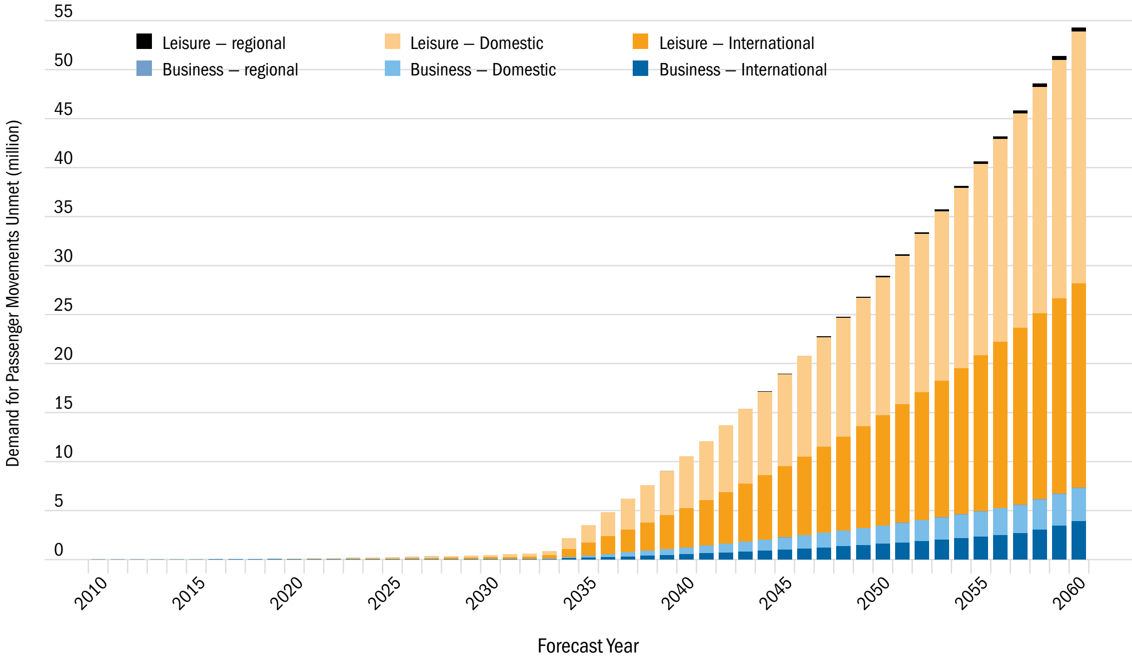
Initially, there may be potential for a relocation of some regional services to a secondary facility, assuming it is located within a reasonable distance of the Sydney CBD. However, the capping of charges imposed on regional operators at Sydney (Kingsford-Smith) Airport makes them relatively low (representing an estimated one per cent of a typical regional fare) and access to the primary gateway is assured with its advantages of convenience and a wide spread of onward linkages. It is not clear whether regional services would remain viable if relocated to a second airport with less efficient interlining, and lower access to the CBD. Importantly, regional airlines need to be able to offer interline services and network connections to meet regional market demand for on-carriage connections. Accordingly, they are unlikely to relocate to a secondary airport with limited connection options as this would mean a smaller number of connecting services compared with Sydney (Kingsford-Smith) Airport.

While freight is an intrinsic part of the demand served at Sydney (Kingsford-Smith) Airport, the airport's curfew creates impediments for night-time movements of freight due to restrictions on the size of aircraft operating during the curfew. Depending on the location, this suggests an opportunity exists for a 24-hour freight facility to be established at a secondary airport in the Sydney region. The development of warehousing districts and distribution bases for major companies in Western Sydney may provide support for such a facility, with potential to efficiently process and transfer goods from air to road transport. Curfew-free status will be critical to creating a freight airport. The issue of whether or not a curfew would be required at any new airport is a matter that would need to be explored at the stage of detailed environmental assessment.

In an Australian context, it may be more difficult to establish a freight-only airport (compared to what has occurred in the United States and Europe) due to the difference in overall freight volumes. As described in Part Three, approximately 70 to 80 per cent of freight is currently carried in the cargo hold of passenger RPT aircraft; the accessibility to a variety of connecting services options is key to this utilisation level.

Figure 140 presents a profile of unmet passenger demand, by purpose of travel. Leisure demand for both international and domestic travellers is estimated to comprise the most significant portion of unmet demand. Booz & Company suggests that as Sydney (Kingsford-Smith) Airport becomes increasingly constrained, it is likely to continue to service predominantly full service airlines and favour higher yielding passengers, resulting in the share of business traffic at the airport increasing relative to leisure.

Figure 140 **Sydney (Kingsford-Smith) Airport expected demand for passenger movements unmet by type and purpose of travel, 2010 to 2060**

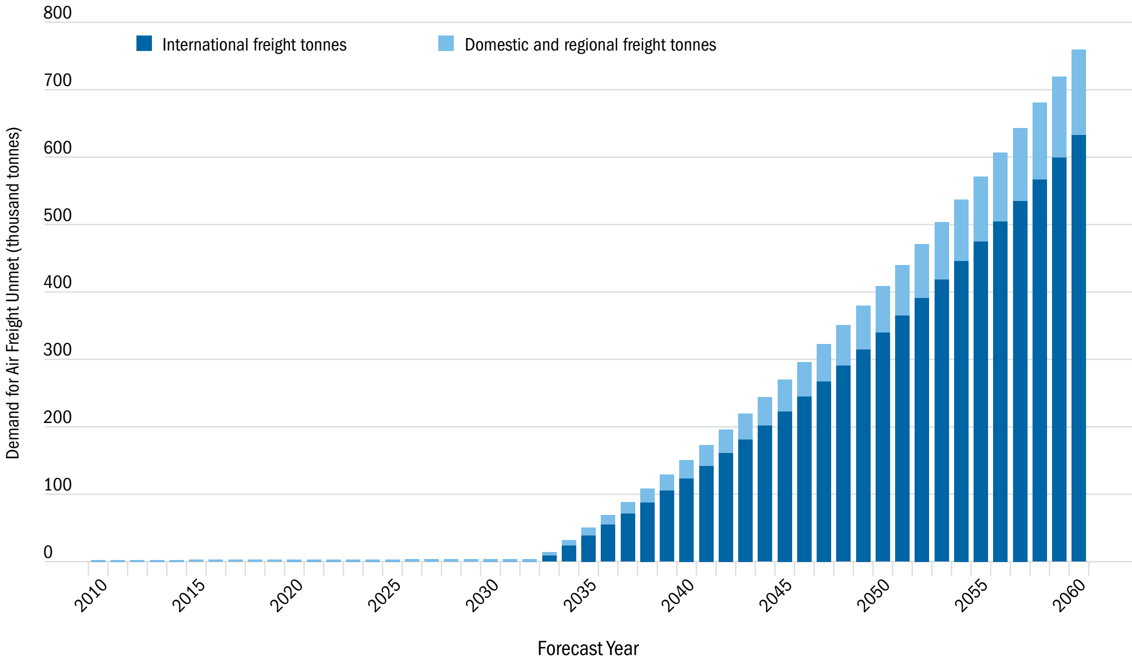


Note: Unmet demand was derived from analysis of the unconstrained demand discussed in Part Three, and assumptions about factors including aircraft upgauging, peak spreading, load factors and traveller share under a constrained scenario, as discussed in Part Four. Further detail is in Technical PaperA3.

Source: Booz & Company analysis.

Figure 141 presents estimates of the volume of air freight that may be unmet in the region over the period to 2060.

Figure 141 **Sydney (Kingsford-Smith) Airport expected demand for air freight unmet, 2010 to 2060**



Note: Unmet demand was derived from analysis of the unconstrained demand discussed in Part Three, and assumptions about factors including aircraft upgauging, peak spreading, load factors and traveller share under a constrained scenario, as discussed in Part Four. Further detail is in Technical Paper A3.

Source: Booz & Company analysis.

The unmet demand presented above (54 million passengers and around 760,000 tonnes of air freight) presents the potential demand a greenfield – in particular, a Type 1 airport – may service in the Sydney region.

Airservices Australia has suggested nominal runway capacity for various runway configurations, as presented in Table 59. This represents an estimated operational nominal capacity in good weather conditions in a mixed traffic environment. The figures will vary subject to local conditions; such variance would not be expected to exceed (+/-) 5 movements per hour. Further information on the nominal capacities is contained in Technical Paper B2.

Table 59 **Nominal runway capacity**

Nominal capacity	Single runway	Cross-runways	Parallel runways (VMC)
Arrivals	25	30	42
Departures	25	25	42
Total	50	55	84

Source: Airservices Australia.

WorleyParsons/AMPC have developed high level estimates of the number of aircraft movements and passengers per year by airport type. As it is considered that each of the shortlisted Type 3 limited service RPT airport sites could accommodate a single runway with 2,600-metre length and 45-metre width, WorleyParsons/AMPC estimated that each of them has the unconstrained, theoretical capacity to accommodate between 20 million and 35 million passengers, or around 240,000 aircraft movements, per year. For the sites considered suitable to locate a Type 1 airport, WorleyParsons/AMPC estimated potential unconstrained capacity of around 370,000 aircraft movements and between 40 and 70 million passengers per year, depending on runway length and layout.

As runway capacity will vary depending on factors, such as the runway layout and supporting taxiways, aircraft fleet mix, weather and airspace and air traffic control procedures, these are indicative runway capacities for planning purposes used in this Study.

Implications for capacity in the region

Development of a greenfield airport site could provide theoretical, unconstrained capacity for up to 70 million passengers and around 370,000 aircraft movements per year in the Sydney region, assisting with aviation capacity issues in the region.

However, the effectiveness of a greenfield airport to provide aviation capacity for the Sydney region will be driven by the level of demand that will take up the new capacity. Should the airline service offering and level of demand attracted to a Type 3 greenfield site reach, for example, 25 million passengers per year (similar to the level estimated by Booz & Company to be attracted to a single north-south runway developed at RAAF Base Richmond, as described in Part Six), it could delay capacity constraints in the region for up to 20 years. The capacity of a Type 1 greenfield site has the potential to accommodate a service offering of more significant passenger levels, and if airlines and passengers demand these services then constraints could be delayed for between 20 and 30 years. If induced demand in the area surrounding a greenfield site takes up some of the capacity, the timing of this impact could be reduced.

The sites enabling initial development as a limited service RPT airport, followed by expansion to a full service international airport (such as for all of the Type 1 sites), would allow for greatest flexibility to meet unmet demand. Booz & Company suggests that international passenger demand could comprise 20 to 30 per cent of total unmet demand at Sydney (Kingsford-Smith) Airport over the period to 2060, and this could not be accommodated at a Type 3 limited service RPT airport.

Provided the physical and airspace capacity of a greenfield airport site can cater for the level of associated aircraft movements, the level of unmet passenger movement demand at Sydney (Kingsford-Smith) Airport could support a progressive increase in the airline service offering to an airport for domestic, short-haul and long-haul international passengers and air freight.

This means that for better long-term flexibility, there is merit to preference Type 3 RPT sites that have scope to be later expanded, subject to airline demand, to a maximum Type 1 full service airport serving all RPT segments. In analysis, quantitative CBA results for the Type 3 airports were generally weaker, as patronage was assumed to be at a far smaller level than for the maximum Type 1 airport sites. However, a Type 3 airport is expected to have lower capital and other operating costs compared to a full service RPT airport, with a Type 3 airport generally costing 60 per cent to 70 per cent of a maximum Type 1 airport.

As identifying maximum Type 1 full service RPT airport capacity has more complexity and has larger economic importance, there appears merit in focusing on resolving the full implications of locating this airport type first. Following this outcome, there may be a need to examine future sites for capacity requiring a limited service Type 3 RPT airport or minimum service Type 4 GA and limited RPT aerodrome. It will be important to locate these facilities in areas that do not create airspace management issues with the aviation network at that time.

8.9 Timing for a greenfield airport

There are already capacity issues for RPT demand to access Sydney (Kingsford-Smith) Airport in peak periods. By around 2027, it is estimated that slot allocation will have reached capacity, and by 2033 growth in movements is expected to cease under current policy settings. However, a second airport will require many years of development and construction and, in order to relieve capacity issues in the Sydney region, may require early commencement of the development phase.

Development timing

The development stage for an airport is considered to be from the initial announcement to the start of construction. During this period all environmental investigations, consultation, planning approvals and preliminary design is assumed to be undertaken. The duration of this period would be dependent on a number of variables, including the airport type and size, location of the site and proximity to exiting communities, and the existing use of the site.

Reflecting the potential variability, Table 60 presents a range of possible durations. These durations are considered to be consistent regardless of whether the airport type is a Type 1 full service airport serving all RPT segments or a Type 3 limited service RPT airport.

Table 60 Indicative airport development timing

Stage	Example timeline (15th percentile)	Example timeline (85th percentile)
Site location study and confirmation	2 years	2 years
Draft environmental impact statement	2 years	3 years
Public consultation	Included in environmental impact statement	2 years
Final environmental impact statement	1 year	1 year
Planning application and rezoning	1 year	2 years
Preliminary design	Included in environmental impact statement/planning	2 years
Total duration	6 years	12 years

Source: Ernst & Young analysis

Construction timing

Considering construction cost estimates to develop a generic full service international airport and a generic limited service RPT airport, Airbiz suggests the following construction periods:

- **Type 1:** assuming all site acquisition, clearing and levelling, and project definition and all pre-approval processes have been completed, an indicative time frame for detailed design, construction and commissioning is a minimum of five years.
- **Type 3:** assuming all site acquisition, clearing and levelling, and project definition and all pre-approval processes have been completed, an indicative time frame for detailed design, construction and commissioning is a minimum of three years. The reduced time frame compared to the full service international airport is based on a smaller scale scope, hence reduced complexity in design, construction and commissioning.

The time it takes to undertake earthworks depends on the area and topography of the land. However, broadly, a full service international airport may require four years of site preparation and levelling, and the limited service RPT may require two years.

Development and construction of supporting infrastructure such as road and rail connections would also involve time prior to operation of the airport, which would likely need to be undertaken concurrently with airport development and construction. Ernst & Young estimated up to four years may be required to undertake supporting infrastructure developments.

Implication on timing of need for a greenfield airport

A new airport facility will need to be opened some time before capacity is reached at Sydney (Kingsford-Smith) Airport, to enable a ramp-up in the airline service offering and attraction of demand in order to ensure the second airport's contribution is noticeable in the region. There are already capacity issues being experienced in peak periods at Sydney (Kingsford Smith) Airport. Around 2027, the airport will reach capacity in terms of the number of additional slots that can be allocated, and around 2033 it will reach capacity in terms of the growth of additional aircraft movements.

However, as described above, development and construction of a second airport could require:

- Type 1: development period of six to 12 years, around four years to undertake site preparation and levelling, and a construction period of around five years (a total of 15 to 21 years); and
- Type 3: development period of six to 12 years, around two years to undertaken site preparation and levelling, and a construction period of around three years (a total of 11 to 17 years).

There will be a need to commence the development phase for a greenfield site almost immediately.

8.10 Indicative costs to develop a greenfield site

The development of an airport in a greenfield location requires the:

- construction of the airport infrastructure itself;
- purchase of land;
- excavation and remediation of the land so that it is able to accommodate an airport; and
- construction of supporting infrastructure such as surface transport and water/wastewater connections.

To efficiently run and operate an airport, the site would need to be connected to a range of infrastructure networks and services (such as transport, water and power). Furthermore, the existing infrastructure networks and services may need to be upgraded if the additional demand from airport users and employees requires additional network capability/capacity (for example, the power network needs upgrading to accommodate the increased demand from the airport).

Some capital expenditure will be relatively similar for a generic type of airport, and some will be site specific. In the Ernst & Young report which is Technical Paper C14, it has estimated indicative capital cost estimates required to develop generic airport types in Australia. These have been supplemented by high-level, desktop-based estimates of the scale and nature of the generic airport types and some site-specific elements, developed by WorleyParsons/AMPC.

The cost estimates are of a high-level, strategic nature, based on a benchmarking process using relevant airports for defined airport types, and they are not based on detailed design. As the costs relate to indicative developments and site locations likely to be refined in an Environmental Impact Statement process, they are by nature more preliminary than costs developed for this Study relating to existing aerodromes.

Generic airport construction costs

Estimates of costs to construct a generic greenfield airport, regardless of location, are presented in Table 61.

Table 61 Indicative generic airport capital costs ($ millions)

Cost category	Type 1 airport	Type 3 airport
Runways/taxiways	551.0	84.0
Apron surfaces	274.1	130.6
Car parking	201.6	48.0
Landing aids/lighting	84.1	21.1
Terminal international	1,811.6	0.0
Terminal domestic	583.2	852.2
Other capital costs	27.5	13.2
Contingency	1,059.9	344.7
Project management and design	706.6	229.8
Total	5,299.7	1,723.6

Note: Risk and contingency costs have been estimated at 50 per cent of total development costs.

Source: Ernst & Young, based on Airbiz and Arup analysis.

Site-specific construction costs

Site-specific costs include:

- land acquisition;
- land remediation/excavation; and
- construction of associated infrastructure necessary to support the operations of an airport.

Land acquisition

One of the first costs of developing an airport is the costs associated with the acquisition of land. WorleyParsons/AMPC analysis of suitable sites indicates that a full service Type 1 international airport at the sites identified may require between 1,300 and 2,200 hectares of land depending on an individual site characteristics such as topography, and also the number of runways. A limited service Type 3 RPT airport at the suitable sites identified and assessed could require between 680 and 1,150 hectares.

For the five shortlisted localities in which suitable sites have been identified, historical sales data suggests there are a range of land values, with Ernst & Young analysis suggesting it could range from between $40,000 to $70,000 per hectare in the Central Coast, Nepean and Cordeaux-Cataract localities, to between $140,000 to $215,000 per hectare in the Hawkesbury and Burragorang localities identified.

With the addition of a 25 per cent factor to take into account risk and contingency, indicative land acquisition costs for a representative full service international airport site could range from $70 million to $600 million, and for a limited service RPT airport site could range from $30 million to $350 million.

Earthworks for site preparation

Any greenfield airport site will require cut and fill earthworks to suitably level or grade the land for use as an airport. The cost and hence volume of earthworks provides a threshold for comparison. This is a cost that can vary significantly by site dependent on topography.

WorleyParsons/AMPC indicative estimates of the amount of earthworks needed to create a platform, or area of land, to configure airport infrastructure at the suitable sites in the Sydney region suggests:

- indicative earthworks costs for a full service (Type 1) international airport that can accommodate parallel runways and potentially also a cross-runway at one of the suitable sites are estimated to range from $280 million to $810 million;
- indicative earthworks costs for a limited service (Type 3) RPT airport site could range from $100 million to $510 million.

Earthworks costs to prepare sites for airport infrastructure will vary significantly by site, owing to the unlevel nature of the land. For example, land preparation costs for the development at a location such as Wilton could range from $350 million for Type 3 development to $810 million for the Type 1 site preparation. In contrast, earthworks costs at a site such as Wallarah could range from $180 million for a Type 3 airport to $280 million for Type 1 earthworks.

With the addition of a 50 per cent allowance of total costs to consider risk, contingency and management costs, the indicative earthworks cost estimates total $420 million to $1,210 million for a Type 1 airport, and $140 million to $760 million for a Type 3 airport.

Construction of associated infrastructure necessary to support the operations of an airport

A range of other infrastructure will have to be constructed and connected to the existing infrastructure networks to support an operational airport.

Road and rail

WorleyParsons/AMPC prepared indicative estimates of the level of investment in road and rail infrastructure to connect the more suitable sites to existing rail links and existing state roads/highways. These are preliminary estimates based on a consideration of the number of kilometres between the site and existing surface transport. The estimates assume that a rail service to support an airport will only be developed in the case of a full service international airport.

This cost analysis suggests:

- indicative road infrastructure costs to connect a full service (Type 1) international airport at one of the suitable sites to existing state roads/highways are estimated to range from $80 million to $455 million;
- indicative rail infrastructure costs for a Type 1 airport are estimated to range from $440 million to $1,290 million; and
- indicative road infrastructure costs for a limited service (Type 3) RPT airport site could range from $80 million to $460 million.

Given the distances to existing infrastructure, the surface transport connection costs were estimated to be highest for sites located in Cordeaux-Cataract, such as Wilton and Wallandoola, and lowest for sites located in the Central Coast, such as Wallarah and Somersby.

With the inclusion of a 50 per cent allowance of total costs to consider risk, contingency and management costs, the indicative road and rail connection cost estimates are $770 million to $2.6 billion for a Type 1 airport. For a Type 3 airport, the indicative road connection costs with this level of risk allowance incorporated are $110 million to $680 million.

Other supporting infrastructure costs

Arup developed indicative costs for other supporting infrastructure required to develop a Type 1 or Type 3 airport in each shortlisted locality, which included estimates for the following:

- water;
- wastewater;
- power;
- communications;
- gas; and
- fuel (bulk supply and storage of aviation fuel to the airport).

These estimates for the five shortlisted localities suggest:

- indicative utilities and fuel infrastructure costs for a full service (Type 1) international airport at one of the suitable sites are estimated to range from $560 million to $660 million; and
- indicative utilities and fuel infrastructure costs for a limited service (Type 3) RPT airport site could range from $140 million to $180 million.

With the addition of a 50 per cent allowance of total costs to consider risk, contingency and management costs, these supporting infrastructure cost estimates total $840 million to $980 million for a Type 1 airport and $220 million to $270 million for a Type 3 airport.

Greenfield airport construction cost elements

Considering the cost elements above, the development of an airport in a greenfield location could require the following levels of upfront investment.

Construction of the airport infrastructure itself could require investment of around $5.3 billion for a full service international airport and $1.7 billion for a limited service RPT airport.

Indicative land acquisition costs for a representative full service international airport site could range from $70 million to $600 million, and for a limited service RPT airport site could range from $30 million to $350 million.

Earthworks costs to prepare land to accommodate an airport could require costs of $420 million to $1.2 billion for a representative full service international airport, and $140 million to $760 million for a limited service RPT airport.

Construction of surface transport infrastructure to connect sites to the existing road and rail network could require investment of $770 million to $2.6 billion for development of both road and rail connections for a Type 1 airport, and $110 million to $680 million for road connections for a Type 3 airport site.

Investment in other supporting infrastructure, including bulk supply and storage of aviation fuel to the airport, and utilities such as water, wastewater, power, communications and gas, could involve investment of $840 million to $980 million for a full service international airport and $220 million to $270 million for a limited service RPT airport.

This suggests investment ranging from $7 billion to $11 billion for a Type 1 full service international airport and $2 billion to $4 billion for a Type 3 limited service RPT airport. These are high-level, indicative costs not based on detailed design. Excluding allowances for project management, design, contingencies and risks, the development cost estimates range from $5 billion to $7 billion for a Type 1 airport and $1 billion to $3 billion for a Type 3 airport.