Joint Study on aviation capacity in the Sydney region

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REPORT TO

Australian Government

NSW GOVERNMENT

Airline-related cost and revenue issues at primary and non-primary airports

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Overview of Study

CAPA Consulting's report considers issues impacting on airline decision-making in regard to the usage of primary or non-primary airports, including relocation and duplication costs, market, operational and competitive advantages, and service pricing.

The report is structured as follows:

- *Section 1* reviews the pressure points confronting airlines, including the long-term economic outlook, recent financial performance, rising fuel prices and operational costs and the impact of low-cost competition.
- *Section 2* examines the major determinants for airport usage ranked in order of importance. This includes a definition of what constitutes a viable market from an airline perspective.
- *Section 3* provides an analysis of operational and cost issues associated with the duplication of facilities within a multi-airport environment for the various types of carrier (full service, Low Cost Carriers (LCCs) and freight operators);
- *Section 4* assesses market, competitive and strategic benefits and revenue implications derived from non-primary airport usage (including effects on market positioning, scheduled and aircraft utilisation and service development);
- *Section 5* considers barriers to service development at non-primary airport facilities; and
- *Section 6* considers the relevance of the issues raised in preceding sections for the Sydney Aviation region.

CAPA Consulting has relied on a combination of background research, case studies assembled from available information and input from its consultant team in compiling this report.

Key Issues Affecting Airport Usage

The medium term market environment for airlines globally is characterised by volatile economic and financial conditions with pressure from rising fuel prices impacting on financial performance. In these conditions, many operators, including Qantas and Virgin Australia, are revisiting their business models and restructuring operations to become more cost competitive.

The evolution of airline structures, coupled with the growth in Low Cost Carriers (LCCs) and alliances, are influencing the manner in which airports are served and whether primary or non-primary airports are preferred.

In considering the cost and revenue drivers of airport usage, the study examined the requirements of four categories of carrier: (1) Full Service (legacy operators); (2) Low

Cost Carriers (LCCs); (3) "Hybrid" LCCs (with some legacy characteristics); and (4) freight airlines.

The consultants noted that the line between these carrier types has become increasingly blurred and new models are emerging. These include:

- Convergence between full service and legacy carriers, with some LCCs adopting legacy characteristics (e.g. "hybrids" with premium products), such as Virgin Australia and Jetstar International. Virgin is transitioning towards a fully service product base, albeit with an LCC cost structure;
- Introduction of long-haul LCCs on intercontinental routes which traditionally were the domain of full service carriers (e.g. AirAsia X, Jetstar and Singapore Airlines' proposed new long-haul LCC);
- Establishment by legacy airlines of multiple product structures through LCC subsidiaries and/or joint ventures (e.g. Qantas/Jetstar, Singapore Airlines/Tiger Airways); and
- Development of offshore base and operations which locate services within key growth markets (e.g. Qantas plans for a premium carrier in Southeast Asia, Jetstar's establishment of joint ventures in Japan and Vietnam).

All of 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 usage of a primary or non-primary airport is becoming less clearly defined. LCCs and legacy carriers alike now often operate out of either airport type depending on the market requirements and level of incentives offered.

Airlines deploy capacity to airports based on a wide range of criteria. The criteria vary but decisions are largely based on rational strategic, commercial and operational objectives:

- Alignment with business case objectives;
- Proximity to markets and size and nature of market catchment;
- Operational efficiency (i.e. access to 24-hour operations);
- Connectivity/distribution capability;
- Level of competition and type;
- Access (i.e. availability of slots) and cost;
- Alliance commitments; and
- Strategic benefits.

Primary airports retain a strong hold on airlines with their convenient locations and a range of inhibitors, including network connectivity requirements and alliance obligations.

Non-primary airports are most appealing to operators when:

- The related primary airport is congested;
- Airlines see a strategic and/or market development opportunity; and
- The airport is marketed aggressively and offers highly attractive incentives.

The relative importance of these issues differs between basic LCCs (which focus on incentives and access/utilisation issues); hybrid LCCs (more dependent on higher yield markets and relationship structures); and legacy airlines (which require network connectivity and are bound by alliances).

Non-primary airport operations present an opportunity for LCCs to secure competitive advantage and enhance growth prospects by brand positioning, particularly as first movers to the airport; greater operational productivity; enhancing linkages to target markets; and providing access to low-cost, efficient infrastructure.

Market viability is determined by a complex mix of issues. Among these are the balance of outbound and inbound traffic; extent of catchment overlap; general market growth prospects; the passenger and freight mix; and availability of ground transport.

Cost and Revenue Factors

Airlines face high establishment costs at an airport. As such, there are a number of benefits for a carrier 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 are either 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.

From an airline perspective, the development of non-primary airports is limited by a range of structural and market impediments including: poor locations and/or transport linkages; the hub-and-spoke/network connectivity model operated by legacy carriers; alliance relationships; airline investment in infrastructure at primary airports; and "fortressing" strategies by dominant airlines.

However, there are some benefits from using non-primary airports:

- Airlines generally can achieve direct savings through lower airport charges;
- Where the primary airport suffers from a high degree of operational inefficiency, for example relating to airport congestion, it is possible that more effective and

cost-efficient labour at the non-primary airport will improve the airline's overall average labour productivity and cost;

- From a revenue perspective, non-primary airports can enable airlines to establish dominant or even monopoly access to facilities within a market. This can confer both strategic and competitive benefits;
- Non-primary airport provide for a bifurcation of brands within airline groupings (e.g. Qantas/Jetstar), with opportunities to outsource support services such as ground handling which may not have been possible at a primary airport; and
- Use of these airports can give rise to opportunities for airlines to target and establish sub-sets of markets or niche markets.

The consequent revenue (and cost) benefits can be significant through the optimisation of returns on capital assets to opportunities for strategic pricing and niche market development.

Full service carriers tend to concentrate services and capacity at primary airports rather than divide operations between multiple airports within a catchment. This avoids a fragmentation of frequencies and ensures a high level of passenger convenience.

The option of relocating some services to a less congested access point to accommodate market growth may be more attractive once these carriers reach a critical mass and it becomes difficult to further expand services.

Established operators can achieve stronger yield and revenue returns through consolidation of services at one airport. This also offers efficiencies of scale and a hub "premium". As such, they are more likely to focus on building market share at a primary airport.

New entrant LCCs, by contrast, are more likely to migrate to non-primary rather than primary airports due to their two key priorities: (1) a need to secure the lowest cost option within a market; and (2) gain unconstrained access.

Air freight generally operates most effectively and efficiently in a mixed environment at major hubs with interconnecting services.

1. The Challenges Confronting the Airline Industry

This section examines the underlying economic and market issues and longer term trends which impact on the cost and revenue performance of airlines. This provides an environmental context for the subsequent analysis and consideration of airline-related factors affecting airport usage.

The pressure points covered include:

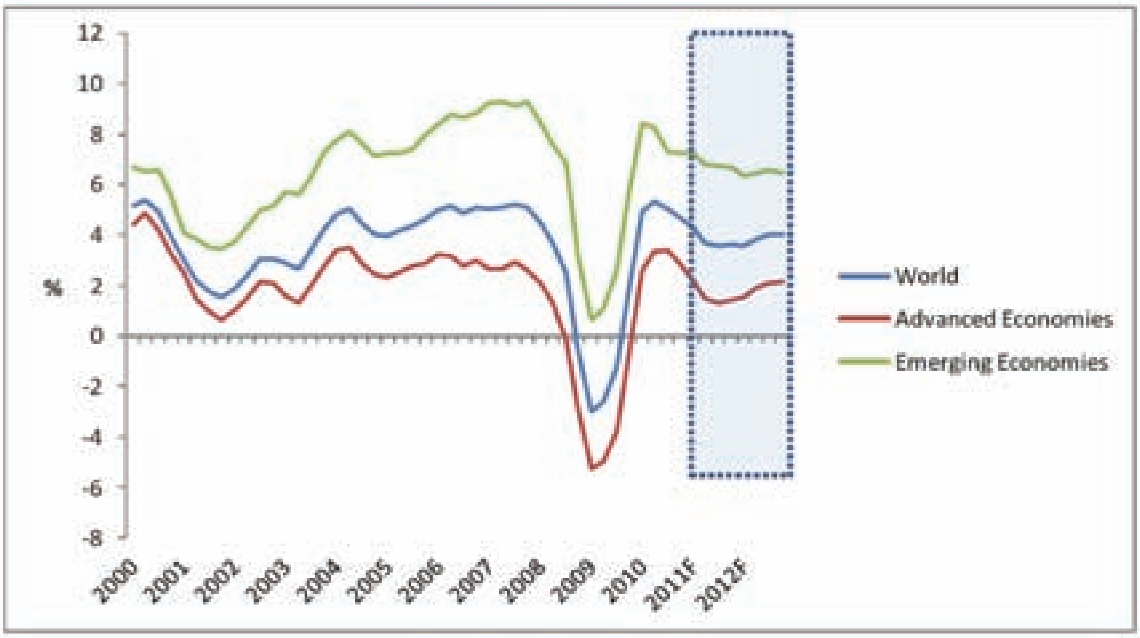
- The global and regional GDP growth outlook;
- Industry financial performance and medium-term prospects;
- The effects of rising fuel prices, particularly on international service structures; and
- Restructuring to strengthen competitiveness and lower overheads.

1.1 Economic Outlook

The combination of continuing weakness in the US economy and the debt crises in parts of Europe is expected to see relatively slow and volatile growth in world GDP for the next two years.

According to the IMF's World Economic Outlook for September 2011, advanced economies are expected to grow by 1.6% in 2011 (well short of forecast global growth of 4%), and 1.9% in 2012. The IMF anticipates that the US economy will slow to 1.5% this year, half the rate of 2010.

Figure 1.1: Real GDP by Quarter, 2000-2012F



Source: International Monetary Fund, World Economic Outlook, September 2011

Figure 1.1 shows real GDP growth rates mapped by quarter between 2000 and the 2011, 2012 forecasts. This shows a recent deterioration in economic conditions across the advanced and emerging economies following the rebound from the Global Financial Crisis in 2010.

While the more developed US and European markets remain soft, Asia will continue to dominate growth and economic activity. The IMF envisaged that:

- China would experience a modest slowdown to 9.5% in 2011 and 9.0% in 2012, after double-digit growth for most of the past decade;
- Japan's economy would contract by 0.5% in 2011, slightly less than the 0.7% forecast by the IMF in June, with a return to positive growth of 2.3% in 2012;
- Southeast Asia would maintain solid growth rates of 5.3% across its five biggest developing economies this year, rising to 5.6% in 2012. While still healthy, this is much slower than the 6.9% seen in 2010 as a consequence of easing exports. However, domestic demand is expected to remain robust for Indonesia, Thailand, Malaysia, the Philippines and Vietnam.
- Singapore was forecast to grow 5.3% in 2011 and 4.3% in 2012, down sharply from its 14.5% growth in 2010.

The IMF predicted Australia's economy would slow to 1.8% in 2011 from the previously forecast 3%. This represents a slight downgrade from the 2.25% growth anticipated in the Federal Budget.

However, the IMF expects stronger growth for Australia in 2012 and 2013 of 3.3% and 3.4% respectively supported by Asia.

The two-speed development of the US and European markets on one hand and those in Asia on the other will see changes in how these markets are served, with a migration towards areas of higher growth in passenger and freight.

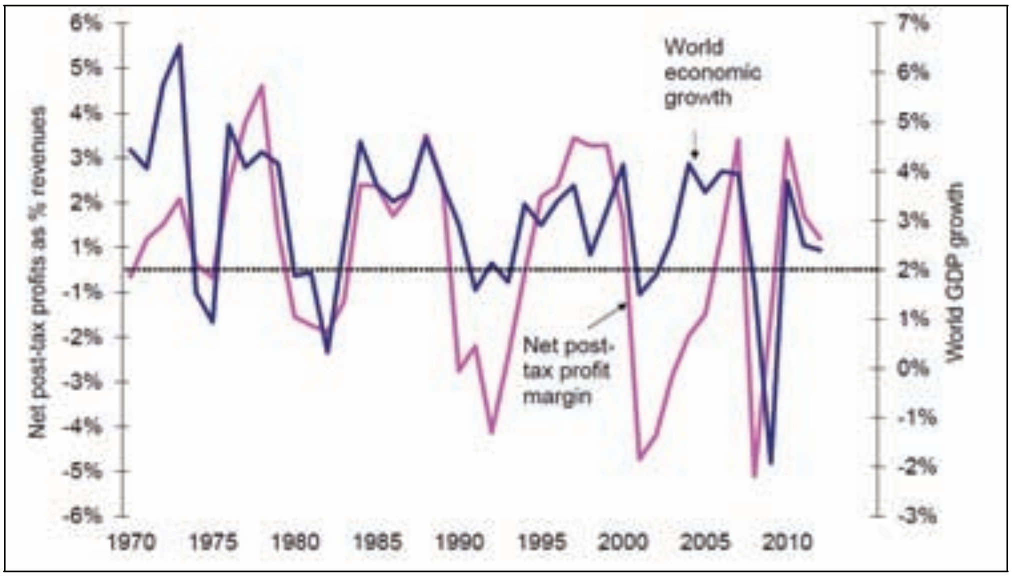
A clear example of this is the recent move by Qantas to withdraw from services to Europe from Hong Kong and Bangkok, and instead use its partner British Airways to operate the European leg of the "kangaroo route" service from these cities. This will enable Qantas to concentrate on building capacity into the Asian market which offers much stronger returns.

Similarly, Qantas has established a joint services relationship with American Airlines to strengthen its Trans-Pacific services, open up a new US hub in Dallas/Fort Worth and extend its reach in the North and South American markets.

1.2 Airline Financial Performance

Airlines are highly sensitive to movements in GDP, as shown in **Figure 1.2** which charts net profit margins against global economic growth between 1970 and 2011.

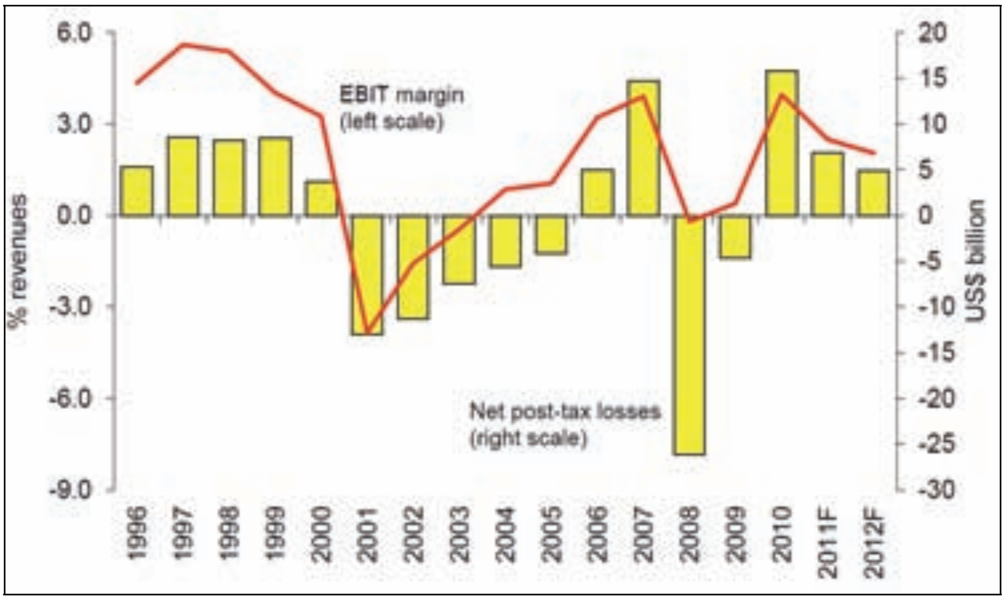
Figure 1.2: World Economic Growth & Airline Profit Margins



Source: International Civil Aviation Organisation, International Air Transport Association, Economist Intelligence Unit

The International Air Transport Association (IATA) expects margins to fall from 4% in 2010 to 2.5% in 2011 and 2% in 2012 in concert with the world economy. Airline returns in the Asia Pacific will be a little better than that at 2.9% and 2.8% for the same two years. Historically, the commercial industry as a whole has experienced losses if global economic growth slows below 2%.

Figure 1.3: Global Commercial Airline Profitability



Source: IATA

In its September Industry Financial Forecast, IATA anticipates a US$6.9 billion profit for the world's commercial airlines in 2011, less than half of the US$15.8 billion achieved in 2010. This will be followed by a weaker US$4.9 billion profit in 2012 (**Figure 1.3**).

The Asia Pacific will be the strongest performer with net earnings of US$2.5 billion in 2011 (36% of the global total) and US$2.3 billion in 2012. North America and Europe are expected to achieve profits of US$1.5 billion and US$1.4 billion this year, reducing to US$1.2 billion and US$0.3 billion in 2012 as the industry responds to the volatile conditions in these regions.

In Australia, Qantas Group achieved an underlying pre-tax profit[1] of A$552 million despite losses of $200 million in the international operation. While international yields grew by 8%, the airline's overseas services were impacted by natural disasters in Japan, New Zealand and Chile and the grounding of the A380s following an engine failure.

Qantas subsequently announced a major restructure of its international services which is discussed in greater detail later in this report. As noted, the over-riding aim is to reduce its exposure to poorly performing long-haul sectors (especially in Europe), lower operating costs and access revenue opportunities in Asia by establishing more offshore ventures. Under this strategy, the group will be investing $5 billion in the next few years.

Virgin Australia recorded a group loss before interest and tax of A$18.4 million in FY11, due largely to the one-off effects of the Queensland floods, Christchurch earthquakes and the volcanic ash cloud. While international operations remained profitable, the domestic segment lost A$40.8 million, reflecting both the natural disasters and impact of pricing competition from Tiger Airways and Jetstar.

Like Qantas, Virgin has also embarked on significant changes from its previously traditional LCC role with the development of wide-ranging international alliances with Etihad Airways, Air New Zealand, Singapore Airlines and Delta Air Lines. The implications of these changes are also examined elsewhere in the report.

According to IATA, 2012 will be a year of sluggish growth and weak profitability for the airlines. The airlines require strong economic growth to offset the impact of escalating fuel prices, in particular. IATA expects traffic growth of 4.5% in 2012, similar to 2011 but well below the 10.4% growth achieved in 2010.

Capacity has expanded at a faster rate than demand over the past 12 months (6-7%), especially in the freight market which has stagnated.

[1] The underlying profit reported by Qantas refers to a financial measure adopted by management and the board to assess performance. Qantas Group's statutory after tax profit for FY11 was $249 million.

1.3 Aviation Fuel Costs

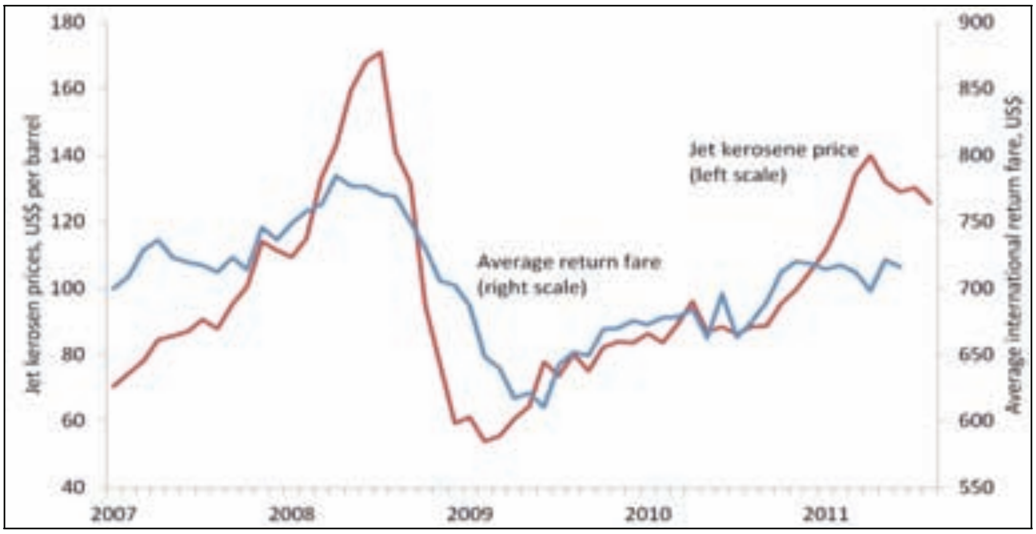
Fuel represents a substantial (and growing) proportion of airline operating costs. The sharp increases experienced recently heavily influenced the strategic approach to route development, particularly on long-haul routes, by:

- deterring or limiting expansion, especially on marginal intercontinental routes with already significant yield pressures through competition;
- encouraging greater use of alliances with connecting services, as opposed to own-operated services, to reduce the fuel-related risk exposure and cost; and
- accelerating the introduction of more economic aircraft types and retirement of older aircraft.

Fuel expenses historically have been manageable and relatively constant, ranging between 10% and 15% of airline operating costs. Since 2003 this ratio has more than doubled as the average price of jet fuel per barrel rose to a peak of US$180 in 2008. When based on a sample of 45 major global passenger airlines, fuel represented about 32.3% of the total operating cost[2]. Fuel was the second largest cost item for Qantas in FY11, accounting for 25% of its total expenditure.

As of October 2011, the jet fuel price was sitting at US$122 per barrel – 28% more than a year earlier – with premiums (the refining margin or spread between crude oil and jet fuel) reaching the highest level since 2008. This was slightly down on the previous month, but most airlines have responded to the increase over the past 12 months by reintroducing ticket surcharges and revising hedging programs.

Figure 1.4: Aviation Fuel Price Trends vs Average Return Airfare for International Airlines, US$



Source: International Air Transport Association (IATA)

[2] International Air Transport Association, Economic Analysis.

Figure 1.4 shows recent trends in aviation fuel prices compared with average international airfares. Average fares are still well below 2008 levels, indicating the effects of increasing competition on international sectors.

The rise in jet fuel prices and a widening in the refinery margin between crude oil and jet fuel, due largely to capacity constraints at refineries, added an extra US$34.5 billion to the industry's fuel costs in 2008. This margin narrowed in 2009 due to an easing of these constraints.

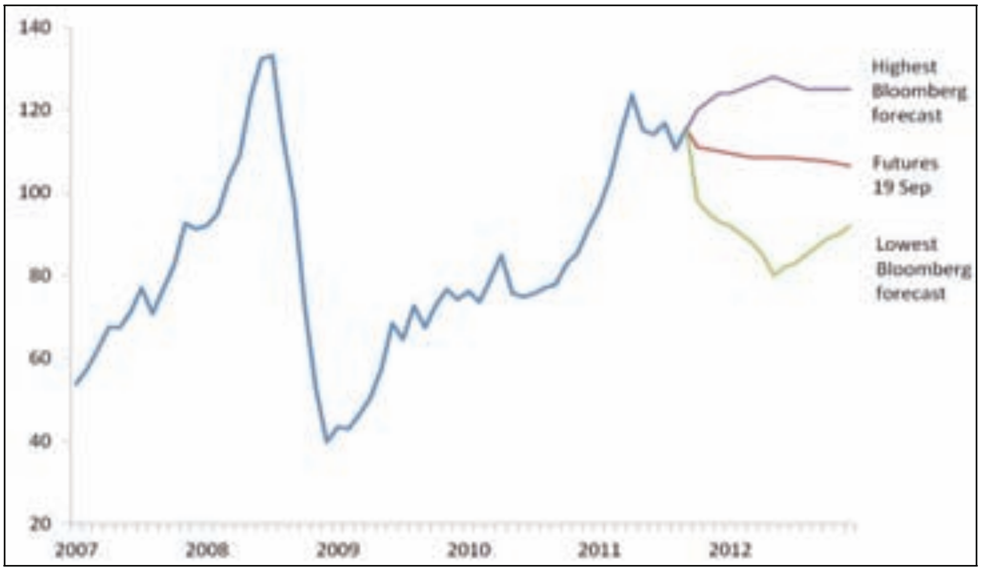
While the increase in cost and flow on effects has been a major problem for airlines, it is the price volatility that makes jet fuel such a critical issue in the airline business mix.

Asia Pacific carriers were the worst affected in a relative sense, with fuel prices rising to an average 37% of costs from 15% in 2001, due to the fact that their overall costs were much lower than North America and European operators.

This underlines the disproportionate impact that fuel prices can have on the region's airlines, despite active hedging programs. The LCCs were even more severely affected by increasing fuel prices, with fuel costs rising to 50%-60% of their total operating costs.

Figure 1.5 shows the upward trend in crude oil prices which had gathered pace in recent months due to northern winter demand and Middle East instability. These trends closely match those for aviation fuel. Forecasts beyond 2012 underline the volatile nature of fuel with Bloomberg's worst case scenario seeing a return to the peaks of 2008.

Figure 1.5: Brent Crude Oil Price & Forecasts, US$



Source: IATA, Financial Presentation, September 2011

The development of cheaper biofuels is expected to have a limited effect on aviation over the next 10 years.

The CSIRO's recent report, *Sustainable Aviation Fuel Road Map*, indicates a more likely scenario is that Australian and New Zealand airlines will source 5% of their jet fuel requirements from bio-stock by 2020, rising to 40% by 2050.

However, rising carbon-based jet fuel prices and demands for a reduced carbon footprint by regulators could well accelerate usage by airlines of biofuels as they become more widely available.

1.4 The Industry Response: Airline Restructuring & Alliances

Airlines have responded in different ways to the financial pressures imposed by the uncertain economic and market conditions and emerging opportunities, particularly in the high growth markets of Asia.

In the US, there has been a long overdue consolidation of operators, with the mergers of United Airlines and Continental Airlines, Delta Air Lines-Northwest Airlines, US Airways-America West and Southwest Airlines-AirTran. US Airways is also reportedly considering an alliance with American Airlines.

This has seen a rationalisation of services at hubs across the US. Daily flights at Cincinnati/Northern Kentucky Airport, for example, reduced from 323 to 200 as Delta relocated many of its operations to Detroit through its partnership with Northwest. The airport has also lost all but one of its four transAtlantic services. As a consequence of these changes, annual passenger numbers at the airport declined from 13.6 million in 2008 to 7.9 million in 2010. Operations at Lambert-St Louis International Airport more than halved following the acquisition of TWA by American in 2001.

Europe went through a similar process some years earlier with Air France-KLM buying into Alitalia, Lufthansa-SWISS-Austrian Airlines and British Airways-Iberia. The EU's LCCs were also active with Air Berlin acquiring three carriers and merging with TUIfly. In most cases, the moves were prompted by a need to improve costs and become more competitive through operational synergies.

Airline mergers have been rare in the Asian region, with the exception of China where the major carriers have amalgamated with regional operators and Cathay Pacific acquired Dragonair (with Air China securing a shareholding in Cathay).

Regionally, there has been an accelerated migration to global and regional alliances and a drive by some operators to establish operational bases outside their home markets through joint ventures.

Alliance structures enhance market penetration and diversity and often enable airlines to maintain profitable off-line linkages, thereby avoiding requirements to commit aircraft and capacity to particular routes.

As such, alliances offer an economic solution to network development which generates revenue at marginal cost.

While co-operative arrangements are subject to oversight by competition regulators, codesharing and interline connections are generally compatible with international Air Services Agreements as they deliver mutual benefits for both marketing and operating carriers.

In the medium and longer terms, the scope and value of commercial linkages between airlines will continue to develop and may even accelerate as jet fuel prices escalate and competition intensifies.

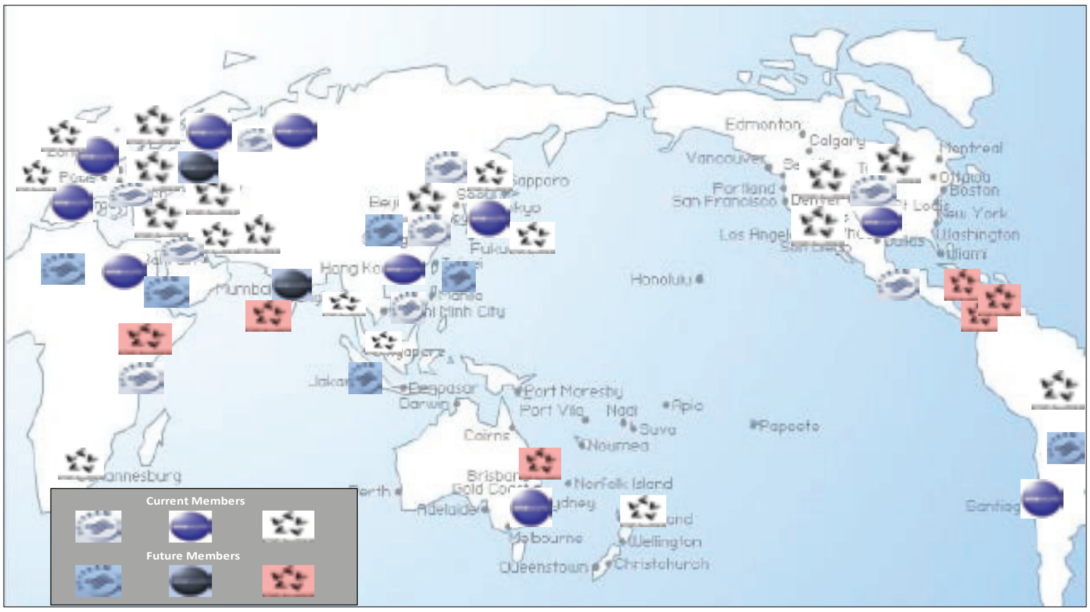
These traditionally have been the domain of full service operators, however increasing numbers of LCCs are expected to join alliances as their operating, product and distribution models become more complex.

Virgin Australia, for example, may join the Star Alliance in future (aligning with its 19.9% shareholder Air New Zealand and key partner Singapore Airlines) while Jetstar seems likely to join Qantas in oneworld.

1.4.1 Further Development of the Global Alliances

Figure 1.6 shows the geographic spread of members of the three global alliances, Star, oneworld and SkyTeam, which provide coverage of most of the major markets for Australia in Europe, Asia, North America and Latin America.

Figure 1.6: Map of Current and Future Global Alliance Members



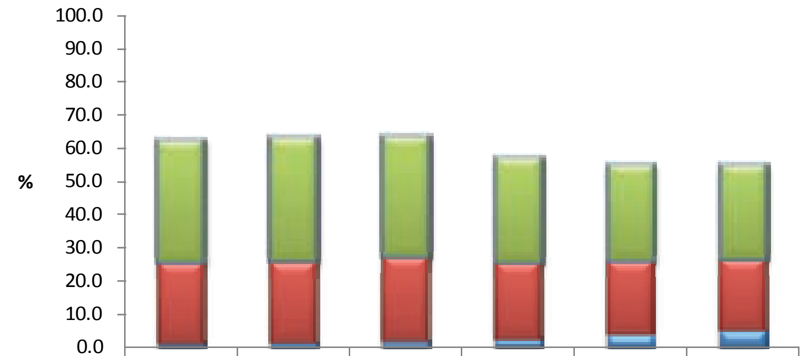
Source: Star Alliance, SkyTeam, oneworld

Star Alliance is particularly strong in Europe and the Americas (half of its 27 members are in the EU). A further 4 carriers are set to join the alliance.

SkyTeam is the next largest with 13 members (6 more due to join in 2011 and 2012); while oneworld is the smallest of the global alliances with 12 members but is well represented in most markets (two more will join in 2011/12).

The shares of total Australian international seats held by oneworld, Star Alliance and SkyTeam operators are depicted in **Figure 1.7**.

Figure 1.7: Percentage Shares held by Global Alliances of Annual Seats into/out of Australia



	2006	2007	2008	2009	2010	2011
oneworld	36.8	37.1	36.0	31.4	29.1	28.3
Star Alliance	24.5	24.3	25.4	23.4	22.1	21.4
SkyTeam	1.0	1.3	1.7	2.0	3.5	4.9

Source: SRS Analyser

oneworld, underpinned by Qantas, is still the dominant alliance though its share has declined from 36.8% in 2006 to 28.3% in 2011 (consistent with Qantas's own weakening position).

Star Alliance carriers have also lost ground, with SkyTeam the only one of the alliances to increase its share from the relatively small base. This reflects the growth in membership of SkyTeam with the entry of China Southern.

The overall seat share of the alliances in the Australian market has diminished in recent years from 62% in 2006 to 55% in 2011. This trend is likely to be reversed in the next few years as other carriers represented in the market join, for example Garuda (2012), China Eastern/Shanghai Airlines (2011), China Airlines (2011) and Aerolineas Argentinas (2012).

Air India is the Star Alliance's only proposed addition with potential Australian links, while oneworld's member-elect Kingfisher Airlines is still to activate plans to operate here. Malaysia Airlines (MAS) also recently announced plans to join oneworld.

Global and bilateral partnerships play a significant role, in particular, in accessing the UK/European market. Only three EU airlines serve Australia directly (Virgin Atlantic, British Airways (BA) and Air Austral[3]).

However, other off-line carriers including Lufthansa, Air France-KLM, Swiss, Finnair and SAS maintain indirect links with the Australian market through Asian codeshare partners.

The oneworld decline shown in **Figure 1.7** reflects in part a loss of market share by Joint Services Agreement (JSA) partners Qantas and BA. The JSA covers all routes between Australia and Europe and has approval to continue at least until 2015.

However the Qantas/BA position has been eroded by changes to the dynamics of the Australia-Europe market with:

- further development of services through Middle East hubs (Dubai, Abu Dhabi and Doha) which are extending to North and South America. Most of the home carriers in these markets (Emirates, Etihad Airways and Qatar Airways) have not aligned with any of the major alliances, instead preferring to build own-operated networks (the exceptions in the Middle East are Royal Jordanian which has joined oneworld; and Star Alliance members Egyptair and Turkish Airlines); and
- the expansion of low cost long-haul operations to Europe by AirAsia X and Jetstar (through Kuala Lumpur and Singapore).

This trend is likely to continue with the establishment of new hubs by the major Chinese carriers between China and Europe, including Guangzhou and Shanghai.

The growth of the hub markets will further strengthen hub-based airlines operating 6th freedom services between Australia and Europe (Emirates, Etihad and Qatar Airways in the Middle East; Singapore Airlines, MAS, Thai Airways, Korean Air and Cathay Pacific in Asia).

1.4.2 Entry into Commercial Partnerships

Appendix II provides a full profile of commercial partnerships between key airlines in the major regions. These arrangements between airlines typically take two forms:

- joint service, codesharing and blocked space relationships; and
- interline arrangements (mostly commercial partnerships which involve agreed fare rates and terms for on-carriage of passengers and freight).

[3] European airlines which have withdrawn from direct services to the Australian market include Lufthansa, KLM Royal Dutch Airlines, Austrian Airlines, Alitalia, Olympic Airways, UTA French Airlines (now Air France), AOM French Airlines and JAT Yugoslav.

Codeshare partnerships enable airlines to extend their reach and access inbound traffic from markets outside their networks. These airline to airline relationships, for the most part, align with global alliance commitments.

However, in markets where particular alliances are not represented, carriers often enter into codesharing arrangements with other operators.

Qantas, for example, codeshares with SkyTeam members Air France/KLM on Asia-Paris services and Vietnam Airlines on Australia-Vietnam; and Star Alliance carrier Asiana on Australia-Korea routes.

Alliances therefore have an increasing role to play in the medium-long term in interlinking international markets, both through the expanding global memberships (especially in Asia) and one-to-one partnerships between carriers.

The twin pressures of rising operating costs and heightened competition will see longer haul operators, in particular, seek alliance solutions with enhanced connectivity to secure a market presence.

1.4.3 Emergence of Offshore Joint Ventures

Another strategy which has become more prevalent in Asia than anywhere else involves the establishment of offshore joint ventures.

Malaysia's AirAsia has been an innovator in this regard, securing minority owned "franchises" in Thailand, Indonesia, Japan and the Philippines[4] as part of a strategy to access revenue and operating rights in those countries.

This has seen AirAsia and its affiliates build a satellite network of intra-Asian airport bases and coordinate services and schedules between them to strengthen overall group earnings.

Jetstar adopted a similar approach by establishing joint ventures in Singapore and Vietnam, and now plans a Tokyo-based operation in Japan while its parent Qantas is pursuing a new premium airline in Southeast Asia. The Qantas venture will be 49% owned by the airline but will have its own management and target business travelers in the Asian market, particularly China.

Singapore Airlines, meanwhile, is proposing a new medium to long haul Low Cost Carrier to compete with AirAsia X and Jetstar. Singapore's short-haul LCC Tiger Airways continues to seek opportunities to add to its offshore partnerships despite the failure of planned ventures in Thailand and South Korea. The development of offshore airlines inevitably will redirect fleet and other resources to new markets, and establish focal points for service growth away from their home airports. This may have the effect of fragmenting route structures, depending on the level of connectivity between the different brands.

[4] A further joint venture agreement planned by AirAsia with VietJet in Vietnam recently lapsed.

2. Major Determinants of Airport Usage

For the purposes of this report, a primary airport is defined as the major traffic airport within a metropolitan market, and one which typically is dominated by the incumbent hub airline.

A non-primary airport refers to any airport which performs a subsidiary market role to that of the primary airport and effectively serves and competes for traffic from the same market (although it may be some distance from that market) or provides a discrete role within that market (i.e. as a Low Cost Carrier (LCC) or freight base).

Non-primary airports can service a range of functions, including:

- a mini-hub with a similar mix of services to the primary airport;
- dedicated international or domestic gateway;
- market-specific facility (appealing to a particular market niche or sub-market); or
- freight only facility, servicing general airfreight and/or express freight.

This section provides an overview of the most relevant airline-related issues impacting on the type of airport used, including those which may influence a carrier to locate services at a non-primary airport or relocate services from a primary hub to a non-primary airport.

A more detailed analysis of the issues raised is provided in **Sections 3-6** of the report.

2.1 Airline-Related Issues

Airlines deploy capacity to airports based on a wide range of criteria. The criteria are generic, however their relative importance varies from market to market and from airline model to airline model (particularly passenger legacy [i.e. Full Service Carrier to LCC/Hybrid LCC] and from passenger to freight).

Decisions on airport usage are based on rational strategic, commercial and operational objectives.

However, there is also a small group of airlines (typically government owned legacy carriers) that can also behave irrationally[5] and distort the criteria.

As a rule, non-primary airports have the most appeal when:

- the related primary airport is congested;
- Airlines see a strategic and/or market development opportunity; and
- the non-primary airport is marketed aggressively with highly attractive incentives from their owners and/or governments.

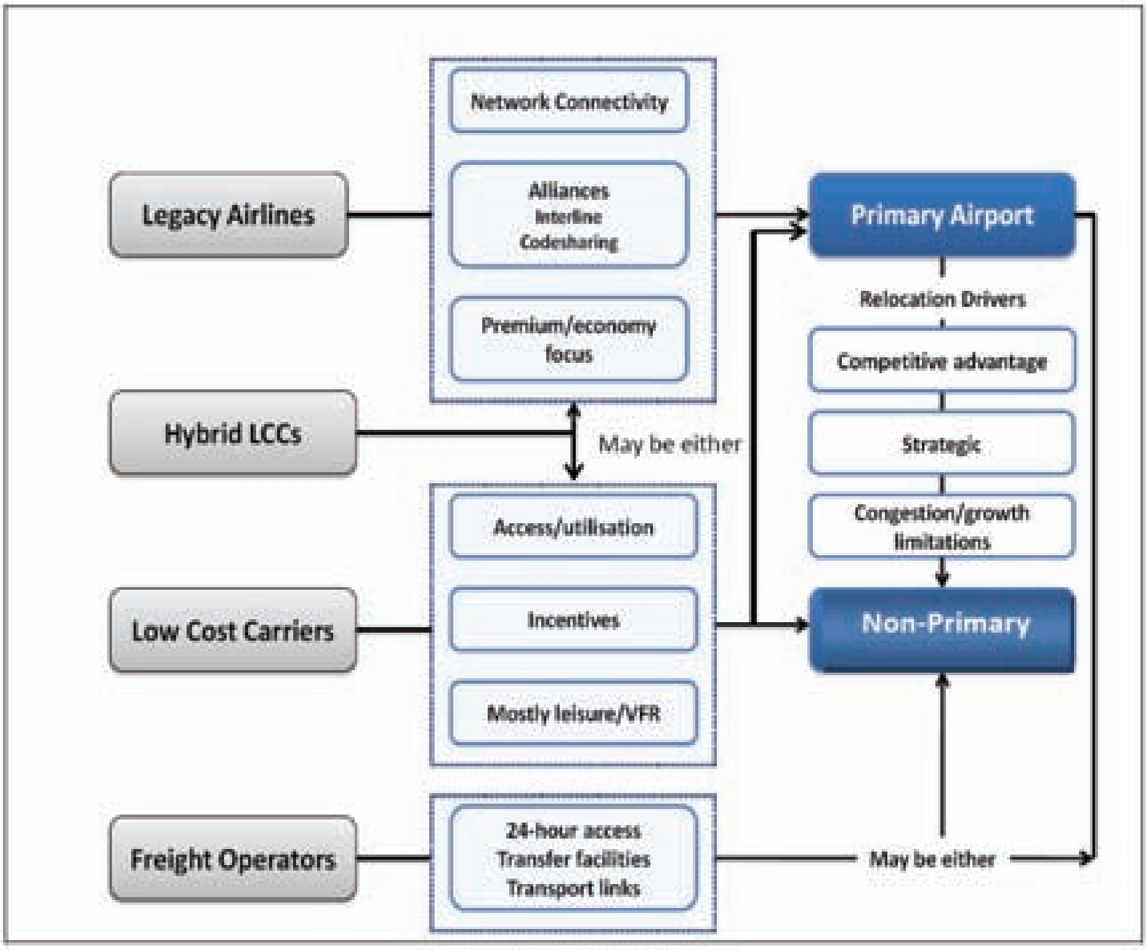
[5] These airlines can behave irrationally in various ways. Capacity can be deployed purely on whim or as a downstream consequence (i.e. an afterthought) of poor fleet planning decisions that result in excessive latent capacity.

Primary airports retain a strong hold on airlines with their convenient locations and a range of inhibitors, including: network connectivity requirements; alliance obligations; culturally not seeing the opportunity (i.e. operators with a narrow strategic focus); and those which consider non-primary airport operations as negatively impacting on their brand and status (reputational).

While not a dichotomy, it is a type of trade-off that has developed for airlines when considering airport usage. Where the conditions outlined above for non-primary airport development are present, (short-haul) LCCs typically gravitate to non-primary airports while legacy carriers generally remain at primary airports. Hybrid LCCs[6] are also more likely to gravitate to primary airports which perform as business hubs, given their mixed service offering (business and economy).

Freight operators tend to remain at primary airports, with some "drift" to (mixed use) non-primary airports. With the exception of express freight, there appears to be no commercially sustainable example of freight only airports.

Figure 2.1: Preferred Primary and Non-Primary Airport Usage by Carrier Type



[6] Hybrid LCCs incorporate features of legacy carriers such as a premium/economy configuration and pricing, airport lounges and frequent flyer programs. As such, they have greater emphasis on penetrating the higher yield business and government travel markets. Virgin Australia is one example; Indonesia's Lion Air another.

Figure 2.1 provides a schematic summary of the likely preferred airports (primary or non-primary) for the different operator types and key issues influencing their decision.

It also indicates some of the considerations for a carrier to relocate services from a primary to non-primary airport (i.e. competitive advantage, strategic and/or an inability to develop further due to congestion problems).

It should be noted that these are not the only options for the airlines, but represent the most likely outcomes on the basis of their operating models and market requirements (LCCs, for example, can be based at primary *or* non-primary airports, as can freight operators).

2.1.1 Alignment with Airline Models

As **Figure 2.2** shows, the criteria for airport usage typically varies by carrier type, namely:

1) Legacy or Full Service Airlines (ranging from international to smaller regional carriers) tend to migrate towards primary gateways but may deploy some services to a non-primary airport for strategic reasons;
2) Low Cost Carriers generally fall into three sub-categories:
    a. Short-Haul LCCs, generally prefer non-primary gateways because of their specific operating characteristics and access incentives (e.g. Tiger Airways and AirAsia);
    b. Long-Haul LCCs, which can use primary or non-primary gateways (e.g. AirAsia X and Jetstar); and
    c. “Hybrid” LCCs (with some legacy characteristics), usually favour primary gateways which align with their market mix (e.g. Virgin Australia) but can also access non-primary gateways. Virgin, for example, operates to a number of non-primary gateways such as Newcastle (north of Sydney), Gold Coast (as well as Brisbane) and Hamilton in New Zealand (an alternative access point to the Auckland market). However, its increasing corporate focus is concentrating growth and development on the major airports which service the business community.
3) Freight airlines (including express freight), usually focus on primary airports due to their relationship with scheduled passenger carriers but may also opt for a non-primary airport depending on the nature of their operation and availability of support facilities.

The development of, and/or participation in, alliances also influences where an airline is based. 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 which enable passenger and freight transfers between member carriers, coordinated scheduling and expand service coverage.

One of the most comprehensive partnerships involves Qantas and British Airways on services between Australia, Asia and Europe[7]. This has seen the development of a chain of shared hubs between the two airlines focused on Singapore, Bangkok, London and Hong Kong.

2.1.2 Other Factors in Airport Selection

Primary or hub airports generally add value to an airline through beyond-market access (whether directly via connecting services or indirectly through alliances). These airports can:

- average out a natural peaking of demand;
- generate hub premiums, density and scope economies; and
- provide opportunities for mixing prices.

Non-primary airports are a more likely option for new entrants (especially LCCs) than market incumbents, and their attractiveness is relative to strategic and competitive issues, access pricing and congestion at the primary airport.

The strategic approach to airport usage is changing through the advent of new aircraft technology and an increasing convergence of the LCC and legacy models.

Use of longer range, more economic aircraft types (e.g. the B787 and A350) and high capacity types (e.g. the A380) have the potential to develop new or existing hubs and concentrate traffic on major gateways. While the market impact of B787s and A350s is yet to be felt, the operation of A380s has entrenched the usage of intermediate hubs and national gateways offering access to sizeable catchments as a means of building traffic levels.

The emergence of "hybrid" carriers (i.e. a mix of LCC and legacy) often have a long haul as well as short haul capability, and are entering into interline and joint service partnerships with full service operators. As a consequence, they have airport requirements more akin to those of the legacy airlines.

Virgin Australia maintains a longer-haul brand V Australia (offering a premium service) as well as domestic and Tasman/Pacific services through Pacific Blue. These brands are all being brought under the one Virgin Australia umbrella as part of a broader restructure which will see the group pursue higher end business traffic and secure a network of alliances with international operators.

[7] The Qantas-British Airways Joint Services Arrangement (JSA) was established in 1995. Regulatory approval for the JSA was extended for a further five years in 2010. The airline also recently restructured the JSA with Qantas withdrawing from Bangkok-London and Hong Kong-London services (these routes will be operated by BA).

Jetstar is also a "hybrid" LCC as its long-haul services offer a premium product. However, Jetstar's short-haul services are still largely focused on the leisure market.

Other examples in the Asian region include Cebu Pacific of the Philippines and Indonesia's Lion Air, both of which mix short-haul LCC services with international premium offerings.

Freight operators have particular requirements which may be met either at a primary or 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 (e.g. Frankfurt-Hahn Airport has developed as a specialist freight gateway due to its 3,800m runway which can accommodate large Antonov freighters. Its remote location, 123kms from Frankfurt also limited its attractiveness to passenger operators compared with Frankfurt International Airport. However, Hahn's operational profile is changing with the entry of LCCs Ryanair and wizz air).

2.2 Key Considerations for Primary/Hub Airport Usage

A number of factors contribute to the success of a primary or hub airport[8]. Some of these factors (e.g. the strength of the main carrier at the airport, the regulatory environment and the quality of the airport's infrastructure, operations and service) can be enhanced over time if they are not already of an appropriate standard. Others such as the size of the airport's catchment population are largely fixed.

Tables 2.1-2.4 show the top hub five airports in each of the key regions of Asia, the Middle East, Europe and North America, and their level of connectivity to other markets.

Table 2.1: Top Five Asian Airports for Connectivity (Weekly Flights, 2011)

ASIA	South America	Europe	Africa	Middle East	Asia	Australasia	North America	TOTAL
Hong Kong, HK		162	17	40	2,133	122	121	2,595
Singapore, SG		161	9	44	2,144	221	14	2,593
Bangkok, TH		214	32	106	1,549	73	7	1,981
Seoul, KR		101		30	1,427	34	180	1,772
Kuala Lumpur, MY		56	5	80	1,376	94		1,611

Note: Domestic flights have been excluded from the total by region

Source: SRS Analyser

These "mid-hemisphere" hubs are experiencing increasing competitive pressure from Dubai and, to a lesser extent, Doha and Abu Dhabi in the Middle East. Dubai has overtaken Singapore Changi airport in terms of passenger numbers, handling 47 million passengers in 2010 compared to Changi's 42 million. While the current Dubai International Airport continues to expand and develop, the new Dubai World Central Al

[8] Primary gateways and hub airports are treated as the same for the purposes of this report. Primary airports typically perform hub functions within a market in that they serve gateway traffic and distribute it to other markets or sub-markets.

Maktoum International Airport opened for cargo operations during 2010 and is expected to start passenger operations in 2012.

When completed, Dubai World Central will be the largest in the world with five runways, four terminal buildings and capacity for the 160 million passengers and 12 million tonnes of cargo forecast by 2030.

Table 2.2: Top Five Middle Eastern Airports for Connectivity (Weekly Flights, 2011)

MIDDLE EAST	South America	Europe	Africa	Middle East	Asia	Australasia	North America	TOTAL
Dubai, AE	7	451	238	877	894	35	66	2,568
Doha, QA	7	209	98	532	320	7	21	1,194
Abu Dhabi, AE		143	48	323	294	21	17	846
Jeddah, SA		89	222	341	119		4	775
Bahrain, BH		66	30	517	152			765

Note: Domestic flights have been excluded from the total by region

Source: SRS Analyser

Table 2.3: Top Five European Airports for Connectivity (Weekly Flights, 2011)

EUROPE	Central America	Caribbean	South America	Europe	Africa	Middle East	Asia	North America	TOTAL
London-Heathrow, EN, GB		5	27	2,541	209	276	382	746	4,186
Paris-De Gaulle, FR		16	74	2,900	317	180	220	335	4,042
Amsterdam, NL	6	19	24	3,170	114	83	156	258	3,830
Frankfurt, DE		22	39	2,765	131	172	273	320	3,722
Munich, DE		4	5	2,463	40	66	93	111	2,782

Note: Domestic flights have been excluded from the total by region

Source: SRS Analyser

The European hubs are well established and “mature”. Compared to the Asian hubs for example, the European hubs serve a much larger proportion of longer haul markets outside the European region. Over 82% of Hong Kong and Singapore’s weekly flights are to destinations within Asia. In contrast, 61% of Heathrow’s international flights are to destinations within Europe.

Table 2.4: Top Five North American Airports for Connectivity (Weekly Flights, 2011)

NORTH AMERICA	Central America	Caribbean	South America	Europe	Africa	Middle East	Asia	Australasia	North America	TOTAL
New York-JFK, NY, US	23	282	97	545	30	66	90		179	1,312
Newark, NJ, US	29	90	21	383		21	56		375	975
Chicago-O'Hare, IL, US	7	14	7	233		12	88		525	886
Los Angeles, CA, US	56		13	122		19	173	91	404	878
Houston-Intercontinental, T	135	24	56	82		21	7		544	869

Note: Domestic flights have been excluded from the total by region

Source: SRS Analyser

Los Angeles is currently the only North American hub of connectivity significance to the Australian market. However, the recent commencement of direct services to Dallas by Qantas will see a shift in this dominance. In the future, new aircraft types with longer range will allow a wider range of US cities to be served by non-stop flights to and from Australia.

The key factors determining usage of a primary or hub airport include:

- *(i) A strong and competitive home carrier*

  A primary airport must have at least one strong airline that has extensive international and domestic operations to cities and regional centres around it. With integrated operations, the airline is able to bring sufficient "feed" into its hub-and-spoke model which in turn provides service efficiency and cost benefits.

  Qantas performs this function at Sydney Airport through connecting linkages between its international, domestic and regional operations. Similarly, Singapore Airlines connects Australia and New Zealand to Europe, India and China through its hub at Changi Airport by having extensive point-to-point third/fourth freedom operations to all these destinations. It then becomes a simple matter of scheduling a flight arriving from Australia conveniently close to another flight leaving for Europe. In between the flights, the transiting passenger is kept occupied at the airport and contributes to the local economy by spending on meals and duty-free purchases. Passengers can also be attracted to spend a few days on stopover, contributing to the country's tourism earnings.

  In the Asia-Pacific region, the main carrier transports between 30 to 50% of an airport's passengers. Qantas and its subsidiaries, for example, carry around 35% to 40% of Sydney Airport's passengers. In Europe and the US, this figure is usually significantly higher.

- *(ii) A supportive regulatory environment*

  For an airline to operate effectively from a hub airport, there needs to be a relatively liberal aviation policy and regulatory regime which promotes traffic growth and connectivity. Policy needs to consider not only broader national socio-economic factors but also global marketplace dynamics, the economics of airline operations and the long term impact of policy decisions on the local community, business, industry, environment and consumer behaviour.

- *(iii) Efficient Infrastructure*

  Highly developed infrastructure is required to support a hub airport's volumes of traffic and effective strategic planning and timely development is required to keep pace with competitive hubs. Major airport infrastructure developments take time and planning for additional capacity needs to take place early. In the short term, better use of existing capacity through more efficient airspace and airport procedures may provide some additional capacity. Infrastructure needs include:

  - sufficient slots and runways, taxiways, aircraft parking areas, and passenger and cargo terminals to meet demand;
  - airport airspace, landside and airside capacity sufficient to ensure the smooth flow of aircraft and passengers and with the potential for expansion for future capacity increases;

- well connected domestic and international terminals allowing ease of transit between the two;
- services and facilities for passengers of an appropriate level of quality, tailored to the type of passengers using the airport (this has the added benefit of maximising non-aeronautical revenue for the airport.); and
- efficient and effective transport infrastructure to/from and around the airport to maximise the airport's population catchment area.

- *(iv) Effective Airport Operations*

  Successful hub airports allow airlines to operate in a timely and cost effective manner and passengers to connect to flights with minimal disruption. To achieve these goals hub airports must demonstrate operational efficiency, adopt streamlined processes and implement state of the art technology. In addition to the processes controlled by the airport company, legislated requirements such as customs and immigration and security clearances must not disrupt the flow of traffic.

  Airports also need to be flexible and competitive in their fee and incentive arrangements to attract new carriers and encourage retention and growth by existing carriers. Efficient and competitively priced airport services need to be provided such as ground handling, catering and fuel supply. Preferably these services will be open to third party suppliers to provide competitive pricing and high quality service.

- *(v) Geographic position and population*

  Primary airports require a substantial base catchment within a local population which can underpin and drive the growth of services. Those performing hub functions can feed off through traffic as well as the resident population.

2.3 Key Considerations for Non-primary Airport Usage

Europe and (to a lesser extent) the US have seen the most growth in non-primary airport usage. The development of LCCs and the progressive commoditisation of short-haul travel has been the major driver of non-primary airport development in Europe, with Ryanair leading the airline contribution to their development in an aggressive, disciplined manner.

Apart from the US and Europe, all other major markets have had limited non-primary airport development, which is primarily due to the absence or lack of airport and transport infrastructure, congested primary airports and best practice LCCs.

Australia is a prime example, where there has been only modest non-primary airport development at Gold Coast[9] and Melbourne (Avalon).

Fundamental differences exist in the Australian market context:

- primary capital city airports in this country are relatively efficient and, for the most part, competitively priced (although charges vary);
- Australia arguably has no genuine non-primary airports. The only relatively inefficient airport is Sydney due to its operational restrictions (curfew and noise) and the closest states to having non-primary airports are Queensland (Gold Coast) and Victoria (Avalon);
- low cost long-haul carriers are the only international LCCs capable of serving Australia's major population centres in the south-east[10] due to the distance from leading Asian markets. AirAsia X and Jetstar International have both opted for mostly primary airport operations in Australia although their initial preference may have been for non-primary access points[11]; and
- few traditional LCCs (i.e. those modeled on Ryanair or easyJet) operate in the Australian market other than Tiger Airways. Virgin Australia has evolved into a hybrid carrier, while Jetstar is a subsidiary of a legacy airline with commercial linkages and a two-class international operation.

These characteristics mean that, unlike the mature markets of the US and Europe, demand for non-primary airports is relatively limited and there is little, if any, available supply within metropolitan markets. Non-primary airports retain their attractiveness where they serve a discrete destination (for example the Gold Coast) and/or provide access to low-cost service provision.

2.3.1 Service Development Priorities

The key criteria in determining non-primary airport usage, ranked in order of importance on the basis of typical airline requirements, are as follows:

- *(i) Access to Efficient 24-hour Operations*

Airlines are complex highly capital intensive businesses and their highest capital cost is aircraft. Leading airlines seek to reduce their unit cost by maximising the daily operating hours of their fleet, with turnaround times at airports being a major factor.

[9] We note that Gold Coast is regarded as a market in its own right and not integral to the Brisbane market. However, Gold Coast is increasingly accessing traffic from the Brisbane market, particularly on long-haul LCC services. For that reason, we have categorised Gold Coast as a "non-primary airport".

[10] Tiger Airways also operates the shorter haul sector between Singapore and Perth with an A320.

[11] We do not consider V Australia to be a low cost long-haul airline.

One of the most important cost compression requirements to move from a legacy to LCC model is increased aircraft utilisation. Approximately 60% of the overall unit cost differential comes from higher aircraft utilisation and greater seat density.

Constraints on access to airports or the availability of take-off and landing slots, in turn, limit the ability of airlines to optimise asset usage and generate revenue. As a consequence, there is a substantial efficiency "cost" which flows through to route profitability.

Fleet utilisation is a major cost driver for airlines and they should be broadly targeting above 12.5 hours for short-haul operations and above 17 hours for long-haul operations[12]. Jetstar and Virgin Australia currently achieve an average utilisation of around 10 hours per day for their domestic operations and 14 hours for international services.

Another key factor in optimising utilisation is achieving rapid turnaround of aircraft at airports. Best practice LCCs are achieving turnaround times of 15-20 minutes compared with 35 minutes for legacy operators.

Freight airlines (or the freight operations of passenger airlines) can have even higher availability requirements due to both the nature of freight operations (i.e. time sensitive, end of day despatch, etc) and the nature of consignments.

Perishable freight is typically higher yield and this is the freight equivalent of premium passenger traffic (which is often the difference between profit and loss for an airline). Freight operators typically require: 24-hour operations; efficient customs clearance facilities; good inter-modal transport access; and reasonable proximity to markets. Rapid turnarounds are also highly desirable (Frankfurt's Hahn Airport in Germany, for example, claims to achieve a three-hour turnaround for freight).

Some airports have a range of limitations that compromise the efficient operations of passenger and freight airlines and their unit cost and service delivery objectives.

These can include:

- curfews;
- slot congestion (or non-availability of slots for long periods of the day);
- design problems, e.g. inefficient taxiway flow;
- operational constraints due to inadequate maintenance;
- (for passenger airlines) the presence of substantial freight operations; and

[12] Airlines typically measure aircraft utilisation in block hours, which is the time from brake release at departure gate/stand to brake application at arrival port. This is typically favoured by airline operations departments as they want to optimise operating efficiencies. Taxi times, ATC efficiency, weather patterns, etc vary between airports. Best practice airlines focus on flying time to measure utilisation. If they see no way to improve utilisation at one airport they consider the option of moving to another airport.

- weather patterns that periodically restrict operations.

Primary airports can also have a range of issues that impact airline customer service, such as poor terminal design, access transport congestion and slow customs clearance for inbound freight consignments.

Customer service considerations are more important for legacy airlines than LCCs, as LCC customers' only real loyalty to the brand is the price of their last ticket.

Unrestricted 24-hour access to an airport allows airline network planners full flexibility to schedule operations. This enables them to balance fleet optimisation with schedule integration and efficiency.

For legacy airlines, scheduling at the time of day to best meet anticipated demand is important. For LCCs, this is less important as their lower pricing model should stimulate a market which is less time of day sensitive.

For freight operators, this provides the freedom to develop and operate their business in their key high yield market segments, such as perishables and express freight.

- *(ii) Proximity to Markets*

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

This simple demand/supply principle has a number of important considerations.

- If an airline's route(s) from the 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 will be determined by the population in the airport's catchment area.
- If the market is inbound then there should be one or more key reasons people have to travel to the airport, including: business-related activities or employment; tourism; proximity to relatives or friends; or easy access to a major city.

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.

Airlines require two-way traffic to support growth on an economic basis. Tourism based markets are examples where much of the traffic is inbound-focused as they generally have relatively small catchments of their own with limited locally-generated volumes. These markets are often highly seasonal and service levels are adjusted to suit demand.

Avalon Airport has struggled to establish itself as a viable alternative to Melbourne Airport, despite the presence and some aggressive pricing by LCCs. This has seen a relocation of some LCC services to Melbourne which closer to the city.

- *(iii) Aggressive and Consistent Market Strategy by Airport Owners and Governments*

Airport owners must also be very receptive to new airlines and the issues that drive their network/capacity deployment decisions. Where ownership is private or by local government, regional/state governments must typically work closely to develop a marketing strategy that aggressively and consistently targets airlines to introduce or expand operations.

Europe has a mature, but still expanding, non-primary airport infrastructure and understanding these drivers has been fundamental to the success of a range of airports, such as: South Brussels Charleroi (46kms south of Brussels); Orio al Serio Airport (45kms east of Milan); and Memmingen (110kms west of Munich).

Ryanair has been the pivotal airline in growing all three airports and is often followed into new markets by other LCCs.

easyJet has also followed the same model, but at times compromises this approach by operating from primary airports even when viable non-primary airports are available[13].

Brussels South Charleroi Airport is an interesting case study in non-primary airport development. Owned by the regional Walloon government, Ryanair commenced operations at Charleroi in 1997, transforming the airport from a basic runway and terminal (shed) to a major airport with four million passengers annually[14] and one of its many hubs.

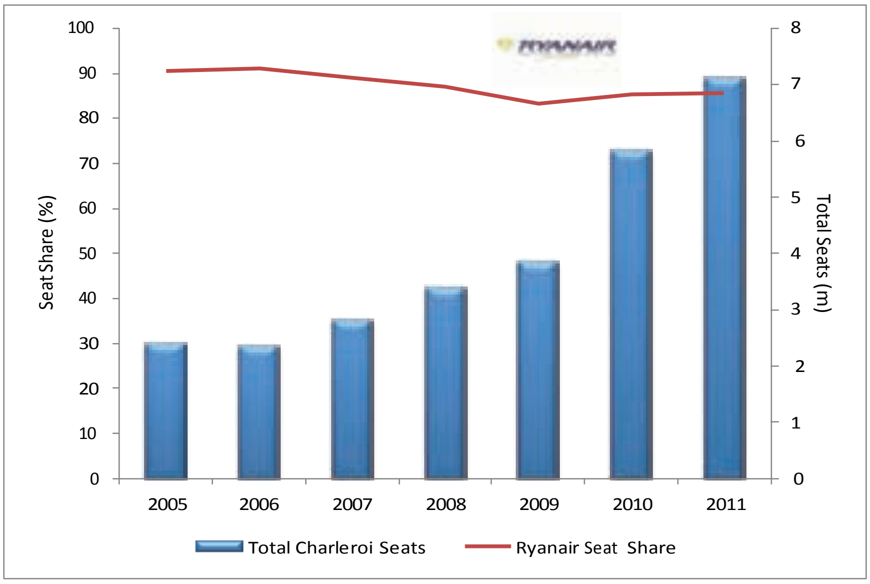
Ryanair's operations are highly incentive driven and the financial support received may mean the difference between profit and loss on some routes. While the European Commission found that these subsidies represented illegal state aid, this was overturned by the European Union Court of First Instance which concluded there had been an error in law (2008). A range of other low cost operators[15] subsequently have followed Ryanair into this market with similar arrangements.

[13] Malpensa (Milan) is one example. Although 40 kms north-west of Milan it is very much a primary airport and in the top 25 busiest airports in Europe. An additional factor may also be Ryanair's dominance of the non-primary airport (Orio al Serio) and easyJet wanting to avoid full head to head route competition with Ryanair.
[14] Source: Brussels South Charleroi Airport S.A. (2011 statistics).
[15] Such as Jet4you and Wizz Air.

The rationale for the Walloon Government's support is the catalytic demand[16] created by airline activity, with the airport's cost of capital a cornerstone investment in regional development.

Brussels South Charleroi has seen substantial growth in airline capacity, as shown in **Figure 2.2** below. The presence of Ryanair, more than anything else, has driven Compound Annual Growth in the Charleroi market of 16.9% between 2005 and 2011. This, in turn, has provided competitive opportunities for other airlines in this high growth market.

Figure 2.2: Brussels South Charleroi Passenger Airline Capacity 2005-2011



Note: Year to June 2005-2011

Source: IATA SRS Analyser

Ryanair's capacity share (also shown in **Figure 2.2**) fluctuates and depends to some extent on the success or failure of other airlines, based on strategic factors and the relative unit cost of all the airport's airlines.

A number of airlines commenced operations during this period in order to capitalise on this "collateral" growth but found they could not compete with Ryanair's low unit cost or broader competitive weaknesses overcame them. By 2011, there were five operators serving Charleroi, with Ryanair still commanding an 86% seat share. Ryanair's aggressiveness was typified by its decision to add substantial capacity during the GFC at

[16] Various models of aviation catalytic demand or economic catalytic impacts have been developed, ranging from the US Department of Transport to Oxford Economic Forecasting. All have the same base principles, modelling the impacts from aviation activity, including: direct impacts (employment and activity in the aviation sector); indirect impacts (employment and activity down the aviation supply chain); induced impacts (employment and activity supported by the spending of those directly or indirectly employed in the aviation sector); and consumer welfare impacts as individuals benefit from the increased availability of travel (obviously stronger for an incentive provider in an origin market).

the same time as two Moroccan operators (Air Arabia Maroc and Jet4you) commenced operations at Charleroi after the signing of the EU/Morocco Open Skies Agreement in 2006.

- *(iv) Incentive Regimes (and Aeronautical Charges)*

As discussed in relation to Charleroi, the range of incentives that can be assembled to attract airlines to airports has been fundamental to the success of both the airport and (often) airline. These are typically delivered by airport owners and governments working together, although in many cases governments (of various levels) are also the non-primary airport owners.

The types of incentives offered include:

- aeronautical charge[17] reductions, waiver periods or exemptions;
- paying growth subsidies to airlines on a passenger carried/landed freight tonnage basis;
- underwriting start-up costs and/or any losses on the route(s) for an agreed period;
- free or greatly subsidised terminal usage;
- free or subsidised check-in, ground handling and operational staff;
- marketing funds;
- free or reduced office rental; and
- (in some jurisdictions) exclusivity periods for the first airline to operate.

As incentive regimes are typically commercial-in-confidence, they can effectively conceal discriminatory pricing. As with the Charleroi case, this can also be interpreted as state aid and be deemed anti-competitive.

Differing incentives offered to airlines can present a powerful barrier to entry, as the deal presented to an incumbent anchor airline (such as a Ryanair) may not be available to another airline that is already at a unit cost disadvantage. Air Arabia Maroc, for example, relocated operations from Charleroi to Brussels for its Casablanca route from October 2010. This was due partly to the lower incentive regime impacting Air Arabia's already higher unit cost than Ryanair, even though they did not compete head-to-head on the same Belgium Morocco routes[18]. There are many other examples of incentives employed to attract new airlines and services. Vancouver International Airport established a five-year program designed to increase services and capacity. This enables

[17] The nature and (carded/rack) rates of Aeronautical charges applied in non-primary airports varies widely across major markets. These can include: aircraft landing and parking fees; passenger arrival, departure, transit and screening fees; baggage screening fees; security surcharges; check-in counter usage.

[18] Ryanair operate from Charleroi to Fez and Tangier, while Air Arabia Maroc operates from Casablanca to Charleroi.

carriers to expand capacity without incurring any additional landing and terminal fees. The provincial fuel tax has also been eliminated to make the airport more cost competitive. Dublin Airport offers aggressive route development support programs for new or additional short and long haul services. The short-haul program provides a 100% discount on airport charges for the first year of services, scaling down to a 50% discount in the third year. The long-haul program operates for 5 years, providing discounts ranging from 100% in year 1 to 25% in year 5.

Tables 2.5 and **2.6** shows the various types of incentives offered at selected European and Asian airports and assesses their impact on traffic growth.

Table 2.5: Examples of Airline Incentives at Selected European Airports

Airport	LCCT	Incentives	Assessment
Marseille Provence	mp2	Dual pricing system - per passenger charge for terminal usage 78% lower than the full service for European services; 50% less for domestic services; same for international services Also 60% discount on landing/parking fees offered for first year of new routes; 40% in second year; and 20% in third year Access to targeted marketing support Assistance to handling agents to reduce fees by 25%	LCC traffic grew by 2.5 times in the first year of operation as Ryanair; 4 LCCs now use the airport established the airport as a French base; European routes increased from 15 to 33. Plans exist to double size of the terminal
Copenhagen	CPH Swift Terminal	5-year arrangement: passenger charge (incl. transfers, handling and security) 35% lower than at the full service terminal	LCC share of the airport's traffic has grown by almost 5% in two years
Budapest	Terminal 1	Differentiated service and charges structure offered to LCCs; no charge for first three hours parked on off-gate stands; passenger charges (incl. security) are 31% below that for main terminal users	LCCs usage has grown sharply to involve 25% of total airport traffic
Bordeaux	billi	Airport tax reduced by 30%; incentive marketing programs with airlines	easyJet and Ryanair exclusively use terminal; handles 23% of traffic. Airport aims to double LCC traffic
Prague	No	75% discount on landing charges for first year of operation of new route; 25% in second year for aircraft up to 100 tonnes take-off weight. High discounts are available over 3 years for operations with larger aircraft. Also a 25% discount on landing charges for additional frequencies on existing routes	LCCs account for 25% of traffic; base of Wizz Air; gained 30 new services between 2008 and 2009
Frankfurt-Hahn	LCC specific	No landing fee for aircraft turnarounds of less than 30 minutes; per passenger charge varies according to number of passengers carried through the airport in one year (up to a 50% discount for operators carrying 2-3 million passengers annually)	Achieved robust LCC growth, supported by Ryanair; one of the highest growth rates in Europe
Amsterdam Schiphol	Pier H, Pier M	20% discount on landing charges for aircraft not linked to an aerobridge	Part of strategy to expand budget airline services (easyJet a substantial operator at the airport)
Basle-Mulhouse	No	New passenger service destination rebate: landing charges reduced by 80% for first 12 months of operation; 50% for next 6 months; and 25% for following six months. Same rebates apply for reintroduction of services previously ceased at the airport. Rebate available based on traffic growth (targets LCCs): this is 10% for traffic growth of 5%-20% per annum, up to a 70% rebate for growth above 100%.	easyJet has increased services (the largest operator at the airport with 39% of capacity)
Birmingham	No	100% rebate on landing charges and 50% rebate on passenger charges for first year; landing charge reduces by 25% annually over four years, and the passenger charge rebate by 12.5% per annum. Also a promotional fare rebate scheme which provides marketing support for carriers selling fares below a certain threshold	Service structure dominated by LCCs. Growth has stagnated despite incentives program
Manchester	No	6 forms of incentive: includes new route incentive for first 3 years (single charge replacing all separate charges); capacity growth incentive for airlines moving to a larger aircraft; and non-stop incentive if an airline replaces a multi-stop service with a direct service (landing and air traffic charges fall by 40% in first year reducing to 20% in third year)	Initiatives are focused generally on airline service growth; a doubling in traffic expected over next 20 years.

Note: LCCT stands for Low Cost Carrier Terminal (i.e. availability of a dedicated LCC facility)

Source: CAPA Consulting Analysis, Various

Table 2.6: Examples of Airline Incentives at Selected Asian Airports

Airport	LCCT	Incentives	Assessment
Kuala Lumpur	LCCT	50% rebate on landing charges at all airports under Stimulus Program; per inbound passenger incentive payments for new services; new airlines receive 3-year waiver on landing fees for each new service operated, free office rentals; existing carriers also receive incentive payments tied to traffic growth	KLIA encouraging hub growth, additional services to position for ASEAN liberalisation; AirAsia based at the airport's LCCT, MAS LCC Firefly also will operate from there
Singapore	Budget Terminal	Airport Growth Incentive program, offers discounts on landing fees for new destinations, ground handling; joint marketing and route development; service enhancements	Changi focused of LCC growth, hub development; Tiger Air and Jetstar/Valuair based at airport
		50% lower charges for check-in counters, office rentals	
		Landing and parking charges same as main terminal	
Incheon	No	One year waiver of landing fees for new airlines, new destinations served; 50% discount for office rentals; 50% discount on landing fees for frequency increase; and 25% discount on landing fees for scheduled flights at night.	Seeking to establish as major hub for North Asia, China; limited LCC involvement

Source: CAPA Consulting Analysis

Incentives are more important for non-primary airports than primary airports. Governments and primary airport owners often overestimate the power of incentives over (particularly long-haul international) airline network planners and strategists. For example, the difference between available incentives for two primary airports may be far outweighed by operational considerations such as schedule integration and aircraft utilisation due to relative operational constraints and sector lengths.

With non-primary airports, their owners often have different objectives (e.g. stimulation of catalytic demand) to primary airport owners and they also have to compete with a primary airport, almost always in a more convenient location.

- *(v) Strategic Benefits*

As noted, airports, governments and airlines over time can create powerful barriers for other airlines trying to enter a market.

Working with the airline (usually an LCC) to significantly increase its scale and economic benefits flowing through to the region can result in the airline "owning" the airport in a strategic sense and thereby becoming a fortress hub in its network.

A multiplier effect strengthens this situation as the incentive regime works with the airline's already low unit cost to allow it to price effectively below their actual unit cost of production of each seat deployed in the market. This provides tremendous strategic advantage for the airline as it is allowed to grow its business effectively shielded from competition.

This is very much a long term criteria for airlines considering non-primary airport operations. It is also arguably far more difficult to do this now than it was a decade ago, as most of the accessible targets (i.e. Europe and US[19]) have been taken.

The growth areas are more likely to be in Asia as markets liberalise and primary airports across the region become congested, although there is not a wide range of obvious non-primary airports for development.

2.4 Determining the "Value Proposition"

In deciding whether to base services at a primary or non-primary airport, airlines develop business cases which assess the value proposition from a number of perspectives:

(i) Competitive and Strategic Advantage

The real value proposition of a purpose built airport facility for airlines lies in being the first to operate from the airport. This usually provides the greatest opportunity for operators to secure lucrative entry arrangements and operate without competition.

As legacy airlines generally have little interest in non-primary airports other than for defensive or strategic purposes[20], the airlines which recognise this value proposition are typically LCCs and to a lesser extent freight operators.

Many airlines are poor businesses and need to capitalise on available competitive advantages to simply survive. Quite a number are profitable (depending on the latest aviation market shock) - the better ones also make an acceptable revenue margin (say ≥ 10%) - but almost none delivers an appropriate return on capital.

Non-primary airport operations present an opportunity for LCCs to secure competitive advantage and growth as they typically offer: operational efficiencies; provide access to new markets; and lucrative incentives. This enables operators to acquire and profitably deploy capacity and accumulate cash from these operations to fund additional fleet units and subsequent growth[21].

Congestion-free operations allow (short-haul) airlines to minimise turnaround times, which in turn reduces their fixed aircraft cost and contributes to other operational efficiencies and schedule integrity. Less operational complexity inherently results in fewer delays.

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[19] Where there is sufficient market scale, congested primary airports, leading edge LCC models and a high level of local/regional government ownership of non-primary airports.

[20] As discussed in Section 2, this occurs for a range of reasons.

[21] In a typical LCC (e.g. Ryanair, easyJet, Air Arabia, Jetstar, Air Asia, etc) the direct selling model allows it to accumulate cash before the service is delivered. This creates a "bow wave" of cash that is used to fund incremental growth in their fleet. This was tempered during the GFC as negative or low GDP growth reduced the demand for air travel.

This underscores the value proposition for LCC customers. With a strong incentive regime and short turnaround times reducing their low unit cost even further, they can price at sustainably low levels. Price is usually the main weapon available to an LCC and it becomes a powerful one when combined with easy airport access and on-time performance.

Providing an attractive range of value-add products (such as seat selection, car rental, meals, etc) plus an acceptable level of customer service completes the value proposition for the price-sensitive target market of LCCs.

As a consequence, 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.

The opportunity to be the first operator at a new non-primary airport, as discussed earlier, also potentially provides a strategic opportunity to "fortress" a hub in the long term by building the relationship of the airline with the airport owner/government(s). Other airlines seeking to enter the market may face substantial barriers to entry under this scenario.

Intuitively, freight operators should also be attracted to non-primary airports to gain competitive advantage, however there is no discernable trend in this regard in any major market. This is likely due to some important differences in comparison to passenger operators which limit that advantage.

- Cargo airlines require relatively little on-airport infrastructure;
- Their predominantly night-time operations and lack of requirements for aerobridges or terminals mean they can avoid many of the constraints and costs associated with primary airport operations. As such, they can operate with minimal disruption and overhead in a primary airport environment; and
- There is a requirement for substantial investment in related facilities (such as inter-modal transport, warehousing and storage) also acts as an obstacle to the establishment of non-primary airport operations.

Integrated freight operators, such as UPS or Federal Express, are the exception as they have quite different infrastructure and operational requirements to multi-vendor forwarders and other general freight operators.

Non-primary freight-only airports may only work if there is a genuine competitive advantage over sea, rail and road freight or an airport owner is able to align an on-airport inter-modal freight hub with some passenger operations and property development (as the Linfox Group is attempting to achieve at Avalon).

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(ii) Enhanced Linkages to Target Markets

Even with massive 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 travelers 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.

A fundamental issue is also the nature of the airline's operations.

Hub operations imply an outbound market and require a large population to be both successfully developed and profitably sustained. Multiple routes from a non-primary airport (possibly with an operational base, where aircraft and crew are positioned overnight) must be supported by strong incentive regimes as they have high establishment costs and possibly a higher commercial risk due to the concentration of market.

If the market is inbound, then the motivation for air travel to the airport needs to be sustainable. This requirement was emphasised by the impact of devaluation of the Sterling against the Euro in recent years which caused a downturn in previously thriving easyJet routes in France. British pensioners living in France were unable to maintain their lifestyles as a consequence, and their four trips home per year became one trip.

(iii) Access to Low Cost Efficient Infrastructure

A perennial issue for airlines is access to airport infrastructure that is efficient, acceptably priced and tenured in their favor. Airport infrastructure includes taxiways/parking bays, terminals, air-bridges, ground transport, car parking and administration/office space.

Private and public sector airport owners often appear to have differing objectives, however they are all trying to maximise returns to shareholders.

Primary airport owners will expect to recover the cost of capital from airport users, including the airlines, for infrastructure developments undertaken through an expenditure program[22].

Governments, on the other hand, may expect to recover only part of the cost of capital for say, a publicly-owned non-primary facility, on the basis that this investment is consistent with broader policy objectives such as regional development and general catalytic demand stimulation.

[22] Cost recovery from airport users has two elements. The first is aeronautical charges which are paid by airlines and typically recovered from their passengers. The second is non-aeronautical charges, such as car parking, retail transaction fees, etc. These are recovered from both airline passengers and anyone else using the airport.

This is also a major element of the value proposition as non-primary airports often provide the opportunity for airlines to have access to this infrastructure at no or a low cost.

Such an approach reduces route establishment and operating costs, and part of the risk is effectively transferred to the airport owner.

Non-primary airport owners also often commit to developing other infrastructure, such as freeway and public ground transport access. This further mitigates the risk for an airline that a relatively remote location will be difficult to access for its target market.

LCCs such as Ryanair, Tiger, AirAsia X and Southwest seek the most attractive access package, often playing one airport owner against the other.

Governments typically have a direct or indirect role in the negotiating process, either through airport ownership or as providers of marketing funds and other entry and development incentives. Support arrangements are usually linked to performance and market growth (although previous experience suggests that monitoring of the key metrics is sometimes inadequate).

2.5 Market Definition and Growth Potential

Airline strategy teams and network planners develop market strategy in the context of a range of major forces driving the global market, as well as common industry techniques and methodologies. Markets are entered, grown and exited based on rigorous route profitability and overall targets for the return on capital deployed[23].

LCCs follow these principles and generally have a lower tolerance for route losses than legacy airlines. These carriers (including hybrid LCCs) can appear to behave irrationally as they cyclically exit established routes and enter new routes often in the same market purely on cost considerations. This often occurs when incentives decline or other more lucrative non-primary airport market opportunities are identified.

The following considerations are relevant to airlines planning to enter a new route or market:

(i) What constitutes a viable market in airline terms

Sections 2.1-2.3 identified a range of factors required for non-primary airport market viability. In summary, airlines require the following base requirements:

- *for outbound markets*, access to a sizeable population of their price sensitive target market population;
- *for inbound markets*, a catchment area with tourism-related interests;

[23] As mentioned in **2.1**, some airlines behave irrationally, particularly state owned enterprise “flag carriers” in either a transformed or untransformed state. We focus on LCCs in this section.

- *for balanced markets,* elements of both to be successful;
- sufficient distance from the related primary airport and its catchment;
- a regime of incentives that at least reduce route establishment and operating costs; and
- low operational complexity and sustainable efficiencies that can support overall schedule integrity.

For a first airline operating to a new non-primary airport, they would also prefer the airport owner to facilitate any measure that would provide a period of exclusivity (within competition legislation guidelines); provide barriers to entry for their competitors and/or overall reduce competition.

Airlines apply different benchmarks to what they consider to be a “viable” market size.

Table 2.7 indicates the number of passengers required to achieve 80% loads at varying weekly frequencies by aircraft type and by basic LCCs, hybrid LCCs and Full Service Carriers. Most LCCs need 80% loads to break even.

Table 2.7: Indicative Passenger Market Requirements for Various Service Frequencies and Airline and Aircraft Types

	Service	Aircraft Type	Seats	No. Return Flights			
				1/week	3/week	5/week	Daily
Basic LCC	Domestic/Int.	A320	180	14,976	44,928	74,880	104,832
Hybrid LCC	Domestic	B737NG	180	14,976	44,928	74,880	104,832
	International	B777-300ER	363	30,202	90,605	151,008	211,411
Full Service Carrier	Domestic	B737NG	168	13,978	41,933	69,888	97,843
	International	A380	450	37,440	112,320	187,200	262,080

*Assumes 80% passenger loads for each aircraft type.

Source: CAPA Consulting

On this basis, a basic LCC (for example Tiger Airways) or a hybrid such as Virgin Australia requires 104,000 passengers for a daily domestic service with an A320 or B737NG, while a market of 211,000 passengers is needed for a daily B777-300ER (as flown internationally by V Australia). The requirement for a daily A380 service at an 80% load is 262,000 passengers.

Realistically, airlines expect to establish at least daily frequencies with sufficient loads to generate an acceptable margin above the break-even level for a service to be considered viable, depending on their fare structure and passenger mix. An 80% load is considered break-even for most LCCs, while 50%-60% loads may achieve that for a legacy airline due to their higher proportion of better-yielding premium passengers.

While successful non-primary airports in the US typically are supported by markets with a population base of 2-7 million and are located within 50kms of the core catchment, many of Europe's non-primary airports are much further away from metropolitan markets in areas with smaller populations (sometimes of less than 1 million).

Table 2.8 compares the distances from metropolitan areas for primary and non-primary airports serving the same catchment. Clearly, the margin of acceptability varies considerably from one city to another. While the larger international airports in London (Heathrow), Frankfurt, Brussels and Miami are all closer than the non-primary airports for their areas, the reverse is true for Seoul, Tokyo, Chicago and Dallas.

Table 2.8: Comparative Distances from City Catchments for Selected Primary & Non-Primary Airports

City	Primary Airport	Distance	Non-Primary	Distance
Seoul	Incheon	70kms	Seoul Gimpo	10kms
Tokyo	Narita	58kms	Haneda	14kms
London	Heathrow	22kms	Gatwick	46kms
			Stansted	48kms
			Luton	57kms
Dallas	Dallas-Forth Worth	32kms	Love	10kms
Frankfurt	Frankfurt International	12kms	Hahn	120kms
Chicago	O'Hare	27kms	Midway	13kms
Miami	Miami International	13kms	Fort Lauderdale	34kms
Brussels	Brussels	11kms	Charleroi	46kms

The US experience also suggests that non-primary airports are more likely to be established where the primary airport performs a spoke role rather than a hub, particularly if local demand is not strong and there is a heavy reliance on connecting traffic.

Most metropolitan areas in the US or Europe with multiple airports have threshold catchments of 12-17 million originating passengers per annum before they move to more than one airport. However, there are no fixed rules in this regard and the entry of LCCs has seen the development of multiple airport systems in areas with much smaller catchments (e.g. Brussels, Copenhagen and Berlin).

(ii) Sizing the current/prospective catchment

This is a very contentious area of market definition and varies from market to market depending on:

- catchment overlap with the related primary airport(s);
- distance and travelling time from the related primary airport(s);
- ground transport (freeways and public transport) access and travelling time to the non-primary airport;
- non-aeronautical charges (particularly car parking) that are applied to passengers, in addition to the price of their ticket; and
- (perhaps most importantly) the distance price sensitive travelers are prepared to travel to an airport for a lower fare.

In developed economies with a high population density, these factors are typically less complex. The UK market is a good example, where most non-primary airports have been successful as they have large population catchments with relatively easy access.

As these markets mature and non-primary airports (and LCCs) proliferate, the degree of difficulty for airlines in market sizing increases. Some examples of non-primary airports in developed markets are: Providence (US), marketed as an alternative to Boston but 70kms south-west; and Memmingen (Germany), marketed as an alternative to Munich but 110kms west. These airports have been successfully utilised by Southwest[24] and Ryanair respectively and have similar attributes.

While airlines usually accurately assess the potential catchment size, they often fail to determine the propensity of that population to travel. LCCs can still fail for a range of reasons, including: insufficient numbers of price-sensitive travelers in the catchment; the airline's failure to consider competitive responses; and/or GDP growth forecasts not being achieved in origin or destination markets.

The criteria are different for a successful hub airport which needs a large local population in the airport's catchment area with the economic means to travel to provide critical mass for the airport. Local passengers provide the core traffic while connecting passengers provide the volume to increase frequencies and the number of cities served from the hub.

As an example, 60% of passengers using a US hub typically connect with other flights. By contrast, only 10-20% of the passengers at a non-hub airport transfer between flights. This means that a non-hub airport requires a considerably larger local catchment to support its development. The threshold for service from a non-hub airport is consequently higher and the frequencies that can be supported generally are lower.

[24] Southwest also operates from the primary airport, Logan.

(iii) Assessing the growth prospect

Air travel is a relatively (price) elastic commodity that follows a predictable pattern of demand/growth, with the propensity to travel broadly tracking GDP growth in most markets.

In the case of LCCs, the growth potential of a non-primary airport market is determined by these and a range of other factors depending on the type of market being considered.

- *Outbound short-haul markets* require steady economic growth working in tandem with competitively-priced fares. As with any commodity, this is also influenced by alternative supply and the level of existing competition (at both primary and non-primary airports). The competitive response to a new entrant has a major influence on the growth potential of the market, as this may result in a withdrawal or reduction of capacity.
- *For inbound short-haul markets*, the same principles generally apply but relate to the origin market(s).
- *For (low cost) long-haul markets*, operators comply with similar principles but typically do not operate from non-primary airports. It is too early to determine if long-haul low cost airlines are a distinct model or simply a well implemented "green-fields" version of a legacy airline[25]. There is no doubt that one of the major global aviation trends is the commoditisation of short-haul travel (under five hours), with airframe and engine development mirroring this trend. It is unclear if long-haul travel will ever commoditise without new technology materially reducing travel times.

Overall, new entrants to a non-primary airport can fail to achieve their objectives if they overestimate the growth potential of the market. If, or when, the incentive regime expires and their unit cost is exposed to full competition, the ability of the airline to survive depends on it realising this market potential.

(iv) Passenger and freight mix

There are few "pure" LCCs remaining as many have added complexity (not necessarily additional cost) to their business. We have referred to these in this report as hybrid LCCs. While traditional LCCs do not specifically cater to the business traveler and lack a premium product, the hybrids now modify their business models and trade-up to a more complex model that appears to be a mix of LCC and legacy.

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[25] Low cost long-haul airlines do not have the same unit cost advantage over their legacy competitors as in short-haul, as legacy airlines typically have high aircraft utilisation. The only two well executed iterations of this model, Jetstar International and Air Asia X have stimulated the market with low fares, but operate from primary airports to allow easy connectivity with their respective short-haul networks.

The successful LCCs do this in a measured and controlled manner that does not increase unit cost and maintains the relative simplicity of their business. All these factors must be considered in determining market viability, as they are now inherent in most LCC business models.

The LCC mantra that price will always prevail over their legacy (and higher unit cost LCC) competitors has undergone a major rethink in the last five years due to the pressure of their own cumulative success in commoditising the short-haul travel market.

Business travelers (i.e. corporate travel/procurement teams and individual SMEs) spread travel spend to LCCs as a cost control measure, causing a trading down from legacy business to economy and from legacy economy to LCC. LCCs have met this trend by developing value-add products, such as two-class service, to increase their yield. This acts to limit some of their non-primary airport selections as they now need to consider the requirements of the business traveler.

Freight, also once seen as an operational complexity for an LCC, is now considered an important source of ancillary revenue. The key factor is the type of freight carried, which should not be time-sensitive as the turnaround time of the aircraft cannot be compromised or the higher order (unit cost) objective will be adversely affected.

This makes perishables and express parcels difficult segments for LCCs to penetrate as the cost of freight non-performance (caused by temporarily suspending freight operations to leave on-time to meet turnaround objectives) is too high for the thin margins of LCCs.

Bulk freight, that is not time sensitive, is a safer segment but delivers lower yields. Passenger and freight market segmentation has become a major part of market viability assessments for LCCs as their business models have become more complex. Non-primary airport market potential must meet the same segment revenue opportunity of any market.

(v) Route profitability models

When considering new routes, airlines develop route profitability projections for at least two to three years based on their likely operating costs and projected revenue. There are a range of route profitability models.

The well-managed airlines have a standard rigorously applied analytical model that feeds into their management reporting once they commence operations. They not only require the route to be profitable, but also have a target revenue margin (say 10%) and a threshold/hurdle return on capital requirement[26].

[26] The rate of return on capital requirement varies from airline to airline as their financial objectives and cost of capital also varies.

LCCs place additional emphasis on cash flow projections due to their direct selling models and their requirement to have substantially cash positive operations to accumulate cash to fund additional fleet units in a growth market. Most strongly-performing LCCs (the real candidates for non-primary airport operations) and legacy airlines would adopt a similar model. The weaker airlines generally lack discipline in establishing new routes and have quite simplistic route profitability forecasting and reporting models or models that are fundamentally flawed. These carriers may not seek to recover even the cost of capital and perhaps consider a simple accounting profit as a success.

Route profitability and reporting models can also introduce the concept of "contribution" or "feed" which tries to notionally include the network effect of transfers to/from connecting routes.

This is often a misleading approach as few routes appear unprofitable or poorly performing. It is also not unknown for airlines (particularly state-owned legacy operators) to commence routes by simply selecting destinations on a map or as an after-thought of a poor fleet decision (i.e. what to do with some "spare" capacity).

Inputs to route profitability models on non-primary airport routes can be materially affected by a range of factors.

- Incentive regimes can substantially reduce an airline's unit cost. Each incentive can also have a separate expiry horizon that causes unit costs to increase over time.
- Cost projections are also subject to normal sensitivity and risk analysis, which includes various fuel price and exchange rate scenarios. Revenue and yield are harder to accurately forecast, particularly for new markets developed around non-primary airports where no current market exists.

Best practice LCCs aggressively apply their route profitability models. They may enter a route in the knowledge that they will eventually withdraw when the incentives disappear and their unit cost advantage reduces. Various factors may influence this over time, including: the ability of LCCs to renegotiate incentives with airports and/or governments; their success in market development; their ability to "fortress" the market against new entrants; and competitor response. Ryanair is a good example of this type of rationale.

2.6 Assessment of Relative Importance of Key Criteria

As discussed in this section, 10 key criteria for each airline model in considering primary or non-primary airport usage are ranked in order of priority in **Table 2.9**.

Table 2.9: Ranking of Key Criteria for Airlines Considering Primary or Non-Primary Airport Usage

Criteria	New Entrant to a Market				Established Operator Considering Non-Primary Airport			
	Legacy	LCC	Hybrid LCC	Freight	Legacy	LCC	Hybrid LCC	Freight
1. Network connectivity	H	L	M	H	L	L	M	H
2. Alliance requirements	H	L	M	M	L	L	M	L
3. Access (24-hour, turnaround/utilisation opportunities)	L	H	M	H	H	H	H	H
4. Operational constraints/congestion at primary airport	L	H	H	M	H	H	H	H
5. Proximity to market	H	H	M	H	H	H	M	H
6. Size/viability of catchment (including passenger mix, yield)	H	H	H	L	H	M	H	L
7. Good transport linkages (road/rail)	H	M	M	H	H	M	H	H
8. Airport owner/government incentives	L	H	M	L	L	M	M	L
9. Competitive advantage	M	H	M	L	H	H	H	L
10. Strategic & market development opportunities	M	M	M	L	H	H	H	M

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

The table also shows variations in relative priorities between an airline already established in a market and a new market entrant.

Congestion at the primary airport, for example, or strategic and/or competitive issues may influence a carrier to move from a primary to non-primary airport or to co-locate operations. This assessment clearly is high level and subjective. However, it highlights the great importance for legacy carriers of network connectivity; alliance linkages; proximity to the catchment; and the availability of land transport in choosing an airport.

All of these issues align with the legacy model, and in the use of primary airports where they probably have relatively open access and can gain a competitive advantage, especially if they are already established in the market and seek to strengthen or “fortress” their position. Relocation of services from the primary airport is unlikely unless there are significant constraints on growth or some competitive/strategic value can be gained from operating from another airport within the same catchment.

A further consideration may be the availability of a sub-market which can be accessed with a particular type of product through a non-primary airport (e.g. a section of the market with a high leisure content or low propensity to travel which is more likely to respond to pricing stimulation, or an area with a rapidly developing population which may be some distance from the primary airport catchment).

LCCs (non-hybrid) place the most emphasis on enhanced access, the absence of congestion (to aid turnarounds and utilisation); entry incentives; and the market mix (proportion of price-sensitive travelers). Catchment proximity is less of an issue as their passenger profile does not have an overly large proportion of time-sensitive business travelers. Proximity also reduces in importance with the availability of good land transport linkages.

Hybrid LCCs, by contrast, are more aligned with the legacy product and therefore see the value of some limited connectivity and alliances, as well as a convenient location and access to the corporate market.

However, they are still focused on asset maximisation and costs which means that airport efficiency is an important criterion. Airport access is all-important for freight operators, given their requirements for night-time flying. They also need some connections for the on-carriage of freight, and may have alliance arrangements in place. An efficient road or rail transport network connected to the airport is essential for the distribution of goods and other items.

The balance in relation to congestion is a more minor consideration in Australia, at least at this stage. The only airport that can be considered even moderately congested is Sydney (Kingsford Smith), which should worsen in the medium term.

Without the “first order” criteria of primary airport congestion, non-primary airport usage in Australia may only grow modestly in the next decade.

3. Analysis of Cost and Duplication Issues

Passenger and freight airlines tend to duplicate their operations at airports in a single city or region only where there is economic or strategic justification for doing so. Examples of this are where a substantial population supports services at each airport (i.e. each airport can draw from a significant and largely non-overlapping catchment area) or where congestion and lack of slots at an airport force growth to occur at a non-primary airport.

LCCs, with their lower cost base and ability to stimulate demand for air travel, generally have the ability to operate successfully at airports with smaller catchment areas than legacy carriers.

There are also a number of examples globally where two airports in a catchment area operate domestic or international services only. In the case of the latter, the airports need to be linked by efficient transport services to enable airlines to maintain service connectivity for passengers transferring between international and domestic flights.

Table 3.1 shows examples of cities in Europe, the US and Asia supporting more than one airport and the operating activities of each airport.

Table 3.1: Operational Profile of Cities Supporting Multiple Airports

City	Population	Airport	Passenger Traffic (2010)	Operating Profile
London	12.5m	Heathrow	65.7m	Domestic, regional, international and cargo services; hub for British Airways, Virgin Atlantic.
		Gatwick	31.4m	Domestic, regional, international and cargo services. British Airways and easyJet make up over half of passenger seat capacity.
		Stansted	18.6m	Largely LCC and charter operations. Almost 70% of passenger seat capacity provided by Ryanair.
		Luton	8.7m	Largely LCC (85%) operations. 87% international passengers. Almost half of passenger seat capacity provided by easyJet.
		City	2.8m	Located in the city of London. 64% business travellers. Serves UK domestic, Europe and US.

City	Population	Airport	Passenger Traffic (2010)	Operating Profile
Paris	10.5m	Charles de Gaulle	58.2m	Continental Europe's busiest airport. Serves most major longhaul airlines operating into Paris; hub for Air France, easyJet, FedEx Express.
		Orly	25.2m	Busiest French domestic airport. Air France, EasyJet, British Airways serve both airports.
Frankfurt	1.9m	Am Main	53.0m	Domestic, regional, international and cargo services. Main hub for Lufthansa.
		Hahn	3.5m	LCC and cargo airport. Main base for Ryanair (97% of passenger seat capacity).
Chicago	9.8m	O'Hare	66.8m	Domestic, regional, international and cargo. Dominated by United and American (82% of seat capacity).
		Midway	17.1m	Mainly domestic. Major base for Southwest.
Tokyo	34.3m	Haneda	64.2m	Mainly domestic and regional Asian passenger and cargo services. Major expansion during 2010-11 will see a significant increase in slots including for longhaul international services. Major hub for ANA and Japan Airlines.
		Narita	33.9m	Main international gateway also serves domestic, regional and cargo. Main hub for ANA and Japan Airlines.
Shanghai	24.8m	Pudong	40.6m	International and regional services. Major hub for Air China, China Eastern and Shanghai Airlines.
		Hongqiao	31.3m	Largely domestic with some limited regional services. Hub for China Eastern and Shanghai Airlines.

Source: CAPA Analysis, Airports Council International, Airport websites

In the Sydney situation, separating the international and domestic airports is not a feasible option given the lack of land availability within a reasonable (short) distance of Mascot and the difficulty in providing a high speed transport link between the two. With a population of 4.6 million in the wider Sydney region[27] the sustainability of two similar airports would be at risk.

However, a non-primary airport that supported differentiated services, such as low cost carrier services, may be more economically viable for a city the size of Sydney.

[27] Australian Bureau of Statistics, Sydney Statistical Division at 30 June 2010

A hub operation is a specialised investment. There are high set-up costs involved in an airline establishing operations at an airport and a number of benefits for an airline to concentrate operations at one airport.

These include economies related to higher frequencies, larger aircraft and joint use of common facilities. Part of the costs of developing a hub operation are sunk costs for an airline and there are high switching costs involved where an airline moves its operations from one airport to another.

Where a carrier is required to operate at two airports within the same catchment area there is likely to be a duplication of assets and supporting resources. The major costs relate to infrastructure financing, upkeep and upgrade, however, there may also be operating costs that are either duplicated or have a higher unit cost at a non-primary airport where an airline may not be able to achieve the economies of scale or cost efficiencies available when operating from one location.

In its consideration of the Lufthansa and SWISS merger, the Commission of the European Communities noted:

"Most traditional airline carriers operate a hub-and-spoke system. At its hub airport an incumbent carrier benefits from economies of scope in terms of overhead and operational costs. Such economies of scope stem from the flexibility of assets used by airlines. Indeed, many aircraft and crew can be used for many destinations. Ground handling and aircraft maintenance are also activities that require a certain amount of fixed costs that can be spread over many markets. In sum, a carrier with an established base of operations at a particular airport will benefit from clear cost advantages".

In addition to cost duplication incurred by airlines, government and other service providers may incur additional costs, for example in establishing border security controls, and air navigation, fire and rescue services. However, government and other suppliers are likely to pass these costs on to the airlines operating at the airport. Airlines may or may not be able to pass on additional costs to passengers, depending on the competitive environment.

3.1 Infrastructure and Other Asset Costs

The extent to which an airline duplicates infrastructure and other assets depends on a number of factors. Airlines may invest in infrastructure such as airport terminals and the facilities within those terminals, cargo storage and handling facilities and hangars at both the primary and non-primary airports.

In some cases, there may already be some established facilities at non-primary airports, for example runways and other airside infrastructure at former military airports (Clark International Airport in the Philippines is one example; Frankfurt Hahn, a former NATO base, is another).

Even where an airline is not financing infrastructure, it is likely to have incurred fit-out costs in customising areas of the terminal such as check-in, departure areas and lounges.

Freight carriers require specialised fit-out of handling facilities. In addition to terminal and other operational areas, airlines need to provide or rent office space and incur the costs of fit-out and office related equipment. Further costs will be incurred for maintenance and upkeep of facilities, along with property-related outgoings.

Infrastructure requirements will vary depending on the airline's operating model. LCCs will seek a simple terminal structure and fit-out in keeping with their no-frills business models and image and their need to keep costs to a minimum. Legacy carriers, by contrast, need to provide a relatively high quality facility for their higher yielding passengers.

The level of IT infrastructure required will depend on the airline's connectivity requirements and the equipment provided by the airport. Many airports offer Common User Terminal Equipment (CUTE)[28] which is charged to airlines based on usage. However airlines still need to fund equipment such as self-service kiosks.

In addition to infrastructure, there can be a duplication of other assets required for operational purposes.

Airlines establishing their own line maintenance operation at an airport (more likely to be legacy carriers than LCCs) will bear the cost of providing additional tooling and spare parts at the non-primary airport.

Similarly, passenger and freight airlines carrying out their own ground handling will need ground service equipment.

3.2 Operational Costs

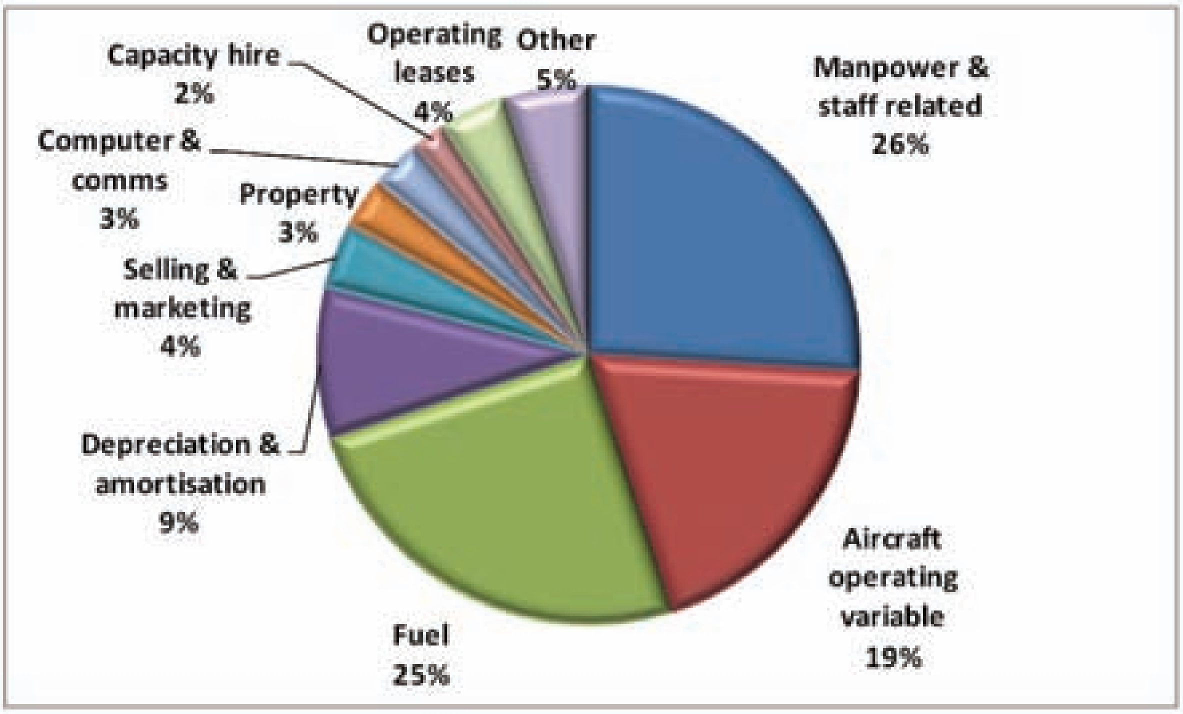
Statutory reporting requirements generally do not impose a level of detail that allows an airline's airport-related costs to be analysed. Airlines themselves tend not to volunteer this information due to the competitive nature of the industry.

Comparison between airlines is further hampered by the lack of consistency in allocation of expense items to each category.

The most detailed breakdown of costs provided by Qantas for the Group (Qantas mainline, Jetstar and QantasLink) for FY11 is shown in **Figure 3.1** below.

[28] CUTE systems enable sharing of equipment and applications at airports (departure control, reservations systems, etc). LCCs are often reluctant to use these systems because of the substantial cost involved, and seek lower cost terminal solutions.

Figure 3.1 Qantas Group Operating Costs (FY11)



Source: Qantas Data Book 2011

As noted earlier, fuel represents some 25% to 30% of total operating costs for legacy airlines compared with 40% or more for LCCs. The Qantas Group's fuel cost of 25% of operating costs compares to the Virgin Australia Group at 27.5%[29] for FY11.

Tiger Airways Group reported fuel costs of 40.0%[30] of operating costs for FY11 while AirAsia Group reported 43.7%[31] for FY10. An overall lower cost structure provides LCCs with a greater capacity to withstand price rises.

Short-haul carriers (both LCC and legacy) incur a fuel cost disadvantage compared to long-haul carriers due to their shorter sector lengths.

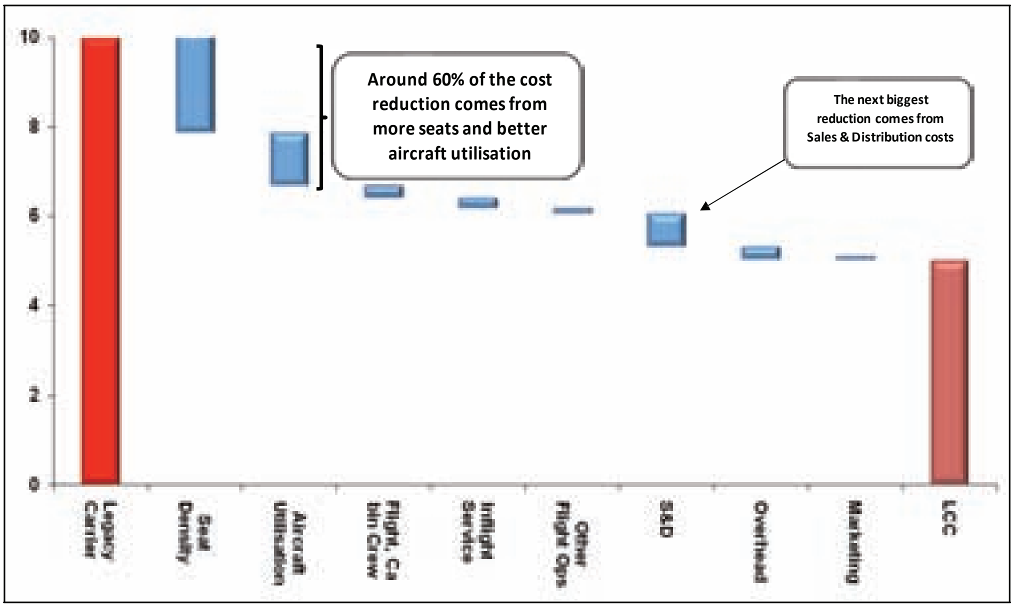
Take-off, climb, decent and landing burns more fuel than cruise. Aircraft also burn fuel at different rates depending on age/model/engine type. LCC's are assumed to have newer aircraft than legacy carriers, but this is not always the case.

The allocation of costs varies between legacy carriers and LCCs. For the same fixed capital costs, an LCC can significantly reduce the costs of putting a seat in the air.

Figure 3.2 shows the main areas of cost differential between legacy carriers and LCCs. This indicates that the majority of savings are related to product, asset utilisation, work practices and distribution systems.

[29] Virgin Blue Holdings Limited Group (now Virgin Australia), Annual Report 2011 (Year ended 30 June 2011)
[30] Tiger Airways Holdings Limited, Annual Report 2011 (Year ended 31 March 2011)
[31] AirAsia Berhad, Annual Report 2010 (Year ended 31 December 2010)

Figure 3.2: Cost Differential Between Legacy Carriers and LCCs (US cents per Available Seat Kilometre[32])



Source: CAPA Analysis

Low cost carriers generally outsource a number of activities to provide a lower and more flexible cost structure. Functions such as aircraft and engine maintenance, ground handling and passenger handling are outsourced to companies specialising in these services at a lower cost than an airline could achieve through carrying out the activities in-house.

Tiger Airways Group estimates that outsourcing enables it to maintain one of the lowest ratios of employees per aircraft of any airline in the world at 32.9 employees per aircraft.

European LCC Ryanair has a similar ratio of 29.6 employees per aircraft[33]. In comparison, the Qantas Group has 115.3 employees per aircraft[34] and Singapore Airlines has 125.8[35]. In addition, to the higher level of aircraft and airline support services carried out in-house, legacy carrier groups tend to contain a greater level of non-airline subsidiaries, for example, holiday booking companies.

However, the economies associated with outsourcing are more difficult to achieve where the airline's operations are spread over two facilities. In smaller markets there may be a greater risk of monopoly suppliers and their charging regimes.

[32] Cost per Available Seat Kilometre is a recognised unit cost metric which represents the cost per available seat for each kilometer travelled.
[33] Ryanair Holdings plc, Annual Report 2011 (year ended 31 March 2011)
[34] Qantas Databook 2011
[35] Singapore Airlines, Annual Report 2010/11

Cost allocations also vary across regions with labour accounting for a higher share of operating costs in North America and Europe than in Asia, reflecting the relatively lower wage levels in that region. As a result, fuel costs for Asian carriers tend to account for a higher proportion of operating costs.

As most costs are flight-related, the majority of an airline's operating costs are not duplicated by operating from two airports in the same city.

However, in spreading operations across two airports, an airline may incur duplication of specific airport-related costs as well as failing to achieve the economies of scale or cost efficiencies available when operating from one location.

3.2.1 Airport and Air Navigation Charges

Airlines are subject to airport charges for the use of the airport infrastructure and facilities. Generally these charges are aimed at recouping the costs of building, maintaining and upgrading the facilities and may take the form of:

- landing charges, often based on aircraft weight;
- aircraft parking charges, generally time based;
- terminal usage charges, usually based on the number of passengers;
- hangar charges; and
- fees for aerobridge use.

Australia's airports operate on a "dual till" basis of charging. This means that only aeronautical activities are taken into account in determining the level of airport charges. The airport's retail, commercial property and other non-aeronautical revenue is not taken into account.

Airport charges calculated using the "single till" basis (i.e. taking into account all airport activities) are likely to be lower than under the dual till system because airlines effectively share in the profits generated by non-aeronautical commercial activities.

Qantas does not separately disclose airport charges, however, the Group's total route navigation and landing fees for FY11 (included in "aircraft operating" variable in **Figure 3.1** above) represented 8.2% (A$1.2 billion) of total operating expenses.

Tiger Airways Group reported airport and handling costs at 10.9% (S$62.7 million) of total operating costs for FY11 with a further 5.5% (S$31.5 million) incurred in route charges. Virgin Australia reported airport charges, navigation and station operations expenses of 18.7% of operating costs for the same period.

As an indication of the various charges, **Tables 1.1** and **1.2** in **Appendix I** set out the charges imposed by Sydney Airport and Airservices Australia.

In theory, operating at two airports does not duplicate airport charges for an airline if the passenger to aircraft ratio is maintained when operations are moved to the non-primary airport and the primary airport is able to replace any lost traffic.

That is, the airline operates the same number of flights and services the same number of passengers in total, and the airport's costs are able to be spread over the same level of activity. This also assumes the same level of per passenger and/or per aircraft charges at each airport.

In practice, an airline may suffer lower load factors through operating additional flights in which case there is a trade-off between lower passenger charges and higher landing charges.

However, lack of congestion and slot availability at the non-primary airport may allow growth in both aircraft movements and passenger traffic, in which case the airline will be generating additional revenue to cover the additional costs.

This also applies to air navigation services. Airlines are charged fees for en-route facilities and services, including approach and aerodrome control charges and distance-based charges for use of a country's or territory's airspace. Airservices charges the following fees calculated per landing based on the maximum take-off weight (MTOW) of an aircraft:

- terminal navigation charges;
- aviation rescue and fire-fighting charges; and
- en-route charges.

Airlines may in fact be able to achieve savings in airport charges by operating from a non-primary airport. To the extent that the airline is funding a lower cost facility, airport charges at the non-primary airport may be lower than at the primary airport.

Incentivised Programs

There are various models for airports to provide incentives to attract airlines to an airport, to encourage new services or growth in services to specific destinations, and to maximise passenger throughput. European LCCs in particular have been aggressive in negotiating incentives, with Ryanair refusing to operate from some airports without being paid by the airport to do so (examples of this are provided in **Section 2**).

Common incentive arrangements in place in Australia include airports, often in conjunction with local and state governments, providing lump sum funding for offsetting costs such as marketing. An example of this was the A$2.25 million incentive package provided by the South Australian Government to Tiger Airways in 2008 to operate out of Adelaide Airport. A further A$0.9 million was contributed by the South Australian Tourism Commission.

An earlier incentive package valued at over A$10 million had been offered by the South Australian Government for Tiger to choose Adelaide as its Australian headquarters. This offer was rejected in favour of an offer by the Victorian Government. The Victorian and Tasmanian Governments also worked with their airports to offer service incentives to Tiger. In return the State expects economic benefits to flow from additional employment and tourism generated by the carrier.

Airports and airlines often negotiate airport charges so that each shares in the risks and benefits. Airlines may be offered lower charges for increased passenger throughput, which benefits the airport through increased non-aeronautical revenue streams such as retail and ground transport.

During times of aviation industry downturn, the airline pays more on a per passenger basis, which helps the airport offset decreases in non-aeronautical revenue. An example of this type of arrangement is the Jetstar agreement entered into with Cairns Airport in late 2009, structured to incentivise international passenger growth.

Some cities offer a dedicated LCC terminal or airport. These airports allow cost savings for airlines through basic facilities for passengers and operational savings from not using aerobridges and pushback tugs.

As an example, Singapore's Changi Airport Budget Terminal imposes a passenger charge of S$18 per departing passenger compared to S$28 at the main airport terminals. In Europe, Frankfurt am Main Airport charges €16.30 to 22.15 per passenger.

By contrast, Frankfurt Hahn Airport, which is now largely a LCC airport, charges on a sliding scale that provides incentives for achieving higher passenger numbers. Hahn's charges are €5.35 per passenger where an airline has less than 100,000 passengers per year. However, these charges reduce to €2.19 per passenger where the airline achieves a passenger throughput of over 10 million.

3.2.2 Labour

Labour costs represent a significant cost item for airlines, in particular for legacy airlines. The Qantas Group's manpower and staff costs for FY11 were A$3.7 billion, or 26% of operating costs. LCCs tend to have a lower level of labour costs due to their outsourcing of services, as discussed above. Tiger Airways Group's staff costs for FY11 of S$81.1 million represents 14.1% of its operating costs.

Duplication of both operational and administrative labour costs may be able to be managed to a large degree by an airline through use of flexible labour agreements allowing shifts, part-time and casual labour. Outsourcing of activities is another means of achieving labour-related efficiencies. This is particularly important where the level of operations at a non-primary airport is not sufficient to warrant a complement of full time operational employees.

However an airline may not achieve the same level of labour productivity operating at two airports compared to one. An exception to this may be where the primary airport suffers from a high degree of operational inefficiency, for example relating to airport congestion. In this case it is possible that more effective and cost-efficient labour at the non-primary airport will in fact improve the airline's overall average labour productivity and cost.

Levels of employment and the ability to source sufficient skilled labour in a non-primary catchment area will impact on the airline's costs relative to those at the primary airport.

An airline is unlikely to require a non-primary crew basing to service one city, however, operating from two airports adds a level of complexity to crew scheduling and may require additional crew to be employed to service operations from the two locations. Repositioning of aircraft between the airports will also impact negatively on labour costs.

3.2.3 Ground Handling

Ground handling is a relatively small component of a passenger airline's operating costs, but likely to be a larger cost item for a freight carrier. For FY11, Qantas Group's ground handling costs represented 1.7% (A$247.4 million) of total operating costs. (Tiger and Virgin Australia do not disclose this cost item separately)

The key area of duplication in ground handling costs relates to labour, as discussed above. In addition there will be duplication of equipment.

Again, outsourcing ground handling activities to a third party service provider may overcome these issues (a common practice among LCCs).

3.2.4 Positioning and Turnaround Times

Airlines operating from non-primary airports may well achieve cost savings and improved utilisation compared to their operations from primary airports as non-primary airports tend not to have the congestion issues associated with many primary airports.

Aircraft turnaround activities include exchange of passengers, crew, catering services, cargo and baggage handling and technical activities such as refueling, line maintenance and cabin cleaning.

Rapid turnaround improves aircraft utilisation, allowing an airline to maximise the number of sectors flown by an aircraft each day (as discussed in **Section 4**). In addition, turnaround costs can be reduced by limiting use of ground equipment such as auxiliary power units and tugs.

There may however be some additional operating costs incurred by an airline in positioning aircraft and crew between airports. These costs include fuel, labour and airport charges.

3.2.5 Maintenance

An airline will require routine line maintenance support at each airport, although more complex heavy maintenance and engine overhaul can be carried out at a separate facility servicing a large portion of the airline's fleet regardless of aircraft basing.

Labour-related issues have been previously discussed. The main area of maintenance cost duplication is likely to be in supplying tools and other equipment and spare parts.

Legacy carriers such as Qantas often carry out line maintenance at their home ports using their own trained engineers. LCCs often outsource line maintenance to specialised engineering firms, for example, Tiger Airways in Australia outsources line maintenance and routine checks to John Holland.

3.2.6 Other costs

Airlines operating from two airports within the same city are likely to incur additional marketing and branding costs to raise awareness and promote services in the non-primary market.

3.3 Transport Linkage Requirements

For a non-primary airport to be successful, fast transport links are required between the airport and the catchment area centre and between the airport and the main city centre. Generally these will be in the form of rail and/or road links.

Airlines do not usually wear the direct costs of these links, although there are airlines that provide bus connections for arriving and departing flights (e.g. Ryanair). However, the costs of transport to and from the airport (along with the journey time involved) are often a consideration for passengers when calculating their total trip costs. LCC passengers are generally more willing to travel further distances to realise lower airfares, as seen in Europe, in particular.

Thus a substantial commitment to providing transport infrastructure is required to support a non-primary airport. Existing roads around the airport precinct may need to be upgraded to ensure there is no congestion. Rail links may need to be built to connect the airport to the nearest existing train station, and existing rail services to the CBD may need substantial upgrade to provide a fast, efficient service.

3.4 Impact on Network Structures and Service Connectivity

Airlines servicing dual airports have an added difficulty in providing service connectivity.

Legacy airlines are, by and large, hub carriers, offering network connections, flexibility, product comfort and more convenient airports. This higher product quality comes at a cost but can be used to attract customers willing to pay a premium for the additional service and convenience. However, legacy carriers need seamless connections.

The hub-and-spoke model allows airlines to fill aircraft with both local and connecting passengers, thus boosting load factors and reducing the cost per seat. Airlines are better able to exploit economies of network through a reduction in the number of sectors operated and increased density of traffic on these sectors. These network economies drive significant cost advantages.

Concentration of traffic at a hub airport also allows carriers to increase frequencies, particularly on high-yielding business routes where passengers tend to be time sensitive and value schedule flexibility. A carrier'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 codesharing arrangements entered into by an airline, which require not connectivity but similar standards and product offerings, such as lounges, across the airlines (these are discussed in other sections of the report).

These connectivity issues may be able to be overcome to some extent where the primary and non-primary airport are relatively closely located and connected by fast and efficient transport links.

By contrast, most LCCs adopt a point-to-point model. Point-to-point services optimise operational efficiency through:

- No passenger hubbing processes or structures;
- Aircraft, pilots and cabin crew generally return to home base each day; and
- Interlining and codeshares are avoided as they add cost and complexity to operations.

However, there is often a transfer of passengers between point-to-point flights which implies a level of connectivity requirement. Generally though, connectivity is less of an issue for LCC passengers, and LCCs advertise the fact that they do not provide any services relating to flight connections such as baggage transfer.

4. Market, Strategic & Competitive Benefits

This section examines airline strategy, market development and revenue-related issues associated with usage of airports, including the competitive, network and utilisation benefits derived from unconstrained access to runway and terminal infrastructure and opportunities to establish differentiated markets and fare pricing.

In the US, non-primary airports emerged as a consequence of primary airport congestion to provide less constrained access to large metropolitan markets. Increasing delays, population shifts and the requirements of LCCs saw an expanded usage of regional airports surrounding core airports.

Europe's network of non-primary airports related for the most part to the proliferation of LCCs requiring highly incentivised lower cost facilities which in turn stimulated demand and lifted traffic levels. In Asia, there has been a greater extent of mixed usage of airports by LCCs and legacy operators due in part to the lack of alternative access points and the operational models adopted.

4.1 Market Positioning and Competitive Advantage

The segmentation of air travel markets has largely driven the development of non-primary airports offering an alternative access point to metropolitan markets in recent years. Globally, users of these airports generally are either innovative service providers offering market niche products (e.g. LCCs) or integrated express freight operators such as DHL, UPS or Federal Express.

However, as discussed in this report, the distinction between different travel types has become increasingly blurred with the further evolution of LCCs and dual brand strategies of some full service operators with LCC offshoots. This has seen adjustments to the requirements of carriers and, in some cases, the establishment of parallel airport systems within markets.

Non-primary airports provide an opportunity for airlines to establish dominant or even monopoly control of facilities within a market (e.g. Jetstar at Melbourne's Avalon Airport). This can confer both strategic and competitive benefits in relation to:

- brand and market positioning;
- service development (through 24-hour access, the absence of slot constraints and incentives for service growth);
- product differentiation and pricing (capitalising on lower access costs to undercut the fares of operators at the primary airport);
- scheduling efficiency and utilisation of aircraft (enhancing revenue and profitability); and

- aligning of infrastructure to particular requirements (e.g. dedicated "no frills" terminal facilities and absence of aerobridges).

Much of this value relates to "first-mover" airlines to the airport which often can negotiate highly competitive user arrangements in return for a commitment to build passenger traffic and service structures.

Other competitive advantages are derived from the ability to leverage operations and pricing to effectively strengthen an airline's position in particular markets.

4.1.1 Low Cost and Hybrid LCC Carriers

The traditional LCCs have been most adept at taking advantage of alternative non-primary airports in Europe, the US and to a lesser extent Asia and Australia. These are typically the preferred entry points to markets which satisfy their operating rationale, namely that have significant populations at either end of a route; and/or catchments with a high propensity to travel; and/or demonstrated leisure-related demand.

Virgin Australia's operating criteria is more specific in that it will only consider markets which offer a catchment of 100,000 or more unless they are tourism-oriented (e.g. Ballina and Hervey Bay). This is partly a product of the larger aircraft type most operated by Virgin (B737s). These are over-sized for the smaller markets, although the airline also found its regional Embraer E-jets mostly were uneconomic on routes outside the major cities due to the reduced payload:cost ratio[36].

Virgin's preference for larger catchments is expected to become even more defined with its strategic refocus on the business/corporate market in Australia, and the development of commercial relationships with overseas operators serving the major cities.

As noted, non-primary airport options are relatively limited in Australia other than Avalon near Melbourne and perhaps Gold Coast Airport, which also serves the Brisbane market. Newcastle Airport also claims to secure some passengers from the north of Sydney, though it could not be regarded as a genuine competitor to Kingsford Smith.

Avalon, Gold Coast and Newcastle are dominated by LCCs. Jetstar has resumed a monopoly hold on Avalon Airport[37] which originally allowed it to operate some services to the Melbourne market which did not compete on a head-to-head basis with Qantas mainline operations out of Tullamarine.

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[36] Virgin is phasing out its E170 aircraft over 2011-12. Its 18 larger E190s are being flown on a mix on metropolitan and regional routes (e.g. Sydney-Canberra). The airline has entered into an agreement to acquire up to 18 Virgin-branded ATR72 turboprop aircraft which will be operated by Skywest on regional routes.

[37] Tiger Airways had gained access to Avalon as a counter to Jetstar, but has since withdrawn from the airport and re-focused on Tullamarine following the airline's temporary grounding. Tiger states that it is unlikely to resume services from Avalon in the next 12 months, citing the additional cost related with duplication of its Melbourne base and supply service issues (fuel, for example, was reportedly 7-8 cents per litre more expensive at Avalon as it had to be trucked in to the airport).

However, this strategy has lost momentum in recent years as Jetstar increasingly participated on routes shared with Qantas mainline services.

Table 4.1 shows that Jetstar and Qantas currently operate together on 8 routes out of Melbourne (Tullamarine), including the major cities of Sydney, Brisbane, Perth, Adelaide and Cairns. Jetstar also serves Brisbane and Sydney out of Avalon (presently the only services based there).

Table 4.1: Comparison of One-Way Weekly Seats operated by Qantas & Jetstar on Competitive Routes out of Melbourne (Tullamarine) Airport; and Jetstar from Avalon

Melbourne-	Qantas	Jetstar	Jetstar as % Qantas
Adelaide	11496	3186	21.7
Brisbane	15344	3969	20.6
Cairns	1176	3438	74.5
Darwin	1491	504	25.3
Hobart	2352	5208	68.9
Launceston	1258	3540	73.8
Perth	12398	2478	16.7
Sydney	44707	8064	15.3
Avalon-			
Brisbane		2478	100.0
Sydney		4248	100.0

Average seats shown are one-way only for the month of October 2011

Source: SRS Analyser

Avalon arguably has developed as a discrete market to Melbourne, with much of the traffic to/from the airport leisure-oriented and focused on the Great Ocean Road.

Southwest Airlines in the US was one of the first to recognise the advantages of operating from a dedicated airport, with its basing at Dallas Love Airfield. The airline remained at Dallas Love after other operators relocated to Dallas Fort Worth Airport which was further away from the city and considerably more expensive to access.

Despite legislative constraints imposed on Southwest's services from Dallas Love, the airport has become the headquarters for the airline's national operations (The airline accounts for 96% of services at Dallas Love).

LCCs are essentially stand-alone operators. However, as noted, the model is changing and a number of LCCs in Australia and elsewhere are upgrading their product mix, forming alliances and entering into commercial arrangements with legacy operators.

These "hybrids" may or may not require access to the same airport as their airline partners to ensure an efficient transfer of passengers between lights. The differentiation between LCC types, therefore, can have a significant bearing on whether a primary and/or non-primary airport is preferred. Both Virgin Australia and Jetstar maintain codesharing relationships with other carriers, while Tiger Airways Australia does not.

Table 4.2 profiles the extensive partnership structures established by Virgin Australia and Jetstar. Virgin Australia now has 4 codeshare and 18 interline partners which provide connections with its international and domestic services; while Jetstar has 3 codeshare arrangements in place and 21 interline linkages with offshore carriers.

Table 4.2: Profile of Virgin Australia and Jetstar Partnerships

	Partner Airline	Type of Arrangement
Virgin Australia (incl. V Australia & Pacific Blue)	Air New Zealand	19.9% shareholder in Virgin; operate joint services on Tasman
	Singapore Airlines	Initial interline; plan to codeshare on each other's networks, coordinate schedules Australia-Singapore and joint sales/marketing
	Delta Air Lines	Codeshare links Australia-US
	Etihad Airways	Access to joint network of 110 destinations; codeshare links between Australia-Middle East-Europe
	Virgin Atlantic	Codeshare partnership on Australia-UK
	Aerolineas Argentinas	Interline partners
	Air Austral	
	Air Mauritius	
	Air Tahiti Nui	
	Air Calin	
	Airlines PNG	
	Cathay Pacific	
	China Southern	
	Garuda	
	Dragonair	
	Emirates	
	Hawaiian Air	
	MAS	
	Qatar Airways	
	Royal Brunei	
	SAA	
	Thai Airways	
	Vietnam Airlines	
Jetstar Group	Qantas	Codeshares across each other's international/domestic networks
	Jetstar Pacific	27% owned, Joint Venture in Vietnam
	Jetstar Asia	49% owned, Singapore-based Joint Venture
	Valuair	Singapore-based Venture
	Jetstar Japan	Proposed domestic Joint Venture in Japan from 2012
	oneworld	Indirect linkage through Qantas, covers flights operated by Jetstar but ticketed by Qantas
	AirAsia	Cooperation on procurement, support services
	Air France-KLM	Interline partnership covering all Jetstar ports, Paris and Amsterdam
	Japan Airlines	Codeshare arrangements on Australia-Japan
	American Airlines	Codeshare on Australia-US
	Air Calin	Interline Partners
	Air Canada	
	Air Niugini	
	Air Pacific	
	Air Tahiti Nui	
	Cathay Pacific	
	Continental	
	Dragonair	
	Etihad Airways	
	Finnair	
	LAN Airlines	
	LAN Argentina	
	LAN Ecuador	
	LAN Peru	
	Qatar Airways	
	Royal Jordanian	

Source: Virgin Australia, Jetstar

The corollary of this is that both airlines require the most convenient service connections with their partners, which inevitably means that they need to share airports where their flights interconnect.

With its progressive upgrading of product and support technology, Virgin Australia increasingly has become the preferred relationship for Star Alliance members which lost their key Australian partner with the demise of Ansett in 2001.

Jetstar serves as a proxy for Qantas on the international and domestic services it operates. As such, the two cater by necessity to a similar range of overseas partners. The LCC, for example, maintains indirect links with the oneworld global alliance through Qantas-ticketed services flown by Jetstar.

The convergence of the two brands and their international linkages has seen Qantas and Jetstar more often than not operating out of the same airport. Singapore, for example, serves as a major hub both operations – a situation which will intensify as Jetstar bases long haul aircraft in Singapore and further develops in intra-Asian system.

If an LCC adopts a premium class, as in the case of Virgin's V Australia, then the focus may turn to airports which offer business travellers more complicating routings and connections with other airlines.

Competition and the ability to build market share in this segment are typically defined more by the availability of regular flight frequencies and service flexibility than by fare price. However, price is growing in importance for business travellers as many companies and government departments adopt "best fare of the day" approaches their travel accounts.

easyJet in Europe and JetBlue in the US have constructed strategies around a mix of primary and non-primary airports to ensure they have a greater penetration of the premium market. As a consequence, some 40-50% of easyJet's passengers are business-related. This substantially strengthens the airline's route returns as business passengers have later booking patterns and pay up to 20% more on average for tickets.

4.1.2 The Options for Full Service Carriers

With some notable exceptions, Full Service Carriers (FSCs) tend to concentrate services and capacity at primary airports rather than divide operations between more than one airport within a given catchment. This avoids a fragmentation of frequencies, optimises passenger convenience and enables them to provide an aggregated service offering.

The level of investment required to sustain operations at primary airports and duplication costs (as discussed in **Section 3**) act as disincentives to the use of non-primary airports.

In the US and Australia, for example, airlines hold long-term leases on terminals (unlike Europe where the airport owners provide terminals). As well, full service airlines rely on the availability of flexible schedules with high frequencies and connectivity to provide a competitive advantage in the important business travel market.

However, once these carriers 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 may be more attractive.

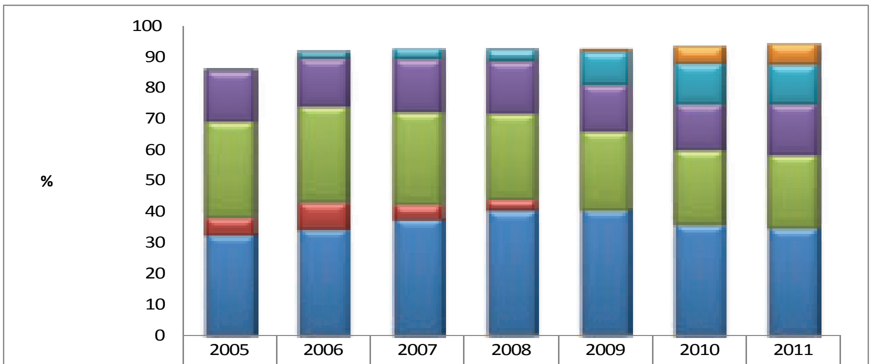
Non-primary airports do provide for a bifurcation of brands within airline groupings (such as Qantas/Jetstar), with consequent opportunities to outsource support services such as ground handling which may not have been possible at a primary airport.

The cost advantages ultimately are balanced against the disadvantages in terms of duplication and labour issues.

In the case of Air New Zealand and its former LCC subsidiary Freedom Air, the operation of two related brands at two different airports within the Auckland market enabled the group to segment fares and market more aggressively. Freedom's services out of Hamilton Airport accessed 25% of the population in southern Auckland. Hamilton and Auckland Airport were equidistant in travel times for this catchment, but Freedom offered fares that were 25-50% lower than Air New Zealand on the same routes.

The dual airport approach enabled the group to secure market share from other competing carriers out of the wider Auckland market (including Hamilton). **Figure 4.1** shows the relative shares of seat capacity by airline between Auckland/Hamilton and Australia between 2005 and 2011.

Figure 4.1: Annual Seat Capacity Share by Airline between Auckland/Hamilton and Australia, 12 months to June 2005-2011



	2005	2006	2007	2008	2009	2010	2011
Jetstar					0.9	5.3	6.6
Pacific Blue	0.2	2.3	3.2	3.5	10.7	13.1	12.4
Emirates	16.2	15.6	16.9	17.2	15.1	14.9	16.5
Qantas	31.2	31.1	30	27.9	25.5	24.3	23.9
Freedom Air	5.8	8.5	4.9	3.4			
Air NZ	32.2	34.3	37.4	40.3	40.4	35.5	34.5

Source: SRS Analyser

Freedom's share peaked in 2006 when it accounted for 8.5% of trans-Tasman seats in the Auckland/Hamilton market. This lifted Air New Zealand group's overall share to 42.8% compared with 31.1% for its nearest competitor Qantas.

Freedom's capacity was scaled back in the two years after that until its departure in late 2008 as Air NZ consolidated its Tasman operations under one brand. Qantas's relative share reduced from 31.2% in 2005 (almost on par with Air NZ) to 25.5% in 2009, reflecting the impact of Freedom and Virgin Australia subsidiary Pacific Blue. By 2011, Qantas mainline's share of the Auckland/Hamilton market was down to 23.9% but Jetstar had increased its share to 6.6%.

Air NZ initially replaced Freedom at Hamilton Airport in 2009, then departed the following year when Pacific Blue took up services to the airport to fill the LCC market gap vacated by Freedom. Pacific Blue (through its owner Virgin Australia) subsequently has formed a joint services partnership on the Tasman with Air NZ, which is unlikely to have an immediate impact on Hamilton operations.

Hamilton Airport currently accounts for less than 2% of the Tasman seats in the wider Auckland catchment and plans to reinvent itself in the longer term as a non-primary gateway for wide-body, long haul services. The airport recently received the necessary approvals to extend its runway to 3,000 metres to accommodate such a development, with a particular focus on international LCCs accessing the central region of the North Island.

This strategy reflects that of Gold Coast Airport which has successfully developed as an LCC base even though its catchment overlaps that of nearby Brisbane International Airport, and the United Kingdom's Stansted Airport which services LCC traffic for the London market. Newcastle Airport also has ambitions in this regard.

Another option in relation to full service carriers could involve the basing of some long-haul international operations at a non-primary airport, as has occurred in Europe.

In theory, this could be achieved without compromising their competitive position, especially if fast transport linkages were provided to the primary airport.

While international services generally are not as time-sensitive as domestic services and operate at a lower frequency, there is a proportion of transfer traffic between airlines in the same alliance.

Long-haul, direct services from non-hub airports can grab a major share of the premium market. An example is the direct premium-focused service between Düsseldorf and New York.

Similarly, Singapore Airlines has taken advantage of the availability of longer rage aircraft to establish a non-stop, business-based service to the US (rather than channel US services via other Asian ports).

PrivateAir also operates a number of business-only services on behalf of Lufthansa, Swiss International and KLM (the latter between Houston and Amsterdam). These are niche services on routes not normally served through the larger hub airports.

These examples suggest that the viability of long-haul services from non-primary airports may be dependent on passenger preferences for direct rather than indirect services and the existence of a strong local demand from high yield customers.

If the yield returns are high enough, services can be operated on a relatively limited basis with smaller capacity aircraft. This model essentially focuses on the use of non-primary airports for business aviation.

Many of the services PrivateAir operates for scheduled airlines in Europe, for example, are charter-style corporate shuttles using business jets. The company maintained a contract with Airbus between 2003 and 2008 to carry its executives between European production sites. PrivateAir also serves Zurich-Newark six times a week with a 56-seat jet on behalf of Swiss International.

The fact that most long-haul services in Australia operate out of major hubs can be attributed to:

- the types of markets served (other than the "kangaroo" route, long-haul services are predominantly non-stop);
- a lack of alternative gateways within metropolitan markets or with sizeable catchments of their own; and
- limitations on aircraft technology (no current aircraft type can fly non-stop both ways between Sydney and London).

4.1.3 The Freight Perspective

The market and operational characteristics of non-primary airports generally are inconsistent with the requirements of freight operators for on-carriage and distribution of goods between international and domestic services and domestic-domestic. Substantial infrastructure is also critical such as warehousing, freight forwarders and IT processing systems.

Air freight operates most effectively and efficiently in a mixed environment at major hubs with interconnecting services. A significant proportion of cargo is carried in the belly-space of scheduled airlines, and this is often transferred to and from dedicated freighters.

As a consequence, few freight-only airports exist. However, a number of airports with a strong focus on freight have been established around economic/trade and logistics zones in Europe and Asia, for example Chalon Vatry Airport in the north east of France.

Vatry is located in close proximity to Europe's largest freight traffic zone[38] in an area with a very low population density. As such, the airport is not subject to environmental constraints and offers unrestricted access at all times of day and night for the mostly international cargo operators serving Vatry.

The 3,860m runway is equipped to take the largest freighters with no payload limitations. Specialised cargo-handling facilities are available which allow for low-cost processing and storage, and major companies and logistics operators are based in Vatry Business Park.

This demonstrates the propensity for freight-based airports to develop within or near designated industry development areas and logistics parks which provide for a robust flow of cargo in a multi-modal environment. Much of the airfreight through Vatry is concentrated on high-end perishable goods and electronic components.

Potential for Express Freight Operations

Another form of cargo which has seen the development of dedicated operations at non-primary airports relates to express freight. Some operators have established stand-alone bases at non-primary airports, particularly in Europe, the US and to a lesser extent Asia.

These companies are highly specialised and maintain a lower dependency on the type of support infrastructure required by general freight carriers. They offer a seamless, door-to-door service; and operate through the night outside the patterns normally associated with scheduled passenger services.

In the large overseas markets, the heavy demands for express freight require high frequency operations which do not sit comfortably with busy major airports. Unconstrained access is extremely important.

Companies such as UPS, Federal Express and DHL typically develop hub-and-spoke systems for the consolidation and distribution of parcels, documents and other express freight. Their aircraft fleets are among the largest in the world, and include everything from turboprop and small jet aircraft to international B747 and A380 freighters (UPS, FedEx and DHL, for example, each operate around 600 aircraft, more than Lufthansa, BA or Air France-KLM).

FedEx and UPS, in particular, have concentrated on building operations at non-primary airports in the US beyond their hubs in Memphis and Louisville, such as Chicago/Rockport, Los Angeles/Ontario; San Francisco/Oakland and Toronto/Hamilton. The advantages are that they can service these metropolitan markets through less congested (and less expensive) airports, thereby optimising the flow of express freight items and revenue. Land transport linkages are essential to this equation, and work in

[38] 75% of the EU's freight traffic is within a six hour drive of Vatry.

tandem with air services to maintain an efficient door-to-door delivery system for higher value time-sensitive goods.

The two operators also established their intra-Asian bases at non-primary airports in the Philippines – the former at Subic Bay International Airport and UPS at the ex-military base Clark International Airport. These airports are strategically placed within four hours' flying time of the major Asian markets. FedEx has subsequently closed its Subic Bay base and transferred operations to Guangzhou in the Chinese Pearl River Delta.

By contrast, Clark is being developed as an ASEAN hub for the Philippines and will eventually assume responsibility for international services from Manila's congested Ninoy Aquino International Airport. Ninoy Aquino will become a domestic airport under these plans.

Round-the-clock access to airports is critical for freight operators. Most express freight movements take place overnight, so that mail, documents and packages and other goods can be distributed to customers by the next business day.

Primary airports, particularly those with operating restrictions or curfews, are often unsuitable. Freight rates are also highly competitive which encourages operations into airports with the lowest access costs.

In Australia, most of the larger express freight operators are focused on the major metropolitan airports. This reflects a range of issues, including relationships with the major airlines (Qantas, for example, is a 50% owner of Australian air Express and road freight group Star Track Express) and a lack of alternative access points in their key markets.

However, existing limitations on night-time jet movements at a number of airports, including Sydney, does have the effect of impeding the capacity utilised by the companies and the flow of freight to and from customers.

4.1.4 The Non-Primary Airport Option for Regional Carriers

For the purposes of this report, regional carriers are defined as operators of smaller jets (100 seats or less) and/or turboprop aircraft which focus on less dense routes than the larger airlines. They generally service markets which do not have sufficient demand to support mainline services, providing links between these markets and the major cities or between regional towns and cities.

In the US, regional operators often act as feeder airlines for the major operators with hub connections or supplement frequencies for their partners during periods of low demand. They can be affiliates of the "majors" or operate as an independent brand.

European regional carriers operate on intra-continental sectors, are often non-aligned (though there are some subsidiaries) and feed passengers into and out of the hub airports, where some connect with longer distance flights on other operators.

The operating models vary from the traditional Full Service Carriers to LCCs. The 65 EU regionals carry a substantial proportion of business traffic (35% of total European regional passengers in 2009[39]).

According to the European Regions Airline Association (ERAA), about 38% of the total passengers carried by regional operators interlined with other services in 2009 (15% domestic, 5% international and 18% intra-EU). This suggests a significant requirement for connectivity by the regional airlines either by serving the same airport as their interline partner or an airport offering efficient transport links between airports.

While the cost incurred through using primary airports are 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.

This is little different to Australia where regional carriers focus on capital city airports and maintain alliance or interline relationships with interstate and international operators (e.g. Regional Express/Virgin; Skywest interline agreements with Qantas, Air New Zealand and Singapore Airlines through Perth; and Airnorth/Qantas).

4.2 Service Growth Opportunities

Airlines typically seek to build their operations at an airport to a critical fleet mass which is cost effective[40] and sustains viability. The definition of critical mass varies between carrier types, with full service carriers generally requiring 10 aircraft while LCCs can achieved this with two aircraft because of their much lower cost structures.

As noted, legacy operators tend to establish bases and concentrate services at primary airports. They extract greater value from adding services at these airports as this:

- builds frequencies and market share, strengthening their competitive position; and
- enables them to provide extra flights at marginal cost.

This strategy is obviously more applicable to established operators in a market than to new entrants or LCCs.

The key criteria for LCCs focus on airport accessibility and incentivised entry structures. LCCs generally move quickly after entry to a new route to a daily service. This is the minimum required to sustain economic operations. If route performance is either marginal or non-viable, operators will not hesitate to relocate services to another destination.

[39] Latest available data for European Regions Airline Association.

[40] Critical mass refers to the number of frequencies required to generate sufficient revenue to support the airport-related costs of maintenance equipment, spare parts, terminal and loading facilities and crew training.

Assuming that sufficient aircraft capacity is available, the ability of carriers to establish and expand services depends on access to slots and gates at appropriate times and other airport facilities required to accommodate demand.

Non-primary or under-utilised airports offer more attractive prospects in that regard, as well as competitive advantages for new market entrants which are often further down the priority list than incumbent operators when slots become available at primary airports. Severe access constraints at Heathrow Airport, for example, effectively underwrote the migration of LCCs to the other London airports, Gatwick, Stansted and Luton.

A list of metropolitan regions served by non-primary airports with LCCs is provided in **Table 4.1**.

Table 4.1: Metropolitan Regions Served by Non-Primary Airports with LCCs

Metropolitan Region	Secondary Airport	Low-cost Airline
Boston	Providence	Southwest
Boston	Manchester, NH	Southwest
Brussels	Charleroi	Ryanair
Copenhagen	Malmo, Sweden	Ryanair
Dallas/Fort Worth	Love	Southwest
Frankfurt	Hahn	Ryanair
Glasgow	Prestwick	Ryanair
Hamburg	Lübeck	Ryanair
Houston/Galveston	Hobby	Southwest
London	Stansted	Ryanair
London	Luton	easyjet
Los Angeles	Long Beach	jetBlue
Manchester (UK)	Liverpool	easyjet
Melbourne (Australia)	Avalon	Jetstar
Miami	Fort Lauderdale	Southwest
Milan	Orio al Serio	Ryanair
New York	Islip	Southwest
Oslo	Torp	Ryanair
Paris	Beauvais	Ryanair
Rome	Ciampino	easyjet, Ryanair
San Francisco	Oakland	Southwest
Stockholm	Skvasta	Ryanair
Vancouver	Abbotsford	Westjet

Source: CAPA Consulting

Given that a sometimes sizeable proportion of the traffic carried by LCCs[41] relates to first-time air travelers, their low-pricing strategies have the potential to deliver collateral revenue benefits for all airlines operating within a particular market.

[41] In Europe, newly-generated traffic accounted for about 50% of LCC-related growth during the early 2000s.

There are numerous examples in the US, Europe and Australia of what was termed the "Southwest effect" or "Ryanair effect" whereby the entry of an LCC stimulates traffic demand to such an extent that other operators feed off that growth.

In the Pacific, the introduction of Pacific Blue services from Australia and New Zealand to Fiji and Vanuatu strengthened the overall market volumes and passenger loads for the existing national carriers (though at the expense of yields).

Traffic patterns at airports with a high concentration of LCCs, particularly during the establishment phase, exhibit very robust double-digit growth which tends to plateau over time. This enables growth to be realised without an appreciable increase in frequencies.

Given the propensity for traffic growth inherent with the LCC model, airports need the capacity and flexibility to service their requirements, including 24-hour all-weather operations, runway infrastructure with no payload limitations and uncomplicated passenger processing and turnaround facilities.

Fleet productivity is paramount (as discussed in **Section 4.3**), whether on the ground or in the air, and LCCs prefer to avoid airports where there is a high risk of delays for air traffic control clearance, access to gates or lengthy taxiing times.

LCCs will serve congested airports, but only if the scale of market opportunity outweighs the disadvantages or there are no alternatives available (e.g. Sydney).

By achieving rapid turnarounds, jetBlue, for example, manages to process between 600,000 and 700,000 passengers annually through its gates at New York/Kennedy Airport, compared with the 250,000 passengers achieved by American Airlines through its own gates.

This differential is typical of the cost and revenue advantages which can be realised through greater efficiencies.

The insistence on "minimal" processing complexities (and cost) has been addressed by the establishment of LCC-dedicated terminals with basic infrastructure at some primary and non-primary airports (e.g. Melbourne, Kuala Lumpur and Singapore and 24 other airports globally).

4.3 Revenue Implications

The most important factors driving revenue growth are yield, load factors and aircraft utilisation. By driving high yield and load factors, an airline optimises returns from the seats flown; maximising utilisation (i.e. the hours flown per day) is central to reducing unit costs and ensures that capital assets are fully employed.

Non-primary airports can deliver benefits in these areas by enabling carriers to schedule services throughout the day and night; maintain schedule integrity; and to undertake tactical pricing and niche market development strategies.

4.3.1 Scheduling and Aircraft Utilisation Benefits

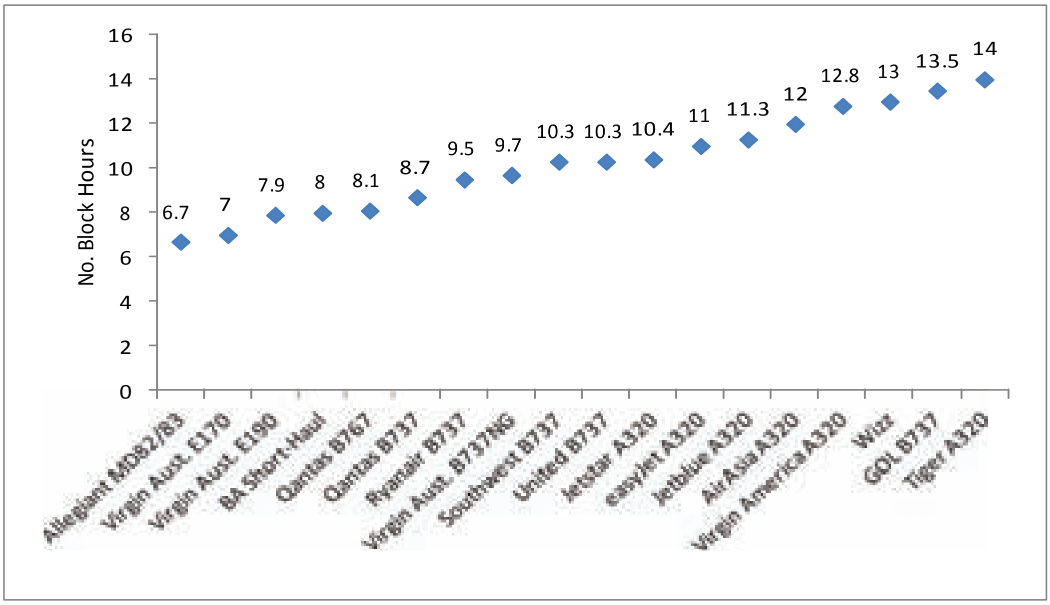
The ability to offer a 24-hour schedule with no limitations on take-off and landing slots allows airlines to optimise utilisation of their fleet, and to structure flights through the night if required.

LCCs, for example, often schedule late night or early morning back-of-the-clock flights to build utilisation. Given their focus on leisure markets, passengers have relatively flexible requirements on timing. By using an unrestricted non-primary airport, Virgin Australia, for example, could operate an overnight service between Sydney and Perth, returning it in time for the morning peak on the eastern seaboard.

As noted, utilisation rates directly flow through to the Profit and Loss accounts by enhancing revenue-generating potential, and ensure operators extract maximum value from their most expensive assets. Best practice for a short-haul aircraft is generally around 13 or 14 block hours[42] per day. While utilisation is greater for a long-haul aircraft, the yield returns (and unit costs) are also spread over a longer distance.

Figure 4.2 compares daily utilisation rates for a range of selected Australian and overseas short-haul operators and aircraft types. Tiger Airways (Singapore) leads the way with 14 hours per day, followed by other LCCs GOL, wizz and Virgin America. Jetstar is the best performer of the Australian LCCs at 10.4 hours, ahead of Virgin Australia with its B737NGs.

Figure 4.2: Average Daily Aircraft Utilisation for Selected Short-Haul Airlines



Source: Airline Financial Reports & Estimates for 2011

[42] A block hour is defined as the time taken between departing the airport terminal gate and arriving at the destination terminal gate.

The Air New Zealand group achieved significant utilisation benefits by operating Freedom Air out of Hamilton Airport. Freedom's average daily utilisation of 12.8 hours compared with 10 hours for Air NZ from its Auckland operations.

The additional 2-3 hours was gained through improved turnaround times for aircraft, reduced taxiing times and greater operating efficiencies.

Table 4.2 illustrates the annualised revenue benefits for Jetstar, Qantas and Virgin Australia from the addition of one daily aircraft cycle (this is defined as achieving one take-off and one landing).

Table 4.2: Indicative Revenue Impacts by Aircraft Type from Increased Daily Utilisation for the three major Australian Airlines

Airline	Aircraft	Utilisation (Hours)	Cycles	Hours per Cycle	Addition of 1 Cycle	Impact on Utilisation (%)	Annualised Revenue Impact A$
Jetstar	A320	10.4	5.8	1.8	6.8	17.3	2,299,500
	A321	10.4	4.7	2.2	5.7	21.2	5,365,500
	A330-2	14.2	2.1	6.7	3.1	47.2	7,741,650
Qantas	B737-8	8.7	4.8	1.8	5.8	20.7	2,146,200
	A330-3	11	1.6	7	2.6	63.6	7,588,350
	B747-4	12.4	1	12	2	96.8	9,019,150
Virgin	E190	7.9	5.5	1.4	6.5	17.7	1,328,600
	B737NG	9.7	5.5	1.8	6.5	18.6	2,299,500
	B777-3ER	10.5	0.9	11.9	1.9	113.3	9,274,650

*Utilisation rates shown are based on Jetstar rates announced for FY11; CAPA Consulting estimates for Qantas and Virgin Australia/V Australia. For the purposes of the impact assessment, it is assumed that Jetstar's A321 and A330-2 are operated internationally and its A320 is domestic. Similarly, Qantas B737-8 is assumed to be a domestic aircraft.

Source: CAPA Consulting

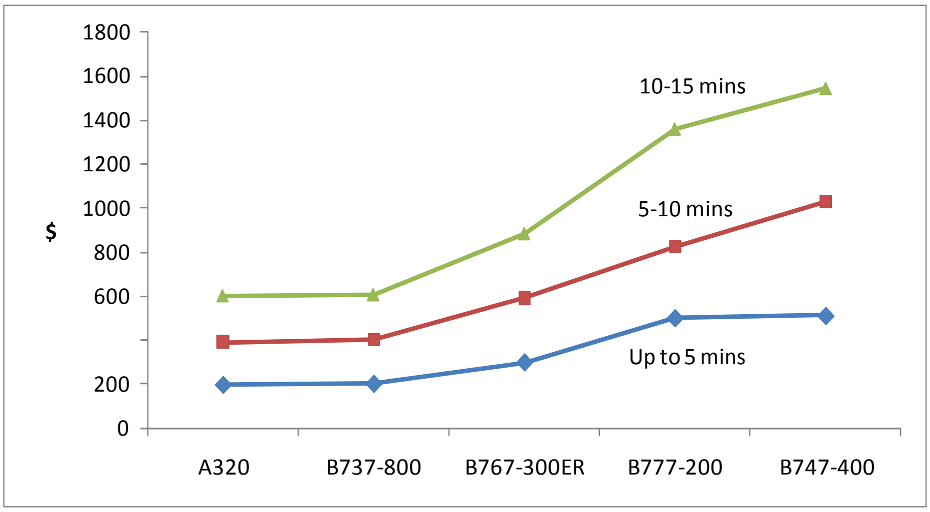
It is assumed that 70% passenger loads are realised by the airlines on the extra flight, and indicative fares of $50 and $100 are charged for each passenger for short-haul and long-haul aircraft respectively. The fares and loads have been adjusted downwards to reflect the type of discounts required for flights and operation at inconvenient times of day or night.

On the above basis, it is estimated that Jetstar could yield an additional $2-$7 million per annum in annualised revenue from one more daily flight depending on the aircraft type; Qantas between $2 million and $9 million; and Virgin Australia from $1-$9 million.

Another factor influencing utilisation rates is the absence of operational delays at an airport, which can be costly even at relatively modest levels and have knock-on implications for the whole network.

Figure 4.3 shows the dollar impacts of delays over 5, 10 and 15 minutes for a typical aircraft operating in the Australian market. These include costs related to fuel, crewing, maintenance, indirect expenditure and network disruption.

Figure 4.3: Typical Delay Costs for Aircraft Types in the Australian Market



Source: CAPA Consulting and Airlines

The impost on airlines ranges from $200 to $600 for 5-15 minutes or around $40 per minute for an A320 or B737-800, both of which are regularly operated in the domestic and trans-Tasman markets and some shorter-haul services to Asia. For an international B777-200 or a B747-400, the delay costs can escalate to about $100 per minute or more.

While this does not appear significant, the overall impact becomes much greater if extended to a large number of flights over a longer period. Airport inefficiency or disruption for whatever reason therefore can add significant amounts to operating costs for an airline. The $46 million cost incurred by Qantas for disruption caused by the Icelandic volcano earlier in 2010, while an extreme example, emphasises the scale of any impost for protracted delays.

On-time performance is also an important selling point for operators, particularly for LCCs which aggressively market their capability for rapid turnarounds at airports and Full Service Carriers pursuing the time-sensitive business travel market.

By using Dallas Love Airfield, Southwest has been able to achieve average turnarounds of 20 minutes compared to 45 minutes for its competitors at the more congested Dallas Fort Worth Airport. This enables the airline to lift utilisation to 10.5 daily flights, more than twice its full service rivals at Dallas Fort Worth, with consequent substantial revenue benefits.

The aircraft productivity argument is compelling for a non-primary airport, on the assumption that the primary airport is subject to frequent operational and slot access constraints. As capacity is reached at the main airport, the peak period inevitably spreads and access for new or additional services is pushed further out.

A dual hub system can overcome some of these problems and provide for increased utilisation by allowing airlines to schedule departures from one airport and arrivals at another. This practice is more commonplace in the US than Europe.

Capacity shortages may force an airline to open a non-primary hub (e.g. Lufthansa at Munich and British Airways at Gatwick) to accommodate general market growth. The Gatwick example, however, was not successful for BA as:

- it led to a duplication of costs with the airline's major London market operations at Heathrow, particularly on the short-haul feeder network;
- long-haul operations could be made more profitable by centralising them at the Heathrow hub;
- the catchments for the two airports were too similar;
- yields at Gatwick were not as high as those at Heathrow; and
- insufficient runway capacity was available at Gatwick to obtain a critical mass of frequencies.

4.3.2 Strategic Pricing

Airlines serving both primary and non-primary airports within the same metropolitan market can strengthen their shares of passenger traffic and revenue by offering fares at differential rates.

As noted previously, Air New Zealand and its LCC subsidiary Freedom Air operated this practice effectively on trans-Tasman routes in the Auckland market, with Freedom rates out of Hamilton Airport up to half those of its mainline parent at Auckland.

Air NZ's focus on the higher value premium market was complemented by Freedom's discounted rates targeting the leisure and VFR segments.

While Freedom has subsequently ceased services, Virgin Australia's Pacific Blue has revived the Auckland-Hamilton strategy through a four times weekly Brisbane-Hamilton link.

Jetstar also operates a multiple airport approach with its Sydney-Melbourne services out of Tullamarine and Avalon airports.

Examples of the fare pricing strategies adopted by the airlines for operations to two markets in the same catchment are shown in **Table 4.3**.

Table 4.3: Comparison of One-Way Airfares for Australian Airlines Serving Two Airports in the Same Market (A$)

	Route	Lowest $	Fully-Flexible $	Highest $
Virgin	Brisbane-Hamilton	359	439	639
	Brisbane-Auckland	248	450	789
	Hamilton vs Auckland	*30.9*	*-2.5*	*-23.5*
	Melbourne-Gold Coast	179.0	249.0	385.0
	Melbourne-Brisbane	165.0	259.0	545.0
	Gold Coast vs Brisbane	*7.8*	*-4.0*	*-41.6*
Jetstar	Melbourne-Gold Coast	219	546	n/a
	Melbourne-Brisbane	219	371	n/a
	Gold Coast vs Brisbane	*0.0*	*32.1*	
	Sydney-Avalon	59	314	n/a
	Sydney-Melbourne	79	344	449
	Avalon vs Melbourne	*-33.9*	*-9.6*	

The fares above are published on the airline websites for travel during a similar period in October 2011.
*The highest fare quoted relates to Corporate Plus for Virgin Australia and the Business Rate for Jetstar.
Source: Airline Websites

Virgin Australia prices its fully-flexible and Corporate Plus fares for Brisbane-Hamilton at a discount to Brisbane-Auckland, reflecting the higher proportion of business-related passengers travelling to Auckland.

The lowest economy rate for Auckland was actually 30% below that for Hamilton due to promotional fares being offered by Virgin, in conjunction with its partner Air New Zealand.

The strategy adopted by Jetstar for Avalon and Tullamarine are similar, with Sydney-Avalon rates anything from 34% below those on the mainstream Sydney-Melbourne (Tullamarine) route. This also ensures that Jetstar does not undermine its Qantas parent on the key Sydney-Melbourne sector. Qantas's lowest fare is broadly consistent with that of its LCC subsidiary.

We note that stimulatory fare levels are sometimes incorporated into commercial agreements between airlines and airports. These have the benefit of ensuring rates remain competitive and have the capacity to grow traffic to target levels.

AirAsia also operates a dual airport approach to the Singapore market through services out of Singapore Changi Airport and nearby Johor Bahru (Senai) across the border in Malaysia.

Its regular fares between Johor Bahru (effectively a non-primary airport for Singapore) and Kuala Lumpur for travel this month are almost 25% cheaper than Singapore-Kuala Lumpur.

However, AirAsia also currently has a promotional one-way fare in the market for Singapore-KL of only A$3, reflecting the heavy competition on that route from Singapore Airlines, Tiger Airways and Malaysia Airlines.

4.3.3 Development of Niche Markets

Non-primary airports can give rise to opportunities for airlines to target and establish sub-sets of markets, for example Jetstar's use of Avalon Airport provides access to tourists visiting the Great Ocean Road as well as passengers in the Geelong and Melbourne markets. Freedom Air was also able to access and develop niche regional markets through its Tasman operations out of Hamilton (the Waikato region) and Palmerston North in New Zealand's North Island.

The development of a "market within a market" can provide competitive advantage, as well as an opportunity to drive revenue returns and stimulate traffic flows even in relatively mature markets.

LCCs originally focused on socio-economic regions where income levels and the propensity to travel by air were relatively low, on the basis that making fares more affordable would reach a new market segment of first-time flyers. As noted earlier, this generated very high growth from the price-sensitive leisure/VFR segment, well in excess of growth rates previously achieved in what were relatively mature markets.

In Australia, Townsville, Hervey Bay, Gold Coast and Newcastle, among others, have been substantial beneficiaries of LCC entry and expansion.

The differentiation between particular market segments is best demonstrated with the London airports. Heathrow, Gatwick, Luton and Stansted, have developed complementary functions within the larger London metropolitan market. Heathrow performs a lynchpin role as a full service intercontinental hub; Gatwick with a largely low fare and leisure focus; and Stansted and Luton as LCC-based operations. While there is some overlap between their markets (particularly with Heathrow and Gatwick), each airport serves a particular niche.

However, the downside of the London airports example is that Gatwick's competitiveness and growth has been stifled by legacy airline preferences for the larger and more diverse Heathrow.

In effect, Gatwick, with its single runway and history as a charter base, has developed by default as a consequence of Heathrow's access constraints even though its catchment extends beyond London to the South-East commuter belt. The removal of restrictions on US carrier access to Heathrow under the Open Skies Agreement between the UK and US has seen the transfer of many US-UK flights to Heathrow (Delta Air Lines and US Airways are the only US airlines still using Gatwick). As a result, Gatwick's North Atlantic traffic fell 35% in FY09, and was still down 1.7% for FY11.

The airport continues to serve a mix of scheduled and charter services, with 4.7 million or one-sixth of total passengers travelling on non-scheduled services in FY11.

While British Airways maintains services at both Heathrow and Gatwick, its share of Gatwick slots has progressively diminished over the past decade from 40% in 2001 to 20% in 2011. easyJet is the largest operator at Gatwick, with 28% of slots and 35% of total passengers. Gatwick now serves as easyJet's largest base.

As noted earlier, it is not uncommon for the major airlines in the US and Europe to serve more than one airport within a market. Air France, for example, operates out of Charles de Gaulle Airport (CDG), Paris, as well as Orly Airport. Orly mostly serves Air France's domestic and regional services, while CDG is the international/EU base.

Like London, Paris has developed a segmented airport system with CDG and Orly mostly focused on international and domestic scheduled traffic and linked to the Paris metropolitan area by rail and road (Air France provides a dedicated bus service from each airport). Le Bourget Airport, 11kms from Paris, has been retained for General Aviation usage, mainly business jets, while Beauvais-Tille Airport (85kms from Paris) is marketed by Ryanair and other LCCs as a gateway to the Paris market.

Ryanair also maintains a distant presence in the Paris market through services to Chalon Vatry Airport, despite it being 145kms from the city. Vatry is the nearest airport to the Euro-Disney theme park.

Over the years, the passenger profile of LCCs has broadened considerably and now resembles that of the legacy carriers in most countries, albeit with a generally smaller corporate representation.

Airlines continue to set fares at rates which exploit varying price elasticities for the different market segments, focusing their heaviest discounting on discretionary leisure/VFR travellers. Until recently, this has been the major source of growth within the Australian market.

Business markets typically are aligned with the function of primary airports because they provide a range of on-carriage and connecting options both internationally and domestically which may not be present at a non-primary airport. However, non-primary airports have the capacity to access peripheral markets for small to medium businesses in specific areas of a conurbation.

4.4 Evaluation of Relative Benefits for an Established Airline and a New Entrant

The relative benefits of primary or non-primary airport usage in strategic, competitive and operational terms were discussed in the preceding section.

In **Section 4.4**, these are prioritised in relation to:

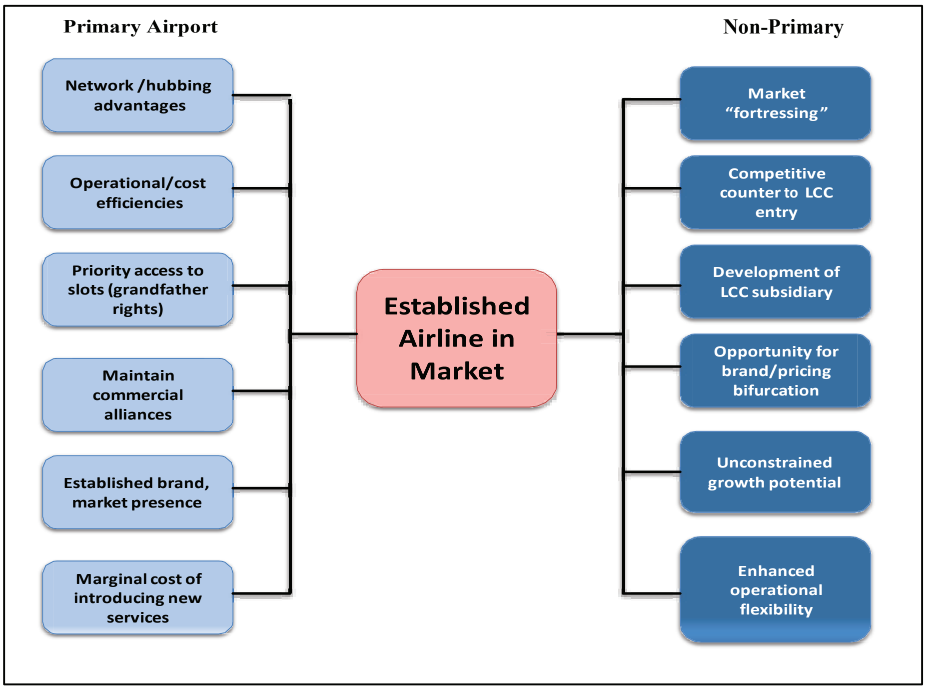
(1) an established airline in a market; and

(2) a new market operator (LCC or otherwise).

4.4.1 An Established Airline

Figure 4.4 provides a summary of the prospective benefits for an airline which is already established in a market of continuing to use a primary airport and/or relocating to a non-primary airport.

Figure 4.4: Summary of Relative Airport Usage Benefits for an Established Airline in a Market



This assumes the airline involved is a legacy operator at a primary airport, with a mixed business/leisure customer base. An established LCC may have a greater degree of mobility due to its outsourced supplier arrangements and lack of any substantial investment in infrastructure.

The overriding priority for an incumbent is to maintain and, if possible, strengthen its existing position in the market and enhance revenue returns and yields. Therefore, the advantages achieved through networking (including connecting services and alliance structures) and access to slots to provide for service growth and incremental market share improvements need to be optimised.

By consolidating operations at one airport (the primary airport), airports can realise efficiencies of scale and cost which translates to enhanced profitability. Additional or new services can be provided at a marginal cost to the operator.

Generally, the carrier will only serve one airport within a particular metropolitan market unless there are specific circumstances which provide a counter-balance to the duplication of costs associated with dual primary and non-primary usage.

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These circumstances have been discussed in this report, and are depicted in **Figure 4.4** under "Non-primary Airports". They broadly fall into two categories:

(1) *Defensive:*

- *Market "fortressing"*: Relocating or establishing services at both primary and non-primary airports provides an opportunity to both build overall market share and establish a deterrent to competition;
- *Countering LCC entry*: Introducing direct competition to a non-primary airport to offset strategic and market benefits accruing to LCCs located or planning to locate there; and
- *Development of an LCC subsidiary*: This provides an opportunity to provide a competitive and pricing counterpoint to LCCs operating in the market, while strengthening an airline's position in price-sensitive market segments.

(2) *Offensive:*

- *Establishment of a dual brand strategy*: Emulating the Qantas/Jetstar approach by introducing two brands with different pricing and cost strategies in a parallel airport system;
- *Pursuing growth opportunities:* As an airline reaches critical mass at the primary airport, and that airport becomes increasingly congested, use of a non-primary airport enables service expansion to take place in a less constrained environment. This scenario allows a coordinated approach to development of the market; and
- *Enhanced operational flexibility:* Establishing complementary services from a non-primary airport may enable the introduction of more flexible schedules and specific targeting of niche markets within the catchment.

Summing up, an incumbent airline is more likely to focus on building a more robust marketing and operational position at the primary airport which offers greater opportunities for these objectives to be achieved.

The capital investment in infrastructure at the airport (terminals or otherwise) make relocation less viable.

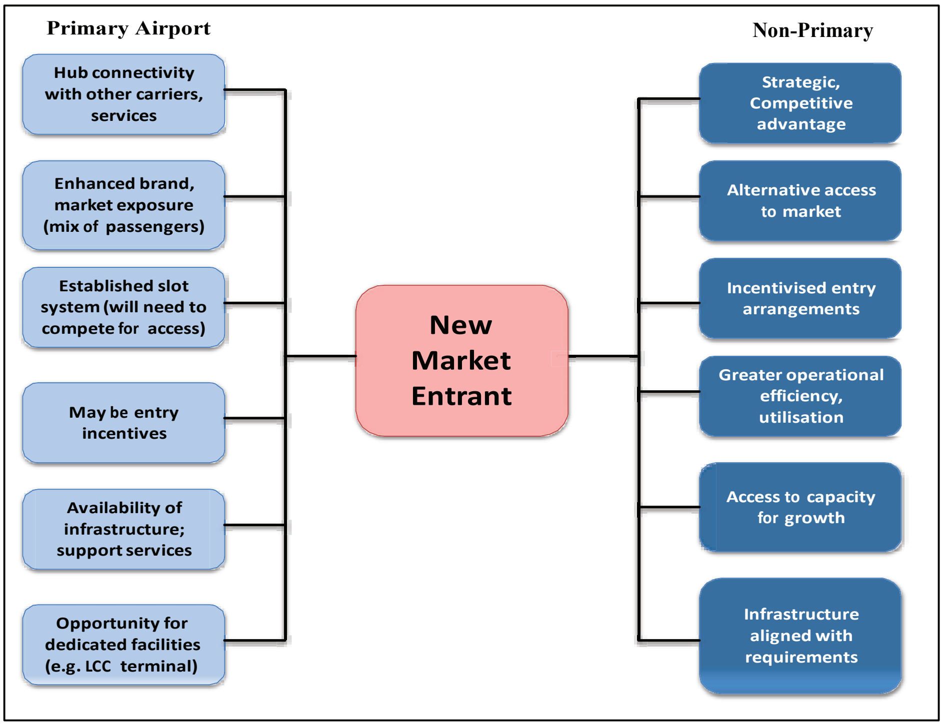
A non-primary airport will be viewed more as a complementary facility, but this does not rule out the potential for "spoiling" strategies to counter emerging competition.

4.4.2 A New Entrant Airline

Figure 4.5 summarises the range of potential benefits available to a new entrant airline in a particular market with a primary and non-primary airport.

In all likelihood, this carrier will either be an LCC seeking an alternative, cheaper entry point to the market or an airline which has been unable to secure access to the primary airport (the default case).

Figure 4.5: Summary of Relative Airport Usage Benefits for a New Market Entrant



The point has been made that LCCs generally are not interested in connectivity, however this may be of greater importance to "hybrid" operators with commercial interline and codesharing relationships.

Their priority is to establish the lowest cost entry to a market which preferably avoids direct competition with larger rivals and provides sufficient room for future growth.

Non-primary airports are more likely to appeal to the prerequisites of the LCC model, as they offer the prospect of greater operational efficiency on the ground and in the air which will optimise aircraft utilisation and provide a competitive advantage over competing users of the primary airport.

Highly incentivised entry packages will be on offer which offset or even underwrite start-up route losses as the non-primary airport and/or government agencies will be keen to encourage the development of traffic.

The primary airport also may have attractive entry provisions available, but it will be careful not to unduly price discriminate against established major airline customers. Discounts or waivers aside, standard charges at the airport will be considerably higher, consistent with the level of sunk costs in the development of infrastructure.

While a new operator may find it difficult to negotiate slots at a primary airport, particularly during peak periods, this should not be an issue at a non-primary airport. As such, the latter provides enhanced opportunities for a rapid build-up of services and for schedule flexibility.

The non-primary airport also may offer purpose-built terminal infrastructure which is more aligned with LCC requirements. However, we note that many primary airports are establishing dedicated LCC terminals.

In summary:

- LCCs (short haul and/or long haul) are more likely to migrate to non-primary rather than primary airports due to their two key priorities:
  - Securing the lowest cost option within a market; and
  - Gaining unconstrained access.

  The benefits in terms of asset utilisation and route profitability, as well as from a strategic and competitive perspective, are significant.
- For non-LCC operators entering a market, a non-primary airport may be a “second best” solution and one that may be only temporary until satisfactory access to the primary airport becomes available. The Gatwick-Heathrow experience suggests that legacy airlines prefer to move to the major hub as soon as they are able to do so.

5. Barriers to Service Establishment

Governments and regulatory systems generally favour usage of non-primary airports as this spreads economic benefits and employment opportunities; is consistent with pro-competitive principles; and relieves pressure on primary infrastructure (Australia is an obvious example of this with its international policy initiatives targeting greater regional airport usage).

However, a number of structural and market impediments potentially limit the introduction and development of services at non-primary airports. Many of these have been discussed in this report, including:

- the hub-and-spoke/network connectivity model operated by most legacy carriers, which requires efficient linkages between services into and out of domestic and international markets;
- alliance relationships between airlines which demand a "seamless" transfer of passengers between interline or codeshare partners;
- airline investment in terminals and other infrastructure at primary airports which acts as a deterrent to relocation of services (e.g. Virgin Australia at Brisbane, Qantas in Sydney and Jetstar in Melbourne);
- high costs associated with the duplication of labour and facilities at more than one airport within a metropolitan market;
- convergence between the LCC model and full service operators which is more closely aligning their product mix and target market. Over time this hybrid form will extend to most if not all airlines in various iterations as LCCs pursue higher yield returns from repeat business travel segments; and
- poor locations and/or infrastructure at some non-primary airports which distances them from core catchments, often without the support of efficient rail or road transport linkages.

Some of the above barriers can be offset by financially lucrative incentive packages and the strategic and competitive advantages associated with domination of a non-primary airport.

Fortressing by dominant airlines can also be an effective deterrent to service establishment by other operators. If a single carrier controls slot access during the peaks and has established a strong brand association with the airport, it is sometimes difficult for competing operators to gain a viable foot-hold (e.g. Southwest at Dallas Love Field).

While historically this was often the case with national carriers at their home airport, more liberal air services policies have seen their market power reduced at some gateways (e.g. Singapore Airlines' share of capacity at Singapore Airport has declined from 45.5% in 2005 to 35.9% in 2011; Qantas/Jetstar has also lost ground at Sydney Airport with their combined seat share falling to 54.0% from 51.6% during the same period[43]).

Table 5.1 shows the change in seat shares for the major airlines between 2005 and 2011 at national gateways in 12 countries. Declines occurred at 7 airports, including Sydney and the Asian hubs of Singapore, Bangkok and Kuala Lumpur. Malaysia Airlines experienced the worst loss of capacity share with a fall of 25.2 percentage points during the period as AirAsia eroded its position at Kuala Lumpur.

The home carrier actually strengthened its position at the other five airports, including Beijing, Hong Kong, Auckland, Frankfurt and Dallas Forth Worth.

Table 5.1: National Carrier % Share of Seats at Gateway Airport, 2005 vs 2011

Airport	Airline	2005	2011	% Change
Singapore	Singapore Airlines	45.5	35.9	-9.6
Sydney	Qantas/Jetstar	54	51.6	-2.4
Hong Kong	Cathay Pacific	32.6	35.2	2.6
Beijing	Air China	35.5	39.4	3.9
Auckland	Air New Zealand	55.9	57.6	1.7
Kuala Lumpur	MAS	59.5	34.3	-25.2
Bangkok	Thai Air	43.2	40.8	-2.4
London Heathrow	British Airways	40.5	40.4	-0.1
Johannesburg	South African Airways	52.9	43.2	-9.7
Frankfurt	Lufthansa	59.5	61.6	2.1
Dallas	American Airlines	77.3	86.1	8.8
Toronto	Air Canada	58.5	58.1	-0.4

Source: CAPA Consulting, SRS Analyser

The Singapore situation, in particular, reflects the Singapore Government's decision to pursue a more aggressive development of Changi Airport as a hub in response to the competitive challenge posed by Dubai.

It is assumed that a non-primary airport is more likely to serve a spoke rather than hub-and-spoke role. However, another scenario could see the non-primary airport develop a similar service structure to the primary airport.

This has occurred in some countries where airports were originally established with specific market functions, for example in Tokyo where Narita served as the international airport and Haneda as a largely domestic gateway.

[43] Some national carriers have maintained or improved their capacity shares at home airports between 2005 and 2010, for example Cathay Pacific's share at Hong Kong has risen from 32.6% to 35.2%. Thai Airways has also held its share at Bangkok at around 41.4% for this period.

Haneda subsequently broadened its role with the opening in October 2010 of a fourth runway to accommodate long-haul international services.

Bangkok also operates a segmented airport system, with Don Mueang Airport serving non-connecting domestic and regional operations (i.e. LCCs) and international and domestic connecting services based at Suvarnabhumi International Airport.

These examples demonstrate how governments can regulate outcomes which ensure that non-primary airports have sufficient airline support to maintain viability.

The dual airport arrangement for Bangkok also separated the services operated by the national carrier Thai Airways (located at Suvarnabhumi) from its 39% owned LCC associate Nok Air at Don Mueang.

The Malaysian Government had considered a similar role for the former Subang International Airport as a base for Malaysian LCC AirAsia in Kuala Lumpur. However, it eventually decided that AirAsia should join other airlines at Kuala Lumpur International Airport, 50kms away from KL, and Subang was relegated to handling turboprop domestic flights, military and General Aviation aircraft.

6. Assessment of Airline-Related Issues for Sydney Aviation Region

Section 6 considers the relevance of financial and operational issues discussed earlier in the report for the Sydney aviation region, which incorporates the wider Sydney metropolitan area, Newcastle and the Central Coast to the north and Wollongong and Canberra to the south and south-west[44].

In particular, we examine the airline-based rationale for usage of Kingsford Smith Airport (KSA) as the primary airport, and opportunities for airline establishment or relocation to a non-primary facility.

Many of the examples used in this report have concentrated on the airline/airport paradigm in the US and European markets. As indicated, non-primary airports are much more prevalent in these markets than in Australia where most metropolitan areas are served by a single primary gateway, complemented by other much smaller airports with a General Aviation focus (e.g. Brisbane, Perth, Melbourne, Sydney and Adelaide).

However, the characteristics of air travel in the US and Europe are also very different, with a broad spread of dense population centres within relatively short distances of each other, more extensive and diverse airline competition and industry structures.

In the US, carriers are defined by their fleet type and turnover with the 20 “majors” a mix of legacy airlines, larger LCCs and express freight companies with revenues exceeding US$1 billion. These operators are supported by (often sub-branded) regional affiliates, feeder airlines and smaller operators (including air taxis). The “regionals” operate aircraft with fewer than 100 seats. Each serves a particular market and their level of engagement with each other varies.

Europe is probably closer to the Australian model with a combination of full service carriers with integrated international, domestic and regional services operating through hubs, and short-haul LCCs on point-to-point routes. However, as discussed in the preceding sections, congestion problems at many of the major metropolitan airports and LCC expansion have seen the emergence and growth of a system of non-primary airports in most EU member states.

Australia’s traffic volumes are relatively small by EU and US standards (other than on Sydney-Melbourne), distances between cities are greater in most cases and airline competition is less diverse (though still intensive).

In short, the pressures, requirements and opportunities driving non-primary airport development in overseas markets generally appear less relevant for Australia other than for Sydney aviation region.

The Sydney aviation region is subject to particular market dynamics which affect the approach of airlines to the provision of services, including the significant influence of

[44] This is consistent with the definition applied by DIT.

Qantas and the primary role of KSA as Australia's largest and most complex international and domestic airport for both passengers and freight.

KSA serves both inbound and outbound markets, feeding off its destinational attractiveness (visitor focus), business centre function and the substantial population catchment of the Sydney metropolitan area. As such, the airport maintains a powerful gateway position, offering a critical mass of services across most markets and extensive hub connectivity. From a domestic airline perspective, the Sydney region offers access to two of the busiest routes in Australia (Sydney-Melbourne/Brisbane) and one of the highest yielding (Sydney-Canberra), as well as a comprehensive interstate and intrastate system. While competitive pressures apply to yields on the major routes, Sydney also presents opportunities to maximise volumes and capitalise on a relatively high proportion of business-related travel.

Internationally, Sydney represents a leading inbound destination with robust levels of outbound traffic underpinned by the metropolitan catchment's high population and the hubbing role of KSA.

6.1 Prospects for a Relocation of Key Airlines from KSA

As **Table 6.1** shows, KSA currently rates highly against most of the key airline-related criteria identified in **Section2 Table 2.2** of this report for establishing services at an airport (H=High, M=Medium and L=Low).

Table 6.1: Rating of KSA by Airline Priorities

	Assessment
1. Network connectivity	H
2. Alliance requirements	H
3. Access (24-hour, turnaround/utilisation opportunities)	L
4. Operational constraints/congestion	M
5. Proximity to market	H
6. Size/viability of catchment (including passenger mix, yield)	H
7. Good transport linkages (road/rail)	H
8. Airport owner/government incentives	L
9. Competitive advantage	H
10. Strategic & market development opportunities	H

The airport offers good network connectivity; satisfies alliance requirements through its hub activity; is in close proximity to the CBD; well connected by rail and road; and performs an important strategic, market and competitive function which gives rise to advantages for airlines operating there.

KSA ranked as “High” in all but three areas where it was either “Low” or “Medium” – the availability of 24-hour access to optimise utilisation (the curfew limits jet operations to 0600-2300); operational constraints (particularly at peak times) and demand for slots during the busy hours; and the provision of airline incentives.

While the availability of pricing incentives was rated as “Low” for KSA, it does offer some discounts for service development and maintain a number of agreements negotiated separately with operators which deliver reduced charges.

The discounts for new off-peak services include:

- reductions of up to 50% in aeronautical charges for new destinations served from KSA. These apply to the international Passenger Service Charge and domestic landing and security charges;
- up to 30% off the above standard charges for increased frequencies; and
- other reductions on an agreed case-by-case basis for services moved from peak to off-peak times.

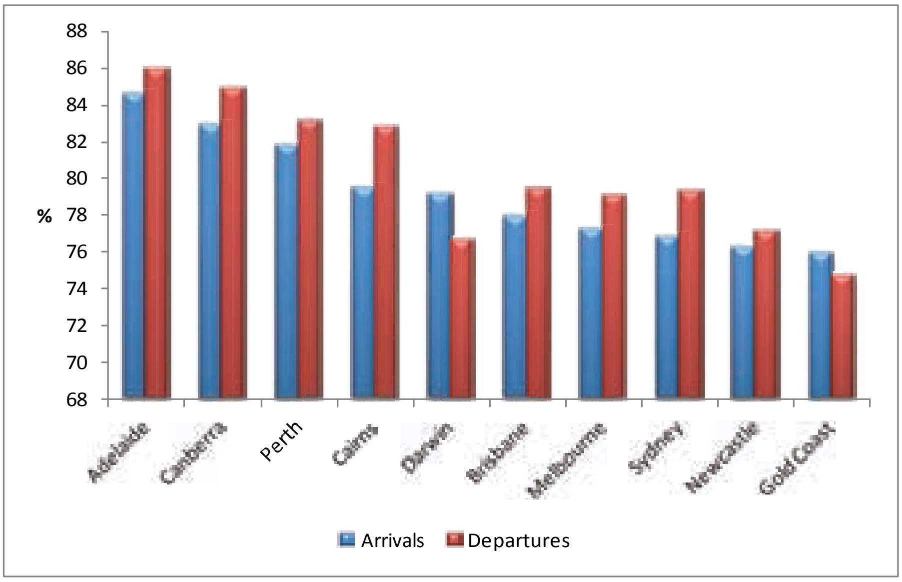
The discount regime indicates that Sydney Airport will apply a commercially competitive approach to pricing to build its service structure, especially at off-peak times when demand is lightest.

While we are not privy to the terms of individual agreements with particular carriers, the airport operates incentivised agreements with Qantas/QantasLink, Jetstar, Virgin Australia and Tiger Airways.

One negative for operators is KSA’s relatively poor on-time performance, as shown in **Figure 6.1**. In FY11, 76.8% of arriving flights and 79.3% of departing flights operated within 15 minutes of the allocated time.

This was the 8th worst performance of the 10 major airports, with Adelaide, Brisbane, Melbourne and Perth all well ahead of Sydney. Sydney also under-performed compared to the national average of 78.8% and 80.6% for arrivals and departures.

Figure 6.1: On-time Performance for All Airlines at the Major Airports in Australia, 2010-11



Based on data supplied by the 7 major domestic airlines which collectively account for more than 95% of total domestic passengers.

Source: BITRE

The reasons for KSA's performance in this regard do not necessarily relate to the efficiency of the airport itself; they can also reflect airline-based issues, delays across the network which feed into Sydney and/or air traffic control problems.

Whatever the cause, however, schedule integrity is a priority for airlines as it can confer competitive advantage, especially for the time-sensitive business market, and ensures optimised aircraft utilisation.

6.2 Qantas Group Developments

While KSA currently accommodates 41 international and domestic airlines, Qantas continues to be the lynchpin for the airport's service development directly through its own branded services, QantasLink and Jetstar LCC subsidiary, and indirectly through its international alliance partners (including British Airways, Cathay Pacific, Air Pacific, Air Niugini, Air Tahiti Nui and Aircalin).

KSA's value for Qantas is multi-fold:

- Driving market growth and yield by providing access to the Sydney metropolitan catchment and its associated business and leisure demand;
- Generating core revenue as a passenger and freight gateway and hub for the group's international and domestic/regional brands and alliance partners, with network linkages to/from interstate and regional services;

- Building third party business through interline arrangements, ground handling, catering and maintenance engineering. Contract work accounted for some 3% of Qantas Group revenue in 2011 ($347 million); and
- Providing a national headquarters and focus for infrastructure development through its own domestic terminal (T3), the international freight facility, MRO facilities at Qantas Jet Base and nearby administrative offices and warehousing.

The competitive advantage derived from the airline's dominance at KSA effectively underwrites its network strength, with extensive access to slots through grandfathering arrangements, a streamlined domestic-international transfer system and the operation of a dedicated terminal.

By operating its own domestic terminal[45], Qantas substantially reduces the access charge per passenger to KSA, as shown in **Table 6.2**. Based on current charges applied by Airservices Australia and SACL[46], the per passenger cost for a Qantas narrow-body aircraft serving Sydney is around one third that of Virgin Australia, Tiger Airways and Jetstar, which all operate from the common-used terminal (T2).

Table 6.2: Impact on Airlines of Access Charges to Sydney Airport (based on 2011 charges)

	Airline	Terminal	Aircraft Type	Seats	80% Load Factor	MTOW (tonnes)	Access Charges $			
							Airservices	SACL	Total	Per pax*
Domestic	Domestic Trunk/Regional									
	Jetstar	T2	A320-200	177	142	73.50	612.99	3684.43	4297.42	15.13
	Tiger	T2	A320-200	180	144	73.50	612.99	3746.88	4359.87	15.14
	Virgin Australia	T2	B737-800	180	144	77.81	648.94	3746.88	4395.82	15.26
	Qantas	T3	B737-800	168	134	77.81	648.94	951.40	1600.34	5.97
	Regional									
	Qantaslink	T3	Q400	74	59	28.15	234.77	199.45	434.22	4.02
	Qantaslink	T2	Q400	74	59	28.15	234.77	833.11	1067.88	9.89
	Regional Express	T2	Saab 340	34	27	13.15	109.67	380.45	490.12	9.08
International	Qantas	T1	A380-800	450	360	500.00	4170.00	18367.20	22537.20	31.30
	Jetstar Int.	T1	A330-200	303	242	230.41	1921.62	12367.25	14288.87	29.52
	AirAsia X	T1	A330-300	377	302	229.55	1914.45	15408.04	17322.49	28.68
Freight	Polar Air	Cargo	B747-400F	n/a	n/a	396.89	3310.06	3500.57	6810.63	n/a
	Federal Express	Cargo	B777F	n/a	n/a	347.45	2897.73	3064.51	5962.24	n/a
	Toll Priority	Cargo	B737-300F	n/a	n/a	63.27	482.75	558.04	1040.79	n/a

Note: Access charges are based on a total of current SACL fees (as of July 2011) and Airservices Australia fees (as of October 2011) for each aircraft type and do not include GST. The per passenger cost assumes 80% loads for each carrier.

Source: Sydney Airport, Airservices Australia and CAPA Consulting Analysis

This type of comparison can be misleading as the charges levied on the LCCs incorporate terminal costs for T2 which are met by Qantas for its T3 terminal. However, it does give the airline the flexibility to allocate costs where it sees fit and to choose what proportion to pass on to passengers.

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[45] The long-term lease for the T3 terminal at KSA is up for renewal in 2014. Qantas has indicated it will renew the lease because of the advantages gained in being able to structure and develop the range of products offered in the terminal.

[46] Current SACL Charges are listed in the table in Appendix I.

We note that on an international basis, the per passenger impact for all airlines is closer to parity and fully reflects the size and capacity of aircraft involved (the A380 flown by Qantas, for example, has a Maximum Take-Off Weight more than twice that of the A330s operated by AirAsia X and Jetstar International).

The sheer scale of investment by Qantas at KSA, and the competitive and cost advantages and revenue generation its dominant role there sustains, make it highly unlikely that the group as a whole would relocate to another facility. However, this does not preclude the airline from deploying some services either under its own brand or that of Jetstar at such an airport.

The Qantas Group's strategy for Melbourne suggests that a similar structure could be adopted for Sydney if a non-primary airport facility was available. In Melbourne, Jetstar was established at Avalon Airport as a means of strengthening the group's hold on the market in tandem with the presence of the mainline brand and its LCC subsidiary at Tullamarine Airport.

This was a defensive as well as offensive move which ensured that:

- Jetstar gained exclusive access (at least temporarily) to an unconstrained airport facility with no other carriers;
- as a first mover, the LCC qualified for an expansive incentives package (marketing, airport access) offered by the Victorian Government; and
- the dual airport approach would "fortress" the Melbourne market as a deterrent to competitors.

As noted in this report, the importance of Avalon to Jetstar has diminished over time with the LCC developing more as a supplementary brand to Qantas mainline rather than a potential threat which risked "cannibalising" yield returns.

Tiger Airways subsequently established services at both Melbourne airports (Avalon services are still suspended) and Jetstar transferred much of its current capacity to Tullamarine while retaining a much-reduced presence at Avalon.

In our view, Qantas is likely to replicate the Melbourne two-airport strategy in a Sydney context if it considered that the introduction of a new facility provided an opportunity for a leakage of traffic in the market and dilution of its dominant position. This is consistent with the "fortressing" strategy for a major market such as Sydney.

6.2.1 Implications of International Restructure Plans

Qantas and Jetstar are undertaking a highly ambitious restructuring agenda with the aim of returning international operations to a more viable level of profitability. This has significant implications for the group's airports strategy, and the future role of KSA.

The key elements of the group's initiatives involve:

- Offshore development through:
  - Establishment by Qantas of a premium airline in Southeast Asia under a new brand;
  - Launch of a long-haul A330 base in Singapore for Jetstar;
  - Introduction of a domestic joint venture between Jetstar and Mitsubishi in Japan in 2012;
- Further expansion of the intra-Asian network and frequencies between Australia and Asia (with a focus on China); and
- Strengthening alliance arrangements, particularly with British Airways and LAN Airlines to improve European and South American coverage.

The restructuring has the potential to transfer a proportion of future international growth and fleet resources for Qantas/Jetstar outside of Australia as part of a deliberate strategy to lower operating costs and strengthen revenue.

Table 6.3 shows the various ventures Qantas Group proposes to locate offshore, including existing ventures in Vietnam (Jetstar Pacific) and Singapore (Jetstar Asia); the fleet currently operated and future orders.

Table 6.3: Qantas Group's "Offshoring" Plans & Fleet to be based Overseas

Brand	Type	Base	Current Fleet	Orders
RedQ	Premium	Singapore or Kuala Lumpur	Launch date not yet set	11 A320s
Jetstar Asia	LCC	Singapore	2 A330-200s	
			14 A320s	
Jetstar Pacific	LCC	Vietnam	5 B737s	8 A320s
			2 A320s	
Jetstar Japan	LCC	Japan	To be launched 2012	24 A320s
Total			23	43

Note: RedQ is one of a number of potential brands for the premium operation. Qantas has not yet announced where this will be based other than in Asia.

Source: Qantas Group Investor Presentations

The aircraft involved represent only a small proportion of the Qantas Group fleet. The group will take delivery of 235 new aircraft by 2024, 80% of which are due to arrive in the next 5-6 years. Jetstar, in particular, will continue to expand out of Australia both internationally and domestically with an additional 110 A320s currently on order for delivery over the next decade. More than two-third of these relate to the A320neo, which offers extended range, a higher payload and 15% lower fuel burn than the existing model.

Jetstar's expanding presence in Southeast and Northeast Asia underline a strategy to capitalise on the anticipated growth in intra-Asian traffic – an approach that is likely to gather momentum with the realisation of an ASEAN Single Aviation Market post 2015.

The future impact on KSA is difficult to gauge at this stage. Much will depend on the rate of growth of the offshore ventures. In the short to medium term, however, there should be some growth benefits from the inter-relationship between the various operations.

6.3 Virgin Group's Transition to a Hybrid Operator

As noted, Virgin Australia is transitioning under its Game Change Program into a mixed LCC and full service operator. The airline's business model has changed considerably since its launch in 2000 as a basic LCC, with the introduction of premium product, long-haul services and different aircraft types.

The strategy is multi-faced with a focus on repositioning the airline in the market place by:

- Reducing its dependence on the lower yield leisure market;
- Improving access to international growth markets through:
  - Consolidation of international operations Pacific Blue and V Australia through the creation of a single Virgin Australia brand across the network and two key international hubs in Abu Dhabi and Los Angeles; and
  - Establishment of strong strategic alliances which extend market reach without requiring capital commitment (e.g. Air New Zealand, Delta Air Lines, Singapore Airlines and Etihad Airways).

As part of this strategy, Virgin's long-haul arm V Australia (now Virgin Australia) has dropped non-performing services to South Africa, Fiji and Phuket in Thailand, and increased frequencies to the US. The withdrawal of Pacific Blue from NZ's domestic market was also triggered by significant losses there.

The convergence of the Full Service and LCC models is likely to see a preference by Virgin to maintain services at KSA, subject to the availability of appropriate capacity to meet growth requirements.

Virgin is targeting an increase in its corporate traffic share from 10-15% to 20% - a strategy which will involve a greater concentration of service frequencies and capacity on KSA and other major business destinations. Reflecting this, the airline has introduced wide-body A330s with its first business class on transcontinental services between Sydney and Perth.

While the primary airport is preferred by Virgin because of its focus on the premium market and complexity of facilities and services, an opportunity exists for the development of a sub-market in Sydney with premium characteristics.

6.4 The LCC Carrier Scenario

The prospect of LCC usage for a non-primary facility in Sydney is feasible, especially in relation to Tiger Airways and Jetstar[47].

While Jetstar's code-sharing arrangement with its parent suggests a need for connectivity, the airline can effectively operate at a separate facility within a similar market. This has occurred, as discussed earlier, at Avalon, the Gold Coast (which arguably overlaps to an extent the Brisbane metropolitan market), and at Newcastle (which accesses some traffic from the north of Sydney).

Tiger Airways, the only fundamental LCC in the market, considered Bankstown Airport as an alternative entry point to the Sydney market before reaching agreement with SACL on slots and charges. Tiger has demonstrated that it will locate to any airport if incentives are applied and the terms are attractive enough (e.g. Avalon).

Like any basic LCC, Tiger has only a limited attachment to infrastructure; ground handling and other support services are outsourced; and it will move anywhere to an airport capable of providing unconstrained 24-hour access. The airline's flexibility in this regard was underscored by its plans to acquire smaller A319 aircraft to comply with restrictions on usage at Bankstown Airport.

If Tiger re-established at a non-primary facility in the Sydney market, it is very likely that Jetstar (and perhaps Virgin Australia) would follow suit as a competitive counter. Virgin Australia's situation, however, is complicated by its strategic redevelopment as a hybrid leisure/premium carrier with an increasing focus on the business market.

As indicated earlier, Virgin's strategy has diverged considerably from its original approach which essentially targeted the leisure market with a basic LCC "user pays" product structure. While the airline remains an LCC hybrid, it has brought wide-body aircraft into the domestic system with a business class configuration, strengthened its frequent flyer program, developed airport lounges and valet parking – all characteristics for full service operators. As well, Virgin is becoming more integrated with the introduction of long-haul international services and commercial partnerships with overseas carriers.

These developments, and Virgin's stated targeting of the corporate market, suggest its operations will become progressively more mainstream with a focus firmly on building frequencies and capacity to the major city airports, including KSA, which offer linkages with its growing team of partner airlines.

[47] This assumes that Tiger will maintain a substantial presence in the Sydney and Australian market following the recent regulatory difficulties which grounded its aircraft.

This is likely to see future demand more evenly balanced between Virgin's core leisure base and its business-related customers.

The high population growth anticipated for the south and south-west of the metropolitan area and accompanying urban expansion may create over time a natural catchment for a non-primary airport for Small to Medium Enterprises and other businesses establishing in these areas.

This suggests future prospects for carriers (LCC or otherwise) to access a higher income populace with a significant propensity for business-related and/or leisure travel.

6.5 Prospects for International Operations

International services generally require a greater degree of connectivity to service their various interline and code-sharing relationships. As such, they tend to migrate towards primary hubs equipped to accommodate passenger transfers.

Long-haul LCCs such as AirAsia X and Jetstar International may be able to operate in isolation to these arrangements. Jetstar International, for example, could establish a subsidiary base at a non-primary facility to provide an opportunity to avoid head-to-head conflicts with Qantas mainline on routes served by both airlines.

Jetstar clearly has plans to emulate AirAsia X by operating through its Singapore hub to the European market.

AirAsia X, meanwhile, currently operates to Gold Coast, Melbourne and Perth and is still hoping to gain Malaysian Government approval to fly to Sydney[48].

The further development of long-haul LCCs with an attractive low-fare product has the potential to diminish the returns, and in some cases overall route viability, of established premium operators which previously dominated intercontinental markets.

Qantas's strategic approach in operating dual brands with Jetstar is seen both as a reflection of the challenges ahead and also a vehicle to drive down costs within the group.

Jetstar is expected to further establish its brand in Asian markets directly through services out of Australia (China, Japan) and those channelled through Singapore, and indirectly through its joint ventures in Singapore (Jetstar Asia) and Vietnam (Jetstar Pacific).

Two long haul A330-200s initially have been based in Singapore. The attraction for Jetstar is two-fold: (1) it can take advantage of Singapore's lower labour costs; and (2) 70% of revenue on flights out of Singapore relate to Singapore point-of-origin sales.

[48] This situation may be resolved through the agreement in August 2011 between Malaysia Airlines System (MAS) and AirAsia to swap shares and collaborate. MAS currently operates to Sydney from Kuala Lumpur.

As noted, Singapore Airlines has also proposed the establishment of a long-haul LCC operating four Boeing B777s from July 2012. Australia is among the key markets identified by Singapore for the operation (other destinations include India, the Gulf States, Europe and North Asia).

SACL would be expected to compete aggressively to retain international operations as these generate much higher margins than domestic or regional services (assuming it was not responsible for both airports). The benefits accruing to airlines from this approach would make it even more difficult to relocate.

We see it as less likely that a non-primary facility would become either a dedicated international gateway or a mixed international/domestic airport because of the relatively high establishment costs for infrastructure (i.e. longer runways, taxiways and complex terminals as well as Customs, Immigration and Quarantine and security).

As noted earlier, experience in overseas markets indicates a city of Sydney's likely future population size probably would be too small to support two international airports.

6.6 Outlook for Regional Airline Services

Regional services to the Sydney region historically have depended on access to KSA for its close proximity to the city centre and connectivity with interstate and international services. This was essential to the competitiveness of operators and their largely business-related customer base.

However, the characteristics of this market have become more aligned with the interstate segment with the entry of LCCs with high capacity jets on mostly leisure-focused routes (Virgin and Jetstar), upgrading of QantasLink and the restructuring of Regional Express. As a consequence, many regional routes are now highly price competitive and carry a greater proportion of leisure traffic.

QantasLink and Regional Express are the largest regional airlines at KSA in terms of passenger numbers followed by Virgin, Jetstar, Aeropelican and Brindabella Airlines. Each of these airlines is either an affiliate or linked by commercial arrangements with one of the major operators at KSA (e.g. Regional Express with Virgin; Aeropelican, Jetstar and QantasLink with Qantas).

While the Federal Government has guaranteed ongoing access by regionals to KSA, the airport owners continue to argue that this leads to operational inefficiencies. These airlines account for only 6% of total passengers using the airport, but occupy 23% of allocated slots[49].

[49] Sydney Airport submission on proposed pricing increases for aeronautical services for regional operators, June 2010.

In FY11, regional airlines delivered an average 31 passengers per aircraft movement at KSA compared with 138 for domestic movements and 183 for international movements[50].

There may be potential for a relocation of some regional services to a non-primary facility, assuming that it is located within a reasonable distance of the Sydney CBD. However, the charges imposed on regional operators at KSA are relatively small (representing an estimated 1% 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.

6.7 Freight-Only Operations

The relatively few freight-only airports operating internationally are either based adjacent to or within trade development zones or serve as dedicated distribution centres for express freight operators.

Other than that, freight activities are generally carried out at passenger airports. This reflects the fact that the majority of freight is carried in the belly-space of passenger aircraft. Some 80% of the freight transiting KSA is borne by scheduled services. Most cargoes consist of high-value goods which are time-sensitive and require efficient transfers between air and land.

KSA currently service both the general freight and express freight markets, handling about half of the international freight tonnages flowing through Australian airports. Its Sydney Freight Terminal is the largest in Australia and features multiple aircraft parking bays, storage areas, an import bypass system and a container and distribution facility. Qantas Freight operates a second terminal, a dedicated express terminal and a mail handling unit.

The 10 dedicated freight airlines at KSA include express freight conglomerates UPS, DHL and FedEx and Australian carriers with Qantas linkages, Australian air Express and Star Track Express. While freight is an intrinsic part of the KSA strategy, the airport's curfew creates impediments for night-time movements of freight due to restrictions on the size of aircraft operating during the curfew. This suggests an opportunity exists for a 24-hour freight facility to be established at a non-primary airport in the Sydney region.

[50] Bureau of Infrastructure, Transport and Regional Economics, FY11 data.

7. Conclusion

The study examines the key criteria, scale of benefits and potential constraints which are likely to be considered by airlines in evaluating opportunities for services at primary or non-primary airports.

On the basis of this analysis, it is clear that:

- *Full Service Carriers* are likely to focus on primary airports where they can secure network connectivity and service alliance relationships.
  - Duplication costs associated with labour and supply may deter relocation of some services to non-primary airports for established operators.
  - However, there may be some niche opportunities for non-primary airport usage either as an overflow from the primary airport or as a competitive matching or blocking strategy.
- *Low Cost Carriers* are more likely to service non-primary airports but may also access primary airports.
  - This is consistent with their operational, financial and strategic prerequisites; and
  - (importantly) non-primary airport owners and/or governments often offer establishment and development incentives which mitigate risk.
- *Hybrid LCCs* could operate either to primary or non-primary airports, but the likelihood is that they will concentrate on similar higher yield business markets to legacy operators and seek out the larger hubs.
- *Freight Airlines* similarly could use primary or non-primary airports, depending on the nature of their operation and the availability of transfer and storage facilities.
  - Express freight carriers may be more likely to establish at non-primary airports, consistent with their largely stand-alone model and the need for overnight access.
  - Few options have been available in Australia, however.

The priorities given to the factors influencing airport selection vary between established carriers in a market and new entrant operators. Numerous examples of non-primary airport usage are available for the mature markets of Europe and North America. Many of these have been discussed in detail throughout the report. However, Australia's experience in this regard is extremely limited and the predilection of airlines to operate out of non-primary airports in this country is largely untested. The focus of LCCs on Avalon and Gold Coast airports – the only two airports with any non-primary credentials - suggests that, given the opportunity, there will be a similar pattern of airline establishment here as in overseas markets.

Appendix I: Access Costs for Australian Airlines Serving Sydney Airport

The tables below provides an overview of Sydney Airport's current charges and indicate the impact of these and Airservices Australia charges on total access costs for various airline and aircraft types to the airport.

The per passenger cost shown reflect the cost for each arriving and departing passenger on an assumption of 80% passenger loads.

Table I.1: SACL Charges (July 2011)

Charge	International (Passenger Service Charge)	Domestic	Regional	Freight, helicopter and GA
Terminal	$25.51 per arriving, departing pax	$7.41 per arriving/departing pax (T2 only)	$4.50 per arriving/departing pax (T2 only)	
T2 Investment		$0.40 per arriving/departing pax		
Runway	$7.53 per pax (included in PSC)	$3.55 per pax	$3.44 per tonne take-off/landing	$4.41 per tonne take-off/landing; Helicopter 30.00 per movement
Common User check-in	$0.19 per pax (included in PSC)			
Passenger, Airfield Security	$4.20 per pax (included in PSC)	$1.46 per pax (T2 only); $0.19 shared airfield security	$0.87 per pax (T2 only)	
Total Charge per pax	*$25.51*	*$13.01*	*$5.37 (plus runway)*	*Runway only*
Bussing/stand-off discount	$3.00 per pax (Code C or < aircraft); $2.00 per pax (>Code C aircraft)			
Apron Parking	$35.00 per 15 mins	45 mins included in Terminal Charge; $35.00 per 15 mins	45 mins included in Terminal Charge; $35.00 per 15 mins	Designated apron: $35.00 per 15 mins; GA: $100-$240 per day depending on MTOW
Ground Power & Pre-conditioned Air	Ground power: $11.90 per 15 mins for 4E and 4F aircraft types; $6.00 for 4D and 4C. Pre-conditioned Air: $10.60 per 15 mins for 4E/4F; $9.60 for 4D; and $6.40 for 4C			
Discounts for New Off-Peak Services	New destinations: Up to 50% of aeronautical charges (international PSC or domestic runway/security charges or other agreed charges); Increased frequencies: Up to 30% (international PSC or domestic runway/security charges or other agreed charges)			
Other Discounts	Negotiable on case-by-case basis for services moved from peak to off-peak times; must demonstrate net gain for SACL			

Note: Charges do not include GST

Source: SACL

Appendix II: Partnership Arrangements for Key Airlines

The table below maps current partnership arrangements involving key carriers in Asia, Europe, the Middle East, the Americas and Australasia.

Table II.1: Commercial Partnerships by Airline by Market

	Airline	Global Alliance	Codeshare Partners by Market				
			Europe	Americas	Pacific	Asia	Middle East/Africa
China	China Eastern	SkyTeam (2011)	Air France, Alitalia	American Airlines (ends May 31), Aeromexico, Delta Air	Qantas	All Nippon Airways, Asiana, Cathay Pacific, China Airlines, China Southern, Shanghai Airlines, Japan Airlines, Korean Air	None
	China Southern	SkyTeam	None	None	None	Asiana, Cathay Pacific, China Air, China Eastern, Dragonair, Garuda, JAL, MAS, Pakistan International	None
	Air China	Star Alliance	Alitalia, Austrian Air, British Airways, EVA Air, Finnair, LOT, Lufthansa, SAS, Swiss,TAP Portugal, Turkish Air, Virgin Atlantic	Air Canada, United Air, US Airways, TAM, Avianca	Air New Zealand	Air Macau, ANA, Asiana, Cathay, Dragonair, Shandong Air	Egyptair, El Al, Ethiopian
	Hainan Airlines	oneworld (possible)	Malev, Brussels Airlines, Air Berlin, Aerosivit	None	None	Hong Kong Air, Hong Kong Express, Garuda	None
	Shanghai Airlines	SkyTeam (2011)	None	None	None	China Eastern, China United Air, Korean Air, Sichuan Air	None
	Shenzhen Airlines	None	None	None	None	ANA, Asiana, EVA Airways	
	Cathay Pacific	oneworld	British Airways, Finnair	American Air, LAN, Westjet, Alaska Air	Qantas, Air Pacific	Air China, Dragonair, Vietnam Airlines Japan Airlines, MAS, PAL	None
Japan	Japan Airlines	oneworld	British Airways, Finnair, Iberia, Malev, Air France, Alitalia,	American Air, Aeromexico	Qantas, Jetstar, Air Tahiti Nui, Air New Zealand	Cathay Pacific, China Air, China Eastern, China Southern, Korean Air, Thai Air, Vietnam Air	Emirates, Royal Jordanian
	ANA	Star Alliance	Austrian Air, bmi, LOT, Lufthansa, Swiss, TAP, Turkish Air, Virgin Atlantic	Air Canada, Continental, TAM, US Airways	None	Air China, Air Japan, Air Macau, Asiana, EVA, MAS, Shanghai Air, Shenzhen Air, SIA, Thai Air	Etihad Air, Qatar Airways, Egyptair
Korea	Korean Air	SkyTeam	Uzbekistan Air	Alaska Air, Hawaiian Air	Aircalin	Air Macau, China Air, China Eastern, Garuda, JAL, MAS, Shanghai Air, Xiamen Air	Emirates
	Asiana	Star Alliance	bmi, LOT, Turkish Air	Air Canada, Continental Air, United, US Airways	Qantas, Air New Zealand	Air Busan, Air China, ANA, China Eastern, China Southern, Shanghai Air, Shenzhen Air, Singapore Air, Thai Air	South African Air, Qatar Airways, Egyptair

	Airline	Global Alliance	Codeshare Partners by Market				
			Europe	Americas	Pacific	Asia	Middle East/Africa
Taiwan	China Airlines	SkyTeam (2011)	Alitalia, Czech Air	Delta Air, Westjet	None	China Eastern, China Southern, Garuda, JAL, Korean Air, Thai Air, Vietnam Air, Xiamen	None
	EVA Air	Star Alliance (possible)		American Air, Air Canada, Continental, US Airways	Qantas	ANA, Bangkok Air, Air China, Shenzhen Air, Shandong Air	None
Southeast Asia	Singapore Airlines	Star Alliance	Aer Lingus, Virgin Atlantic, Lufthansa, Austrian Air, bmi	United Air, US Airways, Air Canada	Air New Zealand	ANA, Garuda, MAS, SilkAir, Air China, Asiana	
	Thai Airways	Star Alliance	Lufthansa, Austrian Air, bmi	United Air, Air Canada, US Airways	Air New Zealand	ANA, Asiana, Bangkok Airways, Nok Air, China Air, China Eastern, JAL, MAS, Royal Brunei	Emirates, Ethiopian, Gulf Air, El Al, Air Madagascar
	Garuda	SkyTeam (2012)	KLM, Turkish Air	Aeromexico, Delta Air	Qantas, Virgin Australia	China Air, China Southern, Hainan, Korean Air, MAS, PAL, Royal Brunei, SilkAir, SIA, Vietnam Air	Emirates, Gulf Air, Qatar Airways, Saudi Arabian Air
	Philippine Air	None	None	None	None	Cathay Pacific, Garuda, Kingfisher Air, MAS	Emirates, Etihad Air, Qatar Airways, Gulf Air
	Vietnam Air	SkyTeam	Air France, Alitalia, Czech Air, KLM	Delta Air	Qantas	Cathay Pacific, Cambodia Angkor Air, China Air, China Southern, Garuda, JAL, Korean air, PAL, Lao Airlines	None
	Malaysia Air	None	Alitalia, Austrian Air, bmi, KLM, Swiss, Turkish Air	Continental Air	Virgin Australia	ANA, Cathay Pacific, China Southern, Dragonair, Garuda, Jet Airways, Korean Air, Myanmar Air, PAL, Royal Brunei, SilkAir, SIA, SriLankan Air, Thai Air	Egyptair, Gulf Air, Oman Air, Royal Jordanian, South African Air
	Jetstar Asia	None	Finnair	American Air, LAN	Jetstar Air, Qantas	Cathay Pacific, JAL, Jetstar Pacific, Myanmar Air, Valuair	None
South Asia	Air India	Star Alliance (2011)	Aeroflot, Austrian Air, bmi, Lufthansa, Turkish Air	None	None	GMG Air	Gulf Air, Air Mauritius, Ethiopian Air, Kuwait Air, South African Air
	Jet Airways	None	Alitalia, Brussels Air	Air Canada, American Air, United Air	Qantas	ANA, JetLite, MAS	Etihad Air, Gulf Air, Kenya Air
	Kingfisher Air	oneworld (2011)	British Airways	American Air	None	PAL	None
	Pakistan Int.	None	Aerosivit, Turkish Air	None	None	China Southern, Thai Air	None
	SriLankan Air	None	bmi	None	None	MAS, Mihin Lanka	Etihad Air

	Airline	Global Alliance	Codeshare Partners by Market				
			Europe	Americas	Pacific	Asia	Middle East/Africa
Australasia	Qantas	oneworld	British Airways (joint services), Air France, Malev, Air Malta	American Air, Alaska Air	Aircalin, Air Vanuatu, Airnorth, Air Pacific, Air Tahiti Nui, Air Niugini, Polynesian Air	Asiana, JAL, EVA Air, China Eastern, Garuda, Jet Airways, Vietnam Air	Gulf Air, Kenya Air
	Jetstar	oneworld affiliate	None	None	Qantas	Jetstar Asia, Jetstar Pacific	None
	Virgin Australia	None	None	Delta Air, United Air	Air New Zealand, Skywest, Polynesian Blue	Singapore Airlines (interline agreements with a range of carriers)	Etihad Airways
	Air New Zealand	Star Alliance	Virgin Atlantic, Lufthansa, Austrian Air	United Air	Virgin Australia, Aircalin, Air Pacific, Air Vanuatu, Air Rarotonga, Air Tahiti Nui	ANA, JAL, Air India	Etihad Airways
Americas	United Air	Star Alliance	Lufthansa, Austrian Air, bmi, Aer Lingus	Hawaiian Air, TACA, Avianca	Air New Zealand	ANA, Air China, Jet Airways, Thai Air, SIA, Asiana	Emirates, Qatar Air
	Delta Air	SkyTeam	Air France, KLM, Olympic Air	Gol, Avianca, Alaska Air, American Eagle	Virgin Australia (V Australia)	China Air, Korean Air, Garuda	Royal Air Maroc, Air Nigeria
	American Air	oneworld	British Airways, Air Berlin, Iberia	Alaska Air, Hawaiian Air, Gol, Westjet	Qantas, Jetstar, Air Tahiti Nui, Air New Zealand	EVA Air, China Eastern, Jet Air	Gulf Air, El Al, Etihad
	Air Canada	Star Alliance	Austrian Air, Lufthansa, bmi, Brussels Air, LOT, SAS, Spanair, Swiss, TAP	United Air, Continental, TAM, Avianca	Air New Zealand	Air China, ANA, Asiana, Jet Airways, SIA, Thai Air	Middle East Airlines
	Aeromexico	SkyTeam	Air France, KLM	Copa, Gol, LAN, Delta Air	None	Korean Air, China Eastern, China Southern, JAL	El Al
	LAN Air	oneworld	British Airways, Finnair, Iberia, Malev	Aeromexico, Alaska Air, American Air, Jet Blue, TAM, Copa Air	Qantas	JAL, Korean Air	Royal Jordanian
Middle East/ Africa	Emirates	None	Air Malta, Aer Lingus	Continental Air	Virgin Australia	JAL, Jet Air, Korean Air, PAL, Thai Air	Oman Air, Royal Air Maroc, South African
	Qatar Air	None	bmi, Lufthansa, TAROM	United Air, US Airways, Air Canada	None	ANA, Asiana, MAS, PAL	Middle East Airlines
	Etihad Air	None	Air Astana, Air Malta, Alitalia, bmi, Brussels Air, Cyprus Air, flybe, Malev, Olympic air, s7 Air, Turkish Air, Ukraine Int.	American Air	Virgin Australia/Pacific Blue, Air New Zealand	ANA, Asiana, Bangkok Air, MAS, SriLankan Air, Jet Air	Yemenia, Middle East Air, Royal Air Maroc
	Gulf Air	None	bmi, KLM	American Air	Qantas	Air India, Biman Bangladesh, Garuda, Jet Air, MAS, PAL, Thai Air	Saudi Arabian Air, Royal Jordanian, Oman Air, Ethiopian Air, Egyptair
	South African Air	Star Alliance	SAS, TAP, Virgin Atlantic	JetBlue	Qantas	MAS	El Al, Emirates, LAM Mozambique, Saudi Arabian Air

	Airline	Global Alliance	Codeshare Partners by Market				
			Europe	Americas	Pacific	Asia	Middle East/Africa
Europe	**British Airways**	oneworld	Flybe, Loganair, Iberia, Spanair, Aer Lingus	American Air, Westjet	Qantas	Cathay Pacific	None
	Lufthansa	Star Alliance	Austrian Air, Air Malta, Air Moldova, Jat Air, Luxair, SAS	United Air, JetBlue, Mexicana, Avianca	None	SIA, Thai Air, Air India	Qatar Airways
	Air France-KLM	SkyTeam	Aeroflot, Air Europa, Alitalia, Czech Air, KLM, TAROM	Delta Air, Aeromexico	Qantas	Vietnam Air, Korean Air, China Southern	None
	Turkish Air	Star Alliance	Aegean Air, Air Malta, Austrian Air, Croatia Air, LOT, Lufthansa, North Cyprus Air, Swiss, TAP, Spanair	United Air, US Airways	None	Air China, Air India, ANA, Asiana, Garuda, MAS, Pakistan Int., SIA, Thai Air	Egpytair, Etihad Air, Ethiopian Air, Royal Air Maroc, Syrian Air

Analysis of airport suitable sites: specified localities

C11

Sydney Region Aviation Capacity Study

Airport Suitable Sites - Specified Localities

Department of Infrastructure and Transport

WorleyParsons resources & energy

AMPC

WorleyParsons

resources & energy

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT

Sydney Region Aviation Capacity Study

Airport Suitable Sites - Specified Localities

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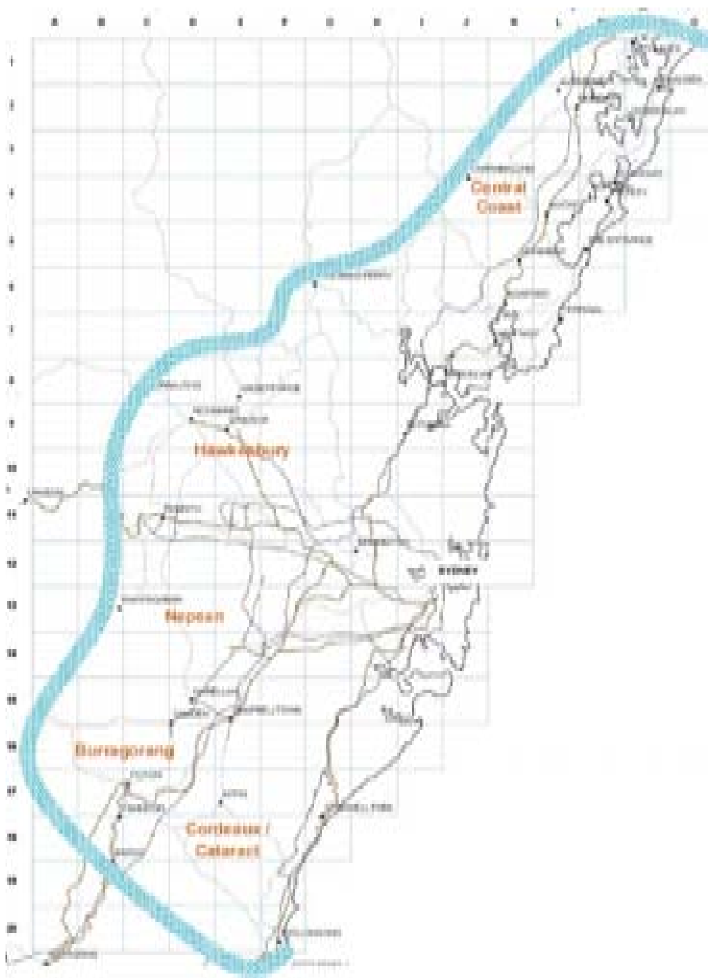
EXECUTIVE SUMMARY

The Airports Suitable Sites – Specified Localities Study examined the ability of five localities in the Sydney region, as specified by the Steering Committee for the Sydney Region Aviation Capacity Study, to 'supply' sites suitable in operational, planning and environment and infrastructure engineering terms for potential airport development.

Important Note: *Within the context of this study, a site may be termed 'suitable' and possibly 'more suitable' but only in terms of the criteria adopted for the stage of analysis being undertaken. It does not mean that a site is without shortcomings and could or should be developed as an airport without planning, design and or other forms of mitigation of identified shortcomings in operational, planning and environment and infrastructure engineering terms for the development of airports.*

The objective of this study was to identify in each specified locality which were the 'more suitable' sites for airport development rather than to identify a single preferred site within the Sydney region. The five localities were specified after a prior analytical process and deliberation by the Steering Committee which initially identified 18 localities and then progressively reduced the localities under consideration to the five specified localities.



As shown in the map above, the specified localities – which are broad, geographic areas of land - are named: Central Coast, Hawkesbury, Nepean, Burragorang and Cordeaux-Cataract.

Two types of airport were considered:

- a limited service single runway airport aimed at providing for low cost carriers offering limited services on both domestic and international routes– referred to as a Type 3 Airport; and
- a full service international airport with at least two wide spaced parallel runways able to accommodate the largest of aircraft and serving all domestic and international routes –referred to as a Maximum Airport.

A four phased approach to the analysis was undertaken in which:

- the entire region - comprising the five specified localities and analysed using a geographic information system (GIS) modelling approach - was reduced by excluding those lands which did not meet any one of a set of six criteria to those lands – the 'suitable' lands- which were able to meet all criteria;
- the 'suitable' land was analysed against set of four criteria which provided a more refined, relative assessment of what were the 'more suitable' lands within the identified 'suitable' land for development of an airport;
- using established detailed airport site location criteria and taking account of where those lands were found to be 'more suitable', the 'suitable' lands were examined closely using a higher resolution of mapping –- in order to identify airport sites which broadly satisfied the detailed site location criteria, though not each to the same degree of satisfactory performance. For each such 'suitable' Type 3 and Maximum site, a conceptual airport layout was developed and, to the extent possible at this level of airport master planning, customised to the site;
- the 'suitable' sites were assessed in greater detail – using both a qualitative data matrix approach with ten broad criteria supported by some fifty specific types of data and a Rapid Cost Benefit Assessment (Rapid CBA)[1.] From these analyses, conclusions were drawn by considering where meaningful differences exist between the otherwise generally 'suitable' sites as to, when there was more than one site of either type in any localities, which were the 'more suitable' sites.

In some instances, changing circumstances and/or additional information which emerged during the course of the study lead to some sites not being taken completely through the process of assessment, as they were considered to be too compromised or too conflicted in terms of one or more of the following criteria:

- mine subsidence;
- airspace management; and
- Urban Growth Centres.

[1] Undertaken separately for the Department by Ernst & Young with data inputs from parties including WorleyParsons AMPC.

Accordingly, sites at Glenorie were culled due to high degree of incompatibility with Sydney Airport airspace management; airport sites at Catherine Field and Windsor Downs culled due to conflict with Sydney region Growth Areas; and airport sites at North Appin culled due to conflict with Mine subsidence district.

The following table lists those criteria adopted at each Phase:

Table E1 – Criteria by Phase				
	Phase 1	**Phase 2**	**Phase 3**	**Phase 4**
Criteria Type	**Absolute Exclusionary Criteria for Sydney Region**	**Criteria for Relative Scaled Assessments of Localities**	**Airport Site Identification Criteria**	**Airport Site Evaluation Criteria**
Criteria Name	Site Terrain Air Navigation Windshear Protected Ecosystems Existing Urban Areas	Earthworks Population Density within 20 ANEC Designated Mine Subsidence Districts (MSD) Proximity to Sydney major road transport network	Flattest land Minimise transport access time Lowest noise exposure Avoid MSDs Runways parallel to Sydney Airport Obstacle Limitation Surfaces Major infrastructure impacts Avoid over flight of urban areas Airspace conflicts Local topographic constraints Incorporate cross runway	General Site Attributes Accessibility of the Sydney land transport network (rail and state roads) Proximity to urban growth centres and commercial opportunities Comparative Earthworks Estimates Noise impacts on residents Mine subsidence Number of lots requiring acquisition Airspace interaction Capacity for future expansion to a Maximum Airport Topographic and other risks at the site Additional potential infrastructure dislocations, relocations and other items likely to involve

Table E1 – Criteria by Phase				
	Phase 1	Phase 2	Phase 3	Phase 4
				costs

Where the same criterion appears more than once from Phase 1 to Phase 4, a progressively more refined view of that criterion was adopted.

In these tables the following indicative rating are used to show where there are relative differences and relative similarities between the sites.

'More suitable'	*'Suitable'*	*'Less suitable'*
✓✓	✓×	××
Adverse issues are 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 will be difficult to remedy through normal planning and design and/or expensive to remedy with likely additional capital cost implications

Table E2 summarises the findings of the study as which were found to be the '*more suitable*' sites.

Table E2 – *'More suitable'* Sites				
Locality Geographic Descriptor	***'Suitable'* *Type 3* Sites**	***'Suitable'* Maximum Sites**	***'More suitable'* Type 3 sites**	***'More suitable'* Maximum sites**
Central Coast	Peats Ridge Somersby Wallarah	Somersby Wallarah	**Wallarah**	**Wallarah**
Hawkesbury	Wilberforce 09/27[2] Castlereagh (including RAAF)	Wilberforce with Royal Australian Air Force (RAAF) 01/19	**Wilberforce 09/27**	**Wilberforce with RAAF 01/19**
Nepean	Kemps Creek	Luddenham	**Luddenham**	**Luddenham**

[2] While not specifically analysed as separate options for a Type 3 airport at Wilberforce, possible first stages to develop a Maximum airport could be a Type 3 Wilberforce 10/28 (to be later used as a cross runway) or Wilberforce with RAAF 01/19.

Table E2 – *'More suitable'* Sites				
Locality Geographic Descriptor	***'Suitable'*** ***Type 3* Sites**	***'Suitable'*** **Maximum Sites**	***'More suitable'*** **Type 3 sites**	***'More suitable'*** **Maximum sites**
	Luddenham Badgerys Creek Bringelly Greendale	Badgerys Creek Bringelly Greendale	**Badgerys Creek** **Bringelly** **Greendale**	**Badgerys Creek** **Bringelly** **Greendale**
Burragorang	The Oaks Silverdale Mowbray park	Mowbray Park	**Silverdale (if Type 3 only)** **Mowbray Park**	**Mowbray Park**
Cordeaux-Cataract	Wilton Southend Wallandoola Dendrobium	Wilton Wallandoola	**Wilton** **Wallandoola**	**Wilton**

Note: A number of earlier configurations at Bringelly were identified and did not proceed.

Table E3 following summarises the evaluation of '*more suitable*' Type 3 Airport sites while Table E4 summarises the evaluation of '*more suitable*' Maximum Airport sites. (See end of this Executive Summary.)

It is notable that, on the basis of the Rapid CBA analysis undertaken by Ernst & Young, the sites configured for a Type 3 Airport yielded lower Net Present Value (NPV) results relative to the Maximum sites, with a number of the Type 3 airport sites resulting in a negative result when assessed as being able to operate in an unconstrained manner i.e. without taking into account the current airspace management practices and the potential effect of Sydney Airport. However, given the rapid nature of the economic appraisal, an NPV below zero was not considered by Ernst & Young to definitively suggest a locality would be unviable; likewise a high NPV was not considered to definitively suggest economic viability.

Across the ten criteria and fifty points of data examined in the data matrices, there are differences- sometimes significant – between the manner in which sites perform both functionally as airports and in terms of how an airport at that site would interact with its environment. As a result, it emerged that the major points of difference between the 'suitable' sites were:

- the unconstrained NPVs – which included, inter alia, capital costs and in particular the costs to create an airport platform in the terrain prevailing at that site as well as the accessibility of that site for the current users of Sydney Airport;

- the way aircraft movements to and from that airport site would interact with the way aircraft movements are currently managed within the Sydney region – i.e. the current constrained capacity;
- the effect of the presence of RAAF Bases at Richmond and Williamtown and a number of other military or other forms of restricted airspace; and
- the way in which a site if developed as an airport could generate adverse effects on people due to aircraft noise, principally as represented by N70 person event noise exposures.

As can be seen in the preceding Table E2, the same sites are generally listed as being '*more suitable*' for both Type 3 and for Maximum Airports (with the exceptions of Wilberforce, where a different site and runway alignment was considered for a Type 3 Airport only and Silverdale as this site is only considered to have potential as a Type 3 Airport. This is due to the fact that, if in other regards there is little to distinguish between Type 3 airport sites, then the issue of whether that site could be developed further to accommodate a Maximum Airport became the final distinguishing factor. However, if the demand requirement is only for a Type 3 airport for the foreseeable future, then other sites may also become '*more suitable*' or even possibly '*most suitable*'.

While the objective in this Study was to not identify the '*most suitable*' site within either the localities themselves or in the Sydney region overall, there are some overall directions which become clear from this Study.

Firstly, of the five localities, three – Central Coast, Burragorang and Cordeaux-Cataract comprise '*suitable lands*' in disaggregated parcels which, in most cases, are not much greater than the area required to accommodate a Maximum Airport. According, they offer a reduced possibility of achieving alternative orientations and configurations for an airport, should that be needed to optimise a workable design either within the site itself or within its wider context and, most notably, its airspace context and its N70 person-event footprint.

Secondly, of the two remaining localities, Hawkesbury is strongly influenced by the presence of RAAF Base Richmond and the existing and proposed patterns of urban development within the Northwest Growth Centre. Both a Type 3 and Maximum Airport development at the identified '*more suitable*' site would require closure of the existing Base because of airspace management incompatibilities and, possibly, its relocation onto the new site.[3]

Thirdly, the remaining locality, Nepean, yields the single largest and most contiguous area of 'suit*able land*' in any of the five localities. As a result, Nepean yields the most number of '*suitable*' and '*more suitable'* sites of all the localities, notwithstanding that there are still some important differences between those sites and significant issues which would require attention during the development of a concept design to overcome their current shortcomings. When investigated in greater detail, these shortcomings would be likely to lead some of these sites being passed over and one of these sites – or a site comprising parts of some or all of these sites - to become the '*most suitable*' site in that locality.

In all cases, capacities at the '*suitable'* and *'more suitable'* sites would be limited below their theoretical maximums, although this would be less so in the case of the Cordeaux-Cataract sites – Wilton and Wallandoola – which are considered able to operate at 80 to 100 movements per hour.

[3] Depending on Defence's future requirements for those operations which are based at Richmond.

Reorientation of the runways proposed in this study and redesign of the Sydney airspace and air traffic management practices, which would be needed in all cases, which may lead to higher capacities being realised.

Finally, in NPV and in overall evaluation criteria terms, the '*more suitable*' sites in Nepean generally outrank the other '*more suitable*' sites in other locations, which again points to the significance of this locality as compared to the other four localities in terms of providing possible sites for airports in the Sydney region.

Table E3 'More suitable' Type 3 Airport Sites

Criterion	Wallarah	Wilberforce 09/27 Runway	Luddenham	Badgerys Creek	Bringelly	Greendale	Silverdale	Mowbray Park	Wilton	Wallandoola
NPV $ billions (Unconstrained results)	--$0.8	+$0.3	+$0.3	+$0.3	+$0.2	--$0.1	--$0.4	--$0.7	--$0.6	--$0.6
1- Transport - Comparative Transport Upgrade Costs $ millions [4]	$70 (road) ✓✓	$259 (road) ✓x	$350 (road) ✓x	$190 (road) ✓x	$270 (road) ✓x	$370 (road) ✓x	$430 (road) ✓x	$400 (road) ✓x	$460 (road) ✓x	$460 (road) ✓x
2 - Growth Centres	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Partial acoustic footprint overlap ✓x	Partial acoustic footprint overlap xx	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓
3 – Earthworks Platform Comparative Cost $ millions	$180 ✓✓	$196 ✓✓	$126 ✓✓	$161 ✓✓	$310 ✓✓	$226 ✓✓	$463 ✓x	$372 ✓✓	$346 ✓x	$345 ✓✓
4 - Noise Impacts (N70) person-events	1,048,700 xx	172,800 ✓x	206,300 ✓x	200,700 ✓x	179,200 ✓x	104,800 ✓x	42,100 ✓✓	159,600 ✓x	19,800 ✓✓	29,400 ✓✓
5 - Mine Subsidence Areas (MSAs)	Surrounded by MSAs ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Partially affected xx	Not directly affected-collieries proximate ✓x
6 - Property Acquisition (number of lots)	200 ✓x	100 ✓x	80 ✓✓	10 ✓✓	150 ✓x	40 ✓✓	40 ✓✓	40 ✓✓	10 ✓✓	5 ✓✓
7 - Airspace Interaction Capacity (Movements per hour)	~40-50 ✓x	~40-50 ✓x	~40-50 ✓x	~40-50 ✓x	~40-50 ✓x	~40-50 ✓x	~40-50 ✓x	~40-50 ✓x	~40-50 ✓x	~40-50 ✓x
8 - Expansion to Maximum	Yes ✓✓	Yes ✓✓	Yes ✓✓	Yes ✓✓	Yes ✓✓	Yes ✓✓	No xx	Yes ✓✓	Yes ✓✓	Yes ✓✓
9 – Major Flood risk	Non major ✓✓	Partial 1:100 and Probable Maximum Flood (PMF) events ✓x	Non major ✓✓	Non major ✓✓	Non major ✓✓	Partial, 1:20, 1:100 and PMF events ✓x	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓

[4] For type 3 – road upgrade cost only

Table E3 'More suitable' Type 3 Airport Sites											
Criterion	**Wallarah**	**Wilberforce 09/27 Runway**	**Luddenham**	**Badgerys Creek**	**Bringelly**	**Greendale**	**Silverdale**	**Mowbray Park**	**Wilton**	**Wallandoola**
10 - Other Major Costs	Freeway, rail & major power realignment Closure of Somersby, Mangrove Mountain airfields ××	No major items ✓✓	RAAF Orchard Hills closure Major power lines Sydney water supply Camden/ Bankstown flying training areas & Wilton PJE may close ××	Camden Airport closure; flying training areas & Wilton Parachute Jumping Exercise (PJE) may close Major power lines ✓×	Camden Airport closure RAAF Orchard Hills and Wilton PJE 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 PJE closure Major power lines ✓×	RAAF Orchard Hills, The Oaks Airfield, Camden Airport, Wilton PJE closures Operations at Bankstown affected Major Power Lines ✓×	The Oaks Airfield, Wilton PJE closures Camden Airport operations affected Major Power Lines ✓×	Water catchment areas Wilton and Wedderburn airfields Major power lines ××	Water catchment areas Wilton and Wedderburn airfields ✓×

Table E4 'More suitable' Maximum Airport Sites

Criterion	Wallarah	Wilberforce with RAAF 01/19 Runway(s)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton
NPV $ billions (Unconstrained results)	+$1.5	+$4.7	+$4.9	+$4.8	+$4.9	+$4.3	+$2.7	+$3.0
1- Transport - Comparative Transport Upgrade Costs $ millions	$110 (road) $740 (rail) ✓✓	$259 (road) $1,320 (rail ✓×	$350 (road) $1,130 (rail) ✓×	$190 (road) $1,130 (rail) ✓×	$270 (road) $1,130 (rail) ✓×	$370 (road) $1,130 (rail) ✓×	$400 (road) $930 (rail) ✓×	$460 (road) $1,100 (rail) ✓×
2 - Growth Centres	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Partially acoustic footprint overlap ✓×	Partially acoustic footprint overlap ××	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓
3 – Earthworks Platform Comparative Cost $ millions	$280 ✓✓	$343 ✓✓	$284 ✓✓	$356 ✓✓	$407 ✓×	$304 ✓✓	$680 ✓×	$805 ✓×
4 - Noise Impacts (N70) person-events	2,534,200 ××	2,020,800[5] ××	1,545,200 ××	1,668,800 ××	1,284,600 ××	499,200 ✓×	799,400 ✓×	81,500 ✓✓
5 - Mine Subsidence Areas (MSAs)	Surrounded by MSAs ✓×	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Partially affected – collieries proximate ××
6 - Property Acquisition (number of lots)	500 ✓×	380 ✓×	140 ✓×	40 ✓✓	180 ✓×	70 ✓✓	100 ✓✓	40 ✓✓
7 - Airspace Interaction Capacity (Movements per hour)	~80-100 ✓✓	~60-70 ✓×	~60-70 ✓×	~60-70 ✓× Note: NE/SW alignment unsuitable for integration	~60-70 ✓×	~60-70 ✓×	60-70[6] ✓×	80-100 ✓✓
8 - Expansion to Maximum Airport	Already Maximum Airport ✓✓	Already Maximum Airport ✓✓	Already Maximum Airport ✓✓	Already Maximum Airport ✓✓	Already Maximum Airport ✓✓	Already Maximum Airport ✓✓	Already Maximum Airport ✓✓	Already Maximum Airport ✓✓

[5] Note that the runway orientation changes from Wilberforce Type 3 to Wilberforce Maximum which is more North South.
[6] Not specifically addressed by ASA but assumed to be similar to Greendale.

Table E4 'More suitable' Maximum Airport Sites

Criterion	Wallarah	Wilberforce with RAAF 01/19 Runway(s)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton
9 – Major Flood risk	Non major ✓✓	Partial 1:100 and PMF events ✓×	Non major ✓✓	Non major ✓✓	Non major ✓✓	Partial, 1:20, 1:100 and PMF events ✓×	Not affected ✓✓	Not affected ✓✓
10 - Other Major Costs	Freeway,rail &major power realignment Closure of Somersby, Mangrove Mountain airfields ××	Relocation of RAAF Base Richmond ××	RAAF Orchard Hills closure May close Camden/Bankstown Flying training areas Wilton PJE closure Major power lines Sydney water supply ××	Camden and Wilton PJE closure May close 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 PJE closure Major power lines ✓×	Impacts on Bankstown Airport Closure of Camden and The Oaks Airports and Wilton PJE, Buffer to RAAF Orchard Hills Major power lines ✓×	The Oaks Airfield, Wilton PJE closures Camden Airport operations affected Major power lines ✓×	Water catchment areas Wilton and Wedderburn airfields closure Holsworthy, Camden and Bankstown operations affected Major power lines ××

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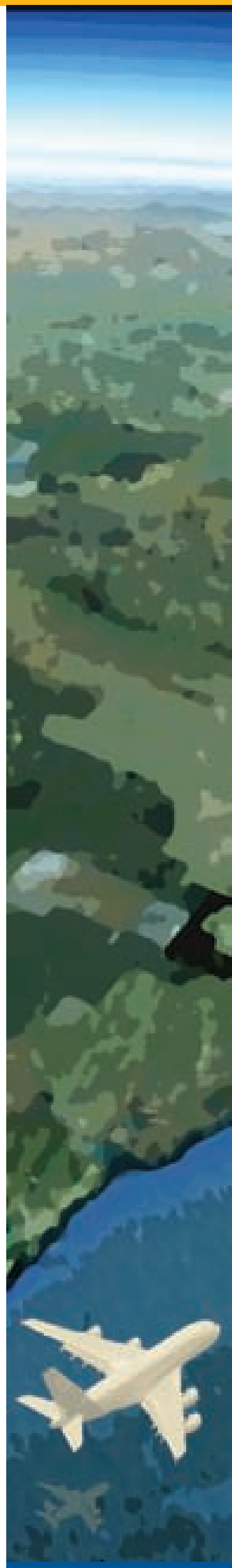
1

Introduction



Introduction

1 INTRODUCTION

The Australian and New South Wales (NSW) Governments are developing an Aviation Strategic Plan (the Plan) for the Sydney region. To support the development of the Plan, a Joint Study is currently underway to identify options and strategies to meet the aviation capacity needs of the Sydney region over the short, medium and long terms (defined as 10, 25, and 25+ years respectively). The Joint Study will also consider land transport infrastructure surrounding Sydney Airport and the future use of the Commonwealth-owned Badgerys Creek site.

A high-level Steering Committee has been established to oversee the Joint Study. The Sydney Aviation Capacity Branch, within the Aviation and Airports Division of the Department of Infrastructure and Transport (the Department), provides advice and secretariat support to the Steering Committee. This Branch liaises with relevant stakeholders, including the NSW Government and relevant Commonwealth agencies, to support the development of the Plan.

For the purposes of the overall Sydney Region Aviation Capacity (SRAC) Study, the Sydney region was initially considered to extend north to the Hunter Valley, south to beyond Nowra, south-west to Canberra and west to Lithgow (see Figure 1-1). As noted below, a number of prior studies were undertaken to inform the Steering Committee which then determined that, for the purposes of this study, a reduced area – termed the specified localities - of the original Sydney region should be considered in terms of those localities to '*supply*'[7] sites for airport.

1.1 Background

Through this current study, WorleyParsons and Airport Master Planning Consultants (AMPC) have been engaged to provide advice to the Sydney Aviation Capacity Branch in its support to the Steering Committee and its advice to Government in relation to the assessment of the Sydney region to '*supply*' greenfield sites at which aviation activities could take place.

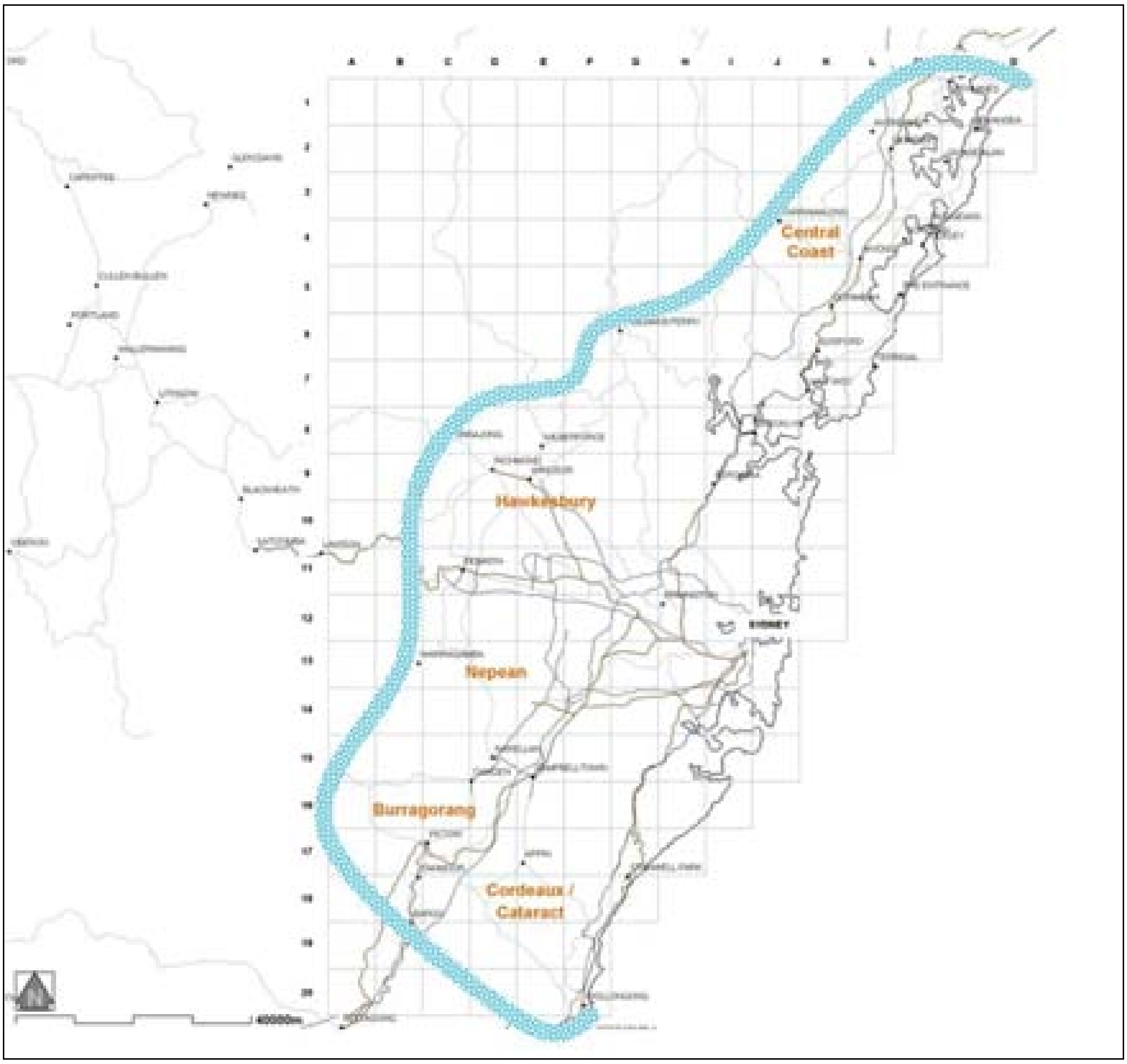
Accordingly, this study is grounded on a number of prior analyses undertaken on airport infrastructure site identification and assessment which comprised:

- **Phase 1 - Identification of all potential locations:** *Greenfields Location Identification and Analysis*[8] -this identified 18 discrete geographic localities which met a set of 10 high level greenfield airport location criteria. These criteria had been established by WorleyParsons AMPC in consultation with PwC[9] and the Department;
- **Phase 2 - Shortlisting of localities**:
  - a *Comparative Assessment of Greenfield Localities*[10] -this assessed all 18 localities against 30 criteria; For each locality one or more representative runway concepts were developed in order to test the locality's ability to accommodate an airport;

[7] In the sense that this is independent of the issue of whether there is a demand for an airport at that site.
[8] *Greenfields Location Identification and Analysis* Version 5 WorleyParsons AMPC for the Department of Infrastructure and Transport January 2011
[9] In a parallel commission to WorleyParsons AMPC
[10] *Comparative Assessment of Greenfield* Localities (*Greenfield site analysis*, 'Matrix 1: Comparative assessment of localities identified in Phase 1 of the greenfield assessment process') WorleyParsons AMPC for the Department of Infrastructure and Transport, February 2011

- on advice from the Steering Committee, the 18 localities were reduced to initially nine and, latterly, seven localities for which '*representative airports*'[11] concepts were prepared[12];
- those seven localities and the representative sites within them were subjected to a Rapid CBA assessment by Ernst & Young (E&Y).

Figure 1-1 Suitable Sites – Specified Localities Indicative Study Area



Based on these prior analyses, five geographic localities were determined by the Steering Committee as being of sufficient interest and were specified for investigation in this study to find the '*suitable'* sites for airports. These five geographic localities were advised to WorleyParsons and AMPC to form the basis for this study. These localities are shown in Figure 1-1 and, adopting generic geographic names, are:

[11] A Representative airport' was solely for the purpose of determining that the locality could supply at least one airport and did not purport to be a design for the site selected;
[12] In some instances it was recognised that the airport concept would conflict with RAAF Base Richmond and accordingly provision was made to relocate the existing Base onto a new airport.

- Central Coast (north of Sydney);
- Hawkesbury (north-west of Sydney);
- Nepean (west of Sydney);
- Burragorang (south-west of Sydney); and
- Cordeaux/Cataract (south of Sydney).

All of the localities required by the Steering Committee to be assessed in this study lie within one hour and a half (1.5 hours) travel time by road of the centroid of Sydney's population which is currently considered to be at or close to the suburb of Ermington. To that extent, they were considered to be acceptably accessible to the population of Sydney.

Additionally, advice on the suitable site or sites in each of these five localities for two different types of airports was required. As requested by the Department, the two airport types to be considered are:

- a limited service airport, servicing all regular passenger transport (RPT) with one runway - referred to in this report as a **Type 3 Airport**. This type of airport would be a limited capacity airport, aimed primarily at Low Cost Carriers (LCCs) serving both international and domestic and regional markets. A Type 3 Airport would provide a low level of landside services including terminals and is assumed to cater for larger aircraft on some international routes currently served by LCCs such as New Zealand and South East Asia.
- a full service international airport servicing all RPT segments, with two wide spaced parallel runways and one cross runway - referred to in this report as a **Maximum Airport**. This airport would service domestic and international markets and would be able to handle wide-bodied aircraft (including B747s, A380s and B777s).

Table 1-1 outlines the key characteristics of these two airport types which are also expanded upon in Section 3.

Table 1-1 Airport Type Key Characteristics

Airport element	**Type 3 Airport** **(Limited service airport)**	**Maximum Airport** **(Full service international airport)**
Number of runways	One	Two – three (two parallel and one cross runway provided where feasible)
Length and width of runway(s)	2500 to 2600m x 45m wide	2500 to 4000m x 60m wide
Runway spacing	Not applicable (only one runway)	Wide spaced (at least 1,650m) capable of independent operations
Landside services	Full domestic terminal services - medium term	Full terminal services
Size of airport site	From 680 to 1,150ha	From 1,370 to 2,190ha

As this study was considered likely to identify some sites which might be incompatible with the continued operation of RAAF Base Richmond, in some cases an additional amount of land was allowed to enable the relocation of the Base onto that new airport. (Refer to Figure 3.2.)

1.2 Overview of methodology

A four phase approach to identify the most suitable sites for airport development in the five localities specified by the Steering Committee was adopted in this study. The phases are:

- Phase One – using geographic information system (GIS) methods, coarse screening of five localities within the Sydney region to identify **broadly suitable land** for airport development;
- Phase Two - using GIS methods, application of key criteria to identify the **more suitable lands** within those areas;
- Phase Three – using 1:25,000 scale mapping to provide enhanced detail, identification of **suitable sites** within the more suitable lands using airport site location planning principles and development of concept plans for both airport types for each site identified; and
- Phase Four - site and location specific analyses to identify the **more suitable sites**.

This process is described in more detail in Section 2.

1.3 Structure of this report

This report is structured as described in Table 1-2.

Table 1-2 Structure of Suitable Sites Study Report

Section	Content
2	Explains in detail the **four phase methodology** used in this study to identify the more suitable sites in each of the five localities under investigation.
3	Presents and discusses the general high level **airport planning principles** used in this study to determine airport types which would provide nominated aviation capacity.
4	Describes the Phase One investigation to identify **broadly suitable land** in the five specified localities for the location of an airport.
5	Describes the Phase Two investigation to identify the **more suitable lands** for airport development within the broadly suitable land.
6	Describes the Phase Three investigation to select **suitable sites** within the more suitable lands for the two specified airport types.
7	Describes the Phase Four assessment of the suitable sites to identify the **more suitable site(s)** for the two specified airport types. Discusses the **key issues** related to the more suitable sites for the two specified airport types.

1.4 Technical limitations

Whilst technical limitations are normal for a project at this stage of definition, the Department's attention is particularly drawn to them, as some or all of these limitations may be required to be addressed prior to subsequent issues of this report or overall finalisation of the Sydney Region Aviation Capacity Study.

Firstly, this document was prepared to meet the objectives outlined in the WorleyParsons - AMPC response to the Department's Brief. Planning and engineering reports are typically based on a limited set of data. Provision of more data in the form of additional survey or other investigations and information may improve the findings of the report or yield different results, due to a range of factors including engineering, planning, and survey or geotechnical investigations.

The findings are based not only on the scope, assumptions, analysis, standards and guidelines in this report, but are also subject to the following limitations in the context of finding the more suitable sites for each specified locality:

- the decision as to what constitutes '*more suitable*' for establishing an airport will vary depending upon the emphasis accorded to the many factors involved in such a decision (for example 'more suitable' could be based on a preference for some or all of the following considerations - lowest cost, least noise impact, lowest environmental impact, best for airspace management, best for increased capacity, shortest travel time, most suitable for regional development, most attractive to an airport investor/bidder, or greatest return on investment for shareholders). Advice from the Department has been that the Steering Committee does not wish to assign preferences or weights to any criteria but would prefer instead to rely on rapid and detailed forms of Cost Benefit Analysis (CBA);

- in the absence of aviation demand forecasts for the Sydney region being available when this study was undertaken, either in terms of volume or in terms of preference for a location for an airport to satisfy demand, the size of aviation facilities needed and the timing of requirements are unknown and, accordingly, a 'supply-side' approach has been adopted in this study – that is, an examination of the ability of the specified localities to '*supply'* a site suitable for a given type of airport and level of airport operation. This has required assumptions to be made as to the type and levels of aviation activity which may occur at the greenfield localities/sites. These assumptions flow through to the consideration of airspace issues, particularly in terms of potential conflicts and/or dependencies with existing air traffic arrangements within the Sydney region; provision of infrastructure, extent of aircraft noise and the like;

- no aviation development scenario or strategy for the whole of the Sydney region has been provided, which may influence recommendations and/or decisions (airspace management, for example, will become more complex with a new airport);

- no complete information on the precise extent of underground (and notably long wall) mining has been provided, although this information has been sought from the NSW Department of Planning and could be incorporated in future phases; However, land identified as being prone to mine subsidence has been identified and taken into account;

- no details of the NSW Government's expectations regarding siting, requirements or acceptability of airports in or near to water catchment areas have been provided; likewise no specific preferences in regard to landside transport have been notified;

- for specific sites and within their notional boundaries, no detailed cadastral survey, geotechnical information or detailed environmental analysis or Planning Certificates pursuant to sections 149 (2) and (5) of the *Environmental Planning and Assessment Act 1979* have been provided or assembled;

- for specific sites, no detailed survey of obstacles in the aircraft/flight approaches beyond the notional airport boundary has been undertaken;

- analysis undertaken by Airservices Australia (ASA) is based on the current airspace design and management practises;

- site-specific comments have yet to be made by key stakeholders including Civil Aviation Safety Authority (CASA), Department of Defence, Airport Operators and Aviation Businesses;
- The ASA analysis refers to matters such as whether Camden and/or Bankstown airports may need to be closed or operations changed in a significant way; RAAF Richmond may need to be closed/relocated; whether Orchard Hills may need to be closed/relocated. For example sites for a replacement Type 4 airport, such as Camden, have not been investigated or identified);
- the site concept development plans for various airport sites are necessarily conceptual and/or generalised and would require further refinement based on additional investigations; and
- costs are indicative at this stage and intended to be comparative between airport sites (for example, calculation of earthworks volumes and resultant costs) and are not suitable for project development budgeting of any particular airport concept.

The findings of this study, therefore, are intended to be informative and useful to the Steering Committee in choosing reasonable options for further investigation for airport location and development. Depending upon the Steering Committee's decisions, further investigations are likely to be required to be undertaken on any such sites.

As a result, the sites identified and those further identified as being 'more suitable' are a starting point for more in-depth analysis and design - for example, runway alignments) which may be refined to better suit the terrain and other issues, such as environmentally significant sites being affected, for those sites considered by the Steering Committee to meet its requirements and overall objectives in selecting sites in the most holistic manner.

1.5 Abbreviations

The following common airport abbreviations and others are used in this report:

AMPC	Airport Master Planning Consultants
ANEC	Australian Noise Exposure Concept
ASA	Airservices Australia
ATC	Air traffic control
ATM	Air Traffic Management
CASA	Civil Aviation Safety Authority
CBA	Cost Benefit Analysis
CFIT	Controlled flight into terrain
CTR	Control zone
DoPI	NSW Department of Planning and Infrastructure
EP&A Act	Environmental Planning and Assessment Act 1979
E&Y	Ernst & Young
FAA	Federal Aviation Administration (USA)
FOBN	Flight Operations Briefing Notes
GA	General Aviation

GBAS	Ground Based Augmentation System
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
ICAO	International Civil Aviation Organisation
IFR	Instrument flight rules
ILS	Instrument landing system
LCC	Low Cost Carrier
LEP	Local Environmental Plan
LGA	Local Government Area
LTOP	Long Term Operating Plan (Sydney Airport)
MGA	Map Grid Australia
MOS	Manual of Standards
nm	nautical miles
NSW	New South Wales
OLS	Obstacle limitation surface
PANS-OPS	Procedures for Air Navigation Services – Operations
PJE	Parachute Jumping Exercise
PMF	Probable Maximum Flood
RAAF	Royal Australian Air Force
RMS	NSW Roads and Maritime Services (previously RTA)
RPT	Regular passenger transport
RTA	NSW Roads and Traffic Authority
SSA	Used to refer to the following study: Department of Aviation 1985 Second Sydney Airport Site Selection Program: Draft Environmental Impact Statement
VFR	Visual flight rules

2

Airport Site Evaluation Methodology

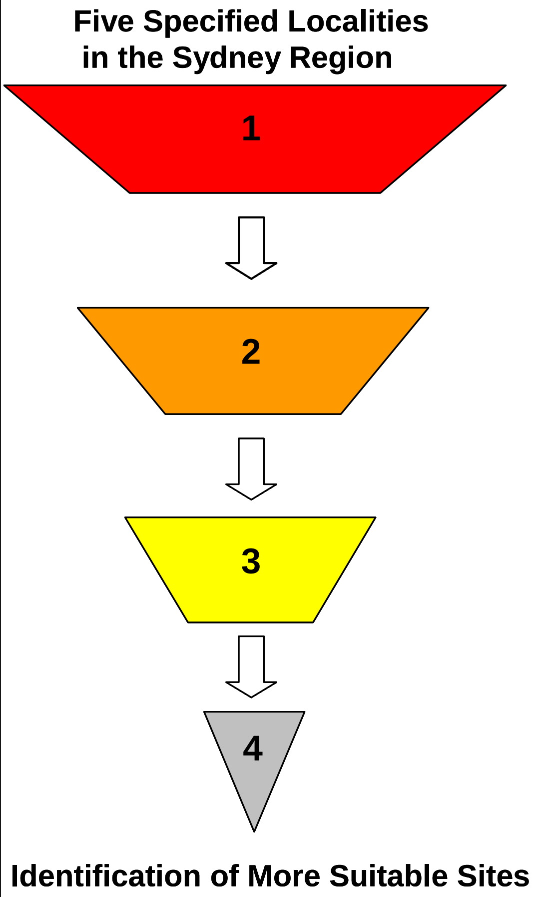
Airport Site Evaluation Methodology

2 AIRPORT SITE EVALUATION METHODOLOGY

2.1 Outline of the methodology

In this study, a four phase process was used to progressively identify the more suitable sites in the five specified localities for both Maximum and Type 3 Airports derived using the airport planning principles and templates presented later in Section 3. The phases in this process are shown in diagrammatic form in Figure 2-1.

Figure 2-1 Methodology to identify the more suitable sites for aviation purposes



Phase One – screen out unsuitable lands within all localities by applying six (6) criteria and using broad environmental planning and costing data to broadly identify suitable land for investigation for airport uses

Phase Two – Apply four (4) criteria to the broadly suitable land identified for investigation for airport purposes to identify the more suitable land for airport purposes in terms of these criteria

Phase Three – identify suitable sites for Type 3 and Maximum airports within the suitable land using established airport site location planning principles and as informed by the outputs of Stage 2 – noting that there will be differences in the relative suitability of sites.

Phase Four - Analyse and assess suitable sites. Apply ten (10) criteria in the form of a data matrix Output information to a rapid CBA process and re-import results Apply further site specific criteria in order to determine the more suitable sites within each locality for each of a Maximum and Type 3 airport (if any exist)

The criteria applied in each phase are discussed in detail in the following sections. The description and sources of the data used to document the criteria used in various phases of the assessment as well as the assumptions used in the analysis are provided at **Appendix 1**.

The five specified localities to be investigated are:

- Central Coast (north of Sydney);
- Hawkesbury (north west of Sydney);
- Nepean (west of Sydney);

- Burragorang (south west of Sydney); and
- Cordeaux/Cataract (south of Sydney).

2.2 Phase One assessment

The intended outcome of the Phase One assessment is the screening out of land unsuitable for airport development in each of the five localities. A WorleyParsons proprietary Geographic Information and Analysis System (GIS)[13] was used to undertake this analysis.

Each of the Phase One criteria are '*absolute excluding criteria'* and act to exclude land as being unsuitable for airport development independently regardless of whether on the other criteria land is suitable. These criteria are (not in any priority):

- site terrain and scale of earthworks to create a platform for airport development beyond a predetermined maximum limit of terrain roughness, obstacles for air navigation within the vicinity of a potential site, and earth moving;
- air navigation comprising air traffic control (CTR) zones associated with the current operation of both Sydney and Williamtown Airports;
- windshear zones (mechanical airflow turbulence due to steep terrain);
- protected ecosystems lands;
- existing urban areas and rural settlements.

Application of these absolute excluding criteria results in the identification of:

- those areas of land which are considered to be unsuitable for airport development and, as a result, are excluded from further investigation in this study; and
- areas of land in each locality that are **broadly suitable** for aviation uses to be further assessed in this study.

2.3 Phase Two assessment

The intended outcome of the Phase Two assessment is to identify the **more suitable land** in each locality within the land identified in Phase One as being broadly suitable for airport development.

Four criteria are used in **Phase Two** to provide scaled, relative assessments of the areas of broadly suitable land identified in Phase One to identify more suitable areas for airport development. These criteria are:

- earthwork volumes required to create a notionally level platform[14] for airport development;
- population density within the ANEC 20 noise contour;
- designated mine subsidence districts; and
- proximity to the major Sydney land transport network (road links) i.e. freeways, tollways and major divided carriageway arterials roads.

[13] waterRIDE™
[14] See discussion in Section 4 herein regarding airport earthworks

Application and mapping of these criteria does not exclude any areas within the five localities but identifies the 'more suitable' areas within the 'broadly suitable land' in a locality in which to search for or locate one or more airport sites. Accordingly, land suitable for an airport may be found in a location which rates well on one or more criteria but not so well on other criteria. The benefit of this is that land which is capable of transformation to an airport site by application of mitigating strategies, actions or funding to overcome a shortcoming is not prematurely discarded.

The relativities in land suitability for an airport, as revealed in the Phase 2 assessment, then inform the assessments of suitable sites made in Phase 3.

2.4 Phase Three assessment

The intended outcome of the **Phase Three** assessment is the identification of **suitable sites** for both Maximum and Type 3 Airport types within the more suitable land in each locality. The GIS approach is limited in its ability to consider specific runway alignments and also the detail of its topographical and features data. As a result, in Phase 3 an analysis using 1:25,000 scale mapping was undertaken which permits a wider range of potential site options to be considered, once the more suitable lands have been identified.

An 8km by 8km grid was superimposed over 1:25,000 topographical maps. This grid size was chosen as being suitable to enclose a Maximum Airport. The Phase Three assessment then uses recognised airport site location planning principles, applied progressively from basic airport layout factors through site-specific infrastructure issues and airspace management issues to the identification of the extent and nature of the impact of airport operations outside the airport's notional boundaries (offsite impacts) to test each of these 8km by 8km cells to assess whether there are, firstly, sites for a Type 3 Airport and then if that site is capable of enlargement to accommodate a Maximum Airport.

Where otherwise suitable sites infringe on any of the Phase Two criteria, this infringement can be assessed to determine whether it can be ameliorated or, if not, the site should be discarded at this stage.

The key planning and assessment activities which are undertaken sequentially in Phase Three are:

- find the flattest available land of sufficient size to accommodate either or both[15] specified airport types;
- initially seek to orient runways parallel to Sydney Airport runways but then vary runway headings to suit constraints(e.g. airspaces, OLS, noise and the like);
- check site specific and runway specific OLS issues[16];
- avoid, to the extent possible, adverse effects on major infrastructure items such as freeways, railway lines and power stations;
- avoid flight paths over known urban areas;
- check for potential conflicts or dependencies with existing airspace management arrangements;

[15] E.g. as a staged development of a Type 3 airport to a maximum
[16] Note: while the GIS analysis includes consideration of terrain OLS, it does not include singularity obstacles such as power station stacks and the like, nor obstacles such as trees or power lines etc.

- consider local topography in the notional location of airport facilities and site boundaries;
- avoid designated mine subsidence areas; and
- assess the ability to locate a cross runway.

The outcome of Phase Three is the definition of one or more suitable sites for both of the specified airport types within each of the five localities.

2.5 Phase Four assessment

The intended outcome of **Phase Four** is to identify the **more suitable site(s)** in each locality for both specified airport types.

In Phase Four, the suitable sites identified in Phase Three are initially analysed and assessed in terms of ten criteria. This is a relative, not an absolute, assessment. This assessment is intended to provide data which, to the extent possible, can be monetized in a Rapid Cost Benefit Analysis (CBA) analysis being undertaken concurrently by Ernst &Young[17] or provides other qualitative forms of distinguishing between the sites. The output of the Rapid CBA, in conjunction with other qualitative assessments, will enable the more suitable site(s) to be identified for both a Maximum and a Type 3 Airport – if any such sites exist – within each locality. Comparison of any such '*more suitable'* sites between different localities was not required to be undertaken, though this became self-evident from the analysis undertaken.

The ten criteria are (not in order of priority):

- accessibility in terms of the proximity of the notional airport site to the existing major transport network (road and rail) and, where this is currently lacking, what investment/development is required to provide a suitable standard of access to and from the airport site;
- proximity of the notional airport site to designated population and employment growth centres;
- comparative earthworks to create an airport platform on the notional airport site, adjusted to allow for the fact that the site does not have to be completely level over its whole extent;
- aircraft noise impacts on residents beyond the notional airport site boundaries (including the number of person-events);
- presence of designated mine subsidence areas within or adjacent to the notional airport site;
- number of property lots to be acquired within the notional airport site;
- airspace interactions based on input provided by ASA, CASA and the Department of Defence[18];
- capacity for future airport expansion (Type 3 Airport only);
- flood risk on the airport site; and
- potential dislocations, relocations and other costs to infrastructure such as airfields, defence installations, water supply pipelines, electricity supply lines, social assets such as schools and the like.

17 Under a separate commission from the Department
18 At the time of finalising this report, a limited response from ASA had been received and nil for either CASA or Defence

This assessment is documented in the form of data matrices (see Section 7).

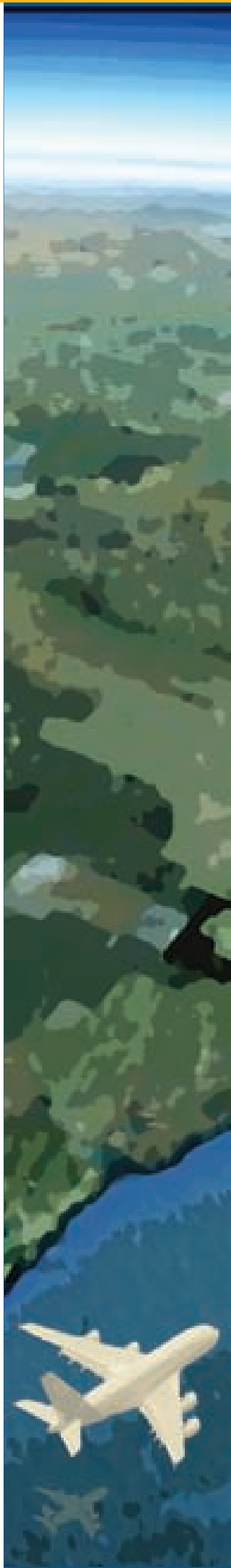
2.6 Conclusion

Application of this four phase assessment process in a clear and sequential manner enables the identification of the '*more suitable'* sites for airport development in each of the five localities under consideration in the Sydney region.

Section 3 following provides an outline of the high level physical planning principles which have been adopted in setting the fundamental '*aviation*' dimensions of both a Maximum and a Type 3 Airport. Sections 4 to 7 describe in detail each of the four phases of the site suitability assessment.

3

Airport Planning Principles



Airport Planning Principles

3 AIRPORT PLANNING PRINCIPLES

In order to identify broad land areas which could potentially accommodate one or more airport sites and then sites suitable for development of airports, it is necessary to define and document the key airport planning principles and parameters which were adopted for the purposes of this study.

The following principles and parameters have been derived from similar contemporary airport planning exercises and/or the applicable international or national standards established by agencies such as the International Civil Aviation Organisation (ICAO) or ASA and CASA respectively. For the purposes of this '*supply side'* study, principles or assumptions have been identified in relation to the following airport planning elements:

- air traffic growth;
- airport planning standards and requirements; and
- airport capacity.

Each of these elements is discussed in the following subsections.

3.1 Air traffic growth

Air traffic forecasts are a necessary input to the airport planning process as they provide a basis to address a range of aeronautical related issues which impact directly on matters such as determining the number and lengthen of runways and the size of terminals and other facilities - all of which then influence the land parcel size need to accommodate that airport. High level, indicative estimates of potential air traffic growth in the Sydney region were prepared as part of the initial stages of greenfield airport identification and assessment undertaken prior to this report (Phase 1 Identification of all potential locations[19] and Phase 2 Shortlisting of localities[20]) for that express purpose only.

In the absence of other more detailed forecasts of air traffic growth in the Sydney region being available in a form relevant to this study, a '*supply side'* approach was adopted in which assumptions were made as to the type and levels of aviation activity which may need to be accommodated at a possible airport sites. These assumptions flow through to the consideration of airport planning and airspace issues particularly in terms of:

- potential conflicts and/or dependencies with existing air traffic arrangements in the Sydney region;
- sizing of airport facilities such as terminals and landside transport links; and
- the calculation of areas beyond notional airport site boundaries likely to be subject to aircraft noise as indicated by commonly used metrics such as Australian Noise Exposure Concepts (ANEC)[21] and N70[22] contours (including calculation of the number of Person Events – refer to the Department's Guidelines) – based on assumed levels of traffic and fleet mix.

[19] *Greenfields Location Identification and Analysis* Version 5 WorleyParsons AMPC for the Department of Infrastructure and Transport January 2011
[20] *Comparative Assessment of Greenfield* Localities (*Greenfield site analysis*, 'Matrix 1: Comparative assessment of localities identified in Phase 1 of the greenfield assessment process') WorleyParsons AMPC for the Department of Infrastructure and Transport, February 2011
[21] Refer to AS 2021-2000

3.2 Airport planning standards and requirements

Airport site identification and evaluation is undertaken in accordance with the ICAO *Airport Planning Manual – Part 1 – Master Planning (ICAO Doc 9814)*. This Manual provides an approach to the broad determination of the overall land area required for airport development based on:

- identifying the space necessary for runway development which generally forms the major proportion of land required for an airport. This requires consideration of the following factors:
  - Runway length;
  - Runway orientation;
  - Number of runways; and
  - Combination of length, number and orientation of runways.

  The *ICAO Aerodrome Design Manual - Part 1 – Runways (ICAO Doc 9157)* provides an explanation of parameters affecting runway length and other associated runway matters. Detailed standards are provided in the *Manual of Standards 139 – Aerodromes (CASA 2010)* (MOS 139).
- the application of criteria for high level identification and screening of sites. These criteria are:
  - Site terrain and fit – based on the nominated airport types (see Table 4-1);
  - Air navigation;
  - Airspace management and separation;
  - Obstacle limitations surfaces (OLS);
  - Natural phenomena including wind patterns and fog events – in accordance with established ICAO airport useability criteria; and
  - Land use including urban areas and residential population and other significant areas such as conservation reserves.

Generic airport templates for both airport types under consideration - Maximum and Type 3 airports - were prepared to facilitate site identification. These templates were based on generic airport planning standards and requirements. That is, those elements that would be similar regardless of the airport site selected. These templates provide an indicative site boundary for each airport type, as shown in Figure 3-1, Figure 3-2 and Figure 3-3 below. Further detail on the location of runways and airport facilities within the site boundary for both of the airport types is shown in Figure 3-4 and Figure 3-5.

[22] An N70 contour defines a set of locations which are subjected to the same number of exposures to a noise event which exceeds 70 db(A) per day as result of airport operations.

Figure 3-1 Type 3 Airport Template site boundary

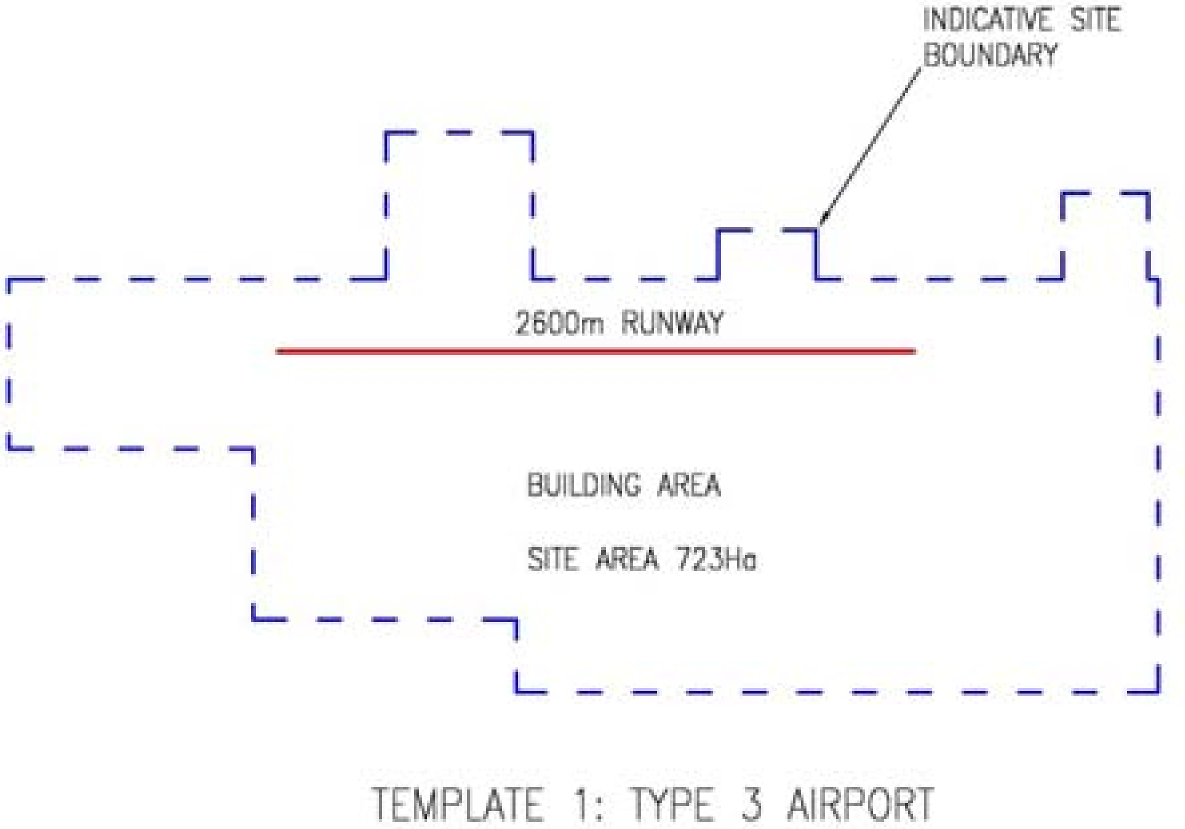


Figure 3-2 Type 3 Airport Template site boundary with relocated RAAF Richmond

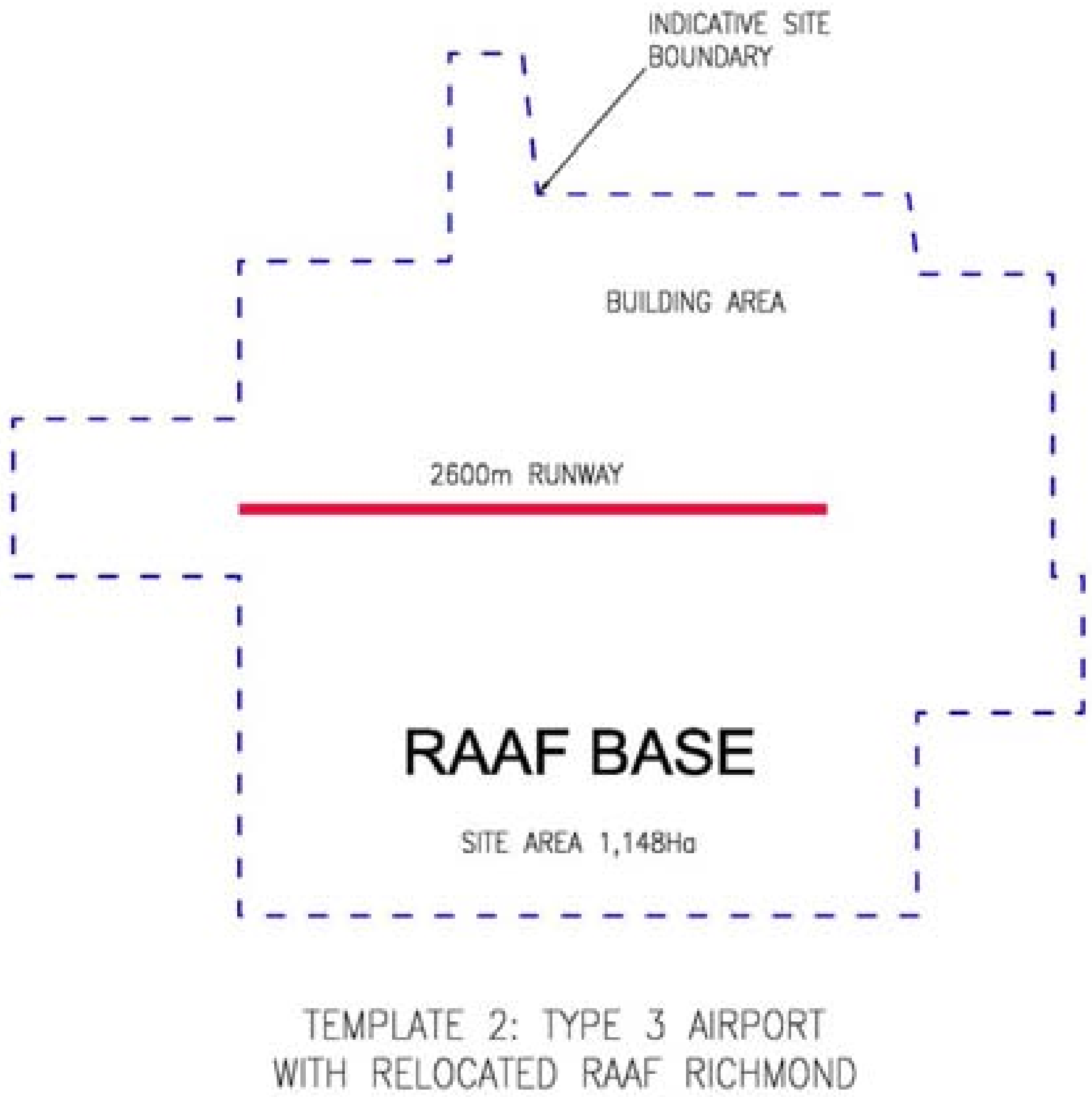


Figure 3-3 Maximum Airport Template site boundary

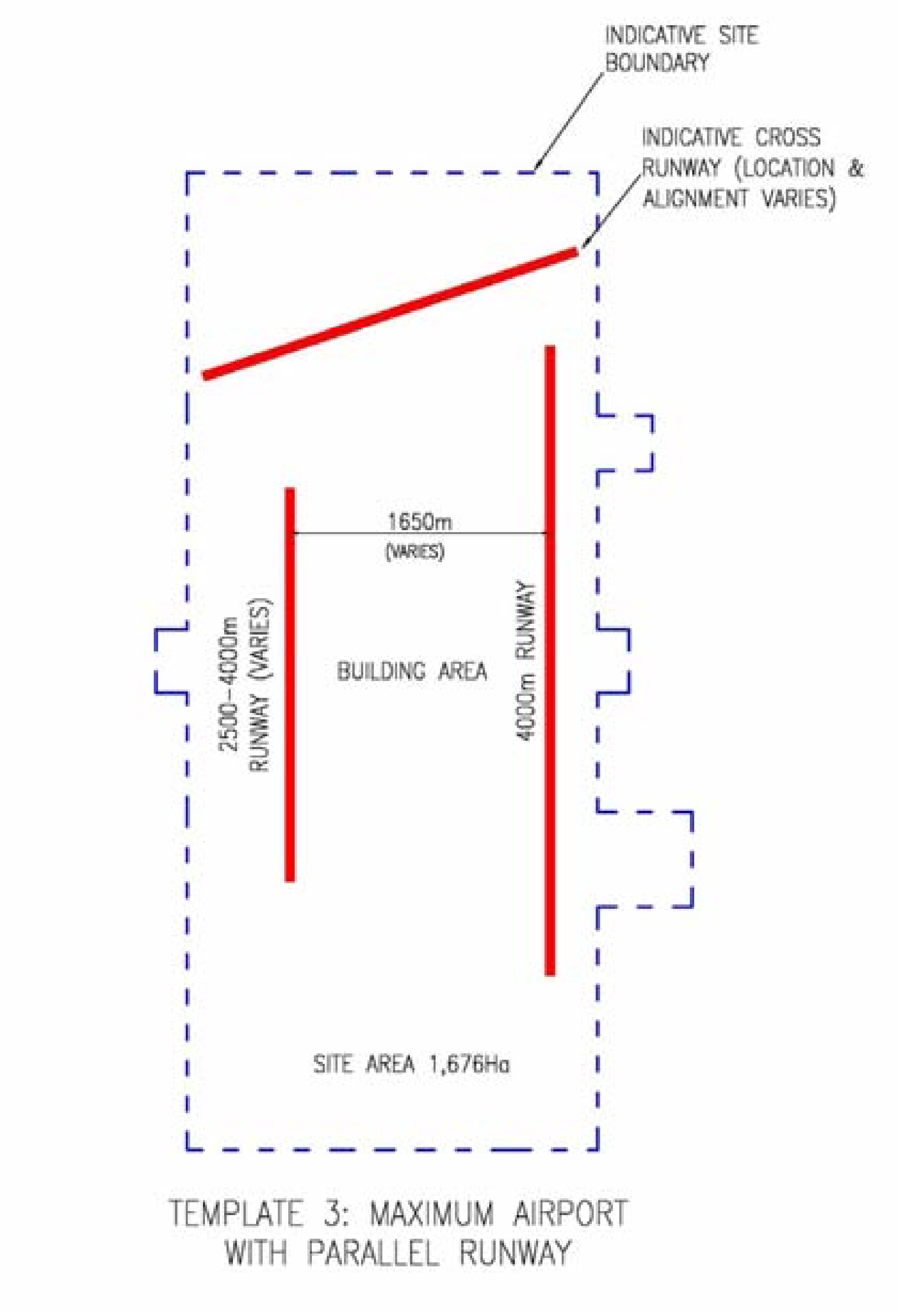


Figure 3-4 Type 3 Airport Template Layout

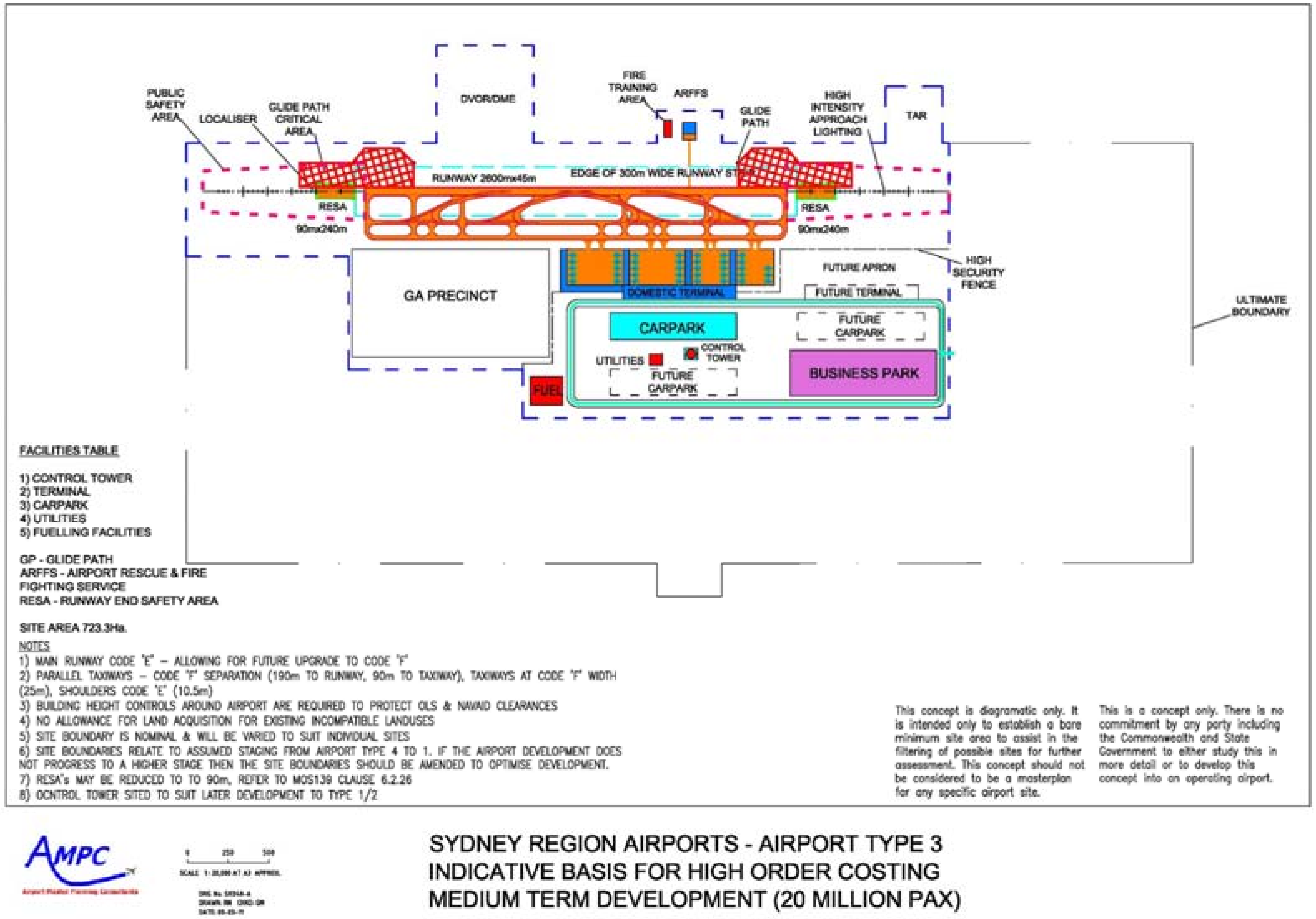
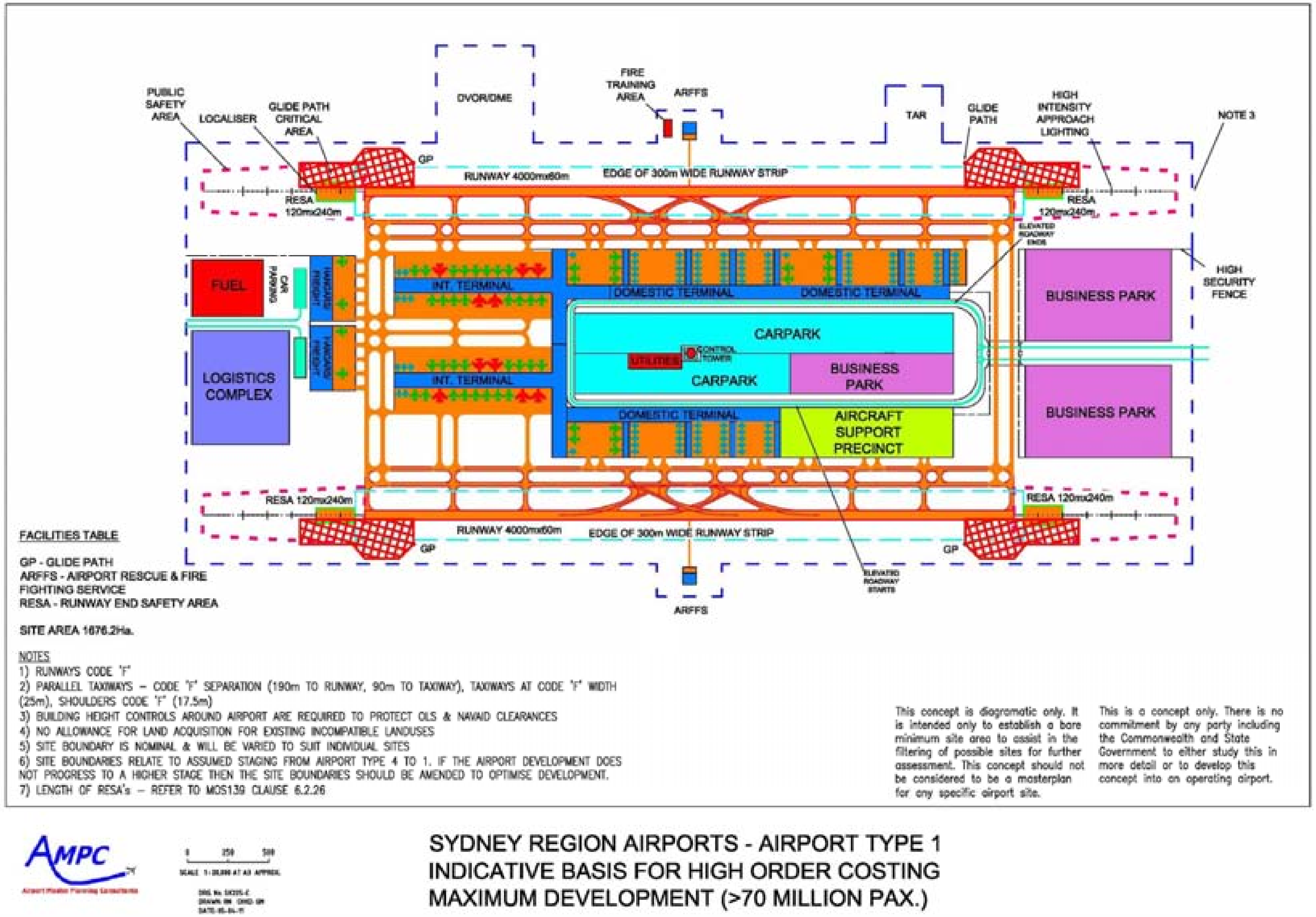


Figure 3-5 Maximum Airport Template Layout



While the templates presented in Figures 3-4 and 3-5 may appear to represent exact and detailed airport layouts, they are diagrammatic representations only and are intended to enable '*a bare minimum*' appropriate land area for each airport type to be identified.

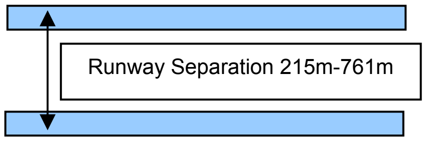
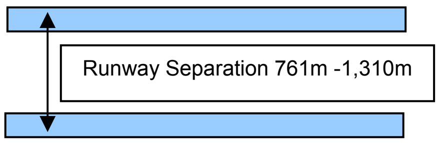
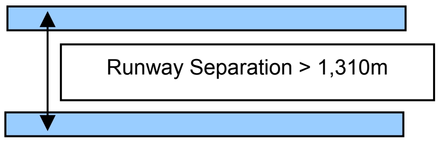
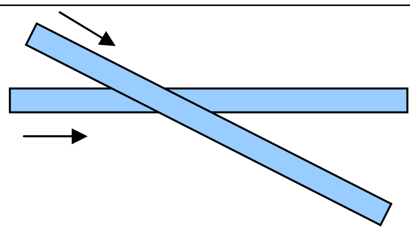
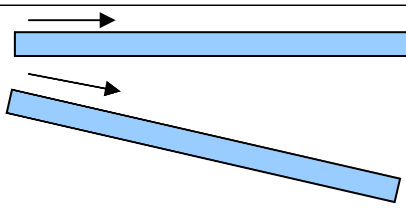
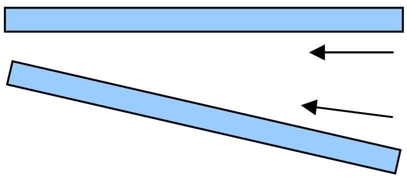
3.3 Airport capacity

For any airport, airfield capacity is normally expressed in terms of the peak number of aircraft movements per hour with an indicative total number of aircraft movements per annum. 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 (ATC) procedures.

Capacity assumptions for the two airport types being considered in this study are given below. Qualifications and descriptions of relevant aviation capacities and standards as they relate to relevant primary and other criteria for evaluation have also been included in the criteria and data matrices for this study in Table 7-4 and Table 7-5.

Table 3-1 shows the indicative runway capacities for planning purposes used in this study based on *ICAO Airport Planning Manual Part 1 Figure 6.1*. These capacities are frequently used internationally and provide a useful starting point for this assessment. However, these capacities are in isolation from an actual operating airspace where other airports already exist and, in the absence of detailed airspace design, may be reduced in a practical situation such as exists in the Sydney region.

Table 3-1 Indicative runway capacities – hourly capacity and annual service volume for long range planning

Number	Runway use configuration	Hourly capacity (Aircraft Movements)		Annual service volume
		Visual flight rules (VFR)	Instrument flight rules (IFR)	
1		51-98	50-59	195,000- 240,000
2		94-197	56-60	260,000- 355,000
3		103-197	62-75	275,000- 365,000
4		103-197	99-119	305,000- 370,000
5		72-98	56-60	200,000- 265,000
6		73-150	56-60	220,000- 270,000
7		73-132	56-60	215,000- 265,000

Source: ICAO Airport Planning Manual Part 1 1.2 Master Planning Figure 6.1

For parallel runways intended for simultaneous use, the minimum runway separation standard is 1,035m, but this distance depends upon the provision of suitable radar and communications equipment. In practice, a greater distance is often adopted to be better able to site terminals and other infrastructure between a pair of parallel runways. This practice has been adopted for this Study where possible. From a practical airport development approach, the most efficient and safest location for the terminal area is between the parallel runways. To achieve a useful depth of building area, the practical minimum separation distance is 1,525m (for example, similar to Hong Kong International Airport). However, a greater separation distance of between 2,300m and 2,600m is preferred. Increased separation enhances the ability of aircraft movements on each runway to operate independently and thus increases the total capacity of the runway system.

Table 3-2 details the application of the assumed runway capacities by airport type (see Table 3-1) to determine indicative aircraft and passenger (pax) capacity numbers for planning purposes. In earlier studies (see Section 1.1, consideration was given to four types of airport – as described in Table 3-2. However, the specified airport types investigated in this study were limited to Maximum and Type 3.

Table 3-2 Indicative runway capacity calculations by airport type

Airport type and runway arrangement	Average passengers per aircraft	Aircraft per hour	Aircraft per annum	Passengers per annum
Type 1 Full Service International Airport servicing all RPT segments 1 x 4000m runway	195 (Source 1 – see below)	Up to 50 (Source 2 – see below)	Up to 240,000 (Source 3 – see below)	Up to 46.8M (Source 1 – see below) At say 130 passengers per aircraft, up to 31M
Capacity assumptions	Aircraft movements – up to 50 per hour or 240,000 pa Passengers – up to 46.8M pa based on Sydney Airport 2029 pax per aircraft mix of 195. 31M based on 130 pax per aircraft			
Maximum – two long runways Full Service International Airport servicing all RPT segments 2 x 3500-4000m wide-spaced runways	195 (Source 1 – see below)	Up to 100 (Source 2 – see below)	Up to 370,000 (Source 4 – see below)	Up to 72M (Source 1 – see below) At say 130 pax per aircraft, up to 48M
Capacity assumptions	Aircraft movements – up to 100 per hour or 370,000 pa Passengers – up to 72M pa based on Sydney Airport 2029 pax per aircraft mix of 195. 48M based on 130 pax per aircraft			
Maximum – one long runway and one short runway Full Service International Airport servicing all RPT segments 1 x 4000m and 1 x 2500 m wide-spaced runways	195 (Source 1 – see below) and 130	Up to 100 (Source 2 – see below)	Up to 370,000 (Source 4 – see below) Assume 240,000 on 4000m runway and 130,000 on 2500m runway	Up to 65M – 46.8M on 4000m runway and 18M on 2500m runway At say 130 pax per aircraft on 4000m runway and 80 pax on 2500m runway, up to 42M
Capacity assumptions	Aircraft movements – up to 100 per hour or 370,000 pa Passengers – up to 65M pa based on *Sydney Airport 2029* pax per aircraft mix of 195 on long runway and assume 140 on short runway (i.e. Maximum plus Type 3). 42M based on 130 pax per aircraft on long runway and 80 pax per aircraft on short runway			

Airport type and runway arrangement	Average passengers per aircraft	Aircraft per hour	Aircraft per annum	Passengers per annum
Maximum – three long runways Full Service International Airport servicing all RPT segments 3 x 3500-4000m wide-spaced runways	195 (Source 1 – see below)	Up to 130 (Source 2 – see below)	Up to 500,000 (Source 5 – see below)	Up to 97.5M (Source 1 – see below) At say 130 pax per aircraft, up to 65M
Capacity assumptions	Aircraft movements – up to 130 per hour or 500,000 pa Passengers – up to 97.5M based on *Sydney Airport 2029* pax per aircraft mix of 195. 65M based on 130 pax per aircraft			
Type 2 Land Constrained Full Service International Airport servicing all RPT segments 1 x 3000-3500m runway	195 (Source 1 – see below)	Up to 50 (Source 2 – see below)	Up to 240,000 (Source 3 – see below)	Up to 46.8M (Source 1 – see below) At say 130 pax per aircraft, up to 31M
Capacity assumptions	Aircraft movements – up to 50 per hour or 240,000 pa Passengers – up to 46.8M pa based on *Sydney Airport 2029* pax per aircraft mix of 195. 31M based on 130 pax per aircraft			
Type 2 Land Constrained Full Service International Airport servicing all RPT segments 2 x 3000 - 3500m runway	195 (Source 1 – see below)	Up to 100 (Source 2 – see below)	Up to 370,000 (Source 3 – see below)	Up to 72M (Source 1 – see below) At say 160 pax per aircraft, up to 59M
Capacity assumptions		N/A		
Type 3 Limited Service Airport servicing all RPT segments 1650-2600m runway	140 (Source 6 – see below)	Up to 50 (Source 2 – see below)	Up to 240,000 (Source 1 – see below)	Up to 33M At say 80 pax per aircraft, up to 19M
Capacity assumptions	Aircraft movements – up to 50 per hour or 240,000 pa Passengers – up to 33Mpa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft			
Type 4 Minimum Service Airport servicing General Aviation (GA) and limited RPT 1600m runway	35 (Source 7 – see below)	Up to 50 (Source 2 – see below)	Up to 240,000 (Source 4 – see below)	Up to 8.4M if all RPT, but say 1M as primarily GA used for flying training and due Class D airspace limitations, as all RPT is not feasible or practical
Capacity assumptions	N/A			

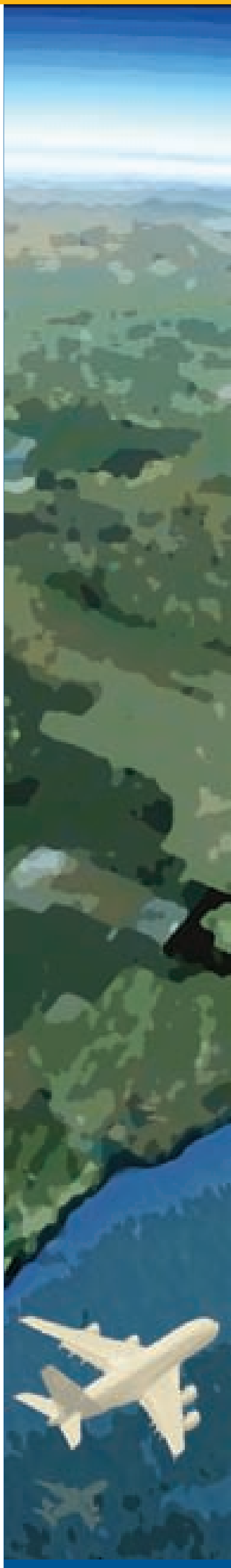
Airport type and runway arrangement	Average passengers per aircraft	Aircraft per hour	Aircraft per annum	Passengers per annum
Qualifications	In the absence of other forecasts, assumptions as to the type and levels of activity which may occur at the localities and sites were made. ICAO *Airport Planning Manual Part 1 Master Planning* is used for higher order planning only. Consideration of the airport's role, aircraft fleet mix, flight paths and noise impacts, environmental impacts, airspace management and policy settings will be required when detailed site evaluations are undertaken.			
Capacity limitation at some higher elevation localities	Higher elevations associated with particular locations may require a greater runway length for a given payload, compared to locations at lower elevations. From a safety and efficiency perspective, locations in less mountainous terrain would be preferred over sites in more mountainous terrain.			
Limitation at some terrain localities	Notwithstanding that it may be physically possible to site a runway or airport in a location which meets the prescribed geometric requirements, there could be significant meteorological issues associated with conducting aircraft operations. These would include matters such as mechanical turbulence, windshear potential and the propensity for fog events.			

Sources:

1. *Assuming Sydney Airport Master Plan 2009 Fig 5.4 year 2029 aircraft mix*
2. *SSA Planning and Design 1987 and ICAO Airport Planning Manual Part 1 Master Planning for single runway - hourly*
3. *SSA Planning and Design 1987 and ICAO Airport Planning Manual Part 1 Master Planning for single runway – per annum*
4. *SSA Planning and Design 1987 and ICAO Airport Planning Manual Part 1 Master Planning 1987 for wide spaced parallel runways (independent operations)*
5. *SSA Planning and Design 1987 and ICAO Airport Planning Manual 1987 for wide spaced parallel runways (independent operations) modified*
6. *80% of B737 aircraft capacity 177 = say 140 passengers*
7. *Sydney Airport Master Plan 2009 average 35 pax per regional aircraft in 2007*

4

Phase One - Broadly Suitable Land Identification



Phase One - Broadly Suitable Land Identification

4 PHASE ONE - BROADLY SUITABLE LAND IDENTIFICATION

4.1 Overview

The objective of Phase One was to assess the five localities specified by the Steering Committee for the Sydney Region Aviation Capacity Study to identify **broadly suitable land** for airport development.

This was done by screening out and excluding from further consideration unsuitable areas within the localities and thus identifying the residual *'broadly suitable'* land for airport development. The six criteria used in this phase are those which are considered to be '*absolute excluding criteria'* for airport development even if only one of these criteria applies to an area of land. These criteria are:

- site terrain;
- air navigation;
- windshear (mechanical air turbulence due to steep terrain);
- protected ecosystems; and
- urban areas and rural settlements.

These criteria were mapped and analysed using a proprietary GIS and database.[23] The details of how each criterion was analysed in the GIS are presented in **Appendix 1.** The application of the above six criteria is discussed in Section 4.2 while matters not included in this assessment are presented in Section 4.3. The overall results of the Phase Three assessment discussed in Section 4.4.

4.2 Excluding criteria

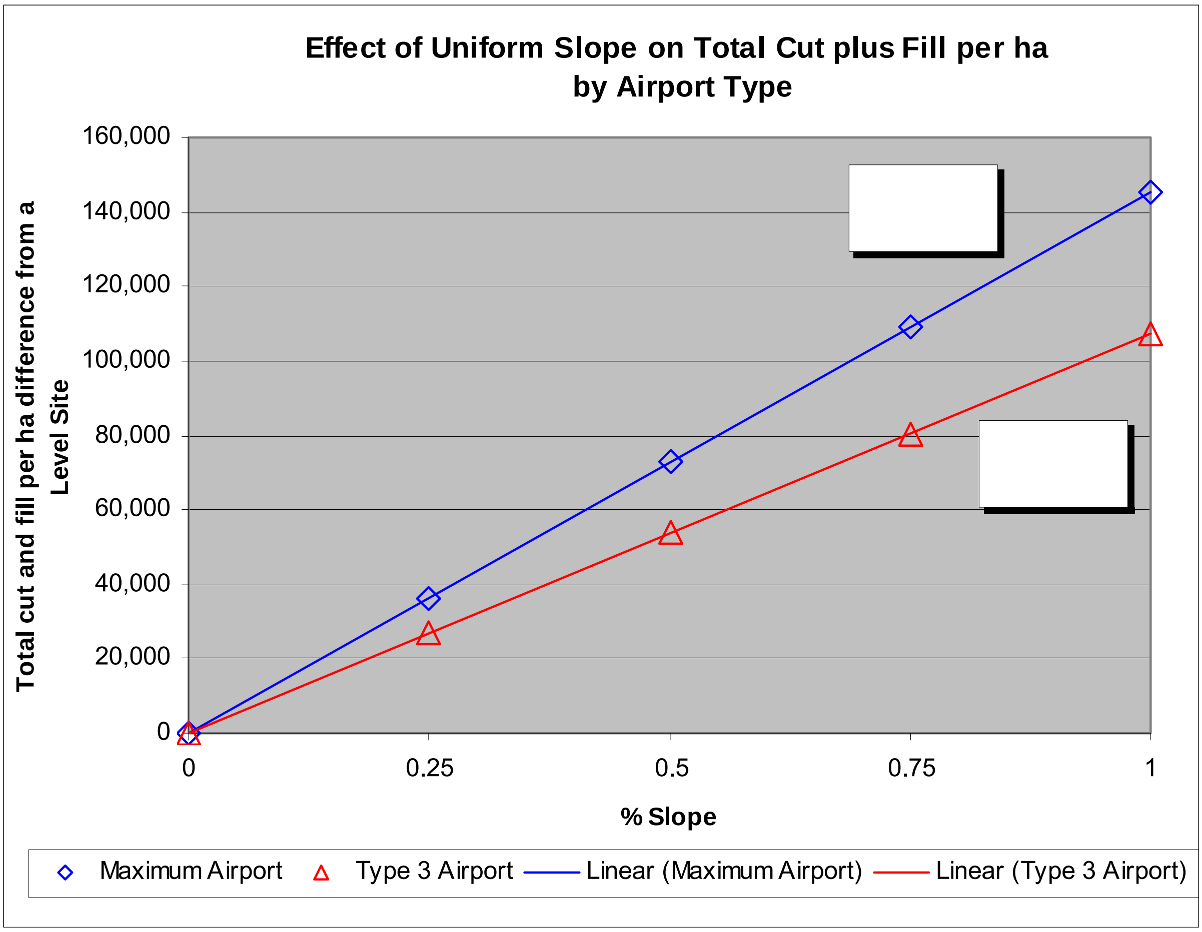
4.2.1 Site terrain

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. Land that is near level or able to be modified at the lowest cost to the required shape is preferred for airport development.

Figure 4.1 shows the effect of slope on total cut plus fill when only very slight tilting[24] - of the order permitted for runways (say from 0.25% to 1%) - is applied to a level airport site of the scale of a Maximum Airport or a Type 3 Airport. What can be concluded from this simple illustration is that, 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 detailed design and documentation of a selected site.

[23] waterRIDE tm
[24] Where a level surface is tilted such that cut equals fill

Figure 4-1 Effect of Slope on Total Cut plus Fill for a Tilted Planar Site



In order to provide a benchmark by which to assess the relative suitability of terrain in the five localities investigated in this study, data was collected on the total amount of earthworks – in the form of cubic metres (m^3) of *'total cut plus total fill'*[25] - required for development of an airport. This data was assembled from a range of recent airport developments internationally as well as relevant data for past airport proposals in the Sydney region and the proposed parallel runway development at Brisbane Airport. The data collected is listed in Table 4-1.

25 In other words, the amount of earth moved from one area (cut) and placed elsewhere (fill) in a given area to achieve a three dimensional surface which meets the geometrical requirements for the major elements of an airport.

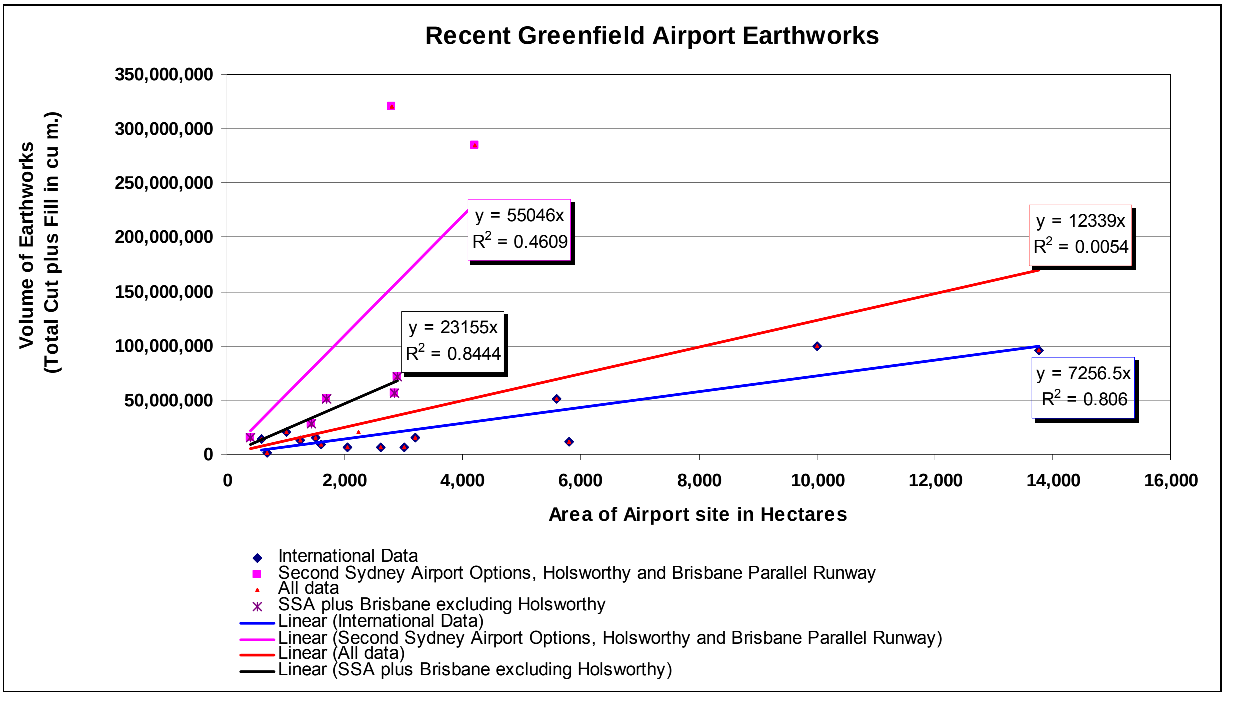
Table 4-1 International and Australian Data for Airport Earthworks

Airport	Site Area (ha)	Cut plus Fill (m^3)	Cut plus Fill (m^3 per ha)
International airport proposals or projects			
Enfida Zine El Abiddine Ben Ali International Airport, Tunisia	5,800	11,500,000	1,983
Begalaru Airport, India	1,600	9,000,000	5,625
Blaise Diagne International Airport, Senegal	2,600	6,704,166	2,579
Kuala Lumpur	10,000	100,000,000	10,000
King Shaka, Durban, South Africa	2,040	5,800,000	2,843
Pakyong Airport, Sikkim	3,000	6,500,000	2,167
Suvarnabhumi Airport, Bangkok	3,200	15,500,000	4,844
Chep Lap Kok, Hong Kong	1,248	12,480,000	10,000
Kansai International Airport, Osaka, Japan	1,000	21,000,000	21,000
Denver International Airport, USA	13,760	95,555,367	6,944
Incheon International Airport, Seoul, South Korea	5,600	51,160,000	9,136
Guangzhou Baiyun International Airport, China	1,500	15,000,000	10,000
Chūbu Centrair International Airport, Japan	580	14,100,000	24,310
Runway 1L-19R, Washington Dulles International Airport, USA	675	1,911,107	2,831
New Hyderabad International Airport, India	2,226	19,850,000	8,918
Australian Airport Proposals or Projects			
Badgerys Creek Option A Proposal Master Plan	1,700	51,000,000	30,000
Badgerys Creek Option B Proposal Master Plan	2,900	72,000,000	24,828
Badgerys Creek Option C Proposal Master Plan	2,850	56,000,000	19,649
Wilton	1440	28,000,000	19,444
Holsworthy Option A	4,200	285,000,000	67,857
Holsworthy Option B	2,800	320,000,000	114,286
Brisbane Parallel Runway project	391	15,000,000	38,363

Sources: Internet Research; Past proposals for Airports in the Sydney region.

Analysis of earthworks volumes relative to area of each airport site are shown in Figure 4-2. It should be noted that this data represents the earthworks planned or executed to create an airport which meets

Figure 4-2 Recent Greenfield Airport Earthworks



From Figure 4-2, it can be seen that:

- for the international airport projects considered, the average amount of cut plus fill earthworks has been about 7,500 m^3 per hectare. These are outturn volumes after an airport has been fitted to a site's particularly topography and therefore take account of any forms of slope compensation as described previously;
- by comparison, the earlier Badgerys Creek and Wilton proposals for Second Sydney Airport averaged about 23,000 m^3 per hectare of cut plus fill per hectare of airport site – that is, about three times the average of the international examples included in Table 4-1;
- proposals for airports at the southern end of the Holsworthy Military Reserve had much higher cut plus fill earthworks per hectare, reflecting the much more rugged terrain that exists on the southern margins of the Sydney Basin than elsewhere in this region;
- accordingly, when the past airport proposals for the Sydney region (including those in the Holsworthy Military Reserve) are taken into account, the average for Sydney region airport proposals increases to about 55,000 m^3 per hectare of cut plus fill earthworks noting that one proposal (Holsworthy Option B) had volumes of up to approximately114,000 m^3 per hectare;
- much of the more rugged terrain that exists in the Holsworthy Military Reserve comprises relatively long and flat-topped ridges with steep-sided deep gulleys and ravines. Accordingly, and given that such terrain is common around the Sydney region and has been contemplated for

airport sites in the past, it is appropriate to not discount similar terrain in this assessment on the basis of terrain analysis alone; and

- in the terrain analysis undertaken in the GIS modelling, assessment is made assuming a level site whereas an airport site can allow for small amounts of slope which, on the scale of site needed for a Maximum Airport, could account for cut and fill earthworks up to the order of 150,000 m^3 per hectare. A further check on this was made during the preparation of cost estimates for Representative Sites, referred to earlier herein. Using more precise CAD[26] models of the required earthworks for a number of sites showed that the total cut and fill required was significantly less when the airport geometry was closely fitted to the terrain as compared to a fully level site.

In view of these findings, the scale shown in Table 4-2 for earthworks was adopted.

Table 4-2 Scale of earthworks for site analysis

Cut plus Fill to produce a level site (m^3 per ha)	Rating Descriptor	Typical Terrain	Comparator Airport Examples
0 – 10,000	Easiest	Coastal floodplain	Many international airports (see Table 4-1)
10,000 – 25,000	More Moderate	Rolling planar	Badgerys Creek and Wilton Proposals
25,000 – 50,000	Moderate	Rolling hilly	None identified
50,000 – 75,000	Difficult	Planar linear ridges and gulleys	Holsworthy Option A
75,000 – 100,000	More difficult	Planar linear ridges and deep gulleys	None identified
100,000 – 125,000	Much More difficult	Dissected plateau and/or sloping terrain	Holsworthy Option B
125,000 – 150,000	Most difficult	Heavily dissected plateau with deep gorges and/or highly sloping terrain	There are examples of runways built on structure over gorges instead of using cut and fill e.g. Madeira Airport

This scale of earthworks shows clearly that terrain in the Sydney region is generally more rugged and, as a result, more difficult for siting an airport than is the case in many places globally.

The site must also be of sufficient size to accommodate the minimum number and length of runways (minimum number dependent on airport type, minimum length dependent on airport type and destinations to be served). For the purposes of terrain analysis undertaken in GIS modelling only, a simple rectangular shape representative of a single runway strip itself was adopted to assess suitability:

- Type 3 Airport Runway - a 3.0 km x 1.0 km rectangular area (300 ha) - capable of accommodating a Type 3 runway (1,650 to 2,600 m);

[26] CAD computer aided design

- Maximum Airport Runway - a 4.5 km x 1.25 km rectangular area (562.5 ha) - capable of accommodating a Maximum runway (3,500 to 4,000 m).

4.2.2 Air navigation

There are several aspects of air navigation requirements for safe airport operation that, when applied to an area under investigation for new airport development, effectively act as absolute excluding criteria for aircraft operations associated with a new airport. These air navigation aspects are airspace management, obstacle limitation surfaces (OLSs) and approach surfaces for an Instrument Runway approach. These aspects are discussed below.

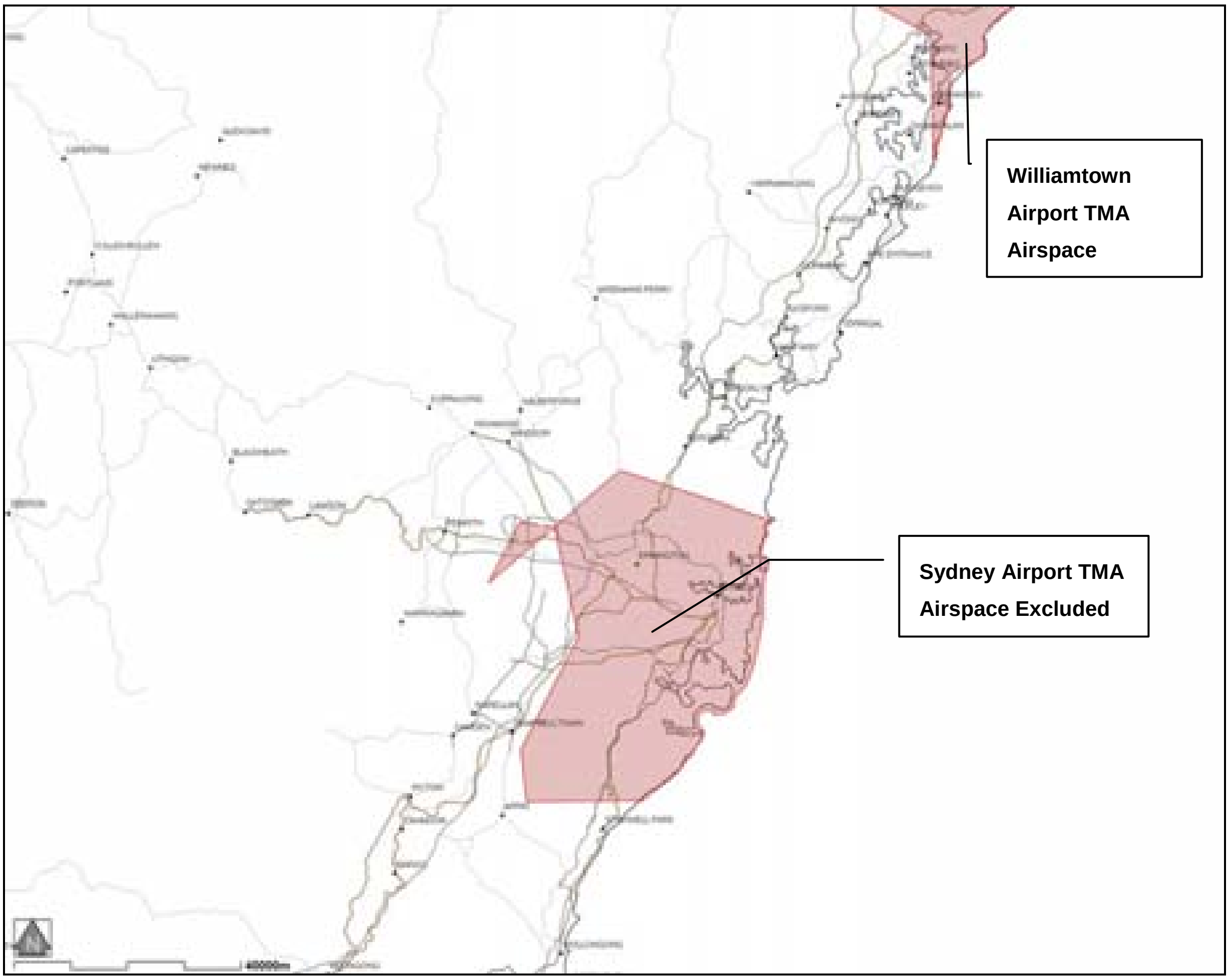
4.2.2.1 Airspace

New airports require adequate separation from existing airports and restricted airspace to enable clear air navigation paths to be defined. These air navigation paths provide for safe operation of aircraft to and from the airport. For the purpose of this study, the areas which have been considered incompatible for airport development with existing air traffic arrangements related to Sydney Airport and RAAF Base Williamtown/Newcastle Airport[27] are shown shaded in Figure 4-3 and have been excluded from further assessment.

Areas outside those shown in Figure 4-3 may also be wholly or partially unsuitable[28] due to existing air space management practices and procedures. These areas have been retained, at this stage, to allow for detailed discussion and advice from ASA and the Department of Defence.

[27] Based on current air space arrangement in the Sydney region as published by ASA.
[28] For example, unsuitability may be in relation to the direction in which a runway points.

Figure 4-3 Areas considered incompatible with existing air space management arrangements



4.2.2.2 Obstacle limitation surface

Airports also have airspace requirements in the form of defined imaginary surfaces in the air. These surfaces, known as obstacle limitation surfaces (OLSs), may not be breached by obstacles that extend from and beyond the runway ends and beyond the physical boundaries of the airport site. OLSs protect the immediate airspace in the vicinity of the airport for visual operations and are based on specifications laid down in the *Manual of Standards 139 – Aerodromes* (CASA 2010) for the applicable runway classification. OLSs comprise a series of imaginary planes which desirably should be kept free of obstacles to ensure the safety of aircraft operations.

Other components of the OLS, such as the take-off climb, transitional, inner horizontal, conical and outer horizontal surfaces, have not been considered at this level of analysis. However, for the review of suitable sites in Phase Three, the take-off and climb surfaces were considered (see Section 6.2.4).

A second set of reference surfaces know as Procedures for Air Navigation Services – Operations (PANS-OPS) apply to instrument operations, as distinct from OLS, which applies to visual operations. As the PANS-OPS are based around aspects of yet to be designed instrument procedures for a particular airport and are influenced by such things as the type and location of navigation aids, they have not been considered at this level of analysis. However, it is noted the Precision Instrument Landing System (ILS) PANS-OPS surface largely reflects the same criteria as the Instrument Precision approach OLS template adopted as the basis of this assessment. Also, in practice, PANS-OPS surfaces will generally (although not always) sit at a higher level in the airspace near an airport than the applicable OLS. As a result, PANS-OPS are often protected by virtue of the definition of the lower OLS.

4.2.2.3 Approach Surface for an Instrument Approach Runway

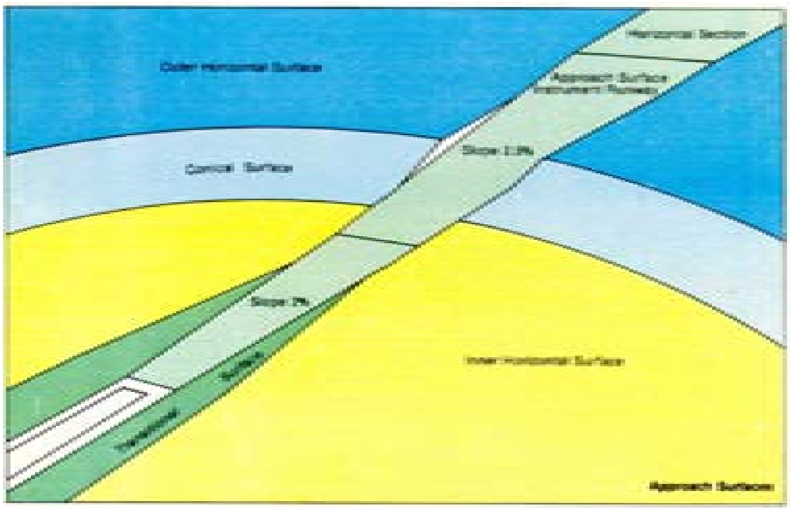
A preliminary check of terrain obstacles was made of the most critical element of the OLS for runways, namely the Instrument Precision approach surface for Code 4 aircraft.[29] This surface is also used to determine the runway threshold location in relation to obstacle clearance requirements. A test for such obstacles conflicting with this surface was incorporated into the GIS terrain analysis.

The dimensions of the Instrument Precision Approach Surface are:

- 300m wide inner edge located 60m beyond the runway threshold;
- divergence of 15% on each side of the runway;
- a first section length of 3,000m at a slope of 2%;
- a second section length of 3,600m at a slope of 2.5%; and
- a horizontal section length of 8,400m.

Application of these dimensions in combination results in an Instrument Precision Approach surface for a total of 15km at each end of a runway, as illustrated in Figure 4-4.

Figure 4-4 Approach surface for an Instrument Approach Runway



Source: CASA 2010 Figure 7.3-3: Approach surface for an instrument approach runway

[29] Code 4 Aircraft have an Aeroplane Reference Field Length (ARFL) of 1800m or greater and range in type and size from A320 to A380 and equivalent type aircraft

4.2.3 Windshear

Adverse weather such as thunderstorms (and other than low visibility and runway condition) is a circumstantial factor in nearly 40 per cent of approach and landing crashes.

Adverse wind conditions, such as strong cross winds, tailwind or windshear, are involved in more than 30 per cent of approach and landing crashes and in 15 per cent of events involving controlled flight into terrain (CFIT) crashes.

Windshear is the primary causal factor in 4 per cent of approach and landing crashes and is the ninth most common cause of fatalities. These data are summarized in Table 4-3.

Table 4-3 Weather factors in approach and landing crashes

Factor	Percentage of Events
Adverse weather	40%
Adverse wind (all conditions)	33%
Windshear	4%

Source: Flight Safety Foundation - Flight Safety Digest - Vol. 17/Vol. 18 - 1998-1999 [30]

Of these weather-related factors in aircraft crashes, the only one that can be readily incorporated into an airport site suitability assessment is windshear because of its specific association with particular terrain formations, especially large-scale escarpments.

Windshear is defined as a sudden change of wind velocity and/or direction. Windshear conditions are usually associated with the following weather situations:

- jet streams;
- mountain waves;
- frontal surfaces;
- thunderstorms and convective clouds; and/or
- microbursts.

Related regulatory material that guides the consideration of windshear in airport planning and aircraft operations includes:

- ICAO – Windshear (Circular 186);
- ICAO – Annex 6 – Part I, 6.21 – Recommendation – Forward-looking Windshear Warning System;
- FAA – AC 00-54 - Pilot Windshear Guide; and
- Airbus Flight Operations Briefing Notes (FOBN) Reference: FLT_OPS – ADV_WX – SEQ 02 – REV 03 – OCT. 2007 are acknowledged.

ICAO [31] notes that '... *it will always be a serious hazard for aviation and a potential killer, and there must be continued vigilance and pilot training on wind shear'*. Likewise the Department of Infrastructure

[30] This appears to still be the most recent analysis of these issues.

and Transport in a discussion paper (2009) noted that *'the safeguards for airports and the communities around them in the context of the proximity of building developments being a critical factor, windshear and turbulence issues will usually be an on-airport consideration. The potential impacts of proposed developments close to runways should be appropriately modelled.'*

In this analysis, a nominal clearance of 5km to the west of the Illawarra Escarpment, which has been recognised as a potential windshear geographic feature, has been used to form an exclusion zone so as to avoid any potential windshear issues arising from terrain in this area. However, no other known windshear areas have been specifically identified in the five nominated localities, although these may have other areas of terrain that, on closer analysis, may regularly contribute to or cause windshear conditions.

4.2.4 Environments and ecosystems protected by planning legislation

Airport sites will be preferred where they avoid any direct or significant indirect effects on areas of protected ecosystems that have been specifically reserved by the Australian and/or NSW Governments in the public interest and within which development for the purpose of an airport is not a permitted land use activity.

For this study, the protected ecosystems listed below and shown in Figure 4-5 have been mapped and excluded from further investigation for airport sites:

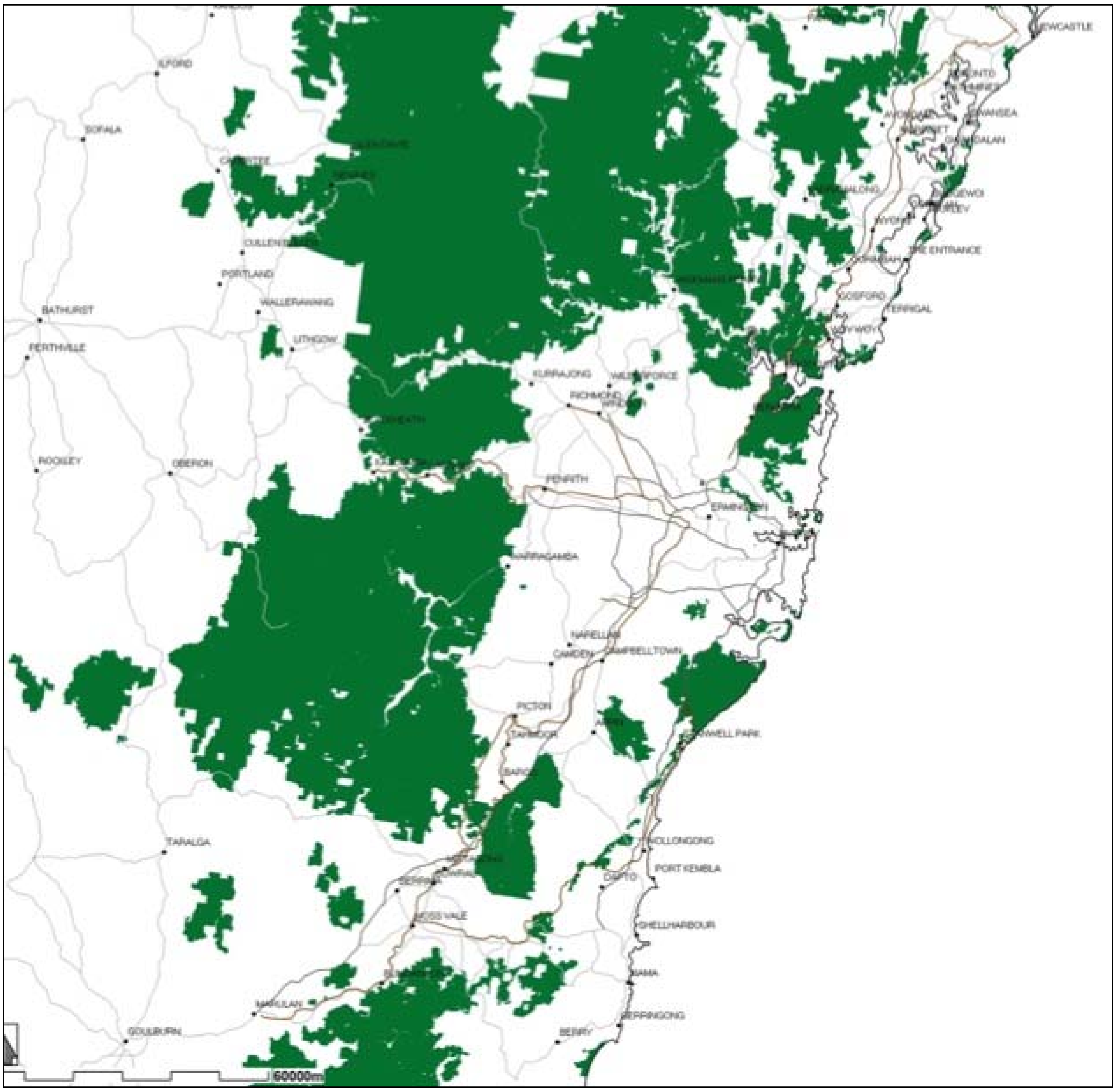
- National Parks;
- State Conservation Areas;
- State Forests; and
- Ramsar Wetlands.

Other environmental assets may still remain in those areas of land that are not excluded[32] and would need to be considered on an individual basis should they be affected by any proposed suitable site.

[31] ICAO Doc 9817 *Manual on Low Level Wind Shear*, ICAO 2005, Foreword p iv

[32] Note - Standard Instrument Local Environmental Plan Zones E1 National Parks and Nature Reserves and E2 Environmental Conservation have not been specifically excluded.

Figure 4-5 Protected environments and ecosystems



Source: NSW Department of Planning and Infrastructure (DoPI) GIS data

4.2.5 Existing urban areas

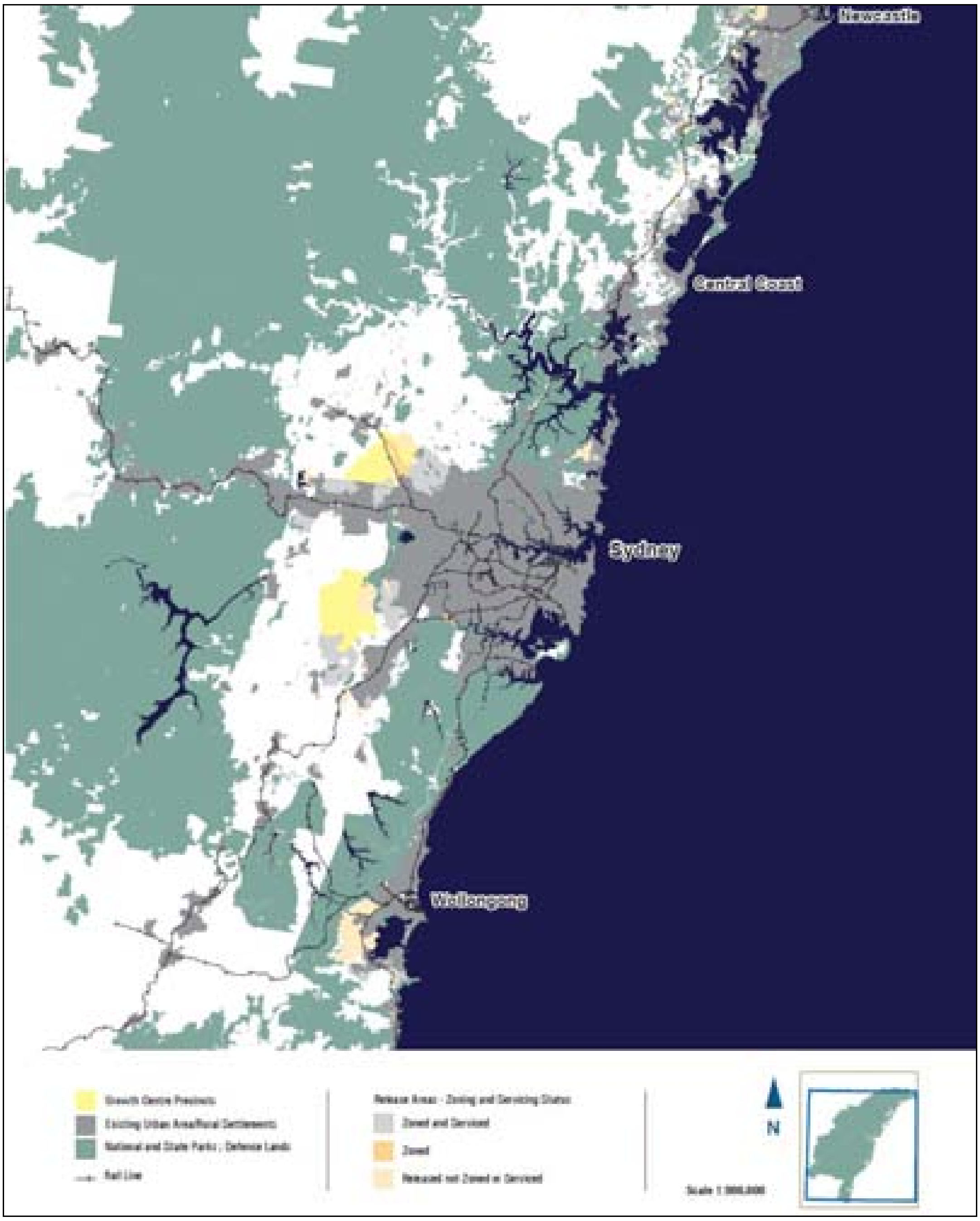
Aircraft operations to and from major airports result in the exposure of surrounding communities to aircraft noise. An airport site will be preferred where its location and runway orientation eliminates or avoids adverse levels of aircraft noise impact on residential populations.

In addition, existing urban areas are considered absolute excluding criteria because locating an airport in an established urban area would result in the need for widescale acquisition of property. It is considered that this would have unacceptable social and economic impacts, as well as adding significant cost to the establishment of an airport site.

It is noted, however, that airports also need to be sufficiently proximate to the markets that they serve and to sources of labour to operate efficiently.

For this study, existing Urban Area and Rural Settlements (as defined by the NSW Department of Planning and Infrastructure (DoPI) and shown shaded grey in Figure 4-6) have been excluded from further consideration. Growth Centre Precincts and Release Areas have not been excluded at the initial stage of this study process as there is no existing use of such land for urban purposes. Consideration of Growth Centre Precincts and Release Areas is incorporated into the Phase Four analysis (see Section 7-4).

Figure 4-6 Existing Urban Area and Rural Settlements



Source: NSW DoPI

4.3 Matters not addressed

The five criteria applied in Phase One are considered to be those most significant in terms of excluding from further considerations those areas of land within a locality which are not capable of supplying sites in which operationally viable airports could be physically located and therefore, in the alternative, of identifying areas of land which are broadly suitable to accommodate airport development.

However, these criteria do not of themselves address such matters as whether an airport, if it were to be located on such areas of land within that locality would:

- be commercially acceptable to the aviation industry;
- be viable in patronage and airport operational commercial terms;
- be expensive to construct – either directly or as a result of any form of modification to the existing uses and infrastructure;
- impact on any form of existing or possible future land use other than directly on the existing urban residential and industrial footprint; or
- impact on any number of designated and site specific environmental matters (including but not limited to flood affectation, flora and fauna, land contamination, bushfire, or indigenous and non-indigenous heritage).

Some of these matters are addressed later in the comparative analysis of sites that emerge from this process as places where an airport could potentially be developed (see Section 7) while others are the subject of other work commissioned by the Department.

4.4 Phase One results

The results of the Phase One analysis, in which broadly suitable land for airport development was identified, are presented in Figure 4-7 for a Type 3 Airport and in Figure 4-8 for a Maximum Airport.

These figures show that each of the five localities have lands which remain after exclusion of lands which are unsuitable in terms of the six criteria applied. These lands are essentially similar in their location and shape for both Type 3 and Maximum Airports though somewhat lesser for the latter.

In general terms, larger areas of broadly suitable land in terms of the potential ability to supply a site for an airport are identified in the Nepean and Hawkesbury localities with smaller areas identified in the Cordeaux/Cataract, Burragorang and Central Coast localities, as follows:

- **Central Coast** – three main areas have been identified – in the vicinity of Warnervale, Somersby and Peats Ridge - these areas of land are discrete and discontinuous with each other;
- **Hawkesbury** – a generally much larger overall area comprising some substantially larger 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 overall continuous area of land of any locality 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 lying west of the Nepean River, south of the Warragamba River and along the generally north south alignment of Silverdale and Montpellier Roads, centred on The Oaks township; and
- **Cordeaux- Cataract** – a set of six discrete, discontinuous areas of land in the vicinity of Appin, Wilton and the Cordeaux – Cataract water catchments areas and lying to the east of the M5 South-Western motorway and west of the F6 Southern Freeway and the Illawarra escarpment.

These areas of land in each of the five localities form the input to the next stage of assessment presented in Section 5.

Figure 4-7 Phase One Output - Type 3 Airport

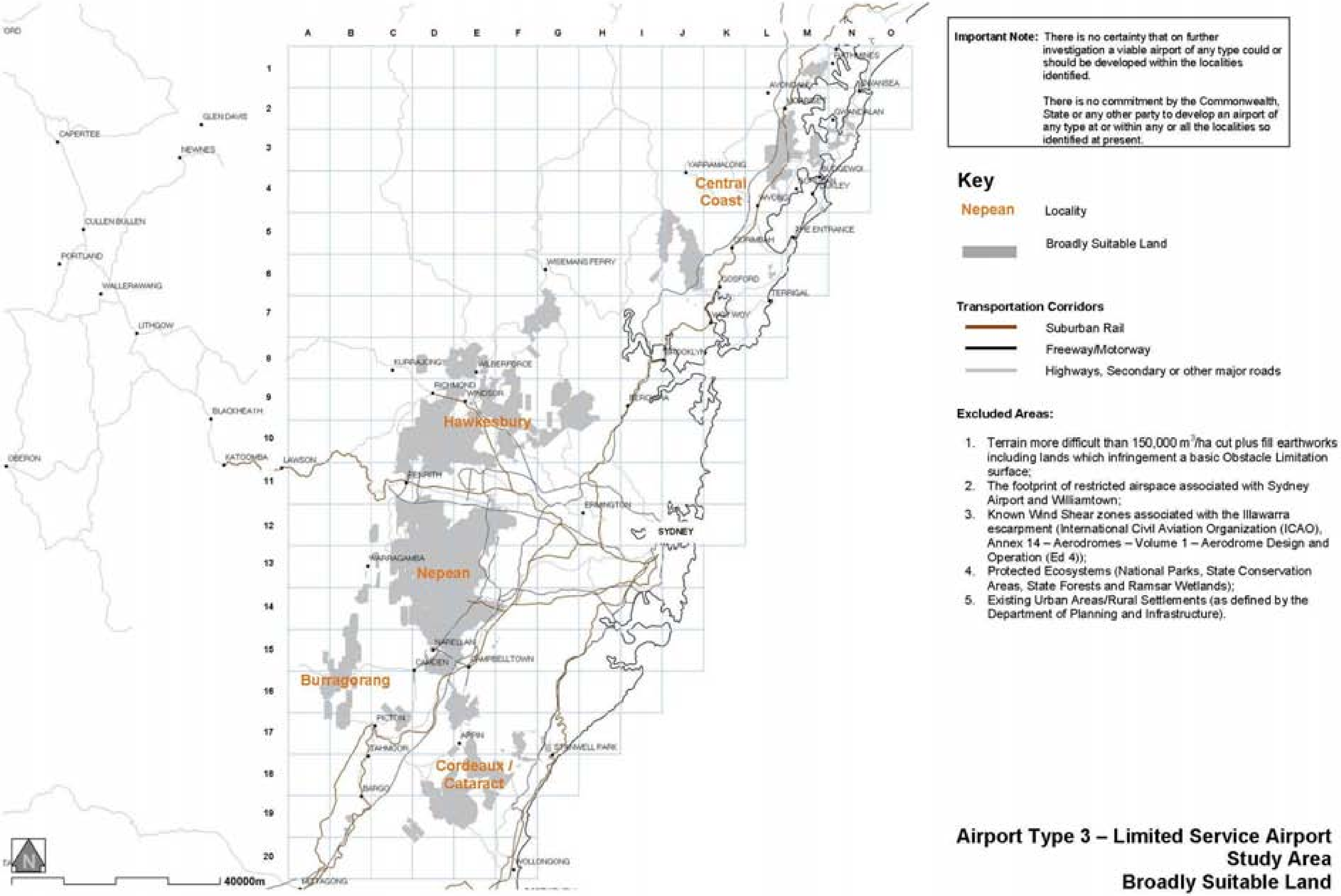
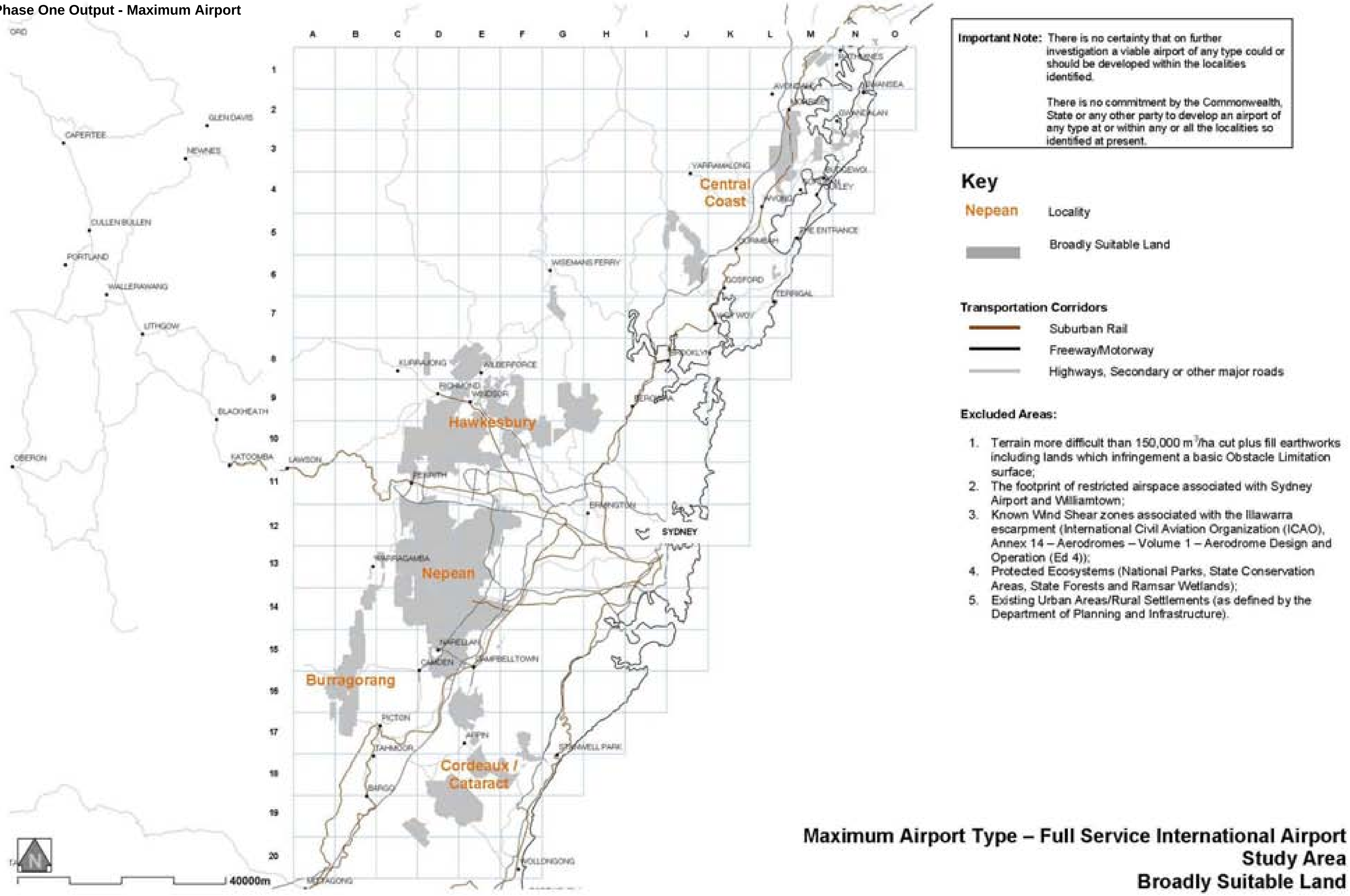
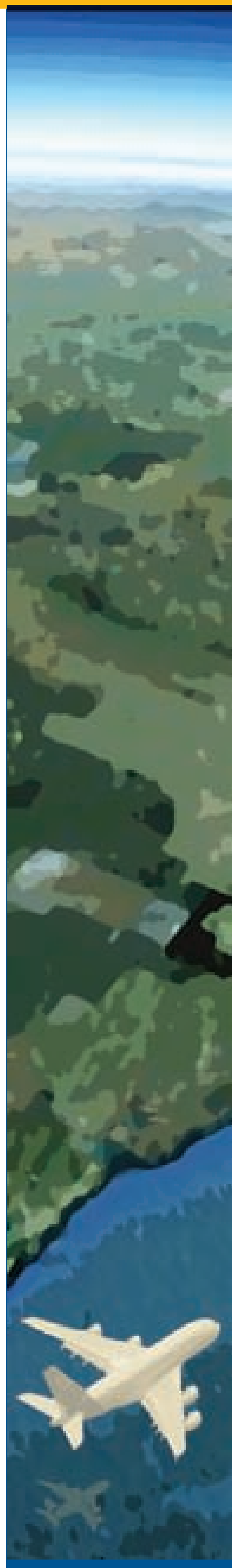


Figure 4-8 Phase One Output - Maximum Airport



5

Phase Two - More Suitable Lands



Phase Two - More Suitable Lands

5 PHASE TWO - MORE SUITABLE LANDS

5.1 Overview

The objective of Phase Two was to provide scaled and rated assessments of the broadly suitable land identified in Phase One in order to delineate, on the basis of the Phase Two criteria, the '*more suitable'* land for aviation uses. In Phase Two, the assessments are individual and discrete such that the assessment on each criterion at any point within the lands being evaluated can be clearly seen.

5.2 Phase Two criteria

The analysis in Phase Two involved the application of four criteria to rate the suitability of all land identified as broadly suitable for airport development in Phase One. The four criteria applied were:

- the extent of earthworks required to create a level runway;
- population density within a notional 20 ANEC contour relating to exposure to aircraft noise;
- designated mine subsidence districts; and
- relative proximity to the Sydney land transport network.

The nature and application of these four criteria is discussed in the following sections and the manner in which they were applied in GIS modelling is further discussed in **Appendix 1**. The maps of these criteria for both airport types are presented at the end of this chapter.

It is self-evident that more suitable lands will have the least amount of earthworks required; the least number of people likely to be impaired by aircraft noise; would not be affected by mine subsidence; and would be proximate to transport network/s; or the best combination of these.

5.2.1 Earthwork volumes

Earthwork volumes (total cut plus total fill) to create a level site were assessed in terms of the following bands (see also Table 4-2):

- 0 – 10,000 m^3 per hectare;
- 10,000 – 25,000 m^3 per hectare;
- 25,000 – 50,000 m^3 per hectare;
- 50,000 – 75,000 m^3 per hectare;
- 75,000 – 100,000 m^3 per hectare;
- 100,000 – 125,000 m^3 per hectare; and
- 125,000 – 150,000 m^3 per hectare.

These bands were mapped for the broadly suitable land in the five localities so that areas which require greater or lesser volumes of earthworks for a notionally level site could be identified (see Figure 5-1 and Figure 5- 5).

5.2.2 Population density within the 20 ANEC contour

To assess the population lying inside a notional 20 ANEC contour[33] for both a single runway Type 3 Airport and Maximum Airport, the 2006 ABS Census data was broken down into a 250m grid format. The data stored in each grid cell - being the approximate number of people that live within the boundaries of that grid cell - was then overlaid with the notional 20 ANEC contour for a Type 3 Airport and Maximum Airport, centred on each of the census data grid cells within each area of the 'broadly suitable' land. The 20 ANEC contour was then progressively orientated in the north-south, east-west, northeast-southwest and northwest-southeast directions to account for the possibility of different runway orientations.

The total population inside the 20 ANEC contour was determined for each orientation by adding the population in the grid cells inside this contour. The smallest total population that was produced by the different contour orientations was recorded and mapped according to the following scale. 1 – 100 persons:

- 101 – 500 persons;
- 501 – 1,000 persons;
- 1,001 – 2,500 persons;
- 2,501 – 5,000 persons;
- 5,001 – 10,000 persons;
- 10,001 – 20,000 persons; and
- 20,001+ persons.

Lands having the lowest count of population within its associated 20 ANEC contour was considered to represent the more suitable land in relation to this criterion (see Figure 5-2 and Figure 5-6).

5.2.3 Mine subsidence (including long wall mining)

Designated mine subsidence districts[34] were mapped to identify those areas which could be potentially affected by mine subsidence and longwall mining activity (see Figure 5-3 and Figure 5-7). Accordingly, areas are either:

- affected by such designation and liable to mine subsidence; or
- not affected by such designation and not liable to mine subsidence.

Additionally, however, the possibility exists that there are:

- areas outside designated mine subsidence districts which are either underlain by old mine workings or as yet unmined coal resources coal resources; and
- areas within designated mine subsidence districts that are underlain by old mine workings or as yet unmined coal resources.

[33] Described as 'notional' as the contour is based on a set of assumptions regarding the key factors from which an ANEC contour is calculated including the number and type of aircraft movements.
[34] By the Mine Subsidence Board of NSW.

Any airport sites identified must be checked at the more detailed investigation stages for each of these possibilities. Where mine subsidence has or could yet occur because mining has taken place, a site is undesirable for development as an airport, unless the mine workings have been remediated. Where mining of a defined coal resource is yet to take place, the site may still be able to be safeguarded for development as an airport site.

5.2.4 Distance to land transport network

Transport accessibility has been assessed in terms of the direct distance of areas within the broadly suitable land to the Sydney land transport network - and specifically to the designated freeway and motorway system[35] (see Figure 5-4 and Figure 5-8). Distance from existing freeways and motorways was mapped, adopting the following bands:

- less than 2km;
- 2 to 5km;
- 5 to10 km;
- 10 to 20km; and
- more than 20 km.

Based on information from the NSW Roads and Traffic Authority (RTA), the following roads are, or are in the process of being upgraded to, four lane divided arterial roads and accordingly, were included in the existing freeway and motorway network for this criteria because of the significance of these roads in providing future access to the northwest and south west region of the Sydney basin.

- Old Hume Highway from Camden Park to Smeaton Grange;
- Narellan Road from Narellan to Rosemeadow;
- Moore-Oxley Bypass from Campbelltown to Eagle Vale;
- Cowpastures Road from Horningsea Park to Bossley Park;
- The Camden Valley Way from Narellan to Leppington;
- The Northern Road from Glenmore Park to Cranebrook;
- Mamre Road from Regentville to Cranebrook;
- Carlisle Avenue from Colyton to Bidwill; and
- Luxford Road from Mount Druitt to Hassall Grove.

It should be noted that, in this case, '*as the crow* lies' distance and not actual existing on-road distances were adopted. This is considered a reasonable assumption since if there was no existing reasonable direct road giving access to the transport network, a development of this scale would warrant one.

[35] The focus here is on road access as it will be likely to be the major mode for passengers, workers and freight/airport consumables. Rail is considered in the detailed evaluation matrices elsewhere herein.

5.3 Phase Two results

5.3.1 Type 3 Airports

The Phase Two outputs for Type 3 Airports are presented in Figure 5-1 to Figure 5-4 and comprise:

- Figure 5-1 Earthworks Volumes - Type 3 Airport – This figure shows that the greatest continuous extent of easy and moderate terrain for creating a platform for airports lie within the Hawkesbury and Nepean localities with only small extents of such lands within any of the other localities. The latter 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;
- Figure 5-2 ANEC 20 Noise Contour - Type 3 Airport – This figure shows that, as might be expected, lands with the lowest populations likely to be affected by aircraft noise are those most distant from existing urban populations. Additionally some lands, though relatively proximate to urban areas, may enable a runway to be oriented such that aircraft noise would not occur over urban or more heavily populated areas. All localities contain some extent of lands which are at the lowest levels of population exposure to aircraft noise with the locality having the greatest extent of such lands being the Cordeaux Cataract locality;
- Figure 5-3 Mine Subsidence Districts - Type 3 Airport – This figure shows that designated mine subsidence districts are exclusively concentrated in two localities – Central Coast to the north of Wyong and Cordeaux- Cataract mostly around Appin. No other localities are affected by designated mine subsidence districts;
- Figure 5-4 Transport Accessibility - Type 3 Airport – as might be expected, this criterion maps inversely to that for aircraft noise exposure given that the transport network tends to address the more urbanised parts of the localities. However, with the exception of Burragorang, all other localities have significant extents of lands less than five kilometres from the major transport network – which for the most part is the road network and the majority of the locality within ten kilometres. In several cases, there are tracts of land adjoining or less than 2 kilometres from the road network.

5.3.2 Maximum Airports

The Phase Two outputs for Maximum Airports are presented in Figure 5-5 to Figure 5-8 and comprise:

- Figure 5-5 Earthworks Volumes - Maximum Airport;
- Figure 5-6 ANEC 20 Noise Contour - Maximum Airport;
- Figure 5-7 Mine Subsidence Districts - Maximum Airport; and
- Figure 5-8 Transport Accessibility - Maximum Airport.

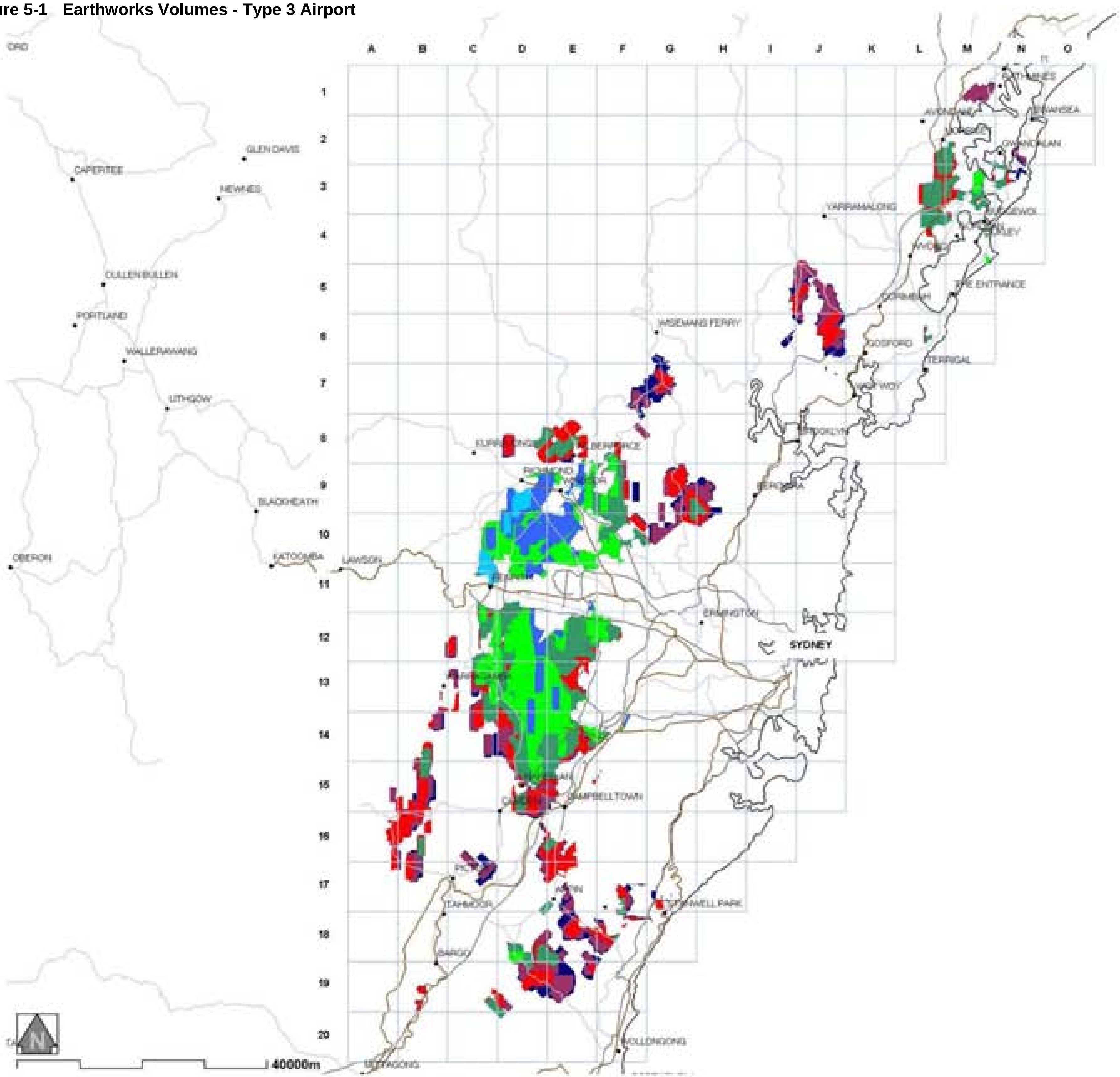
While the comments made above in relation to Type 3 Airports also apply in general to the assessment for a Maximum Airport, the following additional observations can be made:

- earthworks to create an airport platform generally become relative greater on the basis of average cubic metres of cut and fill per hectare than for a Type 3 Airport at any given place in all localities. The Hawkesbury and Nepean localities retain the greatest ability to supply contiguous lands for airport development at the lowest level of earthworks;

- generally, for all points within all localities, there are more people potentially within the notional 20 ANEC contour, which would be expected given the higher number of large aircraft movements which are generally noisier than movements by smaller aircraft;
- there is no basic change in the extent of or location of lands which are within designated mine subsidence districts; and
- there is no change in the accessibility from any given point in any locality to the major road transport network.

These assessments provide data inputs for the process of identification of suitable sites as described in Section 6, enabling the relative attractiveness on these four key criteria to be clearly seen.

Figure 5-1 Earthworks Volumes - Type 3 Airport



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Terrain Analysis

Showing relative degree of difficulty to create a uniformly level land of the scale of a Type 3 airport site as expressed in total cut plus fill over that site.

(light blue)	0 – 10,000 m^3/ha	Easiest terrain
(blue)	10,000 – 25,000 m^3/ha	Moderate terrain
(green)	25,000 – 50,000 m^3/ha	
(dark green)	50,000 – 75,000 m^3/ha	More difficult terrain
(red)	75,000 – 100,000 m^3/ha	
(purple)	100,000 – 125,000 m^3/ha	Most difficult terrain
(navy)	125,000 – 150,000 m^3/ha	

Transportation Corridors

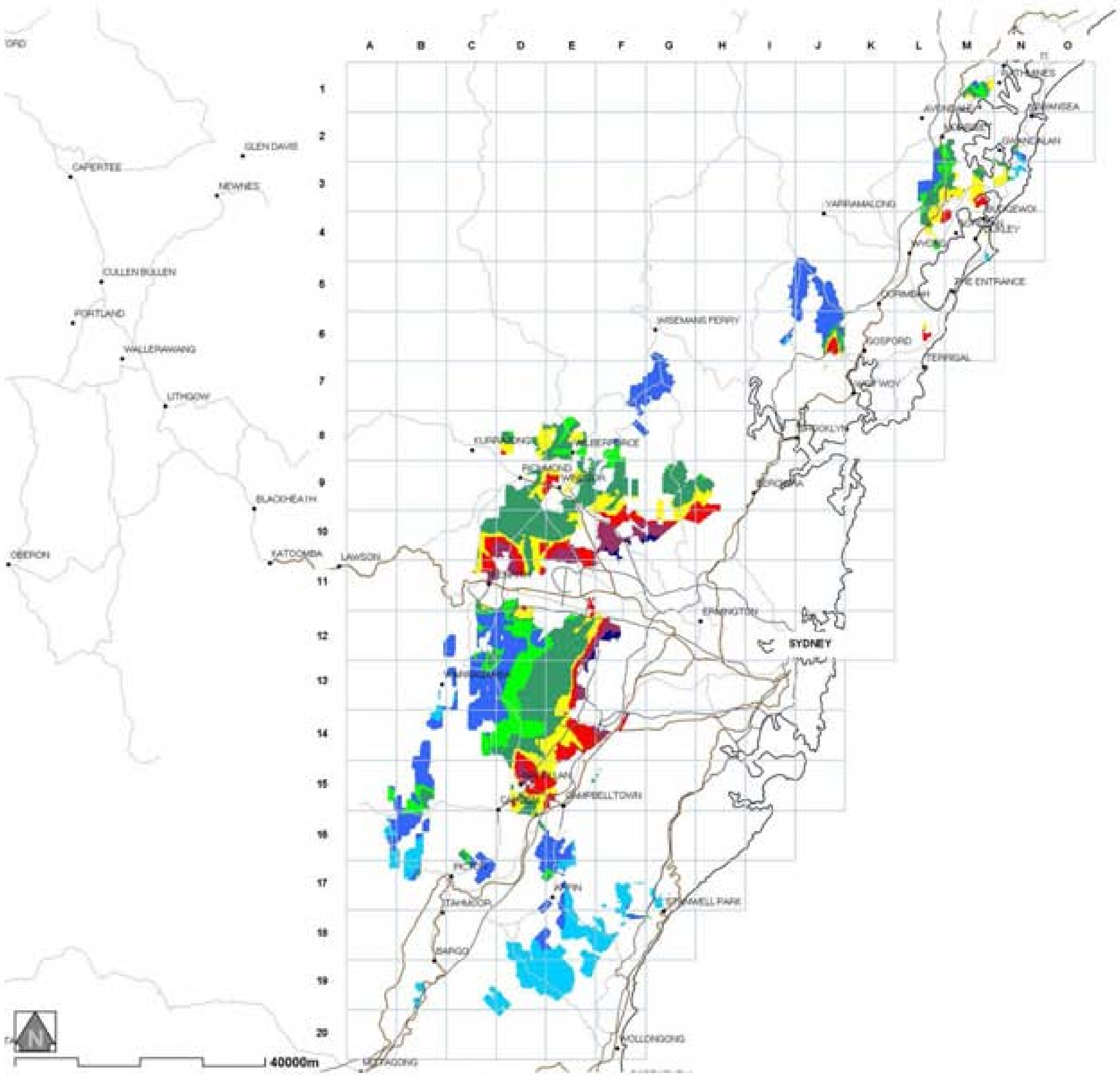
- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Airport Type 3 – Limited Service Airport
Earthworks Volumes

Figure 5-2 ANEC 20 Noise Contour - Type 3 Airport



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Approximate population within the ANEC 20 Noise Contour (based on 2006 ABS Census Data)

- 1 - 100
- 101 – 500
- 501 – 1,000
- 1,001 – 2,500
- 2,501 – 5,000
- 5,001 – 10,000
- 10,001 – 20,000
- 20,001+

Transportation Corridors

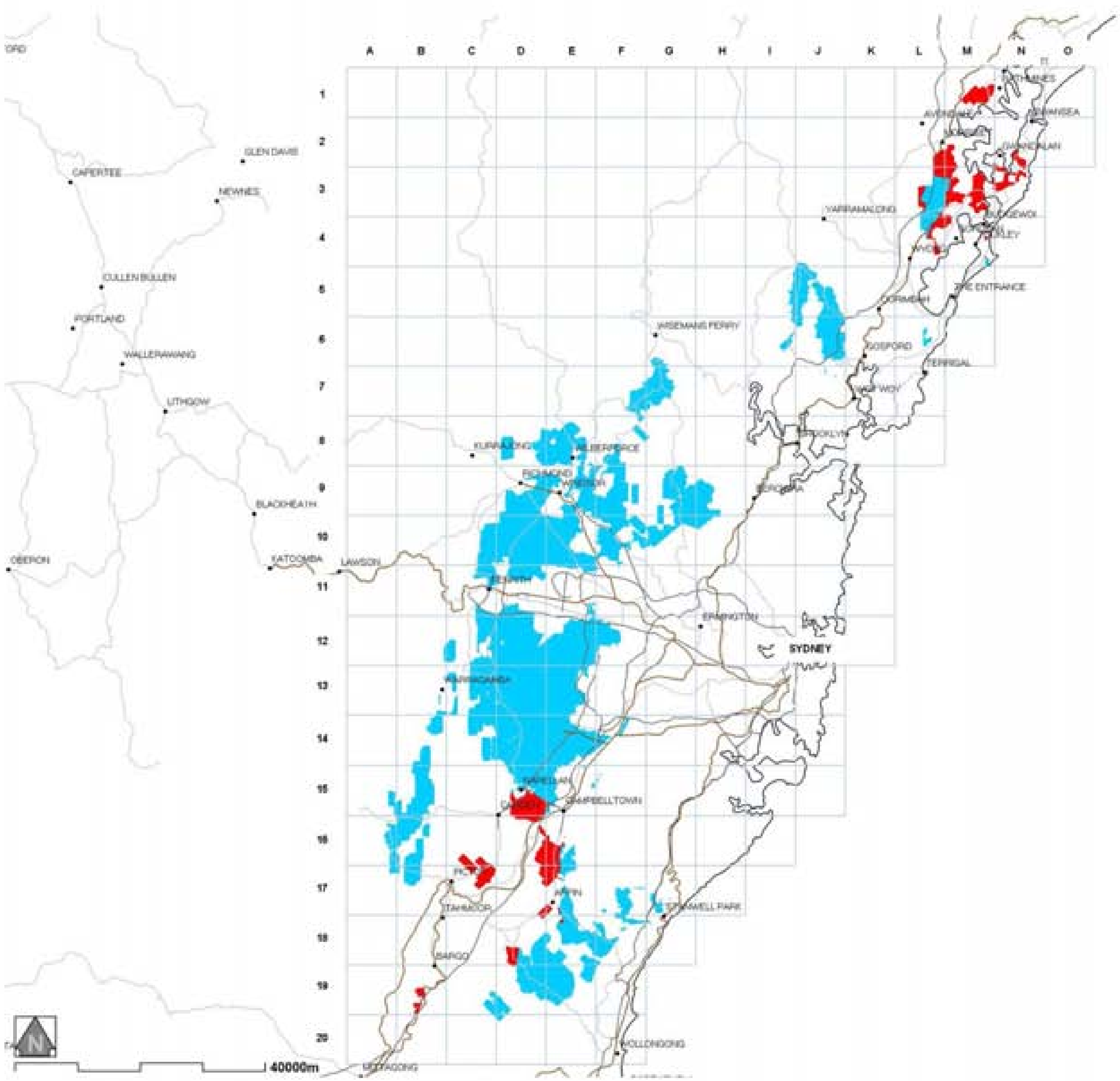
- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Airport Type 3 – Limited Service Airport
ANEC 20 Noise Contour

Figure 5-3 Mine Subsidence Districts - Type 3 Airport



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Mine Subsidence District

Non Mine Subsidence District

Transportation Corridors

Suburban Rail

Freeway/Motorway/4 Lane Roads

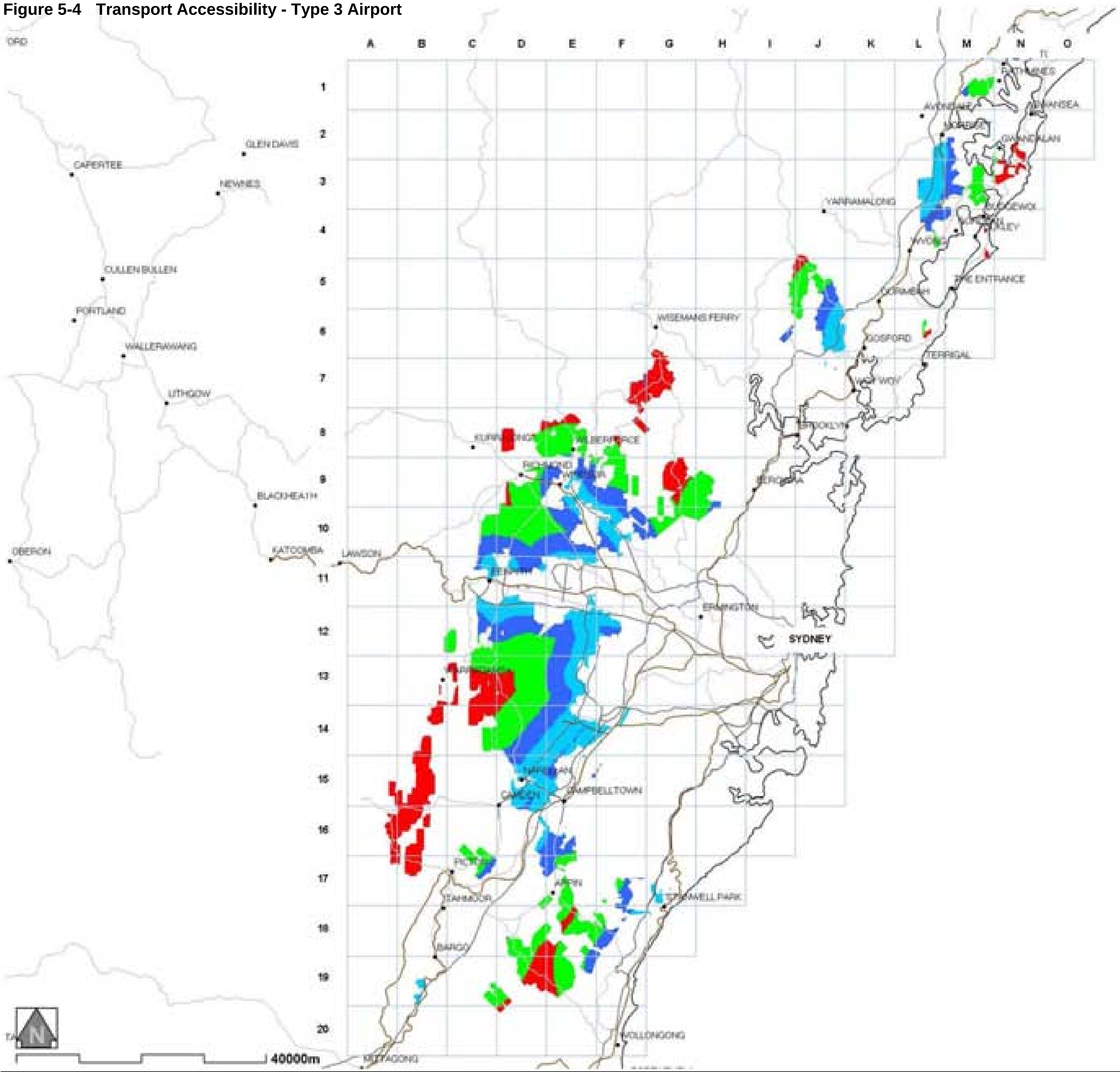
Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Airport Type 3 – Limited Service Airport
Mine Subsidence Districts

Figure 5-4 Transport Accessibility - Type 3 Airport



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Distance from existing Freeway, Motorway & 4 Lane Roads

- < 2 km
- 2km – 5km
- 5km – 10km
- 10km – 20km
- > 20km

Transportation Corridors

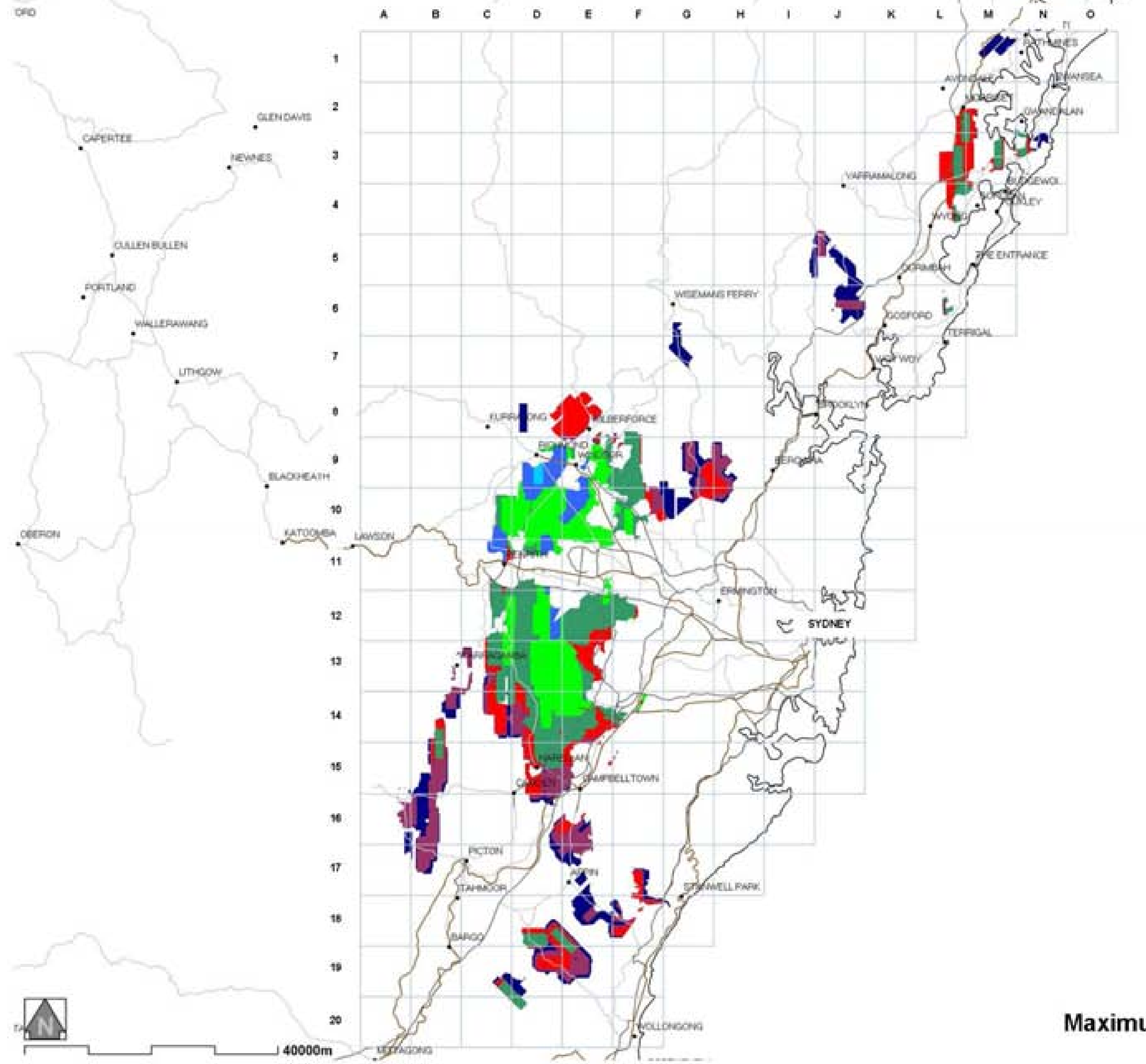
- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Airport Type 3 – Limited Service Airport
Transport Accessibility

Figure 5-5 Earthworks Volumes - Maximum Airport



> Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.
>
> There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Terrain Analysis

Showing relative degree of difficulty to create a uniformly level land of the scale of a maximum airport site as expressed in total cut plus fill over that site.

Light blue	0 – 10,000 m^3/ha	Easiest terrain
Blue	10,000 – 25,000 m^3/ha	Moderate terrain
Bright green	25,000 – 50,000 m^3/ha	
Olive green	50,000 – 75,000 m^3/ha	More difficult terrain
Red	75,000 – 100,000 m^3/ha	
Purple	100,000 – 125,000 m^3/ha	Most difficult terrain
Dark blue	125,000 – 150,000 m^3/ha	

Transportation Corridors

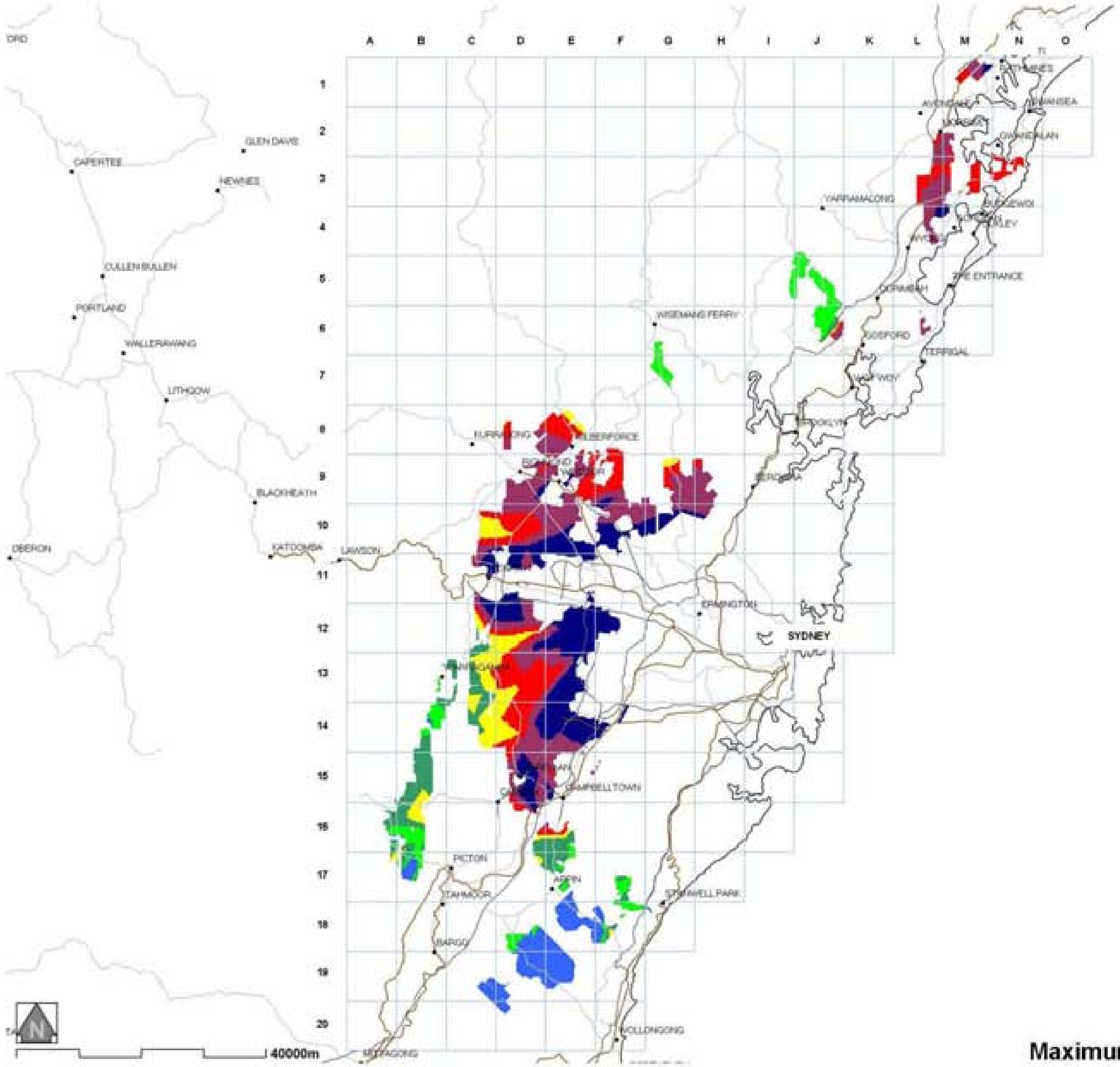
- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Maximum Airport Type – Full Service International Airport Earthworks Volumes

Figure 5-6 ANEC 20 Noise Contour - Maximum Airport



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Approximate population within the ANEC 20 Noise Contour (based on 2006 ABS Census Data)

- 1 - 100
- 101 – 500
- 501 – 1,000
- 1,001 – 2,500
- 2,501 – 5,000
- 5,001 – 10,000
- 10,001 – 20,000
- 20,001+

Transportation Corridors

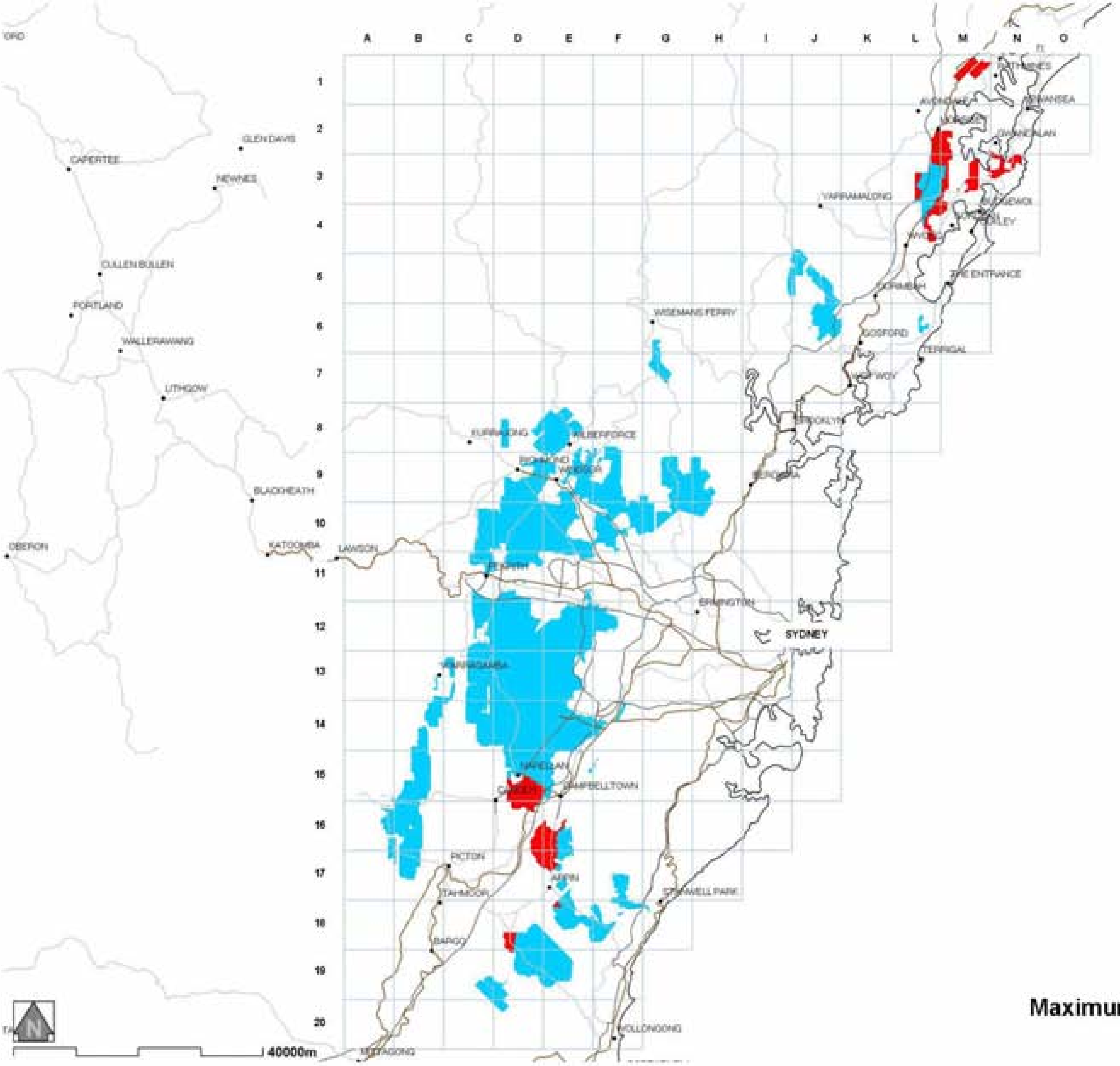
- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Maximum Airport Type – Full Service International Airport
ANEC 20 Noise Contour

Figure 5-7 Mine Subsidence Districts - Maximum Airport



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

- Mine Subsidence District
- Non Mine Subsidence District

Transportation Corridors

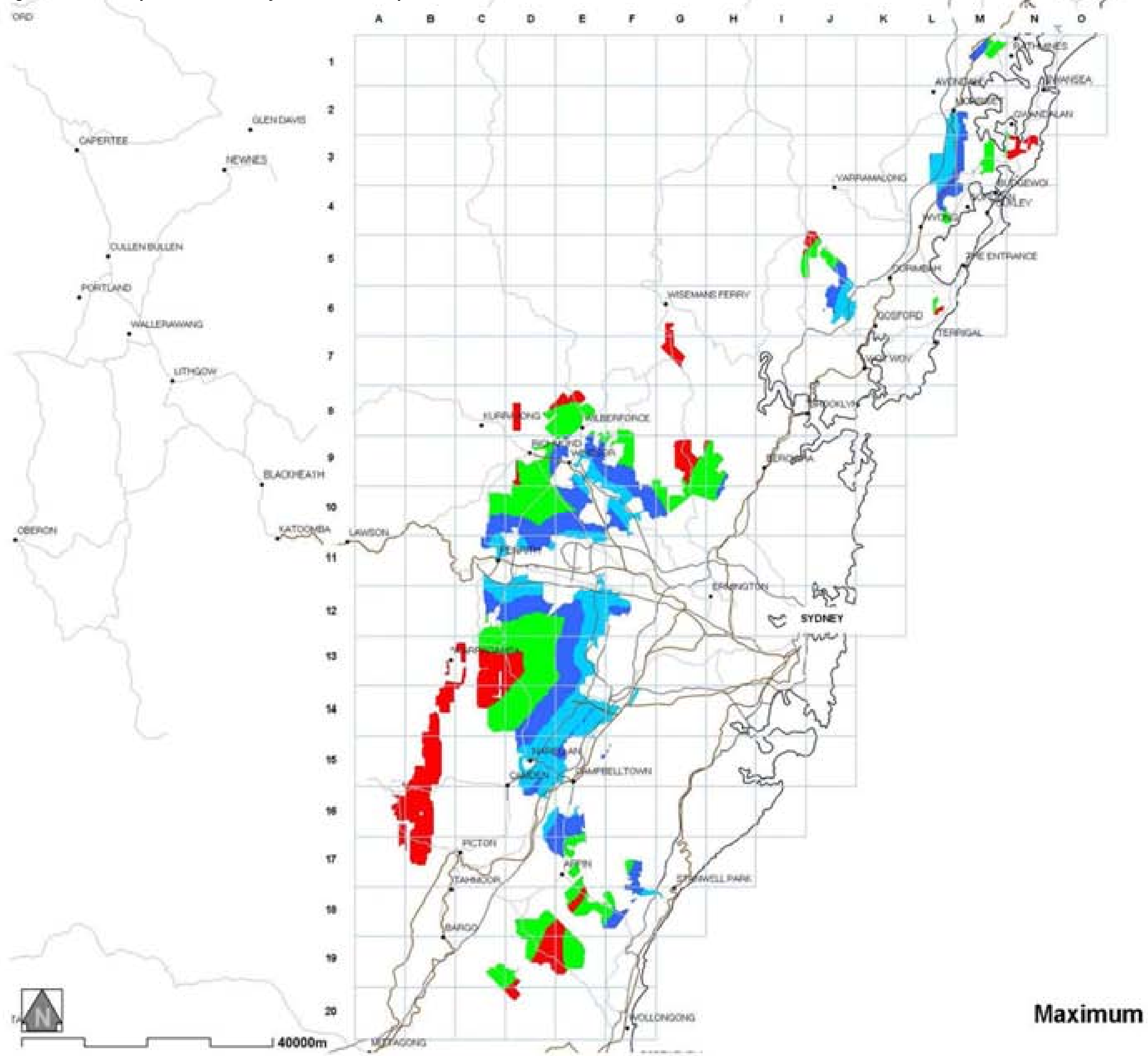
- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Maximum Airport Type – Full Service International Airport
Mine Subsidence Districts

Figure 5-8 Transport Accessibility - Maximum Airport



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Distance from existing Freeway, Motorway & 4 Lane Roads

- < 2 km
- 2km – 5km
- 5km – 10km
- 10km – 20km
- > 20km

Transportation Corridors

- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

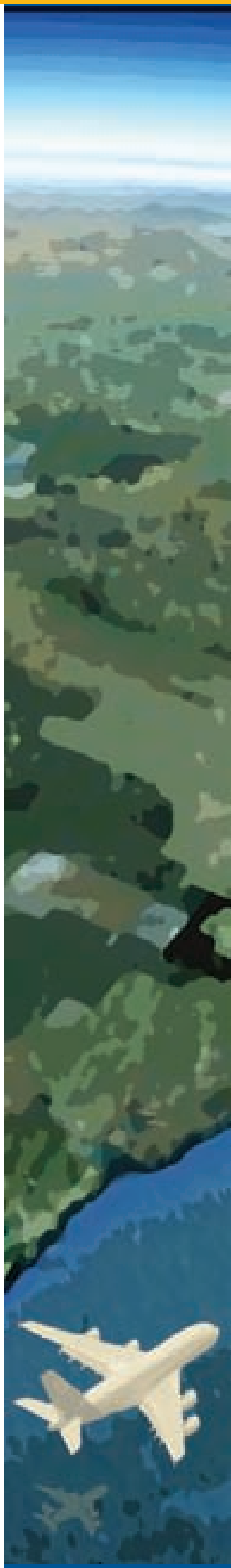
Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Maximum Airport Type – Full Service International Airport
Transport Accessibility

6

Phase Three - Suitable Airport Sites



Phase Three - Suitable Airport Sites

6 PHASE THREE - SUITABLE AIRPORT SITES

6.1 Overview

The intended outcome of Phase Three was to identify **suitable sites** for airport development within the lands identified as broadly suitable in Phase Three, taking account of airport planning criteria presented in Section 3.

As may be seen in the preceding figures Figure 4-7 to Figure 4-8, an 8 km by 8 km mapping grid was superimposed over the broadly suitable land identified in Phase One and as further assessed in Phase 2 (Figure 5-1 and Figure 5-8). The grid size relates to the 1:25,000 scale topographic maps[36] which were examined to assess each locality in greater detail. A grid reference of 'A to O' on the horizontal axis and '1 to 20' on the vertical axis was used as is shown.

Each grid cell was scaled to the 1:25,000 mapping and was reviewed to identify potential airport sites using the outcomes of Phase Two and eight criteria derived from airport site location planning principles (see Section 6.2). Opportunities for Type 3 Airports were reviewed first as the required site area with a single runway is less than that required for a Maximum Airport, which has wide spaced parallel runways. More Type 3 Airport sites are likely to be found than are Maximum airport sites. Subsequently, the identified Type 3 Airport sites were revisited to determine which could be expanded to accommodate Maximum Airport sites. It should be noted that other options are possible making incremental changes in runway headings and by relocating the airport site by small distances in various directions. The identified sites are meant to be typical or representative rather than suggesting that they are the only available concept. Detailed survey, investigations and design are required to refine any of the concepts identified.

Given the nature of this task is only to assess the capacity of the five localities to '*supply*' an airport site, it is likely that the sites identified in this Phase will differ in terms of their ability to add to the overall aviation capacity in the Sydney region. This is because, for example, some of the sites may have greater potential airspace management issues or they differ in terms of their noise impact on the nearby population. In Phase Three, the intention is to identify as many sites as possible for more detailed analysis and assessment to ensure a comprehensive – but within practical limits - coverage of the broadly more suitable land. Some of the sites have marginal ratings against some parameters but have still been included to achieve the comprehensive coverage of the suitable lands. The expectation is that the least suitable sites will be discarded as part of the final assessment Phase Four and thereby identifying the more suitable sites.

Any identified notional airport site boundaries are for concept planning and assessment purposes only and are indicative. In this Phase, notional airport site boundaries may incorporate some small areas listed as excluded in Phase One and, as a result, these boundaries would be subject to modification and refinement, should a particular site prove otherwise worthy of more intensive assessment and concept design.

[36] References for maps:
New South Wales 1:25,000 Topographic Maps Land and Property Management Authority: Paper Copies from 2010 Catalogue various map dates):Catherine Hill Bay; Dooralong; Wyong Mangrove; Gosford; Gunderman; Lower Portland; Cowan; Wilberforce; Kurrajong; Hornsby; Riverstone; Springwood; Prospect; Penrith; Jamison; Liverpool; Warragamba; Campbelltown; Camden; Burragorang; Appin; Picton; Nattai; Bulli; Bargo; Wollongong; Avon River.

6.2 Airport site location considerations

In order to identify suitable airport sites, each grid cell was reviewed against the outcomes on the four criteria of Phase Two and seven additional criteria which apply at the more detailed level of identifying an actual site. Where more suitable land was present, a runway for a Type 3 Airport (2,600m in length) was aligned to best satisfy the eight additional site location criteria listed below:

- Always seek the flattest available land;
- Minimise access time to connect to major road systems;
- Always seek to impose the lowest levels of noise exposure to urban populations;
- avoid designated mine subsidence areas;

and

- initially seek to orient runways parallel to Sydney Airport's 16/34 runways and vary this to suit other constraints (e.g. noise, OLS, airspace and the like);
- check site specific and runway specific OLS issues[37];
- avoid, to the extent possible, adverse effects on major infrastructure;
- avoid flight paths over known urban areas and keep runway ends distant from and not pointing at urban populations;
- check for potential conflicts or dependencies with known airspace management issues;
- consider the local topography in the notional location of airport facilities and site boundaries;
- check ability to incorporate a cross runway.

However, it should be understood that, while on the one hand, there are no lands within the broadly suitable lands in the five specified localities assessed which are universally '*unsuitable*' for airport development, there are equally none that are universally 'suitable' either. However, there are expected to be sites which are sufficiently or more suitable for airport development purposes. Accordingly, all suitable sites identified will vary in their ability to accommodate an operating airport of either Type 3 or Maximum scale.

Further refinement of sites will be required once detailed site investigations, survey and designs are undertaken.

6.2.1 Flattest available land

The flattest land is always preferable for aviation uses - in terms of both site preparation earthworks and definition of the OLS. On this basis, each grid cell was reviewed to identify a suitable area of relatively flat terrain (overall gradient of about 0.8%). In order to be suitable for a Type 3 Airport, the area needs to accommodate one runway of about 2,600m length. In order to be suitable for a Maximum Airport, the area needs to accommodate two parallel runways (with one runway being 4,000m long and the second being between 2,500m and 4,000m long) with a separation of at least

[37] Note: while the GIS modelling approach includes consideration of terrain OLS, it does not include singularity obstacles such as power station stacks, trees and the like.

1,650m to provide space for the building area between runways (note: the approach OLS is based on a runway strip 300m wide and 60m beyond each runway end). For a Maximum Airport, each runway end needs to be at about a 1% gradient in relation to the adjacent (parallel) runway end in order to connect taxiways between the runway ends, that is, the connecting taxiways should not have a gradient of more than 1%.

6.2.2 Avoid mine subsidence districts

A '*more suitable'* airport site will be located outside designated mine subsidence districts. However, given the total site area required within an airport boundary, and subject to detailed investigations, there may be potential to include any such areas as non-developable areas within the total airport site boundary. It is possible, in some instances, to stabilize old mine working using ground injection techniques, although this is very expensive. Caution needs to be taken throughout the Sydney region as there are working collieries outside the designated mine subsidence districts whose workings may extend beneath an otherwise '*suitable*' or a '*more suitable' site*.

6.2.3 Orient runways parallel to Sydney Airport (KSA) runways

For any new airport in the Sydney Basin, the preferable runway alignment is to be parallel (or near parallel) to Sydney Airport's 16/34 (north-south) parallel runways (although in many cases a new airport will be forced to have different runway alignments by other criteria as discussed below). However, it is possible that weather conditions may still result in non-parallel operations with Sydney Airport for considerable periods of time. The real impacts of non-parallel operations and airspace conflicts would potentially be non-optimum flight tracks and increasing track miles and associated costs to airlines.

6.2.4 Check site specifics and runway specific OLS issues

The nominated runway alignment(s) and separations were then checked initially against OLS to terrain.[38] An OLS template, based on the information for an approach surface of 15,000m from a runway end, was applied to the potential runways to determine if the various components of the OLS could be accommodated, given the surrounding terrain (see Figure 4-4). The template was applied over the standard 1:25,000 topographical mapping available for the area. It should be noted that this assessment only looks at terrain clearance based on the vertical accuracy of +/- 5m applicable to the contours shown on the base mapping and does not address any natural or man-made obstacles including trees, power lines, buildings, masts and the like which may be present in the relevant location.[39]

6.2.5 Avoid adverse effects on major infrastructure

Runway locations and orientations were chosen to the extent possible to avoid major infrastructure such as freeways, railway lines and power stations, whilst still being close to transport access - road and rail. In some cases, the aviation procedures associated with a runway may cross or abut danger areas or potential danger areas (such as high velocity gas efflux from power stations). For procedures

[38] Note: while the GIS mapping approach includes consideration of terrain OLS, it does not include singularity obstacles such as power station stacks and the like.
[39] Although where these were observed to be present on mapping or during any site inspections and considered to be affected, allowances were made in costs estimates prepared under a separate assignment for the Department.

with conventional navigation aids horizontally, the danger area must not infringe the procedure primary area. Vertically, the upper limit of the danger area may be used provided obstacle clearance requirements are met. For Global Navigation Satellite System (GNSS) based procedures horizontally, the nominal final approach and missed approach tracks must clear the danger area by a minimum of 1,000m (*MOS 173 8.1.1.5*). (Note: it is assumed that danger areas would be required where the approach and/or departure flight tracks of an airport are located in the general vicinity of existing power stations). The final design of airspace and required buffer zones to danger areas would be subject to review and approval of CASA.

6.2.6 Avoid flight paths over known urban areas

Although existing urban areas and rural settlements were considered absolute excluding criteria for siting of an airport footprint, noise impacts that extend beyond the airport boundary are also a key consideration. As such, the ANEC 20 contour was examined and the runway alignment was modified to primarily avoid overflying identifiable existing urban areas close to the site (for example, less than approximately 10km) to the extent possible. Runway separation was also modified to avoid or, where not possible to avoid, to minimise close overflying in more distant urban areas (for example, 10km to 20km from the airport site boundary).

6.2.7 Airspace management issues

Immediate airspace classifications were identified for possible airport sites and preliminary observations made in relation to likely impacts.

The runway alignment for each possible airport site was also checked for potential conflicts and/or dependencies with airspace management issues (including restricted airspace, crossing extended runway centrelines from Sydney Airport and RAAF Richmond, avoidance of Holsworthy, Orchard Hills and Williamtown military restricted airspace and Camden Airport to the extent possible).

For parallel runway operations, arriving aircraft require a controlled airspace block 25 nautical miles (nm) long by 20nm wide extending from the runway thresholds to accommodate approach tracks. Departing aircraft routes are assumed to be more flexible and it is assumed they probably require a controlled airspace block of no more than 10nm out on the runway heading.

For single runways, the requirements of *Advisory Circular 2-5-1 (0), Guidance for Controlled Airspace Design* (CASA, March 2010) were applied to 20 nm from each threshold.

It is assumed that all runways would require operation for an instrument landing system (ILS) for the midterm, although eventually ILS will be replaced by a Ground Based Augmentation System (GBAS). Where the distance available between the runway and restricted airspace was found to be limited, a nominal length of 13 nm was adopted from the intermediate fix[40] to the runway end and, vertically, the altitude limit over the restricted area must be the vertical limit of the restricted area plus 500 feet (where the restricted area is used for flying activities) or the altitude dictated by obstacle clearance criteria, if higher (*MOS 173 8.1.1.5*).

[40] Intermediate fix point designates the beginning of the intermediate segment of the ILS approach to the runway.

6.2.8 Local topography

The airport site boundaries (based on a template for each airport type as described in Section 3.2) are then selected with regard to local topography (including factors such as flood affected lands and avoiding watercourses to the extent feasible) and attempting to locate the building areas on flatter ground within the site. The template represented the minimum site area required for each airport type. This excluded some potential sites (typically on ridge lines or in constrained areas) that might provide for a runway but lacked the site area required to provide for a building area and support facilities.

6.3 Ability to locate a cross runway

Once a Maximum Airport site is determined, as outlined in the steps above, the opportunity to provide one cross runway ranging in length from 4,000m to 2,600m is considered, essentially repeating the process described above as applicable. Desirably, the cross runway would be at right angles to the main runway direction, with its effectiveness as a cross runway diminishing as the 90 degree angle is reduced by other factors.

Cross runways were not considered for Type 3 Airports.

6.4 Output from grid cell analysis

The above process was repeated for each grid cell across all broadly suitable land identified in Phase Two in order to find suitable sites within each cell covering any broadly suitable lands within the locality able to function as, firstly, a Type 3 Airport and, secondly, as a Maximum Airport with wide spaced parallel runways. Where possible, sites able to accommodate a cross runway were identified. By adopting this order of assessment, the ability of a Type 3 Airport site to expand to a Maximum Airport site is best identified and tested.

The output from the grid cell analysis undertaken in Phase Three is presented in Table 6-1 and the outcomes of this analysis are illustrated in Figure 6-1. This figure shows how the broadly suitable land is reduced to show the land which is suitable for location of a template airport site.

Figures 6 – 2 to 6 – 9 refines this assessment by showing the more suitable lands and as assessed in Phase 2 overlaid by the grid analysis undertaken in this Phase.

This shows that even with a cell which is considered available for accommodating an airport site there is significant variability in terms of the four criteria used in Phase 2 both within the cells and between the cells.

Table 6-1 Airport Site Suitability by Grid Cell Analysis of the *'More Suitable'* Land - Type 3 Airports

Cell Reference	Is Minimum Airport Site Area Available?	Flattest land available (in terms of cut plus fill 1,000s m3/ha)	Approx. persons within20 ANEC	Is a Mine Subsidence District present in cell?	Access to major road System (kms)	Runways able to be oriented to a near northerly direction?	Runway specific OLS	Effects on Major Infrastructure can be avoided?	Avoid flight paths over major urban areas for adopted runway alignment	Current Airspace Management Issues	Local topographic issues e.g. Major Flood Risk	Is a *'suitable'* site available within cell?
Refer to Figure 4-7	Refer to Figure 3-1	Refer to Figure 5-1	Refer to Figure 5-2	See Note 3 Refer to Figure 5-3	Refer to Figure 5-4	See Notes 2, 4 to 5 Refer to sections 6.2.3 to 6.2.8						See Note 1
1M	Yes	100-125	101-5000	Yes	2-10	N/A	N/A	N/A	N/A	Conflict WLM	N/A	No
2L	Yes	25-75	101-2500	Yes	<2	N/A	N/A	N/A	N/A	Conflict WLM	N/A	No
2M	Yes	25-100	1001-2500	Yes	2-10	N/A	N/A	N/A	N/A	Conflict WLM	N/A	No
2N	No	25-150	1-1000	Yes	5-20	N/A	N/A	N/A	N/A	N/A	N/A	No
3L	Yes	25-100	101-5000	Yes/No	<2 to 5	Yes	OK	No	No	Part Conflict WLM	No	Yes
3M	Yes	25-100	1001-10,000	Yes/No	<2 to 10	N/A	N/A	N/A	N/A	Conflict WLM	N/A	No
3N	No	25-100	1-5000	Yes	5-20	N/A	N/A	N/A	N/A	N/A	N/A	No
4J	No	75-100	101-500	No	10-20	N/A	N/A	N/A	N/A	N/A	N/A	No
4L	Yes	25-100	1001-10,000	Yes/No	<2 to 10	Yes	OK	No	No	Part Conflict WLM	No	Yes
4M	No	25-75	1-10,000	Yes	2-20	N/A	N/A	N/A	N/A	N/A	N/A	No
5I	No	75-150	101-500	No	5-20	N/A	N/A	N/A	N/A	Conflict KSA	N/A	No

Cell Reference	Is Minimum Airport Site Area Available?	Flattest land available (in terms of cut plus fill 1,000s m3/ha)	Approx. persons within20 ANEC	Is a Mine Subsidence District present in cell?	Access to major road System (kms)	Runways able to be oriented to a near northerly direction?	Runway specific OLS	Effects on Major Infrastructure can be avoided?	Avoid flight paths over major urban areas for adopted runway alignment	Current Airspace Management Issues	Local topographic issues e.g. Major Flood Risk	Is a *'suitable'* site available within cell?
Refer to Figure 4-7	Refer to Figure 3-1	Refer to Figure 5-1	Refer to Figure 5-2	See Note 3 Refer to Figure 5-3	Refer to Figure 5-4	See Notes 2, 4 to 5 Refer to sections 6.2.3 to 6.2.8						See Note 1
5J	Yes	75-150	101-500	No	<2 to 20	Yes	OK	Yes	Yes	Part Conflict KSA	No	Yes
6G	No	125-150	101-500	No	10-20	N/A	N/A	N/A	N/A	N/A	N/A	No
6I	Yes	75-150	1-500	No	2-10	N/A	N/A	N/A	N/A	N/A	N/A	No
6J	Yes	75-150	101-10,000	No	<2 to 5	Yes	OK	Yes	Yes	Part Conflict KSA	No	Yes
6L	No	25-100	2501-10,000	No	<2 to 10	N/A	N/A	N/A	N/A	N/A	N/A	No
7F	No	100-150	101-500	No	10 to >20	N/A	N/A	N/A	N/A	N/A	N/A	No
7G	No	100-150	101-500	No	10 to >20	N/A	N/A	N/A	N/A	N/A	N/A	No
7J	No	125-150	2501-5000	No	>2	N/A	N/A	N/A	N/A	N/A	N/A	No
8D	No	25-150	501-10,000	No	5-20	N/A	N/A	N/A	N/A	N/A	N/A	No
8E	Yes	25-150	501-5000	No	2-20	No	OK	Yes	Yes	Part Conflict KSA /Richmond	Yes	Yes

Cell Reference	Is Minimum Airport Site Area Available?	Flattest land available (in terms of cut plus fill 1,000s m3/ha)	Approx. persons within20 ANEC	Is a Mine Subsidence District present in cell?	Access to major road System (kms)	Runways able to be oriented to a near northerly direction?	Runway specific OLS	Effects on Major Infrastructure can be avoided?	Avoid flight paths over major urban areas for adopted runway alignment	Current Airspace Management Issues	Local topographic issues e.g. Major Flood Risk	Is a *'suitable'* site available within cell?
Refer to Figure 4-7	Refer to Figure 3-1	Refer to Figure 5-1	Refer to Figure 5-2	See Note 3 Refer to Figure 5-3	Refer to Figure 5-4	See Notes 2, 4 to 5 Refer to sections 6.2.3 to 6.2.8						See Note 1
8F	No	25-150	101-2500	No	5-20	N/A	N/A	N/A	N/A	N/A	N/A	No
8G	No	100-125	101-500	No	10-20	N/A	N/A	N/A	N/A	N/A	N/A	No
9D	Yes	0-50	1001-10,000	No	2-20	N/A	OK	Yes	No	Existing Airport	Yes	Yes (RAAF Richmond)
9E	Yes	0-50	501-10,000	No	<2 to 10	N/A	N/A	N/A	No	Conflict Richmond	Yes	No
9F	Yes	25-150	501-10,000	No	<2 to 10	N/A	N/A	N/A	No	Conflict KSA/Rich.	Yes	No
9G	Yes	25-150	1001-10,000	No	5-20	N/A	OK	Yes	Yes	Part Conflict KSA/Rich.	No	Yes
9H	No	25-150	1001-10,000	No	2-10	N/A	N/A	N/A	N/A	N/A	N/A	No
10C	Yes	0-50	1001-20,000	No	<2 to 10	Yes	OK	Yes	No	Part Conflict KSA/Rich.	Yes	Yes
10D	Yes	0-50	1001-20,000	No	2-10	Yes	OK	Yes	No	Part Conflict KSA/Rich.	Yes	Yes
10E	Yes	10-50	1001-20,000	No	<2 to 10	Yes	OK	Yes	No	Part Conflict KSA/Rich.	Yes	Yes

Cell Reference	Is Minimum Airport Site Area Available?	Flattest land available (in terms of cut plus fill 1,000s m3/ha)	Approx. persons within20 ANEC	Is a Mine Subsidence District present in cell?	Access to major road System (kms)	Runways able to be oriented to a near northerly direction?	Runway specific OLS	Effects on Major Infrastructure can be avoided?	Avoid flight paths over major urban areas for adopted runway alignment	Current Airspace Management Issues	Local topographic issues e.g. Major Flood Risk	Is a *'suitable'* site available within cell?
Refer to Figure 4-7	Refer to Figure 3-1	Refer to Figure 5-1	Refer to Figure 5-2	See Note 3 Refer to Figure 5-3	Refer to Figure 5-4	See Notes 2, 4 to 5 Refer to sections 6.2.3 to 6.2.8						See Note 1
10F	Yes	25-100	2500-20,001(+)	No	<2 to 5	N/A	N/A	N/A	No	Conflict KSA/Rich.	No	No
10G	Yes	25-150	2500-20,001(+)	No	2-5	N/A	N/A	N/A	No	Conflict KSA/Rich.	No	No
10H	No	25-150	5001-10,000	No	2-10	N/A	N/A	N/A	N/A	N/A	N/A	No
11C	No	0-100	501-20,000	No	<2 to 5	N/A	N/A	N/A	N/A	N/A	N/A	No
11D	No	10-50	501-20,000	No	<2 to 5	N/A	N/A	N/A	N/A	N/A	N/A	No
11E	No	10-50	5001-20,000	No	<2	N/A	N/A	N/A	N/A	N/A	N/A	No
11F	No	25-50	10,001-20,000	No	10-20	N/A	N/A	N/A	N/A	N/A	N/A	No
12B	No	125-150	101-500	No	5-10	N/A	N/A	N/A	N/A	N/A	N/A	No
12C	Yes	25-100	101-1000	No	<2 to 10	Yes	OK	Yes	No	Part Conflict KSA/Rich.	Yes	Yes
12D	Yes	10-75	101-5000	No	<2 to 10	Yes	OK	Yes	No	Part Conflict KSA/Rich.	No	Yes

Cell Reference	Is Minimum Airport Site Area Available?	Flattest land available (in terms of cut plus fill 1,000s m3/ha)	Approx. persons within20 ANEC	Is a Mine Subsidence District present in cell?	Access to major road System (kms)	Runways able to be oriented to a near northerly direction?	Runway specific OLS	Effects on Major Infrastructure can be avoided?	Avoid flight paths over major urban areas for adopted runway alignment	Current Airspace Management Issues	Local topographic issues e.g. Major Flood Risk	Is a *'suitable'* site available within cell?
Refer to Figure 4-7	Refer to Figure 3-1	Refer to Figure 5-1	Refer to Figure 5-2	See Note 3 Refer to Figure 5-3	Refer to Figure 5-4	See Notes 2, 4 to 5 Refer to sections 6.2.3 to 6.2.8						See Note 1
12E	Yes	10-100	501-20,001(+)	No	<2 to 10	N/A	N/A	N/A	No	Conflict KSA	N/A	No
12F	No	25-100	2500-20,001(+)	No	<2 to 5	N/A	N/A	N/A	No	Conflict KSA	N/A	No
13B	No	75-100	1-500	No	10-20	N/A	N/A	N/A	N/A	N/A	N/A	No
13C	Yes	25-150	1-2500	No	5-20	Yes	OK	Yes	Yes	Part Conflict KSA/Rich.	Yes	Yes
13D	Yes	10-75	501-2500	No	5-20	Yes	OK	Yes	Yes	Part Conflict KSA/Rich.	Yes	Yes
13E	Yes	10-100	1001-20,000(+)	No	<2 to 10	N/A	N/A	N/A	N/A	Conflict KSA & Bankstown	Yes	No
14B	Yes	25-125	1-500	No	10-20	Yes	OK	Yes	Yes	Part Conflict KSA/Rich.	No	Yes
14C	Yes	10-150	101-2500	No	5-20	Yes	OK	Yes	Yes	Part Conflict KSA/Rich.	Yes	Yes
14D	Yes	10-150	101-10,000	No	<2 to 20	Yes	OK	Yes	Yes	Part Conflict KSA	No	Yes
14E	Yes	25-100	1001-20,000(+)	No	<2 to 5	Yes	OK	No	No	Part Conflict KSA	No	Yes

Cell Reference	Is Minimum Airport Site Area Available?	Flattest land available (in terms of cut plus fill 1,000s m3/ha)	Approx. persons within20 ANEC	Is a Mine Subsidence District present in cell?	Access to major road System (kms)	Runways able to be oriented to a near northerly direction?	Runway specific OLS	Effects on Major Infrastructure can be avoided?	Avoid flight paths over major urban areas for adopted runway alignment	Current Airspace Management Issues	Local topographic issues e.g. Major Flood Risk	Is a *'suitable'* site available within cell?
Refer to Figure 4-7	Refer to Figure 3-1	Refer to Figure 5-1	Refer to Figure 5-2	See Note 3 Refer to Figure 5-3	Refer to Figure 5-4	See Notes 2, 4 to 5 Refer to sections 6.2.3 to 6.2.8						See Note 1
14F	No	10-75	5001-20,000	No	<2	N/A	N/A	N/A	N/A	N/A	N/A	No
15A	No	100-125	101-500	No	10-20	N/A	N/A	N/A	N/A	N/A	N/A	No
15B	Yes	25-150	101-2500	No	10-20	Yes	OK	Yes	Yes	Part Conflict KSA/Rich.	No	Yes
15D	No	25-150	1001-20,000(+)	Yes/No	<2 to 5	N/A	N/A	N/A	N/A	N/A	N/A	No
15E	No	50-150	2501-10,000	Yes/No	<2 to 5	N/A	N/A	N/A	N/A	N/A	N/A	No
15F	No	75-100	101-500	No	<2	N/A	N/A	N/A	N/A	N/A	N/A	No
16A	No	75-100	1-500	No	10-20	N/A	N/A	N/A	N/A	N/A	N/A	No
16B	Yes	25-150	1-1000	No	10-20	Yes	OK	Yes	No	Part Conflict KSA/Rich.	No	Yes
16C	No	100-150	101-500	Yes	5-10	N/A	N/A	N/A	N/A	N/A	N/A	No
16D	Yes	10-100	101-500	Yes	<2 to 5	Yes	OK	Yes	No	Part Conflict KSA	No	Yes
16E	Yes	10-100	1-500	Yes/No	<2 to 10	Yes	OK	Yes	No	Part Conflict KSA	No	Yes

Cell Reference	Is Minimum Airport Site Area Available?	Flattest land available (in terms of cut plus fill 1,000s m3/ha)	Approx. persons within20 ANEC	Is a Mine Subsidence District present in cell?	Access to major road System (kms)	Runways able to be oriented to a near northerly direction?	Runway specific OLS	Effects on Major Infrastructure can be avoided?	Avoid flight paths over major urban areas for adopted runway alignment	Current Airspace Management Issues	Local topographic issues e.g. Major Flood Risk	Is a *'suitable'* site available within cell?
Refer to Figure 4-7	Refer to Figure 3-1	Refer to Figure 5-1	Refer to Figure 5-2	See Note 3 Refer to Figure 5-3	Refer to Figure 5-4	See Notes 2, 4 to 5 Refer to sections 6.2.3 to 6.2.8						See Note 1
17A	No	75-100	1-500	No	10-20	N/A	N/A	N/A	N/A	N/A	N/A	No
17B	Yes	10-150	1-1000	No	10-20	Yes	OK	Yes	No	Part Conflict KSA	No	Yes
17C	No	100-150	101-1000	Yes	2-10	N/A	N/A	N/A	N/A	N/A	N/A	No
17D	No	75-125	101-1000	Yes	2-10	N/A	N/A	N/A	N/A	N/A	N/A	No
17E	Yes	10-150	1-1000	Yes/No	2-10	Yes	OK	Yes	No	Part Conflict KSA & Holsworthy Airspace	No	Yes
17F	No	10-150	1-500	No	2-10	N /A	N/A	N/A	N/A	N/A	N/A	No
17G	No	75-100	1-1000	No	<2	N/A	N/A	N/A	N/A	N/A	N/A	No
18D	Yes	10-150	1-500	Yes/No	5-20	Yes	OK	Yes	Yes	Part Conflict KSA	No	Yes
18E	No	10-150	1-500	Yes/No	2-20	N/A	N/A	N/A	N/A	N/A	N/A	No
18F	Yes	10-150	1-500	No	<2 to 10	Yes	OK	Yes	Yes	Part Conflict KSA	No	Yes

Cell Reference	Is Minimum Airport Site Area Available?	Flattest land available (in terms of cut plus fill 1,000s m3/ha)	Approx. persons within20 ANEC	Is a Mine Subsidence District present in cell?	Access to major road System (kms)	Runways able to be oriented to a near northerly direction?	Runway specific OLS	Effects on Major Infrastructure can be avoided?	Avoid flight paths over major urban areas for adopted runway alignment	Current Airspace Management Issues	Local topographic issues e.g. Major Flood Risk	Is a *'suitable'* site available within cell?
Refer to Figure 4-7	Refer to Figure 3-1	Refer to Figure 5-1	Refer to Figure 5-2	See Note 3 Refer to Figure 5-3	Refer to Figure 5-4	See Notes 2, 4 to 5 Refer to sections 6.2.3 to 6.2.8						See Note 1
18G	No	125-150	501-1000	No	<2	N/A	N/A	N/A	N/A	N/A	N/A	No
19B	No	75-100	1-100	Yes	<2	N/A	N/A	N/A	N/A	N/A	N/A	No
19C	Yes	25-100	1-100	No	5-10	Yes	OK	Yes	Yes	Part Conflict KSA	No	Yes
19D	Yes	10-150	1-100	No	5-20	Yes	OK	Yes	Yes	Part Conflict KSA	No	Yes
19E	Yes	10-150	1-100	No	2-20	Yes	OK	Yes	Yes	Part Conflict KSA	No	Yes
19F	No	125-150	1-100	No	2-5	N/A	N/A	N/A	N/A	N/A	N/A	No
20C	No	25-50	1-100	No	5-20	N/A	N/A	N/A	N/A	N/A	N/A	No
20D	Yes	25-50	1-100	No	10-20	Yes	OK	Yes	Yes	Part Conflict KSA	No	Yes

Note 1 – A *'suitable'* site may overlap specific grid cells – *'suitable'* does not mean totally free of all constraints.

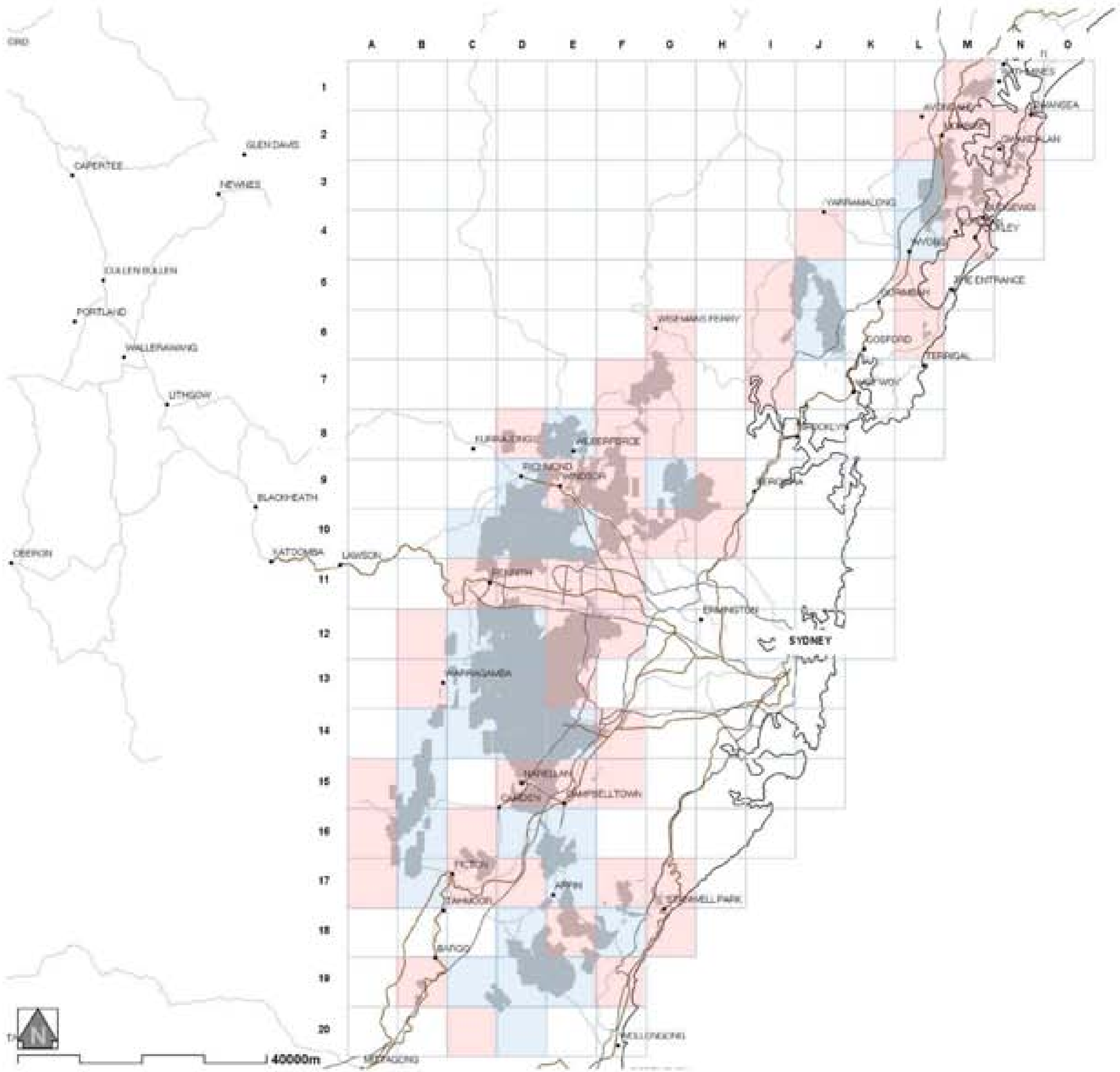
Note 2 KSA=Sydney Airport; WLM=Williamtown Airport; Rich=RAAF Richmond and *'Part Conflict'* means that, to a greater or lesser extent, there is or potentially is an partial conflict on an airspace management issue which would need to be resolved.

Note 3 – Yes means all the *'more suitable'* land in the cell is within a Mine Subsidence District; No means none of it is; Yes\No means some is and some is not.

Note 4 – N/A means that if, for example, a minimum area site is not available then the other parameters such as the runway heading and satisfying OLS standards are no longer relevant.

Note 5 –If, for example, the grid cell does suit a minimum area airport, then it will have an associated runway heading (which may or may not be in a northerly direction) and if the OLS clearances are feasible for that heading, it is noted as OK.

Figure 6-1 Grid cells potentially suitable for siting a Type 3 or Maximum Airport



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Transportation Corridors

- Suburban Rail
- Freeway/Motorway
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the Department of Planning and Infrastructure).

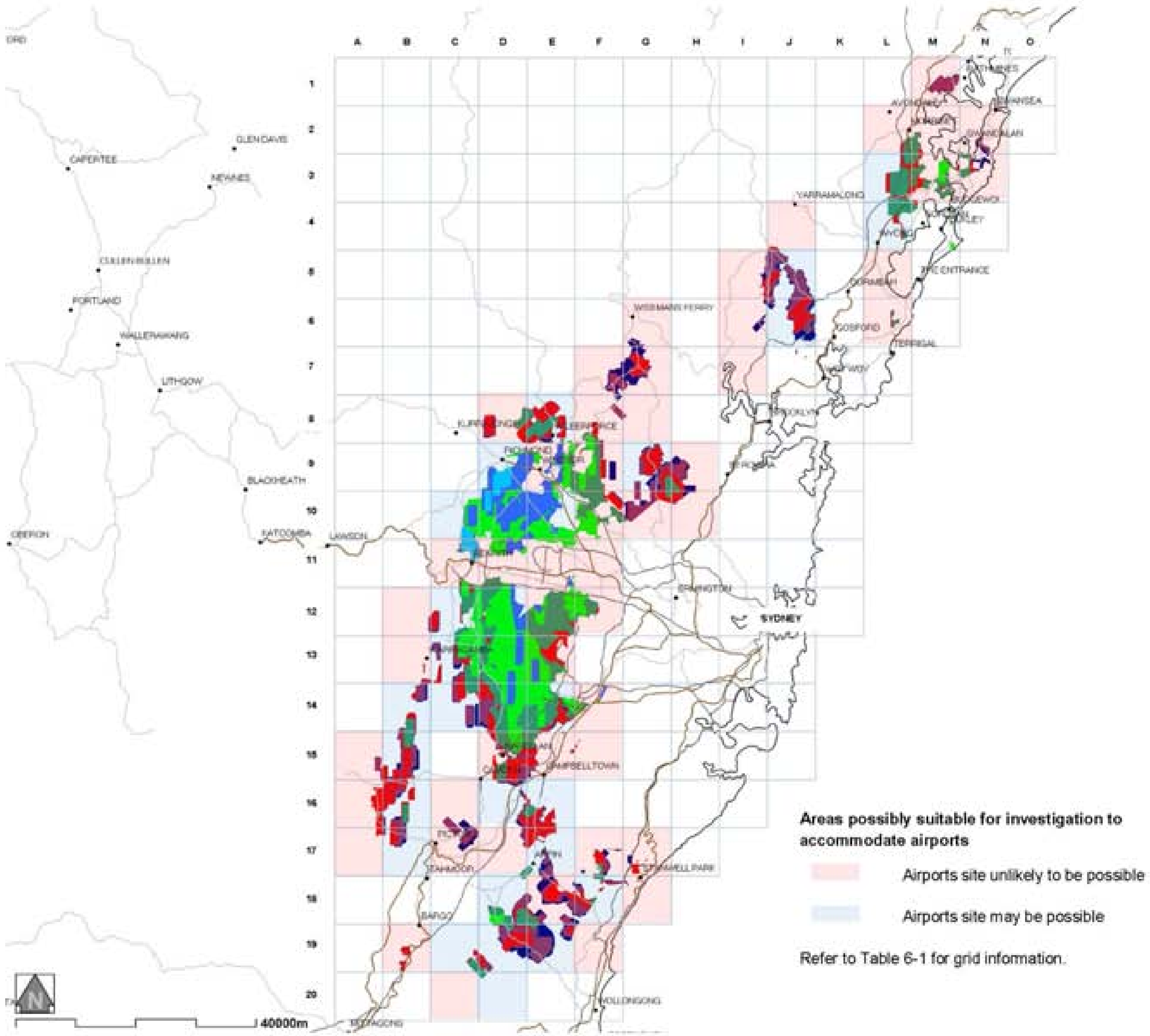
Areas possibly suitable for investigation to accommodate airports

- Potential areas suitable for aviation infrastructure
- Airports not possible
- Airports may be possible

Refer to Table 6-1 for grid information.

Airport Type 3 – Limited Service Airport Study Area

Figure 6-2 Airport Type 3 Limited Service Airport - Earthworks Volumes



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Terrain Analysis

Showing relative degree of difficulty to create a uniformly level land of the scale of a Type 3 airport site as expressed in total cut plus fill over that site.

(light blue)	0 – 10,000 m^3/ha	Easiest terrain
(blue)	10,000 – 25,000 m^3/ha	Moderate terrain
(green)	25,000 – 50,000 m^3/ha	
(dark green)	50,000 – 75,000 m^3/ha	More difficult terrain
(red)	75,000 – 100,000 m^3/ha	
(purple)	100,000 – 125,000 m^3/ha	Most difficult terrain
(dark blue)	125,000 – 150,000 m^3/ha	

Transportation Corridors

- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Airport Type 3 – Limited Service Airport Earthworks Volumes

Figure 6-3 Airport Type 3 Limited Service Airport – ANEC 20 Noise Contour

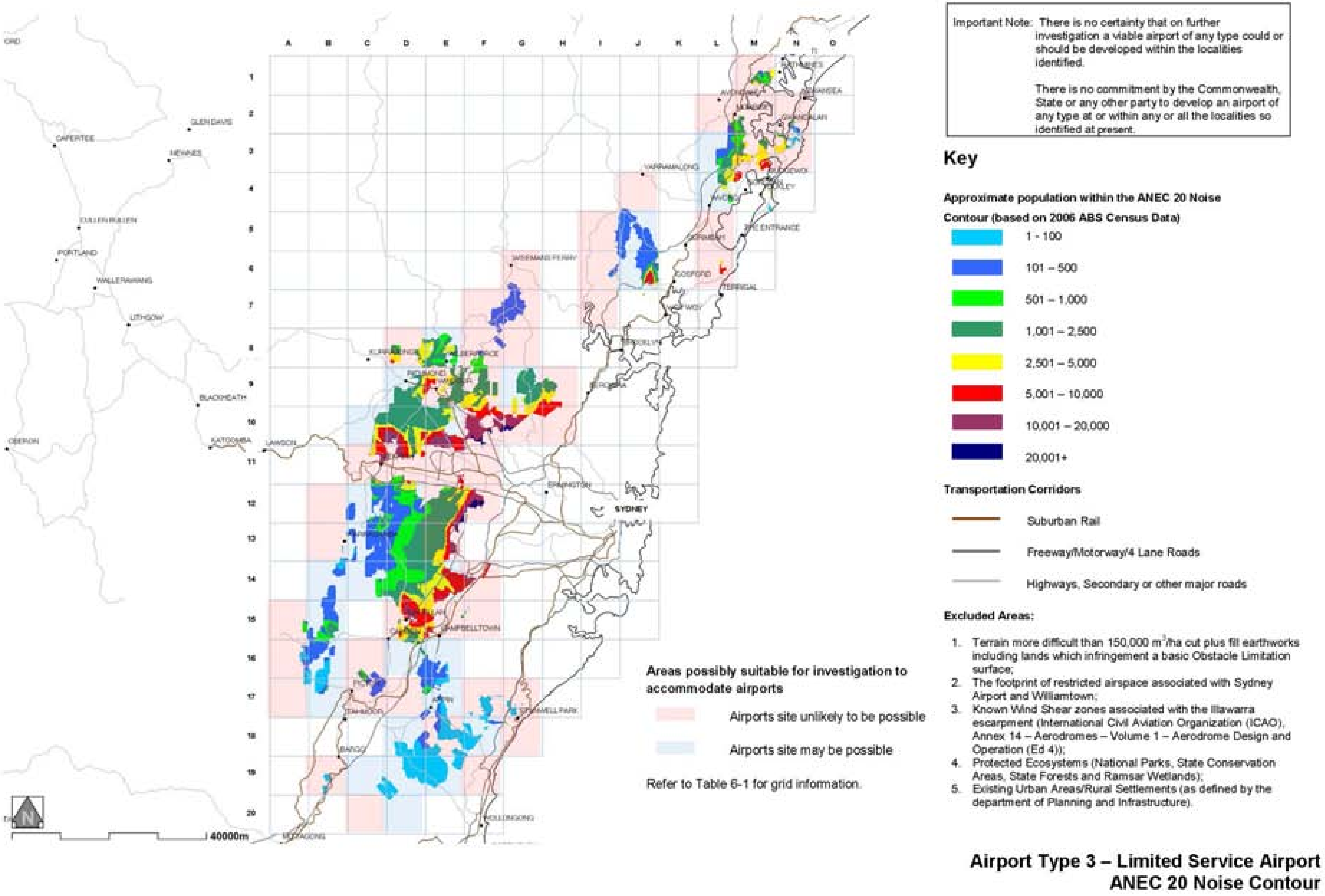
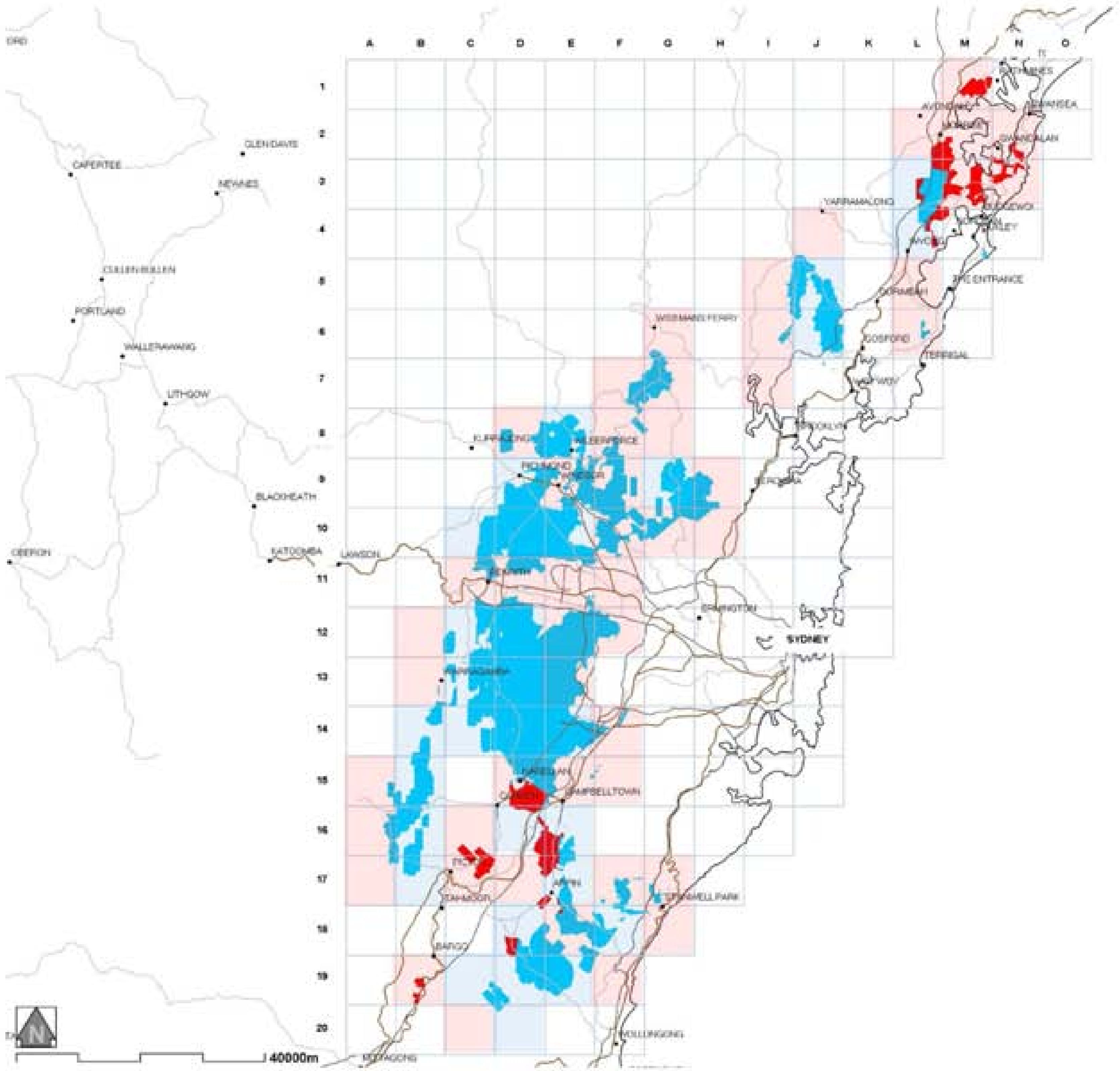


Figure 6-4 Airport Type 3 Limited Service Airport – Mine Subsidence Districts



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

- Mine Subsidence District
- Non Mine Subsidence District

Transportation Corridors

- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

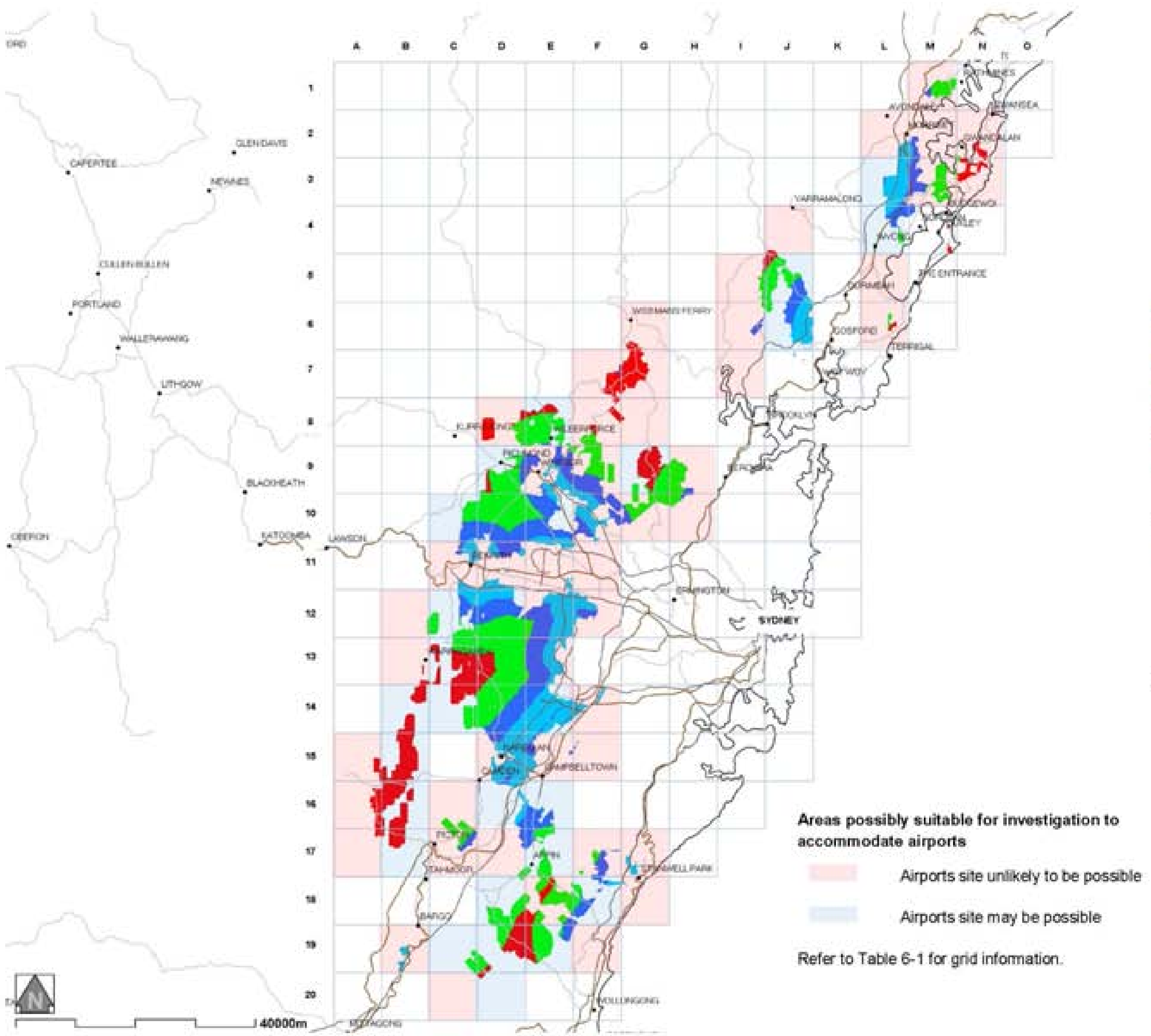
Areas possibly suitable for investigation to accommodate airports

- Airports site unlikely to be possible
- Airports site may be possible

Refer to Table 6-1 for grid information.

Airport Type 3 – Limited Service Airport
Mine Subsidence Districts

Figure 6-5 Airport Type 3 Limited Service Airport – Transport Accessibility



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Distance from existing Freeway, Motorway & 4 Lane Roads

- < 2 km
- 2km – 5km
- 5km – 10km
- 10km – 20km
- > 20km

Transportation Corridors

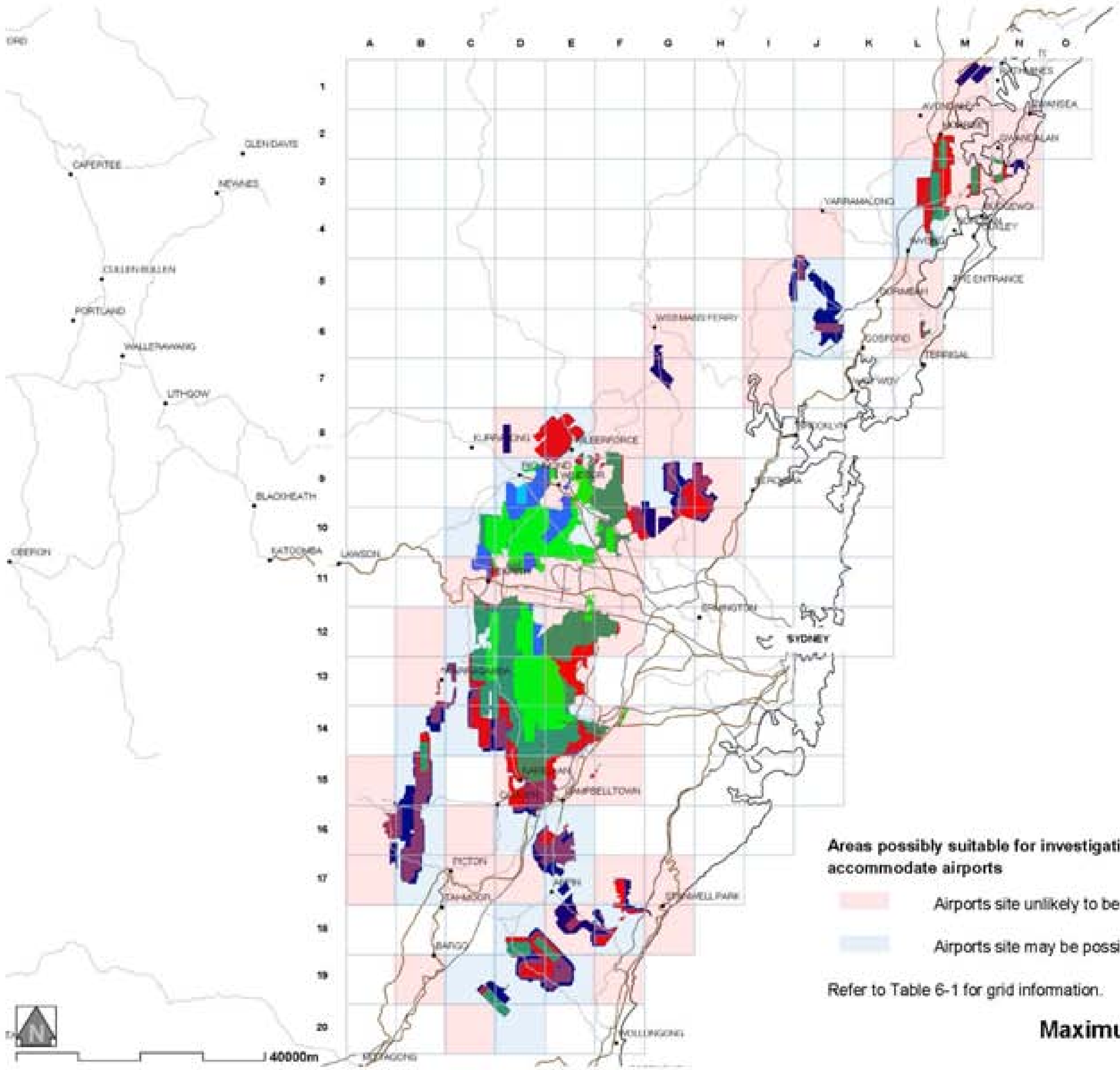
- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Airport Type 3 – Limited Service Airport Transport Accessibility

Figure 6-6 Maximum Airport Type – Full Service International Airport - Earthworks Volumes



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Terrain Analysis

Showing relative degree of difficulty to create a uniformly level land of the scale of a maximum airport site as expressed in total cut plus fill over that site.

	0 – 10,000 m^3/ha	Easiest terrain
	10,000 – 25,000 m^3/ha	Moderate terrain
	25,000 – 50,000 m^3/ha	
	50,000 – 75,000 m^3/ha	More difficult terrain
	75,000 – 100,000 m^3/ha	
	100,000 – 125,000 m^3/ha	Most difficult terrain
	125,000 – 150,000 m^3/ha	

Transportation Corridors

- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Areas possibly suitable for investigation to accommodate airports

- Airports site unlikely to be possible
- Airports site may be possible

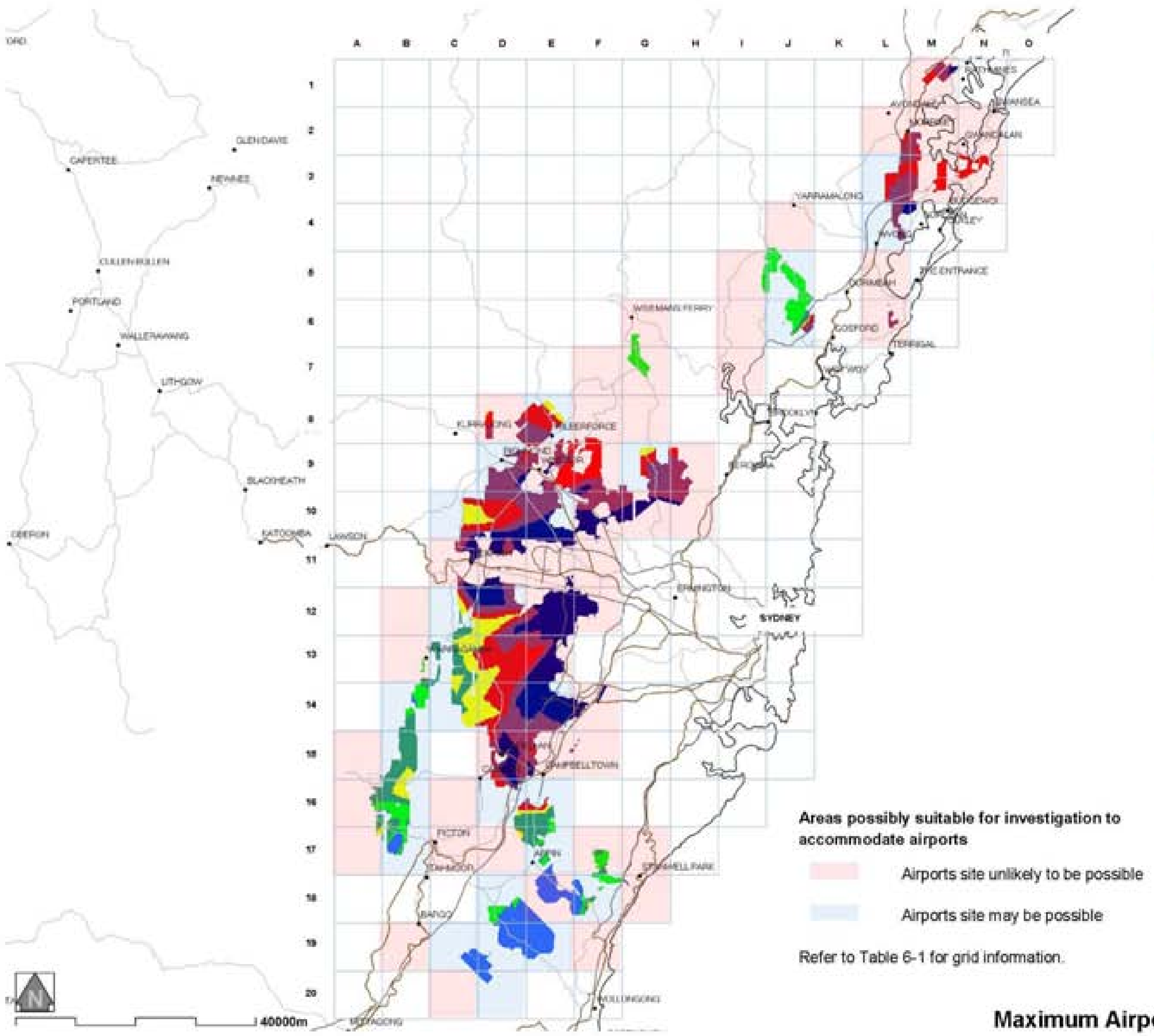
Refer to Table 6-1 for grid information.

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Maximum Airport Type – Full Service International Airport Earthworks Volumes

Figure 6-7 Maximum Airport Type – Full Service International Airport – ANEC 20 Noise Contours



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Approximate population within the ANEC 20 Noise Contour (based on 2006 ABS Census Data)

- 1 - 100
- 101 – 500
- 501 – 1,000
- 1,001 – 2,500
- 2,501 – 5,000
- 5,001 – 10,000
- 10,001 – 20,000
- 20,001+

Transportation Corridors

- Suburban Rail
- Freeway/Motorway/4 Lane Roads
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha cut plus fill earthworks including lands which infringement a basic Obstacle Limitation surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known Wind Shear zones associated with the Illawarra escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the department of Planning and Infrastructure).

Maximum Airport Type – Full Service International Airport ANEC 20 Noise Contour

Figure 6-8 Maximum Airport Type – Full Service International Airport – Mine Subsidence Districts

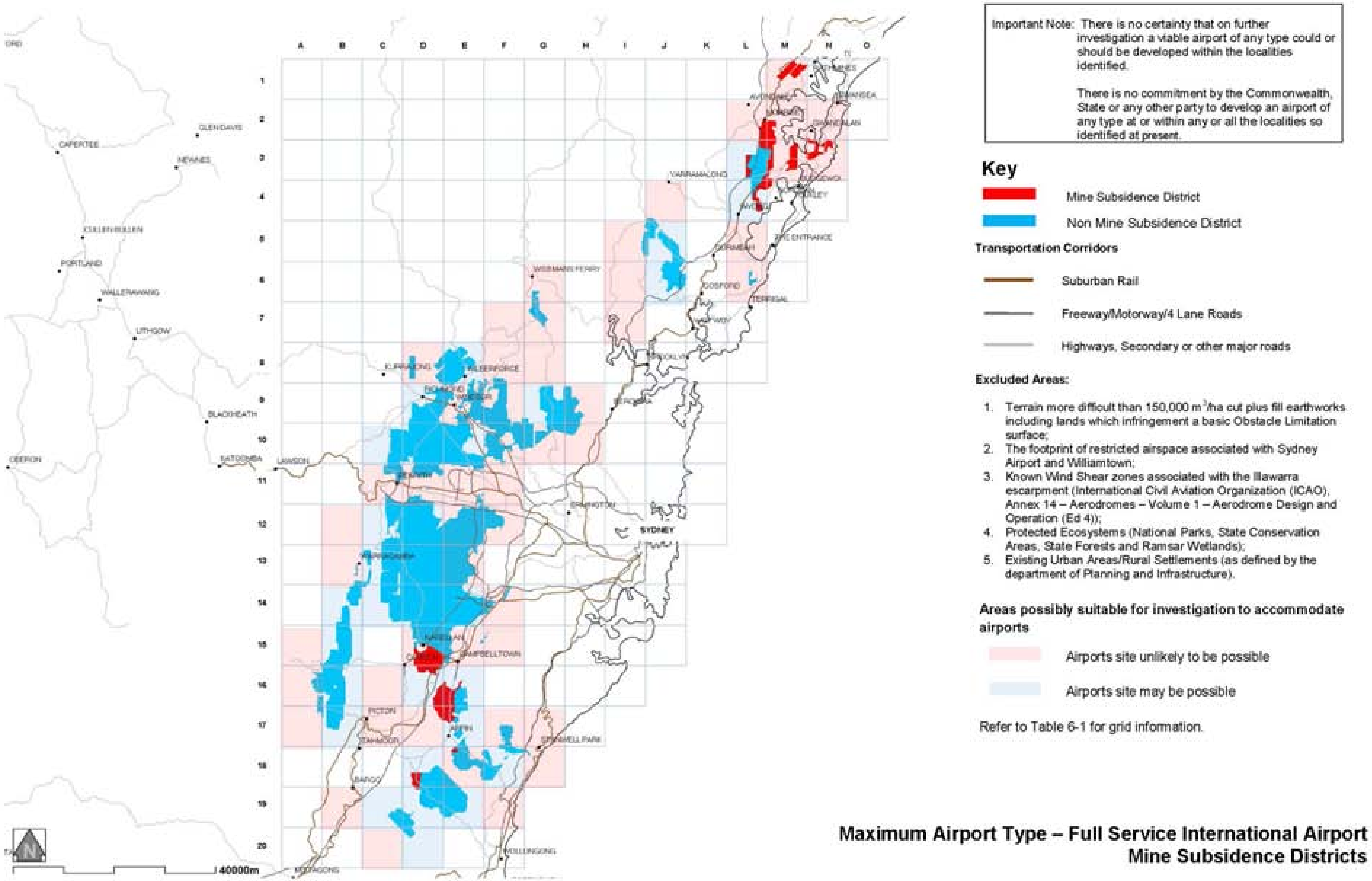
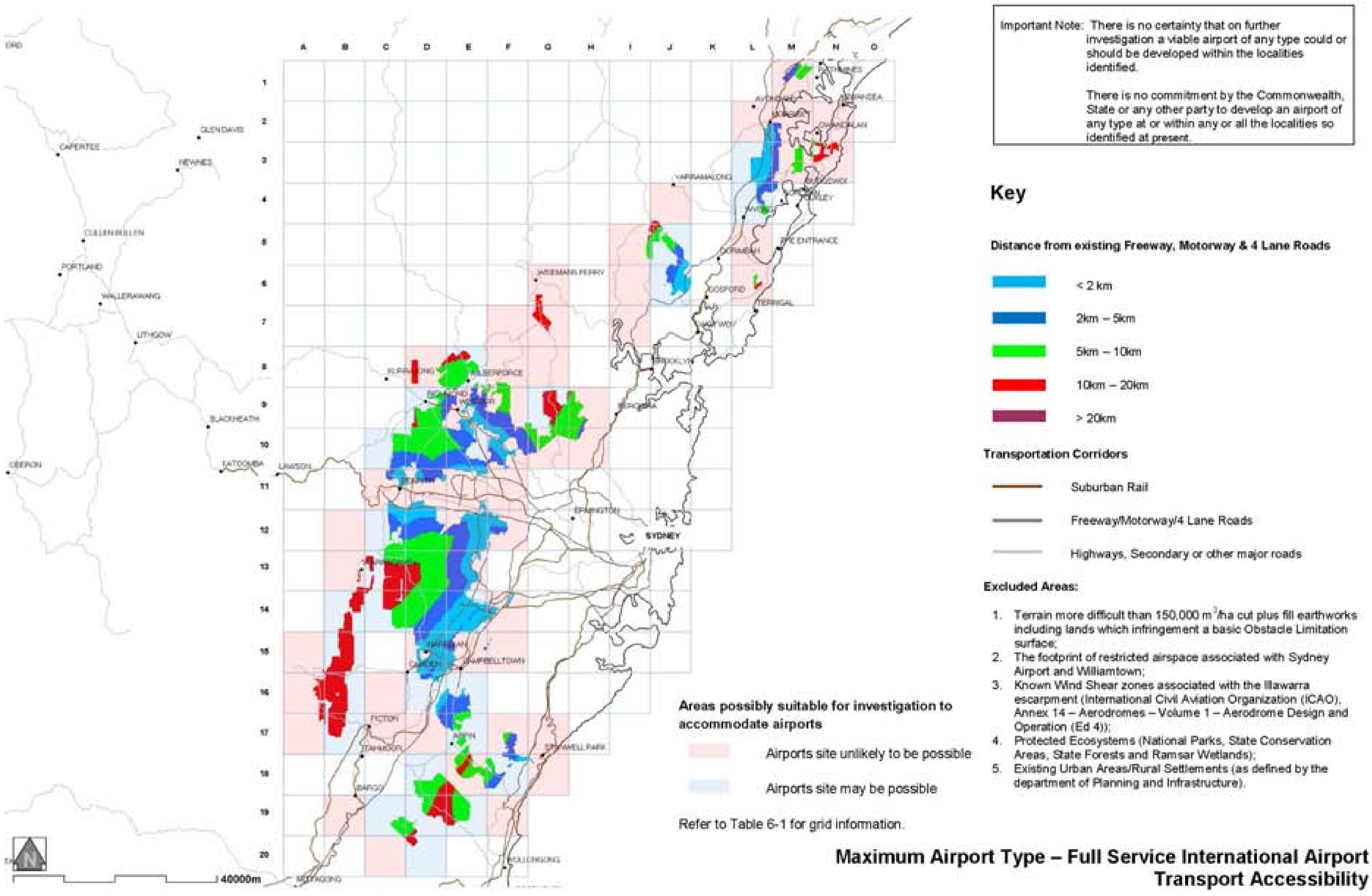


Figure 6-9 Maximum Airport Type – Full Service International Airport – Transport Accessibility



6.5 Phase Three outcomes

6.5.1 Type 3 Airport

Based on the grid cell analysis described above, suitable sites[41] for a Type 3 Airport were identified and are shown on Figure 6-10. The approximate locations of the Type 3 sites are indicated by the coordinates listed in Table 6-2.

Table 6-2 Approximate locations of Type 3 Airport sites

Drawing reference no.[42]	Locality / Site name	Approximate site coordinates (MGA)		Approximate site latitude and longitude	
		X	Y	Latitude South	Longitude
Central Coast					
C2-6	Peats Ridge	335637	6310756	33°20'	151°14'
C3-1 T3	Somersby	340986	6304838	33°23'	151°17.5'
C4-1 T3	Wallarah	356574	6322764	33°13.5'	151°27.5'
Hawkesbury					
W1-1 T3	Wilberforce with RAAF	297513	6286939	33°32.5'	150°49'
W1-2	Castlereagh (including RAAF)	287168	6272746	33°40'	150°42'
W1-3	Windsor Downs (including RAAF)	298499	6271103	33°41'	150°49.5'
W4-3 T3	Glenorie	315312	6278865	33°37'	151°0.5'
Nepean					
W2-1	Kemps Creek	293645	6249722	33°52.5'	150°46'
W3-1 T3	Luddenham	286221	6252107	33°51'	150°41.5'
W3-4 T3	Badgerys Creek	289033	6246921	33°54'	150°43'
W4-1 T3	Bringelly	287797	6242984	33°56'	150°42'
W3-5 T3	Greendale	283550	6241040	33°57'	150°39.5'
S4-4 T3	Catherine Field	295200	6238740	33°58.5'	150°47'
Burragorang					
S2-1	The Oaks	274017	6226490	34°04.7'	150°33'
W3-3	Silverdale	277534	6241056	33°56.8'	150°35.5'
W4-2 T3	Mowbray park	273909	6219828	34°08'	150°33'
Cordeaux-Cataract					

[41] It should be recognised that while these sites have been identified as described, potential exists to develop variants in terms of precise location and runway orientations should any of these sites become selected for a higher level of consideration beyond this study. The same applies in the case of the Maximum sites.
[42] See Appendix 3.

Drawing reference no.[42]	Locality / Site name	Approximate site coordinates (MGA)		Approximate site latitude and longitude	
		X	Y	Latitude South	Longitude
S4-2 T3	Nth Appin	295700	6220000	34°08.5'	150°47'
S1-1 T3	Wilton	291172	6204409	34°17'	150°44'
S1-2	Southend	305503	6205980	34°16'	150°53'
S1-3 T3	Wallandoola	294385	6205056	34°16.5'	150°46'
S4-1	Dendrobium	287194	6194886	34°22'	150°41'

In general, the more detailed data on these sites is presented in the Phase 4 assessment following. However, where the proposed suitable site still has aviation, subsidence or water catchment related site-specific issues which, if unresolved, may affect or prevent its ability to operate effectively as an airport, these are noted in Table 6-3. **Appendix 3** contains Concept Development Plans for the potential Type 3 Airport sites. These show a concept airport with runway dimensions and associated airport infrastructure against the topocadastral background enabling the scale and general environs of the concept to be seen.

Table 6-3 Type 3 Airport suitable sites – Site-Specific Issues

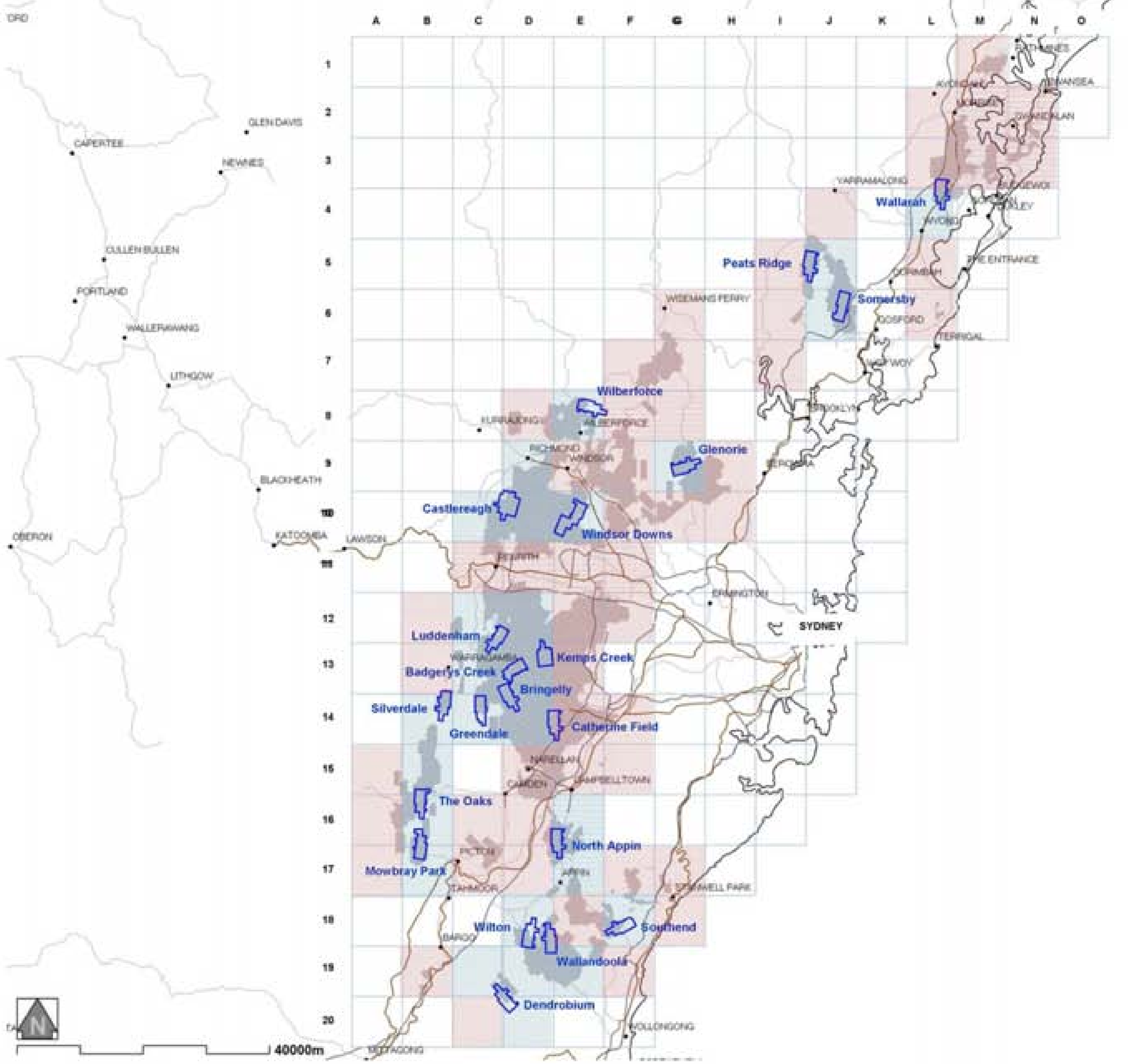
Site Name	Comments
Central Coast	
Wallarah	Site located north of Wyong in the vicinity of Sparks Road and the Motorway Link Road and between the F3 Freeway and the Main North Railway. Site-specific issues include: Relatively close to Williamtown Military Airspace; power station chimneys in the vicinity with high velocity emissions; existing urban developments; and road and rail relocations; may be affected by mine subsidence.
Peats Ridge	Site located along and east of Peats Ridge Road. Site-specific issues include: potential for airspace interaction with Sydney Airport Approaches.
Somersby	Site located along Wisemans's Ferry Road, immediately west of the F3 freeway at Somersby. Site-specific issues include: potential for airspace interaction with Sydney Airport approaches.
Hawkesbury	
Wilberforce	Site located in the vicinity of Stannix Park Road north of Wilberforce. Site-specific issues include: runway alignment aimed to be parallel or near parallel to RAAF Richmond; Assumes coordinated control between the two airports; Site within military airspace with issues for flight paths; High terrain to the west – viability of approaches requires more assessment; potential for airspace interaction with Sydney Airport approaches.

Site Name	Comments
Glenorie	Site located in the vicinity of Cattai Ridge Road and Old Northern Road. Site specific issues include: high potential for interaction with Sydney Airport approaches, light aircraft transit lanes and operation of RAAF Richmond. Runway alignment set east west to avoid/ minimise noise over very heavily developed urban areas to the south.
Castlereagh (RAAF Richmond relocated)	Site located along and west of Londonderry road, Londonderry. Site-specific issues include: Runway nearly perpendicular to that of RAAF Richmond and relatively close; Assumption that RAAF Richmond would have to close and be relocated to this site; The northern flight paths would still enter military restricted airspace; RAAF Orchard Hills explosives depot to the south may need to be closed and relocated.
Windsor Downs (RAAF Relocated)	Site located east of and parallel to South Creek on Richmond Road. Site-specific issues include: runway nearly perpendicular to that of RAAF Richmond and relatively close. Assumption that RAAF Richmond would have to close and be relocated to the site; The northern flight paths would still enter military restricted airspace; Orchard Hills explosives depot to the south may need to be closed and relocated.
Nepean	
Luddenham	Site located on the Northern Road, north of Elizabeth Drive and immediately to the north west of Badgerys Creek Airport site owned by the Commonwealth. Site-specific issues include: Development will require relocation of the Orchard Hills Explosives depot; Runway alignment more northerly than Badgerys Creek (and extent of interaction with Sydney Airport may be improved in comparison to Badgerys Creek); Potential impacts on flying training areas and Camden Airport.
Kemps Creek	Site located along Kemps Creek immediately to the east of the Badgerys Creek Airport site. Site-specific issues include: Potential for interaction with Sydney Airport as it is becoming relatively close to the restricted airspace.
Badgerys Creek	Site is located along Badgerys Creek south of Elizabeth Drive and north east of the Northern Road. Site-specific issues include: Site has been subject to several EIS studies. Potential for interaction with Sydney Airport airspace; Potential impacts on flying training areas and Camden Airport.
Bringelly	Site is located south west of Badgerys Creek site, west of The Northern Road and along Greendale Road. Site-specific issues include: Site is aligned north-west – south-east with the intention of minimising interaction with Holsworthy airspace to the south east; Potential impacts on flying training areas and Camden Airport.
Greendale	Site is located east of the Nepean river and south of Greendale Road. Site-specific issues include: Site is aligned generally north-south to avoid minimise noise on smaller urban areas to the north and south. Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills explosives depot airspace; High terrain to the west – may need to consider wind turbulence issues as a precautionary measure; Potential impacts on flying training areas and Camden Airport.

Site Name	Comments
Catherine Field	Site located north of Camden Valley Way and East of Deepfields Road. Site-specific issues include: Potential for interaction with Sydney Airport as it is becoming relatively close to the restricted airspace.
Burragorang	
The Oaks	Site located along ridge line west of Werriberri Creek and the Oaks township. Site-specific issues include: Site is aligned generally north-south to avoid minimise noise on smaller urban areas to the north and south; Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills explosives depot airspace; High terrain to the west – may need to consider wind turbulence issues as a precautionary measure; Site is closer to high terrain than say Greendale. Potential impacts on flying training areas and Camden Airport and physical impact on The Oaks Airfield.
Silverdale	Site located south of Silverdale township and west of the Nepean River. Site-specific issues include: Site is aligned generally north-south to avoid minimise noise on smaller urban areas to the north and south. Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills explosives depot airspace; High terrain to the west – may need to consider wind turbulence issues as a precautionary measure; Site is closer to high terrain than say Greendale; Potential impacts on flying training areas and Camden Airport.
Mowbray Park	Site located north of Mulhollands Road and along Montpellier Drive west of Picton. Site-specific issues include: Site is aligned generally north-south to avoid minimise noise on smaller urban areas to the north and south; Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills explosives depot airspace; High terrain to the west – may need to consider wind turbulence issues as a precautionary measure; Site is closer to high terrain than say Greendale. Potential impacts on flying training areas and Camden Airport and on The Oaks Airfield.
Cordeaux-Cataract	
North Appin	Site located along Appin road between Rosemeadow and Appin Site-specific issues include: Close to both mine subsidence areas and operating mines. Extent of any old or current mines needs to be established. Site is immediately south of existing urban areas. The site is west of the Holsworthy airspace with potential capacity constraints; Potential for interaction with Sydney Airport as it is becoming relatively close to the restricted airspace.
Southend	Site located along Appin Road west of the F6 Southern freeway Site-specific issues include: Runway alignment east west may conflict with approaches to Sydney Airport; Site is southeast of Holsworthy airspace with potential capacity constraints; West of wind shear avoidance zone but still relatively close to the escarpment. Site is adjacent to water catchment areas and would require flight paths over these areas.
Wilton	Site located along and north of Picton Road between Wallandoola and Cascade Creeks. Site specific issues include: Site is close to both mine subsidence areas and operating mines; Extent of any old or current mine workings needs to be established. Site is adjacent to water catchment areas and would require flight paths over these areas.

Site Name	Comments
Wallandoola	Site is located further east from the Wilton site along north of Picton Road and between Lizard and Wallandoola Creeks. Site-specific issues include: Site is close to both mine subsidence areas and operating mines; Extent of any old or current mine workings needs to be established. Site is adjacent to water catchment areas and would require flight paths over these areas.
Dendrobium	Site located on a ridge north east of Lake Avon and isolated from any road system. Site- specific issues include. Site is wholly within water catchment areas and would require flight paths over these areas. Site is traversed by proposed Maldon-Dombarton railway alignment.

Figure 6-10 **Type 3 Airport suitable sites**



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Transportation Corridors

- Suburban Rail
- Freeway/Motorway
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha including lands which infringe a basic Obstacle Limitation Surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known wind shear zones associated with the Illawarra Escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (limited to National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the Department of Planning and Infrastructure).

Areas possibly suitable for investigation to accommodate airports

- Potential areas suitable for aviation infrastructure
- Airport Site unlikely to be possible
- Airports Site may be possible
- Potential airport footprint and regional name

Refer to Table 6.1 for grid information.

Airport Type 3 – Limited Service Airport Suitable Sites

6.5.2 Maximum Airport

Based on the grid cell analysis described above, suitable sites for a Maximum Airport were identified and are listed in Table 6-4 and shown on Figure 6-11. **Appendix 4** contains Concept Development Plans for the potential Maximum Airport sites. These show a concept airport with runway dimensions and associated airport infrastructure against the topocadastral background enabling the scale and general environs of the concept to be seen.

Table 6-4 Approximate locations of Maximum Airport sites

Drawing reference no.[43]	Site name / locality	Approximate site coordinates (MGA)		Approximate site latitude and longitude	
		X	Y	Latitude South	Longitude
Central Coast					
C3-1X	Somersby	340986	6304838	33°23’	151°17.5’
C4-1	Wallarah	356574	6322764	33°13.5’	151°27.5’
Hawkesbury					
W1-1R	Wilberforce with RAAF	297513	6286939	33°32.5’	150°49’
W4-3	Glenorie	315312	6278865	33°37’	151°0.5’
Nepean					
W3-1	Luddenham	286221	6252107	33°51’	150°41.5’
W3-4X	Badgerys Creek	289033	6246921	33°54’	150°43’
W4-1	Bringelly	287797	6242984	33°56’	150°42’
W3-5	Greendale	283550	6241040	33°57’	150°39.5’
S4-4	Catherine Field	295200	6238740	33°58.5’	150°47’
Burragorang					
W4-2	Mowbray Park	273909	6219828	34°08’	150°33’
Cordeaux-Cataract					
S4-2	North Appin	295700	6220000	34°08.5’	150°47’
S1-1	Wilton	291172	6204409	34°17’	150°44’
S1-3	Wallandoola	294385	6205056	34°16.5’	150°46’

Where the proposed suitable Maximum Airport site still has aviation related site specific issues which, if unresolved, may affect or prevent its ability to operate effectively as an airport, these are noted in Table 6-5 and further commented upon in the final phase of assessment in Section 7 following. While these comments made for Maximum Airports are generally the same as those for a Type 3 Airport located essentially on the same site, they are repeated here for completeness.

[43] See Appendix 4

Table 6-5 Maximum Airport suitable sites – Site Specific Issues

Site Name	Comments
Central Coast	
Wallarah	Site located north of Wyong in the vicinity of Sparks Road and the Motorway Link Road and between the F3 Freeway and the Main North Railway. Site-specific issues include: Relatively close to Williamtown Military Airspace; power station chimneys in the vicinity with high velocity emissions; existing urban developments; and road and rail relocations; may be affected by mine subsidence.
Somersby	Site located along Wisemans's Ferry Road, immediately west of the F3 freeway at Somersby. Site-specific issues include: potential for airspace interaction with Sydney Airport approaches.
Hawkesbury	
Wilberforce	Site incorporates the Type 3 site as a cross runway but is located in north south direction between Stannix Park Road and Bushells Lagoon, north and west of Wilberforce. Site-specific issues include: Assumes RAAF Richmond closed and relocated to new site associated with this site. Site within military airspace with issues for aviation access routes.
Glenorie	Site located in the vicinity of Cattai Ridge Road and Old Northern Road. Site-specific issues include: high potential for interaction with Sydney Airport approaches, light aircraft transit lanes and operation of RAAF Richmond. Runway alignment set east west to avoid or minimise noise over very heavily developed urban areas to the south.
Nepean	
Luddenham	Site located on the Northern Road, north of Elizabeth Drive and immediately to the north west of Badgerys Creek Airport site owned by the Commonwealth. Site-specific issues include: Development will require relocation of the Orchard Hills Explosives depot; Runway alignment more northerly than Badgerys Creek (and extent of interaction with Sydney Airport may be improved in comparison to Badgerys Creek); Potential impacts on flying training areas and Camden Airport.
Badgerys Creek	Site is located along Badgerys Creek south of Elizabeth Drive and north east of the Northern Road. Site-specific issues include: Site has been subject to several EIS studies. Potential for interaction with Sydney Airport airspace; Potential impacts on flying training areas and Camden Airport.
Bringelly	Site is located south west of Badgerys Creek site, west of The Northern Road and along Greendale Road. Site-specific issues include: Site is aligned north-west – south-east with the intention of minimising interaction with Holsworthy airspace to the south east; Potential impacts on flying training areas and Camden Airport.

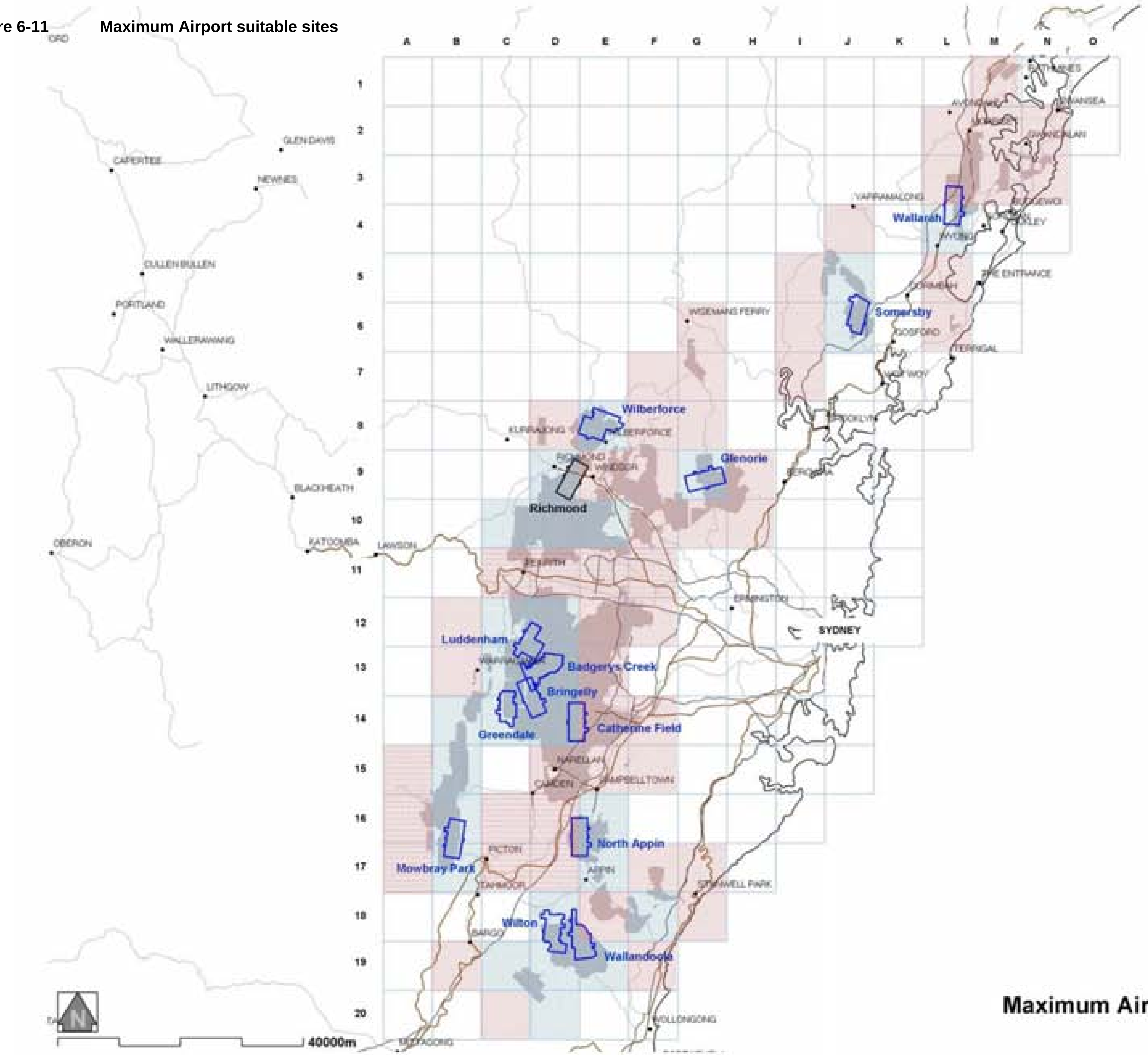
Site Name	Comments
Greendale	Site is located east of the Nepean River and south of Greendale Road. Site-specific issues include: Site is aligned generally north-south to avoid minimise noise on smaller urban areas to the north and south. Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills explosives depot airspace; High terrain to the west – may need to consider wind turbulence issues as a precautionary measure; Potential impacts on flying training areas and Camden Airport.
Catherine Field	Site located north of Camden Valley Way and East of Deepfields Road. Site-specific issues include: Potential for interaction with Sydney Airport as it is becoming relatively close to the restricted airspace.
Burragorang	
Mowbray Park	Site located north of Mulhollands Road and along Montpellier Drive west of Picton. Site-specific issues include: Site is aligned generally north-south to avoid minimise noise on smaller urban areas to the north and south; Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills explosives depot airspace; High terrain to the west – may need to consider wind turbulence issues as a precautionary measure; Site is closer to high terrain than say Greendale. Potential impacts on flying training areas and Camden Airport and on The Oaks Airfield.
Cordeaux-Cataract	
North Appin	Site located along Appin Road between Rosemeadow and Appin. Site-specific issues include: Close to both mine subsidence areas and operating mines. Extent of any old or current mines needs to be established. Site is immediately south of existing urban areas. The site is west of the Holsworthy airspace with potential capacity constraints; Potential for interaction with Sydney Airport as it is becoming relatively close to the restricted airspace.
Wilton	Site located along and north of Picton Road between Wallandoola and Cascade creeks. Site-specific issues include: Site is close to both mine subsidence areas and operating mines; Extent of any old or current mine workings needs to be established. Site is adjacent to water catchment areas and would require flight paths over these areas.
Wallandoola	Site is located further east from the Wilton site along north of Picton Road and between Lizard and Wallandoola Creeks. Site-specific issues include: Site is close to both mine subsidence areas and operating mines; Extent of any old or current mine workings needs to be established. Site is adjacent to water catchment areas and would require flight paths over these areas.

Principally on the basis of current airspace, air navigation and other aviation related constraints, the following potential Maximum Airport sites were unable to meet the study brief requirement for **provision of a cross runway** for reasons presented in Table 6-6.

Table 6-6 Maximum Airport - suitable sites with no cross runway

Maximum Site	Reason for No Cross Runway
Wallarah	Potential conflicts with military airspace and high terrain to the west.
Luddenham	Potential conflicts with Sydney and Bankstown Airports and Holsworthy airspace.
Wilberforce	High terrain to the west (with limited area for building/support facilities).
Glenorie	Potential aircraft noise impacts to urban areas to the south.
Bringelly	Potential aircraft noise impacts on existing urban areas.
Catherine Field	Potential airspace conflicts with existing airports.
Greendale	Proximity of the Blue Mountains terrain.
Mowbray Park	Proximity of the Blue Mountains terrain.
North Appin	Proximity of Holsworthy airspace.

Figure 6-11 **Maximum Airport suitable sites**



> **Important Note:** There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.
>
> There is no commitment by the Commonwealth, State or any other party to develop an airport of any type at or within any or all the localities so identified at present.

Key

Transportation Corridors

- Suburban Rail
- Freeway/Motorway
- Highways, Secondary or other major roads

Excluded Areas:

1. Terrain more difficult than 150,000 m^3/ha including lands which infringe a basic Obstacle Limitation Surface;
2. The footprint of restricted airspace associated with Sydney Airport and Williamtown;
3. Known wind shear zones associated with the Illawarra Escarpment (International Civil Aviation Organization (ICAO), Annex 14 – Aerodromes – Volume 1 – Aerodrome Design and Operation (Ed 4));
4. Protected Ecosystems (limited to National Parks, State Conservation Areas, State Forests and Ramsar Wetlands);
5. Existing Urban Areas/Rural Settlements (as defined by the Department of Planning and Infrastructure).

Areas possibly suitable for investigation to accommodate airports

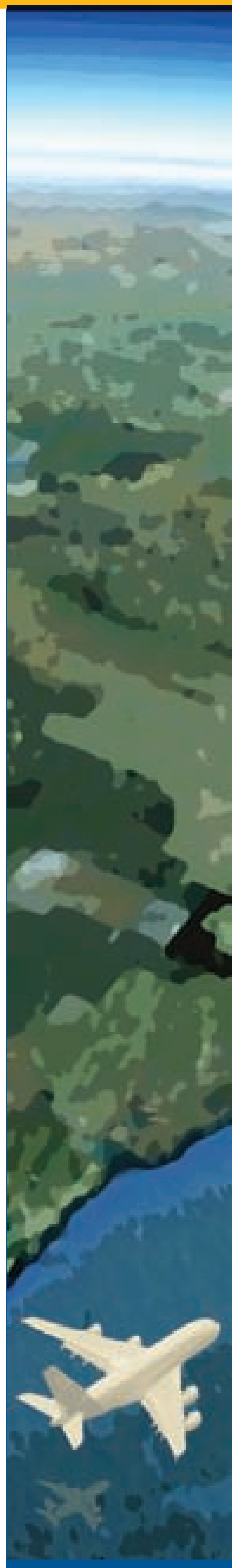
- Potential areas suitable for aviation infrastructure
- Airports site unlikely to be possible
- Airports site may be possible
- Potential airport footprint and regional name

Refer to Table 6.1 for grid information.

Maximum Airport Type – Full Service International Airport Suitable Sites

7

Phase Four - Assessment of Suitable Sites



Phase Four - Assessment of Suitable Sites

7 PHASE FOUR - ASSESSMENT OF SUITABLE SITES

7.1 Overview

The objective of Phase Four was to initially apply a set of criteria to the suitable sites identified in Phase Three in order to generate quantitative and qualitative information on each of these sites which would assist in differentiating between sites in each locality. This information also forms one of a number of data inputs to the Rapid CBA being undertaken in parallel with this study by Ernst &Young (E&Y). The results of the Rapid CBA together with these data analyses then form the basis of assessing the more suitable Type 3 Airport and Maximum Airport (preferably with a cross runway) sites from the range of suitable sites within each locality.

In this study, the single most suitable Type 3 and Maximum Airport sites in the Sydney region have not been specifically identified. It would be possible to do this if required to do so. Additionally, it should be carefully noted that, while an airport site may be identified as the *'more suitable'* in its locality, it is possible that another site – which is not the '*more suitable'* within its locality – would still be superior to that so identified in the other locality.

This particular study does not specifically consider any form of development at RAAF Base Richmond, although it is noted that the Department has investigated this as a '*Brownfield*' site opportunity[44] .

The locations of suitable sites, superimposed on aerial photographs are shown in the following figures:

Figure 7-1 Suitable Site Airport Footprints – Central Coast Locality

Figure 7-2 Suitable Site Airport Footprints – Hawkesbury Locality

Figure 7-3 Suitable Sites Airport Footprints – Nepean Locality

Figure 7-4 Suitable Site Airport Footprints – Burragorang Locality

Figure 7-5 Suitable Site Airport Footprints – Cordeaux – Cataract Locality

[44] '*North South Runway Civil RPT Operations RAAF Base Richmond*' WorleyParsons AMPC for Department of Infrastructure and Transport July 2011; and '*Civil RPT Operations RAAF Base Richmond* 'WorleyParsons AMPC for Department of Infrastructure. Transport, Regional development and Local Government November 2011

Figure 7-1 Suitable Site Airport Footprints – Central Coast Locality

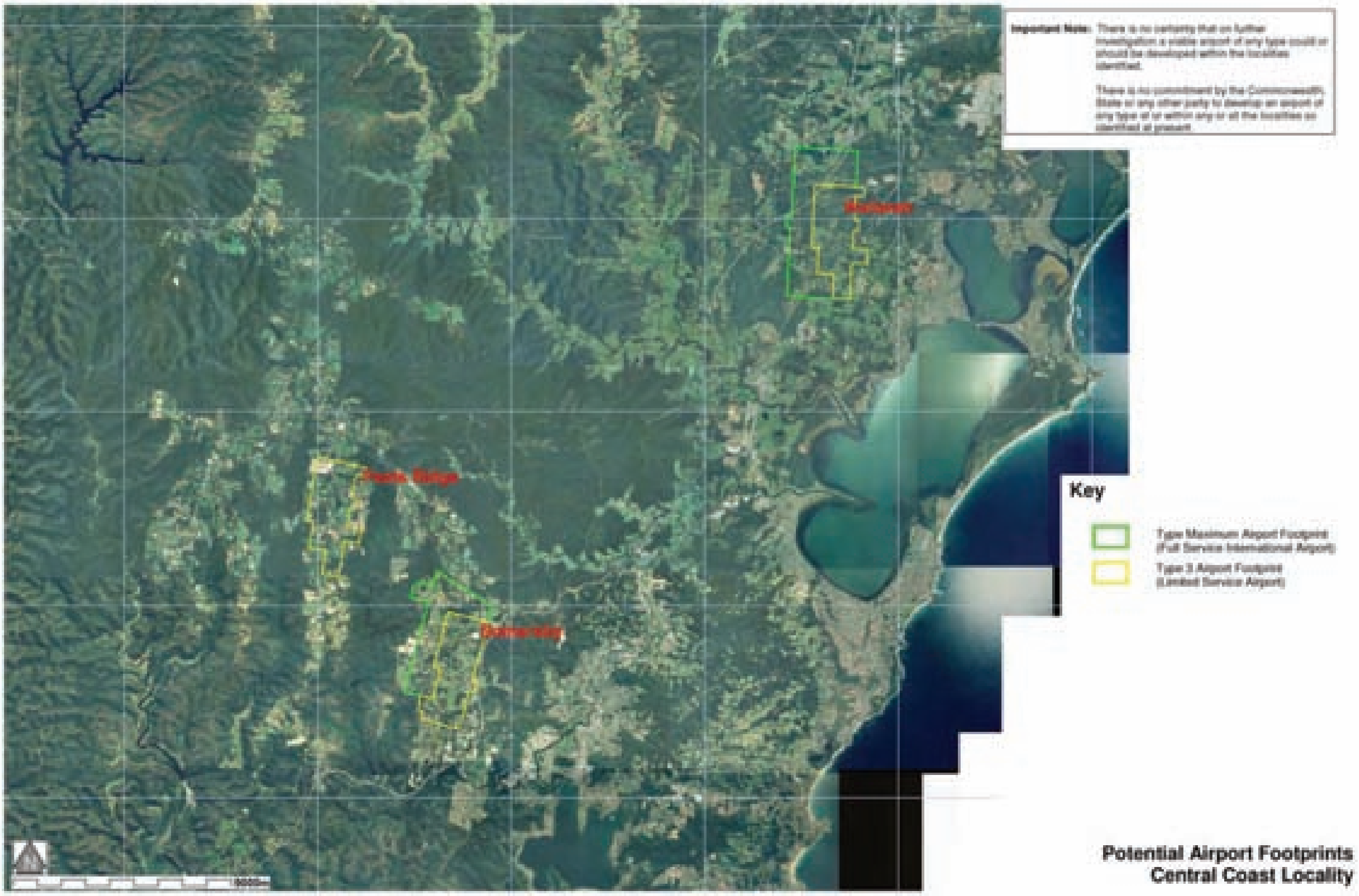


Figure 7-2 Suitable Site Airport Footprints – Hawkesbury Locality

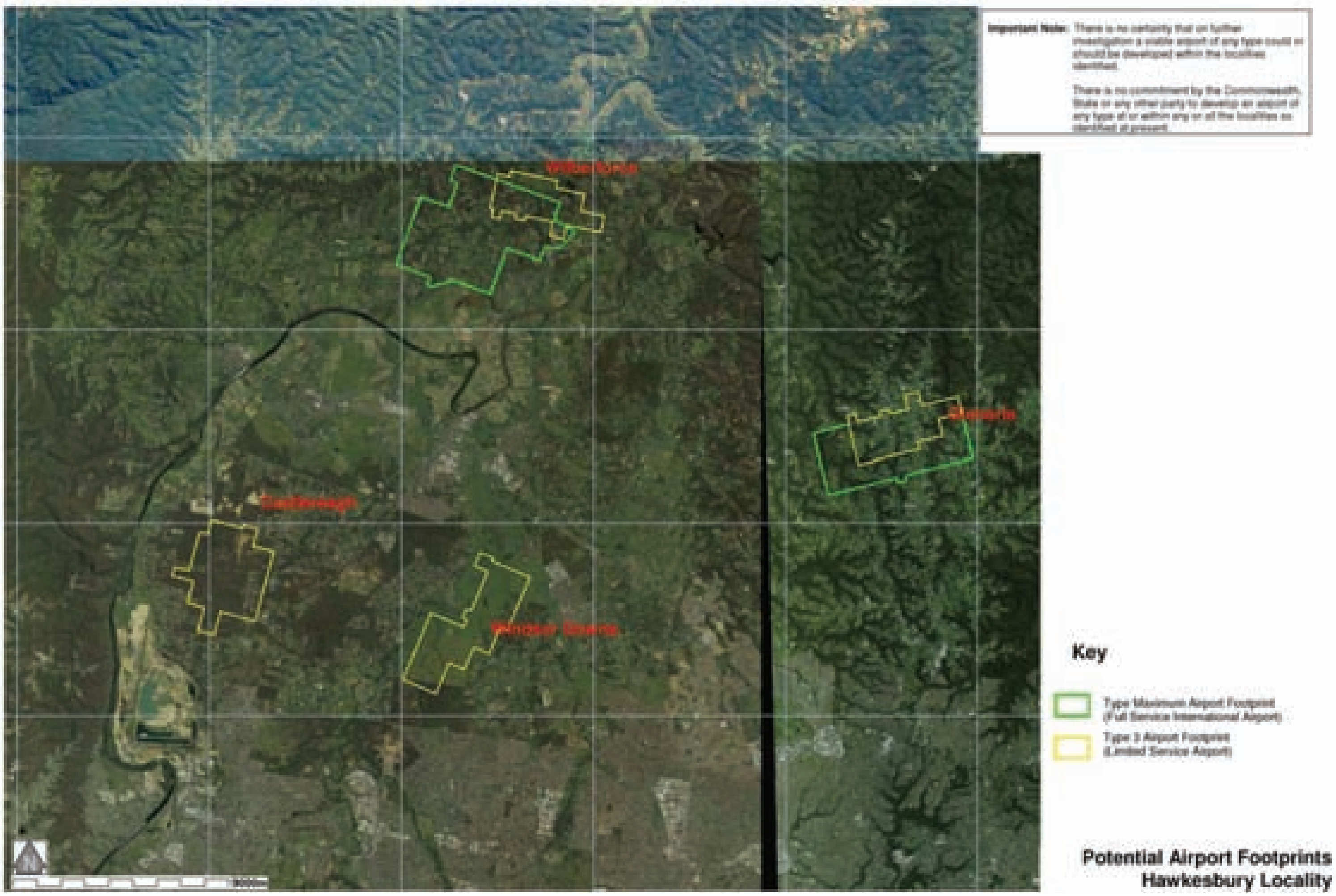


Figure 7-3 Suitable Sites Airport Footprints – Nepean Locality

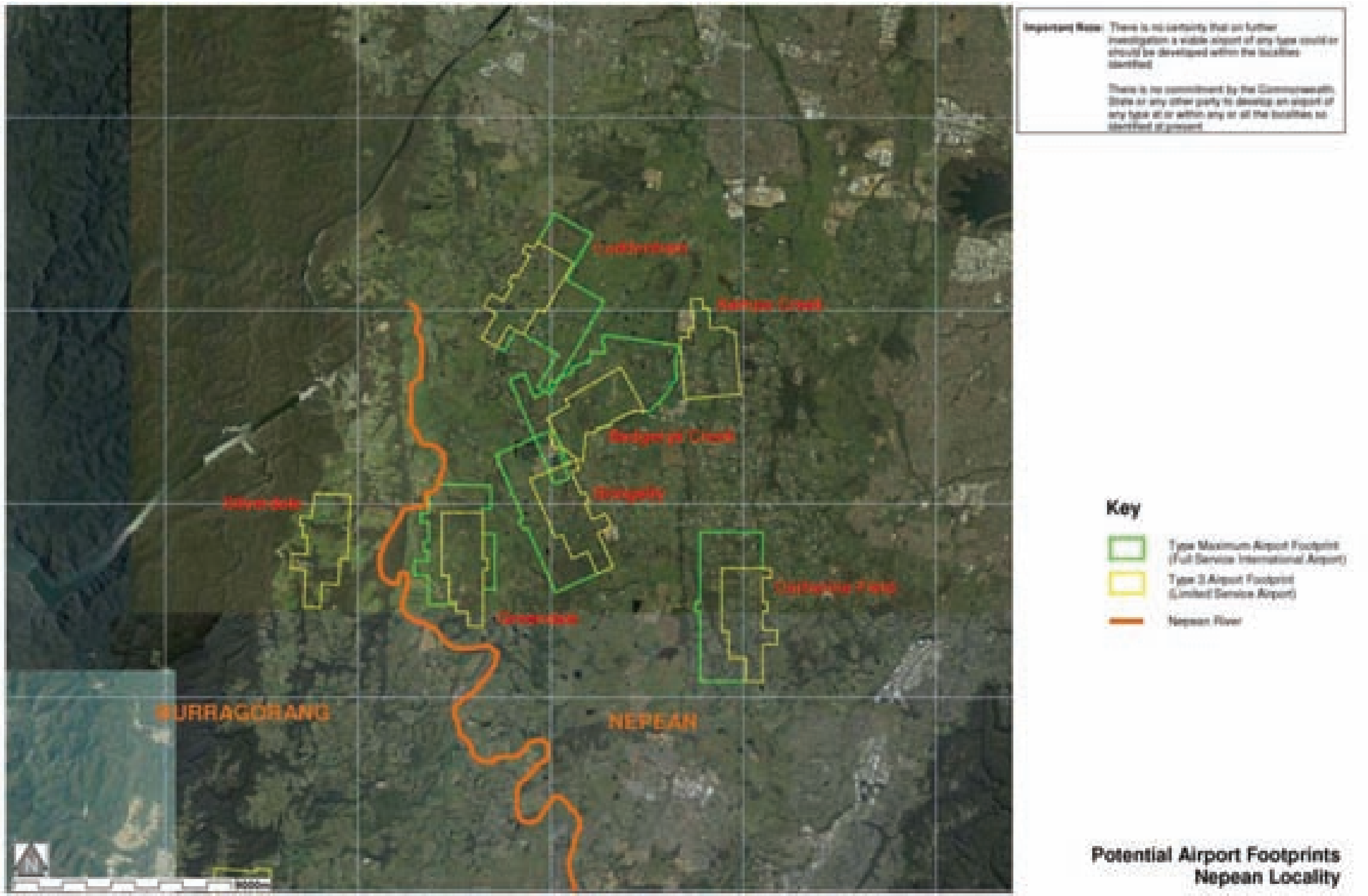


Figure 7-4 Suitable Site Airport Footprints – Burragorang Locality

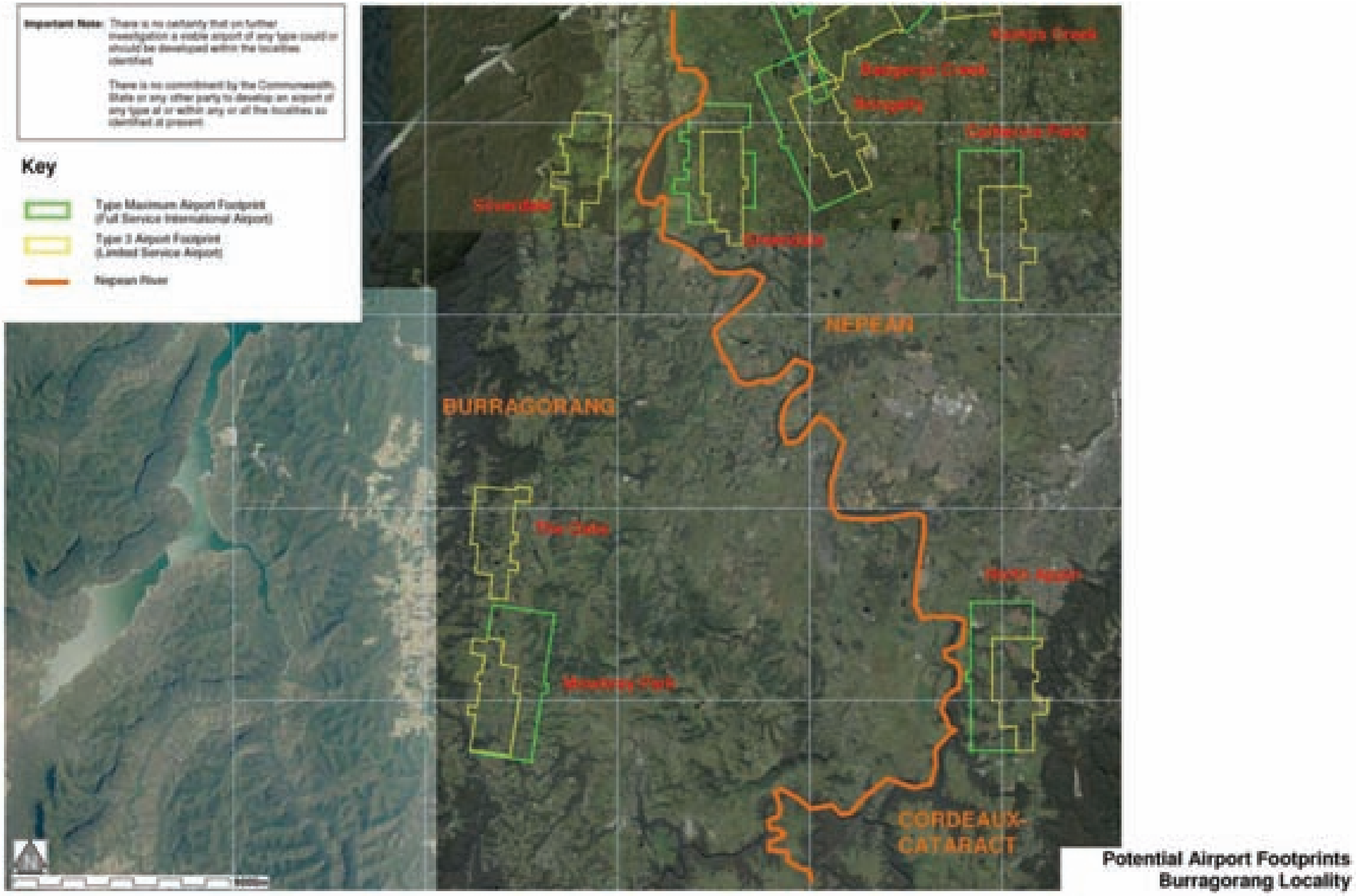
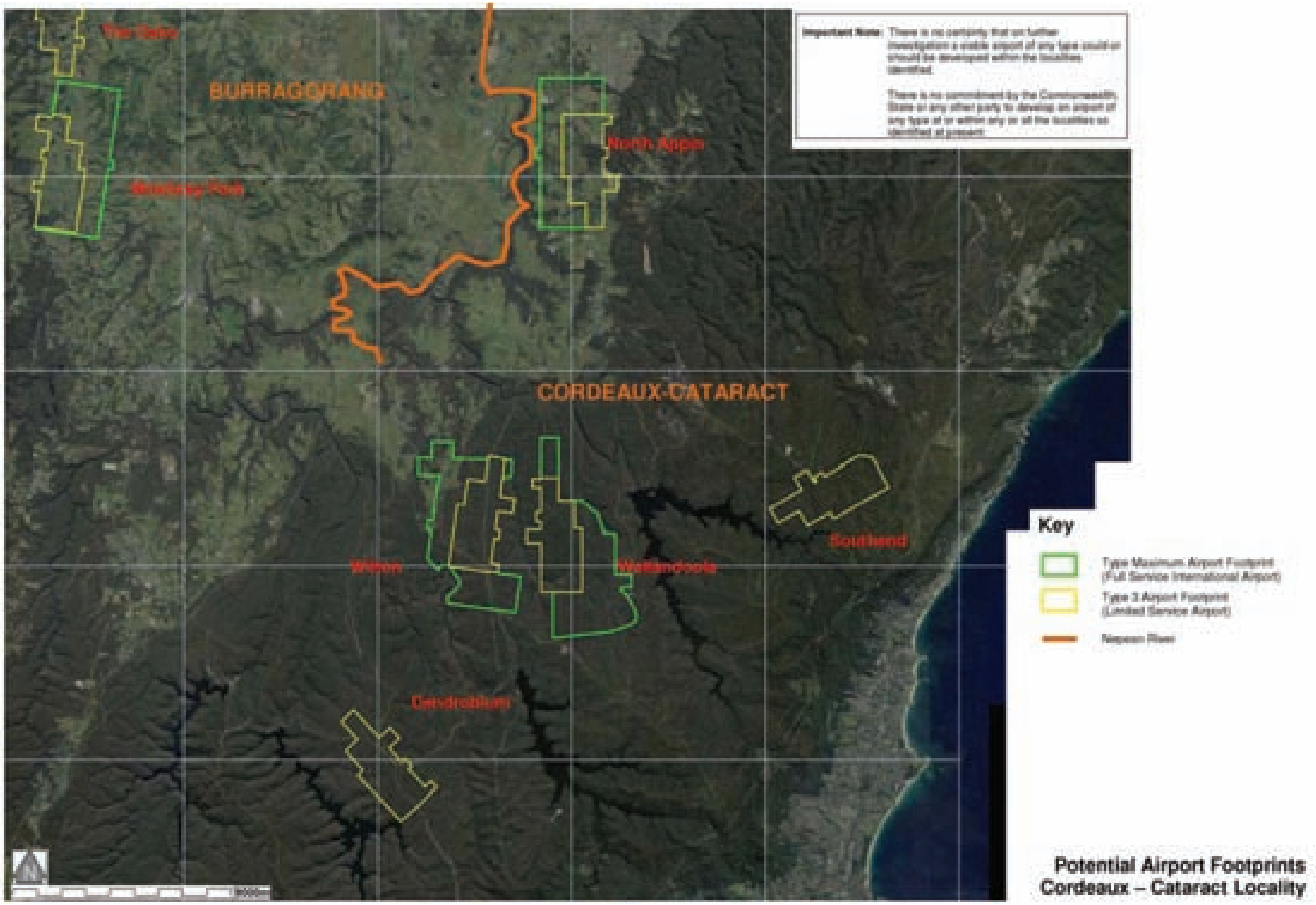


Figure 7-5 Suitable Site Airport Footprints – Cordeaux – Cataract Locality



7.2 Phase Four Criteria

In all instances, the criteria applied preferably need to be measurable, to the extent possible, able to be costed and generally useful to the process of further distinguishing the relative merits of the Suitable Sites identified in the proceeding process. For each Type 3 Airport and Maximum Airport suitable site identified in Phase Three, the following criteria were applied in Phase Four in the form of a data matrix, similar to those used in previous stages of the Greenfields Sites study as noted in Section 1. The matrices record the information listed in Table 7.1.

In view of changing circumstances during the course of this Study, three particular issues were considered to require additional consideration, prior to overall assessment of the suitable sites, in order to determine whether the degree of adverse interaction on any of these following issues criteria was of sufficient magnitude to warrant exclusion of any site from further consideration. These are:

- mine subsidence;
- airspace management issues; and
- Sydney region urban growth centres.

Table 7-1 Type 3 and Maximum Airport Sites Phase Four Criteria – Data Matrices

Criterion Number	Criterion Description
-	**General Site Attributes**
• Geographic Place Name • Local Government Area (LGA) • Local Environmental Plan (LEP) • Site Zoning • Draft LEP (that has been the subject of public consultation under the EP&A Act 1979) • Estimated population within 30km radius of Site centre based on the Census 2006 (rounded to nearest '00) • Estimated population within 15km radius of Site centre based on the Census 2006 (rounded to nearest '00) • Site Footprint • Runway Length and Width • Key Airport Facilities (assumed in Site footprint) • Capacity assuming nil interaction with existing airports and that operations can be managed, albeit with extra track miles and associated economic penalties to operators • Key Transport System(s) within ~5kms of Site • General terrain of Site • Geology • Soil Classification • Major River Systems close to Site	
1	**Accessibility of the Sydney land transport network (rail and state roads)**
• Kilometres to connect Site boundary to existing rail link • Likelihood of a rail link being constructed to or near to the Site, other than an airport specific line • Capacity of the existing rail systems and implications of additional airport traffic requirements for additional capacity • For Maximum Airports only – Rail link Cost • Kilometres to connect Site boundary to existing designated state roads/highways • Specific issues in constructing a road link • Required works • Cost of works	

Criterion Number	Criterion Description
2	**Proximity to urban growth centres and commercial opportunities**
	• Distance from Site boundary to identified commercial growth centres in the NSW Metro and Regional Strategies • Percentage of footprint within North West or South West Growth Centre (Refer also to detailed discussion in Section 7.5) • N70 - 10 Event Contour impact on North West or South West Growth Centre (Refer also to detailed discussion in Section7.5).
3	**Comparative Earthworks Estimates**
	• Comparative cut plus fill earthworks volume to level Site (m^3/ha) • Comparative cost to prepare airport platform
4	**Noise impacts on residents,**
	• Identified as the approximate population within the following noise contour categories based on site specific orientation of the runway: – 20 ANEC – 25 ANEC – 30 ANEC – 35 ANEC – 40 ANEC • Distance (m) from Site boundary to nearest urban areas (as defined by DoPI) • Number of persons exposed to events greater than 70dB (A) (N70). Analysis based on persons exposed to greater than 10 events. • N70 person events (nearest '00) - 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 of 70 dB(A)[45] • AIE (N70/Persons exposed)
5	**Mine subsidence**
	• Designated mine subsidence zone partially present within Site • Percentage of Site within designated mine subsidence zone
6	**Number of lots requiring acquisition**
	• Approximate number of allotments within Site • Average number of allotments per hectare within Site • Population within Site boundary (Census 2006) (rounded to nearest '0)

[45] The PEI allows the total noise load generated by an airport to be computed by calculating the potentially exposed population, 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 day time period and a specified noise level of 70 dB(A).

Criterion Number	Criterion Description
7	**Airspace interaction**
• Refer to detailed discussion in Section 7.3	
8	**Capacity for future expansion to a Maximum Airport**
• For Type 3 airport only - capacity of site for future expansion to Maximum Airport	
9	**Topographic and other risks at the site**
• e.g. Whether the site is identified by the Local Authority as being flood prone or liable to other significant risks	
10	**Additional potential infrastructure dislocations, relocations and other items likely to involve costs**
• Airservices Australia and Defence • Infrastructure affected by airport footprint • Minor airports and airfields in close proximity • Railways • Roads • Water supply • Major electricity supply • Major gas/fuel supply lines • Rivers and estuaries • Social and educational infrastructure	

7.3 Mine Subsidence

As is shown in Figure 5-7, there are two localities in which otherwise more suitable lands and suitable sites potentially interact with designated mine subsidence districts – Central Coast and Cordeaux Cataract. Of these two, suitable sites at Appin for both Type 3 and a Maximum airport lie wholly within the designated mine subsidence district. While, as noted in Section 6.2.3, that it is possible to stabilize lands which are affected by mine subsidence and/or old mine workings, this is very expensive. Accordingly, it was considered that[46] that any site wholly within a designated mine subsidence district be removed from further consideration while sites which are possibly partially affected should continue to be assessed on their merits.

Accordingly, the Type 3 and Maximum sites at North Appin have been not considered further as being '*more suitable'* sites. The Wallarah site is partially affected depending upon whether it is a Type 3 or Maximum Airport as, possibly, are sites at Wilton and Wallandoola

[46] This view was endorsed by the Steering Committee in its meeting of August 2011.

7.4 Airspace Management Issues

7.4.1 Smaller Airports and Airfields

In some localities, the development of a major new airport, whether of Type 3 or Maximum scale, within the Sydney region would impact on existing smaller GA airports and their associated operations. To the north of Sydney, there are small aerodromes or airfields at Warnervale, Somersby and Mangrove Mountain primarily catering to light general aviation (GA) traffic. To the south-west of Sydney, Bankstown and Camden are the primary GA airports for the Sydney region. Significant areas of airspace adjacent to these airports are classified for flying training, which is a major component of these airports' businesses. Aircraft lanes of entry (e.g. to Bankstown airport) are also of significant concern. To the south of Sydney, there are small aerodromes or airfields at The Oaks, Wedderburn and Wilton - also catering primarily catering to light GA traffic. Depending on any decisions taken for the establishment of a major new airport in the Sydney region, there may be a need to consider replacement GA airport facilities depending on the extent of impacts on the particular existing facility and associated flying training areas.

7.4.2 Major Sydney Region Airspace Issues

Given that airspace is such a key consideration in the assessment of suitable sites for aviation infrastructure, ASA and CASA were consulted in order to obtain the most authoritative view on issues related to the interaction of the identified suitable airport site and the management the Sydney region airspace.[47] It is understood the Department has briefed Department of Defence representatives separately in order to similarly seek the Department of Defence's views on locality feasibility. Such views are important because some sites in this assessment would require the relocation of RAAF Base Richmond so its operations can continue.

7.4.2.1 Initial assessment of Locations by ASA

An initial high level airspace analysis was undertaken by ASA[48] which related more to localities than to all of the specific sites now identified for Type 3 and Maximum Airports. ASA's analysis provided some generalised indications of, and guidance on, the issues in relation to maintaining full capacity at Sydney Airport and at any new airport in that locality. These were that:

- based on existing airspace management practices, capacity compatibility was likely to be worst for airport sites in the Central Coast and Hawkesbury location; best in the Cordeaux – Cataract and Burragorang localities and average for the Nepean locality;
- sites, in some localities, if adopted, may require changes to Sydney Airport's Long Term Operating Plan (LTOP); and
- sites, in some localities, if adopted appeared more likely to require flight path noise abatement procedures than others.

[47] At a meeting on 18 May 2011, the Department briefed CASA and ASA representatives on the specified localities
[48] ASA provided a Location Analysis on 27 May 2011 in response to the above briefing.

7.4.2.2 Analysis of Suitable Sites by ASA

Subsequent to this initial assessment, ASA was then provided with each identified site's airspace assessment report (as included in **Appendix 2**) and site plans (as included in **Appendices 3 and 4** respectively) in order to obtain specific comment on all identified suitable sites. ASA provided an updated analysis wherein each of the Type 3 and Maximum sites was considered.[49]

Reconfirming the initial report, ASA again advised that their view was that the locations and sites within them became generally less constrained by airspace and route structures from north to south across the Sydney region. The primary influences on these constraints are stated as being:

> *'1. Military Restricted Airspace – predominantly the areas associated with Williamtown RAAF operations driving a coincident compression of available airspace to accommodate civil route structures, and*
>
> *2. The current circuit structures servicing the various Sydney Airport Runway Modes of Operation.'*

Table 7-2 is drawn and interpreted from the ASA report and summarizes the airport viability in relation to Sydney airport continuing to operate at its maximum permitted 80 movements per hour, taking account of both the ongoing operation of other Sydney region and RAAF Base Williamtown airports and the circuit movements of aircraft in the Sydney region.

The estimated capacities noted in Table 7.2 are based on recognising the constraints imposed by:

- '*suitable sites'* having been identified as described previously in this report;
- Current aviation rules, regulations and procedures;
- Current airspace, aerodrome and air-route structures, including the current usage of these;
- Current volume and usage of designated Restricted Airspace;
- Where noted *'maximum not possible'* this is the result of site limitations, not specifically airspace management issues.

The capacities are necessary expressed as being a range and are therefore indicative only and intended to highlight the differences that exist between the various sites, taking account of the operation of Sydney and other airports in the region.

Abbreviations specific to the ASA report and which are used in Table 7.2 are as follows:

- CTR — Control Zone – Class C airspace in the immediate vicinity of a primary airport
- FT — Feet
- H(xx) — High (jet aircraft) Air-route name
- IAF — Initial Approach Fix – the position and altitude at which an instrument approach is commenced
- LSALT — Lowest Safe Altitude
- NM — Nautical Miles

[49] '*Report on Initial Location Analysis*' Airservices Australia 11 August 2011 and updated 17 February 2012

- PRM Precision Runway Monitor – high definition radar which facilitates independent approaches to parallel runways in instrument conditions
- R(xxx) Restricted area serial number
- SFC Surface (Ground Level)
- TMA Terminal Area – airspace block associated with a primary aerodrome.
- VCA Violation of Controlled Airspace
- W(xxx) Low (propeller aircraft) Air-route name
- R536 Restricted Area = RAAF Orchard Hills (Explosives Demolition)
- R555 Restricted Area = Holsworthy Firing
- D552 Restricted Area = Camden Flying Training
- D556 Restricted Area = Bankstown Flying Training

Table 7-2 Airspace Management Assessment of Suitable Sites

Suitable Site Name; Runway Orientations; Airport Viability; Enabling Actions; Airport capacity
Central Coast
Wallarah 17/35 • Increased and guaranteed access to surrounding RAAF/RAN restricted areas at lower altitudes (North, East and West); • Total review and realignment of interconnecting airway network; • Sydney RWY 16PRM and IMC operations constrained to facilitate integration, affecting capacity; • Realigning proposal to NW/SE runways may resolve integration with Sydney, but does not alleviate the need to access Military restricted areas; • Western side of CTR design may need to be modified to provide suitable uncontrolled VFR transit access; • Maximum Airport ~80-100 movements per hour; • Type 3 ~40-50 movements per hour.
Peats Ridge 18/36 • See above comments; • Would need to operate sympathetically with Sydney runway selection, regardless of prevailing weather; • fully interdependent with Sydney Airport; • Maximum not possible; • Type 3 ~40-50 movements per hour.
Somersby 18/36 & 09/27 • See above comments; • Would need to operate sympathetically with Sydney runway selection, regardless of prevailing weather; • RWY 16 PRM operations would likely need to cease, or departures at Somersby would be classed as dependent on Sydney; • fully interdependent with Sydney Airport; • Maximum Airport ~80-100 movements per hour; • Type 3 ~40-50 movements per hour.
Hawkesbury
Wilberforce 01/19 & 10/28 • Operations on cross runway dependent with Sydney 16 arrivals; • Capacity constrained to west and north of airport due interaction with Sydney circuits; • Single runway (type 3) with 01/19 alignment more feasible as a less constrained operation; • Maximum Airport ~60-70 movements per hour; • Type 3 40-50 movements per hour.
Wilberforce (Type 3) 09/27 • Alignment 01/19 less constrained; • Maximum not possible (with this runway alignment); • Type 3 40-50 movements per hour.

Suitable Site Name; Runway Orientations; Airport Viability; Enabling Actions; Airport capacity

Glenorie 06/24

- The overlaps with Sydney runways make this an unviable selection;
- Sydney northern lanes of entry would require major re-alignment over the vicinity of existing Richmond aerodrome and towards more mountainous terrain. There would be no direct access for such operations across the northern Sydney coastal areas;
- Not viable.

Castlereagh 18/36

- D556B no longer viable;
- Western lanes of entry directed further south over water catchments and mountainous terrain;
- Northern lanes of entry would be lower and may infringe CAR 157 requirements;
- Sydney western arrival and Castlereagh eastern arrival circuits would require RNAV tracking conformance to enable separation assurance and integration;
- R536 needs to close, due interference with approach/departure paths;
- Maximum not possible;
- Type 3 40-50 movements per hour.

Windsor Downs 01/19

- As per Castlereagh, except northern lane of entry would become virtually unflyable by fixed wing aircraft, and collision risk with opposite direction considerations. No apparent alternative;
- Circuit limited to west to enable integration with Sydney operation;
- Maximum not possible;
- Type 3 40-50 movements per hour.

Nepean

Luddenham 01/19

- R536 needs to close, due interference with approach/departure paths;
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney;
- Camden/Bankstown training areas closed;
- Limited IFR operations at Bankstown;
- Wilton Parachute Jumping Exercise (PJE) to cease;
- Western VFR lanes via Richmond airspace (terrain limitations);
- Maximum Airport ~60-70 movements per hour;
- Type 3 40-50 movements per hour.

Kemps Creek (Type 3) 16/34

- No IFR operations at Camden or Bankstown;
- Training areas closed;
- Crossing runway operations at Sydney highly questionable;
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney;

Suitable Site Name; Runway Orientations; Airport Viability; Enabling Actions; Airport capacity

- R536 needs to close, due interference with approach/departure paths;
- R555 limited to below 1500 feet;
- Northern lane of entry and access to/from Bankstown renders it virtually unusable except for circuit training;
- Wilton PJE to cease;
- Maximum not possible;
- Type 3 ~40-50 movements per hour.

Badgerys Creek 05/23 & 14/32

- Comments from EIS remain valid and aerodrome is further constrained by Sydney parallel operations, LTOP and PRM rendering the NE/SW alignment unsuitable for integration;
- Luddenham is a better choice;
- All previous comments are equally applicable; Camden also would need to close;
- Maximum Airport ~60-70 movements per hour;
- Type 3 ~40-50 movements per hour.

Catherine Field 17/35

- R536 needs to close, due interference with approach/departure paths;
- Close Camden;
- No IFR at Bankstown;
- Close VFR training areas;
- Wilton PJE to cease;
- Close R555;
- Maximum Airport ~60-70 movements per hour;
- Type 3 ~40-50 movements per hour.

Bringelly 15/33

- Close Camden;
- No IFR at Bankstown;
- R536 needs to close, due interference with approach/departure paths;
- R555 limited to below 1500 feet;
- Western transit lanes via Richmond airspace;
- Closure of VFR training areas;
- Wilton PJE to cease;
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney;
- Maximum Airport ~60-70 movements per hour;
- Type 3 ~40-50 movements per hour.

Greendale 17/35

- All previous comments applicable;
- Maximum Airport ~60-70 movements per hour;

Suitable Site Name; Runway Orientations; Airport Viability; Enabling Actions; Airport capacity
• Type 3 ~40-50 movements per hour.
Burragorang
Mowbray Park 18/36 • Close The Oaks; • VFR only circuits at Camden; • Close southern VFR training areas; • Wilton PJE not viable; • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney; • Transit lane between CTR and R555 probably compromised by terrain, and may be unsuitable (airspace design); • Maximum Airport ~60-70 movements per hour; • Type ~3 40-50 movements per hour.
The Oaks 17/35 • Close Camden and The Oaks; • Close VFR training areas; • Wilton PJE not viable; • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney; • Maximum not possible; • Type 3 40-50 movements per hour.
Silverdale 17/35 • Close Camden and The Oaks; • No IFR at Bankstown; • Close VFR training areas; • R536 limits circuit and departure options, and should be considered for relocation; • Wilton PJE not viable; • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney; • Maximum not possible; • Type 3 40-50 movements per hour.
Cordeaux- Cataract
Wilton 18/36 & 08/26 • Rotation of RWY alignment more NW/SE would better accommodate competing circuit interaction and departures management. Dependent on weather data such alignment may negate need for a cross runway; • R555 operations limited or negated; • Camden VFR only; • VFR training areas compromised by CTA steps; • Southern lane of entry ex Bankstown would need to traverse existing R555 to the coast. Terrain may limit useability, but with greater lateral options than Wallandoola;

Suitable Site Name; Runway Orientations; Airport Viability; Enabling Actions; Airport capacity
• Close existing Wilton PJE; • Maximum Airport ~80-100 movements per hour; • Type 3 ~40-50 movements per hour.
Southend 05/23 Type 3) • Operations constrained by Sydney 16/34 operations; • Wilton PJE not viable; • Camden VFR circuits only; • Modify D552; • Close R555C/D; • Maximum Airport not possible; • Type 3 ~40-50 movements per hour.
Dendrobium 12/30 (Type 3) • Wilton PJE not viable; • Modify D552; • Wollongong IAL interdependent (partial CTA operations created by new CTA steps). Management plan required; • Maximum Airport not possible; • Type 3 ~40-50 movements per hour.
North Appin 17/35 • Rotate RWY alignment more NW/SE to better accommodate competing circuit interaction and departures management with Sydney; • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney; • Close Camden and Wilton; • Close R555; • Redesign VFR access lanes through Sydney western CTR (avoiding Lucas Heights); • Maximum Airport ~80-100 movements per hour; • Type 3 ~40-50 movements per hour.
Wallandoola 17/35 & 07/25 • Rotate RWY alignment more NW/SE to better accommodate competing circuit interaction and departures management with Sydney. Dependent on weather data such alignment may negate need for cross runway; • R555 operations limited; • Cross runway operations conflict with Sydney 16 departures, creating dependency; • No IFR at Camden; • Camden VFR training areas require reduction; • Maximum Airport ~80-100 movements per hour; • Type 3 ~40-50 movements per hour.

From this, and without further and more intensive airspace management analysis, it may be broadly inferred that:

- In general, the more constrained airport sites could be expected to perform at the lower end of the capacity range indicated while those that are less constrained could be expected to operate at the upper end of the range;
- of the Central Coast *'suitable sites'*, Wallarah is less constrained operationally and accordingly more suitable in terms of airspace than either Peats Ridge or Somersby. Both the latter would suffer in operational capacity terms from having to be fully integrated with Sydney Airport;
- of the Hawkesbury '*suitable sites'*, Glenorie is unviable operationally and accordingly not suitable and Windsor Downs is unviable in terms of operations to/from the north; without redesign of the Sydney TMA Airspace and/or redesign of the runway orientations as adopted, the other sites are operationally constrained, whether as Type 3 or Maximum Airports;
- of the Nepean '*suitable sites'*, without redesign of the Sydney TMA Airspace and/or redesign of the runway orientations as adopted, all sites are operationally constrained, whether as Type 3 or Maximum airports;
- the Burragorang '*suitable sites'* are similarly constrained as are the Nepean sites; and
- other than Southend, the Cordeaux – Cataract '*suitable sites'* are the least operationally constrained in the current airspace situation.

The analysis also provides a check list of actions that would be required and impacts that would result in the event of these suitable sites becoming an actual airport site.

7.4.2.3 Additional Advice by ASA regarding operation modes

ASA has assessed potential runway operating modes for all suitable sites and estimated runway capacity as follows:

- Single runway operation (all landings and take-offs from the same runway), giving a total of 40 to 50 movements per hour;
- Wide spaced parallel runways operated in segregated mode (one runway used exclusively for departing aircraft and the other runway used exclusively for arriving aircraft), giving a total of 60 to 70 movements; and
- Wide spaced parallel runways operated in mixed mode (arriving and departing aircraft using both runways) giving a total of 80 to 100 movements per hour.

ASA have advised that these figures need to be considered cautiously until detailed traffic modelling is conducted and variance on these figures would be likely consequent on factors such as traffic mix and weather.

The determining factor as to whether a particular site might be able to operate in mixed mode (or one of the lesser modes) is the extent to which the required airspace would overlap with KSA operations. Accordingly, when nominating arrival runways for segregated mode of operation at the sites, ASA chose the westernmost runway as being for arrival movements because this uncouples the circuit interference at Sydney Airport. However, as it is a TMA solution only, this may not necessarily provide the best overall fit when integrating with the overall airway structure. Further, ASA advise that to manage the additional traffic, both at Sydney Airport and emanating from of these sites, ongoing and expanded use of the military restricted areas to the north west of Sydney/Richmond will be necessary. In terms of traffic throughput, that should be commensurate with the mode of operation.

The results of this additional analysis are presented in Table 7-3.

Table 7-3 Site Operation Comments on Mode Usage

Runway in Use	Mode			ASA Comment
	Segregated	Semi Mixed	Mixed	
	~60 mvts /hr	~70-80 mvts /hr	~90 – 100+ mvts/hr	
Wilberforce 01/19				
01	01 L Arrival 01 R Departure	01 L Arrival 01 L & R Departure	n/a	Mixed mode needs quantitative analysis
19	19 R Arrival 19 L Departure	19 R Arrival 19 L & R Departure	n/a	Mixed mode needs quantitative analysis
Luddenham 01/19				
01	01 L Arrival 01 R Departure	01 L Arrival 01 L & R Departure	01 L & R Arrival 01 L & R Departure	Mixed mode needs quantitative analysis, precise design for eastern circuit due KSA. Shift of alignment further west would assist.
19	19 R Arrival 19 Departure	19 R Arrival 19 L & R Departure	n/a	Mixed mode difficult to assess due proximal inter-relationship with western KSA circuits. Shift of alignment further west would assist. Less confidence with the 19 direction than the 01 flow.
Badgerys Creek 05/23				
05	05 L Arrival 05 R Departure	05 L Arrival 05 L & R Departure	n/a	Mixed mode using any eastern circuit for arrivals (05R or 23L) is very difficult due proximal inter-relationship with western KSA circuit. The 23R arrival circuit may suffer limitations during IMC operations. Re-alignment to west (at least an 18/36 type) would be a better combination.
23	23 R Arrival 23 L Departure	23 R Arrival 23 L & R Departure	n/a	
Greendale 17/35				
17	17 R Arrival 17 L Departure	17 R Arrival 17 L & R Departure	17 L & R Arrival 17 L & R Departure	Of the preceding sites, Greendale offers probably the best availability of mixed mode operations, provided precise navigation is afforded the eastern circuit at Greendale and western circuit at KSA. Additionally, in segregated mode consideration might be given to swapping the arrival/departure combination (aka Heathrow Airport) for noise amelioration, provided it was sympathetic to the operating mode at KSA. It may also be able to operate in a direction opposite to that at Sydney, but this would require modelling to determine.
35	35 L Arrival 35 R Departure	35 L Arrival 35 L & R Departure	35 L & R Arrival 35 L & R Departure	
Wilton 18/36				
18	18 R Arrival 18 L Departure	18 R Arrival 18 L & R Departure	18 L & R Arrival 18 L & R Departure	As per Greendale comments - an alignment further west would also assist de-coupling interdependence with Sydney.
36	36 L Arrival 36 R Departure	36 L Arrival 36 L & R Departure	36 L & R Arrival 36 L & R Departure	

Source: Advice from ASA per Department of Infrastructure and Transport

This further analysis serves to indicate that an increase the movement capacity of Maximum suitable sites in the Hawkesbury, Nepean and Burragorang localities is potentially available consequent on detailed airspace and airways planning and design. In Table 7-2, ASA also lists enabling actions which, in many cases, have significant implied impacts (e.g. affecting military operations at Holsworthy, affecting aircraft lane of entries, operations at other airports such as Camden and Bankstown and flying training areas and the like).

In summary, the Glenorie Suitable Site for both a Type 3 and Maximum airport is considered unviable and should not be considered further for the purpose of identifying *'more suitable'* sites. All other '*suitable sites'* are considered able to be operated, albeit not necessarily to the level of 100-120 movements per hour in the case of unconstrained Maximum sites and, in the case Type 3 sites, not to an unconstrained 50-60 movements. In the case of some '*suitable'* sites – for example, Badgerys Creek - better outcomes in terms of airspace management and capacity may be achieved by reorienting the runways from the directions shown in concepts.

7.5 Sydney Region Urban Growth Centres

As noted in Section 4.2, only land uses which met the NSW Department of Planning's 'urban' category or land which was designated at the highest level for environment protection reasons were to be considered as being exclusionary, at the outset, for the purposes of finding suitable sites for airports. All other lands were required[50] to be considered as potentially convertible to airport use.

As may be seen from Figure 7-6 two major areas have been designated to accommodate outer metropolitan urban development of Sydney – the North West Growth Centre and the South West Growth Centre. The process of converting and developing lands for urban purposes within these Growth Centres is proceeding on a staged basis, with the status as at July 2011 being shown.

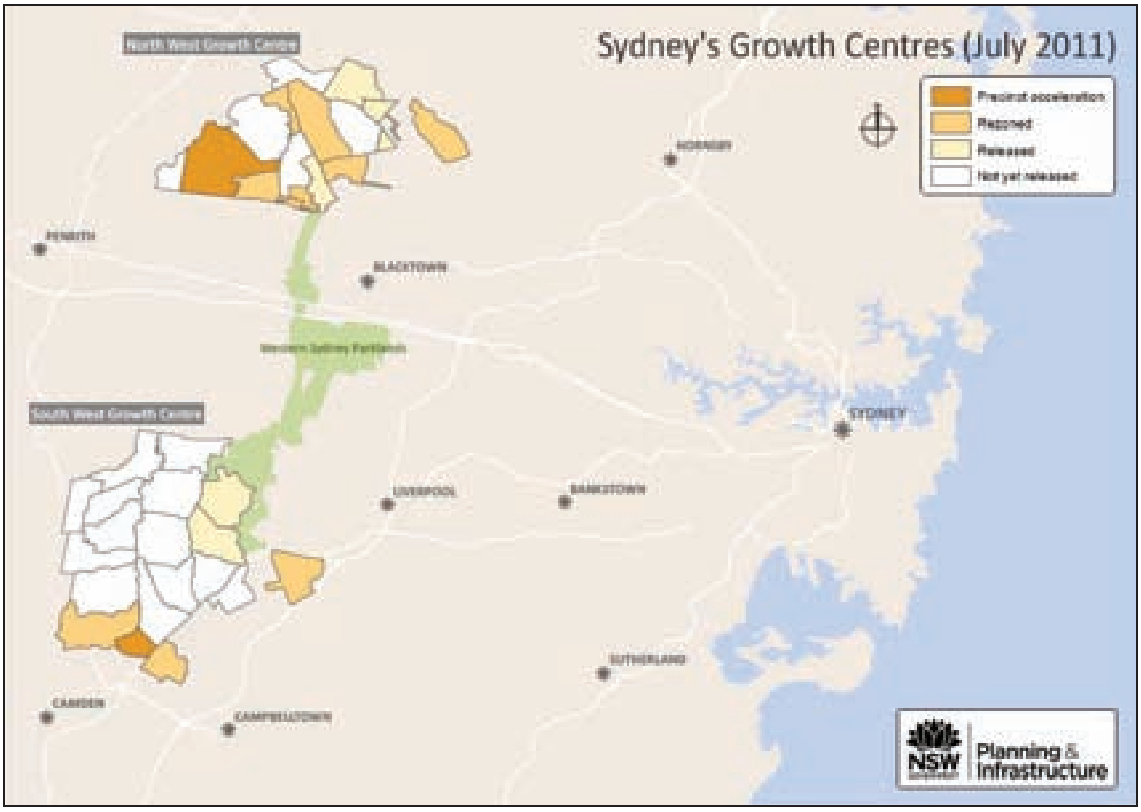
It is evident that, on the assumption that development of these Centres proceeds unaltered, they have the potential to significantly affect the siting of airports by virtue of interactions such as:

- direct impact of the airport footprint of Growth Centres lands; and
- indirect impact of aircraft operations over Growth Centres lands.

While some future uses of Growth Centres lands may be compatible with both forms of effect that an airport may create, quite clearly some land uses will be incompatible.

[50] As instructed by the Department following consultation with the Steering Committee

Figure 7-6 Sydney's Growth Centres (July 2011)



Source: NSW Planning and Infrastructure

Given recent actions by the NSW Government to accelerate development of precincts at Catherine Field in the South West Growth Centre and at Marsden Park in the North West Growth Centre[51], it has been considered appropriate to now include such potential interactions in the assessment of suitable sites. This is done in the figures which follow and as further documented in the evaluation data matrices.

At Catherine Field, it is reported that *'there is land for 300 dwellings as well as industrial, commercial and retail space'* while at Marsden Park '*there is space for a potential 10,000 homes, a town centre and public recreational space'.*[52]

Figure 7-7 shows the relationship of Type 3 Airport sites identified in Phase Three to the Growth Centres indicating:

- the airport footprint; and
- the N70 contours for 10, 20, 50,100 and 200 event conditions.

Figure 7-8 shows a detailed view of the N70 10 event contour in relation to the Growth Centres.

[51] As reported in the Australian Financial Review on 13 July 2011.
[52] Ibid.

Figure 7-9 and Figure 7-10 show the same respectively in regard to Maximum Airport sites.

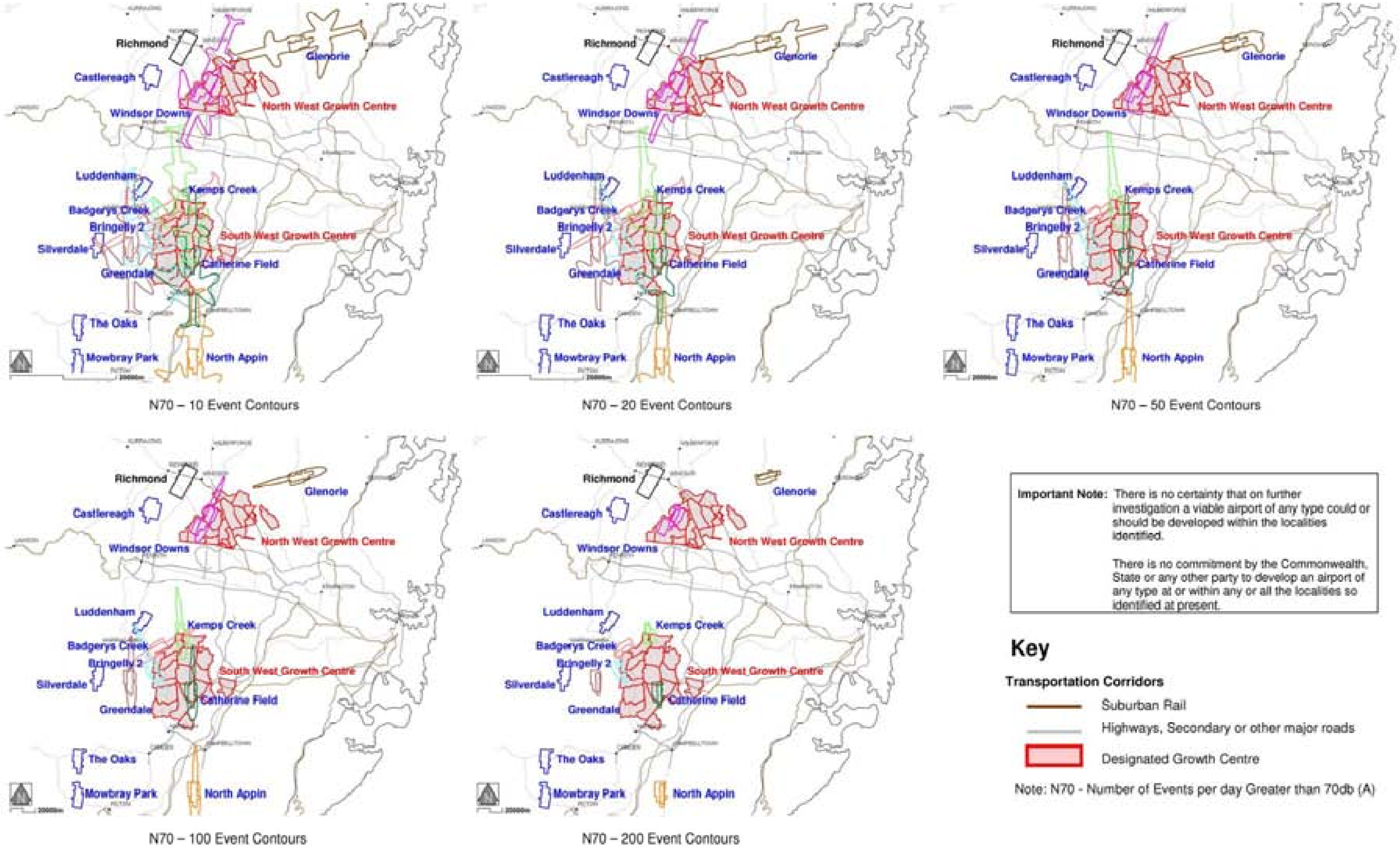
As is further documented in the data matrices:

- the footprint of a Type 3 Airport site at Windsor Downs is wholly within the North West Growth Centre lands and both the Type 3 and Maximum sites at Catherine Field are wholly within the South West Growth Centre lands; while the Type 3 site at Kemps Creek, and both the Type 3 and Maximum sites at Bringelly are partially or wholly within Growth Centre lands; and
- the N70(10) contour of Type 3 Airport sites overlaps the Growth Centres land for sites at Glenorie, Windsor Downs, Kemps Creek, Catherine Field, Badgerys Creek, Bringelly and North Appin as does the N70(10) contour on Maximum Airport sites at Glenorie, Windsor Downs, Kemps Creek, Catherine Field, Badgerys Creek, Bringelly and North Appin.

In view of the that fact that the recent land releases are close to or possibly include part of the possible airport sites at Windsor Downs and Catherine Field and as these sites are, in any event, wholly within the already designated Growth Centres and therefore are intended to become lands which will comply with the Department of Planning's 'urban' category, it was considered that these sites should be removed from further consideration for being '*more suitable'* sites.[53] Other sites which have an interaction with the Growth Centre lands should continue to be assessed on their merits, taking into account that the lands uses within the Growth Centres that are affected, either directly or indirectly, may be planned for land uses that are compatible with an airport.

[53] This view was endorsed by the Steering Committee in its meeting of August 2011.

Figure 7-7 **Relationship of Type 3 Airport sites to North West and South West Growth Centres**



Airport Type 3 – Limited Service Airport
N70 – Acoustic Footprints

Figure 7-8 Detailed view of Type 3 Airport N70 contours

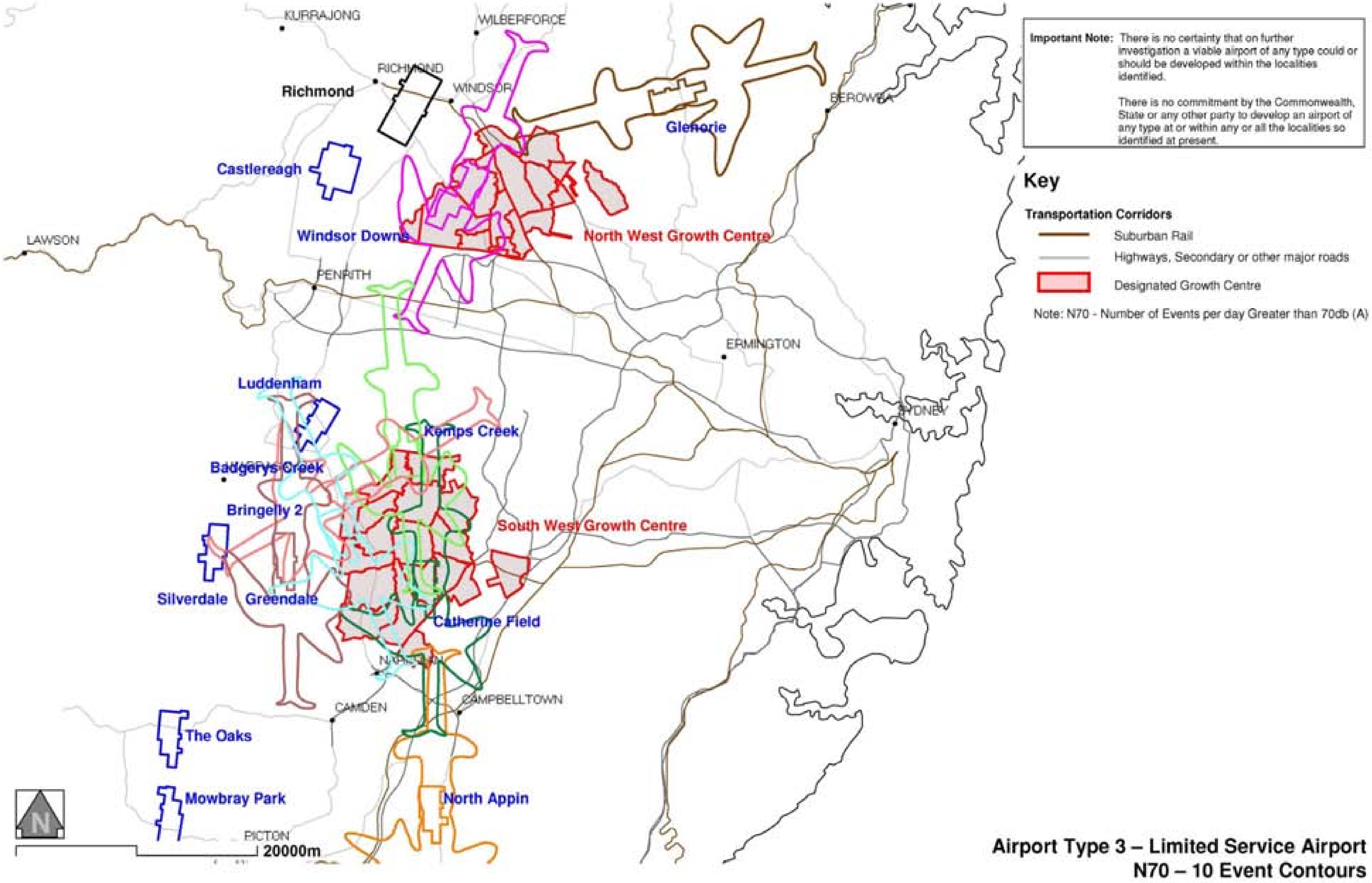
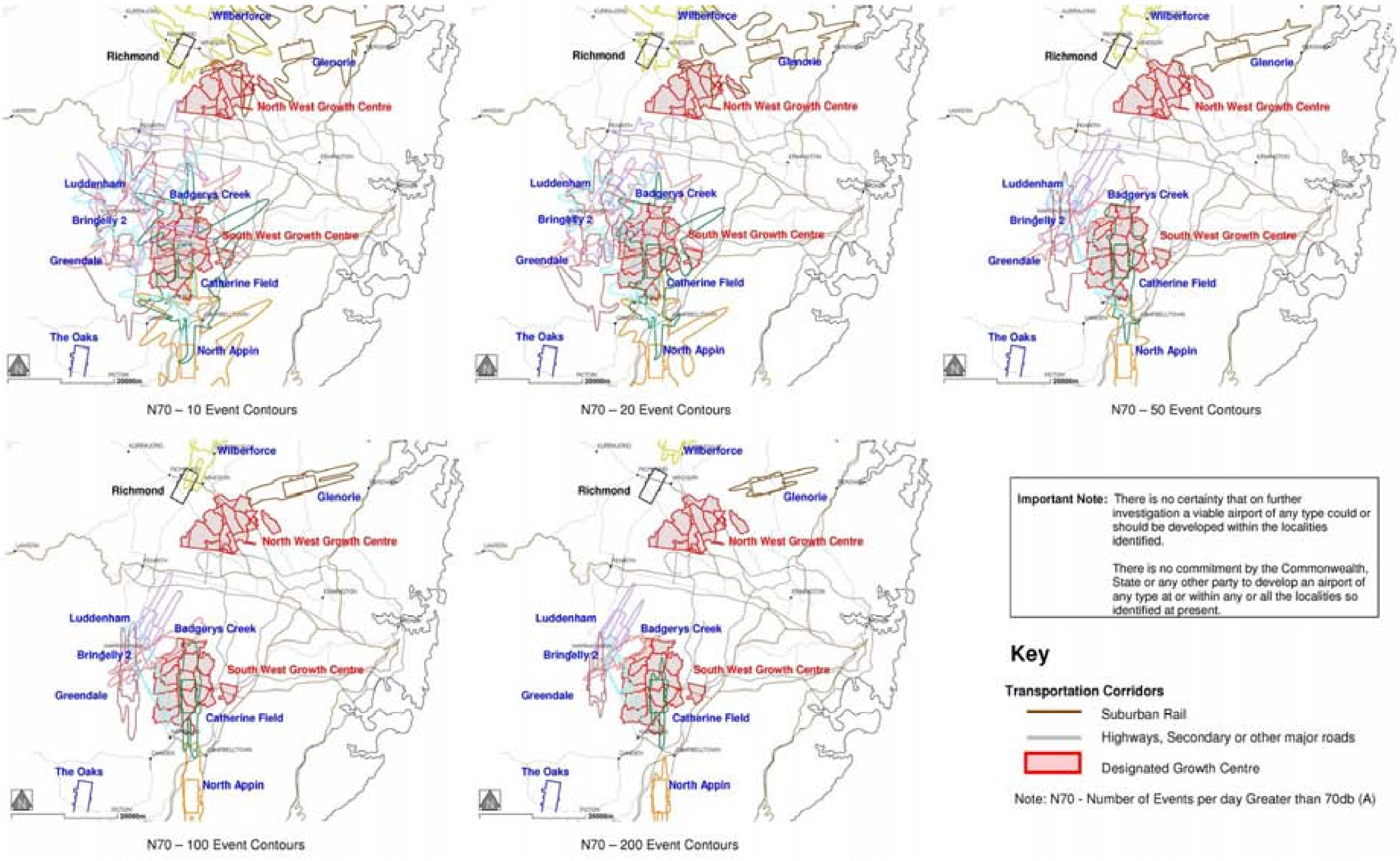
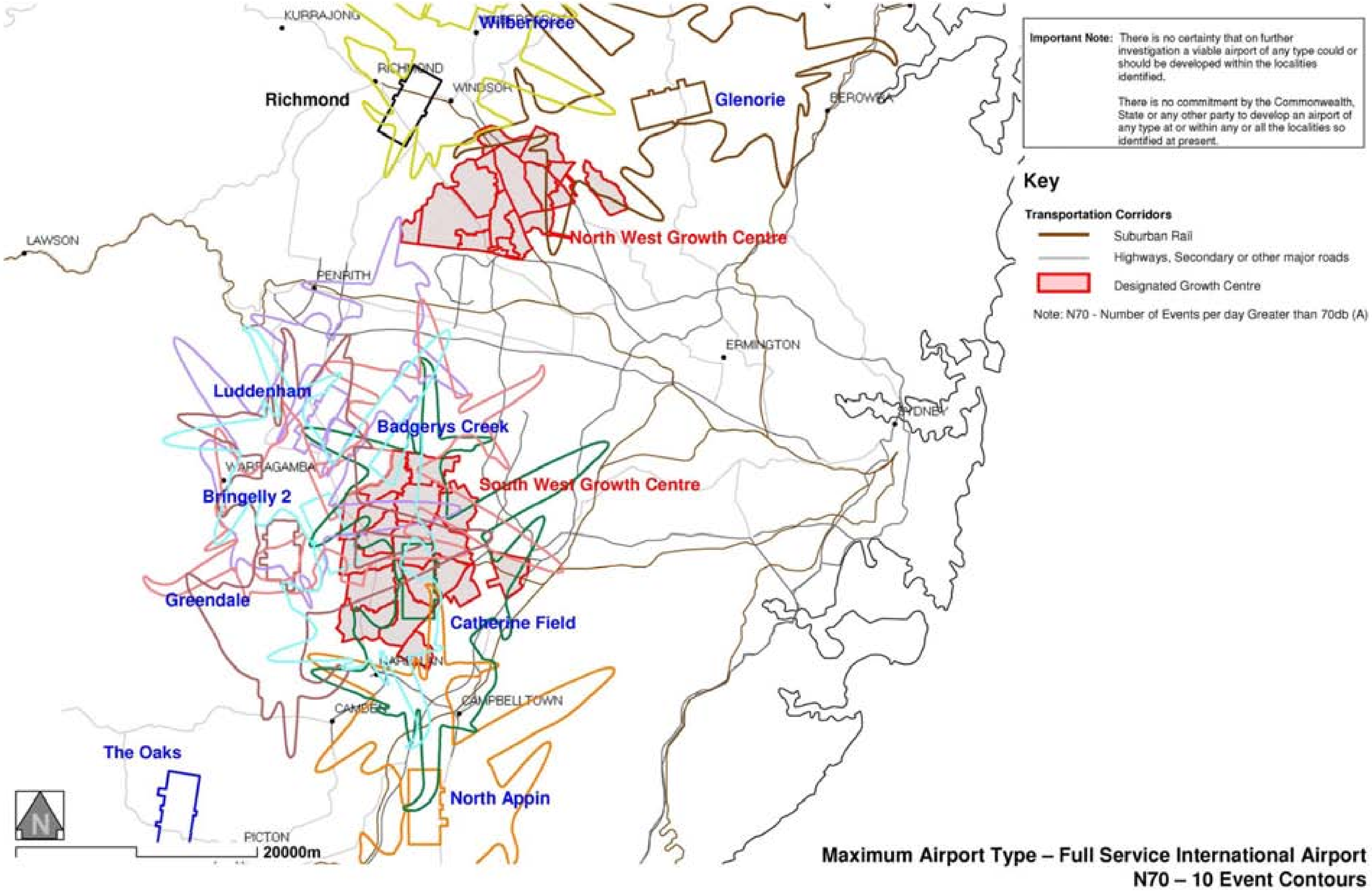


Figure 7-9 **Relationship of Maximum Airport sites to North West and South West Growth Centres (footprint and N70 contours)**



Maximum Airport Type – Full Service International Airport
N70 – Acoustic Footprints

Figure 7-10 **Detailed view of Maximum Airport N70 contours**



7.6 Culled Airport Sites

As a result of these preceding assessments, the following sites can be culled from further consideration as *'more suitable'* sites for airports:

- Type 3 – Glenorie, Windsor Downs, Catherine Field and North Appin; and
- Maximum - Glenorie, Catherine Field and North Appin.

7.7 Data Matrices

Data matrices for suitable site Type 3 and Maximum Airports – excluding those nominated as having been culled - are presented respectively in **Table 7-4** and **Table 7-5**.

These tables present a mix of both qualitative and quantitative data and are intended to be both informative and able to be used as a source for both Rapid CBA and qualitative analysis.

Table 7-4 Phase Four Data Matrix – Type 3 Airports

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name																		
	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
General Site Attributes	Geographic Place Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Londonderry	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Cataract	Wilton	Wilton	Browns Road
	Local Government Area (LGA)	Wyong	Gosford	Gosford	Hawkesbury	Penrith	Penrith	Penrith Liverpool	Liverpool	Liverpool Camden	Liverpool	Wollondilly	Wollondilly	Wollondilly	Wollongong	Wollondilly	Wollondilly Wollongong	Wingecarribee
	Local Environmental Plan (LEP)	Wyong LEP 1991	Gosford PSO & Gosford IDO 122	Gosford IDO 122	City of Hawkesbury LEP 1989	Penrith LEP 2010	Penrith LEP 2010	Penrith LEP 2010 Liverpool LEP 2008	Liverpool LEP 2008	Liverpool LEP 2008 Camden LEP 2010	Liverpool LEP 2008	Wollondilly LEP 2011	Wollondilly LEP 2011	Wollondilly LEP 2011	Wollongong LEP 2009	Wollondilly LEP 2011	Wollondilly LEP 2011 Wollongong LEP 2009	Wingecarribee LEP 2010

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
	Site Zoning	1(c) Non-Urban Constrained Land Zone 2(e) Urban Release Area 4(e) Regional Industry & Employment Development 5(b) Special Uses – Railways 5(d) Arterial Road Reservation 6(a) Open Space & Recreation 7(g) Wetlands Management 10(a) Investigation Precinct B2 Local Centre RE1 Public Recreation R1 General Residential E2 Environmental Conservation	1(a) Rural – Agricultural 5 Special Uses - General 6(a) Open Space – Recreation 6(b) Open Space – Special	1(a) Rural – Agricultural 4(a) Industrial – General 5 Special Uses – General 5(b) Special Uses – Railways 6(b) Open Space – Special Purpose 7(a) Environmental Protection - Conservation 7(b) Environmental Protection – Scenic Protection	1(b) Rural 'B' 7(d1) Environmental Protection (Scenic)	E1 National Parks and Nature Reserves E2 Environmental Conservation RU1 Primary Production RU4 Rural Small Holdings SP2 Infrastructure (future road) Deferred Matter	E2 Environmental conservation E3 Environmental management RU1 Primary Production RU2 Rural Landscape RU4 Rural Small Holdings SP2 Infrastructure (classified road) SP2 Infrastructure (water supply system) Deferred Matter	E2 Environmental conservation RU1 Primary Production RU2 Rural Landscape RU4 Rural Small Holdings SP2 Infrastructure (classified road)	RU1 Primary Production SP1 Special Activities (Commonwealth Activities) SP2 Infrastructure (classified road)	R5 Large Lot Residential RU1 Primary Production SP2 Infrastructure (Educational establishment)	RU1 Primary Production SP2 Infrastructure (Educational establishment)	E1 National Parks and Nature Reserves RU2 Rural Landscape	R5 Large Lot Residential RE1 Public Recreation RU1 Primary Production RU2 Rural Landscape RU4 Rural Small Holdings SP2 Infrastructure (road)	RU1 Primary Production RU2 Rural Landscape SP2 Infrastructure	E2 Environmental Conservation SP2 Infrastructure (road)	E2 Environmental Conservation SP2 Infrastructure (road)	E2 Environmental Conservation	E2 Environmental Conservation SP2 Infrastructure (water supply system)

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
	Draft LEP (that has been the subject of public consultation under the EP&A Act 1979)	N/A (not yet on exhibition)	Draft Gosford LEP 2009 RU1 Primary Production RE1 Public Recreation SP2 Infrastructure (educational establishment) SP2 Infrastructure (road) RU5 Village	Draft Gosford LEP 2009 SP2 Infrastructure (research station) SP2 Infrastructure (road) RU1 Primary Production RU2 Rural Landscape E2 Environmental Conservation IN1 General Industrial RE1 Public Recreation	Draft Hawkesbury LEP 2011 RU1 Primary Production RU2 Rural Landscape	N/A	N/A	N/A	N/A	Liverpool LEP 2008 Draft Amendments 16 and 19 is not within the Site	Draft Camden LEP 2009 RU1 Primary Production Liverpool LEP 2008 Draft Amendments 16 and 19 is not within the Site	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
Estimated population within 30km radius of Site centre based on the Census 2006 (rounded to nearest '00)	347,800	265,800	318,800	580,700	703,600	1,050,100	1,590,700	1,170,600	1,063,800	702,200	469,100	141,200	118,600	341,600	287,300	290,700	270,400
Estimated population within 15km radius of Site centre based on the Census 2006 (rounded to nearest '00)	123,800	37,800	143,400	60,500	202,700	135,000	330,600	139,000	123,700	57,900	13,000	30,100	23,800	78,700	9,100	22,700	5,800
Site Footprint	723.3ha	723.3ha	762.5ha	705.2ha	1,148.2ha	703.1ha	713ha	686.4ha Additional Area 6.4ha	723.3ha	687.8ha	709.3ha	702.3ha	723.3ha	704.2ha	677.8ha	727.5ha	723.3ha
Runway Length and Width (Alignment)	2,600 m x 45 m (17/35)	2,600 m x 45 m (18/36)	2,600 m x 45 m (18/36)	2,600 m x 45 m (09/27)	2,600 m x 45 m (18/36)	2,600 m x 45 m (01/19)	2,600 m x 45 m (16/34)	2,600 m x 45 m (05/23)	2,600 m x 45 m (15/33)	2,600 m x 45 m (17/35)	2,600 m x 45 m (17/35)	2,600 m x 45 m (17/35)	2,600 m x 45 m (18/36)	2,600 m x 45 m (05/23)	2,600 m x 45 m (18/36)	2,600 m x 45 m (17/35)	2,600 m x 45 m (12/30)

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
Key Airport Facilities (assumed in Site footprint)	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	2x Business Parks, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area	Business Park, Commuter Car Park, Future Development area
Capacity assuming nil interaction with existing airports and that operations can be managed, albeit with extra track miles and associated economic penalties to operators	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft	Aircraft movements: up to 50 per hour or 240,000 pa Passengers: up to 33M pa based on 140 pax per aircraft mix. 19M based on 80 pax per aircraft

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
Key Transport System(s) within ~5kms of Site	F3 Sydney - Newcastle Freeway Sparks Road Motorway Link Main North Railway	Peats Ridge Road Gregory Downs Drive Wisemans Ferry Road	F3 Sydney - Newcastle Freeway Peats Ridge Road Wisemans Ferry Road Main North Railway	Putty Road King Road	Londonderry Road Castlereagh Road	The Northern Road Elizabeth Drive Mamre Road	Elizabeth Drive The Northern Road Mamre Road	The Northern Road Badgerys Creek Road Elizabeth Drive	Greendale Road The Northern Road	Greendale Road The Northern Road	Silverdale Road	Burragorang Road	Montpellier Drive Barkers Lodge Road Mowbray Park Road	Appin Road Princes Highway	Picton Road Hume Highway	Picton Road	Hume Highway
General Terrain of Site	Rolling coastal plain drained by Wallarah Creek to Tuggerah Lake Some open, some forested and some developed lands. Existing Airfield to the south	Narrow ridge line as a part of a dissected montane plateau, with some open undulating rural land on the ridge and parallel to the Peats Ridge Road	Large elevated rectangular area of undulating planar rural land, as part of a dissected montane plateau	Undulating terrain on the slopes of the Hawkesbury River valley with some areas of floodplain and open rural land, rising to higher ground the west and north	On the eastern side of the Hawkesbury River valley, mostly planar, gently undulating terrain with open rural and timbered lands	Rolling planar terrain on the watershed between the Nepean River and Badgerys Creek and other headwaters of South Creek mostly in use for rural land activities	Open undulating land in floodplain of Kemps Creek, mostly developed for rural smallholding activities	Rolling planar terrain on the watershed between the Nepean River and Badgerys Creek mostly in use for rural land activities	Rolling planar terrain on the watershed between the Nepean River and Badgerys Creek mostly in use for rural land activities	Open rolling planar terrain within the catchment of the Nepean River mostly in use for rural land activities	Undulating plateau with open rural land located on the escarpment above the Nepean river with dissected rural land to the east and rising rugged forested terrain to the west	Broad open valley of Monkey Creek with long parallel valley ridges, mostly developed for rural smallholding activities and rural uses. Existing airfield on valley floor	Elevated rectangular area of sloping planar in the upper portion valley of Monkey Creek with mostly developed rural uses	Area of gently sloping montane plateau, atop the Illawarra escarpment, comprising areas of forest and open heath	Heavily dissected montane plateau with open rural and some long linear ridge lines adjoining the deep gorges of the major rivers	Heavily dissected montane plateau with open rural and some long linear ridge lines adjoining the deep gorges of the major rivers	Very isolated site lying on a long linear ridge parallel to the Cordeaux River gorge and along the alignment t of the Maldon - Dombarton railway

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

Locality Name		Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name		Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
	Geology	Multi coloured chert sandstone quartzose sandstone shale and claystone	Quartz sandstone with some shale	Quartz sandstone with some shale	Quartz sandstone with some shale	Poorly consolidated sandstone conglomerate siltstone and 'perched' alluvium	Sandstone and shale	Sandstone and shale	Sandstone and shale	Sandstone and shale	Sandstone and shale	Sandstone and shale	Quartz sandstone with some shale	Quartz sandstone with some shale	Quartz sandstone with some shale	Sandstone and shale	Sandstone and shale	Quartz sandstone with some shale
	Note: Geological information sourced from the Department of Primary Industries website, 1:500 000 geological maps. (http://www.dpi.nsw.gov.au/minerals/geological/geological-maps/1-500-000)																	
	Soil Classification	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.4m Subsoil layer 0.7m	Topsoil thickness layer 0.3m Subsoil layer 0.7m	Topsoil thickness layer 0.15m Subsoil layer 1.2m	Topsoil thickness layer 0.2m Subsoil layer 0.3m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.4m Subsoil layer 0.7m	Topsoil thickness layer 0.0m Subsoil layer 0.0m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.4m Subsoil layer 0.7m
	Note: Soil classification information sourced from the Australian Soil Resource Information System (ASRIS) digital atlas website (http://www.asris.csiro.au/themes/Atlas.html#Atlas_Digital)																	
	Major river systems close to Site (e = Site well elevated above river systems)	Wallarah Creek Reach	Mooney Mooney Creek	Mooney Mooney Creek (e)	Hawkesbury River Currency Creek	Nepean River	Nepean River Mulgoa Creek	Badgerys Creek Oaky Creek	Badgerys Creek Oaky Creek	South Creek Town Rural Storage Lowes Creek	Nepean River Bringelly Creek	Nepean River Forest Hill Creek Bushrangers Creek	Back Creek Monkey Creek	Monkey Creek	Lake Cataract Cataract River Stokes Creek	Avon River Cordeaux River (e)	Lake Cataract Cataract River (e)	Avon River Lake Avon

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
CRITERION 1 Accessibility of the Sydney land transport network (rail and state roads)	Kilometres to connect Site boundary to existing rail link	~2.5km to Warnervale Station	~4.5km to Ourimbah Station	~4.5km to Ourimbah Station	~8km to Windsor Station	~7km to Richmond Station ~11km to Penrith Station	~9km to Kingswood Station ~16km to proposed Leppington Station	~11km to Werrington Station ~13km to proposed Leppington Station	~11km to Werrington Station ~13km to proposed Leppington Station	~13km to proposed Leppington Station	~13km to Macarthur Station ~15km to proposed Leppington Station	~18km to Macarthur Station ~23km to proposed Leppington Station	~20km to Menangle Park Station ~ 25km to Macarthur Station on Main South Railway	~7km to Picton Station	~17km to Menangle Station	~20km from Menangle Park Station ~25km to Macarthur Station on Main South Railway	~11km to Douglas Park Station	~11km to Bargo Station
	Likelihood of a rail link being constructed to or near to the Site, other than an airport specific line	Possible given proximity of existing Sydney - Newcastle Line	Unlikely unless the Site is accessed by a new alignment, possibly as a part of Sydney - Newcastle High Speed line	Unlikely unless the Site is accessed by a new alignment, possibly as a part of Sydney - Newcastle High Speed line	Unlikely	Unlikely	Possible as an extension of South West Rail Link	Possible as an extension of South West Rail Link	Possible as an extension of South West Rail Link	Possible as an extension of South West Rail Link	Possible as an extension of South West Rail Link	Very unlikely	Very unlikely	Very unlikely	Very unlikely	Possible, Site adjacent to or incorporates the alignment of the partially constructed Maldon – Dombarton Railway	Unlikely, although Site is ~12kms from the alignment of the partially constructed Maldon – Dombarton Railway	Possible, Site adjacent to or incorporates the alignment of the partially constructed Maldon – Dombarton Railway
	Capacity of the existing rail systems and implications of additional airport traffic requirements for additional capacity (not costed)	Requirements for providing additional capacity for 4 trains per hour: A new alignment or a tunnel between Hawkesbury River and Berowra due to the limit of capacity in Cowan Bank on Main Northern Railway			Assume no rail link	Assume no rail link	Requirements for providing additional capacity for 4 trains per hour on the East Hills Line: • Quadruplication between Revesby and Glenfield • Sextuplication between Erskineville and Tempe • Re-signalling and Electrification • Requirements for providing additional capacity for 4 trains per hour on the East Hills Line: • Quadruplication between Revesby and Glenfield • Sextuplication between Erskineville and Tempe • Re-signalling and electrification					Assume no rail link	Assume no rail link	Assume no rail link	Assume no rail link	Main Southern Railway/East Hills Line does not have sufficient capacity to serve a new airport. • Requirements for providing additional capacity for 4 trains per hour on the Main South Line: • Southern Sydney Freight Line needs to be in place as part of quadruplication to Glenfield. • Quadruplication between Revesby and Glenfield • Sextuplication between Erskineville and Tempe • Re-signalling and electrification • New refuges south of Macarthur		

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

Note: The underlying assumption is that Type 3 airports would not have an airport specific rail link unless the Government deemed it necessary – accordingly costing for Type 3 rail connection has not been undertaken, although costs could be expected to be similar to the relevant Maximum Airport.

Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean
Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly
Kilometres to connect Site boundary to existing designated state roads/highways	Site footprint sits over F3	~7.5km to F3	~125m to F3 (eastern boundary of Site)	~25km to M7	~18km to Western Motorway (M4)	~8km to Western Motorway (M4) ~15km to M7	~6km to M7 ~15km to Western Motorway (M4)	~11km to Western Motorway (M4) ~10km to M7	~13km to M7
Specific issues in constructing a road link	The existing roadway (F3) is at a similar level to the airport Site The F3 would need to be diverted and the diverted road connected to the airport. Connection would be relatively easy	The existing roadway (Peats Ridge Road) would require an upgrade, connection would be relatively easy	The existing roadway (F3) is at a similar level to the airport Site and connections would be relatively easy	The existing roadways (Putty Road, Wilberforce Road and Windsor Road) would require an upgrade. Upgrade to the road bridge over the Hawkesbury River, connection would be relatively easy	The existing roadway (Londonderry Road and The Northern Road) would require an upgrade, connection would be relatively easy	The existing roadways (The Northern Road and Elizabeth Drive) would require an upgrade, connection would be relatively easy	The existing roadways (Mamre Road and Elizabeth Drive) would require an upgrade, connection would be relatively easy	The existing roadways (The Northern Road and Elizabeth Drive) would require an upgrade, connection would be relatively easy	The existing roadways (The Northern Road and Bringelly Drive) would require an upgrade, connection would be relatively easy

Locality Name	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
Kilometres to connect Site boundary to existing designated state roads/highways	~18km to Western Motorway (M4) ~20km to M7	~30km to Hume Highway	~25km to Hume Highway	~16km to Hume Highway	~5km to Southern Freeway	~9km to Hume Highway	~10km to Hume Highway	~4km to Hume Highway
Specific issues in constructing a road link	The existing roadways (Greendale Road and Bringelly Drive) would require an upgrade, connection would be relatively easy	The existing roadway (Greendale Road) would require an upgrade, connection would be relatively easy	The existing roadway (Burragorang Road) would require an upgrade, connection would be relatively easy	The existing roadways (Bakers Lodge Road and Remembrance) require an upgrade, connection would be relatively easy	The existing roadways (Appin Road) would require an upgrade, connection would be relatively easy	The existing roadways (Picton Road) would require an upgrade, connection would be relatively easy	The existing roadways (Picton Road) would require an upgrade, connection would be relatively easy	Connection to Hume Highway and Southern Freeway would need to be built

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
	Required works	5km road diversion of the Pacific Highway and connection to airport	11km upgrade to Peats Ridge Road and connection to airport	3km upgrade to Peats Ridge Road and connection to airport	9km upgrade to Putty Road, Wilberforce Road and Windsor Road, duplication of bridge over the Hawkesbury River and connection to airport	9km upgrade to Londonderry Road and The Northern Road and connection to airport	15km upgrade to The Northern Road and Elizabeth Drive and connection to airport	5km upgrade to Elizabeth Drive and connection to airport	8km upgrade to Elizabeth Drive and connection to airport	12km upgrade to Bringelly Road and connection to airport	15km upgrade to Greendale Road and Bringelly Drive, 2km extension of Greendale Road and connection to airport	15km upgrade to Greendale Road and Bringelly Drive, 7km extension of Greendale Road and connection to airport	14km upgrade to Burragorang Road and connection to airport	14km upgrade to Bakers Lodge Road and Remembrance Drive, 5km extension road and connection to airport	14km upgrade to Appin Road, 5km diversion of Appin Road, 6km extension to Appin road and connection to airport	20km upgrade to Picton Road and connection to airport	20km upgrade to Picton Road and connection to airport	10km extension road to Hume Highway, 11km extension road to Cordeaux Road, upgrade to Cordeaux Road and connection to airport
	Cost of works to nearest $ million	~$73 million	~$258 million	~$82 million	~$259 million	~$214 million	~$346 million	~$126 million	~$192 million	~$270 million	~$369 million	~$426 million	~$324 million	~$397 million	~$450 million	~$456 million	~$456 million	~$367 million
	Note: Estimated costs for road construction are as follows: • Upgrade from a 2 lane corridor to 4 lane corridor - $22 million/km (based on NSW RMS cost estimates of upgrade to the Oxley Highway); • Diversion/Extension of road, new two lane two way road - $11.5 million/km (based on RMS cost estimate of diversion of The Camden Valley Way); • Airport connection, overpasses and connections - $15.5 million each (based on Canberra Airport connection cost); and • Bridge widening - $114million/km (based on RTA cost of Sea Cliff Bridge, Illawarra).																	
CRITERION 2 Proximity to growth centres and commercial opportunities	Distance from Site boundary to identified commercial growth centres (Metro and Regional Strategies)	Tuggerah-Wyong Major Centre (~14km)	Gosford City Centre (~15km)	Gosford City Centre (~7km) Tuggerah-Wyong Major Centre (~14km)	Windsor Town Centre (~9km) Rouse Hill Planned Major Centre (~16km)	Windsor Town Centre (~9km) Mt Druitt Potential Major Centre (~15km) (Penrith Regional City (~9km)	Penrith Regional City (~10km) Leppington Planned Major Centre (~16km) Mt Druitt Potential Major Centre (~14km)	Penrith Regional City (~13km) Leppington Planned Major Centre (~11km) Mt Druitt Potential Major Centre (~10km)	Penrith Regional City (~15km) Leppington Planned Major Centre (~10km) Mt Druitt Potential Major Centre (~12km)	Leppington Planned Major Centre (~10km)	Leppington Planned Major Centre (~14km) Penrith Regional City (~21km) Mt Druitt Potential Major Centre (~22km)	Leppington Planned Major Centre (~19km) Penrith Regional City (~21km)	Camden Town Centre (~12km) Campbelltown-Macarthur Major Centre (~25km)	Camden Town Centre (~23km) Campbelltown-Macarthur Major Centre (` 35km)	Campbelltown-Macarthur Major Centre (~24km) Wollongong Regional City (~17km)	Campbelltown-Macarthur Major Centre (~25km) Wollongong Regional City (~23km)	Campbelltown-Macarthur Major Centre (~22km)	Wollongong Regional City (~28km)

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

		Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
	Percentage of footprint within North West or South West Growth Centre	0%	0%	0%	0%	0%	0%	60%	0%	45%	0%	0%	0%	0%	0%	0%	0%	0%
	N70 - 10 Event Contour impact on North West or South West Growth Centre	Nil	Nil	Nil	Nil	Nil	Nil	High	Medium	High	Low	Nil	Nil	Nil	Nil	Nil	Nil	Nil
CRITERION 3 Comparative Earthworks Estimate	Comparative cut plus fill earthworks volume to level Site (m³/ha) rounded to nearest 100	78,800	157,700	154,200	94,100	38,000	61,100	50,700	74,300	120,000	96,400	172,500	182,800	144,400	168,500	139,000	130,700	105,600
	Comparative cost to prepare airport platform rounded to nearest million|	$184 million	$413 million	$431 million	$196 million	$134 million	$126 million	$96 million	$161 million	$310 million	$226 million	$463 million	$489 million	$372 million	$504 million	$346 million	$345 million	$253 million
	Note: Comparative cut plus fill earthworks volume in m3/ha to create a completely level airport footprint. Note: in practice airport sites do not have to be completely level over their whole area. Costs are based on adjusted earthworks volumes to account for this and for the different geotechnical material expected to be encountered on that site.																	

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
CRITERION 4 Noise Impact on Residents Approximate population within noise contour categories based on Site specific orientation of runway (nearest '0') Refer Australian Standard AS 2021-2000 Acoustics - aircraft noise intrusion - building siting and construction	20 ANEC	3,880	230	530	790	3,430	380	1,370	840	600	440	150	990	470	40	90	140	50
	25 ANEC	1,880	90	160	280	510	160	610	380	210	130	30	500	140	20	40	70	10
	30 ANEC	1,130	40	90	130	230	70	270	140	80	50	10	240	40	10	20	30	10
	35 ANEC	410	20	40	50	90	30	130	70	30	20	0	110	20	10	10	10	10
	40 ANEC	320	10	20	20	40	20	40	40	20	10	0	70	10	0	0	10	0
	Distance (m) from Site boundary to nearest urban areas (as defined by DoPI)	0	9,400	1,950	1,100	2,200	0	4,800	5,000	5,950	2,700	350	100	3,650	2,250	2,900	5,100	7,600
	Number of Persons Exposed to >10 Number of Events >70dB(A)	22,320	640	5,560	2,990	29,950	7,870	6,440	3,560	4,560	2,220	1,200	2,440	4,390	880	370	430	530
	N70 person events (nearest '00)	1,048,700	45,500	236,600	172,800	1,085,400	206,300	330,300	200,700	179,200	104,800	42,100	194,900	159,600	27,200	19,800	29,400	26,100
	AIE (N70/Persons exposed)	47	72	43	58	36	26	51	56	39	47	35	80	36	31	54	69	50

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
	Note 1: This study has chosen specific Sites for more detailed assessment. Bureau of Meteorology (BoM) wind data is available for some Sites but not all Sites. A review could be undertaken to develop an ANEC for the shortlisted airport Sites utilizing actual traffic forecasts, flight tracks and wind direction data applicable to that Site, either from detailed work undertaken in initial stages of greenfield airport identification and assessment undertaken prior to this report (in particular Phase 2 Shortlisting of localities) for those Sites which were part of that work or a new review for new Sites or Sites from that previous Phase 2 analysis which have had a cross runway added. This is for comparative assessment and not an endorsed ANEC with ANEF contours endorsed by Airservices Australia in the manner of endorsement of Ministerial Direction M37/99 and the Airports Act 1996. Note 2: The Department of Infrastructure and Transport considers that further metrics to ANEF/ ANEC give the decision makers a much clearer picture of what the outcomes will be if they approve the project, for example showing actual flight paths and the use of N70 contours, i.e. the number of aircraft noise events above 70 dBA. Person-Events Index (PEI) then allows the total noise load generated by each airport to be computed by summing, over the exposed population, the total number of instances where an individual is exposed to an aircraft event above a specified noise level, in this case N70, over a given time period. Note 3: PEI (70) = $\Sigma P_N N$ where P_N is the number of persons exposed to N70.																	
CRITERION 5 Mine Subsidence	Designated mine subsidence zone present within Site	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes Site is close to mine subsidence areas and operating mines. Extent of any old or current mines needs to be established	No Site is close to mine subsidence areas and operating mines. Extent of any old or current mines needs to be established.	No
	Percentage of Site within designated mine subsidence zone	~15%	0	0	0	0	0	0	0	0	0	0	0	0	0	~10%	0	0

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
CRITERION 6 Number of Lots Requiring Acquisition Based on number of lots directly impacted by Site footprint	Approximate number of allotments within Site	200	110	140	100	180	80	200	10	150	40	40	70	40	10	10	5	5
	Average number of allotments per hectare within Site	0.282	0.156	0.178	0.142	0.160	0.117	0.276	0.007	0.209	0.063	0.062	0.095	0.059	0.007	0.007	0.003	0.001
	Population within Site boundary (Census 2006) (rounded to nearest '0')	960	50	110	200	600	100	570	180	120	60	0	430	70	20	30	50	10

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
CRITERION 7 Airspace Interaction	See Airservices Australia technical paper: *Report on Initial Location Analysis* (February 2012) referred to in Section 7.4 Inputs from CASA and Defence have not been incorporated into this analysis	Major Probable interaction with Military Airspace to the north and east Several power stations in vicinity (potential danger areas due high velocity exhaust)	Major Probable interaction with operations to KSA	Major Probable interaction with operations to KSA	Major Probable interaction with operations to KSA For type 3 assumes runway parallel to existing RAAF Richmond can be operated with coordinated control Site within military airspace with issues for access routes High terrain to the west – viability of approaches requires more assessment	Major Requires closure / relocation of current Richmond RAAF. Northern flight paths would still enter military restricted airspace The Department of Defence Orchard Hills facility would have to be relocated	Major The location of R536A and 536B within the nominal CTR boundary would not be compatible with the proposed 01/19 runway alignment. The Department of Defence Orchard Hills facility would have to be relocated Potential impacts on flying training areas and Camden Airport Runway alignment more northerly than Badgerys Creek (and extent of interaction with Sydney Airport may be improved in comparison to Badgerys Creek)	Major Close to KSA and Bankstown, heading towards RAAF Richmond airspace Feasibility of Site problematic and subject to review / advice from ASA, CASA and Defence	Major Potential impacts on flying training areas and Camden Airport See note below	Major Site is aligned north west / south east with the intention of minimising interaction with Holsworthy Airspace to the south east Potential impacts on flying training areas and Camden Airport	Major Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills Explosives depot airspace Potential impacts on flying training areas and Camden Airport May need to consider wind turbulence due high terrain to the west	Major Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills Explosives depot airspace Potential impacts on flying training areas and Camden Airport May need to consider wind turbulence due high terrain to the west	Major Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills Explosives depot airspace Potential impacts on flying training areas and Camden Airport May need to consider wind turbulence due high terrain to the west	Major Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills Explosives depot airspace Potential impacts on flying training areas and Camden Airport May need to consider wind turbulence due high terrain to the west	Major Probable interaction with operations to KSA and limitations due Holsworthy airspace Feasibility of Site problematic and subject to review/advice from ASA, CASA and Defence	Major	Major	Major Site is on proposed railway alignment

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
	Note 1: In all cases the preliminary observations listed herein need to continue to be tested with relevant authorities; Airservices Australia; Department of Defence; Office of Airspace Regulation; existing airport operators and users at the feasibility stage. Potential conflicts or dependencies with Richmond and KSA's operations and Sydney Basin traffic would require more detailed analysis by Department of Defence, Airservices Australia and/or the Office of Airspace Regulation. The general complexity of existing airspace within and adjacent to the Sydney Basin makes this ongoing review necessary. Major •Airspace where there are significant levels of civil air transport traffic and military activity, such as around Sydney, Williamtown, Nowra and Richmond together with their respective CTR/CTA, and operational procedures and requirements; or • Restricted Areas particularly those with provisional classifications of RA3 and RA2; or • Danger Areas associated with military flying training. Moderate • Airspace where there are significant levels of GA traffic, such as around Bankstown and Camden together with their respective CTR (note in practice as Bankstown and Camden are relatively close to the larger airports, a potential moderate ranking is effectively outweighed by the factors affecting the larger airports); or • Restricted Areas with provisional classifications of RA1; or • Danger Areas associated with civil flying training; or • VFR transit routes. Minor • Airspace where there are lower levels of civil traffic and non-towered aerodromes; or • Danger Areas. (Assessments in italics are taken from Previous Phase 2 Study analysis) Note 2: This assessment of Badgerys Creek has been prepared on the basis of demonstrating technical consideration of all possible sites considered in this study. The following consideration of airspace issues is based generally around the runway geometry determined during the various EIS processes undertaken since 1985 i.e. a runway alignment of 05/23. The 18/36 runway option shown in the most recent EIS has not been considered.																	
CRITERION 8 Capacity for Future Expansion	Capacity for future expansion to Maximum Airport	Yes	No	Yes	No	No	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	No

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
CRITERION 9 Flood Risk at Site	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Part of Site may be subject to 1-100 Flood, PMF Flood Unknown	Part of Site may be located within the Flood Planning Area	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Site identified as within Flood Prone Land as designated by Liverpool City Council Site also identified as within Flood Planning Area as designated by Penrith City Council and Liverpool City Council	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Site identified as within Flood Prone Land as designated by Liverpool City Council Site also identified as within Flood Planning Area as designated by Liverpool City Council	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently

1.Castlereagh (RAAF Relocated)

Flood planning area means the land shown as 'Flood planning area' on the Flood Planning Land Map

2. Windsor Downs (RAAF Relocated)

High Flood Risk Precinct

The High Flood Risk Precinct is the land subject to a high hydraulic hazard (in accordance with the provisional criteria outlined in the N.S.W. Government Floodplain Development Manual 2005) in a 100 year flood event and/or subject to potential evacuation difficulties during a flood

Medium Flood Risk Precinct

The Medium Flood Risk Precinct is the land below the 100 year flood level subject to a low hydraulic hazard (in accordance with the provisional criteria outlined in the N.S.W. Government Floodplain Development Manual 2005).

Low Flood Risk Precinct

The Low Flood Risk Precinct is all land within the floodplain, i.e. within the extent of the Probable Maximum Flood (PMF) but not identified as either a high flood risk or medium flood risk precinct. Therefore the Low Flood Risk Precinct is all the land between the 100 year and the PMF flood extents.

3.Greendale and Kemps Creek

Flood prone land is land susceptible to flooding by the largest flood that could conceivably occur at a particular location estimated from the probable maximum precipitation.

Note: The status of Council's flood assessment and mapping should be checked at the next stage of investigation.

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
	Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
CRITERION 10 Additional Potential infrastructure affected by airport footprint causing dislocations relocations and other items likely to involve costs.	Airservices and Defence	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	Airservices Australia International Radio Transmitter Station Closure or relocation of RAAF Richmond required	Requires closure and relocation of Orchard Hills Explosives Depot	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected
	Minor Airports and Airfields in Close Proximity	Warnervale Airfield	No major items as yet identified to be directly affected	Somersby Airfield	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	The Oaks Airfield	The Oaks Airfield	Wedderburn Wilton Parachuting Club	Wedderburn Wilton Parachuting Club	Wedderburn Wilton Parachuting Club	Wedderburn Wilton Parachuting Club
	Railways	Realignment of Main North Railway or grade separation may be needed	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	Some realignment of the incomplete Maldon-Dombarton Railway may be needed	No major items as yet identified to be directly affected	Some realignment of the incomplete Maldon-Dombarton Railway may be needed

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
Roads	F3 Freeway Motorway Link Road Sparks Road Dakara Road Bruce Cr Warnervale Road Hakone Road	Peats Ridge Road Euloo Road Bushells Road Karee Road	Wisemans Ferry Road Elwins Road Lackersteens Road Keighley Ave Grants Road Lutana Road Nyah Road Bimbil Road Debenham Road North Somersby Falls Road Howes Road Ulinga Road	Sackville Road Stannix Park Road Stannix Park Ln Sargents Road Carrs Road	Proposed route for the M7 to Yarramundi Freeway Torkington Road Nutt Road Spencer Road Fire Trail Road Devin Road Boscobel Road Hinxman Road Smeeton Road Tadmore Road	The Northern Road Littlefields Road Galaxy Road Queenshill Road Oaky Road	Elizabeth Drive Western Road Lawson Road Martin Road Overett Road Sumbray Ave Cuthel Road Turnbull Ave Martin Road Bakefield Ave	The Northern Road Badgerys Creek Road Jagelman Road Fuller St Leggo St Longleys Road Anton Road	Greendale Road Dwyer Road Francis St Findley Road Tyson Road Carr Road	Cut Hill Road Orient Road	Silverdale Road Avoca Road Pineridge Cres	Burragorang Road Binalong Road Yallah St Wanawong St Daley Cl Wanawong St Waterfall Creek Road Quarry Road	Bakers Lodge Road Mowbray Park Road Montpelier Road	Appin Road	Picton Road	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected
Water Supply	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	Sydney Water Supply Pipeline requires relocation or encasement	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	Site is within/or adjacent to Sydney drinking water catchment	Site is within/or adjacent to Sydney drinking water catchment	Site is within/or adjacent to Sydney drinking water catchment	Site is within/or adjacent to Sydney drinking water catchment

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
Major Electricity Supply(OL S = possible conflict with obstacle limitation surface)	330KV power line needs re-alignment 3 sets of 330kV power lines (OLS) –north 500kV power line (OLS) – north	3 sets of 330kV power lines (OLS) – north west 2 sets of 330kV power lines (OLS) – north east	330kV power lines (OLS) – north west	500kV power line (OLS) – east	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	500kV power lines (OLS) - north	330kV power lines (OLS) - north	2 sets of 330kV power lines (OLS) - north and south	2 sets of 330kV power lines need re-alignment	330kV power lines need re-alignment	No major items as yet identified to be directly affected	330kV power lines need re-alignment	330kV power lines (OLS) - east	330kV power lines need re-alignment	No major items as yet identified to be directly affected	330kV power lines (OLS) - south east
Major Gas Supply Lines	Possible conflict with Sydney to Newcastle gas and oil pipeline. Further detailed investigation required	Possible conflict with Sydney to Newcastle gas and oil pipeline. Further detailed investigation required	Possible conflict with Sydney to Newcastle gas and oil pipeline. Further detailed investigation required	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	Possible Conflict with Eastern Gas Pipeline gas and oil pipeline Further detailed investigation required	Possible Conflict with Eastern Gas Pipeline gas and oil pipeline Further detailed investigation required	No major items as yet identified to be directly affected

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
Rivers and Estuaries	2 reaches of Wallarah Creek	No major items as yet identified to be directly affected	Robinson Creek Floods Creek Hunter Creek	Chain of Ponds Creek	No major items as yet identified to be directly affected	Mulgoa Creek	South Creek	Badgerys Creek Oaky Creek	No major items as yet identified to be directly affected	Bringelly Creek	Forest Hill Creek Bushrangers Creek	Monkey Creek	Monkey Creek	No major items as yet identified to be directly affected	Cordeaux River (Site elevated) Cascade Creek Clements Creek Allens Creek Third Point Creek	No major items as yet identified to be directly affected	Cordeaux River (Site elevated)

Table 7-4 - Phase Four Matrix – Type 3 Airports

Suitable Sites - Specified Localities

Site Evaluation – Airport Type 3 (Limited Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Central Coast	Hawkesbury	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Nepean	Burragorang	Burragorang	Burragorang	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract	Cordeaux - Cataract
Site Name	Wallarah	Peats Ridge	Somersby	Wilberforce	Castlereagh (RAAF Relocated)	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale	Silverdale	The Oaks	Mowbray Park	Southend	Wilton	Wallandoola	Dendrobium
Social and Educational Infrastructure	No major items as yet identified to be directly affected Site is close to existing urban developments	Adjacent to national parks Greenhills Golf and Country Club Access to Boral Concrete Depot	Adjacent to national parks Rindean Quarry Access to Pioneer Concrete Quarry	Sydney Equestrian Supplies King Equestrian Academy Hawkesbury High and Primary Schools (3.5km)	Unnamed Primary School (1km) St Pauls Grammar (1km) Cranebrook Cemetery (1km) Londonderry Cemetery (2.5km) Kindalin Christian School (2.5km) Note that there is a large existing urban area close to and around the Site	Luddenham Primary School (0.5km) Holy Family Primary School (0.4km)	Elizabeth Drive Landfill Facility Australian Native Landscape Argus Technologies Fleurs Radio Observation Field Station (University of Sydney) University of Sydney Fleurs Farm Sydney Catholic Lawn Cemetery Novaris Research Centre (Yarrandoo) Kemps Creek Primary (1.0km)	Mendez Equestrian Centre Crown Park Training Centre	Bringelly Primary School (1km)	Sugar Loaf Equestrian Centre University of Sydney University Farms Site is aligned generally north / south. Location seeks to avoid minimise noise on smaller urban areas to the north and south	No major items as yet identified to be directly affected Site is aligned generally north / south. Location seeks to avoid minimise noise on smaller urban areas to the north and south	No major items as yet identified to be directly affected Site is aligned generally north / south. Location seeks to avoid minimise noise on smaller urban areas to the north and south	No major items as yet identified to be directly affected Site is aligned generally north / south. Location seeks to avoid minimise noise on smaller urban areas to the north and south	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected

Table 7-5 Phase Four Data Matrix – Maximum Airports

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
	Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
General Site Attributes	Geographic Place Name	Wallarah	Somersby	Wilberforce	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wilton
	Local Government Area (LGA)	Wyong Shire	Gosford	Hawkesbury	Penrith Liverpool	Liverpool	Liverpool Camden	Liverpool Camden	Wollondilly Shire	Wollondilly Shire	Wollondilly Shire Wollongong
	Local Environmental Plan (LEP)	Wyong LEP 1991 SEPP (Major Projects) 2005	Gosford Interim Development Order 122	Hawkesbury LEP 1989	Penrith LEP 2010 Liverpool LEP 2008	Liverpool LEP 2008	Liverpool LEP 2008 Camden LEP 2010	Liverpool LEP 2008 Camden LEP 2010	Wollondilly LEP 2011	Wollondilly LEP 2011	Wollondilly LEP 2011 Wollongong LEP 2009

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
Site Zoning	1(a) Rural 1(1) Rural (Production) 1(c) Non Urban Constrained Land Zone 2(a) Residential 2(e) Urban Release Area 4(e) Regional Industry & Employment Development 5(a) Special Uses 5(b) Special Uses - Railway 5(c) Local Road Reservation 5(d) Arterial Road Reservation 6(a) Open Space & Recreation 7(2) Conservation (Secondary) 7(g) Wetlands Management 10(a) Investigation Precinct B2 Local Centre E2 Environmental Conservation IN1 General Industrial R1 General Residential RE1 Public Recreation SP2 Infrastructure (water management)	1(a) Rural - Agricultural 4(a) Industrial - General 5 Special Uses - General 6(b) Open Space - Special Purpose 7(b) Environmental Protection - Scenic Protection	1(b) Rural 'B' 1(c1) Rural 'C1' 5(a) Special Uses 'A' 6(a) Open Space (Existing Recreation) 7(a) Environmental Protection (Wetlands) 7(d1) Environmental Protection (Scenic)	E2 Environmental Conservation R2 Low Density Residential R5 Large Lot Residential RU1 Primary Production RU2 Rural Landscape RU4 Rural Small Holdings SP1 Special Activities (defence) SP2 Infrastructure (classified road) SP2 Infrastructure (water supply system) Deferred Matter	RU1 Primary Production RU4 Rural Small Holdings SP1 Commonwealth Activities SP2 Infrastructure (classified road)	R5 Large Lot Residential RU1 Primary Production RU4 Rural Small Holdings SP1 Special activities (Commonwealth activities) SP2 Infrastructure (Educational establishment)	E1 National Parks and Nature Reserves RU1 Primary Production SP2 Infrastructure (Educational establishment)	RU1 Primary Production RU2 Rural Landscape SP2 Infrastructure (road)	E2 Environmental Conservation RU2 Rural Landscape SP2 Infrastructure (road)	E2 Environmental Conservation

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
Draft LEP (that has been the subject of public consultation under the EP&A Act 1979)	N/A (not yet on exhibition)	Draft Gosford LEP 2009 E2 Environmental Conservation IN1 General Industrial RE1 Public Recreation RU1 Primary Production RU2 Rural Landscape RU5 Village SP2 Infrastructure (research station) SP2 Infrastructure (road)	Draft Hawkesbury LEP 2011 RU1 Primary Production RU2 Rural Landscape RU4 Rural Small Holdings SP2 Infrastructure (classified road) SP2 Infrastructure (water supply)	N/A	N/A	N/A	Draft Camden LEP 2009 RU1 Primary Production	N/A	N/A	N/A
Estimated population within 30km radius of Site centre based on the Census 2006 (rounded to nearest '00)	347,900	306,500	553,500	1,114,300	1,146,200	1,001,200	693,100	122,200	285,700	292,500
Estimated population within 15km radius of Site centre based on the Census 2006 (rounded to nearest '00)	119,800	111,800	66,300	139,000	132,300	104,100	43,200	28,000	9,700	43,400
Site Footprint	1,676ha	1,465ha	2,187ha	1,679ha	1,669ha Additional Area 281ha	1,676ha	1,368ha	1,676ha	1,783ha	1,883ha
Runway Length and Width (Alignment)	4,000 m x 60 m (17/35) 2,500 m x 60m (17/35)	2,500 m x 60 m (09/27) 3,500 m x 60 m (18/36) 4,000 m x 60 m (18/36)	2,500 m x 60 m (10/28) 3,500 m x 60 m (01/19) 4,000 m x 60 m (01/19)	2,500 m x 60 m (01/19) 4,000 m x 60 m (01/19)	2,500 m x 60 m (14/32) 2,500 m x 60 m (05/23) 4,000 m x 60 m (05/23)	4,000 m x 60 m (15/33) 2,500 m x 60m (15/33)	2,500 m x 60 m (17/35) 4,000 m x 60 m (17/35)	4,000 m x 60 m (18/36) 2,500 m x 60m (18/36)	2,500 m x 60 m (08/26) 2,500 m x 60m (18/36) 4,000 m x 60 m (18/36)	2,500 m x 60 m (07/25) 2,500 m x 60 m (17/35) 4,000 m x 60 m (17/35)
Key Airport Facilities (assumed in Site footprint)	2x Business Parks, Logistics Complex, Commuter Car Park	3x Business Parks, Logistics Complex, Aircraft Support Precinct, Commuter Car Park	2x Business Parks, Logistics Complex, Aircraft Support Precinct, Commuter Car Park	3x Business Parks, Logistics Complex, Commuter Car Park	2x Business Parks, Logistics Complex, Commuter Car Park	2x Business Parks, Logistics Complex, Commuter Car Park	2x Business Parks, Logistics Complex, Aircraft Support Precinct, Commuter Car Park	2x Business Parks, Logistics Complex, Commuter Car Park	2x Business Parks, Logistics Complex, Commuter Car Park	Business Parks, Logistics Complex, Aircraft Support Precinct, Commuter Car Park

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
Capacity assuming nil interaction with existing airports and that operations can be managed, albeit with extra track miles and associated economic penalties to operators	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 65M pa based on Sydney Airport 2029 pax per aircraft mix of 195 on long runway and assumes 140 on short runway (i.e. Maximum plus Type 3). 42M based on 130 pax per aircraft on long runway and 80 pax per aircraft on short runway	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 72M pa based on Sydney Airport 2029 pax per aircraft mix of 195. 48M based on 130 pax per aircraft	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 72M pa based on Sydney Airport 2029 pax per aircraft mix of 195. 48M based on 130 pax per aircraft	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 65M pa based on Sydney Airport 2029 pax per aircraft mix of 195 on long runway and assumes 140 on short runway (i.e. Maximum plus Type 3). 42M based on 130 pax per aircraft on long runway and 80 pax per aircraft on short runway	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 65M pa based on Sydney Airport 2029 pax per aircraft mix of 195 on long runway and assumes 140 on short runway (i.e. Maximum plus Type 3). 42M based on 130 pax per aircraft on long runway and 80 pax per aircraft on short runway	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 65M pa based on Sydney Airport 2029 pax per aircraft mix of 195 on long runway and assumes 140 on short runway (i.e. Maximum plus Type 3). 42M based on 130 pax per aircraft on long runway and 80 pax per aircraft on short runway	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 65M pa based on Sydney Airport 2029 pax per aircraft mix of 195 on long runway and assumes 140 on short runway (i.e. Maximum plus Type 3). 42M based on 130 pax per aircraft on long runway and 80 pax per aircraft on short runway	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 65M pa based on Sydney Airport 2029 pax per aircraft mix of 195 on long runway and assumes 140 on short runway (i.e. Maximum plus Type 3). 42M based on 130 pax per aircraft on long runway and 80 pax per aircraft on short runway	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 65M pa based on Sydney Airport 2029 pax per aircraft mix of 195 on long runway and assumes 140 on short runway (i.e. Maximum plus Type 3). 42M based on 130 pax per aircraft on long runway and 80 pax per aircraft on short runway	Aircraft movements: up to 100 per hour or 370,000 pa Passengers: up to 65M pa based on Sydney Airport 2029 pax per aircraft mix of 195 on long runway and assumes 140 on short runway (i.e. Maximum plus Type 3). 42M based on 130 pax per aircraft on long runway and 80 pax per aircraft on short runway
Key Transport System(s) within ~5kms of Site	F3 Sydney - Newcastle Freeway Sparks Road Main North Railway	F3 Sydney - Newcastle Freeway Peats Ridge Road	Putty Road King Road	The Northern Road Elizabeth Drive	The Northern Road Badgerys Creek Road Elizabeth Drive	The Northern Road Greendale Road	Greendale Road The Northern Road	Montpellier Drive Barkers Lodge Road	Picton Road F5 Hume Freeway	Picton Road
General terrain of Site	Rolling coastal plain drained by Wallarah Creek to Tuggerah Lake Some open, some forested and some developed lands. Existing Airfield to the south	Large elevated rectangular area of undulating planar rural land, as part of a dissected montane plateau	Undulating terrain on the slopes of the Hawkesbury River valley with some areas of floodplain and open rural land, rising to higher ground the west and north	Rolling planar terrain on the watershed between the Nepean River and Badgerys Creek and other headwaters of South Creek mostly in use for rural land activities	Rolling planar terrain on the watershed between the Nepean River and Badgerys Creek mostly in use for rural land activities	Rolling planar terrain on the watershed between the Nepean River and Badgerys Creek mostly in use for rural land activities	Open rolling planar terrain within the catchment of the Nepean River mostly in use for rural land activities	Elevated rectangular area of sloping planar in the upper portion valley of Monkey Creek with mostly developed rural uses	Heavily dissected montane plateau with open rural and some long linear ridge lines adjoining the deep gorges of the major rivers	Heavily dissected montane plateau with open rural and some long linear ridge lines adjoining the deep gorges of the major rivers
Geology	Multi coloured chert sandstone quartzose sandstone shale and claystone	Multi coloured chert sandstone quartzose sandstone shale and claystone	Sandstone and shale	Shale atop of sandstone	Sandstone and shale	Sandstone and shale	Sandstone and shale	Quartz sandstone with some shale	Sandstone and shale	Sandstone and shale
Note: Geological information sourced from the Department of Primary Industries website, 1:500 000 geological maps. (http://www.dpi.nsw.gov.au/minerals/geological/geological-maps/1-500-000).										
Soil Classification	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.7m	Topsoil thickness layer 0.15m Subsoil layer 1.2m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.4m Subsoil layer 0.7m	Topsoil thickness layer 0.3m Subsoil layer 0.6m	Topsoil thickness layer 0.3m Subsoil layer 0.6m
Note: Soil classification information sourced from the Australian Soil Resource Information System (ASRIS) digital atlas website (http://www.asris.csiro.au/themes/Atlas.html#Atlas_Digital).										

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
	Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
	Major River Systems close to Site (e = Site well elevated above river systems)	Wyong River Wallarah Creek	Mooney Mooney Creek (e)	Bushells Lagoon Hawkesbury River	Nepean River Mulgoa Creek	Badgerys Creek Oaky Creek	South Creek Town Rural Storage Lowes Creek	Nepean River Bringelly Creek	Monkey Creek	Avon River Cordeaux River (e)	Lake Cataract Cataract River (e)
CRITERION 1 Accessibility of the Sydney land transport network (rail and state roads)	Kilometres to connect Site boundary to existing rail link	~2.5km to Warnervale Station	~4.5km to Ourimbah Station	~8km to Windsor Station	~9km to Kingswood Station ~16km to proposed Leppington Station	~11km to Werrington Station ~13km to proposed Leppington Station	~13km to proposed Leppington Station	~13km to Macarthur Station ~15km to proposed Leppington Station	~7km to Picton Station	~20km to Menangle Park Station ~25km to Macarthur station on Main South Railway	~11km to Douglas Park Station
	Likelihood of a rail link being constructed to or near to the Site Note: distances are approximate (~) and straight line – additional length will be needed to accommodate grades and other constraints	An airport could either be served by planning the Site such that direct access to the existing railway was possible or by construction of an airport specific spur line or deviation of the main north to address the Site	Unless the Site is accessed by a new alignment, possibly as a part of Sydney -Newcastle High Speed Line, requires ~21km airport specific spur line branching from the Main North Railway in the vicinity of Ourimbah	Requires ~7km airport specific extension of the Richmond Line on the existing rail network form the existing Richmond station	Requires ~18km extension of the South West Rail Link now under construction or a ~12km airport specific spur line branching from Western Line in the vicinity of Werrington	Requires ~11km extension of the South West Rail Link now under construction	Requires ~7km extension of the South West Rail Link now under construction	Requires ~13km extension of the South West Rail Link now under construction	Requires > 5km airport specific spur line branching from the existing Main South Line near Picton or ~18km to near Menangle	The Site is adjacent or incorporates the alignment of the partially constructed Maldon – Dombarton Railway. A short spur to an airport terminal may be needed	The Site is ~12km from the alignment of the partially constructed Maldon – Dombarton Railway. A ~12km spur to an airport terminal would be required generally along the alignment of the Picton Road
	Specific issues in constructing a rail link	The existing railway is at a similar level to the airport Site and the terrain for connections would be relatively easy. A Site in the same vicinity has been investigated for a rail stabling facility	Existing railway is about 240m different in elevation to the existing, requiring construction in mountainous terrain necessitating long tunnels	Existing Railway is about 45m different in elevation Major extension of the Richmond line required including crossing of Hawkesbury River and construction in hilly terrain	Surface construction through rural and semi rural areas in easy terrain	Surface construction through rural and semi rural areas in easy terrain	Surface construction through rural and semi rural areas in easy terrain	Surface construction through rural and semi rural areas in easy terrain	Construction through rural and semi rural areas, probably requiring tunnels in hilly terrain	Completion of the Maldon - Dombarton Railway would enable diesel hauled but not electric traction service to access the Site Electric traction would require extension of the electrification system from Macarthur	Completion of the Maldon - Dombarton Railway would enable diesel hauled but not electric traction service to access the Site Electric traction would require extension of the electrification system from Macarthur

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
	Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
	Capacity of the existing rail systems and implications of additional airport traffic requirements for additional capacity (not costed)	Requirements for providing additional capacity for 4 trains per hour: A new alignment or a tunnel between Hawkesbury River and Berowra due to the limit of capacity in Cowan Bank on Main Northern Railway	Requirements for providing additional capacity for 4 trains per hour: A new alignment or a tunnel between Hawkesbury River and Berowra due to the limit of capacity in Cowan Bank on Main Northern Railway	Requirements for providing additional capacity for 4 trains per hour: Duplication of Richmond Line If the Western Express Project goes ahead, there may not capacity issues on the Western Line	Requirements for providing additional capacity for 4 trains per hour on the East Hills Line: Quadruplication between Revesby and Glenfield Sextuplication between Erskineville and Tempe Re-signalling and electrification	Requirements for providing additional capacity for 4 trains per hour on the East Hills Line: Quadruplication between Revesby and Glenfield Sextuplication between Erskineville and Tempe Re-signalling and electrification	Requirements for providing additional capacity for 4 trains per hour on the East Hills Line: Quadruplication between Revesby and Glenfield Sextuplication between Erskineville and Tempe Re-signalling and electrification	Requirements for providing additional capacity for 4 trains per hour on the East Hills Line: Quadruplication between Revesby and Glenfield Sextuplication between Erskineville and Tempe Re-signalling and electrification	Main Southern Railway/East Hills Line does not have sufficient capacity to serve a new airport Requirements for providing additional capacity for 4 trains per hour on the Main South Line: Southern Sydney Freight Line needs to be in place as part of quadruplication to Glenfield Quadruplication between Revesby and Glenfield Sextuplication between Erskineville and Tempe Re-signalling and electrification	Main Southern Railway/East Hills Line does not have sufficient capacity to serve a new airport Requirements for providing additional capacity for 4 trains per hour on the Main South Line: Southern Sydney Freight Line needs to be in place as part of quadruplication to Glenfield Quadruplication between Revesby and Glenfield Sextuplication between Erskineville and Tempe Re-signalling and electrification New refuges south of Macarthur	Main Southern Railway/East Hills Line does not have sufficient capacity to serve a new airport Requirements for providing additional capacity for 4 trains per hour on the Main South Line: Southern Sydney Freight Line needs to be in place as part of quadruplication to Glenfield Quadruplication between Revesby and Glenfield Sextuplication between Erskineville and Tempe Re-signalling and electrification New refuges south of Macarthur
	Comparative Order of Cost for Rail Link including rolling stock	~$740	~$2,190	~$1,320	~$1,130	~$1,130	~$1,130	~$1,130	~$930	~$1,100	~$1,630
	Kilometres to connect Site boundary to existing designated state roads/highways	~2.5m to F3	~2.5m to F3 (eastern boundary of Site)	~25km to M7	~8km to Western Motorway (M4) ~15km to M7	~11km to Western Motorway (M4) ~10km to M7	~13km to M7	~18km to Western Motorway (M4) ~20km to M7	~16km to Hume Highway	~9km to Hume Highway	~10km to Hume Highway
	Specific issues in constructing a road link	The existing roadway (F3) is at a similar level to the airport Site The F3 would need to be diverted and the diverted road connected to the airport. Connection would be relatively easy	The existing roadway (F3) is at a similar level to the airport Site and connections would be relatively easy	The existing roadways (Wilberforce and Windsor Roads) would require an upgrade. Upgrade to the road bridge over the Hawkesbury River, connection would be relatively easy	The existing roadways (The Northern Road and Elizabeth Drive) would require an upgrade, connection would be relatively easy	The existing roadways (The Northern Road and Elizabeth Drive) would require an upgrade, connection would be relatively easy	The existing roadways (The Northern Road and Bringelly Drive) would require an upgrade, connection would be relatively easy	The existing roadways (Greendale Road, The Northern Road and Bringelly Drive) would require an upgrade, connection would be relatively easy	The existing roadways (Barkers Lodge Road, Remembrance Drive and Woodbridge Road) would require an upgrade, connection would be relatively easy	The existing roadways (Picton Road) would require an upgrade, connection would be relatively easy	The existing roadways (Picton Road) would require an upgrade, connection would be relatively easy
	Works Required	8km road diversion of the Pacific Highway and connection to airport	3km upgrade to Peats Ridge Road and connection to airport	9km upgrade to Putty Road, Wilberforce Road and Windsor Road and connection to airport	15km upgrade to The Northern Road and Elizabeth Drive and connection to airport	8km upgrade to Elizabeth Drive and connection to airport	12km upgrade to Bringelly Road and connection to airport	15km upgrade to Greendale Road and Bringelly Drive, 2km extension of Greendale Road and connection to airport	14km upgrade to Bakers Lodge Road and Remembrance Drive, 5km extension road and connection to airport	20km upgrade to Picton Road and connection to airport	20km upgrade to Picton Road and connection to airport

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
	Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
	Cost of works to nearest $ million	~$108 million	~$82 million	~$259 million	~$345 million	~$192 million	~$270 million	~$369 million	~$397 million	~$456 million	~$456 million
	Note: Estimated costs for road construction are as follows: • Upgrade from a 2 lane corridor to 4 lane corridor - $22 million/km (based on NSW RMS cost estimates of upgrade to the Oxley Highway) • Diversion/Extension of road, new two lane two way road - $11.5 million/km (based on RMS cost estimate of diversion of The Camden Valley Way) • Airport connection, overpasses and connections - $15.5 million each (based on Canberra Airport connection cost) • Bridge widening - $114million/km (based on RTA cost of Sea Cliff Bridge, Illawarra)										
CRITERION 2 Proximity to growth centres and commercial opportunities	Distance from Site boundary to identified commercial growth centres (Metro and Regional Strategies)	Tuggerah-Wyong Major Centre (~14km)	Gosford City Centre (~7km) Tuggerah-Wyong Major Centre (~14km)	Windsor Town Centre (~9km) Rouse Hill Planned Major Centre (~16km)	Penrith Regional City (~10km) Leppington Planned Major Centre (~16km) Mt Druitt Potential Major Centre (~14km)	Penrith Regional City (~15km) Leppington Planned Major Centre (~10km) Mt Druitt Potential Major Centre (~12km)	Leppington Planned Major Centre (~10km)	Leppington Planned Major Centre (~14km) Penrith Regional City (~21km) Mt Druitt Potential Major Centre (~22km)	Camden Town Centre (~23km) Campbelltown-Macarthur Major Centre (~35km)	Campbelltown-Macarthur Major Centre (~25km) Wollongong Regional City (~23km)	Campbelltown-Macarthur Major Centre (~22km)
	Percentage of footprint within North West or South West Growth Centre	0%	0%	0%	0%	0%	25%	0%	0%	0%	0%
	N70 - 10 Event Contour impact on North West or South West Growth Centre	Nil	Nil	Low	Medium	High	High	High	Nil	Nil	Nil
CRITERION 3 Comparative Earthworks Estimate	Comparative cut plus fill earthworks volume to level Site (m^3/ha) rounded to nearest '00.	97,800	177,500	87,300	80,900	115,400	126,900	119,000	197,900	208,900	149,200
	Comparative cost to prepare airport platform rounded to nearest million	$280 million	$530 million	$343 million	$284 million	$356 million	$407 million	$304 million	$680 million	$805 million	$564 million
	Note: Comparative cut plus fill earthworks volume in m3/ha to create a completely level airport footprint. Note: in practice airport sites do not have to be completely level over their whole area. Costs are based on adjusted earthworks volumes to account for this and for the different geotechnical material expected to be encountered on that site.										

Table 7-5 Phase Four Matrix – Maximum Airports

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Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
	Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
CRITERION 4 Noise Impact on Residents	20 ANEC	10,700	4,180	10,250	3,290	3,200	3,990	1,920	5,920	290	1,280
	25 ANEC	3,420	790	2,290	1,170	1,360	970	650	3,250	130	240
	30 ANEC	1,930	200	780	460	540	310	220	1,520	60	110
	35 ANEC	970	100	330	110	200	110	80	610	30	50
	40 ANEC	380	50	110	50	100	50	30	300	10	30
Approximate population within noise contour categories based on Site specific orientation of runway (nearest '0')	Distance (m) from Site boundary to nearest urban areas (as defined by DoPI)	0	1,950	0	0	3,750	4,300	1,950	2,450	750	4,000
	Number of Persons Exposed to >10 Number of Events >70dB(A)	60,360	8,080	33,600	43,130	52,400	32,460	12,670	13,680	1,950	11,880
Refer to Australian Standard AS 2021-2000 Acoustics - aircraft noise intrusion - building siting and construction	N70 person events (nearest '00)	2,534,200	670,600	2,020,800	1,545,200	1,668,000	1,284,600	499,200	799,400	81,500	324,800
	AIE (N70/Persons exposed)	40	80	60	40	30	40	40	60	40	30
CRITERION 5 Mine Subsidence	Designated mine subsidence zone present within Site	Yes	No	No	No	No	No	No	No	Yes Site is close to mine subsidence areas and operating mines. Extent of any old or current mines needs to be established	No Site is close to mine subsidence areas and operating mines. Extent of any old or current mines needs to be established
	Percentage of Site within designated mine subsidence zone	~20%	0	0	0	0	0	0	0	~25%	0

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

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	Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
CRITERION 6 Number of Lots Requiring Acquisition Based on number of lots directly impacted by Site footprint	Approximate number of allotments within Site	500	190	380	140	40	180	70	100	40	10
	Average number of allotments per hectare within Site	0.298	0.130	0.370	0.081	0.018	0.103	0.048	0.057	0.023	0.003
	Population within Site boundary (Census 2006) (rounded to nearest '0)	1,120	170	940	210	490	250	150	130	70	130
CRITERION 7 Airspace Interaction	See Airservices Australia technical paper: *Report on Initial Location Analysis* (February 2012) referred to in Section 7.4 Inputs from CASA and Defence have not been incorporated into this analysis	Major Probable interaction with military airspace to the north and east Several power stations in vicinity (potential danger areas due high velocity exhaust)	Major Probable interaction with operations to KSA	Major Probable interaction with operations to KSA Site within military airspace with issues for access routes For maximum airport assumes RAAF Richmond closed and relocated	Major The location of R536A and 536B within the nominal CTR boundary would not be compatible with the proposed 01/19 runway alignment The Department of Defence Orchard Hills facility would have to be relocated Potential impacts on flying training areas and Camden Airport Extent of interaction with KSA may be improved in comparison to Badgerys Creek as runway alignment more northerly than Badgerys Creek	Major Potential impacts on flying training areas and Camden Airport See note below	Major Site is aligned north west - south east with the intention of minimising interaction with Holsworthy Airspace to the south east Potential impacts on flying training areas and Camden Airport	Major Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills Explosives depot airspace Potential impacts on flying training areas and Camden Airport May need to consider wind turbulence due to high terrain to the west	Major Site well south of the RAAF Richmond military airspace and minimises interaction with Orchard Hills Explosives depot airspace Potential impacts on flying training areas and Camden Airport May need to consider wind turbulence due to high terrain to the west	Major	Major

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
	Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
CRITERION 8 Capacity for Future Expansion	Capacity for future expansion to Maximum Airport	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
CRITERION 9 Flood Risk at Site		Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Part of the Site identified as within 1 in 100 Year Flood and PMF Flood Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Site identified as within Flood Prone Land' & Flood Planning Area (designated by Liverpool City Council) Site identified as within 5%, 1% and PMF Flood line (designated by Camden City Council)	Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Council Flood mapping does not include area of airport footprint Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently	Council Flood mapping does not include area of airport footprint Not identified by Local Authority as being flood prone by rising flood waters Local minor creeks may flood intermittently

Note 1:

In all cases the preliminary observations listed herein need to continue to be tested with relevant authorities; Airservices Australia; Department of Defence; Office of Airspace Regulation; existing airport operators and users at the feasibility stage. Potential conflicts or dependencies with Richmond and KSA's operations and Sydney Basin traffic would require more detailed analysis by Department of Defence, Airservices Australia and/or the Office of Airspace Regulation. The general complexity of existing airspace within and adjacent to the Sydney Basin makes this ongoing review necessary.

Major

• Airspace where there are significant levels of civil air transport traffic and military activity, such as around Sydney, Williamtown, Nowra and Richmond together with their respective CTR/CTA, and operational procedures and requirements; or

• Restricted Areas particularly those with provisional classifications of RA3 and RA2; or

• Danger Areas associated with military flying training.

Moderate

• Airspace where there are significant levels of GA traffic, such as around Bankstown and Camden together with their respective CTR (note in practice as Bankstown and Camden are relatively close to the larger airports, a potential moderate ranking is effectively outweighed by the factors affecting the larger airports); or

• Restricted Areas with provisional classifications of RA1; or

• Danger Areas associated with civil flying training; or

• VFR transit routes.

Minor

• Airspace where there are lower levels of civil traffic and non-towered aerodromes; or

• Danger Areas.

Note 2:

This assessment of Badgerys Creek has been prepared on the basis of demonstrating technical consideration of all possible sites considered in this study. The following consideration of airspace issues is based generally around the runway geometry determined during the various EIS processes undertaken since 1985 i.e. a runway alignment of 05/23. The 18/36 runway option shown in the most recent EIS has not been considered.

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
	Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
CRITERION 10 Additional Potential infrastructure affected by airport footprint causing dislocations relocations and other items likely to involve costs	Airservices and Defence	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	Requires closure and relocation of RAAF Richmond	Requires closure and relocation of Orchard Hills Explosives Depot	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected
	Minor Airports and Airfields in Close Proximity	Warnervale Airfield	Somersby Airfield	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	The Oaks Airfield	Wedderburn Wilton Parachuting Club	Wedderburn Wilton Parachuting Club
	Railways	Realignment of Main North Railway or grade separation may be needed	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	Some realignment of the incomplete Maldon- Dombarton Railway may be needed	No major items as yet identified to be directly affected
	Roads	F3 Freeway Motorway Link Road Sparks Road Mountain Road Dakara Road Bruce Cr Warnervale Road Hakone Road	Wisemans Ferry Road Anembo Road Silvesters Road Robinson Road Elwins Road Lackersteens Road Keighley Ave Grants Road Vitasalo Road Lutana Road Nyah Road Bimbil Road Debenham Road North Somersby Falls Road Howes Road Ulinga Road	Putty Road Singleton Road Kurmond Road Creek Ridge Road Blacktown Road Vollers Ln Reserve Road Godalla Road Old East Kurrajong Road Lamrock Ave Moles Road Kamrock Grv Hayes Road Wenban Road Uworra Road Rockyhall Pl Stannix Place Road Carrs Road Argents Road Sargents Road Salters Road McKinnons Road Roland Ln Stewarts Ln Geakes Road Joshua Road Thomas Road Reserve Road Sheppards Road	The Northern Road Elizabeth Dr Park Road Littlefields Road Adams Road Gates Road Galaxy Road Queenshill Dr Oaky Road	The Northern Road Badgerys Creek Road Taylors Road Winston Cl Gardiner Road Pitt St Longley Road Leggo Road Fuller St Ferndale Road Anton Road Jagelman Road Willowdene Ave Vicar Park Ln Dwyer Road	Greendale Road Dwyer Road Findlay Road Francis St	Wolstenholm Ave Orient Road Cut Hill Road	Bakers Lodge Road Mowbray Park Road Montpelier Dr Craigend Road Evelyns Ridge Road Victoria Park Road	Picton Road Macarthur Dr	No major items as yet identified to be directly affected

Table 7-5 Phase Four Matrix – Maximum Airports

Suitable Sites - Specified Localities

Site Evaluation Matrix – Airport Type Maximum (Full Service Airport)

Greenfield Locality and Site Name

	Locality Name	Central Coast	Central Coast	Hawkesbury	Nepean	Nepean	Nepean	Nepean	Burragorang	Cordeaux-Cataract	Cordeaux-Cataract
	Site Name	Wallarah	Somersby	Wilberforce (RAAF Relocated)	Luddenham	Badgerys Creek	Bringelly	Greendale	Mowbray Park	Wilton	Wallandoola
	Water Supply	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	Requires relocation or encasement of Sydney Water Supply Pipelines	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected
	Major Electricity Supply (OLS = possible conflict with obstacle limitation surface)	2 sets of 330 KV power lines need re-alignment 2 sets of 330kV power lines (OLS) – north 500kV power line (OLS) – north	330kV power lines (OLS) – north west	500kV power line (OLS) – east	330kV power line needs re-alignment	330kV power line needs re-alignment	330kV power line needs re-alignment 330kV power lines (OLS) south	2 sets of 330kV power lines need re-alignment	330kV power line needs re-alignment	330kV power line needs re-alignment	No major items as yet identified to be directly affected
	Major Gas Supply Lines	Possible conflict with Sydney to Newcastle gas and oil pipeline. Further detailed investigation required	Possible conflict with Sydney to Newcastle gas and oil pipeline. Further detailed investigation required	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected	Possible conflict with Eastern Gas Pipeline gas and oil pipeline Further detailed investigation required	Possible conflict with Eastern Gas Pipeline gas and oil pipeline Further detailed investigation required
	Rivers and Estuaries	2 reaches of Wallarah Creek	Robinson Creek Floods Creek Hunter Creek	Howes Creek Chain of Ponds Creek Currency Creek	Mulgoa Creek and tributaries Blaxland Creek and Tributaries	Oaky Creek Badgerys Creek	Duncan's Creek Bringelly Creek	Bringelly Creek and Tributaries	Monkey Creek Stonequarry Creek	Cordeaux River (Site elevated) Cascade Creek Clements Creek Allens Creek Third Point Creek	No major items as yet identified to be directly affected
	Social and Educational Infrastructure	No major items as yet identified to be directly affected Site is close to existing urban developments	Rindean Quarry Access to Pioneer Concrete Quarry Adjacent to national parks	River Oak Arabian Stud Farm King Equestrian Academy Sydney Equestrian Supplies Hawkesbury High and Primary Schools (3.5km) Nature parks adjacent, existing quarry	Luddenham Primary School (0.1km) Holy Family Primary School (0.3km)	Mendez Equestrian Centre Crown Park Training Centre	University of Sydney University Farms Leppington Pastoral Company Bringelly Primary School (1km)	Sugar Loaf Equestrian Centre University of Sydney University Farms Site is aligned generally north / south. Location seeks to avoid minimise noise on smaller urban areas to the north and south	Mowbray Park Country Estate Site is aligned generally north / south. Location seeks to avoid minimise noise on smaller urban areas to the north and south	No major items as yet identified to be directly affected	No major items as yet identified to be directly affected

7.8 Ernst & Young's Rapid CBA Outputs

The results from the Rapid Cost Benefit Analysis (Rapid CBA) undertaken by Ernst &Young (E&Y)[54] are summarised in the following tables for each of the Type 3 and Maximum airports sites. A 50 year period was adopted for assessing costs and benefits.

This Rapid CBA was developed by E & Y to provide a relative comparison between localities. Given the rapid nature of the economic appraisal, a relative NPV or less than zero (or a relative benefit cost ratio (RBCR) of less than 1.0) was not considered to definitively suggest a locality or site would be unviable; likewise a high NPV or RBCR was not considered to definitively suggest economic viability.

The core analysis for Maximum Airports undertaken by E&Y was for an unconstrained scenario, on the assumption that any adverse interactions with the current operation of Sydney Airport could be resolved in planning and design of the site and/or of the Sydney region airspace, This is an important qualification, since, as was outlined in Section 7.2.4, the current airspace design and operation is considered to have significant and variable constraining effects on the numbers of aircraft movements possible at each of the sites.

Table 7-6 Rapid CBA Net Present Values (NPV) for Maximum Airport Sites

Suitable Site	Locality	Unconstrained		
		NPV $billions	Rank	Ratio % compared to 1st ranked
Luddenham	Nepean	4.9	1	100%
Bringelly	Nepean	4.9	1	100%
Badgerys Creek	Nepean	4.8	3	98%
Wilberforce	Hawkesbury	4.7	4	96%
Greendale	Nepean	4.3	5	88%
Somersby	Central Coast	3.3	6	67%
Wilton	Cordeaux-Cataract	3.0	7	61%
Wallandoola	Cordeaux-Cataract	2.8	8	57%
Mowbray Park	Burragorang	2.7	9	55%
Wallarah	Central Coast	1.5	10	31%

Source: *Aviation Capacity Cost Benefit Economic Assessment (*Ernst & Young - February 2012*)*

Note: According to Ernst & Young, based on unconstrained analysis, which assumed all sites can provide the same passenger access and capacity with no operating, planning or engineering restrictions which might result from the current airspace operations. Results presented are discounted costs and benefits (7% discount rate). To allow for comparison across sites on a like basis, land acquisition costs are included in the appraisal of Badgerys Creek so these results do not reflect that acquisition has already occurred. In some instances RBCR results do not result in the same ranking of sites.

[54] E&Y 2012, 'Aviation Capacity Cost Benefit Economic Assessment', 11 January 2012, prepared for the Department of Infrastructure and Transport

In addition to the economic results presented above, E&Y also undertook a number of scenario analyses to determine the potential impacts of a number of potentially constraining factors on the unconstrained results presented above, including:

- Implications of airport interactions with other assets;
- Operational implications of the proposed sites due to existing aviation network patterns; and
- The likely subjective quantitative noise implication of developing an airport in that specific location.

According to E & Y, the effect of applying the three constraints above impacts on the scale of the net economic benefits, but has a minimal impact on the ranking of sites, with the Nepean sites continuing to perform well. However, as is shown in Tables 7-4 and Table 7-5, there is considerable variation in the numbers of people liable to be affected by aircraft noise and this is taken into account in the site assessments made in this report.

In the case of Type 3 sites, Table 7-7 shows the NPVs and ranking that apply to Type 3 airport sites. Six of the sites were estimated to have positive NPVs between $0.2 billion and $0.7 billion, and these are all located in either the Nepean or Hawkesbury localities. The remaining ten sites were estimated in the rapid appraisal to have negative NPVs ranging from -$0.8 billion (Wallarah) and -$0.1 billion (Somersby).

It is notable that, of the six top ranked Type 3 Airport sites which are able to be developed into Maximum Airports, these sites are also the top ranked Maximum Airport sites, though there is some variation in the rank order. These six Sites include all four Maximum Sites in the Nepean Locality and both Hawkesbury Locality Maximum sites.

Table 7-7 Rapid CBA Net Present Values for Type 3 Airport Sites

Suitable Site	Locality	Unconstrained		
		NPV $billions	Rank	Ratio % compared to 1st ranked
Kemps Creek	Nepean	0.7	1	100%
Wilberforce^	Hawkesbury	0.3	2	43%
Badgerys Creek^	Nepean	0.3	2	43%
Luddenham^	Nepean	0.3	2	43%
Castlereagh	Hawkesbury	0.2	5	29%
Bringelly^	Nepean	0.2	5	29%
Somersby^	Central Coast	-0.1	7	-14%
Southend	Cordeaux-Cataract	-0.1	7	-14%
Greendale^	Nepean	-0.1	7	-14%
Silverdale	Burragorang	-0.4	10	-57%
The Oaks	Burragorang	-0.6	11	-86%
Dendrobium	Cordeaux-Cataract	-0.6	11	-86%
Wallandoola^	Cordeaux-Cataract	-0.6	11	-86%
Wilton^	Cordeaux-Cataract	-0.6	11	-86%
Mowbray Park^	Burragorang	-0.7	15	-100%
Peats Ridge	Central Coast	-0.7	15	-100%
Wallarah^	Central Coast	-0.8	17	-114%
^ indicates able to be expanded to a maximum scale airport				

Source: *Aviation Capacity Cost Benefit Economic Assessment (*Ernst & Young - February 2012*)*

Note: According to Ernst & Young, based on unconstrained analysis, which assumed all sites can provide the same passenger access and capacity with no operating, planning or engineering restrictions which might result from the current airspace operations. Results presented are discounted costs and benefits (7% discount rate). To allow for comparison across sites on a like basis, land acquisition costs are included in the appraisal of Badgerys Creek so these results do not reflect that acquisition has already occurred. In some instances RBCR results do not result in the same ranking of sites.

7.9 Identification of *'more suitable'* sites

The task in this study has been to identify the *'more suitable'* greenfield sites for airport development in each of five specified localities in the Sydney region. This process applies where there is more than one site for either a Type 3 or Maximum Airport in each of the five localities. However, where there is only one site in a locality for a given airport type, that site becomes the *'more suitable'* site.

The following rating scale has been adopted:

- to assess each generally suitable airport site based on the data assembled in the matrices in Section 7-7; and
- to order their general and relative suitability, based on where there are distinguishing differences between them, using the indicator ratings shown below.

More suitable	Suitable	Less suitable
✓✓	✓✗	✗✗
Adverse issues are 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 will be difficult to remedy through normal planning and design and/or expensive to remedy with likely additional capital cost implications

In the application of these ratings, no attempt has been made to rank the criterion and, therefore, each line of the following tables is a separate discrete assessment of the identified airport sites one against another only. However, the approach adopted does enable major differentiators to be identified and the assessments which follow focus on what is different between sites rather than what is reasonable the same between sites. Data is drawn from the detail given in Table 7-3 Phase Four Data Matrix - Type 3 Airports and Table 7-4 Phase Four Data Matrix - Maximum Airports, and the Ernst &Young Rapid CBA.

It should be noted that even the '*more suitable'* airport sites will have some degree of adverse issues. However, it is matter of degree and the ease with which a remedy to any adverse issue can be achieved.

Caution should be exercised in regard to the use of any such identified sites beyond this Suitable Sites Study because:

- the site has been only identified by application of a customized template airport for both the Type 3 and Maximum airports;
- more detailed airport planning and engineering studies, based on material including but not limited to detailed topocadastral data, are need to identify any specific land parcels and titles which may be affected;
- development of an airport design will require inputs from other aspects of the overall Sydney Region Aviation Capacity Study that have not or may not as yet been taken into account;
- as yet, only limited inputs from major stakeholders, such as Airservices Australia, CASA and Department of Defence, have been available in terms of airspace management and runway capacity;

- it has been assumed that there would be only one new airport site developed and, as such, any assessment is only of each suitable site in the context of Sydney Airport and other airspace constraints, not of multiple sites; and
- at any site, refinement of the site boundary and orientation of the site and runways can be expected to occur to take account of the specific aviation, environmental, social and infrastructural issues and assets which are particular to that site and which would be expected to be revealed and addressed in the environmental impact assessment (EIA) process in which alternatives and a preferred option are assessed.

All dollar costs are in either billions or millions to the nearest ten (10) million and are for the purposes of comparison only.

7.9.1 Central Coast Locality

Table 7-8 provides a summary comparison and qualitative assessment of the Central Coast Suitable Sites.

Table 7-8 Central Coast Locality Suitable Sites

	Type 3 Airport Sites			Maximum Airport Sites	
Criterion	**Peats Ridge**	**Somersby**	**Wallarah**	**Somersby**	**Wallarah**
NPV $billions Capacity Unconstrained	-$0.7	-$0.1	-$0.8	+$3.3	+$1.5
1- Transport - Comparative Transport Upgrade Costs $ millions[55]	$260 ✓✗	$80 ✓✓	$70 ✓✓	$80 (road) $2,190 (rail) ✓✗	$110 (road) $740 (rail) ✓✓
2 - 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 (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 ✓✗

[55] For type 3 – road upgrade cost only

	Type 3 Airport Sites			Maximum Airport Sites	
Criterion	Peats Ridge	Somersby	Wallarah	Somersby	Wallarah
7 - Airspace Interaction Capacity (Movements per hour)	~40-50[56] ×× fully interdependent with Sydney Airport	~40-50[57] ×× fully interdependent with Sydney Airport	~40-50 ✓×	~80-100[58] ×× fully interdependent with Sydney Airport	~80- 100 ✓✓
8 - Expansion to Maximum	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 & Major Power Realignment Closure of Somersby, Mangrove Mountain Airfields ××	No major items ✓✓	Freeway, Rail & Major Power Realignment Closure of Somersby, Mangrove Mountain Airfields ××

It can be observed that none of the Type 3 Airports has a positive net present value (NPV). However, both those sites which are capable of expansion to a Maximum Airport (Somersby and Wallarah) do have positive NPVs when assessed as Maximum Airports. The Type 3 Airport sites are distinguished principally by:

- noise impacts - 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; and
- additional capital costs – with Wallarah having much greater possible additional costs to relocate or make alignment adjusts to major infrastructure.

The key factor overall which distinguishes between Central Coast Type 3 Airport ‘suitable sites’ is airspace management. Both the Peats Ridge and Somersby sites are considered to be operationally connected to Sydney Airport and, as a result, their actual day to day capacity in terms of aircraft movements is liable to be seriously reduced.

[56] Must be integrated with Sydney Airport airspace management and may be unable to operate for periods of time due to close connection with Sydney airport e.g. during major wind shifts requires change of runway at Sydney Airport; may also be further constrained by military airspace associated with Richmond and Williamtown.
[57] ditto
[58] ditto

However, this capacity may be worsened in specific circumstances. For example, a southerly front passing through Sydney, which causes a change of runway from say Runway 34 to Runway 16 at Sydney Airport, may take more than an hour to reach Peats Ridge or Somersby. An airport at either the Peats Ridge or Somersby locations could be still operating under a wind direction from the north (i.e. in the opposite direction to Sydney Airport). During this time, until the southerly passed through these sites, these airports would have to be 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 a '*more suitable'* site in the Central Coast.

Wallarah, while not subject to such a limitation in regard to Sydney 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% of theoretical runway capacity. This may entail reorientation of the runway(s) and this may have adverse consequences for effects on infrastructure and of aircraft noise on residents [4]. It may also be difficult to achieve while continuing to keep the airport site's footprint outside lands designated as mine subsidence areas.

Nevertheless, notwithstanding that Wallarah has some major shortcomings which would need to be addressed, of the Central Coast sites, it is the *'more suitable*' site for both a Type 3 and a Maximum Airport. As noted, this assessment would only change if the Somersby and Peats Ridge sites could be operationally decoupled from airspace arrangements for Sydney Airport, which on current advice from ASA appears unlikely.

7.9.2 Hawkesbury Locality

The key issue in respect of any site in this locality is the presence of the RAAF Base at Richmond and the interaction that any new airport would have with that operation. Either runway orientations have to be compatible with an ongoing operation at RAAF Base Richmond or if not, then, on the assumption that the RAAF require to continue the activities that currently take place at Richmond within the locality, provision needs to be made for an RAAF precinct on any new airfield. Table 7-9 provides a summary comparison and qualitative assessment of the Hawkesbury Locality Suitable Sites.

	Type 3 Airport Sites		**Maximum Airport Sites**
Criterion	**Castlereagh (including RAAF)**	**Wilberforce (09/27 Runway)**	**Wilberforce with RAAF (01/19 Runway(s))**
NPV $billions Capacity Unconstrained	+$0.2	+$0.3	+$4.7
1- Transport - Comparative Transport Upgrade Costs $ millions [59]	$210 (road) ✓x	$259 (road) ✓x	$259 (road) $1,320 (rail ✓x

[59] For type 3 – road upgrade cost only.

	Type 3 Airport Sites		Maximum Airport Sites
Criterion	Castlereagh (including RAAF)	Wilberforce (09/27 Runway)	Wilberforce with RAAF (01/19 Runway(s))
2 - Growth Centres	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓
3 – Earthworks Platform Comparative Cost $ millions	$134 ✓✓	$196 ✓✓	$343 ✓✓
4 - Noise Impacts (N70) person-events	1,085,400 ✗✗	172,800 ✓✗	2,020,800[60] ✗✗
5 - Mine Subsidence Areas (MSAs)	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓
6 - Property Acquisition (number of lots)	180 ✓✗	100 ✓✗	380 ✓✗
7 - Airspace Interaction Capacity (Movements per hour)	~40-50 ✓✗	~40-50 ✓✗	~60-70 ✓✗
8 - Expansion to Maximum	No ✗✗	Yes ✓✓	Not applicable – already a maximum ✓✓
9 – Major Flood Risk	Partial 1:100 and 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 RAAF Orchard Hills Bankstown flying training areas may close Severe impacts on aircraft lane of entry ✗✗	No major items ✓✓	Relocation of RAAF Base Richmond ✗✗

Two Type 3 Airports and one Maximum Airport site were identified in the Hawkesbury locality. The standalone Type 3 Airport site identified and assessed at Wilberforce has a runway orientation of 09/27 which is close to parallel to the existing runway at RAAF Base Richmond. While not specifically analysed as separate options 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 10/28 (to be later used as a cross

[60] Note that the runway orientation changes from Wilberforce Type 3 to Wilberforce Maximum which is more North South.

runway) or a Type 3 Wilberforce with RAAF 01/19. While the 10/28 orientation would have greater compatibility with RAAF Base Richmond, 01/19 would have greater compatibility with Sydney Airport.

Both Type 3 Airports and the Maximum Airport assessed generate a positive economic NPV in unconstrained analysis, with a Type 3 at Castlereagh (RAAF located on site) assessed to have a NPV of $0.2 billion, a Type 3 Airport at Wilberforce (09/27) slightly higher at $0.3 billion, and a Maximum Airport at Wilberforce (01/19 and RAAF located on site) higher again at $4.7 billion.

Beyond this, the major factors which provide differentiation between the Wilberforce and Castlereagh Type 3 Airport sites are:

- noise effects with a Type 3 Airport at Wilberforce 09/27 predicted to generate only 172,800 N70 person-events while a Type 3 Airport at Castlereagh would generate more than five times that amount at 1.085 million person-events;
- the ability to expand Wilberforce into a Maximum Airport (as discussed above, 09/27 could form a cross runway; or alternatively the Type 3 Airport at Wilberforce could be developed with a 01/19 orientation), should this be required in the future; 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 would Castlereagh for a Type 3 Airport, ASA's advice is that, due to interaction with Sydney 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 Type 3 Airport 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 Terminal Area (CTA), though not without adverse interactions with current Sydney Airport airspace management.

Only one site in the Hawkesbury locality – Wilberforce 01/19 - was identified as capable of accommodating a Maximum scale airport and, accordingly, it is nominated as the '*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. The other key issue for a maximum airport at Wilberforce would be the relatively high effects on people with more than 2 million N70 person-events being predicted, as well some 380 property lots having to be acquired.

7.9.3 Nepean Locality

Table 7-10 and Table 7-11 provide a summary comparison and qualitative assessment of the Nepean Suitable Sites for Type 3 and for Maximum Airports respectively.

Five Type 3 sites remain for assessment in the Nepean locality, of which four are capable of being upgraded to Maximum Airports.

Table 7-10 Nepean Locality Suitable Sites - Type 3 Airport

	Type 3 Airports Sites

Criterion	Luddenham	Kemps Creek	Badgerys Creek	Bringelly	Greendale
NPV $ billions Capacity Unconstrained	+$0.3	+$0.7	+$0.3[61]	+$0.2	-$0.1
1- Transport - Comparative Transport Upgrade Costs $ millions[62]	$350 (road) ✓✗	$130 (road) ✓✓	$190 (road) ✓✗	$270 (road) ✓✗	$370 (road) ✓✗
2 - Growth Centres	Not affected ✓✓	Partial Direct Footprint ✗✗	Partially Acoustic Footprint ✓✗	Partially Acoustic Footprint ✗✗	Not affected ✓✓
3 – Earthworks Platform Comparative Cost $ millions	$126 ✓✓	$96 ✓✓	$161 ✓✓	$310 ✓✓	$226 ✓✓
4 - Noise Impacts (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)	~40-50 ✓✗	~40-50 ✓✗	~40-50 ✓✗	~40-50 ✓✗	~40-50 ✓✗
8 - Expansion to Maximum	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/Bankst	RAAF Orchard Hills Closure Flying training areas and Wilton PJE closures Operations at	Camden Airport closure; flying training areas & Wilton PJE may close Major power lines	Camden Airport closure RAAF Orchard Hills and Wilton PJE Closure Operations at Holsworthy and	RAAF Orchard Hills may require a buffer zone. Operations at Bankstown affected

[61] To allow for comparison across sites on a like basis, land acquisition costs were included in the CBA of Badgerys Creek so these results do not reflect that acquisition has already occurred.
[62] For type 3 – road upgrade cost only.

	Type 3 Airports Sites				
Criterion	**Luddenham**	**Kemps Creek**	**Badgerys Creek**	**Bringelly**	**Greendale**
	own flying training areas & Wilton PJE may close ×× 	Holsworthy, Camden and Bankstown affected: New GA airport may be needed Severe impacts on aircraft lane of entry Major power lines ××	✓×	Bankstown severely affected. Major power lines ✓×	Camden and The Oaks airport, Wilton PJE Closure Major power lines ✓×

In terms of economic NPV, three of the five Type 3 sites in the Nepean locality return a positive value. Of the five sites, Kemps Creek is the most positive at $0.7 billion, possibly because it one of the easier sites on which to create a platform in terms of earthworks and because of a lower cost of 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 Southwest growth centre. Finally, Kemps Creek is considered only capable to providing a site for a Type 3 airport which could not be expanded to a Maximum airport.

Of the remainder, all are considered capable of expansion to a Maximum airport. Greendale has the lowest NPV at -$0.1 billion while the NPVs for Luddenham, Badgerys Creek and Bringelly are similar at around $0.2 to $0.3 billion. All sites are reasonably equivalent[63] in terms of operational capability as Type 3 airports, though this is not necessarily the case if they are expanded to Maximum 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 180,000 to 210,000 based on the current distribution of population; Proximity to the land designated for the Southwest Growth Centre would result in an overlap of the acoustic footprint of airports at Kemps Creek, Badgerys Creek and Bringelly. 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. 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, while Bringelly would require the highest number of lots at an estimated 150 lots.

All sites would require adjustment of some form 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 liable to flooding by its position lower in the Nepean River valley.

[63] All sites interact with existing airspace constraints that influence capacity in some way or another as outlined by ASA in Table 7-2.

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 the *'more suitable'* sites 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, which could incorporate some or all of these sites, to be found in the future.

Kemps Creek should only be considered further if there is no requirement for the site to ever be expanded to a Maximum 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 7-11 Nepean Locality - Suitable Sites Maximum Airports

	Maximum Airport Sites			
Criterion	**Luddenham**	**Badgerys Creek**	**Bringelly**	**Greendale**
NPV $ billions Capacity Unconstrained	+$4.9	+$4.8[64]	+$4.9	+$4.3
1- Transport - Comparative Transport Upgrade Costs $ millions [65]	$350 (road) $1,130 (rail) ✓✗	$190 (road) $1,130 (rail) ✓✗	$270 (road) $1,130 (rail) ✓✗	$370 (road) $1,130 (rail) ✓✗
2 - Growth Centres	Not affected ✓✓	Partially acoustic footprint ✓✗	Partially acoustic footprint ✗✗	Not affected ✓✓
3 – Earthworks Platform Comparative Cost $ millions	$284 ✓✓	$356 ✓✓	$407 ✓✗	$304 ✓✓
4 - Noise Impacts (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)	~60-70 ✓✗	~60-70 Note: NE/SW alignment unsuitable for integration ✓✗	~60-70 ✓✗	~60-70 ✓✗

[64] To allow for comparison across sites on a like basis, land acquisition costs were included in the CBA of Badgerys Creek so these results do not reflect that acquisition has already occurred.
[65] For type 3 – road upgrade cost only.

	Maximum Airport Sites			
Criterion	**Luddenham**	**Badgerys Creek**	**Bringelly**	**Greendale**
8 - Expansion to Maximum	Not applicable – already a maximum ✓✓	Not applicable – already a maximum ✓✓	Not applicable – already a maximum ✓✓	Not applicable – already a maximum ✓✓
9 – Major Flood risk	Non Major ✓✓	Non Major ✓✓	Non Major ✓✓	Partial, 1:20, 1:100 and PMF events ✓x
10 - Other Major Costs	RAAF Orchard Hills Closure May close Camden/Bankstown Flying training areas Wilton PJE closure Major Power lines Sydney Water Supply xx	Camden and Wilton PJE closure May close Camden/Bankstown Flying training areas Major power lines ✓x	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 PJE closure. Major power lines ✓x	Impacts on Bankstown Airport, closure of Camden and The Oaks Airports and Wilton PJE, Buffer to RAAF Orchard Hills. Major power lines ✓x

When considered as unconstrained Maximum Airport sites, the Nepean sites have been estimated by Ernst & Young to return some of the highest NPVs of all the localities considered. The economic NPVs of the Maximum Nepean sites range between $4.3 and 4.9 billion, all within a similar range. This is in part because some of the component costs such as upgrading to transport links and earthworks to create an airport platform are essentially similar.

The key distinguishing factors for Maximum Airport sites in the Nepean locality are firstly, the possible effects of people with the Greendale site assessed to generate an N70 of 499,200 person- events based on current population distributions which is about three times less than predicted for the sites at Luddenham, Bringelly and Badgerys Creek. Greendale and Luddenham would not cause either direct, partial or indirect affects of the Southwest 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, the proposed land use in this area of overlap is not yet known and may or may not be compatible with exposure to aircraft noise. As with the Type 3 airports, the Badgerys Creek site being 100% or very nearly so in Commonwealth ownership, whereas other sites which would require between 70 and 180 lots to be acquired to achieve a similar aggregated land area to that at Badgerys Creek.

The second key distinguishing factor is in terms of airspace and operational compatibility with Sydney Airport, in which, on the basis of currently proposed runway allocations and orientations, the Luddenham, Bringelly and Greendale sites would yield greater movement capacity than the Badgerys Creek site. However, reorientation of runways at Badgerys Creek specifically and more intensive regional airspace modeling and realignment of generally runways may achieve better results at all sites.

Like the Type 3 sites, all these Maximum sites would require adjustment of some form of major infrastructure, notably power transmission lines. But 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 liable to flooding because of its position at a lower level in the Nepean River valley.

Accordingly, while there are variations in suitability between the sites, given the runway orientations as currently depicted, at Luddenham, Badgerys Creek, Bringelly and Greendale, they are all sufficiently similar[66] and potentially able to be improved, to be retained as the *'more suitable'* sites for Maximum airports in the Nepean locality at this stage of investigation. In particular and like the Type 3 sites, by being virtually contiguous sites, the possibility of a yet better site being found, which incorporates some or all of these currently identified sites, is retained.

7.9.4 Burragorang Locality

Table 7-12 provides a summary comparison and qualitative assessment of the Burragorang Suitable Sites.

Table 7-12 Burragorang Locality - Suitable Sites

	Type 3 Airport Sites			Maximum Airport Sites
Criterion	**Silverdale**	**The Oaks**	**Mowbray Park**	**Mowbray Park**
NPV $ billions Capacity Unconstrained	-$0.4	-$0.6	-$0.7	+$2.7
1- Transport - Comparative Transport Upgrade Costs $ millions [67]	$430 (road) ✓✗	$320 (road) ✓✗	$400 (road) ✓✗	$400 (road) $930 (rail) ✓✗
2 - Growth Centres	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓
3 – Earthworks Platform Comparative Cost $ millions	$463 ✓✗	$489 ✓✗	$372 ✓✓	$680 ✓✗
4 - Noise Impacts (N70) person-events	42,100 ✓✓	194,600 ✓✗	159,600 ✓✗	799,400 ✓✗
5 - Mine Subsidence Areas (MSAs)	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓

[66] All sites interact with existing airspace constraints that influence capacity in some way or another as outlined by ASA in Table 7-2.
[67] For type 3 – road upgrade cost only

	Type 3 Airport Sites			Maximum Airport Sites
Criterion	**Silverdale**	**The Oaks**	**Mowbray Park**	**Mowbray Park**
6 - Property Acquisition (number of lots)	40 ✓✓	70 ✓✓	40 ✓✓	100 ✓✓
7 - Airspace Interaction Capacity (Movements per hour)	~40-50 ✓✗	~40-50 ✓✗	~40-50 ✓✗	~60-70[68] ✓✗
8 - Expansion to Maximum	No ✗✗	No ✗✗	Yes ✓✓	Not applicable – already a maximum ✓✓
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 PJE closures. Operations at Bankstown affected Major Power Lines ✓✗	The Oaks Airfield, Camden Airport, Wilton PJE closures ✓✗	The Oaks Airfield, Wilton PJE closures Camden Airport operations affected Major Power Lines ✓✗	The Oaks Airfield, Wilton PJE closures. Camden Airport operations affected Major Power Lines ✓✗

Three Type 3 sites have been identified in the Burragorang locality and all three have negative economic NPVs of between $0.4 and $0.7 billion. On most criteria, while there are some differences, these are not great and do not distinguish between them. Those criteria which do provide some degree of differentiation between them are that:

- Silverdale is predicted to have a much lower effect on the current distribution of population, with an N70 of 42,500 person-events, compared to 194,600 person-events at the Oaks and 159,600 person-events for Mowbray Park;
- the comparative cost of creating an airport platform has been assessed to be lower at Mowbray Park than the other sites;
- only Mowbray Park has been assessed as being capable of expansion to a maximum scale airport;
- construction of an upgraded access road to The Oaks has been assessed as being lesser in cost than to either to the other two sites;

[68] Not specifically addressed by ASA but assumed to be similar to Greendale

- Mowbray Park would require closure of The Oaks Airfield but Silverdale and the Oaks would require closure of both the Oaks Airfield and Camden Airport.

On the basis of these differentiations, Mowbray Park is indicated as the *'more suitable'* of these sites, most notably because of its ability to be upgraded to a Maximum Airport. However, if only a Type 3 Airport is sought then given its much lower effect on people, Silverdale may be regarded as '*more suitable'* but 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 Airport scale 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 was assessed as having a positive economic NPV of about $2.7 billion. This site has is not as capacity constrained in relation to Sydney Airport, although high terrain to the west would need to be further investigated as this could cause wind shear and turbulence problems at the site. Its relatively more remote location would require relatively greater investment in transport infrastructure and the site is in relatively more difficult terrain so airport platform costs accordingly, would be higher. However, its remoteness would result in relatively lower levels of N70 events at about 799,400 person-events.

7.9.5 Cordeaux-Cataract Locality

Table 7-13provides a summary comparison and qualitative assessment of the Cordeaux-Cataract Suitable Sites.

Table 7-13 Cordeaux-Cataract Locality Suitable Sites Type 3 Airport

	Type 3 Airport Sites			
Criterion	**Southend**	**Wilton**	**Wallandoola**	**Dendrobium**
NPV $ billions Capacity Unconstrained	-$0.1	-$0.6	-$0.6	-$0.6
1- Transport - Comparative Transport Upgrade Costs $ millions [69]	$450 (road) ✓✗	$460 (road) ✓✗	$460 (road) ✓✗	$370 (road) ✗✗
2 - Growth Centres	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓
3 – Earthworks Platform Comparative Cost $ millions	$504 ✓✓	$346 ✓✗	$345 ✓✓	$253 ✓✓
4 - Noise Impacts (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 ✓✗

[69] For type 3 – road upgrade cost only

	Type 3 Airport Sites			
Criterion	**Southend**	**Wilton**	**Wallandoola**	**Dendrobium**
6 - Property Acquisition (number of lots)	10 ✓✓	10 ✓✓	5 ✓✓	5 ✓✓
7 - Airspace Interaction Capacity (Movements per hour)	<40-50 xx Operations constrained by Sydney 16/34 operations;	~40-50 ✓x	~40-50 ✓x	~40-50 ✓x
8 - Expansion to Maximum	No xx	Yes ✓✓	Yes ✓✓	No xx
9 – Major Flood risk	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓	Not affected ✓✓
10 - Other Major Costs	Wilton PJE to close Holsworthy, Camden operations affected Water catchment areas Major power lines ✓x	Wilton PJE to close Holsworthy, Camden and Bankstown operations and Wedderburn Airfields affected Water catchment areas Major power lines xx	Wilton PJE to close Holsworthy, Camden operations and Wedderburn Airfields affected Water catchment areas ✓x	Wilton PJE to close Camden operations affected Illawara Regional Airport affected Water catchment areas Major power lines ✓x

As has been the case with all other localities, the Type 3 Airports in Cordeaux-Cataract all have negative NPVs, although there is marked difference between them with the Southend site being least negative by a significant margin.

ASA has indicated a specific reduced capacity for a Type 3 Airport at Southend as it would be liable to be constrained by interaction with operations at Sydney Airport. In other regards, the Type 3 Airport sites are relatively the same except 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 immediately below these sites at present;
- neither the Dendrobium or Southend sites are considered capable of being expanded to a Maximum airport, due to their limited site areas;

- airports at the Wilton and Wallandoola sites would require closure of the Wilton Parachute Jumping Centre (PJE) 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 7-14 Cordeaux-Cataract Locality Suitable Sites - Maximum Airport

	Maximum Airport Sites	
Criterion	**Wilton**	**Wallandoola**
NPV $ billions Capacity Unconstrained	+$3.0	+$2.8
1- Transport - Comparative Transport Upgrade Costs $ millions[70]	$460 (road) $1,100 (rail) ✓✗	$460 (road) $1,630 (rail) ✓✗
2 - Growth Centres	Not affected ✓✓	Not affected ✓✓
3 – Earthworks Platform Comparative Cost $ millions	$805 ✓✗	$564 ✓✗
4 - Noise Impacts (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)	~80-100 (Note: assuming R555 (Holsworthy) operations limited or negated) ✓✓	~80-100 (Note: assuming R555 (Holsworthy) operations limited or negated) ✓✓
8 - Expansion to Maximum	Not applicable – already a maximum ✓✓	Not applicable – already a maximum ✓✓
9 – Major Flood risk	Not affected ✓✓	Not affected ✓✓

[70] For type 3 – road upgrade cost only

	Maximum Airport Sites	
Criterion	**Wilton**	**Wallandoola**
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 ✓✗

As has been already noted, there are two sites within the Cordeaux-Cataract locality capable of accommodating a Maximum Airport – Wilton and Wallandoola. In unconstrained NPV terms, they are very similar with Wilton valued slightly more at $3.0 billion compared to Wallandoola's $2.8 billion. Neither is capacity constrained through its interaction with Sydney Airport. In the Maximum Airport configuration, these sites perform relatively well and similarly in all aspects other than:

- Wilton is close to the M5 freeway although Wallandoola is about equidistant between the M5 freeway 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 airport site at Wilton has an overlap with a designated Mine Subsidence District;
- in addition to the need to close both Wilton PJE and Wedderburn Airfield, there are major transmission lines to be relocated at Wilton.

The major point of differentiation, however, is in terms of N70 effects with Wilton generating about a quarter of N70 person events (81,500), compared to Wallandoola (324,800), based on current population distributions and runway orientations.

On the basis of this latter significant distinction, Wilton is considered the *'more suitable'* maximum site in the Cordeaux-Cataract locality, subject to further detailed checking on the occurrence and effects of mining as there are several existing collieries in this locality which are not within the designated Mine Subsidence District.

7.10 Summary - More Suitable Sites by Locality

Table 7-15 summarizes the assessment of the suitable Type 3 and Maximum Airport sites and those sites which have been assessed to be 'More Suitable'.

Table 7-15 More Suitable Sites by Locality

	Localities				
	Central Coast	**Hawkesbury**	**Nepean**	**Burragorang**	**Cordeaux-Cataract**
Type 3 '*Suitable*' sites	Peats Ridge Somersby Wallarah	Wilberforce 09/27 Castlereagh (including RAAF)	Kemps Creek Luddenham Badgerys Creek Bringelly Greendale	The Oaks Silverdale Mowbray Park	Wilton Southend Wallandoola Dendrobium
'More suitable' **Type 3** Airport(s) sites	Wallarah	Wilberforce 09/27[71]	Luddenham Badgerys Creek Bringelly Greendale	Silverdale (a) Mowbray Park (b)	Wilton Wallandoola
Key reason(s) for being '*more suitable*'	Airspace relationship to Sydney Airport	Compatibility with RAAF Base Richmond	Ability to expand to maximum airport type	a) for least noise impact b) for ability to expand to maximum airport type	Ability to expand to maximum airport type
'*Suitable*' Maximum Airport sites	Somersby Wallarah	Wilberforce with RAAF	Luddenham Badgerys Creek Bringelly Greendale	Mowbray Park	Wilton Wallandoola
'More suitable' Maximum Airport(s)	Wallarah	Wilberforce with RAAF	Luddenham Badgerys Creek Bringelly Greendale	Mowbray Park	Wilton
Key reason(s) for being *'more suitable'*	Airspace Relationship to Sydney airport	Only available suitable site for Maximum	Such differences as exist between them 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 Maximum	Much lower noise impact

[71] While not specifically analysed as separate options for a Type 3 airport at Wilberforce, possible first stages to develop a Maximum airport could be a Type 3 Wilberforce 10/28 (to be later used as a cross runway) or Wilberforce with RAAF 01/19.

The reasons why a site has been identified as being *'more suitable'* vary from location to location but, in general, they are principally related to:

- the magnitude of predicted N70 person-event impacts on people;
- the extent to which aircraft movement capacity is constrained by virtue of the site's interaction with the way in which airspace in the Sydney region is currently managed; and
- in the case of Type 3 Airports, whether they are capable of being expanded to a Maximum Airport.

The localities clearly vary in terms of their ability to supply *'more suitable'* sites with, in most cases, only one or possibly two sites being able to be identified, especially for Maximum airports.

The Nepean locality, however, has been assessed to be able to supply up to four separate sites including the Badgerys Creek site. It may be observed that, in rapid CBA terms as shown in Tables 7-6 and 7-7, the Nepean sites in general outperform the nominated *'more suitable'* sites in all other localities, both as Maximum Airports sites and as Type 3 Airport sites.

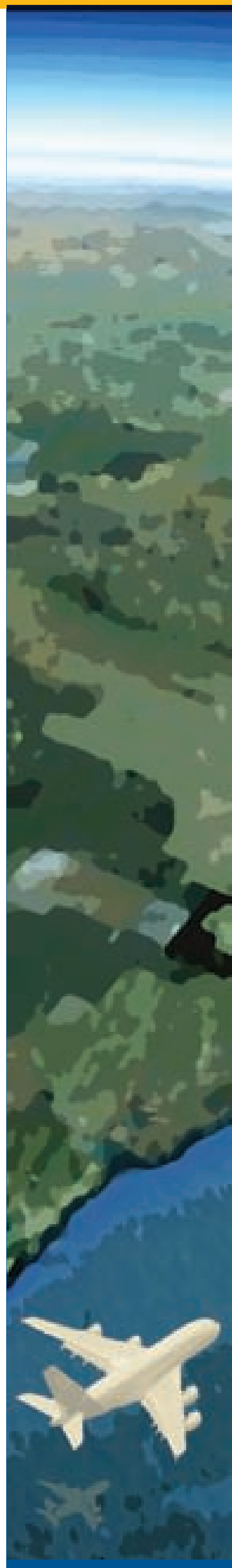
Although these Nepean sites are currently shown as discrete, they are either contiguous or nearly contiguous along sections of their site boundaries.

In the way these four Nepean sites are currently configured in terms of runway orientation, there is a certainly a degree of variation in terms of the principal differences in effect on people and interaction with air space management. However, it is most notable and uniquely significant that, in combination, these sites form a larger contiguous precinct of '*more suitable'* sites than exists in any other locality considered in this Study, where the most suitable lands in which to locate suitable sites tend to be disaggregated, discontinuous and, in most cases, not very much greater than the land size required for a Maximum Airport.

8

References

References



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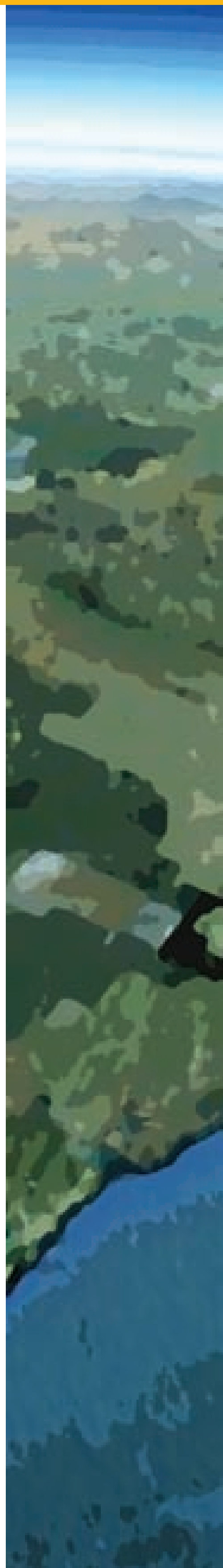
1
Appendix

GIS Model Assumptions



GIS Model Assumptions

WorleyParsons
consulting practices

EcoNomics™

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT

Sydney Region Aviation Capacity Study

GIS Technical Report

301015-02388 – RP001-0

28-July-2011

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PROJECT 301015- 02388 - SYDNEY AVIATION CAPACITY STUDY

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CUSTOMER APPROVAL	DATE
A	Issued for internal review	CG Campbell Grant	DMC David McConnell	N/A	01-July-2011	N/A	
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1. INTRODUCTION

WorleyParsons carried out a Geographic Information Systems (GIS) analysis to help to determine the most suitable areas for the potential development of additional aviation capacity within the Sydney Region. This analysis was carried out for two airport types:

- .a limited service airport serving all regular passenger transport (RPT) segments (all domestic and limited international markets) with one runway – referred to in this report as a Type 3 Airport;
- a full service domestic and international airport serving all RPT segments with two wide spaced parallel runways and one cross runway – referred to in this report as a Maximum Airport.

Consistent with the four phase methodology adopted for the Most Suitable Sites Study, GIS analyses were carried out for nominated criteria (also referred to as metrics) in various datasets. The results of the analyses were weighted and combined to form one dataset. The combined dataset and the results of the individual analyses were mapped and used to help to determine the most suitable areas for the potential development of the two nominated airport types.

This report details the data and methodology that was used for each of the analyses.

2. INPUT DATA

Two datasets were utilised for the GIS analysis. The first dataset was used to exclude areas within nominated localities from the analysis that were identified as being unsuitable for a new airport (Phase One). This dataset is referred to as the exclusionary dataset. The second dataset was used to calculate the four metrics that were in turn used to help to determine the most suitable areas and sites for the potential development of a new airport (Phases Two, Three and Four). This dataset is referred to as the calculation dataset.

The data utilised was assumed to be the most current and comprehensive at the date of acquisition. No verification or ground truthing of the data was undertaken other than as is described in the report and the site inspections contained elsewhere herein.

2.1 Exclusionary Dataset

Certain areas were excluded from the analysis as they were identified as being unsuitable for the nominated airport types. These areas are:

1. National Parks
2. State Forests
3. State Conservation Areas
4. Ramsar wetlands
5. Existing urban areas
6. Air traffic control zones
7. Wind shear areas
8. Areas outside a 90 minute travel time boundary from Sydney's population centroid.[1]

The exclusionary dataset was comprised of these areas.

2.1.1 National Parks

A National Parks shape file was provided by the NSW Department of Planning and Infrastructure to WorleyParsons. Within the shape file was a GIS field labelled 'TYPE'. This field was filtered so that only the record labels relevant to the analysis were retained. The record labels contained within the 'TYPE' field and their relevance to the analysis is

[1] This factor was used to help exclude localities in the Sydney Region from detailed investigation for the two nominated airport types.

summarised in Table 2.1The relevant record labels were used to identify the extent of National Parks and State Conservation Areas.

Table 2.1: Record labels within National Parks shape file provided to WorleyParsons

Record	Relevant
Aboriginal Heritage Area	No
CCA Zone 1 National Park	Yes
CCA Zone 3 State Conservation Area	Yes
Historic Site	No
Karst Conservation Reserve	No
National Park	Yes
Nature Reserve	No
Regional Park	No
State Conservation Area	Yes

The record labels that were not used identified areas that would be taken into consideration at a later environmental impact assessment stage of the study.

2.1.2 State Forests

A State Forests shape file was provided by the NSW Department of Planning and Infrastructure to WorleyParsons. This file was used to identify the extent of State Forests.

2.1.3 State Conservation Areas

The National Parks shape file provided by the NSW Department of Planning and Infrastructure to WorleyParsons was used to identify the extent of State Conservation Areas.

2.1.4 Ramsar Wetlands

A Ramsar wetlands shape file was provided by the NSW Department of Planning and Infrastructure to WorleyParsons. This file was used to identify the extent of Ramsar wetlands.

2.1.5 Existing Urban Areas

An existing urban areas shape file was provided by the NSW Department of Planning and Infrastructure to WorleyParsons. This file was used to identify the extent of existing urban areas.

2.1.6 Existing Aviation Airspace

An existing aviation airspace drawing exchange file was provided by Airport Master Planning Consultants to WorleyParsons. This file was used to identify the Sydney and Williamtown Airports restricted airspace footprints.

2.1.7 Wind Shear Areas

A wind shear areas drawing exchange file was provided by Airport Master Planning Consultants to WorleyParsons. This file was used to identify the extent of known wind shear areas along the Illawarra escarpment.

2.1.8 Areas Outside a 90 Minute Travel Time Boundary

While sophisticated modelling of road travel times was provided by Transport NSW for the PM peak, this had several limitations for the purpose of this Study:

- It addressed only the peak periods and therefore not the spectrum of times which an airport user would use to travel to/from an airport;
- It represented travel times to and from the CBD rather than the centroid of population which had been directed by the Steering Committee to be adopted as the point from which to measure travel times -based on 2006 Census data, Sydney's population centroid is currently taken to be at Ermington
- It ignored the likelihood of travel to an airport located remote from the CBD being counter flow to the AM and PM peak travel directions flow times

For these reasons, this data was not used and, instead, Google Maps was used to determine how far it is possible to travel by car in 90 minutes from Ermington. This data was used to create the 90 minute travel time boundary. This approach is less sophisticated but provides a reasonably average road travel time prediction – one which is more likely to be used by the travelling public in their decision making – and which was found in several field trips to be reasonably accurate under free flowing conditions.

2.2 Calculation Dataset

The calculation dataset was used to calculate four metrics that were in turn used to help to determine the most suitable areas within the five nominated localities for the potential development of the two nominated airport types. The calculation dataset is comprised of the following data:

1. Digital elevation model (DEM);
2. 2006 Census data;

3. ANEC 20 noise contours;
4. Main roads – being agreed to be the major travel mode to/from airports; and
5. Mine subsidence areas.

2.2.1 Digital Elevation Model (DEM)

Elevation data on a 25m grid was purchased from AAM Group, a specialist geospatial data provider. The following information was provided by AAM Group as to the data origin and quality:

> *Topographic 3 dimensional 25 metre grid data derived from contour and drainage data sourced from the New South Wales Topographic Map Archive (pre 1995). Predominantly 10 metre and 20 metre contours used as source data. Sydney basin data was supplemented by integrating 2 metre contours as a 3 dimensional 5 metre grid where they were available.*

The approximate geographic extent of the data that was purchased is as follows:

Bounding Rectangle

- West Longitude: 150.0
- East Longitude: 151.8
- North Latitude: -32.82
- South Latitude: -34.9

This extent is more recognisably defined as the rectangular area of land east of Lithgow, South of Newcastle and North of Gerringong (Figure 2-1). This area includes all of the area generally known as the Sydney Region (or Basin).

The 25m grid elevation data was used to ensure that that the earthworks and Obstacle Limitation Surface (OLS) acceptability metric could be calculated with an acceptable level of accuracy. It was decided that grid elevation data with a resolution finer than 25m would not provide any additional information as to one area's suitability over another at a regional level.

The 25m grid elevation data was provided to WorleyParsons by AAM Group in a tiled format. WorleyParsons proprietary software was used to stitch the tiles together to create a single 25m DEM grid. This was done to allow the earthworks and OLS acceptability metric to be calculated.

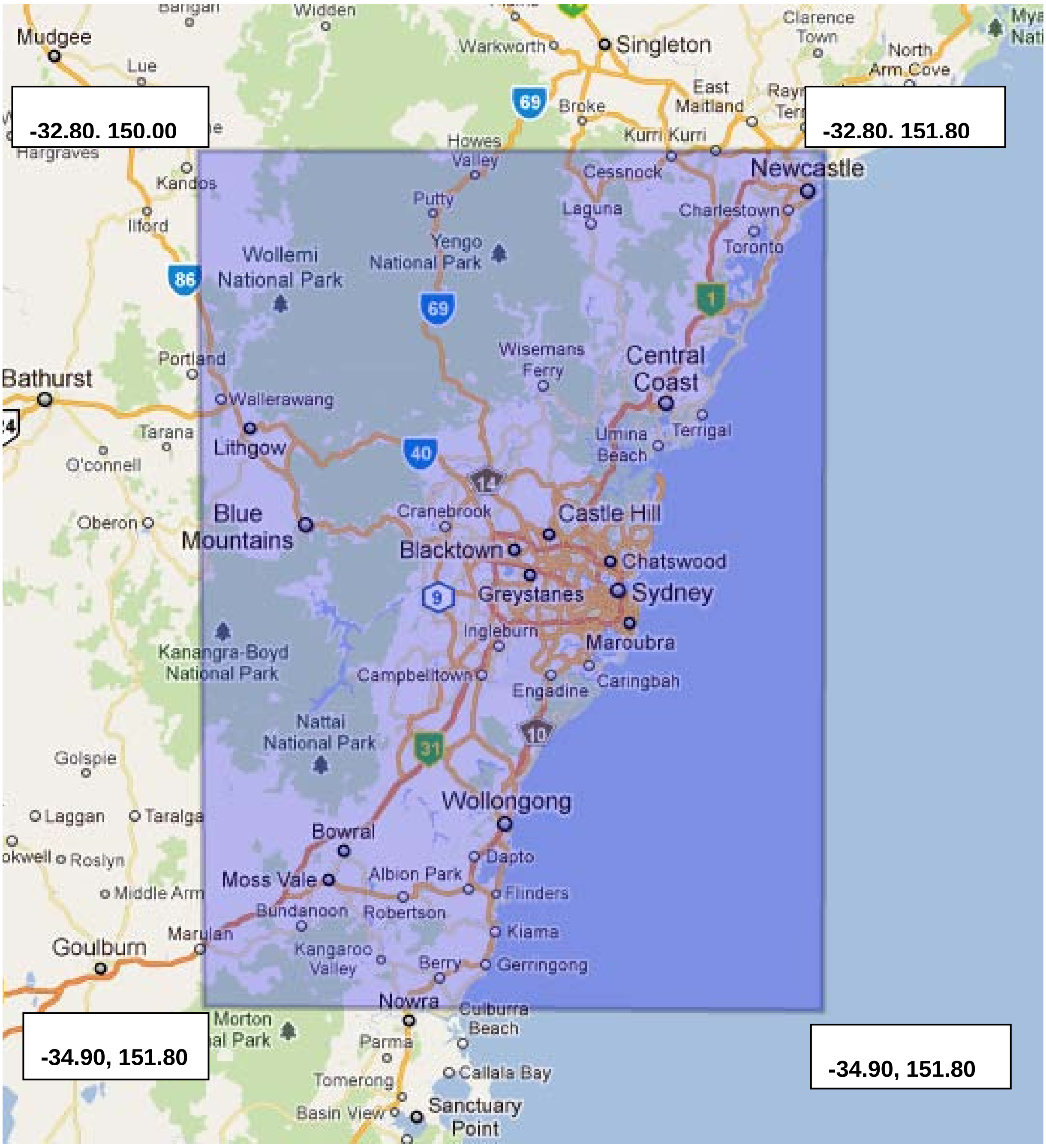


Figure 2-1: Geographic extent of data purchased

2.2.2 2006 Census Data

The 2006 Australian Census data pack was purchased from the Australian Bureau of Statistics (ABS). The purchased data pack contained a shape file detailing the extent of every Census collection district (CD) within NSW. Associated with the shape file was the data collected within each CD. This data was filtered so that each CD's total population and area was retained.

The retained population and area data contained within the shape file was mapped to a 250m grid as population per hectare using proprietary WorleyParsons software.[2] This was done to allow the population within ANEC 20 noise contours metric to be calculated.

2.2.3 ANEC 20 Noise Contours

An ANEC 20 noise contours drawing exchange file was provided by Airport Master Planning Consultants to WorleyParsons. Within the file were two ANEC 20 noise contours. The first contour was a typical ANEC 20 contour for a Maximum Airport. The second contour was a typical ANEC 20 contour for a Type 3 Airport. This file was used to calculate the population within ANEC 20 noise contours metric.

2.2.4 Main Roads

A major roads MapInfo interchange format file is provided with the MapInfo software product which is licensed to WorleyParsons. This file was edited by WorleyParsons to include all freeways, motorways and four lane roads within the greater Sydney area. The position of the freeways, motorways and four lane roads was obtained from Google Maps. This file was used to calculate the distance from main roads metric.

2.2.5 Mine Subsidence Areas

A mine subsidence areas shape file was provided by the NSW Department of Planning and Infrastructure to WorleyParsons. This file was used to determine the extent of mine subsidence areas and calculate the mine subsidence exposure metric.

[2] WaterRide ™

3. CALCULATED METRICS

Four metrics were identified that were used to help to determine the most suitable areas for the potential development of the two nominated airport types. The metrics that were identified are:

1. Earthworks and OLS acceptability;
2. Population within ANEC 20 noise contours;
3. Distance from main roads; and
4. Mine subsidence exposure.

Analyses were carried out for each metric.

3.1 Earthworks and Obstacle Limitation Surface

An earthworks and OLS acceptability analysis was carried out for each cell in the 25m DEM grid. This analysis was conducted for two purposes:

- to determine where potential airport runways can be positioned such that an OLS criterion is satisfied; and
- to determine the volume of earthworks that would be required for the potential runways that satisfy the OLS criterion.

The analysis was carried out by centring a number of runway templates on each grid cell and assessing the potential earthworks and OLS acceptability. Eight separate runway templates were analysed for each grid cell, comprising four orientations (North-South, East-West, Northwest-Southeast and Northeast-Southwest) and two different size rectangular runways (4.5km by 1.25km and 3km by 1km). The larger rectangular area is typical of a Maximum Airport runway, the smaller rectangular area is typical of a Type 3 Airport runway.

The earthworks analysis was carried out for each template by determining the volume of earthworks required to produce a level site. This was done such that the cut and fill for the site were balanced. If the cut plus fill for a potential runway was found to be more than 100 million cubic metres, then the potential runway was deemed to be not feasible. The rationale for this is explained in the Main report and this figure has been adopted as an upper limit given that the analysis is testing for a runway strip not a full airport site

The OLS analysis was carried out for each template by placing an OLS template on both ends of the runway. The geometry of the OLS that was used for the analysis can be seen in Figure 3-1. The starting height for the OLS was taken to be the level determined from the earthworks analysis that produced a balance of cut and fill. If the natural ground elevation was found to exceed the OLS elevation within its bounds, then the potential runway was deemed to be not feasible. Allowance was made in this calculation for a potential runway slope of up to 1% along the runway length.

For each potential runway that was found to be feasible for both earthworks and OLS, the calculated volume of earthworks for the runway (cut plus fill) was saved to a results grid. Where more than one potential runway was deemed feasible for a grid cell, the lowest calculated volume of earthworks was saved to the results grid.

The results for the two different size rectangular runways were stored in separate results grids, so that they could be viewed and analysed independently.

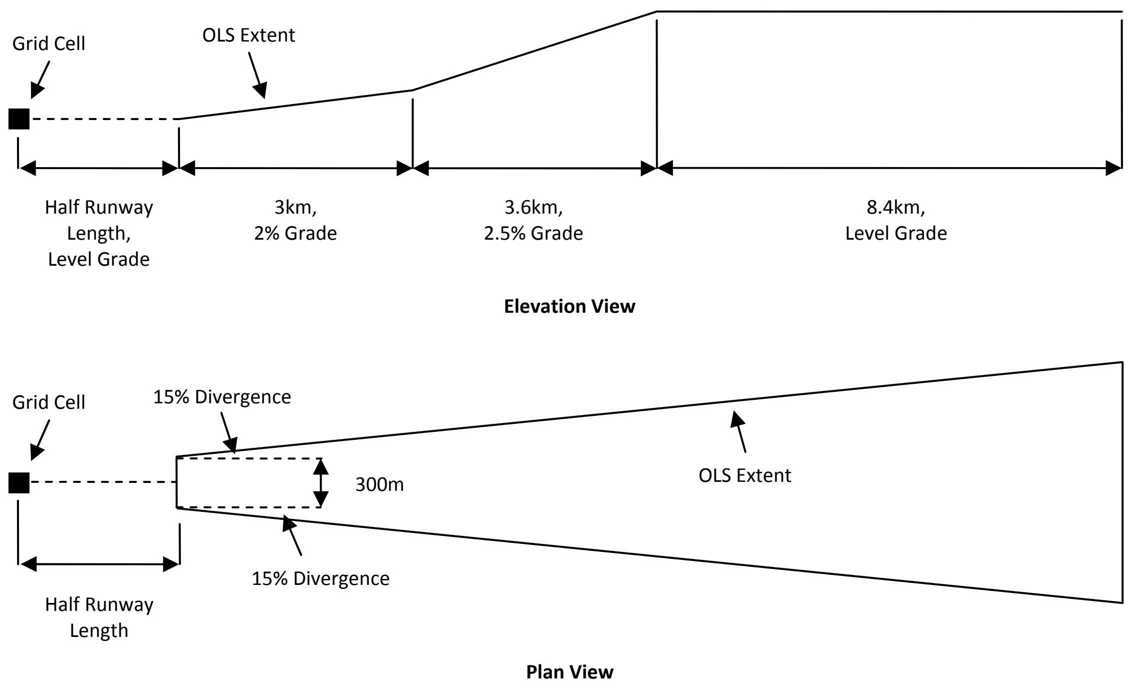


Figure 3-1: OLS template (not to scale)

3.2 Population within ANEC 20 Noise Contours

An analysis to determine the population within a number of ANEC 20 noise contours was carried out for each cell in the 250m population data grid. This analysis was carried out to determine the minimum population potentially affected by noise due to the development of a new airport.

The analysis was carried out by centring two ANEC 20 contour templates on each grid cell and calculating the total population within each template. The two templates simulated a Maximum Airport, and a Type 3 Airport. The ANEC 20 contour templates were orientated in the same four directions as the earthworks analysis, that is North-South, East-West, Northwest-Southeast and Northeast-Southwest. In total, eight ANEC 20 contours were analysed for each grid cell, comprising the four different orientations and the two different airport types.

The total population inside each ANEC 20 contour was calculated by checking each population data grid cell to see if it was inside the contour. If a cell was found to be inside the contour then the population within the grid cell was added to a running count of the population inside the contour.

The lowest calculated population for each grid cell was saved to a results grid. The results for the two different airport sizes were stored in separate results grids, so that they could be viewed and analysed independently.

3.3 Distance from Main Roads

An analysis to determine the distance from main roads was carried out for each cell in the 250m population data grid. This analysis was carried out to determine which areas of land have the best existing connections to main roads.

The main roads data file was used as the basis for this analysis. For each cell in the population data grid, the shortest distance to the roads contained within the main roads data file was calculated. This distance was then saved to a results grid.

3.4 Mine Subsidence Exposure

An analysis to determine mine subsidence exposure was carried out for each cell in the 250m population data grid. This analysis was carried out to determine which areas of land are exposed to mine subsidence.

The mine subsidence areas data file was used as the basis for this analysis. Each cell in the population data grid was checked to see if it was inside the polygons contained within the mine subsidence areas data file. A yes/no[3] result was then saved to a results grid.

[3] Ie the land contained in the cell under consideration is in or is not in a mine subsidence district.

4. COMBINATION OF CALCULATED METRICS

During the course of the analysis, consideration was given to using a weighted combination approach to mapping factors, in order to try to identify areas of land which, of all the areas of land were the least suitable. While a number of test cases were derived and considered, it was ultimately decided, in consultation with the Department, that this approach, while shown to be possible, did not strongly assist the process of building a transparent, evidence based approach as it:

- **Required both internal ranking of factors and weighting between criteria;**
- **Tended to obscure rather than illuminate which criteria was driving the way any particular cell was being rated overall;**

This approach was not adopted in the analysis and the following discussion then is solely for the purpose of documenting that this approach was tested and remains available should it be desired that it be revisited.

The calculated metrics were weighted and combined to form one dataset. This was done to gain an overall picture of the most suitable areas for the potential siting of a new airport. This combination was carried out for both a large international airport and a smaller domestic airport using a number of different weighting factors.

To combine the datasets, the calculated metrics were placed on a common framework. The earthworks and OLS acceptability metric was recorded on a 25m grid. The population within ANEC 20 noise contours metric, distance from main roads metric and mine subsidence exposure metric were all recorded on a 250m grid. The earthworks and OLS acceptability metric was sampled to the same 250m grid as the other metrics using averages.

To facilitate mapping and individual metrics as well as combined metrics, the results for each metric were divided into a number of bands. These bands were chosen to represent logical categories or divisions for each metric from least to greatest value. Each band was assigned a value. The bands and values that were assigned for each metric can be seen in Table 4.1. The earthworks and OLS acceptability metric was converted to the given banding by dividing the total earthworks volume for a potential runway by the area of that runway in hectares.

The four metrics were combined by checking the four results grids simultaneously. The earthworks and OLS acceptability result was first checked to determine if a potential runway was feasible for a given grid cell. If a potential runway was found to be feasible then each of the metrics was assigned a value based on the banding in Table 4.1. The assigned values for each metric were then summed. The sum was divided by the maximum possible summation value and saved to a results grid, giving a minimum possible value of 0 and a maximum possible value of 1 for each grid cell. Areas with a value of 0 are the most suitable for the potential siting of a new airport, while areas with a value of 1 are the least suitable.

Relative weighting was then applied across the four metrics to facilitate a comparison of a number of perspectives on the outcome. Three weighting scenarios were applied to each of the two airport types as shown in Table 4.2. These scenarios reflected WorleyParsons AMPC views about which criteria might be likely to be relatively more important to the Steering Committee and were for the purposes of testing the methodology and software only.

Table 4.1: Bands and values used for the combination of calculated metrics

Metric	Bands	Value
Earthworks and OLS acceptability	0 - 10,000 m^3/ha	0
	10,000 - 25,000 m^3/ha	1/6
	25,000 - 50,000 m^3/ha	2/6
	50,000 - 75,000 m^3/ha	3/6
	75,000 - 100,000 m^3/ha	4/6
	100,000 - 125,000 m^3/ha	5/6
	125,000 - 150,000 m^3/ha	1
Population within ANEC 20 noise contours	0 - 100	0
	100 - 500	1/7
	500 - 1,000	2/7
	1,000 - 2,500	3/7
	2,500 - 5,000	4/7
	5,000 - 10,000	5/7
	10,000 - 20,000	6/7
	> 20,000	1
Distance from main roads	0 - 2 kms	0
	2 - 5 kms	1/4
	5 - 10 kms	2/4
	10 - 20 kms	3/4
	> 20 kms	1
Mine subsidence exposure	Not in designated mine subsidence area	0
	In designated mine subsidence area	1

Note: Any potential runway requiring more than 150,000 m^3/ha of earthworks was deemed to be not feasible

Table 4.2: Parameters used for combinations

Airport	Metric	Weighting
Maximum	Earthworks and OLS acceptability	25%
	Population within ANEC 20 noise contours	25%
	Distance from main roads	25%
	Mine subsidence exposure	25%
Maximum	Earthworks and OLS acceptability	20%
	Population within ANEC 20 noise contours	50%
	Distance from main roads	20%
	Mine subsidence exposure	10%
Maximum	Earthworks and OLS acceptability	10%
	Population within ANEC 20 noise contours	75%
	Distance from main roads	10%
	Mine subsidence exposure	5%
Type 3	Earthworks and OLS acceptability	25%
	Population within ANEC 20 noise contours	25%
	Distance from main roads	25%
	Mine subsidence exposure	25%
Type 3	Earthworks and OLS acceptability	20%
	Population within ANEC 20 noise contours	50%
	Distance from main roads	20%
	Mine subsidence exposure	10%
Type 3	Earthworks and OLS acceptability	10%
	Population within ANEC 20 noise contours	75%
	Distance from main roads	10%
	Mine subsidence exposure	5%

2
Appendix

Airport Planning Volume & Airspace Reports

Airport Planning Volume & Airspace Reports

Wallarah Airspace Considerations – (Type 1 Maximum and Type 3)

Wallarah is based on a runway alignment of 17/35. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 17/35. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Wallarah overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 13nm from the edge of the Williamtown Military CTR which has an upper limit of 5,000ft. RAAF Base Williamtown itself is situated approximately 25nm from the edge of nominal CTR boundary (not shown in **Figure 1**).
- There are several Restricted and Danger Areas associated with RAAF Base Williamtown close to the nominal CTR boundary as follows:
    - R578A lies about 3nm to the north-east and operates from 5,000ft to FL125 in the airspace above the Military CTR. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
    - R578B lies about 3nm to the east of the nominal CTR boundary and operates from the surface to FL125. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
    - R578C lies about 1nm to the north-east of the nominal CTR boundary and operates from 4,500ft to FL125. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
    - R578E is located about 20nm from the nominal CTR boundary to the north and operates from the surface to 10,000ft. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
    - R587A is located about 1nm from the nominal CTR boundary to the north-east and operates from FL125 to FL600. It is associated with military flying training, is activated by NOTAM and has a conditional status of RA2; and
    - D600 is located about 4nm to the north of the nominal CTR. It operates from the surface to 8,500ft, is activated by NOTAM and is a military jet corridor;
- The existing aerodrome at Cessnock (not certified or registered) lies about 18nm to the north-western edge of the nominal CTR boundary. Aviation activities include parachuting, ultralights and hot air ballooning;
- The existing aerodrome at Aero Pelican (not certified or registered) is located about 5nm to the north-east of the nominal CTR boundary;
- The existing aerodrome at Warnervale (not certified or registered) lies within the nominal CTR boundary;
- The existing aerodrome at Mangrove Mountain (not certified or registered) lies about 5nm to the south-west of the nominal CTR boundary. Winch launched gliding activities are undertaken;
- The existing aerodrome at Somersby (not certified or registered) also lies about 4nm to the south-west of the nominal CTR boundary. Powered hang gliding activities are undertaken;
- The former aerodrome at Cooranbong (no longer shown on aeronautical charts) lies about 1nm north of the nominal CTR boundary;
- The nominal CTR boundary is overlaid by the Sydney CTA 30 DME and 45 DME steps with lower limits of 7,500ft and 8,500ft respectively;
- Traffic may be in conflict or have dependencies with Sydney Airport's Runway 16/34 operations (not shown in **Figure 1**);

- The nominal CTR boundary lies about 19nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 33nm from the edge of nominal CTR boundary;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- North/south coastal VFR transit traffic may be impacted by the imposition of the nominal CTR boundary;
- The water aerodrome at Gosford (not certified or registerd) lies about 7nm to the south of the nominal CTR boundary;
- Hangliding activites occur along the coast to the south from Norah Head within the nominal CTR boundary; and
- There are a number of power stations with stacks within and adjacent to the nominal CTR boundary. Stack heights and/or plume rise considerations may be an issue. Currently only the Munmorah power station which is located within the nominal CTR boundary has a promulgated Danger Area (D567) in relation to plume rise. It is active from the surface to 3,300ft.

The following preliminary observations can be made:

- Potential conflicts or dependencies with RAAF Base Williamtown operations and airspace may exist with this site. This would require more detailed analysis by Airservices Australia/Defence and/or the Office of Airspace Regulation (OAR);
- Potential conflicts or dependencies with Sydney Airport's Runway 16/34 operations would require more detailed analysis by Airservices Australia and/or the Office of Airspace Regulation (OAR);
- Continued operation of Warnervale Aerodrome will not be possible given its location within the nominal CTR boundary;
- Aero Pelican, Somersby and Mangrove Mountain aerodromes may be able to continue to operate subject to CTA design;
- The status of the former aerodrome at Cooranbong needs to be determined;
- A VFR lane for coastal VFR traffic may be required on the eastern side of the nominal CTR (perhaps with a modification of the CTR along its eastern edge which would also permit hangliding activities to continue); and
- The status of any potential additional plume rise restrictions needs to be ascertained.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

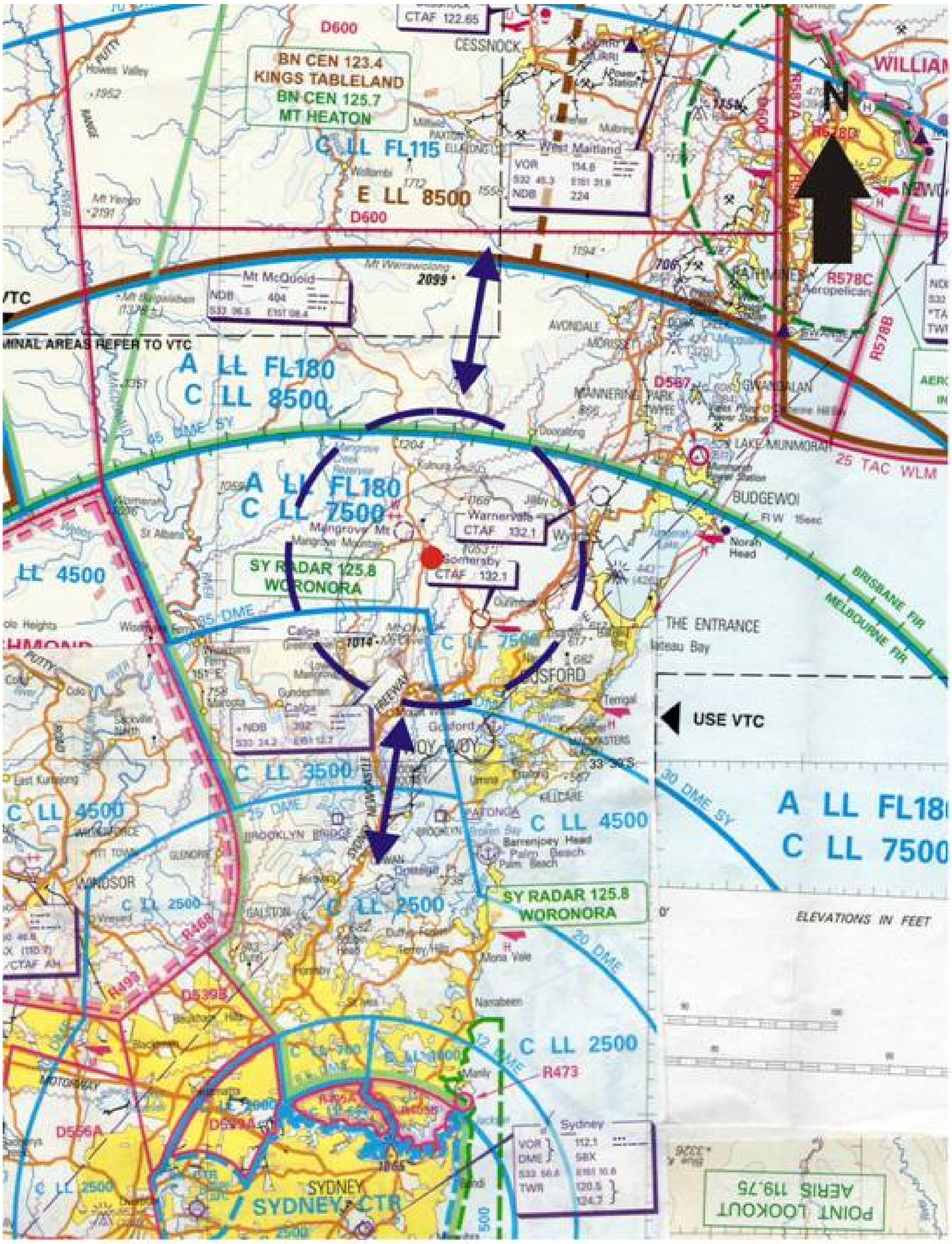
Peats Ridge Airspace Consideration – Type 3

Peats Ridge is based on a runway alignment of 18/36. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 18/36. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Peats Ridge overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



● Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 30nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 37nm from the edge of nominal CTR boundary;
- Traffic may be in conflict or have dependencies with Sydney Airport's Runways 16/34 operations (not shown in **Figure 1**);
- The nominal CTR boundary is overlaid by the Sydney CTA 25 DME, 35 DME and 45 DME steps with lower limits of 3,500ft, 7,500ft and 8,500ft respectively;
- The nominal CTR boundary lies about 23nm from the edge of the Williamtown Military CTR which has an upper limit of 5,000ft. RAAF Base Williamtown itself is situated approximately 35nm from the edge of nominal CTR boundary;
- Restricted Area R578A lies about 23nm to the north-east of the nominal CTR boundary and operates from 5,000ft to FL125. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
- Restricted Area R578B lies about 16nm to the east of the nominal CTR boundary and operates from the surface to FL125. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
- Restricted Area R578C lies about 14nm to the north-east of the nominal CTR boundary and operates from 4,500ft to FL125. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
- Restricted Area R587A is located about 14nm to the north-east of the nominal CTR boundary and operates from FL125 to FL600. It is associated with military flying training, is activated by NOTAM and has a conditional status of RA2;
- The nominal CTR boundary lies about 7nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 21nm from the edge of nominal CTR boundary;
- Restricted Area R559A lies about 11nm to the west of the nominal CTR boundary and operates from a lower limit of 7,000ft to FL260. It is associated with military flying training, is activated by NOTAM and has a conditional status of RA2;
- Danger Area D600 lies about 11nm to the north of the nominal CTR boundary. It operates from the surface to 8,500ft, is activated by NOTAM and is a military jet corridor;
- The existing aerodrome at Mangrove Mountain (not certified or registered) falls within the nominal CTR boundary. Winch launched gliding activities are undertaken;
- The existing aerodrome at Warnervale (not certified or registered) lies about 3nm to the north-east of the nominal CTR boundary;
- The existing aerodrome at Somersby (not certified or registered) lies within the nominal CTR boundary. Powered hang gliding activities are undertaken;
- The existing water aerodrome at Gosford (not certified or registered) lies about 3nm to the south-east of the nominal CTR boundary;

- The existing aerodrome at Aero Pelican (not certified or registered) lies about 19nm to the north-east of the nominal CTR boundary;
- The former aerodrome at Cooranbong (no longer shown on aeronautical charts) lies about 12nm to the north-east of the nominal CTR boundary;
- North/south coastal and non-coastal VFR transit traffic may be impacted by the imposition of the nominal CTR boundary and associated CTA steps; and
- There are a number of power stations with stacks which lie external to the nominal CTR boundary. Stack heights and/or plume rise considerations may be an issue. Currently, only the Munmorah power station which is located about 11nm from the north-eastern edge of the nominal CTR boundary has a promulgated Danger Area (D567) in relation to plume rise. It is active from the surface to 3,300ft.

The following preliminary observations can be made:

- The site is very approximately equidistant to Sydney, RAAF Base Richmond and RAAF Base Williamtown Airports. As such the potential for conflicts or dependencies with operations and airspace at these locations exists. This would require more detailed analysis by Airservices Australia/Defence and/or the Office of Airspace Regulation (OAR);
- Continued operation of the existing aerodrome at Mangrove Mountain would not be possible;
- Continued operation of the existing aerodrome at Somersby would probably not be possible;
- A shelf or cutout to the nominal CTR boundary to enable Warnervale Aerodrome to continue to operate may be required;
- A shelf or cutout to the nominal CTR boundary to enable Gosford Water Aerodrome to continue to operate may be required;
- The status of the former aerodrome at Cooranbong needs to be determined;
- VFR lanes for coastal and non-coastal VFR traffic may be required on the eastern side and western sides of the nominal CTR; and
- The status of any potential additional plume rise restrictions needs to be ascertained.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Somersby Airspace Considerations (Type 1 – Maximum)

Somersby is based on a primary runway alignment of 18/36 with provision for a cross wind runway aligned 09/27. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignments i.e. 18/36 and 09/27. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Somersby overlaid in dark blue with the nominal CTR and CTA information.

Figure 1– Airspace Considerations (Not to Scale)

● Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 32nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 37nm from the edge of nominal CTR boundary;
- Traffic may be in conflict or have dependencies with Sydney Airport's Runways 16/34 operations particularly in relation to 18/36 operations;
- The nominal CTR boundary is overlaid by the Sydney CTA 20 DME, 25 DME and 30/35 DME 30 steps with lower limits of 4,500ft, 3,500ft and 7,500ft respectively;
- The nominal CTR boundary lies about 24nm from the edge of the Williamtown Military CTR which has an upper limit of 5,000ft. RAAF Base Williamtown itself is situated approximately 35nm from the edge of nominal CTR boundary (not shown in **Figure 1**);
- Restricted Area R578A lies about 24nm to the north-east of the nominal CTR boundary and operates from 5,000ft to FL125. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
- Restricted Area R578B lies about 13nm to the north-east of the nominal CTR boundary and operates from the surface to FL125. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
- Restricted Area R578C lies about 12nm to the north-east of the nominal CTR boundary and operates from 4,500ft to FL125. It is associated with military flying, is activated by NOTAM and has a conditional status of RA1;
- Restricted Area R587A is located about 12nm to the north-east of the nominal CTR boundary and operates from FL125 to FL600. It is associated with military flying training, is activated by NOTAM and has a conditional status of RA2;
- The nominal CTR boundary lies about 8nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 21nm from the edge of nominal CTR boundary;
- Restricted Area R559A lies about 15nm to the north-west of the nominal CTR boundary and operates from a lower limit of 7,000ft to FL260. It is associated with military flying training, is activated by NOTAM and has a conditional status of RA2;
- Danger Area D600 lies about 13nm to the north of the nominal CTR boundary. It operates from the surface to 8,500ft, is activated by NOTAM and is a military jet corridor;
- The existing aerodrome at Mangrove Mountain (not certified or registered) falls within the nominal CTR boundary. Winch launched gliding activities are undertaken;
- The existing aerodrome at Warnervale (not certified or registered) lies about 2nm to the north-east of the nominal CTR boundary;
- The site is at the existing aerodrome at Somersby. Powered hang gliding activities are undertaken;
- The existing water aerodrome at Gosford (not certified or registered) lies within the nominal CTR boundary;

- The existing aerodrome at Aero Pelican (not certified or registered) lies about 14nm to the north-east of the nominal CTR boundary;
- The former aerodrome at Cooranbong (no longer shown on aeronautical charts) lies about 13nm to the north-east of the nominal CTR boundary;
- North/south coastal and non-coastal VFR transit traffic may be impacted by the imposition of the nominal CTR boundary and associated CTA steps;
- Hangliding activities occur on the coast near Terrigal on the boundary of the nominal CTR, and
- There are a number of power stations with stacks which lie external to the nominal CTR boundary. Stack heights and/or plume rise considerations may be an issue. Currently, only the Munmorah power station which is located about 8nm from the north-eastern edge of the nominal CTR boundary has a promulgated Danger Area (D567) in relation to plume rise. It is active from the surface to 3,300ft.

The following preliminary observations can be made:

- The site is very approximately equidistant to Sydney Airport,and RAAF Bases Richmond Williamtown Airports. As such the potential for conflicts or dependencies with operations and airspace at these locations exists. This would require more detailed analysis by Airservices Australia/Defence and/or the Office of Airspace Regulation (OAR);
- The potential for contra-flow operations with Sydney Airport's 16/34 direction due to wind differences between the two sites is possible;
- Continued operation of the existing aerodrome at Somersby would not be possible;
- Shelfs or cutouts to the nominal CTR boundary to enable Warnervale and Mangrove Mountain Aerodromes, and Gosford Water Aerodrome to continue to operate may be required;
- The status of the former aerodrome at Cooranbong needs to be determined;
- VFR lanes for coastal and non-coastal VFR traffic may be required on the eastern side and western sides of the nominal CTR; and
- The status of any potential additional plume rise restrictions needs to be ascertained.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Wilberforce Airspace Considerations (Type 3)

Wilberforce is based on a runway alignment of 09/27. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures and that RAAF Base Richmond Runway 10/28 operations, located about 5nm to the south would continue. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR) (noting the location of the existing Richmond Military CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 09/27 (again noting the location of the existing Richmond Military CTR). The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

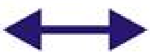
At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Wilberforce overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

 Site

 Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

 Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary falls within the existing Richmond Military CTR which has an upper limit of 2,500ft. The distance between the two airport sites is approximately 8nm;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Danger Area 538A adjoins the north-western edge of the Richmond Military CTR. It is associated with military flying training and operates from the surface to 7,500ft. Hours of operation are by NOTAM;
- The nominal CTR boundary lies about 13nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 22nm from the edge of nominal CTR boundary;
- The nominal CTR is overlaid by the Sydney CTA and 45 DME CTA steps with lower limits of 2,500ft and 4,500ft respectively;
- Traffic associated with Wilberforce's runway alignment of 09/27 may be in conflict or have dependencies with Sydney Airport's Runway 16/34 operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 13nm to the south- east of the nominal CTR boundary;
- Restricted Areas R536A and 536B lie about 8nm to the south of the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3;
- Danger Area D556A (upper limit 2,500ft) lies approximately 7nm south of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Area D556B (upper limit 4,500ft) lies approximately 10nm south of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Palm Beach Water Aerodrome (not certified or registered) lies approximately 13nm to the east of the nominal CTR boundary;
- Mangrove Mountain Aerodrome (not certified or registered) lies approximately 15nm to the north-east of the nominal CTR boundary. Winch launched gliding activities are undertaken;
- The existing aerodrome at Somersby (not certified or registered) lies approximately 15nm to the north-east of the nominal CTR boundary. Powered hang gliding activities are undertaken;

- The existing water aerodrome at Gosford (not certified or registered) lies about 15nm to the east of the nominal CTR boundary;
- Danger Areas D539A (upper limit 2,000ft) and D539B (upper limit 2,500ft) lie approximately 10nm and 4nm south-east of the nominal CTR boundary respectively. These areas provide the Bankstown Lane of Entry for VFR traffic; and
- Restricted Areas R555A and R555B lie about 18nm to the south of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2.

The following preliminary observations can be made:

- Wilberforce's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- Assuming RAAF Base Richmond remains operational, the existing Military CTR may be able to accommodate an airport at Wilberforce without CTR modification, although CTA steps would probably need to be redesigned. It is assumed each airport would be equipped with its own control tower;
- The proposed runway alignment of 09/27 is near parallel to Richmond' s Runway 10/28;
- The proposed runway alignment is similar to Sydney Airport's 07/25 runway direction;
- The proposed runway alignment suggests a potential conflict point with Sydney Airport's Runway 16/34 operations in the airspace to the north of Berowra;
- There may be a conflict with military airspace and operations within and to the west of the existing Military CTR;
- Bankstown Lane of Entry VFR traffic may be impacted by CTA step design to the east of nominal CTR boundary;
- Potential conflicts or dependencies with Richmond and Sydney Airport's operations would require more detailed analysis by Defence, Airservices Australia and/or the OAR.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Wilberforce Airspace Considerations (Type 1 – Maximum)

Wilberforce is based on a primary runway alignment of 01/19 with provision for a cross wind runway aligned 10/28. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures and that RAAF Base Richmond would need to close and relocate to the Wilberforce site i.e. becoming a joint-user airport. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR) (noting the location of the existing Richmond Military CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignments i.e. 01/19 and 10/28 (again noting the location of the existing Richmond Military CTR). The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Wilberforce overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary falls within the existing Richmond Military CTR which has an upper limit of 2,500ft. The distance between the two airport sites is approximately 8nm;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Danger Area 538A adjoins the north-western edge of the Richmond Military CTR. It is associated with military flying training and operates from the surface to 7,500ft. Hours of operation are by NOTAM;
- The nominal CTR boundary lies about 13nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 22nm from the edge of nominal CTR boundary;
- The nominal CTR is overlaid by the Sydney CTA and 45 DME CTA steps with lower limits of 2,500ft and 4,500ft respectively;
- Traffic associated with Wilberforce's runway alignments of 01/19 and 10/28 may be in conflict or have dependencies with Sydney Airport's Runway 16/34 operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 13nm to the south- east of the nominal CTR boundary;
- Restricted Areas R536A and 536B lie about 8nm to the south of the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3;
- Danger Area D556A (upper limit 2,500ft) lies approximately 7nm south of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Area D556B (upper limit 4,500ft) lies approximately 10nm south of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Palm Beach Water Aerodrome (not certified or registered) lies approximately 13nm to the east of the nominal CTR boundary;
- Mangrove Mountain Aerodrome (not certified or registered) lies approximately 15nm to the north-east of the nominal CTR boundary. Winch launched gliding activities are undertaken;
- The existing aerodrome at Somersby (not certified or registered) lies approximately 15nm to the north-east of the nominal CTR boundary. Powered hang gliding activities are undertaken;
- The existing water aerodrome at Gosford (not certified or registered) lies about 15nm to the east of the nominal CTR boundary;

- Danger Areas D539A (upper limit 2,000ft) and D539B (upper limit 2,500ft) lie approximately 10nm and 4nm south-east of the nominal CTR boundary respectively. These areas provide the Bankstown Lane of Entry for VFR traffic; and
- Restricted Areas R555A and R555B lie about 18nm to the south of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2.

The following preliminary observations can be made:

- It assumed RAAF Base Richmond would be closed and relocate to the Wilberforce site which would have a dedicated RAAF Building Area i.e. the airport would operate as a joint user facility;
- Wilberforce's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The proposed runway alignment of 01/19 converges with Sydney Airport's 16/34 configuration near St Albans;
- The proposed runway alignment of 01/19 intersects with Sydney Airport's 07/25 alignment to the north of Camden;
- The proposed runway alignment of 10/28 may have dependencies/conflicts with military airspace to the north-west of the nominal CTR boundary;
- The proposed runway alignment of 10/28 converges with Sydney Airport's 16/34 configuration near Glenorie;
- It is assumed R536A/B would not be compatible with the 01/19 runway alignment and therefore need to be closed/relocated;
- The south-eastern corner of R559A need to be modified to cater for the CTA step design to the north of the nominal CTR boundary;
- Parts of D556A/B may need to be modified to cater for the CTA step design to the south of the nominal CTR boundary; and
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Defence, Airservices Australia and/or the OAR.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Glenorie Airspace Considerations (Type 1 – Maximum and Type 3)

Glenorie is based on a runway alignment of 06/24. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. There may be implications for continued operations at RAAF Base Richmond and if retained it is assumed each airport would have its own control tower service. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR) (noting the location of the existing Richmond Military CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 06/24 (again noting the location of the existing Richmond Military CTR). The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Glenorie overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- About half of the nominal CTR boundary and the airport site itself fall within the existing Richmond Military CTR which has an upper limit of 2,500ft. The distance between the two airport sites is approximately 12nm;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Danger Area 538A adjoins the north-western edge of the Richmond Military CTR. It is associated with military flying training and operates from the surface to 7,500ft. Hours of operation are by NOTAM;
- The nominal CTR boundary lies about 6nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 12nm from the edge of nominal CTR boundary;
- The nominal CTR is overlaid by the Sydney 12 and 25 DME CTA steps with lower limits of 2,500ft and 3,500/4,500ft respectively;
- Traffic associated with Glenorie's runway alignment of 06/24 may be in conflict or have dependencies with Sydney Airport's Runway 16/34 operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 8nm to the south of the nominal CTR boundary;
- Restricted Areas R536A and 536B lie about 10nm to the south-west of the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3;
- The northern corner of D539B (upper limit 2,500ft) falls within the nominal CTR boundary; This provides the Bankstown Lane of Entry for VFR traffic;
- Danger Areas D539A (upper limit 2,000ft) lies approximately 2nm to the south of the nominal CTR boundary. This provides the Bankstown Lane of Entry for VFR traffic;
- Danger Area D556A (upper limit 2,500ft) lies about 4nm to the south-west of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Area D556B (upper limit 4,500ft) lies about 10nm to the south-west of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Palm Beach water aerodrome (not certified of registered) lies about 7nm to the east of the nominal CTR boundary;

- Gosford water aerodrome (not certified of registered) lies about 8nm to the east of the nominal CTR boundary;
- An aerodrome symbol (not certified or registered) is depicted at Cottage Point about 1nm to the east of the nominal CTR boundary. The nature of operations at this site is not known;
- The existing aerodrome at Mangrove Mountain (not certified or registered) lies about 14nm to the north-east of the nominal CTR boundary. Winch launched gliding activities are undertaken; and
- The existing aerodrome at Somersby (not certified or registered) lies about 13nm to the north-east of the nominal CTR boundary. Powered hang gliding activities are undertaken.

The following preliminary observations can be made:

- Glenorie's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The runway alignment of 06/24 is approximately at right angles to Sydney's 16/34 and near parallel to the 07/25 alignment;
- The extended centreline of Sydney's 16/34 runways passes relatively close to the airport site;
- There may be dependencies/implications for Richmond's operations (assuming it remains) due to the differing runway alignments applicable to each site;
- Modifications to the nominal CTR boundary to accommodate D539B and existing VFR operations would be required. The 06/24 runway alignment may assist in this regard;
- Restructuring of part of D556A/B may be necessary for CTA design purposes; and
- Potential conflicts or dependencies with Sydney and Richmond Airport's operations would require more detailed analysis by Defence, Airservices Australia and/or the OAR.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

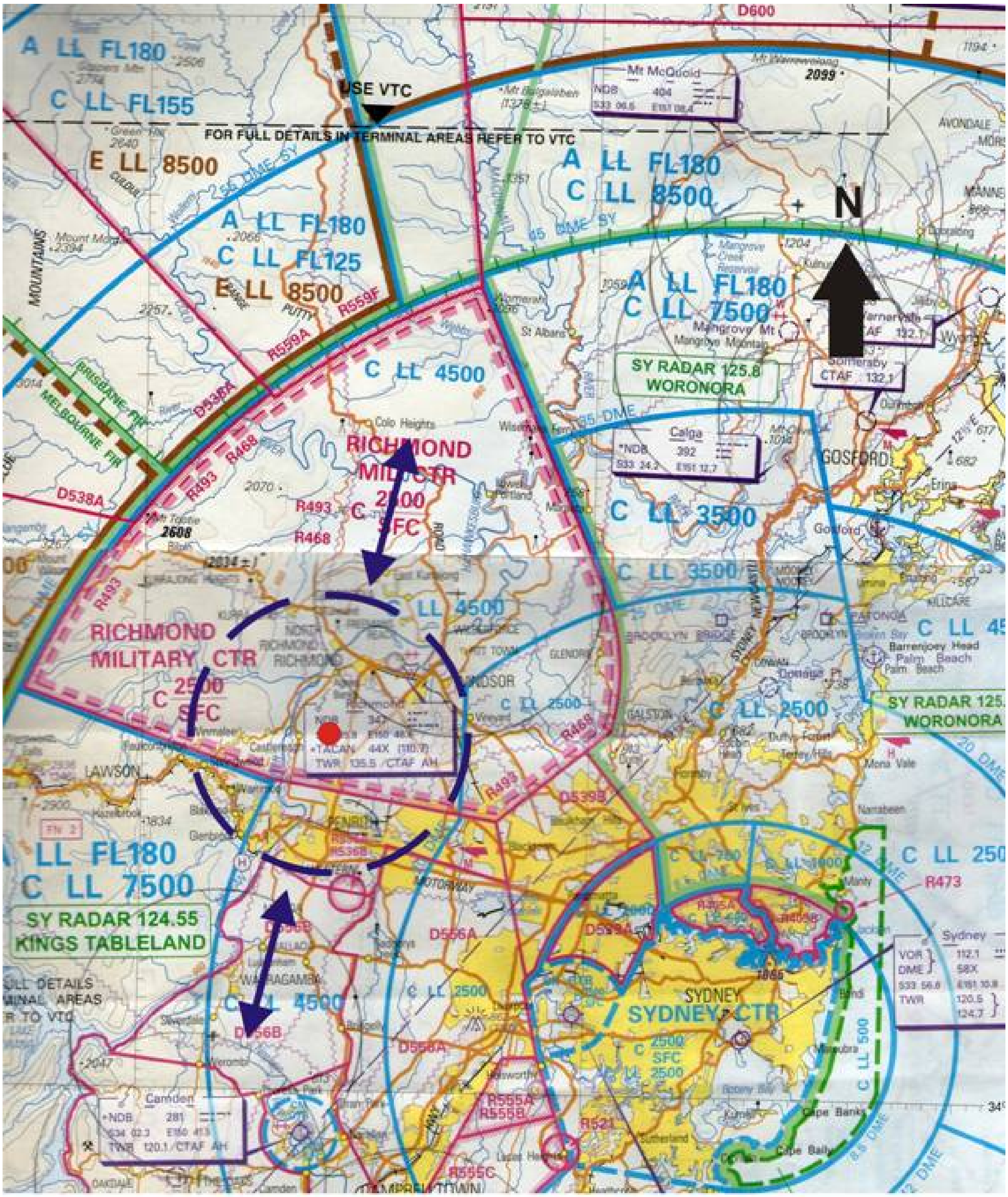
Castlereagh Airspace Considerations (Type 3)

Castlereagh is based on a runway alignment of 18/36. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures and that RAAF Base Richmond would need to close and relocate to the Castlereagh site i.e. becoming a joint-user airport. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR) (noting the location of the existing Richmond Military CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 18/36 (again noting the location of the existing Richmond Military CTR). The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Castlereagh overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



● Site

— — Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

⟷ Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary falls within the existing Richmond Military CTR which has an upper limit of 2,500ft. The distance between the two airport sites is approximately 5nm;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Danger Area 538A adjoins the north-western edge of the Richmond Military CTR. It is associated with military flying training and operates from the surface to 7,500ft. Hours of operation are by NOTAM;
- The nominal CTR boundary lies about 13nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 21nm from the edge of nominal CTR boundary;
- The nominal CTR is overlaid by the Sydney CTA, 20 DME and 30 DME CTA steps with lower limits of 4,500ft, 4,500ft and 7,500ft respectively;
- Traffic associated with Castlereagh's runway alignment of 18/36 may be in conflict or have dependencies with Sydney Airport's Runway 16/34 operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 10nm to the south- east of the nominal CTR boundary;
- Restricted Areas R536A and 536B lie on the southern edge of the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3;
- The north-western corner of Danger Area D556A (upper limit 2,500ft) lies just inside the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- The north-western corner of Danger Area D556B (upper limit 4,500ft) lies just insidethe nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- The Class D CTR associated with Camden Airport lies about 13nm to the south of the nominal CTR boundary;
- Danger Area D552 (upper limit 4,500ft) lies about 11nm to the south of the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- Mangrove Mountain Aerodrome (not certified or registered) lies approximately 20nm to the north-east of the nominal CTR boundary. Winch launched gliding activities are undertaken;

- The existing aerodrome at Somersby (not certified or registered) lies approximately 20nm to the north-east of the nominal CTR boundary. Powered hang gliding activities are undertaken;
- Danger Areas D539A (upper limit 2,000ft) and D539B (upper limit 2,500ft) lie approximately 9nm and 3nm south-east of the nominal CTR boundary respectively. These areas provide the Bankstown Lane of Entry for VFR traffic;
- The Oaks airfield (not certified or registered) lies approximately 18nm south of the nominal CTR boundary;
- Katoomba airfield (not certified or registered) lies approximately 11nm west of the nominal CTR boundary;
- Restricted Areas R555A and R555B lie about 13nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2; and
- Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) lie approximately 15nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2.

The following preliminary observations can be made:

- Castlereagh's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The proposed runway alignment of 18/36 is similar to Sydney's 16/34 configuration;
- The proposed runway alignment is approximately at right angles to Sydney Airport's 07/25 runway direction;
- There may be a conflict with military restricted airspace and operations to the north of the existing Military CTR;
- The location of R536A and 536B may not be compatible with operations at Castlereagh;
- Restructuring of the northern sections of D556A/B may be necessary for CTA design purposes; and
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Defence, Airservices Australia and/or the OAR.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

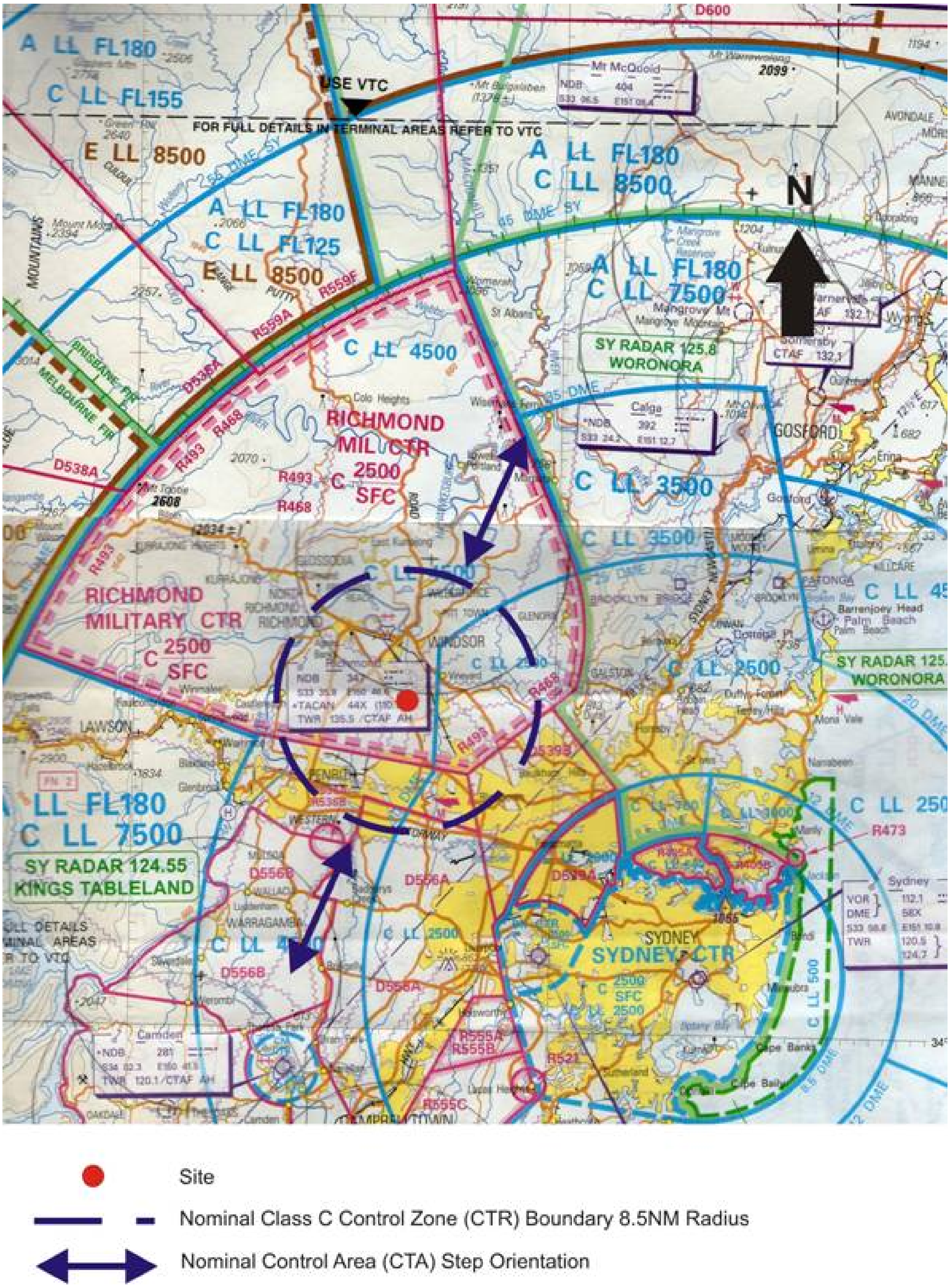
Windsor Downs Airspace Considerations (Type 3)

Windsor Downs is based on a runway alignment of 01/19. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures and that RAAF Base Richmond would need to close and relocate to the Windsor Downs site i.e. becoming a joint-user airport. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR) (noting the location of the existing Richmond Military CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 01/19 (again noting the location of the existing Richmond Military CTR). The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Windsor Downs overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary falls within the existing Richmond Military CTR which has an upper limit of 2,500ft. The distance between the two airport sites is approximately 5nm;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Danger Area 538A adjoins the north-western edge of the Richmond Military CTR. It is associated with military flying training and operates from the surface to 7,500ft. Hours of operation are by NOTAM;
- The nominal CTR boundary lies about 8nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 16nm from the edge of nominal CTR boundary;
- The nominal CTR is overlaid by the Sydney CTA and 20 DME CTA steps with lower limits of 2,500ft and 4,500ft respectively;
- Traffic associated with Windsor Downs's runway alignment of 01/19 may be in conflict or have dependencies with Sydney Airport's Runway 16/34 operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 5nm to the south- east of the nominal CTR boundary;
- Restricted Areas R536A and 536B lie just outside the southern edge of the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3;
- A northern section of Danger Area D556A (upper limit 2,500ft) lies within the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Area D556B (upper limit 4,500ft) lies about 3nm to the south of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Area D539A (upper limit 2,000ft) lies approximately 4nm to the southeast of the nominal CTR boundary and about half of D539B (upper limit 2,500ft) lies within the nominal CTR boundary. These areas provide the Bankstown Lane of Entry for VFR traffic;
- The Class D CTR associated with Camden Airport lies about 13nm to the south of the nominal CTR boundary;
- Danger Area D552 (upper limit 4,500ft) lies about 12nm to the south of the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;

- Palm Beach water aerodrome (not certified of registered) lies about 16nm to the east of the nominal CTR boundary;
- Gosford water aerodrome (not certified of registered) lies about 19nm to the east of the nominal CTR boundary;
- Katoomba airfield (not certified or registered) lies approximately 18nm west of the nominal CTR boundary;
- Restricted Areas R555A and R555B lie about 10nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2;
- Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) lie approximately 15nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2; and
- Powered hangliding activities take place at the south-eastern edge of the nominal CTR boundary.

The following preliminary observations can be made:

- Windsor Downs's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- There may be a conflict with Sydney's 16/34 operations in the airspace near Wisemans Ferry;
- It is assumed R536A/B would not be compatible with operations at Windsor Downs and therefore need to close/relocate;
- The proposed runway alignment of 01/19 is closer in alignment to Sydney's 16/34 direction compared to the 07/25 direction;
- Restructuring of the northern sections of D556A/B may be necessary for CTA design purposes; and
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Defence, Airservices Australia and/or the OAR.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

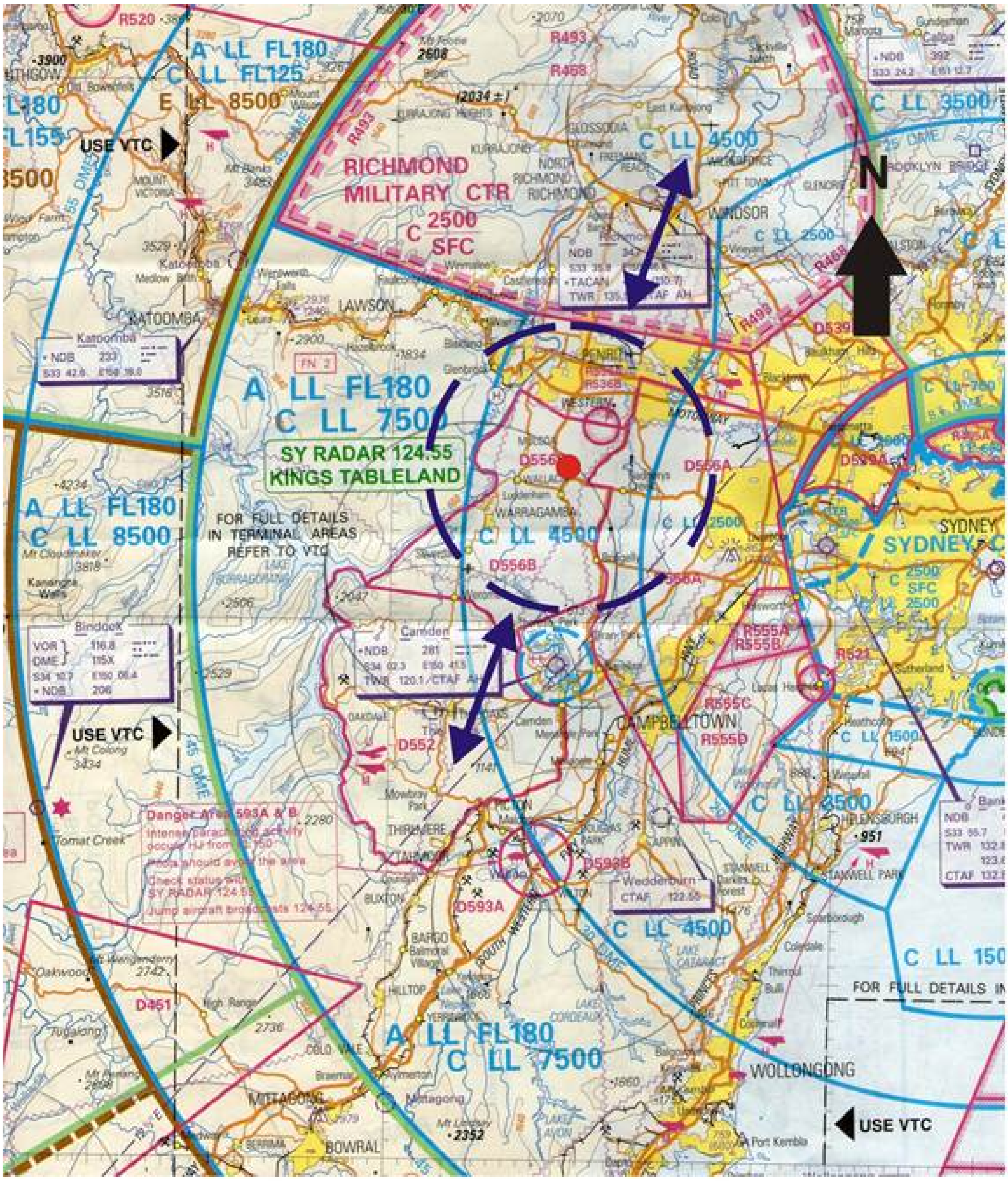
Luddenham Airspace Considerations (Type 1)

Luddenham is based on a runway alignment of 01/19. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 01/19. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Luddenham overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 11nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 16nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney CTA, and 20 DME and 30 DME CTA steps with lower limits of 2,500ft, 4,500ft and 7,500ft respectively;
- Traffic associated with Luddenham's runway alignment of 01/19 may be in conflict or have dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 4nm to the east of the nominal CTR boundary;
- The nominal CTR boundary lies on the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 8nm from the edge of nominal CTR boundary;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Restricted Areas R536A and 536B lie within the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3.
- The Class D CTR associated with Camden Airport lies about 1nm outside the nominal CTR boundary;
- The nominal CTR boundary overlays much of Danger Area D556A (upper limit 2,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The nominal CTR boundary overlays much of Danger Area D556B (upper limit 4,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The Oaks airfield (not certified or registered) lies about 8nm to the south-west of the nominal CTR boundary;
- Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) lie approximately 5nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Restricted Areas R555A and R555B lie about 4nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is

operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2;

- Danger Areas D539A (upper limit 2,000ft) and D539B (upper limit 2,500ft) lie approximately 5nm and 3nm east of the nominal CTR boundary respectively. These areas provide the Bankstown Lane of Entry for VFR traffic;
- The existing uncertified and unregistered airfield at Wilton lies approximately 14nm south of the nominal CTR boundary. Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, are approximately 9nm south of the nominal CTR boundary. They operate during daylight hours; and
- East-west and north-south VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Luddenham.

The following preliminary observations can be made:

- Luddenham's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- **The location of R536A and 536B within the nominal CTR boundary would not be compatible with the proposed 01/19 runway alignment. The Orchard Hills facility would have to be relocated for Luddenham to be operable;**
- There may be a conflict point over Richmond Airport based on the extended 01/19 runway centreline for Luddenham;
- Operations at Camden Airport may be impacted by the CTA step design and Luddenham's 01/19 runway alignment;
- Significant sections of the training area airspace associated with Bankstown (D556A and D556B) would be impacted/closed by the nominal CTR boundary which may have congestion implications for that airport's training operations;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the OAR; and
- VFR lanes for east-west and north-south VFR traffic may be required to avoid the nominal CTR boundary.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Kemps Creek Airspace Considerations (Type 3)

Kemps Creek is based on a runway alignment of 16/34. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 16/34. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Kemps Creek overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 6nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 13nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney CTA and 20 DME CTA step with lower limits of 2,500ft and 4,500ft respectively;
- Traffic associated with Kemps Creek's runway alignment of 16/34 may be in conflict or have dependencies with Sydney Airport's 16/34 and 07/25 operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 1nm to the east of the nominal CTR boundary;
- The nominal CTR boundary lies about 1nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 13nm from the edge of nominal CTR boundary;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Restricted Areas R536A and 536B lie within the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3.
- The Class D CTR associated with Camden Airport lies about 1nm to the south of the nominal CTR boundary;
- The nominal CTR boundary overlays much of Danger Area D556A (upper limit 2,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The nominal CTR boundary overlays much of Danger Area D556B (upper limit 4,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Areas D539A (upper limit 2,000ft) and D539B (upper limit 2,500ft) lie approximately 2nm and on the nominal CTR boundary respectively. These areas provide the Bankstown Lane of Entry for VFR traffic;
- The Oaks airfield (not certified or registered) lies about 8nm to the south-west of the nominal CTR boundary;
- Wedderburn airfield (not certified or registered) lies about 10nm to the south of the nominal CTR boundary;

- Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) lie approximately 3nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Restricted Areas R555A and R555B lie about 1nm to the east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2.
- The existing uncertified and unregistered airfield at Wilton lies approximately 14nm south of the nominal CTR boundary. Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, are approximately 11nm south of the nominal CTR boundary. They operate during daylight hours;
- Powered hang gliding is undertaken near the north-eastern section of the nominal CTR boundary; and
- East-west and north-south VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Kemps Creek.

The following preliminary observations can be made:

- Kemps Creek's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The location of R536A and 536B within the nominal CTR boundary are significant given the proposed runway alignment of 16/34 and it is assumed they would need to close/relocate;
- Depending on CTA step design there may be a conflict with Richmond airspace and operations requiring consideration of closure/relocation;
- Modifications to R555C/D for operations to the south of the nominal CTR boundary may be required;
- Continued operation of Camden Airport would be dependent on CTA step design to the south of the nominal CTR boundary;
- Significant sections of the training area airspace associated with Bankstown (D556A and D556B) would be impacted/closed by the nominal CTR boundary which may have congestion implications for that airport's training related operations;
- There may be VFR conflict issues to the north-east of the nominal CTR boundary in relation to D539A/B;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the OAR; and
- VFR lanes for east-west and north-south VFR traffic may be required to avoid the nominal CTR boundary.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Badgerys Creek Airspace Considerations (Type 1 – Maximum and Type 3)

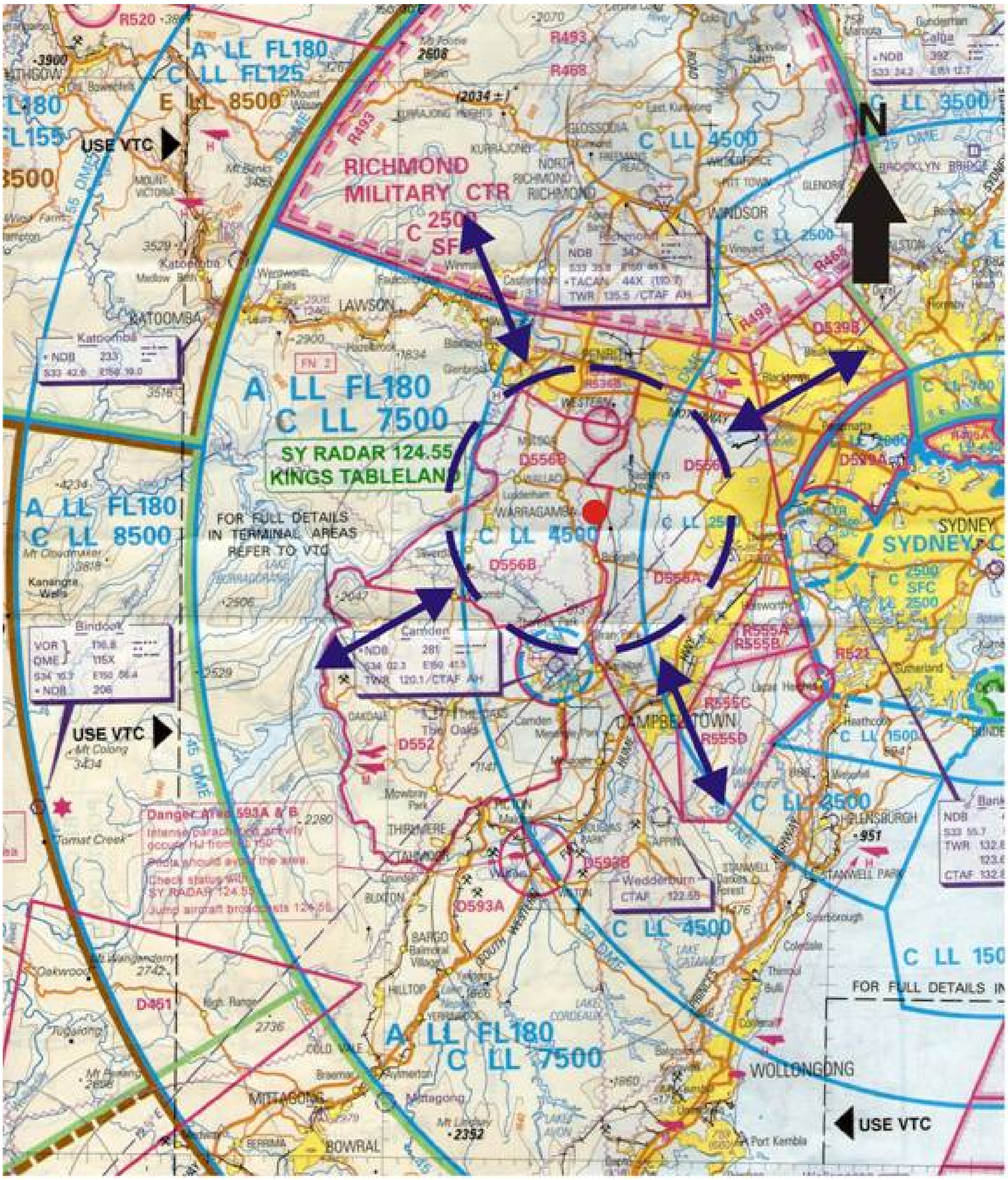
Important Note
This assessment of Badgerys Creek has been prepared on the basis of demonstrating technical consideration of all possible sites. However, it is acknowledged that the Federal Government's policy is not to develop a new airport at Badgerys Creek. The following consideration of airspace issues is based generally around the runway geometry determined during the various EIS processes undertaken since 1985 i.e. a runway alignment of 05/23. The 18/36 runway option shown in the most recent EIS has not been considered although a 14/32 cross runway direction for the Type 1 Maximum has been included. For reference purposes, an extract from this EIS in relation to airspace matters is reproduced at the conclusion of this assessment.

Badgerys Creek is based on a primary runway alignment of 05/23 with provision for cross runway aligned 14/32 for the Type 1 – Maximum airport. A Type 3 airport is based on the primary 05/23 alignment only. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignments i.e. 05/23 and 14/32. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Badgerys Creek overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



● Site

— — Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

↔ Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 8nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 15nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney CTA, and 20 DME and 30 DME CTA steps with lower limits of 2,500ft, 4,500ft and 7,500ft respectively;
- Traffic associated with Badgerys Creek's runway alignment of 05/23 may be in conflict or have dependencies with Sydney Airport's operations, in particular Runway 16/34 (not shown in **Figure 1**);
- Traffic associated with Badgerys Creek's runway alignment of 14/32 may also be in conflict or have dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 3nm to the east of the nominal CTR boundary;
- The nominal CTR boundary lies about 3nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 15nm from the edge of nominal CTR boundary;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Restricted Areas R536A and 536B lie within the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3;
- The Class D CTR associated with Camden Airport falls within the nominal CTR boundary;
- The nominal CTR boundary overlays much of Danger Area D556A (upper limit 2,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The nominal CTR boundary overlays much of Danger Area D556B (upper limit 4,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Areas D539A (upper limit 2,000ft) and D539B (upper limit 2,500ft) lie approximately 4nm and 2nm north-east of the nominal CTR boundary respectively. These areas provide the Bankstown Lane of Entry for VFR traffic;
- A small section of Danger Area D552 (upper limit 4,500ft) falls within the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- The Oaks airfield lies about 6nm to the south-west of the nominal CTR boundary;

- Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) lie approximately 3nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Restricted Areas R555A and R555B lie about 2nm to the east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2.
- The existing uncertified and unregistered airfield at Wilton lies approximately 11nm south of the nominal CTR boundary. Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, are approximately 9nm south of the nominal CTR boundary. They operate during daylight hours; and
- East-west and north-south VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Badgerys Creek.

The following preliminary observations can be made:

- Badgerys Creek's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The 05/23 alignment is approximately at right angles to Sydney's 16/34 alignment but near parallel to the 07/25 direction;
- The 14/32 alignment is approximately near parallel to Sydney's 16/34 alignment but approximately at right angles to the 16/34 direction;
- The location of R536A and 536B within the nominal CTR boundary are significant but given the proposed runway alignments of 05/23 and 14/32 may be compatible with operations at Badgerys Creek;
- Depending on CTA step design there may be a conflict with Richmond airspace and operations to the south of that airport, particularly for the 14/32 alignment;
- The 14/32 alignment may have implications for R559A/F activities depending on CTA step design to the north-west of the nominal CTR boundary;
- Continued operation of Camden Airport would require a step or cutout to the nominal CTR boundary, however, the proposed runway alignments of 05/23 and 14/32 may assist in this regard;
- The 14/32 alignment would appear to be impacted by R555C/B and possibly R555A/B to the south-east of the nominal CTR boundary;
- Significant sections of the training area airspace associated with Bankstown (D556A and D556B) would be impacted/closed by the nominal CTR boundary which may have congestion implications for that airport's training operations with possible flow on impacts if operations in D552 also need to be restricted/modified;
- There may be CTA design issues/VFR conflict to the north-east of the nominal CTR boundary in relation to D539A/B for the 05/23 alignment;

- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the OAR, in particular a possible conflict point is the airspace to the north-east of Badgerys Creek and north of Sydney Airport; and
- VFR lanes for east-west and north-south VFR traffic may be required to avoid the nominal CTR boundary.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

The following is an unedited extract from the most recent EIS conducted for the Badgerys Creek site in relation to airspace issues. It is provided for reference purposes.

"Airspace Considerations

Badgerys Creek Option A would require complex airspace management procedures for arriving and departing aircraft to ensure safety. Procedures would reflect the fact that aircraft from Sydney Airport would be sharing the airspace with aircraft from the Second Sydney Airport on certain flight paths. Aircraft taking off to the north-east or landing from the north-east at the Second Sydney Airport would interact with aircraft from Sydney Airport taking off to the north or landing from the north. This would mean a significant number of aircraft in the general area approximately 15 nautical miles (28 kilometres) north of Sydney Airport, resulting in some aircraft having to fly at lower altitudes (below 6,000 feet/1800 metres). The air traffic management procedures required to manage this convergence of aircraft may limit the capacity of one or both airports.

Preliminary flight paths and flight zones are shown on Figures 2.3 and 2.4.

Impacts on other airports and airspace users in the Sydney region would include:

- access to Bankstown airport would be affected and its associated flying training areas would need to be relocated;
- modification would be required to current instrument approach and departure procedures at Bankstown airport;
- it is very likely Hoxton Park aerodrome would need to be closed;
- operation at Camden aerodrome would be restricted including loss of instrument approaches;
- modification would be required to the existing Richmond military zone;
- parachute activities at Menangle and Wilton aerodromes would be affected.

Airspace Considerations

Airspace considerations, for operations on the main parallel runways are as for Badgerys Creek Option A.

The cross wind runway would be used when wind conditions restrict the use of the parallel runways and could be used for noise management purposes.

Preliminary flight paths and flight zones are shown on Figures 2.8 to 2.11.

Impacts on the airports and airspace users in the Sydney Region would be similar to those for Option A with the following additions:

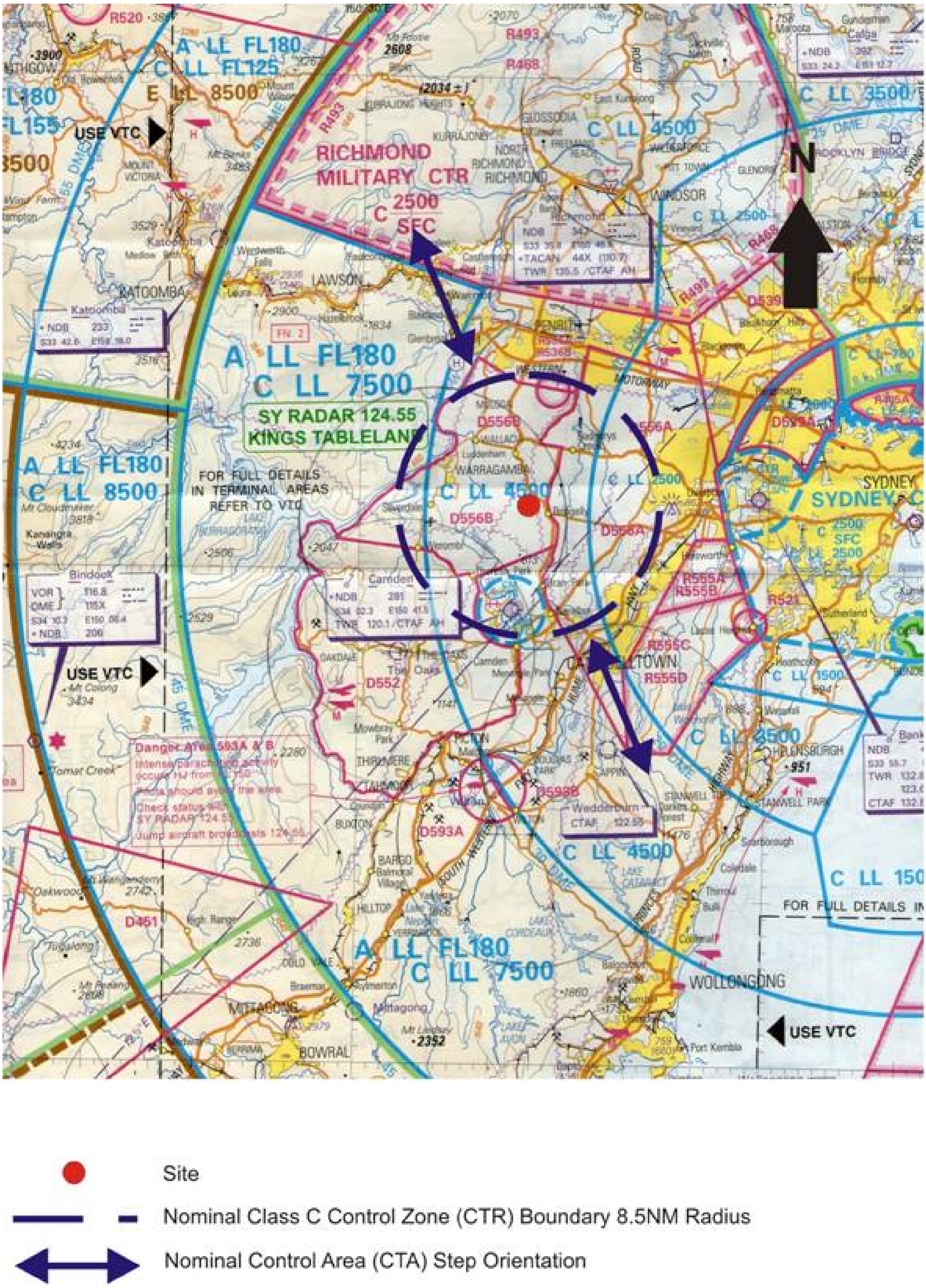
- increased need for civil access to military airspace at Richmond;
- additional limitations on Camden airport to accommodate approach/departures on runway 15/33.”

Bringelly 2 Airspace Considerations (Type 1 – Maximum and Type 3)

Bringelly 2 is based on a runway alignment of 15/33. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 15/33. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

Figure 1 depicts the current immediate airspace environment for Bringelly 2 overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 4nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 11nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney CTA, and 20 DME and 30 DME CTA steps with lower limits of 2,500ft, 4,500ft and 7,500ft respectively;
- Traffic associated with Bringelly's runway alignment of 15/33 may be in conflict or have dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 3nm to the east of the nominal CTR boundary;
- The nominal CTR boundary lies about 3nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 10nm from the edge of nominal CTR boundary;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Restricted Areas R536A and 536B lie within the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3.
- The Class D CTR associated with Camden Airport and the airport itself fall within the nominal CTR boundary;
- The nominal CTR boundary overlays much of Danger Area D556A (upper limit 2,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The nominal CTR boundary overlays much of Danger Area D556B (upper limit 4,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- A small section of Danger Area D552 (upper limit 4,500ft) falls within the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- The Oaks airfield lies about 5nm to the south-west of the nominal CTR boundary;
- Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) lie approximately 3nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Restricted Areas R555A and R555B lie about 3nm to the east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2;

- Danger Areas D539A (upper limit 2,000ft) and D539B (upper limit 2,500ft) lie approximately 5nm and 3nm north-east of the nominal CTR boundary respectively. These areas provide the Bankstown Lane of Entry for VFR traffic;
- The existing airfield at Wedderburn (uncertified and unregistered) lies about 9nm to the south-east of the nominal CTR boundary;
- The existing uncertified and unregistered airfield at Wilton lies approximately 10nm south of the nominal CTR boundary. Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, are approximately 9nm south of the nominal CTR boundary. They operate during daylight hours; and
- East-west and north-south VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Bringelly 2.

The following preliminary observations can be made:

- Bringelly 2's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The runway alignment of 15/33 is near parallel to Sydney's 16/34 and approximately at right angles to 07/25;
- The location of R536A and 536B within the nominal CTR boundary may be significant. The runway alignment adopted is the best fit possible in terms of seeking to avoid R536A/B;
- Depending on CTA step design there may be a conflict with Richmond airspace and operations at that airport and potentially in R559A/F;
- The location of R555C/D and potentially R555A/B would be significant in terms of CTA step design, potentially requiring modifications to the restricted airspace;
- Continued operation of Camden Airport appears problematic and would require a step or cutout to the nominal CTR boundary, however, the proposed runway alignment of 15/33 is not ideal in relation to Camden;
- Significant sections of the training area airspace associated with Bankstown (D556A and D556B) would be impacted/closed by the nominal CTR boundary which may have congestion implications for that airport's training operations;
- Continued operations at Wedderburn and Wilton airfields (and operations in D593A/B) will depend on the CTA step design although Wilton appears less severely impacted;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the OAR; and
- VFR lanes for east-west and north-south VFR traffic may be required to avoid the nominal CTR boundary.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

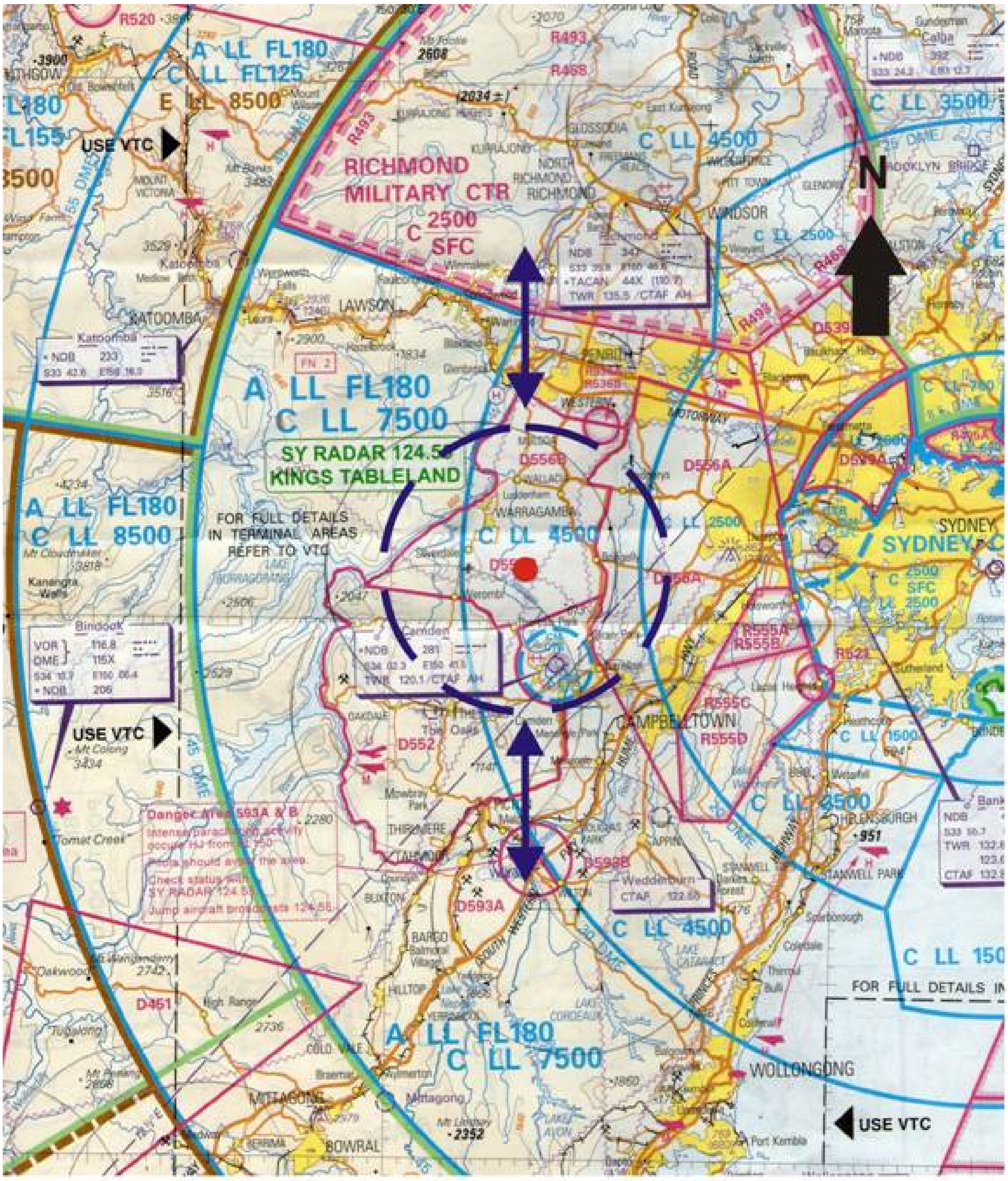
Greendale Airspace Considerations (Type 1 – Maximum and Type 3)

Greendale is based on a runway alignment of 17/35. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 17/35. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Greendale overlaid in dark blue with the nominal CTR and CTA information.

Figure 1



●	Site
— —	Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius
⟷	Nominal Control Area (CTA) Step Orientation

Airspace Considerations (Not to Scale)

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 10nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 17nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney CTA, 20 DME and 30 DME steps with lower limits of 2,500ft, 4,500ft and 7,500ft respectively;
- Traffic associated with Greendale's runway alignment of 17/35 may be in conflict or have dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 9nm to the east of the nominal CTR boundary;
- The nominal CTR boundary lies about 6nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 16nm from the edge of nominal CTR boundary;
- Restricted Areas R 468 and R 493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R536A and 536B lie at the north-eastern edge of the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3.
- The Class D CTR associated with Camden Airport and the airport itself fall within the nominal CTR boundary;
- The nominal CTR boundary overlays the western section of Danger Area D556A (upper limit 2,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The nominal CTR boundary overlays most of Danger Area D556B (upper limit 4,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- Approximately half of Danger Area D552 (upper limit 4,500ft) falls within the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- The Oaks airfield lies just outside the nominal CTR boundary;
- Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) lie approximately 4nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Restricted Areas R555A and R555B lie about 4nm to the east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational

24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2.

- The existing uncertified and unregistered airfield at Wilton lies approximately 8nm south of the nominal CTR boundary. Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, are approximately 7nm south of the nominal CTR boundary. They operate during daylight hours; and
- East-west VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Greendale.

The following preliminary observations can be made:

- The proposed runway alignment is very similar to Sydney Airport's 16/34 runway direction but approximately at right angles to the 07/25 direction;
- Greendale's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- Depending on CTA step design there may be a conflict with Richmond airspace and operations at that airport;
- Continued operation of Camden Airport would seem to be compromised unless a step or cutout to the nominal CTR boundary is achievable. The proposed runway alignment of 17/35 is not ideal in this regard;
- Significant sections of the training area airspace associated with Bankstown and Camden (D556A, D556B and D552) would be impacted/closed by the nominal CTR boundary which may have congestion implications for those airport's operations;
- Continued operation of the existing Wilton airfield may be possible although D593A/593B may appear to be impacted by CTA step design;
- Continued operation of the existing The Oaks airfield may be possible;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the OAR; and
- A VFR lane for east-west VFR traffic may be required to the northern and/or southern side of the nominal CTR boundary.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

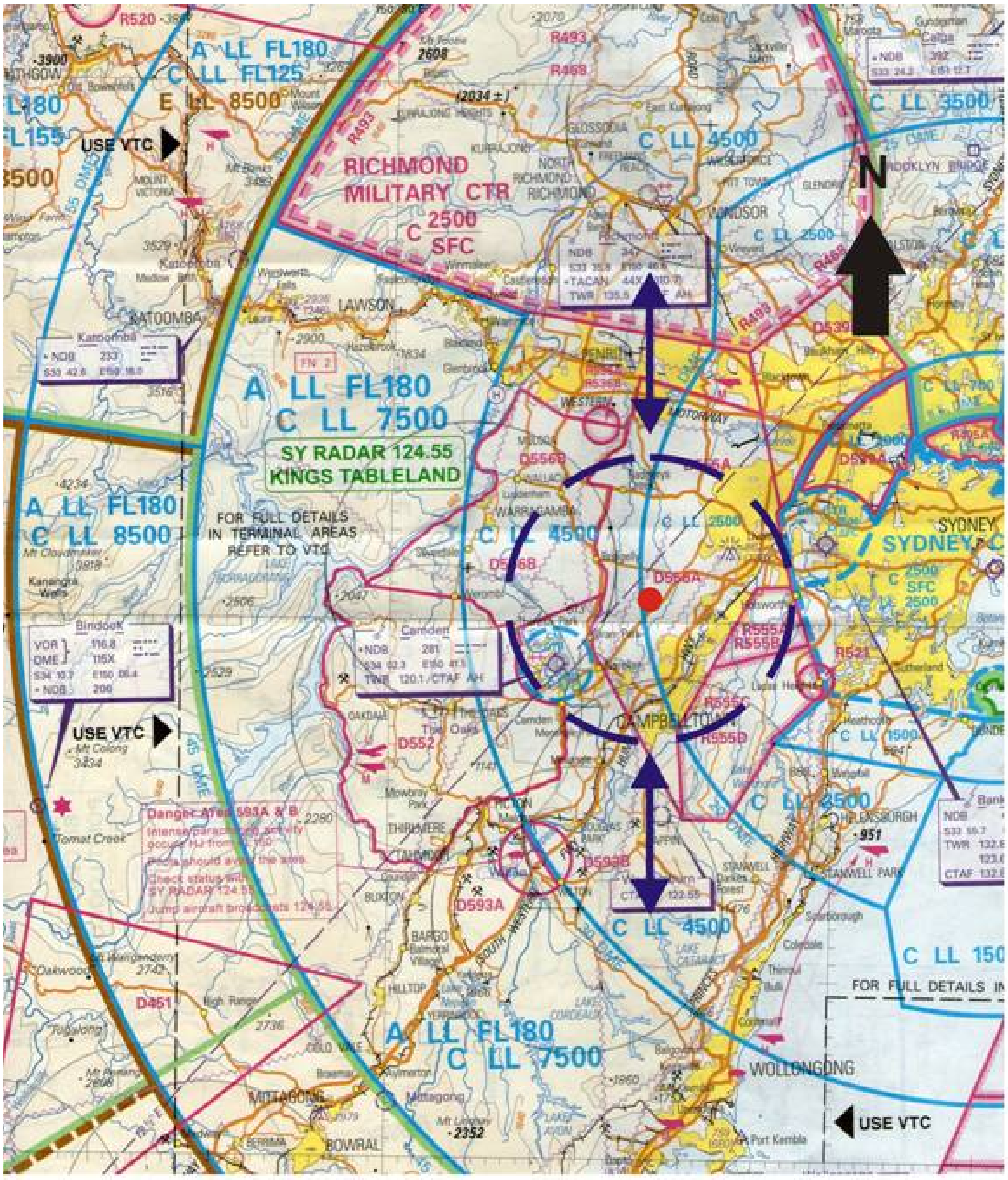
Primary Assessment KPI Ranking – Major

Catherine Field Airspace Considerations (Type 1 – Maximum and Type 3)

Catherine Field is based on a runway alignment of 17/35. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 17/35. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

Figure 1 depicts the current immediate airspace environment for Catherine Field overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary abuts the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 11nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney CTA, and 20 DME CTA step with lower limits of 2,500ft and 4,500ft respectively;
- Traffic associated with Catherine Field's runway alignment of 17/35 may be in conflict or have dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport abuts the edge of the nominal CTR boundary;
- The nominal CTR boundary lies about 7nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 14nm from the edge of nominal CTR boundary;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Restricted Areas R536A and 536B lie about 1nm to the north of the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3;
- The Class D CTR associated with Camden Airport and the airport itself fall within the nominal CTR boundary;
- The nominal CTR boundary overlays much of Danger Area D556A (upper limit 2,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The nominal CTR boundary overlays about half of Danger Area D556B (upper limit 4,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The Oaks airfield (not certified or registered) lies about 6nm to the south-west of the nominal CTR boundary;
- A major north-west section of Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) falls within the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Most of Restricted Areas R555A and R555B falls within the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2;

- Restricted Area R521 (upper limit 2,00ft) lies about 2nm to the east of the nominal CTR boundary. This area is associated with the nuclear facility at Lucas Heights, operates 24 hours and has a conditional status of RA3;
- Danger Areas D539A (upper limit 2,000ft) and D539B (upper limit 2,500ft) lie approximately 1-2nm north-east of the nominal CTR boundary. These areas provide the Bankstown Lane of Entry for VFR traffic;
- The existing airfield at Wedderburn (uncertified and unregistered) lies about 4nm to the south of the nominal CTR boundary;
- The existing uncertified and unregistered airfield at Wilton lies approximately 7nm south of the nominal CTR boundary. Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, are approximately 6nm south of the nominal CTR boundary. They operate during daylight hours; and
- East-west and north-south VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Catherine Field.

The following preliminary observations can be made:

- Catherine Field's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The runway alignment of 17/35 is near parallel to Sydney's 16/34 and approximately at right angles to 07/25;
- The location of R536A and 536B close to the nominal CTR boundary may be significant. The runway alignment adopted is the best fit possible in terms of seeking to avoid R536A/B;
- Depending on CTA step design there may be a conflict with Richmond airspace and operations at that airport. The extended 15/33 runway centreline would be virtually directly over RAAF Base Richmond;
- The location of R555C/D and R555A/B within the nominal CTR boundary would be significant, potentially requiring major modifications to the restricted airspace and/or nominal CTR;
- Continued operation of Camden Airport would require a step or cutout to the nominal CTR boundary, the proposed runway alignment of 17/35 may assist in this regard;
- Significant sections of the training area airspace associated with Bankstown (D556A and D556B) would be impacted/closed by the nominal CTR boundary which may have congestion implications for that airport's training operations;
- VFR access to/from both Bankstown and Camden airports to/from particular tracks may be difficult to achieve;
- Continued operations at Wedderburn and Wilton airfields (and operations in D593A/B) will depend on the CTA step design although Wilton appears less severely impacted;
- Potential conflicts or dependencies with Sydney, Bankstown, Camden and Richmond Airport's operations would require more detailed analysis by Airservices Australia, Defence and/or the OAR; and
- VFR lanes for east-west and north-south VFR traffic may be required to avoid the nominal CTR boundary.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Silverdale Airspace Considerations (Type 3)

Silverdale is based on a runway alignment of 17/35. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 17/35. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Silverdale overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

● Site

— — Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

⟷ Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 15nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 22nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney 20 DME and 30 DME CTA steps with lower limits of 4,500ft and 7,500ft respectively;
- Traffic associated with Silverdale's runway alignment of 17/35 may be in conflict or have dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 9nm to the east of the nominal CTR boundary;
- The nominal CTR boundary lies about 5nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 15nm from the edge of nominal CTR boundary;
- Restricted Areas R 468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R536A and 536B lie about 1nm to the north of the nominal CTR boundary. R536A and R536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3.
- The Class D CTR associated with Camden Airport and the airport itself fall within the nominal CTR boundary;
- The nominal CTR boundary overlays small section s of Danger Area D556A (upper limit 2,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The nominal CTR boundary overlays most of Danger Area D556B (upper limit 4,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- Approximately half of Danger Area D552 (upper limit 4,500ft) falls within the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- The Oaks airfield lies just within the nominal CTR boundary;
- Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) lie approximately 7nm to the south-east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Restricted Areas R555A and R555B lie about 7nm to the east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2.
- The existing uncertified and unregistered airfield at Wilton lies approximately 8nm south of the nominal CTR boundary. Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit

7,500ft) both of which are associated with parachuting activity at Wilton, are approximately 7nm south of the nominal CTR boundary. They operate during daylight hours; and

- East-west VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Silverdale.

The following preliminary observations can be made:

- The proposed runway alignment is very similar to Sydney Airport's 16/34 runway direction and near right angled to the 07/25 direction;
- Silverdale's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- Depending on CTA step design there may be a conflict with Richmond airspace and operations to the west of that airport;
- Continued operation of Camden Airport would require a step or cutout to the nominal CTR boundary. The proposed runway alignment of 17/35 may help in this regard;
- Significant sections of the training area airspace associated with Bankstown and Camden (D556A, D556B and D552) would be impacted/closed by the nominal CTR boundary which may have congestion implications for those airport's operations;
- Continued operation of the existing The Oaks airfield may require a step or cutout to the nominal CTR;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the OAR; and
- A VFR lane for east-west VFR traffic may be required to the northern and/or southern side of the nominal CTR boundary.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

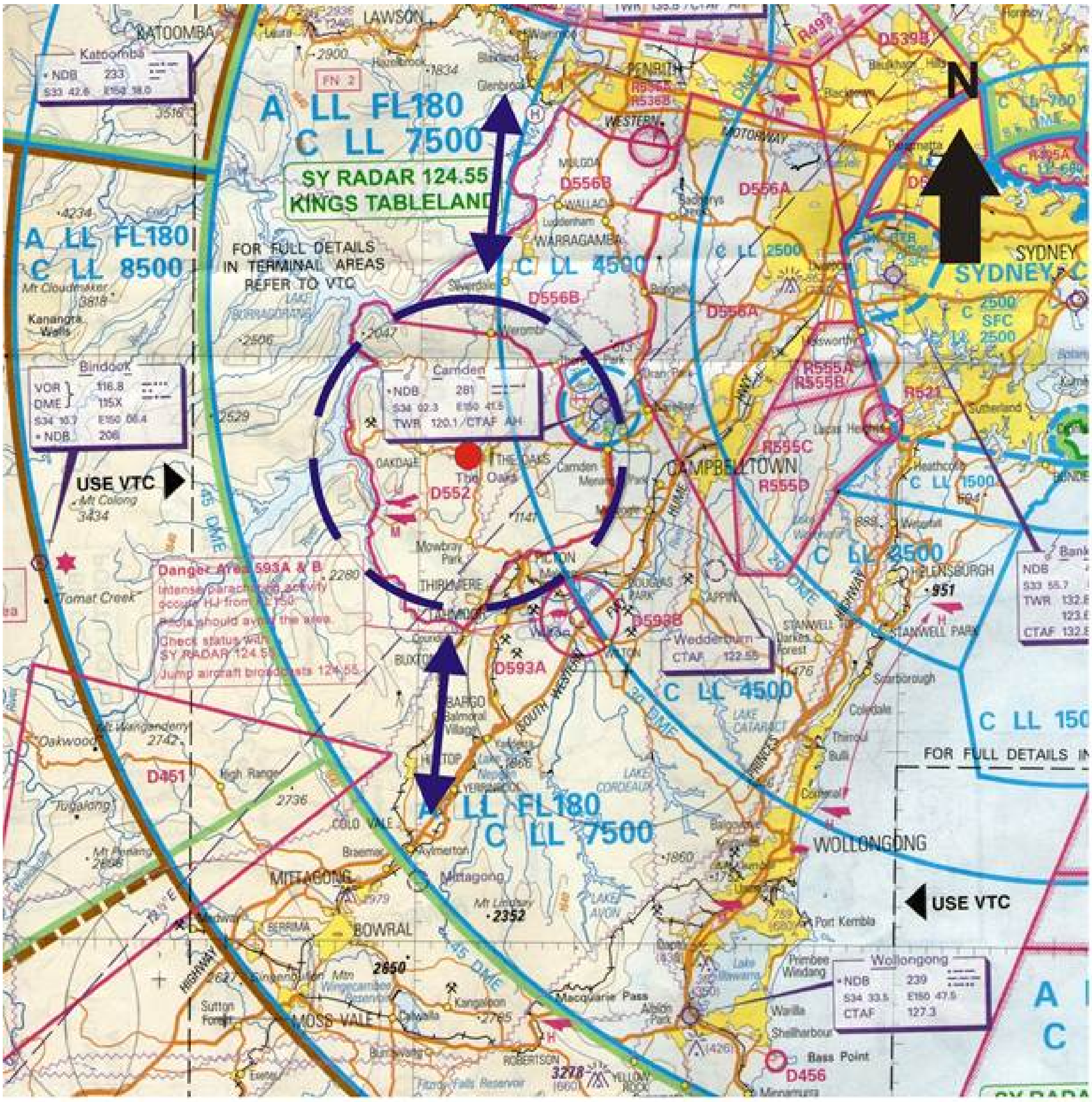
The Oaks Airspace Considerations (Type 1)

The Oaks is based on a runway alignment of 17/35. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 17/35. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for The Oaks overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 13nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 25nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney 20 DME and 30 DME CTA steps with lower limits of 4,500ft and 7,500ft respectively;
- Traffic associated with The Oaks runway alignment of 17/35 may be in conflict or have dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 13nm to the north east of the nominal CTR boundary;
- The nominal CTR boundary lies about 13nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 23nm from the edge of nominal CTR boundary (not shown in **Figure 1**);
- Restricted Areas R 468 and R 493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- The site essentially subsumes the existing uncertified and unregistered airfield of The Oaks;
- The Class D CTR associated with Camden Airport and the airport itself fall within the nominal CTR boundary;
- The existing uncertified and unregistered airfield at Wilton falls just outside the nominal CTR boundary, however Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, may fall within the nominal CTR boundary. They operate during daylight hours;
- Virtually all of Danger Area D552 (upper limit 4,500ft) falls within the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- Part of the southern section of Danger Area D556B (upper limit 4,500ft) falls within the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Mittagong airfield (not certified or registered) lies about 14nm south of nominal CTR boundary;
- Powered hang gliding and ultralight activity take place to the south-west of the site within the nominal CTR boundary;
- Part of Danger Area D451 (upper limit 4,500ft) lies about 9nm south-west of the nominal CTR boundary. This is activated by NOTAM and is associated with unmanned aerial vehicle testing; and
- North/south non-coastal VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving The Oaks.

The following preliminary observations can be made:

- The proposed runway alignment is very similar to Sydney Airport's 16/34 runway direction and at approximate right angles to the 07/25 alignment;
- The Oak's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- Depending on CTA step design there may be a conflict with Richmond airspace;
- Continued operation of the existing The Oaks airfield would not be possible;
- Continued operation of Camden Airport would require a step or cutout to the nominal CTR boundary. The proposed runway alignment of 17/35 may help in this regard. However, D552 would need to close, transferring Camden training traffic to the north to D556A/B, which may have congestion implications, and it too may need to be reduced in area and possibly altitude to take account of the nominal CTR boundary and associated CTA steps;
- Continued operation of the airfield at Wilton and D593A/B may require a step or cutout to the nominal CTR boundary. The proposed runway alignment of 17/35 may help in this regard. The ability to conduct higher altitude parachute drops may be impacted by the associated CTA steps;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the OAR;
- A VFR lane for non-coastal VFR traffic may be required to the eastern side of the nominal CTR boundary;
- CTA step design may require modification to a section of D451; and
- Current powered hang gliding and ultralight activity within the nominal CTR boundary would probably have to cease.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

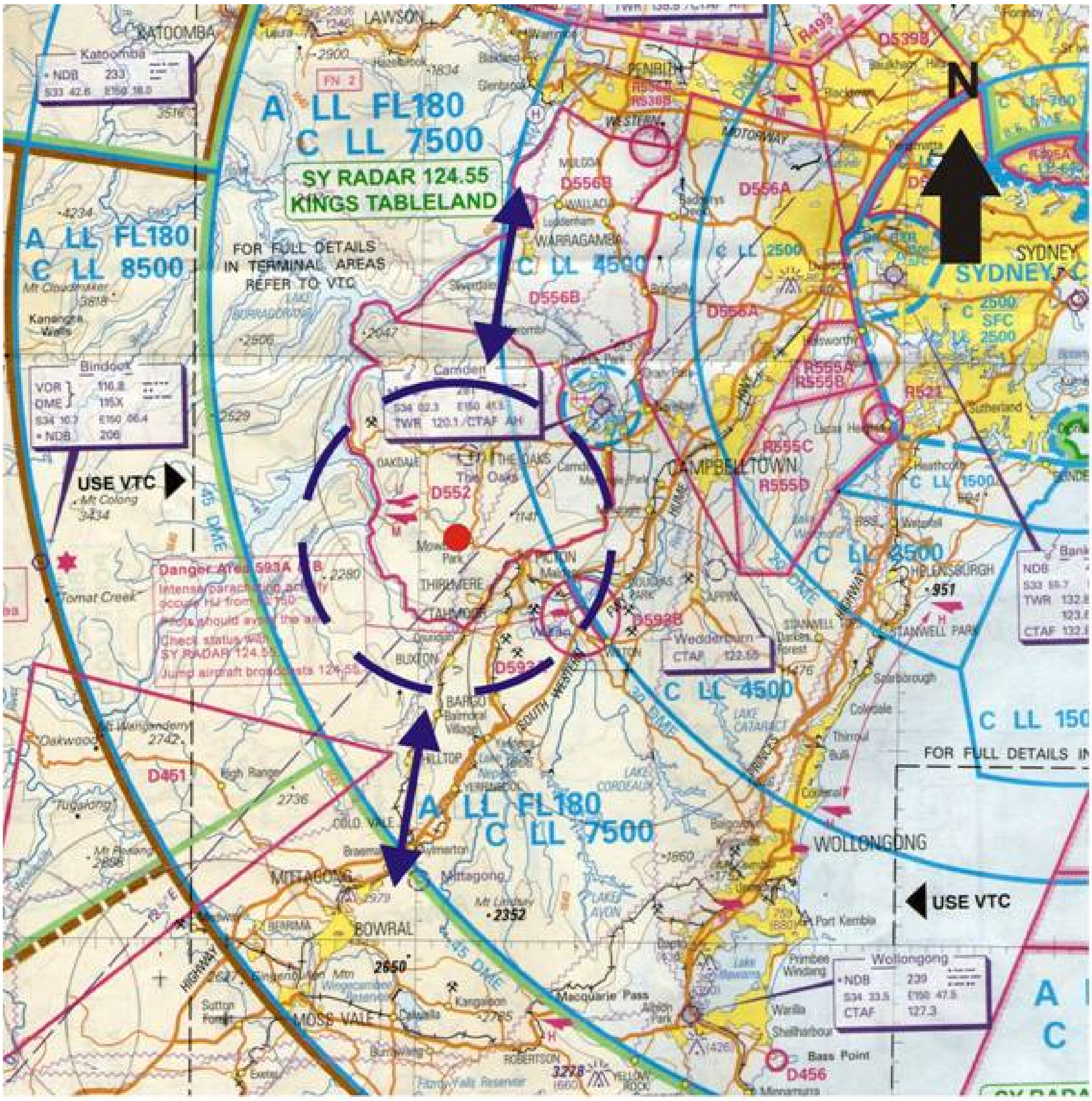
Mowbray Park Airspace Considerations (Type 1 and Type 3)

Mowbray Park is based on a runway alignment of 18/36. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 18/36. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Mowbray Park overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 14nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 26nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney 20 DME and 30 DME CTA steps with lower limits of 4,500ft and 7,500ft respectively;
- Traffic associated with Mowbray Park runway alignment of 18/36 may be in conflict or have dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 13nm to the north east of the nominal CTR boundary;
- The nominal CTR boundary lies about 17nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 27nm from the edge of nominal CTR boundary (not shown in **Figure 1**);
- Restricted Areas R 468 and R 493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R536A and 536B lie about 14nm to the north of the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3;
- The existing uncertified and unregistered airfield of The Oaks falls within the nominal CTR boundary;
- The Class D CTR associated with Camden Airport abuts the nominal CTR boundary;
- Most of Danger Area D552 (upper limit 4,500ft) falls within the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- Danger Area D556B (upper limit 4,500ft) lies about 2nmfrom the edge of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Area D556A (upper limit 2,500ft) lies about 4nm to the north-east of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) lie approximately 6nm to the east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Restricted Areas R555A and R555B lie about 10nm to the east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2.

- The existing uncertified and unregistered airfield at Wilton falls just inside the nominal CTR boundary as well as about half of Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton. They operate during daylight hours;
- Wedderburn Airfield (not certified or registered) lies about 6nm east of nominal CTR boundary;
- Mittagong airfield (not certified or registered) lies about 10nm south of nominal CTR boundary;
- Powered hang gliding and ultralight activity take place to the north-west of the site within the nominal CTR boundary;
- Part of Danger Area D451 (upper limit 4,500ft) lies about 3nm south-west of the nominal CTR boundary. This is activated by NOTAM and is associated with unmanned aerial vehicle testing; and
- North/south non-coastal VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving The Oaks.

The following preliminary observations can be made:

- The proposed runway alignment is similar to Sydney Airport's 16/34 runway direction and at approximate right angles to the 07/25 alignment;
- Mowbray Park's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- Depending on CTA step design there may be a conflict with Richmond airspace;
- Continued operation of the existing The Oaks airfield would not be possible;
- Continued operation of Camden Airport may be possible. The proposed runway alignment of 18/36 may help in this regard. However, most/all of D552 would need to close, transferring Camden training traffic to the north to D556A/B, which may have airspace congestion implications, and it too may need to be reduced in area and possibly altitude to take account of the associated CTA steps;
- Continued operation of the airfield at Wilton and D593A/B may require a step or cutout to the nominal CTR boundary. The proposed runway alignment of 18/36 may help in this regard. The ability to conduct higher altitude parachute drops may be impacted by the associated CTA steps;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the OAR;
- A VFR lane for non-coastal VFR traffic may be required to the eastern side of the nominal CTR boundary;
- CTA step design may require modification to a section of D451; and
- Current powered hang gliding and ultralight activity within the nominal CTR boundary would probably have to cease.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

North Appin Airspace Considerations (Type 1 – Maximum and Type 3)

North Appin is based on a runway alignment of 17/35. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 17/35. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

Figure 1 depicts the current immediate airspace environment for North Appin overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation (Primary and Secondary Runway/s)

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 3nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 14nm from the edge of nominal CTR boundary.
- The nominal CTR is overlaid by the Sydney CTA, 20 DME and 30 DME CTA steps with lower limits of 2,500ft, 4,500ft and 7,500ft respectively;
- Traffic associated with North Appin's runway alignment of 17/35 may be in conflict or have dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 5nm from the edge of the nominal CTR boundary;
- The nominal CTR boundary lies about 15nm from the edge of the Richmond Military CTR which has an upper limit of 2,500ft. RAAF Base Richmond itself is situated approximately 22nm from the edge of nominal CTR boundary;
- Restricted Areas R468 and R493 overlay the Richmond Military CTR and have lower limits of 2,500ft and 4,500ft respectively. They are activated by NOTAM and have conditional status of RA1;
- Restricted Areas R559A and R559F adjoin the north-western edge of the Richmond Military CTR. They are associated with military flying training, operate from 10,000ft and FL260 respectively, are both activated by NOTAM and have conditional status of RA2;
- Restricted Areas R536A and 536B lie about 10nm to the north of the nominal CTR boundary. R536A and 536B are associated with explosives demolition at Orchard Hills and operate from the surface to an altitude of 1,500 feet and 4,500 feet respectively. R536A is active from daylight to sunset, and R536B is active Monday to Friday 0900-1200 hours and 1300-1600 hours local. Both areas have a conditional status of RA3;
- The Class D CTR associated with Camden Airport and the airport itself fall within the nominal CTR boundary;
- The nominal CTR boundary overlays part of the southern section of Danger Area D556A (upper limit 2,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The nominal CTR boundary falls about 2nm from Danger Area D556B (upper limit 4,500ft). This area is associated with Bankstown flying training and operates during daylight hours;
- The eastern section of Danger Area D552 (upper limit 4,500ft) falls within the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- The Oaks airfield (not certified or registered) lies about 4nm to the north-west of the nominal CTR boundary;
- Most of Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM) falls within the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;

- The south-western section of Restricted Areas R555A and R555B falls within the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2;
- Restricted Area R521 (upper limit 2,00ft) lies about 3nm to the north-east of the nominal CTR boundary. This area is associated with the nuclear facility at Lucas Heights, operates 24 hours and has a conditional status of RA3;
- The existing airfields at Wedderburn and Wilton (both uncertified and unregistered) fall within the nominal CTR boundary;
- Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, partly fall within the nominal CTR boundary. They operate during daylight hours; and
- North-south VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving North Appin.

The following preliminary observations can be made:

- North Appin's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The runway alignment of 17/35 is near parallel to Sydney's 16/34 and approximately at right angles to 07/25;
- The location of R536A and 536B may have implications for CTA step design. The runway alignment adopted is the best fit possible in terms of seeking to avoid R536A/B;
- Depending on CTA step design there may be a conflict with Richmond airspace and operations at that airport. The extended 17/35 runway centreline would be virtually directly over RAAF Base Richmond;
- The location of R555C/D and R555A/B within the nominal CTR boundary would be significant, potentially requiring major modifications to the restricted airspace and/or nominal CTR;
- Continued operation of Camden Airport may be possible with a step or cut-out to the nominal CTR boundary. The 17/35 runway alignment may assist in this regard;
- Sections of the training area airspace associated with Bankstown (D556A and D556B) and Camden (D552) would be impacted/closed by the nominal CTR boundary/CTA step design which may have congestion implications for those airport's training operations;
- Continued operations at Wedderburn airfield will not be possible;
- Continued operations at Wilton airfield (and operations in D593A/B) would require a step or cut-out to the nominal CTR boundary and will also be dependent on the CTA step design. The 17/35 runway alignment may assist in this regard;
- Potential conflicts or dependencies with Sydney, Bankstown, Camden and Richmond Airport's operations would require more detailed analysis by Airservices Australia, Defence and/or the OAR; and
- VFR lane/s for North-south traffic may be required to avoid the nominal CTR boundary.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

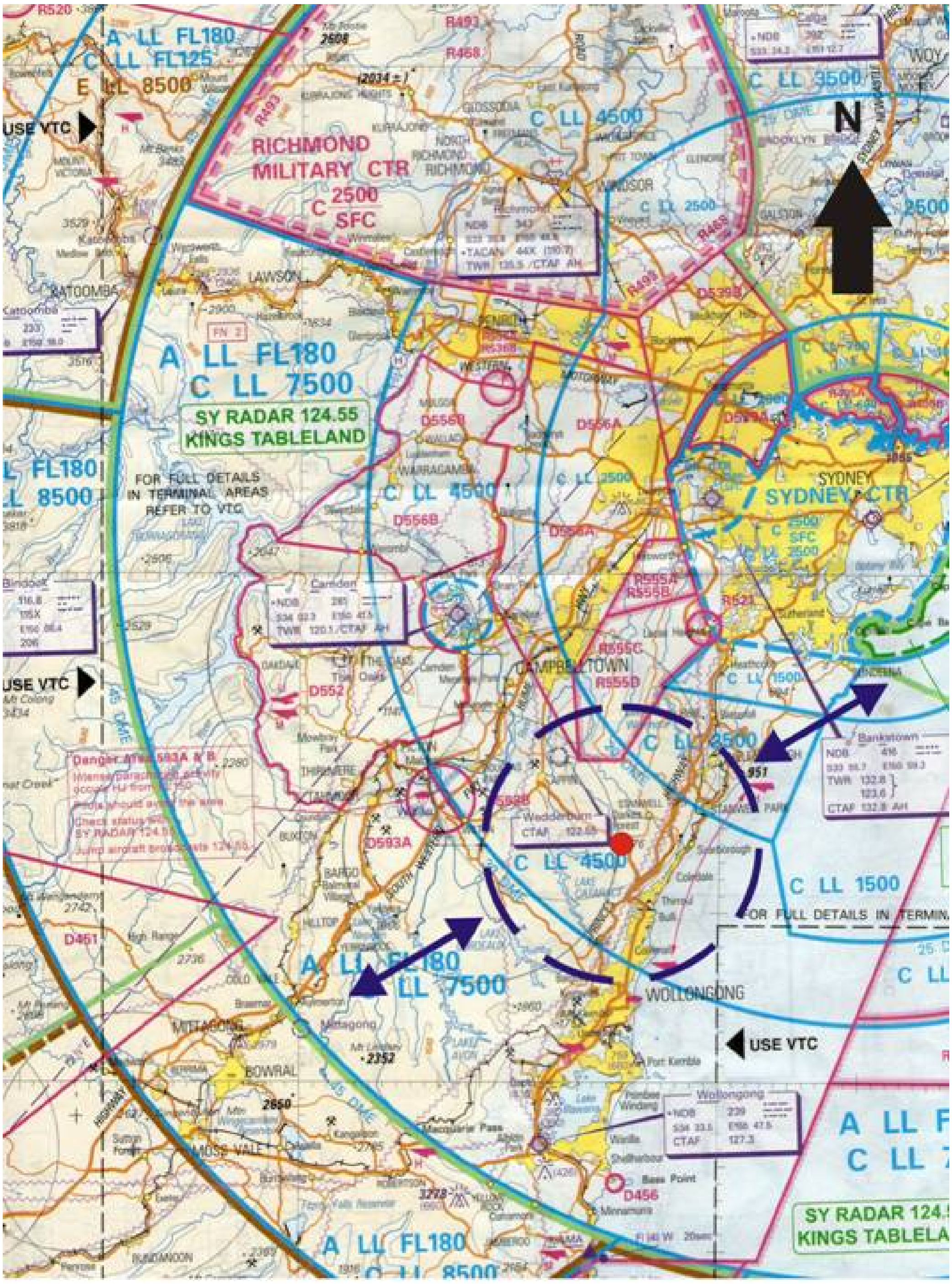
Southend Airspace Considerations (Type 3 Airport)

Southend is based on a runway alignment of 05/23. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 05/23. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Southend overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)



Site

Nominal Class C Control Zone (CTR) Boundary 8.5NM Radius

Nominal Control Area (CTA) Step Orientation

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 5nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 16nm from the edge of nominal CTR boundary.
- The Class D CTR boundary associated with Bankstown Airport lies about 11nm to the north of the nominal CTR boundary;
- The existing airfield of Wedderburn falls within the nominal CTR boundary. This airfield is not currently certified or registered
- The existing airfield of Wilton lies about 3nm to the west of the nominal CTR boundary. This airfield is not currently certified or registered.
- Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, fall about 1nm to the west of the the nominal CTR boundary. They operate during daylight hours;
- The southern section of Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM), fall within the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- R485A and R485B lie approximately 7nm and 10nm to the east and south-east of the nominal CTR boundary respectively. They are both associated with military flying training and operate from the surface to 1,500ft and 7,500ft respectively. Both have conditional status of RA2;
- The southern corner of Danger Area D556A (upper limit 2,500ft) falls within the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- R521 lies about 4nm to the north of the nominal CTR boundary. This is associated with nuclear research, operates from the surface to 2,000ft, is active continuously and has a conditional status of RA3;
- The Class D CTR boundary associated with Camden Airport lies about 6nm to the north-west of the nominal CTR boundary;
- The southernmost part of Danger Area D552 (upper limit 4,500ft) lies about 4nm to the north-west of the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- The nominal CTR is overlaid by the Sydney CTA, 20 DME and 30 DME CTA steps with lower limits of 2,500ft, 4,500ft and 7,500ft respectively;
- Traffic associated with Southend's Runway 05/23 may be in conflict or have dependencies with Sydney Airport's Runways 16/34 operations (not shown in **Figure 1**);
- Wollongong Airport (certified) lies approximately 9nm to the south of the nominal CTR boundary;
- The Oaks airfield (currently uncertified and unregistered) lies approximately 12nm to the north-west of the nominal CTR boundary;
- North/south non-coastal VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Southend; and

- Hangliding activities are undertaken along the coast within and along the full extent of the nominal CTR boundary.

The following preliminary observations can be made:

- The proposed runway alignment is very similar to Sydney Airport's 07/25 runway configuration but virtually at right angles with the 16/34 runway configuration. The relative proximity to Sydney Airport and the extended runway centreline for Southend may therefore result in dependency/conflict issues;
- Southend's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- Continued operation of Wedderburn and Wilton airfields may be possible, although a shelf or cutout to the nominal CTR boundary may be required for Wedderburn. The proposed runway alignment of 05/23 for Southend may help in this regard;
- A contraction of the R555C/D boundary to the edge of the nominal CTR boundary, or a shelf or cutout to the nominal CTR boundary to exclude it from R555C/D may be possible. The proposed runway alignment of 05/23 for Southend may help in this regard;
- A small contraction to the southern corner of Danger Area D556A, or a shelf or cutout to the nominal CTR boundary may be possible to remove the airspace conflict;
- Wollongong's operations would not appear to be significantly impacted;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the Office of Airspace Regulation (OAR);
- If feasible, a VFR lane (similar to Victor 1) for coastal traffic may be required; and
- The current hangliding activities along the coastline may need to be restricted

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Wilton Airspace Considerations (Type 1 – Maximum)

Wilton is based on a primary runway alignment of 18/36 with provision for a cross wind runway aligned 08/26. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignments i.e. 18/36 and 08/26. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Wilton overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 10nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 25nm from the edge of nominal CTR boundary.
- The Class D CTR boundary associated with Bankstown Airport lies about 13nm to the north east of the nominal CTR boundary;
- The existing airfields of Wilton and Wedderburn fall within the nominal CTR boundary, both of these airfields are currently uncertified and unregistered;
- Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, fall within the nominal CTR boundary. They operate during daylight hours;
- The south-western corner of Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM), may fall within the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Restricted Areas R555A and R555B lie about 7nm to the north of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2;
- Restricted Area R521 (upper limit 2,00ft) lies about 8nm to the north-east of the nominal CTR boundary. This area is associated with the nuclear facility at Lucas Heights, operates 24 hours and has a conditional status of RA3;
- The southern corner of Danger Area D556A (upper limit 2,500ft) may fall within the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Area D556B (upper limit 4,500ft) lies about 8nm to the north of the nominal CTR boundary. . This area is associated with Bankstown flying training and operates during daylight hours;
- The Class D CTR boundary associated with Camden Airport lies about 3nm to the north of the nominal CTR boundary, and the associated Visual Flight Rules (VFR) approach points of Menangle and Picton fall within the nominal CTR boundary;
- A small section of the southernmost part of Danger Area D552 (upper limit 4,500ft) falls within the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- The nominal CTR is overlaid by the Sydney 20 DME and 30 DME CTA steps with lower limits of 4,500ft and 7,500ft respectively;
- Danger Area D451 lies approximately 4nm to the south-west of the nominal CTR boundary. This is activated by NOTAM and is associated with unmanned aerial vehicle testing;
- Wollongong Airport (certified) lies approximately 10nm to the south of the nominal CTR boundary;

- The Oaks airfield (currently uncertified and unregistered) lies approximately 5nm to the north-west of the nominal CTR boundary;
- North/south non-coastal VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Wilton; and
- Hang gliding activities occur along the coast about 3nm from the eastern edge of the nominal CTR boundary.

The following preliminary observations can be made:

- Wilton's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The proposed primary runway alignment of 18/36 converges with Sydney Airport's 16/34 runway configuration well to the north of Sydney;
- The proposed secondary runway alignment of 08/26 is similar to Sydney Airport's 07/25 runway alignment;
- Traffic associated with Wilton's primary Runway/s 18/36 may be in conflict or have dependencies with Sydney Airport's Runway 07/25 operations (not shown in **Figure 1**);
- Traffic associated with the secondary 08/26 alignment may be in conflict or have dependencies with Sydney Airport's Runway 16/34 operations (not shown in **Figure 1**);
- Continued operation of the airfields at Wilton and D593A/B, and Wedderburn is unlikely to be possible, subject to the comments on R555C/D which follow;
- Either a small contraction of the R555C/D boundary to the edge of the nominal CTR boundary, or a shelf or cutout to the nominal CTR boundary to exclude it from R555C/D may be possible. Modifications to R555C/D may also be necessary for CTA design purposes;
- These latter adjustments might enable Wedderburn to remain operational;
- A small contraction to the southern corner of Danger Area D556A, or a shelf or cutout to the nominal CTR boundary may be possible to remove the airspace conflict, although D556A modifications may also be needed for CTA design purposes;
- Modifications to D556B may be required for CTA design purposes;
- Continued operations at Camden may be possible subject to CTA design requirements;
- Part of D451 may need to be modified for CTA step design for the 08/26 runway alignment;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the Office of Airspace Regulation (OAR);
- A VFR lane for non-coastal VFR traffic may be required on the western side of the nominal CTR; and
- Some hang gliding activities may need to be modified along the coastal strip depending on CTA step design.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Wallandoola Airspace Considerations (Type 1 – Maximum with Cross Runway Provision and Type 3)

Wallandoola is based on a primary runway alignment of 17/35. For the Type 1 Maximum, provision has also been made for a cross runway aligned 07/25. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignments i.e. 17/35 for the primary and in addition for the Type 1 Maximum 07/25. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Wallandoola overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 9nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 19nm from the edge of nominal CTR boundary;
- Traffic associated with Wallandoola's Runway 17/35 would be near parallel to Sydney's 16/34 but near right-angled to 07/25. Conversely, the crosswind 07/25 alignment (Type 1 Maximum only) is parallel with Sydney's 07/25 but near right-angled to 16/34. There may therefore be conflicts or dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- The Class D CTR boundary associated with Bankstown Airport lies about 13nm to the north east of the nominal CTR boundary;
- The existing airfields of Wilton and Wedderburn fall within the nominal CTR boundary, both of these airfields are currently uncertified and unregistered;
- The majority of Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, fall within the nominal CTR boundary. They operate during daylight hours;
- The south-western corner of Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM), falls within the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- A small section of the southern corner of Danger Area D556A (upper limit 2,500ft) falls within the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- The Class D CTR boundary associated with Camden Airport lies about 5nm to the north of the nominal CTR boundary;
- The southernmost part of Danger Area D552 (upper limit 4,500ft) falls about 3nm to the north-west of the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- The nominal CTR is overlaid by the Sydney 20 DME and 30 DME CTA steps with lower limits of 4,500ft and 7,500ft respectively;
- Wollongong Airport (certified) lies approximately 8nm to the south of the nominal CTR boundary;
- The Oaks airfield (currently uncertified and unregistered) lies approximately 10nm to the north-west of the nominal CTR boundary;
- Danger Area D451 (upper limit 4,500ft) lies approximately 8nm to the west of the nominal CTR boundary. This is activated by NOTAM and is associated with unmanned aerial vehicle testing;
- North/south coastal and non-coastal VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Wallandoola; and
- Hangliding activities are undertaken along the coast within and along the full extent of the nominal CTR boundary.

The following preliminary observations can be made:

- The primary 17/35 runway alignment is near parallel with Sydney Airport's 16/34 runway configuration but near right-angled to 07/25;
- The cross wind runway (Type 1 Maximum only) is parallel to Sydney Airport's 07/25 runway but near right-angled to 16/34;
- Wallandoola's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- Continued operation of the airfield at Wilton and D593A/B may be possible subject to being able to provide a shelf or cutout to the nominal CTR boundary. The proposed runway alignments of 17/35 and 07/25 may assist in this regard ;
- Continued operation of the airfield at Wedderburn would be less certain given the proposed primary runway alignment of 17/35 and the airfield's location within the nominal CTR boundary;
- Either a small contraction of the R555C/D boundary to the edge of the nominal CTR boundary, or a shelf or cutout to the nominal CTR boundary to exclude it from R555C/D may be possible. Modifications to R555C/D may also be necessary for CTA design purposes;
- A small contraction to the southern corner of Danger Area D556A, or a shelf or cutout to the nominal CTR boundary may be possible to remove the airspace conflict;
- Modifications may be necessary to D451 to facilitate the secondary 07/25 runway alignment (Type 1 Maximum only);
- There may be conflicts with Wollongong Airport's operations given its primary Runway 16/34 alignment;
- If feasible, a VFR lane (similar to Victor 1) for coastal traffic may be required;
- The current hangliding activities along the coastline may need to be restricted; and
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the Office of Airspace Regulation (OAR);

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Major

Dendrobium Airspace Considerations (Type 3)

Dendrobium is based on a runway alignment of 12/30. It is assumed an airport at this site would be operated under Class C air traffic control (ATC) procedures. A nominal 8.5 nautical mile (nm) radius has been assumed for the control zone (CTR). This is based on a conservative application of the design principles contained in the Civil Aviation Safety Authority's (CASA) Advisory Circular AC 2-5-1(0) *Guidance for Controlled Airspace Design March 2010.* The associated control area (CTA) steps would be assumed to be delineated so as to encompass sufficient airspace to contain the flight paths of those Instrument Flight Rules (IFR) flights or portions thereof to which it is desired to provide the applicable parts of the ATC service, taking into account the navigation aids provided for the airport. In practical terms, it is assumed the CTA steps would generally be oriented as for the runway alignment i.e. 12/30. The CTR is assumed to extend upwards from the surface to the lower limit of the CTA. The lateral and vertical design of the CTA steps will be dependent on the types of navigation aids proposed for the airport and their respective operating tolerances.

At a meeting on 18 May 2011, the Department of Infrastructure and Transport (DoIT) briefed CASA and Airservices Australia representatives on the various localities. The organisations were tasked with undertaking airspace assessments of the localities with a view to determining their feasibility for future potential airport development. It is understood DoIT will be briefing Defence representatives separately and similarly seeking their views on locality feasibility. Airservices, CASA and Defence will then need to review the specific airport sites and the outcome of this process may not be known within the timeframe of this report.

Figure 1 depicts the current immediate airspace environment for Dendrobium overlaid in dark blue with the nominal CTR and CTA information.

Figure 1 – Airspace Considerations (Not to Scale)

Source: Base Image Airservices Australia 2010

Notable airspace issues are as follows:

- The nominal CTR boundary lies about 15nm from the edge of the Sydney CTR which has an upper limit of 2,500ft. Sydney Airport itself is situated approximately 27nm from the edge of nominal CTR boundary.
- The Class D CTR boundary associated with Bankstown Airport lies about 19nm to the north east of the nominal CTR boundary;
- The existing airfields of Wilton and Wedderburn lie about 1nm and 4nm respectively to the north of the nominal CTR boundary, both of these airfields are currently uncertified and unregistered;
- Danger Areas D593A (upper limit 4,500ft) and D593B (upper limit 7,500ft) both of which are associated with parachuting activity at Wilton, partly fall within the nominal CTR boundary. They operate during daylight hours;
- The south-western corner of Restricted Areas R555C (upper limit 3,000ft) and R555D (upper limit NOTAM), lie about 5nm to the north-east of the nominal CTR boundary. Both areas are associated with firing. R555C has a conditional status of RA3 and that of R555D is RA2;
- Restricted Areas R555A and R555B lie about 13nm to the north-east of the nominal CTR boundary. Both areas are associated with firing. R555A operates from the surface to 1,500ft, is operational 24 hours and has a conditional status of RA3. R555B operates from 1,500ft to NOTAM altitude, is activated by NOTAM and has a conditional status of RA2;
- Restricted Area R521 (upper limit 2,00ft) lies about 13nm to the north-east of the nominal CTR boundary. This area is associated with the nuclear facility at Lucas Heights, operates 24 hours and has a conditional status of RA3;
- The southern corner of Danger Area D556A (upper limit 2,500ft) lies about 5nm to the north-east of the nominal CTR boundary. This area is associated with Bankstown flying training and operates during daylight hours;
- Danger Area D556B (upper limit 4,500ft) lies about 13nm to the north of the nominal CTR boundary. . This area is associated with Bankstown flying training and operates during daylight hours;
- The Class D CTR boundary associated with Camden Airport lies about 9nm to the north of the nominal CTR boundary;
- Danger Area D552 (upper limit 4,500ft) lies about 3nm to the north-west of the nominal CTR boundary. This area is associated with Camden flying training and operates during daylight hours;
- The nominal CTR is overlaid by the Sydney 20 DME and 30 DME CTA steps with lower limits of 4,500ft and 7,500ft respectively;
- Danger Area D451 lies approximately 3nm to the west of the nominal CTR boundary. This is activated by NOTAM and is associated with unmanned aerial vehicle testing;
- Wollongong Airport (certified) lies approximately 4nm to the south of the nominal CTR boundary;

- Danger Area D456 lies about 9nm to the south-east of the nominal CTR boundary. It operates from the surface to 500ft and is associated with blasting. Hours of operation are published in ERSA;
- The Oaks airfield (currently uncertified and unregistered) lies approximately 9nm to the north-west of the nominal CTR boundary;
- Mittagong airfield (currently uncertified and unregistered) lies approximately 3nm to the south-west of the nominal CTR boundary;
- Tallawarra power station (subject to a current OAR plume rise assessment) lies about 3nm to the south-east of the nominal CTR boundary;
- North/south coastal and non-coastal VFR transit traffic may be impacted by the imposition of the nominal CTR boundary serving Dendrobium; and
- Hang gliding, powered hang gliding and parachuting activities occur along the coast adjacent to the eastern edge of the nominal CTR boundary.

The following preliminary observations can be made:

- Dendrobium's airspace management would need to be integrated into the complex airspace arrangements which characterise the Sydney Basin;
- The proposed primary runway alignment of 12/30 falls about midway between Sydney Airport's 16/34 and 07/25 runway configurations;
- Traffic associated with Dendrobium's 12/30 alignment may have some conflicts or dependencies with Sydney Airport's operations (not shown in **Figure 1**);
- Continued operation of the airfield at Wilton and D593A/B, may be possible through a shelf or cutout to the nominal CTR boundary;
- Continued operation of Mittagong and Wedderburn airfields would seem possible given the 12/30 runway alignment;
- CTA step design may have implications on Wollongong Airport operations;
- Modifications to a small section of D552 may be required for CTA design purposes;
- Potential conflicts or dependencies with Sydney Airport's operations would require more detailed analysis by Airservices Australia and/or the Office of Airspace Regulation (OAR);
- The outcome of the Talawarra power station plume rise assessment may be of relevance for Dendrobium operations given the 12/30 runway alignment;
- VFR lanes for coastal and non-coastal VFR traffic may be required on the eastern and western sides respectively of the nominal CTR; and
- Some hang gliding, powered hang gliding and parachuting activities may need to be modified along the coastal strip depending on CTA step design.

These preliminary observations will need further consideration by Airservices Australia/Defence and/or the OAR. Note only aerodrome facilities that are depicted on aeronautical charts have been considered. The possibility always exists there could be other aerodrome facilities not shown on these charts.

Primary Assessment KPI Ranking – Moderate

3
Appendix

Type 3 Airport (Limited Service Airport)
Site Concept Development Plans

Type 3 Airport (Limited Service Airport)
Site Concept Development Plans

WorleyParsons
resources & energy

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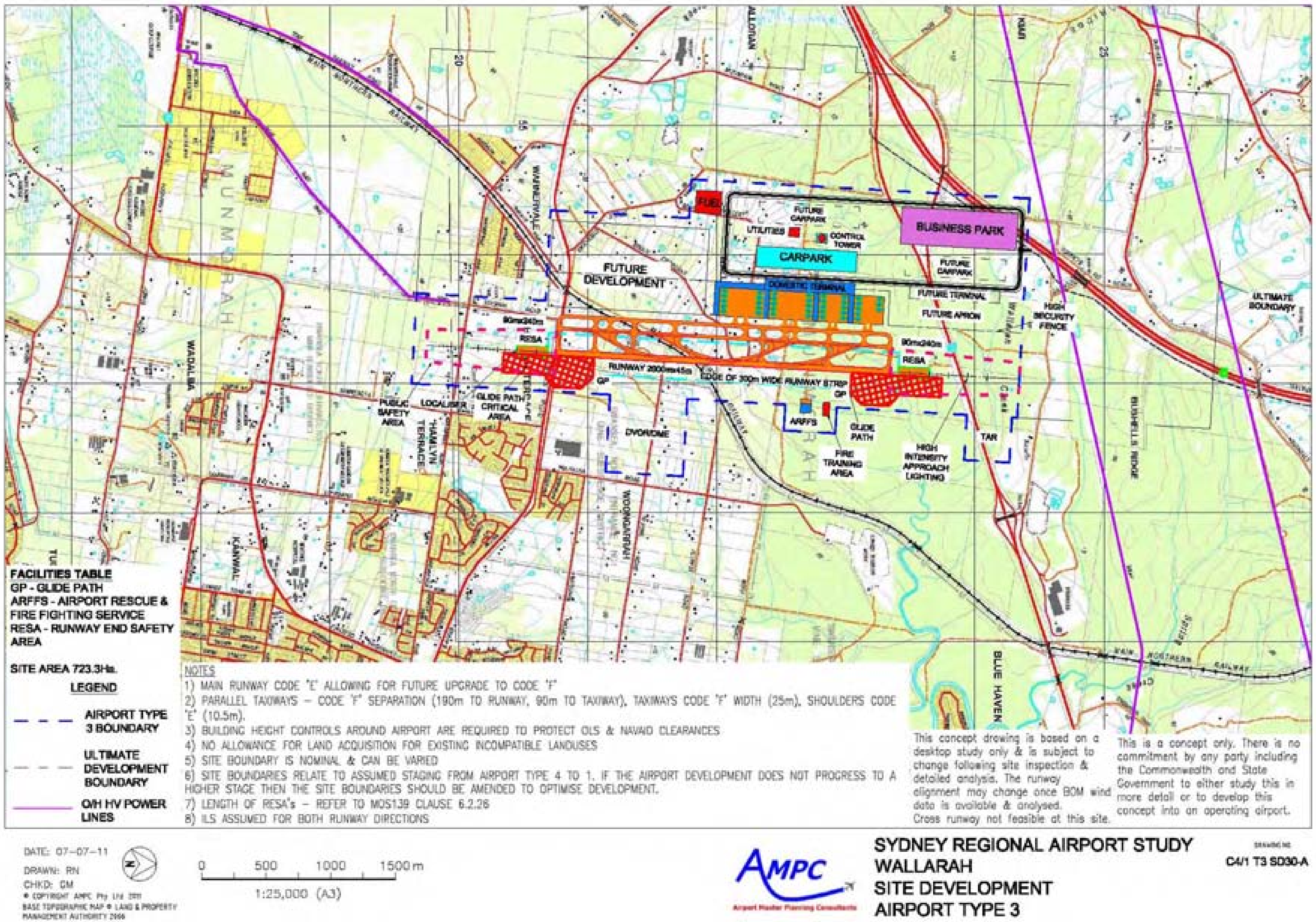
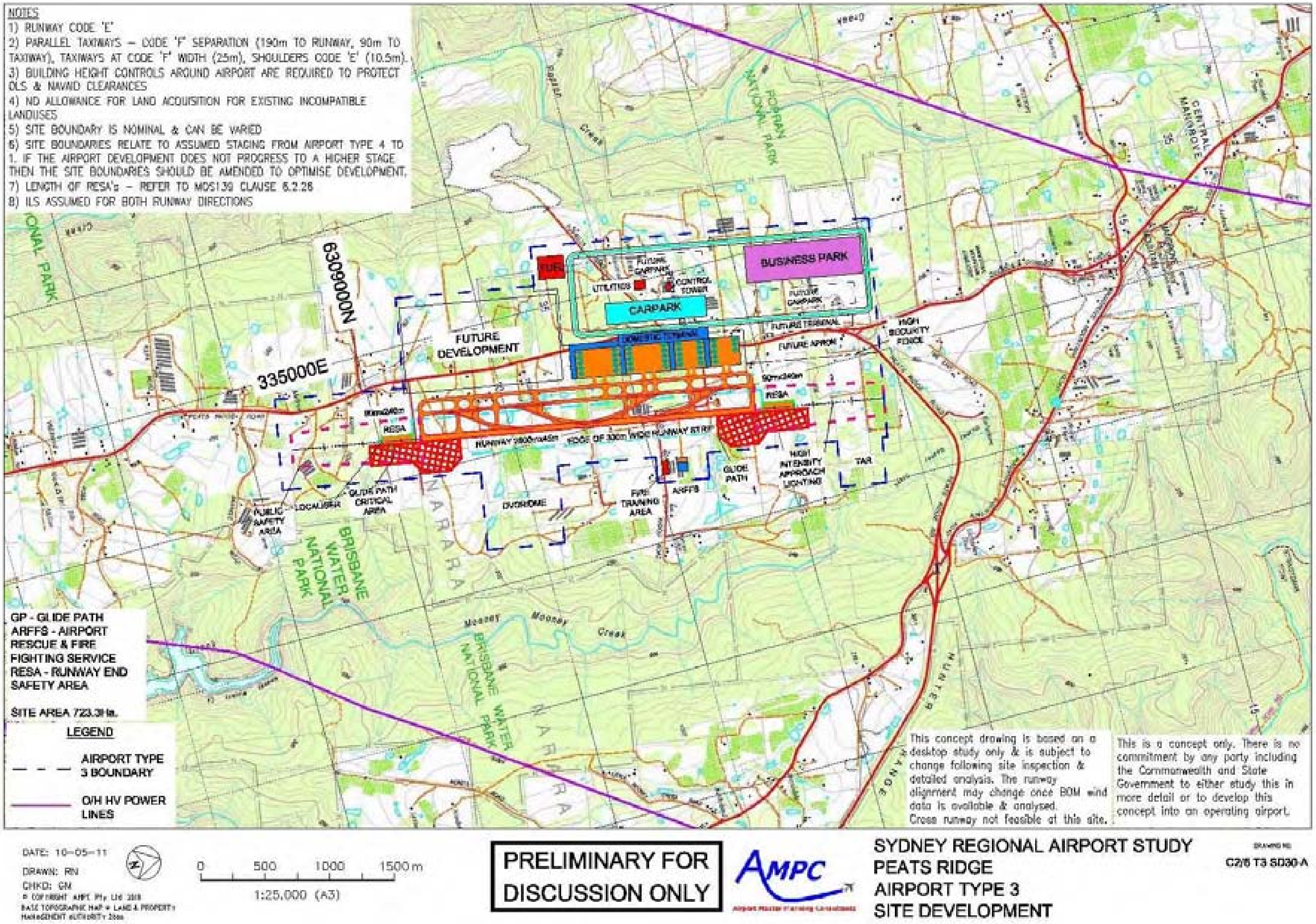
DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
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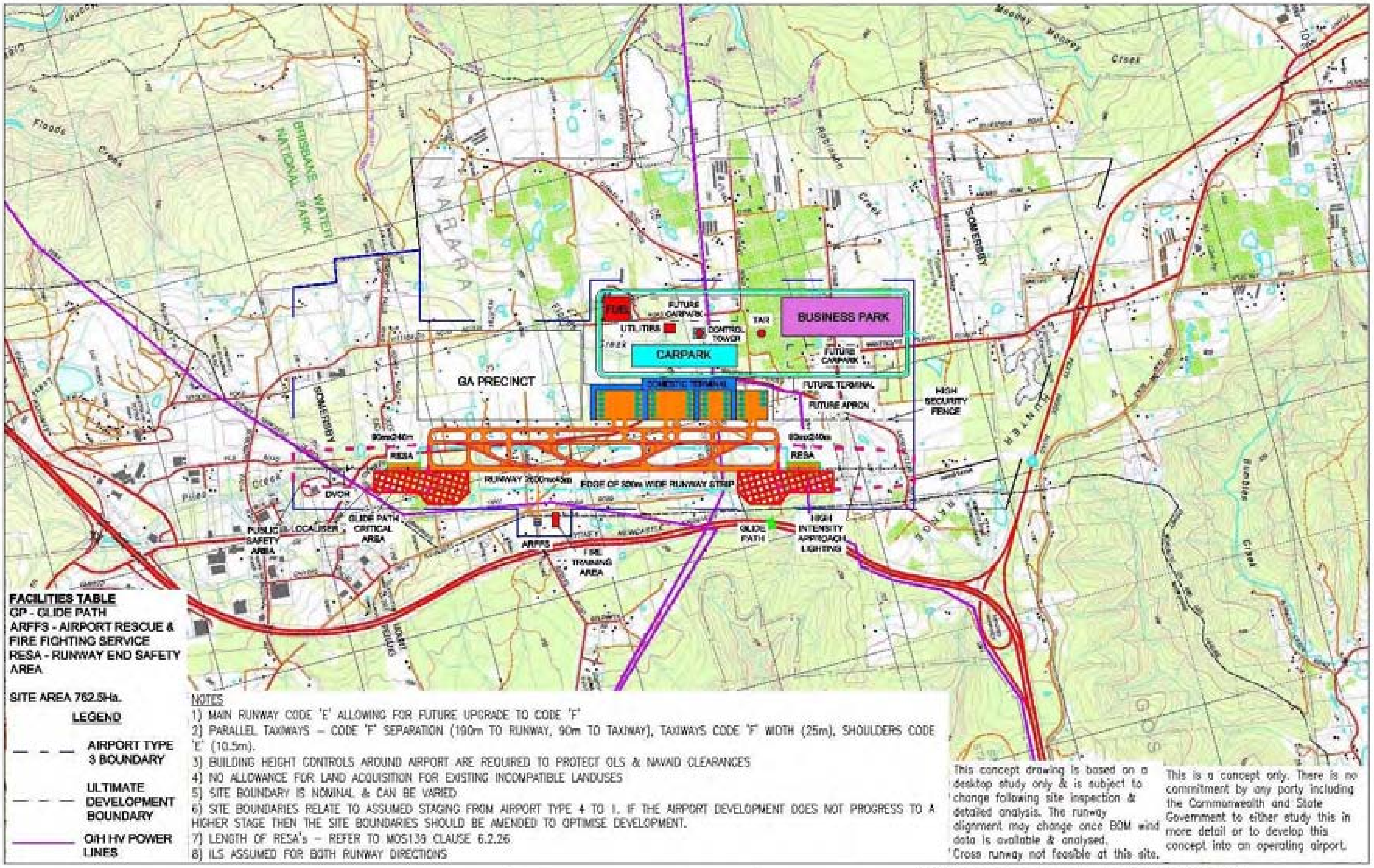
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



DATE: 18-03-11
DRAWN: RN
CHKD: GM

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PRELIMINARY FOR DISCUSSION ONLY

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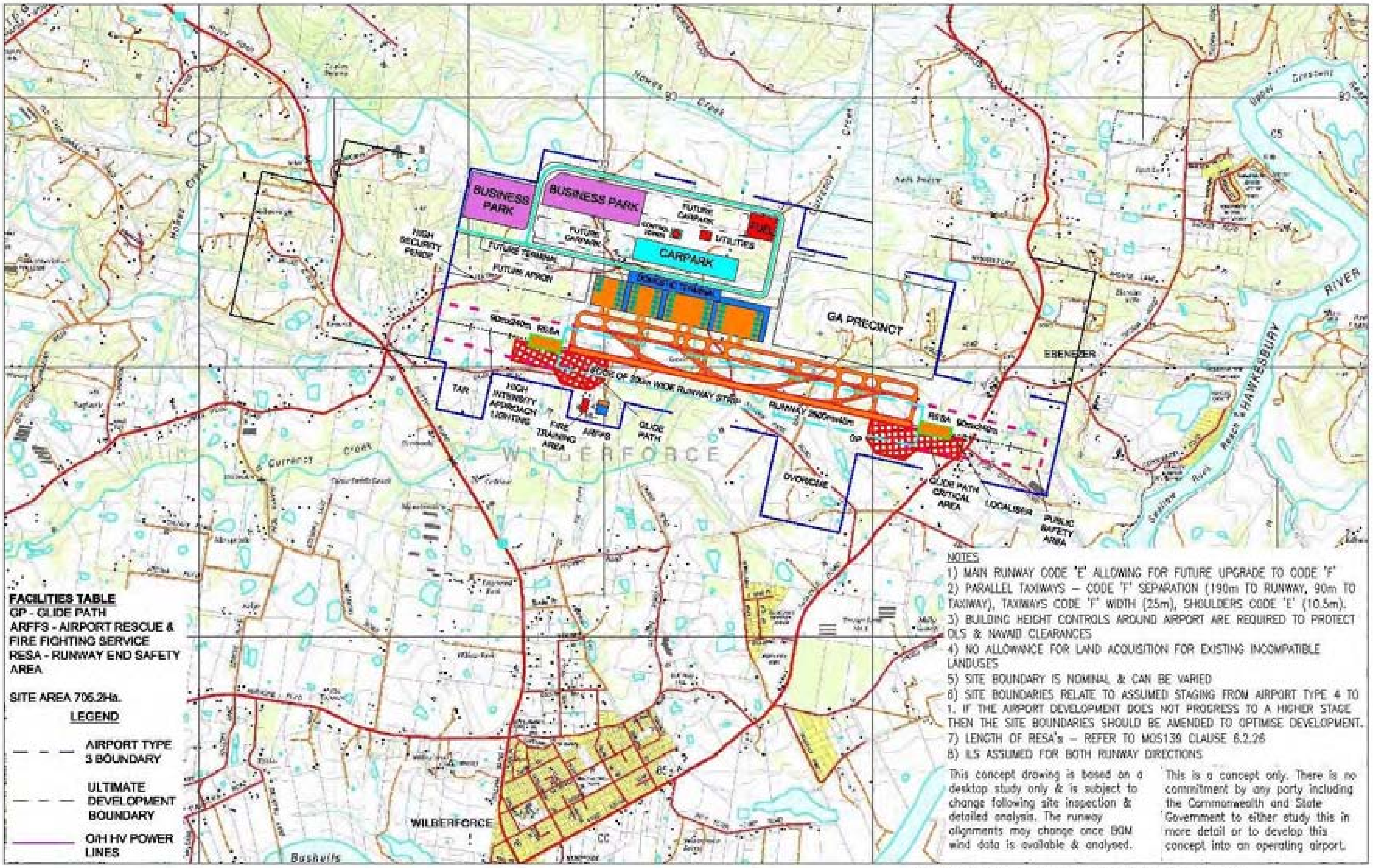
SYDNEY REGIONAL AIRPORT STUDY
SOMERSBY
SITE DEVELOPMENT
AIRPORT TYPE 3

DRAWING NO
C3/1 T3 S030-A



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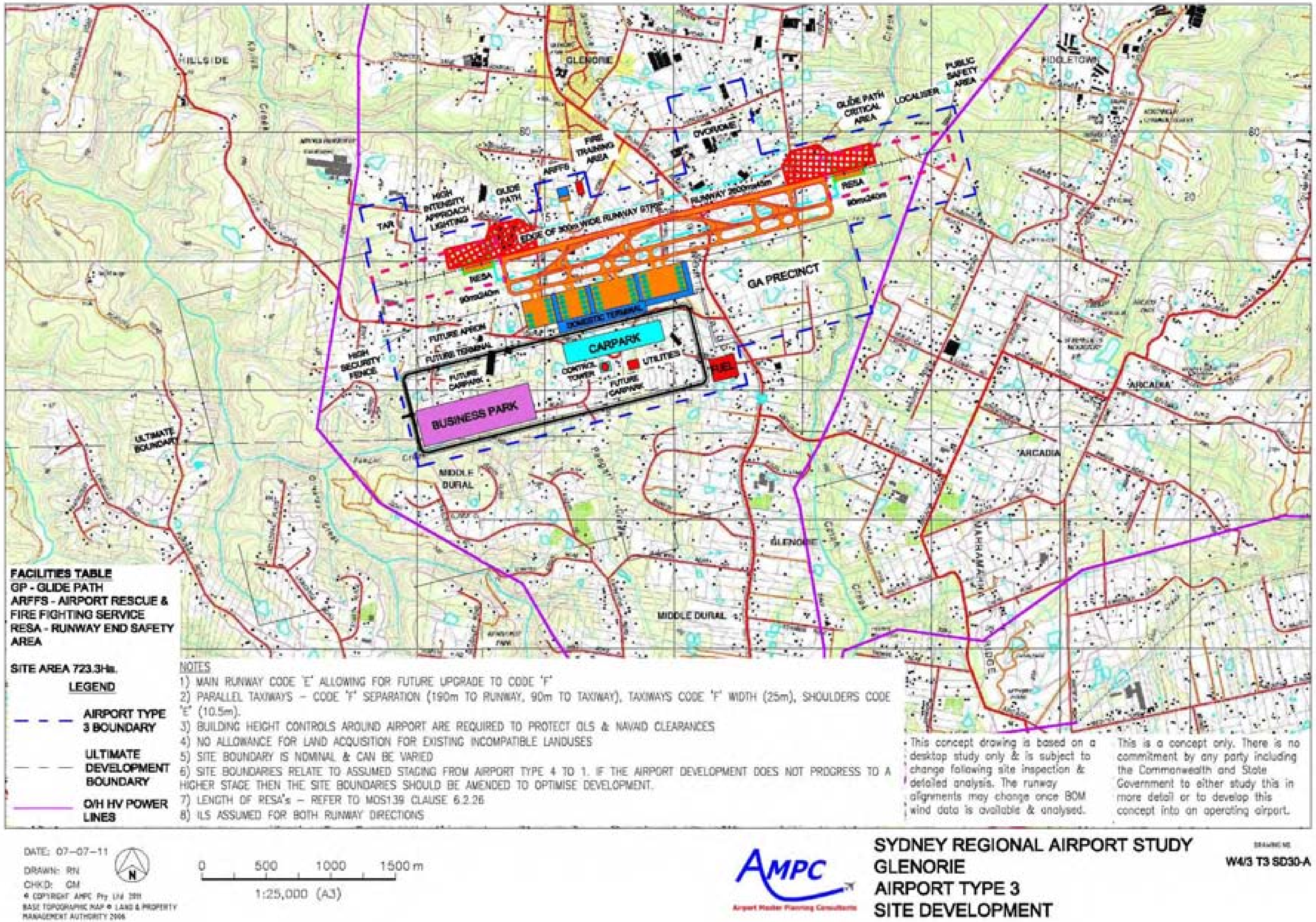
SYDNEY REGIONAL AIRPORT STUDY
WILBERFORCE
AIRPORT TYPE 3
SITE DEVELOPMENT

DRAWING NO.
W1/1 T3 SD30-A


HILLSIDE
GLENORIE
MIDDLE DURAL
ARCADIA
GLENORIE
MIDDLE DURAL
PUBLIC SAFETY AREA
GLIDE PATH CRITICAL AREA
LOCALISER
OVORDME
FIRE TRAINING AREA
ARFFS
GLIDE PATH
HIGH INTENSITY APPROACH LIGHTING
TAR
EDGE OF 300m WIDE RUNWAY STRIP
RUNWAY 2800mx45m
RESA 90mx240m
RESA 90mx240m
GA PRECINCT
DOMESTIC TERMINAL
FUTURE APRON
FUTURE TERMINAL
HIGH SECURITY FENCE
CARPARK
UTILITIES
CONTROL TOWER
FUTURE CARPARK
FUTURE CARPARK
FUEL
BUSINESS PARK
ULTIMATE BOUNDARY
FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA
SITE AREA 723.3Ha.
LEGEND
AIRPORT TYPE 3 BOUNDARY
ULTIMATE DEVELOPMENT BOUNDARY
O/H HV POWER LINES
NOTES
1) MAIN RUNWAY CODE 'E' ALLOWING FOR FUTURE UPGRADE TO CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS CODE 'F' WIDTH (25m), SHOULDERS CODE 'E' (10.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS
This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignments may change once BOM wind data is available & analysed.
This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
DATE: 07–07–11
DRAWN: RN
CHKD: GM
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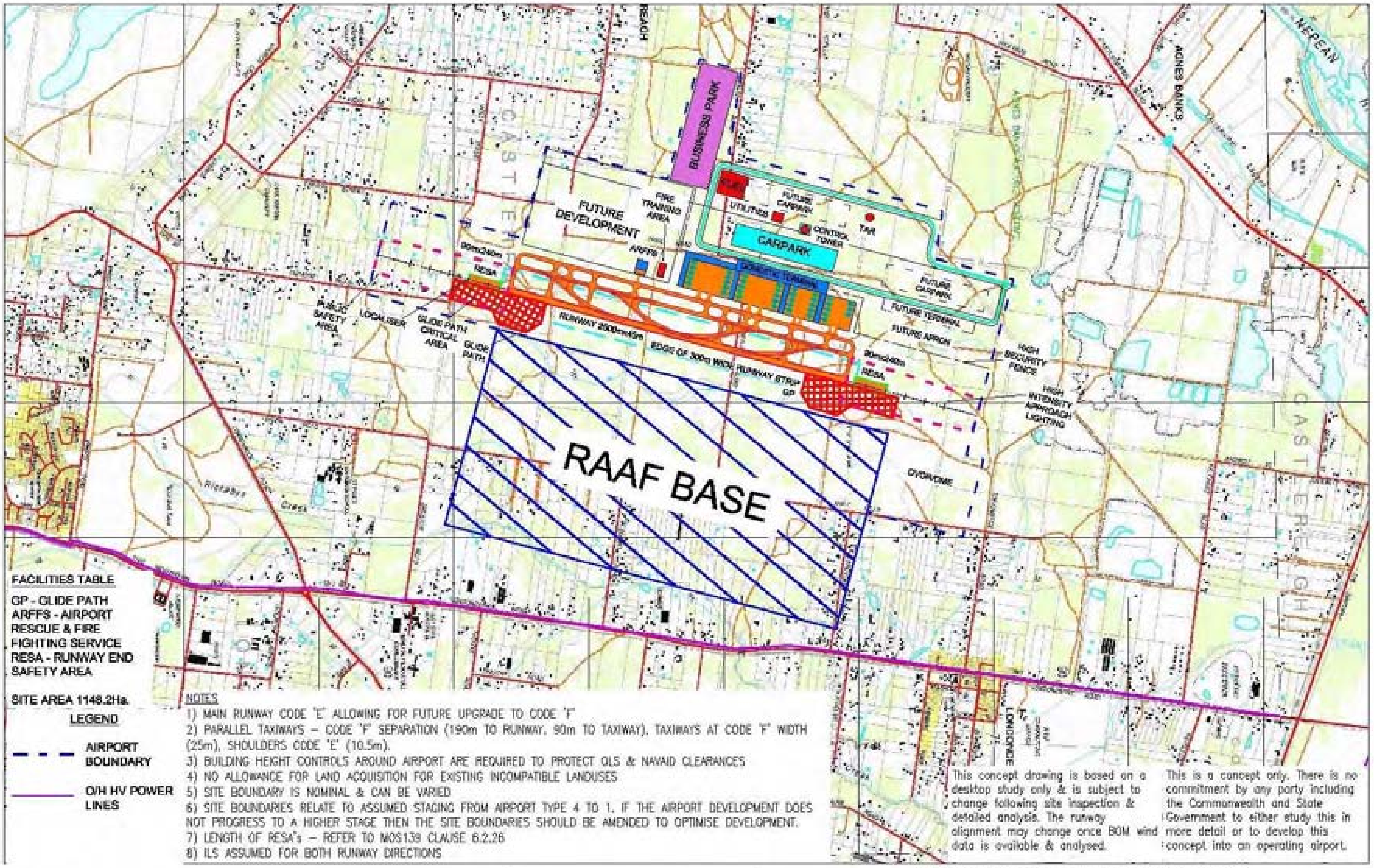
AMPC
Airport Master Planning Consultants
SYDNEY REGIONAL AIRPORT STUDY
GLENORIE
AIRPORT TYPE 3
SITE DEVELOPMENT
W4/3 T3 SD30-A

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



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PRELIMINARY FOR DISCUSSION ONLY

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SYDNEY REGIONAL AIRPORT STUDY
CASTLEREAGH
AIRPORT TYPE 3
SITE DEVELOPMENT

DRAWING NO.
W1-2 T3 SD30-A

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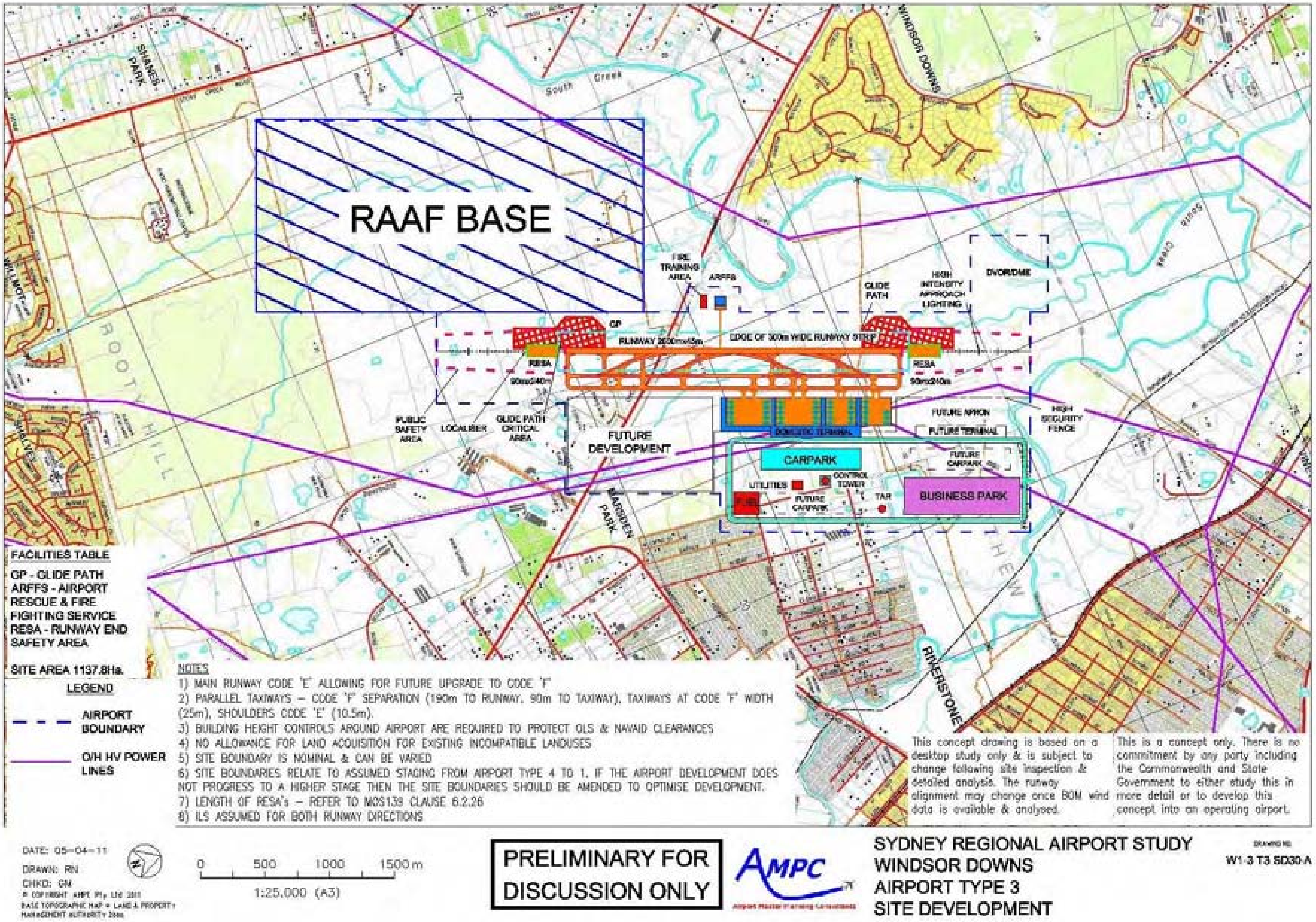
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SHANES PARK
WINDSOR DOWNS
South Creek
ROOTY HILL
MARSDEN PARK
RIVERSTONE
FIRE TRAINING AREA
ARFFS
GLIDE PATH
HIGH INTENSITY APPROACH LIGHTING
DVOR/DME
GP
RUNWAY 3200mx45m
EDGE OF 300m WIDE RUNWAY STRIP
RESA 90mx240m
RESA 90mx240m
PUBLIC SAFETY AREA
LOCALISER
GLIDE PATH CRITICAL AREA
FUTURE DEVELOPMENT
DOMESTIC TERMINAL
FUTURE APRON
FUTURE TERMINAL
HIGH SECURITY FENCE
CARPARK
FUTURE CARPARK
UTILITIES
CONTROL TOWER
FUEL
FUTURE CARPARK
TAR
BUSINESS PARK
FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA
SITE AREA 1137.8Ha.
LEGEND
AIRPORT BOUNDARY
O/H HV POWER LINES
NOTES
1) MAIN RUNWAY CODE 'E' ALLOWING FOR FUTURE UPGRADE TO CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY. 90m TO TAXIWAY). TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'E' (10.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS
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This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
DATE: 05-04-11
DRAWN: RN
CHKD: GN
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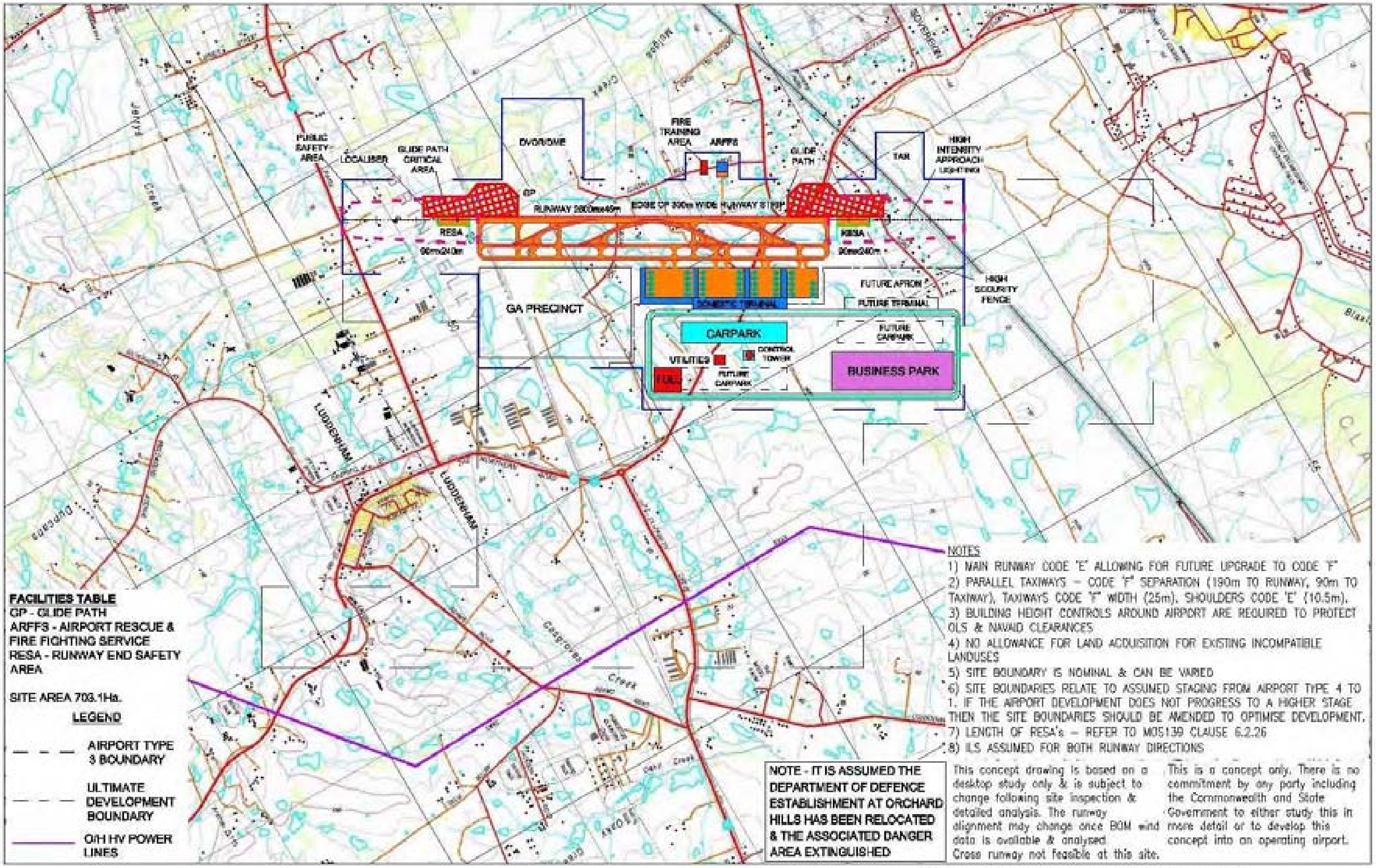
PRELIMINARY FOR DISCUSSION ONLY
SYDNEY REGIONAL AIRPORT STUDY
WINDSOR DOWNS
AIRPORT TYPE 3
SITE DEVELOPMENT
W1-3 T3 SD30-A



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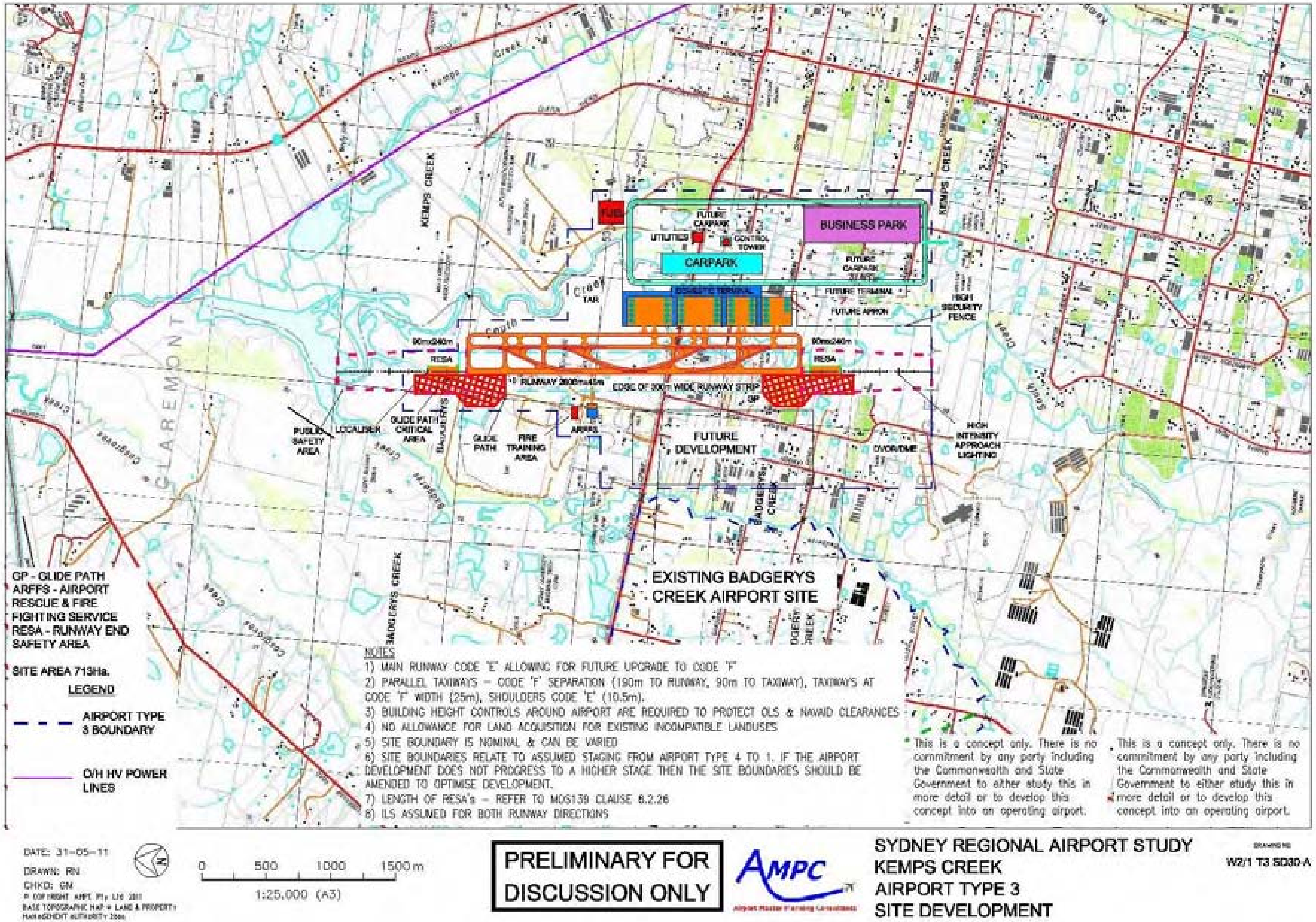
SYDNEY REGIONAL AIRPORT STUDY
LUDDENHAM
SITE DEVELOPMENT
AIRPORT TYPE 3

DRAWING NO.
W3/1 T3 SD30-A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CARPARK
FUTURE CARPARK
UTILITIES
CONTROL TOWER
FUEL
DOMESTIC TERMINAL
FUTURE TERMINAL
FUTURE APRON
HIGH SECURITY FENCE
RUNWAY 2600mx45m
EDGE OF 300m WIDE RUNWAY STRIP
RESA
GP
PUBLIC SAFETY AREA
LOCALISER
GLIDE PATH CRITICAL AREA
GLIDE PATH
FIRE TRAINING AREA
ARFFS
FUTURE DEVELOPMENT
DVOR/DME
HIGH INTENSITY APPROACH LIGHTING
KEMPS CREEK
BADGERYS CREEK
CLAREMONT
EXISTING BADGERYS CREEK AIRPORT SITE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA
SITE AREA 713Ha.
LEGEND
AIRPORT TYPE 3 BOUNDARY
O/H HV POWER LINES
NOTES
1) MAIN RUNWAY CODE 'E' ALLOWING FOR FUTURE UPGRADE TO CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'E' (10.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS
This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
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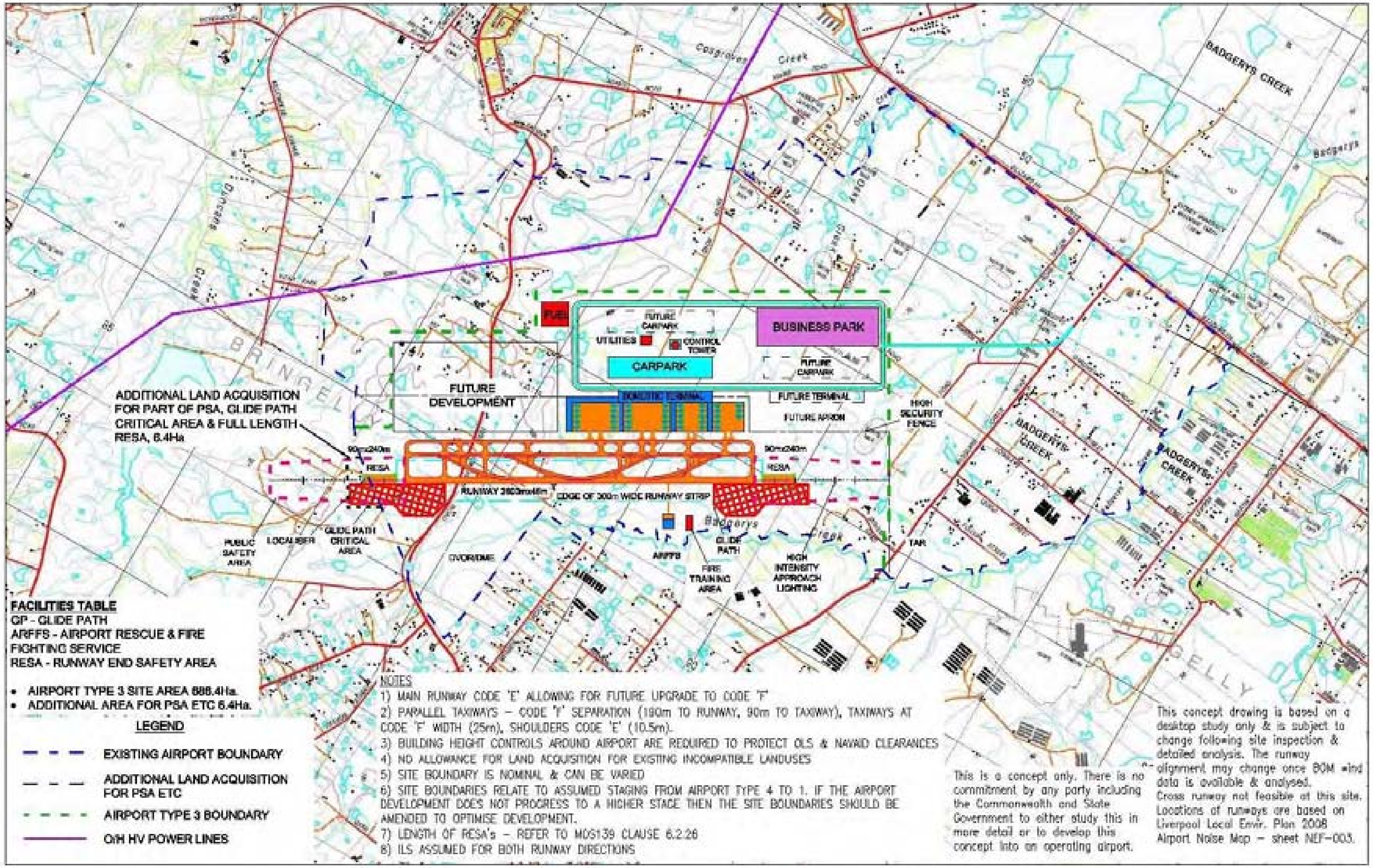
AMPC
SYDNEY REGIONAL AIRPORT STUDY
KEMPS CREEK
AIRPORT TYPE 3
SITE DEVELOPMENT
W2/1 T3 SD30-A



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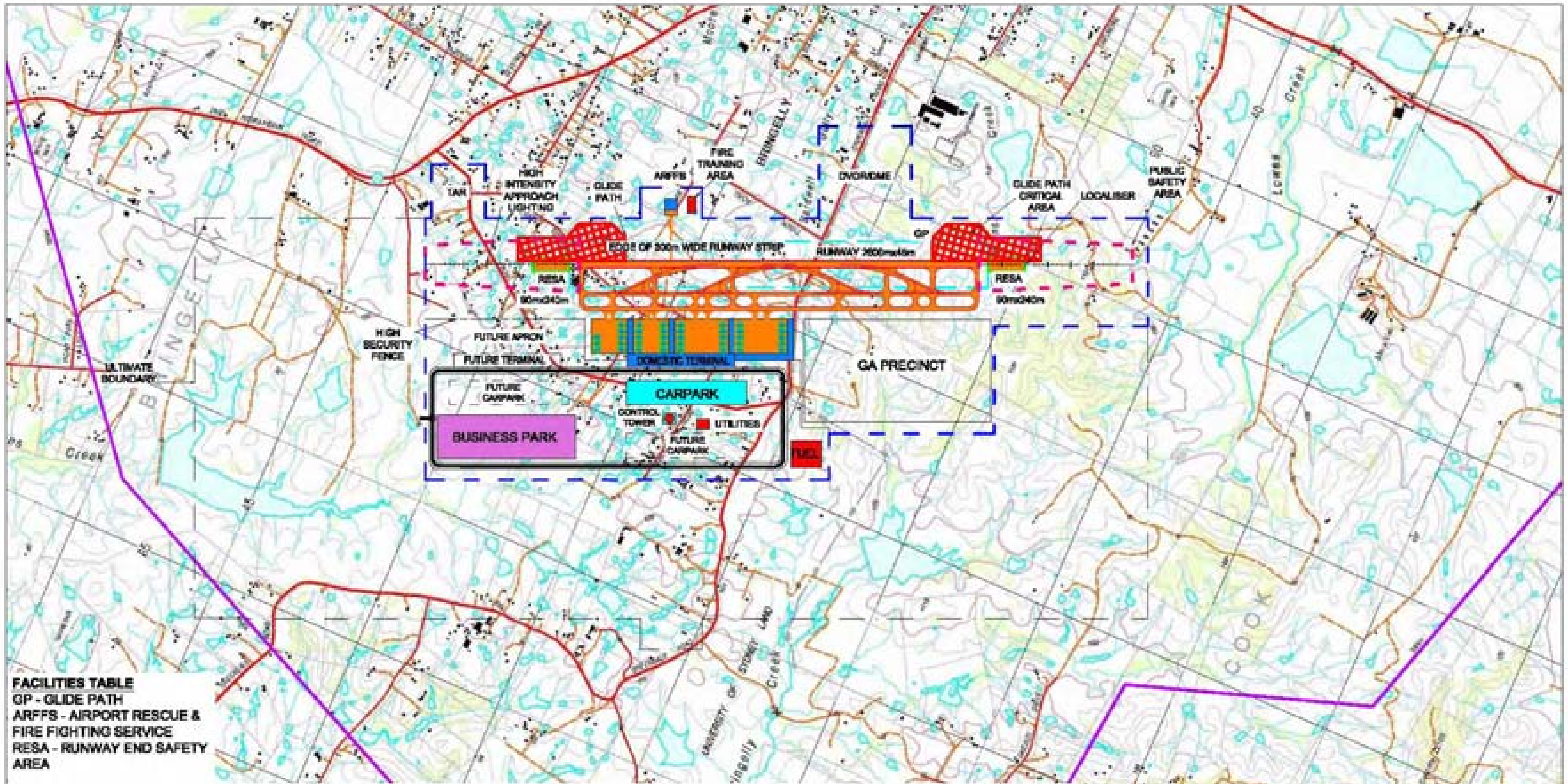
SYDNEY REGIONAL AIRPORT STUDY
BADGERYS CREEK
AIRPORT TYPE 3
SITE DEVELOPMENT

DRAWING NO
W3/4 T3 SD30-A



FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA

SITE AREA 723.3Ha.

LEGEND

- AIRPORT TYPE 3 BOUNDARY
- ULTIMATE DEVELOPMENT BOUNDARY
- O/H HV POWER LINES

NOTES
1) MAIN RUNWAY CODE 'E' ALLOWING FOR FUTURE UPGRADE TO CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS CODE 'F' WIDTH (25m), SHOULDERS CODE 'E' (10.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 3. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS

This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignments may change once BOM wind data is available & analysed.

This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.

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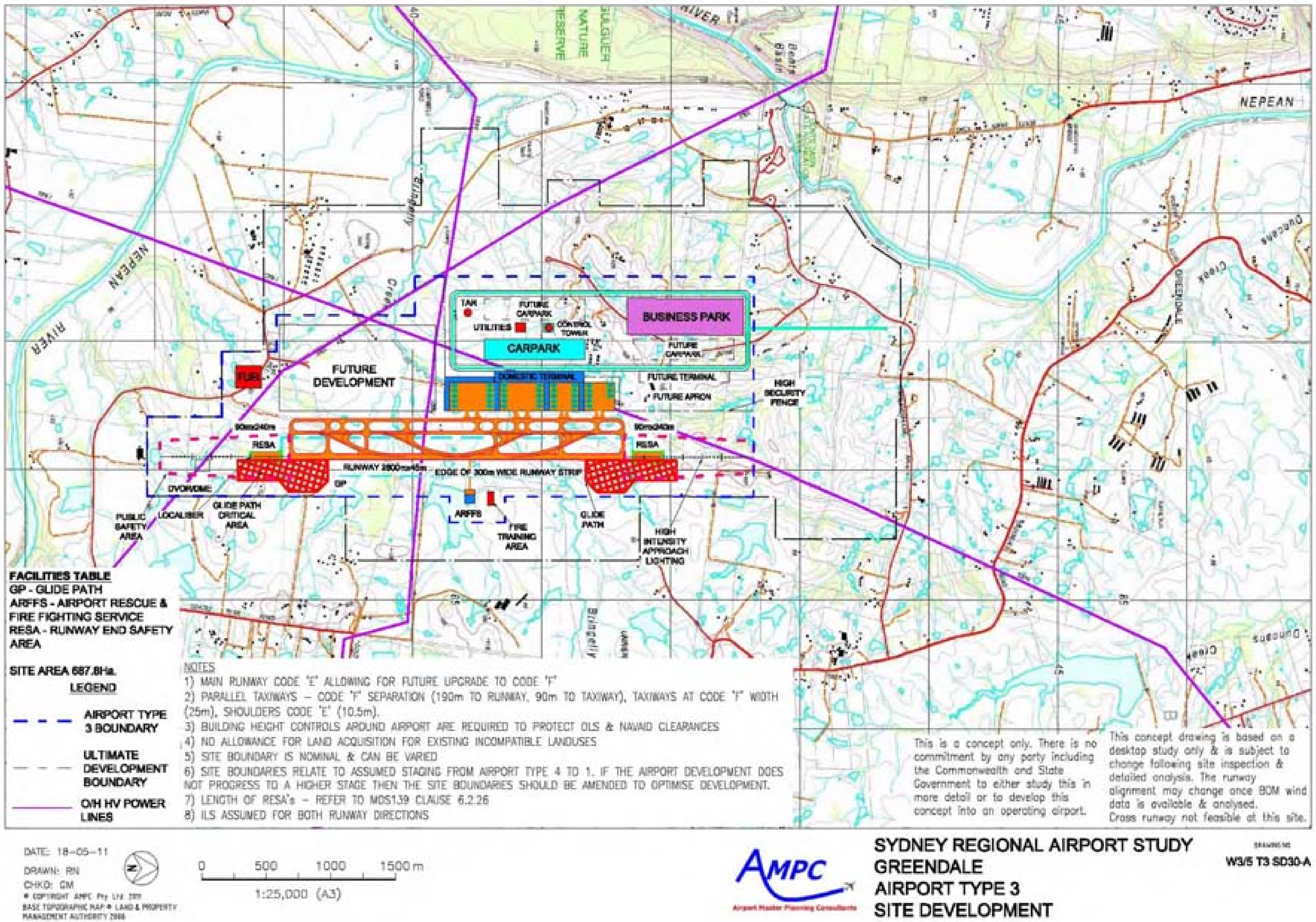
SYDNEY REGIONAL AIRPORT STUDY
BRINGELLY 2
AIRPORT TYPE 3
SITE DEVELOPMENT

DRAWING NO.
W4/1 T3 SD30-A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RIVER
BULGUERI NATURE RESERVE
BUSINESS PARK
CARPARK
UTILITIES
CONTROL TOWER
FUTURE CARPARK
TAR
FUEL
FUTURE DEVELOPMENT
DOMESTIC TERMINAL
FUTURE TERMINAL
FUTURE APRON
HIGH SECURITY FENCE
RESA
RUNWAY 2800mx45m
EDGE OF 300m WIDE RUNWAY STRIP
GP
DVOR/DME
LOCALISER
PUBLIC SAFETY AREA
GLIDE PATH CRITICAL AREA
ARFFS
FIRE TRAINING AREA
GLIDE PATH
HIGH INTENSITY APPROACH LIGHTING
FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA
SITE AREA 687.8Ha.
LEGEND
AIRPORT TYPE 3 BOUNDARY
ULTIMATE DEVELOPMENT BOUNDARY
O/H HV POWER LINES
NOTES
1) MAIN RUNWAY CODE 'E' ALLOWING FOR FUTURE UPGRADE TO CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'E' (10.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
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7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS
This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignment may change once BOM wind data is available & analysed. Cross runway not feasible at this site.
DATE: 18-05-11
DRAWN: RN
CHKD: GM
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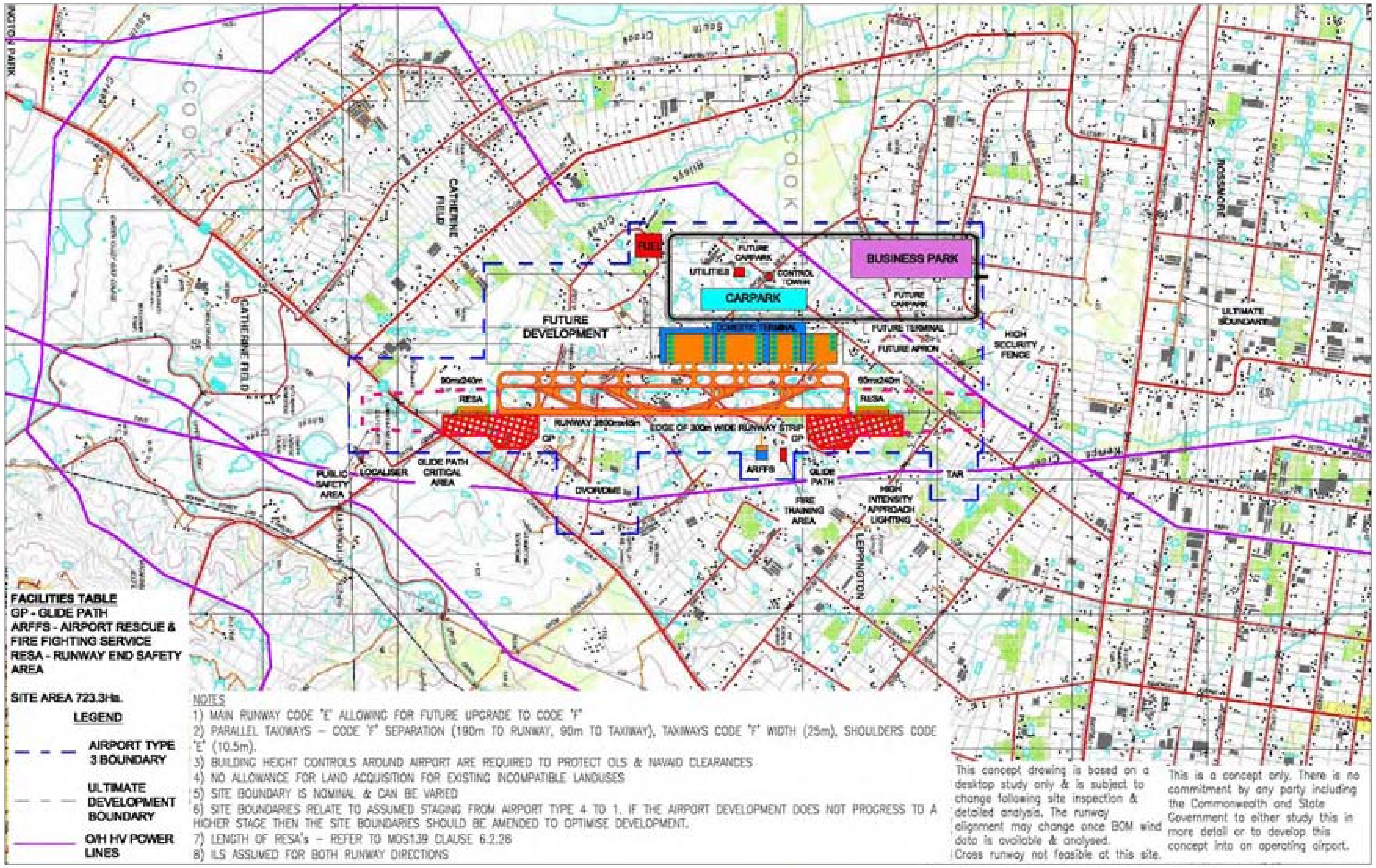
Airport Master Planning Consultants
SYDNEY REGIONAL AIRPORT STUDY
GREENDALE
AIRPORT TYPE 3
SITE DEVELOPMENT
DRAWING NO.
W3/5 T3 SD30-A

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



DATE: 07-07-11
DRAWN: RN
CHKD: GM
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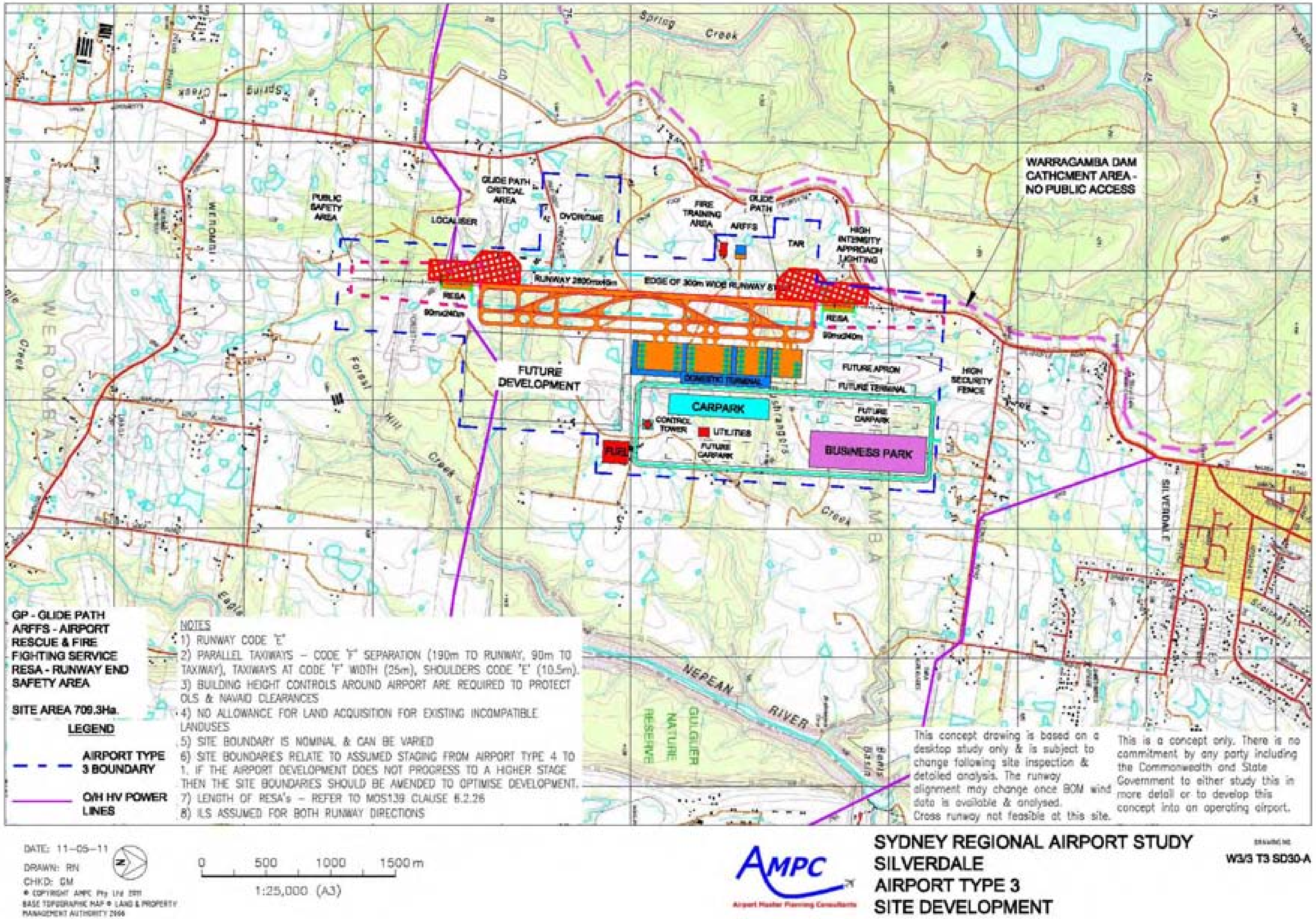
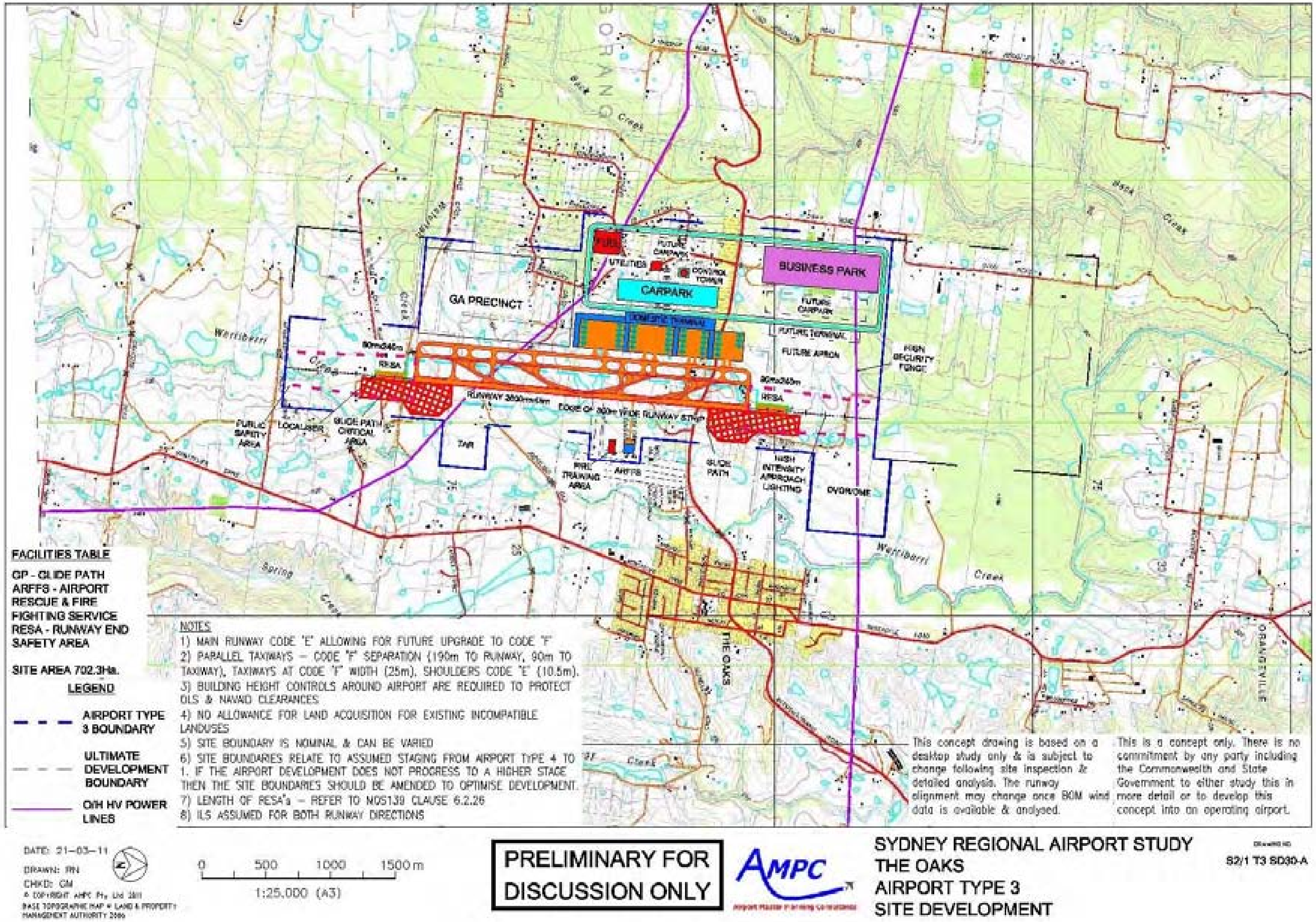
SYDNEY REGIONAL AIRPORT STUDY
CATHERINE FIELD
SITE DEVELOPMENT
AIRPORT TYPE 3

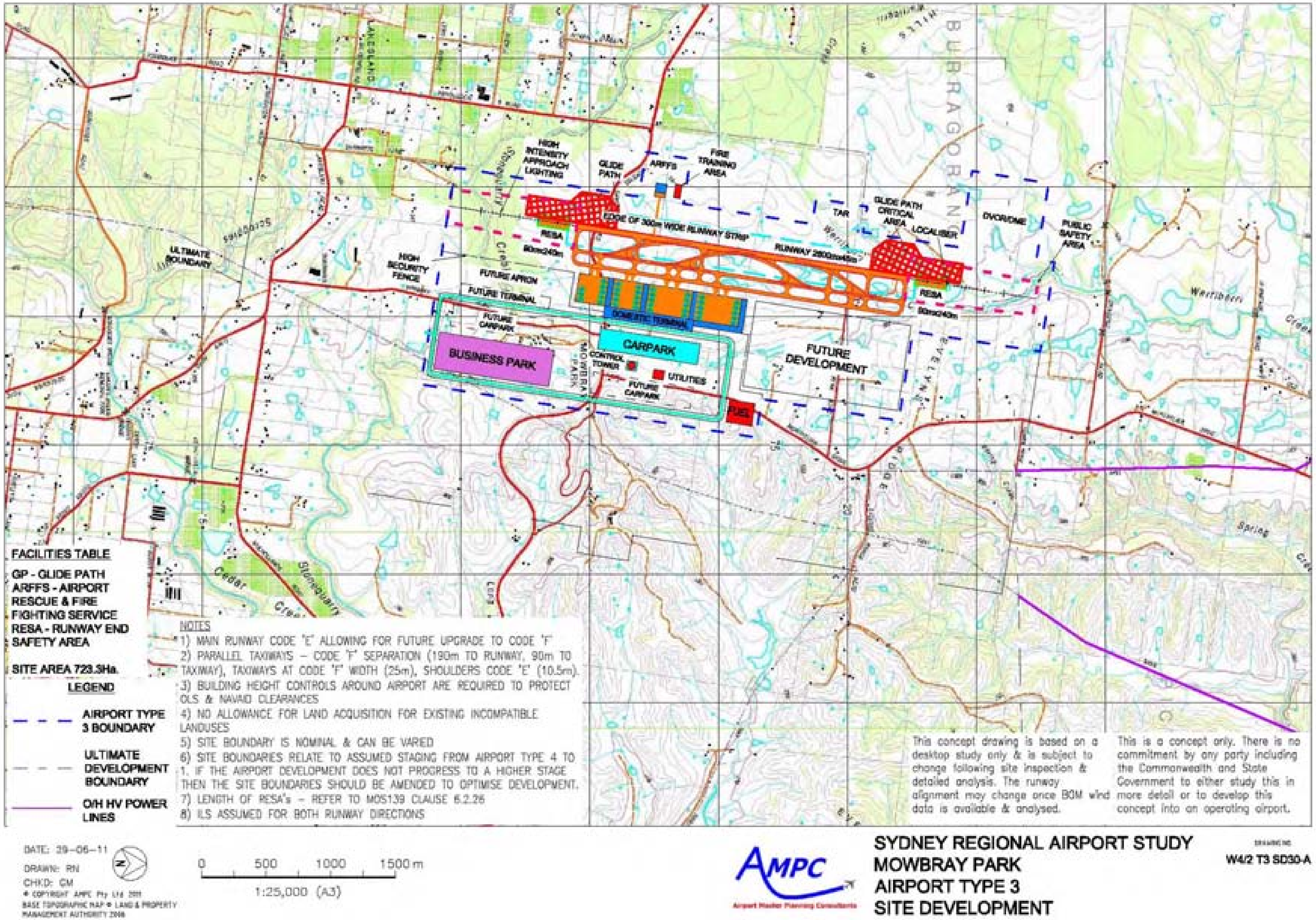
DRAWING NO
S4/4 T3 SD30-A

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES




HIGH INTENSITY APPROACH LIGHTING
GLIDE PATH
ARFFS
FIRE TRAINING AREA
EDGE OF 300m WIDE RUNWAY STRIP
RESA
90mx240m
RUNWAY 2800mx45m
TAR
GLIDE PATH CRITICAL AREA
LOCALISER
DVOR/DME
PUBLIC SAFETY AREA
ULTIMATE BOUNDARY
HIGH SECURITY FENCE
FUTURE APRON
FUTURE TERMINAL
FUTURE CARPARK
DOMESTIC TERMINAL
CARPARK
BUSINESS PARK
CONTROL TOWER
UTILITIES
FUTURE CARPARK
FUTURE DEVELOPMENT
FUEL
MOWBRAY PARK
BURRAGORANG
Werriberri Creek
FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA
SITE AREA 723.3Ha.
LEGEND
AIRPORT TYPE 3 BOUNDARY
ULTIMATE DEVELOPMENT BOUNDARY
O/H HV POWER LINES
NOTES
1) MAIN RUNWAY CODE 'E' ALLOWING FOR FUTURE UPGRADE TO CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'E' (10.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS
This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignment may change once BOM wind data is available & analysed.
This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
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CHKD: GM
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0 500 1000 1500 m
1:25,000 (A3)
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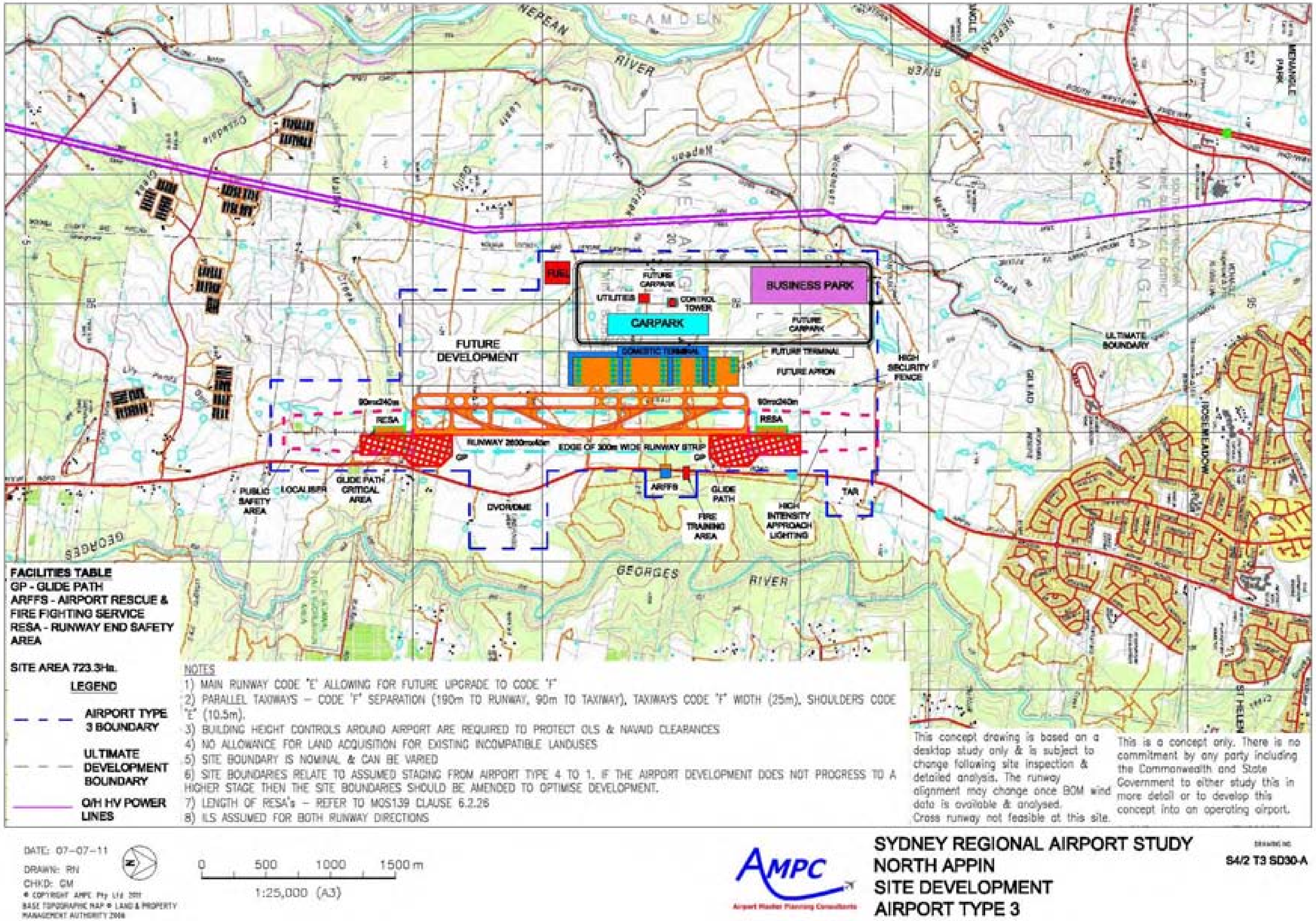
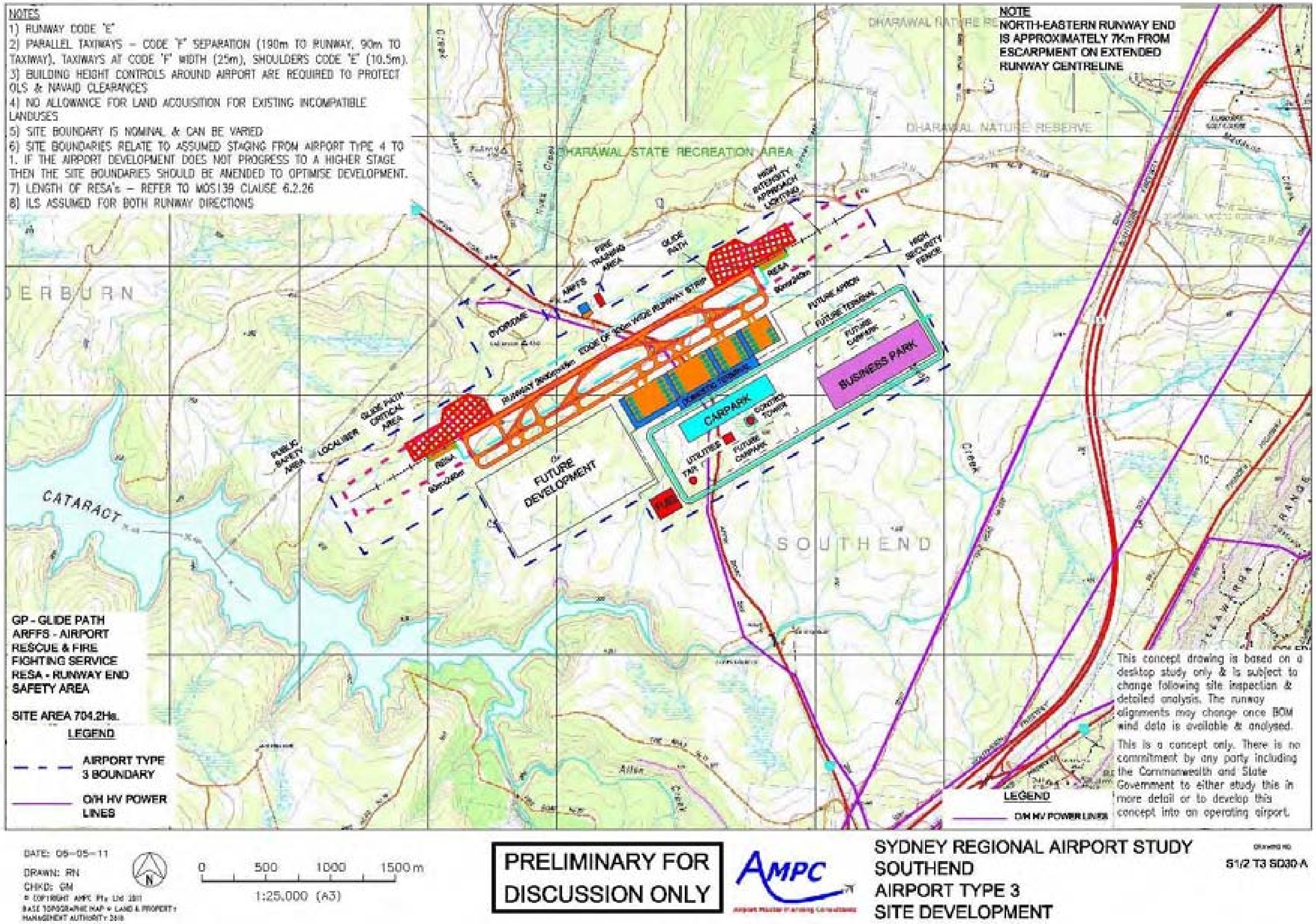
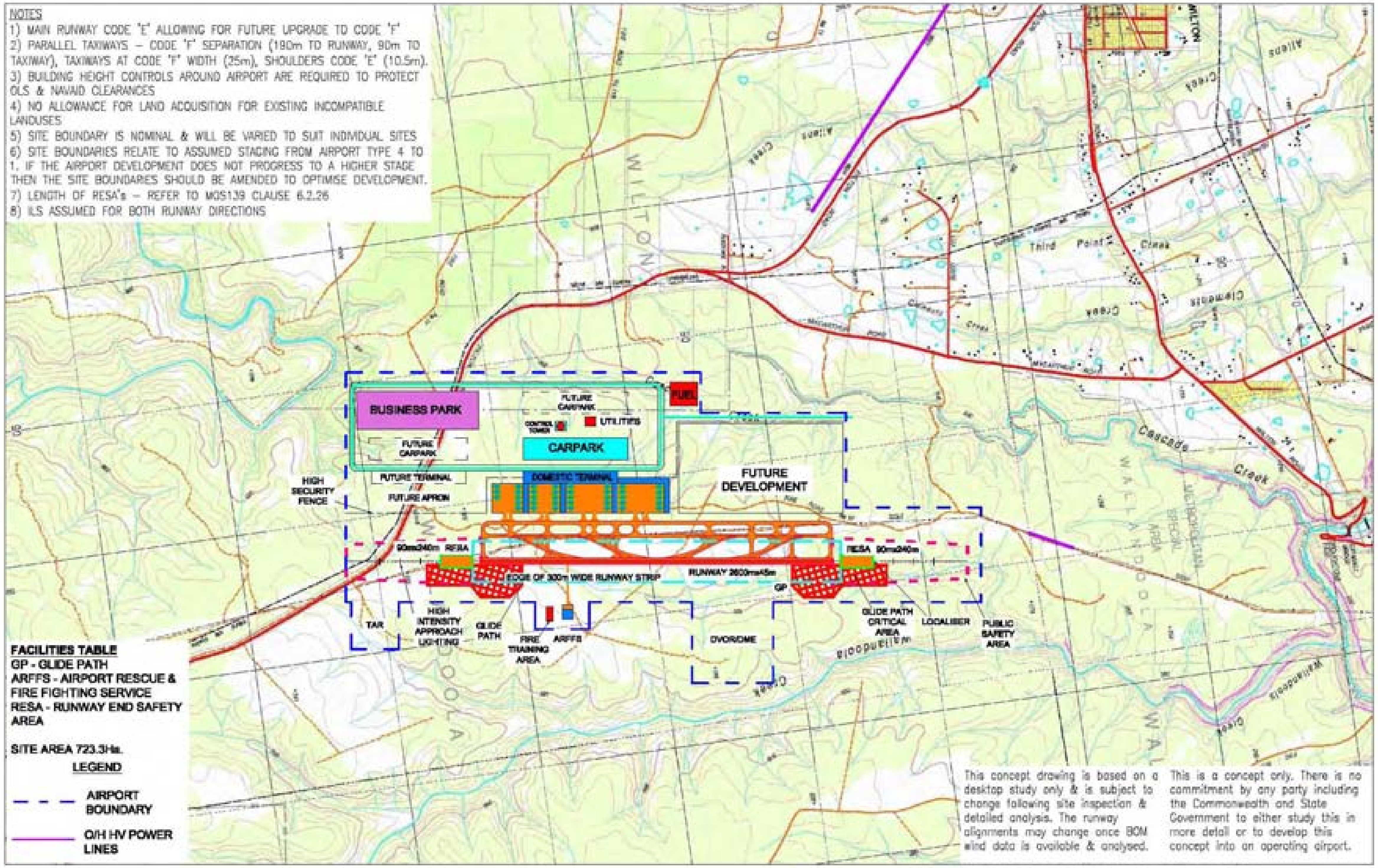
Airport Master Planning Consultants
SYDNEY REGIONAL AIRPORT STUDY
MOWBRAY PARK
AIRPORT TYPE 3
SITE DEVELOPMENT
W4/2 T3 SD30-A

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES





DATE: 06-07-11
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CHKD: GM

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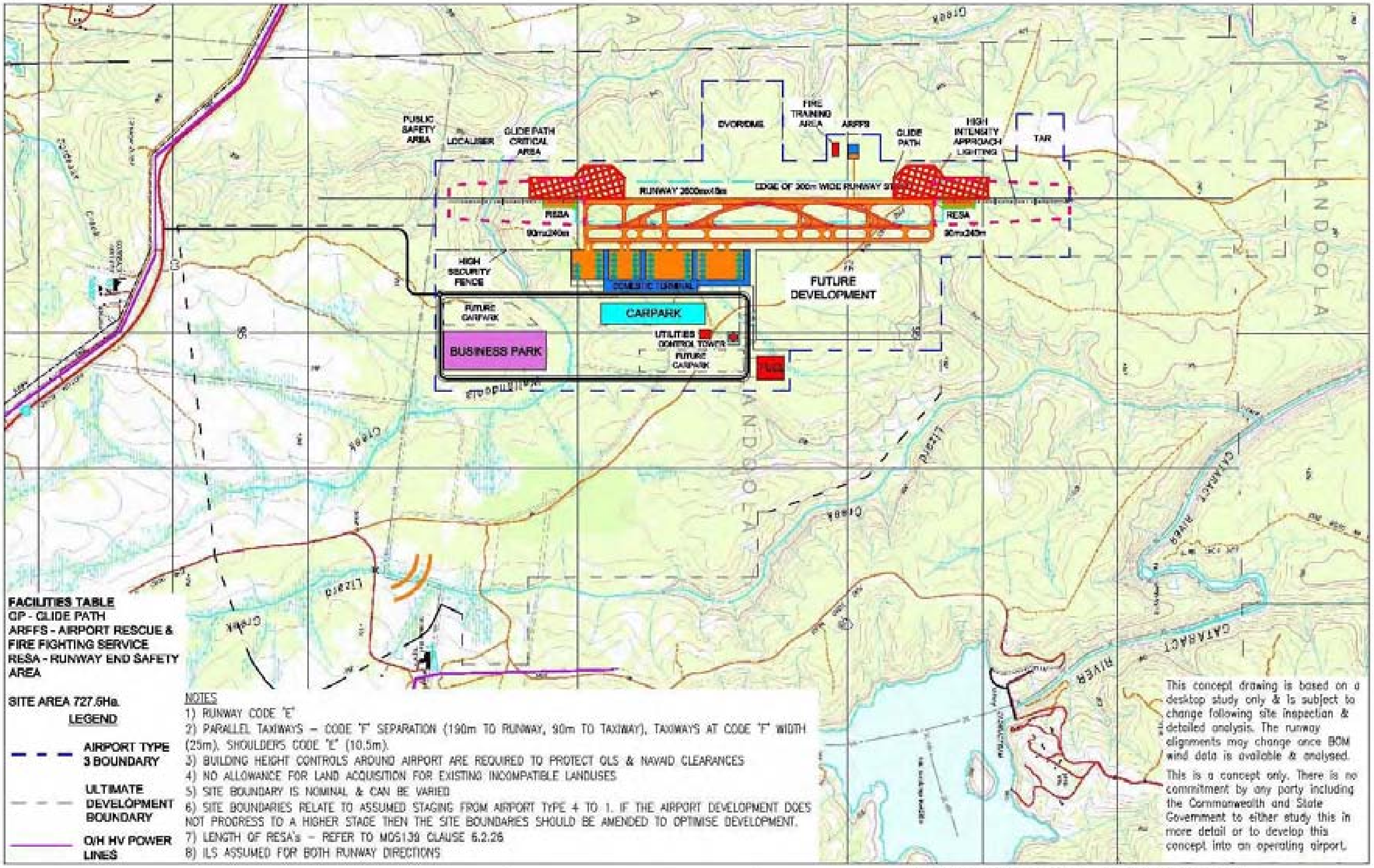
AMPC
Airport Master Planning Consultants

SYDNEY REGIONAL AIRPORT STUDY
WILTON
AIRPORT TYPE 3
SITE DEVELOPMENT

DRAWING NO
S1/1-T3 SD30-B

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



DATE: 24-05-11
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0 500 1000 1500 m
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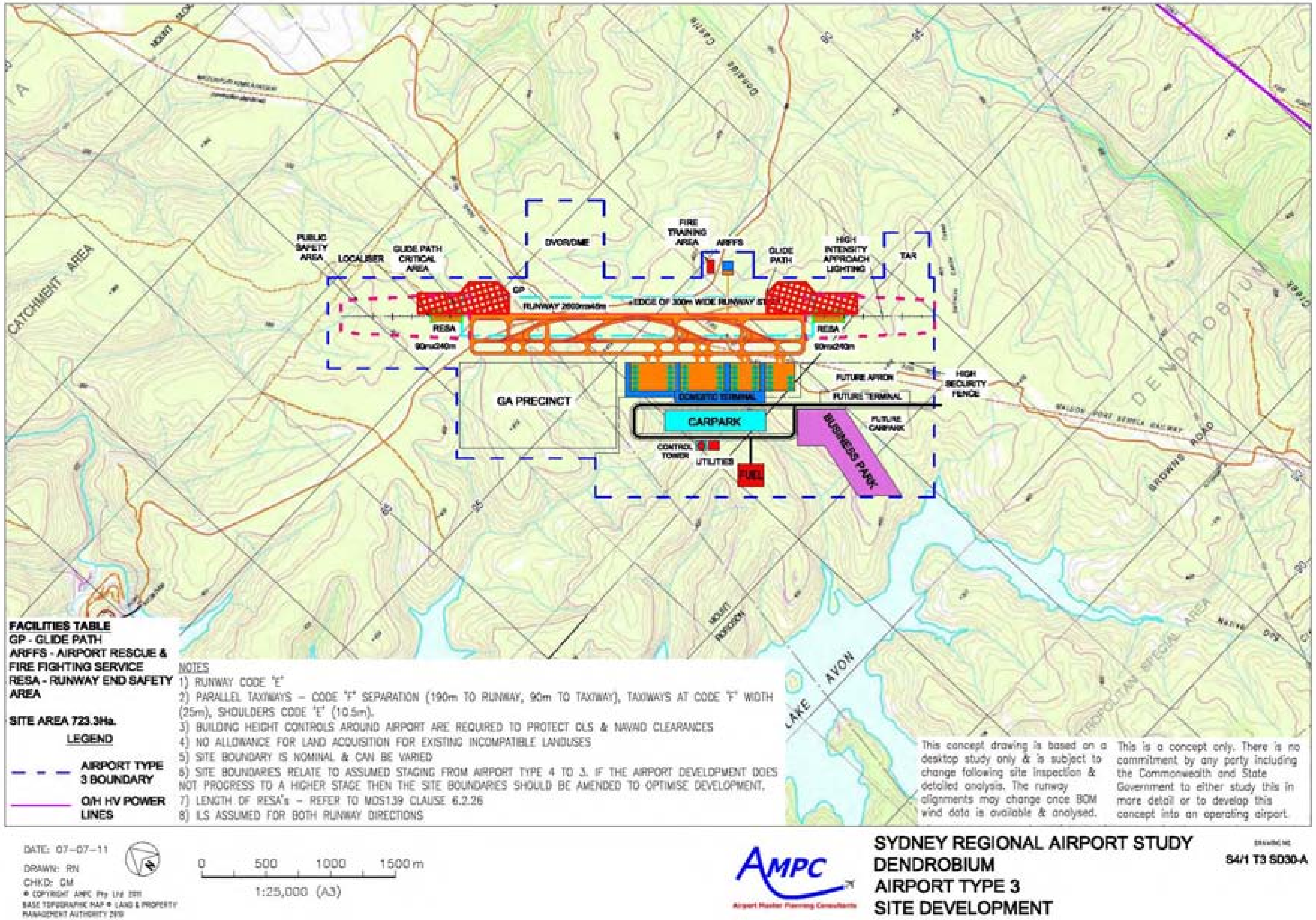
PRELIMINARY FOR DISCUSSION ONLY

SYDNEY REGIONAL AIRPORT STUDY
WALLANDOOLA
AIRPORT TYPE 3
SITE DEVELOPMENT

DRAWING NO
S1/3 T3 SD30-A

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES

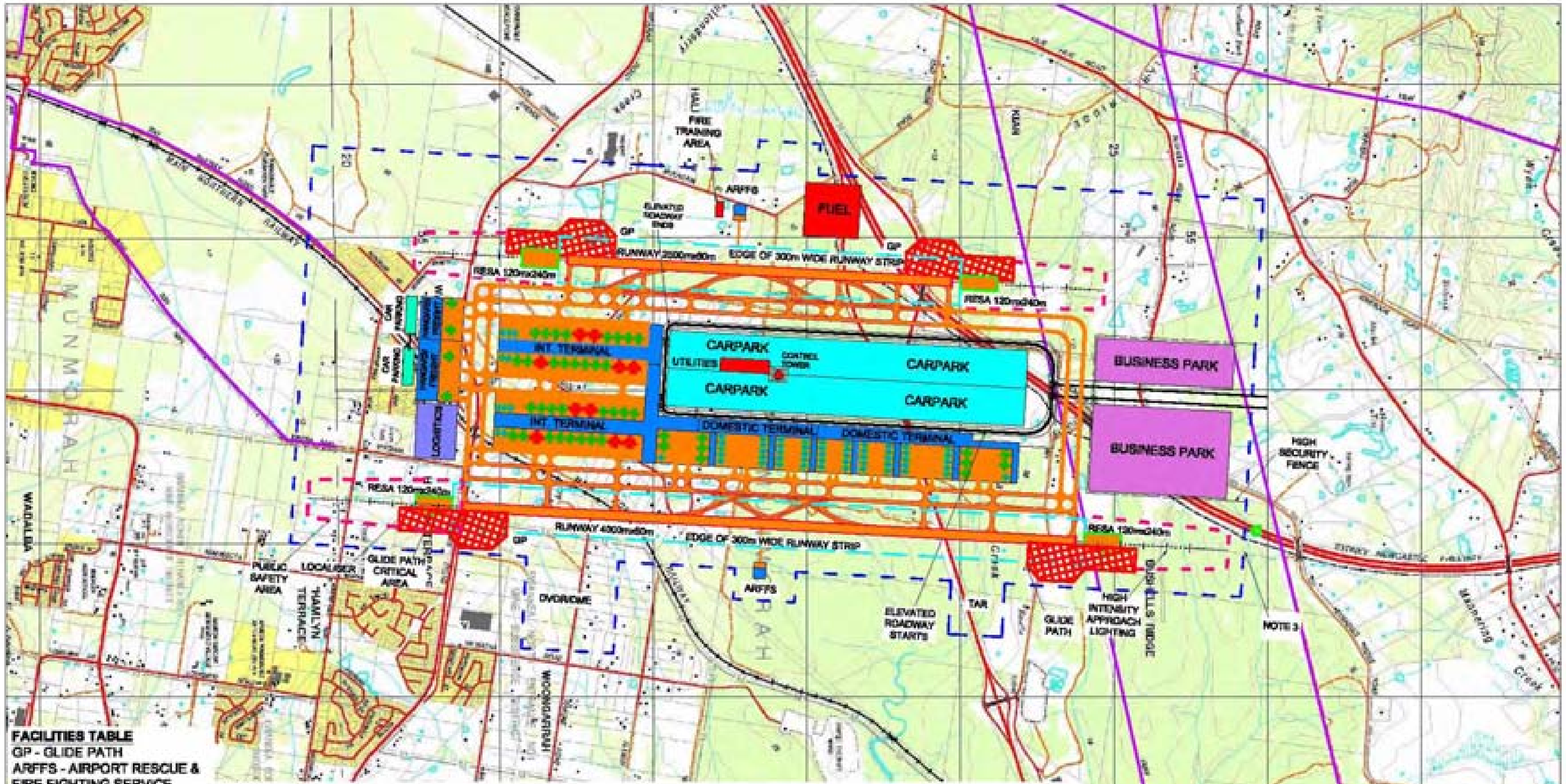


4

Appendix

Maximum Airport (Full Service Airprt) Site Concept Development Plans

Maximum Airport (Full Service Airport) Site Concept Development Plans



FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA

SITE AREA 1676.2Ha.

LEGEND
AIRPORT BOUNDARY
O/H HV POWER LINES

NOTES
1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR ALL RUNWAY DIRECTIONS

This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignment may change once BOM wind data is available & analysed.

This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.

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CHKD: GM
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0 500 1000 1500m
1:25,000 (A3)

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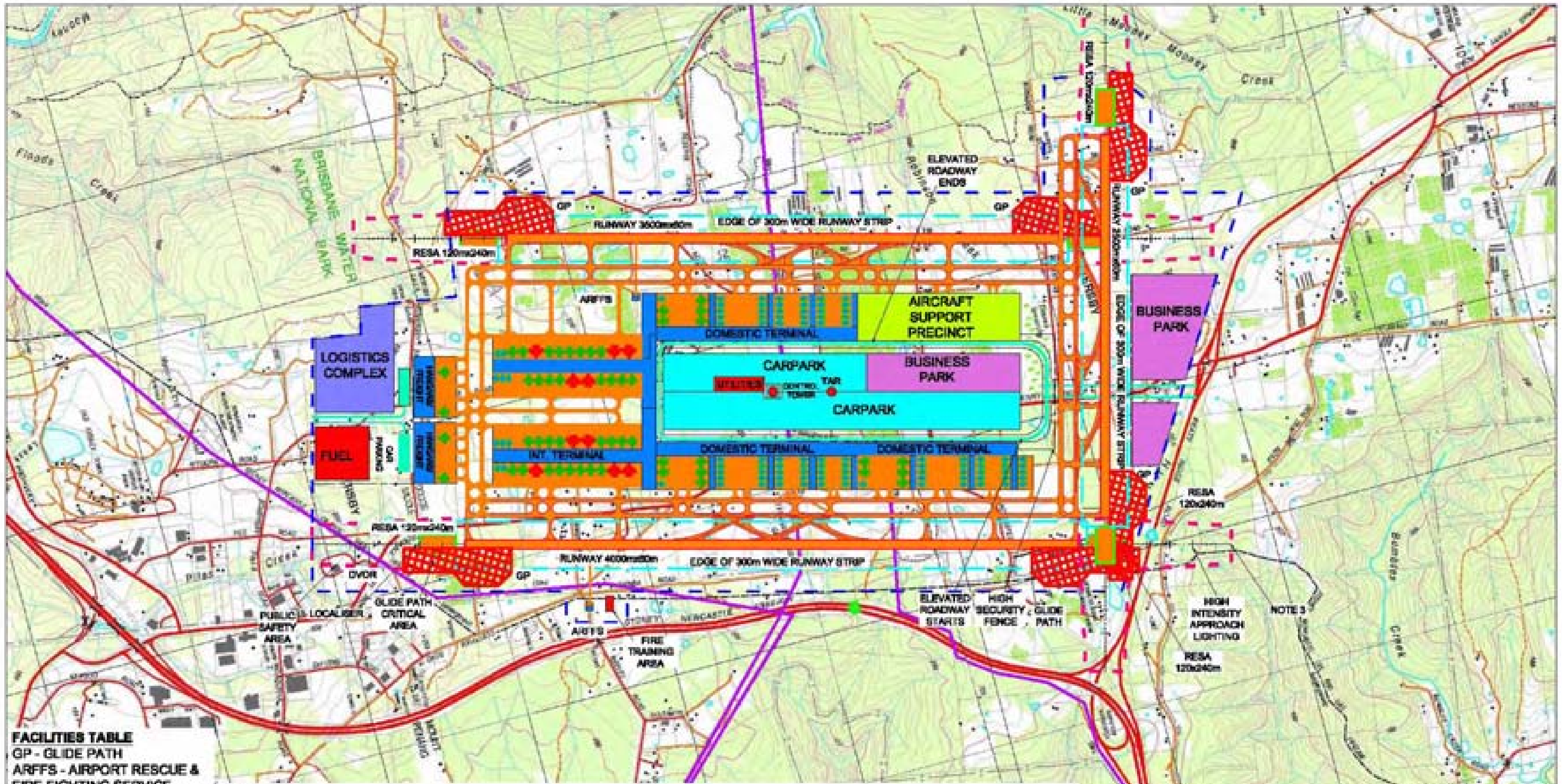
SYDNEY REGIONAL AIRPORT STUDY
WALLARAH
SITE DEVELOPMENT
AIRPORT TYPE 1 - MAXIMUM

DRAWING NO
C4/1 T1 SD05-A



FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA

SITE AREA 1464.5Ha.

LEGEND

- - - AIRPORT BOUNDARY
— O/H HV POWER LINES

NOTES
1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR ALL RUNWAY DIRECTIONS

This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignment may change once BOM wind data is available & analysed.

This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.

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0 500 1000 1500 m
1:25,000 (A3)

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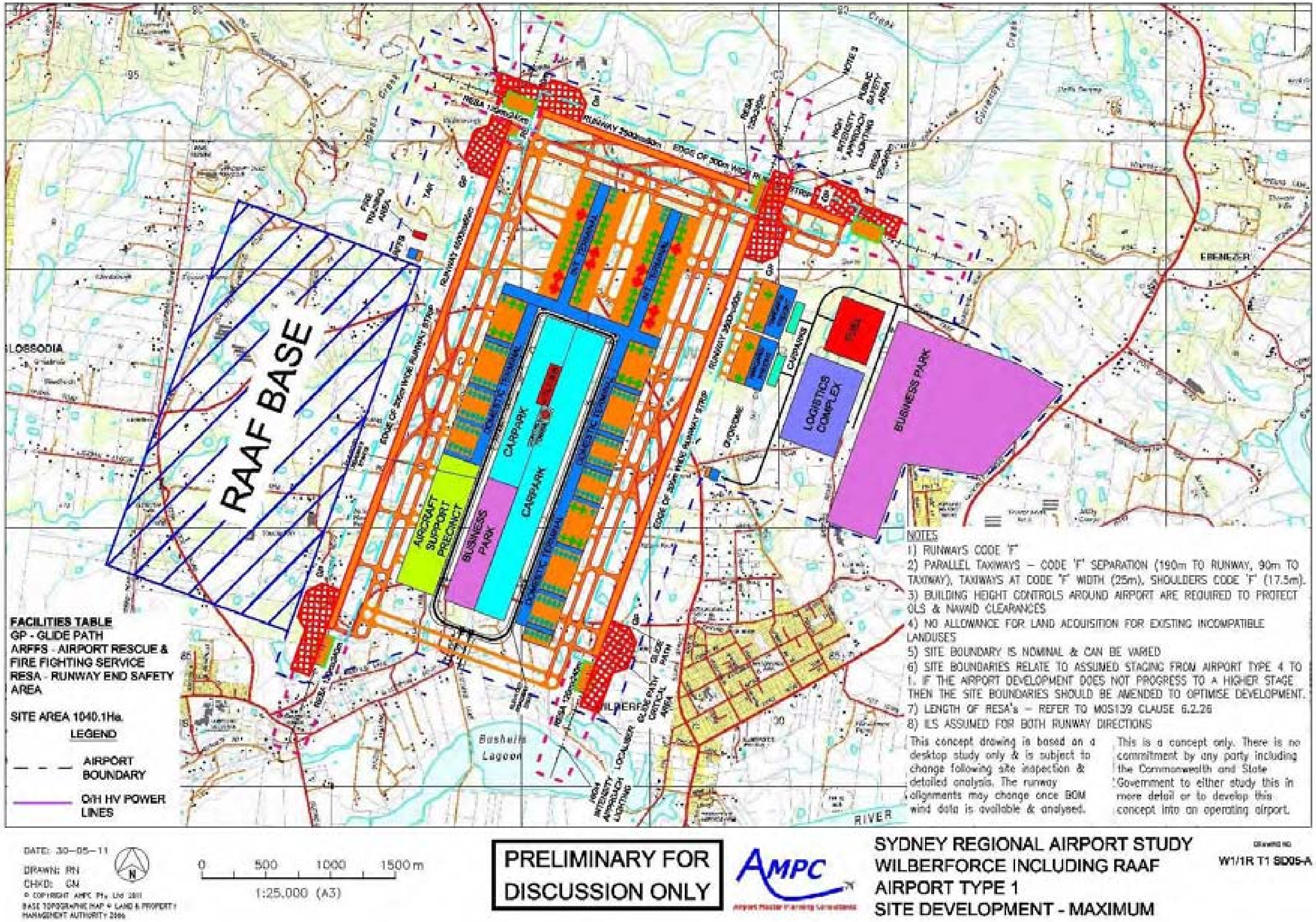
SYDNEY REGIONAL AIRPORT STUDY
SOMERSBY WITH CROSS RUNWAY
SITE DEVELOPMENT
AIRPORT TYPE 1 - MAXIMUM

DRAWING NO.
C3/1X T1 SD05-A


RAAF BASE
CARPARK
CARPARK
AIRCRAFT SUPPORT PRECINCT
BUSINESS PARK
LOGISTICS COMPLEX
BUSINESS PARK
FUEL
LOSSODIA
EBENEZER
Bushells Lagoon
RIVER
FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA
SITE AREA 1040.1Ha.
LEGEND
AIRPORT BOUNDARY
O/H HV POWER LINES
NOTES
1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS
This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignments may change once BOM wind data is available & analysed.
This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
DATE: 30–05–11
DRAWN: RN
CHKD: CN
N
0 500 1000 1500 m
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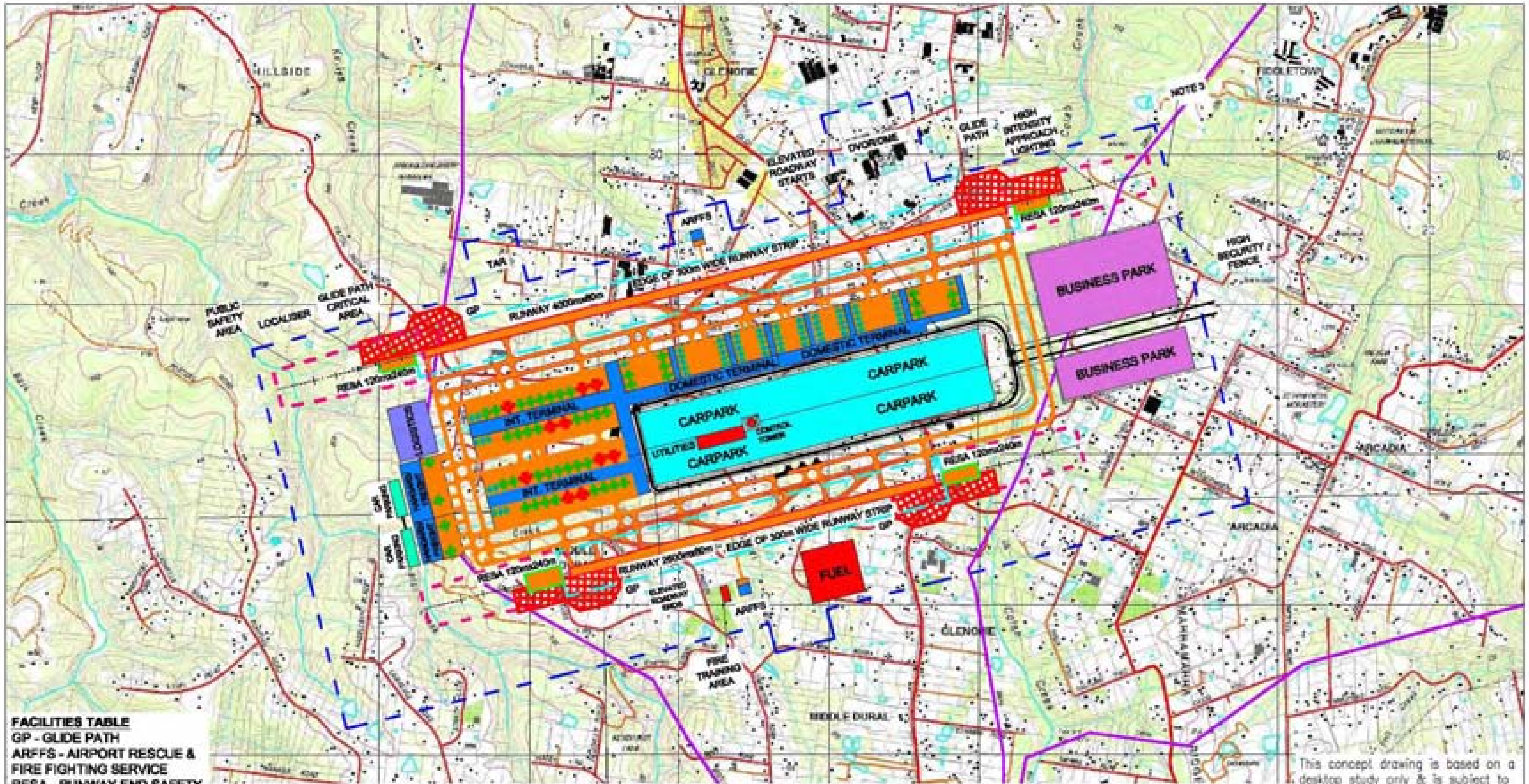
PRELIMINARY FOR DISCUSSION ONLY
AMPC
SYDNEY REGIONAL AIRPORT STUDY
WILBERFORCE INCLUDING RAAF
AIRPORT TYPE 1
SITE DEVELOPMENT - MAXIMUM
W1/1R T1 SD05-A



FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA

SITE AREA 1676.2Ha.

LEGEND

- – – – AIRPORT BOUNDARY
- ——— O/H HV POWER LINES

NOTES
1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS

This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignments may change once BOM wind data is available & analysed.

This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.

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DRAWN: RN
CHKD: GM
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N

0 500 1000 1500 m
1:25,000 (A3)

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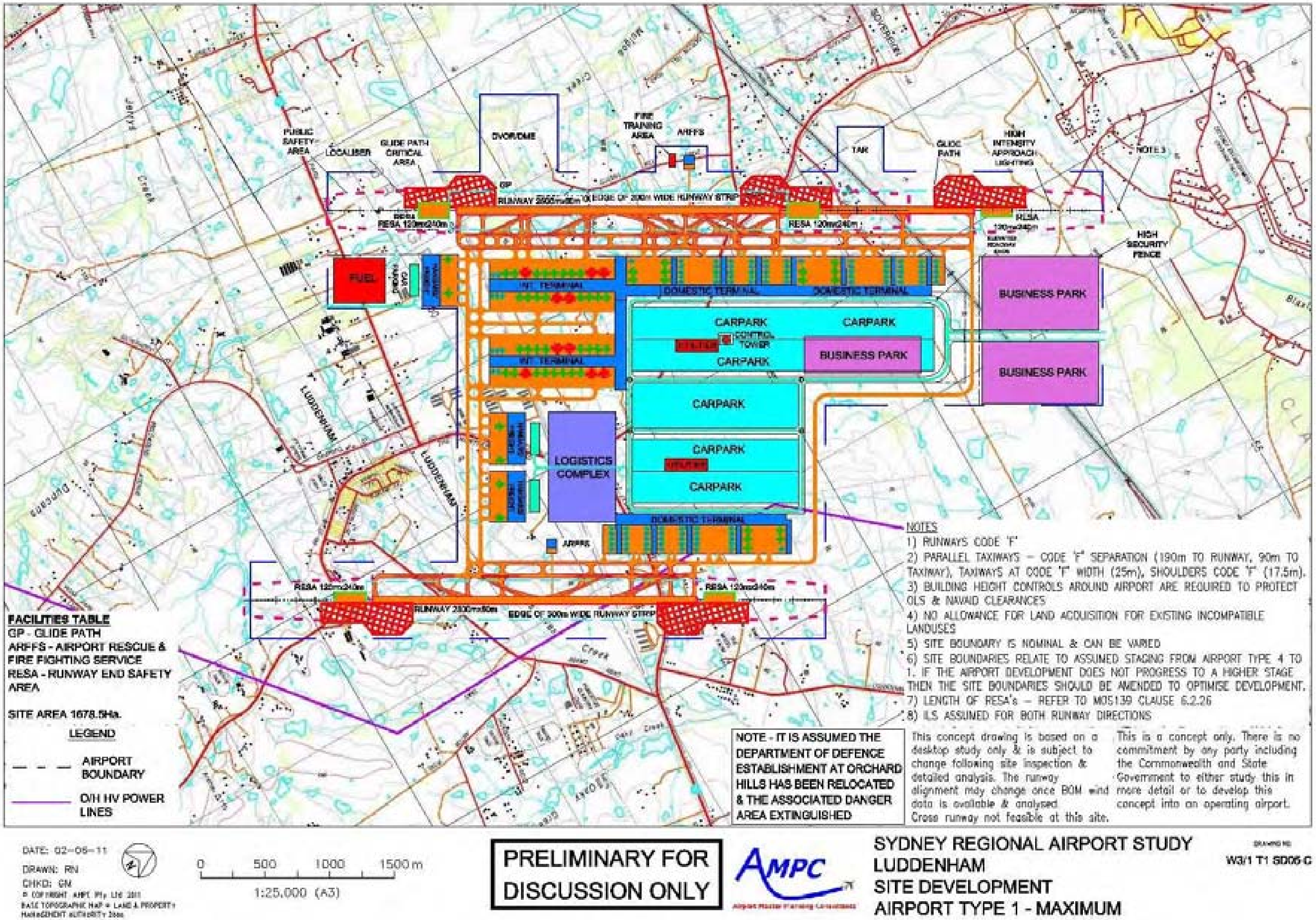
SYDNEY REGIONAL AIRPORT STUDY
GLENORIE
AIRPORT TYPE 1
SITE DEVELOPMENT - MAXIMUM

DRAWING NO
W4/3 T1 SD05-A

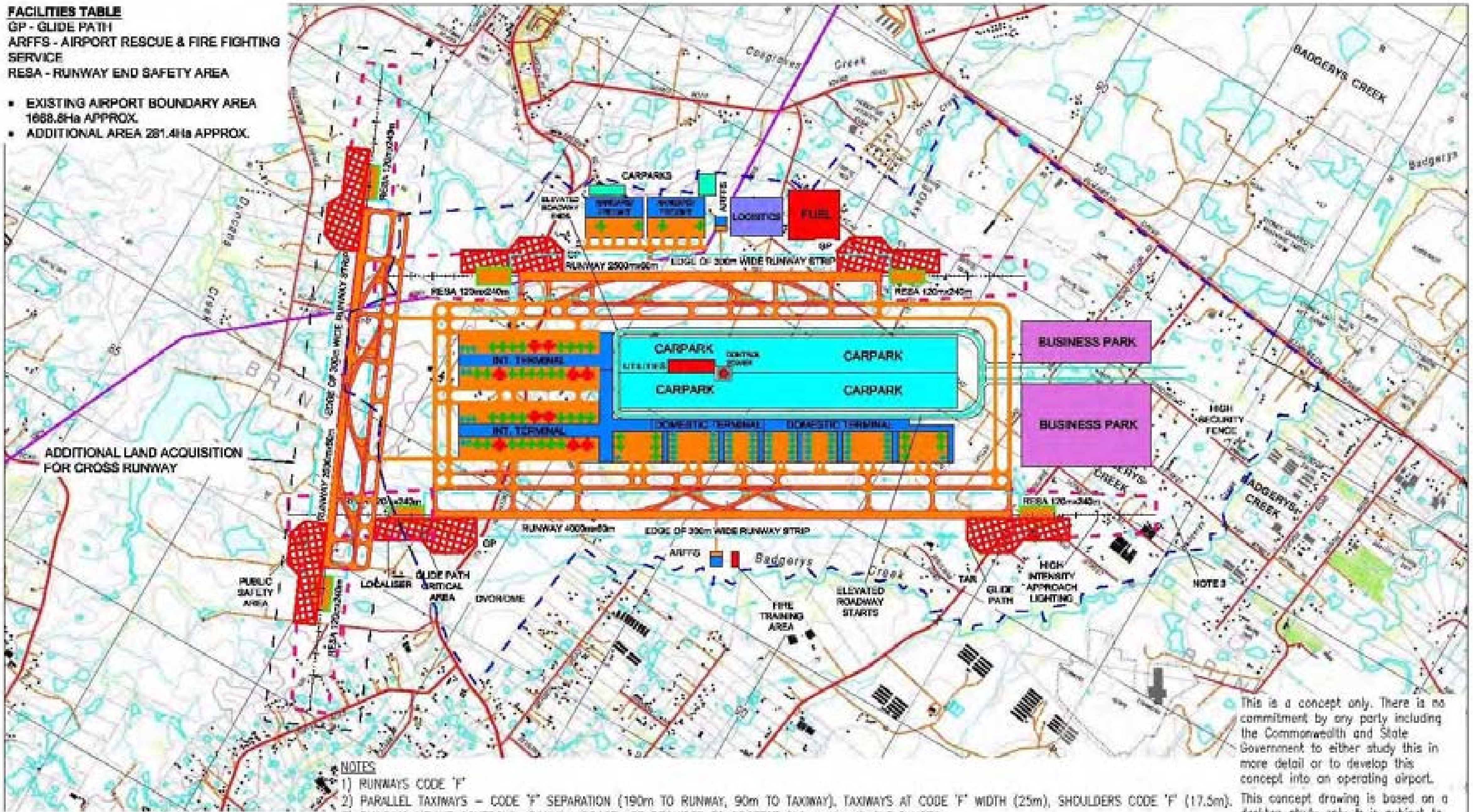
WorleyParsons
resources & energy

AMPC

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



NOTES
1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS

This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.

This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignment may change once BOM wind data is available & analysed. Locations of main runways are based on Liverpool Local Envir. Plan 2008 Airport Noise Map – sheet NEF-003.

LEGEND
- EXISTING AIRPORT BOUNDARY
- ADDITIONAL LAND ACQUISITION FOR CROSS RUNWAY
- O/H HV POWER LINES

DATE: 08-05-11
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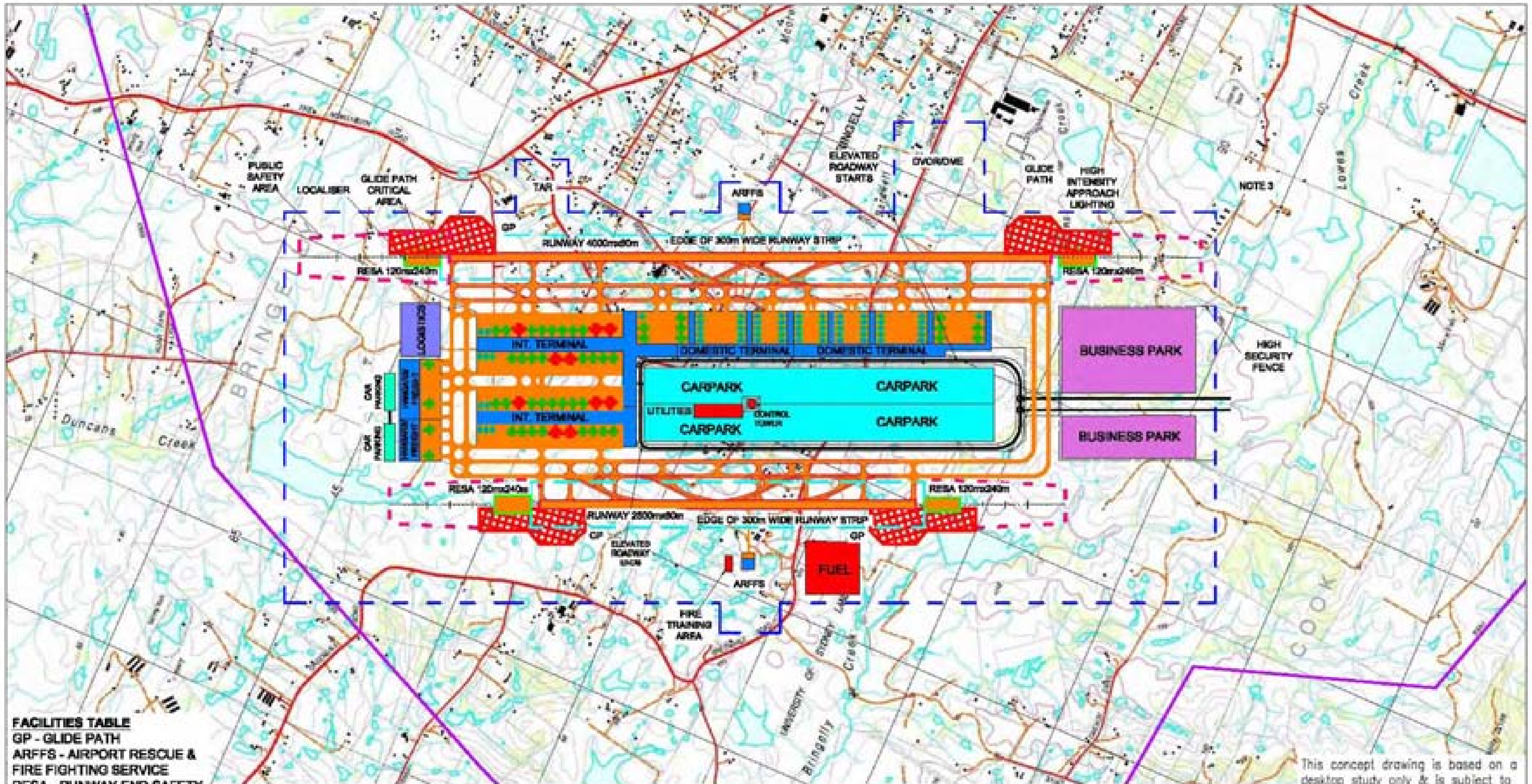
SYDNEY REGIONAL AIRPORT STUDY
BADGERYS CREEK
WITH CROSS RUNWAY AIRPORT TYPE 1
SITE DEVELOPMENT - MAXIMUM

DRAWING NO.
W3/4X T1 SD05-A



FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA

SITE AREA 1676.2Ha.

LEGEND

- - - AIRPORT BOUNDARY
—— O/H HV POWER LINES

NOTES
1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS

This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignments may change once BOM wind data is available & analysed.
This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.

DATE: 07-07-11
DRAWN: RN
CHKD: GM

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0 500 1000 1500 m
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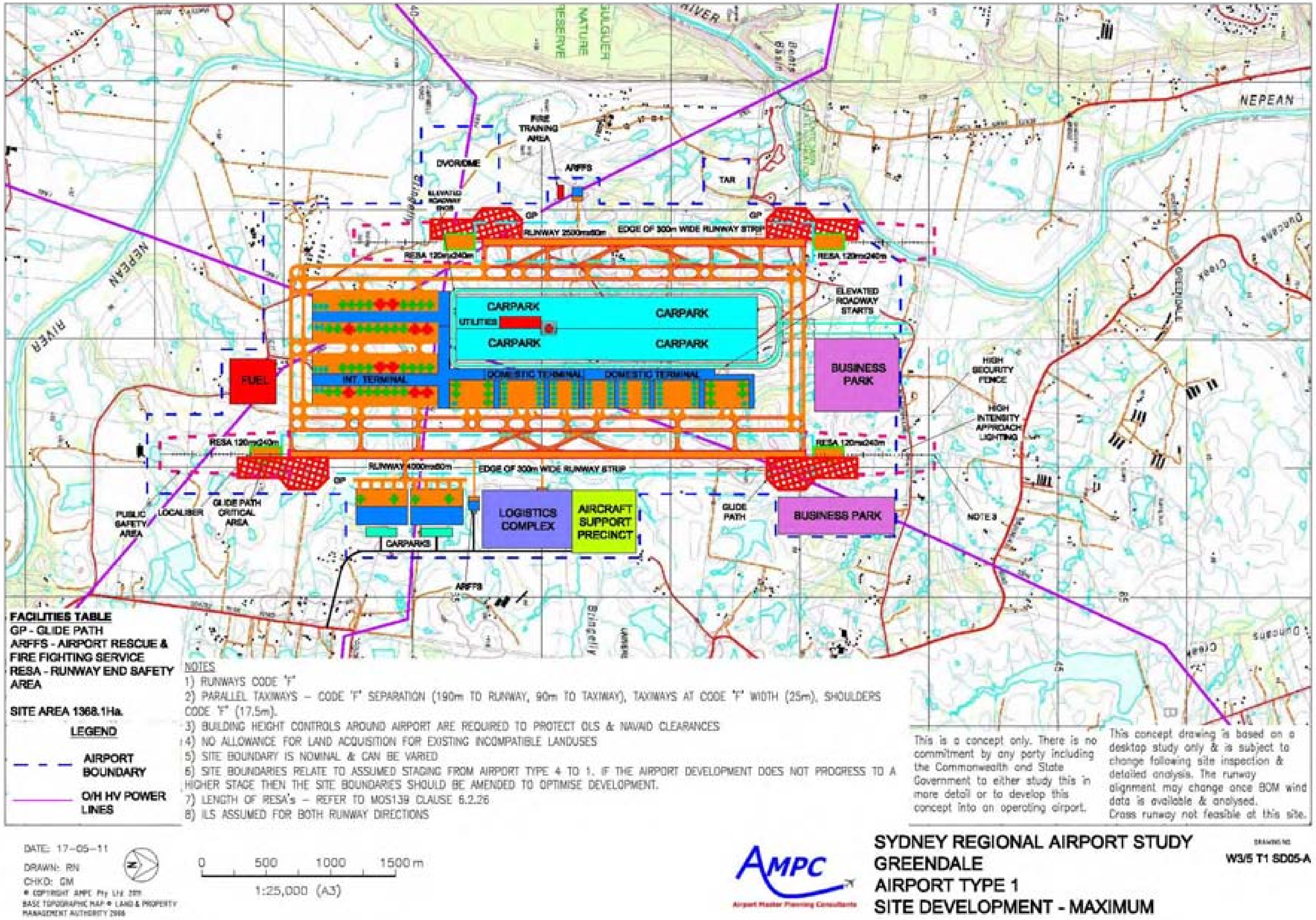
SYDNEY REGIONAL AIRPORT STUDY
BRINGELLY 2
AIRPORT TYPE 1
SITE DEVELOPMENT - MAXIMUM

DRAWING NO
W4/1 T1 SD05-A


NEPEAN
RIVER
NATURE RESERVE
DVOR/DME
FIRE TRAINING AREA
ARFFS
TAR
ELEVATED ROADWAY ENDS
GP
RUNWAY 2500mx60m
EDGE OF 300m WIDE RUNWAY STRIP
RESA 120mx240m
ELEVATED ROADWAY STARTS
CARPARK
UTILITIES
INT. TERMINAL
DOMESTIC TERMINAL
FUEL
BUSINESS PARK
HIGH SECURITY FENCE
HIGH INTENSITY APPROACH LIGHTING
RUNWAY 4000mx60m
PUBLIC SAFETY AREA
LOCALISER
GLIDE PATH CRITICAL AREA
GLIDE PATH
LOGISTICS COMPLEX
AIRCRAFT SUPPORT PRECINCT
CARPARKS
NOTE 3
GREENDALE
FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA
SITE AREA 1368.1Ha.
LEGEND
AIRPORT BOUNDARY
O/H HV POWER LINES
NOTES
1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
6) SITE BOUNDARIES RELATE TO ASSUMED STAGING FROM AIRPORT TYPE 4 TO 1. IF THE AIRPORT DEVELOPMENT DOES NOT PROGRESS TO A HIGHER STAGE THEN THE SITE BOUNDARIES SHOULD BE AMENDED TO OPTIMISE DEVELOPMENT.
7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS
This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignment may change once BOM wind data is available & analysed. Cross runway not feasible at this site.
DATE: 17-05-11
DRAWN: RN
CHKD: GM
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0 500 1000 1500 m
1:25,000 (A3)
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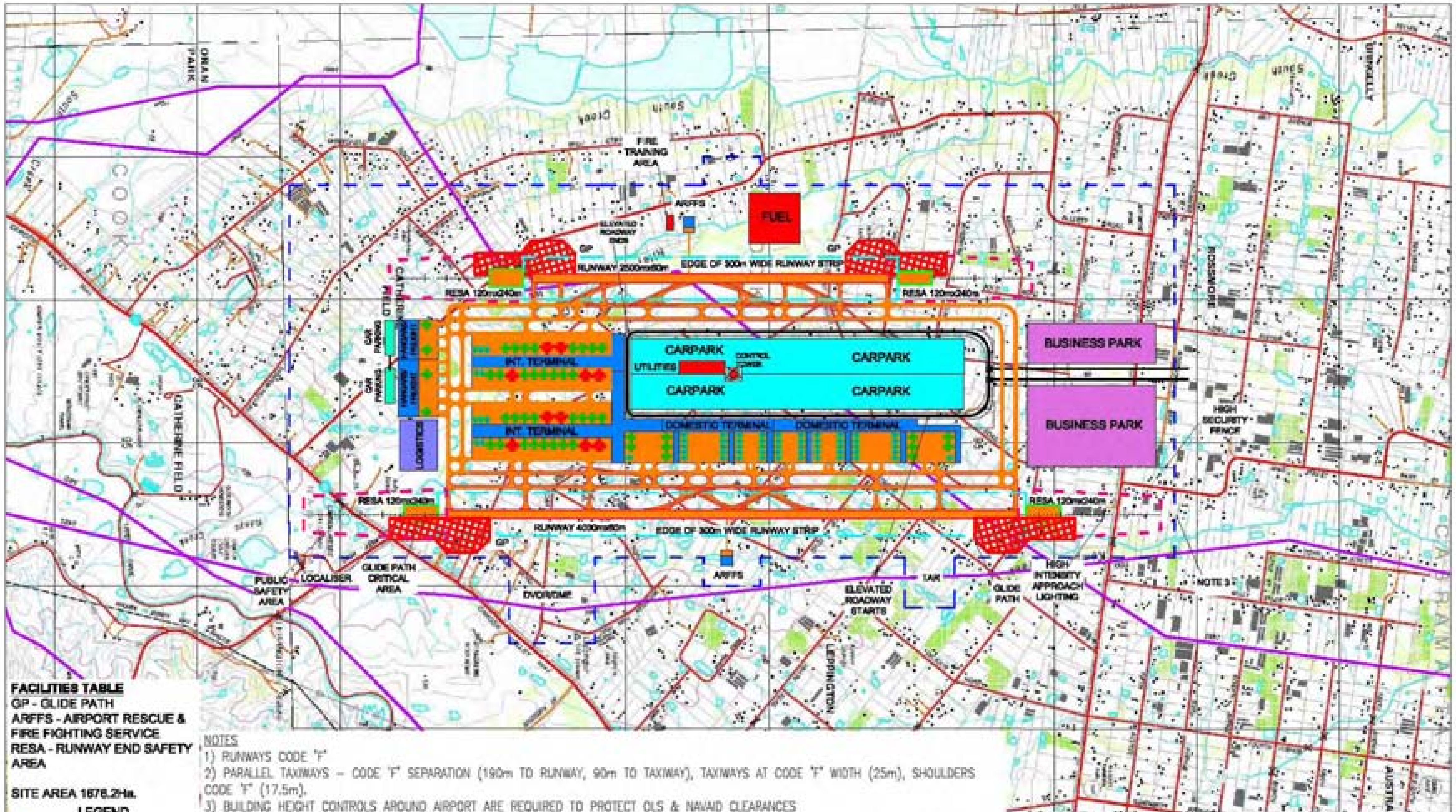
Airport Master Planning Consultants
SYDNEY REGIONAL AIRPORT STUDY
GREENDALE
AIRPORT TYPE 1
SITE DEVELOPMENT - MAXIMUM
DRAWING NO.
W3/5 T1 SD05-A



FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA

SITE AREA 1676.2Ha.

LEGEND

- - - AIRPORT BOUNDARY
—— O/H HV POWER LINES

NOTES
1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
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7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR ALL RUNWAY DIRECTIONS

This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignment may change once BOM wind data is available & analysed.

This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.

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CHKD: GM
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0 500 1000 1500 m
1:25,000 (A3)

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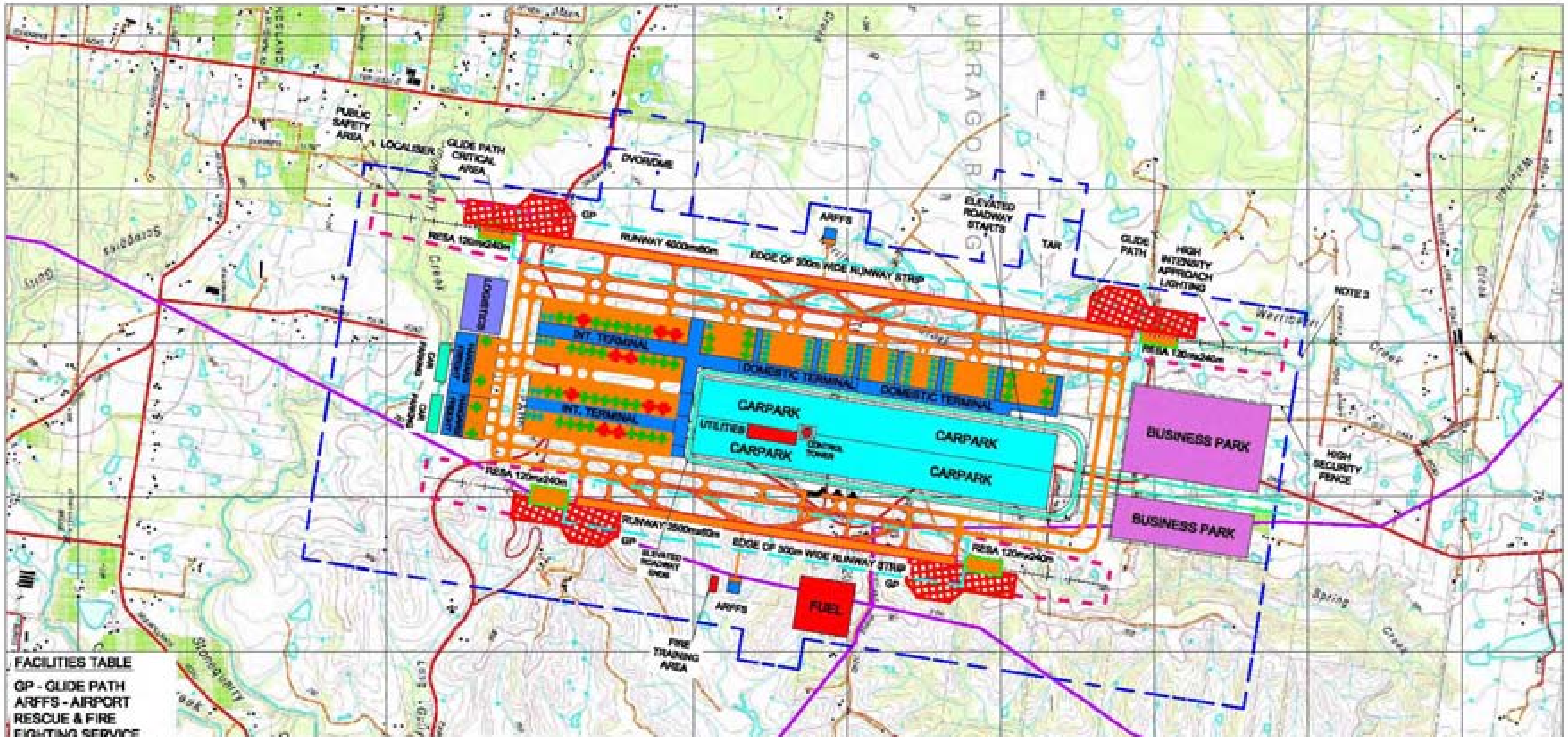
SYDNEY REGIONAL AIRPORT STUDY
CATHERINE FIELD
SITE DEVELOPMENT
AIRPORT TYPE 1 - MAXIMUM

DRAWING NO
S4/4 T1 SD05-A



FACILITIES TABLE

GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA

SITE AREA 1676Ha.

LEGEND

AIRPORT BOUNDARY

O/H HV POWER LINES

NOTES

1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS - CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
4) NO ALLOWANCE FOR LAND ACQUISITION FOR EXISTING INCOMPATIBLE LANDUSES
5) SITE BOUNDARY IS NOMINAL & CAN BE VARIED
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7) LENGTH OF RESA's - REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR BOTH RUNWAY DIRECTIONS

This concept drawing is based on a desktop study only & is subject to change following site inspection & detailed analysis. The runway alignment may change once BOM wind data is available & analysed.

This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.

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DRAWN: RN
CHKD: GM

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0 500 1000 1500 m
1:25,000 (A3)

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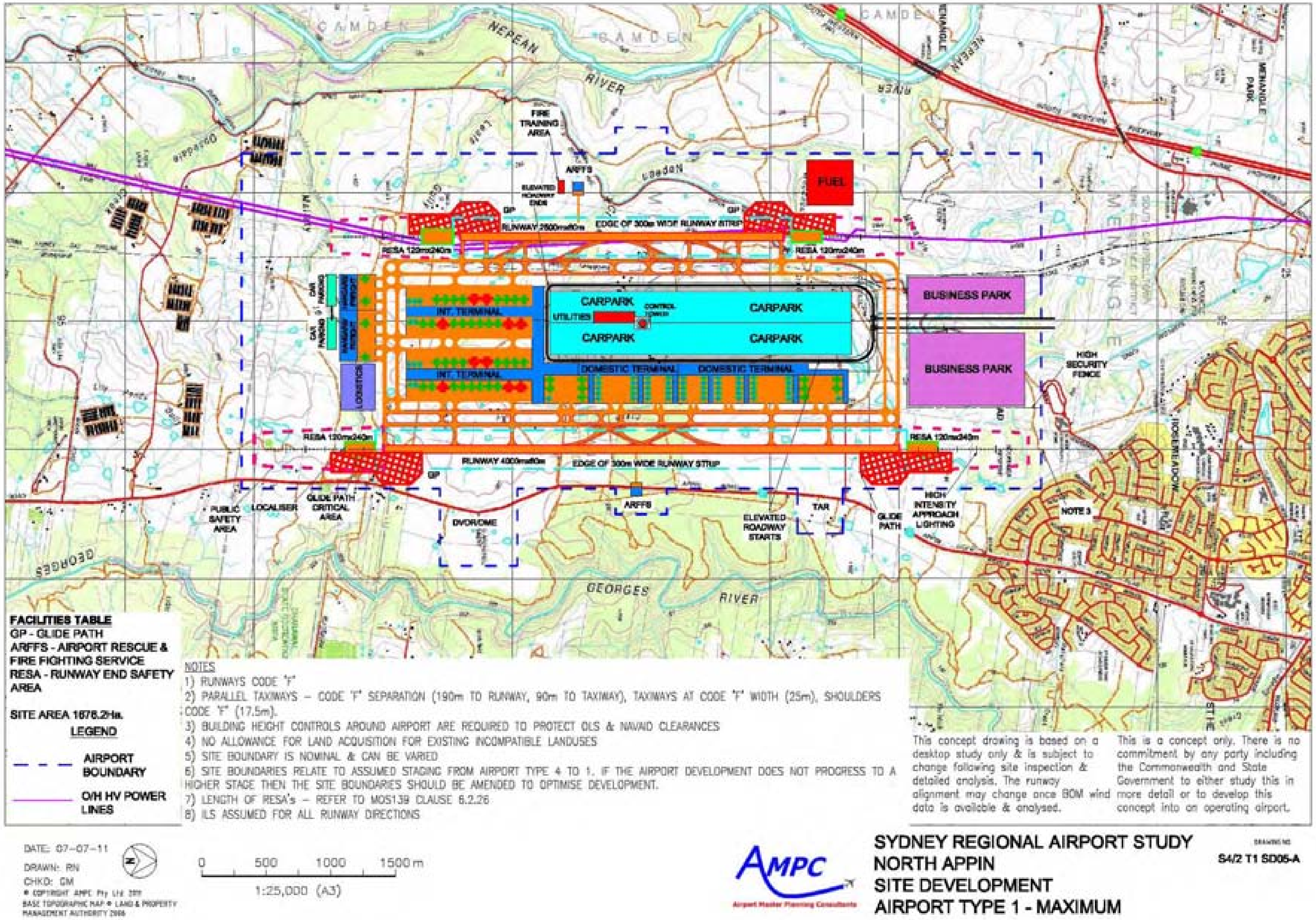
SYDNEY REGIONAL AIRPORT STUDY
MOWBRAY PARK
AIRPORT TYPE 1
SITE DEVELOPMENT - MAXIMUM

DRAWING NO.
W4/2 T1 SD05-A


FACILITIES TABLE
GP - GLIDE PATH
ARFFS - AIRPORT RESCUE & FIRE FIGHTING SERVICE
RESA - RUNWAY END SAFETY AREA
SITE AREA 1676.2Ha.
LEGEND
AIRPORT BOUNDARY
O/H HV POWER LINES
NOTES
1) RUNWAYS CODE 'F'
2) PARALLEL TAXIWAYS – CODE 'F' SEPARATION (190m TO RUNWAY, 90m TO TAXIWAY), TAXIWAYS AT CODE 'F' WIDTH (25m), SHOULDERS CODE 'F' (17.5m).
3) BUILDING HEIGHT CONTROLS AROUND AIRPORT ARE REQUIRED TO PROTECT OLS & NAVAID CLEARANCES
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7) LENGTH OF RESA's – REFER TO MOS139 CLAUSE 6.2.26
8) ILS ASSUMED FOR ALL RUNWAY DIRECTIONS
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This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
FIRE TRAINING AREA
ARFFS
FUEL
RUNWAY 2500mx60m
EDGE OF 300m WIDE RUNWAY STRIP
RESA 120mx240m
BUSINESS PARK
CARPARK
UTILITIES
CONTROL TOWER
INT. TERMINAL
DOMESTIC TERMINAL
LOGISTICS
HIGH SECURITY FENCE
RUNWAY 4000mx60m
GP
PUBLIC SAFETY AREA
LOCALISER
GLIDE PATH CRITICAL AREA
DVOR/DME
ELEVATED ROADWAY STARTS
TAR
GLIDE PATH
HIGH INTENSITY APPROACH LIGHTING
NOTE 3
NEPEAN RIVER
GEORGES RIVER
CAMDEN
MENANGLE PARK
ROSEMEADOW
DATE: 07-07-11
DRAWN: RN
CHKD: GM
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BASE TOPOGRAPHIC MAP © LAND & PROPERTY MANAGEMENT AUTHORITY 2006
0 500 1000 1500 m
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AMPC
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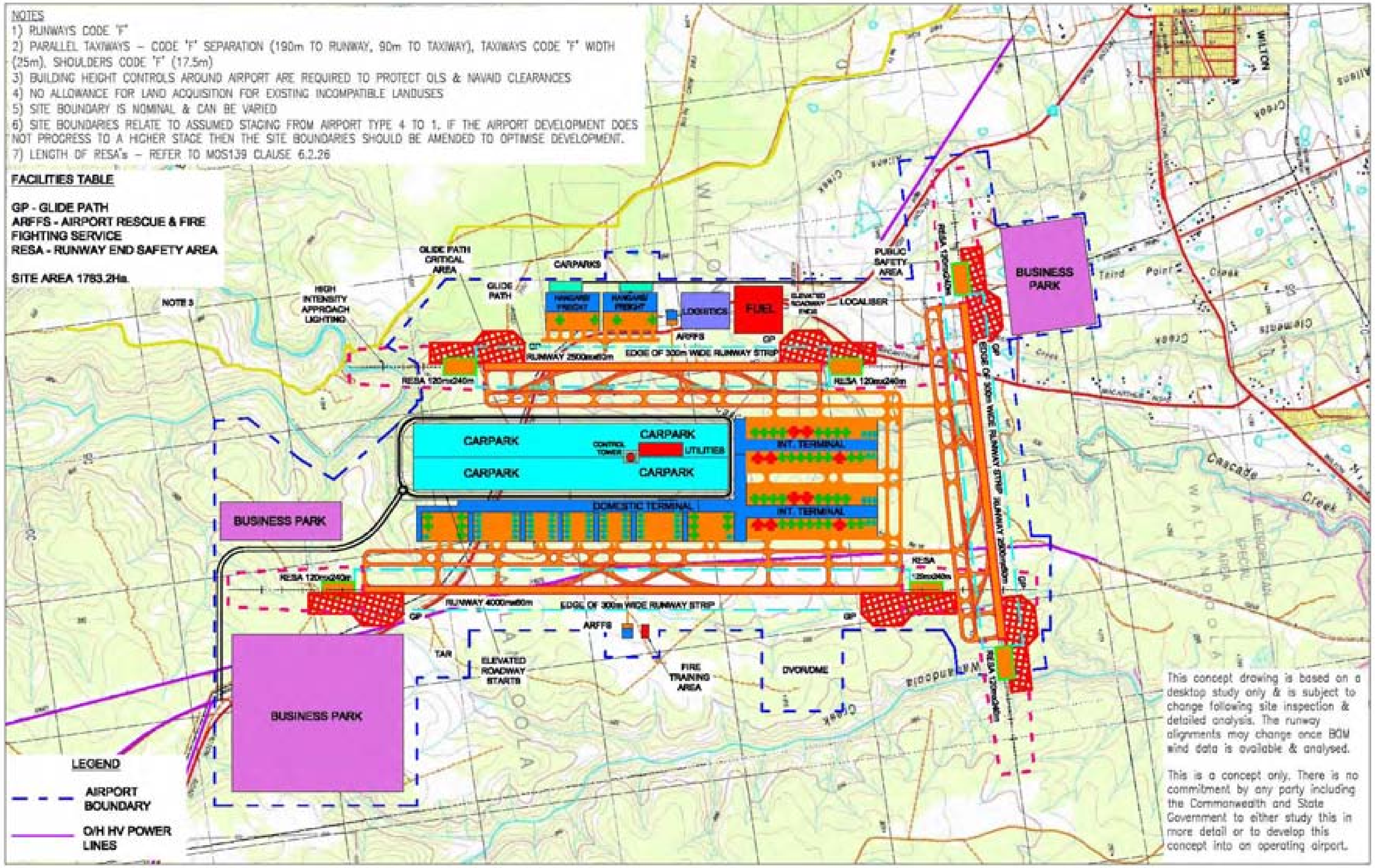
SYDNEY REGIONAL AIRPORT STUDY
NORTH APPIN
SITE DEVELOPMENT
AIRPORT TYPE 1 - MAXIMUM
DRAWING NO.
S4/2 T1 SD05-A

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



DATE: 05-07-11
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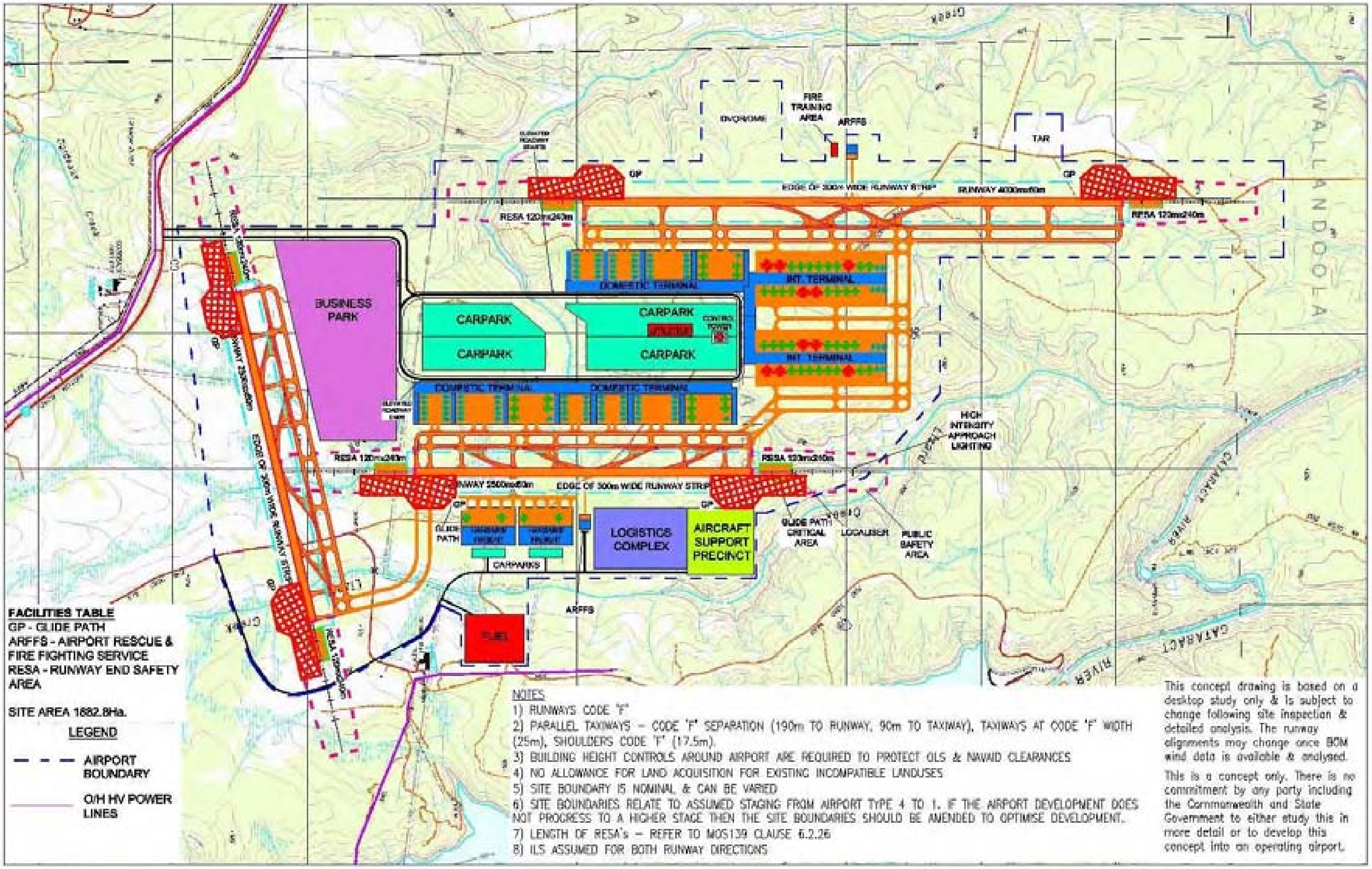
AMPC
Airport Master Planning Consultants

SYDNEY REGIONAL AIRPORT STUDY
WILTON WITH CROSS RUNWAY
AIRPORT TYPE 1
SITE DEVELOPMENT - MAXIMUM

DRAWING NO.
S1/1-T1 SD05-C

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT
AVIATION INFRASTRUCTURE
MOST SUITABLE SITES STUDY - SPECIFIED LOCALITIES



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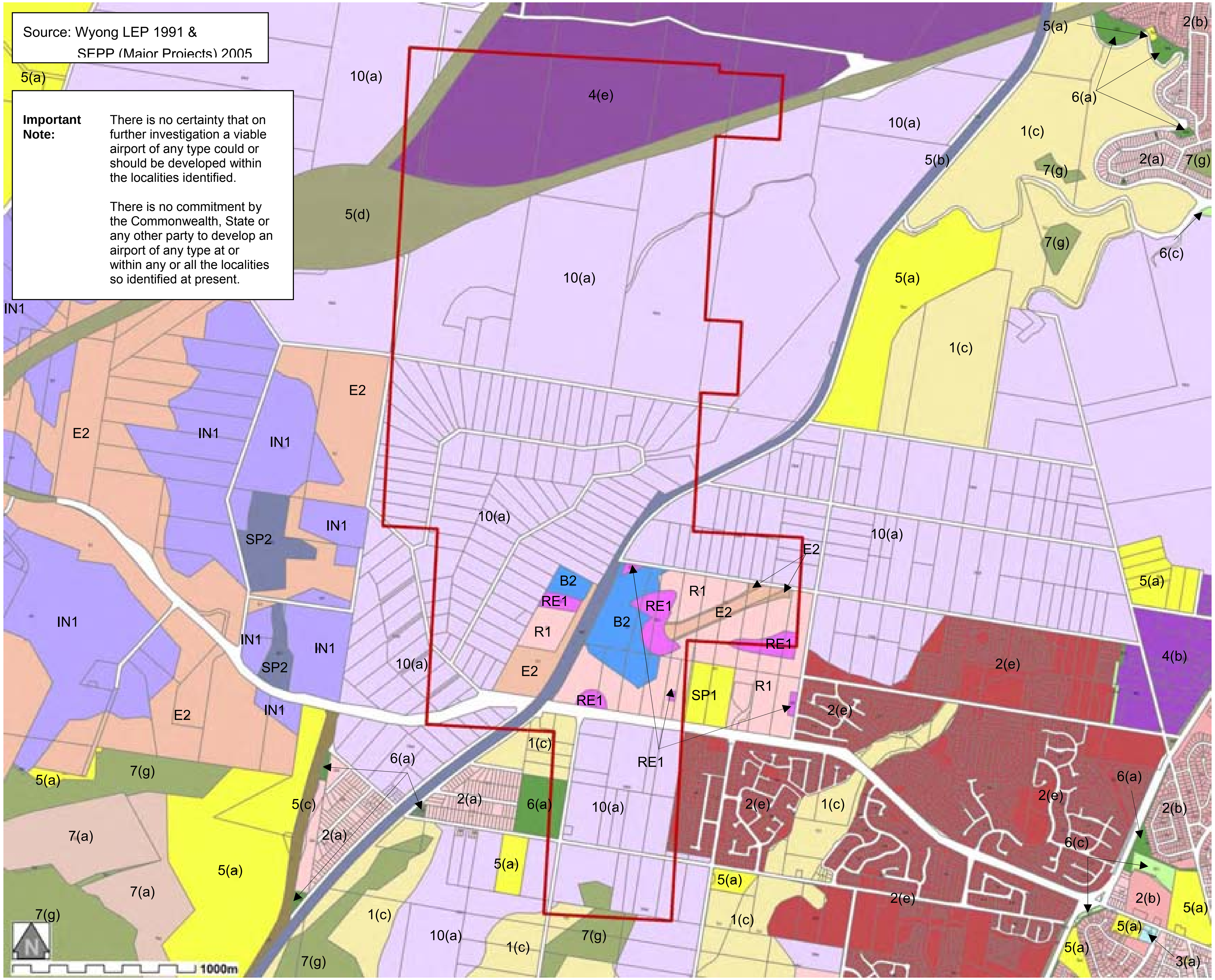
PRELIMINARY FOR DISCUSSION ONLY

AMPC Airport Master Planning Consultants

SYDNEY REGIONAL AIRPORT STUDY
WALLANDOOLA
AIRPORT TYPE 1
SITE DEVELOPMENT - MAXIMUM

DRAWING NO.
S1/3 T1 SD05-B

Type 3 Airport (Limited Service Airport) Site Zoning



LEGEND

Wyong LGA Zones

1(c)	Non Urban Constrained Land Zone
2(a)	Residential
2(b)	Multiple Dwelling Residential
2(e)	Urban Release Area
3(a)	Business Centre
3(b)	Support Centre
4(b)	Light Industry
4(e)	Regional Industry & Employment Development
5(a)	Special Uses – General
5(b)	Special Uses – Railways
5(c)	Local Road Reservation
5(d)	Arterial Road Reservation
6(a)	Open Space & Recreation
6(b)	Regional Open Space & Recreation
6(c)	Proposed Open Space & Recreation
7(a)	Conservation
7(b)	Scenic Protection
7(c)	Scenic Protection – Small Holdings
7(g)	Wetlands Management
10(a)	Investigation Precinct
B2	Local Centre
E2	Environmental Conservation
E3	Environmental Management
IN1	General Industrial
R1	General Residential
RE1	Public Recreation
SP1	Special Activities (School)
SP2	Infrastructure (Water Management)
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

WorleyParsons resources & energy

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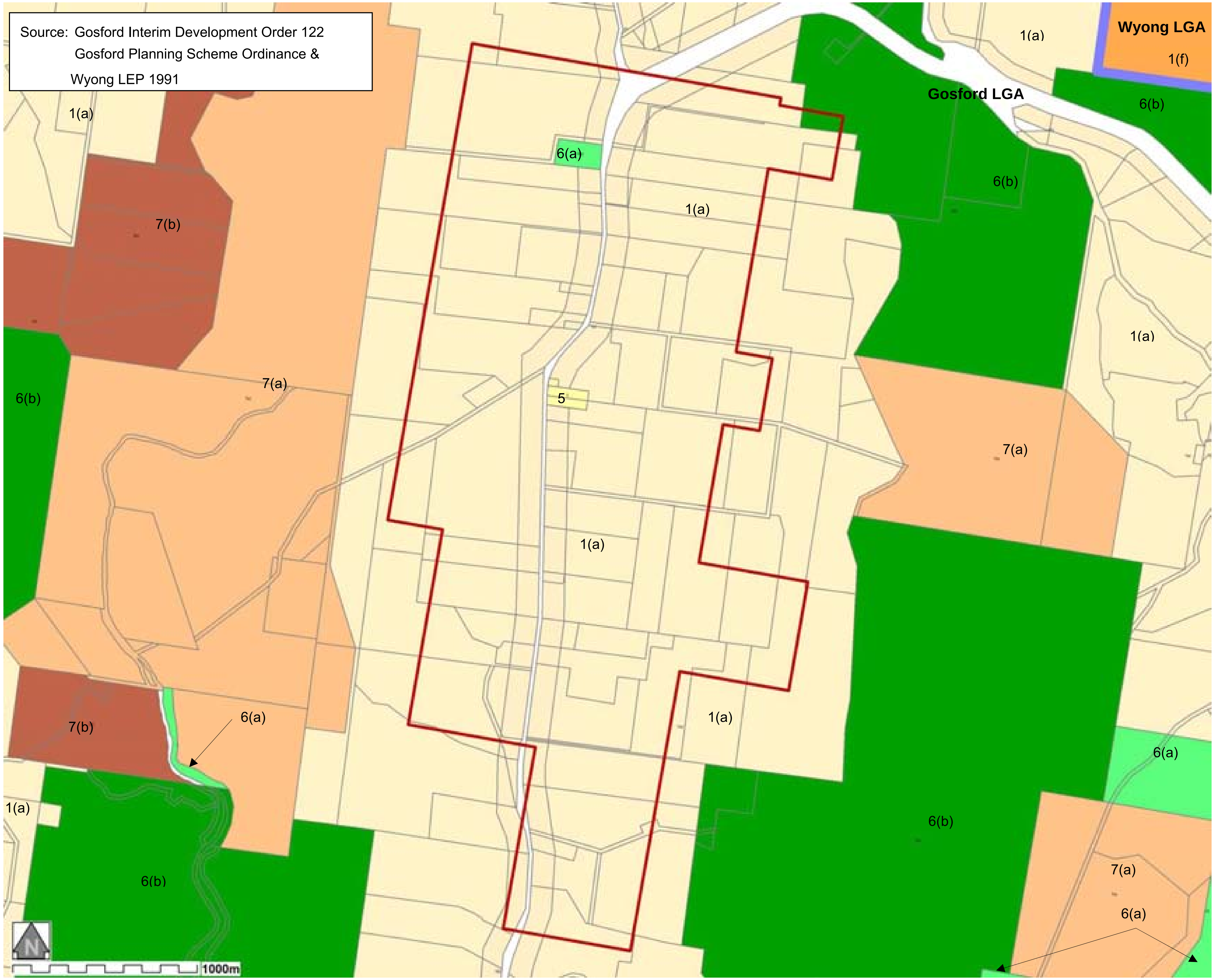
Wallarah – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

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LEGEND

Gosford LGA Zones

1(a)	Rural – Agricultural
1(c)	Non Urban
2(a)	Residential
3(a)	Business – General
4(a)	Industrial – General
4(c)	Industrial – Extractive
5	Special Uses – General
5(b)	Special Uses – Railways
5(d)	Special Uses – Road Reservation
6(a)	Open Space – Recreation
6(b)	Open Space – Special Purpose
6(e)	Open Space – Proposed
7(a)	Environmental Protection - Conservation
7(b)	Environmental Protection – Scenic Protection
7(c2)	Scenic Protection – Rural Small Holdings
9(a)	Restricted Development – Flood Prone Land

Wyong LGA Zones

1(f)	Rural – Forestry
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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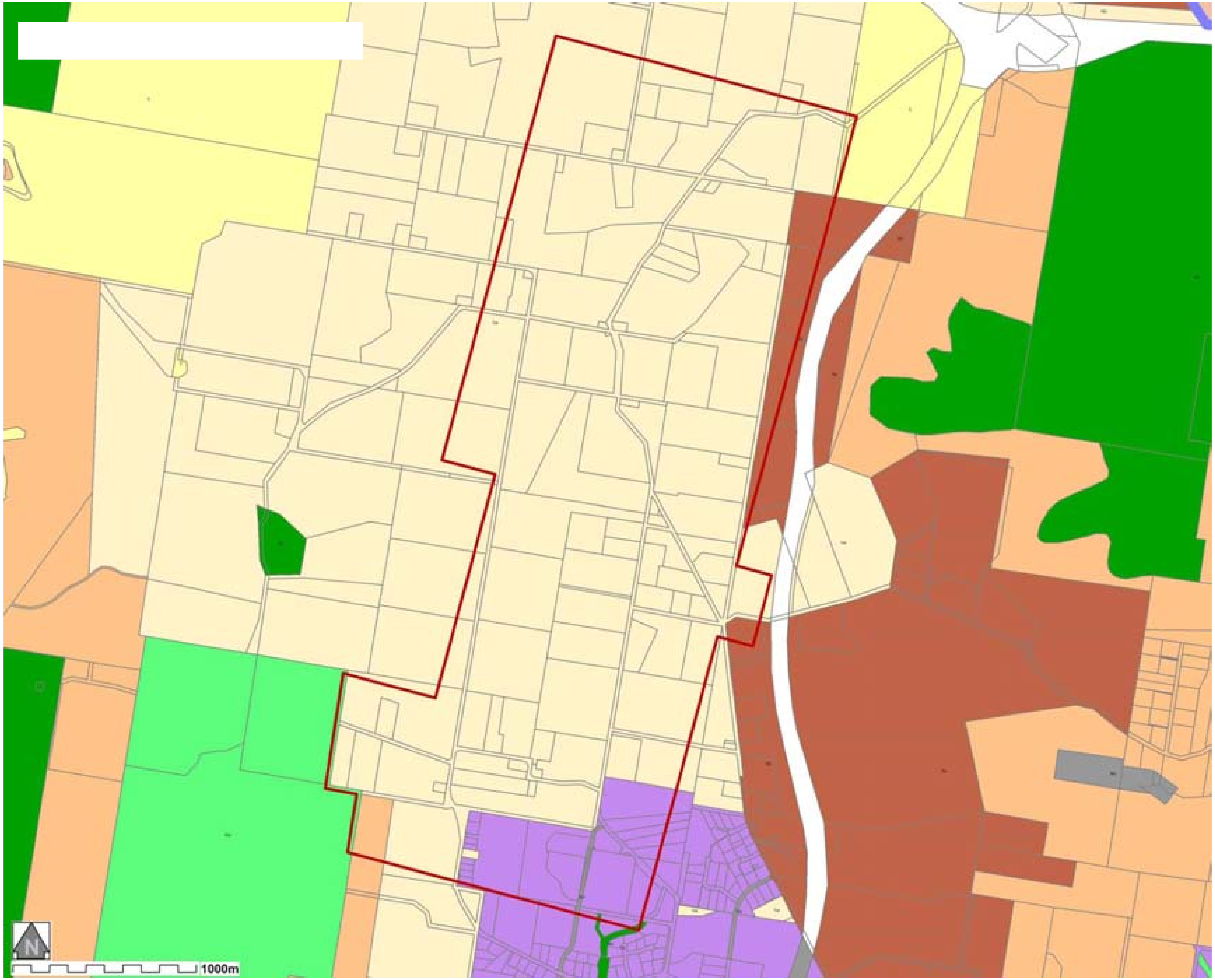
Peats Ridge – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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LEGEND

Zones

1(a)	Rural – Agricultural
1(c)	Non Urban
2(a)	Residential
3(a)	Business – General
4(a)	Industrial – General
4(c)	Industrial – Extractive
5	Special Uses – General
5(b)	Special Uses – Railways
5(d)	Special Uses – Road Reservation
6(a)	Open Space – Recreation
6(b)	Open Space – Special Purpose
6(e)	Open Space – Proposed
7(a)	Environmental Protection - Conservation
7(b)	Environmental Protection – Scenic Protection
7(c2)	Scenic Protection – Rural Small Holdings
9(a)	Restricted Development – Flood Prone Land
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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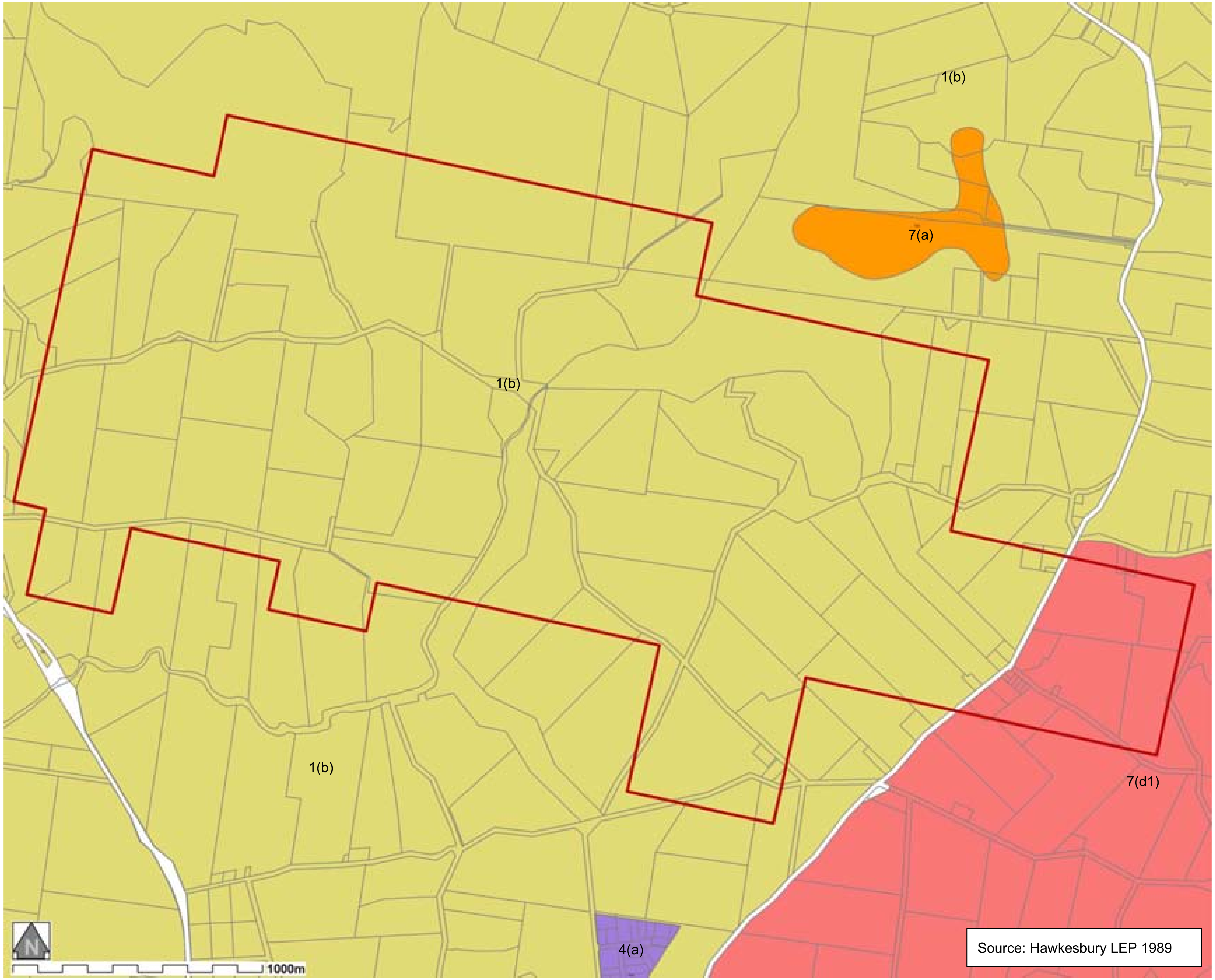
Somersby – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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LEGEND

Zone

1(b)	Rural "B"
1(c1)	Rural "C1"
2(a)	Residential "A"
3(a)	General Business
4(a)	Industry General
5(a)	Special Uses "A"
6(a)	Open Space (Existing Recreation)
6(c)	Open Space (Private Recreation)
7(a)	Environmental Protection (Wetlands)
7(d1)	Environmental Protection (Scenic)
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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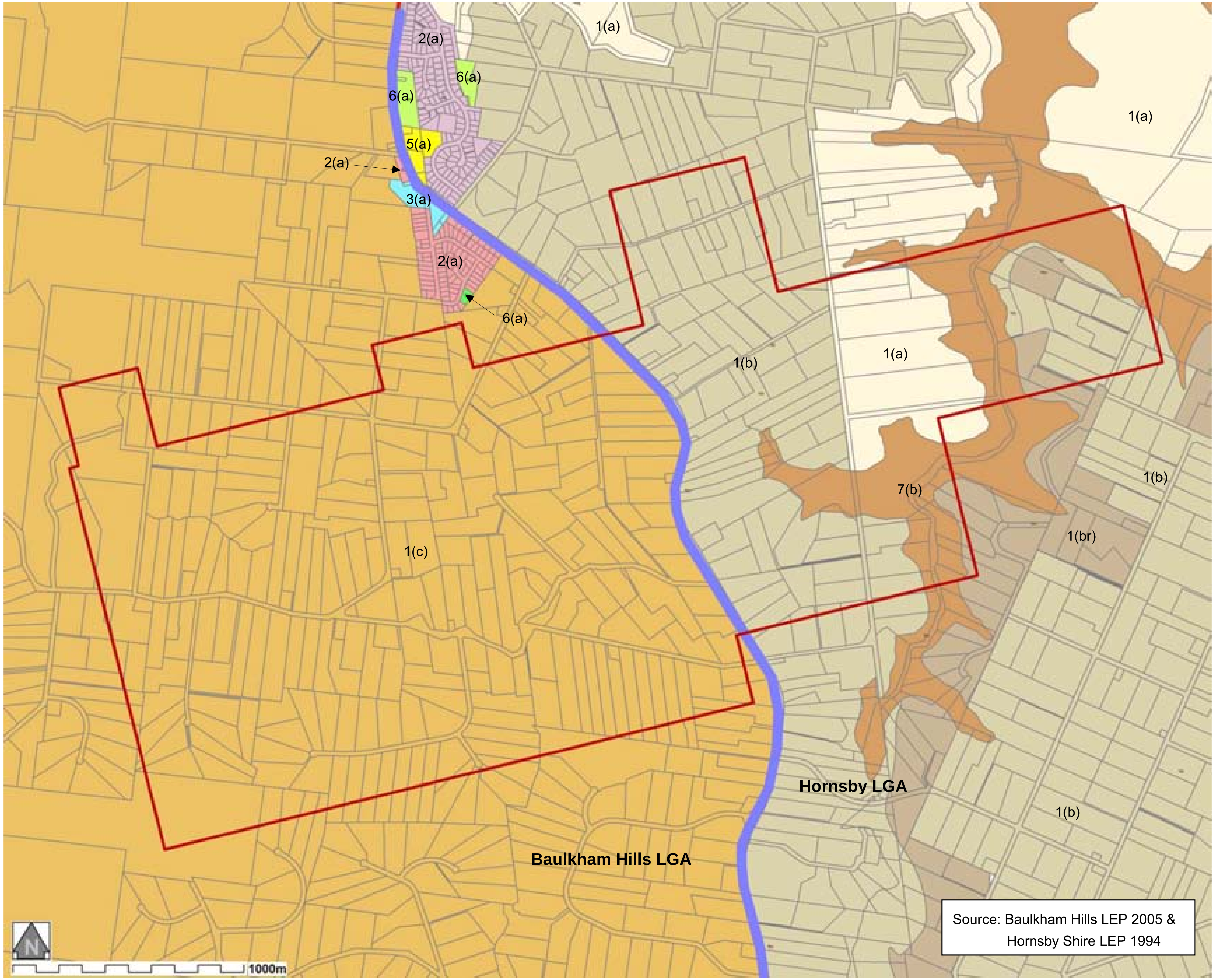
Wilberforce – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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LEGEND

Baulkham Hills LGA Zoning

1(c)	Rural
2(a)	Residential
3(a)	Business (Retail)
6(a)	Open Space

Hornsby LGA Zoning

1(a)	Rural Large Holding (Agricultural Landscapes)
1(b)	Rural Small Holding (Agricultural Landscapes)
1(br)	Rural Small Holding (Rural Landscapes)
2(a)	National Parks & Natural Reserves
5(a)	Environmental Conservation
6(a)	Rural Small Holdings
7(b)	Special Activities

Source: Baulkham Hills LEP 2005 & Hornsby Shire LEP 1994

Cadastre based data 17/05/2010 © NSW LPMA

LGA Boundaries

WorleyParsons resources & energy

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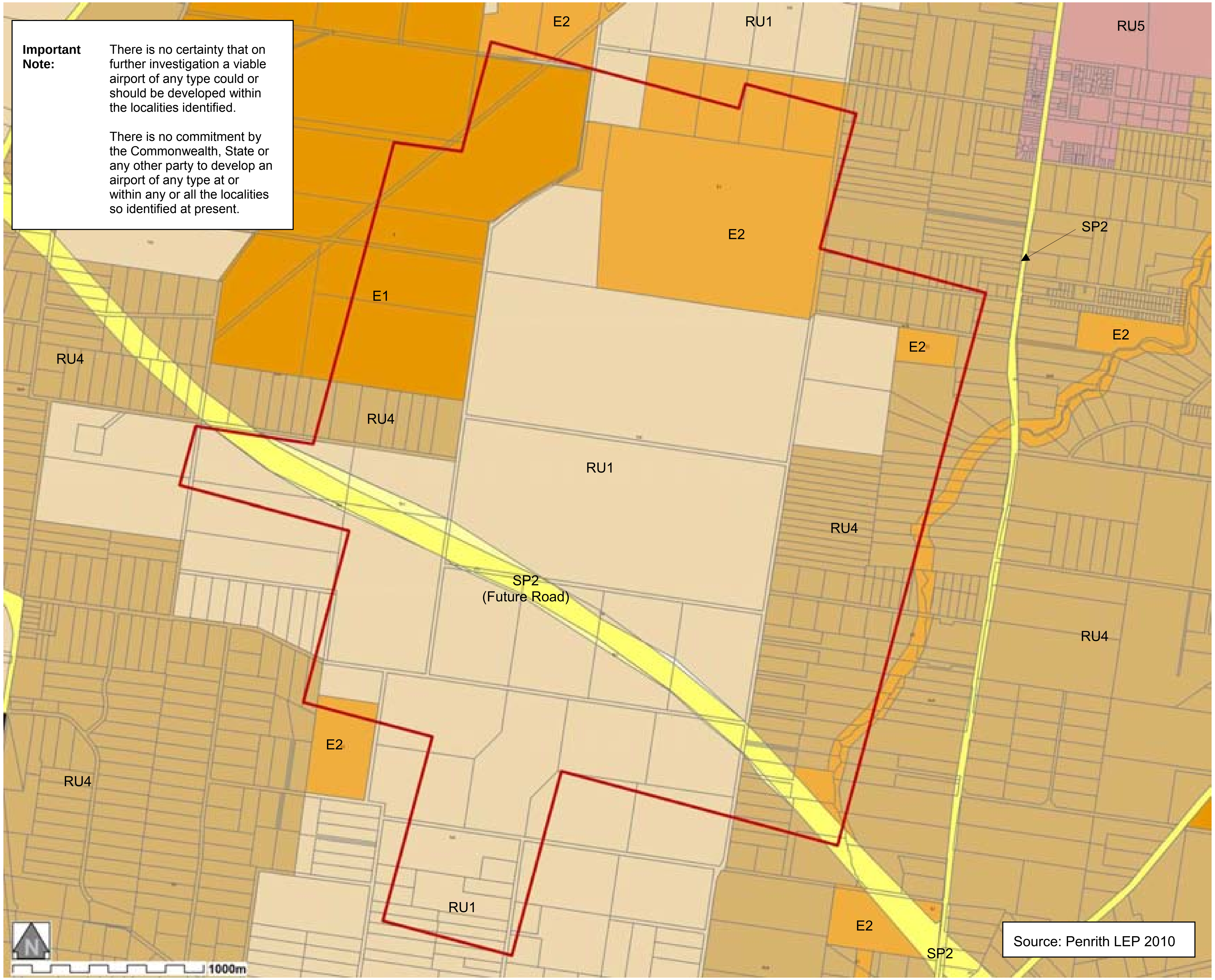
Glenorie – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
B4	Mixed Use
B5	Business Development
B6	Enterprise Corridor
B7	Business Park
E1	National Parks and Nature Reserves
E2	Environmental Conservation
E3	Environmental Management
E4	Environmental Living
IN1	General Industry
IN2	Light Industry
IN3	Heavy Industry
IN4	Working Waterfront
R1	General Residential
R2	Low Density Residential
R3	Medium Density Residential
R5	Large Lot Residential
RE1	Public Recreation
RE2	Private Recreation
RU1	Primary Production
RU2	Rural Landscape
RU4	Rural Small Holdings
RU5	Village
SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

WorleyParsons resources & energy

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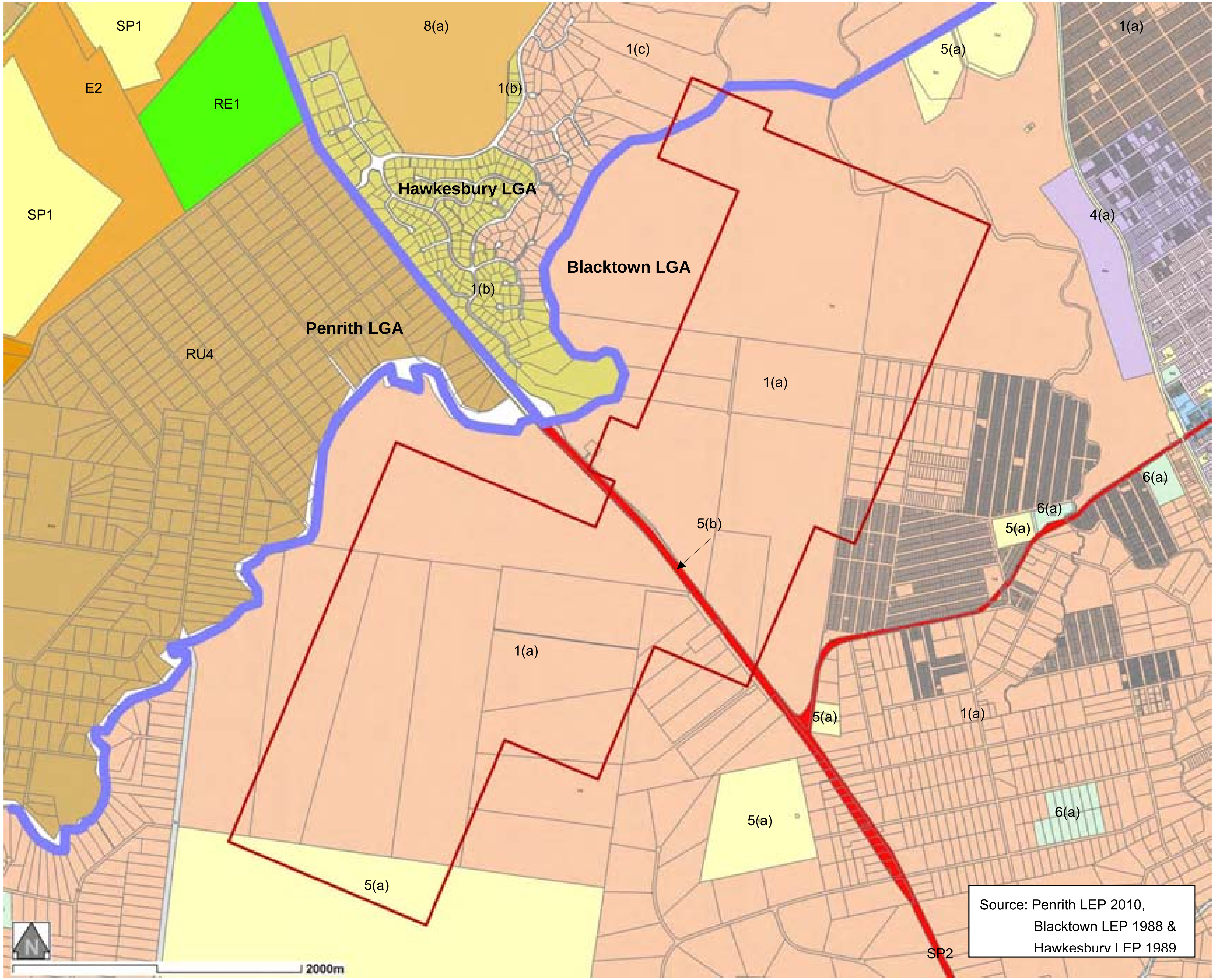
Castlereagh – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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LEGEND

Blacktown LGA Zoning

1(a)	Rural
2(a)	Residential
3(a)	General Business
4(a)	General Industry
5(a)	General Special Uses
5(b)	Arterial Road
5(c)	Local Road
6(a)	Public Recreation
6(b)	Private Recreation

Hawkesbury LGA Zoning

1(b)	Rural – Rural Living
1(c)	Rural – Mixed Agricultural
8(a)	National Parks & Nature Reserves

Penrith LGA Zoning

E1	National Parks & Natural Reserves
E2	Environmental Conservation
RU4	Rural Small Holdings
SP1	Special Activities
RE1	Public Recreation

Cadastre based data 17/05/2010 © NSW LPMA

LGA Boundaries

Source: Penrith LEP 2010, Blacktown LEP 1988 & Hawkesbury LEP 1989

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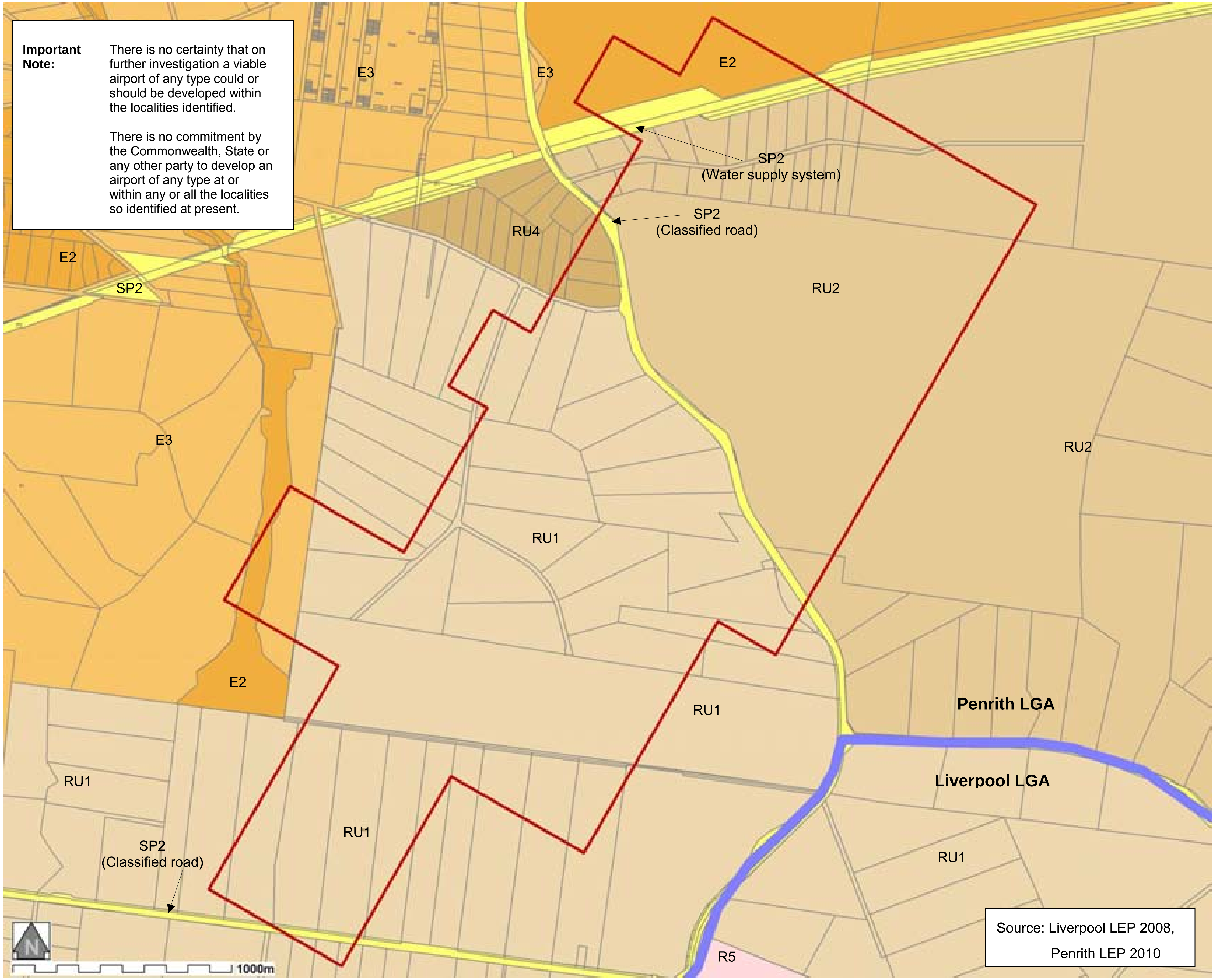
Windsor Downs – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
B4	Mixed Use
B5	Business Development
B6	Enterprise Corridor
B7	Business Park
E1	National Parks and Nature Reserves
E2	Environmental Conservation
E3	Environmental Management
E4	Environmental Living
IN1	General Industry
IN2	Light Industry
IN3	Heavy Industry
IN4	Working Waterfront
R1	General Residential
R2	Low Density Residential
R3	Medium Density Residential
R5	Large Lot Residential
RE1	Public Recreation
RE2	Private Recreation
RU1	Primary Production
RU2	Rural Landscape
RU4	Rural Small Holdings
RU5	Village
SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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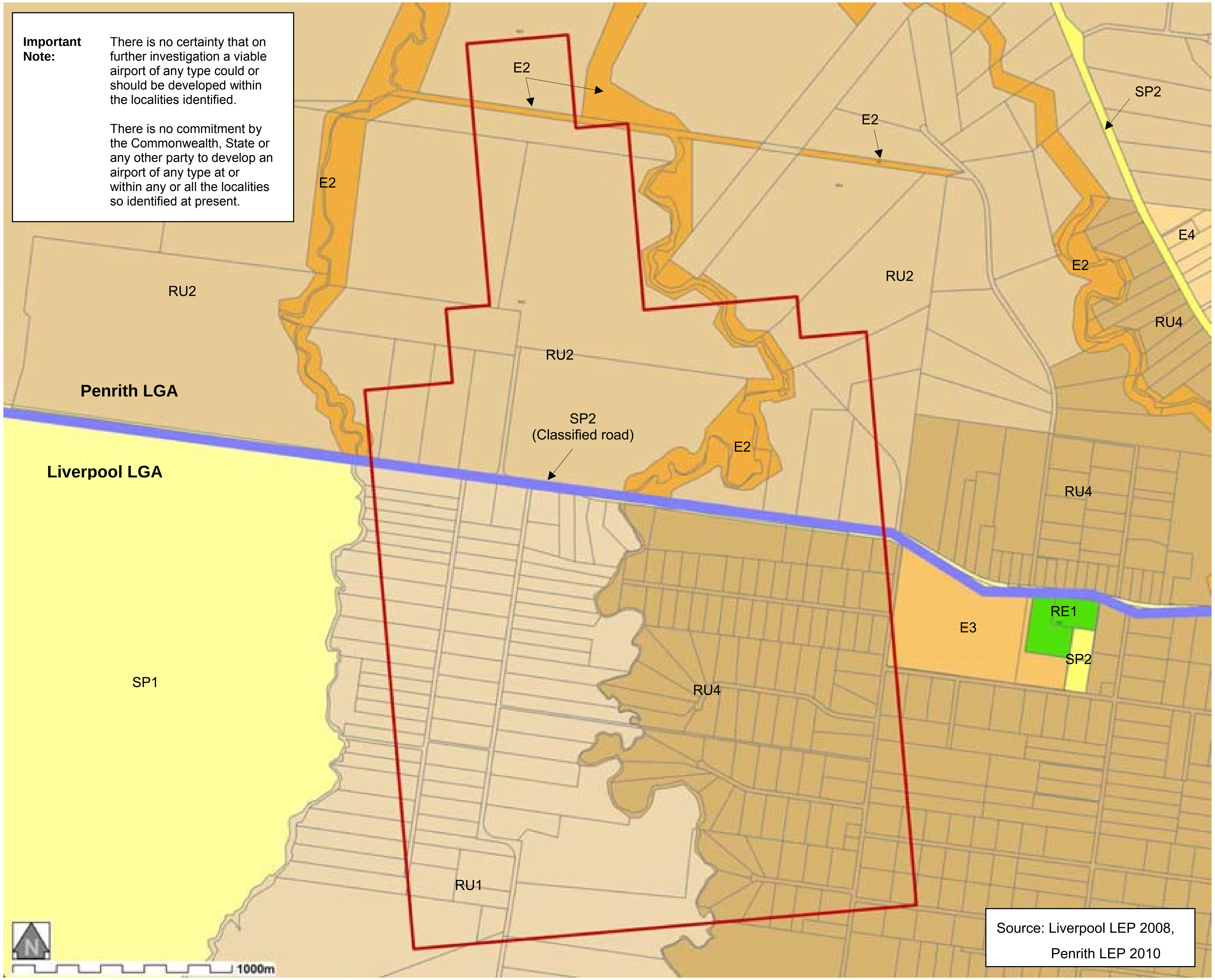
Luddenham – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
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B5	Business Development
B6	Enterprise Corridor
B7	Business Park
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RU4	Rural Small Holdings
RU5	Village
SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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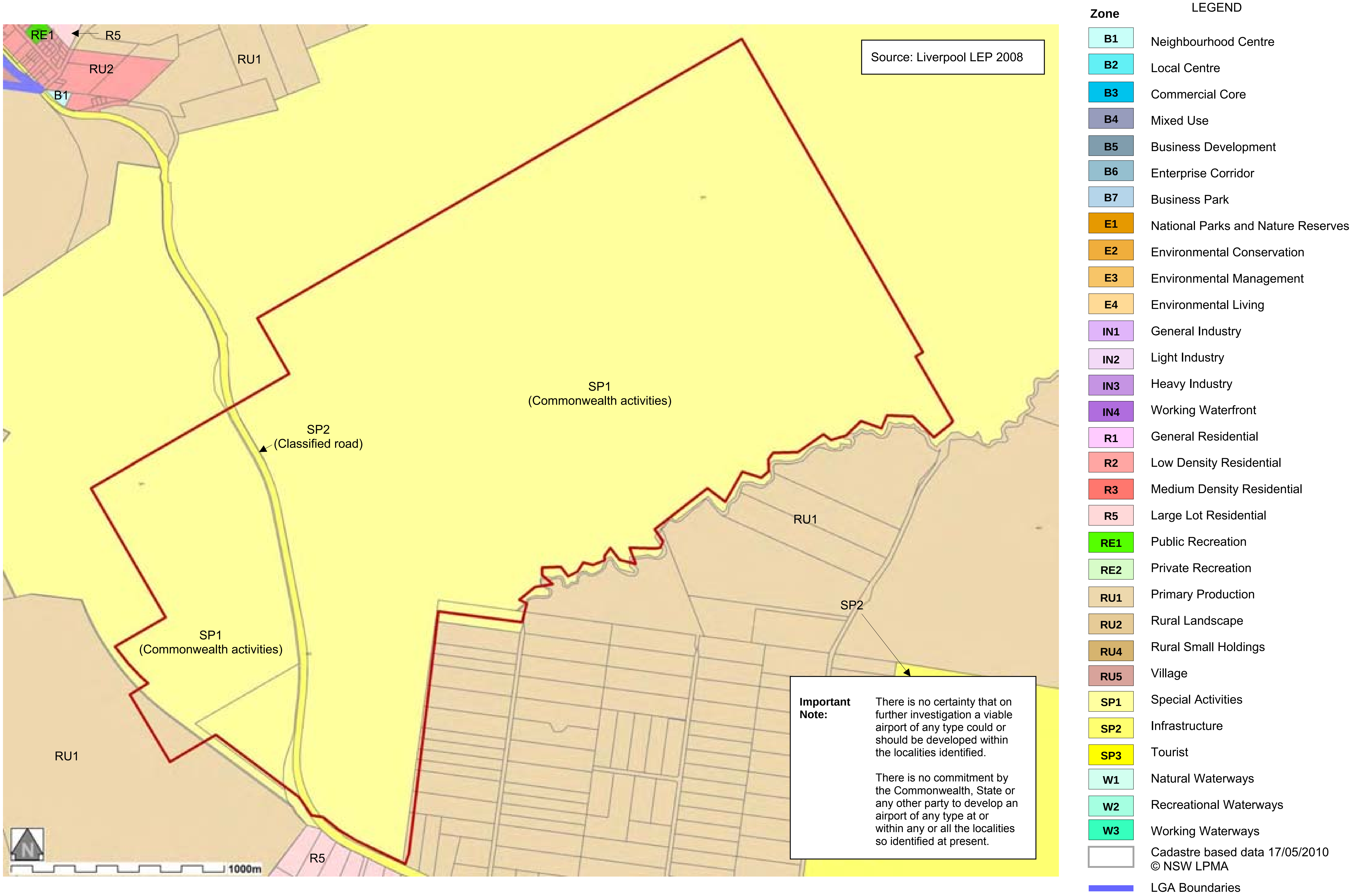
Kemps Creek – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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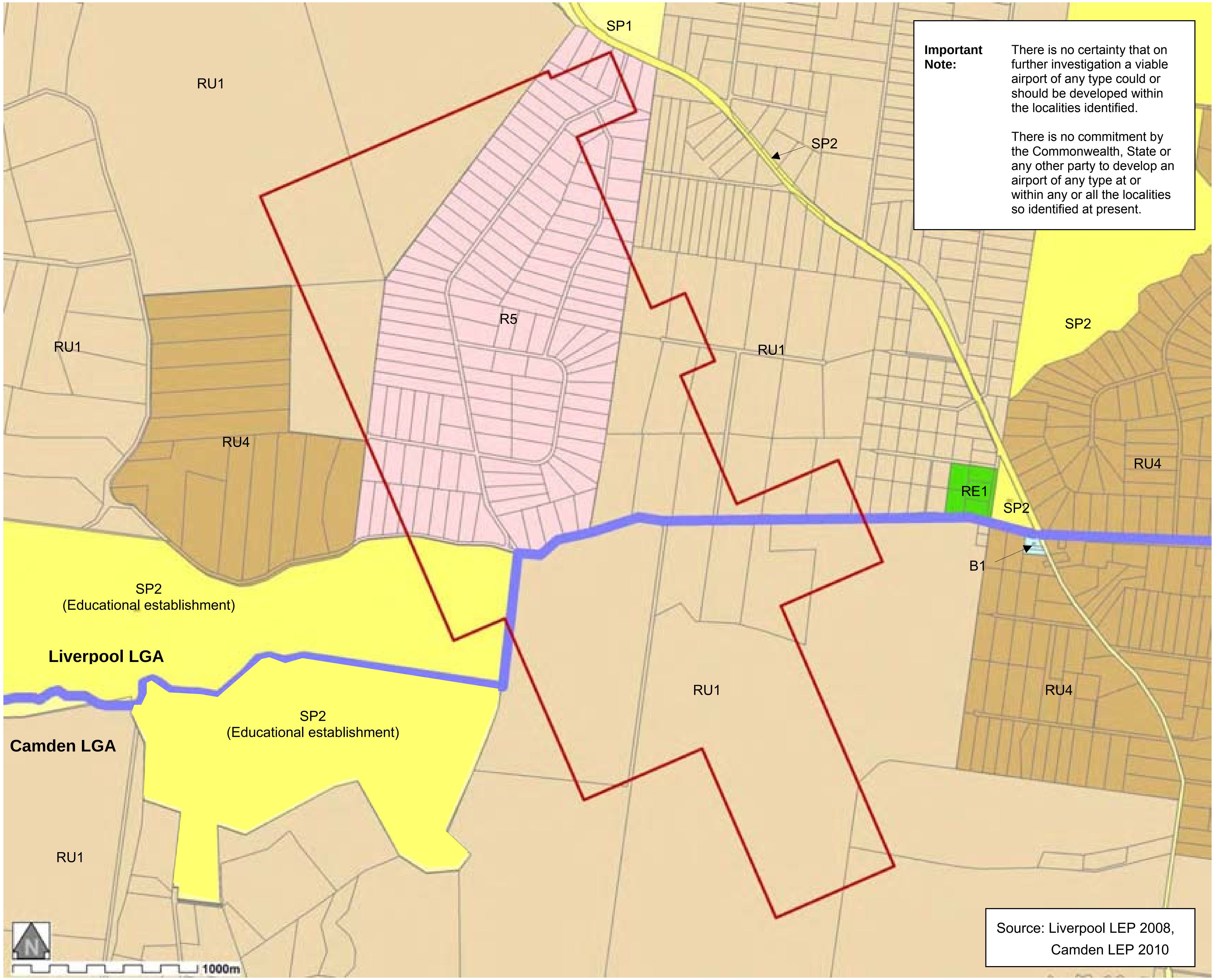
Badgerys Creek – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
B1	Neighbourhood Centre
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B5	Business Development
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E3	Environmental Management
E4	Environmental Living
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IN3	Heavy Industry
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R3	Medium Density Residential
R5	Large Lot Residential
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RE2	Private Recreation
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RU4	Rural Small Holdings
RU5	Village
SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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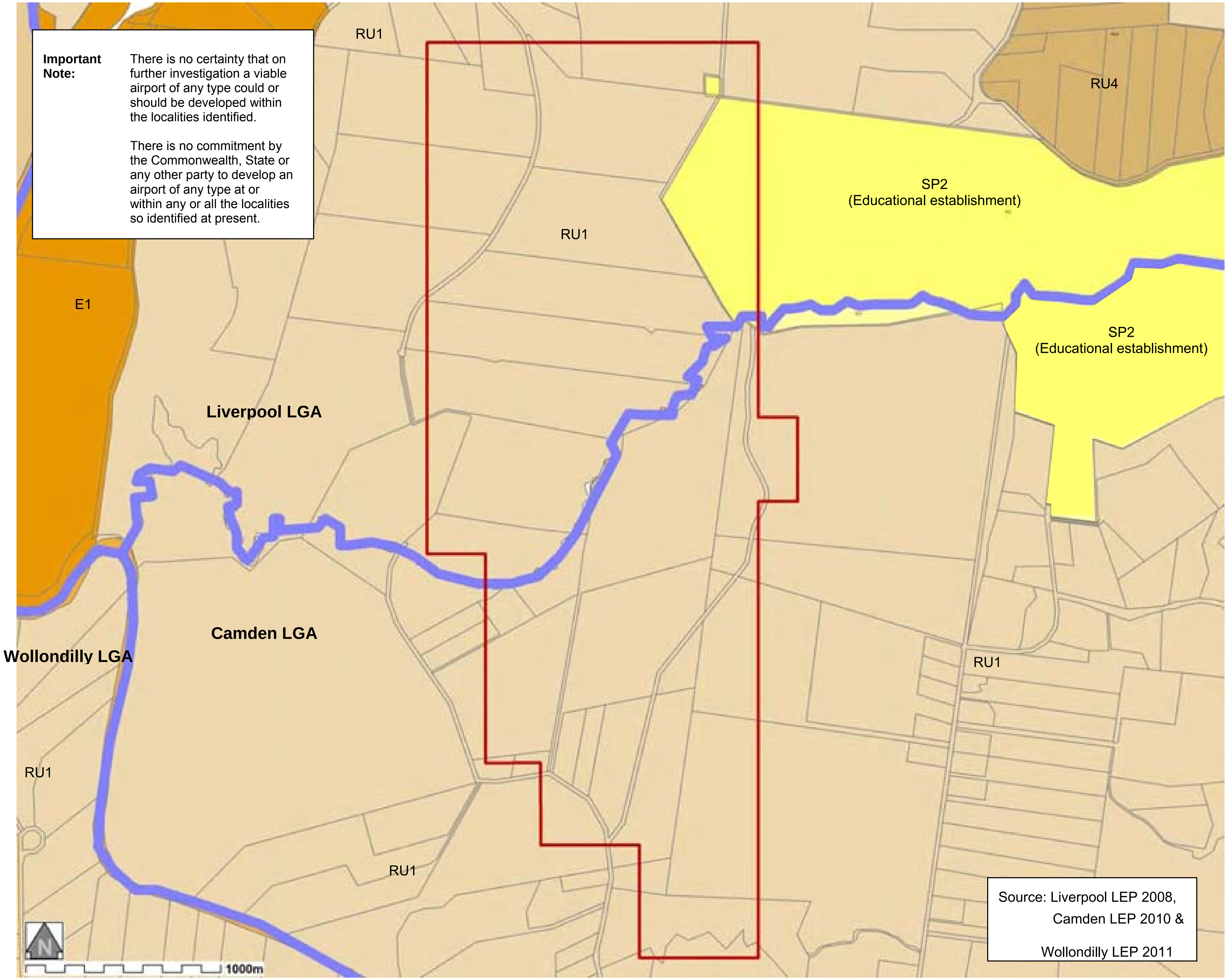
Bringelly – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
B1	Neighbourhood Centre
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SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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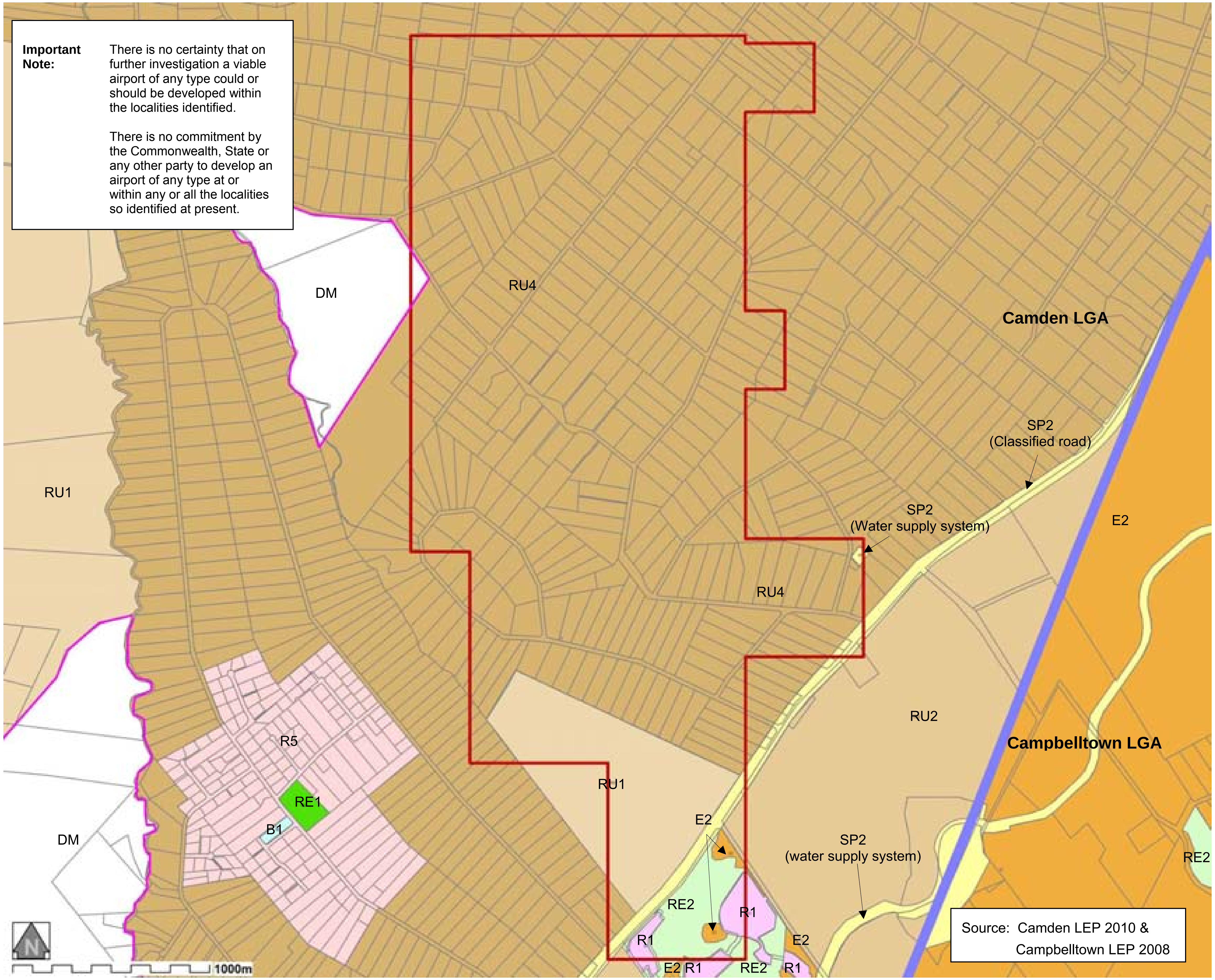
Greendale – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
B1	Neighbourhood Centre
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E2	Environmental Conservation
E3	Environmental Management
E4	Environmental Living
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IN2	Light Industry
IN3	Heavy Industry
IN4	Working Waterfront
R1	General Residential
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R5	Large Lot Residential
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RE2	Private Recreation
RU1	Primary Production
RU2	Rural Landscape
RU4	Rural Small Holdings
RU5	Village
SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
DM	Deferred Matter
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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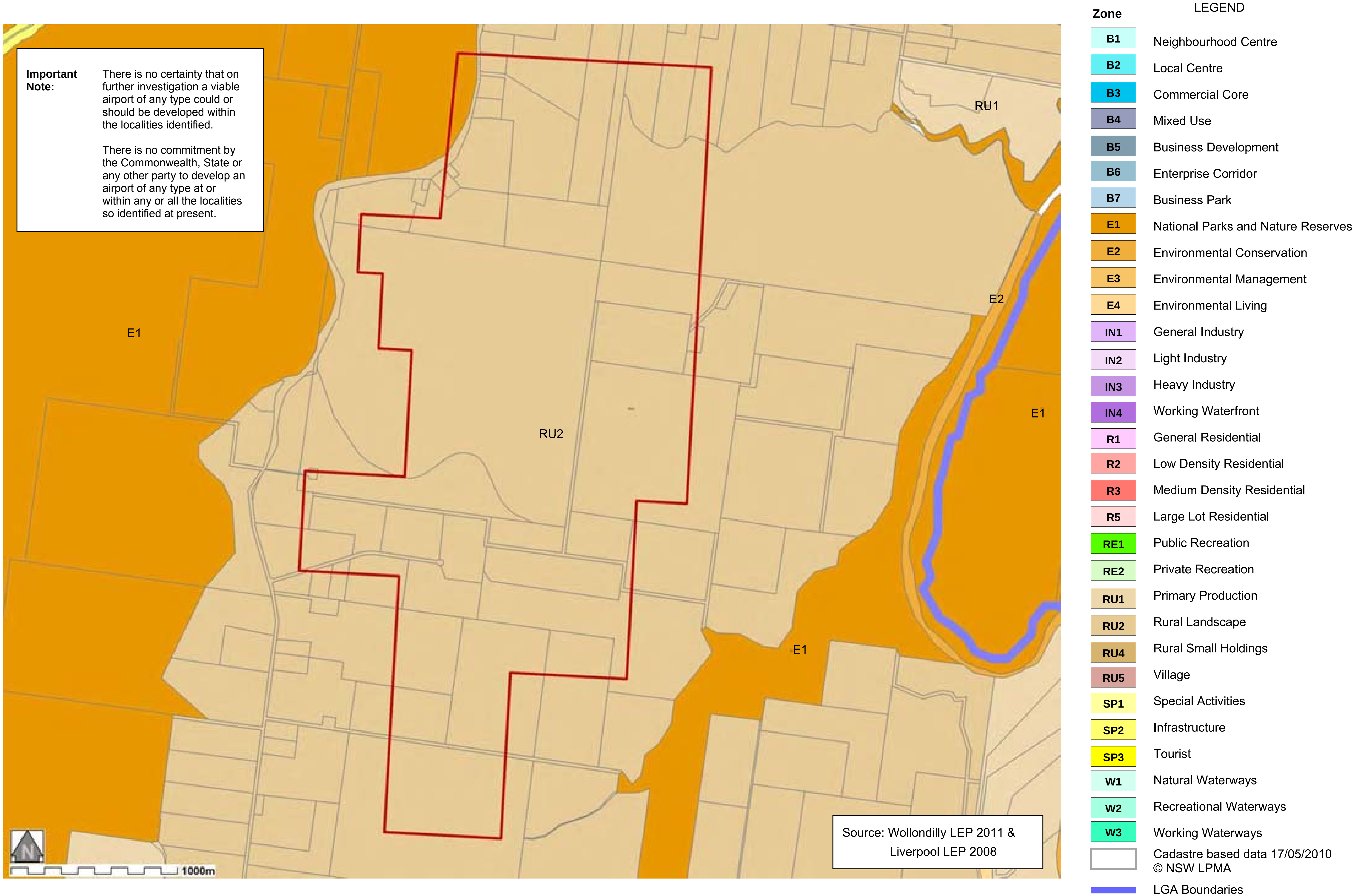
Catherine Field – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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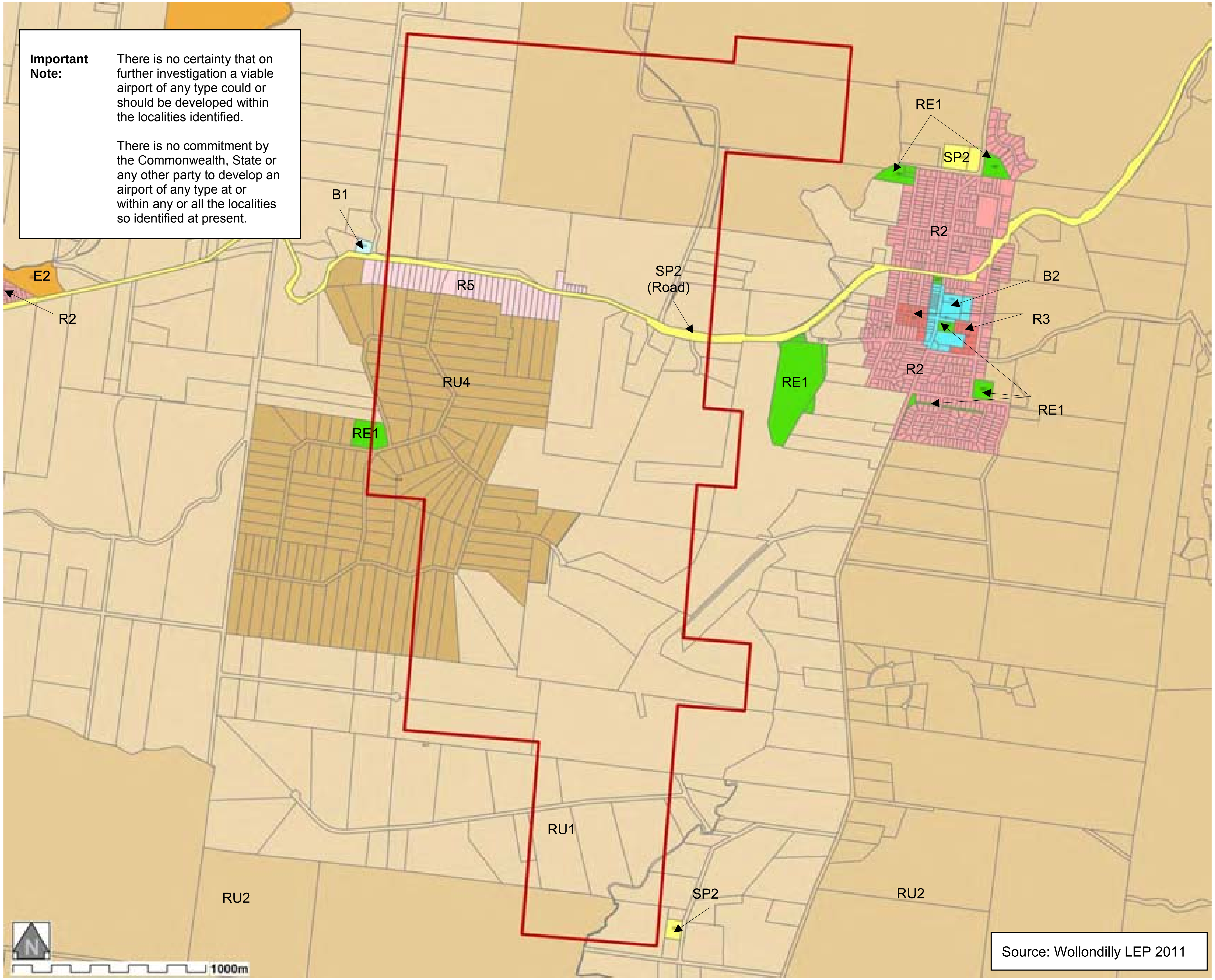
Silverdale – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
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B5	Business Development
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RU5	Village
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SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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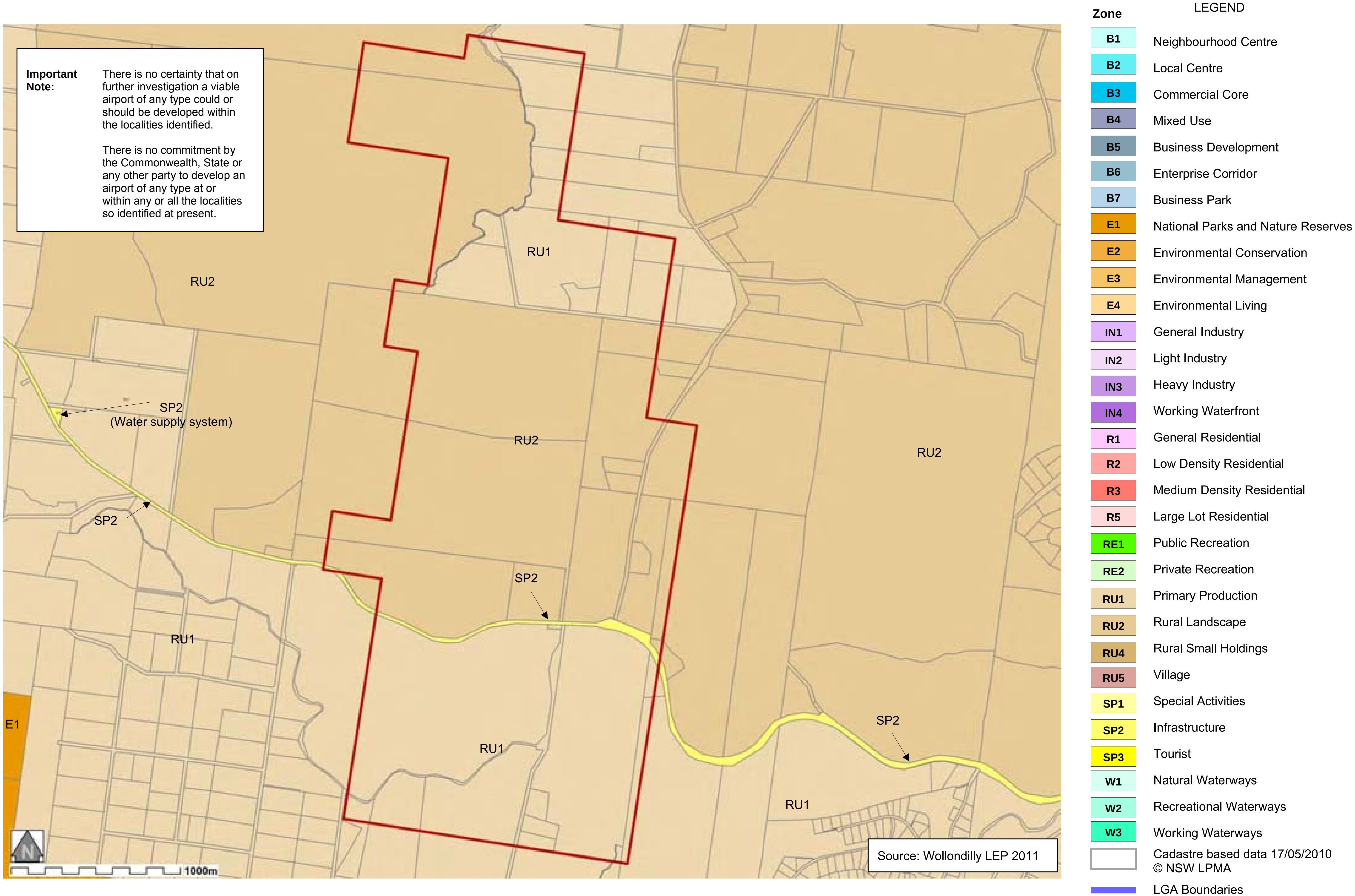
The Oaks – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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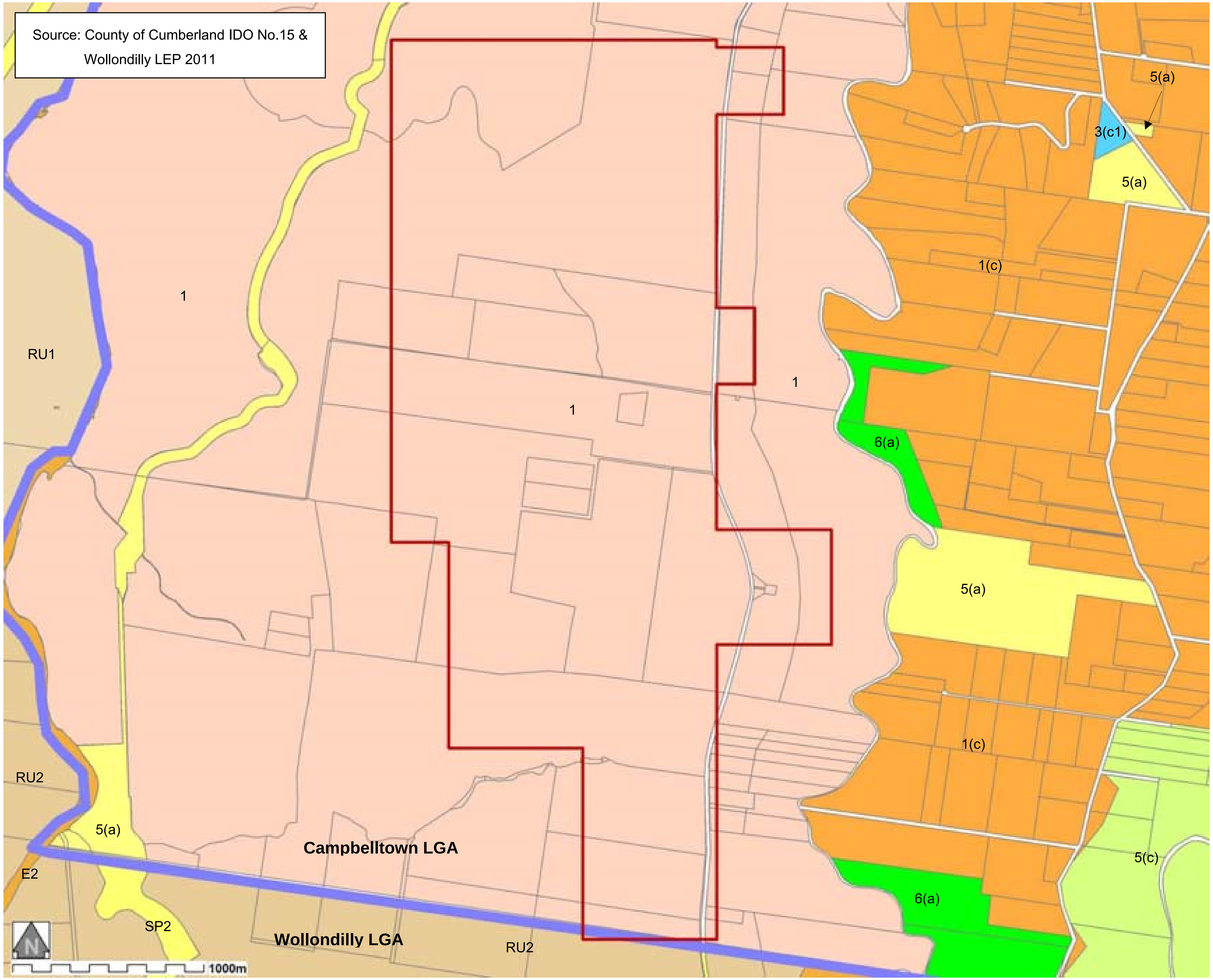
Mowbray Park – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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LEGEND

Campbelltown LGA Zones

1	Non Urban
1(c)	Rural"C"
2(b)	Residential "B"
3(c1)	Neighbourhood Business
5(a)	Special Uses (Church, Roads)
5(c)	Special Uses (Water Catchment)
6(a)	Open Space (Local)
6(c)	Open Space (Private)
7(l)	Environmental Protection (Plateau)

Wollondilly LGA Zones

RU1	Primary Production
RU2	Rural Landscape
E2	Environmental Conservation
SP2	Infrastructure
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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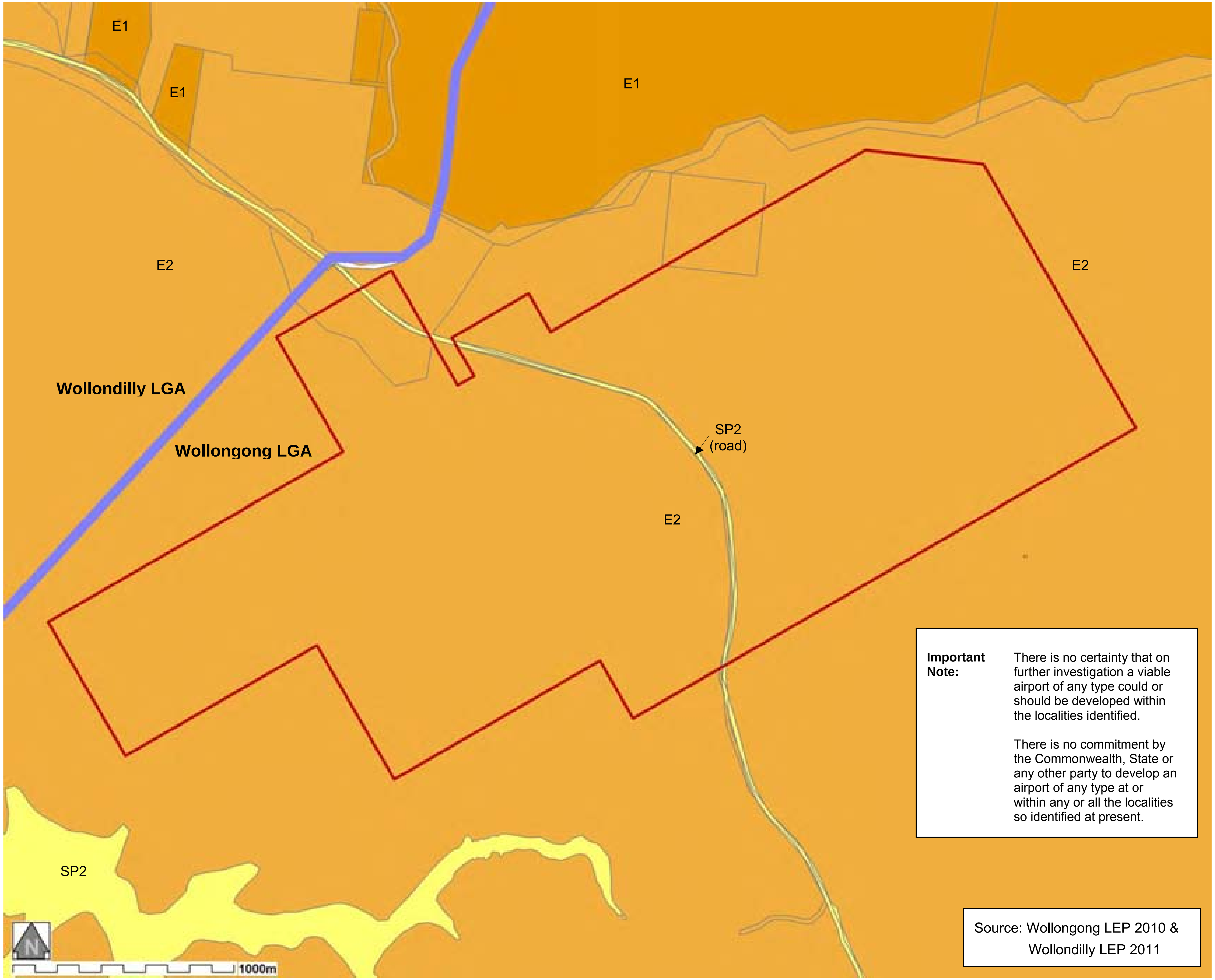
North Appin – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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Source: Wollongong LEP 2010 & Wollondilly LEP 2011

LEGEND

Zone	
B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
B4	Mixed Use
B5	Business Development
B6	Enterprise Corridor
B7	Business Park
E1	National Parks and Nature Reserves
E2	Environmental Conservation
E3	Environmental Management
E4	Environmental Living
IN1	General Industry
IN2	Light Industry
IN3	Heavy Industry
IN4	Working Waterfront
R1	General Residential
R2	Low Density Residential
R3	Medium Density Residential
R5	Large Lot Residential
RE1	Public Recreation
RE2	Private Recreation
RU1	Primary Production
RU2	Rural Landscape
RU4	Rural Small Holdings
RU5	Village
SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

WorleyParsons resources & energy

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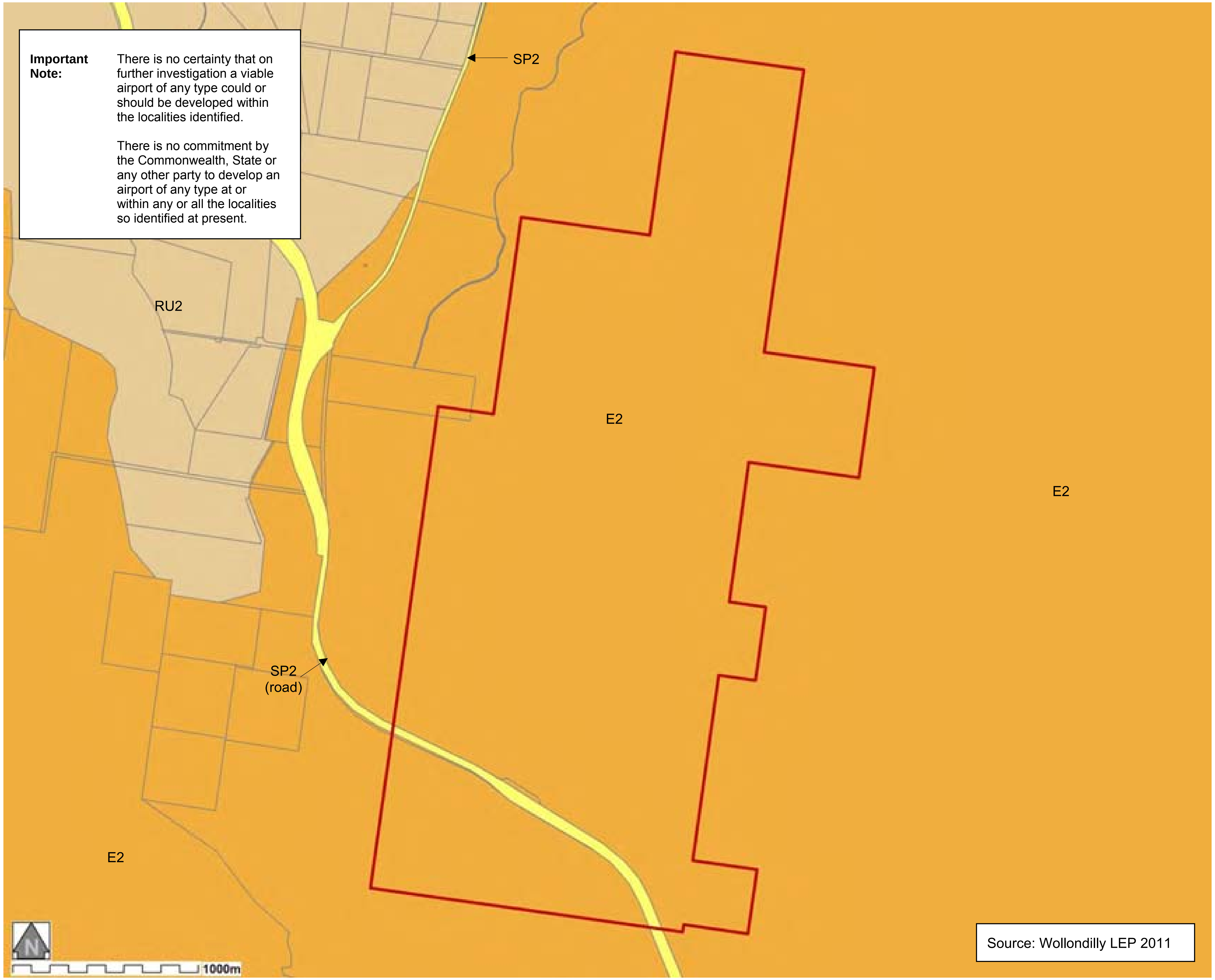
Southend – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
B4	Mixed Use
B5	Business Development
B6	Enterprise Corridor
B7	Business Park
E1	National Parks and Nature Reserves
E2	Environmental Conservation
E3	Environmental Management
E4	Environmental Living
IN1	General Industry
IN2	Light Industry
IN3	Heavy Industry
IN4	Working Waterfront
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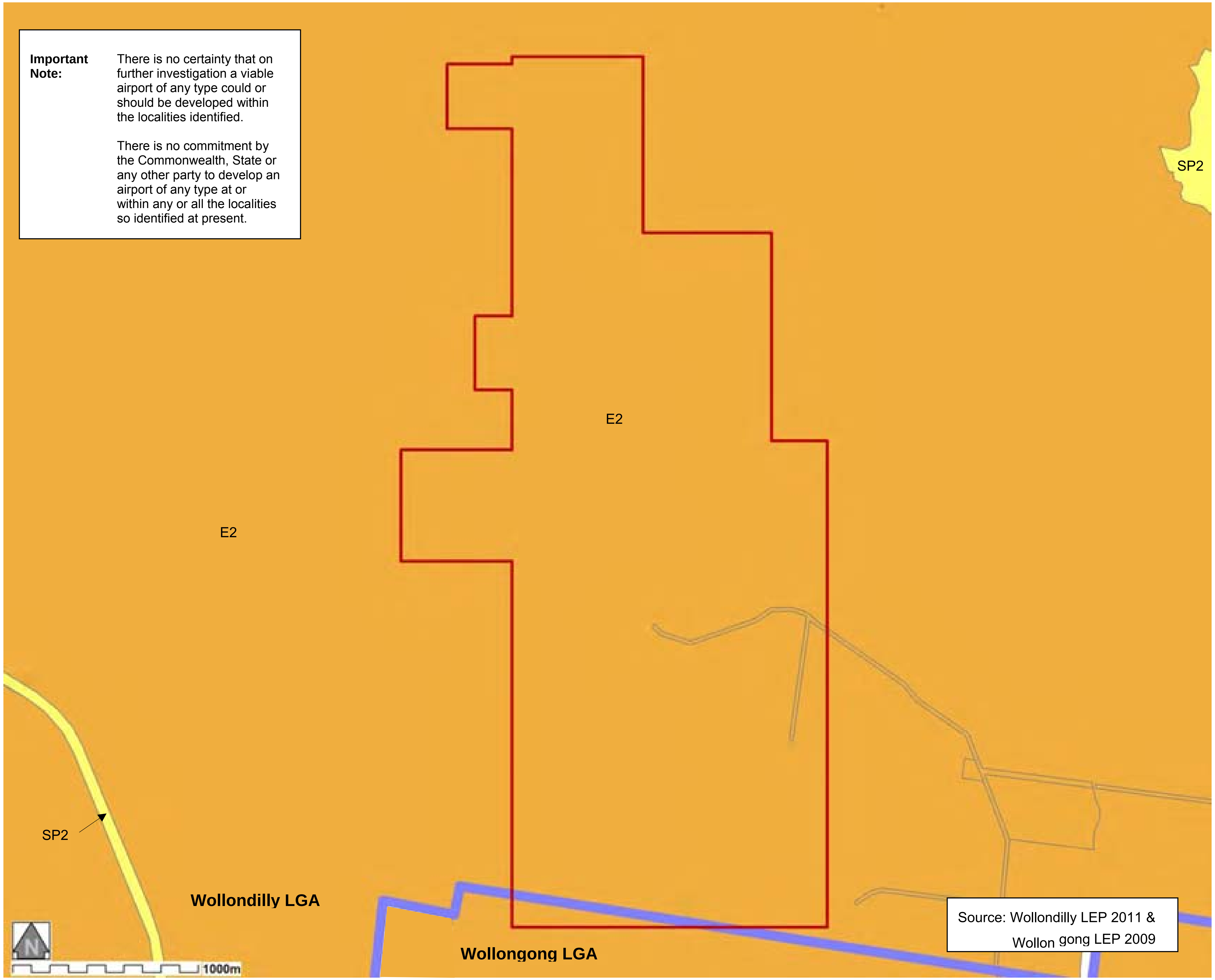
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

WorleyParsons resources & energy

AMPC Airport Master Planning Consultants

Wilton – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

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W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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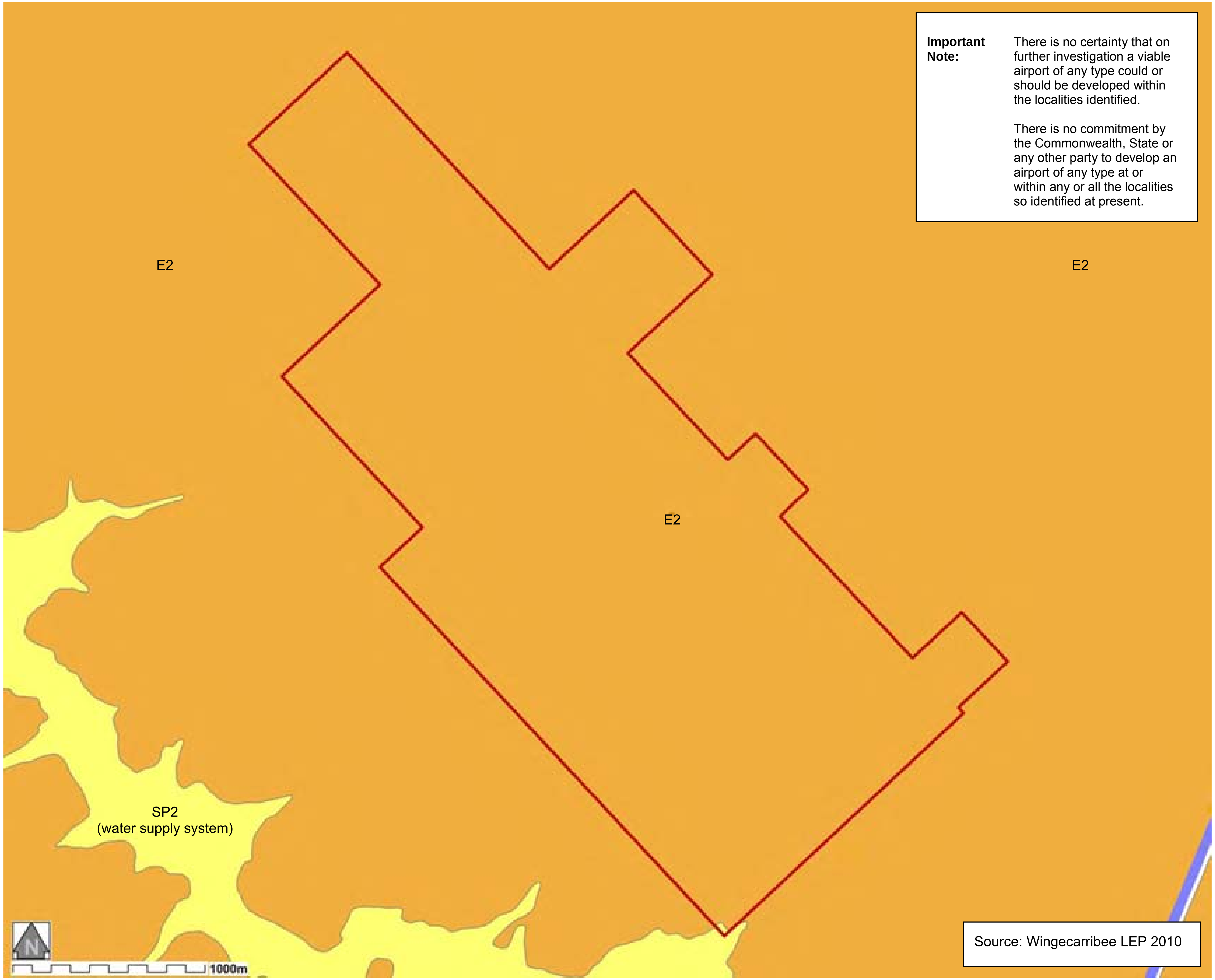
Wallandoola – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

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W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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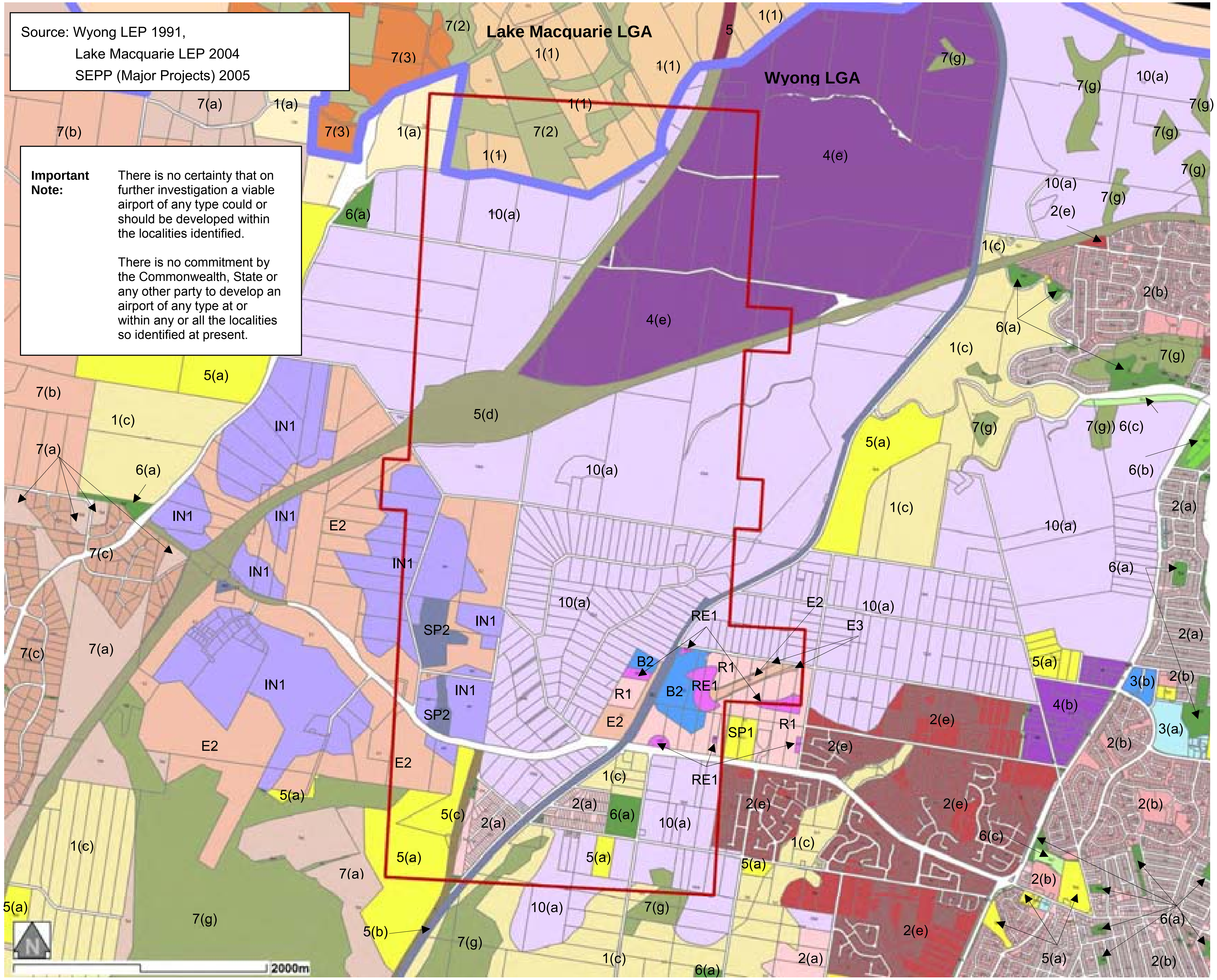
Dendrobium – Existing LEP Zoning
Airport Type 3 – Limited Service Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES

6

Appendix

Maximum Airport (Full Service International Airport) Site Zoning

Maximum Airport (Full Service International Airport) Site Zoning



LEGEND

Wyong LGA Zones

1(a)	Rural
1(c)	Non Urban Constrained Land Zone
2(a)	Residential
2(b)	Multiple Dwelling Residential
2(e)	Urban Release Area
3(a)	Business Centre
3(b)	Support Centre
4(b)	Light Industry
4(e)	Regional Industry & Employment Development
5(a)	Special Uses
5(b)	Special Uses – Railways
5(c)	Local Road Reservation
5(d)	Arterial Road Reservation
6(a)	Open Space & Recreation
6(b)	Regional Open Space & Recreation
6(c)	Proposed Open Space & Recreation
7(a)	Conservation
7(b)	Scenic Protection
7(c)	Scenic Protection – Small Holdings
7(g)	Wetlands Management
10(a)	Investigation Precinct
B2	Local Centre
E2	Environmental Conservation
E3	Environmental Management
IN1	General Industrial
R1	General Residential
RE1	Public Recreation
SP1	Special Activities (School)
SP2	Infrastructure (Water Management)

Lake Macquarie LGA Zones

1(1)	Rural (Production)
5)	Infrastructure
7(2)	Conservation (Secondary)
7(3)	Natural Resources
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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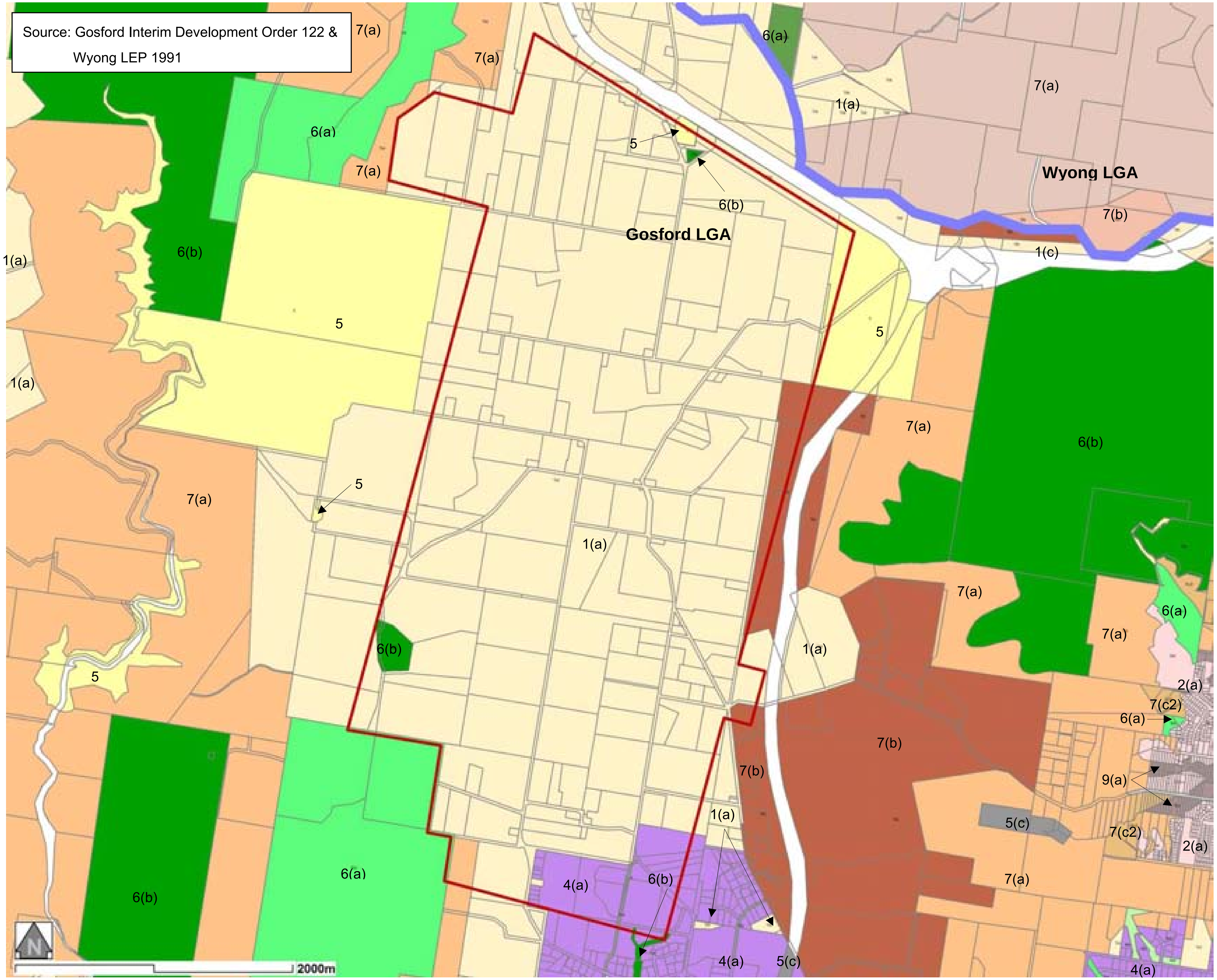
Wallarah – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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LEGEND

Gosford LGA Zones

1(a)	Rural – Agricultural
1(c)	Non Urban
2(a)	Residential
3(a)	Business – General
4(a)	Industrial – General
4(c)	Industrial – Extractive
5	Special Uses – General
5(b)	Special Uses – Railways
5(d)	Special Uses – Road Reservation
6(a)	Open Space – Recreation
6(b)	Open Space – Special Purpose
6(e)	Open Space – Proposed
7(a)	Environmental Protection - Conservation
7(b)	Environmental Protection – Scenic Protection
7(c2)	Scenic Protection – Rural Small Holdings
9(a)	Restricted Development – Flood Prone Land

Wyong LGA Zones

1(a)	Rural – Rural
6(a)	Open Space – Recreation
7(a)	Environmental Protection – Conservation
7(b)	Environmental Protection – Scenic Protection

Cadastre based data 17/05/2010 © NSW LPMA

LGA Boundaries

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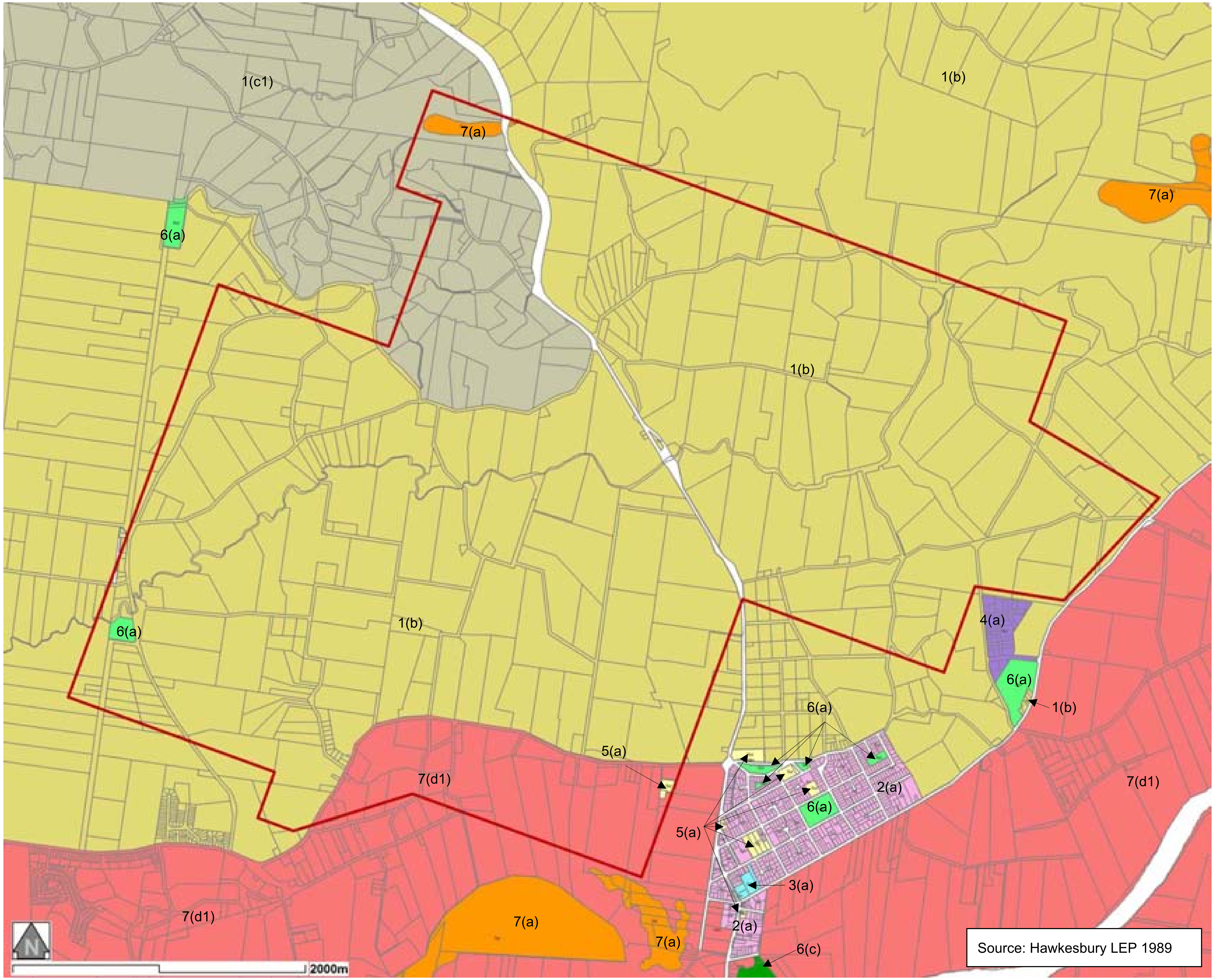
Somersby – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



Important Note: There is no certainty that on further investigation a viable airport of any type could or should be developed within the localities identified.

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Source: Hawkesbury LEP 1989

LEGEND

Zone

1(b)	Rural "B"
1(c1)	Rural "C1"
2(a)	Residential "A"
3(a)	General Business
4(a)	Industry General
5(a)	Special Uses "A"
6(a)	Open Space (Existing Recreation)
6(c)	Open Space (Private Recreation)
7(a)	Environmental Protection (Wetlands)
7(d1)	Environmental Protection (Scenic)
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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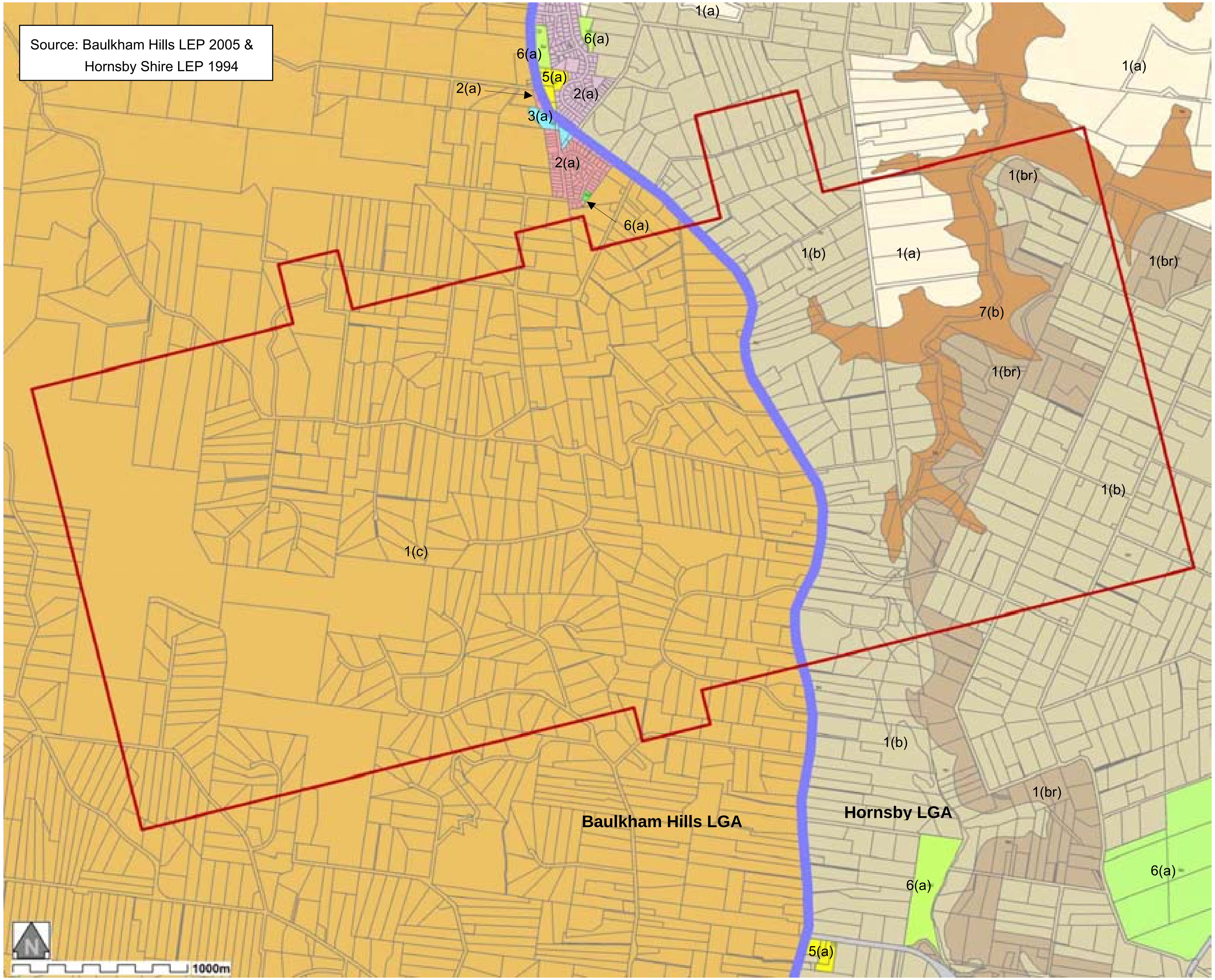
Wilberforce – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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LEGEND

Baulkham Hills LGA Zoning

1(c)	Rural
2(a)	Residential
3(a)	Business (Retail)
6(a)	Open Space

Hornsby LGA Zoning

1(a)	Rural Large Holding (Agricultural Landscapes)
1(b)	Rural Small Holding (Agricultural Landscapes)
1(br)	Rural Small Holding (Rural Landscapes)
2(a)	National Parks & Natural Reserves
5(a)	Environmental Conservation
6(a)	Rural Small Holdings
7(b)	Special Activities

Cadastre based data 17/05/2010
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LGA Boundaries

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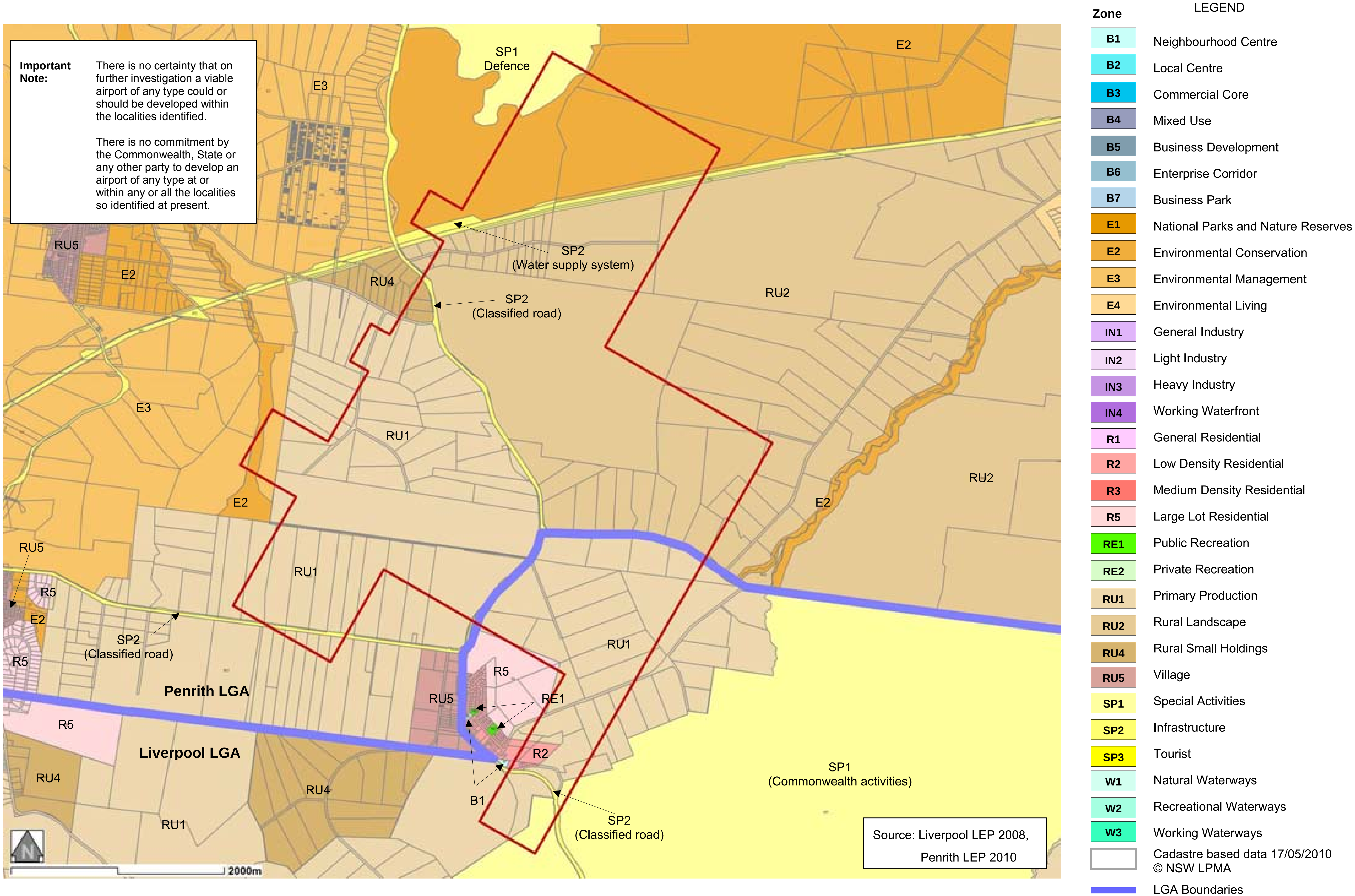
Glenorie – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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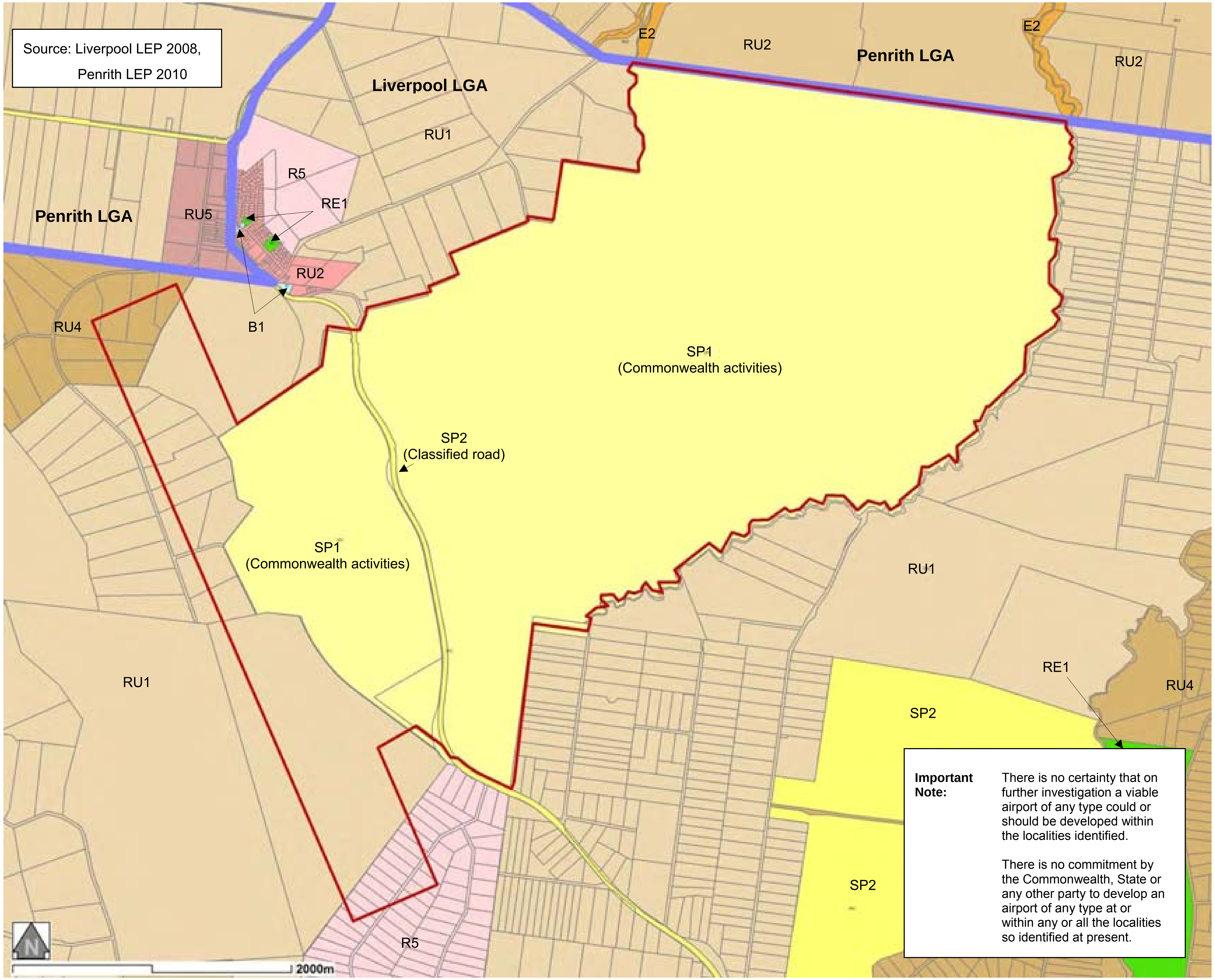
Luddenham – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



Zone	LEGEND
B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
B4	Mixed Use
B5	Business Development
B6	Enterprise Corridor
B7	Business Park
E1	National Parks and Nature Reserves
E2	Environmental Conservation
E3	Environmental Management
E4	Environmental Living
IN1	General Industry
IN2	Light Industry
IN3	Heavy Industry
IN4	Working Waterfront
R1	General Residential
R2	Low Density Residential
R3	Medium Density Residential
R5	Large Lot Residential
RE1	Public Recreation
RE2	Private Recreation
RU1	Primary Production
RU2	Rural Landscape
RU4	Rural Small Holdings
RU5	Village
SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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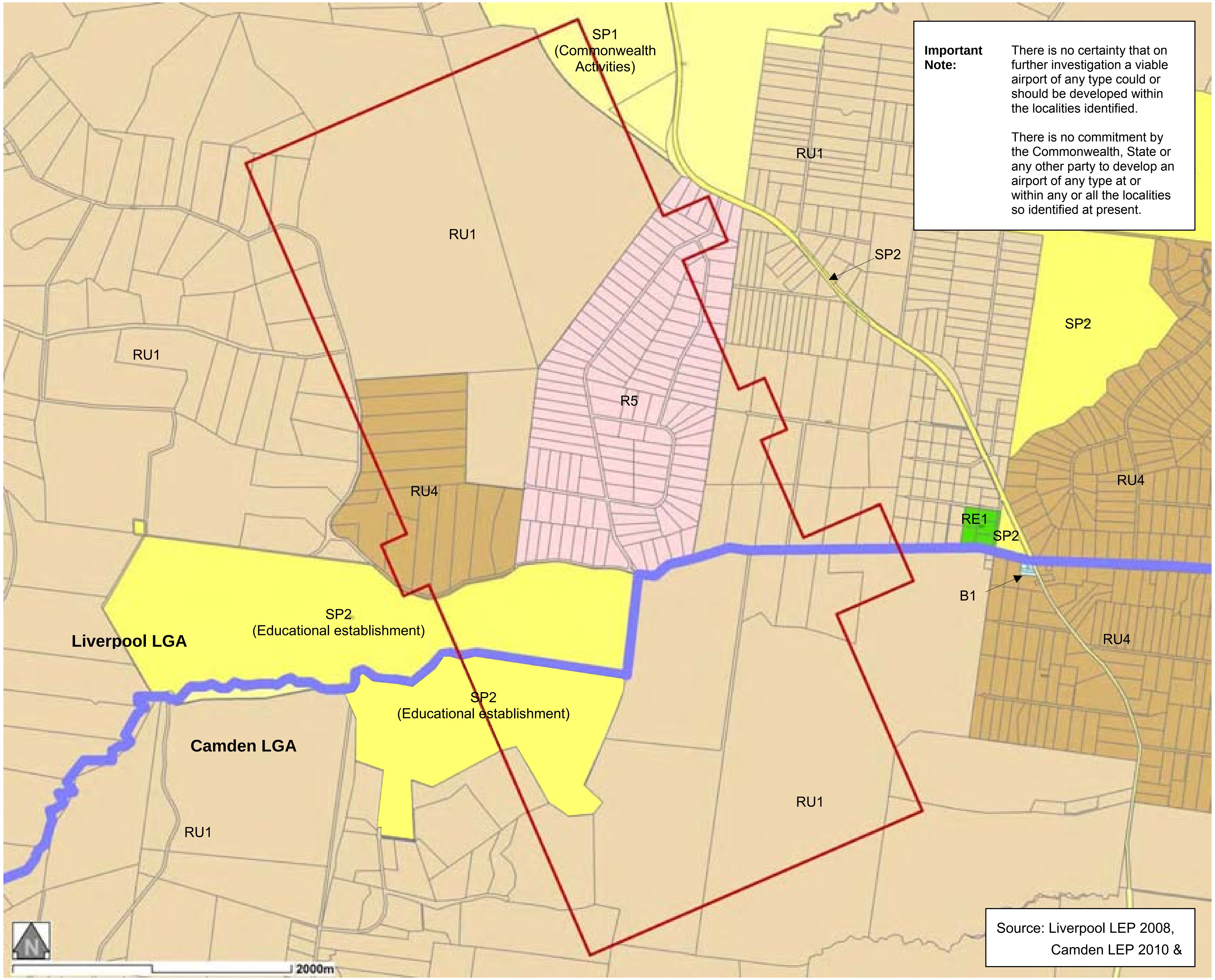
Badgerys Creek – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
B1	Neighbourhood Centre
B2	Local Centre
B3	Commercial Core
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B5	Business Development
B6	Enterprise Corridor
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SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
W3	Working Waterways
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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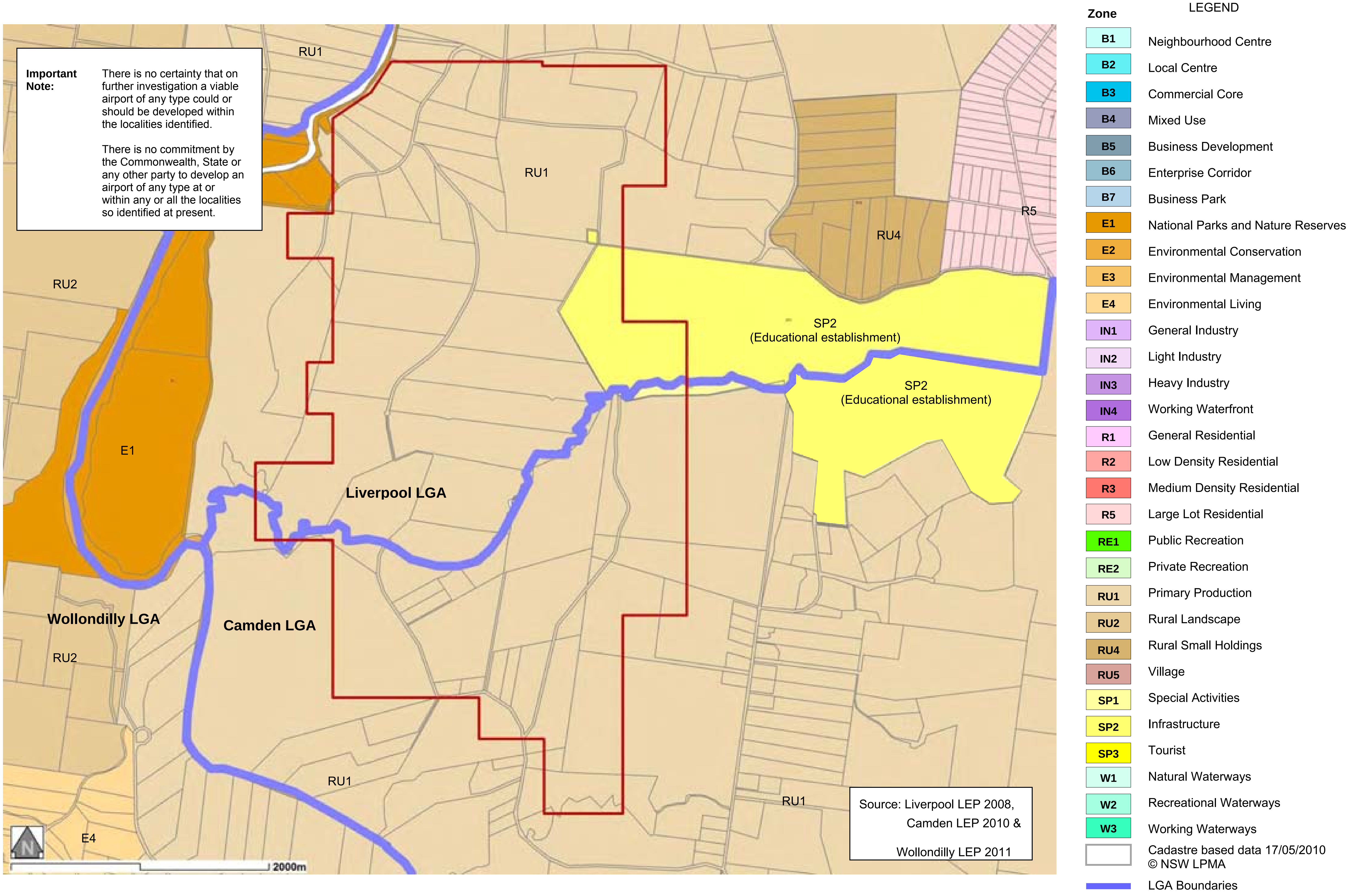
Bringelly – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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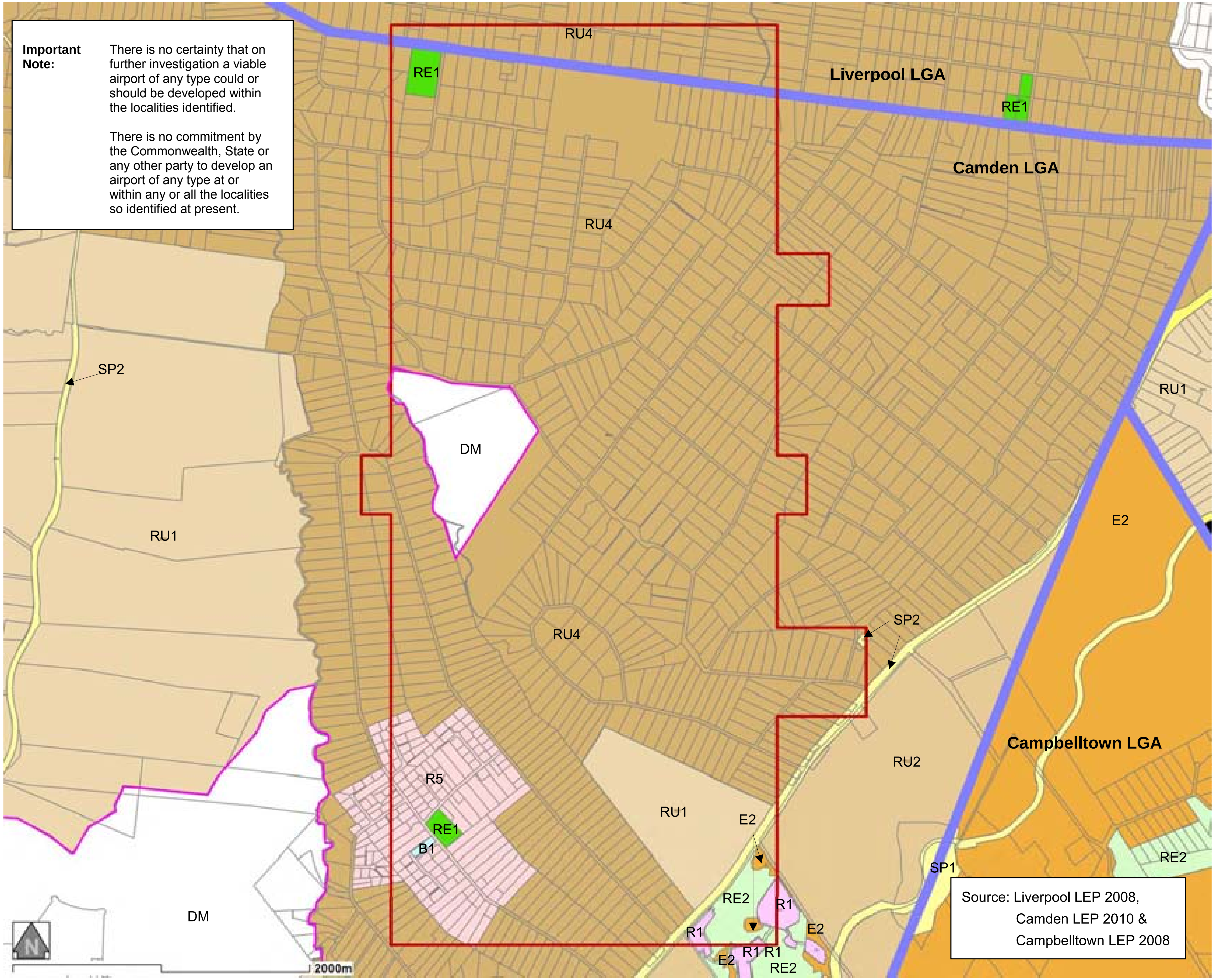
Greendale – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

Zone	
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B2	Local Centre
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RE1	Public Recreation
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RU1	Primary Production
RU2	Rural Landscape
RU4	Rural Small Holdings
RU5	Village
SP1	Special Activities
SP2	Infrastructure
SP3	Tourist
W1	Natural Waterways
W2	Recreational Waterways
DM	Deferred Matter
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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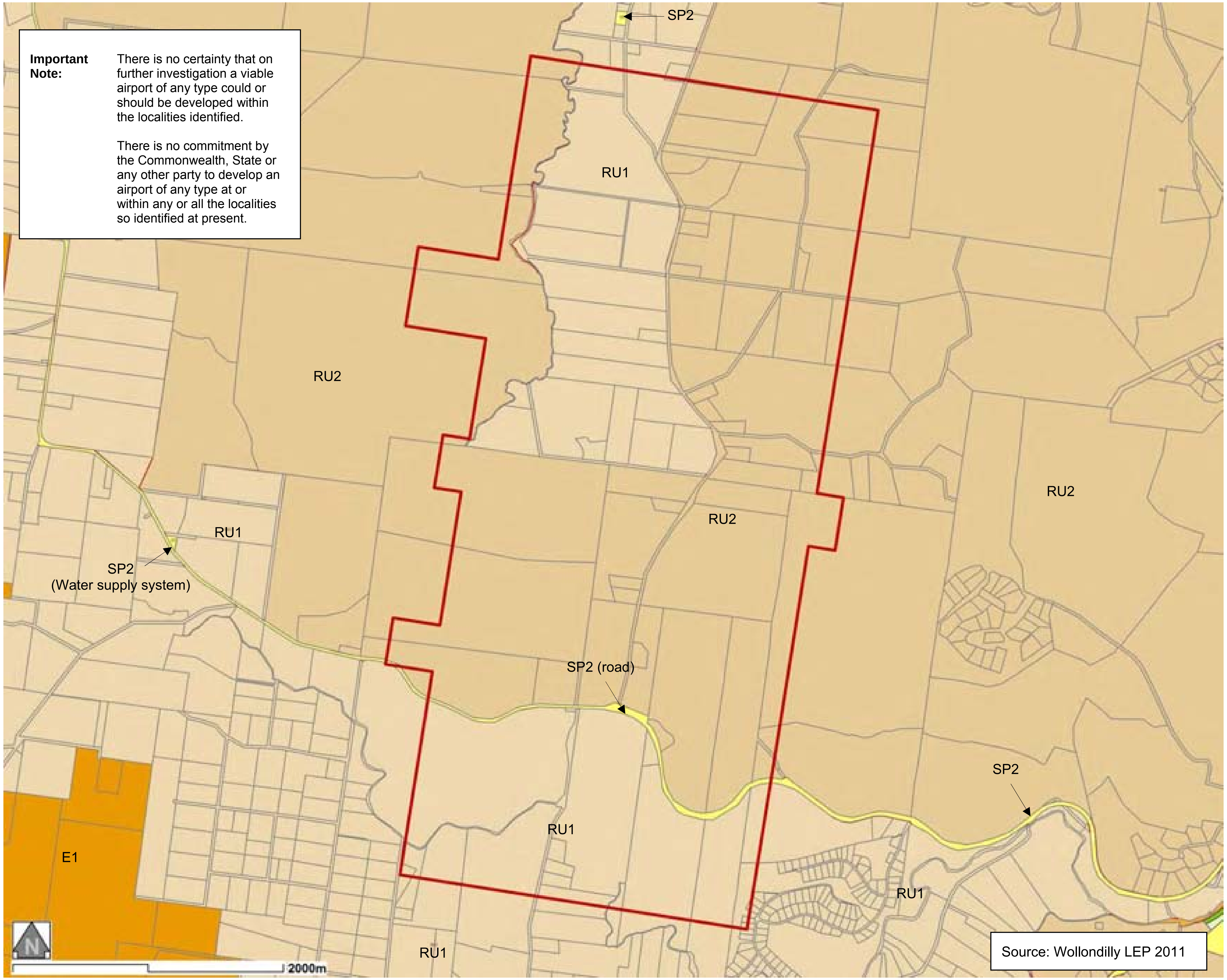
Catherine Field – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

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	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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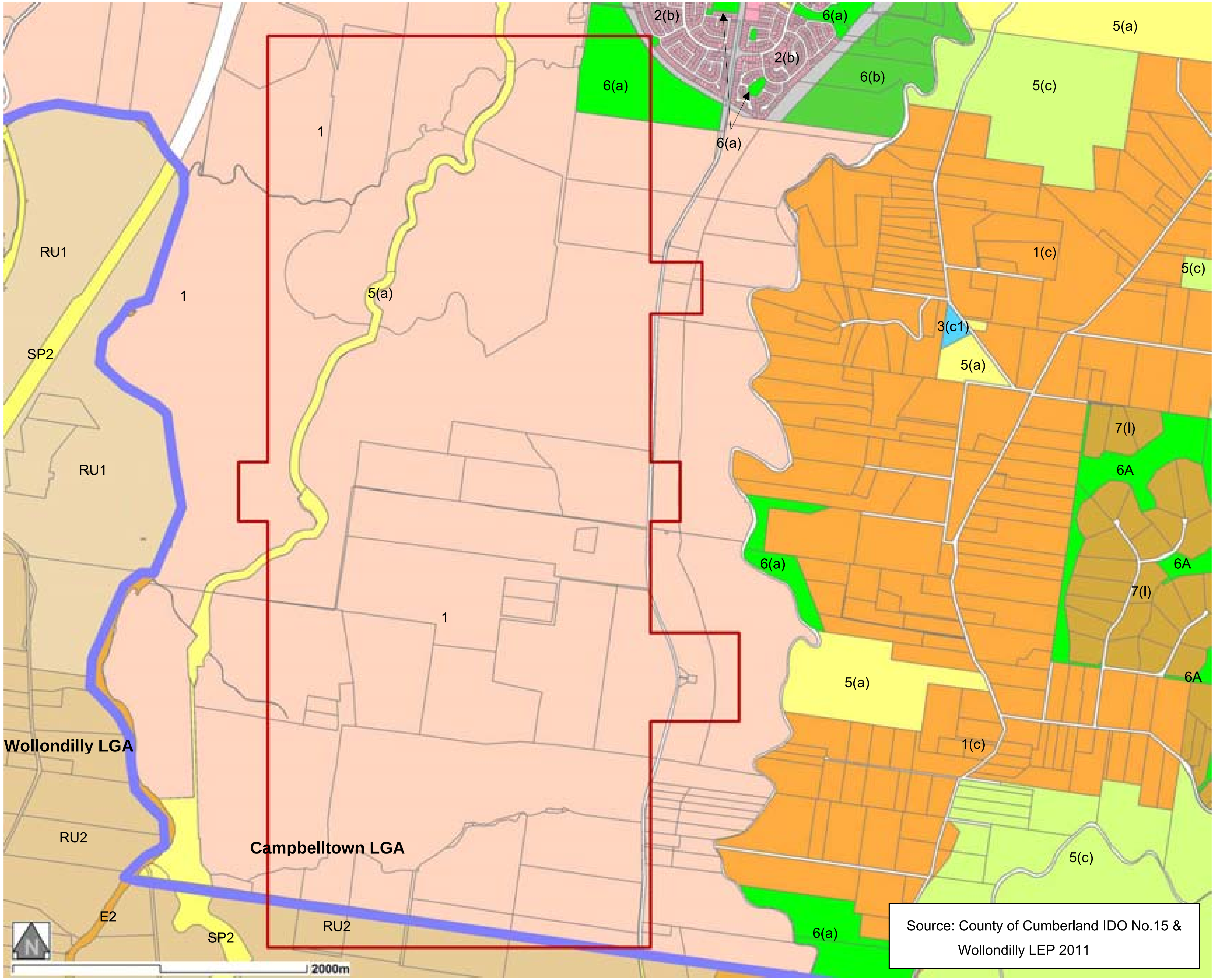
Mowbray Park – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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Source: County of Cumberland IDO No.15 & Wollondilly LEP 2011

LEGEND

Campbelltown LGA Zones

1	Non Urban
1(c)	Rural"C"
2(b)	Residential "B"
3(c1)	Neighbourhood Business
5(a)	Special Uses (Church, Roads)
5(c)	Special Uses (Water Catchment)
6(a)	Open Space (Local)
6(c)	Open Space (Private)
7(l)	Environmental Protection (Plateau)

Wollondilly LGA Zones

RU1	Primary Production
RU2	Rural Landscape
E2	Environmental Conservation
SP2	Infrastructure
	Cadastre based data 17/05/2010 © NSW LPMA
	LGA Boundaries

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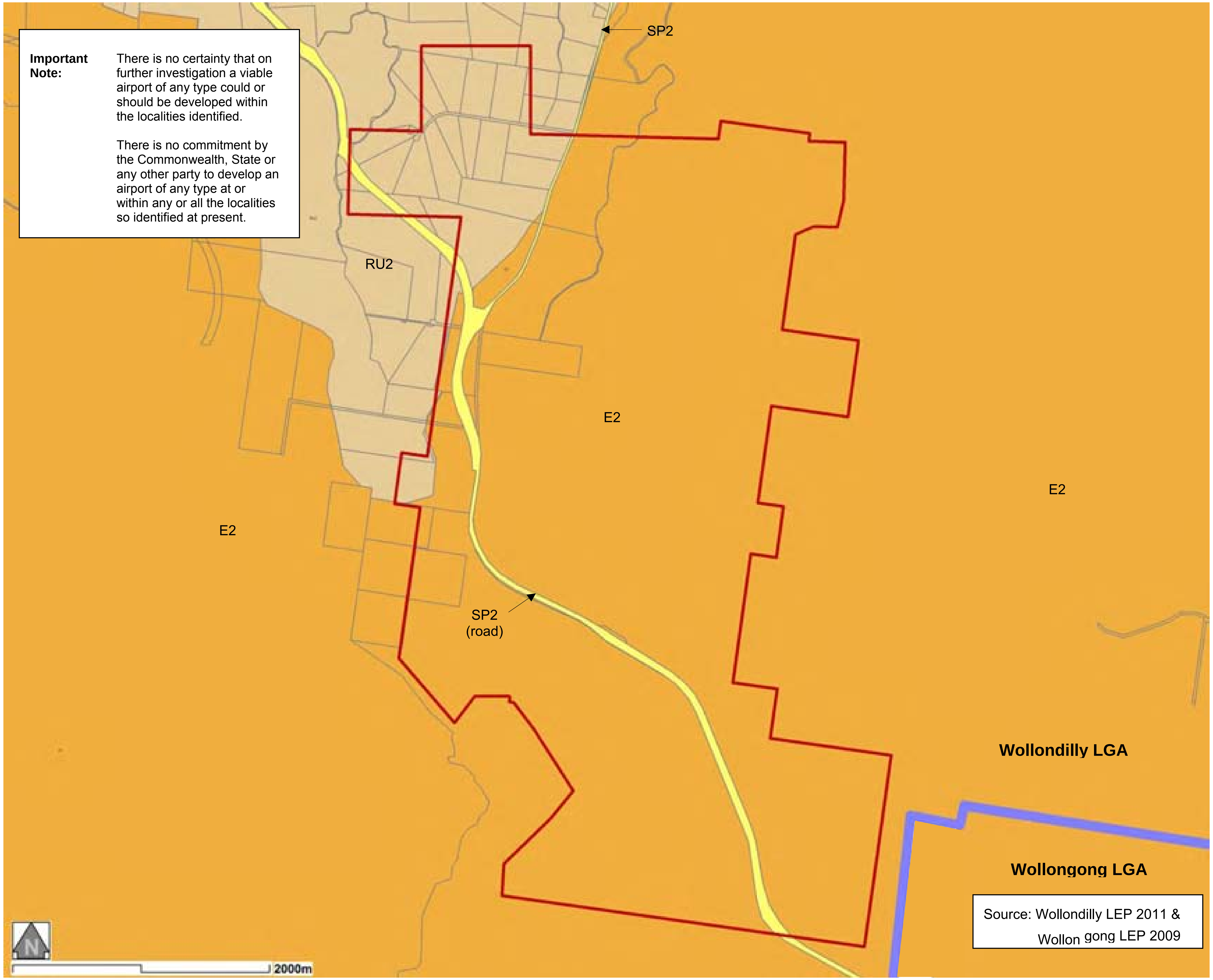
North Appin – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



LEGEND

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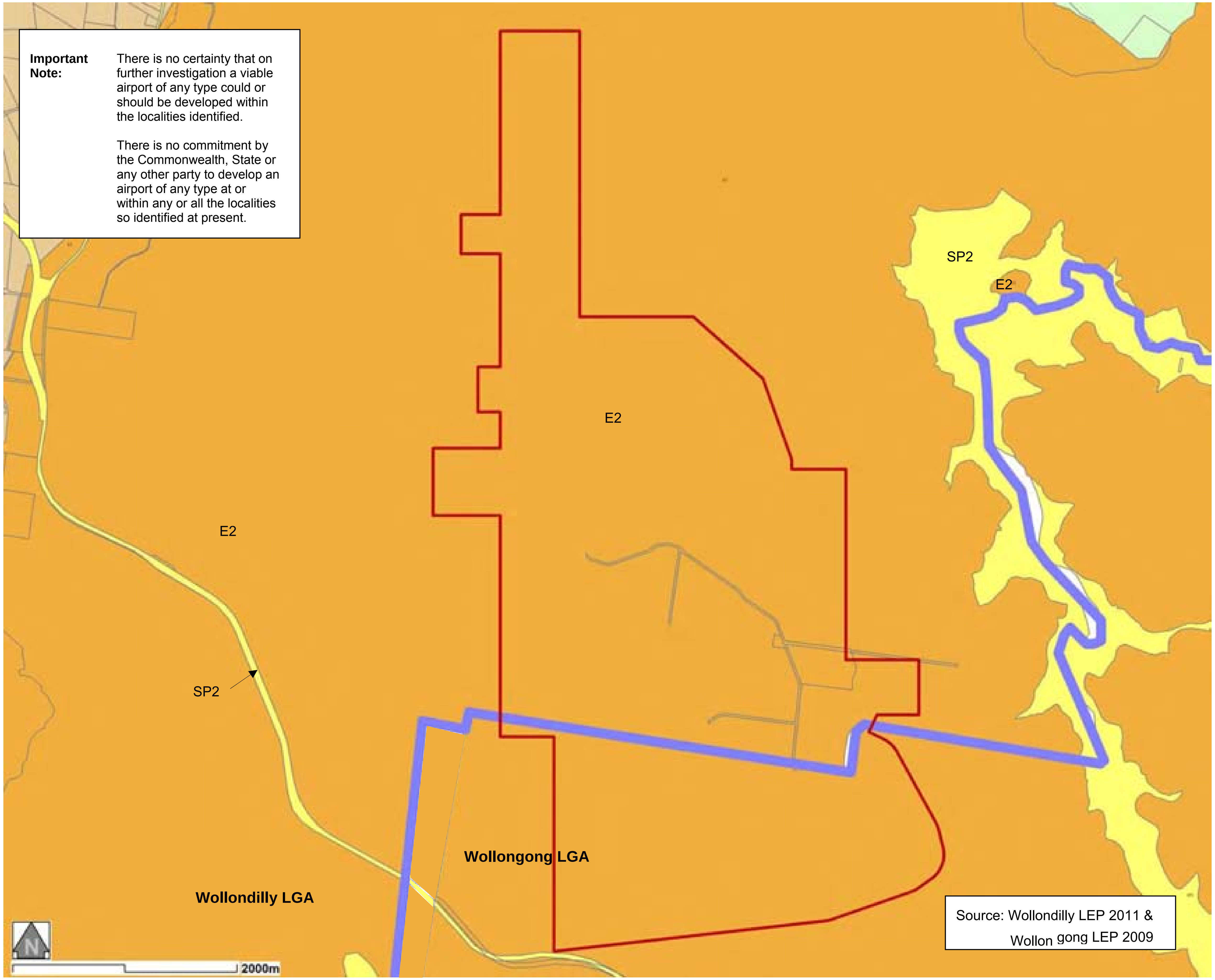
Wilton – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES



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	LGA Boundaries

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Wallandoola – Existing LEP Zoning
Maximum Airport Type – Full Service International Airport
AVIATION INFRASTRUCTURE
SUITABLE SITES STUDY – SPECIFIED LOCALITIES

Report on initial location analysis: airspace considerations

C12

JOINT STUDY ON AVIATION CAPACITY FOR THE SYDNEY REGION

AIRSERVICES AUSTRALIA

REPORT ON INITIAL LOCATION ANALYSIS

Executive Summary

As part of a joint Commonwealth and NSW State Government initiative to develop an Aviation Strategic Plan for the Sydney region, Airservices has been requested to undertake analysis in relation to aviation capacity in the Sydney region. Airservices' role is strictly limited to the provision of information relating to Air Traffic Management.

The task undertaken in this report is an initial analysis of potential site locations for additional aviation infrastructure. Locations analysed in this report are as supplied by the Sydney Aviation Capacity Branch of the Department of Infrastructure and Transport, comprising various broad geographic areas.

This analysis should be considered preliminary and is provided to the Department of Infrastructure and Transport as an initial report. The findings presented will require further analysis. In particular, the capacity estimates presented are considered nominal and will vary after detailed analysis on the various factors influencing specific locations.

This report is not intended for circulation beyond the Department and Steering Committee.

Airservices provides no warranty or guarantee as to the accuracy or completeness of this report. Readers should rely on their own enquiries and seek independent advice.

Airservices makes no representation, warranty or guarantee concerning any findings in this report. Any findings are to be treated as indicative only, and based on Airservices limited role in the overall study.

This report represents the view of Airservices and not the view of any individual person.

Key Findings

Broad Location Findings

Locations were analysed in the order presented in this report. At the conclusion of initial analysis it was evident that locations became generally less constrained by airspace and route structures as the analysis moved south; i.e. higher levels of constraint in the north and constraints easing with the lowest levels of constraint in the southern areas.

The primary influences on these constraints are:

1. Military Restricted Airspace – predominantly the areas associated with Williamtown RAAF operations driving a coincident compression of available airspace to accommodate civil route structures, and;
2. The current circuit structures servicing the various Sydney Airport Runway Modes of Operation.

Sub-Area Findings

1. Location 5 (North) is significantly constrained by existing military airspace associated with Williamtown RAAF and civil air-routes servicing Sydney. Significant access to current Military airspace is required at this location. The location would be independent to Sydney operations. The location is limited to single runway operations or segregated parallel runway operations.

   Nominal capacity is estimated to be 40 - 50 movements per hour for a single runway and 60 - 70 movements per hour for parallel runways.

2. Location 5 (Middle) is constrained by existing military airspace associated with Williamtown RAAF and significantly constrained by civil air-routes servicing Sydney. The location would be independent to Sydney operations. The location would allow mixed mode independent parallel runway operations.

   Nominal capacity is estimated to be 80 - 100 movements per hour.

3. Location 5 (South) is predominantly ridgelines and valleys in a north/south orientation in the western portion and populous areas in the eastern portion. This location is constrained by existing military airspace associated with Williamtown RAAF and severely constrained by civil air-routes servicing Sydney.

   Terrain in the Peats Ridge area will restrict the availability of wide spaced parallel runways. A cross runway configuration is not considered feasible and segregated parallel runway operations are most likely in this area at this site.

   The area south of Somersby may support a Type 1 aerodrome and independent parallel runway operations are feasible.

   Nominal capacity is estimated to be 40 - 50 movements per hour for a single runway and 60 -70 movements per hour for parallel runways at a Peats Ridge site.

   At a Somersby site, nominal capacity is estimated to be 80 - 100 per hour however this would be constrained by the requirement to integrate with Sydney traffic.

4. Location 10 (North) is predominantly rising terrain or flood prone. A relatively small area was assessed between Richmond airbase and a 10nm arc to the north. This location is significantly constrained by Sydney airport operations. Access to the route network is constrained by Military airspace (R559 series) to the northwest. The location will be interdependent with Sydney operations. Due to Sydney circuit constraints, segregated parallel runway operations are most likely.

   Nominal capacity is estimated to be 60 – 70 movements per hour.

5. For Location 10 (South), the area west of the Nepean River was not assessed due to terrain. This location is significantly constrained by Sydney airport operations. Access to the northern route network is constrained by Military airspace (R559 series) to the northwest. Military

Restricted Area (R536) Orchard Hills is within the circuit area. An aerodrome in this location will be interdependent with Sydney operations. Due to Sydney circuit constraints, segregated parallel runway operations are most likely.

Nominal capacity is estimated to be 60 – 70 movements per hour.

6. The western portion of Location 12 was not assessed due to terrain and water catchment area. This location is slightly less constrained by Sydney airport operations than Location 10. Access to the northern route network is constrained by Military airspace (R559 series) to the northwest. An aerodrome in this location will be interdependent with Sydney operations. Due to Sydney circuit constraints, segregated parallel runway operations are most likely.

   Nominal capacity is estimated to be 60 - 70 movements per hour.

7. The western portion of Location 13 was not assessed due to terrain and water catchment area. The location has a similar level of constraint imposed by Sydney airport operations as Location 12. Access to the southern route network requires integration with Sydney operations. An aerodrome in this location will be interdependent with Sydney operations. Due to Sydney circuit constraints, segregated parallel runway operations are most likely.

   Nominal capacity is estimated to be 60 - 70 movements per hour.

8. Location 14 is constrained by the occasional activation of artillery range firing above 3000FT at Holsworthy. For optimum route network access, the northern portion of Navy administered Tasman Sea Restricted Areas (R495A/B) would require redesign. The location is compatible with the application of the Sydney Long Term Operating Plan. A segregated airspace structure is possible, independent to Sydney airport operations. Independent parallel runway operations are feasible with no identified impediments for a cross runway configuration.

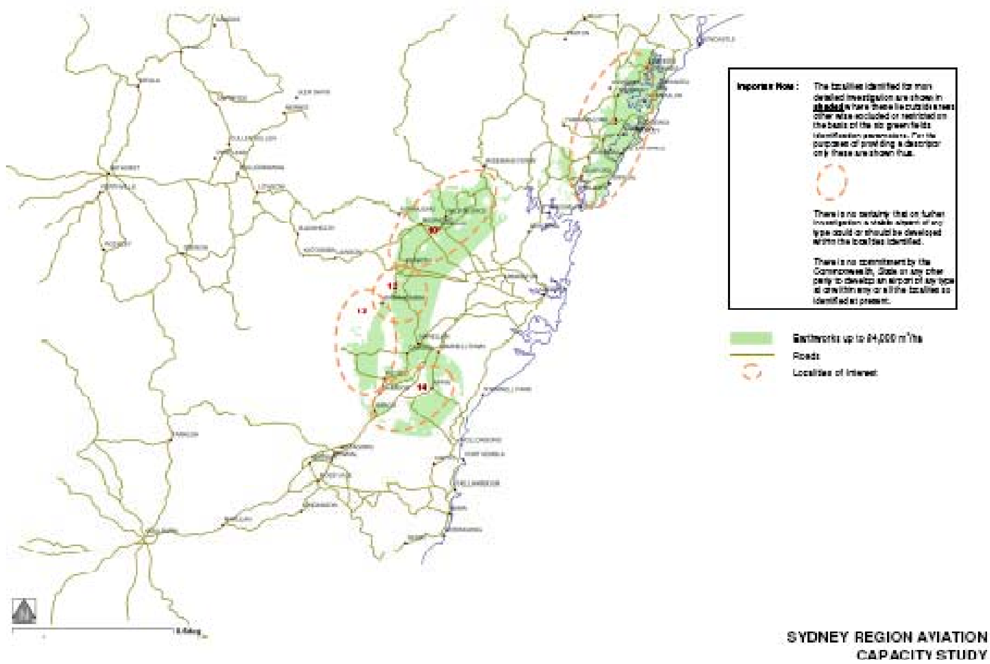
   Nominal capacity is estimated to be 80 - 100 per hour using the parallel runways, additional departure capacity may be realised with turbo-prop stub departures.

Summary

1. For Location 5, the middle area is least constrained.
2. For Location 10, the south area is least constrained.
3. Locations 5 (South), 10, 12 and 13 will be constrained by Sydney airport operations.
4. Site specific analysis within Locations 5 (South), 10, 12 and 13 will have minimal effect on the assessed level of constraint imposed by terrain and Sydney airport operations.
5. Location 14 has the least level of constraint.
6. A site east of the Hume Highway in Location 14 will reduce the impact on operations in western Class G airspace and at Camden Aerodrome.

7. A site east of the Hume Highway in Location 14 will better facilitate segregation from Sydney airport operations and access to main northern and southern air-routes.
8. Location 5 (Middle), Location 5 (South) and Location 14 are the only areas assessed as being able to support independent, mixed mode, parallel runway operations.

Locations Map



Assumptions

The following assumptions are applied to this analysis:

1. Current aviation rules, regulations and procedures
2. Current airspace, aerodrome and air-route structures, including current usage of same
3. Current volume and usage of Restricted Airspace
4. Areas of high terrain, national park, water catchments and significant population are excluded

Analysis and Assessment Methodology

This report contains a significant amount of technical detail for each location. The end of each location section provides a summary of assessment findings.

Locations with a large assessment area are broken into to sub-areas (e.g. North, South, and Middle). In these cases, an ATM compatibility assessment on the sub-area within a location is made.

The following general assessment criteria are summarised for each location or sub-area:

- Level of constraint imposed by the existing airspace infrastructure;
- Level of constraint imposed by the existing ATS route structure;

- Compatibility with existing certified[1] or registered[2] aerodromes;
- Compatibility with existing uncertified or unregistered aerodromes;
- Interaction with Sydney Airport operations (current operational configurations);
- Effect on the Long Term Operating Plan;
- Optimum runway alignment and feasibility;
- Operational efficiency – limitations and capacity estimate.

The technical assessment criteria are explained in detail below.

Runway Alignment
Possible runway alignments are assessed for each sub-area. The primary consideration in this assessment relates to terrain in the area affecting the arrival and departure airspace. This assessment influences the other assessment components and is therefore considered an essential starting point.

Grid Lowest Safe Altitude
Grid Lowest Safe Altitude (LSALT) is based on a grid of 1 degree square (60 square nautical miles) and represents the maximum height of any obstacle or landform in the grid area, plus 1000 feet. The Grid LSALT is provided as an indication of probable Lowest Safe Altitudes for routes servicing a particular location.

Controlled Airspace
An assessment of controlled airspace requirements is made for each sub-area.
Airspace design protocol assumptions around the primary aerodrome location are in accordance with CASA Advisory Circular 2-5-1 (0), Guidance for Controlled Airspace Design (March 2010):

- Class C CTR– 7nm from runway thresholds, SFC to 1,500FT;
- Adjacent Class C step (minimum 700FT) to approximately 10nm;
- Next Class C step 2500FT to 20nm.

It should be noted that parallel runway approaches in instrument flight conditions may require a larger portion of controlled airspace than described above.

The controlled airspace requirement for each location is not explicitly stated in the report as it is site specific. CASA design guidance is utilised to determine the potential effect of airspace establishment on relative aerodromes and restricted areas.

Restricted Airspace

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[1] **Certified Aerodrome:** An aerodrome with runway suitable for aircraft with more than 30 passenger-seats, or able to carry 3400kg, and is available for regular public transport or charter operations by such aircraft. Certified aerodromes have higher operating standards than registered aerodromes. (Certified by CASA under CASR subpart 139.B)

[2] **Registered Aerodrome:** An aerodrome which meets certain operating standards and is regularly inspected. (Registered by CASA under CASR subpart 139.C)

Locations are assessed against restricted airspace volumes which may affect air traffic management at a particular location. This assessment relates to the volume of airspace required to operate the proposed aerodrome and access to the route network against any restricted airspace impediments or dependencies. Restricted airspace impediments and dependencies are also assessed in detail in the route structure assessment.

Aerodrome Type

Locations are assessed for Type 1[3] and Type 3[4] aerodromes. A specific assessment is made for Type 1 aerodromes, including cross runway considerations, at each location. In some locations, a Type 1 aerodrome option is assessed to be incompatible, due to terrain constraint.

Metroplex Interdependency

"Metroplex" interdependency is assessed for each area. A Metroplex can be defined as a situation where the proximity of individual airports does not allow the operation of those airports as individual entities, but rather as members of a larger, interdependent group. This assessment relates to the level of operational dependency of a particular location with Sydney airport operations. For example, if Sydney airport was operating a particular runway direction or Mode of Operation, the other aerodrome would be required to operate in a compatible runway direction or traffic pattern.

Access Lanes to Relative Aerodromes

The assessment for access lanes to relative aerodromes relates to the feasibility of aircraft transit outside controlled airspace associated with the proposed aerodrome site. This assessment mainly considers visual navigation cues, terrain, altitude containment and distance from coast for the establishment of light aircraft transit lanes.

Manoeuvring around Relative Aerodromes

The assessment for manoeuvring around relative aerodromes relates to the containment of aircraft operations in the circuit area and, for this assessment, within 4nm[5] of the relative aerodrome. Controlled Airspace Design protocol is applied in the airspace surrounding the proposed aerodrome site and the possibility of circling area infringement of controlled airspace by aircraft operating at the relative aerodrome is assessed. This section of the report only mentions relative aerodromes where this may occur.

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[3] **Type 1 aerodrome:** Full scale international airport; up to full A380; 2 X 4000m parallel runways (2km separation) + 1 X 3000m cross runway; 70-120 mill passengers per annum; up to 130 movements per hour.

[4] **Type 3 aerodrome:** Low Cost Carrier regional overflow (domestic and short haul international); up to B787/A330; 1 X 3000m runway; 6-10 million passengers per annum; 75,000 movements per annum.

[5] 4nm based on IFR circling area radius of 2.66nm for Performance Category B aircraft (V_{at} speed between 91 and 120 knots IAS) plus a 1nm buffer.

LTOP
The LTOP assessment relates to identified impediments to the application of the Long Term Operating Plan for Sydney Airport.

Hours of operation
This assessment relates to populous areas in the vicinity of the location or underneath probable flight-paths. An “hours of operation” determination is based on consideration of the effect on surrounding communities during night hours. This determination is speculative and should not be regarded in any way as an environmental assessment.

Route Structure
The route structure assessment relates to access from each sub-area to and from existing routes on the network. In some cases, a determination is made regarding the possibility of amendments or additions to the current route network. This assessment also considers the relationship of the location to the route network against existing restricted airspace in the area. Aerodrome type does not influence the route structure assessment.

Operating Plan
The operating plan assessment relates to terminal area design and operation, including identified constraints to optimum design, operating plan limitations and a capacity estimation.

Optimum design for parallel runways allows independent mixed mode runway operations[6]; arrival/departure direction based contra-rotational circuits and arrival-departure path segregation using vertical profile compatible segregated airspace blocks.

Single runway airspace design is significantly simpler than parallel runway airspace design due to the flexible availability of circuits on either side of the runway and a commensurate reduction to flight-path conflict points when compared to parallel runway airspace design.

Reference Documents
1. Sydney and Newcastle/Williamtown Visual Terminal Chart (VTC)
2. Terminal Area Chart 5 (TAC-5)
3. Designated Airspace Handbook (DAH)
4. Departure and Approach Procedures (DAP East)
5. Sydney Radar Terrain Clearance Chart
6. CASA Advisory Circular 2-5-1 (0), Guidance for Controlled Airspace Design
7. ICAO Annex 14, Volume 1, Section 3
8. ICAO Pans-ATM (Doc 4444), Section 6.7

[6] Mixed mode is arrivals and departures on both runways – capacity in the order of 50 per hour per runway. Segregated runway operations are arrivals to one runway and departures from the other runway – capacity in the order of 25 per hour per runway.

Locations Analysis

Location 5 North (Central Coast)

Runway alignment (assumed)
NNE/SSW to NE/SW

Grid LSALT
3500FT AMSL

Restricted airspace

- R578C 10nm to E, base 4,500FT (flying training and Williamtown terminal area manoeuvring).
- Williamtown Military Control Zone (and R578A overlying) 13nm to the NE.
- Singleton range areas (Army) R564A (SFC to 4000FT and R564B above 4000FT by NOTAM, normally up to 12,000FT) also used for "Black Dagger" exercises by air strike assets at least 4 times per year for two week blocks and a component of the FCI (top gun) course once every two years. Transit from Williamtown is by declared Temporary Restricted Area between existing Singleton and Williamtown Restricted Areas.
- R489 (Navy) (Fire Bombing and Radar Tracking, SFC up to 60,000FT) activated by NOTAM, 40nm to the SE.
- R559 series 40nm to the W.

Relative aerodromes

- Williamtown RAAF 25nm to NNE
- Cooranbong in immediate vicinity
- Cessnock 15nm to N
- Maitland 20nm to N
- Warnervale 10nm to S

Access lanes to relative aerodromes

- Light aircraft transit lane are compatible to the east (a track via Newcastle to the coast at 1,500), but problematic to the west due to the Singleton Restricted Areas, rising terrain and lack of visual navigation cues.
- For a Type 1 airport with an East/West runway, a coastal transit lane would be below 700FT in order to avoid the CTR.
- The proposed transit lanes would concentrate General Aviation aircraft over current populous areas.

Manoeuvring around relative aerodromes

- Cooranbong will be severely restricted due to proximity.

- Manoeuvring to the north of Warnervale will be restricted by the CTR boundary. Controlled airspace required for parallel runway arrivals in IMC may severely restrict operations.

Route structure

- **Network access to other aerodromes**
    - Williamtown is the primary consideration:
        - Low incidence of Military travel flights – primary activities are non-travel (Military operations) which do not require access to the civil network.
        - Any military travel flights are issued with clearances which conform to the civil traffic pattern.

- **Into network (Departures)**
    - Jet departures to the North will not have the required track miles to meet vertical requirements to join the Civil Jet Corridor (H185) over WLM airspace. Jet departures will require tracking via WMD and will be required to climb through Sydney turbo-prop departures on the (northbound) WMD (W220) route.
    - A feasible option is a redesign of routes emanating from RIC to allow establishment of new inbound routes in the H12 / W365 area. This will free up airspace in the Hunter region to accommodate additional departure routes clear of Williamtown airspace.
    - Normal climb profiles for all civil aircraft types would not achieve vertical clearance with R578E (Williamtown Terminal Operations, SFC to 10,000FT) 12nm north of the location.
    - Departures to the East are restricted by R574 (RAAF) (Military Flying Training, SFC to 60,000FT) and R489 (Navy) (Fire Bombing and Radar Tracking, SFC up to 60,000FT). R574 in particular will require a civil corridor to facilitate civil departures.
    - Increased route crossing points in the en-route Oceanic Sector, northeast of Sydney. Although this airspace has radar surveillance, the additional complexity will require detailed assessment.
    - Departures to the West will be required to integrate with Sydney traffic to join the western departure routes emanating from Sydney. This will impose a complex airspace structure in an already constrained and busy area. The most viable option is a corridor through R559 series.
    - Departures to the West will be held below optimum vertical profile due the requirement to cross the dual inbound tracks to Sydney.
    - Departures to the South would need to mimic Eastern departures, track via DONIC to join W778.

- **Out of network (Arrivals)**
    - Arrivals from the North – if via current routes, main issue is arrival sector complexity handling streams to both airports (Sydney and new location).
    - A feasible option is to establish a segregated route between H62 and W342.

- Feasibility exists to redesign routes emanating from RIC to allow establishment of new inbound routes in the H12 / W365 area.
- Arrivals from the East are restricted by R574 (RAAF) (Military Flying Training, SFC to 60,000FT) and R489 (Navy) (Fire Bombing and Radar Tracking, SFC up to 60,000FT). R574 in particular will require a civil corridor.
- Increased route crossing points in the en-route Oceanic Sector, northeast of Sydney. Although this airspace has radar surveillance, the additional complexity will require detailed assessment.
- Arrivals from the West require a corridor through R559 series – integration with Sydney arrival traffic streams is not considered a viable option.
- Arrivals from the West will be forced below optimum vertical profile due crossing dual inbound tracks to Sydney.
- Arrivals from the South will be extremely problematic with any volume of traffic due to conflictions with Sydney departure tracks H185 and W139 (climbing/descending conflictions) and limited options for additional routing except for significantly east of the coast (approximately 25nm east and underneath Sydney jet departure routes) – this option would have an effect on southern departures from this location, pushing that track out to in excess of 30 miles east of the coast.

LTOP
Nil effect

Hours of operation
Compatible H24 (assumed runway alignment operations would avoid populous areas)

Metroplex dependencies
No interdependency with Sydney airport.

<u>Type 1 aerodrome</u>

Cross runway considerations

- Populous areas to the east.
- R578C could be a minor issue – airspace below 4,500FT is available for civil use.
- R578B (SFC to 12,500FT) within 10nm of final approach, is a significant constraint on the arrival circuit.
- D567 (Lake Munmorah Power Station) – close to centreline and may pose plume issues for circuit traffic.
- Plume issues from other power stations will limit flight path options to the east of the area.
- Current coastal recreational flying activities (hang gliding etc.) may encounter wake turbulence from aerodrome traffic.

Operating Plan

For a Type 1 aerodrome, mixed mode runway operations are limited by Military (Singleton and Williamtown) airspace – segregated runway and airspace operations will be problematic due to restricted airspace constraining the circuit area.

- Southern runway flow: departures from the eastern runway, arrivals to the western runway.
- Northern runway flow: departures from the western runway, arrivals to the eastern runway.

Segregated operations will impose a capacity constraint in the order of 60 - 70 movements per hour.

Summary

Level of constraint imposed by the existing airspace infrastructure
Significant constraints due to proximity of Williamtown RAAF terminal airspace and Singleton Army range.

Level of constraint imposed by the existing ATS route structure
Due to Military airspace, there is limited civil airspace in this area. This constrains existing route structures. Major issues with this location:

- the ability to access routes to the east and west are constrained by Military airspace
- Access to and from the north requires integration with Sydney traffic and additional routes in a confined area in order to segregate turbo-prop and jet aircraft.
- Departures to the south will require significant extra track miles due to the requirement to clear the Sydney traffic route structures.
- Arrivals from the south will conflict with Sydney Jet departures in a climbing/descending configuration with limited scope to build a segregated route structure.

Compatibility with existing certified or registered airports

- Maitland – compatible circuit area, restrictions in surrounding airspace.

Compatibility with existing uncertified or unregistered airports

- Cessnock - compatible circuit area, restrictions in surrounding airspace.
- Cooranbong – incompatible.
- Warnervale – compatible circuit area, but vertical restrictions would apply (0 – 1500’), parallel runway arrival operations may impose additional restrictions, restrictions in surrounding airspace.

Interaction with Sydney Airport operations
Main issues relate to integration with routes servicing Sydney, in particular:

- Conflictions with northern jet departure route ex-Sydney.
- Segregating jets from turbo-props on routes into and out of Sydney.
- Access to and from the East and West will require additional (conflicting) routes in an already constrained and busy environment.

Effect on the Long Term Operating Plan
Nil effect

Optimum runway alignment and feasibility

- Alignment relative to escarpment (west of the location) indicates NNE to NE.
- East / West alignment would entail overflight of existing residential areas, coupled with terrain to the west, considered not compatible.

Operational efficiency

Limited to single runway operations or segregated parallel runway operations**.** Nominal capacity is estimated 40 - 50 per hour for a single runway or 60 - 70 per hour for parallel runways.

There are no consultant specific assessed locations in this area.

Location 5 Middle (Central Coast)

Runway alignment (assumed)
NNE/SSW to NE/SW
E/W runway assessed to be constrained by terrain to the West.

Grid LSALT
3500FT AMSL

Restricted airspace

- R578C 15nm to NE, base 4,500FT (Williamtown terminal area manoeuvring and flying training).
- Williamtown Military Control Zone (and R578A overlying) 25nm to the NE.
- R489 (Navy) (Fire Bombing and Radar Tracking, SFC up to 60,000FT) activated by NOTAM, 30nm to the SE.
- R559 series 40nm to the W.
- Richmond Military CTR (SFC to 2,500FT) and R493, R468 overlying 25nm to the W.

Relative aerodromes

- Williamtown RAAF 30nm to NNE
- Cooranbong 15nm to N
- Warnervale in immediate vicinity
- Somersby 10nm to S
- Mangrove Mountain (winched gliding) 10nm to SW

Access lanes to relative aerodromes

- Light aircraft transit lane compatible to the East (track via Newcastle to coast at 1,500).
- Light aircraft transit lane is problematic to the West due to rising terrain and lack of visual navigation cues.
- For a Type 1 aerodrome, an E/W runway will push the coastal transit lane to an altitude below 700FT.
- A coastal transit lane would concentrate General Aviation aircraft over populous areas.

Manoeuvring around relative aerodromes

- Warnervale, Somersby and Mangrove Mountain would be within Terminal Area airspace.
- Manoeuvring to the south of Cooranbong will be restricted by the CTR boundary. Controlled airspace required for parallel runway arrivals in IMC may further restrict operations.

Route structure

- **Network access to other aerodromes**
    - Sydney airport operations need to be integrated with operations at this site.
    - Williamtown remains a consideration but less so than with Location 5 North:
        - Low incidence of Military travel flights – primary activities are non-travel or "fighting" activities which do not require access to the civil network.
        - Any military travel flights are issued with clearances which conform to the civil traffic pattern.

- **Into network (Departures)**
    - Jet departures to the North will not have the required track miles to meet vertical requirements to join the Civil Jet Corridor (H185) over Williamtown airspace. Jet departures will require tracking via WMD and will be required to climb through Sydney turbo-prop departures on the (northbound) WMD (W220) route.
    - Departures to the East are restricted by R574 (RAAF) (Military Flying Training, SFC to 60,000FT) and R489 (Navy) (Fire Bombing and Radar Tracking, SFC up to 60,000FT). R574 in particular will require a civil corridor to facilitate civil departures.
    - Increased route crossing points in the en-route Oceanic Sector, northeast of Sydney. Although this airspace has radar surveillance, the additional complexity will require detailed assessment.
    - Departures to the West will be required to integrate with Sydney traffic to join the western departure routes emanating from Sydney. This will impose a complex airspace structure in an already constrained and busy area. The most viable option is a corridor through R559 series.
    - Departures to the West will be held below optimum vertical profile due to the requirement to cross the dual inbound tracks to Sydney.
    - Departures to the South would need to mimic Eastern departures, track via DONIC to join W778.

- **Out of network (Arrivals)**
    - Arrivals from the North – if via current routes, main issue is arrival sector complexity handling streams to both airports (Sydney and new location).
    - A feasible option is to establish a segregated route between H62 and W342/274.
    - Feasibility exists to redesign routes emanating from RIC to allow establishment of new inbound routes in the H12 / W365 area.
    - Arrivals from the East are restricted by R574 (RAAF) (Military Flying Training, SFC to 60,000FT) and R489 (Navy) (Fire Bombing and Radar Tracking, SFC up to 60,000FT). R574 in particular will require a civil corridor.
    - Increased route crossing points in the en-route Oceanic Sector, northeast of Sydney. Although this airspace has radar surveillance, the additional complexity will require detailed assessment.
    - Arrivals from the West require a corridor through R559 series – integration with Sydney arrival traffic streams is not considered a viable option.

- o Arrivals from the West will be forced below optimum vertical profile due to the requirement to cross the dual inbound tracks to Sydney. The required vertical profile will be worse than Location 5 North. The alternative entails significant additional track miles to approach the aerodrome from the North.
- o Arrivals from the South will be extremely problematic with any volume of traffic due to conflictions with Sydney departure tracks H185 and W139 (climbing/descending conflictions) and limited options for additional routing except for significantly east of the coast (approximately 25nm east of coast and underneath Sydney jet departure routes) – this option would have an effect on southern departures from this location, pushing that track out to approximately 30 miles east of the coast.

LTOP issues
Nil effect

Hours of operation
Compatible H24 (assumed runway alignment operations would avoid populous areas)

Metroplex dependencies

- No direct interdependency with Sydney airport, however;
- Integration with Sydney route structures is significant.

Type 1 aerodrome

Cross runway considerations

- Populous areas to the east
- R578B (SFC to 12,500FT) within 12nm of final approach will constrain the northern circuit.
- Current coastal recreational flying activities (hang gliding etc.) may encounter wake turbulence from aerodrome traffic.

Operating Plan considerations

- Mixed mode runway operations possible.
- IAF joining altitudes are estimated to be unconstrained by terrain.
- Nominal capacity estimated at 80 - 100 movements per hour.

Summary

Level of constraint imposed by the existing airspace infrastructure
Significant constraints are imposed due to the proximity of Williamtown RAAF terminal airspace.

Level of constraint imposed by the existing ATS route structure
Due to Military airspace, there is limited civil airspace in this area. This constrains existing route structures. Major issues with this location:

- The ability to access routes to the east and west are constrained by Military airspace.
- Access to and from the north requires integration with Sydney traffic and additional routes in a confined area in order to segregate turbo-prop and jet aircraft.
- Departures to the south will require significant extra track miles due to the requirement to clear the Sydney traffic route structures.
- Arrivals from the south will conflict with Sydney Jet departures in a climbing/descending configuration with limited scope to build a segregated route structure.

Compatibility with existing certified or registered airports

- No existing aerodromes of this category in the vicinity

Compatibility with existing uncertified or unregistered airports

- Warnervale, Somersby and Mangrove Mountain – incompatible.
- Cooranbong – compatible circuit area, but vertical restrictions would apply (0 – 1500’), parallel runway arrival operations may impose additional restrictions. Restrictions in surrounding airspace due to the establishment of controlled airspace.

Interaction with Sydney Airport operations

Main issues relate to integration with routes servicing Sydney, in particular:

- Conflictions with northern jet departure route ex-Sydney.
- Integrating jets with turbo-prop on routes into and out of Sydney.
- Access to and from the east and west will require additional (conflicting) routes in an already constrained and busy environment.

Effect on the Long Term Operating Plan

Nil effect

Optimum runway alignment and feasibility

- Alignment relative to escarpment (west of the location) indicates NNE/SSW to NE/SW.
- East / West alignment would entail overflight of existing residential areas, coupled with terrain to the west, considered not compatible.

Operational efficiency

Mixed mode parallel runway operations are compatible**.** Nominal capacity is estimated 80 - 100 per hour.

Wallarah

PRM 16 severely constrained, other 16 IMC operations very constrained.
Eastern circuit is below optimum vertical profile due to R578
Alignment NW/SE may resolve these issues to an extent

Location 5 South (Central Coast)

Runway alignment (assumed)
N/S to NNE/SSW
In the Peats Ridge area there appears to be limited suitable land area to accommodate a 2km spacing of parallel runways and a cross runway would be constrained by terrain, mainly valleys and ridgelines running north/south. The area south of Somersby would accommodate a Type 1 aerodrome with a cross runway.

Grid LSALT
3500FT AMSL

Restricted airspace

- R559 series 30nm to the W.
- R489 (Navy) (Fire Bombing and Radar Tracking, SFC up to 60,000FT), 35nm to the E.
- R574 (RAAF) (Military Flying Training, SFC to 60,000FT), 45nm to the E.
- Richmond Military CTR (SFC to 2,500FT) (and R493, R468 overlying) 20nm to the W.

Relative aerodromes

- Sydney 35nm to the S
- Warnervale 10nm to the NE
- Somersby in the immediate vicinity
- Mangrove Mountain (winched gliding) 8nm to the NW

Access lanes to relative aerodromes

- Light aircraft transit lane would be compatible to the east (coastal at 1,500).
- A light aircraft transit lane problematic to the west due to rising terrain and lack of visual navigation cues.
- A coastal transit lane would concentrate General Aviation aircraft over current populous areas.

Manoeuvring around relative aerodromes

- Warnervale, Somersby and Mangrove Mountain would be within the terminal area. Operations at these aerodromes will be unviable.

Route structure

- **Network access to other aerodromes**
    - Sydney aerodrome operations need to be integrated with operations at this site.

- **Into network (Departures)**
    - Jet departures to the North will not have the required track miles to meet vertical requirements to join the Civil Jet Corridor (H185) over Williamtown airspace. Jet departures will require tracking via WMD and will be required to climb through Sydney turbo-prop departures on the (northbound) WMD

(W220) route. This constraint will be worse than with Location 5 North and Location 5 Middle as turbo-prop Sydney departures are lower in altitude.
  - Departures to the East are restricted by R574 (RAAF) (Military Flying Training, SFC to 60,000FT) and R489 (Navy) (Fire Bombing and Radar Tracking, SFC up to 60,000FT). R574 in particular will require a civil corridor to facilitate civil departures.
  - Route crossing points northeast of Sydney (conflictions with North and Northeast departures from Sydney) will increase.
  - Increased route crossing points in the en-route Oceanic Sector, northeast of Sydney. Although this airspace has radar surveillance, the additional complexity will require detailed assessment.
  - Departures to the West will be required to integrate with Sydney traffic to join the western departure routes emanating from Sydney. This will impose a complex airspace structure in an already constrained and busy area. The most viable option is access through R559 series.
  - Departures to the West will be held below optimum vertical profile due to the requirement to cross the dual inbound tracks to Sydney. This constraint will be worse than with Location 5 North and Middle. Aircraft may have to proceed north before heading west.
  - Departures to the South would need to mimic Eastern departures, track East to join W778.

- **Out of network (Arrivals)**
  - Arrivals from the North – if via current routes, main issue is arrival sector complexity handling streams to both airports (Sydney and new location).
  - A feasible option is to establish a segregated route between W180 and W220.
  - Arrivals from the East are restricted by R574 (RAAF) (Military Flying Training, SFC to 60,000FT) and R489 (Navy) (Fire Bombing and Radar Tracking, SFC up to 60,000FT). R574 in particular will require a civil corridor.
  - Route crossing points northeast of Sydney (conflictions with North and Northeast departures from Sydney) will increase.
  - Increased route crossing points in the en-route Oceanic Sector, northeast of Sydney. Although this airspace has radar surveillance, the additional complexity will require detailed assessment.
  - Arrivals from the West require access through R559 series – integration with Sydney arrival traffic streams is not considered a viable option.
  - Arrivals from the West will be forced below optimum vertical profile due to the requirement to cross the dual inbound tracks to Sydney. The required vertical profile will be worse than Location 5 North and Middle. The alternative entails significant extra track miles to approach the aerodrome from the North.
  - Arrivals from the South will be extremely problematic with any volume of traffic due to conflictions with Sydney departure tracks H185 and W139 (climbing/descending conflictions) and limited options for additional routing except for significantly east of the coast (approximately 25nm east of coast and underneath Sydney jet departure routes) – this option would have an

effect on southern departures from this location, pushing that track out to approximately 30 miles east of the coast. Only other possible option is via BIK KAT RIC but this will increase conflictions with Sydney western departures.

LTOP issues
This location will have an effect on the timing and duration of Sydney aerodrome runway mode changes.

Hours of operation
Compatible H24 (assumed runway alignment operations can avoid populous areas)

Type 1 and Type 3 aerodromes

Cross runway considerations

- Not considered for a Peats Ridge area due to terrain.
- Populous areas to the east of the Somersby area.
- Rising terrain to the west.

Metroplex dependencies

- Interdependent with Sydney aerodrome operations.
- The requirement for route structure integration is significant.

Operating Plan considerations

- For a Type 1 aerodrome, independent mixed mode runway operations would be possible, subject to distance between runways.
- IAF joining altitudes are considered to be unconstrained by terrain.
- Estimated nominal capacity 80 - 100 movements per hour if runway displacement is 1035 metres or greater; 60 - 70 per hour if runway displacement is less than 1035 metres. Additional departure capacity may be realised with turbo-prop stub departures from a cross runway.
- Practical capacity will be constrained by the requirement to integrate with Sydney traffic. The extent of this constraint is dependent on the runway mode in use at Sydney and the amount of traffic operating in the area.

Summary

Level of constraint imposed by the existing airspace infrastructure
Significant constraints imposed due to the proximity of Military restricted areas (R574, Richmond CTR and Williamtown RAAF terminal airspace), and existing route infrastructure servicing Sydney airport.

Level of constraint imposed by the existing ATS route structure
Due to Military airspace, there is limited civil airspace in this area. This constrains existing route structures. Major issues with this location:

- The ability to access routes to the east and west are constrained by Military airspace.
- Access to and from the north requires integration with Sydney traffic and additional routes in a confined area in order to segregate turbo-prop and jet aircraft.
- Departures to the south will require significant extra track miles due to the requirement to clear the Sydney traffic route structures.
- Arrivals from the south will conflict with Sydney Jet departures in a climbing/descending configuration with limited scope to build a segregated route structure.

Compatibility with existing certified or registered airports

- No existing aerodromes of this category in the vicinity.

Compatibility with existing uncertified or unregistered airports

- Warnervale, Somersby and Mangrove Mountain – incompatible.

Interaction with Sydney Airport operations

Main issues relate to integration with or segregation from, routes servicing Sydney, in particular:

- Conflictions with northern jet departure route ex-Sydney.
- Segregating jets from turbo-prop on routes into and out of Sydney.
- Access to and from the east and west will require additional (conflicting) routes in an already constrained and busy environment.

Effect on the Long Term Operating Plan

This location is interdependent with Sydney airport operations due to proximity and will influence the timing and duration of runway mode changes at Sydney airport.

Optimum runway alignment and feasibility

- Alignment relative to the escarpment (west of the location) indicates N/S to NNE/SSW.
- In the Peats Ridge area, a cross runway is considered not compatible due to valleys and ridgelines, coupled with rising terrain to the west.
- In the Somersby area, populous areas to the east and rising terrain to the west may limit the feasibility of a cross runway.

Operational efficiency

Terrain in the Peats Ridge area will restrict the availability of wide spaced parallel runways and the likelihood of a cross runway configuration. The area south of Somersby would support a Type 1 aerodrome.

Mixed mode parallel runway operations are compatible but, due to the limited scope to build an independent parallel runway system (distance between runways 1035 metres or greater) in the Peats Ridge area, may entail dependent or segregated runway operations.[7]

[7] ICAO Annex 14, Volume 1, 3.1.12

Nominal capacity is estimated to be 40 - 50 movements per hour for a single runway and 60 – 70 movements per hour for parallel runways at a Peats Ridge site, constrained by interdependency with Sydney operations.

At a Somersby site, nominal (aerodrome) capacity is estimated to be 80 - 100 per hour however this will be severely constrained by the requirement to integrate with Sydney traffic.

Peats Ridge

- PRM 16 severely constrained, other 16 IMC operations very constrained.
- Eastern circuit is below optimum vertical profile due to R578
- Alignment NW/SE may resolve some of these issues to an extent
- Runway selection dependent on Sydney, not weather

Somersby

- PRM 16 severely constrained, other 16 IMC operations very constrained.
- Eastern circuit is below optimum vertical profile due to R578
- Alignment NW/SE may resolve some of these issues to an extent
- Runway selection dependent on Sydney, not weather

Location 10 North (Hawkesbury)

Runway alignment (assumed)
NE/SW
E/W runway unlikely due rising terrain to west

Grid LSALT
5900FT AMSL

Restricted airspace

- Richmond Military Control Zone (and R468, R493 overlying). The report assumes this will become civil airspace.
- R559 series – military flying training – large airspace blocks to the NW of RIC. The viability of Location 10 relies on access to these areas.

Relative aerodromes

- Richmond RAAF in immediate vicinity
- Sydney 35nm to SE
- Bankstown 25nm to SSE

Access lanes to relative aerodromes

- Existing light aircraft transit lane (Lane of Entry) north of Bankstown compatible.
- Western and Southern (Class G airspace) access to Bankstown unaffected.

Manoeuvring around relative aerodromes

- Sydney Runway 16 parallel runway operations, particularly PRM, would be affected. The runway 16R arrival circuit is within 5 nm of the site (base leg area) at an altitude of 3000FT.
- This airspace is currently the primary northern access area for Bankstown IFR arrivals and departures in Class C airspace[8].

Route structure

- **Network access to other aerodromes**
    - No significant change to routes accessing Sydney airport
    - Bankstown IFR routes will be challenged. This will require careful analysis and route structure re-design.

- **Into network (Departures)**
    - Departures to the West, North and South would be processed west/northwest toward the rocket routes (Melbourne -Brisbane route network)
    - A high gradient initial climb profile over western terrain will impose a payload limitation on some aircraft operations.

[8] Civil aircraft in Restricted airspace receive a Class C Air Traffic Service level.

  - Departures to the East will require integration with Sydney traffic to join the existing route structure.

- **Out of network (Arrivals)**
  - Arrivals from the North – if via current routes, main issue is arrival sector complexity handling streams to both airports (Sydney and new location)
  - A feasible option is a redesign of routes emanating from RIC to allow establishment of new inbound routes in the H12 / W365 area.
  - Arrivals from the East would use current route structure but require integration with Sydney traffic.

LTOP issues
No effect if operations are constrained to the west of the area.
Operations east of the area will have a significant effect on all LTOP modes.

Hours of operation
H24 operations would require stringent noise abatement procedures. This location may be subject to curfew.

<u>Type 1 aerodrome and Type 3 aerodrome</u>

Cross runway considerations
- Not considered due to terrain to the west.
- The eastern approach path to a cross runway will conflict with approaches to Sydney runways 16 R and L.

Metroplex dependencies
- Complete interdependency for Type 1 airport:
  - The eastern circuit to the new airport conflicts with the western circuit to Sydney runway 16R;
  - The climb profile of heavy jet departures from runway 34L will infringe eastern circuit operations at the site.
  - The alternative is constraining the circuit to the western side of new airport which will reduce airspace capacity and limit available altitudes due to terrain
- The main issue for a Type 3 aerodrome is the constraint of circuits to the western side of the site which will limit available altitudes due to terrain.

Operating Plan considerations
- Parallel runway arrival altitudes are estimated to be a 3000FT/4000FT IAF join for southern runway flow and a 4000FT/5000FT IAF join for northern runway flow.
- This location requires full integration with Sydney airport operations.

<u>Summary</u>

<u>Level of constraint imposed by the existing airspace infrastructure</u>
Significant constraints are imposed due to the proximity to Sydney airport circuit operations and Military R559 series airspace.

Level of constraint imposed by the existing ATS route structure

- Access to existing civil route structures are constrained by the activation of Military R559 series airspace.
- The ability to access routes to and from the east is constrained by Sydney airport operations.
- Access to and from the north and south would be through western airspace in order to segregate Sydney operations. This will impose significant additional track miles.

Compatibility with existing certified or registered airports

- This location will require a significant re-design of northern IFR routes to and from Bankstown.
- This site will be significantly constrained by Sydney operations.

Compatibility with existing uncertified or unregistered airports

- No existing uncertified or unregistered aerodromes in the vicinity.

Interaction with Sydney Airport operations

Main issues relate to segregation with Sydney circuit traffic and integration with routes servicing Sydney, in particular:

- Integration with western departures from Sydney airport during activation of R559 series airspace.
- Integration of eastern departures with Sydney airport operations.
- Circuit constraints at the proposed site to accommodate Sydney circuits.

Effect on the Long Term Operating Plan

No effect if operations are constrained to the west of the area.
Operations east of the area will have a significant effect on all LTOP modes.

Optimum runway alignment and feasibility

- Alignment relative to escarpment (west of the location) indicates NE/SW.
- East / West alignment considered not compatible due to terrain to the west and conflict with the circuit to Sydney runway 16R.

Operational efficiency

Segregated parallel runway operations are most likely at this location due to circuit constraints.

Nominal capacity is estimated 60 – 70 per hour.

Wilberforce

- Runway alignment 10/28 conflicts with runway 16 western circuit and straight-in approach – coincident altitude.
- CTA step 2500 required to east and south.
- Operations confined to western and northern circuits – significant capacity constraint.

- A single runway (type 3) operation is feasible with runway 01/19 alignment. This will, however, introduce complete dependency with Richmond operations.
- Segregated parallel operations possible – no scope for high capacity mixed mode.

Glenorie

- See above
- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Bankstown LOE altitudes would not allow compliance with CAR 157 and would need to close. Runway alignment would make matters worse.

Location 10 South (Hawkesbury)

The area west of the Nepean River was not assessed due to terrain.

Runway alignment (assumed)
NNE
E/W runway is possible but limited in use (mainly western runway flow) due to rising terrain to the west.

Grid LSALT
5900FT AMSL

Restricted airspace
- Richmond Military Control Zone (and R468, R493 overlying). The report assumes this will become civil airspace.
- R559 series – military flying training – large airspace blocks to the NW of RIC. The viability of Location 10 relies on access to these areas.
- R536A and B (Orchard Hills) 10NM to the south – explosives demolition, SFC to 4500FT.

Relative aerodromes
- Richmond RAAF in the immediate vicinity
- Sydney 30nm to the SE
- Bankstown 20nm to the SE
- Camden 25nm to the S

Access lanes to relative aerodromes
- The existing light aircraft transit lane (Lane of Entry) north of Bankstown is compatible.
- Access through Class G airspace to Bankstown from the south and west would require new lanes of entry, avoiding the CTR and the first Class C airspace step.

Manoeuvring around relative aerodromes
- Runway 16 parallel runway operations, particularly PRM, would be affected.
- This airspace is currently a primary northern access area for Bankstown IFR traffic.
- Western training areas would not be compatible.
- Current instrument approaches to Bankstown would commence in the circuit area of the new airport and not be compatible. IFR operations at Bankstown would most probably become unviable.
- CN instrument approaches (RNAV GNSS RWY 06 and NDB-A) may infringe parallel runway approaches from the south.

Route structure
- **Network access to other aerodromes**
    - No significant change to routes accessing Sydney airport

    - Bankstown IFR routes will be challenged – requires analysis and redesign. Most probably unviable.
- **Into network (Departures)**
    - Departures to the West, North and South would be processed west/northwest toward the rocket routes (Melbourne -Brisbane route network)
    - A high gradient initial climb profile over western terrain will impose a payload limitation on some aircraft operations.
    - Departures to the East will require integration with Sydney traffic to join existing route structure.

- **Out of network (Arrivals)**
    - Arrivals from the North – if via current routes, main issue is arrival sector complexity handling streams to both airports (Sydney and new location)
    - A feasible option is a redesign of routes emanating from RIC to allow establishment of new inbound routes in the H12 / W365 area.
    - Arrivals from the East would use current route structure but require integration with Sydney traffic.

LTOP issues

- May limit availability of Mode 14A
- Runway 25 departures Modes would require integration.

Hours of operation

H24 operations would require stringent noise abatement procedures during night hours. This location may be subject to curfew.

<u>Type 1 aerodrome</u>

Cross runway considerations

- Mainly limited to western flow and only when Sydney is operating runway 25 (arrivals and departures) in strong westerly winds (interdependency).
- Approach gradient from the west may be too steep for eastern runway flow operations.

Metroplex dependencies

- Complete interdependency for Type 1 airport:
    - Circuit conflictions if runway 16 or 07 is in use at Sydney. The eastern circuit to the new airport (conflicts with western (16) and northern (07) circuits to SY and 34L departures from SY). The alternative is constraining the circuit to the western side of new airport which will reduce airspace capacity and limit available altitudes due to terrain
    - The climb profile of heavy jet departures from runway 34L will infringe eastern circuit operations at this location.
- The main issue for a Type 3 aerodrome is the constraint of circuits to the western side of the site which will limit available altitudes due to terrain.

Operating Plan Considerations

- Parallel runway arrival altitudes are estimated to be a 3000FT/4000FT IAF join for southern flow and a 4000FT/5000FT IAF join for northern flow.
- This location requires full integration with Sydney.

Summary

Level of constraint imposed by the existing airspace infrastructure

- R536A and R536B will infringe arrival airspace.
- Significant constraints are imposed due to the proximity to Sydney airport circuit operations and Military R559 series airspace.

Level of constraint imposed by the existing ATS route structure

- Access to existing civil route structures are constrained by the activation of Military R559 series airspace.
- The ability to access routes to the east is constrained by Sydney airport operations.
- Access to and from the north and south would be through western airspace in order to segregate Sydney operations. This will impose significant additional track miles.

Compatibility with existing certified or registered airports

- This location will require a significant re-design of all IFR routes to and from Bankstown.
- Instrument approaches to Bankstown will be unviable.
- Significant constraints are imposed by Sydney operations.
- Instrument approaches to Camden will require re-design.

Compatibility with existing uncertified or unregistered airports

- No existing uncertified or unregistered aerodromes in the vicinity.

Interaction with Sydney Airport operations

Main issues relate to segregation with Sydney circuit traffic and integration with routes servicing Sydney, in particular:

- Integration with western departures from Sydney airport during activation of R559 series airspace.
- Integration of eastern departures with Sydney airport operations.
- Circuit constraints at the proposed site to accommodate Sydney operations.

Effect on the Long Term Operating Plan

No effect if operations are constrained to the west of the site.
Operations east of the area will have a significant effect on all LTOP modes.

Optimum runway alignment and feasibility

- Alignment relative to the escarpment (west of the location) indicates NE/SW.
- E/ W alignment is considered not compatible due to terrain to the west and conflict with the circuit to Sydney runway 16R.

Operational efficiency

Segregated parallel runway operations are most likely at this location due to circuit constraints**.**

Nominal capacity is estimated 60 - 70 per hour.

Castlereagh

- Operations confined to western circuits – significant capacity constraint.
- Segregated parallel operations possible – no scope for high capacity mixed mode.
- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Bankstown LOE altitudes would not allow compliance with CAR 157 and would need to close.
- CASA to determine buffers for R536 separation

Windsor Downs

- Operations confined to western circuits – significant capacity constraint.
- Segregated parallel operations possible – no scope for high capacity mixed mode.
- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Bankstown LOE altitudes would not allow compliance with CAR 157 and would need to close
- CASA to determine buffers for R536 separation

Location 12 (Nepean)

The western portion of Location 12 was not assessed due to terrain and water catchment area.

Runway alignment (assumed)
N to NNE
E/W runway is possible but limited use (mainly western flow) due to rising terrain to the west.

Grid LSALT
5900FT AMSL

Restricted (and Danger) airspace
- Richmond Military Control Zone (and R468, R493 overlying) – may be required for civil traffic management.
- R536A and B (Orchard Hills) 18NM to the N, explosives demolition, SFC to 4500FT – may infringe the northern approach circuit.
- R559 series – military flying training – large airspace blocks northwest of Richmond. Viability of Location 12 relies on access to these areas.
- Holsworthy (R555 series) – artillery range activity – activation of firing areas above 3000FT may not be compatible due to circuit area operations east of the new airport.
- Wilton parachuting (D593A/B) in the circuit area - not compatible
- Bankstown and Camden training areas (D556 series and D552) are within the circuit area - not compatible.

Relative aerodromes
- Richmond RAAF 20nm to N
- Sydney 25nm to E
- Bankstown 15nm to E
- Camden 5nm to S

Access lanes to relative aerodromes
- The existing light aircraft transit lane (Lane of Entry) north of Bankstown is compatible.
- Access through Class G airspace to Bankstown from the south and west would require new lanes of entry, avoiding the CTR and the first Class C airspace step.

Manoeuvring around relative aerodromes
- Sydney Runway 16 parallel runway operations would be affected.
- This airspace is currently a primary western access area for Bankstown IFR traffic.
- Western training areas would not be compatible.
- Current instrument approaches to Bankstown would commence in the circuit area of the new airport and not be compatible. IFR operations at Bankstown would most probably become unviable.

- Circuit operations at Camden would be severely constrained and would most probably become unviable
- Camden instrument approaches (RNAV GNSS RWY 06 and NDB-A) are in the circuit area and not compatible.

Type 1 aerodrome and Type 3 aerodrome

Route structure

- **Network access to other aerodromes**
  - No significant change to routes accessing Sydney airport
  - Bankstown IFR routes will be challenged – requires analysis and redesign.
- **Into network (Departures)**
  - Departures to the West and North would be processed west/northwest toward the rocket routes (Melbourne -Brisbane route network).
  - A high gradient initial climb profile over western terrain will impose a payload limitation on some aircraft operations.
  - Departures to the East will require integration with Sydney traffic to join the existing route structure.
  - Departures to the South and East would require integration with Sydney traffic to join the existing route structure.

- **Out of network (Arrivals)**
  - Arrivals from the North – if via current routes, main issue is arrival sector complexity handling streams to both airports (Sydney and new).
  - A feasible option is a redesign of routes emanating from RIC to allow establishment of new inbound routes in the H12 / W365 area.
  - Arrivals from the South would utilise a route similar to the WATLE STAR (from the WSW).
  - Arrivals from the East would utilise current route structure but require integration with Sydney traffic.

LTOP issues

- Limitations on the availability of Mode 14A.
- Runway 25 departures Modes would require integration.

Hours of operation

H24 operations would require stringent noise abatement procedures during night hours. A curfew is a possibility at this location.

Cross runway considerations

- Mainly limited to western flow and only when Sydney is operating runway 25 (arrivals and departures) in strong westerly winds (interdependency).
- Approach gradient from the west may be too steep for eastern runway flow operations.

Metroplex dependencies

- Complete interdependency with Sydney for Type 1 airport.

- Less significant issues for Type 3 than for Type 1 due to the availability of western circuit single runway operations.

Operating Plan considerations

- Parallel runway arrival altitudes are estimated to be a 3000FT/4000FT IAF join for southern flow and a 4000FT/5000FT IAF join for northern flow. Final approach legs from the south will be between 15 and 20 NM in length.
- This location requires integration with the Sydney route structure.

Summary

Level of constraint imposed by the existing airspace infrastructure

- Some constraints are imposed due to the proximity to Sydney airport circuit operations and Military R559 series airspace.
- Possible constraint to the northern approach path due to R536 A and B.

Level of constraint imposed by the existing ATS route structure

- Access to existing civil route structures are constrained by the activation of Military R559 series airspace.
- The ability to access routes to the east is constrained by Sydney airport operations.
- Access to (and possibly from) the north would be through western airspace in order to segregate Sydney operations. This will impose significant additional track miles.

Compatibility with existing certified or registered airports

- This location will require a significant re-design of all IFR routes to and from Bankstown.
- Camden is not considered to be compatible due to proximity.

Compatibility with existing uncertified or unregistered airports

- No existing uncertified or unregistered aerodromes in the vicinity.

Interaction with Sydney Airport operations (Airspace and Aerodrome)

Main issues relate to segregation with Sydney circuit traffic and integration with routes servicing Sydney, in particular:

- Integration with western departures from Sydney airport during activation of R559 series airspace.
- Integration of eastern departures with Sydney airport operations.
- Circuit constraints at the proposed site to accommodate Sydney operations.

Effect on the Long Term Operating Plan

No effect if operations are constrained to the west of the site.
Operations east of the area will have an effect on some LTOP cross runway modes.

Optimum runway alignment and feasibility

- Alignment relative to the escarpment (west of the location) indicates NE/SW.
- E/ W alignment is considered not compatible due to terrain to the west and conflict with the circuit to Sydney runway 16R.

Operational efficiency

Segregated parallel runway operations are most likely at this location due to circuit constraints.

Nominal capacity is estimated 60 – 70 per hour.

Luddenham

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.

Kemps Creek

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Bankstown and Camden severely restricted, high probability of VCA.
- IFR to both precluded.
- CTR encompasses PSP. Very limited arrival and departure track availability (opposite direction) airspace high probability of airprox.
- Mode 14A not viable,

Badgerys Creek

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Comments in EIS remain largely valid. Additional constraints imposed since the introduction of a parallel runway, LTOP and PRM at Sydney.
- Mode 14A not viable,

Bringelly

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Bankstown severely restricted, high probability of VCA.
- IFR precluded.
- Very limited arrival and departure track availability (opposite direction to/from west) high probability of airprox.
- Camden closed.
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.
- Mode 14A not viable,

Catherine Field

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Bankstown restricted to performance category A aircraft (single engine GA), high probability of VCA.
- IFR precluded.
- Very limited arrival and departure track availability (opposite direction to/from north) high probability of airprox.
- Re-alignment of SY CTR to allow access to/from the south (assuming HW airspace gone)

- Camden closed.
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.
- Heading restrictions on Sydney runway 25 departures.
- Mode 14A not viable,
- CASA to determine buffer required R536A/B and runway centreline.

Greendale

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Bankstown IFR precluded.
- Very limited arrival and departure track availability (opposite direction to/from north) high probability of airprox.
- LOE access to/from the south may not allow compliance with CAR 157
- Camden and the Oaks closed.
- Wilton PJE not viable.
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.
- Mode 14A not viable,
- CASA to determine buffer required R536A/B and runway centreline.

Location 13 (The Oaks)

The western portion of Location 13 was not assessed due to terrain and water catchment area.

Runway alignment (assumed)
N to NNE
E/W runway not considered compatible due rising terrain to the immediate west.
The area west of Camden would only support a Type 3 airport with a N/S alignment.

Grid LSALT
5900FT AMSL

Restricted (and Danger) airspace

- Richmond Military Control Zone (and R468, R493 overlying) – may be required for civil traffic management.
- R536A and B (RAAF) (Orchard Hills) 20NM to the north – explosives demolition, SFC to 4500FT – most likely clear of the circuit area but remains a consideration.
- R559 series – military flying training – large airspace blocks northwest of Richmond. Viability of Location 13 relies on these areas having civil access.
- Holsworthy (R555 series) – artillery range activity – firing above 3000FT possibly not compatible due to circuit area operations east of the location.
- Wilton parachuting (D593A/B) in the circuit area - not compatible
- Bankstown and Camden training areas (D556 series and D552) in the circuit area - not compatible.

Relative aerodromes

- Richmond RAAF 30nm to the N
- Sydney 30nm to the E
- Bankstown 20nm to the ENE
- Camden in the immediate vicinity
- The Oaks in the immediate vicinity

Access lanes to relative aerodromes

- The existing northern light aircraft transit lane (Lane of Entry) is compatible.
- Southern access to Bankstown would require a transit lane, west of the CTR and the first Class C airspace step. Possibility of additional access via the coast and then north of R555C (Holsworthy).
- Western training areas are generally not compatible, except for northern portions around D556A.

Manoeuvring around relative aerodromes

- Significant effect on Sydney runway 07 operations. Circuits to the east of this location would conflict with the northern circuit and straight-in approach to runway 07.

- CN instrument approaches (RNAV GNSS RWY 06 and NDB-A) are in the circuit area and not compatible.

Route structure

- **Network access to other aerodromes**
  - No significant change to routes accessing Sydney airport
  - Bankstown IFR routes will be challenged – requires analysis and redesign.
- **Into network (Departures)**
  - Departures to the West and North would be processed to the west/northwest toward the rocket routes (Melbourne - Brisbane network).
  - A high gradient initial climb profile over western terrain will impose a payload limitation on some aircraft operations.
  - Departures to the South would be processed to join the existing southern routes.
  - Departures to the East would require integration with Sydney traffic to join the existing route structure.

- **Out of network (Arrivals)**
  - Arrivals from the North – if via current routes, main issue is arrival sector and TMA complexity handling streams to both airports (Sydney and new).
  - There is feasibility to redesign routes emanating from the Richmond area to allow construction of new inbound routes in the H12 / W365 area.
  - Arrivals from the south would utilise a route similar to the existing tracks servicing Sydney airport.
  - Arrivals from the East would use current route structure but require integration with SY traffic.

LTOP issues

- This location would significantly limit the availability of Mode 14A
- Runway 25 departures Modes would require integration.

Hours of operation

H24 operations would require stringent noise abatement procedures during night hours. A curfew is a possibility.

Type 1 aerodrome

Cross runway considerations

- Mainly limited to western flow and only when Sydney is operating runway 25 (arrivals and departures) in strong westerly winds.
- Cross runway operations would be significantly interdependent with Sydney airport operations.
- Approach gradient from the west may be too steep for eastern runway flow operations.

Metroplex dependencies

- Some interdependency with Sydney for Type 1 airport, predominantly the effect on runway 07 operations.

- A cross runway will significantly increase interdependency with Sydney runway 07 arrival and runway 25 departure operations.
- Less significant issues for Type 3 than for Type 1 due to a smaller airspace requirement for single circuit operations.

Operating Plan considerations

- The Oaks area is limited to aircraft manoeuvring to the east of the site.
- Parallel runway arrival altitudes are estimated to be a 3000FT/4000FT IAF join for southern flow and a 4000FT/5000FT IAF join for northern flow.
- This location requires some integration with Sydney.
- Due to the likelihood of segregated runway operations, nominal capacity is estimated to be 60 -70 per hour.

Summary

Level of constraint imposed by the existing airspace infrastructure

- Some constraints are imposed due to the proximity to Sydney airport circuit operations and Military R559 series airspace.
- Possible constraint to the northern approach path due to R536 A and B.

Level of constraint imposed by the existing ATS route structure

- Access to existing civil route structures are constrained by the activation of Military R559 series airspace.
- The ability to access routes to the east is constrained by Sydney airport operations.
- Access to existing southern departure routes requires integration with Sydney traffic. This may impose less than optimum vertical profiles on departures from this location (altitude restrictions).
- Access to and from the north would be through western airspace in order to segregate Sydney operations. This will impose significant additional track miles.

Compatibility with existing certified or registered airports

- This location will require some re-design of southern and western IFR routes to and from Bankstown.
- Camden is not compatible due to proximity.

Compatibility with existing uncertified or unregistered airports

- The Oaks is not compatible due to proximity.

Interaction with Sydney Airport operations

Main issues relate to segregation with Sydney circuit traffic and integration with routes servicing Sydney, in particular:

- Integration with western departures from Sydney airport during activation of R559 series airspace.
- Integration of eastern arrivals and departures with Sydney airport operations.
- Circuit constraints at the proposed site to accommodate Sydney circuits.

Effect on the Long Term Operating Plan

- No effect if operations are constrained to the west of the site.
- Eastern circuit operations would influence the timing and ability to implement Sydney runway 25 departures and runway 07 arrivals Modes of Operation.

Optimum runway alignment and feasibility

- Alignment relative to the escarpment (west of the location) indicates NE/SW.
- E/ W alignment considered not compatible due to terrain to the west and conflict with Sydney operations (the arrival circuit to runway 07 and runway 25 departures).

Operational efficiency

Segregated parallel runway operations are most likely at this location due to circuit constraints**.**

Nominal capacity is estimated 60 - 70 per hour.

Silverdale

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Bankstown IFR precluded.
- Very limited arrival and departure track availability (opposite direction to/from north) high probability of airprox.
- LOE access to/from the south may not allow compliance with CAR 157
- Camden and the Oaks closed.
- Wilton PJE not viable.
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.
- Mode 14A not viable.
- CASA to determine buffer required R536A/B and runway centreline.

Mowbray Park

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Camden VFR circuits only with limited training area access relocated north
- The Oaks closed.
- Wilton PJE not viable.
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.
- VFR transit lane to east constrained by R555 to east – possible terrain issues.
- Western circuit limited by raising terrain which would influence parallel intercept altitudes landing north.
- Note that proposal doesn’t include a cross runway (good thing)

The Oaks

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Camden and the Oaks closed.
- Wilton PJE not viable.
- Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.

- Sydney LTOP Mode 14A may not be viable.

Location 14 (Wilton – Appin)

Runway alignment (assumed)
The site appears to be suitable for all points of the compass. For Air Traffic Management, a NW/SE parallel configuration is optimal for segregation from Sydney operations. A cross runway would ideally be E/W for the same reason.

Grid LSALT
5900FT AMSL

Restricted (and Danger) airspace

- Richmond Military Control Zone (and R468, R493 overlying) – access would be required for northern arrivals (and possibly departures).
- Holsworthy (R555 series) – artillery range activity – in the circuit area – not compatible above 3000FT.
- R495A/B – (Navy) – northern portions may need to be civil airspace to segregate Sydney and new airport traffic.
- Wilton parachuting (D593A/B) in the circuit area – not compatible
- Flagstaff Point parachuting (near Wollongong) significantly restricted and probably not compatible.
- Camden training area (D552) infringes the circuit area – requires redesign.

Relative aerodromes

- Sydney 25nm to the NE.
- Bankstown 20nm to the N.
- Camden 10nm to the NW.
- Wollongong 15nm to the S.
- Wedderburn and Wilton in the immediate vicinity.

Access lanes to relative aerodromes

- The existing northern light aircraft transit lane (Lane of Entry) is compatible.
- Southern access to Bankstown would require a transit lane, probably west of the CTR and the first Class C airspace step. Possibility of additional access via the coast and then north of R555C (Holsworthy).
- Western Class G training areas require redesign.

Manoeuvring around relative aerodromes

- Camden will be restricted vertically (1500FT) and laterally to the southeast, dependent on proposed runway alignment and site location (actual proximity to Camden).

Type 1 aerodrome and Type 3 aerodrome

This location appears to be the suitable for a Type 1 airport. A Type 3 airport, by inference, is also suitable.

Route structure

- **Network access to other aerodromes**
  - No significant change to routes accessing Sydney airport
  - Bankstown IFR routes may require redesign.
  - Sydney southern turbo-prop departure routes would require re-design.
- **Into network (Departures)**
  - Departures to the West have easy access to the existing route structure.
  - Departures to the North would be processed northwest toward the rocket routes (Melbourne – Brisbane network) or (subject to some adjustment to Navy areas) access east of the coast to join existing northern routes.
  - Departures to the South have easy access to the existing route structure.
  - Departures to the East have easy access to the existing route structure.

- **Out of network (Arrivals)**
  - Arrivals from the North – if via current routes, main issue is arrival sector and TMA complexity handling streams to both airports (Sydney and new).
  - There is feasibility to redesign routes emanating from RIC area to allow construction of new inbound routes in the H12 / W365 area.
  - Arrivals from the south would utilise a route similar to the existing tracks servicing Sydney airport.
  - Arrivals from the East would use the current route structure into a circuit segregated from Sydney operations.

LTOP issues

- Possible effect on the timing of Mode 14A.

Hours of operation

H24 operations appear to be compatible. Night operations may be restricted to an opposite direction runway mode to the northwest of the location in order to avoid coastal townships.

Cross runway considerations

- If aligned East / West, no identified issues.

Metroplex dependencies

- Limited interdependency with Sydney and probably can be built as a segregated operation.

Operating Plan considerations

- Parallel runway arrival altitudes are estimated to be a 4000FT/5000FT IAF join for south-eastern flow and a 3000FT/4000FT IAF join for north-western flow.
- This location can be designed as a circuit operation segregated from Sydney airport operations. Route redesign may be required for both airports to support efficient operations.

Summary

Level of constraint imposed by the existing airspace infrastructure

- The primary constraint is R555 series (Holsworthy)

- The northern portion of R495 A and B would require adjustment to accommodate northern departures.

Level of constraint imposed by the existing ATS route structure
- This location provides relatively easy access to the existing route structures.

Compatibility with existing registered airports
- Camden may be airspace constrained but should be compatible.
- Wollongong would be compatible.

Compatibility with existing unregistered airports
- Wedderburn is within the circuit and incompatible
- Wilton will be airspace constrained and parachute operations at this aerodrome will be incompatible.

Interaction with Sydney Airport operations
- This site allows an airspace design which is segregated from Sydney operations.
- Preliminary evaluation indicates limited vertical profile constraint by current Sydney operations in the airspace design.

Effect on the Long Term Operating Plan
- All modes of operation are compatible.
- Possibility of some effect on the timing of Mode 14A.

Optimum runway alignment and feasibility
- NW/SE will optimise segregation with Sydney operations.
- E/W cross runway is feasible.

Operational efficiency

Independent runway operation, segregated from Sydney operations.

Nominal capacity 80 - 100 per hour using the parallel runways, additional departure capacity may be realised with turbo-prop stub departures from the cross runway.

Wilton
- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Rotation of RWY alignment more NW/SE would better accommodate competing circuit interaction and departures management. Dependent on weather data such alignment may negate need for a cross runway.
- R555 operations limited or negated.
- Cross runway operations potentially conflict with Sydney Modes 5, 10 and 14A (due 16 departures)
- Camden limited to VFR operations, with adjacent training areas similarly reduced vertically to cater for CTA steps.

- Southern lane of entry ex Bankstown would need to traverse existing R555 to the coast. Terrain may limit useability, but with greater lateral options than Wallandoola.
- Existing Wilton not viable

Southend

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Circuits and departures constrained by Sydney operations (16 departures/34 arrivals)
- Wilton PJE not viable
- Camden VFR circuit below step, IFR operations constrained.
- Camden training area D552 requires modification
- VFR access to coast restricted by CTA steps, terrain issues.
- Transit OCTA along coast limited by CTR
- R555C/D not viable

Dendrobium

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Wilton PJE not viable
- Wollongong instrument procedures complicated and will create dependencies for arrival/departure and missed approach management.
- Camden D552 requires adjustment to north to remain semi-useable, although vertically lower.

North Appin

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Runway alignment – eastern circuit RNAV conformance with SY western circuit.
- Rotation of RWY alignment more NW/SE would better accommodate competing circuit interaction and departures management
- R555 not viable
- No southern VFR access lane to south, and further impeded by Lucas Heights and western SY CTR – redesign required.
- Camden and Wilton not viable

Wallandoola

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Rotation of RWY alignment more NW/SE would better accommodate competing circuit interaction and departures management. Dependent on weather data such alignment may negate need for a cross runway.
- R555 operations limited or negated.
- Cross runway operations potentially conflict with Sydney Modes 5, 10 and 14A (due 16 departures)
- Camden limited to VFR operations, with adjacent training areas similarly reduced vertically to cater for CTA steps.
- Southern lane of entry ex Bankstown would need to traverse existing R555 to the coast. Terrain may limit useability.
- Wilton not viable

Specific Site Enablers

General assumption is that the catalyst to build a second airport with H24 parallel capacity is on the basis that KSA would be operating at or above traffic levels that historically would have allowed the noise sharing modes espoused in LTOP. All locations are in known fog prone areas, and a CAT III ILS (or equivalent) would be needed to support these localities for such eventualities. Being inland, fog clearance rates are much slower than occurs at Sydney.

Locality	Site	RWY	Enablers
Central Coast (Location 5)	Wallarah	17/35	• Increased and guaranteed access to surrounding RAAF/RAN restricted areas at lower altitudes (North, East and West). • Total review and realignment of interconnecting airway network • Sydney RWY 16PRM and IMC operations constrained to facilitate integration, affecting capacity • Realigning proposal to NW/SE runways may resolve integration with Sydney, but does not alleviate the need to access Military restricted areas. • Western side of CTR design may need to be modified to provide suitable uncontrolled VFR transit access.
	Peats Ridge	18/36	• See above comments • Would need to operate sympathetically with Sydney runway selection, regardless of prevailing weather
	Somersby	18/36 & 09/27	• See above comments • Would need to operate sympathetically with Sydney runway selection, regardless of prevailing weather • RWY 16 PRM operations would likely need to cease, or departures at Somersby would be classed as dependent on Sydney.

Hawkesbury (Location 10)	Wilberforce	01/19 & 10/28	• Operations on cross runway dependent with Sydney 16 arrivals • Capacity constrained to west and north of airport due interaction with Sydney circuits. • Single runway (type 3) with 01/19 alignment more feasible as a less constrained operation.
	Wilberforce (Type 3)	09/27	• Alignment 01/19 less constrained.
	Glenorie	06/24	• The overlaps with Sydney runways make this an unviable selection. • Sydney northern lanes of entry would require major re-alignment over the vicinity of existing Richmond aerodrome and towards more mountainous terrain. There would be no direct access for such operations across the northern Sydney coastal areas.
	Castlereagh	18/36	• D556B no longer viable • Western lanes of entry directed further south over water catchments and mountainous terrain. • Northern lanes of entry would be lower and may infringe CAR 157 requirements • Sydney western arrival and Castlereagh eastern arrival circuits would require RNAV tracking conformance to enable separation assurance and integration. • R536 needs to close, due interference with approach/departure paths
	Windsor Downs	01/19	• As per Castlereagh, except northern lane of entry would become virtually unflyable by fixed wing aircraft, and collision risk with opposite direction considerations. No apparent alternative solution. • Circuit limited to west to enable integration with Sydney operations

Nepean (Location 12)	Luddenham	01/19	• R536 needs to close, due interference with approach/departure paths • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney. • Camden/Bankstown training areas closed • Limited IFR operations at Bankstown • Wilton PJE to cease • Western VFR lanes via Richmond airspace (terrain limitations)
	Kemps Creek	16/34	• No IFR operations at Camden or Bankstown • Training areas closed • Crossing runway operations at Sydney highly questionable. • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney. • R536 needs to close, due interference with approach/departure paths • R555 limited to below 1500 feet • Northern lane of entry and access to/from Bankstown renders it virtually unusable except for circuit training • Wilton PJE to cease
	Badgerys Creek	05/23 & 14/32	• Comments from EIS remain valid and aerodrome is further constrained by Sydney parallel operations, LTOP and PRM rendering the NE/SW alignment unsuitable for integration. • Luddenham is a better choice • All previous comments are equally applicable; Camden also would need to close.
	Catherine Field	17/35	• R536 needs to close, due interference with approach/departure paths • Close Camden • No IFR at Bankstown • Close VFR training areas • Wilton PJE to cease • Close R555
	Bringelly	15/33	• Close Camden • No IFR at Bankstown • R536 needs to close, due interference with approach/departure paths • R555 limited to below 1500 feet • Western transit lanes via Richmond airspace • Closure of VFR training areas • Wilton PJE to cease • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.
	Greendale	17/35	• All previous comments applicable

The Oaks (Location 13)	Mowbray Park	18/36	• Close The Oaks • VFR only circuits at Camden • Close southern VFR training areas • Wilton PJE not viable • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney. • Transit lane between CTR and R555 probably compromised by terrain, and may be unsuitable (airspace design)
	The Oaks	17/35	• Close Camden and The Oaks • Close VFR training areas • Wilton PJE not viable • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.
	Silverdale	17/35	• Close Camden and The Oaks • No IFR at Bankstown • Close VFR training areas • R536 limits circuit and departure options, and should be considered for relocation • Wilton PJE not viable • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney.

Wilton – Appin (Location 14)	Wilton	18/36 & 08/26	• Rotation of RWY alignment more NW/SE would better accommodate competing circuit interaction and departures management. Dependent on weather data such alignment may negate need for a cross runway. • R555 operations limited or negated. • Camden VFR only • VFR training areas compromised by CTA steps • Southern lane of entry ex Bankstown would need to traverse existing R555 to the coast. Terrain may limit useability, but with greater lateral options than Wallandoola. • Close existing Wilton
	Southend	05/23	• Operations constrained by Sydney 16/34 operations • Wilton PJE not viable • Camden VFR circuits only • Modify D552 • Close R555C/D
	Dendrobium	12/30	• Wilton PJE not viable • Modify D552 • Wollongong IAL interdependent (partial CTA operations created by new CTA steps). Management plan required.
	North Appin	17/35	• Rotate RWY alignment more NW/SE to better accommodate competing circuit interaction and departures management with Sydney • Eastern circuits require close track conformance (RNAV) and similarly with western circuits to Sydney. • Close Camden and Wilton • Close R555 • Redesign VFR access lanes through Sydney western CTR (avoiding Lucas Heights)
	Wallandoola	17/35 & 07/25	• Rotate RWY alignment more NW/SE to better accommodate competing circuit interaction and departures management with Sydney. Dependent on weather data such alignment may negate need for cross runway. • R555 operations limited • Cross runway operations conflict with Sydney 16 departures, creating dependency • No IFR at Camden • Camden VFR training areas require reduction

ABBREVIATIONS	
CTR	Control Zone – Class C airspace in the immediate vicinity of a primary airport
FT	Feet
H(xx)	High (jet aircraft) Air-route name
IAF	Initial Approach Fix – the position and altitude at which an instrument approach is commenced
LSALT	Lowest Safe Altitude
NM	Nautical Miles
PRM	Precision Runway Monitor – high definition radar which facilitates independent approaches to parallel runways in instrument conditions
R(xxx)	Restricted area serial number
SFC	Surface (Ground Level)
TMA	Terminal Area – airspace block associated with a primary aerodrome.
VCA	Violation of Controlled Airspace
W(xxx)	Low (propeller aircraft) Air-route name