Australian Government
Department of Infrastructure and Transport

Further assessment of airport development options at Wilton

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Department of Infrastructure and Transport

Site Identification & Preliminary Assessment of Suitability

Further Assessment of Airport Development Options at Wilton

AMPC
Airport Master Planning Consultants

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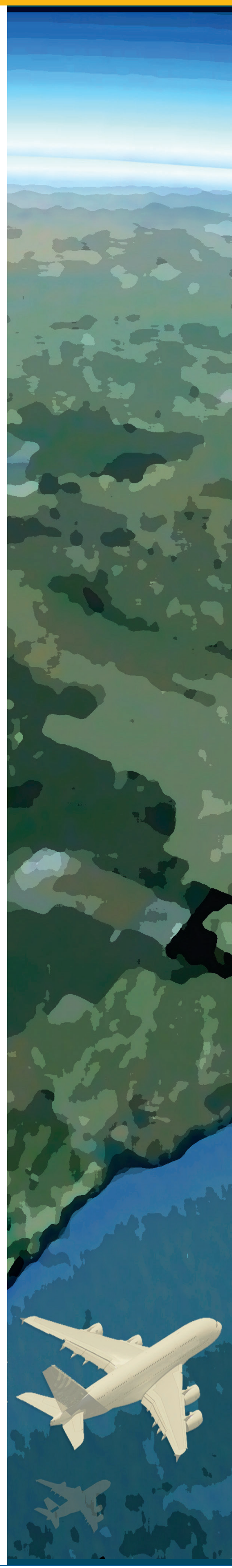
Executive Summary



Executive Summary

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT

Further Assessment of Airport Development Options at Wilton

Executive Summary and Overview of Study

In association with

Henson Consulting

301015-03019 – EN-REP-002

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EXECUTIVE SUMMARY

- This report presents the results of a study, which identifies sites and assesses the suitability of land in environmental and planning terms in the general vicinity of Wilton, New South Wales (NSW), to accommodate airport development of a sufficient scale to meet a predicted shortfall in aviation capacity in the Sydney region.
- While no absolute *"showstoppers"* were identified to building an airport within the general vicinity of Wilton, there will be a set of very challenging issues to resolve for an airport proposal in this locality, in order to meet, amongst other legislative requirements, the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- The work undertaken comprises an assessment of site suitability, including identification of environmental and planning issues, at a level to permit an understanding of the issues and degree of challenge that would be involved.
- Accordingly, this assessment has been undertaken to understand the implications of airport development at Wilton beyond the more strategic analysis that was undertaken in the *Joint Study on Aviation Capacity for the Sydney Region*. The Joint Study included the general area around Wilton as a part of only one of several localities tested for their ability to provide sites for an airport and the airport site termed "*Wilton*" in the Joint Study was only representative of what might be possible at Wilton.
- In the context of the entire environmental planning and engineering design process for creating an airport at a particular site, the work in this Study is at a preliminary level, as it is intended to contribute information to assist in a determination by Government whether or not to continue to develop an airport proposal for a particular airport site or sites at Wilton. If a site or sites was to be carried forward, further and yet more detailed studies would be required in order satisfy Commonwealth, State and other planning legislation.
- The Study was undertaken in the following steps:
  - Step 1 – Define the airport type and scale required to meet forecast demand;
  - Step 2 – Define the Study Area based on key constraints;
  - Step 3 – Undertake further screening to identify and eliminate the parts of the Study Area which are least suitable to accommodate or be incorporated into the site for the required airport type;
  - Step 4-1 – Identify sites and runway alignments that will form base case airport concept level options for further analysis;
  - and closely in parallel;
  - Step 4-2 – Preliminary technical assessment of the environment of the Study Area and the effect of airport options on it; and
  - Step 5 – Develop a summary matrix comparing options.
- The Study process took the form of researching and preparing 25 separate working papers covering those topics which could be expected to be addressed in the preparation of an Environmental Impact Statement, as might be needed under Commonwealth and NSW Government legislation, in particular the EPBC Act or the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The Study was undertaken essentially as a desktop study with limited site reconnaissance and no public consultation was undertaken.

- A Study Area was defined based on key constraints and in consultation with the Department of Infrastructure and Transport, having regard to the work carried out previously for the Joint Study - the Study Area excluded lands which were in State Conservation Areas, which were zoned as urban, and which form natural boundaries to the major water catchment areas of Cordeaux and Cataract Reservoirs. The Study Area, which is greater than the airport site identified as "*Wilton*" in the Joint Study, was selected to enable broad and comprehensive testing of the general area in and around Wilton for its ability to provide a site(s) for an airport that met the specified needs and to ensure that this study would be clearly seen to have looked for sites and assessed the environment broadly in the vicinity of Wilton.
- This Study Area is about 8,000 hectares in size but is effectively divided into two major parts by Wallandoola Creek - the eastern and western precincts. These component parts of the Study Area have a natural north - south orientation, which is reinforced by many of the ridges and drainage lines internal to the Study Area. Runway alignments which follow these terrain linearities are therefore relatively easier to locate.
- For the purposes of testing the Study Area's ability to provide sites, a *"maximum"* airport template was adopted, comprising two 4,000 metres (m) by 60m parallel runways with a separation of 2,000m, one 2,500m by 60m cross runway, and a minimum site area of 1,800 hectares to accommodate terminal facilities and aviation infrastructure needed for 70 million passengers per annum (mppa).
- The airport template size is comparable at the lower end with many new airport developments which occur on sites ranging from 1,800 to 4,000 hectares. Indeed, the whole Study Area, while much larger than the area of the template airport, is of a similar size to some international sites for modern major airports.
- Although the two parts of the Study Area themselves each contain land which exceeds the minimum airport template requirement, the nature of the topography imposes significant constraints when trying to identify suitable locations to accommodate, even when customised, the airport template. Accordingly, the area of land realistically able to accommodate an airport or even elements of an airport is reduced.
- A total of eight airport site options were identified – three in the eastern precinct and five in the western precinct (with one being a variant relating to placement of the cross runway). These site options were developed in order to test a range of locations and runway orientations within the Study Area. The airport template was customised to address the particular circumstances that each site entailed. For example, runways were staggered to displace them relative to one another in order to fit the terrain.
- Through this process, it became evident that sites for a single 4,000 m runway airport can be relatively easily identified and potentially created in the Study Area, in a range of orientations. However, the nature of the terrain in the Study Area leads the second 4,000 m runway - at a minimum 2,000 m separation - and then the cross runway, being much harder to position.
- It also became apparent that, rather than a series of fully independent and discrete sites being identified within the Study Area, these sites have a large degree of land overlap. This effectively resulted in an eastern set of options and a western set, each within a maximum overall site of about 3,000 to 4,000 hectares and identified as potentially able to accommodate a range of options for runway orientation and hence, overall airport configurations.
- Through preparation of Working Papers, assessment of the Study Area and the eight indicative airport sites covered, inter alia, the following topics: Planning and approvals; National transport policy context; Strategic and statutory planning; Land use planning context and future; Airport planning criteria- Meteorology; Airspace, existing aerodromes and aviation-related operational assessment; Acoustic footprints; Land transportation links; Utilities; Regional geology; Regional resource and resource extraction; Drinking water catchment, hydrology and drainage; Water and wastewater management; Earthworks; Flora, fauna and ecological values; Effects on airshed and air quality; Risks and site hazards- vulnerability to flood and fire; European cultural heritage; Aboriginal cultural heritage; Airport safeguarding; Impact on

property and commercial enterprise; Social effects of airports; Visual impacts of airport; and Acoustic effects on people. The Working Papers included a qualitative assessment of how each option performed when considered in respect of the issues and findings associated with the subject matter of that Paper.

- A key finding was that many of these topics do not lead to clear distinctions between either of the two maximum airport sites or indeed between the eight options themselves, although they do provide information relevant to the absolute consideration of an airport located within the Study Area, as compared to elsewhere in the Sydney region. This was not unexpected as, for example, the effects on regional air quality that result from an airport in the Study Area would be materially the same regardless of the source of those emissions within the Study Area. However, these matters may be relevant to an overall decision to proceed with an airport in the Study Area.
- The topics which do appear to provide differentiation are: current and future proposed coal mining and consequent mine subsidence; drinking water catchments and designated *"Special Areas";* European heritage; flora and fauna assets; extent of clearing of land and scale of earthworks required for an airport platform; the extent to which people and property is affected; and the relative ease of creating high quality land access links without creating further adverse effects and to the most appropriate existing transportation systems. On most of these topics, a preference can be found for the options in the western precinct, as development of any of the eastern precinct options is judged to entail massive challenges, even beyond those challenges which would still need to be addressed for the western precinct options.
- Two of the most critical considerations are the effects of aircraft noise on people and the ability to integrate flight tracks into the overall Sydney Region Airspace management plan.
- While the eastern precinct options are the more remote from centres of population and their airport site footprints directly affect almost no people, they were still found to generate noise effects remote from the site itself, depending on runway orientation. The set of western precinct options have the greater direct footprint noise effect and, depending on runway orientations, could have noise effects on established communities in the near and far fields. However, as the options chosen show, it is possible to select runway orientations such that noise effects are minimised. Nevertheless, and as was shown in the Joint Study, the number of people who may be affected by aircraft noise under any of the Options assessed in this Study is small, particularly when compared to the other localities evaluated in the Joint Study.
- A variety of runway headings can potentially be achieved in both the eastern and western precincts as the airport concepts show. This suggests that compatibility with Air Services Australia's (ASA's) current and or future operational management of the Sydney Region Airspace should be able to be achieved through runway orientation optimisation, assuming of course, that the preferred runway headings also leads to minimum noise exposures. Both parts of the Study area - east and west - have potential for further runway orientations to be considered, though input from ASA would be required before this is attempted. More detailed meteorological, climatology and air quality data is also required and, to this end, an Automatic Weather Station should be established at Wilton, if further consideration of this Area is to be undertaken.
- There are some very challenging issues to be resolved in order to site an airport in the Study Area at Wilton. These issues are relatively more and greater for the eastern precinct. Sites in the western part will still face significant challenges and issues to be resolved in order to achieve approval under the relevant legislation.
- Of the western set of options, Option 1 South (1S) (which has a basically north - south alignment) and Option 7 (which has a more northwest - southeast orientation) are considered the most promising sites and configurations, particularly in terms of airspace compatibility and minimising noise effects. The sites for these two options have a significant overlap and, in effect, are the one site.

- The major challenges for and realities of these most promising sites were identified as:
  - Airport Scale - a single 4,000 m runway scale airport site can be relatively easily found but a twin 4,000 m runway with cross runway ("maximum") scale airport becomes much more difficult without incurring significant earthworks costs or resulting in environmental, operational and cost implications of having to fill gullies and creeks that are common across the Study Area. Even if the airport scale was reduced, a number of challenges still exist in the Study Area.
  - Earthworks to create a platform for a "maximum" scale airport at Wilton are estimated as being around 100 to 110 million cubic metres cut plus fill and are around twice that estimated in the Joint Study for the same scale development at Badgerys Creek and, at around $800 to $1,100 million, likely to be at least twice as expensive as at Badgerys Creek.
  - The majority of the airport site footprints are within the Metropolitan Special Area of the Sydney Drinking Water Catchment. While this does not preclude airport development per se, it will result in imposition of extremely rigorous, extensive and expensive works to preclude contamination of the catchments.
  - All of the Study Area is underlain by coal measures and a significant proportion of the western part falls within an active mining lease. There are apparently no current plans to actually mine beneath the aggregate footprint of the western set of airport sites. However, the remainder of that footprint is the subject of an exploration licence. Airports are not compatible with the subsidence effects of long wall mining and accordingly negotiations would be needed to sterilise up to 20 square kilometres of coal, with an expected lost value of from $5 to $20 billion.
  - A large number of threatened species and ecological communities occur throughout the Study Area. Most symbolic of these is the koala which is known to occur throughout the area and which has several identified habitat linkages that traverse the western part. Very detailed field studies, and potentially compensatory habitat, will likely be needed to satisfy the requirements of the EPBC Act;
  - By comparison to other localities and representative airport sites across the Sydney region, as examined in the Joint Study, the acoustic footprint of a "maximum" airport anywhere in the Study Area and, in particular Options 1S and 7, is assessed as having far less effect on people. However, there are still some people currently residing within the 20 Australian Noise Exposure Concept (ANEC) for the Options 1S and 7 and active design and management of this issue will be required.
  - To accommodate 70 mppa, very substantial upgrading of the land transport links to any airport site at Wilton would be required, including access road and interchange upgrading, as well as capacity enhancements on the F5 Hume Highway such as additional lanes. A functional airport rail link would also be needed.
  - The social effects on the existing township of Wilton will be entirely transformational with a likely influx of new residents and increased development to provide support enterprises for the airport as well as airport worker accommodation.
- In summary, there are no potential, absolute *"showstoppers"* that have been clearly identified to preclude development of a *"maximum"* airport along the lines of either Option 1S or 7. If there is a decision to continue to develop of an airport proposal within the Wilton Study Area in the form of either Options 1S or 7, most issues could be addressed and resolved through application of planning skills and design refinements to incorporate environmental safeguards and protection strategies, but also would entail the application of major financial resources. There would be major challenges in terms of planning, approval and design processes, such as those embodied in the EPBC Act and other relevant legislation, to take an airport proposal on these sites at Wilton through planning and design to construction and operation. The highest levels of active issue management and environmentally responsive design would be required.

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STUDY OVERVIEW

1 ROLE OF THIS STUDY

In March 2012, the Commonwealth and New South Wales (NSW) Governments were presented with the report of the *Joint Study on Aviation Capacity for the Sydney Region* (the Joint Study), which had been overseen by an independent Steering Committee of government and industry experts. Wilton was selected by the Commonwealth Government, following its consideration of the Joint Study, for further assessment of its potential to accommodate an airport which would satisfy or contribute to satisfying the predicted shortfall in aviation capacity in the Sydney region.

As the Wilton site examined in the Joint Study was determined from an initial, strategic analysis of the whole of the Sydney region based on limited information, the Commonwealth Department of Infrastructure and Transport (the Department) engaged a team led by WorleyParsons Services Pty Ltd (WorleyParsons) and comprising Airport Master Planning Consultants Pty Ltd (AMPC), PricewaterhouseCoopers Australia (PwC) and a number of technical specialists to conduct further and closer assessment of the general area previously identified at Wilton to determine its ability to supply site options for an airport and to identify the most suitable site or sites.

1.1 Scope of the assessment

The initial stage of assessment, presented in this report, involves site identification at Wilton along with a preliminary assessment[1] of site suitability, including identification of environmental and planning issues. This involves consideration of issues that would ultimately need to be addressed under the Commonwealth *Environment Protection and Biodiversity Conversation Act 1999* (EPBC Act). Broadly, the scope of this analysis includes:

- The preparation of indicative plans for potential airport sites;
- The application of planning and environmental criteria for the assessment of airport concepts;
- The identification of key environmental issues and how these would be impacted by airport development;
- The identification of measures to avoid or reduce environmental impacts;
- The identification and assessment of land transport linkages that may be required and any requirements to relocate existing land transport links;
- The identification of:
  - Properties that would need to be acquired;
  - Land clearing and earthworks necessary for airport development;
  - Watershed impacts and potential water catchment impacts; and
  - Any possible need for relocating service infrastructure including power transmission lines and oil and gas pipelines;
- The preparation of:
  - Topographical maps and aerial photographs showing the location of proposed airport sites;
  - Australian Noise Exposure Concept (ANEC) contour maps; and
  - Preliminary flight path maps.

[1] Preliminary in the sense that this is the first round of studies that specifically focus on Wilton and because further and yet more intensive studies will be required in the event that consideration of a site at Wilton proceeds beyond this Study.

This work has been commissioned as a desktop study, with consultation only undertaken to obtain data, not to obtain viewpoints and inputs from potential stakeholders. Such consultation has principally been with agencies of Commonwealth and State Government, with limited informal consultation with private sector mining interests. No public consultation was undertaken.

1.2 Purpose of the study

The Study seeks to identify a range of potential greenfield airport site options in the general area of Wilton. The Study conducts preliminary analysis of the implications of developing an airport in this area, focusing on potential issues that may become identified as key constraints in a formal environmental impact assessment process conducted under Commonwealth and/or State legislation.

The objective of the Study is to determine, through desktop analysis supported by some limited site reconnaissance visits, what the best site options and configurations for that airport are, when considered against the multifaceted attributes of the general locality of Wilton.

The Study is also intended to provide the Department with a basis for assessing whether the provisions of the Commonwealth's environmental legislation would be triggered and the degree of difficulty in obtaining a positive passage through that legislative process for an airport proposal in the Wilton locality.

A next stage of assessment and analysis of the best or most suitable site options, if commissioned, would involve detailed assessment of associated development issues and costings of the best site or sites.

1.3 Working Papers produced

The Study process took the form of researching and preparing 25 separate working papers covering those topics which could be expected to be addressed in the preparation of an Environmental Impact Statement, as might be needed under Commonwealth and NSW Government legislation, in particular the EPBC Act or the NSW EP&A Act. The Study was undertaken essentially as a desktop study with limited site reconnaissance and no public consultation was undertaken.

The 25 working papers were collated into a number of sections and, with this Executive Summary and Overview form the *Further Assessment of Airport Development Options at Wilton*. The complete contents of this document are as follows:

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2 JOINT STUDY FINDINGS ON THE WILTON AREA

This section summarises the findings of the Joint Study regarding the future demand in the Sydney region and how the Wilton site may play a role in meeting this demand.

The further analysis presented in this report and its accompanying working papers builds on the findings of the Joint Study. However, this Study is not constrained by any of the Joint Study findings or assumptions.

2.1 Future demand in the Sydney region

The Joint Study found that as Sydney's population and activity grows, there will be increasing demand for aviation services.[2] By 2036, Sydney's Metropolitan Area will have a population of 6.2 million and the surrounding region will have a population of 2 million.[3]

The Joint Study suggests Sydney (Kingsford-Smith) Airport will continue to be the most important airport for both passengers and freight in the Sydney region and for Australia.[4] However, the study concluded that *"immediate action is needed to meet the airport's capacity to meet growing demand".*[5]

It was found that, even if the investments proposed in Sydney Airport Corporation Limited's (SACL) *Sydney Airport Master Plan 2009* (the Master Plan) and the concept for terminal redevelopment are undertaken, the airport will be unable to meet projected aircraft movements for the medium and long term.[6] The airport has a limited ability to handle passenger growth, not only because of the legislated cap on runway movements per hour, but also because of:

- Physical constrains on runway length and land area;
- Constrains on taxiway, gate and apron development; and
- The commercial mix of services operating to the airport.

Under the current constraints, the Joint Study found that Sydney (Kingsford-Smith) Airport will become unable to meet demand for new services in the future. Specifically, it was concluded that:

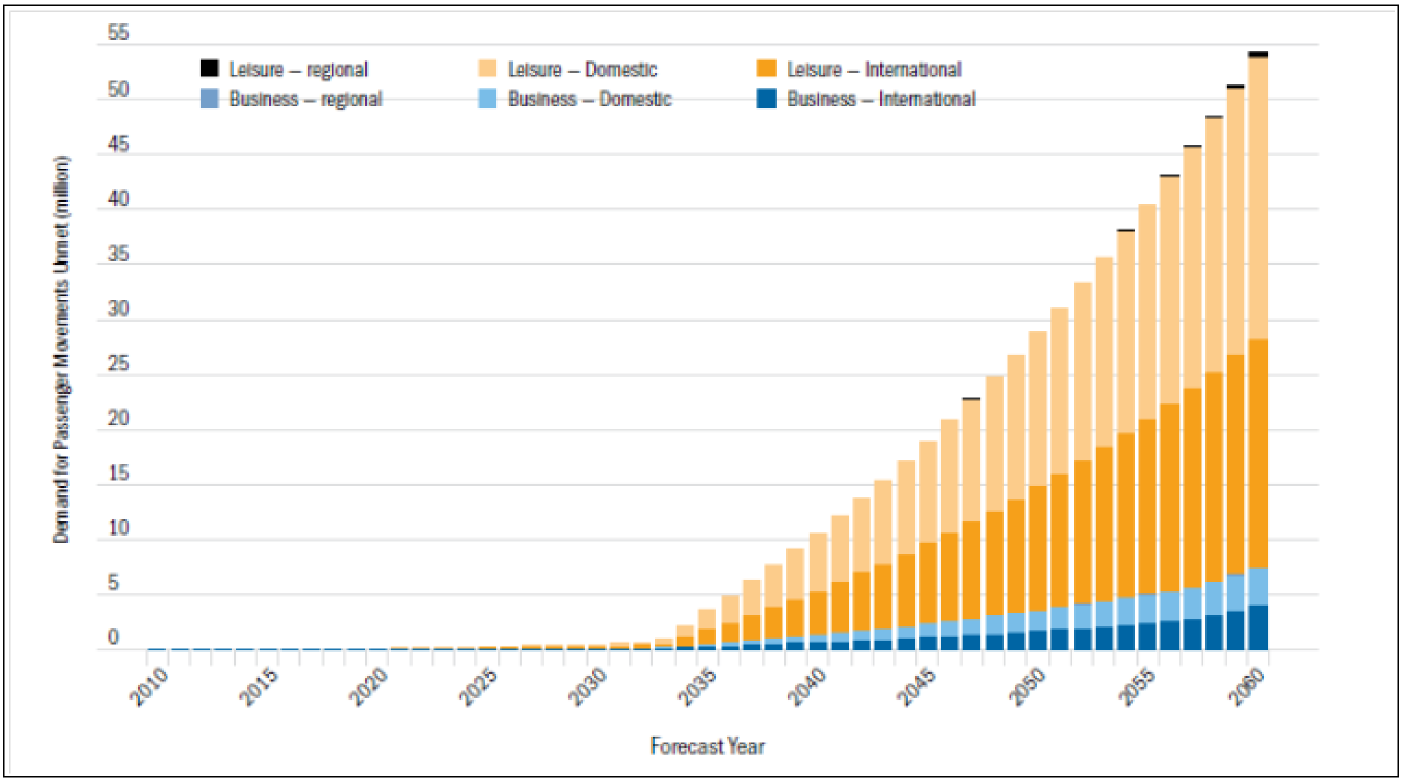
- By 2020, all slots on weekday mornings between 6.00am and 12.00pm and between 4.00pm and 7.00pm will be fully allocated so growth of passenger capacity at these times will depend on aircraft upgauging;
- By around 2027 all slots will be allocated so new entrants will not be able to be accommodated unless other services are cancelled; and
- By around 2035 there will be practically no scope for further growth of Regular Public Transport (RPT) services at the airport.[7]

Furthermore, using conservative estimates, it was found that by 2060 demand for RPT services in the region will exceed capacity by 54 million passenger movements per year.[8] The total cumulative unmet demand would be approximately 665 million passenger movements between 2035 and 2060.[9]

Figure 1.1 shows the profile of unmet demand, by purpose of travel. Leisure demand for both international and domestic travellers is estimated to comprise the most significant portion of unmet demand.

[2] *Joint Study on Aviation Capacity in the Sydney Region*, 2012.
[3] *Ibid.*
[4] *Ibid.*
[5] *Ibid.*
[6] *Ibid,* p. 6
[7] *Ibid,* p. 6
[8] *Ibid,* p. 17
[9] *Ibid,* p. 17

Figure 1.1 Sydney (Kingsford-Smith) Airport expected demand for passenger movements unmet by type and purpose of travel, 2010 to 2060



Source: Commonwealth and NSW Governments, 2012. Joint Study on Aviation Capacity in the Sydney Region, p. 317.

2.2 Meeting demand in the Sydney region and potential role of Wilton

The Joint Study recommended that *"investment in airfield infrastructure is required now to minimise delays and loss of potential services as operations continue to grow and the airport approaches its peak period capacity".*[10]

As well as considering better use of existing airports and new airport development, the Joint Study considered changes to regulatory arrangements for operations at Sydney (Kingsford-Smith) Airport.[11] It was also found that existing airports in and surrounding the Sydney region (such as Newcastle Airport, Canberra Airport, Bankstown Airport and Royal Australian Air Force (RAAF) Base Richmond) *"should each take important roles but not as a second major airport for Sydney"*[12] and are *"not expected to divert any significant level of future demand from Sydney (Kingsford-Smith) Airport"*.[13]

Based on the findings regarding capacity constraints and future demand, it was concluded that *"from around 2030, an additional airport will be needed to supplement the capacity of Sydney (Kingsford-Smith) Airport"*.[14] It was recommended that governments will need to determine the location and commence investment into another airport site capable of handling large RPT aircraft within the next five years. [15]

The Joint Study proposed that the Badgerys Creek site, which was acquired by the Commonwealth between 1986 and 1991, is the best site for a future airport. However, if Badgerys Creek is ruled out, Wilton is *"the next best site"*[16] and it was recommended that the Australian and NSW Governments *"proceed without delay to secure and protect the*

[10] *Ibid*, p. 7
[11] *Ibid*, p. 7
[12] *Ibid*, p. 7
[13] *Ibid*, p. 8
[14] *Ibid*, p. 8
[15] *Ibid*, p. 8
[16] *Ibid*, p. 8

Wilton site for the development of a supplementary airport in the future".[17] As the business case for commencement of airport operations at Wilton by 2030 might be harder to establish than at Badgerys Creek, it was concluded that *"opening RAAF Base Richmond to RPT services would provide improved access to aviation services for the growing population of western Sydney in the interim"*.[18]

The Cordeaux - Cataract locality and the representative site[19] therein at Wilton was initially shortlisted in the Joint Study through a multi-phase evaluation process. In the final stage of the Joint Study analysis, a *"more suitable"* representative site at Wilton was assessed in the south-west of the Study Area, as defined below for the purposes of this study. This *"more suitable"* representative site was based on its ability to accommodate a full service international airport with the following characteristics:

- Site footprint of approximately 1,800 ha;
- Runways of the following length and a north - south alignment:
  - 4,000 m x 60 m (18/36);
  - 2,500 m x 60 m (18/36);
  - 2,500 m x 60 m (08/26) - cross runway; and
  - Capacity of up to 65 million passengers per annum.20

Some of the benefits identified in the Joint Study for an airport located at Wilton included:

- Airspace interactions with Sydney (Kingsford-Smith) Airport are less constrained than other sites;
- A smaller number of people would be impacted by both land acquisition and aircraft noise relative to the other sites assessed; and
- Sydney's growth is expected to spread further to the southwest in the long term.[21]

Some of the challenges included:

- Being located further from the potential market (but would be well located if Sydney's longer-term growth is to the southwest);[22]
- Having amongst the highest earthworks platform costs of all the sites assessed in the Joint Study due to the geomorphology of the terrain;
- The cost for rail access could be higher than some other localities; and
- Relatively high preliminary road connection costs.[23]

[17] *Ibid,* p. 364
[18] *Ibid,* p. 364
[19] Representative in the sense that only one Option was identified to represent what could be possible within the lands that were considered suitable for airport development
[20] *Ibid,* p. 33 (Matrix 3)
[21] *Ibid,* p. 30
[22] *Ibid,* p. 273
[23] *Ibid,* p. 30-40 (Matrix 3)

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3 DRAFT 1985 EIS FINDINGS ABOUT THE WILTON STUDY AREA

As part of the Second Sydney Airport Site Selection Programme commissioned by the then Department of Aviation in 1985, a Draft Environmental Impact Statement (the Draft 1985 EIS) was prepared for potential airport options at Wilton and Badgerys Creek.[24] This section summarises the findings of the Draft 1985 EIS in relation to the then Wilton Study Area and the site that was identified.

As part of the preparation of the Draft 1985 EIS, a preliminary master plan was prepared for the proposed site at Wilton.[25] The site was on the south-western side of the current Wilton Study Area.

Assessment was conducted on the basis that the Wilton site would accommodate a set of two widely spaced parallel runways, one 4,000 m in length and the other 2,500 m in length, with a separation of 1,660 m between the runways.[26] This layout was selected as it allowed greater operational flexibility for an aircraft mix containing a high proportion of smaller aircraft and it was more efficient in terms of total runway capacity related to land area requirements.

All detailed flight track and aircraft assignment and noise assessment was undertaken on an east - west alignment. This alignment was selected as it avoided the need to acquire land within the village of Wilton and had lower impacts on large areas suitable for potential urban development.[27]

Some of the benefits identified in the Draft 1985 EIS for an airport located at Wilton included:

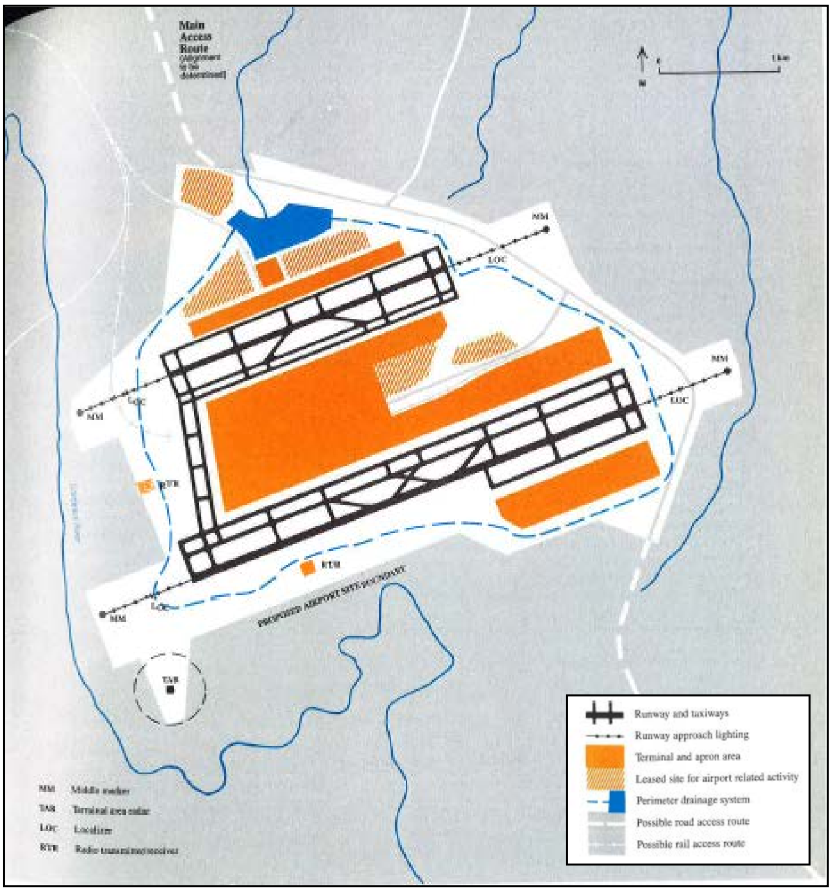
- It would require '*minor restructuring'* to airspace arrangements';[28]
- The number of residents that would be displaced at Wilton was relatively low;[29]
- The market value of land that would need to be acquired at Wilton was relatively low;[30] and
- The number of people impacted by noise at Wilton was relatively low.[31]

Some of the challenges included:

- Accessibility of the Wilton site from the city centre;[32]
- The value of the extractable mineral resources under the site, particularly coal;[33]
- The high proportion of steep slopes on the site;[34]
- The ecological value of the site;[35] and
- The creeks surrounding the site had the highest classification of protection in NSW.[36]

[24] Williams, Paul. 1998. *Background Paper 20: 1997/98 Second Sydney Airport: A Chronology.* Published by the Australian Parliamentary Library. Available at: http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Publications_Archive/Background_Papers/bp9798/98BP20
[25] Kinhill Stearns, 1985. *Second Sydney Airport Site Selection Programme: Draft Environmental Impact Statement*. Prepared for the Department of Aviation, p 353.
[26] Kinhill Stearns, 1985. *Second Sydney Airport Site Selection Programme: Draft Environmental Impact Statement*. Prepared for the Department of Aviation, p 353.
[27] Kinhill Stearns, 1985. *Second Sydney Airport Site Selection Programme: Draft Environmental Impact Statement*. Prepared for the Department of Aviation, p 359.
[28] *Ibid,* p. 536
[29] *Ibid,* p. 536
[30] *Ibid,* p. 536
[31] *Ibid,* p. 537
[32] *Ibid,* p. 546
[33] *Ibid,* p. 541
[34] *Ibid,* p. 540
[35] *Ibid,* p. 547
[36] *Ibid,* p. 543

Figure1.2 Draft 1985 EIS Master Plan Layout for Wilton



Source: Kinhill Stearns, 1985. Second Sydney Airport Site Selection Programme: Draft Environmental Impact Statement. Prepared for the Department of Aviation, p 360.

Following the release of the Draft 1985 EIS, the Hawke Government announced in 1986 that airport development would occur at the Badgerys Creek site.[37] In 1989, it was announced that, in addition to the construction of an airport development at Badgerys Creek, a third runway would be developed at Sydney (Kingsford-Smith) Airport and that runway was opened in 1994.[38]

It should be noted that, since the Draft EIS was prepared in 1985, there have been some changes in the Sydney region which effect consideration of the Wilton Study Area. In particular:

- The parallel (16L/34R) runway has been developed at Sydney (Kingsford-Smith) Airport;
- The Long Term Operating Plan (LTOP) was introduced at Sydney (Kingsford-Smith) Airport which puts in place noise sharing arrangements; and
- The Upper Nepean State Conservation Area has been created and it conflicts with the 1985 proposed site.

[37] Williams, Paul. 1998. *Background Paper 20: 1997/98 Second Sydney Airport: A Chronology.* Published by the Australian Parliamentary Library. Available at: http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Publications_Archive/Background_Papers/bp9798/98BP20

[38] Williams, Paul. 1998. *Background Paper 20: 1997/98 Second Sydney Airport: A Chronology.* Published by the Australian Parliamentary Library. Available at: http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Publications_Archive/Background_Papers/bp9798/98BP20

4 SITE IDENTIFICATION AND ANALYSIS PROCESS

This section outlines the site identification and analysis process applied to undertake the assessment of the general Wilton area's ability to provide site options, in addition to the "*more suitable*" site identified in the Joint Study, for airport development and to assess which of those options is the best site or sites.

The site identification and analysis process was developed in order to firstly identify optimum areas within a defined Wilton Study Area that reasonably can accommodate an airport of the type required. It then applied additional evaluation screens to screen out areas less suitable to accommodate an airport. This allowed for the identification of sites and runway alignments that were subjected to further, more detailed, environmental and other impact analysis through the technical working papers contained in this report.

The Study process included the steps shown in **Figure 1.3** and outlined below:

- Step 1 – Define the airport type and scale required to meet forecast demand;
- Step 2 – Define the Study Area based on key constraints;
- Step 3 – Undertake further screening to identify and eliminate the parts of the Study Area which are least suitable to accommodate or be incorporated into the site for the required airport type;
- Step 4-1 – Identify sites and runway alignments that will form base case airport concepts options for further analysis;

and closely in parallel;

- Step 4-2 – Preliminary technical assessment of the environment of the Study Area and the effect of airport options on it; and
- Step 5 – Develop a summary matrix comparing options.

A full service ("*maximum*") airport has been adopted with a layout comprising operationally independent, wide-spaced parallel runways and a cross runway. This enabled assessment of the least capacity constrained, optimised airport that is capable of accommodating Sydney's forecast aviation demand that cannot be handled at existing airports.

Following this, establishment of the boundaries of the Study Area was undertaken to focus on lands within the Wilton locality generally suitable to accommodate the required full service airport. A site footprint and alignment capable of accommodating a full service airport was then applied within the refined Wilton Study Area to identify specific indicative[39] sites and runway alignments capable of accommodating the airport type required.

The sites identified were then assessed in a set of technical working papers, with each paper identifying potential issues with developing an airport and where possible, presenting mitigation strategies.[40] Only at this point was consideration given to possible modifications to the specified full service airport template as a means of mitigating specific issues that were identified in the assessment. This was undertaken to provide the Department with a set of tradeoffs available relating to a decision for proceeding with any of the site options, and to ensure that each option was initially compared on a like-for-like basis.

[39] Used in the sense that these are intended to test the ability of the Study area to accommodate an airport and not in the sense that these are concepts capable of being taken forward without further refinement to a design development phase.
[40] Note: Preparation of cost estimates associated with these strategies was not a part of the scope of work of this Study although for the purposes only of facilitating some cost comparisons, in regard to some of the issues assessed, have been made.

Figure 1.3 Site Identification and Assessment Process

Stage 1: Site identification and Preliminary Assessment of Site Suitability	
Step 1: Define airport type required	Two Independent, wide-spaced parallel runways 4,000m x 60m and a cross runway 2,500 x 60 m.
Step 2: Define study area based on key constraints	West: Upper Nepean State Conservation Area East: Cataract River dam area North: Townships of Wilton, Douglas Park and Appin South: Cordeaux River dam area
Step 3: Undertake screening within Study Area to refine areas more suitable to accommodate airport type	Avoid areas of steep terrain, Avoid deep gorges using Slope Analysis to understand terrain.
Step 4- 1: Identify sites and runway alignments that will form base case airport concepts for analysis and relative suitability	- Option 1 - Option 1 South - Option 2 - Option 3 - Option 4 - Option 5 - Option 6 - Option 7
Step 4-2: Preliminary technical assessment of the environment of Wilton using base case airport concepts to compare options, assess issues and identify mitigation strategies	Preparation of 25 Working Papers to address airport and infrastructure planning and environmental issues in order to understand the constraints and opportunities of the Wilton Study Area and its surrounds
Step 5: Develop summary matrix of options	Using the data from both Steps 4-1 Airport configurations and Step 4-2 summarize quantitative and qualitative data to show, to the extent possible, the relative differences, merits and demerits of each airport concept.

5 SITE IDENTIFICATION AND PRELIMINARY ASSESSMENT OF SITE SUITABILITY

The process applied to identify sites and runways configurations for further analysis of the Wilton Study Area is outlined below. A full service *"maximum"* airport template has been adopted in order to ensure that, as demand increases, the later stages of development can be accommodated. However, it is noted that, in practice, airport development would begin with a simpler configuration of runways and terminals, with expansion in stages to ultimately achieve the optimised master plan layout, as this evolves over time and as demand for capacity develops.

5.1 Step 1 – Define airport type required

According to the findings of the *Joint Study* that are also outlined above, unmet aviation demand in the Sydney region is expected across general aviation (GA), international, interstate and domestic movements. By 2060, demand for RPT services is expected to exceed capacity by 54 million passenger movements per year at Sydney (Kingsford-Smith) Airport.

To provide for all segments of unmet demand outlined above, a *"Wilton"* airport development must be able to accommodate all international and domestic aircraft. Furthermore, to accommodate the scale of unmet demand estimated, a full service airport servicing all market segments and capable of handling a future parallel runway layout would be required.

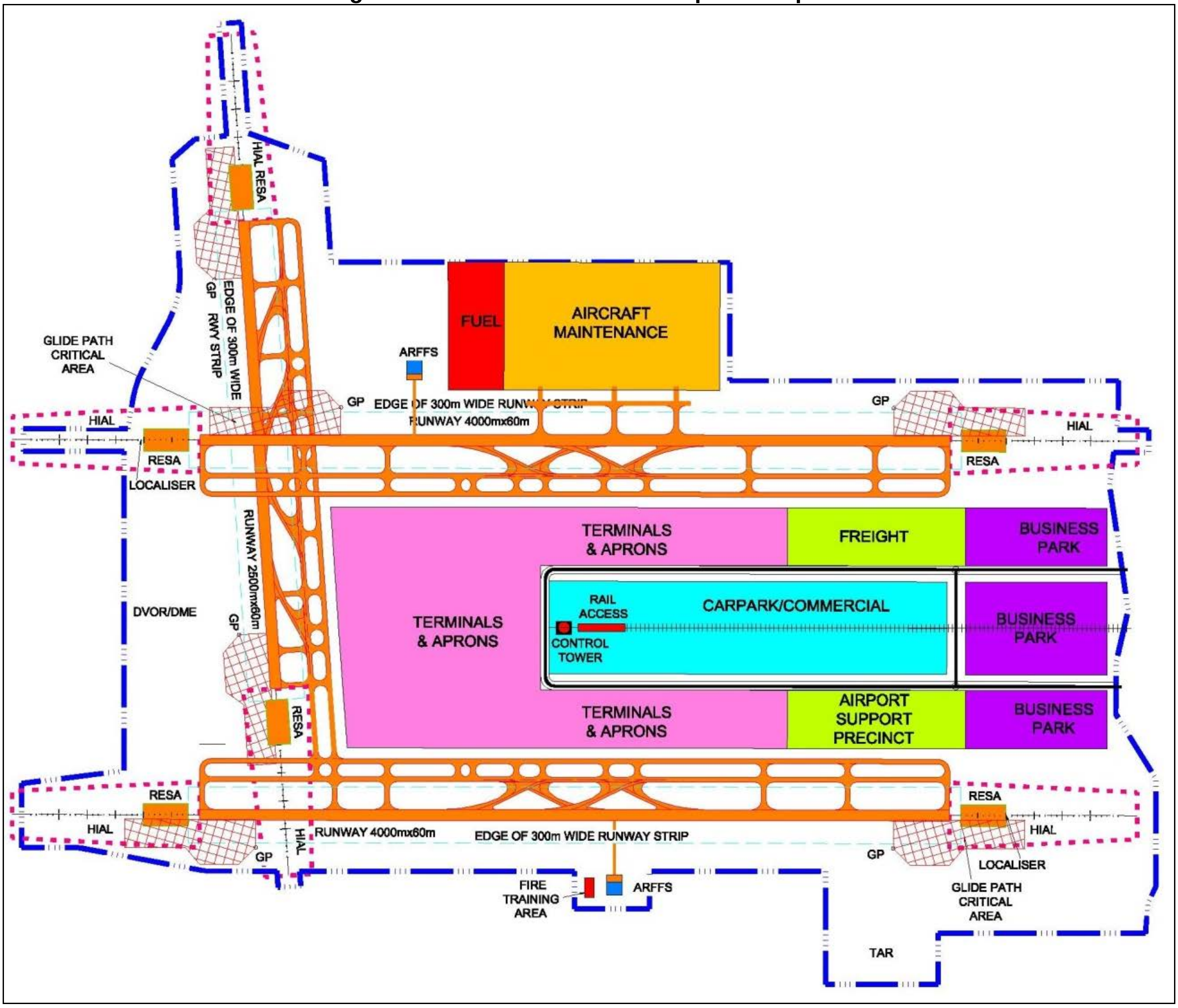
For the purpose of this analysis, it is considered appropriate to assess the least capacity constrained airport and assess the level of demand that such an airport could accommodate. Therefore, the airport type required is assumed to need to provide capacity for 70 million passenger movements per year.

A template *"maximum"* airport was developed in order to assess how to accommodate a full range of aviation activity over a planning horizon of more than 50 years at this level of aviation capacity and to provide space for supporting infrastructure such as car parking, rail access and business park development. The template is shown in **Figure 1.4** and has a minimum area of approximately 1,800 hectares.

This level of passenger movements has been used throughout the remainder of the identification and assessment process to enable analysis of the potential impacts and issues likely to be encountered in developing this scale of airport at Wilton.

Further information on development of the airport template and the rationale and assumptions behind this can be found in the Working Paper *Airport Performance Specification for Wilton - Task and Infrastructure*.

Figure 1.4 Wilton *"Maximum"* Airport Template



Notes: Assumes: parallel runway separation 2,000 m; two 4,000 m x 60 m and one 2,500 x 60 m runways; site area 1,789 ha.

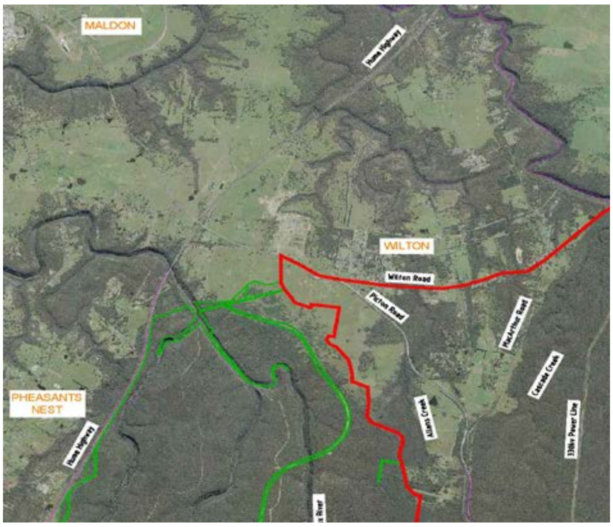
5.2 Step 2 – Define Study Area based on key constraints

For the purposes of this assessment, the Wilton Study Area is defined as the area contained within the following external boundaries:

- Upper Nepean State Conservation Area (west);
- The townships of Wilton, Douglas Park and Appin (north); and
- The Cordeaux River and Cataract River dam areas (east - Cataract and south - Cordeaux).

These external boundaries are assumed to guide identification of initial base site selections. However, if analysis identified particular issues then a mitigation strategy may well be to consider shifting a site across these boundaries. This may entail Government making a trade-off decision between achieving the maximum capacity of the airport and causing some other impact or affecting some form of environmental value. The Study Area is presented in **Figure 1.5**.

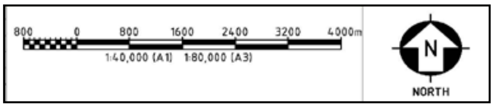
Figure 1.5 Wilton Study Area (as indicated by red line)



LEGEND

Wilton Study Area [1] Boundary

[1] Defined as the area contained within the following external boundaries: (1) Upper Nepean State Conservation Area (West), (2) the townships of Wilton, Douglas Park and Appin (North) and (3) the Cordeaux River and Cataract River dam areas (East-Cataract and South – Cordeaux).



The boundaries of the Wilton Study Area have been developed from identification in the Joint Study of key issues and constraints that occur in the area. The boundaries and the rationale for their selection are outlined in **Table 1.1**.

The Study Area encapsulates the contiguous land in the general area of Wilton, identified in the Joint Study as able accommodate a *"maximum"* airport and both the representative Wilton site, as identified in the Joint Study, as well as much of the site which had been identified in 1985.

Table 1.1 Criteria to exclude areas that cannot accommodate the required airport

External Boundary	Key Performance Indicator (KPI)	Rationale
Upper Nepean State Conservation Area (west)	Exclude state conservation areas	The Upper Nepean State Conservation Area is located in the vicinity of the Wilton Study Area. Areas designated as a State Conservation Area will not be included in the site analysis in order to avoid any direct or significant indirect effects on areas of protected ecosystems that have been reserved by the Commonwealth and/or NSW Governments. Development in such areas would clearly be less desirable on environmental grounds. This is consistent with criterion used in the Joint Study to shortlist greenfield locations in the Sydney region.
The townships of Wilton, Douglas Park and Appin (north)	Exclude existing urban areas	Almost any land parcel is likely to have some pre-existing use (such as residential, employment, recreational or agricultural). The impact on urban areas from land acquisition should be minimised so that dense residential and business areas are not included. Urban areas excluded were those zoned for residential land use, significant commercial land use and significant heavy industry land use. It was considered that these areas are not convertible for aviation purposes. This is consistent with criterion used in the Joint Study to identify potential greenfield locations in the Sydney region. The townships of Wilton, Douglas Park and Appin are located to the north of the area where the Wilton representative site was located in the Joint Study. The southern side of Wilton Road has been defined as the notional northern boundary as a means of eliminating the urban areas defined above.
The Cordeaux River and Cataract River dam areas (east - Cataract and south - Cordeaux)	Avoid dam catchment areas	The eastern and southern Study Area boundaries have been established to avoid the dam catchments of Cataract River and Cordeaux River. The western dam catchment boundary is defined as the physical ridge line along Lake Cataract, which separates the direction in which water will flow. To the east of the ridge line, water will generally flow into the dam, and to the west it will generally flow away from the dam. The southern dam catchment seeks to avoid Lake Cordeaux. From the eastern boundary to Lake Cordeaux, the boundary follows areas of significant slope. From the lake, the boundary has been extended directly to the Upper Nepean State Conservation Area. These boundaries have been established with the objective to avoid impact on the reservoirs. In fact the ridge line could be crossed to some extent with appropriate drainage works – but for the identification of initial representative options, the boundary seeks to provide some buffer between the airport site and the dam catchment.

5.3 Step 3 – Screening out areas less suitable to accommodate the required airport type

Following refinement of the Wilton Study Area, a fairly significant land area still remained within Wilton. Based on the areas remaining, it would be possible to physically locate a range of preliminary runway layout options.

In considering potential sites and runway alignments that could form base case concepts for further analysis, however, the following issues were identified that would limit some land areas in their ability to accommodate an airport.

Slope

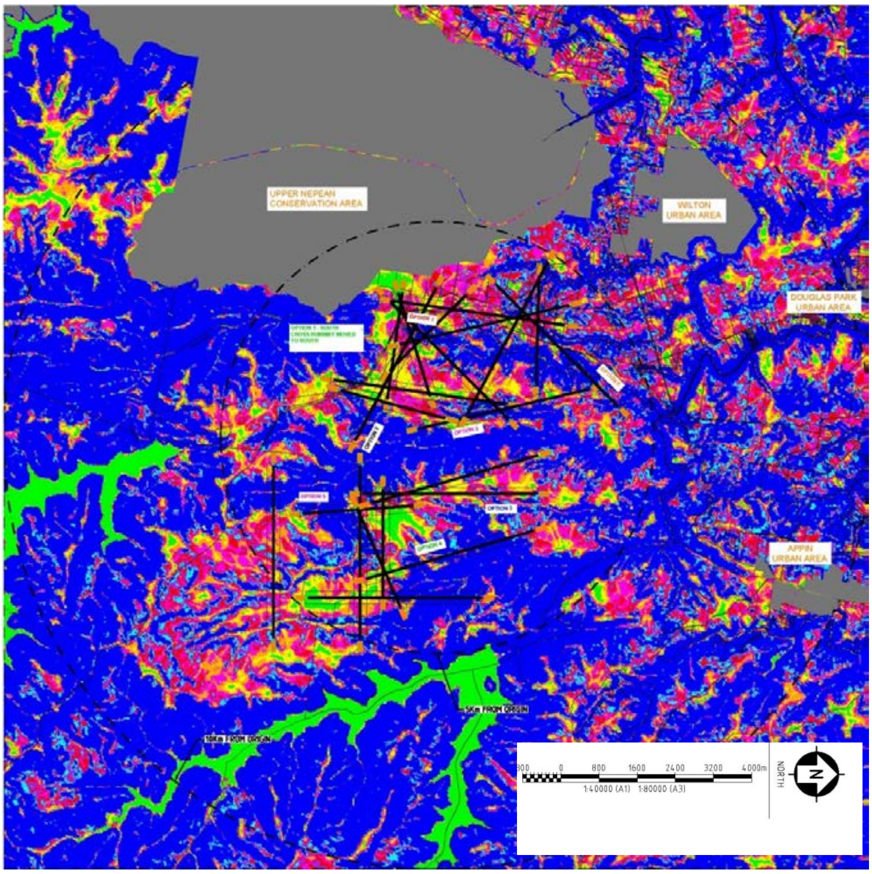
Particular parts of the Wilton Study Area are characterised by terrain with slopes that would be disproportionally costly to accommodate International Civil Aviation Organisation (ICAO) standards and Civil Aviation Safety Authority (CASA) regulations. These standards and regulations set out maximum longitudinal slopes and specifications for obstacle limitation surfaces (OLS) for airport runways.

Figure 1.6 shows the Study Area topography analysed into the following classes of slope:

- Flat terrain — 0-1% slope (green - yellow) (noting that the water surfaces of the reservoirs are also shown as *"green"*);
- Gently sloping terrain — 1-5% slope (yellow - red);
- Undulating terrain — 5-7% slope (red - purple); and
- Steep terrain — > 7% slope (shades of blue).

The linearity of the Study Area in a generally north - south orientation can be seen from this analysis, as can the fact that there is very little flat or near flat land.

Figure 1.6 Slope analysis of the Wilton Study Area



Terrain

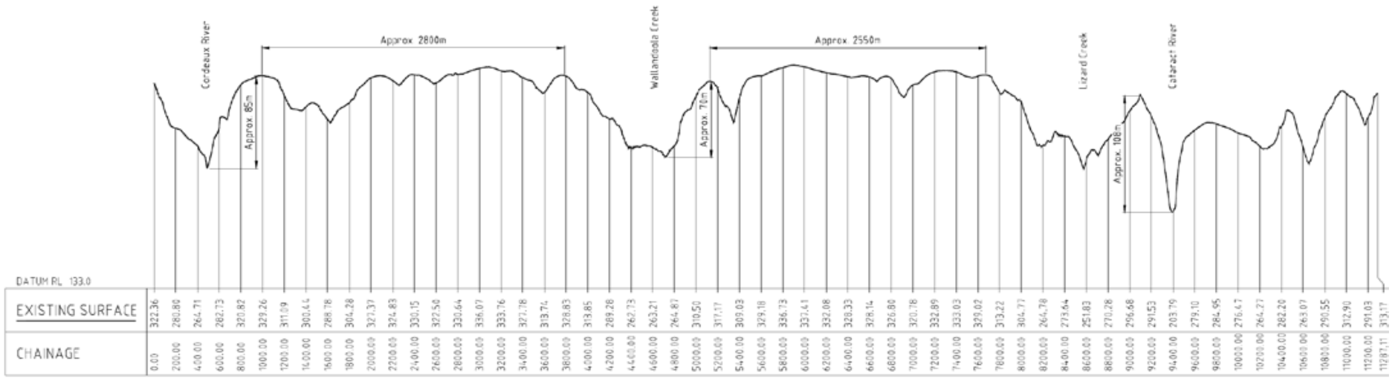
Deep gorges within the Study Area were identified as potential major limitations to developing a greenfield airport. In particular, there is a deep gorge in which Wallandoola Creek is located, in a north - south alignment and more or less cutting within the middle of the Study Area.

The environmental, operational and cost implications of having to fill or bridge a deep gorge in order to accommodate an airport in the area were identified as less desirable than locating a site elsewhere in the Study Area or to orienting runways in such a way as to avoid such crossings.

While slope analysis outlined above provided insight into the areas of increasing slope, the analysis does not specifically identify the location/presence of the gorges. For this reason, analysis of a set of cross-sections was undertaken in order to identify the gorges and to understand if any of these might create difficulties for constructing an airport site.

Figure 1.7 depicts one of the five cross-sections of the Wilton Study Area that was selected to assess the scale of drops in the terrain across the gorges based on longitudinal analysis. This cross-section runs east - west across the Study Area and the gorge in which Wallandoola Creek is located.

Figure 1.7 Variation in terrain height at one of the cross-sections analysed



Source: Working Paper *Land Clearing and Earthworks.*

As the example cross-section above indicates, there are parts of the Study Area where the terrain elevation varies dramatically. These variations occur principally at the location of the gorge which is central in the Study Area, in which Wallandoola Creek flows. The elevation differences in the terrain shown in some parts of these cross-sections are so extreme that in order to cross them with a runway, cut and fill earthworks even greater than that used to create parts of the Sydney-Newcastle Freeway would be required.

Based on the slope and gorge analysis, therefore, the following criteria (**Table 1.2**) were applied to refine areas within the Wilton Study Area considered less suitable to accommodate and airport.

Table 1.2 Criterion to exclude areas less suitable to accommodate an airport

Criteria	KPI	Rationale
Slope analysis: Avoid areas likely to require significant cut and fill	Avoid areas with current slope of greater than 7 per cent	For safety reasons there are International ICAO standards and CASA regulations setting out maximum longitudinal slopes and specifications for OLS for airport runways. While any greenfield airport site is likely to require some cut and fill earthworks to suitably level or grade the land for use as an airport, this criterion excludes areas where the terrain and surrounding landscape is expected to make particular parts of the Wilton Study Area disproportionally costly relative to accommodating safety requirements within other parts of the Study Area. This is similar to the approach used in the Joint Study to identify potential greenfield locations in the Sydney region.
Avoid deep gorges: Avoid land with deep gorges	Avoid areas that would require deep gorges to be in-filled	Locating an airport across deep gorges within the Wilton Study Area has been identified as a risk to developing a greenfield airport across. The environmental, operational and cost implications of having to fill or bridge a deep gorge in order to accommodate an airport in the area are clearly less desirable than locating a site elsewhere in the Study Area and that still fulfils the Step 3 exclusionary criteria.

5.4 Step 4-1 – Identify sites and runway alignments for base case airport concepts

Following definition of the airport type required, the land within the Wilton Study Area was tested using the airport template, applied on areas remaining after the less suitable land was eliminated, to assess its ability to accommodate the required full service airport and identify a set of representative airport sites.

Eight site options were developed that could accommodate a *"maximum"* airport having flexible operational capability (comprising two independent wide-spaced 4,000 m parallel runways and a 2,500 m cross runway) based on the process undertaken above.

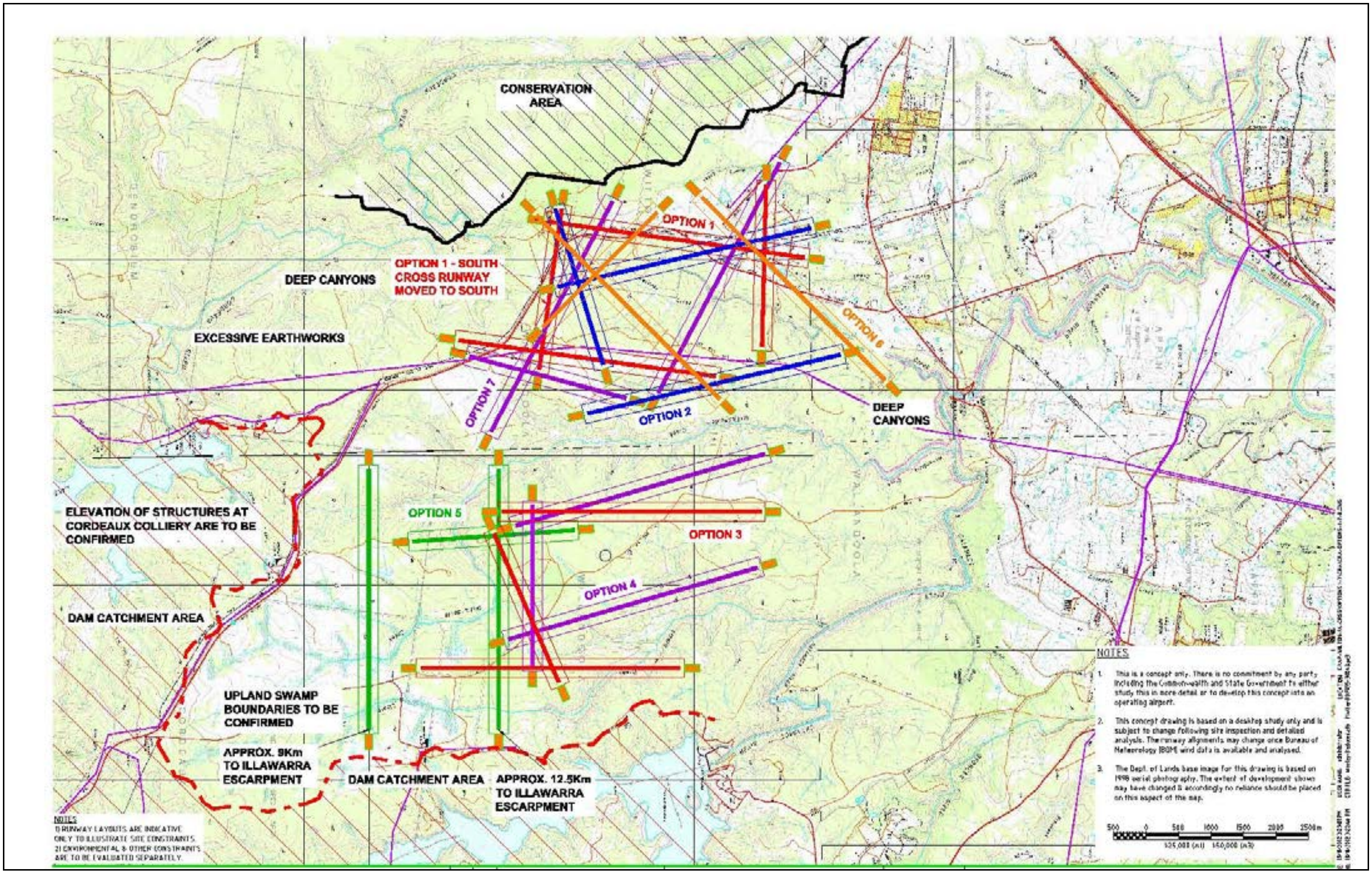
The airport concepts provide for major facilities including: an air traffic control tower; rescue and fire fighting services; navigation and landing aids; passenger terminals and aprons; airport support facilities; freight; aircraft maintenance; roads and car parks; rail; fuel storage; and business park areas. These major facilities vary in scale and location depending on the option. Space has also been provided for water detention basins as identified through the process.

These should not be considered as proposed configurations but as indicative concepts to test the ability of the Study Area to accommodate an airport in terms of matters such as:

- Response to the Study Area boundaries;
- Terrain;
- Runway headings;
- The distribution of population;
- How land is used; and
- A broad range of environmental factors.

It should be noted that the effects of an airport are both those which result from its physical footprint within the airport boundaries as well as its operational footprint which extends well beyond the site boundaries. The identified runway options are presented in **Figure 1.8**.

Figure 1.8 Identified sites and runway options



The key attributes of these runway configurations are listed below:

Sites located in western precinct of the Wilton Study Area:

- **Option 1** (approximately north - south alignment) – Similar to the Wilton representative site which was selected in the Joint Study. However, the Joint Study concept layout for the airport was modified to provide for two 4,000 m long main runways with a 2,000 m runway separation. (Proposed runway alignments: main 18/36, secondary 08/26);
- **Option 1S** (approximately north - south alignment) – Involves modification to Option 1 with relocation of the cross runway from the northern end of the airport site to the southern end of the airport site. This modification was proposed to improve the concept layout and facilitate better road and potential future rail access. (Proposed runway alignments: main 18/36, secondary 09/27);
- **Option 2** (approximately northwest - southeast alignment) – This option has been aligned to Sydney (Kingsford-Smith) Airport 16/34 runway direction to reduce complexity with airspace management. (Proposed runway alignments: main 16/34, secondary 06/24);
- **Option 6** (approximately northeast - southwest alignment) – Provides for an option with a different heading to seek to reduce noise impacts to the north. The site is, however, limited by steep terrain including the Wallandoola Creek gorge, resulting in noise being directed over Appin. (Proposed runway alignments: main 03/21, secondary 12/30); and
- **Option 7** (approximately northeast - southwest alignment) – Provides for an option with a different heading to seek to reduce noise impacts to the north. The site is, however, limited by steep terrain including the Wallandoola Creek gorge, resulting in noise being directed towards Tahmoor. (Proposed runway alignments: main 11/29, secondary 18/36).

Sites located in eastern precinct of the Wilton Study Area:

- **Option 3** (approximately north - south alignment) – Identified in the eastern part of the Wilton Study Area to enable consideration of the area east of Wallandoola Creek. In order to minimise the impacts of the environmentally sensitive Upland Swamps and Lizard Creek, the runway separation was increased 20% to 2,400 m. (Proposed runway alignments: main 17/35, secondary 05/23);
- **Option 4** (approximately northwest - southeast alignment) – Rotates the site to seek to achieve a runway alignment closer to runway 16/34 at Sydney (Kingsford-Smith) Airport. This necessitated narrowing of the runway separation to 1,650 m to fit the terrain, but with modifications to avoid the Upland Swamps.(Proposed runway alignments: main 15/33, secondary 08/26); and
- **Option 5** (approximately east - west alignment) – Provides for an east - west option, partially located in the Upland Swamps to enable consideration of a site in this location of the Study Area. It is the option in closest proximity to the Illawarra Escarpment. (Proposed runway alignments: main 08/26, secondary 16/34).

The placement of airport facilities, such as airport support, freight and business parks relative to the terminals and aprons (which are located between the main runways) in Options 3, 4 and 5 is considered to be less efficient than the other five options, in terms of airport layout.

How do the options above relate to previous Wilton studies undertaken?

Option 1 has a similar alignment to the Wilton representative site identified in the Joint Study and Option 3 has a similar alignment to the Wallandoola site identified in the Joint Study.

The Draft 1985 EIS conducted detailed flight track and aircraft assignment, noise assessment and preliminary master planning on an east - west alignment at the then Wilton site. This alignment was selected as it avoided the need to acquire land within the village of Wilton, after a north - south alignment was rejected. The Draft 1985 EIS preliminary master plan site (the preferred site) is in a similar location to Options 1, 1S and 7 (although Options 1 and 1S have a north - south alignment, whilst the preferred alignment in the Draft 1985 EIS had an east - west alignment). The rejected north - south alignment in the Draft 1985 EIS is similar to Option 1. The Draft 1985 EIS preliminary master plan did not have two 4000 m runways and did not include a cross runway.

The Draft 1985 EIS preliminary master plan site now conflicts with the Upper Nepean Conservation Area and was eliminated as an option in this Working Paper. If, through discussion with Sydney Catchment Authority (SCA), this boundary is found to be moveable, that site, in part or in its entirety, may be reconsidered.

Following the progressive screening undertaken in the steps outlined above, which identified indicative site options, a preliminary analysis of eight options was undertaken to consider environmental, planning and other factors and constraints in a set of working papers as outlined below.

5.5 Step 4-2 – Detailed Assessment of the Wilton Study Area

A detailed multidisciplinary technical and environmental assessment of the Wilton Study Area was undertaken to enable analysis of the indicative airport concepts in a multi-attribute matrix, compare options, assess issues and identify mitigation strategies.

The Wilton Study Area, in general, and the identified sites in particular, were assessed in a set of technical working papers. Each paper identified potential issues with developing an airport and where possible, presented preliminary mitigation strategies. Only at this point was consideration given to possible modifications to the specified full service airport as a means of mitigating specific issues that were identified in the assessment. This was undertaken to provide the Department with a set of tradeoffs relating to a decision for proceeding with any of the site options. This was also to ensure that, to the extent possible at this stage, each option was initially compared on a like-for-like basis.

From this analysis, broad conclusions have been drawn on the basis of those key issues that differentiate the options in order to determine where within the Study Area there is the best potential to accommodate an airport and any high level strategies to achieve it.

Planning, approvals and policy context

The *Airports Act 1996*[41] and the EPBC Act are the primary pieces of Commonwealth planning legislation potentially relevant to a proposed airport development in Australia. Works proposed beyond the external boundaries of the airport footprint such as road, rail and power connections would normally be conducted in accordance with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

Section 89(1) of the *Airports Act 1996* provides for construction of new railways (k) and roads (h). It is yet to be determined how the application of these clauses would interact with the requirement to prepare an environmental impact assessment for these forms of infrastructure under the EP&A Act, particularly the *State Environmental Planning Policy (State and Regional Development) 2011* and the *State Environmental Planning Policy (Infrastructure) 2007*.

In terms of environmental impact assessment and approval, previous airport developments, such as the Brisbane New Parallel Runway Project, have been considered in one document that addresses the requirements of the Major Development Plan (MDP), required under the *Airports Act 1996*, and an EIS required under the EPBC Act. This approach appears to have been successful due to the overlapping requirements of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) and the Department.

Considering that planning approvals may be required under both Commonwealth and NSW Government legislation, the technical analysis undertaken as part of this assessment has been undertaken in a way that would create the kind of data and information needed under this legislation.

While the Commonwealth Government has primary responsibility for passenger and freight aviation in terms of transport policy and planning, the development, design and construction of an airport at Wilton will require input by the NSW Government due to the significant role it conventionally plays in land use and road and rail planning, investment and operation.

Strategic and statutory planning

The Wilton Study Area is located primarily in the Wollondilly Shire Local Government Area (LGA), situated on the Woronora Plateau, about 80 kilometres southwest of Sydney. The south eastern part of the Wilton Study Area includes part of the Maddens Plains within the Wollongong LGA (southeast of Wilton).

The villages of Wilton and Douglas Park, with a combined population of 2,657 (2006 Census), are located approximately three kilometres to the north and northwest of the site.

Wollondilly Shire LGA spans 2,560 square kilometres and is one of the largest local government regions in NSW. The LGA is comprised of 16 towns and villages including: Appin; Bargo; Belimba Park; Brownlow Hill; Buxton; Camden Park; Cawdor; Couridjah; Douglas Park; Glenmore; Menangle; Mount Hunter; Mowbray Park; Nattai; Burragorang Valley; Oakdale; Picton; Pheasants Nest; Razorback; Tahmoor; Silverdale; The Oaks; Theresa Park; Thirlmere; Warragamba; Wilton; Yanderra; and Yerranderie. However, much of the Wollondilly Shire LGA is comprised of National Parks and similar land reservations as well as rugged terrain.

[41] Noting that, at present, a new airport at Wilton would not, in fact, be covered by this legislation which was established to regulate development at existing Airports leased by the Commonwealth to the private sector. It is assumed that the principles and heads of consideration would be similar however and are the best guide available as to what might be required.

Wollondilly Shire LGA contains significant coal resources as well as rural land uses comprised of orchards, dairy and poultry and market gardens The LGA supplies around 30% of Sydney's vegetables

The 2006 Census estimated a resident population for the Wollondilly Shire LGA of 41,221, giving an overall population density of 16.8 persons per square kilometre. However, most of this population is concentrated in the towns and small villages or is scattered among dispersed rural areas.

Population increase over the next 20 years could take the population to over 60,000 in the early to mid-2030s which would require over 7,500 extra houses and additional jobs. In 2011, the NSW Minister for Planning and Infrastructure invited owners of large lots to express their interest in developing their land for housing ("Landowner Nominated Sites"). The process resulted in 10 sites being nominated within the Wollondilly Shire LGA, with five of these within three kilometres of the Study Area that, if developed, would further increase population and be potentially impacted in terms of aircraft noise. The NSW Government has commenced a review of potential housing opportunities on sites nominated by landowners and a draft report was expected in August 2012.

The *Wollondilly Local Environmental Plan 2011* (Wollondilly LEP 2011) applies to the land within the Wollondilly Shire LGA. The *Wollongong Local Environmental Plan 2009* (Wollongong LEP 2009) applies to the majority of land in the Wollongong LGA. Under the Wollondilly LEP 2011 and the Wollongong LEP 2009, the Wilton Study Area is zoned RU2 Rural Landscape, RU4 Rural Small Holdings, E2 Environmental Conservation and SP2 Infrastructure. Under the Wollondilly LEP 2011, development for the purpose of an "*airport*" is permissible with consent on land zoned RU2 Rural Landscape (land zoning that partially comprises the western options: Options 1, 1S, 2, 6 and 7). However, development for the purpose of an *"airport"* is prohibited on land zoned RU4 Rural Small Holdings, E2 Environmental Conservation, SP2 Special Infrastructure (which represents the zoning in the eastern precinct options: Options 3, 4 and 5).[42]

Airport planning considerations

Meteorology

In terms of meteorological conditions, the options are all, to some degree, sited in areas where there are deep gorges and ravines adjacent to ridge lines. Any of the airport site options examined for the Wilton Study Area may suffer from some wind shear and / or mechanical turbulence and this issue should be examined in detail. However, this situation is not unusual as it occurs at a number of major airports, for example, Hong Kong International Airport.

The east - west alignment of Option 5 is likely to have a greater propensity to suffer wind shear as it is closer to the Illawarra Escarpment (the distance from the escarpment being nine kilometres, or 4.8 nautical miles). On approach, aircraft reduce altitude by 300 feet per nautical mile, that is, they would cross the escarpment at about 1,500 feet elevation compared to the runway end level. It is recommended that an Automatic Weather Station be established in the Wilton area as a matter of urgency to enable better estimates of runway usability and the requirements for a cross runway. Further research and analysis on the likely impacts of mechanical turbulence and wind shear in relation to the proposed runway layouts should be undertaken by a specialist aviation meteorologist with the objective of helping inform a siting decision. It is recommended that this be undertaken immediately, should Wilton be considered further for an airport site.

Airspace, existing aerodromes and aviation-related operational assessment

On the basis of the Airservices Australia's (ASA's) comments in the Joint Study that a northwest - southeast parallel configuration is optimal for segregation from Sydney (Kingsford-Smith) Airport operations, Options, 2, 3, 4 and 7 require least complexity of airspace management and redesign for segregation from Sydney (Kingsford-Smith) Airport operations. However, Options 1 and 5 would involve a reasonable level of complexity and Option 6 would be the most

[42] Under the provisions of WLEP 2011, 'air transport facility' and 'airport' are defined as follows: (i) Air transport facility means an airport or a heliport that is not part of an airport, and includes associated communication and air traffic control facilities or structures; (ii) Airport means a place that is used for the landing, taking off, parking, maintenance or repair of aeroplanes, and includes associated buildings, installations, facilities and movement areas and any heliport that is part of the airport.

complex. Significant restructuring of parts of the existing Sydney Region Airspace architecture will be necessary to accommodate the required Class C CTR and associated CTA[43] steps. Restructuring may be a relatively lengthy process, and may need to include some Restricted and Danger Area changes. The primary existing airspace constraint is R555 series (Holsworthy) - artillery range activity - in the circuit area, which is not compatible above 3000 feet (i.e. potentially involving significant changes to the types of activities and/or the coordination of activities that can occur at the Defence facilities at Holsworthy).

Acoustic Footprints

In order to assess the acoustic footprint of each airport concept as developed in the Working Paper *Wilton Airport Site Selection and Airport Concepts,* it is necessary to postulate the flight tracks that aircraft would fly on approach to and departure from each airport concept. The final design of such flight tracks would be a complex task requiring ASA to design the Sydney airspace to accommodate both the existing Sydney Airport and the new airport at Wilton. Accordingly in this study, the flight tracks have been based on general principles of airspace design within the airports circuit area and which would be likely to be the basis of any future airspace design. The assessment is also based on assumptions about the volume and mix of aircraft traffic forecast to use a Wilton Airport, based on the Booz & Co. forecasts.

The flight tracks form an important input to the Integrated Noise Model (INM), which was used to produce the aircraft noise contours (ANEFs and N70 contours) for each the airport site option. Therefore the assessment covers only noise from aircraft in flight. These flight tracks are generally located within the circuit areas of the various runway layouts and do not provide other than a general description of the flight tracks away from the proposed airport. It does not cover ground-based operations of aircraft or noise from other airport sources, e.g. construction, buildings and vehicular traffic.

The metrics derived from the aircraft noise modelling were the 20, 25, 30, 35 and 40 Australian Noise Exposure forecasts (ANEFs) for each site option, as well as the additional metrics N60 and N70 and the supplementary metrics PEI and AEI. These metrics, together with flight tracks and aircraft frequency, supplement the ANEFs and assist in better understanding the implications of a new airport development and in options selection;

For the purposes of options differentiation only, which task differs from land use planning and airport protection, these metrics are considered adequate. By summing all the single events at an airport, say for an average day, a total PEI (70) (or PEI (80), etc.) can be developed. The PEI (70) is the total number of instances on the average day where a person is exposed to a noise event greater than 70 dB (A) and is a measure of the total noise load generated by the airport.

The AIE gives the average individual noise exposure in the number of events greater than the specified noise level over the specified time. When comparing options at a particular airport, the AIE indicates the extent to which the noise is concentrated or shared. Both indices are also useful in comparing site options, as undertaken in this Study.

Based on the assumptions made, the populations affected by aircraft noise for each option are assessed in the Working Paper *Acoustic Effects on People*. Operational noise mitigation measures are also suggested. Possible noise insulation and compensation measures which may be applicable are outlined in the Working Paper, noting that while there is no current Government policy, there was a noise related property acquisition policy implemented by the Australian Government for a proposed airport at Badgerys Creek in 1990.

[43] A Control Area [CTA] is controlled airspace that extends from a specified limit above the surface (e.g. 8500 feet amsl) to some upper level (e.g. 18 000 feet amsl •A Control Zone [CTR] is controlled airspace, surrounding a civil or military aerodrome (with a manned Air Traffic Control tower), that extends from ground level and is stepped up to the lower limit of the overlying CTA. The steps provide the airspace for the airport approach and departure paths source: http://flysafe.raa.asn.au/navigation/airspace.html

Infrastructure analysis

Land transportation links

The Wilton Study Area is located approximately 85 kilometres southwest of Sydney. Access is available from Picton Road (off the Hume Highway) and Macarthur Drive.

All sites are on undulating topography which would likely require large volumes of cut and fill earthworks and possibly tunnelling to provide high quality road and rail links, commensurate with the ambience of a *"gateway"* to a large international airport.

Major upgrading of sections of the Sydney regional road network, primarily the F5/M5 and M7 will be needed to accommodate road traffic drawn to a *"maximum"* airport in the Wilton Study Area and is a common requirement for all options. Considering existing levels of traffic demand (e.g. Port Kembla traffic) and the implication of airport traffic growth from Sydney, the Illawarra, business parks and the local area, development of an airport at Wilton is expected to have a transformational effect on land use and road and rail transport. The eastern precinct site (Options 3, 4 and 5) are not located on existing major roads and require no relocation of existing roads. They would require extensive new access roads from existing roads into the airport sites. However, the other sites would require relocation of existing roads (in particular, Picton Road). These eastern sites are, however, slightly further by road and by rail from main markets in the Sydney region and are not as easily linked by two separate road connections (in order to provide redundancy in the road network).

Major upgrading of the existing rail network, to accommodate an airport express service, is also common to all options. The proposed Maldon Dombarton Rail Freight Link may be modified to present some potential to also connect passengers to an airport development at Wilton, providing them access to the Sydney rail network. However, the feasibility of this connection would be dependent on whether coal, freight and passenger services could be safely and efficiently coordinated and integrated on the rail line. It is possible that any future rail link could be an integral part of a high speed rail system, currently being considered by the Commonwealth Government.

Utilities

Analysis of existing electricity, gas, telecommunications and fuel supply utilities found that there would be a need to relocate some existing utilities. In particular:

- There is likely to be a need to relocate in the order of 20 kilometres of TransGrid's 330 kV Transmission Line 17 Avon-Macarthur to avoid airport footprints and / or meet the assumed OLS requirements for all options;
- There is likely to be a need to relocate a 66 kV distribution line, remove some 11 kV and 415 V distribution lines and potentially relocate others, all of which are owned by Endeavour Energy;
- There is likely to be a need to provide two 66 kV distribution lines from secure bulk supply points each capable of supplying an estimated load of 80 MVA for all options; and
- There is likely to be a need to reduce the OLS requirements for Options 3, 4 and 5, if it is not possible to route the above Transmission Line 17 through the State Conservation Area.

However, the environmental impacts of utility changes are expected to be manageable under the normal planning processes with the possible exception of relocating Transmission Line 17 through the State Conservation Area for Options 3, 4 and 5.

Environmental analysis

Earthworks

The earthworks required for an airport at Wilton are large compared to other airport developments internationally and large when compared to – for example – a freeway project. This is primarily because the topography at Wilton is an undulating montane plateau with many deeply incised rivers and creeks.

Whilst in many options, the runways have been aligned parallel to the contours and between the creek lines, a high volume of fill is still required to fill the creeks between the runways in order to create a pad for the terminal buildings and car parks. In the majority of airport options, filling across the creeklines has been limited to the upper regions of the catchments, which means that flow conveyance structures are not required to allow creeks to flow from one side of the fill to the other.

However, Option 3 fills across Lizard Creek and Option 5 fills across the upper reaches of Wallandoola Creek. As these crossings are lower down in the reach of the creek then flow conveyance structures will be required. Option 1S has the lowest amount of earthworks (cut plus fill) per hectare and Option 3 the highest. The primary reason for the difference in volumes between the options is the extent of the existing incised creek lines that need to be filled to allow construction of an airport platform.

Land clearing

Preliminary investigations have shown that clearing of trees for OLS requirements outside of the site boundary is likely to be required for Options 3 and 5 only. The option site areas include an allowance for business parks. For all options other than Options 1 and 2, all stormwater infrastructure can be accommodated within the currently defined site boundaries.

Regional geology

In terms of surface geology, most of the Study Area is underlain by Triassic Hawkesbury Sandstone, with a few of the patches of higher ground in the northwest capped by Wianamatta Shales. This is very similar to the geology of the built up area of Sydney. It is benign from the viewpoint of foundation conditions for structures and runways, and equally benign from the viewpoint of major earthworks.

The Wilton Study Area is underlain by the coal measures of the Sydney Basin, which are the key economic resource relevant to the area.

Regional resource and resource extraction

From a broad assessment of practical constraints on future coal extraction, it is considered that Option 1, Option 1S and Option 7 are likely to cause the least sterilisation of coal resources. All of these options are in the southwest of Study Area. Additionally, these options are located further from where current active mining and planned mining is to take place in existing coal mining lease areas. For airport development to occur at the site of other options, and areas where mining is yet to occur, it would be necessary to either sterilise an amount of coal or defer airport construction until the coal has been removed and major subsidence has occurred. This is because during mining, the nature and magnitude of subsidence from longwall mining is incompatible with the presence of a major airport on the surface above. In contrast, post-mining and post major subsidence surface movements would not preclude the construction and operation of an airport.

Drinking water catchment, hydrology and drainage

The Wilton Study Area is within the Metropolitan Special Area of the Sydney Drinking Water Catchment. Under the *Sydney Water Catchment Management Act 1998*, public agencies must first give notice to SCA of their intention to exercise their functions within a Special Area, and those agencies may not exercise those functions contrary to any representations that SCA makes except with 28 days' notice (refer Section 47 of the *Sydney Water Catchment*

Management Act 1998). Issues relating to the discharge of treated effluent and stormwater from an airport development at Wilton with respect to the boundary of the Sydney Drinking Water Catchment include:

- The discharge of treated effluent from the airport site into creeks and rivers that form part of the direct water supply route is not permitted;
- Airport options located to the west (Options 1, 1S, 2, 6 and 7) will be able to drain to Allens Creek, which is located outside of the water supply route and drinking water catchment;
- Airport options located to the east (Options 3, 4 and 5) will require additional works to ensure that discharges up to the 100 year average recurrence interval (ARI) flow are drained back to Allens Creek via a pipe or tunnel system. Alternative strategies have been considered, including moving the Sydney Water supply off-take location and thereby, effectively moving the boundary of the drinking water catchment; and
- All options will result in a loss of catchment area that drains to the water supply route, thereby posing a cost to SCA for the lost water.

Water and wastewater management

Water treatment technologies exist to treat all the effluent generated on site (no matter how highly polluted the water is) to a class better than drinking water standards. As the water demand, and hence the volume of polluted effluents generated, would be fairly low, the cost of treatment compared to the total capital cost of the project would be minimal. All waters generated on the site could be contained and treated on site with beneficial outcomes by reusing the water for purposes of irrigation and toilet flushing in the airport and surrounds. Mitigation strategies, such as these, can be put into place to prevent pollution to the streams and rivers at Wilton.

Option 1 or 1S, and to a lesser extend Option 2, would be the most preferred locations for preventing effluent generated on site from gravitating into the drinking water catchment streams and rivers. Options 6 and 7 could also work, though not as effectively as Options 1/1S and 2. The other options, although possible to execute, would be less preferable from a water treatment perspective as they are far from Allens Creek[44], which would be the release conduit into the natural river environment of excess but treated effluent that cannot be reused on site.

Flora, fauna and ecological values

In addition to a large number of threatened flora and fauna identified to occur in the Wilton Study Area, five threatened ecological communities were found to occur. The Cumberland Koala Linkage and two Priority Fauna Habitats were also found to occur. The high incidence of threatened species at the Wilton Study Area is due to its location in and adjacent to the Metropolitan Special Area (drinking water catchment) which has been relatively undisturbed.

All options require substantial clearing of native vegetation including threatened ecological communities and priority fauna habitat. This would impact a large number of threatened flora and fauna. Options 1, 1S, 2, 6 and 7 would impact the Cumberland Koala Linkage. Options 3, 4 and 5 would not impact this linkage. However, these options would still impact Koala habitat (as well as other threatened species). Each option is likely to significantly impact watercourses and aquatic habitat containing threatened aquatic fauna (frogs and fishes). Due to the large area required for clearing, residual impacts to terrestrial and aquatic flora and fauna are likely to be significant. Environmental offsets, in a form and scale yet to be determined, are therefore likely to be required.

Effects on airshed and air quality

The key factors affecting air quality are the numbers of annual vehicle and aircraft movements. It is expected that each option will result in the same level of vehicle and aircraft movements and therefore the same level of air emissions. However, there may be local issues with drainage of air flows down the various gullies and canyons leading into the Cordeaux, Cataract and Nepean Rivers. This could affect the transport of pollutants from the site into

[44] As Allens Creek is proposed to be used in the same manner as had been proposed in 1985

the local and the Sydney metropolitan regions. Only high resolution pollution dispersion modelling can address these local issues in the context of regional air quality and possible differentiate between options.

Risks and site hazards

Investigation of the potential for flooding and bushfire in the Wilton Study Area found that all sites are on undulating montane plateau topography, which ensures that there is no risk of major riverine flooding at any of the airport options. Extensive systems of detaining water on the site for water pollution management would also prevent drainage from the airport affecting waterways or causing flooding.

However, all sites are situated within historic bushfire prone lands. The westernmost sites are possibly less susceptible to bushfire given they are not situated as deep within forested areas and, by virtue of features such as the airport security buffer zones, the freeway and new urban development, may be relatively more defendable. Depending on the wind direction at the time of the event, all sites are likely to be adversely effected by smoke from bushfire given the close proximity to forested areas.

European cultural heritage

All listed European heritage items identified in the area are outside the footprints of all of the airport options. Therefore, consideration of impacts, if any, relate to *"development in the vicinity of heritage items".* Impacts, if any, will arise from the construction and operation of the airport through enlargement or removal of existing infrastructure (e.g. roads) or through new infrastructure (e.g. new roads and suggested rail options, both passenger and freight). The land provision for a business park indicated in the *"maximum"* airport templates in the northwest corner of Options 1S, 2, 6 and 7 is likely to intensify vehicular activity and have a more direct effect on two heritage items in the vicinity of those footprints, namely, the Cottage at No. 1090 and St Luke's Church at Nos. 1096-1099 Argyle Street, Wilton. Resolution of mitigation of impacts, if any, on the two heritage items in Argyle Street, will relate to consideration of context and setting of the items in relation to the proposed business park component in the northwest footprints of those options.[45]

Aboriginal cultural heritage

It appears that there are some 22 Aboriginal heritage sites located within the footprints of the options considered. Most of these sites lie within the footprints of Options 1, 1S, 2, 4, 6 and 7. It is possible that at least nine heritage sites would be directly impacted by the current location of the business parks in the northwest of the airport layouts for Options 1S, 2, 3, 6 and 7. Approximately 31 heritage sites are also within the vicinity of Options 1, 1S, 2, 6 and 7, with approximately 35 further sites lying within the north to west section of the Study Area.

Mitigation of impacts on the heritage sites would relate to consideration of design resolution, and context and setting of the sites in relation to both the proposed airport itself and the business park component of the airport. Consultation with the Local Aboriginal Land Council will also be required to understand the significance of these items and how they need to be treated.

Social and economic analysis

Impact on property and commercial enterprise

The option with the most number of properties impacted is Option 6, with approximately 494 properties located within all ANEC contours 40, 35, 30 and 25. The airport option with the least amount of properties impacted is Option 5 with approximately five properties located within all ANEC contours 40, 35, 30 and 25.

Notwithstanding the above, the Australian Standard AS2021 provides guidance to regional, local authorities and others associated with urban and regional planning and building construction on the acceptable location of new buildings in relation to aircraft noise. Zones that are described as *"conditionally acceptable"* may be approved as building sites provided that any new construction incorporates sound proofing measures. There are five landowner nominated sites for potential residential release within the vicinity of the Wilton Study Area. These sites are Bingara

[45] These are notional locations as shown and subject to planning and design refinement.

Gorge, Wilton West, Wilton South, Brooks Point and Appin Vale. With the exception of Option 5, all other options impact, with varied degree of ANEC contours, the landowner nominated sites.

In terms of compulsory land acquisition, it is important to provide environments for negotiation over the compulsory purchase to insure that the interests of existing property and business owners are catered for. Ameliorative strategies could include measures to communicate and harness positive social benefits of airport development arising from increased scope of employment opportunities and consequential facilities that are likely to be available from an airport development.

Social effects of airports

A suite of social issues are likely to be associated with the various stages of the planning, development and operation of an airport at Wilton. Based on global and local experience, the planning, development and operation of large scale airports can have a range of social impacts - both positive and negative - on various communities. The nature and locational spread of such impacts depend to a large extent on either the proximity of residential areas to the airport or the functional relationship that people have to the airport as either airport users or airport workers.

The direct and quantitative social impacts of airport development at Wilton include:

- Turnover of population - dislocation of current residents - influx of new residents;
- Change in social character of the area;
- The number of properties to be acquired (discussed above) and;
- The number of social assets to be acquired and potentially requiring re-establishment elsewhere in the local area.

Visual impacts of airport

Because of the projected scale of a "*maximum*" airport, regardless of mitigation measures, all airport options (as detailed in the Working Paper *Wilton Airport Site Selection and Airport Concepts)* have the potential for significant visual impact because of the extensive amount of earthworks and related vegetation clearance required.

However, Options 2, 3 and 5 have substantially higher modelled cut and fill as well as area of vegetation cleared which arguably, have the potential for greater visual impact at the construction stage. The remaining options (Options 1, 1S, 4, 6 and 7) all have lower levels of both modelled cut and fill and vegetation cleared. Regardless of these relativities, the overall effect with be transformational in visual impact at the local and regional scale.

Acoustic effects on people

An analysis combining projected ANEC, N70[46] and 2011 Census data was undertaken to estimate the effect of noise on residential populations in and around Wilton for each of the eight airport site options.

Of the two groupings of airports in the Wilton Study Area, those in the eastern precinct generate the lowest impacts on current patterns of residents, provided a non north - south orientation of runways is adopted.

The western precinct, however, can supply a number of sites, which include north - south pointing runways, from which noise effects on people are the next lowest in magnitude.

Within either precinct, sites and runway orientations can be found which result in equally the worse effect on people in terms of noise exposure, though these are likely to not be the same set of persons. This emphasizes the need for caution when setting runways directions regardless of whether, in general, the eastern precinct or the western precinct is preferred to supply an airport site.

[46] N70 contours indicate the predicted average number of noise events above 70 dB (A) for a particular location.

There are five landowner nominated sites for potential residential release within the vicinity of the Wilton Study Area. These sites are Bingara Gorge, Wilton West, Wilton South, Brooks Point and Appin Vale. With the exception of Option 5, all options impact on the landowner nominated sites with varied degree of ANEC contours.

5.6 Step 5 – Develop summary matrix comparing options

A summary matrix has been developed in order to compare each of the eight site options. This is presented in **Table 1.3**. The matrix provides an objective qualitative and quantitative means of assessing the options in relation to the issues considered in the working papers.

Table 1.3 Summary matrix

Note: the intention of these options is to test the ability of the Wilton Study Area to accommodate a Full Service Airport and to provide a range of sites which enable their effects and interactions on a range of multidimensional factors to be assessed.

WILTON STUDY AREA		Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
SITE CHARACTERISTICS	Location	West	West	West	East	East	East	West	West
	Site Area (ha)	1,930	2,077	2,084	1,988	1,727	2,209	2,022	1,823
	Local Government Area (LGA)	Wollondilly	Wollondilly	Wollondilly	Wollondilly Wollongong	Wollondilly	Wollondilly Wollongong	Wollondilly	Wollondilly
AIRPORT DESIGN PARAMETERS	Airport Type	Full service airport capable of serving all market segments	Full service airport capable of serving all market segments	Full service airport capable of serving all market segments	Full service airport capable of serving all market segments	Full service airport capable of serving all market segments	Full service airport capable of serving all market segments	Full service airport capable of serving all market segments	Full service airport capable of serving all market segments
	Runways	Independent, wide spaced parallel runways: 4,000 m x 60 m 4,000 m x 60 m Cross runway: 2,500 m x 60 m	Independent, wide spaced parallel runways: 4,000 m x 60 m 4,000 m x 60 m Cross runway: 2,500 m x 60 m	Independent, wide spaced parallel runways: 4,000 m x 60 m 4,000 m x 60 m Cross runway: 2,500 m x 60 m	Independent, wide spaced parallel runways: 4,000 m x 60 m 4,000 m x 60 m Cross runway: 2,500 m x 60 m	Independent, wide spaced parallel runways: 4,000 m x 60 m 4,000 m x 60 m Cross runway: 2,500 m x 60 m	Independent, wide spaced parallel runways: 4,000 m x 60 m 4,000 m x 60 m Cross runway: 2,500 m x 60 m	Independent, wide spaced parallel runways: 4,000 m x 60 m 4,000 m x 60 m Cross runway: 2,500 m x 60 m	Independent, wide spaced parallel runways: 4,000 m x 60 m 4,000 m x 60 m Cross runway: 2,500 m x 60 m
	Main Runway Heading	18/36	18/36	16/34	17/35	15/33	08/26	03/21	11/29
	Cross Runway Heading	08/26	09/27	06/24	05/23	08/26	16/34	12/30	18/36
	Main Runway Separation (m)	2,000	2,000	2,000	2,400	1,650	2,000	2,000	2,000
	Runway slope	1%	1%	1%	1%	1%	1%	1%	1%
	Business Parks	239	457	276	244	180	359	450	234
	Overall airport layout efficiency	Efficient	Efficient	Efficient	Less Efficient	Less Efficient	Less Efficient	Efficient	Efficient
	1. The Site Areas vary as the nominated Business Park areas are variable sizes 2. Terminals have been located between parallel runways: • Domestic terminal floorspace is 250,000 sq. m with 15,000 parking spaces. Aircraft gates 63 Code E and C • International terminal floorspace is 500,000 sq. m with 10,000 parking spaces. Aircraft gates 56 Code F, E and C and 3 Code E freight 3. Runway capacity – 100 movements per hour 4. Taxiways – two single direction taxiways parallel to each runway 5. Apron stand dimensions of: • Code F 11,200 sq. m • Code E 8,190 sq. m • Code C jet and turboprop 3,050 sq. m 6. Airport Layout Efficiency - based on the general layout for each option and the placement of airport support, freight and business parks relative to the terminals and aprons (which are located between the main runways)								
LAND USE PLANNING	Current land uses within airport site	• Rural residential • Picton Road • Local Roads • Metropolitan Catchment Area • Coal mining • 330 kv power line	• Rural residential • Picton Road • Local Roads • Metropolitan Catchment Area • Coal mining • 330 kv power line	• Rural residential • Picton Road • Local Roads • Metropolitan Catchment Area • Coal mining • 330 kv power line	• Metropolitan Catchment Area • Coal mining • 330 kv power line	• Metropolitan Catchment Area • Coal mining • 330 kv power line	• Metropolitan Catchment Area • Coal mining (and headworks of Gujarat NRE Wonga West) • 330 kv power line	• Metropolitan Catchment Area • Picton Road • Local Roads • Coal mining • 330 kv power line	• Rural residential • Picton Road • Local Roads • Metropolitan Catchment Area • Coal mining • 330 kv power line
	Zoning under relevant Local Environmental Plan (LEP)	RU2 Rural Landscape E2 Environmental Conservation SP2 Infrastructure *Wollondilly LEP 2011*	RU2 Rural Landscape RU4 Rural Small Holdings E2 Environmental Conservation SP2 Infrastructure *Wollondilly LEP 2011*	RU2 Rural Landscape RU4 Rural Small Holdings E2 Environmental Conservation SP2 Infrastructure *Wollondilly LEP 2011*	E2 Environmental Conservation *Wollondilly LEP 2011* *Wollongong LEP 2009*	E2 Environmental Conservation *Wollondilly LEP 2011*	E2 Environmental Conservation *Wollondilly LEP 2011* *Wollongong LEP 2009*	RU2 Rural Landscape RU4 Rural Small Holdings E2 Environmental Conservation SP2 Infrastructure *Wollondilly LEP 2011*	RU2 Rural Landscape RU4 Rural Small Holdings E2 Environmental Conservation SP2 Infrastructure *Wollondilly LEP 2011*
	Zoning on which development for the purpose of an '*airport*' is permissible with development consent	RU2 – yes E2 – no SP2 – no *Wollondilly LEP 2011*	RU2 – yes RU4 - no E2 – no SP2 – no *Wollondilly LEP 2011*	RU2 – yes RU4 - no E2 – no SP2 – no *Wollondilly LEP 2011*	E2- no *Wollondilly LEP 2011* *Wollongong LEP 2009*	E2- no *Wollondilly LEP 2011*	E2- no *Wollondilly LEP 2011* *Wollongong LEP 2009*	RU2 – yes RU4 - no E2 – no SP2 – no *Wollondilly LEP 2011*	RU2 – yes RU4 - no E2 – no SP2 – no *Wollondilly LEP 2011*

WILTON STUDY AREA		Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
LAND USE PLANNING (continued)	Approximate number of allotments within airport concept site	69	88	102	4	4	4	106	102
	Estimated population within airport concept site (ABS Census data)	69	109	138	Nil	Nil	Nil	145	149
	Approximate number of allotments within airport concept site zoned RU2 Rural Landscape	48	63	73	Nil	Nil	Nil	77	77
	Approximate number of allotments within airport concept site zoned RU4 Rural Small Holdings	Nil	2	2	Nil	Nil	Nil	2	2
	Approximate number of allotments within airport concept site zoned E2 Environmental Conservation	21	23	27	4	4	4	27	23
	Approximate number of allotments within airport concept site zoned SP2 Infrastructure	Macarthur Dr Picton Rd	Macarthur Dr Picton Rd	Macarthur Dr Picton Rd	Fire Rd	Fire Rd	Fire Rd	Macarthur Dr Picton Rd	Macarthur Dr Picton Rd
	Runway footprint within Protected Lands (National Park, State Conservation Area, RAMSAR)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Airport concept site within Protected Lands (National Park, State Conservation Area, RAMSAR)	Upper Nepean State Conservation Area (part of High Intensity Approach Lighting)	Upper Nepean State Conservation Area (part of High Intensity Approach Lighting)	Upper Nepean State Conservation Area (part of High Intensity Approach Lighting)	Nil	Nil	Nil	Upper Nepean State Conservation Area (part High Intensity Approach Lighting)	Upper Nepean State Conservation Area (part of High Intensity Approach Lighting)
	1. Under the provisions of *Wollondilly LEP 2011,* development for the purpose of an '*airport'* is permissible with consent on land zoned RU2 Rural Landscape 2. Under the provisions of the *Wollondilly LEP 2011,* development for the purpose of an '*airport'* is prohibited on land zoned RU4 Rural Small Holdings, E2 Environmental Conservation, SP2 Special Infrastructure 3. Under the provisions of the *Wollongong LEP 2009,* development for the purpose of an '*airport'* is prohibited on land zoned E2 Environmental Conservation 4. Options 3, 4 and 5 which are primarily located entirely on land zoned E2 Environmental Conservation impact the least number of allotments (<5) 5. Options 2, 6 and 7 impact the greatest number of allotments (>100)								
METEOROLOGY	Meteorological Conditions: 95% runway useability	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
	Mechanical Turbulence: Propensity for wind shear	Moderate	Moderate	Moderate	Moderate	Moderate	More severe	Moderate	Moderate
	1. The east - west alignment Option 5 is likely to have a greater propensity to wind shear as it is closer to the Illawarra escarpment (the distance from the escarpment being 9 km (4.8 nautical miles)). 2. An Automatic Weather Station (AWS) in the Wilton area should be established as a matter of urgency to enable better estimates of runway usability and the requirements for a cross runway. 3. Further research and analysis on the likely impacts of mechanical turbulence/wind shear in relation to the proposed runway layouts should be undertaken by a specialist company with the objective of helping inform a siting decision. It is recommended that this be undertaken immediately.								
AIRSPACE MANAGEMENT	Difference to Airservices' preferred runway directional range of 280 to 300 degrees (100 to 120 degrees) (plus or minus degrees)	60	60	40	50	30	10	70	20
	Optimal for segregation from Sydney (Kingsford-Smith) Airport operations	Most complex	Most complex	Complex	Complex	Complex	Complex (assuming vertical separation with northerly flow to Sydney (Kingsford-Smith) Airport is possible)	Most complex	Complex

WILTON STUDY AREA		Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
AIRSPACE MANAGEMENT (continued)	Compatibility with Holsworthy R555 with aircraft crossing at greater than 3000 feet	Potential conflict as Northerly departures overfly. Compatible in southerly direction	Potential conflict as Northerly departures overfly. Compatible in southerly direction	Compatible	Compatible	Compatible	Compatible	Major conflict as Southwest direction flight track overflies	Compatible
	1. Airservices' comments outlined in their *Joint Study on Aviation Capacity for the Sydney Region – Further Assessment of Wilton Sites,* from an air traffic management perspective a NW/SE parallel runway configuration is optimal for segregation from Sydney (Kingsford-Smith) Airport operations. The runway directional range should be within 280 to 300 degrees (100 to 120 degrees). 2. With the potential for concurrent Regular Passenger Transport operations occurring at all four airports in the Sydney region, i.e. Sydney, Wilton, Bankstown and Richmond at some point in the future, Airservices' identified need for an integrated airspace operating plan for Sydney, Bankstown and Richmond may equally apply to the integration of Wilton airspace as part of this overall plan. 3. A detailed airspace modelling exercise (using e.g. TAAM (Total Airspace and Airport Modeller) with inputs from Airservices and Defence is recommended. 4. Identification of the aircraft operating costs/costs of delay and adding a factor for complexity and a range of extra costs say +10% and +20% for increasing levels of complexity, could be incorporated into the operating costs in E+Y's current Impact Assessment for the preferred options. 5. The primary existing airspace constraint is R555 series (Holsworthy) artillery range activity in the circuit area, which is not compatible above 3000 feet (i.e. potentially involving significant changes to the types of activities and/or the coordination of activities that can occur at the Defence facilities at Holsworthy). Relocation would be at significant cost. The preliminary flight tracks for all options overfly R555C and R555D. If Defence NOTAMs any height greater than 3000 feet, there is complete incompatibility with landings in the southwest direction for Option 6 (which is 6.1 nm distant), unless Holsworthy is relocated. Relocation would be at significant cost. 6. There are a number of residual impacts to existing aviation facilities/activities arising from airspace changes for a Wilton airport, including loss of Sydney region GA capacity due to aerodrome closures and some reduced operational capabilities of Bankstown and Camden Airports.								
AIRPORT SAFEGUARDING	Presence of terrain obstacles penetrating the lowest Obstacle Limitation Surface (OLS)	Moderate	Moderate	Moderate	Moderate Off-site earthworks required	Moderate	Moderate Off-site earthworks required	Moderate	Moderate
	1. Through CASA, Obstacle Assessment Surfaces (OAS) is assessed and specific aircraft operating procedures may be applied if necessary.								
ROAD AND RAIL	Primary Existing Road Access from Sydney and Canberra	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road
	Secondary Existing Road Access from Sydney and Wollongong	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road
	Tertiary Existing Connecting Roads	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road
	Alternative New Primary Access Point	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park
	Proximity to Sydney Market	Closer	Closer	Closer	Further	Further	Further	Closer	Closer
	Differential Primary road distance from Wilton timing point to Airport (from Sydney)	6.5 km	3.5 km	2.5 m	8 km	6.5 km	18.5 km	6 km	2.5 km
	Proximity to Canberra and Regional South-Western NSW Market	Closer	Closer	Closer	Further	Further	Further	Closer	Closer
	Differential Primary road distance from Wilton timing point to Airport (from Canberra)	6.5 km	3.5 km	2.5 km	8 km	6.5 km	18.5 km	6 km	2.5 km
	Differential Road Distance to the Illawarra and South Coast	Further	Further	Further	Much further	Much further	Closer	Further	Further
	Primary Airport Road access tunnel under runway	No	No	No	No	No	No	No	No
	Picton Road (Route 88) under Runway End Safety Area (RESA)	Yes	Yes	No	No	No	No	No	No
	Move or tunnel existing Picton Road (Route 88)	Yes	Yes	Yes, but minor	No	No	No	Yes	Yes
	Availability of Alternate Access Road	Yes	Yes	Yes	No	No	No	Yes	Yes
	Primary Existing Rail Access from Sydney and Canberra	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway

WILTON STUDY AREA		Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
ROAD AND RAIL (continued)	Distance to Central Railway Station	83 km	83 km	83 km	91 km	91 km	86 km	83 km	83 km
	Travel Time to Central Railway Station	65 minutes	65 minutes	65 minutes	69 minutes	69 minutes	67 minutes	65 minutes	65 minutes
	Potential Secondary Rail Access from Sydney and Wollongong	Unfinished Maldon – Dombarton Line	Unfinished Maldon – Dombarton Line	Unfinished Maldon – Dombarton Line	Unfinished Maldon – Dombarton Line	Unfinished Maldon – Dombarton Line	Unfinished Maldon – Dombarton Line	Unfinished Maldon – Dombarton Line	Unfinished Maldon – Dombarton Line
	Distance to Wollongong Railway Station	44 km	44 km	44 km	52 km	52 km	47 km	44 km	44 km
	Travel Time to Wollongong Railway Station	34 minutes	34 minutes	34 minutes	38 minutes	38 minutes	36 minutes	34 minutes	34 minutes
	Alternative New Primary Access Point (a)	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment
	Distance to Central Railway Station (a)	79 km	79 km	79 km	87 km	87 km	82 km	79 km	79 km
	Travel Time to Central Railway Station by high performance train (a)	52 minutes	52 minutes	52 minutes	54 minutes	54 minutes	53 minutes	52 minutes	52 minutes
	Alternative New Primary Access Point (b)	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park
	Distance to Central Railway Station (b)	74 km	74 km	74 km	82 km	82 km	77 km	74 km	74 km
	Travel Time to Central Railway Station by high performance train (b)	50 minutes	50 minutes	50 minutes	52 minutes	52 minutes	51 minutes	50 minutes	50 minutes
	Primary Airport Rail access tunnel under runway	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
	Relocation of existing transport infrastructure	No	No	No	No	No	No	No	No
	Possible to link to potential High Speed Rail link via purpose built airport connection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	1. Major upgrading of Sydney Regional road network, primarily F5/M5 and M7 to accommodate road traffic drawn to the Wilton study area is common to all options. 2. Major upgrading of the existing rail network, to accommodate an airport express service, is common to all options. 3. "Wentworth Railway" – refers to the prospective high speed railway alignment running from Glen Alpine (South of Campbelltown) to Aylmerton (South of Mittagong). 4. Travel times are inclusive of 5% recovery plus typically 2 minutes station stops at Wolli Creek, Glenfield, and Campbelltown. 5. It is assumed for all options that there would be connections to suburban rail services to reach the Eastern Suburbs, North Shore, Illawarra and Main Western Lines. 6. Rail access to Canberra is being dealt with by the Commonwealth in their current High Speed Rail Study Stage 2								
UTILITIES	Relocate 330 kV Line 17	Move least line 8 km E	Move least line 8 km E	Move least line 8 km E	Move least line 8 km W	Move less line 8 km W	Move more line 5 km W	Move more line 7 km E	Move less line 9 km E
	Impact of 330 kV Line 17 move to the west	N/A	N/A	N/A	Least entry Conservation Area	Less entry Conservation Area	More entry Conservation Area	N/A	N/A
	Relocate 66 kV Line	Not significant impact	Not significant impact	Not significant impact	Less impact than Options 1, 2, 6 & 7	Less impact than Options 1, 2, 6 & 7	Less impact than Options 3 & 4	Not significant impact	Not significant impact
	Relocate 11 kV Lines	Not material	Not material	Not material	Not material	Not material	Not material	Not material	Not material
	New airport power supply	All options similar cost	All options similar cost	All options similar cost	All options similar cost	All options similar cost	All options similar cost	All options similar cost	All options similar cost
	Wilton - Wollongong Gas Pipeline	Move west approximately 8 km	Move west approximately 8 km	Move west approximately 8 km	No issue	No issue	No issue	Move west approximately 8 km	Move west approximately 8 km
	1. There is likely to be a need to relocate in the order of 20 km of TransGrid's 330 kV transmission line 17 Avon-Macarthur to avoid airport footprints and / or meet the assumed OLS requirements for all options; 2. There is likely to be a need to relocate a 66 kV distribution line, remove some 11 kV and 415 V distribution lines and potentially relocate others, all of which are owned by Endeavour Energy; 3. There is likely to be a need to provide two 66 kV distribution lines from secure bulk supply points each capable of supplying an estimated load of 80 MVA for all options; 4. There is likely to be a need to reduce the OLS requirements for Options 3, 4 and 5 if it is not possible to route the above transmission line (Line 17) through the State Conservation Area; and 5. The environmental impacts of utility changes should be manageable under the normal planning processes with the possible exception of relocating transmission Line 17 through the State Conservation Area for Options 3, 4 and 5.								

WILTON STUDY AREA		Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
EARTHWORKS	Cut + Fill per ha (000 m^3/ha)	59	49	70	84	63	62	53	60
	Modelled Cut (000 m^3)	-52,000	-45,000	-69,000	-78,000	-49,000	-60,000	-50,000	-49,000
	Modelled Fill (000 m^3)	52,000	46,000	67,000	79,000	49,000	66,000	48,000	50,000
	Modelled Balance (000 m^3)	0	1,000	-2,000	1,000	0	6,000	-2,000	1,000
	Modelled Cut + Fill (000 m^3)	104,000	91,000	136,000	157,000	98,000	126,000	98,000	99,000
	Max cut depth (m)	18	21	23	36	30	23	20	25
	Max fill depth (m)	40	41	51	63	65	66	43	50
	Additional infrastructure required	Nil	Nil	Drainage conveyance under runway fill structure along Lizard Creek	Nil	Nil	Drainage conveyance under runway fill structure along Wallandoola Creek	Nil	Nil
	1. The topography at Wilton is undulating with many incised creeks. Whilst in many options, the runways have been aligned parallel to the contours and between the creek lines a high volume of fill is still required to fill the creeks between the runways in order to create a pad for the terminal buildings and car parks. 2. In the majority of airport options, filling across the creeklines has been limited to the upper regions of the catchments which means conveyance structures are not required to allow creeks to flow from one side of the fill to the other. However, Option 3 fills across Lizard Creek and Option 5 fills across Wallandoola Creek. As these crossings are lower down in the reach of the creek then conveyance structures will be required. 3. Option 1S has the lowest amount of earthworks (cut + fill) per hectare and Option 3 the highest. The primary reason for the difference in volumes between the options is the extent of the existing incised creek lines that need to be filled to allow construction of an airport.								
LAND CLEARING REQUIREMENTS	Site Area (ha)	1,930	2,077	2,084	1,988	1,727	2,209	2,022	1,823
	Site Area + Bushfire Buffer (ha)	2,131	2,293	2,263	2,198	1,901	2,395	2,201	2,012
	Additional Area for Retarding Dam (ha)	29	0	56	0	0	0	0	0
	Electrical Easement (ha)	95	120	120	60	60	60	120	120
	Road and Rail Easements (ha)	156	179	154	143	135	108	170	161
	Total Clearing Required (ha)	2,411	2,592	2,593	2,401	2,096	2,563	2,491	2,293
	Clearing of Trees in Obstacle Limitation Surfaces (OLS) Required	No	No	No	Yes	No	Yes	No	No
	1. Preliminary investigations have shown that clearing of trees for OLS requirements outside of the site boundary is likely to be required for Options 3 and 5 only. 2. All options include an allowance for Business Parks – note that the site area of each business park is variable. 3. Other than options 1 and 2 all other options can accommodate stormwater infrastructure within the currently defined site boundaries.								
REGIONAL GEOLOGY AND GEOTECHNICAL MATTERS	Possible minor expansive soil potential (Wianamatta Shale)	Yes	Yes	Yes	No	No	No	Yes	Yes
	Site underlain by known geological structure	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
	Site underlain by coal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Site covered by current mining lease	Yes > 50%	Yes >50%	Yes 50%	Yes 100%	Yes 100%	Yes 100%	Yes 100%	Yes 50%
	Site subject to a mining investigation licence	Yes	Yes	Yes	No	No	No	Yes	Yes
	Past or Active mining	No	No	No	Yes	Yes	Yes	No	No
	Proposed mining beneath airport site	No	No	Yes partial	Yes	Yes	Yes	Yes partial	No
	Potential for airport site to subside	No	No	Yes partial site	Yes entire site	Yes entire site	Yes entire site	Yes partial site	No
	Scale of mining subsidence expected	Unlikely	Unlikely	Up to 1.5m	Up to 2.5m	Up to 2.5m	Up to 2.5m	Up to 1.5m	Unlikely
	Additional design cost for infrastructure	Less likely	Less likely	Very likely	Very likely	Very likely	Very likely	Very likely	Less likely

WILTON STUDY AREA		Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
REGIONAL GEOLOGY AND GEOTECHNICAL MATTERS (continued)	1. Options 1, 1S and 7 are the least likely to be affected by subsidence in the foreseeable future. 2. In the case of Option 1, it would be significantly better because the cross runway, as currently positioned, is basically above what would always remain as a barrier of unmined coal between the BHP Bulli Seam operations in the north, and the possible Gujarat NRE colliery holdings to the south. In addition, the western NS runway is above what would have to be a barrier pillar between the Gujarat holdings and the Exploration area to the west. Option 1 could be considered as in effect sterilising only the coal from midway between the parallel north - south runways and the eastern footprint of the easternmost north - south runway. This could reduce the degree of sterilisation to about 5 - 6 sq. km. 3. The footprint of Option 7 would similarly create a reduced degree of sterilisation. However, in all cases, this degree of reduced effect requires more detailed assessment. 4. In addition to the economic cost of sterilisation there may be compensatory costs in some form required to be paid to the mining companies for their loss of sections of their existing mining leases.								
DRINKING WATER CATCHMENT, HYDROLOGY AND DRAINAGE	Watercourses impacted by the footprint of the airport	Allens Creek, Cascade Creek and tributaries	Allens Creek, Cascade Creek and tributaries	Allens Creek, Cascade Creek and tributaries	Lizard Creek and tributaries of Wallandoola Creek	Tributaries of Wallandoola and Lizard Creeks	Wallandoola Creek, Lizard Creek	Allens Creek, Cascade Creek	Allens Creek, Cascade Creek
	Area of lost drinking water catchment (ha)	1,530	1,570	1,600	1,990	1,730	2,210	1,420	1,210
	Financial cost to Sydney Catchment Authority of lost water p.a.	$0.7M	$0.8M	$0.8M	$1.0M	$0.8M	$1.1M	$0.7M	$0.6M
	Long term economic cost to SCA of lost water p.a.	$19.4M	$19.9M	$20.4M	$25.2M	$21.9M	$28.0M	$18.0M	$15.4M
	Discharge of treated stormwater and effluent	Direct to Allens Creek	Direct to Allens Creek	Direct to Allens Creek	To Allens Creek via 5 km pipe/tunnel system (~$1.0B)	To Allens Creek via 5 km pipe/tunnel system (~$1.0B)	To Allens Creek via 6 km pipe/tunnel system (~$1.2B)	Direct to Allens Creek	Direct to Allens Creek
	Alternative strategies to avoid discharge of treated effluent and stormwater to drinking water catchment	NA	NA	NA	3 km pipe/tunnel to downstream of Broughtons Pass off-take (~$600M) Move the water supply off-take upstream to Cataract Dam (~$1.2B) Water supply augmentation (~$5.0B)	3 km pipe/tunnel to downstream of Broughtons Pass off-take (~$600M) Move the water supply off-take upstream to Cataract Dam (~$1.2B) Water supply augmentation (~$5.0B)	8 km pipe/tunnel to downstream of Broughtons Pass off-take (~$1.6B) Move the water supply off-take upstream to Cataract Dam (~$1.2B) Water supply augmentation (~$5.0B)	NA	NA
	Flood retarding dam operation (during storms up to 100 yr. ARI event)	Low flow outlet and spillway flow	Low flow outlet and spillway flow	Low flow outlet and spillway flow	Pipe outflow only	Pipe outflow only	Pipe outflow only	Low flow outlet and spillway flow	Low flow outlet and spillway flow
	Size of retarding dam	~5,000 ML	~5,000 ML	~5,000 ML	~8,000 ML	~7,000 ML	~9,000 ML	~5,000 ML	~5,000 ML
	Discharge of excess stormwater in extreme rainfall event (>100 yr.)	to Allens Creek	to Allens Creek	to Allens Creek	Spillage to drinking water catchment	Spillage to drinking water catchment	Spillage to drinking water catchment	to Allens Creek	to Allens Creek
	Flow conveyance structure required for local waterway(s)	No	No	No	Yes, at Lizard Creek (1.5 km)	No	Yes, at Lizard Creek (4 km)	No	No
	1. The Wilton Study Area is within the Metropolitan Special Area of the Sydney Drinking Water Catchment. Under the SWCM Act, public agencies must first give notice to SCA of their intention to exercise their functions within a Special Area, and those agencies may not exercise those functions contrary to any representations that SCA makes except with 28 days' notice (see s. 47 SWCMA). 2. Issues relating to the discharge of treated effluent and stormwater from an airport development at Wilton with respect to the boundary of the Sydney Drinking Water Catchment include: • The discharge of treated effluent from the airport site into creeks and rivers that form part of the direct water supply route is not permitted. • Airport options located to the west (Options 1, 1S, 2, 6 and 7) will be able to drain to Allens Creek, which is located outside of the water supply route / drinking water catchment. • Airport options located to the east (Options 3, 4 and 5) will require additional works to ensure that discharges up to the 100 year ARI flow are drained back to Allens Creek via a pipe/tunnel system. Alternative strategies have been considered, including moving the Sydney water supply off-take location and thereby, effectively moving the boundary of the drinking water catchment. 3. All options will result in a loss of catchment area that drains to the water supply route, thereby posing a cost to SCA for the lost water.								
FLORA, FAUNA AND ECOLOGICAL VALUES	Previously cleared land	Yes (approximately 10%)	Yes (approximately 10%)	Yes (approximately 15%)	No (except for access roads)	No (except for access roads)	No (except for access roads)	Yes (approximately 15%)	Yes (approximately 15%)
	Clearing of Endangered Ecological Community	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Clearing of Protected Fauna Habitat	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Clearing of Koala Habitat	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

WILTON STUDY AREA		Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
FLORA, FAUNA AND ECOLOGICAL VALUES (continued)	Cumberland Koala Linkage Impacted	Yes	Yes	Yes	No (not impacted directly by airport footprint but may be impacted by noise)	No (not impacted directly by airport footprint but may be impacted by noise)	No (not impacted directly by airport footprint but may be impacted by noise)	Yes	Yes
	Location within Metropolitan Special Area	1,348 ha (70%)	1,496 ha (72%)	1,510 ha (72%)	100%	100%	100%	1,346 ha (67%)	1,111 ha (61%)
	Aquatic Habitat Impacted	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	1. A large number of threatened flora and fauna species have been identified to occur in the Wilton Study Area. The high incidence of threatened species at the Wilton Study Area is due to its location in and adjacent to the Metropolitan Special Area (drinking water catchment) which has been relatively undisturbed 2. Five endangered ecological communities were found to occur. 3. The Cumberland Koala Linkage and two Priority Fauna Habitats were also found to occur. 4. All options require substantial clearing of native vegetation including endangered ecological communities and priority fauna habitat. This would impact a large number of threatened flora and fauna. 5. Options 1, 1S, 2, 6 and 7 would impact the Cumberland Koala Linkage. Options 3, 4 and 5 would not impact this linkage however these options would impact Koala habitat (as well as other threatened species). 6. Each option is likely to significantly impact watercourses and aquatic habitat containing threatened aquatic fauna (frogs and fishes). 7. Due to the large area required for clearing, residual impacts to terrestrial and aquatic flora and fauna are likely to be significant. Environmental offsets are therefore likely to be required.								
NOISE	Population exposed to greater than 20 N70 events per day	512	483	1,456	1,692	245	1,986	1,707	3,287
	Person-Events Index (PEI) greater than 20 N70 events per day	42,162	41,431	150,016	221,431	16,509	72,976	331,727	194,188
	Average Individual Exposure (AIE) greater than 20 N70 events per day	82	86	103	131	67	37	194	59
	Properties within ANEC 40	10	6	7	1	NA	NA	4	10
	Properties within ANEC 35	16	15	18	2	NA	1	11	16
	Properties within ANEC 30	31	27	70	2	1	2	35	27
	Properties within ANEC 25	73	66	144	8	11	2	444	66
	Total properties within ANEC 40, 35, 30 and 25	130	114	239	13	12	5	494	119
	Population within ANEC 40	0	0	0	0	0	0	0	0
	Population within ANEC 35	0	4	2	0	0	0	0	0
	Population within ANEC 30	18	20	98	0	0	0	27	4
	Population within ANEC 25	77	77	205	9	11	0	952	51
	Total population within ANEC 40, 35, 30 and 25	95	101	305	9	11	0	979	55
	Potential for ANECs to impact on Landowner Nominated Site	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
	1. The option with the most number of properties impacted is Option 6 with approximately 494 properties located within all ANEC contours 40, 35, 30 and 25. 2. The airport option with the least amount of properties impacted is Option 5 with approximately 5 properties located within all ANEC contours 40, 35, 30 and 25. 3. Notwithstanding the above, the Australian Standard AS2021 provides guidance to regional, local authorities and others associated with urban and regional planning and building construction on the acceptable location of new buildings in relation to aircraft noise. Zones that are described as “conditionally acceptable”, i.e. 20-25 ANEF, may be approved as building sites provided that any new construction incorporates sound proofing measures. 4. There are five landowner nominated sites being assessed by the Department of Planning and Infrastructure for potential residential release within the vicinity of the Wilton study area. These sites are Bingara Gorge, Wilton West, Wilton South, Brooks Point and Appin Vale. With the exception of Option 5, all other options impact with varied ANEC contours, the landowner nominated sites.								
INDIGENOUS HERITAGE	Indigenous heritage sites within footprint	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

WILTON STUDY AREA		Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
INDIGENOUS HERITAGE (continued)	Number of Indigenous heritage sites within footprint	20	13	19	1	8	Nil	18	15
	Indigenous heritage sites within immediate vicinity of footprint	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Number of Indigenous heritage sites within vicinity of footprint	22	21	18	6	7	2	20	16
	1. There are heritage sites located within the footprints of the options and in the vicinity of the sites. 2. There are some 22 heritage sites within the area within which the footprints of all airport options are located. Most of them lie within the footprints of Options 1, 1S, 2, 4, 6 and 7. 3. It is possible that at least 9 heritage sites would be directly impacted on by the current location of the business parks located in the northwest of the airport layouts for Options 1s, 2, 3, 6 and 7. 4. Approximately 31 heritage sites are also within the vicinity of Options 1, 1s, 2, 6 and 7. 5. Approximately 35 further sites lie within the north to west segment beyond the heritage sites stated above as being in the vicinity of the footprints of Options 1, 1s, 2, 6 and 7. 6. Resolution of mitigation of impacts, on the heritage sites will relate to consideration of design resolution, and context and setting of the sites in relation to both the proposed airport itself and the “Business Park” component in the footprints of those Options.								
EUROPEAN HERITAGE	Heritage item within footprint	No	No	No	No	No	No	No	No
	Number of heritage items within footprint	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Heritage item within immediate vicinity of footprint	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Number of heritage item within immediate vicinity of footprint	2	4	4	Nil	Nil	2	4	4
	1. All listed Heritage Items identified in the area are outside the footprints of all of the airport options. Therefore, consideration of impacts, if any, relate to “development in the vicinity of heritage items”. 2. Impacts, if any, will arise from the construction and operation of the airport through enlargement or removal of existing infrastructure (e.g. roads) or through new infrastructure (e.g. new roads and suggested rail options, both passenger and freight). 3. The proposed ‘Business Park’ in the northwest corner of Options 1S, 2, 6 and 7 is likely to intensify vehicular activity and have a more direct effect on two heritage items in the vicinity of those footprints, namely, the Cottage at No. 1090 and St Luke’s Church at Nos. 1096-1099 Argyle Street, Wilton. 4. Resolution of mitigation of impacts, if any, on the two heritage items in Argyle Street, will relate to consideration of context and setting of the items in relation to the proposed “Business Park” component in the northwest footprints of those Options.								
HAZARDS	Flooding hazard	No	No	No	No	No	No	No	No
	Bushfire hazard	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Numbers of people – exposed to risk to third parties due to aircraft crash (Typical UK NATS Public Safety Zone)	Nil	20	44	Nil	Nil	Nil	2	2
	Numbers of allotments exposed to risk to third parties due to aircraft crash (Typical UK NATS Public Safety Zone)	3	10	33	1	1	Nil	10	9
	1. Desktop analysis to investigate the potential for flooding and bushfire in the area found that all sites are on undulating topography which ensures that there is no risk of flooding at any of the airport options. 2. All options are situated within historic bushfire prone lands, with the western most sites being less susceptible to bushfire given they are not situated deep within the forest area. 3. All sites are will be adversely effected by smoke from bushfire given the close proximity to forested areas. 4. Numbers of allotments exposed to risk to third parties due to aircraft crash does not include the allotments within the airport footprint								
WATER AND WASTEWATER MANAGEMENT	Close to access roads	Yes	Yes	Yes	No	No	No	Yes	Yes
	Close to Allens Creek	Yes	Yes	Yes	No	No	No	Yes	Yes
	Close to Drinking Water Catchments	No	No	No	Yes	Yes	Yes	No	No
	Close to town for sharing water services	Yes	Yes	Yes	No	No	No	Yes	Yes
	Next to Retarding Dam	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	1. Option 1 and to a lesser extent Option 2 would be the most preferred locations for preventing effluent generated on site to gravitate into the Drinking Water Catchment streams and rivers. 2. Options 6 and 7 could also work, although not as effectively as the first two options. The other options, although possible to execute, would be less preferable from a water treatment perspective as they are far from Allens Creek which would be the receiving waters of excess effluent that cannot be reused on site.								

WILTON STUDY AREA		Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
WATER AND WASTEWATER MANAGEMENT (continued)	3. Water treatment technologies exist to treat all the effluent generated on site (no matter how highly polluted the water is) to a class better than drinking water standards. As the water demand and hence the volume of polluted effluents generated would be fairly low the cost of treatment compared to the total capital cost of the project would be minimal. 4. All waters generated on the site could be contained and treated on site with beneficial outcomes by reusing the water for purposes of irrigation and toilet flushing in the airport and surrounds. Mitigation strategies can be put into place to prevent any pollution to the sensitive streams and rivers at Wilton								
AIR QUALITY	Produces air pollution impacts as a function of runway option	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	1. The high level of assessment performed in this study does not allow the air quality impacts for each option to be assessed. Notwithstanding this, it is expected that there would be no discernible difference in the air quality impacts of each option, and that each option would result in the same reduction in air quality. 2. The key factors affecting air quality are the numbers of annual vehicle and aircraft movements. It is expected that each option will result in the same level of vehicle and aircraft movements and therefore the same level of air emissions. 3. There may be local issues with drainage of air flows down the various gullies and canyons leading into the Cordeaux, Cataract and Nepean Rivers. This could affect the transport of pollutants from the site into the local and the Sydney metropolitan regions. Only high resolution pollution dispersion modelling can address these local issues in the context of regional air quality.								

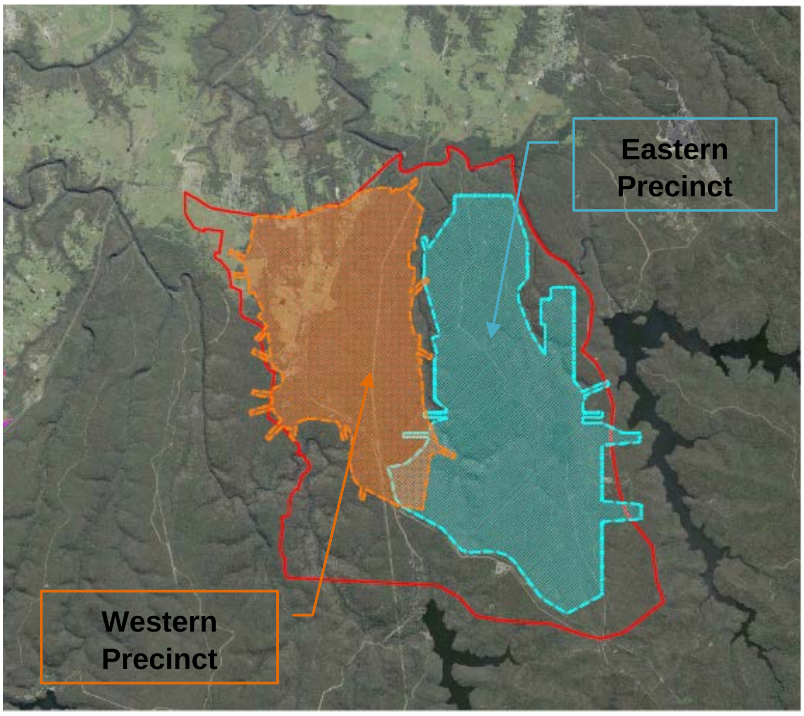
6 SUMMARY OF FINDINGS

6.1 Clustering of options

It can be seen from **Figure 1.8** that the options investigated within the Wilton Study Area fall into two distinct precincts, separated by Wallandoola Creek. This forms a natural physical constraint internal to the Study Area and, while of a slightly lesser topographic feature than are the Cataract and Cordeaux River gorges, it is a terrain feature of sufficient scale to have been regarded as a barrier, if not on other grounds, then at least for planning, engineering and construction of an airport. Within the two precincts, however, there are other lesser gorges, valleys and gullies which have been considered able to be filled for airport engineering purposes.

Figure 1.9 shows the Wilton Study Area and within it, the land enclosed by the loci of the site boundaries for all of the options. The figure shows the breakdown of the Study Area into two major precincts – eastern and western. In effect there are two aggregated sub-sites of about the same area, within the overall Study Area. Notwithstanding this, at present there are some slight transgressions, both of the Study Area boundary and the Wallandoola Creek gorge.

Figure 1.9 Loci of site boundaries for all options



Accordingly, the eastern and western precincts need to be considered in terms of whether:

- There are *"show stopper"* constraints present which would preclude one or both of these precincts (or parts thereof) and the airport options therein from further consideration; and
- There are issues that emerge from the analysis in the Working Papers and which differentiate between these precincts (or parts thereof) and the airport options therein to enable a clear choice to be made between them.

From the assessments made, as recorded in the preceding **Table 1.3**, it has been demonstrated that within each precinct, there are several possible airport site configurations options, covering a range of runway headings. Furthermore, the conclusion can be drawn that there are yet further options (or refinements or variants of those shown) which, on more detailed planning and concept engineering, could be developed in order to:

- Avoid or mitigate to acceptable[47] levels associated environmental shortcomings of the site;
- Achieve an acceptable runway orientation within the constraints of the Sydney Region Airspace; and
- Achieve a level of noise impact which may be generally acceptable.

Other than the latter, since aircraft noise at any level may be unacceptable to some person or numbers of people, these issues can be resolved by planning, design and expenditure of capital.

In fact, no absolute potential *"show stoppers"* were found from the Working Paper analyses, if there is a will to develop an airport at Wilton. There are, however, specific and challenging issues which differentiate between the eastern and western precincts - and the site options therein - sufficiently for one of these precincts and the Options therein - to be preferred and the other to be discarded.

Finally, it is worth recognising that there are airport sites in other countries with land area similar to the whole of the Wilton Study Area and several that are similar to the size of either the eastern or western precincts therein. Denver International Airport is on a site of 13,760 hectares while Kuala Lumpur's new airport is on a site of 10,000 hectares. Incheon International Airport is on a site of 5,600 hectares. By comparison, the whole of the Wilton Study Area is about 8,000 hectares and the eastern or western precincts are each about half this size. In both precincts, the airport site options have a major overlap and are differentiated principally by their runway orientations rather than their individual sites.

6.2 Factors which differentiate between the precincts

On review of **Table 1.3**, it is apparent that many of the issues against which assessment of the eight options was undertaken are common to both precincts. In terms of differentiating between the precincts, these issues are effectively neutral or near neutral. This also applies to distinguishing between the options within each of those precincts. This does not mean that they are unimportant in overall terms but effectively equal in their significance - whether lesser or greater - for either precinct and in terms of each option.

On other issues, there are differences which emerge, to one extent or another, between the two precincts, which may be the basis for distinguishing between the precincts and, within the precincts, between the options themselves.

Table 1.4 lists the issues, as assessed in **Table 1.3**, according to whether they are common or favour either the eastern or western precinct. By implication, if one precinct is favoured over the other in regard to a particular issue, it is the case that the issue is worse in the precinct not favoured. Reference should be made to the relevant working paper for more detailed information on each issue.

It is most important to recognise that there may be mitigating strategies which, if applied, could negate or reverse any such preferences.

[47] Acceptable in the sense that the planning design construction and operation of the airport could achieve approval under the relevant legislation, would conform to any special regulatory requirements, would meet airport engineering and operational standards and may achieve political and social acceptance.

Table 1.4 Factors which have an ability to differentiate between Eastern and Western Precincts

Favours Western Precinct	Common	Favours Eastern Precinct
Active mining and proposed mining leases Mine subsidence Relocation of 20 km of 330 kV transmission line Lesser area of drinking water catchment impacted Able to drain to Allens Creek (outside the water supply route/drinking water catchment) Water and wastewater management Clearing of native vegetation Road and rail linkages	Airspace management Airport safeguarding Indigenous heritage Flooding hazard Bushfire hazard Social (major change regardless) Meteorology Air quality	Least number of allotments impacted by airport footprint Least impact on landowner nominated sites Least number of properties within ANEC 40, ANEC 35 and ANEC 30 Lesser impact on Cumberland Koala Linkage (but still koala habitat) European heritage
Summary of Factors in Western Precinct	**Summary of Common Factors**	**Summary of Factors in Eastern Precinct**
Relatively more people; less mineral and natural resources; relatively lower earthworks cost; relatively more disturbed environment; closer to transport corridors	Key issues to be resolved for all Wilton Study Area and all options	Relatively fewer people; more mineral and natural resources, relatively higher earthworks cost; more pristine environment; further from transport corridors

In terms of the **common** factors:

- Both precincts contain options with an array of runway alignments and other alignments may still be possible on refinement to meet ASA's final preferences;
- All options require safeguarding and similar provisions to do so;
- Both precincts contain known Aboriginal heritage sites and are also likely to contain as yet unidentified Aboriginal heritage sites;
- The entire Study Area is free from major riverine flooding;
- The Study Area, in its entirety, is within lands which are bush fire prone;
- Regardless of the location of options within the Study Area, the scale of development would generate similar social changes - depending on personal viewpoints - for better and for worse by the mere presence of an airport anywhere within Study Area;
- Meteorological effects would not differ sufficiently across the Study Area to be material but nevertheless, more detailed site specific data is needed for the Study Area; and
- The location of an airport anywhere within the Study Area would generate essentially the same scale of air quality effect both locally and within the Sydney region.

The eastern precinct versus the western precinct

The eastern precinct is favoured when the following issues are considered:

- It is the more remote from lands used by people and as a result its direct *"footprint"* and its consequent noise *"footprint"* have, on most runway alignments, the least effect on private property and people;
- It has the least effect on lands that have been nominated for future housing development;
- To the extent that it has to date been studied, it has a lesser effect on known koala linkages but still potentially provides habitat for koalas over its entirety; and
- It does not affect any items of European heritage.

In summary, the eastern precinct is more remote from people but options within it are liable to have far greater effects on environmental values and are also likely to be affected by, or to affect, future coal mining.

The western precinct is favoured when the following issues are considered:

- While it is still underlain by coal reserves and in part by active mining leases, there are no known current plans to mine under much of the western precinct and part of the precinct is underlain by coal for which only an exploration license has been issued. The western precinct is therefore less likely or can be made less likely to be affected by future mining subsidence;
- All land within the western precinct naturally drains to points lower in the water catchment region or into Allens Creek which is entirely outside water catchment area boundaries. As such, water management and pollution control strategies are likely to be easier to implement and more effective as a result. No water drains directly into the reservoirs themselves;
- Given the extent to which the precinct has already been modified for human activity, the western precinct requires less clearing of native vegetation and, as a result, less loss of habitats and ecological assemblages;
- The terrain is somewhat more suitable for the development of an airport site platform and, on the options tested to date, most of those in the western precinct achieve a lower volume of cut to fill earthworks. As a result, the cost of an earthwork platform is correspondingly less, notwithstanding that in absolute terms it will be very expensive, other than by comparison to other new airports such as those constructed on floodplains and similarly flat lands; and
- The western precinct lies generally closer to the major transport corridor likely to serve an airport. This transport corridor comprises that in which lies the F5 Freeway and the existing Main Southern Railway. Any future High Speed Rail alignment, to which a Wilton airport might become linked, would most likely lie within this corridor also. The western precinct also retains cross regional links to the Illawarra and the possibility of creating alternative local routes.

In summary, the western precinct is physically closer to where people currently reside, but is liable to generate relatively lesser environmental effects on otherwise pristine bushland and water catchment lands. The western precinct is underlain by coal resources but these are not currently being actively mined. Based on existing available information, no mining of these resources is currently planned. Land transport links are likely to need less upgrading in the early stages of airport development as passenger volumes will be at low levels and offer reasonable travel times to the central business district (CBD) and other destinations in the metropolitan area of Sydney. The western precinct still offers site configuration opportunities to ensure that effects on people, such as aircraft noise, are at levels that are considered acceptable for residential exposure. While some people will be affected, the numbers will still be at far lesser levels than at some localities considered in the Joint Study. The terrain in the western precinct appears likely to be able to be shaped to create an airport platform at lower cost than the terrain in the eastern precinct.

6.3 Mitigation Strategies

General

Mitigation strategies for externality effects can be developed in a range of ways, for example:

- Ultimate mitigation occurs when the project under consideration, which is the source of undesired effects, is not undertaken at all. For example, no airport at Wilton;
- Planning mitigation can occur when the project is located so as to avoid or reduce to acceptable levels undesirable effects. For example, selection of an optimal site;
- Design mitigation can occur when the project's components are designed to eliminate, avoid or reduce to acceptable levels specific undesirable effects. For example, orientation of runways;
- Construction mitigation can occur when the project is created in such a way that construction activities do not cause specific undesirable effects. For example, conditions imposed as a result of an EIS process, such as hours of construction activity, control of dust and the like;
- Operational mitigation can occur when the project operates with limits which reduce or ameliorate to acceptable levels. For example, as at Sydney (Kingsford-Smith) Airport with cap and curfew; and
- External mitigation can occur when actions are taken to modify, for example, the environment, existing infrastructure or occupation of land so that, while the undesirable effects may still occur, they are not a problem for receptors. For example, through the acquisition of property liable to be exposed to adversely high noise levels.

In regard to the creation of a *"maximum"* scale airport within the Wilton Study Area, it is assumed that it would be unacceptable to lock in operational constraints through Operational Phase mitigations and on the other hand, it would be desirable to reduce to a minimum the need for external mitigations.

The mitigating strategies available at this stage are those in planning and design of an airport in the eastern or western precinct, assuming, of course, there is an overall will to locate an airport at Wilton.

Mitigating strategies for the eastern precinct

The eastern precinct is an area characterised principally by:

- Relative remoteness from people and the likely major transportation corridor;
- Being wholly within the Metropolitan Special Area of the Sydney Drinking Water Catchment with direct drainage paths into Lake Cataract;
- As a result of the hitherto protection afforded by its *"Special Areas"* status, containing virtually undisturbed terrain and flora and fauna assets;
- Being completely underlain by current active and planned future coal mining; and
- Requiring relatively greater earthworks required to create an airport platform.

Mitigation strategies will require consideration of, inter alia:

- In general, an overall planning mitigation strategy for the eastern precinct will be to orient runways to both avoid overflight – and hence noise - over current and future urban areas – while also simultaneously satisfying ASA's requirements for airspace management – the indicative airport layouts produced to date suggest that these conditions could be met;
- The incompatibility of long wall mining occurring after airport development – this may mean either acquisition of the coal leases that underlie that part of the eastern precinct site and sterilization of the coal resource or not developing an airport until after all economic coal has been extracted i.e. all associated

subsidence has occurred; This will need to be resolved in conjunction with NSW Government and the holders of affected mining leases;

- In view of the fact that the eastern precinct is wholly within the *"Special Area",* and assuming it is possible to acquire the site, approval will be required from the SCA; obtaining this will be contingent on being able to demonstrate that both during construction and during operation of the airport, water entering the water storage and distribution systems meet the required water quality standards. This will require major complex engineering works which will need to be failsafe;
- Dealing with these and other matters will probably mean making changes to the current site positions and configurations as a part of design development and optimisation – the eastern precinct is a sufficiently large precinct to enable a degree of such optimisation; and
- Finally, adopting an ultimate mitigation strategy of not proceeding with the eastern precinct would avoid having to address these complex issues and would preserve intact a substantial tract of undeveloped land which is likely to remain undeveloped. This would have the advantage of creating a major buffer zone in government ownership to the east of the western precinct, should that precinct and one of the options therein, be preferred.

Mitigating strategies for the western precinct

The western precinct is an area characterised principally by:

- Being the precinct in which the site of 1985 proposal for an airport at Wilton lies;
- Being relatively closer to the established community of Wilton and containing other forms of rural and semi-rural land use as well as undeveloped lands;
- While being completely underlain by coal measures, only being partially underlain by active mining leases;
- While being substantially within the Drinking Water Catchment, also comprising lands which are outside the DWC;
- Having a clear means of managing water discharges into receiving waters which avoids the drinking water catchment;
- Containing lands which are both highly modified from their natural form and which are not at all or are less modified; Accordingly, there are likely to be found some pockets of flora, fauna and indigenous heritage which will require closer consideration as to their significance – for example koala linkages;
- Relatively closer to the major transport corridor by which an airport in the Wilton Study Area is likely to be accessed, particularly during its initial phases; and
- Engineering earthworks to create a platform being relatively lesser than the eastern precinct.

Mitigation strategies will require consideration of, inter alia:

- In general, and as for the eastern precinct, an overall planning mitigation strategy for the western precinct will be to position and orient runways to maximise separation from and minimise over flight of current and future urban areas – while also simultaneously satisfying ASA's requirements for airspace management. The indicative airport layouts produced to date suggest that these conditions could be met;
- Maximising the usage, for any airport related purposes, of lands which are furthest away from people and incompatible with existing or proposed future land uses[48;] this indicates a preference for the southwest portion of the western precinct;

[48] Unless these land uses can be prevented or otherwise controlled to protect the airport.

- Orientation of runways to achieve, to the extent possible, minimum levels of noise exposure for residential property;
- The incompatibility of long wall mining occurring after airport development – this may mean either acquisition of the coal leases that underlie that part of the preferred the western precinct site option – but for which there are no known current mining plans - and sterilization of the coal resource or not developing an airport until after all economic coal has been extracted i.e. all associated subsidence has occurred; This will need to be resolved in conjunction with NSW Government and the holders of affected mining leases;
- Modification of the options investigated to date in order to maximise the area of a site to be outside the "*Special Areas"* or able to be drained – via Allen's Creek - to non- drinking water receiving waters; and planning and designing a failsafe means to preclude airport site stormwater from entering the DWC lands; and investigating whether any adjustments to the DWC boundaries are possible without jeopardising the asset they are intended to protect;
- Optimisation of earthworks to both avoid changes to the terrain unless needed and to achieve a minimum construction cost;
- Adjusting the configuration of the site to both allow optimal connection of the airport to transportation links and also provide for continued regional traffic moving between the F5 and the F6 Freeways;
- While not reducing the airport's capacity, reducing the scale of the airport infrastructure e.g. runway length to avoid transgressing any of the study boundaries and preferably keeping any development and associated work well within the Study Area boundaries;
- Making changes to the current site positions and configurations as a part of design development and optimisation – the western precinct is a sufficiently large precinct to enable a degree of such optimisation. Of the options already investigated two, 1S and 7, have locations and configurations which are the most suitable assessed in this Study and these, potentially, can be further optimized;
- Adoption of the western precinct as the preferred precinct in which to refine an option or options has the mitigating effect of preserving the environmental assets of the eastern precinct and Wallandoola Creek intact.

On an overall assessment it is considered that, the western precinct and Options 1S and 7 therein, while still very challenging to develop for a *"maximum'* airport, would be more likely to progress through the Commonwealth's EPBC Act processes and through other relevant State legislation, than would the eastern precinct and its options.

6.4 Next Actions to Progress Airport Design Optimisation

On the basis that the western precinct is accepted as the preferred airport precinct for a "*maximum"* airport site and can provide several different options and configurations of airport - of which Options 1S and 7 are considered the best - the following matters, *inter alia*, require clarification through more detailed consultation in order to select a preferred configuration on which, if required, to develop a masterplan and cost estimate.

- The overall acceptability to decisions makers of the predicted effects and challenges in resolving them, as have been found in this Study for an airport at Wilton, on people and on the environment more generally resulting from an airport development;
- The particular requirements of DSEWPaC in respect of the information needed to progress an approval through the EPBC Act for Options 1S or 7, noting that these Options differ principally in terms of runway orientation as their sites have a high degree of overlap;
- The preferences of ASA with respect to orientation of runways and airspace design in the Sydney region;

- Timing of airport development versus timing of resource extraction or sterilisation of coal reserves and negotiation with mining lessees;
- Fundamental acceptability of this scale of development, even with safeguards in drinking water catchment *"Special Areas"* and further input from Sydney Catchment Authority on their requirements for safeguarding the drinking water catchment;
- The transformational impact on Wilton and nearby villages and the extent to which the Department would be prepared to acquire property and land and/or undertake modifications to buildings and infrastructure;
- The sources of likely users and their transport mode split to better refine the requirements on land access to the airport and the upgrading and new infrastructure that would be needed to support this;
- The likely staging of the capacity need and how this translates to staging of the provision of airport infrastructure, such as timing of building a parallel runway, expansion of terminal facilities and upgrading of land transport links; and
- The acceptability of scaling back the airport development to better suit the constraints of the area (e.g. by having one 4000 m and one 2600 m runway, with no cross runway, rather than having two 4000 m runways and a cross runway or by having only a single runway airport). It is clear that western precinct sites can be found to accommodate a single 4000 m runway airport development, by adopting the best position available for this. Adding a second 4000 m runway and also a cross runway generally adds complexity in terms of the constraints encountered, as the location for this runway will likely be - in this terrain and environment - the less optimal of the two runway locations.

6.5 Key Points

- This report identifies sites and assesses in a five step process, the suitability of land in aviation engineering, environmental and planning terms in the general vicinity of Wilton, New South Wales (NSW), to accommodate airport development of a sufficient scale to meet a predicted shortfall in aviation capacity in the Sydney region;
- This assessment goes beyond the more strategic analysis that was undertaken in the Joint Study on Aviation Capacity for the Sydney Region. The airport site termed *"Wilton"* in the Joint Study was only representative of what might be possible at Wilton;
- 25 separate working papers were prepared covering those topics which could be expected to be addressed in the preparation of an Environmental Impact Statement, as might be needed under Commonwealth and NSW Government legislation, in particular the EPBC Act or the NSW Environmental Planning and Assessment Act 1979 (EP&A Act);
- The Study is intended to provide an understanding of the issues and degree of challenge that would be involved in order to assist determination Government to make a determination whether or not to continue to develop an airport proposal for a particular airport site or sites at Wilton;
- A Study Area was defined based on key constraints which built on those adopted in the Joint Study and excluded lands which were in State Conservation Areas, which were zoned as urban, and which form natural boundaries to the major water catchment areas of Cordeaux and Cataract Reservoirs;
- The Study Area was selected to enable broad and comprehensive testing of the general area in and around Wilton for its ability to provide a site(s) for a *"maximum"* scale airport. It is about 8,000 hectares in size and has two major parts - the eastern and western precincts. These component parts of the Study Area have a natural north - south orientation, which is reinforced by many of the ridges and drainage lines internal to the Study Area;

- A *"maximum"* airport template was adopted for 70 million passengers per annum, comprising two 4,000 metres (m) by 60m parallel runways with a separation of 2,000m, one 2,500m by 60m cross runway, and a minimum site area of 1,800 hectares to accommodate terminal facilities and aviation infrastructure needed. This is at the lower end of site area for an airport at this scale with 3000 – 4000 ha sites not being uncommon and even larger airport sites are being developed;
- The nature of the topography in the Study Area imposes significant constraints when trying to identify suitable locations to accommodate, even a customised airport template. Accordingly, the area of land in the Study Area realistically able to accommodate an airport or even elements of an airport is reduced;
- A total of eight airport site options were identified – three in the eastern precinct and five in the western precinct (with one being a variant relating to placement of the cross runway). These site options were developed in order to test a range of locations and runway orientations within the Study Area and customised to the constraints of the site;
- A single runway airport can be relatively easily identified and potentially created in the Study Area, in a range of orientations. However, the second 4,000 m runway - at a minimum 2,000 m separation - and then addition the cross runway, make a site being much harder to locate;
- These sites have a large degree of land overlap. This effectively means there is an eastern set of options and a western set, each within a maximum overall site of about 3,000 to 4,000 hectares and potentially can accommodate a range of options for runway orientation and hence, overall airport configurations;
- Not all factors provide clear distinctions between either of the two precincts or indeed between the eight options themselves. However, these factors may be relevant to an overall decision to proceed with an airport in the Study Area at any of the site options;
- Two of the most critical considerations are the effects of aircraft noise on people and the ability to integrate flight tracks into the overall Sydney Region Airspace management plan;
- The eastern precinct options are the more remote from centres of population and their airport site footprints directly affect almost no people. The western precinct options have the greater direct footprint noise effect on people but those may be affected by aircraft noise under any of the Options assessed in this Study is very small compared to the other localities evaluated in the Joint Study;
- A variety of runway headings can potentially be achieved in both the eastern and western precincts as the airport concepts show. This suggests that compatibility current and or future operational management of the Sydney Region Airspace should be able to be achieved through runway orientation optimisation;
- The other major challenges for and realities of the sites were identified as follows:
  - Earthworks to create a platform for a "maximum" scale airport at Wilton are estimated as being around 100 to 110 million cubic metres cut plus fill and around $800 to $1,100 million;
  - The majority of the airport site footprints are within the Metropolitan Special Area of the Sydney Drinking Water Catchment. While this does not preclude airport development per se, it will result in imposition of extremely rigorous, extensive and expensive works to preclude contamination of the catchments.
  - All of the Study Area is underlain by coal measures and a significant proportion of the western part falls within an active mining lease. There are apparently no current plans to actually mine beneath the aggregate footprint of the western set of airport sites. However, the remainder of that footprint is the subject of an exploration licence. Airports are not compatible with the subsidence effects of long wall mining and accordingly negotiations would be needed to sterilise up to 20 square kilometres of coal, with an expected lost value of from $5 to $20 billion.

  - A large number of threatened species and ecological communities occur throughout the Study Area including the koala which is known to occur throughout the area and which has several identified habitat linkages that traverse the western part. Very detailed field studies, and potentially compensatory habitat, will likely be needed to satisfy the requirements of the EPBC Act;
  - To accommodate 70 mppa, very substantial upgrading of the land transport links from metropolitan Sydney to any airport site at Wilton would be required;
- The social effects on the existing township of Wilton will be entirely transformational;
- Overall, the western set of options, notably Option 1 South (1S) (which has a basically north - south alignment) and Option 7 (which has a more northwest - southeast orientation) are considered the most promising sites and, in effect, are the one land site.

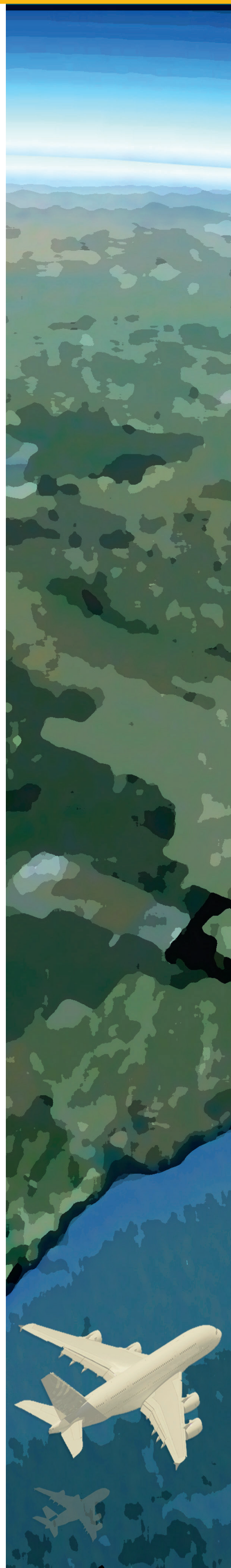
In summary, there are no potential, absolute *"showstoppers"* that have been clearly identified to preclude development, through stages, of a *"maximum"* airport along the lines of either Option 1S or 7 in the Wilton Study area.

Most issues associated with either Options 1S or 7could be addressed and resolved through application of planning skills and design refinements to incorporate environmental safeguards and protection strategies, but also would entail the application of major financial resources.

However, there would be major challenges in terms of planning, approval and design processes, such as those embodied in the EPBC Act and other relevant legislation, to take an airport proposal, in the form of either Option 1S or 7 at Wilton, through planning and design to construction and operation. The highest levels of active issue management and environmentally responsive design would be required in order to achieve resolution of these challenges

1

Airport Site Selection



Airport Site Selection

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Further Assessment of Airport Development Options at Wilton

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CONTENTS

1 WORKING PAPER – AIRPORT PERFORMANCE SPECIFICATION FOR WILTON – TASK AND INFRASTRUCTURE

SUMMARY

This Working Paper outlines a series of assumptions for an airport development in the Wilton Study Area, to enable selection of airport development sites that would be able to accommodate a full range of aviation activity over a planning horizon of some 50 plus years. In order to identify sites within the Wilton area that could accommodate the airport development, a template airport was produced.

For planning purposes, it is appropriate to assess the least capacity constrained airport and assess the "*maximum*" level of demand that the airport could accommodate, called a "*maximum*" airport. The Joint Study found that by 2060 demand for regular passenger transport (RPT) services will exceed capacity by 54 million passenger movements per year in the Sydney region. Meeting this capacity will require two parallel runways. Therefore, it is appropriate to identify a site that can accommodate the maximum airport capacity of 70 million passengers per year.

A summary of the key assumptions used in developing the airport template are outlined in this Working Paper and detailed in Section 2.2. This airport template is used in the Working Paper - *Wilton Airport Site Selection and Airport Concepts* to identify airport site options.

1.1 Introduction

The preceding summary of this study outlines the site identification and analysis process applied to undertake the preliminary environmental and engineering assessment of the general area in and around Wilton for major airport development. The first step in the identification process involves defining the type of airport required. This will set the basis for the type and scale of development required to be located in the general area of Wilton, and will guide the identification of representative sites to enable further analysis of airport options the Wilton area.

This Working Paper outlines a series of assumptions for an airport development in the Wilton Study Area, which forms Step 1 in the identification process outlined in Figure 1.3 in this study's Overview Working Paper.

The purpose of this Working Paper is to identify a template that would be able to accommodate a full range of aviation activity over a planning horizon of some 50 plus years. Therefore, the assumptions developed are intended to ensure the airport templates will have capacity for 70 million passenger movements per year. For planning purposes, it is appropriate to assess the least capacity constrained airport and assess the "*maximum*" level of demand that the airport could accommodate, called a "*maximum*" airport.

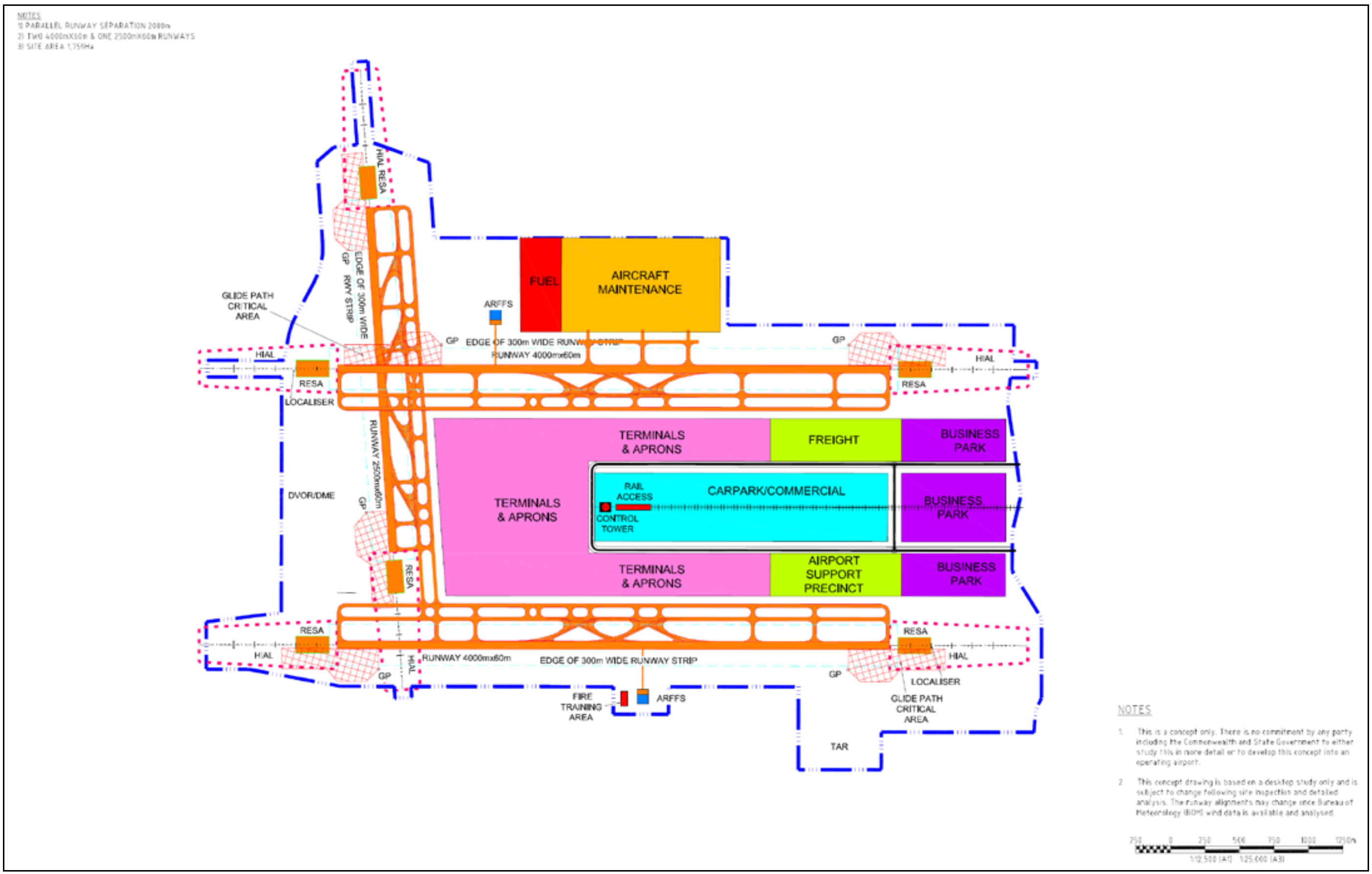
In order to identify sites within the Wilton area that could accommodate the required type of airport development, a template airport will be required. The assumptions detailed in this Working Paper, as well as a number of Australian and international standards, have been used to develop the template.

The template is for a wide-spaced parallel runway airport with independent runway operations and a cross-runway that:

- Will have flexible operational capability in order to optimise future air traffic management requirements; and
- Will be capable of staged development commencing with a single runway layout.

Based on these assumptions, a template has been developed to be used for the development of airport options in the Working Paper *Wilton Airport Site Selection and Airport Concepts*. The template is shown in the **Figure 1.1**.

Figure 1.1 Wilton representative airport template



1.1.1 Contents of paper

This Working Paper presents a set of proposed assumptions relating to:

- Airport type and role;
- The runway length, alignment, capacity and separation;
- Terminal precinct;
- Taxiways and aprons;
- Support facilities;
- Business parks; and
- The airport template used for site selection and assessment.

1.2 Airport Design Parameters

This section summarises the key assumptions that have been developed.

Key parameters and assumptions

Parameter	Assumption Proposed	Basis of Assumption
Airport type	A full service airport with a runway length up to 4,000 m, capable of serving all market segments and accommodating a future parallel runway layout.	A full service airport was selected so that the airport's: • Main runways has flexible operation capacity in order to optimise future air traffic management requirements; • Is capable of staged development commencing with a single runway layout; and • Is capable of accommodating Sydney's forecast aviation demand that cannot be handled at existing airports as per the Joint Study findings.
Runways	Runway length and width: Independent, wide-spaced parallel runways: • 4,000 m x 60 m; and • 4,000 m x 60 m.	Runways of 60 m in width are required so that the airport can accommodate all existing, planned and foreseeable civil aircraft types including large international aircraft (Code F) such as Boeing A380, from Civil Aviation Safety Authority (CASA) *Manual of Standards (MOS) 139 – Aerodromes*. Runways 4,000 m in length are appropriate given that: • The airport should be able to accommodate the maximum, unconstrained demand; • The airport will need to cater for large international aircraft; and • Many overseas airports have one or two runways of greater than 4,000 m.
	Cross runway: • 2,500 m x 60 m	*Annex 14 – Aerodromes (*International Civil Aviation Organisation, ICAO, *Edition 5)* specifies that runways should be oriented so aeroplanes may be landed at least 95% of the time with crosswind components as follows: • 20 knots for aeroplane reference field length 1,500 m or over; • 13 knots for aeroplane reference field length 1,200 m up to but not including 1,500 m; and • Applicable to all conditions of weather. Width is from *CASA MOS 139 – Aerodromes*
	Runway capacity: 100 movements per hour	Depending on aircraft fleet mix, runway configuration - whether staggered etc., this is a typical/indicative practical capacity in Instrument Meteorological Conditions (IMC) of a two parallel runways. Airservices confirm a nominal capacity of 80 to100 movements per hour. Booz & Co. aircraft movement forecasts for Scenario 5 of 70 million passengers will not challenge this capacity.
	Runway alignment	A range of screening factors in Working Paper 4 will be used to determine runway alignment, including: the orientation criteria under cross runway above and cognizance taken of runway alignments closest to Northwest/Southeast preferred by Airservices Australia in their *Further Assessment of Wilton Sites* as optimal for segregation from Sydney (Kingsford-Smith) Airport (Sydney Airport) operations. Other alignments will also be considered, with increasing levels of complexity to design and manage the existing Sydney airspace.

Parameter	Assumption Proposed	Basis of Assumption
	Runway separation: 1,525 m minimum Adopted separation: 2,000 m	A minimum runway separation of 1,525 m will be used, from benchmarking of comparable airports, as this is necessary for independent operation of the two runways and to maintain capacity. Benchmarking analysis of international airports. Allows sufficient space for the terminals and supporting infrastructure to be located between the runways.
	Runway slope: 1 %	The overall runway slope, defined by dividing the difference between the maximum and minimum elevation along the runway centreline by the runway length, must not be more than: • If the runways' code number is 3 or 4 (as in this case) -1%, based on CASA MOS 139 – Aerodromes.
Terminals	Terminals location: between the parallel runways	The terminal precinct will be located between the parallel runways due to airport planning issues posed by locating the terminals to one side of the runways and to allow assessment of the least capacity constrained, optimised airport.
	Domestic terminal Floor space: 250,000 sq. m Parking spaces: 15,000 Aircraft gates: 63 Code E and C	Indicative assumptions based on: • Providing for 70 million overall passengers per annum; and • Benchmarking against Sydney Airport Master Plan concept for 2029.
	International terminal Floor space: 500,000 sq. m Parking spaces: 10,000 Aircraft gates: 56 Code F, E and C and 3 Code E freight	Indicative assumptions based on: • Providing for of 70 million overall passengers per annum; and • Benchmarking against Sydney (Kingsford-Smith) Airport Master Plan concept for 2029. *Note 1: detailed carparking analysis is undertaken in the Working Paper Land Transportation Links*
Taxiways	Two single direction taxiways parallel to each runway.	This taxiway arrangement maximises the flexibility for aircraft circulation, minimizes runway occupancy time and accommodates the aircraft required.
Apron stands	Apron stand dimensions of: Code F- 11,200 sq. m Code E - 8.190 sq. m Code C jet and turboprop - 3,050 sq. m	This apron stand accommodates the aircraft required, based on *CASA MOS 139 – Aerodromes.*
Business parks	Business park scale depends on land available after aviation user requirements for airport concept option.	Proposed runway separations also allow for flexible business park incorporation.

1.3 Airport runways

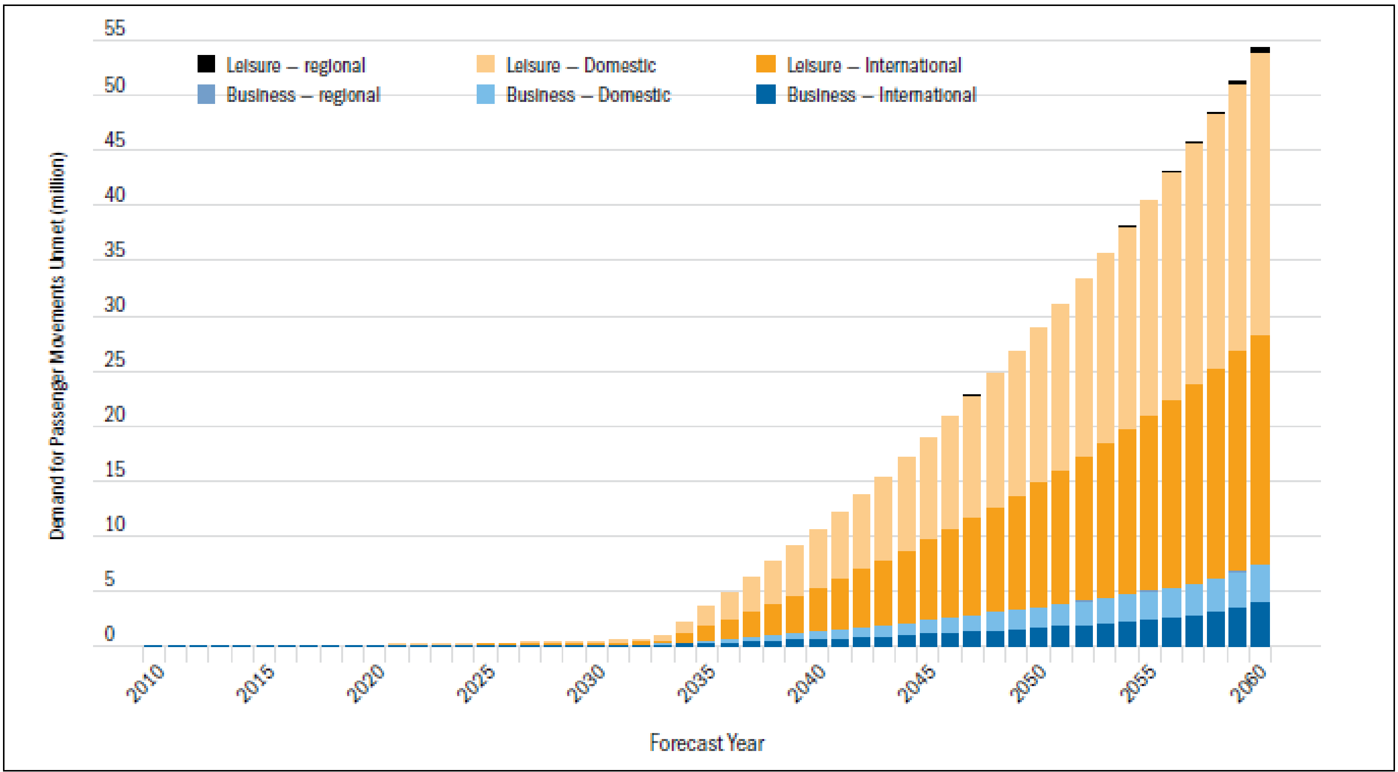
This section summarises the runways assumed to be required for a potential Wilton airport development. This section details the basis for the assumption that a site at Wilton should have the ability to accommodate:

- Two, independent wide-space parallel runways 4,000 m in length and 60 m in width;
- A minimum runway separation of 1,525 m to permit wide-space independent operations;
- The parallel runways should provide capacity of up to 100 aircraft movements per hour; and
- A cross-runway 2,500 m in length and 60 m in width.

1.3.1 Aircraft types expected at a potential Wilton airport development

According to the findings of the *Joint Study,* unmet aviation demand in the Sydney region is expected across General Aviation (GA), interstate, domestic and international movements. As shown in **Figure 1.2**, it was found that by 2060 demand for RPT services will exceed capacity by 54 million passenger movements per year at Sydney Airport.[1] This is based on an assessment of the number of movements and the demand profile; however, it does not include induced demand in the immediate catchment area.

Figure 1.2 Sydney (Kingsford-Smith) expected demand for passenger movements unmet by type and purpose of travel, 2010 to 2060[2]



To provide for all segments of unmet demand outlined above, Wilton airport development must be able to accommodate all international and domestic aircraft. The *Joint Stu*dy identified that in order to accommodate the scale of unmet demand estimated, a full service airport servicing all market segments and capable of handling a future parallel runway layout would be required.[3]

[1] Commonwealth Government and NSW Government, 2012. *Joint Study on Aviation Capacity in the Sydney Region,* p. 17
[2] *Ibid.*
[3] *Ibid,* p. 346

For the purpose of this analysis, it is appropriate to assess the least capacity constrained airport and assess the maximum level of demand that the airport could accommodate, called a "*maximum*" airport. Therefore, the assumptions developed are intended to ensure the airport templates will have capacity for 70 million passenger movements per year.

Table 1.1 provides the hourly aircraft movement forecasts for the maximum capacity of 70 million passengers per annum, known as Scenario 5, developed by Booz & Co. as part of this further assessment.

Table 1.1 Hourly aircraft movement forecast (for 70 million passengers)

	Scheduled		Wilton
Hours	**Departure**	**Arrivals**	**Total** *(Note 1)*
1	0	0	2
2	0	0	2
3	0	0	2
4	0	0	3
5	0	0	4
6	8	21	31
7	38	27	69
8	39	36	77
9	27	31	61
10	29	22	52
11	26	34	61
12	18	24	43
13	21	17	40
14	23	25	49
15	19	35	56
16	21	23	46
17	35	27	64
18	34	35	72
19	28	27	58
20	20	10	32
21	17	12	31
22	9	6	16
23	0	0	0
24	0	0	0
Total	412	412	869

Note 1: Includes scheduled, freight, regional and general aviation
Source: Booz & Co. 12 July 2012

Table 1.2 details the aircraft characteristics and codes that the runways would need to accommodate given the types of unmet demand identified in the *Joint Study,* as well as Booz & Co. further analysis of the potential demand segments that will use an airport at Wilton, namely both domestic and international passenger movements. **Appendix 1A** provides a detailed list of aircraft and aerodrome codes.

Table 1.2 Characteristics by Aircraft Code

Aircraft Code	Aircraft Wingspan	Most Common Routes	Aircraft Examples	Approximate Seat Capacity
Code A	Up to 15 m	General Aviation	Cessna Citation CJ1 Cessna 340 / 404 Beechcraft 390/55/Beechjet	5-10
Code B	15 – 24 m	Regional	Saab 340 BAe Jetstream 32 Beechcraft SKA 200	13-37
Code C	24 – 36 m	Domestic	Airbus A320 Boeing 737 Bombardier Dash 8	50-213
Code D	36 – 52 m	Domestic	Boeing 767	214-249
Code E	52 – 65 m	International	Airbus A330 Boeing 747 Boeing 777	253 – 400
Code F	65 – 80 m	International	Airbus A380	489
Helicopter	N/A	General Aviation	Eurocopter EC 120 Robinson 44	N/A

Source: Joint Study, Part 12 Appendices, Airservices Australia, Booz & Co. analysis.

As shown in the above table, Code F aircraft are the largest and therefore, if an airport can accommodate a Code F aircraft, it can accommodate all the other codes. It should be noted that Code D aircraft are subject to imminent removal from the Australian fleet. Based on the aircraft characteristic outlined above, the minimum runway and taxiway requirements from CASA *MOS – Aerodromes* are summarised in **Table 1.3**.

Table 1.3 Airport dimensional criteria

Airport element	Criteria (metres)		
	Aircraft Code F	Aircraft Code E	Aircraft Code C
Runway width	60	45	45
Taxiway width	25	23	15
Runway /taxiway centreline separation	190	182.5	168
Taxiway/taxiway centreline separation	97.5	80	44
Taxiway centreline/apron edge separation	85	68.5	36.5

For the airport concepts, runways are Code F, parallel taxiways are to Code F, separation to the runway and other taxiways and taxiways are to Code F width, as highlighted in **Table 1.3**.

1.3.2 Runway Length

Parallel runway lengths of 4,000 m have been used to develop a template for the site selection of options at Wilton. The basis for this is outlined in this section.

The ICAO *Aerodrome Design Manual - Part 1 – Runways (ICAO Doc 9157) 2006* provides an explanation of parameters affecting runway length and other associated runway matters. Detailed standards are provided in the *CASA Manual of Standards 139 – Aerodromes (2012).*

The runway length required for aircraft operations is dependent upon a number of factors including:

- Aircraft type and weight as they take off;
- Type and thrust of aircraft engines;
- Routes served;
- Individual airlines' operating procedures, particularly in relation to fuel reserves;
- Forecast enroute weather;
- Elevation of the runway (a higher elevation requires a greater length for the same payload);
- Ambient temperature;
- Atmospheric pressure;
- Wind strength and direction; and
- Runway longitudinal slope.

Appendix 1A shows the Aerodrome Reference Field lengths (ARFL) for a variety of aircraft. The ARFL is the minimum field length for take-off at maximum certified take off mass, sea level, standard atmospheric conditions, still air and zero runway slope as shown in the appropriate flight manual. The ARFL is not necessarily the maximum take-off distance required in all cases as each individual take off will be subject to a range of other variables which may result in a greater length being required for a particular operator and a specific individual company's operating procedures. **Table 1.4** shows a selection of ARFL for a number of aircraft. [4]

Table 1.4 Indicative aerodrome reference field lengths

Aircraft	ARFL (metres)
International Aircraft	
A380-800	3,350
B747-400	3,383
B777-300	3,140
B767-300	2,743
A340-500	3,275
A330-300	2,560

[4] Future aircraft such as the B787 which may be come into service are not yet included in CASA MOS 139.

Aircraft	ARFL (metres)
Domestic Aircraft	
A320-200	2,058
B737-800	2,256

Source: CASA MOS 139

The actual runway length requirement will be greater than the ARFL. Sydney is geographically located such that it hosts some of the longest non-stop route sectors in the world (e.g. Sydney Airport to Dallas Fort Worth Airport in the US, a circle distance of some 14,556 km). This route is currently operated by Qantas using B747-400ER aircraft. The significant number of long non-stop routes further emphasises the need to accommodate large international aircraft at an airport development at Wilton.

This being said, it should be noted that both aircraft and navigational technology is continually evolving, particularly in the context of the 50 year planning horizon of this study. Although aircraft size and weight has been increasing, advances in engine and wing design have to a large extent overcome the need for longer runways. Many of the aircraft types listed in **Table 1.4** above are in the process of being phased out and will be unlikely to be operating in any numbers by the time an airport is commissioned at Wilton. Current new generation aircraft and as yet to be developed aircraft with expected better field performance will largely replace them. For example, the two largest jet passenger transport aircraft in service and production are the A380-800 and B747-8I.

Figure 1.3 shows for the A380-800 and B747-8I these aircraft manufacturers approximate take-off runway length requirements with the aircraft operating at their respective maximum take-off weights, from an airport elevation of 1,000 feet (305 m) as would apply at Wilton, a sea level temperature of 30^{0}C and nil wind.

Note that the landing distance requirements are typically much less than that required for take-off for most aircraft types.

The actual payload for an aircraft depends upon a range of factors including airline operating procedures, engine types, route being served, wind speed and direction and ambient temperature.

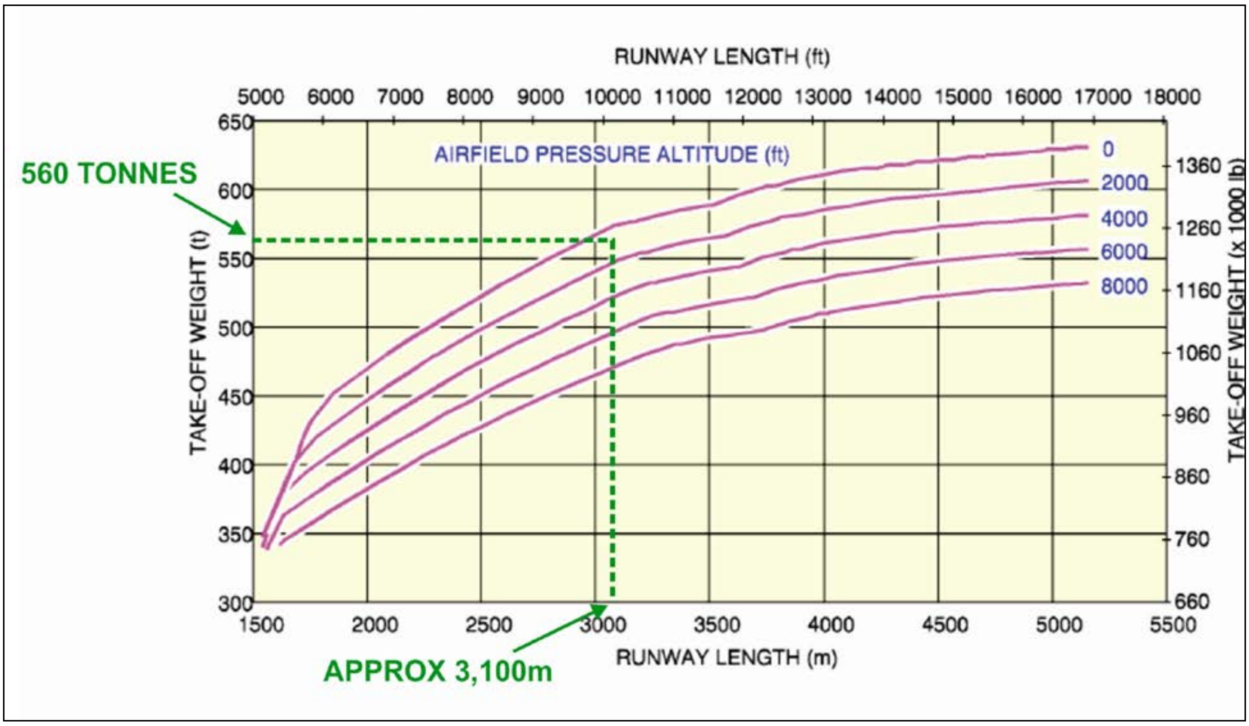
Additionally performance curves for take-off are based on an effective runway gradient of 0%, where effective gradient is the maximum difference in runway centreline elevations divided by the runway length. The US Federal Aviation Administration (FAA) specifies that the runway lengths for take-off be increased by the following rates for each 1% of effective runway gradient:

- For piston and turboprop aircraft, 20%; and
- For turbojet aircraft, 10%.

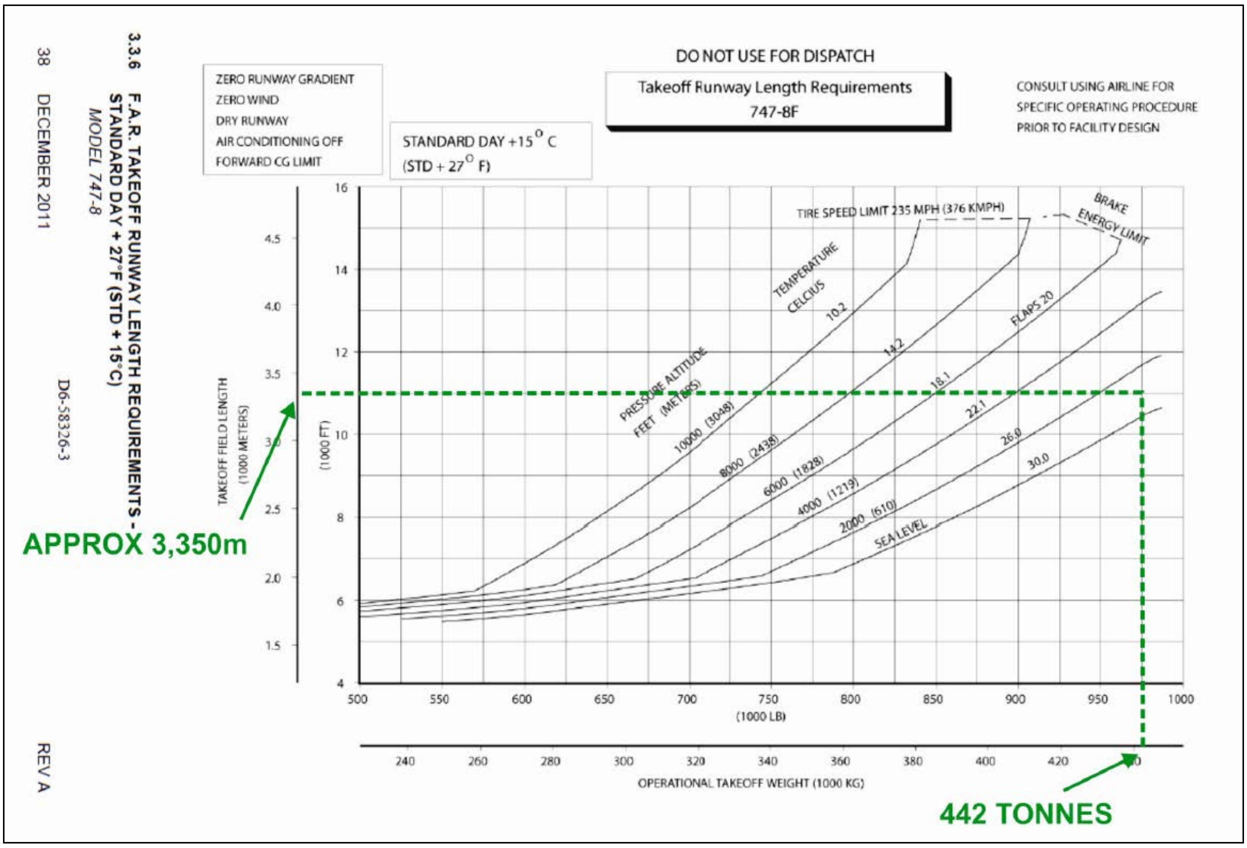
At Wilton runways will have a gradient of 1%, which means 10% has to be added to the calculated lengths.

Figure 1.3 A380-800 and B747-8I indicative take-off length requirements

A380-800



B747-8I



Source: Airbus 2010, Boeing 2011

Figure 1.3 shows the indicative take-off length requirements for the A380-800 and B747-8I. Adding a 10% allowance for a runway gradient of 1% increase the runway length required to 3,410 m for the A380-800 and 3,685 m for the B747-8I. A 4,000 m long runway will accommodate these aircraft with some additional length available to take account of individual company operating procedures, which may require a greater length for some operations. Similarly, a runway length of 4,000 m would accommodate domestic operations between capital cities and domestic operations from regional centres. For domestic operations between capital cities runway lengths of about 2,500 m to 3,200 m are typical for aircraft up to and including Code 4E such as A330. See Section 1.4 in regard to the use and length of a cross runway, which is intended to be primarily used for landings in high cross winds. Benchmarking of international airport runway lengths also support a 4,000 m runway. As shown in **Table 1.5**, a number of overseas airports have one or two runways of 4,000 m or greater in length:

- Dallas (Fort Worth);
- Dubai (International);
- Frankfurt (Main);
- New York (JFK);
- Paris (Charles de Gaulle); and
- Singapore (Changi).

Table 1.5 is comparative to the runway lengths at many airports overseas. **Table 1.5** includes a range of older and newer airports and does not take into account any influence obstacle clearance may have had in terms of the lengths adopted.

Table 1.5 Representative airport runway lengths

Airport	Runway Lengths (metres)	Airport Elevation (feet)	Average High Monthly Temperature (degrees C) (*Note 1*)
Amsterdam (Schiphol)	1 x 3,800 1 x 3,500 1 x 3,453 1 x 3,300 1 x 2,014	-11	21
Bangkok (International)	1 x 3,700 1 x 3,500	5	34
Brisbane	1 x 3,500 1 x 1,700	13	28
Dallas (Fort Worth)	2 x 4,085 2 x 4,084 1 x 2,591	607	35
Dubai (International)	1 x 4,447 1 x 4,000	62	39
Frankfurt (Main)	3 x 4,000	364	23
Guangzhou	1 x 3,800 1 x 3,600	49	32
Hong Kong (Chek Lap Kok)	2 x 3,800	28	31
London (Heathrow)	1 x 3,901 1 x 3, 658	80	21

Airport	Runway Lengths (metres)	Airport Elevation (feet)	Average High Monthly Temperature (degrees C) (*Note 1*)
Los Angeles (International)	1 x 3,685 1 x 3,382 1 x 3,135 1 x 2,720	126	28
Melbourne	1 x 3,657 1 x 2,286	434	26
New York (JFK)	1 x 4,442 1 x 3,460 1 x 3,048 1 x 2,560	14	29
Paris (Charles de Gaulle)	1 x 4,215 1 x 4,200 2 x 2,700	390	23
Seoul (Incheon)	2 x 3,750	23	27
Singapore (Changi)	2 x 4,000 1 x 2,748	22	31
Sydney	1 x 3,962 1 x 2,530 1 x 2,438	21	26

Sources: Airservices Australia 2012, www.azworldairports.com, www.weatherbase.com
Note 1: Not necessarily measured at airport location.

A further consideration is that significant differences in runway length result in increased complexity of tactical operational planning (e.g. air traffic flow management) and complex airspace and circuit design. Runways of similar length allow for more accurate and predictable air traffic management planning relating to aircraft operational requirements and permit segregated circuit operations aligned with point of origin or destination, thus reducing the number of conflict points in the airspace design with a consequent reduction in sub-optimal aircraft vertical profiles.[5]

1.4 Runway Orientation and Cross Runway

It is proposed to assume a cross runway of 2,500 m in order to deliver capacity during high cross winds.

Annex 14 (ICAO Edition 5) specifies that runways should be oriented so aeroplanes may be landed at least 95% of the time with crosswind components, applicable to all conditions of weather, as follows:

- 20 knots for aeroplane reference field length 1,500 m or over (e.g. for larger jets from F100 to A380); and
- 13 knots for aeroplane reference field length 1,200 m up to but not including 1,500 m (e.g. for smaller aircraft such as the SAAB SF 340 and Q400).

Note that the Working Paper - Meteorology demonstrates that for the larger aircraft the ICAO cross runway criteria is satisfied and a cross runway is not required (based on currently available wind data).

[5] Airservices July 2012

In Australia, Air Traffic Control (ATC) must not nominate a particular runway for use if an alternative runway is available:

(a) For runway conditions that are completely dry:

(i) The cross-wind component, including gusts, exceeds 20 knots;

(ii) The downwind component, including gusts, exceeds 5 knots.

(b) For runway conditions that are not completely dry:

(i) The cross-wind component, including gusts, exceeds 20 knots; and

(ii) There is a downwind component.

Also, a particular airlines' cross wind operating policy may be more conservative than the manufacturers demonstrated cross wind limit, established at the time of aircraft certification *(CASA 2 June 2011).*

A cross runway of 2,500 m is considered an appropriate length because it would be sufficient for the landing of domestic and international aircraft. It should be noted that the landing distance requirements are typically much less than that required for take-off for most aircraft types and Sydney Airport's cross runway is 2,530 m long and is capable of landing A380 aircraft. For the smaller aircraft types with an ARFL of 1,200 m up to 1,500 m (including SAAB SF 340 and Q400) if a cross runway were considered necessary, it need only be about 1,600 m long.

1.4.1 Runway separation

It is proposed that there be a minimum runway separation of 1,525 m as this:

- Is sufficient for independent operation of the runways;
- Provides capacity of 100 aircraft movements per hour; and
- Ensures the terminal precinct can be located between the parallel runways.

The *Joint Study* found that:

- The largest overall runway capacity will be achieved with parallel runways spaced at least at 1,035 m (with a precision runway monitor (PRM) to enable independent parallel runway approaches to be conducted in poor weather, or a wide area multilateration system (WAM)) and lesser spacings are relatively inefficient; and
- To maximize the independent operation of the parallel runways and maintain runway capacity, a runway separation of at least 1,525 m needed, but a larger distance of 2,000 m is often preferred for the efficiency of the apron and terminal precinct layout.

Where parallel instrument runways are intended for simultaneous use, from *CASA MOS 139 – Aerodromes* the minimum distance between the runway centrelines must not be less than:

- For independent parallel approaches: 1,035 m;
- For dependent parallel approaches: 915 m;
- For independent parallel departures: 760 m; and
- For segregated parallel operations: 760 m.

It should be noted that, for the separation distance of 1,035 m, a PRM (which has land hungry clearance requirements) or equivalent is required to enable full capacity to be maintained in IMC. Without this equipment the separation needs to be increased to either 1,310 m or 1,525 m depending on the type of surveillance radar employed to maintain the airport capacity, sought in Section 3.5. An additional advantage is that these latter separations or greater are often used to be able to centrally locate terminals and supporting infrastructure and to provide a logical, safe and efficient means of separating taxiing aircraft with dual parallel taxiways.

This means that the minimum distance required, so that capacity is not affected, is 1,035 m. Where the separation is reduced below 1,035 m the dependencies listed above all serve to limit the individual runway capacities to below those achievable under wider spacings.[6]

As a very approximate guide and depending on such things as fleet mix, runway configuration - whether staggered etc., typical/indicative practical capacities in IMC of a two runway parallel arrangement under each of these separations are:

- 1035 m / 1310 m / 1525 m 90 to 100 movements/hour;
- 915 m 60 movements/hour;
- 760 m (independent parallel departures) 55 movements/hour; and
- 760 m (segregated parallel operations) 55 movements/hour.

Maximising the separation between runways associated with a central terminal precinct is necessary in order to be able to physically locate all the necessary movement area elements, terminal, ground access etc. **Table 1.7** provides typical cross section information based on meeting Code F aircraft (e.g. A380-800) requirements for a runway separation of 1,035 m, 1,525 m, 2,000 m and 2,400 m, assuming dual parallel Code F taxiways to each runway with the terminal concourses oriented at right angles to the runway. As can be seen from **Table 1.7** the 1,035 m separation does not provide an adequate space to fit a useful terminal precinct, apron building area and the necessary ground access elements, as any terminal/concourse development would be restricted to a single-sided linear operation, rather than the preferred right angled arrangement envisaged.

Table 1.7 Typical airport cross section details

First Runway Centreline Chainage	First Apron Edge Terminal Precinct Chainage	Far Apron Edge Terminal Precinct Chainage	Second Runway Centreline Chainage	Available Width of Terminal and Apron Precinct
1,035 m Parallel Runway Separation				
0 m	355 m	680 m	1,035 m	**325 m**
1,525 m Parallel Runway Separation				
0 m	355 m	1,170 m	1525 m	**815 m**
2,000 m Parallel Runway Separation				
0 m	355 m	1,645 m	2,000 m	**1,290 m**
2,400 m Parallel Runway Separation				
0 m	355m	2,045 m	2,400 m	**1,690 m**

A 1,550 m separation is similar to Hong Kong, but note that the airport was built on reclaimed land and set to the then minimum independent parallel runway separation (refer **Figure 1.4**).

As a further example, the new and existing Brisbane Airport runways will be separated by a distance of 2,000 m, placing the proposed runway as close as practicable to the western boundary of the Airport and the Kedron Brook Floodway. The design of the new runway optimises the separation distance available between the new and existing

[6] Note that if the runways are staggered the required spacing can vary depending upon how the runways are intended to be operated.

runways, providing maximum flexibility in the design of future airport developments between the runways, such as additional terminal development (*Brisbane Airport Draft EIS/MDP approved in 2007*).

As part of the additional analysis conducted for this assessment, benchmarking of the runway separations at a number of airports both overseas and in Australia was undertaken. Airports were selected for benchmarking had a wide-spaced parallel runway system and, for overseas airports, had passenger movements of 50 million or more per annum and are listed in **Table 1.8**.

Table 1.8 Benchmarking of runway separation

Airport Name	Runway Separation (metres)	Features
Kuala Lumpur International Airport	2,535	• Two dual parallel taxiways • A linear terminal with satellite • Landside access at the ends only, but suitable for terminal scale
Soekarno-Hatta International Airport	2,410	• Two dual parallel taxiways • A curved terminal with piers • Landside access within midfield
Denver International Airport	2,315	• Two dual parallel taxiways plus apron edge taxiways • A linear satellite terminal • Landside access at ends only but suitable for scale
Munich Airport	2,300	• Two dual parallel taxiways plus apron edge taxiways • A linear terminal • Landside access within midfield
Shanghai Pudong International Airport	2,260	• Two dual parallel taxiways plus apron edge taxiways • A linear terminal • Landside access within midfield allowed staged construction of a second terminal when required
Guangzhou Baiyun International Airport	2,200	• Two dual parallel taxiways • A curved terminal with piers • Landside access within midfield
Incheon International Airport	2,075	• Two dual parallel taxiways • A curved terminal with piers • Landside access at ends only but suitable for scale
Brisbane Airport	2,000	• Two dual parallel taxiways • A curved terminal with piers • Landside access within midfield for staged construction
Perth Airport	2,000	• Two dual parallel taxiways • A curved terminal with piers • Landside access within midfield for staged construction
Dallas Fort Worth International Airport	1,950	• Two dual parallel taxiways plus apron edge taxiways • A curved terminal • Landside access within midfield

Airport Name	Runway Separation (metres)	Features
Tokyo International Airport	1,700	• Two single parallel taxiways with apron edge taxiways (one side only) • Linear terminals with short piers • Tight landside access within midfield
O'Hare International Airport	1,650	• Two single parallel taxiways • A pier terminal • Landside access within midfield by removing additional potential apron
Singapore Changi Airport	1,800	• Two single parallel taxiways on one side only • A linear terminal with short pier • Landside access within midfield
Hong Kong International Airport	1,540	• Two dual parallel taxiways with some push backs on inner taxiway • A Y shaped terminal • Landside access at the ends only but suitable for scale
Beijing Capital International Airport	1,525	• Two dual parallel taxiways • A thin Y shaped terminal with long walking distances • Landside access at the ends only, but suitable for scale
London Heathrow Airport	1,420	• Two single parallel taxiways • A linear terminal with a satellite configuration • Landside access at the ends only
Los Angeles International Airport	1,380	• Two single parallel taxiways with apron edge taxiways • A short pier terminal • Tight landside access within part of the midfield
Hartsfield-Jackson Atlanta International Airport	1,340	• Two dual parallel taxiways • A linear terminal with satellite terminals • Landside access at the ends only but suitable for large scale

Source: L&B 2012, Examples of Parallel Runway Separation at Other Airports.

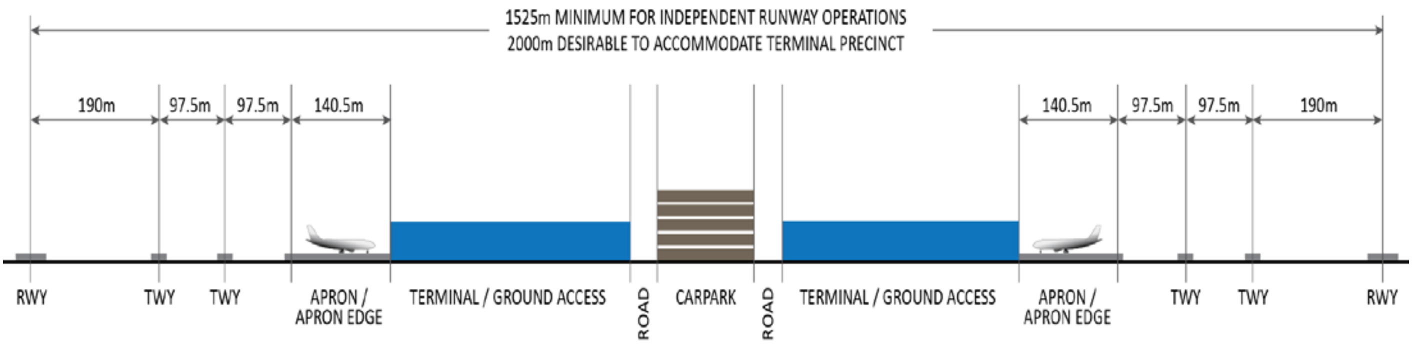
In particular, Guangzhou Baiyun International Airport, Brisbane Airport, Perth Airport and Dallas Fort Worth International Airport all have runway separations of approximately 2,000 m.[7] Based on this benchmarking, it is concluded that runway separation of 2,000 m minimum provides suitable planning flexibility for a major airport that is required to be incrementally expanded to 70 million passengers per annum.

[7] L&B, 2012. *Examples of Parallel Runway Separation at Other Airports.*

Figure 1.4 Hong Kong International Airport showing 1,540 m runway separation

Consequently a 2,000 m runway separation has been adopted for the airport template. **Figure 1.5** shows the desirable separation.

Figure 1.5 Desirable runway 2,000 m separation (not to scale)



Notwithstanding the above, other site selection factors also have a bearing on runway separation. In the Working Paper *Wilton Airport Site Selection and Airport Concepts* the recommended minimum separation is met, however, obstacles and steep terrain have a bearing on the runway separation for any given option.

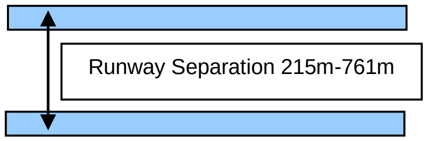
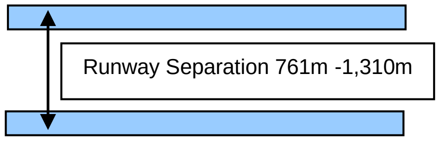
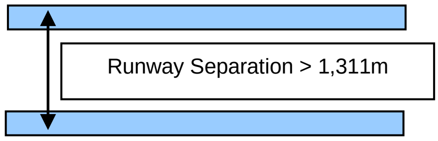
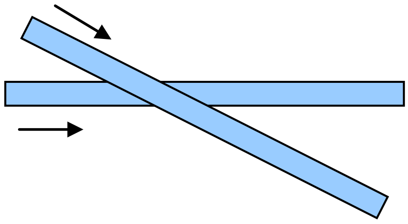
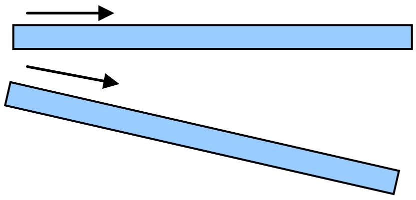
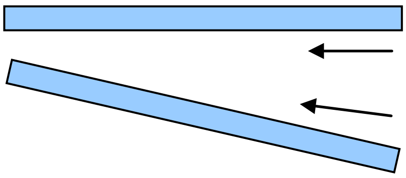
1.4.2 Runway capacity resulting from the above assumptions

Based on the runway assumptions outlined, the airport would accommodate up to 100 aircraft movements per hour.

For planning and operational purposes, the airfield capacity is normally expressed in terms of the peak number of aircraft movements per hour with an indicative annual number of aircraft movements per annum. The runway capacity will vary depending upon factors such as the runway layout and supporting taxiways, fleet mix, and weather, airspace and ATC procedures etc.

Figure 1.6 shows the indicative runway capacities for planning purposes based on ICAO guidelines.

Figure 1.6 Indicative runway capacities – ICAO Airport Planning Manual

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 - Master Planning Figure 6.1.

For parallel runways intended for simultaneous/independent use, the minimum runway separation standard in *CASA MOS 139 – Aerodromes* Section 6.2.5 is 1,035 m, but this depends upon the provision of suitable radar and communications equipment. From a practical airport development approach, the most efficient and safest location for the terminal area is between the parallel runways.

To provide independent parallel runway operations and to maintain the airport capacity sought of 100 movements per hour, a practical minimum separation distance is 1,525 m, as described in Section 3.4 above. To gain the additional benefit of achieving a useful depth of terminal precinct, additional separation of 2,000 m is proposed in Section 3.4.

Given the hourly aircraft movement forecasts for the maximum capacity of 70 million passengers per year in **Table 1.1**, where for example the maximum is 77 movements per hour, the capacity of the parallel runways is not likely to be challenged.

1.4.3 Runway Slope

A 1% runway slope criterion derives from *CASA Manual of Standards 139 – Aerodromes* (*2012)*, for runway longitudinal slope, whereby:

> *"... the overall runway slope, defined by dividing the difference between the maximum and minimum elevation along the runway centreline by the runway length, must not be more than:*
>
> *(a) if the runway's code number is 3 or 4 (as in this case) — 1%."*

1.5 Terminal Precinct

It has been assumed that the terminal and apron precincts will be located between the runways. The basis for this assumption is detailed below.

1.5.1 Efficient Terminal location

The terminals are proposed to be located between the parallel runways. Locating the terminals and supporting infrastructure to one side of a parallel runway arrangement is not desirable airport planning practice for the following reasons:

- It will require crossing of the near runway by aircraft wishing to enter/exit the far runway. This both reduces capacity on the near runway and increases the probability of a runway incursion (a known hazard which regulators are focused on reducing). Note that each runway crossing may substitute for an aircraft arrival or departure and for a busy airport this is clearly inefficient and undesirable;
- To avoid runway crossings it would be necessary to develop a perimeter taxiway system around the near runway. For Code F aircraft this would need to be some 1,200 m from the ends of the near runway to achieve obstacle clearance based on taxiing aircraft being considered non-transient due to the frequency of taxiing events. The airport ground movement becomes very long, inefficient and creates more costs (fuel burn) and emissions; and
- A central parallel taxiway would be required between the runways. This coupled with the parallel taxiway system serving the terminal and parallel runways (particularly where they are close-spaced), visually presents pilots with a series of similarly aligned elements. For a new airport this is not desirable for safety reasons due to the risk of the central taxiway being misidentified as a runway.

For the reasons given above, the terminal and apron precincts in all cases are located between the runways, in the context of a runway separation which allows efficient, substantial and flexible terminal development.

1.5.2 Terminal design and size

The design and size of the terminal facilities is based on factors including:

- The airport function (whether there are international and domestic operations);
- The type of operations and traffic (low cost carriers or not);
- The number of user airlines and their alliances;
- The airfield configuration and apron access;

- The number of passengers to be accommodated (recognizing a staged approach to airport development based on a number of Booz & Co. forecast scenarios); and
- The types of ground access available.

It is proposed for indicative purposes using high level benchmarking in **Table 1.9** that an airport development at Wilton, capable of catering for 70 million passenger movements per annum, could have:

- A domestic terminal with:
  - 250,000 sq. m in floor space;
  - Aircraft gates that meet Code E and C requirements; and
  - Public and staff car parking of 15,000 spaces.
- An international terminal with:
  - 500,000 sq. m in floor space;
  - Aircraft gates that meet Code F, E, and C; and
  - Public and staff car parking of 10,000 spaces.

Table 1.9 High level benchmarking of terminal elements

	Sydney Airport 2009	**Wilton - 70 Million Passengers, Based on Sydney Airport 2029**
DOMESTIC		
Terminal floor area	100,000 sq. m (Terminals T2 and T3)	250,000 sq. m
Aircraft gates	51 including 32 contact, 15 remote and regional	63 Code E and C (SACL - 11 Code E, 36 Code C, plus 3 Code E and 13 Code C layover) *Note 1*
Car parking (spaces)	7,741	15,000 *Note 2*
INTERNATIONAL		
Terminal floor area	254,000 sq. m	500,000 sq. m
Aircraft gates	42 including 25 contact 7 joint freight remote and 10 layover	56 Code F, C and 3 Code E freight (SACL - 17 Code F, 19 Code E, 2 Code C plus 7 Code F and 11 Code E layover and 3 Code E freight) *Note 1*
Car parking (spaces)	6,150	10,000 *Note 2*

Sources: Terminal area and aircraft gates*: SACL Master Plan 2009 Section 6.2.3 existing, Table 6.2 year 2029 for 79M passengers* Car parking*: SACL media statements*

Note 1: Landrum & Brown Airfield Capacity Review Dec 2011 in the *Joint Study* noted a 15 gate shortfall in SACL's forecast gate requirements in 2015 – 8 international and 17 domestic, decreasing to 16 in 2035 – 6 international and 10 domestic.

Note 2: detailed car parking analysis is undertaken in the Working Paper *Land Transportation Links.*

1.5.3 Terminal floor space

It has been assumed that the international terminal would be larger than domestic terminal. This is in line with standard airport planning as international terminals need additional areas for customs, immigration and quarantine processing and will mostly have a greater area of retail offerings, given the longer dwell time of passengers. Areas can be significantly reduced for low cost carrier terminals. It should be noted that, the introduction of kiosks and self check-in and online check-in is also likely to have an impact on queue lengths and the area required.

Terminal capacity and specific passenger facilities will need to be designed in accordance with International Air Transport Association (IATA) level of service guidelines. Security facilities will be designed in accordance with the requirements of the Office of Transport Security and the *Transport Security Act 2004*.

Level of service (LOS) describes the ability of a terminal to process passengers at different levels of comfort and delay. IATA has developed guidelines for terminal development and levels of service (refer Appendix C). The IATA recommended LOS is Category C which is described as: good level of service, conditions of stable flow, acceptable delays and a good level of comfort.

IATA recommends minimum areas as guidelines for planning and assessing terminal development. Planning parameters for individual elements of a terminal required to meet service standards for processing times, queue lengths can have a major impact on the total terminal area. The general principles of the IATA level of service criteria are accepted worldwide but there are differences between the IATA guidelines and the service and space standards established by others. The IATA guidelines do not cover all aspects of terminal development. The IATA standards would be used in detailed planning and have been used in this Working Paper along with other benchmarked criteria.

As a guide some IATA level of service areas are in **Table 1.10**. Other parameters relate to specific operational areas, for example passenger processing times for sizing check-in areas, aircraft mix and passengers per aircraft for sizing baggage reclaim lengths and areas.

Table 1.10 IATA level of service Category C facility areas

Facility	Area (sq. m) per passenger
Check-in queue area	1.4
Wait/circulate	1.9
Holding room	1.0
Bag claim area	1.6
Government inspection	1.0

The above IATA areas are operational areas (i.e. net areas) only. Other areas which need to be allocated and added include:

- Retail;
- Airline and other offices;
- Public toilets;
- Circulation between the main functional areas;
- Plant and services; and
- Concourses.

The detailed design of the terminals will come at a later stage – the terminal area/precinct in the template provides for the higher order of terminal area in **Table 1.10**.

1.5.4 Aircraft gates

Aircraft gates need to cater for Code C to Code F aircraft, in line with forecasts. Initial provision in the template and airport concepts is in line with the high level benchmarking in **Table 1.10**.

1.5.5 Car parking

In this case 15,000 car spaces are contemplated for international related parking and 10,000 spaces for domestic operations related parking, based on the current Sydney Airport Master Plan concept for 2029 (see **Table 1.10**), with further refinement made in the Working Paper - *Land Transportation Links*.

1.6 Taxiways and Aprons

This section details the assumptions that have been developed regarding taxiways and apron areas.

1.6.1 Taxiways

To maximize flexibility for aircraft circulation, provision has been made for two single direction taxiways running parallel to each of the runways. As shown in **Table 1.3**, in order to accommodate for Code F aircraft, taxiway widths of 25 m in width are required.

1.6.2 Aprons

Apron stands are provided in accordance with the expected mix of aircraft based on the aircraft code. Therefore, an airport development at Wilton would need to have apron stands that can accommodate Code C, E and F aircraft, recognizing the imminent removal from the Australian fleet of Code D aircraft. An indication of apron stand dimensions for various aircraft based on clearances in *CASA's MOS 139 - Aerodromes* is:

- Code F 11,200 sq. m;
- Code E 8,190 sq. m; and
- Code C jet and turboprop 3,050 sq. m.

1.7 Other airport facilities

The following facilities have also been assumed:

- Instrumental landing systems;
- Visual guidance systems;
- ATC facilities;
- Landing aids;
- Stormwater detention;
- Wastewater treatment;
- Utility corridors and provision;
- Aircraft fuelling facilities;
- An airport business park/s;
- Logistics/freight facilities; and
- Aircraft maintenance facilities.

It is noted that the details of air navigation infrastructure will need to be verified with Airservices Australia.

In regard to aircraft navigational aids, the following comments are made for the template and emerging technology.

Depending on the timing of any future civil operations, it is prudent to allow for the installation of VOR/DME equipment to support instrument non-precision approaches, ahead of a more widespread removal of these and other ground-based navigation aids and their replacement by satellite-based technology such as Required Navigation Performance (RNP) etc. Airservices Australia's current policy is to retain a strategic network of back-up ground based navigation aids in any event.

In accordance with ICAO's recommendations, Australia has agreed to implement Performance Based Navigation, the regulatory framework for RNAV and Approach Procedures with Vertical Guidance (APV) for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016. A précis of Performance Based Navigation and associated future technology such as the incorporating of vertical guidance on Global Navigation Satellite Systems (GNSS) is available separately. A general comment on this future technology is that it will also provide more flexible options in regard to aircraft landing and take-off for capacity management and noise amelioration.

The long-term goal is to eventually replace the traditional ILS with a satellite-based system. These require a ground-based antenna to be provided and are known generically as a ground based augmentation system (GBAS). Sydney Airport has one of the first systems in the world which has been under trial for several years. It is anticipated CASA certification meeting Category 1 requirements will be achieved during 2012. Ultimately, the objective will be to meet the more stringent Category 111 requirements. The main spatial implication of the GBAS and some of the other satellite-based navigation and surveillance systems will be to reduce the amount of land required for their operation and protection compared with traditional systems.

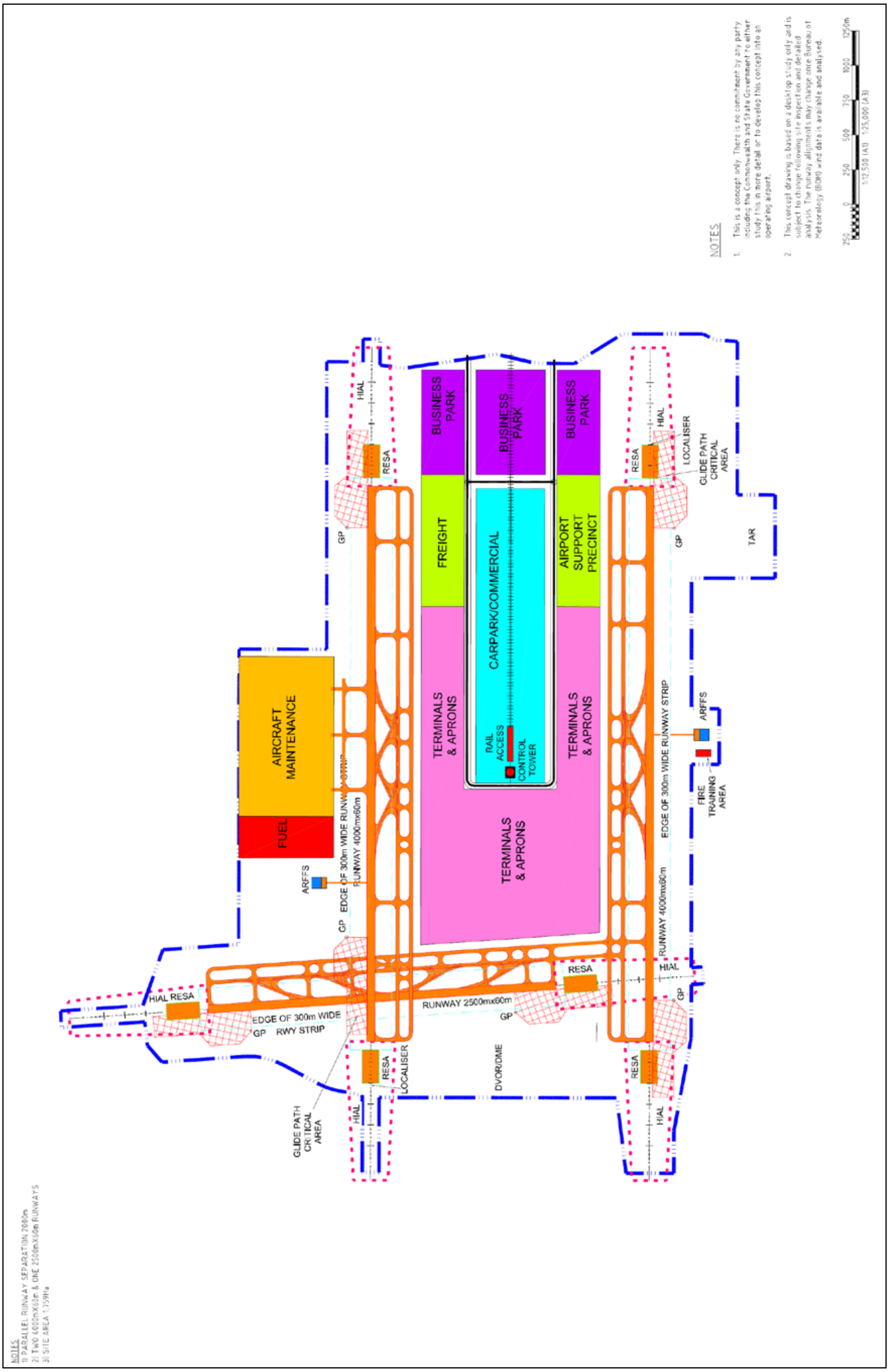
As the timing of operations at a future Wilton airport is unknown, the more spatially intensive requirements of the current technologies have been adopted for planning purposes.

1.8 Key findings

Based on the proposed assumptions detailed in this Working Paper, the airport template in **Figure 1.7** has been developed for site selection purposes.

The template provides for major facilities including ATC tower, rescue and fire fighting service, navigation and landing aids, passenger terminals and aprons, airport support facilities, freight, aircraft maintenance, roads and car parks, rail, fuel storage and business park areas.

Figure 1.7 Wilton representative airport template



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APPENDIX 1A AERODROME REFERENCE CODES AND AEROPLANE CHARACTERISTICS FOR RELEVANT CURRENT AIRCRAFT

Aeroplane Type	Reference Code	Aeroplane Characteristics					
		ARFL (m)	Wing-span (m)	OMGWS (m)	Length (m)	MTOW (kg)	TP (kPa)
DHC-8:							
100	2C	948	25.9	8.5	22.3	15650	805
300	2C	1122	27.4	8.5	25.7	18642	805
Lear Jet 55	3A	1292	13.4	2.5	16.8	9298	-
IAI Westwind 2	3A	1495	13.7	3.7	15.9	10660	1000
BAe 125-400	3B	1713	15.7	3.3	15.5	12480	1007
Canadair:							
CL600	3B	1737	18.9	4.0	20.9	18642	1140
CRJ-200	3B	1527	21.21	4.0	26.77	21523	1117
Cessna 650	3B	1581	16.3	3.6	16.9	9979	1036
Dassault-Breguet:							
Falcon 900	3B	1515	19.3	5.3	20.2	20640	1300
Embraer EMB 145	3B	1500	20	4.8	29.9	19200	-
Fokker F28-2000	3B	1646	23.6	5.8	29.6	29480	689
Metro 23	3B	1341	17.4	5.4	18.1	7484	742
Shorts SD3-60	3B	1320	22.8	4.6	21.6	11793	758
Bae:							
Jetstream 31	3C	1440	15.9	6.2	14.4	6950	448
Jetstream 41	3C	1500	18.3	-	19.3	10433	-
146-200	3C	1615	26.3	5.5	26.2	42185	1138
146-300	3C	1615	26.3	5.5	31.0	44225	945
Bombadier Global Express	3C	1774	28.7	4.9	30.3	42410	-
Embraer:							
EMB 120	3C	1420	19.8	.3	20.0	11500	828
EMB 170	3C	1600	26.0	5.8	29.90	37200	940
Fokker:							
F27-500	3C	1670	29.0	7.9	25.1	20412	540
F28-4000	3C	1640	25.1	5.8	29.6	32205	779
F50	3C	1760	29.0	8.0	25.2	20820	552
F100	3C	1695	28.1	5.0	35.5	44450	920
SAAB SF-340	3C	1220	21.4	7.5	19.7	12371	655
Airbus A300 B2	3D	1676	44.8	10.9	53.6	142000	1241
Bombardier Dash 8 – Q400	3D	1354	28.4	9.6	32.8	29000	1020
Airbus A320-200	4C	2058	33.9	8.7	37.6	72000	1360
Boeing:							
B717-200	4C	2130	28.4	6.0	37.8	51710	-
B737-200	4C	2295	28.4	6.4	30.6	52390	1145
B737-300	4C	2749	28.9	6.4	30.5	61230	1344
B737-400	4C	2499	28.9	6.4	36.5	63083	1400
B737-800	4C	2256	35.8	6.4	39.5	70535	-
Embraer EMB 190	4C	2110	28.72	6.6	36.24	51800	1080

Aeroplane Type	Reference Code	Aeroplane Characteristics					
		ARFL (m)	Wing-span (m)	OMGWS (m)	Length (m)	MTOW (kg)	TP (kPa)
McDonnell Douglas:							
DC9-30	4C	2134	28.5	6.0	37.8	48988	-
DC9-80/MD80	4C	2553	32.9	6.2	45.1	72575	1390
Airbus:							
A300-600	4D	2332	44.8	10.9	54.1	165000	1260
A310-200	4D	1845	43.9	10.9	46.7	132000	1080
Boeing:							
B707-300	4D	3088	44.4	7.9	46.6	151315	1240
B757-200	4D	2057	38.0	8.7	47.3	108860	1172
B767-200ER	4D	2499	47.6	10.8	48.5	156500	1310
B767-300ER	4D	2743	47.6	10.8	54.9	172365	1310
McDonnell Douglas:							
DC8-63	4D	3179	45.2	7.6	57.1	158757	1365
DC10-30	4D	3170	50.4	12.6	55.4	251744	1276
Lockheed:							
L1011-100/200	4D	2469	47.3	12.8	54.2	211378	1207
McDonnell Douglas MD11	4D	2207	51.7	12.0	61.2	273289	1400
Airbus:							
A330-200	4E	2713	60.3	12.0	59.0	230000	1400
A330-300	4E	2560	60.3	12.0	63.6	230000	1400
A340-300	4E	2200	60.3	12.0	63.7	253500	1400
A340-500	4E	3275	63.70	12.0	67.80	368000	1400
A340-600	4E	3185	63.70	12.0	75.30	365000	1400
Boeing:							
B747-SP	4E	2710	59.6	12.4	56.3	318420	1413
B747-300	4E	3292	59.6	12.4	70.4	377800	1323
B747-400	4E	3383	64.9	12.4	70.4	394625	1410
B777-200	4E	2500	60.9	12.8	63.73	287800	1400
B777-300	4E	3140	60.93	12.6	73.86	299370	1400
Airbus A380-800	4F	3350	79.8	14.3	72.7	560000	1400

MOS has included ICAO Code F specifications for aerodrome facilities intended for aeroplanes larger than B 747 wide body jets.

APPENDIX 1B LEGISLATIVE REQUIREMENTS

Any airport development must comply with a range of legislative requirements. This section details both international and Australian standards that any development at Wilton must meet, including:

- The Convention on International Civil Aviation;
- The Civil Aviation Act 1988;
- The Civil Aviation Regulation 1988 (CAR 1988); and
- The Civil Aviation Safety Regulations 1998 (CASR 1998).

International Standards

The International Standards and recommended practices are formalised in *Annex 14* of the Convention on International Civil Aviation, adopted by ICAO.

Australian Standards

The national standards and advisory publications are administered in Australia by CASA under the *Civil Aviation Act 1988*, the *Civil Aviation Regulation 1988 (CAR 1988)* and the *Civil Aviation Safety Regulations 1998 (CASR 1998)*. The CASR 1998 is divided into a number of sections. The *Manual of Standards (MOS)* specifies the requirements for safe air navigation. The key sections of the *MOS* are:

- *MOS* Part 139 Aerodromes 2012 - the requirements for aerodromes used in air transport operations are prescribed in the CASA policy manual;
- *MOS* Part 172 Air Traffic Services - the requirements and standards for compliance by an air traffic service (ATS) provider, including the facilities and equipment required; and
- Advisory Circulars (ACs) - intended to provide recommendations and guidance to illustrate a means of complying with the Regulations.

Airport Development at Wilton: Legislative Standards

The planning and design considerations for the geometry of the aircraft movement area are predominantly the requirements and recommendations of ICAO and *Part 139 CASA MOS*.

Australia has adopted the ICAO methodology of using a code system, known as the Aerodrome Reference Code, to specify the standards for individual aerodrome facilities which are suitable for use by aeroplanes within a range of performances and sizes. The Code is composed of two elements:

- The first is a number related to the aerodrome reference field length, the aerodrome code; and
- The second is a letter related to the aeroplane wingspan and outer main gear wheel span, the aircraft code.

Many of the movement area standards published in the *MOS*, make use of the Aerodrome Reference Code to prescribe the physical and geometric requirements for planning of the aircraft movement area, and the provision of aerodrome infrastructure, as described in this Report.

Unless otherwise agreed by CASA, aerodrome operators must maintain the runways and taxiways in accordance with the applicable standards set out in *MOS* for the notified aerodrome reference code for that runway or taxiway, reproduced in **Table C1.**

Table C1 Aerodrome reference code

Aerodrome Reference Code				
Code Element 1		**Code Element 2**		
Code Number	**Aeroplane Reference Field Length**	**Code Letter**	**Aircraft Wing Span**	**Outer Main Gear Wheel Span**
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1200 m up to but not including 1800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80 m	14 m up to but not including 16 m

Source: CASA MOS 139 2012

A list of representative aeroplanes operating in Australia and others is shown in **Appendix 1A.**

APPENDIX 1C IATA TERMINAL GUIDELINES

Level of Service (LOS) - Categories

- 6 categories (IATA Airport Development Man.):

LOS	Flows	Delays	Comfort
A - Excellent	Free	None	Excellent
B - High	Stable	Very Few	High
C - Good	Stable	Acceptable	Good
D - Adequate	Unstable	Passable	Adequate
E - Inadequate	Unstable	Unacceptable	Inadequate
F - Unacceptable	--- System Breakdown ---		Unacceptable

Level of Service (LOS) – space to be provided for passengers in different functions

Activity	Situation	Level of service standard (LOS) (sq. m per passenger)					
		A	B	C	D	E	F
Waiting and circulating	Moving about freely	2.7	2.3	1.9	1.5	1.0	Less
Bag claim area (outside claim devices)	Moving with bags	2.0	1.8	1.6	1.4	1.2	**Less**
Check-in queues	Queued, with bags	1.8	1.6	1.4	1.2	1.0	Less
Hold room: government inspection area	Queued, without bags	1.4	1.3	1.0	0.8	0.6	Less

Source: de Neufville, R and Odoni, A 2003, Airport Systems – planning, design and management. McGraw Hill, New York, 2003.

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2 WORKING PAPER – WILTON AIRPORT SITE SELECTION AND AIRPORT CONCEPTS

SUMMARY

The site identification process is shown in **Figure 1.3** in this study's Overview Working Paper. This Working Paper outlines the steps undertaken to identify sites for further analysis (Steps 2 to 4.1).

Based on screening of the key issues – development of external boundaries defined to avoid Upper Nepean Conservation Area, urban areas, and dam areas, as well as slope analysis and identification of deep gorges – eight site options have been identified as representative locations within the Wilton Study Area to test its ability to accommodate a "*maximum*" airport. These site options were developed in order to test a range of airport sites and runway orientations within the Wilton Study Area, alongside the site assessed in the Joint Study[8]. This "*maximum*" airport is defined as having flexible operational capability in order to optimise future air traffic management requirements, comprising two independent wide-space 4,000 m parallel runways and a 2,500 m cross runway. Sites such as Wilton and Badgerys Creek were based in the Joint Study Report on parallel runways 4,000 m and 2,500 m long with narrower separations than used in this report.

Runway alignments corresponding to the options are as follows:

- Option 1 main 18/36 cross runway 08/26;
- Option 1 South (1S) main 18/36 cross runway 09/27;
- Option 2 main 16/34 cross runway 06/24;
- Option 3 main 17/35 cross runway 05/23;
- Option 4 main 15/33 cross runway 08/26;
- Option 5 main 08/26 cross runway 16/34;
- Option 6 main 03/21 cross runway 12/30; and
- Option 7 main 11/29 cross runway 18/36.

Airport concepts have been developed specifically to accommodate "*maximum*" airports for each option to the level required for the Further Assessment task, and include all major airport facilities. These are identified as base case airport concepts in this Working Paper. The screening undertaken in this Working Paper to identify airport site options is supplemented by detailed constraints and planning and environmental impacts analysis of each airport concept in subsequent Working Papers. That is to say, the site options are not likely to be judged to be equivalent in their overall acceptability when all of the assessments are considered.

Emerging and future technology which may affect the manner in which the final airport layout is developed over the planning period once a final site is chosen and the project moves to a design phase is discussed in the Working Paper *Airport Performance Specification for Wilton - Task and Infrastructure*. General comments on this future technology are: that it is likely to provide more flexible options in regard to aircraft landing and take-off for capacity management and noise amelioration; and that future navigation aids are likely to be less land intensive than current navigational aids provided in the airport concepts.

However, given the uncertainties of future technological changes, the current generally "*land intensive*" technology has been included in the airport concepts.

[8] Note that the airport template (Figure 1.7 in Working Paper Airport Performance Specification for Wilton- Task and Infrastructure) is larger than that used in the Joint Study Report

Considering placement of airport facilities and aspects such as airport support, freight and business parks relative to the terminals and aprons (which are located between the main runways), and preliminary efficient ratings of the option layouts are shown in **Table 2.3**. Based on experience in airport planning, broadly Options 3, 4 and 5 are considered to be less efficient in terms of airport layout, considering factors such as freight precinct location and distance of support facilities relative to other airport facilities

As noted, the intention of these concepts is to test the ability of the Study Area to accommodate a "*maximum*" airport and to provide a range of options which enable their effects and interactions on a range of multidimensional factors to be assessed. By doing so, the most likely sub region of the Wilton Study Area in which an airport might be located and its most likely general configuration may be identified.

It should be expected that any and all of the options, developed to achieve such testing, would be further refined in design development in terms of optimising the airport as an aviation facility within the site and sub region identified, in terms of physical layout, within the broader context of the Sydney Airspace and in terms of further avoiding or ameliorating unacceptable or undesirable levels of externality effects.

As such it should be allowed that modifications such as movement of runways, changing of headings, closing up of runway separations, alternative locations and configurations for terminal and other facilities and the like could occur to respond to the constraints of the site as these are revealed through continual design refinement.

2.1 Introduction

In order to identify a site within the Wilton Study Area that could accommodate airport development, a template airport was developed in the Working Paper *Airport Performance Specification for Wilton - Task and Infrastructure*. The template is for a wide-spaced parallel runway airport with independent runway operations and a cross-runway, which will have flexible operational capability in order to optimise future air traffic management requirements; and capable of staged development commencing with a single runway layout.

This Working Paper describes the site identification process leading to the progressive development of potential site options located within the Wilton Study Area, which will provide the basis for testing the Study Area's ability to accommodate a "*maximum*" airport. The Working Paper discusses the application of the standards, parameters and guidelines outlined in the Working Paper *Airport Performance Specification for Wilton - Task and Infrastructure* to the identification of specific sites by which to achieve such testing, the application of airport concepts based primarily on runway configuration and suitability at these sites and the preliminary screening of planning and environmental criteria.

2.1.1 Summary of Issues from Second Sydney Airport Site Selection

As part of the Second Sydney Airport Site Selection Programme, a Draft Environmental Impact Statement (the Draft 1985 EIS) was prepared, which examined a site in Wilton. For the purposes of assessment, a preliminary master plan was developed for an airport at Wilton. Relevant issues from the Draft 1985 EIS to this Working Plan selection are:

- A wide-space parallel runway (WSPR) layout was selected over close-space parallel runways (CSPR) as it allowed greater operational flexibility for an aircraft mix containing a high proportion of smaller aircraft and it was more efficient in terms of total runway capacity related to land area requirements. WSPR did require about 25% more land area – as for this study. (See Working Paper *Airport Performance Specification for Wilton - Task and Infrastructure* for the adopted wide-spaced runway assumption and its basis for this study); and
- All detailed flight track and aircraft assignment, noise assessment and the preliminary master plan in the Draft 1985 EIS were undertaken on an east-west alignment only, as it avoided the need to acquire land within the village of Wilton and it did not affect large areas suitable for potential urban development, after a north-south alignment was rejected. The Draft 1985 EIS preliminary master plan site (the preferred site) is similar to the site for Option 1 in this Working Paper (although Option 1 has a north-south alignment, whilst the preferred alignment in the Draft 1985 EIS had an east-west alignment). The rejected north-south alignment in the Draft 1985 EIS is similar to Option 1 in this Working Paper.

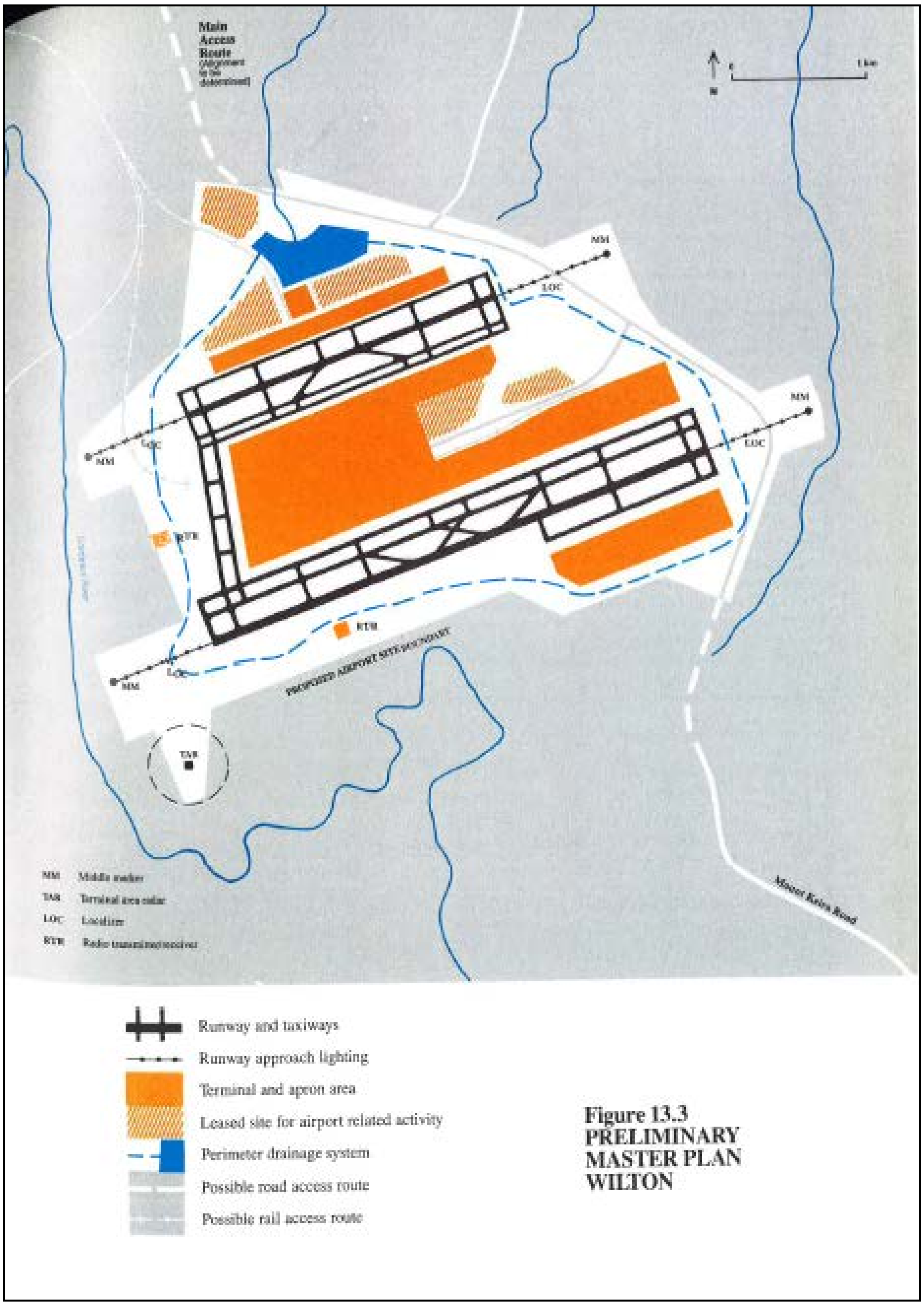
It should be noted that since the Draft 1985 EIS there have been some major aviation changes in the Sydney region which are relevant to considering the previous concepts:

- The provision of the parallel runway north-south (16L/34R) runway at Sydney Airport; and
- The introduction of the Long Term Operating Plan (LTOP).

Furthermore the Draft 1985 EIS preliminary master plan did not include a cross runway.

Most significantly the Draft 1985 EIS preliminary master plan site now substantially conflicts with the Upper Nepean Conservation Area and to that extent cannot be considered as an option in its previous form in this Working Paper.

Figure 2.1 Draft 1985 EIS Master Plan Layout Wilton



2.1.2 Summary of process

The Overview Working Paper outlines the site identification and analysis process applied by WorleyParsons and AMPC to undertake the preliminary assessment of the Wilton area's suitability for airport development. The first step in the identification process, which involved defining the airport type required, is explained in Working Paper *Airport Performance Specification for Wilton - Task and Infrastructure*. This Working Paper outlines the remaining steps undertaken to identify sites for further analysis (Steps 2 to 4.1). The further analysis (Steps 4.2 and 5) is then contained in subsequent technical Working Papers.

The steps in the identification process explained in this Working Paper are highlighted in Figure 1.3 in the Overview Working Paper.

2.2 Description of site selection process

2.2.1 Step 1 – Define airport type required

The Working Paper *Airport Performance Specification for Wilton - Task and Infrastructure* has proposed that a site at Wilton should have the ability to accommodate:

- Two independent wide-space parallel runways 4,000 m in length and 60 m in width;
- A minimum runway separation of 1,525 m to permit wide-space independent operations, with 2,000 m desirable and adopted as a parameter;
- The parallel runways should provide capacity of up to 100 aircraft movements per hour; and
- A cross-runway 2,500 m in length and 60 m in width.

2.2.2 Step 2 – Define Study Area based on key constraints

The boundaries have been developed from the key issues and constraints adopted in the Joint Study and as occur in the general area of Wilton and similarly applied in the identification of representative site termed *"Wilton"* in the Joint Study. The nature of these boundaries is outlined below.

Accordingly, for the purposes of this assessment, the Wilton Study Area is defined as the area contained within the following external boundaries:

- Upper Nepean State Conservation Area (west)
- The townships of Wilton, Douglas Park and Appin (north); and
- The Cordeaux River and Cataract River dam areas (east – Cataract and south – Cordeaux).

This Study Area, as defined, encapsulates the area of land, as was identified in the Joint Study within in the Cordeaux – Cataract Locality and in the general vicinity of Wilton, as being capable of accommodating a "*maximum*" Airport.

Coincidently, the major axes of this Study Area align quite closely to the runway orientations at Sydney Airport.

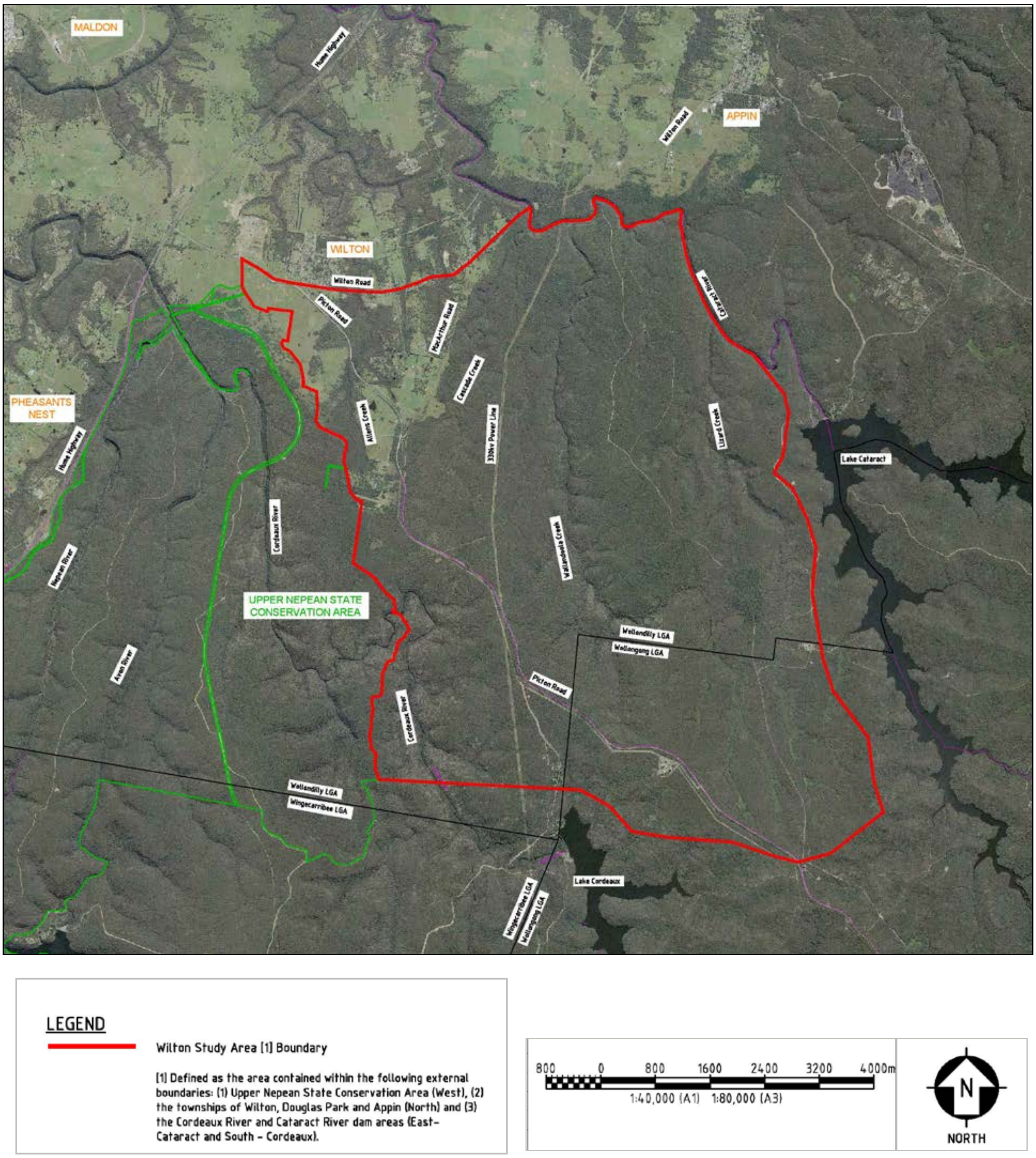
Upper Nepean State Conservation Area (west)

Areas designated as State Conservation Areas will not be included in the site analysis in order to avoid any direct or significant indirect effects on areas of protected ecosystems that have been reserved by the Commonwealth and/or New South Wales (NSW) Governments. Development in such areas would clearly be less desirable on environmental grounds.

This is consistent with criterion used in the Joint Study to shortlist greenfield locations for airport development in the Sydney region.

The Upper Nepean State Conservation Area is located in the vicinity of the Wilton sites assessed in the Joint Study and the Draft 1985 EIS. This Conservation Area has been defined as the western external boundary of the Wilton Study Area in order to avoid any direct or significant indirect effects on areas of protected ecosystems that have been clearly reserved at this level of status by Government.

Figure 2.2 Wilton Study Area (as indicated by red line)



The townships of Wilton, Douglas Park and Appin (north)

Almost any land parcel outside preserved areas is likely to have some pre-existing use (such as residential, employment, recreational or agricultural). The impact on urban areas from land acquisition should be minimised so that dense residential and business areas are not included. Urban areas have therefore been excluded from the Study Area being considered for airport development, as they are not considered to be land uses convertible for aviation purposes.

Urban areas excluded as they are not considered to be land convertible for aviation purposes are (Based on NSW Department of Planning and Infrastructure 2006 Standard LEP Order):

- Residential land use (R1 General Residential, R2 Low Density Residential, R3 Medium Density Residential, R4 High Density Residential);
- Significant commercial land use (B1 Neighbourhood Centre, B2 Local Centre, B3 Commercial Core, B4 Mixed Use, B6 Enterprise Corridor , B7 Business Park); and
- Significant heavy industry land use (IN1 General Industrial, IN2 Light Industrial, IN3 Heavy Industrial).

This is consistent with criterion used in the Joint Study to identify potential greenfield locations in the Sydney region.

The townships of Wilton, Douglas Park and Appin are located to the north of the area where the Wilton representative site was located in the Joint Study. These urban areas have been defined as the northern external boundary of the Wilton Study Area in order to minimise urban land area impacts from land acquisition. The southern side of Wilton Road has been defined as a practical northern boundary and as means of eliminating the denser urban areas[9], as defined above from inclusion in the Study Area.

The Cordeaux River and Cataract River dam areas (east – Cataract and south – Cordeaux)

The eastern and southern Study Area boundaries have been established as *"notional"* boundaries to avoid the immediate catchments of Lake Cataract and Lake Cordeaux.

The western boundary is defined the crest of the main ridge line along the west side of the western arm of Lake Cataract, which separates the direction in which water will flow. To the east of the ridge line water will generally flow into the lake, and to the west it will generally, but not exclusively, flow away from the lake.

The southern dam catchment seeks to avoid Lake Cordeaux. From the eastern boundary to Lake Cordeaux, the boundary follows areas of significant slope. From the lake, the boundary has been extended directly to the Upper Nepean State Conservation Area.

These boundaries have been established with the objective to avoid impact on the reservoir; the boundary seeks to provide some buffer between the airport site and the dam catchment.

These boundaries generally encapsulate the land identified in the Joint Study, based on elimination of steeply sloping land, as exists from the ridges lines above both Lake Cataract and Lake Cordeaux to the edges of these lakes.

2.2.3 Step 3 – Undertake further screening to refine areas less suitable to accommodate the required airport type

Following delineation of the Wilton Study Area outlined above, a fairly significant gross land area - in the order of 8,000 ha - still remained. Based on the gross areas remaining, it would be possible to physically locate a range of preliminary runway layout options.

In considering potential sites and runway alignments that could form base case concepts for further analysis, however, the following issues were identified that would act to practically limit some land with the Study Area in their ability to realistically accommodate an airport site:

- Particular parts of the Wilton Study Area are characterised by terrain that would be disproportionally costly to engineer to accommodate ICAO standards and CASA regulations setting out maximum longitudinal slopes and specifications for obstacle limitation surfaces (OLS) for airport runways; and

[9] Though not all lands upon which there are residences.

- Location of very deep gorges on major watercourses within the site – most particularly a deep gorge through which Wallandoola Creek flows, which is closely parallel to the eastern and western Study Area boundaries and which effectively divides the majority of the Study Area into two parts (eastern and western parts) – were identified as a massive potential cost risk to developing a greenfield airport across them and to the extent possible were avoiding when siting runways.

Slope Analysis

For operational safety reasons, there are ICAO standards and CASA regulations setting out maximum longitudinal slopes and specifications for OLS for airport runways. These regulations are the basis for establishing the geometrical configurations of an airport and cannot be breached.

While any greenfield airport site is likely to require some cut and fill earthworks to suitably level or grade the land for use as an airport, this criterion excludes areas where the terrain and surrounding landscape is expected to make particular parts of the Wilton Study Area disproportionally costly relative to accommodating safety requirements within other parts of the Study Area.

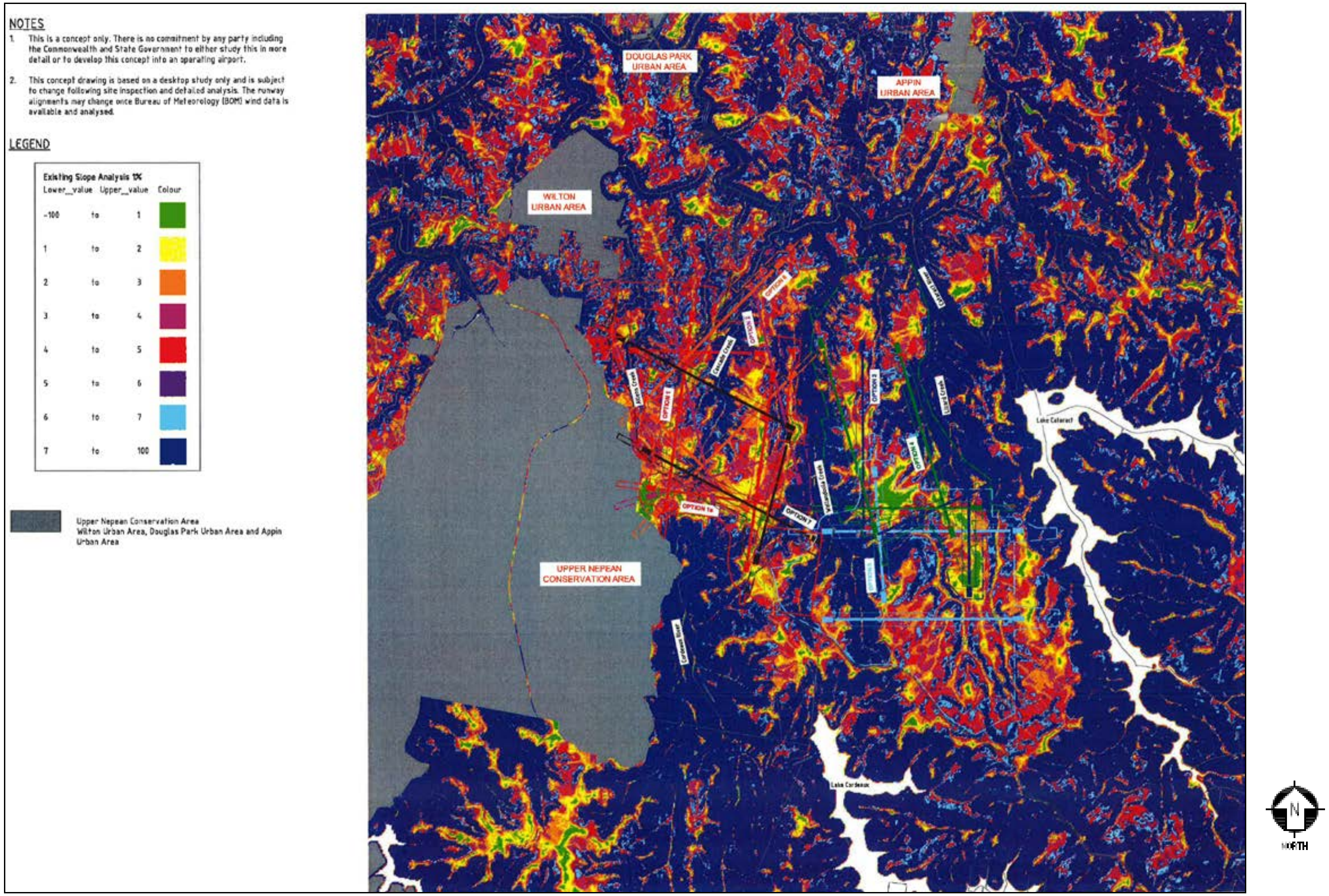
This is similar to the approach used in the Joint Study to identify potential greenfield locations in the Sydney region.

Figure 2.3 identifies the Upper Nepean State Conservation Area (west), the townships of Wilton, Douglas Park and Appin (north) and the Dam Catchment Areas (east – Cataract and south – Cordeaux) as the previously identified external boundaries of the Wilton Study Area and also defines the terrain slope percentage across the Study Area that will be used to locate runway alignments, targeting the lowest percentage slope and the least degree of terrain roughness to gain an understanding of where the flatter land within the Study Area is located. The figure shows the Study Area topography analysed into the following classes of slope:

- Flat terrain 0-1% slope (green - yellow);
- Gently sloping terrain 1-5% slope(yellow - red);
- Undulating terrain 5-7% slope (red - purple);
- Steep terrain > 7% slope (light blue - dark blue);

..

Figure 2.3 Slope analysis



Avoid deep gorges

The Woronora Plateau is deeply incised by numerous gorges, with the elevation of gorges ranging from about 65 m above sea level in the lower northern part to about 300 m above sea level in the higher southern part. The part of the plateau which is the Study Area is bounded by the Cordeaux River gorge (about 100 m deep) to the west and the Cataract River gorge to the east, with the Wallandoola Creek gorge (50 to 70 m deep) and a number of other gorges and lesser gullies being in the middle of the Study Area.

The airport site platform assumed for the "*maximum*" airport concept occupies an area of about 4.5 to 5 km long and about 2.5 to 3 km wide. Accordingly, if the site crosses a deep gorge, there are several problems to be addressed:

- Large volume of additional earthworks to fill the deep gorge;
- There are waterways within some of the deep gorges in the Study Area (e.g. Cascade Creek) which may need to be crossed with major earthworks structures. If the river/creek needs to continue to flow this could require a substantial drainage structure to allow for a peak maximum flood event, which could only be achieved at significant cost per metre;
- The deep fill undertaken to allow an airport footprint to cross a deep gorge is likely to experience differential settlement with the sides of the gorge being on hard rock and the filled section being compacted. This could create geometrical deformations in the runways and taxiways[10] which may be serious enough to take them out of specification for landing and take-off operations; and
- There will be significant environmental issues associated with impacting the waterways.

As these problems suggest, the environmental, operational and cost implications of having to fill a deep gorge in order to accommodate an airport in the area are clearly less desirable than locating a site elsewhere in the Study Area.

While slope analysis undertaken and outlined above provided insight into the areas of increasing slope, that analysis does not specifically identify the location/presence of the gorges. This is because all areas with slope above 7% are grouped together in the analysis given the significant slope beyond that point (as shown above in **Figure 2.4)**. For this reason, an analysis was undertaken of a set of cross sections and of an aerial photo in order to identify the gorges and understand if any may create difficulties constructing an airport site.

Figure 2.4 shows seven cross-sections of the Wilton Study Area that were selected to assess and demonstrate the scale of the drop in the terrain across the gorges based on longitudinal analysis.

[10] As well as major cracking of pavements.

Figure 2.4 Visual of five cross sections identified for longitudinal analysis

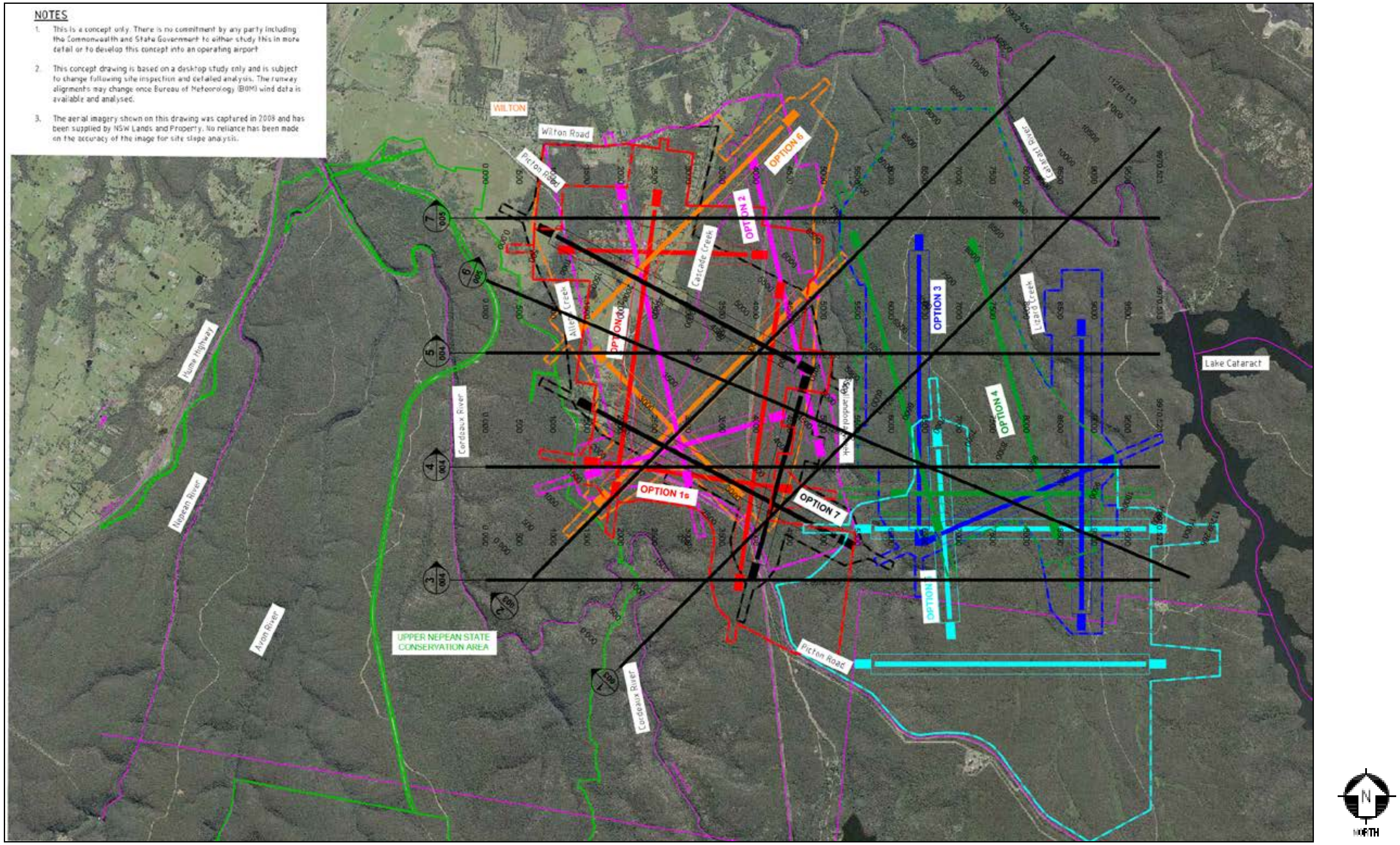
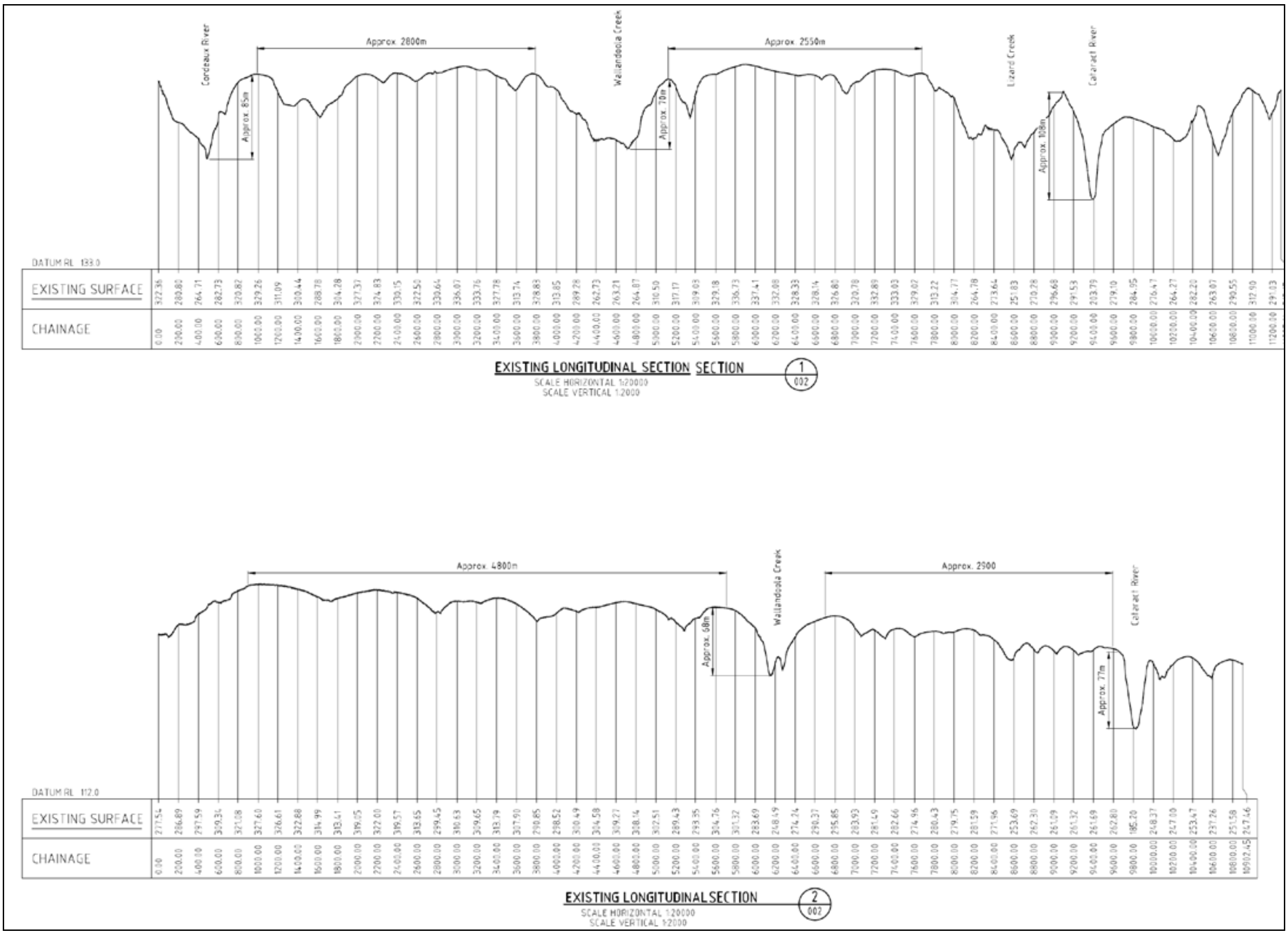
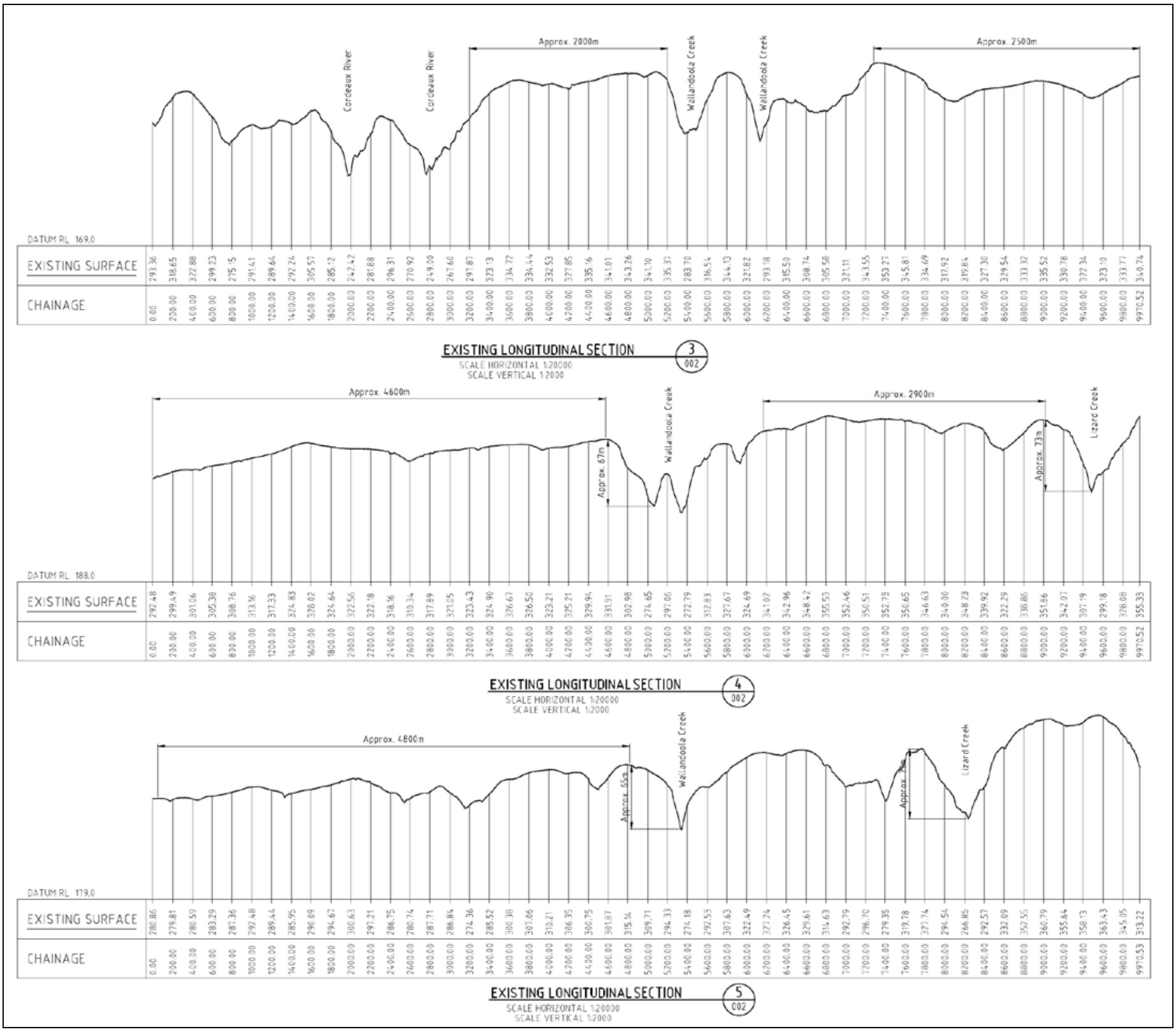


Figure 2.5 below presents the variation in terrain height across the seven cross sections. As these clearly indicate, there are few parts of the site where even moderately undulating terrain exists on which to fit a 4,000 m runway without major earthworks. More specifically, the relative depths of the major gorges within the terrain can be seen and in particular the effect of the gorge in with Wallandoola Creek in located.

Figures 2.5 Variation in terrain height at five cross sections



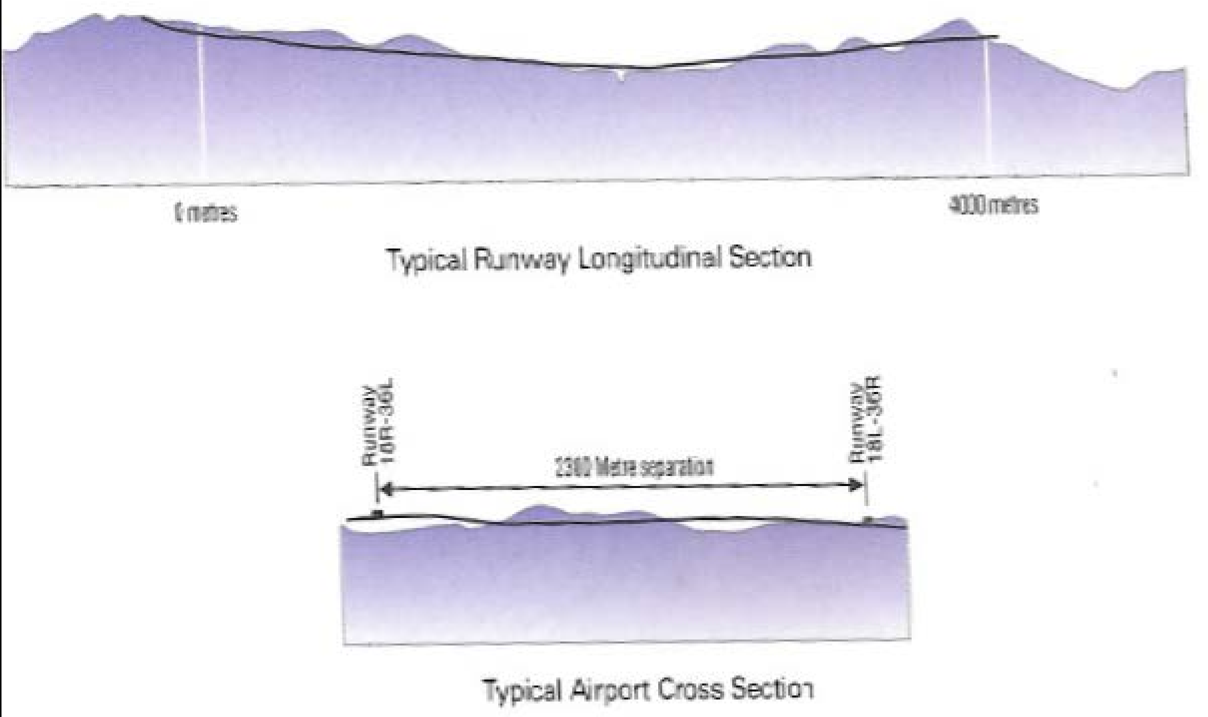


The vertical differences in the elevation of terrain shown in some parts of these cross sections are so extreme that in order to cross them with a runway, earthworks even greater than used to create the Sydney-Newcastle freeway[11] would be required.

By comparison, the **Figure 2.6** presents typical sections proposed for runways for the Badgerys Creek airport options considered in the 1997 *Draft Environmental Impact Statement: Second Sydney Airport Proposal.* The longitudinal section has 10:1 vertical to horizontal exaggeration, cross section has 5:1 vertical to horizontal exaggeration.

[11] Refer to the Working Paper on Land Clearing and Earthworks

Figure 2.6 Typical sections of airport site



Note: Longitudinal section has 10:1 vertical to horizontal exaggeration, cross section has 5:1 vertical to horizontal exaggeration.

Source: PPK, 1997. Draft Environmental Impact Statement: Second Sydney Airport Proposal, Volume 1, Section 9-24, Figure 9-21.

This shows the significantly easier terrain that exists at the Badgerys Creek locality in terms of the ability to fit 4,000 m runways to the terrain at lesser degrees of earthmoving than would exist at Wilton.

Outcome

Based on the analysis outlined above, the following criteria were applied to refine areas within the Wilton Study Area, considered less suitable to accommodate an airport due to adverse terrain and excessive engineering difficulty.

- Avoid where possible areas likely to require significant cut and fill; and
- Avoid where possible land with deep gorges.

2.2.4 Step 4-1 – Identify sites and runway alignments that will form base case airport concepts for further analysis

2.2.4.1 Apply "*maximum*" airport template to identify sites

To identify a set of representative airport site options within the Wilton Study Area, the "*maximum*" airport template presented in the Working Paper *Airport Performance Specification for Wilton - Task and Infrastructure* (with two parallel 4,000 m runways with 2,000 m separation and a 2,500 m cross runway) was overlaid on topographic maps of the Study Area, firstly avoiding, as possible, deep gorges and areas with slope greater than 7%.

In terms of adopting a practical approach to identifying runway alignments and options, which might after further assessment in the specific working papers, remain as realistic possibilities as airport sites, consideration was given to a number of environmental and other planning issues that had been influential – though not necessarily absolute – considerations in the Joint Study such as:

- Minimising the impact on urban areas by avoiding directing the runways towards the existing urban areas of Wilton, Douglas Park and Appin and proposed urban developments, to the extent possible permitted by the terrain;
- Avoiding rivers and areas of known environmental value, though these areas may not as yet have been accorded the status of National Parks or Conservation Areas;
- Minimising use of areas under which mining is or is planned to occur so as to avoid mine subsidence and the potential for major damage occurring to airport assets, noting that the entire area is underlain by coal measure; and
- Generally but not exclusively seeking runway alignments that would have maximum compatibility with Sydney Airport, noting that in any event, both the Study Area and both the major and lesser gorges which dissect it have a broadly parallel linearity with Sydney Airports 16/34 and 7/250 runways.

Following this, base case site options were identified as being representative of what may be realistically achievable and as a basis to test the ability of the Study Area to accommodate them. These will be subject to further review and design refinement taking account of the specific findings of the Working Papers. Of note, the Draft 1985 EIS preferred site was not identified as an option as it substantially now lies within the Upper Nepean Conservation Area. However, parts of that site are captured in sites developed in this Working Paper.

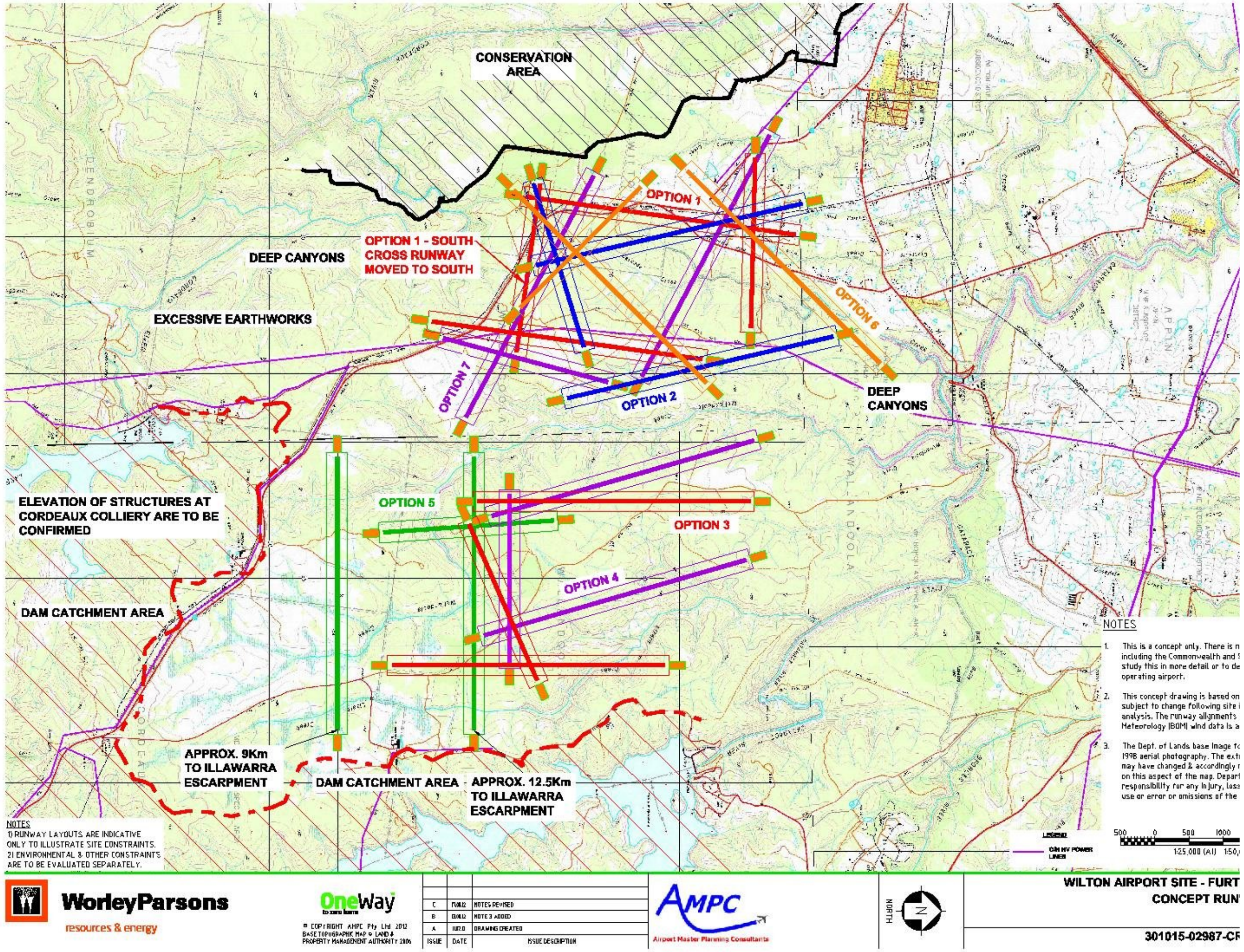
Table 2.1 Identified base template options for Step 4-1 Screening

Option Number	Location	Runway Orientation	Comments
1	West	N-S	Similar to the representative site which was selected in the *Joint Study.* The previous concept layout for the airport was modified to provide for two 4,000 m long main runways and a 2,000 m runway separation.
1S	West	N-S	Modification to Option 1 with a relocation of the cross runway from the northern end of the airport site to the southern end of the airport site (to improve the concept layout and to facilitate future road and rail access).
2	West	NW-SE	New Option aligned to Sydney Airport's 16/34 runway direction.
3	East	N-S	Similar to site identified as "*Wallandoola"* in the *Joint Study;* Included in this analysis to test a range of possible locations and runway orientations within the Wilton Study Area, alongside the *"more suitable"* site assessed in the *Joint Study*. Both *"Wilton"* and *"Wallandoola"* were *"suitable"* as a "*maximum*" airport sites in the *Joint Study* but "*Wilton"* generated less N70 effects; However the suitability of *"Wilton"* was noted as being subject to further detailed checking on the occurrence and effects of mining – see page 311 of the *Joint Study* Report. The runway separation was also made 2,400 m to better fit the dissected and steep terrain.
4	East	NW-SE	Rotates the site to seek to achieve a runway alignment closer to Sydney Airport's runway 16/34. This necessitated narrowing of the runway separation to 1,650 m to fit the terrain, but with modifications to try to minimise direct effects on upland swamps.[12]
5	East	E-W	Provides for an east west option, ignoring the potential environmental significance of the Upland Swamps – for the purpose of comparative analysis. Note issue of proximity to the Illawarra escarpment (9 km to the east – wind turbulence issue).
6	West	NE-SW	Provides for an option with a different heading to seek to reduce noise impacts to the north. The site was however limited by steep terrain/Wallandoola Creek gorge – resulting in noise being directed over Appin.
7	West	NE-SW	Provides for an option with a different heading to seek to reduce noise impacts to the north and to be closer to ASA's preferred Runway headings. The site was however limited by steep terrain/Wallandoola Creek gorge – resulting in noise being directed towards Tahmoor.

These selected options are shown in **Figure 2.7**.

[12] Refer to working paper on *Flora Fauna Ecology for information about these features.*

Figure 2.7 Identified options for further review



It was not always possible to identify airport sites to the required dimensions fully within the external boundaries identified, or that completely avoid deep gorges or steep terrain. For example, in some options, the High Intensity Approach Lighting field does penetrate the boundary of the Upper Nepean Conservation area, to an extent. This is outlined in more detail for each option in the section below explaining the base case airport concepts developed for each of the eight options. However, it is considered that combining this step by step site options identification process with the GIS slope analysis, a comprehensive options identification process has been undertaken to reveal the eight options shown in **Figure 2.7**.

2.2.4.2 Specify runway coordinates

For the purposes of options identification, detailed GIS analyses and overlays for the assessment of environmental impacts, the runway options latitude and longitude coordinates details are given in Appendix A.[13]

2.2.4.3 Develop base case airport concepts for each option

Following on from these template options, base case airport concepts for the options have been developed. Underlying guidelines and assumptions are given in the Working Paper *Wilton Airport Site Selection and Airport Concepts - Task and Infrastructure*.

The airport concepts provide and indicate conceptual locations for major facilities including ATC tower, rescue and fire fighting service, navigation and landing aids, passenger terminals and aprons, airport support facilities, freight, aircraft maintenance, roads and car parks, rail, fuel storage and business park areas, as sought in the Scope to varying scale and location depending in the option. Space has also been provided for water detention basins, as identified through the planning process.

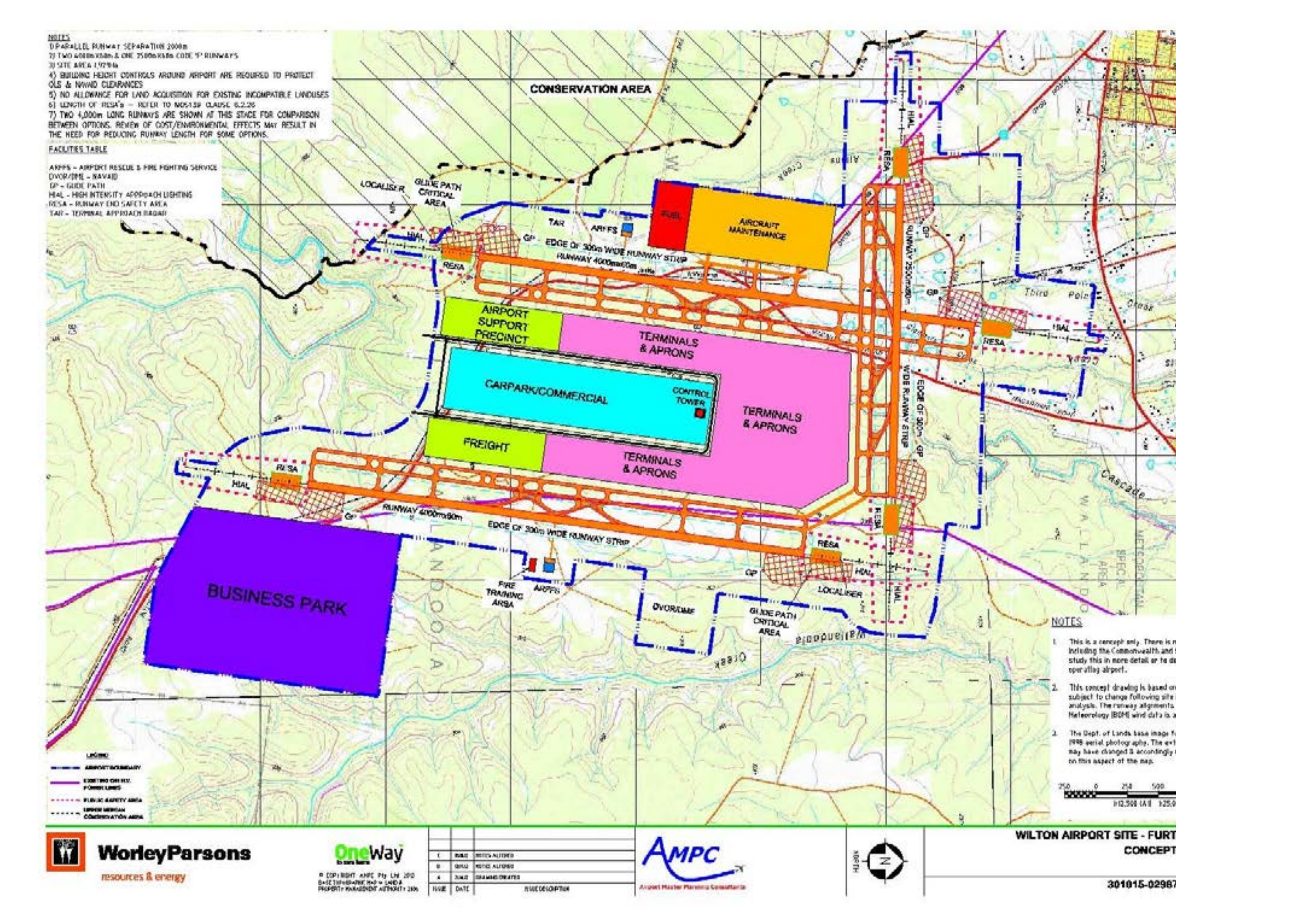
The preferred airport layout is illustrated in Figure 1.7 of the Working Paper – *Airport Performance Specification for Wilton – Task and Infrastructure*. This layout is considered to be *"efficient"* in that it:

- Locates the terminal and aprons between the parallel runways (refer to section 1.5.1 of the Working Paper – *Airport performance Specification for Wilton – Task and Infrastructure*. On Terminal Location);
- Locates freight adjacent to the apron to facilitate transfer of cargo from the belly hold of passenger aircraft;
- Locates Airport Support adjacent to the apron to facilitate the movement of ground support (e.g. catering, ramp handling equipment and the like); and
- Locates the Business Parks near to the terminal precinct and on the major airport access roads to leverage most commercial advantage from the airport site.

The airport concepts are presented in **Figures 2.8** to **2.15**. Each concept is broadly compared to the preferred airport template in terms of being *"efficient"* or *"less efficient"* where the layout is modified from the "efficient "template as a result of being constrained in some way.

[13] As required to be provided in the Department's stated scope.

Figure 2.8 Airport concept for Option 1



Note: Runway alignments: main 18/36 and secondary 08/26.

Features of this concept are as follows:

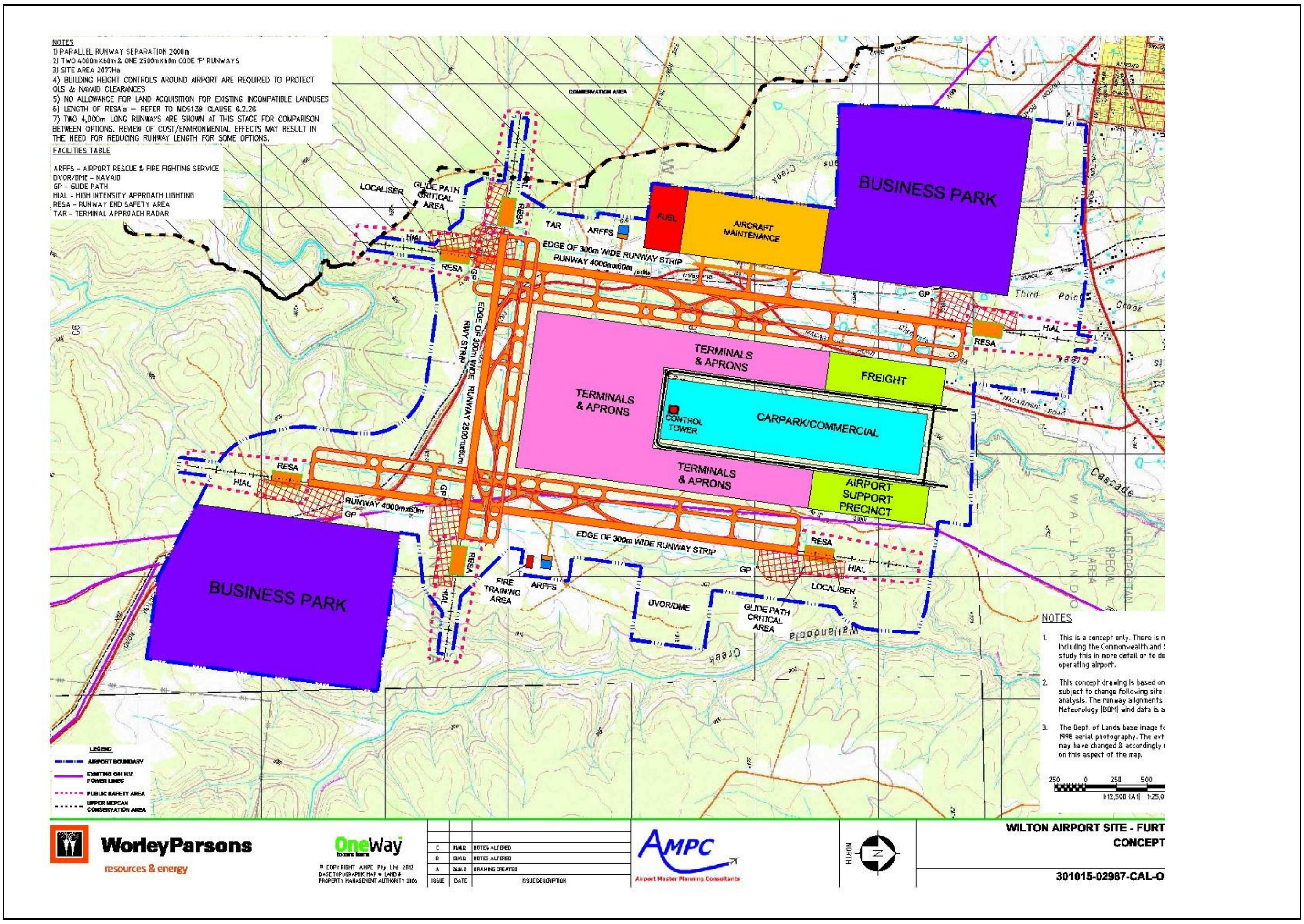
- A similar alignment to Wilton representative site identified in the Joint Study. Similar alignment of main runway to Sydney Airport 16/34 (Airservices Australia prefers more northwest - southeast);
- A western boundary generally limited by the Upper Nepean Conservation Area and the need to provide for the relocation of Picton Road;
- A southern boundary limited by steep terrain (and obstacles due high terrain further to the south which may affect the runway location);
- An eastern boundary limited by Wallandoola Creek;
- A northern boundary which impinges on Cascade Creek;
- The general layout of airport is reasonable with terminal, freight and airport support between main runways. Aircraft maintenance hangars to one side, which is reasonable, if not ideal.[14] The business park is to the east of the airport entrance, but has good access to Picton Road;
- The ground access from the south is liable to be constrained by the steep terrain;

[14] Need to consider wind turbulence due to hangars in the detailed design.

- Relatively close to existing pipelines and utilities (if these can be used to supply services); and
- Other issues – noise, earthworks, impacts on water catchment, environmental impacts are subject to review in other Working Papers.

The overall layout is considered, based on experience and in comparison to other similar airport to be rated "*efficient*" taking account of the general layout comments above.

Figure 2.9 Airport concept for Option 1S

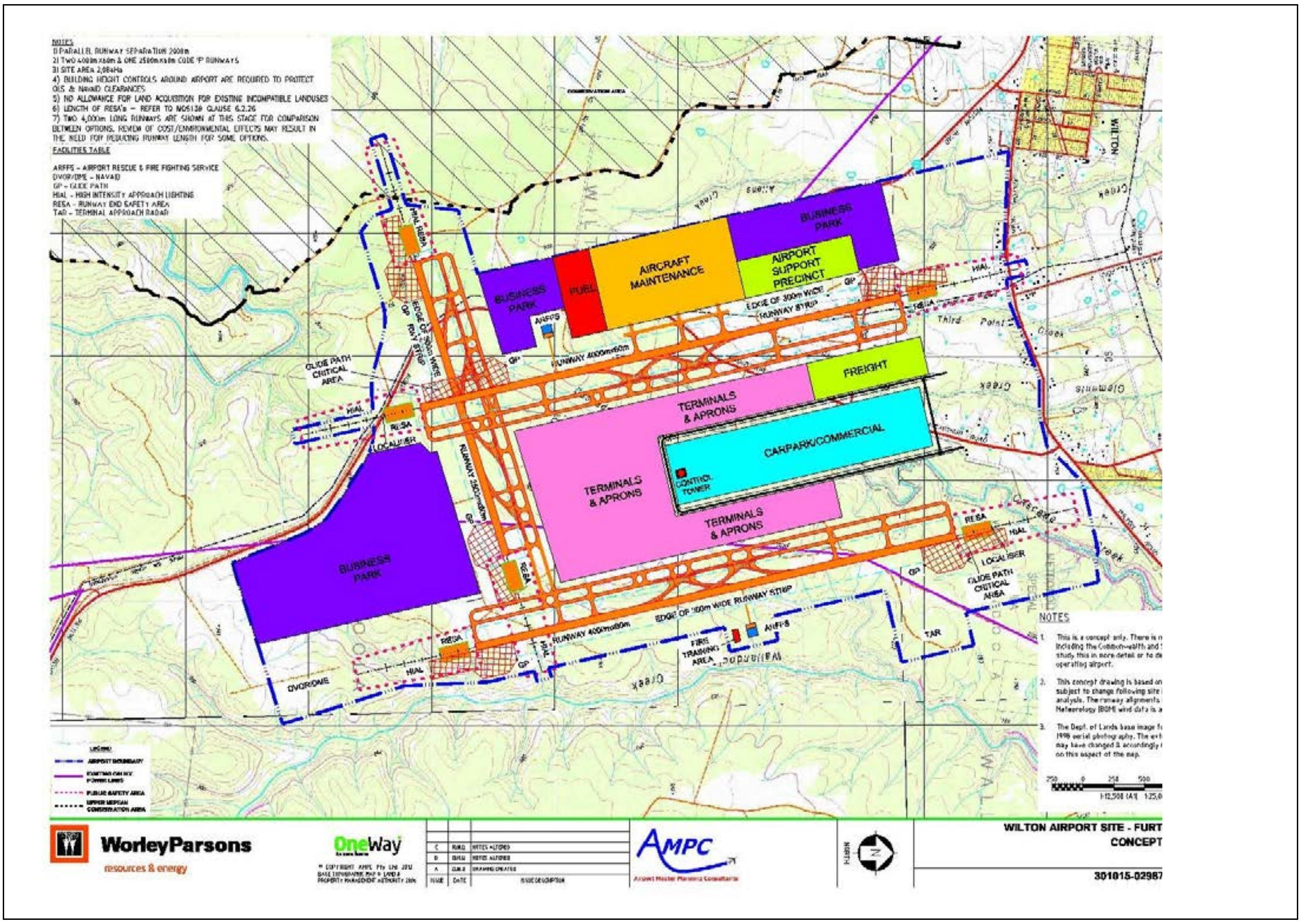


Notes: Runway alignments Main 18/36 Secondary 09/27.

- Comments are as for Option 1 above;
- The relocation of cross runway potentially improves ground access design and permits an area for potentially a second business park; and
- Other issues – noise, earthworks, impacts on water catchment, environmental impacts are subject to review in other Working Papers.

The overall layout is considered, based on experience and in comparison to other similar airport to be rated "*efficient*" taking account of on the general layout comments above.

Figure 2.10 Airport concept for Option 2

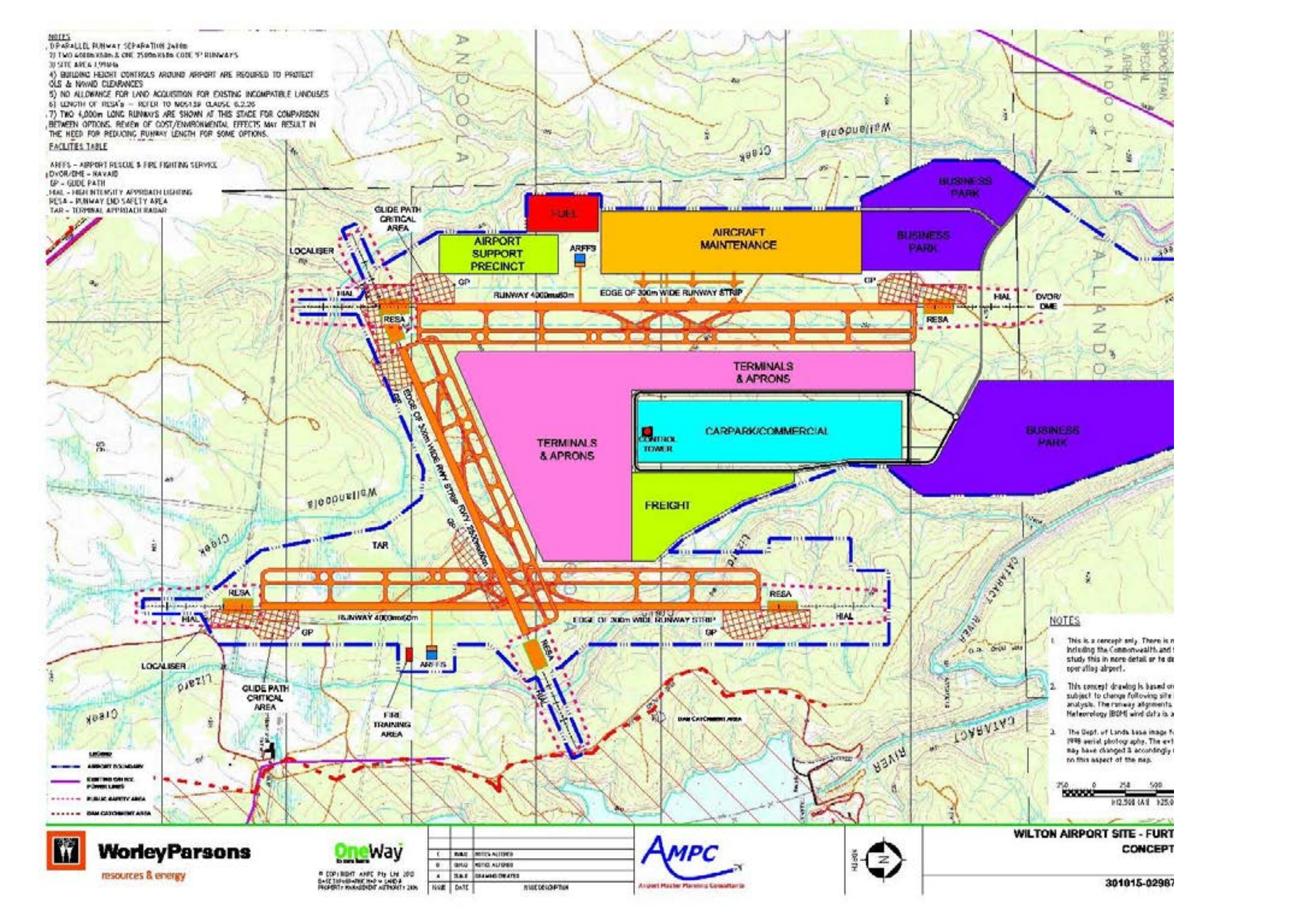


Note: Runway alignment Main 16/34 Secondary 06/24.

- Runways are closely aligned to Sydney Airport;
- Western boundary limited by Upper Nepean Conservation area and need to provide for relocated Picton Road;
- The southern boundary limited by steep terrain (and obstacles due high terrain further to the south which may affect the runway location);
- The eastern boundary limited by Wallandoola Creek;
- The northern boundary limited by Cascade Creek and urban areas;
- The general layout is reasonable with terminals and aprons and freight between main runways. Airport support is to the west of the runway, but is still relatively close to the runway end with reasonable access. Aircraft maintenance is to one side of the runway and reasonably clear for wind turbulence issues. The business park to the south has good access to Picton Road. The northern business park also has good access to the relocated Picton Road (west of airport site) and there are much larger adjacent areas possible to the south west of Wilton;
- Relatively close to existing pipelines and utilities (if these can be used to supply services); and
- Other issues – noise, earthworks, impacts on water catchment, environmental impacts are subject to review in other Working Papers.

The overall layout is considered, based on experience and in comparison to other similar airport to be rated *"efficient"* taking account of the general layout comments above.

Figure 2.11 Airport concept for Option 3



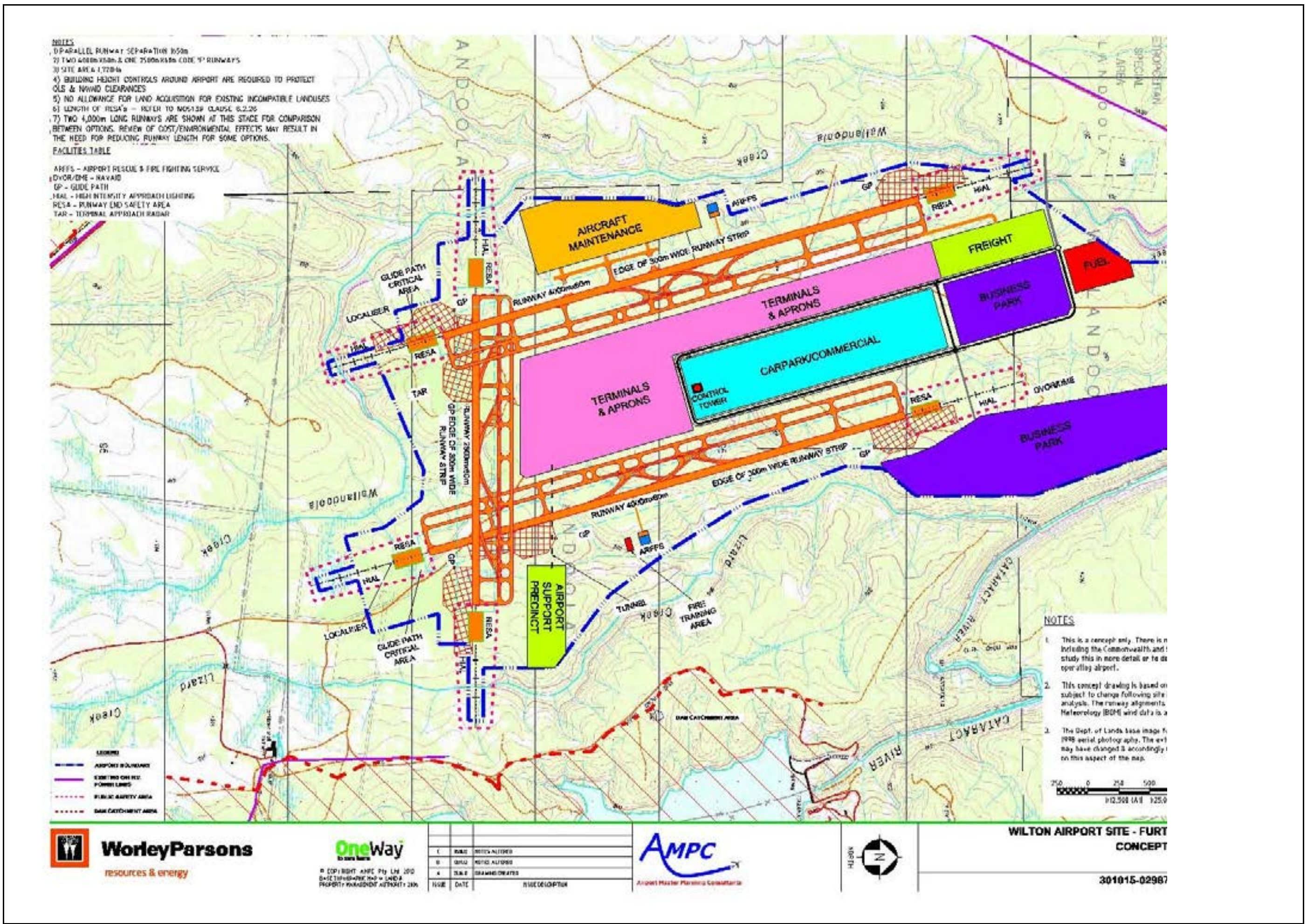
Note: Runway alignment Main 17/35 Secondary 05/23.

- Similar alignment to Wallandoola site identified in the Joint Study;
- The western boundary limited by Wallandoola Creek;
- The southern boundary limited by Upland Swamps (and obstacles due high terrain further to the south which may affect the runway location);
- The eastern boundary limited by Lake Cataract and Lizard Creek;
- Northern boundary limited by Cataract River and steep terrain;
- To minimise impacts on the Upland Swamps and Lizard Creek the runway separation was increased to 2,400 m;
- General layout of airport reasonable with terminal, freight between main runways. The freight area is not rectangular shape due terrain/Lizard Creek. Aircraft maintenance hangars to one side, which is reasonable, if not ideal. Airport support is distant to main terminals and apron and may require linking via a tunnel. One business park is on the airport entrance, but the other is more remote. The business parks are distant to existing main roads and would rely on airport induced traffic;

- Ground access from the west is constrained by needing to cross some steep terrain;
- Relatively close to existing pipelines and utilities (if these can be used to supply services);
- Other issues – noise, earthworks, impacts on water catchment, environmental impacts are subject to review in other Working Papers; and
- The eastern main runway is over areas subject to mining.

The overall layout is considered, based on experience and in comparison to other similar airport to be rated *"less efficient"* taking account of the general layout comments above.

Figure 2.12 Airport concept for Option 4



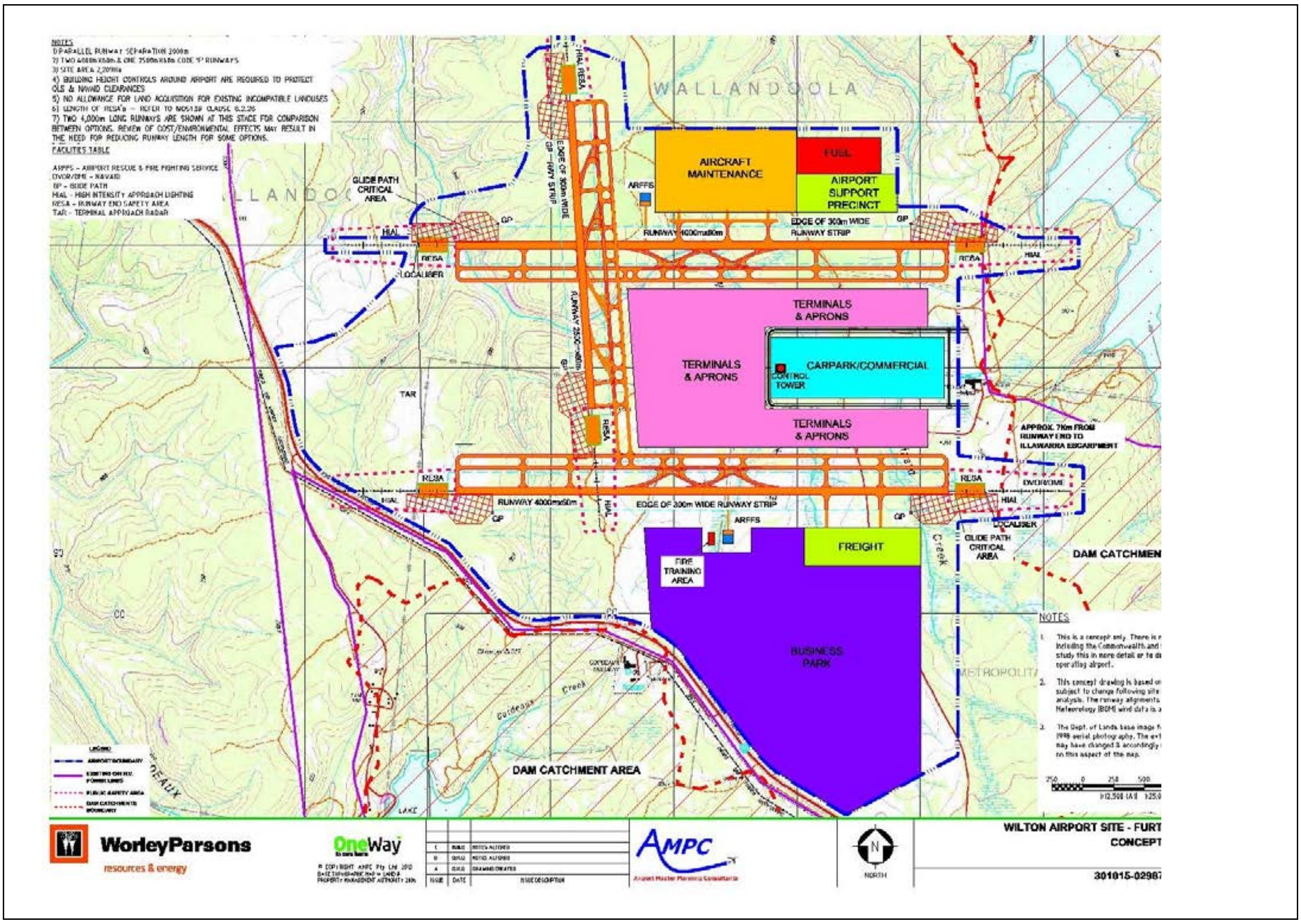
Note: Runway alignment: Main 15/33 Secondary 08/26.

- The western boundary limited by Wallandoola Creek;
- The southern boundary limited by Upland Swamps (and obstacles due high terrain further to the south which may affect the runway location);
- The eastern boundary limited by Lizard Creek;
- The northern boundary limited by Wallandoola Creek, Cataract River and steep terrain;
- In order to minimise impacts on the Upland Swamps and Lizard Creek, the runway separation was reduced to 1,650 m (note: still above minimum for wide spaced runways of 1,525 m – compare to Hong Kong International Airport with a runway separation of 1,540 m);

- General layout of airport is reasonable with terminal, freight between main runways. Aircraft maintenance hangars to one side, which is reasonable, if not ideal. The site for aircraft maintenance is constrained by steep terrain, and wind turbulence would need to be checked in any detailed design phase due proximity to cross runway (if used); Airport support is distant to main terminals and apron and may require linking via a tunnel. One business park is on the airport entrance, but the other is more remote. The business parks are distant to existing main roads and would rely on airport induced traffic;
- Ground access from the west is constrained by needing to cross some steep terrain;
- Relatively close to existing pipelines and utilities (if these can be used to supply services);
- Other issues – noise, earthworks, impacts on water catchment, environmental impacts are subject to review in other Working Papers; and
- The eastern main runway is over areas subject to mining.

The overall layout is considered, based on experience and in comparison to other similar airport to be rated "*less efficient*" taking account of the general layout comments above.

Figure 2.13 Airport concept for Option 5



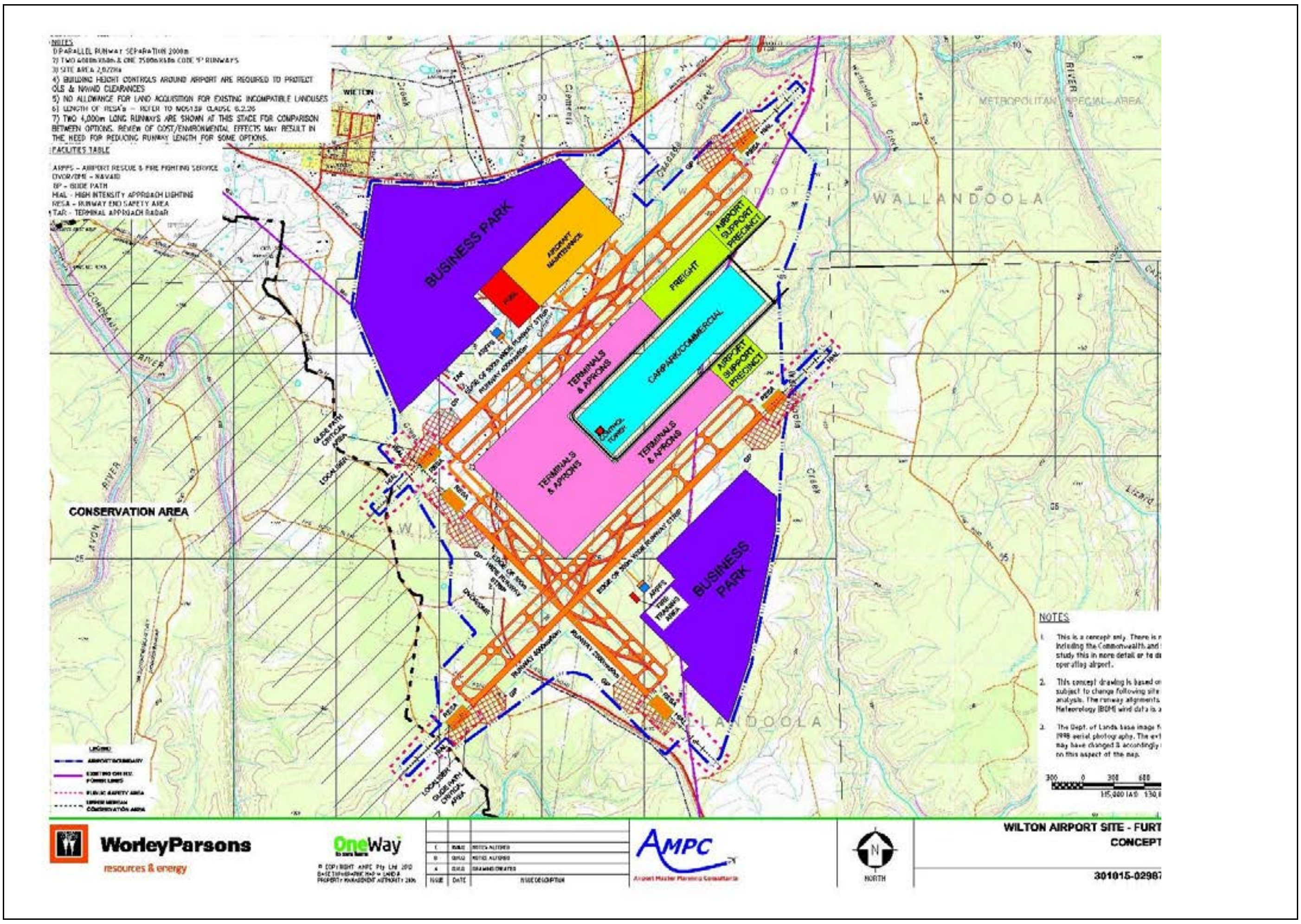
Note: Runway alignment: Main 08/26; Secondary 16/34.

- The main runways not closely aligned to Sydney Airport;
- The western boundary limited by Wallandoola Creek and steep terrain;
- The southern boundary limited by dam catchment areas;

- The eastern boundary limited by dam catchment areas;
- The northern boundary limited by Wallandoola Creek and Lizard Creek (steep terrain);
- The site likely to be affected by mining; and
- General layout is limited with terminals and apron only between main runways. Airport support is to the north of the runway, but is still relatively close to the runway end with reasonable access. Aircraft maintenance is to the north of the runway and with need to check for wind turbulence issues (depending upon height of buildings). The business park to the south has good access to Picton Road, but impacts on Upland swamps.

The overall layout is considered, based on experience and in comparison to other similar airport to be rated "*less efficient*" taking account of the general layout comments above.

Figure 2.14 Airport concept for Option 6



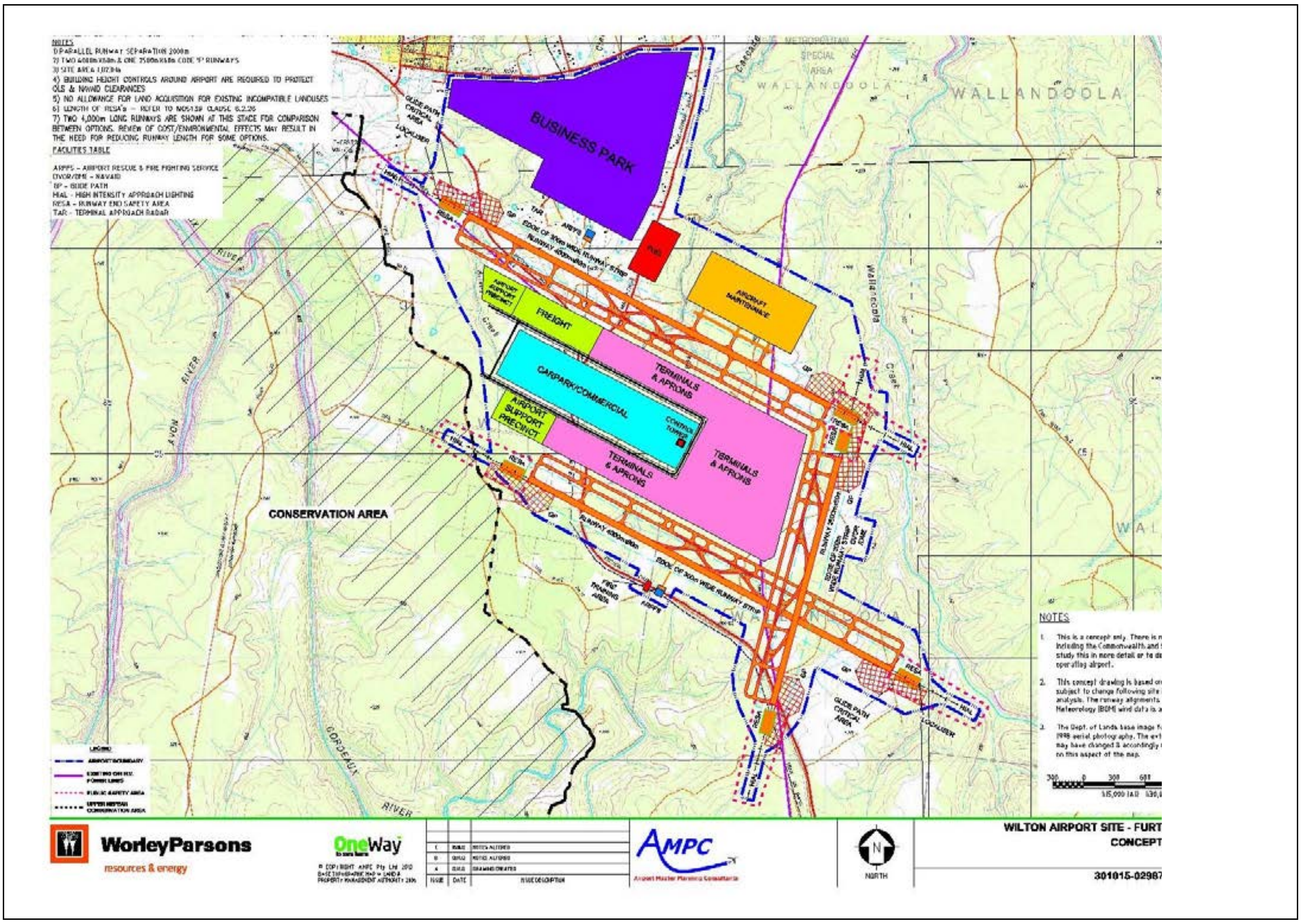
Note: Runway alignment: Main 03/21 Secondary 12/30.

- Runways are not closely aligned to Sydney Airport;
- Western boundary limited by Upper Nepean Conservation area and need to provide for relocated Picton Road;
- Southern boundary limited by steep terrain;
- Eastern boundary limited by Wallandoola Creek;
- Northern boundary limited by Cascade Creek and urban areas;

- General layout reasonable with terminals and aprons, airport support and freight between main runways. Aircraft maintenance is to one side of the runway and reasonably clear for wind turbulence issues. The business park to the south has access to Picton Road. The northern business park also has good access to the relocated Picton Road (west of airport site) and there are much larger adjacent areas possible to the south west of Wilton;
- Relatively close to existing pipelines and utilities (if these can be used to supply services); and
- Other issues – noise, earthworks, impacts on water catchment, environmental impacts are subject to review in other Working Papers.

The overall layout is considered, based on experience and in comparison to other similar airport to be rated "*efficient*" taking account of the general layout comments above.

Figure 2.15 Airport concept for Option 7



Note: Runway alignment: Main 11/29 Secondary 18/36.

- Runways are not closely aligned to Sydney Airport;
- The western boundary limited by Upper Nepean Conservation area and the need to provide for relocated Picton Road;
- The southern boundary limited by steep terrain and the difficulty of constructing alternate roads through it;
- The eastern boundary limited by Wallandoola Creek;
- The northern boundary limited by Cascade Creek and urban areas;

- The general layout is reasonable with terminals and aprons, airport support and freight between main runways. Aircraft maintenance is to one side of the runway and reasonably clear for wind turbulence issues. The northern business park also has good access to the relocated Picton Road (west of airport site) and there are much larger adjacent areas possible to the south west of Wilton;
- Relatively close to existing pipelines and utilities (if these can be used to supply services); and
- Other issues – noise, earthworks, impacts on water catchment, environmental impacts are subject to review in other Working Papers.

The overall layout is considered, based on experience and in comparison to other similar airport to be rated *"efficient"* taking account of the general layout comments above.

2.2.4.4 Comparison of airport layout efficiency of options

A summary of the overall efficiency of each option layout is shown in **Table 2.2**, based on the general layout comments above. Site area is not specifically taken into account in this rating of efficiency – as the efficiency of an airport's layout relates more to if airport support, freight etc. can be sited between the main runways. See Working Paper *Wilton Airport Site Selection and Airport Concepts - Task and Infrastructure* for the assumptions and rational in regard to the siting of building precincts with respect to runways. A larger site is preferable, but again not specifically taken into account.

In the case of Options 3 and 4, it was necessary to vary the runway separations from the desirable given the major gorges and due to OLS issues.

Table 2.2 Overall rating of efficiency of each option layout

Factor	Option							
	1	1S	2	3	4	5	6	7
Site Area (ha)	1,930	2,077	2,084	1,988	1,727	2,209	2,022	1,923
Main Runway Heading	18/36	18/36	16/34	17/35	15/33	08/26	03/21	11/29
Cross Runway Heading	08/26	09/27	06/24	05/23	08/26	16/34	12/30	18/36
Main Runway Separation (m)	2,000	2,000	2,000	2,400	1,650	2,000	2,000	2,000
Overall layout "efficiency" rating	***Efficient***	***Efficient***	***Efficient***	***Less Efficient***	***Less Efficient***	***Less Efficient***	***Efficient***	***Efficient***

2.3 Key findings

- Eight site options have been identified. These eight options have been developed to a conceptual stage for testing the ability of the area to accommodate a “maximum” airport;
- Runway alignments corresponding to the options can be achieved:
  - Option 1 Main 18/36 Cross runway 08/26;
  - Option 1S Main 18/36 cross runway 09/27;
  - Option 2 Main 16/34 Cross runway 06/24;
  - Option 3 Main 17/35 Cross runway 05/23;
  - Option 4 Main 15/33 Cross runway 08/26;
  - Option 5 Main 08/26 Cross runway 16/34;
  - Option 6 Main 03/21 Cross runway 12/30; and
  - Option 7 Main 11/29 Cross runway 18/36;
- While the options are sufficient to enable testing of major airport site attributes, they remain representative at this point and are principally intended to allow a clearer definition of where and in what configuration sites for a “*maximum*” airport can be found within the Study Area;
- Airport concepts have been developed specifically to accommodate “*maximum*” airports for each option to the level required for the Further Assessment task, and include all major airport facilities. The screening undertaken in this Working Paper to identify airport site options is supplemented by detailed constraints and planning and environmental impacts analysis of each airport concept in subsequent Working Papers; and
- If Working Paper analysis identifies particular issues, then a mitigation strategy may be to shift a site partially across the Study Area external boundaries, or to amend the defined “*maximum*” airport requirements, though this would be likely to result in a trade-off between airport capacity and reduction in likely cost.

2.4 References

References are provided in the supporting Working Papers

Kinhill Stearns 1985, *Second Sydney Airport Site Selection Programme, Draft Environmental Impact Statement*, a report prepared for the Department of Aviation

APPENDIX 2A WILTON OPTIONS RUNWAY COORDINATES

For the purposes of options identification, detailed GIS analyses and overlays for the assessment of environmental impacts, the runway options latitude and longitude coordinates details are below.

Table B1 Wilton options runway coordinates

WILTON SITE OPTIONS - RUNWAY COORDS and LAT-LONGS								
MGA 94 ZONE 56								
DATE	26/09/2012	DRG VERSION	10	OPTIONS 1-4				
NOTES								
MGA coords based on Dept. of Lands 25K scale Topo Maps and converted to Lat/Longs using Geod - medium accuracy.								
	Lat/Longs	GDA 94	Example:	150.4401834	IS 150 DEG	44 MIN	1.834 SEC	
OPTION=1	E	N			South	East		
Assumed ARP	290384.271	6205666.582			34.16081	150.43234		
Rwy Ends	South End		North End					
RWY Length	E	N	E	N				
4000	289412.6766	6203747.6281	289969.3878	6207708.6973				
4000	291240.1223	6202379.9870	291796.8147	6206341.0593				
	West End		East End					
2500	288842.268	6207114.343	291341.41	6207048.881				
OPTION=2	E	N			South	East		
Assumed ARP	290749.2851	6205623.862			34.16098	150.43377		
Rwy Ends	South End		North End					
RWY Length	E	N	E	N				
4000	290416.7756	6203909.0985	289512.8139	6207805.6161				
4000	292365.0323	6204361.0899	291461.052	6208257.6037				
	West End		East End					
2500	289227.5590	6203870.4587	291617.5414	6204603.9312				
OPTION=3	E	N			South	East		
Assumed ARP	295201.9163	6204171.07			34.17	150.46304		
	South End		North End					
RWY Length	E	N	E	N				
4000	293877.9458	6203043.1384	293877.9458	6207043.1384				
4000	296277.9458	6201792.408	296277.946	6205792.408				
	West End		East End					
2500	294208.4329	6202920.9678	296500.016	6203920.292				
OPTION=4	E	N			South	East		
Assumed ARP	294553.2829	6204637.835			34.16445	150.46055		
	South End		North End					
RWY Length	E	N	E	N				
4000	294090.7706	6203253.746	292984.12	6207097.614				
4000	295840.423	6203140.402	294733.772	6206984.270				
	West End		East End					
2500	293764.8314	6203517.206	296264.831	6203517.187				
OPTION=1 SOUTH	E	N			South	East		
Assumed ARP	290384.271	6205666.582			34.16081	150.43234		
	South End		North End					
RWY Length	E	N	E	N				
4000	289412.6766	6203747.6281	289969.3878	6207708.6973				
4000	291240.1223	6202379.9870	291796.8147	6206341.0593				
	West End		East End					
2500	289219.9752	6203966.1606	291695.6450	6203618.2252				
OPTION 1 SOUTH uses 4Km Runways as per OPTION 1, but cross runway moved to south.								

OPTION=5	E	N			South	East	
Assumed ARP	294822.266	6202282.717			34.18015	150.46139	
	West End		East End				
RWY Length	E	N	E	N			
4000	293226.9925	6200994.17	297226.993	6200994.17			
4000	293226.9925	6202994.17	297226.993	6202994.17			
	South End		North End				
2500	294332.4945	6201667.437	294158.149	6204161.35			
OPTION=6	E	N			South	East	
Assumed ARP	290397.334	6205667.238			34.16085	150.43239	
	South End		North End				
RWY Length	E	N	E	N			
4000	289313.2318	6203570.968	292141.167	6206399.885			
4000	289030.041	6206116.569	291857.976	6208945.486			
	West End		East End				
2500	289269.0722	6205438.719	291037.145	6203671.259			
OPTION=7	E	N			South	East	
Assumed ARP	291010.9023	6204505.757			34.16467	150.43469	
	South End		North End				
RWY Length	E	N	E	N			
4000	292644.8702	6202877.964	289107.569	6204745.448			
4000	292048.2869	6205454.865	288510.985	6207322.349			
	West End		East End				
2500	291483.7613	6202542.482	292130.809	6204957.296			

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3 WORKING PAPER – PLANNING AND APPROVALS

SUMMARY

The purpose of this Working Paper is to document the expected planning and approvals pathway, including legislation under which a potential Environmental Impact Assessment (EIA) would be conducted if airport development at Wilton is pursued by the Commonwealth Government.

While the Commonwealth Government is yet to make a determination that any new airport would be declared an airport under the *Airports Act 1996*, it was considered prudent to include the requirements of the *Airports Act 1996* in the likely planning and approvals process documented in this Working Paper on the basis that the provisions therein are the best guide as to the possible requirements that may be imposed.

The Commonwealth *Airports Act 1996* and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are the primary pieces of planning legislation relevant to a proposed airport development in Australia. Works proposed for the external boundaries of the airport footprint such as road, rail and power connections would be conducted according to the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). A review of the planning and approval components of the most recent major airport development in Australia, the Brisbane Airport New Parallel Runway Project was conducted, to determine how the approval process would apply to a potential airport development at the Wilton Study Area. Aviation approvals were also reviewed.

Key issues include:

- Section 89(1) of the *Airports Act 1996* also provides for construction of new railways (k) and roads (h) and it is not clear how the application of these clauses would interact with the requirement to prepare an EIA under the EP&A Act, particularly the *State Environmental Planning Policy (State and Regional Development) 2011* and the *State Environmental Planning Policy (Infrastructure) 2007*.
- In terms of EIA and approval, previous airport developments, such as the Brisbane New Parallel Runway Project, have prepared one document that addresses the requirements of the Major Development Plan (MDP), required under the *Airports Act 1996*, and an Environmental Impact Statement (EIS) required under the EPBC Act. This approach appears to have been successful due to the overlapping requirements of the Department of Infrastructure and Transport (the Department) and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).
- The project would require an EPBC referral to the DSEWPaC to determine the likelihood of significant impacts to matters of National Environmental Significance. A decision on the environmental assessment process to be conducted under the EPBC Act would be made at this time. It is likely that the outcome would be a “*Controlled Action”* and an EIS would be required.
- Current major road (F3 Freeway to Raymond Terrace, Coffs Harbour Bypass, Woolgoolga to Ballina) and rail (North West Rail Link, CBD light rail extension) projects in NSW have been declared Critical State Significant Infrastructure (SSI) as listed in Schedule 5 of the State Environmental Planning Policy (State and Regional Development) 2011. Critical (and Staged) SSI must be declared by the Minister for Infrastructure and Transport. The likelihood of this is uncertain.
- A number of aviation industry authority approvals are required, once the detailed design and the EIS and, if ultimately required, a Master Development Plan, are completed.

3.1 Introduction

Development at Wilton would involve a new greenfield airport and while major upgrade developments have recently occurred at existing airports in Australia, there has not been a new airport development on the scale of the proposed second Sydney Airport for many decades.

This Working Paper therefore documents the expected planning and approvals pathway, including legislation under which a potential EIA would be conducted if airport development at Wilton is pursued by the Commonwealth Government. It seeks to identify key issues that the Commonwealth Government should be aware of, suggests strategies to mitigate any identified issues and in particular considers the form of any potential future EIS process, which may be conducted by the Australian and NSW Governments under one or all of the *Airports Act 1996 (Cwth),* EPBC Act (Cwth) and the EP&A Act (NSW).

This Working Paper draws on the findings of the Joint Study but, however is not constrained by any of the Joint Study findings or assumptions.

3.2 Planning and approval pathway

A number of Commonwealth and NSW Acts and related regulations have specific implications for the planning, development and operation of Australian airports and aviation generally. The key Acts, related regulations and policies which directly affect the planning, development and approval pathways for an airport development are discussed below.

Aviation land use, building and environmental matters on formerly Commonwealth owned airports are principally administered by the *Airports Act 1996*. The relevance of State legislation on the Airport site depends on the application of the *Airports Act*, Part 5, Division 5 which excludes State laws relating to land use planning and the regulation of building activities and Part 6 which provides that State environmental laws do not apply if certain prescribed matters are covered by a Regulation made pursuant to the *Airports Act* (the relevant statute being the *Airports (Environment Protection) Regulations 1997*. A description of NSW legislation that applies to the project can be found in Section 3.5 of this Working Paper.

An *"Airport site"* is defined in the *Airports Act 1996* as a place that is:

> *"(a) declared by the regulations to be an airport site; and*
>
> *(b) a Commonwealth place; and*
>
> *(c) used, or intended to be developed for use, as an airport (whether or not the place is used, or intended to be developed for use, for other purposes)."*

The Wilton Study Area has not been declared by the Regulations as an airport site and the Commonwealth Government is yet to make a determination that any new airport would be declared an airport under the *Airports Act 1996*. Nevertheless, it was considered prudent however, to include the requirements of the *Airports Act 1996* in the likely planning and approvals process documented in this Working Paper as the best currently available guide as to the types of processes and approval that may be required for a new greenfields airport.

An airport is a *'Commonwealth Place'* under the *Commonwealth Places (Application of Laws) Act 1970 (Cwth)* that applies State laws *"in accordance with their tenor"* to Commonwealth places. However, a State law does not apply if, for example, it is inconsistent with a Commonwealth law in which case the Commonwealth law prevails and the State law will not apply to the relevant Commonwealth place. This is as a consequence of Section 109 of the Australian Constitution. This has implications for the planning and approval process as Commonwealth legislation would apply within the "*airport site*" and NSW legislation would apply outside of this boundary.

The Wilton Study Area is also regarded as an *"airport site"* if it is intended to be developed for use, as an airport. The site would be required to be acquired by the Commonwealth and this is discussed in the Working Paper *Impact on Property and Commercial Enterprises*.

Development of an Airport at Wilton would consist of works on the Airport site as well as works that occur on land and water outside the Airport boundary (such as drainage channels and the approach lighting structure) and works associated with infrastructure connections including rail, road and power. Section 3.5 discusses the relevant State approvals likely to be required for the project in areas outside of the Airport boundary.

The proposal would also trigger the EPBC Act as a Commonwealth action / land and also as it is likely to significantly impact on matters of National Environmental Significance.

Approvals for an airport at the Wilton Study Area would be required to address the following Commonwealth and NSW legislation.

3.3 Commonwealth legislation

Commonwealth legislation which is liable to be activated by, or to be influential upon, an airport development at the Wilton Study Area includes:

- *Airports Act 1996; and*
- EPBC Act.

The approvals from the Australian Government which would be required for the Project under this legislation are discussed in the following Sections.

3.3.1 Airports Act 1996

The following approvals are required for an airport development which is regulated under the *Airports Act 1996*.

- Approval of a MDP;
- Approval for building activities under the Airports (Building Control) Regulations; and
- Approval for controlled activities under the Airports (Protection of Airspace) Regulations.

Under the *Airports Act 1996*, the proposal would require referral to the Australian Government Minister for the DSEWPaC under Section 160 of the EPBC Act. Guidelines for the EIS would be issued which would address the potential impacts of the project on all aspects of the environment including the matters of National Environmental Significance discussed in Section 3.3.2.1. As a consequence of this, Section 130 (1B) of the EPBC Act, which would otherwise require a notice from NSW about the assessment of other impacts on the environment (for on-airport matters), is not required because of the exemption under Section 130 (1E) of the EPBC Act.

Additionally, under the *Airports Act 1996*, a MDP is required to be approved by the Australian Government Minister for Transport in relation to each major airport development. The Proposal, which could be conducted in stages, would potentially be within the ambit of a major airport development as defined in the *Airports Act 1996* by virtue of Section 89(1) which refers to:

> *"(a) constructing a new runway"*
>
> *(c) constructing a new building wholly or principally for use as a passenger terminal, where the building's gross floor space is greater than 500 square metres; or*
>
> *(e) constructing a new building, where:*
>
>> *(i) the building is not wholly or principally for use as a passenger terminal; and*

(ii) the cost of construction exceeds $20 million or such higher amount as is prescribed; or

(f) constructing a new taxiway, where:

(i) the construction significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft; and

(ii) the cost of construction exceeds $20 million or such higher amount as is prescribed; or

(h) constructing a new road or new vehicular access facility, where:

(i) the construction significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft; and

(ii) the cost of construction exceeds $20 million or such higher amount as is prescribed; or

(j) extending a road or vehicular access facility, where:

(i) the extension significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft; and

(ii) the cost of construction exceeds $20 million or such higher amount as is prescribed; or

(k) constructing a new railway or new rail handling facility, where:

(i) the construction significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft; and

(ii) the cost of construction exceeds $20 million or such higher amount as is prescribed; or

m) a development of a kind that is likely to have significant environmental or ecological impact; or

(n) a development of a kind that is likely to have a significant impact on the local or regional community"

Section 90 of the *Airports Act 1996* provides that major Airport developments must not be carried out except in accordance with an approved MDP. Among the matters that must be addressed in an MDP (Section 91 (1) (h)) are:

"...the Airport-lessee company's assessment of the environmental impacts that might reasonably be expected to be associated with the development."

An MDP would therefore need to be prepared in accordance with, and in order to meet, the requirements of the *Airports Act 1996* as outlined above.

3.3.2 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's key piece of environmental legislation which commenced 16 July 2000 therefore, was not included in the impact assessment of the Wilton site conducted in 1985. The EPBC Act is administered by the Commonwealth DSEWPaC.

The EPBC Act enables the Australian Government to focus on environment and heritage protection and biodiversity conservation through the protection of matters of National Environmental Significance, with the states and territories having responsibility for matters of state and local significance. The EPBC Act also requires the Australian Government to determine impacts of proposed actions conducted by the Commonwealth and / or on Commonwealth land.

3.3.2.1 Matters of National Environmental Significance

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of National Environmental Significance, require approval from the Australian Government Minister for DSEWPaC (the Minister). The Minister will decide whether assessment and approval is required under the EPBC Act.

The eight matters of National Environmental Significance protected under the EPBC Act are:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mines).

Other matters protected include:

- The environment, where actions proposed are on, or will affect Commonwealth land and the environment; and
- The environment, where Commonwealth agencies are proposing to take an action.

The EPBC Act is triggered as the Department is proposing to take an action (i.e. develop an airport) and the proposed site at Wilton also contains listed threatened species and ecological communities under the EPBC Act.

Three categories exist for listing threatened flora and fauna and threatened ecological communities under the EPBC Act:

- Critically endangered;
- Endangered; and
- Vulnerable.

3.3.2.2 EPBC Referral

The first stage in the Commonwealth Approvals Process under the EPBC Act is to prepare an EPBC Referral to the Minister. The referral would need to be prepared in accordance with the *Significant impact guidelines 1.2 Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* (DSEWPaC 2010).

Following the receipt of a valid referral, the Minister has 20 business days to decide if the proposed action triggers the matters protected by the EPBC Act and requires a formal assessment and approval.

As part of the 20 business days, the EPBC Act provides a public comment period of 10 business days (with no extensions). This provides an opportunity for relevant Australian, State and Territory government ministers and members of the public to comment on the proposed action.

At the end of the 20 business days, the Department will advise of the outcome of the referral and whether or not formal assessment and approval under the EPBC Act is required. The decision will also be available on the public notices page.

During the decision process (including comments from the public) the Minister can make one of three decisions:

- Not controlled action: the proposed action is not likely to be significant, approval is not required if the action is taken in accordance with the referral. Consequently, the action can proceed (subject to any State or local government requirements);
- Not controlled action - "*particular manner": i*f the proposed action is not likely to be significant if undertaken in a particular manner, approval is not required; and
- Controlled action.

If the proposed action is likely to be significant, it is called a "*controlled action"*. The matters which the proposed action may have a significant impact on (e.g. threatened species) are known as the "*controlling provisions*".

Given the nature of the action and the possibility of significant impacts to threatened species, it is likely the proposed action will require approval and would be subject to the formal assessment and approval process. The type of environmental impact assessment would be decided and Draft Guidelines issued.

3.3.3 EIS and MDP Guidelines

It is likely that the Minister would decide that the environmental impact assessment approach to address the EPBC Matters of National Environmental Significance and MDP approvals would be the environmental impact process provided for under the EPBC Act and issue Draft guidelines for an EIS for public input prior to finalizing. Thus, the assessment approach in relation to the matters of National Environmental Significance and to the MDP would be the same environmental impact process. This assumption is based on the decision made by the DSEWPaC on the EIS/MDP preparation for the Brisbane Parallel Runway Project.

Guidelines for the environmental impact statement would be required to address the potential impacts of the project on all aspects of the environment including the matters of National Environmental Significance previously referred to. As a consequence of this, Section 130 (1B) of the EPBC Act, which would otherwise require a notice from NSW about the assessment of other impacts on the environment (for on-airport matters), is not required because of the exemption under Section 130 (1E) of the *EPBC Act.*

An assessment of criteria listed by the *EPBC Act* 1999 for a *"significant impact"* against the matters of National Environmental Significance would be required in an EIS.

3.3.3.1 Preparation of EIS and MDP

The EIS would need to be prepared in accordance with the guidelines referred to above and is likely to include the following:

- Background and need:
    - Background;
    - Need for the project;
    - Options and alternatives;
    - Project description;
    - Community consultation; and
    - Sustainability;
- Airport and surrounds
    - Context and project description;

- Land use and planning;
- Geology, soils and groundwater;
- Hydrology and water quality;
- Terrestrial and aquatic ecology;
- Cultural heritage;
- Social impact assessment;
- Surface transport;
- Air quality;
- Noise and vibration;
- Landscape and visual; and
- Environmental management framework;

- Airspace
    - Background to airspace architecture;
    - airspace architecture;
    - Noise;
    - Air;
    - Human health;
    - Hazards and risks; and
    - Social.

In terms of legislative requirements, the EIS would need to ensure that the construction and operation of an airport at Wilton would meet National Environment Protection Measures (NEPMs) defined in the *National Environment Protection Council Act 1994* as well as NSW Government requirements in the surrounding area (see Section 3.5).

3.3.3.2 Combined EIS/MDP Report

As requirements for the EIS and MDP documents overlap it would be recommended to develop a single document that responded fully to the requirements of all relevant legislation, as was the case with the Brisbane New Parallel Runway Project.

It would also be recommended to create a *"Core Project Team"* for development of the Draft EIS/ MDP which was an apparently successful approach used to develop the EIS/MDP for the Brisbane New Parallel Runway Project.

3.3.3.3 Sustainability assessment

The EIS/MDP would also need to present details of how the development of an airport is consistent with the principles of ecologically sustainable development as defined in Section 3A of the EPBC Act and other relevant documents. In addition, the National Strategy for Ecologically Sustainable Development would also need to be considered.

3.3.3.4 Community consultation

Part of the approval process for the MDP under the *Airports Act 1996* is the requirement that the Draft MDP be made available for public comment for 90 days.

3.3.3.5 Supplementary Report

Once the 90 day public consultation period has passed, a Supplementary Report to the Draft EIS and MDP would need to be prepared that addresses all comments received during the public comment period. The Draft EIS/MDP and the Supplementary Report would then form the Final EIS.

3.3.3.6 Approval of EIS/MDP

Approval of the MDP is required under the *Airports Act 1996* and the approval of controlled actions under the EPBC Act.

The process for approval of the MDP is contained in the *Airports Act 1996*. In addition, s160 of the EPBC Act requires the Australian Government Transport Minister to obtain and consider advice from the Australian Government Minister for Environment and Heritage before giving approval to the MDP (Section 160(1)).

After completion of the assessment report regarding the EIS, the Minister would provide advice to the Minister for Infrastructure and Transport which will state:

- If the MDP should be approved;
- Any conditions which should be attached to protect the environment; and
- Any other matter relating to protection of the environment concerning the MDP.

In making a decision about the MDP, the Minister for Infrastructure and Transport must consider the advice provided by the Minister and must subsequently report to that Minister the decision made and if that Minister's advice was not followed an explanation.

The environmental assessment undertaken and presented in the Draft EIS/MDP should provide:

- The Minister with sufficient information to decide whether to approve the EIS for the purposes of the EPBC Act;
- The Minister with sufficient information to provide advice to the Minister for Infrastructure and Transport before that Minister can approve the MDP (this is a requirement of the EPBC Act);
- The Minister for Infrastructure and Transport with sufficient information to decide whether to approve the MDP for the purposes of the *Airports Act 1996*; and
- To enable the Airport to proceed to construction.

In addition, the EIS/MDP assessment will provide the Minister with information to provide advice to Airservices Australia before it can adopt and implement airspace requirements which are likely to have a significant impact on the environment (again, a requirement of the EPBC Act).

3.4 Aviation approvals

The second step in the process is approval for the adoption and implementation of a number of aviation operational buildings, instruments and procedures including:

- Final detailed procedures, including flight tracks to be operated after the airport becomes operational submitted to OAR for assessment;

- Building Approvals Under the Airports (Building Control) Regulations;
- Controlled Activities Approvals Under the Airports (Protection of Airspace) Regulations;
- Determinations may be made by Airservices Australia relevant to aviation airspace management; and
- CASA Regulations.

3.4.1 Approval by the Office of Airspace Regulation (OAR)

Approval for the adoption and implementation of airspace requirements by the Office of Airspace Regulation (OAR), currently a division of CASA, is the next step in the approvals process. The role of OAR is to exercise authority for airspace and environment responsibilities as defined with prescribed legislation including:

- *Airspace Act 2007;*
- *Airspace Regulations 2007;* and
- EPBC Act 1999.

Official adoption of the design to allow a new airport to become operational cannot occur until the construction of the runway is approved and final detailed specifications (e.g. exact elevation, length, width, alignment, coordinates of thresholds and extent of navigation aids) are fully known. This would not happen until the new airport/runway is close to completion. At this time, detailed procedures for the flight tracks are designed by experts who must be certified by CASA to undertake such design.

Those final detailed procedures, together with the new flight tracks to be operated after the airport becomes operational, would be submitted to OAR for assessment. A detailed Safety Case and Environmental Assessment would be undertaken closer to the completion of the construction of the airport. The OAR would take into account the environmental assessment contained in the EIS/MDP in making its assessment. Additionally, the detailed design of the new airspace just prior to the airport becoming operational would be based on the flight tracks and procedures outlined in the EIS/MDP.

The OAR assessment is based on a number of criteria, including:

- Safety implications;
- ICAO obligations;
- Environment considerations;
- Consultation and cooperation;
- Government policy; and
- Promoting and fostering civil aviation.

If OAR decides to approve the airspace requirements, the following occurs:

- Advice is issued through the Aeronautical Information Service process;
- Industry training will occur as required; and
- The changes are made available on OAR website.

3.4.2 Building approvals under the Airports (Building Control) Regulations

The proposal for an airport at Wilton would involve a number of building activities which are described in Section 98 of the *Airports Act 1996*. The proponent is required to obtain an approval under these regulations in relation to each building activity. It is anticipated that the following building activities will be involved:

- Constructing buildings or other structures (Section 98(1)(a));
- Undertaking, constructing or altering earth works (Section 98(1)(c)); and
- Undertaking, constructing or altering engineering works, electrical works or hydraulic works (Section 98 (1) (d)).

For an existing airport, these approvals are issued by the Airport Building Controller (ABC). However for a new airport the ABC may be appointed under Part 4 4.01 of the *Airports (Building Control) Regulations 1996* as:

> *"(a) an authority of the Commonwealth, or of the State in which the airport site is located; or*
>
> *(b) a local government body*
>
> *(c) an individual, a body or a corporation"*

3.4.3 Controlled activities approvals under the Airports (Protection of Airspace) Regulations

Part 12 of the *Airports Act 1996* deals with Airspace which is declared in the interests of safety, efficiency or regularity of air transport operations, to be prescribed airspace. It identifies activities known as '*controlled activities'* which result in intrusions into that prescribed airspace which require approvals. The approval procedures for controlled activities are determined by the *Airports (Protection of Airspace) Regulations 1996*.

3.4.4 Airspace approvals – Airservices Regulations

There are two relevant determinations that may be made by Airservices Australia relevant to aviation airspace management and which would be a consequence of any proposed airport at Wilton. These are:

- The designation of air routes and their determination of conditions of use for those air routes (regulation 2.02); and
- The determination about volumes of airspace being within particular classes from the Chicago Convention on International Civil Aviation, a determination of flight information areas or regions or control areas or zones (regulation 2.04).

Relevant determinations about these matters are made having regard to operational requirements for a new airport. These determinations may not be strictly categorized as *"authorisations"* for the purposes of Section 160 (1) of the EPBC Act although they would need to be submitted to the Minister for the Minister's advice under Section 160.

3.4.5 Civil Aviation Safety Regulations

Flight procedures would need to be prepared to allow for the operation of a new airport. These procedures include terminal instrument flight procedures which are referred to in Subpart 173.A of the *Civil Aviation Safety Regulations, 1998*. That subpart provides for the standards that apply to the design of instrument flight procedures and applies to persons who design instrument flight procedures and those who are or wish to become certified or authorised designers of terminal instrument flight procedures.

Under this part, CASA may issue procedure design certificates or procedure design authorisations which will generally allow the holder to carry out design work on a terminal instrument flight procedure.

3.5 NSW approvals and local planning

There are several pieces of legislation that are relevant to the NSW approvals process. The type of approval process would depend on whether the NSW Minister for Infrastructure and Planning (the Planning Minister) listed the off-site infrastructure associated with an airport (such as roads, railway, and power) as Critical State Significant Infrastructure.

The legislation discussed below may or may not be triggered during preparation of an EIS, depending on how the NSW Government wishes to proceed with approvals.

- *Environmental Planning and Assessment Act 1979;*
- *Threatened Species Conservation Act 1995;*
- *Fisheries Management Act 1994;*
- *National Parks and Wildlife Act 1974;*
- *Native Vegetation Act 2003;*
- *Heritage Act 1977;*
- *Sydney Water Catchment Management Act 1998;*
- *Catchment Management Authorities Act 2003;*
- *Water Management Act 2000;*
- *Mining Act 1992;*
- *Protection of the Environment Operations Act 1997; and*
- *Contaminated Land Management Act 1997.*

3.5.1 Environmental Planning and Assessment Act 1979

The EP&A Act establishes the system of environmental planning and assessment in NSW. The former Part 3A of the EP&A Act prescribed the environmental impact assessment for those developments classified as major projects. Part 4.1 of the EP&A Act now deals with State Significant Development (SSD), while State Significant Infrastructure (SSI) is assessed under the provisions of Part 5.1 of the EP&A Act.

Projects that fall under either of these categories are assessed by the Department of Planning and Infrastructure (DoPI). For the purposes of the following discussion, it is assumed that the application of NSW planning and approvals legislation would mostly be for the area surrounding the airport footprint and for infrastructure associated with the Proposal.

3.5.1.1 State Environmental Planning Policies

Relevant State Environmental Planning Policies (SEPPs) that apply to a proposed airport site at Wilton include:

- State Environmental Planning Policy (State and Regional Development) 2011;
- State Environmental Planning Policy (Infrastructure) 2007;
- State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011; and
- State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44).

3.5.1.1.1 State Environmental Planning Policy (State and Regional Development) 2011

Construction of new road, rail (passenger) and power infrastructure is not listed in Schedule 3 or 4 of the State Environmental Planning Policy (State and Regional Development) 2011 as SSD or SSI. Certain road and rail projects however have been listed as Critical State Significant Infrastructure by the Planning Minister. Proposals can also be listed as Staged Infrastructure.

Critical State Significant Infrastructure

Any SSI application can also be declared to be Critical State Significant Infrastructure (CSSI) if the Planning Minister believes the infrastructure is essential for the State for economic, environmental or social reasons.

An application for a CSSI project can be lodged without the consent of landowners.

Staged Infrastructure

Staged Infrastructure refers to an application for SSI that sets out concept proposals for the proposed infrastructure and where separate proposals for different parts of the development will require separate approvals from the Minister.

This means the Minister has the power to consider applications that only have detailed proposals for the first stage of the development.

However, the granting of an approval for the first stage of development does not authorise the development of further stages unless subsequent, detailed applications have been submitted for the Minister's approval.

Water storage, water treatment facilities and pipelines are listed as SSI.

Assessment of SSI proposals

An application that describes the infrastructure project to the Director-General of Planning and Infrastructure must be lodged. The Director-General will then prepare site-specific environmental assessment requirements (DGRs) which the proponent must address in an EIS. In preparing the DGRs, the Director-General must consult with relevant public authorities such as the Office of Environment and Heritage (OEH). Importantly, the Director-General can modify these requirements at a later date, simply by providing written notice of the modifications to the proponent.

The proponent then prepares and submits an EIS to the Director-General. The Director-General can ask the proponent to revise the EIS to address certain matters.

Public exhibition and submissions

Once the Director-General is satisfied with the EIS, it will be placed on public exhibition for a minimum of 30 days. During this exhibition period, any person or public authority may comment on the EIS.

The Director-General must then submit either the submissions or a report on the issues raised by the submissions to the proponent and any other public authority that the Director-General considers appropriate, including OEH if the SSI will require an environment protection licence.

The Director-General may require the proponent to respond to the issues raised by the submission and/or lodge a 'preferred infrastructure report' that outlines any proposed changes to the development to minimise its environmental impact or to deal with any other issue raised.

If the Director-General believes that these proposed changes to the SSI are significant, he or she may make the preferred infrastructure report available to the public, but this is discretionary.

Documents relating to SSI applications must be made publicly available on the DoPI website or by an electronic link on the DoPI website to the document on another website for a minimum of 30 days.

The Planning Minister is the consent authority for all SSI projects.

The Director-General is required to prepare an environmental assessment report which must be considered by the Planning Minister during the decision-making process.

The Planning Minister may then decide whether or not to approve the project. The Minister can approve the project with modifications, and can grant an approval subject to any conditions that the Minister thinks fit.

For example, the Minister can make it a condition of consent that the proponent acquires BioBanking credits that are to be retired as part of the proposal, and to comply with the conditions of a BioBanking statement.

Landholder's consent

SSI projects are often proposed over land that is privately owned. Where this is the case, landholder consent is required before the project can go ahead unless:

- The application is made by a public authority;
- It is a critical SSI project; or
- The SSI relates to linear transport or utility infrastructure.

If landholder consent is not required, the proponent must still notify the landholder of the proposal in writing no later than fourteen days after lodging the SSI application, or by an advertisement published in a newspaper circulating in the area in which the SSI is to be carried out at least fourteen days before the EIS relating to the SSI is placed on public exhibition.

Relevance to Local Environmental Plans

Local environmental plans (LEPs) and SEPPs do not apply to SSI except in very limited circumstances (i.e. where they apply to the declaration of infrastructure as SSI or as CSSI).

Relevance to other environmental legislation

SSI projects do not require a range of additional authorisations that would ordinarily be needed before the project could proceed. For example, they do not require:

- An Aboriginal heritage impact permit;
- A permit to clear native vegetation;
- A bushfire safety authority; and
- A water use approval.

In addition, where consent has been granted for a SSI development, a number of additional approvals must be granted if they are necessary for carrying out the approved SSI and are substantially consistent with the SSI approval, including an environment protection licence which would be required prior to construction commencing.

3.5.1.1.2 State Environmental Planning Policy (Infrastructure) 2007

The *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across NSW by a range of initiatives, including:

- Improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services; and
- Providing greater flexibility in the location of infrastructure and service facilities.

Clause 22 (1) of the Infrastructure SEPP states development for the purpose of an airport may be carried out by or on behalf of a public authority without consent on land in any of the following land use zones or in a land use zone that is equivalent to any of those zones:

(a) RU1 Primary Production;

(b) RU2 Rural Landscape,

(c) IN4 Working Waterfront;

(d) SP1 Special Activities;

(e) SP2 Infrastructure;

(f) W2 Recreational Waterways;

(g) W3 Working Waterways.

Additionally, Clause 23 states that development for any of the following purposes may be carried out with consent on land within the boundaries of an existing air transport facility, if the development is ancillary to the air transport facility:

(a) passenger terminals;

(b) facilities for the receipt, forwarding or storage of freight;

(c) hangars for aircraft storage, maintenance and repair;

(d) premises for retail, business, recreational, residential or industrial uses.

Clause 94(1) of the Infrastructure SEPP states that development for the purpose of a road or road infrastructure may be carried out by, or on behalf of, a public authority without consent on any land, with the exception of certain development on land reserved under the *National Parks and Wildlife Act 1974*. As the land which would be affected by an airport development is not reserved under the *National Parks and Wildlife Act 1974*, the proposal is permissible without consent under the provisions of the Infrastructure SEPP.

Clause 79 (1) states development for the purpose of a railway or rail infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land.

Clause 41 (1) states that development for the purpose of an electricity transmission or distribution network may be carried out by or on behalf of an electricity supply authority or public authority without consent on any land.

Clauses13 to 16 of the Infrastructure SEPP state that development that may have significant impact on council infrastructure or services, heritage items, flood-liable land or public authorities other than council may require consultation with council. Key agencies, particularly Council, have been consulted during design development and the environmental assessment process (see Section 3.5); consultation will continue throughout detailed design and construction.

3.5.1.1.3 State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

Under the EP&A Act, the *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*, which commenced on 1 March 2011, aims to:

- Provide for healthy water catchments that will deliver high quality water while permitting development that is compatible with that goal;
- Provide that a consent authority must not grant consent to a proposed development unless it is satisfied that the proposed development will have a neutral or beneficial effect on water quality; and
- Support the maintenance or achievement of the water quality objectives for the Sydney drinking water catchment.

The implications of this SEPP are that

> *"a consent authority must not grant consent to a proposed development unless it is satisfied that the proposed development will have a neutral or beneficial effect on water quality. This must be demonstrated using the Neutral or Beneficial Effect on Water Quality Assessment Guideline 2011 (**NorBE Guideline)** prepared by the Authority and the **NorBE Tool** set out in Appendix 1 to the NorBE Guideline."*

Any development within the Sydney Drinking Water Catchment Area would have to demonstrate that water quality will not be negatively impacted. This is further discussed in Section 3.5.7.

3.5.1.1.4 The State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)

Koala (*Phascolarctos cinereus*) populations in Queensland, NSW and the Australian Capital Territory have recently (2 May 2012) been listed as vulnerable under the EPBC Act. The Koala is also listed as vulnerable under the *Threatened Species Conservation Act 1995* (TSC Act). As discussed in the Working Paper *Flora, Fauna and Ecological Impacts*, the entire Wilton Study Area is potential Koala habitat and Koalas have been sighted in the Study Area. Additionally, the western-most options would impact the Cumberland Koala Linkage which is a Koala and other fauna species movement corridor. The Working Paper *Flora, Fauna and Ecological Impacts* discusses the requirements for assessing impacts to threatened species and approvals required.

3.5.1.2 Wollondilly LEP

The provisions of the Wollondilly LEP, and the consent of Wollondilly Shire Council, would not apply to the proposal if it is listed as CSSI or Staged Infrastructure. Additionally if the proposal is conducted under the Infrastructure SEPP, Clause 94(1) states that the consent of Council is not required.

3.5.2 Threatened Species Conservation Act 1995

The TSC Act identifies threatened species, populations, ecological communities (TECs), critical habitats and key threatening processes, with the exception of fish and marine plants, which are protected under Part 7A of the *Fisheries Management Act 1994* (see below).

All terrestrial threatened species, populations and ecological communities are listed in Schedules to the TSC Act. OEH administers the TSC Act, but the Schedules are maintained by an independent Scientific Committee.

The TSC Act provides for the identification, conservation and recovery of threatened species and their populations and ecological communities, but it does not contain a specific approval regime. Instead, the Act is integrated with regulatory procedures under both the EP&A Act and the *National Parks and Wildlife Act 1974*. This allows for integration of threatened species assessment into the planning system and removes the requirement to obtain a separate threatened species licence in addition to development consent or project approval under the EP&A Act.

Section 5A of the EP&A Act requires that for the purposes of the Act, consideration of whether the proposal is likely to impact on threatened species, populations or ecological communities is required. It establishes seven factors on which this assessment must be based (the *'Seven Part Test'*). Where a significant impact is considered likely, a Species Impact Statement (SIS) must be prepared. The SIS would then be considered in and submitted with the EIS.

Under Section 91 of the TSC Act, the Director-General may grant a licence authorising a person to take action which is most likely to result in harm to any animal that is of, or is part of, a threatened species, population or ecological community. A licence under Section 91 of the TSC Act is not required for the carrying out of an activity by or in accordance with an approval by a determining authority within the meaning of Part 5 of the EP&A Act if the determining authority has complied with that Part.

Recent amendments to the TSC Act also provide for developers to provide native vegetation offsets where their activities will lead to impacts on biodiversity values (the *'BioBanking Scheme'*). The OEH is currently undertaking a pilot for the BioBanking Scheme. Under the Scheme, developers may be required to purchase and retire sufficient biodiversity credits to ensure that the impact of their development on biodiversity values is fully offset, as well as to take onsite measures to minimise any negative impact on biodiversity values.

Recent amendments to the EP&A Act provide that the Planning Minister may approve SSI subject to a condition that requires the proponent to acquire and retire (in accordance with the TSC Act) biodiversity credits of a number and class specified by the Minister (see Section 115ZC EPAA).

The TSC Act also is aimed at reducing the threats faced by threatened species. One initial step in doing this is for the Scientific Committee established under the Act to list what are termed *'key threatening processes'*. These are processes that could:

- Adversely affect threatened species, populations or ecological communities, or
- Cause species, populations or ecological communities that are not threatened to become threatened.

Clearing of native vegetation is listed as a key threatening process in Schedule 3 of the TSC Act. A range of threatened species and ecological communities are known to occur in the region and this is discussed further in the Working Paper *Flora, Fauna and Ecological Values*.

A SIS is required under Sections 109 to 113 of the TSC Act (terrestrial species) for a proposed activity that:

- Would have a significant effect on threatened species, populations or ecological communities or their habitats; or
- Adversely affect threatened species, populations or ecological communities.

The following directions, orders or notices cannot be made or given so as to prevent or interfere with the carrying out of approved CSSI:

> *(a) an interim protection order (within the meaning of the National Parks and Wildlife Act 1974 or the Threatened Species Conservation Act 1995); or*
>
> *(b) an order under Division 1 (Stop work orders) of Part 6A of the National Parks and Wildlife Act 1974, Division 1 (Stop work orders) of Part 7 of the Threatened Species Conservation Act 1995 or Division 7 (Stop work orders) of Part 7A of the Fisheries Management Act 1994.*

Consideration of the effect of the project on critical habitat and threatened species, populations and communities is included the Working Paper *Flora, Fauna and Ecological Values*.

3.5.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* contains provisions for the identification and protection of threatened species, populations and ecological communities of marine and freshwater fish and aquatic plants. These provisions are parallel to those in the TSC Act covering terrestrial species, including the concepts of threatened species, key threatening processes, recovery plans and a Scientific Committee. The *Fisheries Management Act 1994* is also integrated with the EP&A Act in a similar way as is the TSC Act.

The provisions of the *Fisheries Management Act 1994* cover all fish (freshwater, estuarine and marine), aquatic invertebrates and marine plants. The definition of fish includes any marine, estuarine or freshwater fish or other aquatic animal (e.g. oysters, prawns, sharks, rays, starfish, insects and worms), at any stage of their life history. It does not include whales, mammals, birds, reptiles and amphibians.

Part 7 of the *Fisheries Management Act 1994* requires a permit for a number of activities, including those involving dredging and reclamation work and those involving harm to marine vegetation.

In accordance with Section 115ZG of the EP&A Act, a permit under Section 201, 205 or 219 of the *Fisheries Management Act 1994*, is not required for approved SSI. Additionally, the following directions, orders or notices cannot be made or given so as to prevent or interfere with the carrying out of approved CSSI:

> *(a) an interim protection order (within the meaning of the National Parks and Wildlife Act 1974 or the Threatened Species Conservation Act 1995); or*
>
> *(b) an order under Division 1 (Stop work orders) of Part 6A of the National Parks and Wildlife Act 1974, Division 1 (Stop work orders) of Part 7 of the Threatened Species Conservation Act 1995 or Division 7 (Stop work orders) of Part 7A of the Fisheries Management Act 1994.*

A SIS is required under Sections 221J and 221K of the *Fisheries Management Act 1994* (aquatic species) for a proposed activity that:

- Would have a significant effect on critical habitat of flora or fauna; or
- Would have a significant effect on threatened species, populations or ecological communities or their habitats.

Consideration of the effect of the project on aquatic habitat and threatened species is included in the Working Paper *Flora, Fauna and Ecological Values*.

Thus, a development application which is likely to significantly affect a threatened species of fish will require a species impact statement to accompany the development application. Instead of requiring the concurrence of the Environment Minister, the concurrence of the Minister for Primary Industries will be required.

Threatened species are known to occur in the region and this is discussed further the Working Paper *Flora, Fauna and Ecological Values*.

3.5.4 National Parks and Wildlife Act 1974

The principal approvals under the *National Parks and Wildlife Act 1974* that would affect development of the Wilton site are approvals under Part 6 of that Act to conduct Aboriginal archaeological surveys (Section 87 permits) or to damage or destroy Aboriginal sites or objects (Section 90 consents). These approvals are granted by the OEH.

If development activities are likely to destroy damage or deface an Aboriginal object or site, the proponent must first obtain consent under Section 90, or else risk prosecution for the offence. In considering whether to issue this consent, OEH takes into account the:

- Significance of the Aboriginal object(s) or Aboriginal site(s) to be impacted;
- Effect of the proposed impact and the mitigation measures proposed;
- Justification of the proposed impacts; and
- Outcomes of the Aboriginal community consultation regarding the proposed impact and conservation outcomes.

To avoid the risk of prosecution for inadvertently damaging an Aboriginal site or object, proponents must first conduct site surveys, including surface and occasionally subsurface investigations. Before disturbing or excavating land to look for an Aboriginal object, or disturb or move an Aboriginal object, they must obtain a permit under Section 87. In considering whether to issue a Section 87 permit, OEH takes into account the:

- Views of the Aboriginal community about the proposed activity;
- Objectives and justification for the proposed activity; and
- Appropriateness of the methodology to achieve the objectives of the proposed activity.

Parts of the Wilton Study Area are close to or directly adjacent to within the system of parks and reserves managed by the National Parks and Wildlife Service (now part of OEH) e.g. the Upper Nepean State Conservation Area.

In accordance with Section 115ZG of the EP&A Act, an Aboriginal heritage impact permit under Section 90 of the *National Parks and Wildlife Act 1974* is not required for approved SSI. Additionally, the following directions, orders or notices cannot be made or given so as to prevent or interfere with the carrying out of approved CSSI:

> *(a) an interim protection order (within the meaning of the National Parks and Wildlife Act 1974 or the Threatened Species Conservation Act 1995); or*
>
> *(b) an order under Division 1 (Stop work orders) of Part 6A of the National Parks and Wildlife Act 1974, Division 1 (Stop work orders) of Part 7 of the Threatened Species Conservation Act 1995 or Division 7 (Stop work orders) of Part 7A of the Fisheries Management Act 1994.*

3.5.4.1 Upper Nepean State Conservation Area

The Upper Nepean State Conservation Area was created in February 2007 and covers an area of 25,237 hectares.

State Conservation Areas are lands reserved to protect and conserve significant or representative ecosystems, landforms, natural phenomena or places of cultural significance, while providing opportunities for sustainable visitation, enjoyment, use of buildings and research.

The principal difference between the management, objectives and principles of national parks and state conservation areas is that mineral and petroleum exploration and mining may be permitted in State Conservation Areas.

The airport footprint is not expected to impact the Upper Nepean State Conservation Area. However, there are Guidelines for developments adjoining land and water managed by the OEH for use by councils and other consent authorities when assessing development applications that may impact on areas managed by OEH (NPWS).

3.5.5 Native Vegetation Act 2003

The *Native Vegetation Act 2003* regulates the clearing of native vegetation outside national parks, conservation areas, state forests and reserves and urban areas (as defined in Schedule 1 to the Act).

Section 25(g) of the Act provides that any clearing that is, or is part of, an activity carried out by a determining authority within the meaning of Part 5 of the EP&A Act does not require approval for the clearing of native vegetation if the determining authority has complied with that Part.

Section 25 of the *Native Vegetation Act 2003* lists clearing that is authorised under other legislation. Once clearing is authorised under an Act listed in section 25 it does not require approval under the *Native Vegetation Act 2003.*

The Act requires development approval from the relevant Zone Management Authority for the clearing of any native vegetation. Approval can only be granted under the Act for proposals that improve or maintain environmental outcomes.

A review of the regulations for the *Native Vegetation Act 2003*, including the *Native Vegetation Regulation 2005*, the Environmental Outcomes Assessment Methodology (EOAM) and the Private Native Forestry Code of Practice (PNF Code) is currently being conducted.

In accordance with Section 115ZG of the EP&A Act, an authorisation referred to in Section 12 of the *Native Vegetation Act 2003* (or under any Act repealed by that Act) to clear native vegetation or State protected land, is not required for approved SSI.

3.5.6 Heritage Act 1977

Under Section 57 of the *Heritage Act 1977*, an approval must be obtained for works, which have the potential to interfere with a heritage item or place, which is either listed on the State Heritage Register or the subject of an interim heritage order. The Working Paper *European Cultural Value* discusses Heritage issues.

In accordance with Section 115ZG of the EP&A Act, an approval under Part 4, or an excavation permit under Section 139, of the *Heritage Act 1977*, is not required for approved SSI. Additionally, Division 8 of Part 6 of the *Heritage Act 1977* does not apply to prevent or interfere with the carrying out of approved SSI.

3.5.7 Sydney Water Catchment Management Act 1998

The *Sydney Water Catchment Management Act 1998* establishes the Sydney Catchment Authority (SCA) to manage and protect Sydney's water catchment areas. The *Sydney Water Catchment Management Act 1998* sets out the principal objectives of the SCA as being:

- To ensure that the catchment areas and the catchment infrastructure works are managed and protected so as to protect water quality, protect public health and safety, and protect the environment;
- To ensure that water supplied by the SCA complies with appropriate standards of quality;
- Where SCA activities affect the environment, to conduct its activities in compliance with the principles of ecologically sustainable development; and
- To manage SCA's catchment infrastructure works efficiently and economically and in accordance with sound commercial principles.

Areas surrounding SCA dams and storages are subject to additional management measures to especially protect the quality of water. These areas, known as Special Areas, are lands declared under the *Sydney Water Catchment Management Act 1998* for their value in protecting the quality of the raw water used to provide drinking water to greater Sydney and for their ecological integrity. The SCA manages around 3,700 sq. km of Special Areas.

SCA states that the Special Areas are a critical element in its multi-barrier approach to protecting drinking water quality. This approach includes managing the hydrological catchments, the storages, quality treatment and delivery of water to retail customers. The Special Areas essentially act as a filtration system for water entering water storages by reducing nutrients, sediments and other substances that can affect water quality. The ecological integrity of the Special Areas is therefore important in their role of protecting water quality.

The Special Area within the area of the proposed Wilton site includes the Metropolitan Special Area. This includes all land draining to Pheasants Nest Weir on the Nepean River or Broughtons Pass Weir on the Cataract River (a total of 89,000 ha). This Special Area includes the Cataract Dam (upstream of Broughtons Pass Weir) and the Cordeaux, Avon and Nepean Dams (upstream of Pheasants Nest Weir) which are all within the Upper Nepean catchment.

Under the *Sydney Water Catchment Management Act 1998*, public agencies must first give notice to SCA of their intention to exercise their functions within a Special Area, and those agencies may not exercise those functions contrary to any representations that SCA makes except with 28 days' notice (see Section 47 *Sydney Water Catchment Management Act 1998*). The *Sydney Water Catchment Management (General) Regulation 2000* regulates conduct in Special Areas to protect water supply and biodiversity. It categorises Special Area lands as:

- Schedule 1 - No Entry; or
- Schedule 2 - Restricted Access.
- The Metropolitan Special Area is classified as Schedule 1 - No Entry.

The SCA's management approach for the Special Areas is outlined in its *Special Areas Strategic Plan of Management*, which was first adopted by the Government in 2001 and replaced by a fully revised version in February

2007. The SCA and OEH are joint sponsors of the plan. The *Special Areas Strategic Plan of Management* essentially seeks to control impacts on the water supply catchments rather than to control land uses as such. The SCA supports, oversees and regulates planning and development in the catchment to protect catchment health and water quality. They are responsible for implementing the *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011* to regulate development and activities in the catchment. SCA also implement the associated Local Planning Direction 5.2 Sydney Drinking Water Catchments to influence land planning and zoning in the catchment.

3.5.8 Catchment Management Authorities Act 2003

The Hawkesbury-Nepean Catchment Action Plan (CAP) 2007-2016 sets the direction for the activities and investment of the Hawkesbury Nepean CMA and documents management of the catchment with the following goals:

- Improve river health;
- Protect biodiversity; and
- Encourage best practice soil and land management.

These goals are underpinned by *community* and *partnership programs* which build community awareness and capacity, and support Indigenous community involvement.

The CAP is a non-regulatory statutory plan created under the *Catchment Management Authorities Act* 2003 (i.e. its contents are not legally binding or enforceable).

3.5.9 Water Management Act 2000

The *Water Management Act 2000* governs sustainable and integrated management of water sources across the State.

Under the provisions of Section 115ZG (1)(g) of the EP&A Act, *'a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the Water Management Act 2000'* is not required for approved State Significant Infrastructure.

A controlled activity approval is required for certain types of developments and activities that are carried out in or near a designated waterway.

3.5.10 Mining Act 1992

The *Mining Act 1992* permits that underground mining may take place under a mining lease which does not extend all the way to the surface of the land. Most underground mining of coal in the Southern Coalfield takes place on subsurface mining leases, which do not extend to the land surface. The usual exception to this rule is the land around the surface facilities associated with the mine, where a surface mining lease is also obtained.

However, coal miners need access to the surface of land for a variety of reasons, the most important of which is prospecting (i.e. exploration). The *Mining Act 1992* permits prospecting operations (including exploration drilling and seismic surveys) to take place above a subsurface lease with the consent of the landholder, with notice to the Director-General of DPI and subject to any security deposit the Director-General may require.

The other principal means by which a coal mine operator may gain access to the surface to conduct exploration is to obtain an exploration licence under the *Mining Act 1992*. Certain additional rights and responsibilities flow from holding an exploration licence, including the requirement to enter into an access arrangement with any affected landholder.

The Working Paper *Regional Resources and Resource Extraction* addresses the implications of mining and subsidence for a potential airport development.

3.5.11 Protection of the Environment Operations Act 1997

Protection of the Environment Operations Act 1997 (POEO Act) is the primary piece of environmental protection legislation in NSW and is administered by the OEH. Major features of the legislation include protection of the environment policies relating to water quality, air quality, noise emissions, contaminated land and waste disposal impacts. The POEO Act also regulates activities that have potential to cause environmental harm.

Chapter 3 of the POEO Act states that an Environment Protection Licence is required for scheduled activities. Schedule 1 of the POEO Act lists '*scheduled activities*' for which an Environment Protection Licence is required under Sections 48 or 49 of the Act.

Section 115ZH of the EP&A Act provides that an Environment Protection Licence under Chapter 3 of the POEO Act (for any of the purposes referred to in Section 43 of that Act) cannot be refused if it is necessary for carrying out approved SSI.

3.5.12 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* provides a regime for investigating and, where appropriate, remediating land affected by contamination, which represents a significant risk of harm to human health or the environment.

Based on past and present land use, the presence of contaminated soil material is considered unlikely.

3.6 Key findings

A major task will be to ensure the airport proposal meets all the legislative, environmental and technical standards set by the approval agencies. It is recommended rigorous attention to coordination and management of liaison with all stakeholders in order to produce and obtain concurrence for a single set of project approval documents.

There are two steps in the approvals process for a potential airport development in NSW:

- Environmental approvals; and
- Aviation approvals.

3.6.1 Environmental approvals summary

- The environmental approvals pathway for an airport development in NSW is relatively straightforward for the airport footprint which would be conducted under Commonwealth legislation. However, there are several possibilities for approvals required for infrastructure and other development outside of the airport footprint. An EIS would need to be prepared to address both Commonwealth and NSW legislation. A possibility is to prepare an EIS for the airport footprint and immediate surrounds and separate EISs for infrastructure development (under NSW legislation);
- The cooperation of the NSW Government is required for approvals outside of the airport boundary. The development of an airport within the Wilton Study Area would trigger or would potentially be influenced by the following legislation:
  - *Airports Act 1996* (Cwth);
  - EPBC Act (Cwth); and
  - EP&A Act (NSW).
- Under the EPBC Act, a referral for a proposed *"Action"* must be submitted to the DSEWPaC. Due to the likelihood of significant impacts to threatened species and endangered ecological communities, it is likely that

the proposal would be a controlled action and an EIA would be required. A formal decision on the assessment approach would not be made by the Commonwealth Environment Minister or Minister's delegate until the EPBC referral stage;

- Previous airport developments, such as the Brisbane New Parallel Runway Project, have prepared one document that addresses the requirements of the MDP and the EPBC Act. This approach appears to have been successful due to the overlapping requirements of the Department and DSEWPaC;
- Outside the airport footprint, environmental approvals for infrastructure associated with an airport development would be required to address the EP&A Act and other NSW legislation. Section 89(1) of the Airports Act 1996 however also provides for construction of new railways (k) and roads (h). It is not yet fully clear how the application of these clauses would interact with the requirement to prepare an environmental impact assessment under the EP&A Act, particularly the State Environmental Planning Policy (State and Regional Development) 2011 and the State Environmental Planning Policy (Infrastructure) 2007;
- Critical (and Staged) SSI must be declared by the Minister for Infrastructure and Transport. The likelihood of this is uncertain. An Environmental Impact Assessment prepared under Critical SSI would require fewer approvals from stakeholders than an EIS prepared under Part 4 of the EP&A Act. An airport and its supporting infrastructure are considered certain to be considered as Critical (and Staged) SSI.

3.6.2 Aviation approvals summary

A number of aviation approvals are required once the detailed design and the EIS and MDP are completed. The aviation approvals are detailed in Section 3.4 of this Working Paper and include the following approvals under the *Airports Act 1996*:

- Approval of a MDP;
- Approval for building activities under the *Airports (Building Control) Regulations*; and
- Approval for controlled activities under the *Airports (Protection of Airspace) Regulations*.

3.7 References

SEWPAC (2010) Significant impact guidelines 1.2 Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies *Environment Protection and Biodiversity Conservation Act 1999*

Brisbane Airport Corporation (2007) Environmental Impact Statement (EIS) and Major Development Plan (MDP) for New Parallel Runway Project.

4 WORKING PAPER – NATIONAL TRANSPORT POLICY CONTEXT FOR AIRPORT DEVELOPMENT

SUMMARY

This Working Paper outlines the policy context for airport development at Wilton. The purpose of the paper is to identify how the three levels of government (the Commonwealth Government, State Government and Local Government) may have responsibility for different policies relating to airport development.

- The Commonwealth Government has primary responsibility for domestic and international passenger movements and freight movements in Australia;
- However, the construction of an airport at Wilton is likely to require input by NSW Government due to the significant role it conventionally plays in road and rail planning, investment and operation. There are historical challenges in airport development when there is residential development in the area. Therefore, there may be challenges in developing an airport at Wilton due to increasing residential development in the area. For example, there are currently five land-owner nominated sites in Wilton currently under consideration for development by the NSW Government. That being said, the Commonwealth could choose to fund most or all of the land transport infrastructure costs and oversee delivery;
- It is also likely that the private sector may also play roles particularly in terminal / runway construction and airport operations as well as potential subsequent rail links to an airport development at Wilton. The Commonwealth Government began privatising major airports in 1997 with Melbourne, Brisbane, Perth, Adelaide, Canberra and Darwin Airports privatised by 1998, and Sydney Airport privatised in 2002. A number of smaller airports are operated by the private sector on similar long-term leases, for example in 1997 the Linfox Group purchased the lease for the Avalon Airport from the Commonwealth Government. Furthermore, there are a number of airports in Australia that are wholly owned and operated by the private sector or private organisations. While they do not receive regular transport passengers they make up approximately 90% of the airports and airfields in Australia. These airports are usually small aerodromes in holiday or mining areas. The trend for private sector involvement in airport development and operation in Australia suggests that an airport development at Wilton would ultimately involve private sector in its operation in some form; and
- Local Government will also be involved in airport development if this was to occur in the Wilton Study Area, as Wollondilly Council is responsible for zoning of land and smaller scale development approvals in the area, and for local road links.

The area of Wilton is not specifically addressed in Commonwealth and State transport policies. However, the area will be indirectly impacted by a number of plans and policies. Current plans that could most affect the Wilton Study Area include a potential High Speed Rail (HSR) and the Maldon-Dombarton Freight Railway. The Commonwealth Government is currently considering the feasibility of both. However it is not likely that airport development would be the only driver to ensure either development is feasible. Further analysis would be required if either proposal was to be amended to serve an airport development at Wilton, although a preliminary assessment of how this might be done has been made elsewhere herein this study in Working Paper *Land Transport Access*.

4.1 Introduction

4.1.1 Overview

This Working Paper outlines the policy context and government responsibilities relevant for development of an airport in the Wilton area being considered in this assessment.[15] The purpose of the paper is to inform analysis of a potential airport site at or near Wilton and consider the responsibilities of the different levels of government, as well as policies that may directly impact on the successful development of an airport at Wilton.

4.1.2 Contents of Working Paper

The Working Paper commences with an overview of the roles of the Commonwealth, State and Local Government in decisions and funding relating to airport development in the Wilton Study Area.[16] It then identifies and explains policies that may have direct implications for airport development at Wilton. The paper is organised into sections relating to aviation, road, rail and land use.

4.2 Role of Government in airport development

The Commonwealth Government is responsible for international and domestic aviation[17] while the NSW State Government is responsible for the regulation of some intrastate aviation.[18] Any airport development at Wilton that services international and domestic aviation would primarily be regulated by the Commonwealth Government. However, some intrastate routes to the site may be regulated by the NSW Government. The private sector and local governments also own airport sites and as detailed below, it is likely there would be private sector involvement in the operation of an airport at Wilton.

4.2.1 Commonwealth Government

The Commonwealth Government has primary responsibility for aviation policy and airports in Australia including domestic and international passenger movements and freight movements.[19] It should be noted that this responsibility is not specifically defined in the Constitution of Australia, as aviation technology was not in active use at the time of the writing of the Constitution. In 1937, amending the Constitution to give the Commonwealth Government the power to legislate on air navigation and aircraft was put to a referendum - however it failed.[20] This being said, the High Court of Australia has never questioned that the Australian Government should have responsibility for interstate and international aviation.

The planning and development on Commonwealth airport sites such as Sydney Airport is regulated by the Commonwealth Government under the *Airport Act 1996*.[21] However, this Act is intended to regulate the operation and development of airports which had been owned by the Commonwealth and have been leased to the private sector rather than new airports developed by the Commonwealth. Nevertheless its provisions are a guide as to the type of requirements that might apply to a new airport.

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[15] Defined as the area contained within the following external boundaries: (1) Upper Nepean State Conservation Area (West), (2) the townships of Wilton, Douglas Park and Appin (North) and (3) the Cordeaux River and Cataract River dam areas (East– Cataract and South – Cordeaux).
[16] For simplicity hence forth stated as "at Wilton"
[17] The Commonwealth Government of Australia, 2009. *National Aviation Policy: White Paper*, p. 154.
[18] Transport for NSW, 2012. *Air transport regulation and licensing in NSW.* Available at: http://www.transport.nsw.gov.au/content/air-transport-regulation-and-licensing-nsw
[19] The Commonwealth Government of Australia, 2009. *National Aviation Policy: White Paper*, p. 154.
[20] Australian Electoral Commission, 2011. *Referendum dates and results 1906- present.* Available at: http://www.aec.gov.au/elections/referendums/Referendum_Dates_and_Results.htm
[21] The Commonwealth Government of Australia, 2009. *National Aviation Policy: White Paper*, p. 154.

Any development of an airport at Wilton that services domestic interstate and international movements is expected to be regulated by the Commonwealth Government,[22] regardless of whether the actual delivery and/or operation of the airport is by the private sector.

Under the *Civil Aviation Act 1988*, CASA is responsible for safety regulation relating to the licensing of pilots and aviation engineers and the certification of aircraft and operators,[23] as well as certain aspects of airport planning.

4.2.2 State Government

If an airport development at Wilton was used for intrastate movements, the NSW Government may be involved in regulating some of the lower volume intrastate routes. Some state governments regulate routes from small to mid-sized intrastate airports in order to provide certainty and viability. Intrastate aviation within NSW linking smaller communities to Sydney Airport is regulated by the NSW Government under the *Air Transport Act 1964*.[24] Higher volume intrastate routes have been deregulated by the NSW Government as volumes are sufficient to support two or more operators. Deregulated higher volume intrastate routes include Albury, Armidale, Coffs Harbour and Orange and were deregulated to encourage competition. Regulated lower volume routes regulated by the NSW Government include Cooma, Mudgee, Narrabri and Lord Howe Island.[25]

4.2.3 Local Government

Most of the regional airports in Australia are owned by local councils.[26] From 1958 to 1990 the Commonwealth Government transferred ownership of 21 regional airports to local councils under the Aerodrome Local Ownership Plan.[27] In 1990 the Commonwealth Government announced it would withdraw completely from the ownership of over 230 local airports over five years[28] and has done so. Around these local government owned airports, the local government authority typically provides the road transport infrastructure. However, these airports are predominantly used for GA and the airport development being considered at Wilton is for domestic and international passenger movements and freight movements for which the Commonwealth Government has primary responsibility. It is therefore unlikely that the local an airport development at Wilton would be owned or operated by local government.

4.2.4 Private sector

The Commonwealth Government began privatising major airports in 1997 with Melbourne, Brisbane, Perth, Adelaide, Canberra and Darwin Airports privatised by 1998.[29] Sydney Airport was privatised in 2002.[30] These privatised airports are now operated by the private sector on long term leases from the Commonwealth. For example, Sydney Airport is operated by the Sydney Airport Corporation Limited (SACL) on a 99 year lease and Melbourne (Tullamarine) Airport is operated by the Australia Pacific Airports Corporation Limited also on a 99 year lease (an initial 50 year lease with a 49 year extension optional).[31] It is possible that an airport development at Wilton would ultimately involve private sector in its operation in some form.

[22] Department of Infrastructure and Transport, 2012. *Airport Regulation.* Available at: http://www.infrastructure.gov.au/aviation/airport/planning/index.aspx
[23] The Civil Aviation Safety Authority, 2012. *About CASA*. Available at: http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_91621
[24] Transport for NSW, 2012. *Air transport regulation and licensing in NSW.* Available at: http://www.transport.nsw.gov.au/content/air-transport-regulation-and-licensing-nsw
[25] Transport for NSW, 2012. *NSW Rural and Regional Air Transport Operators.* Available at: http://www.transport.nsw.gov.au/content/nsw-rural-and-regional-air-transport-operators
[26] Department of Infrastructure and Transport, 2011. *Airport Safeguarding Guidelines, Chapter 11.* Available at: www.infrastructure.gov.au/aviation/environmental/.../Guideline_A.p...
[27] *Ibid.*
[28] *Ibid.*
[29] Productivity Commission, 2010. *The Economic Regulation of Airport Services,* p. 9
[30] URS Australia (2007), *Assessing the Impact of Airport Privatisation – Final Report*, prepared for TTF Australia
[31] Productivity Commission, 2010. *The Economic Regulation of Airport Services,* p. 9

A number of smaller airports are also operated by the private sector on similar long-term leases. In 2003, the BaCH Consortium purchased the long term lease for the management and operation of the Bankstown Airport from the Commonwealth Government.[32] The BaCH Consortium also purchased the lease for the Camden Airport. In 1997 the Linfox Group purchased the lease for the Avalon Airport from the Commonwealth Government.[33] The Linfox Group, along with the Beck Corporation, also own the management rights of the Essendon Airport.[34]

There are a number of airports in Australia that are wholly owned and operated by the private sector or private organisations. These airports on the whole do not receive regular transport passengers and they make up approximately 90% of the over 2000 airports and airfields in Australia.[35] These airports are usually small aerodromes in holiday or mining areas.[36] It is noted that these airports tend to be very small and not used or licensed for RPT and therefore not of a similar scale to the development being considered in the Wilton Study Area, which is more likely to involve both Government and the private sector.

4.3 Role of Government in transport and land use policy

Road and rail access to the site would involve all tiers of government, and there may be private sector involvement in rail access, if a dedicated rail line were required to the airport in the future.

4.3.1 Road access to the Wilton Study Area

All levels of government are involved in the management, funding and planning of road infrastructure:

- The Commonwealth Government is responsible for the national highways system;
- State Governments are responsible for state roads; and
- Local Governments are responsible for local and regional roads.[37]

Road access to an airport site at Wilton is likely to involve all levels of government. The Wilton area being considered in this further airport assessment is located near to a national highway (the Hume Highway), a state road (Picton Road) and a number of local and regional roads.

4.3.1.1 Commonwealth Government

The Commonwealth Government manages the national highways system. The national highway system comprises of major road links between mainland state and territory capital cities and urban road links through capital cities which connect to national highways.[38] The national highway system consists of over 18,000 km of road.[39] The Hume Highway, which runs along the western side of the Wilton area, is a national highway.

[32] WorleyParsons and AMPC, 2011. Sydney Regional Aviation Capacity Study: Airport Infrastructure in the Sydney Region. Prepared for the Department of Infrastructure and Transport.
[33] Avalon Airport, 2012. *About Avalon.* Available at: http://www.avalonairport.com.au/corporate/about-avalon/vision-values/
[34] Essendon Airport, 2012. Essendon Airport. Available at: http://www.essendonairport.com.au/5/about-us/corporate/default.aspx
[35] Productivity Commission, 2010. *The Economic Regulation of Airport Services,* p. 9
[36] *Ibid.*
[37] Road and Transport Authority, 2008. *NSW Road Management Arrangements.* Available at: http://www.rta.nsw.gov.au/doingbusinesswithus/downloads/lgr/road_mgmt_arrangements.pdf
[38] Department of Infrastructure and Transport, 2012. *History of Road and Rail in Australia.* Available at: http://www.infrastructure.gov.au/transport/publications/files/history_of_road_and_rail.pdf
[39] Department of Infrastructure and Transport, 2012. *History of Road and Rail in Australia.* Available at: http://www.infrastructure.gov.au/transport/publications/files/history_of_road_and_rail.pdf

4.3.1.2 State Government

State Governments are responsible for managing, funding and identifying priorities for major state roads. Major state roads are the major arterial links throughout NSW and within major urban areas.[40] The Wilton site area is accessed via Picton Road which is a State Highway and currently links the Hume Freeway, a national highway, and Southern Freeway, which is not a national highway. Appin Road, which also bounds the Wilton site, is also a state road. Therefore, access via roads to a potential airport development at Wilton is likely to require NSW Government involvement.

4.3.1.3 Local Government

Local governments are responsible for local and regional roads:

- Local roads provide local circulation and access and local governments have responsibility to fund, determine and carry out work on local roads; and
- Regional roads are routes between state and local roads that provide the main connections to and between smaller towns and districts.[41] Local government are ultimately responsible for regional roads, however, receive some State government funding.[42]

There are a small number of local and regional roads in the vicinity of Wilton, particularly surrounding the Wilton Recreation Ground and the Wilton Public School.

4.3.2 Rail access to the Wilton Study Area

The interstate rail network is managed by the Australian Rail Track Corporation (ARTC) and the intrastate rail network is operated and managed by the NSW Government within the Sydney Metropolitan area. As largely intrastate passengers (travelling to or from the Sydney region) are likely to use an airport site at Wilton, the NSW Government might be expected to be responsible for passenger rail connections. However, given the scale of the project and its direct relationship to airport development, there is likely to be direct Commonwealth Government involvement and possibly private sector involvement in some form, for example in service delivery.

The rail policy context for airport development at Wilton will also be impacted by the possible development of HSR and the possible development of the Maldon-Dombarton Freight Railway.

4.3.2.1 Australian Rail Track Corporation

The ARTC has responsibility for managing interstate rail in Australia including providing access for passenger train movements.[43] The ARTC is a company that was established by an Inter-Government Agreement between Commonwealth and mainland State Governments in 1997.[44] None of the ARTC rail corridors pass directly through the Wilton Study Area. However, the Main South Rail Line passes about 15 km northwest of the airport site.

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[41] Road and Transport Authority, 2008. *NSW Road Management Arrangements.* Available at: http://www.rta.nsw.gov.au/doingbusinesswithus/downloads/lgr/road_mgmt_arrangements.pdf
[42] Road and Transport Authority, 2008. *NSW Road Management Arrangements.* Available at: http://www.rta.nsw.gov.au/doingbusinesswithus/downloads/lgr/road_mgmt_arrangements.pdf
[43] ATRC, 2012. *About ARTC.* Available at: http://www.artc.com.au/Content.aspx?p=14
[44] ATRC, 2012. *ARTC History.* Available at: http://www.artc.com.au/Content.aspx?p=32

4.3.2.2 State Government

The State Government have primary responsibility for the intrastate passenger rail network including funding and operation.[45] The NSW Government recently announced a number of changes to the operation of passenger rail in NSW:

- NSW Trains (formerly CountryLink and CityRail interurban) will operate passenger services to regional centres of NSW and other cities outside NSW (e.g. Canberra, Melbourne and Brisbane); and
- Sydney Trains (formerly CityRail) will operate electric passenger services in the Sydney metropolitan region.[46]

Within the Sydney metropolitan area, provision and maintenance of rail infrastructure, with the notable exception of the Airport Rail Link[47], and operation of train services has been the exclusive province of the NSW Government.

As passengers travelling to a potential airport site at Wilton would almost exclusively be travelling to or from within NSW and, more specifically metropolitan Sydney and the CBD, provision of a major component rail access infrastructure and the operation of rail services are most likely to require NSW Government involvement. This being said, there may be involvement of Commonwealth Government and the private sector, as detailed below.

4.3.2.3 Private sector

While the private sector is not currently involved in provision or rail services to the Wilton Study Area, there is precedence for its involvement in airport rail access that may be relevant if an airport development was to occur at Wilton. Both Sydney and Brisbane Airports can be accessed by rail to both the domestic and international terminals. The infrastructure of these links was delivered under a form of public private partnerships and as a result the infrastructure continues to be operated by the private sector.[48]. In both cases, however, the operation of train services is by the relevant state rail authority.

Brisbane and Sydney are the only cities in Australia with rail links to the airport. However, in neither case is the link a truly dedicated, purpose designed and independent rail link as is, for example, the Hong Kong airport rail link.

As these examples suggest, if a dedicated rail link to the Wilton site was found to be required (which is not likely to be many years after the airport has opened and once passenger volumes have built up), there may be an opportunity to involve the private sector in the construction and operation of the passenger rail link.

Further analysis on the specific requirements for a dedicated rail line is considered in Working Paper *Land Transport Access.*

4.3.2.4 Broader plans and policies in vicinity of the Wilton Study Area

Plans and policies that could most affect the Wilton Study Area include a potential HSR and Maldon-Dombarton rail link.

[45] Department of Infrastructure and Transport, 2012. *Rail.* Available at: http://www.infrastructure.gov.au/rail/
[46] Saulwich, Jacob 2012. Rail bosses will have to ask for their jobs back. Published in the Sydney Morning Herald, May 19. Available at: http://m.smh.com.au/nsw/rail-bosses-will-have-to-ask-for-their-jobs-back-20120518-1yvzn.html
[47] This project was developed by the private sector under an exclusive mandate from government – Government provided the funding for the alignment infrastructure and operating systems and the private sector funded construction of the stations; trains are operated by Government while the private sector has a contract for maintenance;
[48] Air Train, 2012. *About Us.* Available at: http://www.airtrain.com.au/aboutus.php.
Airportlink, 2012. *The Airportlink Company.* Available at: http://www.airportlink.com.au/company.php

Commonwealth Department of Infrastructure and Transport Phase 1 High Speed Rail Study

The Department is currently considering the feasibility of a HSR, and as part of their Phase 1 analysis considered a Sydney to Canberra corridor in the vicinity of the Wilton Study Area.[49] None of the corridors shortlisted for analysis in Phase 2 pass directly through Wilton. However, a number of the Sydney to Canberra corridors pass through the areas adjoining Wilton, generally in the corridor of the Hume Freeway.

It is unlikely that the development of HSR would negate the need for airport development in Wilton. The Joint Study concluded that:

> *"consideration of a future High Speed Rail (HSR) system linking Sydney to other cities does not remove the need to act to provide additional aviation capacity. HSR and additional aviation capacity should not be considered mutually exclusively. HSR could provide an alternative for some domestic travel between cities in south eastern Australia, but is not an alternative for much of the Sydney aviation passenger demand."* [50]

BITRE analysis supports the Joint Study finding that:

> *"HSR is not a substitute for all air travel, especially international travel. A range of factors including frequency, travel time, cost, station location, and the likely competitive airline response, mean HSR will not remove the need for a supplementary airport."*[51]

Therefore, it appears that the likelihood of a HSR being available to provide connectivity to an airport at Wilton would be dependent on whether the Phase 2 HSR analysis indicates the line, which in its full form is considered as being Brisbane - Newcastle - Sydney - Canberra - Melbourne, is economically viable on a standalone basis in some form.

Such form could include an initial component of the full route such as Sydney - Canberra with a link into the airport. This would enable range of service structures to be offered such as Sydney - Canberra direct; Sydney - Canberra via airport thereby connecting both cities and Sydney only. Further consideration of this is in Working Paper *Land Transport Access*.

Maldon-Dombarton Rail Line

For a several decades, the construction of a dedicated freight rail line between Maldon and Dombarton has been considered to service Southern Highlands coal mines and decrease the need to run rail freight movements via Sydney to reach Port Kembla's export terminal and also to decrease the amount of coal traffic on roads. Construction of a coal freight rail link between Maldon and Dombarton commenced in the 1980s and was later abandoned,[52] although the majority of the ground work for the line had already been constructed. However, a number of expensive elements (a major bridge, part of another major bridge, a tunnel and all railway systems fit out) that are required for the line to be operational have not been constructed.[53]

Since that time, analysis has been undertaken on the feasibility to recommence construction of the line. In September 2011 the Commonwealth Government released a feasibility study of freight rail line between Maldon (near Picton on the Main South railway line south of Sydney) and Dombarton (near Port Kembla).[54]

In August 2012, the Commonwealth Infrastructure and Transport Minister approved funding to complete planning and detailed design work expected to be completed within the next two years.[55]

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[49] AECOM, Grimshaw, KPMG and SKM, 2011. *High Speed Rail Study: Phase 1.* Prepared for the Department of Infrastructure and Transport.
[50] *Ibid.*
[51] Commonwealth Government and NSW Government, 2012. *Joint Study on Aviation Capacity in the Sydney Region,* p 27
[52] Hyder and ACIL Tasman, 2011. *Maldon-Dombarton Rail Link Feasibility Study,* p. 10
[53] *Ibid*
[54] Department of Infrastructure and Transport, *Maldon-Dombarton Rail Link.* Available at: http://www.nationbuildingprogram.gov.au/projects/ProjectDetails.aspx?Project_id=044401-11ACT-MDD

There may be potential to modify or add to this rail link to provide a connection to an airport development at Wilton, and thereby enable a passenger service to be provided linking to the Sydney Metropolitan Railways systems and the Sydney CBD providing them access to the CBD rail network. However, analysis of the feasibility for passenger rolling stock to concurrently use the planned freight line, and comparison with other possible forms of rail connection options would be required to further understand the scope for this rail line to provide a viable passenger service to an airport at Wilton.

4.4 Land use planning

The land use planning considerations relevant to airport development at Wilton are discussed in the Working Paper *Land Use Planning Context and Future*. This section briefly outlines the responsibility of different levels of government in land use planning and the potential impacts of residential development in the Wilton area.

4.4.1 Role of Government in land use planning

As detailed in the Working Paper *Land use planning context and future*, all levels of government are involved in land use planning. The Commonwealth Government would be involved in land use planning around the airport site under the EPBC Act and the NSW Government would be involved under the EP&A Act. The Wollondilly Shire Local Government Area (LGA), which includes the majority of the Wilton Study Area, would also be involved through the *Wollondilly Local Environment Plan 2011*.

4.4.2 Residential development around airports

A key issue in airport planning and operation is residential development around existing or proposed airport sites. Residential development in the vicinity of airports or in the vicinity of proposed airports can pose a risk to the viability of airport development and operation due to growth in complaints about aircraft noise and other effects such as increased road traffic and the like.

For example, there have been a number of proposals for residential developments in the areas surrounding Canberra Airport and under the flight paths to the airport. The managing director of Canberra Airport, Stephen Byron, has said that such plans place at risk Canberra Airport's plans to develop international services and their strategy to become a freight hub.[56] This is not an uncommon issue, with similar issues being faced in Calgary in Canada where a residential development of 3,500 dwellings has been proposed for a site adjacent to the Springbank Airport.[57]

4.4.3 Landowner nominated sites

In 2011, the NSW Planning Minister extended a general invitation to owners of large lots to express their interest in developing their land for housing.[58] The government is now reviewing potential housing opportunities at these landowner nominated sites.[59] There are five sites within 15 km of Wilton.

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[55] Minister for Infrastructure and Transport (2012), Maldon to Dombarton Rail Link: Taking the Next Step - A Media Release, 17 August 2012, Joint release with: Sharon Bird Federal Member for Cunningham and Stephen Jones Federal Member for Throsby, Available at: http://www.minister.infrastructure.gov.au/aa/releases/2012/august/aa176_2012.aspx

[56] Taylor, Lenore. 2012. *Hazard housing plan puts him in Canberra flight path.* Available at: http://canberratimes.domain.com.au/hazzard-housing-plan-puts-him-in-canberra-flight-path-20120706-21m96.html

[57] McMurray, Jenna, 2012. *Proposed residential development near Springbank airport draws flak.* Published in the Calgary Sun 2 July, 2012. Available at: http://www.calgarysun.com/2012/07/02/proposed-residential-development-near-springbank-airport-draws-fla

[58] Department of Planning and Infrastructure, 2012. *Review of Potential Housing Sites.* Available; *http://www.planning.nsw.gov.au/HousingDelivery/HousingDeliveryOverview/ReviewofPotentialHousingSites/tabid/561/Default.aspx*

[59] Department of Planning and Infrastructure, 2012. *Review of Potential Housing Sites.* Available; *http://www.planning.nsw.gov.au/HousingDelivery/HousingDeliveryOverview/ReviewofPotentialHousingSites/tabid/561/Default.aspx*

The land-owner nomination sites are discussed in the Working Paper *Land Use Planning Context and Future* including the detailed assessment currently being undertaken of each site.

4.5 Key findings

The three levels of government (Commonwealth, State and Local) may have responsibility for different policies relating to airport development. The Commonwealth Government has primary responsibility for domestic and international passenger movements and freight movements in Australia. However, the construction of an airport at Wilton is likely to require input by NSW Government due to the significant role it conventionally plays in road and rail planning, investment and operation. That being said, the Commonwealth could choose to fund most or all of the land transport infrastructure costs and oversee delivery.

Local Government will also be involved in airport development if this was to occur in the Wilton Study Area, as Wollondilly Council is responsible for zoning of land and smaller scale development approvals in the area, and for local road links.

It is likely that the private sector may also play roles, for example in commercial elements of airport development such as terminals and airport operations as well as potential subsequent rail links to an airport development at Wilton.

While the area of Wilton is not specifically addressed in Commonwealth and State transport policies, current plans that could most affect the Wilton Study Area include a potential HSR and Maldon-Dombarton rail link. The Commonwealth Government is currently considering the feasibility of both, however it is not likely that airport development alone would be the only driver to ensure either development is feasible. Further analysis would be required if either proposal was to be amended to serve an airport development at Wilton.

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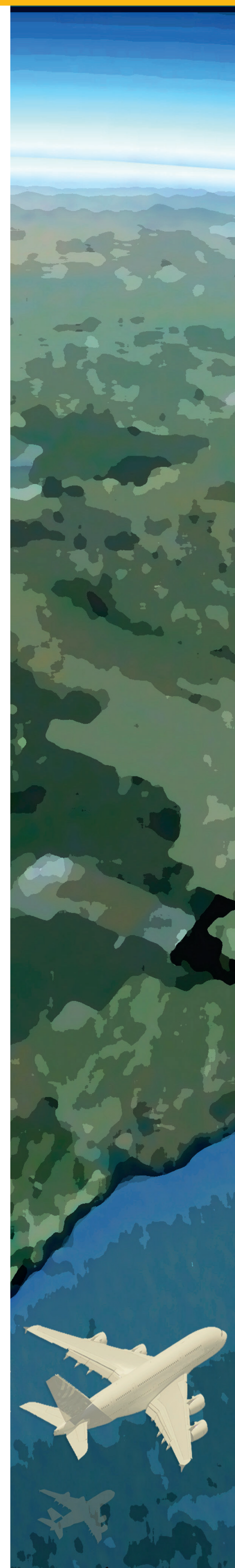
2

Strategic & Statutory Planning



Strategic & Statutory Planning

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT

Further Assessment of Airport Development Options at Wilton

Strategic and Statutory Planning

In association with

301015-03019 – EN-REP-002

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CONTENTS

1 WORKING PAPER – LAND USE PLANNING CONTEXT AND FUTURE DEVELOPMENT

SUMMARY

The Wilton Study Area (the Study Area) is being assessed in terms of the potential implications of developing a new greenfield airport. The purpose of this working paper is to provide a preliminary assessment of the current land uses within and around the Study Area and identify any existing or proposed potential land use conflicts that may act as a barrier to airport development at Wilton. The working paper also identifies potential strategies to mitigate any identified issues. Key points are:

- The Study Area is located primarily in the Wollondilly Shire Local Government Area (LGA) with a small portion of the south eastern part of the Study Area in the Wollongong LGA;
- Wollondilly LGA spans 2,560 square kilometres (km) and is one of the largest regions in NSW. The Shire is comprised of 16 towns and villages including: Appin, Bargo, Belimba Park, Brownlow Hill, Buxton, Camden Park, Cawdor, Couridjah, Douglas Park, Glenmore, Menangle, Mount Hunter, Mowbray Park, Nattai, Burragorang Valley, Oakdale, Picton, Pheasants Nest, Razorback, Tahmoor, Silverdale, The Oaks, Theresa Park, Thilmere, Warragamba, Wilton, Yanderra and Yerranderie;
- Wollondilly LGA contains significant coal resources as well as rural land uses comprised of farms, horse training, grazing, orchards, dairy and poultry and market gardens. The LGA supplies around 30% of Sydney's vegetables; [1]
- A significant proportion of the LGA is covered by National Parks, State Conservation Areas, State Forest and water catchment areas, particularly in the west and the southeast. Major topographic features include Burragorang and Warragamba Dams in the west and Lake Cataract and Cordeaux Dam in the south, which supply much of the water to the greater Sydney metropolitan area;
- Land use planning is a term used for a branch of public policy encompassing various disciplines which seek to order and regulate land use in an efficient and rigorous way, with the objective of preventing land use conflicts;
- Land is a finite resource increasingly affected by the competition of mutually exclusive uses. Land use is closely related to land ownership as the defined ownership of the land may pre-determine who will use the land. On the other hand, the property regime (private, public or crown) may also have an influence on possible land uses and tenure of land (residential, commercial, industrial, water supply, forests, minerals etc);
- Local Environmental Plans (LEPs) and State Environmental Planning Policies (SEPPs) guide planning decisions for LGAs. Through zoning and development controls, they allow Councils and other consent authorities to manage the ways in which land is used; and
- Current land use planning in the Wollondilly LGA has to manage pressure for growth against the context of a broad community desire to keep the Shire rural. This is a challenging balancing act and an inevitable consequence of being a rural area on the fringe of a major metropolis.

Successful planning involves a balanced mix of analysis of the existing conditions and constraints, extensive public engagement, practical planning design, and financially and politically feasible strategies for implementation.

The key information sources used in the compilation of this paper include:

- *Environmental Planning and Assessment Act 1979;*
- Environmental Planning and Assessment Regulation 2000;
- Sydney Metropolitan Strategy 2036;
- Metropolitan Strategy for Sydney and South West Subregional Plan;
- Wollondilly LEP 2011;
- Wollongong LEP 2009; and
- NSW Government Review of Potential Housing Sites.

The key land use planning findings of this paper are:

- The Study Area is located southeast of the village of Wilton on the Woronora Plateau. The Plateau is incised by the drainage systems of numerous creeks and rivers including the Cordeaux River, Cataract River, Wallandoola Creek, Cascade Creek, Lizard Creek, Clements Creek, Third Point Creek and Allens Creek;
- The Study Area is underlain by the coal measures of the Sydney Basin. The Bulli Seam is at a depth of approximately 400 metres (m) below the surface and the Wongawilli Seam is about 25 m below the Bulli Seam. Both seams have been mined for coking coal in the Southern Coalfields for over a century;
- BHPB Illawarra Coal operates Appin Mine immediately north of the Study Area, and has to date only mined the Bulli Seam. In the southern and south eastern parts of the Study Area is the operation of Gujarat NRE, which is commencing mining the Wongawilli Seam in the area of the old Bellambi Colliery, which mined the Bulli Seam;
- Within the central and western parts of the Study Area, there are no current mining leases, but the area is underlain by the same coal seams. The website of the New South Wales (NSW) Department of Mines indicates that there is an exploration lease over this area but the operative status of this lease is unknown;
- Predominant land uses in the Study Area are the Sydney Drinking Water Catchment managed by the Sydney Catchment Authority (SCA), Picton Road, and rural residential dwellings and rural businesses along Macarthur Road, Lisa Place and Wilton Road;
- All of the Options for development of an airport are within the SCA's Drinking Water Special Area – while this does not preclude airport development per se, it would result in imposition of extremely rigorous, extensive and expensive works to preclude contamination of the catchments. Road access to the Study Area is off the Hume Highway (F5), exiting at the Picton – Wollongong interchange and continuing east along Picton Road;
- There is no direct rail access to the Study Area at present although State Rail began construction of the Maldon - Dombarton - Port Kembla railway line in 1980. This line, which passes along the western boundary of the Study Area, was abandoned prior to completion. The Main South railway line is the closest railway to Wilton, and as a result, a completed Maldon-Dombarton Rail Link may present the potential to connect passengers to an airport development at Wilton, providing them access to the Central Business District (CBD) rail network;
- The Australian Bureau of Statistics (ABS) 2006 Census estimated a resident population for the Wollondilly LGA of 41,221;
- Population increase over the next 20 years could take the population of Wollondilly LGA to over 60,000 in the early to mid-2030s, which would require over 7,500 extra houses and additional jobs;

- The villages of Wilton and Douglas Park, with a combined population of 2,657 (2006 Census), are located approximately 3 km to the north and northwest of the Study Area;
- A series of reviews are currently underway by the NSW Government as part of its commitment to increase housing supply to meet projected housing demand across NSW. Nine sites are currently being considered by the NSW Department of Planning and Infrastructure for housing development within the Wollondilly LGA as part of the Review of Potential Housing Opportunities 2011/2012 (Land Owner Nominated Sites). No sites were nominated within the Wollongong LGA;
- Pursuant to the provisions of the Wollondilly LEP 2011, development for the purposes of '*air transport facilities*' is currently permissible with consent in the following zones: RU1 Primary Production, B2 Local Centre, B4 Mixed Use and IN3 Heavy Industrial. Development for the purposes of an '*airport*' is currently permissible with consent in the following zones: RU2 Rural Landscape, B1 Neighbourhood Centre, B2 Local Centre, B4 Mixed Use, IN2 Light Industrial, IN3 Heavy Industrial, and SP1 Special Activities;
- Pursuant to the provisions of the Wollongong LEP 2009, development for the purposes of '*airport facilities*' and an '*airport*' is currently prohibited in all zones;
- As all eight Options (as developed in the Working Paper - *Wilton Site Selection and Airport Concepts*) contain some land zoned E2 Environmental Conservation, under the provisions of the Wollondilly and Wollongong LEPs, no option in its present layout is permissible with development consent; and
- **Table 1.1** identifies the approximate number of properties that are located within each airport footprint within the Study Area and the subsequent zoning.

Table 1.1 Approximate number of properties within each airport footprint and the subsequent zoning

Airport Option	Allotments Within Airport Footprint	Roads / Infrastructure	Zoning
Option 1	48	Alkoomie Pl and Lisa Rd	RU2 Rural Landscape
	21	Alkoomie Pl and Fire Rd	E2 Environmental Conservation
	0	Macarthur Dr and Picton Rd	SP2 Infrastructure
TOTAL	**69**		
Option 1 (south)	63	Alkoomie Pl and Lisa Rd	RU2 Rural Landscape
	2		RU4 Rural Small Holdings
	23	Alkoomie Pl and Fire Rd	E2 Environmental Conservation
	0	Macarthur Dr and Picton Rd	SP2 Infrastructure
TOTAL	**88**		
Option 2	73	Alkoomie Pl, Lisa Rd, Wilton Rd and Wilton Lane	RU2 Rural Landscape
	2		RU4 Rural Small Holdings
	27	Alkoomie Pl and Fire Rd	E2 Environmental Conservation
		Macarthur Dr and Picton Rd	SP2 Infrastructure

Airport Option	Allotments Within Airport Footprint	Roads / Infrastructure	Zoning
TOTAL	**102**		
Option 3	4	Fire Rd	E2 Environmental Conservation
TOTAL	**4**		
Option 4	4	Fire Rd	E2 Environmental Conservation
TOTAL	**4**		
Option 5	4	Fire Rd	E2 Environmental Conservation
TOTAL	**4**		
Option 6	77	Alkoomie Pl and Lisa Rd	RU2 Rural Landscape
	2		RU4 Rural Small Holdings
	27	Alkoomie Pl and Fire Rd	E2 Environmental Conservation
		Macarthur Dr and Picton Rd	SP2 Infrastructure
TOTAL	**106**		
Option 7	77	Alkoomie Pl and Lisa Rd	RU2 Rural Landscape
	2		RU4 Rural Small Holdings
	23	Alkoomie Pl and Fire Rd	E2 Environmental Conservation
		Macarthur Dr and Picton Rd	SP2 Infrastructure
TOTAL	**102**		

Options 3, 4 and 5, which are primarily located on land zoned E2 Environmental Conservation, impact on the least number of allotments (less than five). These eastern set of options are more remote from centres of population and their footprints directly affect almost no people. Options 2, 6 and 7, which are located on land zoned RU2 Rural Landscape, RU4 Rural Small Holdings, SP2 Infrastructure and E2 Environmental Conservation, impact on the greatest number of allotments (more than 100). These western set of options have the greatest direct footprint affectation.

1.1 Introduction

The Wilton Study Area is being assessed in terms of the potential implications of developing a new greenfield airport in the area. The purpose of this working paper is to provide a preliminary assessment of the current land uses within and around the Wilton Study Area and identify any existing or proposed potential land use conflicts that may act as a barrier to airport development at Wilton. The working paper also identifies potential strategies to mitigate any identified issues.

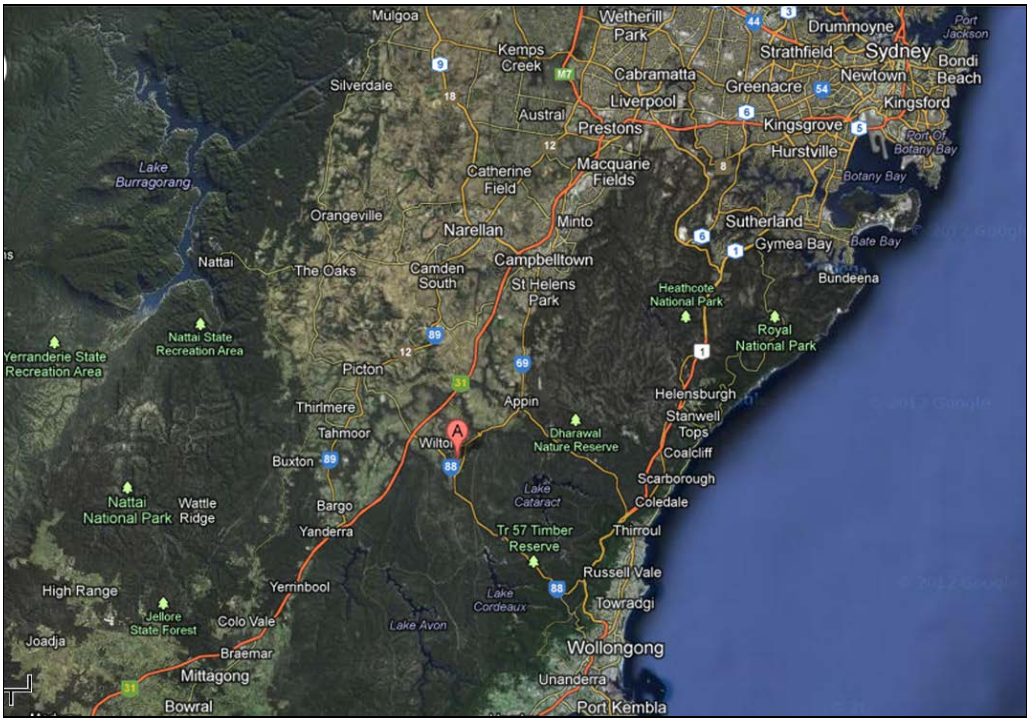
This working paper expands on the preliminary investigations, analyses and indicative designs undertaken for the *Joint Study on Aviation Capacity in the Sydney Region* (the Joint Study) in relation to land use planning context and future development matters, taking into account both the potential on-site and off-site impacts.

1.2 The Wilton Study Area and surrounding lands

1.2.1 Location

Wilton is situated on the Woronora Plateau and Maddens Plains, about 80 km southwest of Sydney and 20 km northwest of Wollongong (refer **Figure 1.1** - identified by “A”).

Figure 1.1 Location of Wilton



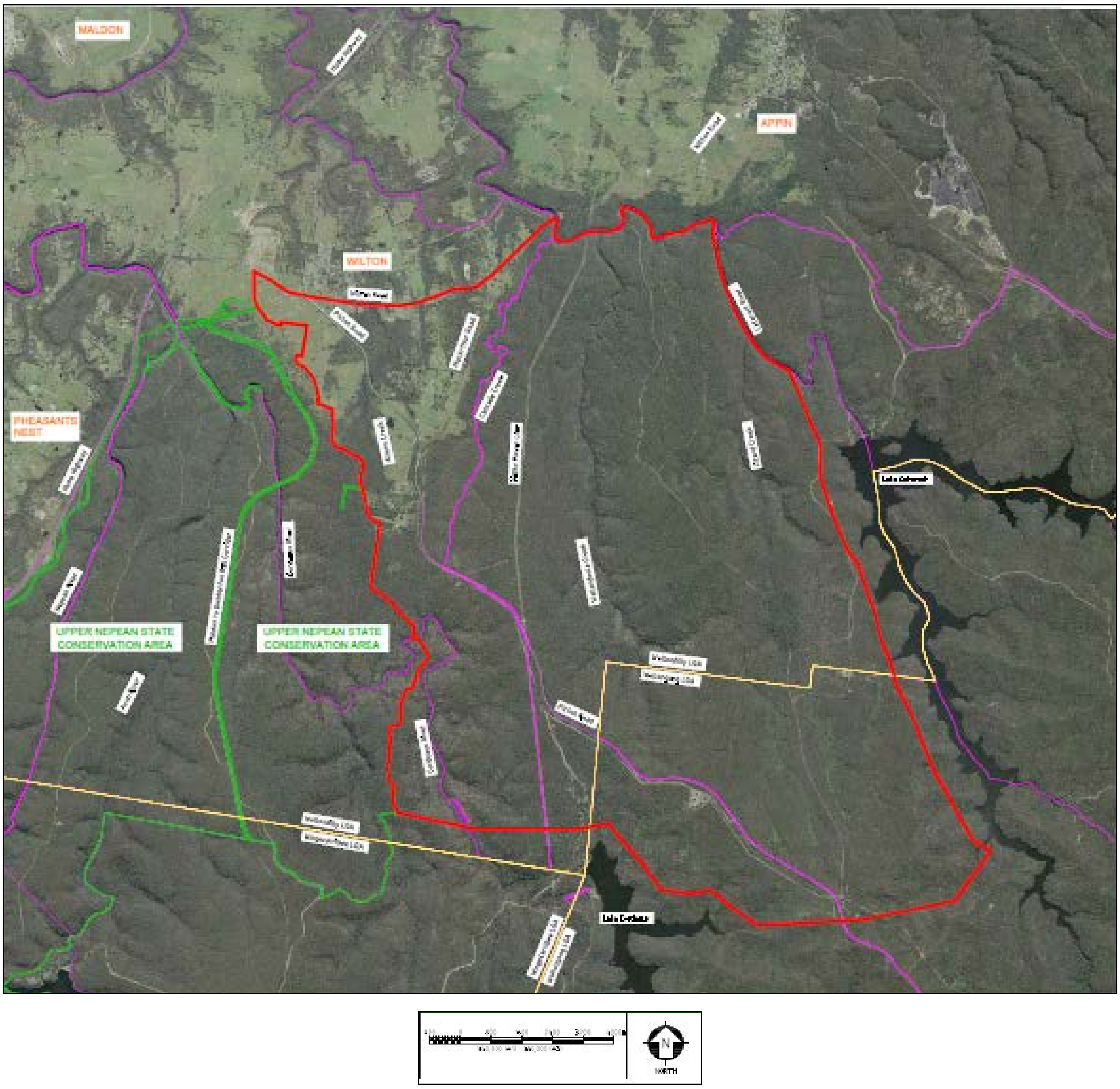
Source: Google 2012

For the purposes of this assessment, the Wilton Study Area is defined as the area contained within the following external boundaries:

- Upper Nepean State Conservation Area (west);
- The townships of Wilton, Douglas Park and Appin (north); and
- The Cordeaux River and Cataract River dam areas (east - Cataract and south - Cordeaux).

The Study Area is shown in **Figure 1.2**.

Figure 1.2 Wilton Study Area



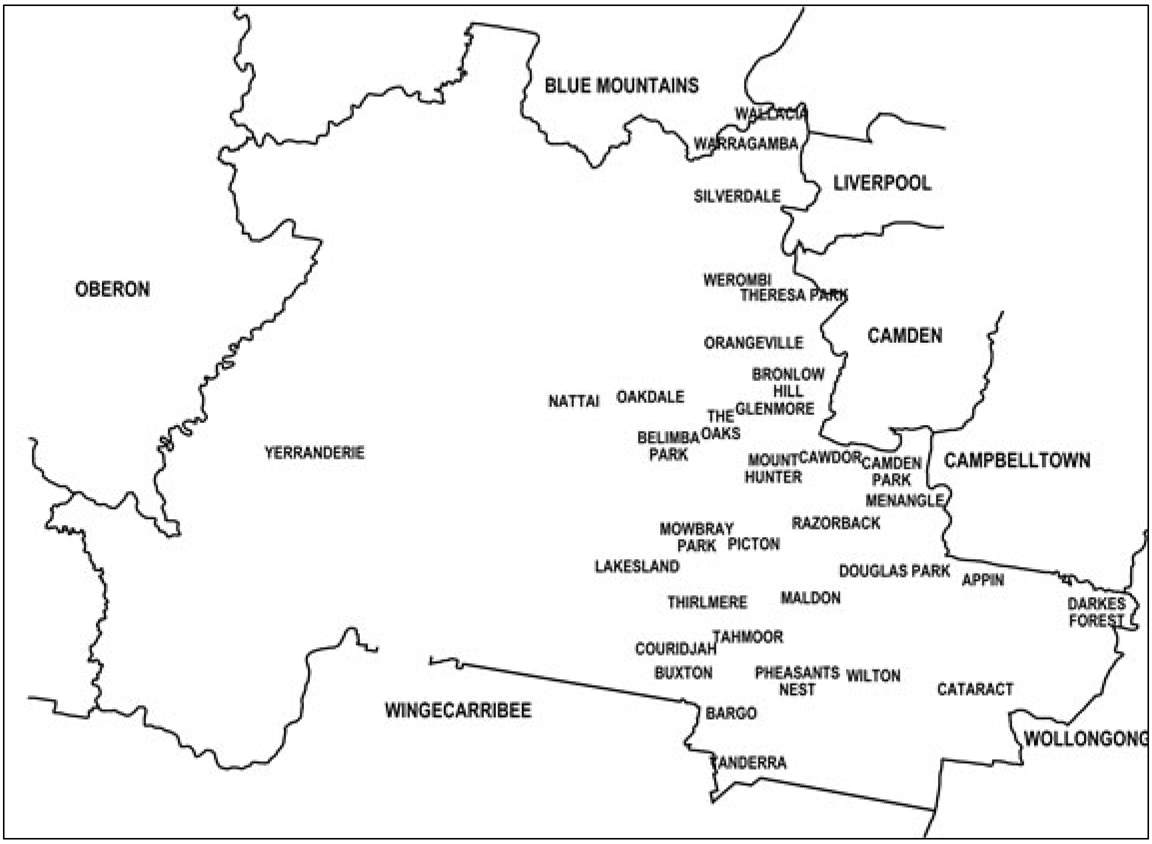
LEGEND

Wilton Study Area [1] Boundary

[1] Defined as the area contained within the following external boundaries: (1) Upper Nepean State Conservation Area (West), (2) the townships of Wilton, Douglas Park and Appin (North) and (3) the Cordeaux River and Cataract River dam areas (East-Cataract and South – Cordeaux).

The Study Area is located primarily in the Wollondilly LGA with a small portion of the south-western part of the Study Area in the Wollongong LGA. It is worth noting that the Wingecarribee LGA boundary abuts the Wollondilly and Wollongong LGA boundaries to the southwest of the Study Area. However, the Wingecarribee LGA is not located within the Wilton Study Area. Other adjoining local government areas also include Camden, Liverpool, Campbelltown and the Blue Mountains (refer **Figure 1.3**).

Figure 1.3 Wollondilly LGA including major towns and villages and adjoining LGAs



Source: Wollondilly Shire Council

1.2.2 General Characteristics of the Wollondilly LGA

Wollondilly LGA spans 2,560 km^2 and is one of the largest regions in NSW. The Shire is comprised of 16 towns and villages including: Appin, Bargo, Belimba Park, Brownlow Hill, Buxton, Camden Park, Cawdor, Couridjah, Douglas Park, Glenmore, Menangle, Mount Hunter, Mowbray Park, Nattai, Burragorang Valley, Oakdale, Picton, Pheasants Nest, Razorback, Tahmoor, Silverdale, The Oaks, Theresa Park, Thilmere, Warragamba, Wilton, Yanderra and Yerranderie.

Settlement in the LGA is mainly confined to the Hume Freeway Corridor. The largest towns are Picton, Tahmoor and Thirlmere, which are located in the central part of the Shire off the Hume Freeway[1].

Wollondilly LGA contains significant coal resources as well as rural land uses comprised of farms, horse training, grazing, orchards, dairy and poultry and market gardens. The LGA supplies around 30% of Sydney's vegetables. [2]

A significant proportion of the LGA is covered by National Parks, State Conservation Areas, State Forest and water catchment areas, particularly in the west and the south east. Major topographic features include Burragorang and Warragamba Dams in the west and Lake Cataract and Cordeaux Dam in the south, which supply much of the water to the greater Sydney metropolitan area.

Current land use planning in the Wollondilly LGA has to manage pressure for growth against the context of a broad community desire to keep the Shire rural. This is a challenging balancing act and an inevitable consequence of being a rural area on the fringe of a major metropolis.[3]

[1] http://forecast2.id.com.au/Default.aspx?id=248&pg=5000
[2] http://www.wollondillyshire.com.au/

1.2.3 General characteristics of the Wilton Study Area

The Wilton Study Area is located on the Woronora Plateau at an average elevation of about 310 m above sea level. The Plateau is incised by the drainage systems of numerous creeks and rivers including the Cordeaux River, Cataract River, Wallandoola Creek, Cascade Creek, Lizard Creek, Clements Creek, Third Point Creek and Allens Creek.

Predominant land uses onsite are the Sydney Drinking Water Catchment managed by the SCA, Picton Road, and rural residential dwellings along Macarthur Road, Lisa Place and Wilton Road.

The site contains electrical infrastructure largely in the form of power lines owned by NSW Government utilities. A 330 kV transmission line owned by TransGrid traverses the proposed site in a general north - south direction.

The villages of Wilton and Douglas Park, with a combined population of 2,657 (2006 Census), are located approximately 3 km to the north and northwest of the Study Area.

Bingara Gorge, adjoining the town of Wilton to the west, is the most recent urban release area within the LGA. Wollondilly Council approved a masterplan for the site in 2006 which proposes 1,165 dwellings to accommodate 3,500 residents. Land parcels range from 450 m^2 to 4000 m^2.

The key surrounding land uses are summarised in **Table 1.2**.

Table 1.2 Key Land Uses Surrounding the Wilton Study Area

Key Surrounding Land Uses	Area (Ha)
Dharawal National Park	6,500
Dharawal State Conservation Area	71
Upper Nepean State Conservation Area	25,237
Lake Cataract	850[4]
Lake Cordeaux	780[5]
Wallandoola Creek, Cascade Creek, Lizard Creek, Clements Creek, Third Point Creek, Allens Creek and the Cataract River	
Sydney Drinking Water Catchment	1,600,000 (16,000 km^2) [6]
Township of Wilton	6,490 (64.9 km^2)[7]
Township of Bingara Gorge	450 (4.5km^2)
Township of Douglas Park	4,440 (44.4 km^2)[8]
Township of Appin	10, 200 (102 km^2) [9]
Maddens Plains	74,450 (744.5 km^2) [10]

[4] http://www.sydney.com/destinations/sydney/sydney-west/appin/attractions/cataract-dam
[5] http://www.visitnsw.com/destinations/south-coast/wollongong-and-surrounds/wollongong/attractions/cordeaux-dam
[6] http://www.environment.nsw.gov.au/water/sdwc2010.htm
[7] ABS 2011 Census
[8] ABS 2011 Census
[9] ABS 2011 Census
[10] ABS 2011 Census

1.2.4 Access

Road access to the Study Area is off the Hume Highway (F5), exiting at the Picton – Wollongong interchange and continuing east along Picton Road. Macarthur Drive passes through the Study Area for its entire length. Lisa Road is within the Study Area.

There are a number of access tracks used by the SCA personnel for managing the Sydney Drinking Water Catchment which traverse the Study Area. Some of the tracks also provide access to transmission lines.

There is no direct rail access to the Study Area at present although State Rail began construction of the Maldon - Dombarton - Port Kembla railway line in 1980. This line which passes along the western boundary of the Study Area was abandoned prior to completion. The Main South railway line is the closest railway to Wilton, and as a result, a completed Maldon-Dombarton Rail Link may present the potential to connect passengers to an airport development at Wilton, providing them access to the CBD rail network.

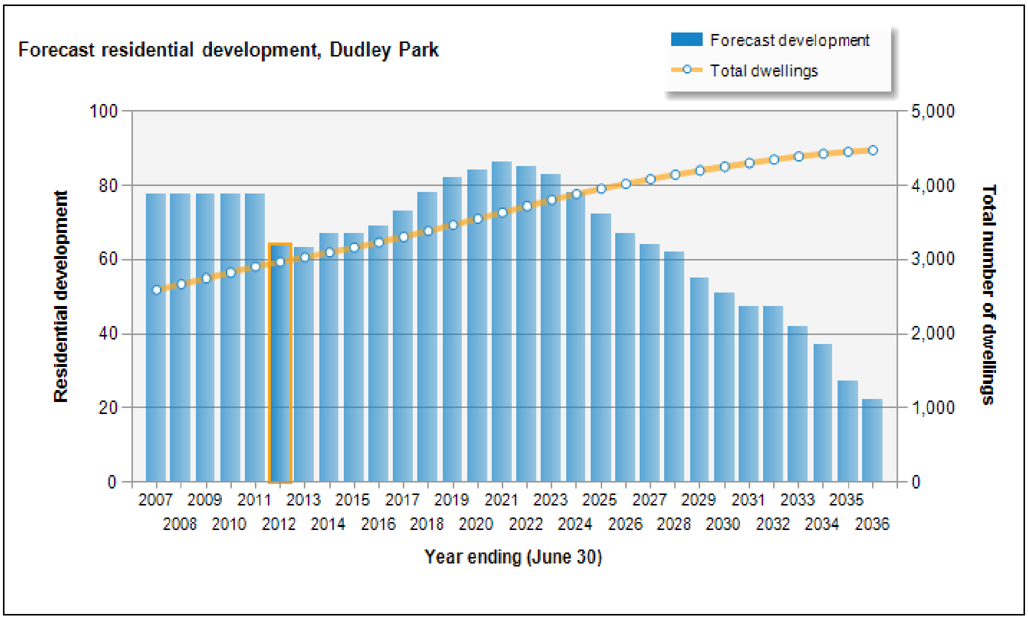
1.2.5 Population

The Australian Bureau of Statistics (ABS) 2006 Census estimated a resident population for the Wollondilly LGA of 41,221, giving an overall population density of 16.8 persons per square kilometre. However, most of this population is concentrated in towns and small villages or is scattered among dispersed rural areas.

Between 1981 and 2006, the population of Wollondilly LGA more than doubled from 20,000 to 41,221[11]. Wollondilly was listed as the 16th fastest growth and 35th largest growth LGA out of the 152 LGAs in NSW. This population growth was aided by greater access to employment in south western Sydney with major improvements to road transport in the area (Hume Freeway and Camden Bypass).

Population increase over the next 20 years could take the population of Wollondilly LGA to over 60,000 in the early to mid 2030s (refer **Figure 1.4**) which would require over 7,500 extra houses and additional jobs.

Figure 1.4 Forecast population of Wollondilly LGA



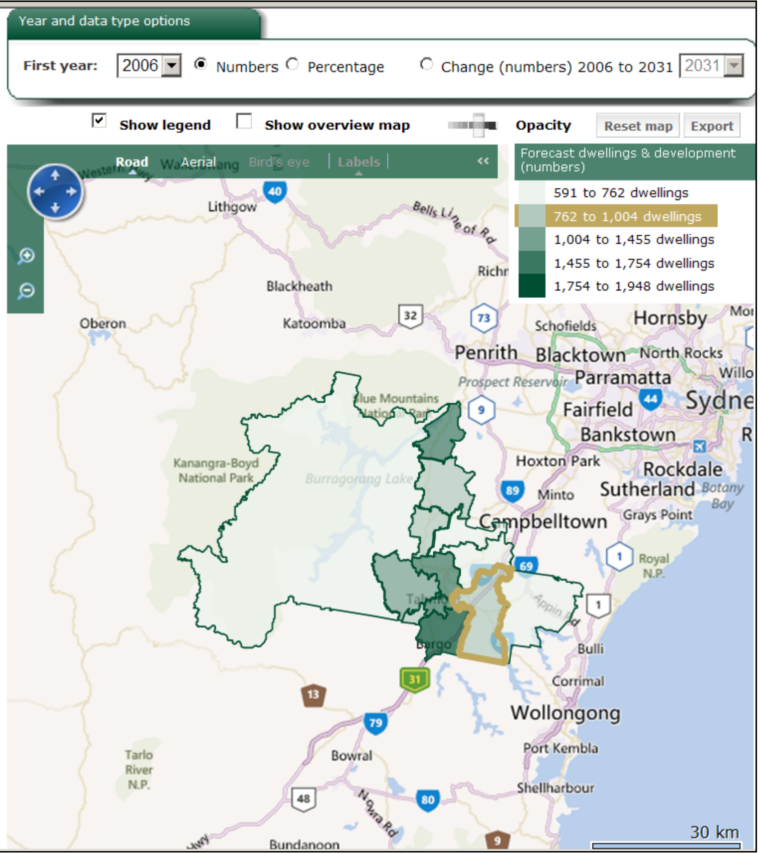
[11] ABS 2011 Census

The villages of Wilton and Douglas Park, with a combined population of 2,657 (2006 Census), are located approximately 3 km to the north and northwest of the Study Area.

Figure 1.5 shows the breakdown of the number of dwellings and development within the Wollondilly LGA in 2006 and a forecast as to the likely number of dwellings in 2031. The area of Douglas Park and Wilton is shown highlighted and is forecast to have an 11% increase in dwelling numbers from 2006 to 2031 and is predicted to be one of the highest growth areas in the Wollondilly LGA.

Figure 1.5 Existing dwellings and forescast development for the Wollondilly LGA (2006-2031)

Wollondilly Shire Council's small areas Structural Private Dwellings	2006 num	2006 %	2031 num	2031 %	Change 2006 to 2031
Wollondilly Shire	14,735	100.0	21,585	100.0	6,850
Appin - Cataract - Darkes Forest	606	4.1	843	3.9	237
Bargo - Yanderra - Pheasants Nest	1,947	13.2	2,388	11.1	441
Buxton - Couridjah	763	5.2	832	3.9	69
Camden Park - Mount Hunter - Cawdor	749	5.1	1,039	4.8	290
Douglas Park - Wilton	934	6.3	2,401	11.1	1,467
Menangle - Razorback	592	4.0	850	3.9	258
Oakdale - Nattai - Natrional Park	708	4.8	741	3.4	33
Orangeville - Werombi & District	879	6.0	1,108	5.1	229
Picton - Mowbray Park - Maldon	1,658	11.3	2,350	10.9	692
Tahmoor	1,754	11.9	2,820	13.1	1,066
The Oaks - Belimba Park - Glenmore	1,004	6.8	1,282	5.9	278
Thirlmere - Lakesland	1,455	9.9	2,584	12.0	1,129
Wallacia - Warragamba - Silverdale	1,687	11.4	2,348	10.9	661



Source: http://forecast2.id.com.au/Default.aspx?id=248&pg=5330 Forecast.id (2012)

A Growth Management Strategy 2011 has been prepared by Wollondilly Shire Council to guide decisions about growth and to have a long-term strategic approach to the future of the LGA[12].

1.3 Legislation

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) are the primary pieces of land use planning legislation relevant to the proposed airport development.

[12] Wollondilly Shire Growth Management Strategy 2011 (Wollondilly Council)

1.3.1 Commonwealth legislation and studies

Relevant Commonwealth Government legislation and studies are outlined in the Working Papers - *Planning and Approvals*, *National Transport Policy Context for Airport Development*, and *Land Transportation Links*. These include the *Airports Act 1996,* National Environment Protection Measures 1994 and the recent Commonwealth Government *High Speed Rail Study*.

1.3.2 NSW legislation and studies

1.3.2.1 Environmental Planning and Assessment Act 1979

Planning and development in NSW is carried out under the provisions of the EP&A Act and *Environmental Planning and Assessment Regulation 2000.*

It is important to note that at the time of writing, the NSW Government is undertaking a major review of the EP&A Act. It is understood that the Government will issue a "Green Paper" by the end of July 2012. Further it is understood that the focus of environmental planning under the new legislation will be on strategic and statutory planning with a major shift involving the input of the community in the plan making processes. It is also understood that there will be reduced opportunities for community input in the development assessment phase.

There are several other pieces of legislation that are relevant to the NSW approvals process. These include:

- *Sydney Water Catchment Management Act 1998;*
- *Threatened Species Conservation Act 1995;*
- *Fisheries Management Act 1994;*
- *National Parks and Wildlife Act 1974;*
- *Native Vegetation Act 2003;*
- *Heritage Act 1977;*
- *Catchment Management Authorities Act;*
- *Water Management Act 2000;*
- *Mining Act;*
- *Dams Safety Act 1978;* and
- *Protection of the Environment Operations Act 1997.*

1.3.2.2 State Environmental Planning Policies

SEPPs address issues significant to the State and people of NSW. They are made by the Minster for Planning. The following SEPPs are relevant to the further assessment of the Wilton site:

- State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011;
- State Environmental Planning Policy No. 26 Littoral Rainforests;
- State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44);
- State Environmental Planning Policy No. 55 – Remediation of Land;
- State Environmental Planning Policy (Infrastructure) 2007;
- State Environmental Planning Policy (Major Development) 2005;

- State Environmental Planning Policy (Rural Lands) 2008; and
- State Environmental Planning Policy (State and Regional Development) 2011.

1.3.2.3 Metropolitan Plan for Sydney 2036

In December 2010, the then NSW Department of Planning released the Metropolitan Plan for Sydney 2036, the latest blueprint for Sydney's long term growth. The Metropolitan Plan for Sydney 2036 sets out the strategic framework for sustainable growth across the city to 2036.

Key features of this strategy are:

- Latest forecasts show Sydney's population will grow by 1.7 million people to 6 million by 2036 (average annual rise of 56,650);
- 770,000 new homes needed;
- Greatest population growth expected to occur in south west Sydney;
- South west subregion housing target is 155,000 new homes by 2036 (83,000 of which will be in new release areas including the south west growth centre);
- Ageing population - currently 1 in 8 persons are over 65. By 2036 it will be 1 in 6;
- Average household size will fall from 2.6 persons to 2.5 persons;
- 69% increase in the number of single person households by 2036;
- The Metropolitan Plan's vision is to create a compact sustainable city which preserves our natural environments and agricultural regions and provides employment opportunities close to where people live;
- Continuing emphasis on a highly centres-based model of growth for Sydney – aim is locate 80% of all new housing within walking distance of centres;
- Continuation of the policy of 70% of new housing being located in existing urban areas and 30% in greenfield areas;
- No new greenfield fronts to Sydney's existing urban footprint under the plan with continued emphasis on Sydney's greenfield housing growth being focussed on the north west and south west growth centres;
- Reiteration of the current position that Macarthur South is not needed to accommodate Sydney's housing needs at this stage;
- Greater recognition of the need to ensure Sydney's growth considers climate change mitigation and adaptation, and transition to a low carbon economy;
- Greater recognition of the need for western Sydney's growth to be matched by a range of strategies to increase job numbers;
- Greater recognition of the need to protect Sydney's valuable agricultural lands, resource lands and environmental lands; and
- Very strong acknowledgement of the importance of agriculture in the Sydney Basin.

The following are extracts from the Metropolitan Plan for Sydney 2036 which are of particular relevance to Wollondilly and the Wollondilly Growth Management Strategy 2011:

Extract 1:

> *"Rural settlements outside the Growth Centres, including rural residential (large lot residential) and rural villages, will be managed through new comprehensive local strategies prepared by local councils and endorsed*

> *by the Department of Planning. Local strategies will cover the entire local government area, respect the character and integrity of existing villages, acknowledge the physical village limits, and promote agricultural viability and environmental quality.*
>
> *Future rural settlement growth should focus on infill in towns and villages where adequate infrastructure and services exist. Large-scale expansion of settlements is inconsistent with containing Sydney's urban footprint. Further subdivision of rural and resource land for additional dwellings should also be avoided unless in the form of minor incremental expansion to accommodate local growth. No new significant development fronts, other than the Growth Centres, need to be considered, until the next five year review of the Metropolitan Plan".*

Extract 2:

> *"Macarthur South*
>
> *In July 2009, the Government considered urban development in Macarthur South after approaches by several major landowners to release their land for housing. Options ranged from proceeding with the existing Mt Gilead MDP release area for 5,500 dwellings to fully developing the area for up to 62,000 dwellings. The Government decided to suspend investigation of the area primarily due to existing adequate stocks of land available for housing in the South West Growth Centre, prohibitively expensive infrastructure costs, and the high value of resources in the area"*

The potential Macarthur South housing precinct considered the building of up to 62,000 homes on 17,000 hectares (ha) between Wilton, Douglas Park and Appin.

Key matters for the South West Subregion (Liverpool, Campbelltown, Camden and Wollondilly LGAs) relevant to the Wilton Study Area are:

Employment

- The South West subregion is targeted for the biggest proportional growth in employment capacity in Sydney. There is a strong focus on business park development;
- Target of 141,000 new jobs between 2006 and 2036 in the South West subregion – more than double the 133,000 jobs in the South West in 2006;
- This target includes:
  - Increasing employment capacity in Liverpool (Regional City) from 16,000 in 2006 to 31,000 by 2036; and
  - Increasing employment capacity in Campbelltown/Macarthur (major centre) from 14,000 in 2006 to 25,000 by 2036.

Transport

- Construct the South West Rail Link, from Glenfield to Leppington;
- Road upgrades including widening of the M5 between Liverpool and Campbelltown; and
- Investigation of a Western Sydney Orbital road.

Housing

- Target of 155,000 new homes between 2006 and 2036, including 83,000 in new release areas. This target remains the same as the target for 2004 to 2031, which was contained in the 2005 Metropolitan Strategy.

1.3.2.4 Metropolitan Strategy for Sydney and South West Subregional Plan

The Metropolitan Strategy for Sydney is currently being developed and will provide a framework for Sydney's growth to help plan for housing, employment, transport, infrastructure, the environment and open space. The Strategy will update the current Metropolitan Plan for Sydney 2036 and will link to other long-term government plans such as the Long Term Transport Master Plan and the State Infrastructure Strategy.

The NSW Government released a discussion paper titled *Sydney over the Next 20 years* for public consultation in May 2012. The feedback on the discussion paper will inform the development of the Metropolitan Strategy for Sydney.

It is anticipated that the Metropolitan Strategy for Sydney will be finalised and released to the public by the end of 2012.

1.3.2.5 Employment Lands Development Program

Since 2008, the NSW Government has run an Employment Lands Development Program (ELDP) to monitor supply and demand for employment lands and plan for new employment lands.

Employment lands are zoned industrial or similar purposes in planning instruments. They are generally lower density employment areas containing concentrations of businesses involved in: manufacturing; transforming and warehouse of goods; services and repair trades and industries; integrated enterprises with a mix of administration, production, warehousing, research and development; and urban services and utilities.

The 2010 Employment Lands Development Program Report (ELDP Overview and Subregional Reports) provides a comprehensive assessment of the existing and future supply of Employment Lands in the Sydney Region and subregions. The Report examines:

- The existing supply as at January 2010 and its distribution and size;
- Whether the existing supply is developed or undeveloped and serviced;
- The identified potential future supply;
- Recent industrial building activity, construction and take-up rates; and
- Employment characteristics.

As a subset of the Employment Lands Development Program (ELDP) 2010 Overview Report, 11 Subregional Reports were prepared which provide more local information on the provision of employment land at an LGA and subregional level. Report 10 addresses the South West Subregion.

Subregional Report 10 - South West Subregion

There is a total zoned Employment Lands supply in the South West Subregion of 2,202 ha, making it the third largest contributor of Employment Lands in the Sydney Region (14% of all Employment Lands), after the North West and West Central subregions.

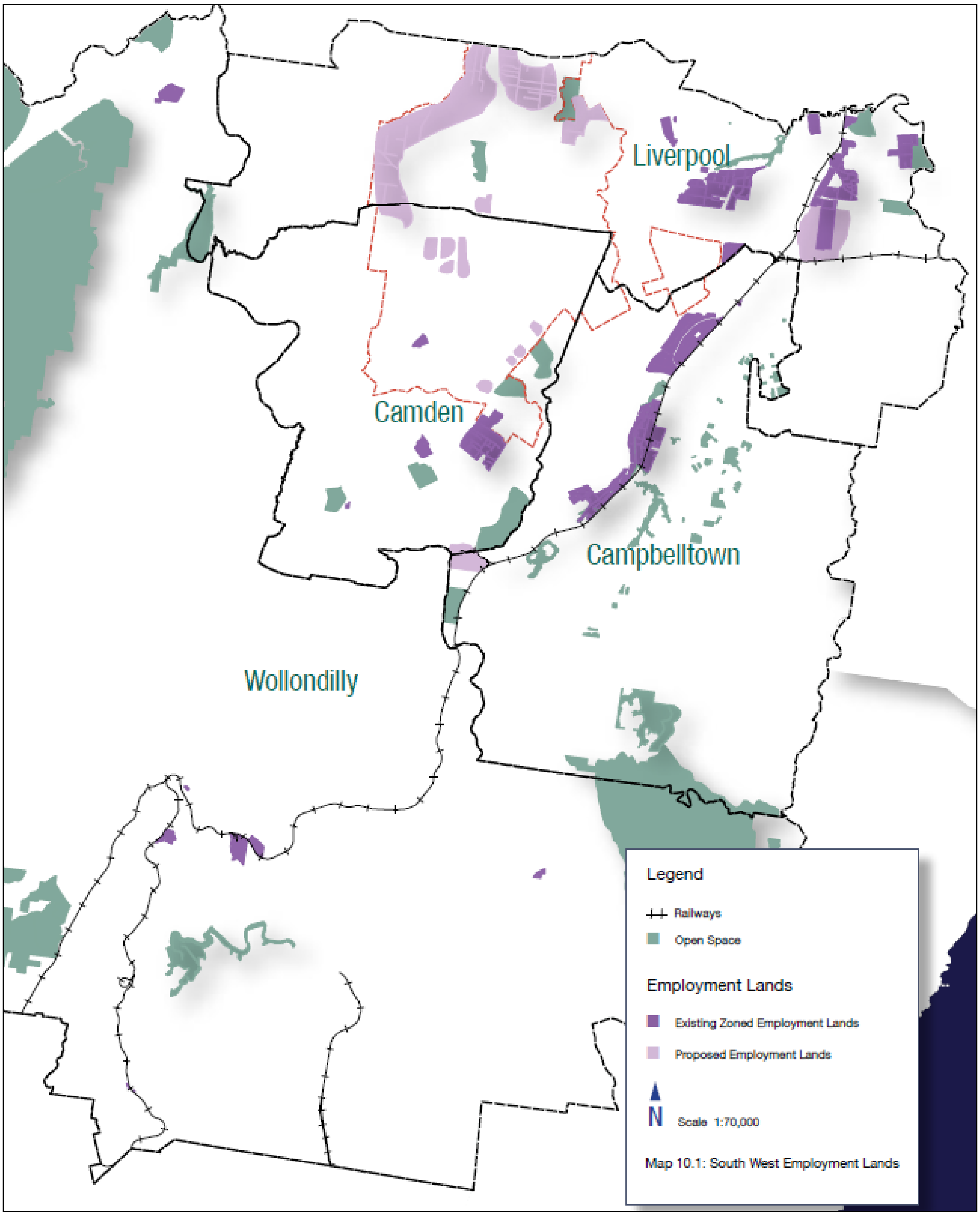
Liverpool LGA supplies 44% of the subregion's total stocks (959 ha), Campbelltown LGA supplies 731 ha with Camden and Wollondilly supplying 306 ha and 205 ha respectively.

Key findings and trends:

- 2,202 ha zoned as existing Employment Lands (14% of Sydney Region's total stocks);
- 581 ha of undeveloped zoned lands (13% of Sydney Region's total undeveloped land);
- 2,700 ha of future unzoned Employment Lands identified (63% of Sydney Region total future supply);
- $995 million of industrial building approvals between 2001/02 and 2008/09 (16% of Sydney Region's total approvals);

- 38 ha of Employment Lands taken up in 2009, compared to 71 ha in 2008;
- 40,000 jobs in Employment Lands (30% of all jobs within the subregion); and
- 25 jobs per hectare (second lowest job density in the Sydney Region).

Figure 1.6 Employment Lands Development Program – South West Employment Lands



Source: Employment Lands Development Program (Department of Planning and Infrastructure, 2011)

1.3.3 NSW Government review of potential housing sites

A series of reviews are currently underway by the NSW Government as part of its commitment to increase housing supply to meet projected housing demand across NSW. These include looking at the impediments to the release of additional housing, along with a review of major landholdings for their potential to provide more homes. To assist in this process, the NSW Department of Planning and Infrastructure requested the participation of a range of major development companies, industry associations and landowners.

In 2011 the Minister for Planning and Infrastructure invited owners of large lots to express their interest in developing their land for housing ('Landowner Nominated Sites'). Forty three submissions were received by the closing date of 29 November 2011. Of these, 12 submissions were found to be inadequate and a decision was made that no further assessment would be undertaken on them under the current process.

The process resulted in 10 sites being nominated within the Wollondilly LGA. One of the sites within the Wollondilly LGA was not considered suitable for further assessment (a 2.3 ha site at Reservoir Road, Bargo). The remaining nine sites are currently being considered by the Department of Planning and Infrastructure for housing development (refer **Table 1.3**).

Table 1.3 Landowner nominated sites within Wollondilly being considered by the Department of Planning and Infrastructure

Site Name	Site Location	Area (ha)
Wollondilly LGA		
Appin Vale	West of Appin Village	517.1
Bingara Gorge	North of Picton Road and east of the F6 Freeway (Hume Highway), Wilton	290.3
Brooks Point, Appin	South west of Appin village	240.0
Cawdor	Cawdor Road and Remembrance Drive Cawdor	531.2
Mayfarm Road	Mayfarm Road, Brownlow Hill	406.0
Silverdale	Taylors Roads and Eltons Road, Silverdale	238.0
West Thirlmere	Stone Quarry Creek and Lakes Street, Thirlmere	819.5
Wilton South	South of Picton Road and east of F6 Freeway (Hume Highway), Wilton	391.9
Wilton West	West of F6 Freeway (Hume Highway) and north of Picton Road, Wilton	626.6

Source: NSW Department of Planning and Infrastructure

No sites were nominated within the Wollongong LGA.

One site within the Wingecarribee LGA at Mary Street, Mittagong (75.8 ha) was nominated however the site was found to be inadequate and a decision was made that no further assessment would be undertaken.

The NSW Government has commenced a review of potential housing opportunities on sites nominated by landowners and a draft report is expected August 2012.

The Objectives and Matters for Consideration in the review of potential housing opportunities are set out below:

1. Housing delivery

Objective: To identify sites which are suitable for urban development and have viable prospects to produce houses in the short term.

Matters for consideration:

- Physical and environmental capability of the land for urban development;
- Importance of the land for food production, mineral resource extraction, employment purposes and city-shaping infrastructure (e.g. ports and airports);
- Lead times associated with investigating the land, rezoning and providing enabling infrastructure
- Views of the local council; and
- Likelihood houses will be built within three years taking into account landownership patterns, planning processes and demand.

2. Infrastructure

Objective: To provide infrastructure and services for new communities in a timely and efficient manner at no additional cost to Government.

Matters for consideration:

- Willingness and capacity of the landowner to finance the planning and infrastructure associated with delivery of the housing;
- Availability of enabling infrastructure, capacity of regional transport networks and accessibility of human services;
- Capital and recurrent costs to state and local government of providing infrastructure and services; and
- Impact on existing government infrastructure investment and commitments to other areas.

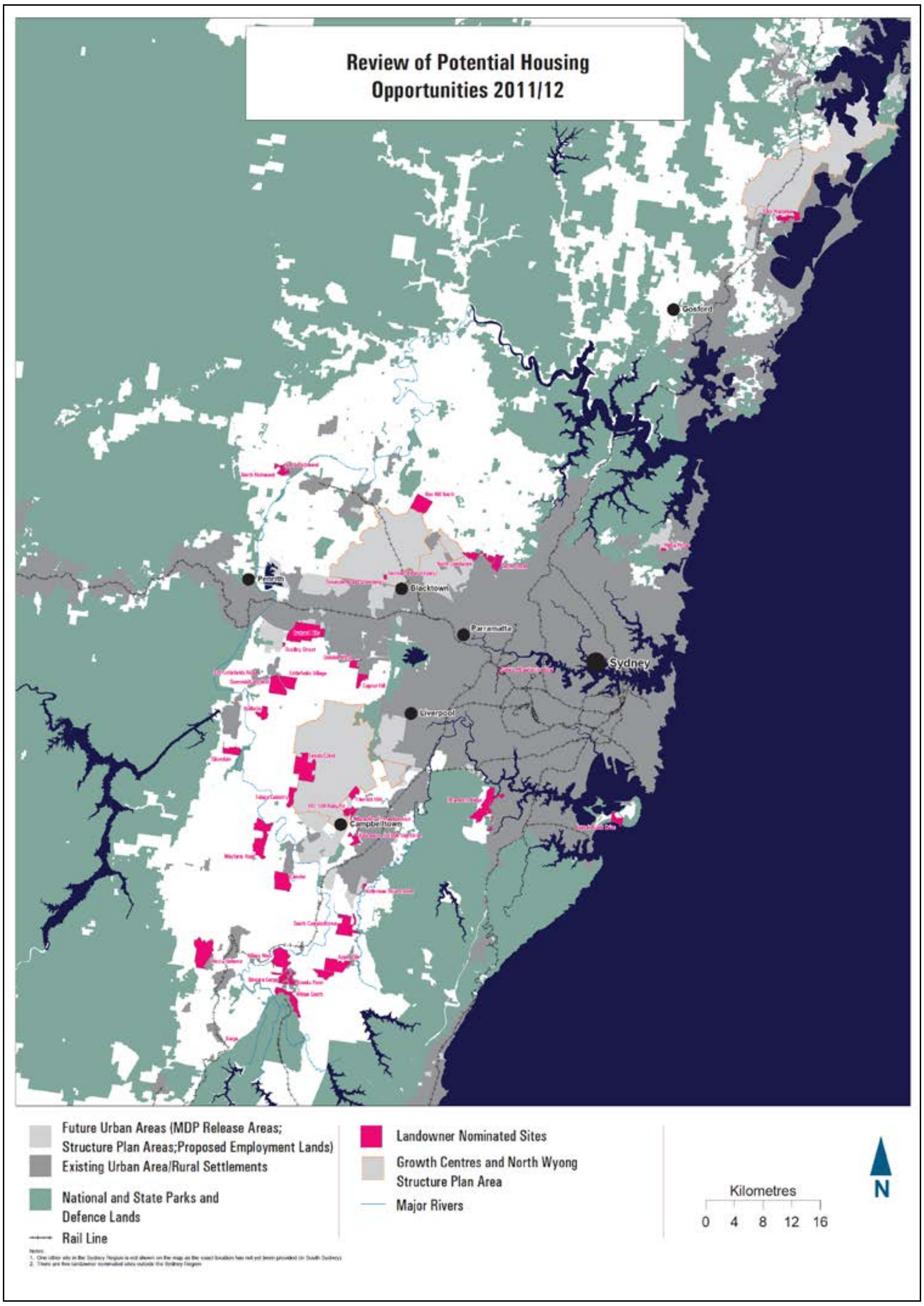
3. Strategic setting

Objective: To support the broad planned pattern of growth and urban policies.

Matters for consideration:

- Consistency with local, state and national strategies, plans and policies;
- Accessibility and liveability; and
- Cumulative implications.

Figure 1.7 Review of potential housing opportunities (2011-2012)



Source: Department of Planning and Infrastructure (2011)

1.3.3.1 Wollondilly Local Environmental Plan 2011

LEPs guide planning decisions for LGAs. Through zoning and development controls, they allow Councils and other consent authorities to manage the ways in which land is used.

The *Wollondilly Local Environmental Plan 2011* (Wollondilly LEP 2011) applies to the land within the Wollondilly LGA.

Under the provisions of Wollondilly LEP 2011, '*air transport facility*' and '*airport*' are defined as follows:

> ***Air transport facility*** *means an airport or a heliport that is not part of an airport, and includes associated communication and air traffic control facilities or structures.*
>
> ***Airport*** *means a place that is used for the landing, taking off, parking, maintenance or repair of aeroplanes, and includes associated buildings, installations, facilities and movement areas and any heliport that is part of the airport.*

Note Airports are a type of ***air transport facility***

Development for the purposes of '*air transport facilities'* is permissible with consent in the following zones:

- RU1 Primary Production;
- B2 Local Centre;
- B4 Mixed Use; and
- IN3 Heavy Industrial.

Development for the purposes of an '*airport'* is permissible with consent in the following zones:

- RU2 Rural Landscape;
- B1 Neighbourhood Centre;
- B2 Local Centre;
- B4 Mixed Use;
- IN2 Light Industrial;
- IN3 Heavy Industrial; and
- SP1 Special Activities.

1.3.3.2 Wollongong Local Environmental Plan 2009

There are three Local Environmental Plans within the Wollongong LGA. These are:

- Wollongong LEP 2009;
- Wollongong LEP (West Dapto) 2010 (Applies to Dapto town centre, Kembla Grange, Horsley and Wongawilli); and
- Wollongong LEP 1990 (Applies to Marshall Mount and parts of Huntley and Yallah).

For the purposes of this study, Wollongong LEP 2009 is the relevant LEP that applies to the majority of the land within the Wollongong LGA (except West Dapto).

Development for the purposes of '*airport facilities'* or an '*airport'* is prohibited in all zones under the provisions of the Wollongong LEP 2009.

1.4 Summary of issues from SSA Site Selection Programme

As part of the Second Sydney Airport (SSA) Site Selection Programme, a Draft Environmental Impact Statement (the Draft 1985 EIS) was prepared that included a preliminary master plan for an airport development at Wilton. The following extracts are from the Draft 1985 EIS with commentary as to the current day relevancy of the extracts, where significant.

- Sydney was recognised as having finite and dwindling supply of land suitable for development because of the containment of the Cumberland Plain by mountains;
- Over more than three decades, a number of potentially suitable airport sites within the Cumberland Plain progressively became unavailable as a result of continued population expansion and replacement candidate airport sites were necessarily located further from the city's centre;
- Population of the Sydney region was expected to grow from a 1981 level of 3.28 million to approximately 4 million by the year 2000. By 2011, the population of Sydney would be between 4.3 and 4.7 million, depending upon the effects of immigration to Australia:
    - Sydney's current population is 4.61million (ABS, 2011);
- The total capacity of the Cumberland Plain was estimated to be approximately 4.7 million people, to accommodate population increased beyond this figures, areas would have to be developed on the Central Coast and in the surrounding foothills and highlands:
    - Across Greater Sydney, growth between 2001 and 2011 was highest in the north-west corridor, with the Statistical Area Level 4 (SA4) of Sydney - Parramatta and Sydney - Blacktown up 64,400 and 48,100 people respectively. There was also significant growth in the two inner-city SA4s of Sydney - City and Inner South (up 62,000 people) and Sydney - Inner South West (49,700). During the same period the Central Coast SA4 grew by 25,400 people (ABS, 2011);
- There were a large number of competing uses for land in the Cumberland Plain. A site for a second Sydney airport was perhaps one of the most significant of these, as the site plus the noise-affected areas over which land use controls would need to be imposed would exceed 25 km^2:
    - This is still a relevant matter;
- Under the projected population growth rate for the Sydney area, the population capacity of the Cumberland Plain of 4.7 million people would be reached by the year 2011, at which time, unless a site had earlier been acquired, there would be no land available for airport development;
- The process of progressive introduction, evaluation, discarding and reintroduction of candidate second airport sites over more than three decades has introduced a great deal of uncertainty into the lives of those people living in the affected areas:
    - This is still a relevant matter;
- This lack of a decision has also affected the NSW Government's urban development program, particularly as far as medium to long term plans are concerned. This is because areas identified for urban development after about 1990, and for which a considerable amount of investigation and planning has been undertaken, has been limited to land not affected by future airport options, which closed off from consideration many areas that may have been more suitable for medium-term urban development:
    - This is still a relevant matter;
- The short-term consequences of no action are likely to be a reintroduction of uncertainty for the potentially affected populations and continuing difficulties for the State Government in its metropolitan planning program:
    - This is still a relevant matter;
- A decision to abandon or defer selection of a site is more likely to give rise to negative effects in the long-term. In the short-term, deferral or abandonment of site selection is most likely to be followed after a short period by resurrection of the search for a site for a second airport, with the attendant costs, controversy and uncertainty for the potentially affected populations.

Regional Planning and Development

- The site lies wholly within the Macarthur Sub-region, but lies close to the boundary of the Wollongong Sub-region of the Illawarra Region. The main emphasis is on the probable effects of airport development on the potential for changes in land use in the two Sub-Regions. Some effects might restrict development in certain places, most would encourage it:
  - This matter is considered in this working paper;
- These effects on land use relate mainly not to the acquisition of a site but to the possible development of the airport and to its economic and social effects and its access needs:
  - This matter is considered in this working paper;
- Potential noise effects from airport operations at Wilton are unlikely to have any significant consequences for land use:
  - This matter is considered in this working paper.

1.5 Analysis of issues in terms of current airport concepts

This chapter explores potential conflicts with an airport development having regard to the following:

- Strategic Planning:
  - NSW Government Review of Potential Housing Sites;
  - Rural land capability;
  - Land Rezoning Applications (Planning Proposals) within Wollondilly LGA;
  - Major Projects Assessments; and
  - Illawarra Regional Strategy;
- Statutory Planning:
  - Standard Instrument LEPs;
  - Zoning;
  - Wollondilly Growth Management Strategy 2011; and
  - Wollondilly Council’s position.

1.5.1 Residential growth

The 2006 Census estimated a resident population for the Wollondilly LGA of 41,221, giving an overall population density of 16.8 persons per square kilometre. However, most of this population is concentrated in the towns and small villages or is scattered among dispersed rural areas. Wollondilly was listed as the 16th fastest growth and 35th largest growth LGA out of 152 LGAs.

The villages of Wilton and Douglas Park, with a combined population of 2,657 (2006 Census), are located approximately 3 km to the north and north-west of the site.

Forecast population increase over the next 20 years could take the population of Wollondilly LGA from 41,221 to over 60,000 in the early to mid-2030s which would require over 7,500 extra houses and additional jobs.

Bingara Gorge, adjoining the town of Wilton to the west, is the most recent urban release area within the LGA. Wollondilly Council approved a masterplan for the site in 2006 which proposes 1,165 dwellings to accommodate 3,500 residents. Land parcels range from 450 m^2 to 4000 m^2.

Within Bingara Gorge, 127 homes have already been completed providing housing for 340 residents. Wilton Public School, the first new school to be built in NSW in a decade opened in 2011. Twenty-three homes are currently under construction. An 18 hole golf course is scheduled for completion in 2013.

A new stage of 42 lots is scheduled for construction and release to the market in August 2012. The new release will be named "Greenbridge". Lot sizes will range from 430 m^2 up to 800 m^2.

1.5.2 NSW Government review of potential housing sites

As outlined in Section 1.3.3, the NSW Government has commenced a review of potential housing opportunities on sites nominated by landowners and a draft report is expected August 2012.

Five of the sites are located within 3 km of the site:

- Wilton West;
- Brooks Point;
- Bingara Gorge;
- Wilton South; and
- Appin Vale.

The above five proposals if approved, would result in approximately 26,000 dwellings and between 60,000 and 75,000 additional people around the Wilton site. This population increase would significantly increase the population density adjoining the Wilton Study Area.

1.5.3 Land Rezoning Applications (Planning Proposals) within Wollondilly LGA

Table 1.4 contains a list of Planning Proposals reported to Wollondilly Council in 2011 - 2012.

Table 1.4 Planning Proposals reported to Wollondilly Council in 2011 - 2012

Location	Applicant	Proposal	Council Resolution	Current Status
Extension of the Menangle Heritage Conservation Area	Wollondilly Shire Council	Extension of the Menangle Heritage Conservation Area to create the Menangle Landscape Conservation Area	February 2011	To be sent to Department of Planning for a Gateway determination
Reclassification of land in Wonga Road Picton	Wollondilly Shire Council	Reclassification of land in Wonga Road Picton to allow for potential relocation of Council's works depot, resolve an existing anomaly and allow for a range of other potential future operational uses of the subject land if required.	March 2011	With Department of Planning for a Gateway determination

Location	Applicant	Proposal	Council Resolution	Current Status
'Clearview' site, Thirlmere Way Picton	Tesrol Holding Pty Ltd	Part R2 Low Density Residential; Part R5 Large Lot Residential	April 2011	With Department of Planning for a Gateway determination
Rezoning of land fronting Production Avenue Warradale and Silverdale Roads, in the locality of Silverdale	Siteplus	Part R2 Low Density Residential; Part E2 Environmental Conservation; Part IN2 Light Industrial	June 2011	To be sent to Department of Planning for a Gateway determination

Table 1.5 contains a list of Planning Proposals submitted but not yet reported (determined) by Council.

Table 1.5 Planning Proposals submitted but not yet reported (determined) by Council

Location	Applicant	Proposal	Council Resolution	Current Status
Rezoning of 'JR Stud' – 165-185 River Road, Tahmoor	RPS	Part R5 Large Lot Residential; Part E2 Environmental Conservation; Part RE2 Private Recreation	February 2011	Applicant revising proposal
Rezoning of 35 Egans Road, Oakdale	Precise Planning	Part R2 Low Density Residential	May 2011	Report to August 2011 Ordinary Meeting of Council for consideration
West Appin – land in Macquariedale Road	Walker Corporation	Part R2 Low Density Residential; Part E2 Environmental Conservation; Part SP2 Infrastructure (Appin bypass route)	June 2007	Report to August 2011 Ordinary Meeting of Council for consideration
Land between Tahmoor and Thirlmere	Rein Warry & Co. (on behalf of the Picton Tahmoor Thirlmere Action Group)	Rural residential development	July 2011	Report to August 2011 Ordinary Meeting of Council for consideration

The following **Table 1.6** Rezoning Applications progressing as draft LEPs.

Table 1.6 Rezoning Applications progressing as draft Local Environmental Plans

Location	Applicant	Proposal	Council Resolution	Current Status
Picton Tahmoor Thirlmere Urban (six separate precincts) Draft LEP No. 73	Various landowner / precinct groups	Part R2 Low Density Residential - six new residential precincts around the three towns	October 2005 December 2005 January 2006 February 2006 March 2006 April 2006	Draft Local Environmental Study (LES) prepared
Montpelier Drive, The Oaks Draft LEP No. 77	Haskew Planning	Part R2 Low Density Residential	May 2007	To be forwarded to the Minster for Planning for publication
Picton Road, Maldon Draft LEP No. 75	Allied Mills in association with other landowners	Part IN1 General Industrial	June 2007	Draft Specialist Studies prepared

The above proposals provide some indication of the current level of activity in residential growth that the Wollondilly LGA is experiencing.

Table 1.7 shows Planning Proposals and Rezoning Applications not supported by Council.

Table 1.7 Planning Proposals and Rezoning Applications not supported by Council

Location	Applicant	Proposal	Council Resolution	Current Status
Moreton Park Road, Menangle	Elton Consulting	240 hectares of employment land	February 2010	Reported to August 2010 Ordinary Meeting of Council. Resolution No. 224/2010: *that Council not endorse the planning proposal at this stage and therefore not forward the proposal to the NSW Minister for Planning for a gateway determination*

The suburb of Menangle is located approximately 10 km north of the Study Area. A copy of Council's Planning Report should be obtained to review the reasons for Council's resolution to not endorse the proposed 240 ha employment land release.

1.6 Major Project Assessments

The following **Table 1.8** lists the Major Project Assessments for the Wollondilly Shire LGA submitted to the NSW Department of Planning and Infrastructure and their status, (as of 20 July 2012).

Table 1.8 Wollondilly Shire LGA Major Assessments

Major Projects Assessments	Status
Picton Sewerage Scheme - Modification 3 - Scheme Boundary Expansion	Proponent Reviewing Submissions
Camden Gas Project - Stage 3	Proponent Reviewing Submissions
Wilton Quarry - Wilton Quarry Project	Revoked
Appin - Concept Plan application	Revoked
Appin - Stage 1 Project Application	Revoked
Camden Gas Project - Mount Taurus - Harness Racing Club Mod 2 (DA 183-8-2004i - Mod 2)	Determination
Appin-West Cliff Mining Complex - Appin Gas Drainage Project Modification 2	Determination
Appin-West Cliff Mining Complex - Bulli Seam Operations Project	Determination
Appin-West Cliff Mining Complex - West Cliff Goaf Gas Drainage Modification 3	Determination
Appin-West Cliff Mining Complex - Appin Ventilation Shaft No. 6 Project	Determination
Appin-West Cliff Mining Complex - West Cliff Coal Mine - Goaf Gas Drainage Project S75W Mod 2	Determination
Camden Gas Project - PA 06_0291 Mod 2	Determination
Camden Gas Project - PA 06_0291 Mod 3	Determination
Camden Gas Project - DA 246-8-2002-i_Mod 4	Determination
Camden Gas Project - Spring Farm - Mod 3	Determination
Camden Gas Project - Spring Farm - Menangle Park Mod 1 (MP 06_0291 MOD 1)	Determination
Appin-West Cliff Mining Complex - Appin Gas Drainage Project - s75W Mod 1	Determination
Camden Gas Project - DA 282-6-2003i MOD 12	Determination
Camden Gas Project - DA 9-1-2005 MOD 3	Determination
Camden Gas Project - DA 75-4-2005 (Sugarloaf Farm) MOD 2	Determination
Appin-West Cliff Mining Complex - West Cliff Coal Mine - Surface Goaf Gas Drainage Project Modification 1	Determination
Appin-West Cliff Mining Complex - Appin Gas Drainage Project	Determination
Camden Gas Project - Stage 2 Modification 11	Determination

Major Projects Assessments	Status
Appin-West Cliff Mining Complex - West Cliff CPP Project	Determination
Picton Sewerage Scheme - Modification to Picton Sewerage Scheme	Determination
Appin-West Cliff Mining Complex - West Cliff Fuel Facility Project	Determination
Appin-West Cliff Mining Complex - West Cliff Gas Drainage Project	Determination
Camden Gas Project - Stage 2 Concept Plan	Determination
Camden Gas Project - Spring Farm and Menangle Park	Determination
Appin-West Cliff Mining Complex - Water Supply Pipeline Project	Determination
Appin-West Cliff Mining Complex - Douglas North Substation Project	Determination
Camden Gas Project - EMAI Modification 1	Determination
Camden Gas Project - Razorback	Determination
Camden Gas Project - EMAI	Determination
Appin-West Cliff Mining Complex - East Appin Switching Station Project	Determination
Wilton - Wilton Park (Bingara Gorge) VPA	VPA Executed
Camden Gas Project - Spring Farm and Menangle Park - Modification 1	Withdrawn
Stone Quarry Resort, Picton - State Significant Site Listing - Stone Quarry	Discontinued

Table 1.8 provides an indication of the significant number of new and expansion industrial proposals (being assessed and determined) including mining and gas projects within the Wollondilly LGA.

Table1.9 lists the Major Project Assessments submitted to the NSW Department of Planning and Infrastructure and their status for the Wollongong LGA (as of 20 July 2012).

Currently there are two State Significant Site listings for gazettal including:

- Sandon Point Residential Development; and
- Calderwood – rezoning for residential, commercial and retail development.

These sites are not located within the Wilton Study Area and are located approximately 20 km to the southeast of the Study Area.

Table 1.9 Wollongong LGA Major Assessments

Major Projects Assessments	Status
Tallawarra Lands - MP09_0131 Mixed Use Development Concept	Exhibition
Lake Illawarra Entrance Works - Modification to Lake Illawarra Entrance Works	Assessment
None - Resource Recovery Facility	DGRs Issued

Major Projects Assessments	Status
Port Kembla Coal Terminal - Sec 75W Modification to the Port Kembla Coal Terminal	DGRs Issued
Whytes Gully Waste Facility - Whytes Gully Landfill Extension Project	DGRs Issued
Bluescope Steel Commonwealth Rolling Mill (CRM) Works - Bluescope Steel CRM Works Project	DGRs Issued
Warwick Street - MP 10_0147 Life City Wollongong - Hi-Tech Holistic Cancer & Medical Hospital Campus	DGRs Issued
Water and Wastewater Servicing of the West Dapto Urban Release Area and Adjacent Growth Areas - Concept Plan	DGRs Issued
Water and Wastewater Servicing of the West Dapto Urban Release Area and Adjacent Growth Areas - Project Application	DGRs Issued
NRE No. 1 Mine - Underground Expansion Project	DGRs Issued
Illawarra Employment and Teaching Centre - Major Project 08_0247	DGRs Issued
Orica Chemnet - Remediation Project	Revoked
Sandon Point Residential Development - MP 07_0132 - Project Application - ARV Seniors / Retirement Village & modification to Concept Plan MP06_0094 MOD 3	DGRs Issued
Redlam Medical Waste Incinerator - Redlam Medical Waste Project	Revoked
NRE No. 1 Mine - Mod 1 - Longwalls 4 and 5	Application Received
Keira St, Wollongong - MP06_0335 MOD 2 & MP06_0209 MOD 4- Proposed modification to GPT retail/commercial/residential development	Assessment
Port Kembla Biodiesel Facility - National Biodiesel Limited 08_0083 MOD1 - Site layout changes	DGRs Issued
Cement Australia Grinding Mill - Modification to Cement Australia Grinding Mill	Determination
Wollongong Hospital - MP10_0213 - Wollongong Hospital Redevelopment	Determination
Calderwood - Stage 1 Project Application	Determination
Coalcliff, Stanwell Park, Stanwell Tops & Otford Sewerage Scheme - Modification 2 - Extension of the Approved Service Boundary	Determination
Appin-West Cliff Mining Complex - Appin Gas Drainage Project Modification 2	Determination
Appin-West Cliff Mining Complex - Bulli Seam Operations Project	Determination
Shone Avenue, Horsley - Shone Avenue, Horsley Voluntary Planning Agreement	VPA Executed
Keira St, Wollongong - MP 06_0209 MOD 3 - West Keira and Wollongong Central Shopping Centre	Determination
Port Kembla Grain Handling Terminal - Port Kembla Grain Handling Terminal	Determination
Wongawilli Mine - Continued Operations Project - Nebo Area	Determination

Major Projects Assessments	Status
Water and Wastewater Servicing of the West Dapto Urban Release Area and Adjacent Growth Areas - West Horsley Early Works Major Project Application	Determination
NRE No. 1 Mine - Preliminary Works Project	Determination
31 and 47 Crown St, Wollongong (Dwyers and Oxford Tavern site) - MP06_0257 - Mixed Use Development	Determination
Cement Australia Grinding Mill - Cement Australia Grinding Mill	Determination
Port Kembla Outer Harbour Development - Port Kembla Outer Harbour Stage 1 - MOD 1	Determination
Port Kembla Outer Harbour Development - Port Kembla Outer Harbour Concept Plan - MOD 1	Determination
Appin-West Cliff Mining Complex - West Cliff Goaf Gas Drainage Modification 3	Determination
Metropolitan Mine - 08_0149 MOD 2 Traffic Management	Determination
Sandon Point Residential Development - MP07_00032 - Mod 3 - Sandon Point	Determination
Appin-West Cliff Mining Complex - Appin Ventilation Shaft No. 6 Project	Determination
Appin-West Cliff Mining Complex - West Cliff Coal Mine - Goaf Gas Drainage Project S75W Mod 2	Determination
Wollongong Private Hospital - MP07_0070 - Wollongong Private Hospital	Determination
Calderwood - Calderwood VPA	VPA Executed
Port Kembla Outer Harbour Development - Port Kembla Outer Harbour Development - Concept Plan	Determination
Port Kembla Outer Harbour Development - Port Kembla Outer Harbour Development - Stage 1 Project	Determination
West Dapto Urban Release Area - West Dapto VPA	VPA Executed
Calderwood - State Significant Site	Gazettal
Tallawarra Gas Turbine Power Station - Project Application - Tallawarra Stage B Gas Turbine Power Station	Determination
Offshore Artificial Reefs Project - 08_0095	Determination
Calderwood - Concept Plan	Determination
Appin-West Cliff Mining Complex - Appin Gas Drainage Project - s75W Mod 1	Determination
Metropolitan Mine - 08_0149 MOD 1 Replacement Drift Modification	Determination
Cookson Plibrico - Cookson Plibrico Refractory Project	Determination
Port Kembla Copper - Port Kembla Copper Demolition Project	Determination
Sandon Point Residential Development - MP 07_0032 - Mod 1 - Modification to Conditions of	Determination

Major Projects Assessments	Status
Consent	
Sandon Point Residential Development - MP 06_0094 - Mod 2 - Modification to conditions of Consent	Determination
Illawarra International Health Precinct - MP08_0156 Stage 1 (MOD 1)	Determination
Port Kembla Steelworks - BlueScope Steel Limited - Illawarra Cogeneration Project (ICP) 08_0031 MOD 2	Determination
Sandon Point Residential Development - MP 07_0032 - Mod 2 - Modification to Project Application	Determination
Wongawilli Mine - Bathhouse Project	Determination
Illawarra International Health Precinct - Concept Plan Application 08_0156	Determination
Appin-West Cliff Mining Complex - West Cliff Coal Mine - Surface Goaf Gas Drainage Project Modification 1	Determination
Sandon Point Residential Development - MP 06_0094 Mod 1 - Modification to Concept Plan	Determination
Sandon Point Residential Development - MP 07_0032 - Project Application - Residential Subdivision	Determination
Sandon Point Residential Development - State Significant Site Listing	Gazettal
Appin-West Cliff Mining Complex - Appin Gas Drainage Project	Determination
Appin-West Cliff Mining Complex - West Cliff CPP Project	Determination
Metropolitan Mine - Project Approval	Determination
Port Kembla Coal Terminal - Port Kembla Coal Terminal Project	Determination
Port Kembla Biodiesel Facility - Soybean Processing & Biodiesel Facility	Determination
Appin-West Cliff Mining Complex - West Cliff Fuel Facility Project	Determination
06_0305 Princes Hwy, Helensburgh - Golf resort	Determination
Keira St, Wollongong - Mod 2 - GPT West Keira + Wollongong Central Redevelopment	Determination
Keira St, Wollongong - Mod 1 - GPT West Keira + Wollongong Central Redevelopment - mods to conditions of Concept Plan + Project Application	Determination
Port Kembla Steelworks - BlueScope Steel Injection Station Project	Determination
Port Kembla Steelworks - BlueScope Cogeneration Plant Project	Determination
Appin-West Cliff Mining Complex - West Cliff Gas Drainage Project	Determination
Manildra Park Bulk Liquids Facility - Kooragang Island - P 07_0066	Determination
Keira St, Wollongong - GPT retail/commercial/residential development	Determination

Major Projects Assessments	Status
Appin-West Cliff Mining Complex - Water Supply Pipeline Project	Determination
Appin-West Cliff Mining Complex - Douglas North Substation Project	Determination
Port Kembla Steelworks - Project Application - Ore Preparation Area Upgrade	Determination
Sandon Point Residential Development - Concept Plan (Stockland & ARV) MP 06_0094	Determination
Appin-West Cliff Mining Complex - East Appin Switching Station Project	Determination
Port Kembla - Port Kembla General Cargo Handling Facility	Determination
Lake Illawarra Entrance Works - Lake Illawarra Entrance Works	Determination
Illawarra International Health Precinct - MP08_0156 MOD 3 - Illawarra International Health Precinct	Withdrawn
Port Kembla Steelworks - Bluescope Steel Scrap Handling Facility MP 10_0005	Withdrawn
NRE No. 1 Mine - NRE No. 1 Colliery Project (withdrawn)	Withdrawn
Blackwell Landscape Supplies - resource recovery facility	Withdrawn

Table 1.9 provides an indication of the significant number of new and expansion industrial proposals (being assessed and determined) including mining, steelworks, waste recovery and major residential release areas within the Wollondilly LGA.

1.6.1 Standard Instrument Local Environmental Plans

Of relevance to the Wilton Study Area, new LEPs have been prepared by Wollondilly, Wollongong and Wingecarribee Councils, based on the State Government's Standard Instrument (LEP Template).

In preparing the new LEPs Councils have had regard to:

- Zoning - which zones to use and where these zones should be placed within their LGA boundaries, after considering any regional or State policies which may apply;
- Local objectives - outline Council's vision for land use; and
- Additional permitted or prohibited land uses.

1.6.1.1 Zoning

Under the Wollondilly LEP 2011 and the Wollongong LEP 2009, the Wilton Study Area is zoned:

- RU2 Rural Landscape;
- RU4 Rural Small Holdings;
- E2 Environmental Conservation; and
- SP2 Infrastructure.

The zoning of the land for each of the eight Options (as developed in the Working Paper - *Wilton Site Selection and Airport Concepts)* is shown in the **Table 1.10**.

Table 1.10 Zoning within the footprint of each Wilton airport option

Option	Local Government Area	RU2 Rural Landscape	RU4 Rural Small Holdings	E2 Environmental Conservation	SP2 Infrastructure
Option 1	Wollondilly LEP 2011	Yes	No	Yes	Yes
Option 1 (south)	Wollondilly LEP 2011	Yes	Yes	Yes	Yes
Option 2	Wollondilly LEP 2011	Yes	Yes	Yes	Yes
Option 3	Wollondilly LEP 2011 Wollongong LEP 2009	No	No	Yes	No
Option 4	Wollondilly LEP 2011	No	No	Yes	No
Option 5	Wollondilly LEP 2011 Wollongong LEP 2009	No	No	Yes	No
Option 6	Wollondilly LEP 2011	Yes	Yes	Yes	Yes
Option 7	Wollondilly LEP 2011	Yes	Yes	Yes	Yes

The land upon which '*air transport facilities'* or an '*airport'* is permissible with consent is outlined at Section 1.3.3.1 and 1.3.3.2.

Development for the purpose of '*air transport facilities'* or an '*airport'* is currently **prohibited** on land zoned RU4 Rural Small Holdings, SP2 Infrastructure and E2 Environmental Conservation.

Development for the purpose of an '*airport'* is currently **permitted with consent** on land zoned RU2 Rural Landscape.

As all of the options contain some land zoned E2 Environmental Conservation, under the provisions of the Wollondilly and Wollongong LEPs, no option in its present layout is currently permissible with development consent.

The zoning of the land for each of the eight Options (as developed in the Working Paper *Wilton Site Selection and Airport Concepts)* is shown in **Figures WP-301015-03019-LUP-SK-000 to 007 Zoning** provided at the end of this section.

1.6.2 Wollondilly Growth Management Strategy 2011

A Growth Management Strategy 2011 has been prepared by Wollondilly Shire Council to guide decisions about growth and to have a long-term strategic approach to the future of the Shire.

The Growth Management Strategy sets new directions for accommodating growth within the Wollondilly Shire for the next 25 years.

Wollondilly's population of around 43,000 is expected to grow over the next 25 years to over 60,000 people sometime in the early to mid-2030s which would require over 7,500 extra houses and additional jobs. The Growth Management Strategy was commenced in recognition of the need to have a plan for future growth.

The key elements contained in the Growth Management Strategy include:

- Planning for "natural" rates of growth. This means we will continue to grow at similar rates to the last 15 years (average 1.9% pa) rather than trying to accelerate our growth. This will still mean a 20,000 population increase in the next 25 years;

- Not having further major urban release within the Macarthur South area at this stage;
- Planning for the delivery of at least 7,500 new houses over the next 25 years;
- Planning for a range of different housing types to meet the needs of our future community;
- Planning for a range of new employment opportunities so that residents have greater opportunities for working locally and within the region;
- Ensuring all forms of growth are compatible with the vision of "rural living" which now has a definition in the Growth Management Strategy;
- Acknowledging and seeking to protect the Shire's rural and resource lands because of their special economic, environmental and cultural values;
- Encouraging sustainable growth which supports our existing towns and villages, and makes the provision of services and infrastructure more efficient and viable; and
- Planning for the majority of new housing growth to be focused within or immediately adjacent to existing settlements, rather than spreading it through rural areas.

1.6.3 Illawarra Regional Strategy

The Illawarra Regional Strategy is one of a number of regional strategies that have been prepared by the then Department of Planning for high growth areas in NSW. It builds on the Illawarra and South Coast Background Paper prepared by the Department in 2005.

The Illawarra's population of around 280,000 is anticipated to grow with an additional 46,700 residents by 2030 most of which will be concentrated around existing centres already supported by essential infrastructure.

The primary purpose of the Regional Strategy is to ensure that adequate land is available and appropriately located to sustainably accommodate the projected housing and employment needs of the Region's population over the next 25 years.

1.6.4 Rural land capability - agricultural land use

NSW Agriculture Land Classification

There are two techniques currently used to evaluate rural land in NSW:

- Rural land capability mapping; and
- Agricultural land classification.

Rural land capability mapping

An eight class system, used by the Department of Land and Water Conservation, considers the erosion hazards in the use of the land. It classifies land in terms of its inherent physical characteristics, or physical constraints, and denotes measures needed to protect the land from soil erosion and other forms of land degradation.

Refer to *Rural Land Capability Mapping* (undated), Department of Land and Water Conservation

Agricultural land classification

A five class system used by NSW Agriculture classifies land in terms of its suitability for general agricultural use. This system was developed specifically to meet the objectives of the *Environmental Planning and Assessment Act 1979,* in particular 5(a) (i) *'to encourage the proper management, development and conservation of natural and man-made resources, including agricultural land for the purpose of promoting social and economic welfare of the community and a better environment'*.

Agricultural land is classified by evaluating biophysical, social and economic factors that may constrain the use of land for agriculture. In general terms, the fewer the constraints on the land, the greater its value for agriculture. Each type of agricultural enterprise has a particular set of constraints affecting production. Consequently, agricultural land classification is based on a set of constraining factors common to most agricultural industries.

The factors that influence agricultural suitability include those shown in **Table 1.11**.

Table 1.11 Factors that influence agricultural suitability

Biophysical Factors	Social Factors	Economic Factors
Environmental impact: fertilisers, pesticides, wastes, erosion, salinisation, siltation, vegetation learing	Legislative and/or regulatory constraints	Regional and local infrastructure to support agriculture
Topography: slope (angle and length), erosion hazard, aspect, altitude, flood liability, exposure, land slip, surface drainage	Potential conflict with other land users: e.g. noise, odour, dust	Geographic location
Soil physics: texture, structure, erodibility, depth, water holding capacity, internal and surface drainage, rockiness, stoniness, depth to watertable, permeability, clay type, colour, surface crusting, density, aeration, trafficability, stability under irrigation	Availability of permanent or seasonal, skilled or unskilled labour	Accessibility and location with respect to transport requirements and costs
Soil chemistry: fertility, toxicity, organic matter, soil reaction, cation exchange capacity, salinity, sodicity, rates of fixation, dispersibility		Accessibility to local and export markets
Climate: length of growing season, temperatures, rainfall, evaporation, wind, humidity, frost occurrence, irrigation, hail, exposure		Presence of any comparative market advantage
Pests and Diseases: presence of noxious or pest animals, noxious weeds, insects, plant or animal pathogens (field and storage)		Structure of local farming and marketing, e.g. co-operatives and marketing bodies
		Availability and cost of land locally and elsewhere
		Costs of removing biophysical constraints
		Site contamination from previous land use

Source: Agfact NSW Agriculture Land Classification

Agricultural land classification maps place land into one of five classes according to its suitability for a wide range of agricultural activities. Class 1 land has few constraints to agricultural production, so a wide range of crops can be profitably grown; while Class 5 land has severe constraints and is, in general, unsuited to agriculture.

The essential characteristics of these classes are described below:

- **Class 1:** Arable land suitable for intensive cultivation where constraints to sustained high levels of agricultural production are minor or absent;
- **Class 2:** Arable land suitable for regular cultivation for crops, but not suited to continuous cultivation. It has a moderate to high suitability for agriculture but edaphic (soil factors) or environmental constraints reduce the overall level of production and may limit the cropping phase to a rotation with sown pastures;
- **Class 3:** Grazing land or land well suited to pasture improvement. It may be cultivated or cropped in rotation with sown pasture. The overall production level is moderate because of edaphic or environmental constraints. Erosion hazard, soil structural breakdown or other factors, including climate, may limit the capacity for cultivation and soil conservation or drainage works may be required;
- **Class 4:** Land suitable for grazing but not for cultivation. Agriculture is based on native pastures or improved pastures established using minimum tillage techniques. Production may be seasonally high but the overall production level is low as a result of major environmental constraints; and
- **Class 5:** Land unsuitable for agriculture, or at best suited only to light grazing. Agricultural production is very low or zero as a result of severe constraints, including economic factors which prevent land improvement.

Options 1, 1S, 2, 6 and 7 are located in part on land zoned either RU2 Rural Landscape or R4 Rural Small Holdings. The rural land capability and agricultural land classification of this land should be investigated.

1.6.5 Wollondilly Council’s position

1.6.5.1 No Airport in Wilton Campaign (15 May 2012)

On 15 May 2012, Wollondilly Shire Council released a report entitled ‘*The Case Against an Airport in Wilton’*. A summary of Council’s key Issues is below:

1. **Water quality** – potential airport sites in the Wilton area are all located in extremely sensitive drinking water catchments.
2. **Land use and housing** – the future Macarthur south release area is estimated to provide an additional 62,000 lots as the existing South West Growth Centre reaches capacity, much of this development would be sacrificed by developing an airport at Wilton.
3. **Curfew and Noise** – a curfew free airport at Wilton will mean 24/7 noise impacts on surrounding communities.
4. **No existing ANEF protection** – buildings at Wilton have not been constructed to cope with aircraft noise.
5. **Air quality in South Western Sydney** – the construction of an airport coupled with significant increases in road transport generated exhaust emissions that would result from such a development would be completely inappropriate and unsustainable.
6. **Heritage, ecology and biodiversity** – the development and operation of a major airport at Wilton would threaten sensitive heritage sites and ecological systems including vulnerable koala populations.
7. **Lack of coordination and integration** – the NSW Government has commenced a twelve month process to develop a long term transport master plan for NSW; is in the process of developing a NSW freight strategy, and is also due to present a 20 year State infrastructure study in September this year. None of these studies have been appropriately coordinated or integrated.
8. **False Urgency** – there is enough time to make a properly considered decision about future airport needs, including the role for High Speed Rail in addressing transport needs.

9. **There are no magic bullet solutions** – it is very important that proper plans and actions are put in place to underwrite Sydney's future transport needs. However, Sydney's transport challenge is complex – and satisfactory outcomes will require carefully integrated and implemented solutions.

10. **Economics of failure** – an airport at Wilton is likely to fail in economic terms, and the cost of that failure would be borne by Australian taxpayers.

11. **The alternative approach** – the better and smarter alternative to an airport in Wilton is based on providing transport alternatives from a number of sources, including:

- The reasonable optimisation of capacity and performance at Sydney's existing major airport (Sydney Airport);
- Providing the ground transport infrastructure that is needed to support Sydney Airport and avoiding undue congestion;
- Making best use of Sydney's other existing airports – including Bankstown and Richmond; and
- Planning for the progressive implementation of an Australian east coast High Speed Rail system.

1.7 Key findings

1.7.1 Potential site specific impacts from current land uses

1.7.1.1 Number of properties within airport footprints

Table 1.12 identifies the approximate number of properties that are located within each airport footprint. The impact of airport options on properties is described in the Working Paper - *Impacts on Property and Commercial Enterprise.*

Table 1.12 Approximate number of properties within each airport footprint and the subsequent zoning

Airport Options	Allotments Within Airport Footprint	Roads / Infrastructure	Zoning
Option 1	**48**	Alkoomie Pl, Lisa Rd	RU2 Rural Landscape
	21	Alkoomie Pl, Fire Rd	E2 Environmental Conservation
	0	Macarthur Dr, Picton Rd	SP2 Infrastructure
TOTAL	**69**		
Option 1 (south)	63	Alkoomie Pl, Lisa Rd	RU2 Rural Landscape
	2		RU4 Rural Small Holdings
	23	Alkoomie Pl, Fire Rd	E2 Environmental Conservation
	0	Macarthur Dr, Picton Rd	SP2 Infrastructure
TOTAL	**88**		
Option 2	73	Alkoomie Pl, Lisa Rd, Wilton Rd, Wilton Lane	RU2 Rural Landscape
	2		RU4 Rural Small Holdings

Airport Options	Allotments Within Airport Footprint	Roads / Infrastructure	Zoning
	27	Alkoomie Pl, Fire Rd	E2 Environmental Conservation
		Macarthur Dr, Picton Rd	SP2 Infrastructure
TOTAL	**102**		
Option 3	4	Fire Rd	E2 Environmental Conservation
TOTAL	**4**		
Option 4	4	Fire Rd	E2 Environmental Conservation
TOTAL	**4**		
Option 5	4	Fire Rd	E2 Environmental Conservation
TOTAL	**4**		
Option 6	77	Alkoomie Pl, Lisa Rd	RU2 Rural Landscape
	2		RU4 Rural Small Holdings
	27	Alkoomie Pl, Fire Rd	E2 Environmental Conservation
		Macarthur Dr, Picton Rd	SP2 Infrastructure
TOTAL	**106**		
Option 7	77	Alkoomie Pl, Lisa Rd	RU2 Rural Landscape
	2		RU4 Rural Small Holdings
	23	Alkoomie Pl, Fire Rd	E2 Environmental Conservation
		Macarthur Dr, Picton Rd	SP2 Infrastructure
TOTAL	**102**		

1.7.2 Impact on sites identified as Fast Track sites

Bingara Gorge, adjoining the town of Wilton to the west, is the most recent urban release area within the LGA (refer to **Figure WP-301015-03019-LUP-SK-010 Wollondilly LEP Urban Release Plan** provided at the end of this section). Wollondilly Council approved a masterplan for the site in 2006 which proposes 1,165 dwellings to accommodate 3,500 residents. Land parcels range from 450 m^2 to 4000 m^2.

Within Bingara Gorge, 127 homes have already been completed providing housing for 340 residents. Wilton Public School, the first new school to be built in NSW in a decade opened in 2011. Twenty-three homes are currently under construction. An 18 hole golf course is scheduled for completion in 2013.

A new stage of 42 lots is scheduled for construction and release to the market in August 2012.

Whilst none of the airport options are located within the Bingara Gorge site, other matters for consideration include property, acoustic, social and visual impacts. These matters have been addressed in the Working Papers - *Property Impacts*, *Acoustic Effects on People*, *Social Effects of Airports* and *Visual Impacts of Airports,* respectively.

1.7.3 Impact on Protected Lands

As outlined in the Working Paper - *Wilton Airport Site Selection and Airport Concepts*, the runways of representative airport options were sited in order to avoid impacts on the Upper Nepean State Conservation Area. However, in some cases, some small areas of the airport footprints were required to be sited partially in Conservation Area in order to maintain a maximum airport type (Refer to **Figure WP-301015-03019-LUP-SK-008 Protected Lands** provided at the end of this section).

Table 1.13 identifies the Protected Lands[13] areas that will be affected by the airport footprints for all options.

Table 1.13 Protected Lands that will be affected by the airport footprints for all options

Airport Options	Protected Lands Affected by Runway Footprint	Protected Lands Affected by Airport Footprint
Option 1	Nil	Upper Nepean State Conservation Area (part of Runway End Safety Area)
Option 1S	Nil	Upper Nepean State Conservation Area (part of Runway End Safety Area including High Intensity Approach Lighting)
Option 2	Nil	Upper Nepean State Conservation Area (part of Runway End Safety Area including High Intensity Approach Lighting)
Option 3	Nil	Nil
Option 4	Nil	Nil
Option 5	Nil	Nil
Option 6	Nil	Upper Nepean State Conservation Area (part of Runway End Safety Area including High Intensity Approach Lighting)
Option 7	Nil	Upper Nepean State Conservation Area (part of Runway End Safety Area including High Intensity Approach Lighting)

As indicated in the table above, airport concept footprints for Options 1, 1S, 2, 6 and 7 slightly encroach on the Upper Nepean State Conservation. The airport concept footprints affecting the State Conservation Area are all restricted to the Runway End Safety Area (RESA).

No runway footprints are located within the protected land areas. Instead, it is principally the runway end safety area and high intensity approach lighting that are currently located in these lands based on the base case airport templates being assessed.

[13] For the purpose of this study, 'Protected Lands' is defined as National Parks, State Conservation Areas, RAMSAR wetlands

1.7.4 Potential site specific impacts from proposed land uses

1.7.4.1 Impact on sites identified as Fast Track sites

Five of the sites identified by the NSW Government as fast track landowner nominated sites are located within 3 km of the site:

- Wilton West;
- Brooks Point;
- Bingara Gorge (already approved in part);
- Wilton South; and
- Appin Vale.

The above five proposals if approved, would result in approximately 26,000 dwellings and between 60,000 and 75,000 additional people around the Wilton site.

The impact of airport options on noise, including a consideration of the landowner nominated sites is contained in the Working Paper - *Impact on Property and Commercial Enterprises* and *Acoustic Effects on People*.

Figure WP-301015-03019-LUP-SK-009 Land Owner Nominated Sites Plan (provided at the end of this section) shows the location of the five land owner nominated sites.

1.7.5 Planning issues

There are numerous challenges confronting land use planning for an airport including:

- The location of and relationship between the existing land uses in the area and the proposed airport site;
- The likely effects of any proposed airport development;
- The accessibility to, and within, the airport site;
- Lack of integration between Federal, State and Local planning regimes;
- Operation and interaction between the Commonwealth's Airports Act and the Environment Protection and Biodiversity Conservation Act and the State's Environmental Planning and Assessment Act; and
- Competitive advantage gained by airports conducting non-aviation based activities (in business parks) over commercial businesses outside of airports that are subject to State and Local planning controls.

1.8 Recommended further analysis and mitigation methods and strategies

Further consideration of land use planning impacts should be undertaken and should comprise detailed analysis of:

- Land ownership within and adjoining the concept airport sites;
- Rural land capability;
- Infrastructure capability;
- Employment land capability;
- Residential land capability and growth areas;
- Drinking water catchment objectives and requirements;
- Current mining leases and proposed exploration areas; and

- The findings of the NSW Government's Review of Potential Housing Opportunities 2011/2012 (Land Owner Nominated Sites) – due August 2012.

Whilst there is no commitment by any party including the Commonwealth and State Government to either study these options in more detail or to develop any concept option into an operating airport, the following land use planning mitigation methods could be considered:

- Review the airport concept footprints to refine location, layout and size of the airport facilities and non-aeronautical developments;
- Review the runway alignments (impact on ANEC contours);
- Effective land use planning;
- Consideration of buffer zones; and
- Communication and consultation of current information.

1.9 References

Joint Study on Aviation Capacity in the Sydney Region: Report to Australian Government and NSW Government March 2012

Department of Aviation, Sydney Second Airport Site Selection Programme Draft Environmental Impact Statement, prepared by Kinhill Stearns, 1985

Bureau of Infrastructure, Transport and Regional Economics (BITRE)

2011 quickstats for
Wollondilly http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/LGA18400?opendocument&navpos=95

2011 quickstats for Maddens Plains

http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/SSC11438?opendocument&navpos=95

http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/SSC11438

NOTES

1. 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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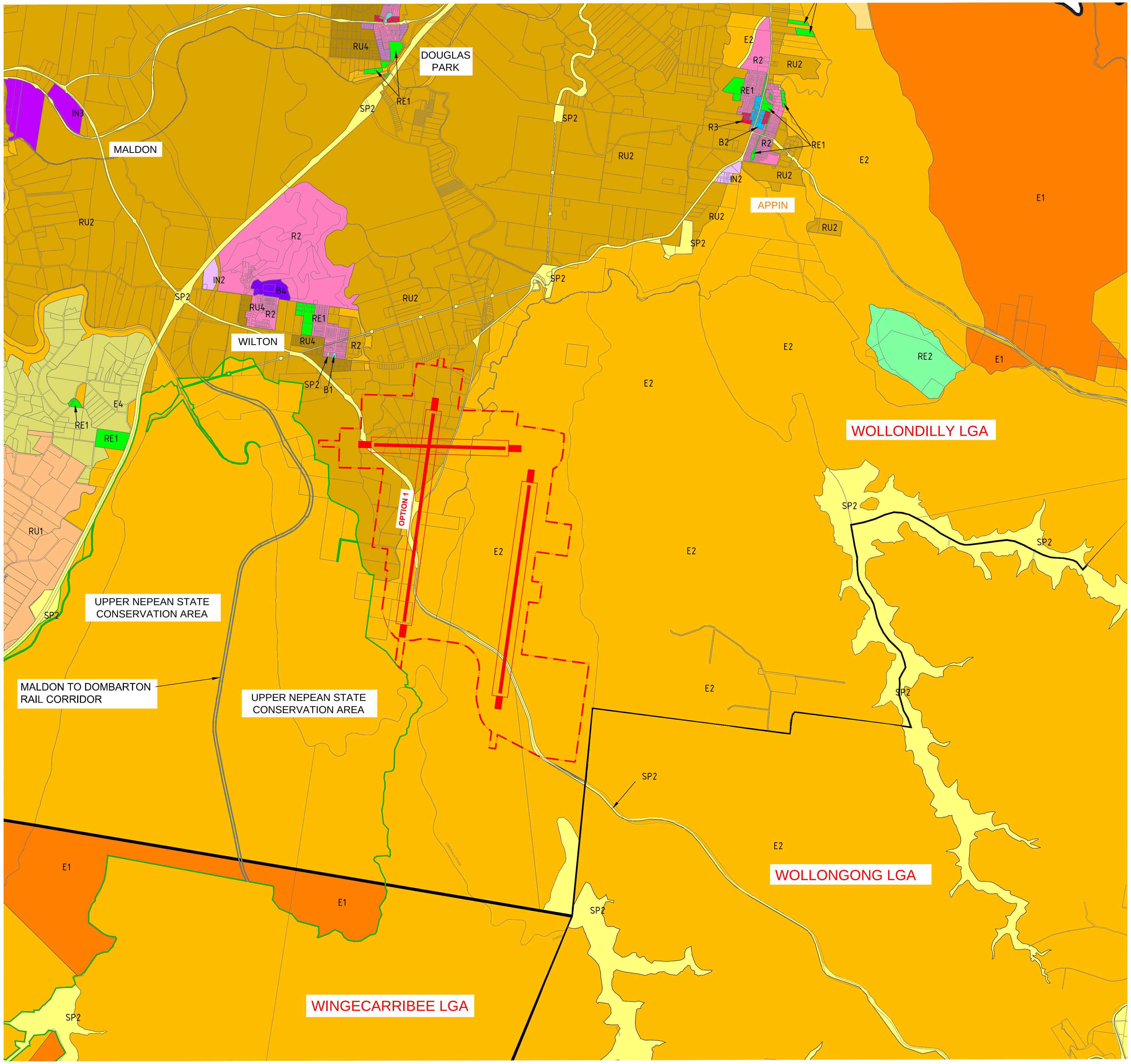
3. Land zoning on this drawing is based on Wollongong LEP 2009, Wollondilly LEP 2011, and Wingecarribee LEP 2010
4. Cadastre base data as provided by NSW LPMA. Addendum Data: 17.05.2010 Wollondilly Shire Council, 28.10.09 & 10.11.11 Wollongong City Council and 04.05.10 Wingecarribee Shire Counccil

LEGEND

B1	B1 Neighbourhood Centre
B2	B2 Local Centre
B4	B4 Mixed Use
E1	E1 National Parks and Nature Reserves
E2	E2 Environmental Conservation
E3	E3 Environmental Management
E4	E4 Environmental Living
IN2	IN2 Light Industrial
IN3	IN3 Heavy Industrial
R2	R2 Low Density Residential
R3	R3 Medium Density Residential
R5	R5 Large Lot Residential
RE1	RE1 Public Recreation
RE2	RE2 Private Recreation
RU1	RU1 Primary Production
RU2	RU2 Rural Landscape
RU4	RU4 Rural Small Holdings
SP2	SP2 Infrastructure
	Local Government Area Boundary



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ISSUE	DATE	ISSUE DESCRIPTION
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B	20.07.12	ISSUED WITH WORKING PAPER
A	18.07.12	DRAWING CREATED

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NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
LAND ZONING SITE MAP- OPTION 1

WP-301015-03019-LUP-SK-001

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SAVE DATE & TIME: 1/8/2012 8:37:10 AM
USER NAME: enosh.newar
CTB FILE: __00-WP-Syd-std.ctb

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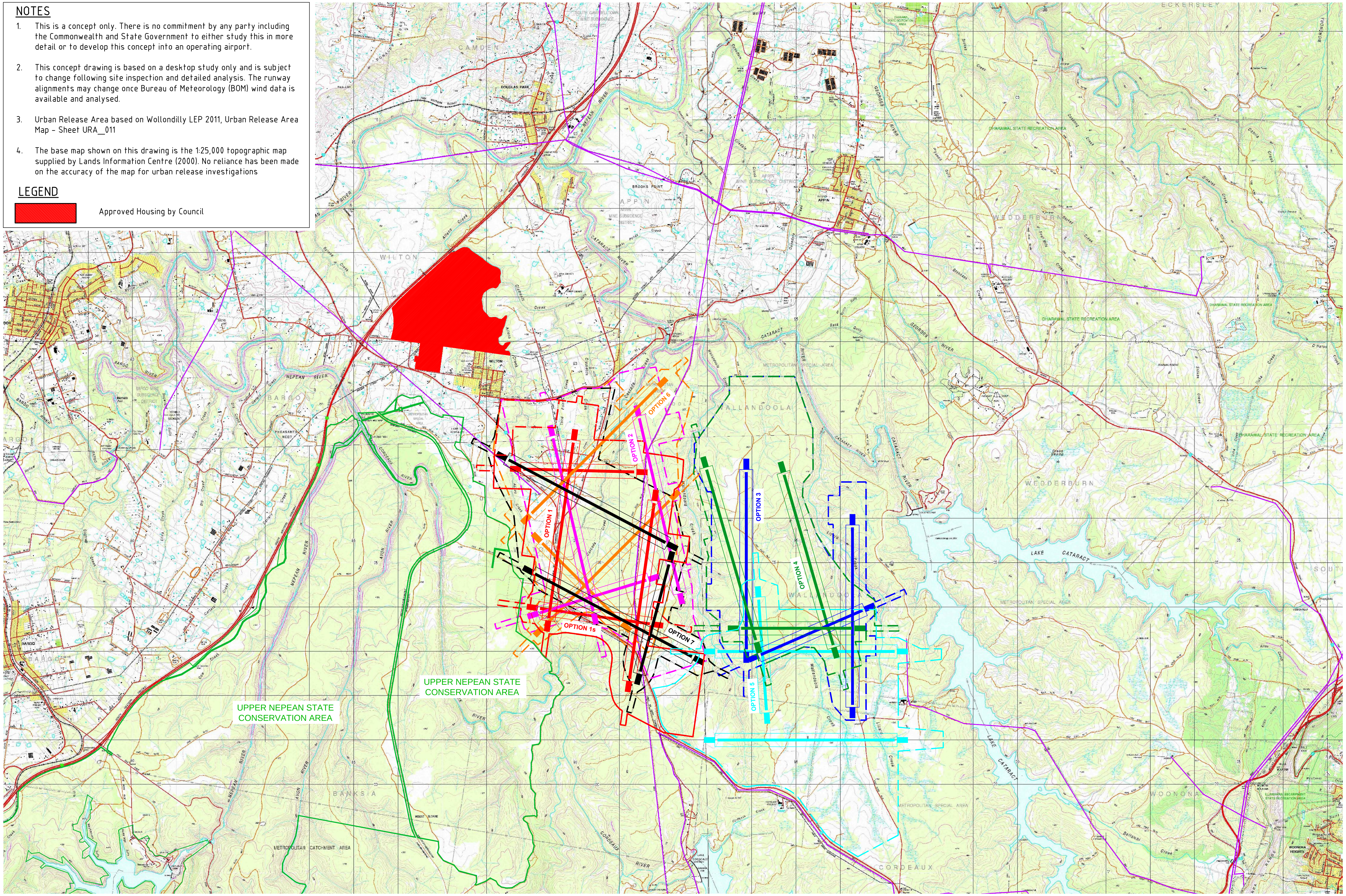
3. Urban Release Area based on Wollondilly LEP 2011, Urban Release Area Map – Sheet URA__011

4. The base map shown on this drawing is the 1:25,000 topographic map supplied by Lands Information Centre (2000). No reliance has been made on the accuracy of the map for urban release investigations

LEGEND

Approved Housing by Council



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NORTH

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FURTHER ASSESMENT OF AIRPORT DEVELOPMENT OPTIONS

WILTON STUDY AREA

WOLLONDILLY LEP URBAN RELEASE AREA PLAN

WP-301015-03019-LUP-SK-010

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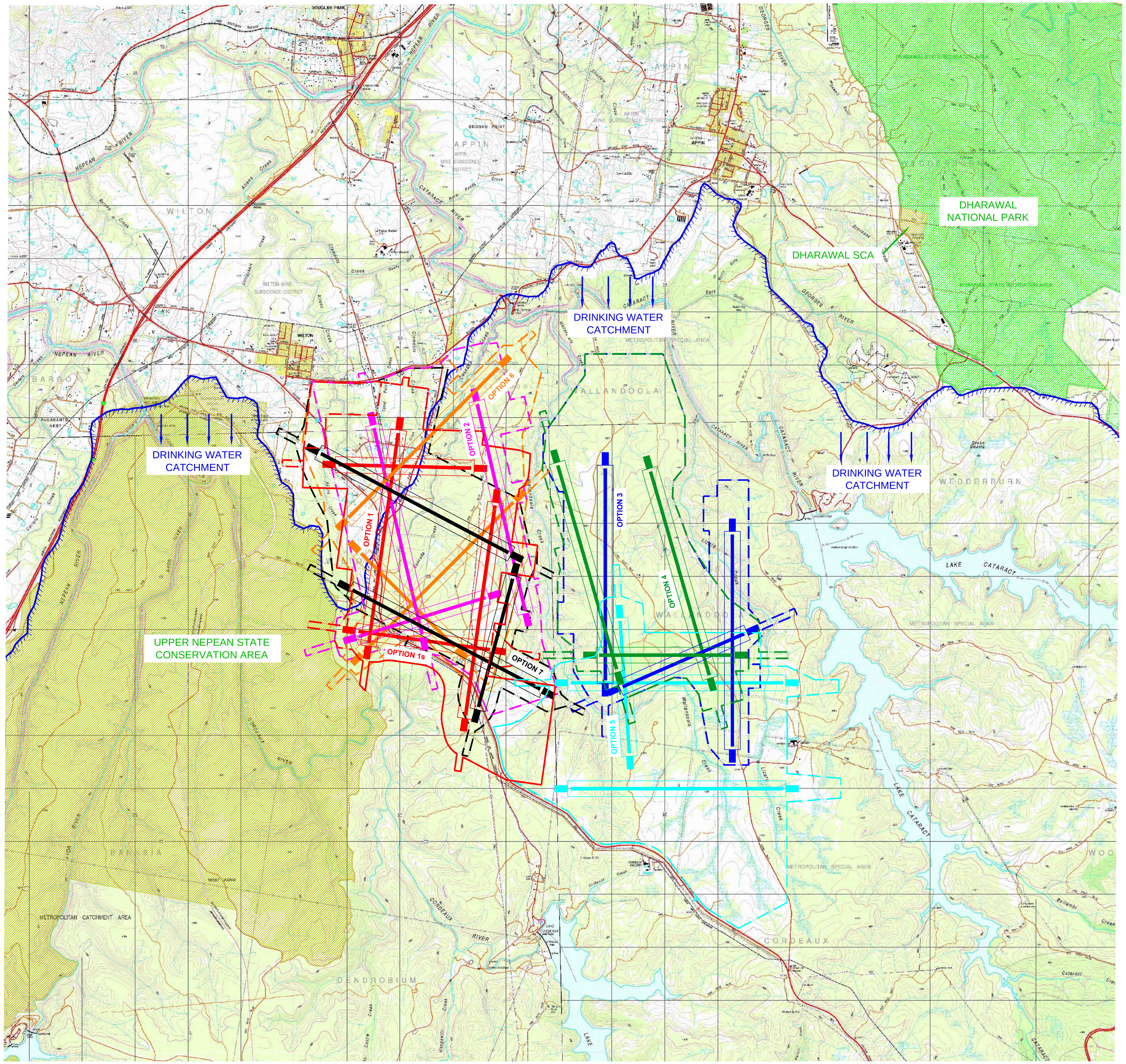
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.
3. The majority of Dharawal State Conservation Area became Dharawal National Park on 26 March 2012. The remaining areas comprising Dharawal State Conservation have been sketched from the NPWS map in the park Plan of Management.
4. GIS layers for the State Conservation Areas and National Parks supplied by DECCW, Jan 2011.
5. Sydney Water Catchment Boundary taken from Wingecarribee Digital Topographic Database supplied by LPMA, Dec 2011.3.
6. The base map shown on this drawing is the 1:25,000 topographic map supplied by Lands Information Centre (2000). No reliance has been made on the accuracy of the map for protected lands investigations.

LEGEND

- Aboriginal Area
- CCA Zone1 National Park
- CCA Zone 3 State Conservation Area
- Historic Site
- Karst Conservation Reserve
- National Park
- Nature Reserve
- Regional Park
- State Conservation Area
- State Forest
- State Recreation Area
- Approximate Sydney Drinking Water Catchment Boundary



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FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PROTECTED LANDS MAP

WP-301015-03019-LUP-SK-008

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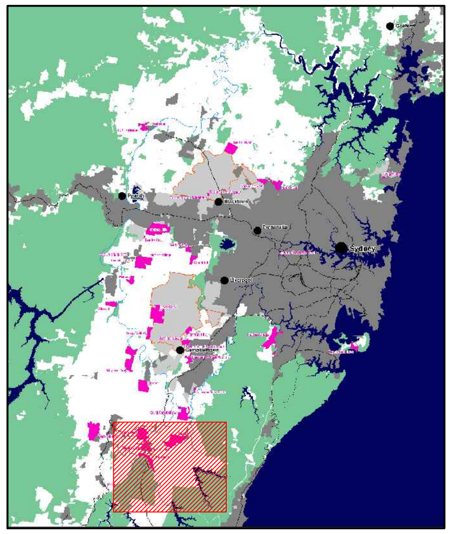
3. Potential Housing Map based on NSW Review of Potential Housing 2011/2012

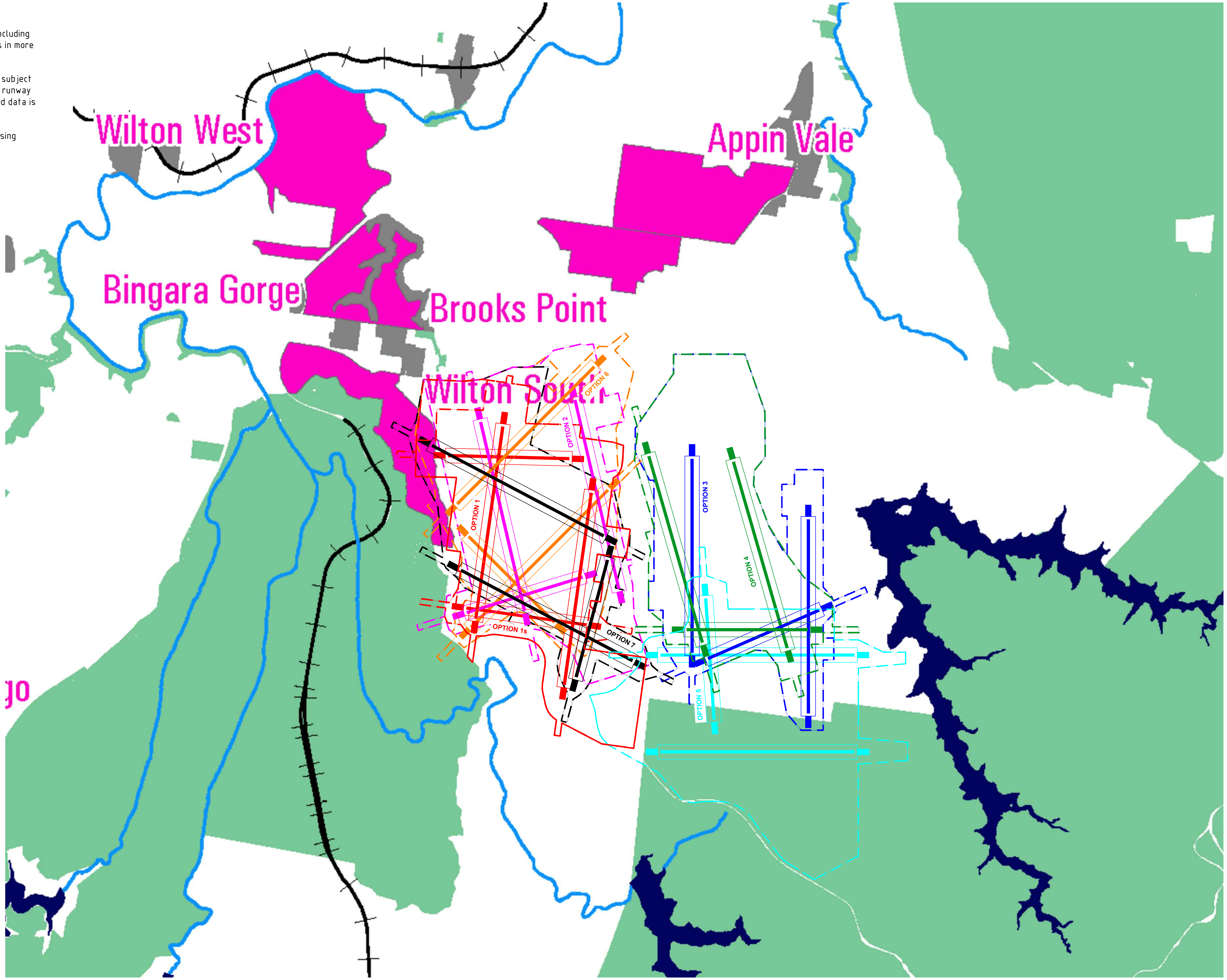
LEGEND

- Landowner Nominated Sites
- Growth Centres and North Wyong Structure Plan Area
- Major Rivers
- Future Urban Areas (MDP Release Areas; Structure Plan Areas;Proposed Employment Lands)
- Existing Urban Area/Rural Settlements
- National and State Parks and Defence Lands
- Rail Line

Notes:
1. One other site in the Sydney Region is not shown on the map as the exact location has not yet been provided (in South Sydney)
2. There are five landowner nominated sites outside the Sydney Region



KEY PLAN



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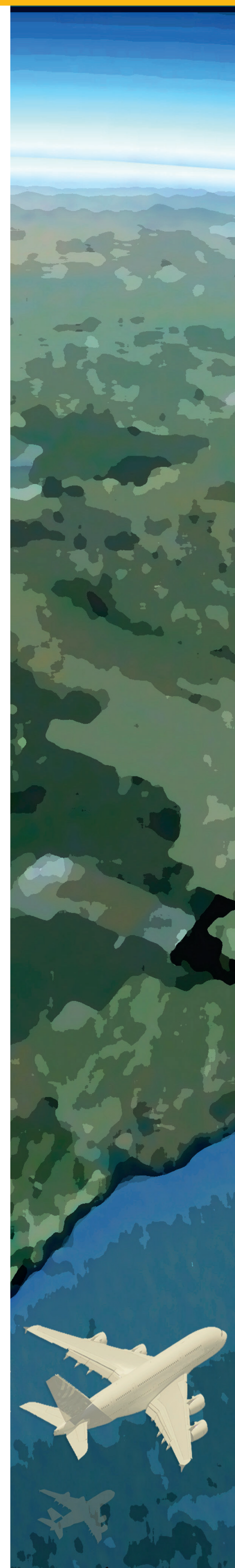
FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
LAND OWNER NOMINATED SITES PLAN

WP-301015-03019-LUP-SK-009

3

Airport Planning Criteria



Airport Planning Criteria

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT

Further Assessment of Airport Development Options at Wilton

Airport Planning Criteria

In association with

301015-03019 – EN-REP-002

Infrastructure & Environment
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CONTENTS

1 WORKING PAPER – METEOROLOGY

SUMMARY

This Working Paper presents the operational usability of the airport site options (developed in Working Paper *Wilton Airport Site Selection and Airport Concepts*) in the Wilton Study Area in terms of meteorological conditions.

- The runway usability has been assessed based on analysis of wind data to determine if International Civil Aviation Organisation (ICAO) requirements will be fulfilled for each of the site options and the percentage of time that either direction of the main runways would be usable, as this has implications for runway capacity. With a 20 knots crosswind and 5 knots downwind criteria, none of the airport options would require the provision of a cross runway (e.g. for larger jets between F100 to A380). However with the lower runway usability criteria of 13 knots crosswind and 0 knots downwind (e.g. for smaller aircraft such as SAAB SF 340 and Q400), all options would require a cross runway. It is expected that the majority of aircraft utilising the facility will be able to operate under the higher ICAO crosswind standard for aircraft with a Reference Field Length of 1,500 metres (m) (i.e. 20 knots). The cross runway required for smaller aircraft may only need to be about 1,600 m long; and
- An automatic weather station (AWS) should be established in the Wilton area as a matter of urgency to enable better estimates of runway usability, and the requirements for a cross runway, to be determined.

The Working Paper also considers the propensity of the airport options to be affected by mechanical turbulence and wind shear. The key findings are detailed below:

- The options are all, to some degree, sited in areas where there are deep gorges and ravines adjacent to ridge lines which have been adopted in some cases as the basis for runway siting locations. To the extent possible, the runways have been sited to provide a buffer of flat ground beyond the runway ends. Any of the airport site options examined for the Wilton area may suffer from some wind shear and / or mechanical turbulence and this issue should be examined in detail (e.g. using wind tunnel simulation). This situation is not unusual as it occurs at a number of major airports, for example, Hong Kong International Airport. A survey of other airports has been undertaken in this Working Paper and concludes that with modern commercial aircraft site topography issues usually do not impose significant operational constraints in non-mountainous areas. These phenomena when severe are a potential hazard to aircraft operations;
- Further research and analysis on the likely impacts of mechanical turbulence / wind shear in relation to the proposed runway layouts should be undertaken with the objective of helping inform a siting decision. It is recommended that this be undertaken immediately;
- The east - west alignment Option 5 is likely to have a greater propensity to windshear as it is closer to the Illawarra Escarpment (the distance from the escarpment being nine kilometres, or 4.8 nautical miles). On approach aircraft reduce altitude by 300 feet per nautical mile (i.e. they would cross the escarpment at about 1,458 feet elevation compared to the runway end level); and
- Low level wind shear warning detection equipment is assumed to be an integral component of weather related facilities which would be provided at a major new airport, as at Hong Kong International Airport.

Table 1.1 shows the rating of options by meteorological conditions and mechanical shear.

Table 1.1 Rating of options by meteorological conditions and mechanical shear

Criterion	Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Meteorological Conditions - 95% runway useability	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
Mitigation measure	An AWS in the Wilton area should be established as a matter of urgency to enable better estimates of runway usability and the requirements for a cross runway							
Mechanical Turbulence - Propensity for wind shear	Moderate	Moderate	Moderate	Moderate	Moderate	More severe	Moderate	Moderate
Mitigation measure	Further research and analysis on the likely impacts of mechanical turbulence/wind shear in relation to the proposed runway layouts should be undertaken by a specialist company with the objective of helping inform a siting decision. It is recommended that this be undertaken immediately							

1.1 Introduction

1.1.1 Purpose

This Working Paper presents the operational usability of the airport site options in the Wilton Study Area in terms of meteorological conditions.

This usability has been assessed based on analysis of wind data to determine if ICAO requirements for runway availability under given crosswind and downwind criteria will be fulfilled for each of the site options and the percentage of time that either direction of the main runways would be usable, as this has implications for runway capacity and aircraft noise exposure.

At a technical level, this usability relies on the calculation of crosswind and downwind limitations on the main and crosswind runways and a given order of runway nomination. This percentage of time for runway usability also forms an input for the aircraft noise calculations in the Working Paper *Airport Planning Criteria - Acoustic Footprints* and can give an indication as to the requirements for a cross runway.

The Working Paper also considers the propensity of the airport options to be affected by mechanical turbulence and wind shear.

1.1.2 Runway orientation criteria

Annex 14 (ICAO Edition 5) specifies that runways should be oriented so aeroplanes may be landed at least 95% of the time with crosswind components as follows:

- 20 knots for aeroplane reference field length 1,500 m or over (e.g. for larger jets F100, B737, A300, B747,and A380); and
- 13 knots for aeroplane reference field length 1,200 m up to but not including 1,500 m (e.g. for SAAB SF 340, Q400 and Metro 23), applicable to all conditions of weather.

Table 1.13 shows that, for the 20 knot criteria, the percentage of time the main runways are available for use with gust wind speeds are between 97.3% to 99.3% of the time with excessive crosswinds only occurring between 0.7% to 2.7% of the time (i.e. well below the ICAO criteria for a cross runway to be provided). For the 13 knot criteria, cross runways may be required for the smaller aircraft types. However, note that these aircraft would only require a runway length of the order of 1,600 m.

Additionally, in Australia, Air Traffic Control (ATC) must not nominate a particular runway for use if an alternative runway is available, when:

(a) for runway conditions that are completely dry:

(i) the crosswind component, including gusts, exceeds 20 knots;

(ii) the downwind component, including gusts, exceeds 5 knots.

(b) for runway conditions that are not completely dry;

(i) the crosswind component, including gusts, exceeds 20 knots;

(ii) there is a downwind component.

Also, a particular airline's crosswind operating policy may be more conservative than the manufacturers demonstrated crosswind limit, established at the time of aircraft certification.[1]

[1] CASA, Manual of Standards Part 172 - Air Traffic Services, Version 1.6, 2 June 2011

The wind analysis will be used to determine the percentage of time that either direction of the main runways would be usable. The direction of use is a function of the calculated downwind on the main runway and also the order of nomination for use of those runway directions. This runway usability forms an important part of the estimation of aircraft noise exposure. Runways having a greater percentage of the arrival traffic have a greater aircraft noise exposure than those runways with a greater number of departures.

1.2 Wind analysis

1.2.1 Bureau of Meteorology automatic weather station selection

As there are no Bureau of Meteorology (BoM) recording sites located close to the proposed airport options at Wilton, three remote weather station sites were examined: Picton Council Depot located 20 kilometres (km) to the northwest; Camden Aerodrome located 27 km to the northwest; and Badgerys Creek located 42 km almost due north. These three sites have the advantage of being inland and as such, remote from the coastal weather influences. However, they are some distance from Wilton and at significantly lower altitudes. Consequently, the reliability of the wind data is not ideal and the reliability of the analysis needs to be considered with this limitation in mind.

Other BoM recording sites have been considered, notably Royal Australian Air Force (RAAF) Base Richmond and Bankstown Airport. Although these sites are inland, they are at a considerable distance from Wilton. The previous *Joint Study on Aviation Capacity for the Sydney Region* (the Joint Study) comparison site, Bellambi, is not considered suitable, being located 22 km to the southeast on the coastal plain and subject to coastal weather influences.

The pattern of winds recorded at the three remote sites was examined with particular reference to the incidence of stronger winds: those that could possibly generate a crosswind in excess of 13 knots (24 km/h) and those that could generate a crosswind in excess of 20 knots (37 km/h). **Tables 1.2** and **1.3** provide the percentages of observations exceeding these limits for all three sites. The recordings for Camden and Badgerys Creek are at half hourly intervals and to the nearest 10°, while those for Picton are at the standard hours of 9:00 am and 3:00 pm and give the wind direction in the 16 cardinal points of the compass. The Camden and Badgerys Creek recordings were converted to the Picton methodology for this analysis.

Table 1.2 Percentage of wind speed greater than 13 knots

Direction	Camden	Badgerys Creek	Picton
N	2.45	4.34	1.54
NNE	0.90	1.52	0.14
NE	0.83	0.82	2.80
ENE	3.90	2.37	0.00
E	2.14	6.67	0.56
ESE	0.57	2.44	0.42
SE	1.70	2.32	17.34
SSE	4.41	2.21	0.84
S	6.00	5.76	13.29
SSW	5.34	6.78	1.54

Direction	Camden	Badgerys Creek	Picton
SW	6.55	11.56	18.32
WSW	24.09	16.20	3.08
W	26.04	19.34	20.56
WNW	6.22	10.61	2.80
NW	6.46	5.50	16.22
NNW	2.41	1.56	0.56

Table 1.3 Percentage of wind speed greater than 20 knots

Direction	Camden	Badgerys Creek	Picton
N	1.02	3.78	1.35
NNE	0.38	0.32	0.00
NE	0.00	0.12	2.03
ENE	0.13	0.12	0.00
E	0.06	0.28	0.00
ESE	0.06	0.12	0.00
SE	0.32	0.12	8.11
SSE	1.02	0.44	0.68
S	1.41	1.77	7.43
SSW	3.20	5.27	2.70
SW	5.12	9.18	20.27
WSW	27.27	19.07	4.73
W	37.90	31.67	27.70
WNW	10.12	17.55	3.38
NW	8.07	8.57	21.62
NNW	3.91	1.61	0.00

The above tables show that the majority of the higher wind speeds were westerlies. For wind speeds in excess of 24 km/h from the southwest through to the northwest, Camden recorded 69% of the observations, Badgerys Creek 63% and Picton 61%. At the higher limit of 37 km/h, the westerly effect was even more pronounced with Camden recording 88% of the observations, Badgerys Creek 86% and Picton 78%.

There are significant limitations with the Picton data as it is from 47 to 37 years ago, there are only two observations per day, over 10% of the available observations times have no records, there is no wind gust information, there appears to be a pattern of recording the eight major cardinal points rather than all sixteen and there is no weather data (low cloud: reduced visibility) available. Therefore, it was decided that the Camden data forms the best record for estimating the overall runway usage of the various Wilton site options and providing an initial evaluation of the requirements for a crosswind runway. A further factor in this assumption is that Picton and Camden are quite close together with Picton 20 km to the northwest and Camden 27 km in a similar direction. The conclusion is that the Camden data is the best available closely followed by that from Badgerys Creek. Picton data is not suitable for this analysis. It is noted, however, that all three sites show a similar pattern of the incidence of stronger winds from the west.

The incidence of low cloud, reduced visibility and fog is expected to be significantly different at the Wilton site due to the difference in altitudes between Wilton and any of the above three locations. The Wilton sites are at approximately 300 m above mean sea level (AMSL), Picton at 165 m AMSL and both Camden and Badgerys Creek at 80 m AMSL. The difference is such that it is thought that the Camden weather observations would not form a reliable guide to the likely weather conditions at Wilton for this purpose and so no analysis of the needs for precision landing aids and other factors was undertaken.

There is the possibility of mechanical turbulence at the Wilton sites (see Sections 1.3 and 1.6 below) but it is beyond the scope of this Working Paper (or the underlying data) to make any estimates of the frequency of this problem.

If further analysis and investigations are to be undertaken for an airport at Wilton, it is recommended that a BoM AWS be located at the preferred Wilton Option site as soon as possible to assist in the provision of accurate / usable wind and weather observations.

1.2.2 Runway usage

The BoM half hourly observations for Camden contain two wind speed descriptors: average speed over the preceding ten minutes and peak gust speed over the same period. The peak speed is often significantly in excess of the average speed and as ATC take wind gusts into account when nominating a runway for use, the gust speed was used in this analysis. For the aircraft noise exposure modelling the gust speed was used in determining the probable percentage of use of the various runways. This assumption somewhat lowers the percentage of time that the first runways in the runway nomination order would be selected for use: from just over 90% to about 84%.

It should be noted that the runway nomination order markedly influences the average percentage use of any particular direction. With a generally south-westerly wind pattern, a southerly traffic flow for Wilton Options 1 to 4, a westerly flow for Option 5 and a south-westerly flow for Option 6 were assumed to be preferred. For Option 7 the parallel runways are approximately across the general wind pattern and it was assumed that a south-easterly flow would be preferred. These runway directions were the preferred runways in this analysis. If either northerly or easterly flows were nominated then the percentage of time that the first runway to be nominated for use were, in fact, usable would be lower but the requirements for a crosswind runway would not vary.

The analysis was undertaken for both the Average and the Peak Gust wind speeds for comparative purposes however the Peak Gust wind speeds were used in the following runway availability analysis.

1.2.3 Weather conditions

The cloud base, cloud amount and visibility figures contained in the half hourly recordings from the BoM AWS sites can be used to determine the overall meteorological conditions at the recording site. However with the Wilton options being at a considerably higher altitude (from 220 m or 720 feet to 300 m or 980 feet), it is believed that conditions at Wilton will differ markedly from those at either Camden Aerodrome or Badgerys Creek and so a weather analysis, using the Camden Aerodrome data was not undertaken.

Recordings from a BoM AWS in the Wilton area would assist in the analysis of the likely incidence of reduced meteorological conditions and hence the requirements for precision landing aids.

1.2.4 Significant wind velocities

As the proposed airport in the Wilton Study Area will be designed as a major international / domestic facility it is expected that the majority of aircraft utilising the facility will be able to operate under the higher ICAO crosswind standard for aircraft with a Reference Field Length of 1,500 m (i.e. 20 knots). If Wilton is to have a staged development a small cross runway of about 1,600 m length may be required to cater for Q400 and similar aircraft. A future link taxiway could, for example, be developed in an initial stage to serve as an interim cross runway.

Using the 20 knot crosswind criteria the BoM records for Camden, Badgerys Creek and Sydney (Kingsford Smith) Airport (Sydney Airport) were examined to determine the incidence of winds which exceeded this limit.

- At Camden Aerodrome 0.6% of the observations exceeded the 20 knots and nearly all from the direction of 240°T to 330°T;
- At Badgerys Creek AWS 0.9% of the observations exceeded the 20 knots and nearly all from the direction of 210°T to 330°T; and
- At Sydney Airport 7.9% of the observations exceeded the 20 knots and were not concentrated into any particular direction although the summer north-easterly sea breezes showed a distinct peak and also there was some indication that southerly weather conditions also predominated.

The wind speed exceeding the 20 knots limit does not necessarily indicate excess crosswind. The angle between the runway heading and the wind direction is important. With this angle at zero, there is no crosswind and this crosswind then increases at the sine (SIN) of the included angle, until at 90° the wind speed is also the crosswind. Once the included angle exceeds 90°, then there starts to be a downwind on the runway and this increases as the cos of the angle until at 180° the downwind is the wind speed.

Using the observations with the wind speed in excess of 20 knots, the runway layout for Options 5 and 6 provide the most into-wind runways, with Option 7 having the most crosswind affected runways.

In deciding the percentage of time that a runway would be in use in the calm or low velocity winds the order of runway nomination is important. With a wind speed below 5 knots, any runway will fall within the usage criteria of a maximum of 20 knots / 5 knots and so in these conditions the preferred order for runway usage will have the first runway selected.

- At Camden Aerodrome 68.9% of the observations had a wind speed below 5 knots;
- At Badgerys Creek AWS 58.3% of the observations had a wind speed below 5 knots; and
- At Sydney Airport 25.5% of the observations had a wind speed below 5 knots.

Section 1.5 of this Working Paper provides the results of crosswind / downwind calculations applied to an assumed runway order of nomination for use for each of the options' runway layouts.

1.3 Mechanical turbulence and wind shear

An issue which will require consideration and further research and analysis is the propensity of the options to be affected by mechanical turbulence and wind shear.

Mechanical turbulence is disrupted air-flow resulting from wind flowing over or around terrain or man-made obstructions, whereby normal horizontal wind flow is disturbed and transformed into eddies and other irregular movements. The degree of mechanical turbulence depends on wind speed and roughness of the obstructions. The higher the speed and/or the rougher the surface, the greater is the turbulence. The wind carries the turbulent eddies downstream. How far depends on wind speed and stability of the air. Unstable air allows larger eddies to form than those that form in stable air, but the instability breaks up eddies quickly, while in stable air they dissipate slowly.

Wind shear is a wind direction and/or speed change over a vertical or horizontal distance. In aviation terms, wind shear can be defined as "*variations in the wind along the aircraft flight path of a pattern, intensity and duration that displace an aircraft abruptly from its intended path such that substantial control action is required*". Turbulence and wind shear cause the aircraft to move about in short, sharp, varying directions. Mechanical turbulence is therefore a form of shear, induced when a rough surface disrupts the smooth wind flow. The amount of shearing and the depth of the shearing layer depends on the wind speed, the roughness of the obstruction and the stability of the air.

Wind shear is often associated with weather-related aspects such as a low level temperature inversion or the passage of a frontal zone, as well as resulting from mechanical turbulence described above. Adverse weather (other than low visibility and runway condition) is a circumstantial factor in nearly 40% of approach-and-landing accidents. Adverse wind conditions (i.e. strong crosswinds, tailwind and windshear) are involved in more than 30% of approach-and-landing accidents and in 15% of events involving controlled flight into terrain (CFIT) accidents. Windshear is the primary causal factor in 4% of approach-and-landing accidents and is the ninth cause of fatalities. These statistical data are summarised in **Table 1.4** below.

Table 1.4 Weather factors in approach-and-landing accidents

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

1.4 Summary of issues from Draft 1985 EIS

1.4.1 Runway alignments

As part of the Second Sydney Airport (SSA) Site Selection Programme a Draft Environmental Impact Statement (the Draft 1985 EIS), which examined the Wilton site, was prepared. The extract from the Draft 1985 EIS relating to layout selection is reproduced below, with the two alignments assessed in the EIS shown in **Figure 1.1**.

Figure 1.1 Alternative runways

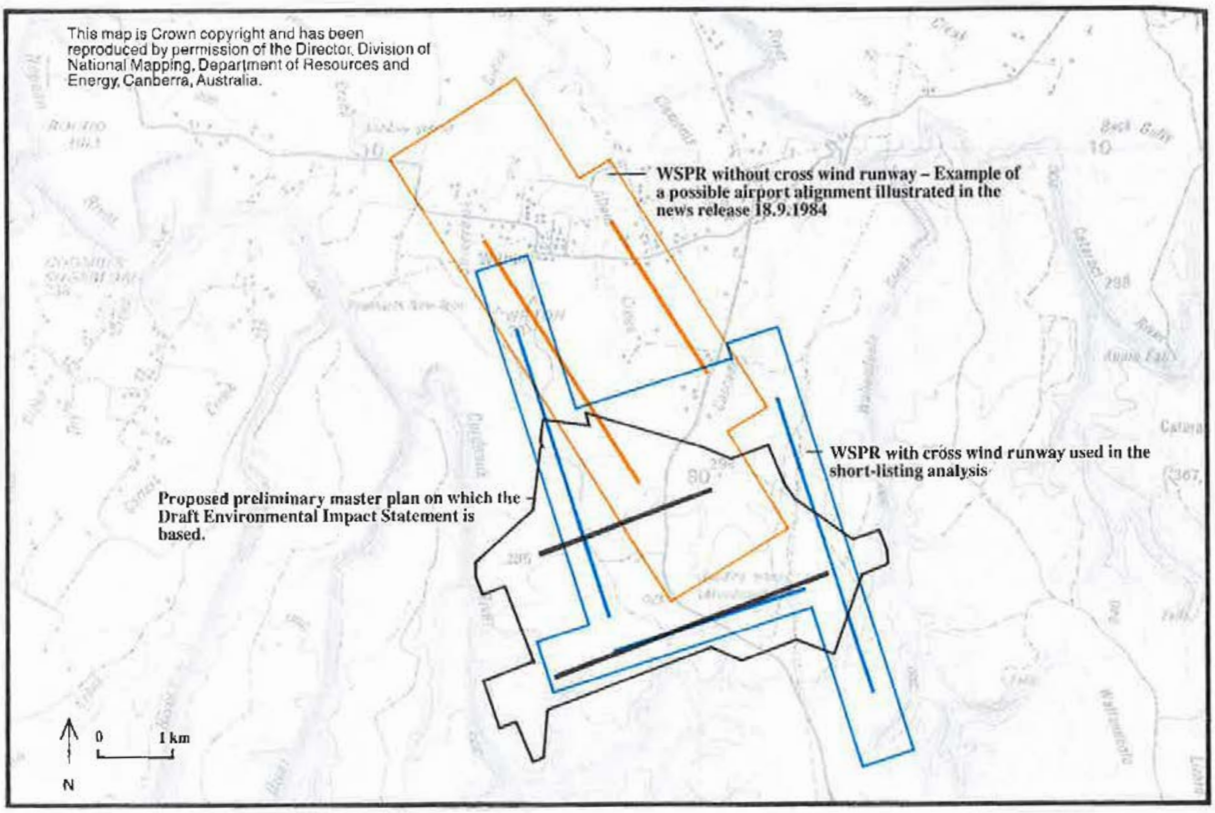

Figure 13.2
ALTERNATIVE RUNWAY ALIGNMENTS

Source: 1985 Draft 1985 EIS

Alignments

The Draft 1985 EIS Section 13.5.1 discusses alternative airport layouts as follows:

"For the short-listing phase of the present study, a layout with a north/south primary runway orientation was used. Subsequent to the short-listing of Wilton, two additional alignments were examined. These were a north-west/south-east alignment (published in the 18 September press release announcing the short-listing of the Wilton and Badgerys Creek sites) and an east-west alignment. These two alignments plus the one used in the earlier short-listing phase are shown in Figure 13.2 (Figure 1.1 above). The principal bases for selecting the east/west alignment for the preliminary master plan were that it avoided the need to acquire land within the village of Wilton, and that it did not affect large areas suitable for potential urban development. Section 1.4.1 describes the relative noise impacts of the two alignments examined for this Draft Environmental Impact Statement."

All further flight track and aircraft assignment, noise assessment and the preliminary master plan in the Draft 1985 EIS is then undertaken on an east-west alignment only.

In regard to the current Wilton study, it should be noted that since the Draft 1985 EIS there have been:

- The provision of the parallel runway north-south (16L/34R) runway at Sydney Airport;
- The introduction of the Long Term Operating Plan (LTOP); and
- The closure of a number of general aviation (GA) aerodromes in the Sydney region.

1.4.2 Cross runway

The airport concepts in the Draft 1985 EIS did not provide for a cross runway. This is in the context of the preferred Wilton airport site in the EIS having an east-west alignment.

The Draft 1985 EIS stated:

"The requirement for the inclusion of a cross-wind runway at a second Sydney airport was reviewed following the completion of the short-listing phase of the study. It was concluded that the Department of Aviation's current requirements for wind coverage (99.8% at capital city airports) would be unnecessary when applied to a second Sydney airport, given the presence of Kingsford Smith Airport and several general aviation airports within a reasonable flying distance of either of the short-listed sites. It was therefore recommended that the Department of Aviation's requirement be relaxed to 95% wind coverage for the second airport. When this criteria was applied to the two short listed sites at Badgerys Creek and Wilton, it was found that there was no need to provide a cross-wind runway.

It is estimated that aircraft certified to operate in cross-winds up to 10 knots would be able to use an airport at Wilton for 95.8% of the time, while aircraft certified to operate in 20 knot cross-winds would be able to use it for more than 99.9% of the time."

It is not clear which data was used for this analysis. The air quality section of the *Draft 1985 EIS* uses data from Picton, the limitations of which are discussed in Section 7.2.1.

In regard to the current Wilton study, it should be noted that there are now fewer GA airports in the Sydney region, that Sydney Airport is at capacity and that the type of GA anticipated at Wilton in the Booz & Co forecasts (detailed in the Working Paper *Airport Performance Specification for Wilton- Task and Infrastructure)* is not the beginners or *'ab initio'* flying training, as at Camden Aerodrome and Bankstown Airport.

As stated previously, should a cross runway be required at Wilton it may need to be only about 1,600m in length and may form part of a staged development plan.

1.5 Analysis of current airport options

Airservices Australia prefers a northwest - southeast parallel configuration as being optimal for segregation from Sydney Airport operations in their current comments in the Working Paper *Airport Planning Criteria- Airspace, Existing Aerodromes and Aviation Related Operational Assessment*, north - south and east - west runway alignments have been assessed for the current Wilton options and also compared in the Working Paper *Wilton Airport Site Selection and Airport Concepts* to the primarily east-west option adopted in the Draft 1985 EIS.

This Section assesses the preferred airport site options runway alignments.

1.5.1 Interaction with Sydney Airport

The database of half hourly observations for Sydney Airport was obtained and the records from 2003 to the present were analysed for the overall pattern of the wind. Two analyses were undertaken: one for runway usability and the other for the wind pattern.

At Sydney Airport for the period 06:30 to 09:00 there is a slight preference for the runway 34 direction to be used, but that reverses quite markedly in the afternoon with the 16 direction being strongly favoured from 12:00 onwards. Note these are average annual figures and conditions vary markedly with the seasons.

The analysis of the overall wind pattern shows the wind velocity generally favouring the 120 through west to 360 degree direction although there are a marked number of observations from the 030 to 060 degree direction showing the effects of the summer north-easterly sea breezes.

Throughout the winter months it could be generally expected that Sydney Airport and the Wilton options would be able to operate with both airports operating in the same direction, but for the summer months the north-easterly sea breeze is likely to be evident at and result in Sydney Airport requiring a northerly traffic flows and Wilton utilising a southerly flow.

Sydney Airport and Wilton Option 5 will have airspace interactions regardless of the traffic flow directions in use with Wilton, probably preferring a westerly flow to suit the prevailing winds. The Quarterly reports from the Sydney Noise and Flight Path Monitoring System (NFPMS) show that arriving aircraft to parallel runways require approximately 40 km of distance from the runway thresholds for sequencing purposes. This will cause interactions with either Sydney northerly flow arrivals or southerly flow departures with aircraft being required to adopt non-optimal flight profiles.

For Sydney Airport, given a 20 knot / 5 knot crosswind / downwind criteria for runway selection and a runway preference order of 16 - 34 - 07 - 25 the overall pattern of runway usage (based on time) is shown in **Table 1.5**.

Table 1.5 Sydney Airport runway usage pattern

20 kts / 5 kts criteria	Percentage of Time	
	Average Windspeed	Gust Windspeed
R16	68.5	59.0
R34	30.4	35.7
R07	0.2	1.7
R25	0.8	2.9
Nil usable	0.1	0.7

Crosswind / downwind criteria exceeded: 9 hours per year for average wind speed and 61 hours per year for gust speed.

1.5.2 Option 1 and Option 1 South (1S)

The main runways for Option 1 in direction 18/36 are on an approximate alignment of 188°T/008°T with the cross runway (either north or south option) 08/26 aligned approximately 092°T/272°T.

The runway order of nomination was 18 – 36 – 26 – 08.

The Camden Aerodrome BoM observations from 2003 to the present date were used, as it was only in late 2002 that the half hourly observations became available with the installation of an AWS for these and the following options.

Runway usability, as percentage of time, was determined using the crosswind/downwind criteria for both 20 knots/5 knots and 13 knots/0 knots (only the higher limits shown below) for both the BoM average speed and gust speed and no allowance was made for wet conditions for these and the following options.

With the above criteria the following tables show the overall runway usage pattern. Note that only the *"nil usable"* row indicates the percentage of time that no runway would fall within the runway selection criteria of crosswind not exceeding 20 knots and downwind not exceeding 5 knots. These conditions generally only occur with a strong wind that falls between the two runway directions (main and cross runways).

Table 1.6 Option 1 and Option 1S runway usage pattern

20 kts/5 kts criteria	Percentage of Time Runway Available for Use	
	Average Windspeed	Gust Windspeed
R18	90.3	82.4
R36	9.4	15.4
R26	0.2	0.1
R08	0.0	2.3
Nil usable	0.0	0.1

Crosswind / downwind criteria exceeded: zero hours per year for average wind speed and 9 hours per year for gust speed.

The main runways in direction 18/36 are available for use 90.3 plus 9.4 = 99.7% of the time for average windspeed and 82.4 plus 15.4 = 97.8% of the time. Overall use for this option and the following options is summarized in **Table 1.13**.

1.5.3 Option 2

The main runways for Option 2 in direction 16/34 are on an approximate alignment of 167°T/347°T with the cross runway 06/24 aligned 073°T/253°T (where T is true north).

The runway order of nomination was 16 – 34 – 24 – 06.

Table 1.7 Option 2 runway usage pattern

20 kts/5 kts criteria	Percentage of Time Runway Available for Use	
	Average Windspeed	Gust Windspeed
R16	91.7	84.1
R34	8.1	13.2
R24	0.3	2.5
R06	0.0	0.1
Nil usable	0.0	0.1

Crosswind / downwind criteria exceeded: zero hours per year for average wind speed and 9 hours per year for gust speed.

The main runways in direction 16/34 are available for use 91.7 plus 8.1 = 99.8% of the time for average windspeed and 84.1 plus 13.2 = 97.3% of the time.

1.5.4 Option 3

The main runways for Option 3 in direction 17/35 are on an approximate alignment of 180°T/360°T with the cross runway 05/23 aligned 066°T/246°T (where T is true north).

The runway order of nomination was 17 – 35 – 23 – 05.

Table 1.8 Option 3 runway usage pattern

20kts/5kts criteria	Percentage of Time Runway Available for Use	
	Average Windspeed	Gust Windspeed
R17	91.1	82.9
R35	8.7	14.6
R23	0.0	0.1
R05	0.2	2.2
Nil usable	0.0	0.3

Crosswind / downwind criteria exceeded: zero hours per year for average wind speed and 26 hours per year for gust speed.

The main runways in direction 17/35 are available for use 91.1 plus 8.7 = 99.8% of the time for average windspeed and 81.9 plus 14.6 = 97.5% of the time. Overall use for this option and the other options is summarized in **Table 1.13**.

1.5.5 Option 4

The main runways for Option 4 in direction 15/33 are on an approximate alignment of 164°T/344°T with the cross runway 08/26 aligned 090°T/270°T (where T is true north).

The runway order of nomination was 15 – 33 – 08 – 26.

Table 1.9 Option 4 runway usage pattern

20kts/5kts criteria	Percentage of Time Runway Available for Use	
	Average Windspeed	Gust Windspeed
R15	91.8	84.1
R33	8.0	13.2
R26	0.0	0.1
R08	0.2	2.5
Nil usable	0.0	0.0

Crosswind / downwind criteria exceeded: zero hours per year for average wind speed and zero hours per year for gust speed.

The main runways in direction 15/33 are available for use 91.8 plus 8.0 = 99.8% of the time for average windspeed and 84.1 plus 13.2 = 97.3% of the time. Overall use for this option and the other options is summarized in **Table 1.13**.

1.5.6 Option 5

The main runways for Option 5 in direction 08/26 are on an approximate alignment of 190°T/270°T with the cross runway 16/34 aligned 176°T/356°T (where T is true north).

The runway order of nomination was 08 – 26 – 16 – 34.

Table 1.10 Option 5 runway usage pattern

20kts/5kts criteria	Percentage of Time Runway Available for Use	
	Average Windspeed	Gust Windspeed
R08	87.6	82.8
R26	12.4	16.5
R16	0.0	0.5
R34	0.0	0.2
Nil usable	0.0	0.0

Crosswind / downwind criteria exceeded: zero hours per year for average wind speed and zero hours per year for gust speed.

The main runways in direction 08/26 are available for use 87.6 plus 12.4 = 100% of the time for average windspeed and 82.8 plus 16.5 = 99.3% of the time. Overall use for this option and the other options is summarized in **Table 1.13**.

1.5.7 Option 6

The main runways for Option 6 in direction 03/21 are on an approximate alignment of 045°T/225°T with the cross runway 12/30 aligned 135°T/315°T.

The runway order of nomination was 22 – 04 – 13 – 31.

Table 1.11 Option 6 runway usage pattern

20kts/5kts criteria	Percentage of Time Runway Available for Use	
	Average Windspeed	Gust Windspeed
R21	89.5	82.5
R03	10.4	16.3
R12	0.0	0.2
R30	0.1	0.9
Nil usable	0.0	0.1

Crosswind / downwind criteria exceeded: zero hours per year for average wind speed and 9 hours per year for gust speed.

The main runways in direction 21/03 are available for use 89.5 plus 10.4 = 99.89 of the time for average windspeed and 82.5 plus 16.3 = 98.8% of the time. Overall use for this option and the other options is summarized in **Table 1.13**.

1.5.8 Option 7

The main runways for Option 7 in direction 11/29 are on an approximate alignment of 118°T/298°T with the cross runway 18/36 aligned 015°T/195°T.

The runway order of nomination was 11 – 29 – 36 - 18.

Table 1.12 Option 5 runway usage pattern

20kts/5kts criteria	Percentage of Time Runway Available for Use	
	Average Windspeed	Gust Windspeed
R11	89.8	84.6
R29	10.2	14.5
R36	0.0	0.6
R18	0.0	0.1
Nil usable	0.0	0.2

Crosswind / downwind criteria exceeded: zero hours per year for average wind speed and 18 hours per year for gust speed.

The main runways in direction 11/29 are available for use 89.8 plus 10.2 = 100% of the time for average windspeed and 84.6 plus 14.5 = 99.1% of the time. Overall use for this option and the other options is summarized in **Table 7.12**.

1.5.9 Mechanical turbulence and wind shear

1.5.9.1 General

The options under consideration are all, to some degree, sited in areas where there are deep gorges and ravines adjacent to ridge lines which have been adopted in some cases as the basis for runway siting locations. To the extent possible, the runways have been sited to provide a buffer of flat ground beyond the runway ends. The Illawarra Escarpment is also located approximately nine kilometres to the south of the southernmost site option in this assessment.

The situation of most concern is an aircraft in the final approach or initial take-off phase encountering mechanical turbulence/wind shear at a low altitude. Valleys and gorges tend to develop their own turbulent air circulation, somewhat independently of the ambient wind overflow. They have a tendency to flow up or down the valley/gully regardless of the general wind direction. However, if the overflowing wind exceeds 20 knots or so then significant down-flow and turbulent eddies may form over the windward slopes of larger valleys, whilst rising air may be experienced over the leeward slopes. Turbulence may develop with strong low-level winds especially when the terrain is elevated or there are sharp topographical features (e.g. escarpments).

Significant shearing can occur when the surface wind blowing along a valley varies significantly from the free flowing wind above the valley. Updrafts and downdrafts also induce shears. An abrupt downdraft will cause a brief decrease in the wing's attack angle resulting in a loss of lift. An updraft will increase the wing's attack angle and consequently increase the lift.

When winds blow against a steep cliff or over rugged terrain, gusty turbulent winds result. Eddies often form downwind of the hills, which create stationary zones of stronger and lighter winds. These zones of strong winds are fairly predictable and usually persist as long as the wind direction and stability of the air stream do not change. The lighter winds, which occur in areas called wind shadows, can vary in speed and direction, particularly downwind of higher hills. In the lee of the hills, the wind is usually gusty and the wind direction can be completely opposite to the wind blowing over the top of the hills. Smaller reverse eddies may also be encountered close to the hills.

1.5.10 Effects and mitigation measures

The above situation where wind shear may occur is not unusual as it occurs at a number of major airports, e.g. Hong Kong. L&B[2], through their international offices, undertook a brief survey of the presence of deep gorges of a similar scale at runway ends and their impacts. The responses provided numerous examples of this, with no obvious major issues identified with respect to turbulence. They included a runway at San Jose Airport in Costa Rica, Quito in Ecuador, Greater Pittsburgh and Seattle in the USA.

L&B did note that a smaller airport with limited commercial service and a very severe elevation change at the runway end is St. George Utah - approaches there can be quite rough. To get an accurate understanding of turbulence related experience inquiries to ATC would be needed and/or airlines providing service at locations with topography similar to the prospective Sydney sites.

> *"With modern commercial aircraft site topography issues usually do not impose significant operational constraints in non-mountainous areas"* [3]

It is recommended that research and analysis be undertaken on the likely impacts of mechanical turbulence/wind shear on aircraft operations. This will help inform a siting decision from the available options.

It would be expected that low level wind shear warning detection equipment would be an integral component of weather related facilities to be provided at a major new airport, as in the case of Hong Kong International Airport.

1.6 Key findings

1.6.1 Runway usability

Using the Camden Aerodrome AWS recordings as a reasonable indication of the likely wind conditions at any of the Wilton options assessed, the wind velocities likely to be experienced throughout the year do not appear to be a limiting issue.

With a 20 knots crosswind and 5 knots downwind criteria, none of the eight options would require the provision of a cross runway. However with the lower runway usability criteria of 13 knots crosswind and 0 knots downwind, all eight options would require a cross runway. It is expected that the majority of aircraft utilising the facility will be able to operate under the higher ICAO crosswind standard for aircraft with a Reference Field Length of 1,500 m (i.e. 20 knots).

The crosswind / downwind limits for runway nomination and the use of either the Average or the Gust wind speed needs to be further considered and an AWS in the Wilton area should be established as a matter of urgency to enable better estimates of runway usability, and the requirements for a cross runway, to be determined.

The table below gives the estimated percentage of time that the main runway directions for each of the options would be available for use.

[2] As sub consultants to WorleyParsons
[3] (L&B email 21 July 2012).

Table 1.13 Runway usability for the options

Option	Criteria	Percentage of Time Main Runways Available for Use	
		Average Windspeed	Gust Windspeed
Option 1 and Option 1S	20kts/5kts	99.7	97.8
	13kts/0kts	97.2	91.1
Option 2	20kts/5kts	99.8	97.3
	13kts/0kts	96.9	90.5
Option 3	20kts/5kts	99.8	97.5
	13kts/0kts	96.9	90.7
Option 4	20kts/5kts	99.8	97.3
	13kts/0kts	95.0	90.4
Option 5	20kts/5kts	100.0	99.3
	13kts/0kts	99.1	94.3
Option 6	20kts/5kts	99.9	98.8
	13kts/0kts	98.6	93.9
Option 7	20kts/5kts	100.0	99.1
	13kts/0kts	98.7	92.4

With only casual observations as to the prevailing weather, cloud base and visibility available, no reliable estimate can be made as to the percentage of time that some form of instrument approach would be required. Provision should be made for the installation of precision landing aids as the Wilton area is subject to considerable winter fogs. The installation of an AWS would assist in quantifying this aspect of operating an airport in the Wilton Study Area.

1.6.2 Mechanical turbulence

Mechanical turbulence phenomena when severe are a potential hazard to aircraft operations. A survey of other airports has been undertaken in this Working Paper and concludes that, with modern commercial aircraft, site topography issues usually do not impose significant operational constraints in non-mountainous areas.

Further research and analysis on the likely impacts of mechanical turbulence/wind shear in relation to the proposed runway layouts should be undertaken with the objective of helping inform a siting decision. It is recommended that this be undertaken immediately.

The east - west alignment Option 5 is likely to have a greater propensity to windshear as it is closer to the Illawarra escarpment, the distance being nine kilometres (4.8 nautical miles). On approach aircraft reduce altitude by 300 feet per nautical mile (i.e. they would cross the escarpment at about 1,460 feet elevation compared to the runway end level).

Low level wind shear warning detection equipment is assumed to be an integral component of weather related facilities which would be provided at a major new airport, as at Hong Kong International Airport.

The key findings in respect of each of the options are shown in **Table 1.14**.

Table 1.14 Key findings of options by meteorological conditions and mechanical shear

Criterion	Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Meteorological Conditions - 95% runway useability for larger aircraft (20 knot criteria)	Complies	Complies	Complies	Complies	Complies	Complies	Complies	Complies
Mitigation measure	An AWS in the Wilton area should be established as a matter of urgency to enable better estimates of runway usability and the requirements for a cross runway							
Mechanical Turbulence - Propensity for wind shear	Moderate	Moderate	Moderate	Moderate	Moderate	More severe	Moderate	Moderate
Mitigation measure	Further research and analysis on the likely impacts of mechanical turbulence/wind shear in relation to the proposed runway layouts should be undertaken with the objective of helping inform a siting decision. It is recommended that this be undertaken immediately							

1.7 References

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NavCanada 2001, *Local Area Weather Manuals*.

2 WORKING PAPER – AIRSPACE, EXISTING AERODROMES AND AVIATION RELATED OPERATIONAL ASSESSMENT

SUMMARY

The purpose of this Working Paper is to present a preliminary assessment of the suitability of eight potential site options in the Wilton Study Area, considering airspace and other existing aerodrome/aviation-related operational issues that may occur from airport development.

The *Manual of Air Traffic Services (MATS)* requires airspace to be designed with the application of strategic separation assurance. Strategic separation assurance is the designing of airspace, air routes, air traffic management plans and air traffic control practices, to reduce the likelihood that aircraft will come into conflict, particularly where traffic frequency congestion or system performance, amongst other considerations, may impair control actions.

The Working Paper combines this approach to assess impacts of the options on existing airspace classification and activities, together with Airservices Australia's comments as outlined in their *Joint Study on Aviation Capacity for the Sydney Region – Further Assessment of Wilton Sites* (included at Appendix A), including that, from an air traffic management perspective, a northwest - southeast parallel configuration is optimal for segregation from Sydney Airport operations (i.e. to generally align with Sydney Airport's 16/34 runways). The runway directional range should be within 280 to 300 degrees (100 to 120 degrees).

The assumptions and the detailed modelling of preliminary aircraft flight tracks is in the Working Paper *Acoustic Footprints* and *Acoustic Effects on People* respectively.

The differences between the options are in **Table 2.1** below.

Table 2.1 Differences between the options

	Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Main runways heading	18/36	18/36	16/34	17/35	15/33	08/26	03/21	11/29
Difference to Airservices' preferred runway directional range of 280 to 300 degrees (100 to 120 degrees) (plus or minus degrees)	60	60	40	50	30	20	70	10 (within preferred range)
CRITERION								
Optimal for segregation from Sydney Airport operations	Most complex	Most complex	Complex	Complex	Complex	Complex[4]	Most complex	Complex

[4] assuming vertical separation with northerly flow to Sydney Airport is possible

2.1 Introduction

The purpose of this Working Paper is to present a preliminary assessment of the suitability of eight potential site options in the Wilton Study Area, considering airspace and other existing aerodrome/aviation-related operational issues that may occur from airport development. It is based on the eight airport development concepts presented in the Working Paper *Wilton Airport Site Selection and Airport Concepts*. It draws on the preliminary findings of Airservices Australia's *Joint Study on Aviation Capacity for the Sydney Region – Further Assessment of Wilton Sites* received by the Department on 16 July 2012. It is noted that from an air traffic management perspective, Airservices Australia's optimal runway alignment is a northwest - southeast parallel configuration for segregation from Sydney Airport operations (i.e. to generally align with Sydney Airport's 16/34 runways). The runway directional range should be within 280 to 300 degrees (100 to 120 degrees). Assuming this alignment, differences in alignment of small magnitude would not have a significant effect on flight paths at higher levels, except in the immediate vicinity of the proposed Wilton airport.

Other sites being considered will have increasing levels of complexity to incorporate into the Sydney Airport airspace management framework.

It is necessary in this Working Paper to refer to the existing small aerodrome at Wilton which supports parachuting operations. Where this is referred to, the term *"existing"* is used to distinguish it from a possible new major airport at Wilton.

The airspace and related implications for existing aerodromes and aviation-related operations which would need to be resolved for a major new airport at Wilton to be developed, may be a lengthy process given the range of issues, numerous stakeholders and regulatory responsibilities of the relevant agencies. Given the length of time before a new Wilton airport would be developed, it is probable that, in any event, some airspace changes in the Sydney region will occur over that period for other reasons.

2.1.1 Statement of issue

Development of a major new airport at Wilton will involve:

- New/restructured airspace classifications to be developed;
- Have implications for some existing airspace classifications, and
- Have implications for some existing aerodrome/aviation-related facilities and their current operations.

2.1.2 Airspace management

In Australia, there are two major types of airspace: controlled, and uncontrolled. Controlled airspace is monitored and most traffic is directed, to varying extents, by air traffic controllers. Much of the Australian airspace below 18,000 feet (5472 m) outside the eastern seaboard is classified as uncontrolled airspace. It is in this airspace where most recreational aircraft generally operate.

As well as being broken into controlled or uncontrolled airspace, Australian airspace is further divided into different classes, where internationally agreed rules for visual flight and instrument flying apply.[5]

In line with the International Civil Aviation Organization (ICAO) *Annex 11 – Air Traffic Services* and as described in the *Australian Airspace Policy Statement 2010* (AAPS), Australian airspace is classified as Class A, C, D, E and G depending on the level of service required to manage traffic safely and effectively. ICAO airspace Classes B and F are not currently used in Australia. The airspace classification determines the category of flights permitted, Instrument Flight Rules (IFR) and/or Visual Flight Rules (VFR), and the level of air traffic services (ATS) provided.

[5] Airservices Australia (2012), *How air traffic control works*, http://www.airservicesaustralia.com/services/how-air-traffic-control-works/

In line with ICAO *Annex 15 – Aeronautical Information Services*, Australia designates volumes of airspace as a Prohibited, Restricted or Danger Area as follows:

- A Prohibited Area (PA) is designated for reasons of military necessity to prohibit the flight of aircraft over the area. There are no designated PAs within the airspace areas considered in this Working Paper;
- A Restricted Area (RA) is designated in the interests of public safety or for the protection of the environment to restrict the flight of aircraft over the area to aircraft flown in accordance with specified conditions;
- RAs have been assigned an RA status as follows:
  - RA1 Pilots may plan through the RA and upon request will be granted a clearance from ATC when the area is active unless a Notice to Airmen (NOTAM) indicates that a clearance is not available. A NOTAM is a notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations;
  - RA2 Pilots may not plan through the RA or expect a clearance from ATC. However, tracking through the RA may be offered on a tactical basis by ATC unless a NOTAM indicates that a clearance is not available;
  - RA3 Clearance through the RA is not available except in a declared emergency; and
- A Danger Area (DA) is designated where there exists within or over the area an activity that is a potential danger to aircraft flying over the area.

Airspace classifications are promulgated in the *Aeronautical Information Package* (AIP) and aeronautical charts. These include control zones (CTR), control areas (CTA), RA and DA and so on.

A CTR is defined as a controlled airspace extending upwards from the centre of the earth to a specified upper limit. CTRs surround controlled aerodromes. A major new airport at Wilton would be administered by a civil air navigation service provider such as Airservices Australia in accordance with Class C procedures and services.

If an ATC service is to be provided to VFR flights, classification options range from Class B down to D:

- Class B – VFR flights are treated the same as IFR, and all flights are separated;
- Class C – VFR flights are separated from IFR flights; and
- Class D – only IFR flights are separated.

Class D could be used at an aerodrome with minimal VFR aerodrome traffic, but the Civil Aviation Safety Authority (CASA) notes that the design advantages would not accrue.

A CTA is defined as a controlled airspace extending upwards from a specified limit above the earth.

CTRs and CTAs provide one of the means of maintaining aircraft separation, operating in accordance with their flight categories.

RAs and DAs are depicted on aeronautical charts as R or D followed by a unique identification number. Their details including the activities undertaken, lateral and vertical dimensions, hours of operation and conditional status (for RAs) are listed in the AIP *Designated Airspace Handbook* (DAH).

Section 4 considers the existing lower level airspace architecture in the vicinity of the proposed site options in terms of these designations and within the context of the AAPS.

2.2 Legislative status

Australian airspace is regulated under the *Airspace Act 2007* and its associated regulations by CASA through the Office of Airspace Regulation (OAR). The OAR utilises where appropriate, the specific design standards for airspace classifications contained in the *Civil Aviation Safety Regulation Part 71* (under development) and the AAPS. Additional standards, practices and procedures are published in the AIP and manuals published by Air Navigation Service providers (i.e. Airservices Australia/Defence).

The role of the OAR is to regulate Australian airspace to Ensure that Australian airspace is administered and used safely, taking into account:

- Protection of the environment;
- Efficient use of that airspace;
- Equitable access to that airspace for all users of that airspace;
- National security; and
- Continue the reform of Australia's airspace and move towards closer alignment with the ICAO system and adoption of proven international best practice.

The administration of Australian airspace as a national resource shall:

- Consider safety of Passenger Transport Services as the first priority;
- Be in the best interests of Australia;
- Consider the current and future needs of the Australian aviation industry;
- Adopt proven international best practice airspace systems adapted to benefit Australia's aviation environment; and
- Take advantage of advances in technology wherever practicable.

To meet the requirements and guidance, the OAR undertakes the following activities:

- Assessing and managing Airspace Change Proposals (ACPs);
- Consulting with industry on airspace matters;
- Reviews of the airspace classification and designation to ensure that the airspace is fit for purpose; and
- Participating in future strategic airspace planning.

2.2.1 Summary of issues from SSA Site Selection Programme

The SSA Site Selection Programme Draft 1985 EIS contains a section on airspace which suggests that development of a second major airport in the Sydney Region would require changes in the existing allocation of airspace to accommodate the different arrival and departure patterns at Sydney Airport and the second airport. Changes identified included:

- The requirement for a new CTR at Wilton; and
- The requirement for a combined CTA serving both Sydney Airport and Wilton.

The impacts on military and restricted airspace and GA are also discussed and included:

- The conclusion that the RAs associated with the Fleurs Radio Observatory, the Orchard Hills defence facility and munitions factory at St Marys would be compatible. Note Fleurs and St Marys are no longer in operation and their RAs are no longer active;

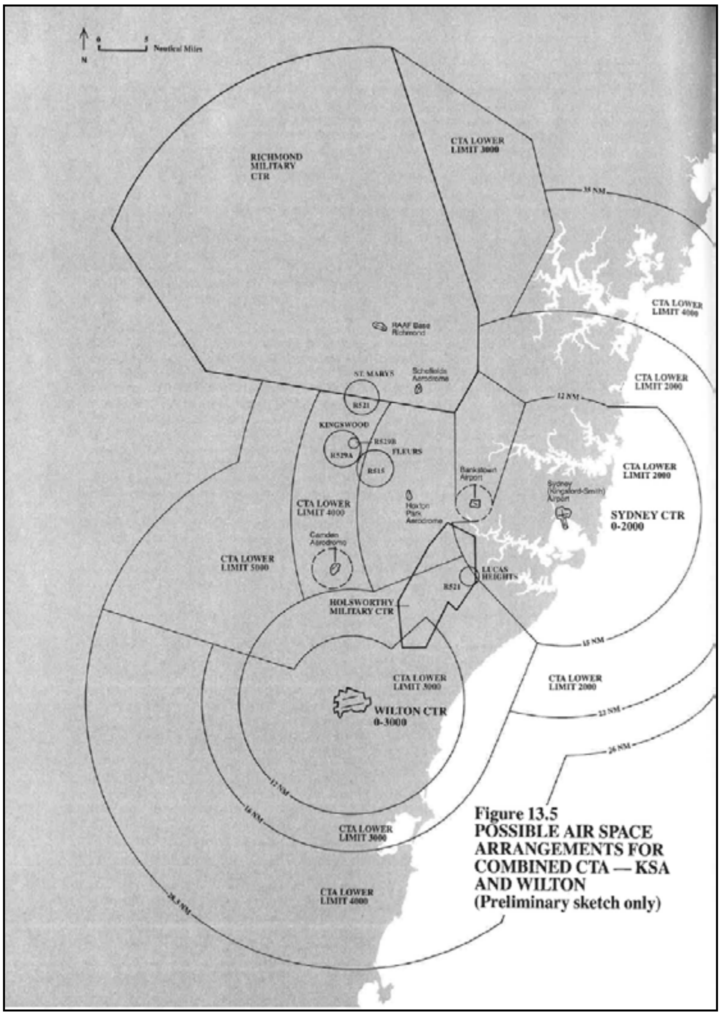
- The conclusion that the RAAF Base Richmond CTR would be unaffected but that restricted airspace above 6,000 feet would be subject to increased civil use;
- Continued use of the Holsworthy restricted airspace would impose some restrictions on operations at both Sydney Airport and the proposed Wilton airport; and
- GA aircraft operating outside controlled airspace would be presented with another airspace constraint in the form of the Wilton CTR when transiting the area, requiring tracking further to the west over more rugged terrain.

The Draft 1985 EIS contains a preliminary sketch (reproduced below as **Figure 2.1**) showing possible airspace arrangements with a CTR and a combined CTA encompassing Sydney Airport and a new Wilton airport.

Since 1985 there have been numerous changes, such that the Draft 1985 EIS airspace arrangements depicted are unlikely to be as relevant in the context of the current site option analysis. These changes include:

- The publication of CASA's Advisory Circular AC 2-5-1(0) Guidance for Controlled Airspace Design March 2010;
- Changes to the Sydney Airport CTR and parts of the adjoining CTA since 1985;
- The provision of the parallel runway (16L/34R) at Sydney Airport; and
- The introduction of the Long Term Operating Plan (LTOP).

Figure 2.1 Draft 1985 EIS possible airspace arrangements



Source: Kinhill Stearns 1985

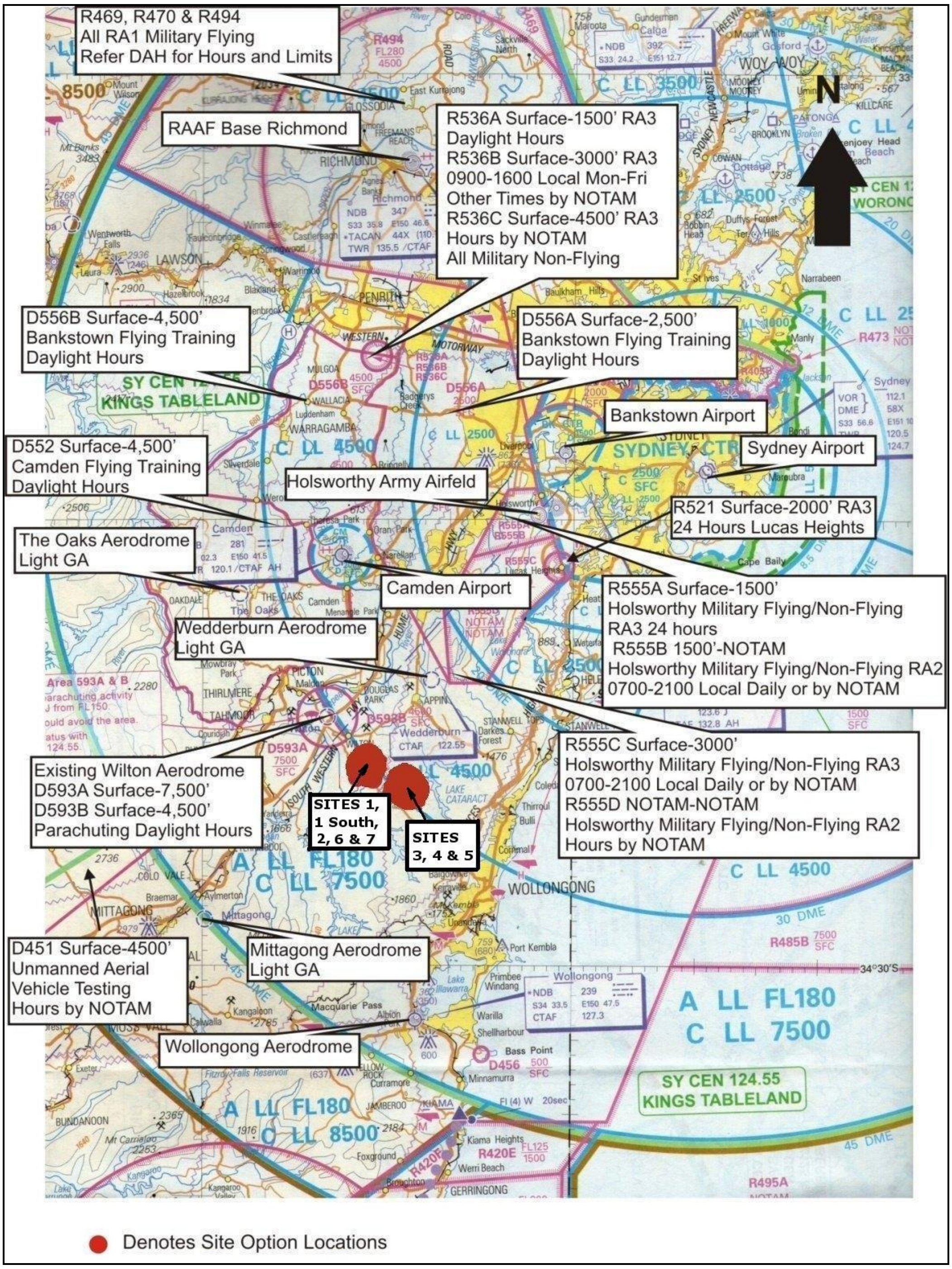
2.2.2 Analysis of airspace in terms of current airport concepts

2.2.2.1 Existing airspace classifications and activities

Figure 2.2 shows the main characteristics of current airspace classifications, existing known fixed wing aerodromes and known aviation-related activities in proximity to the site options, using the base data from the Sydney Visual Navigation Chart (VNC) dated 28 June 2012. Note the possibility exists there could be other fixed or rotary wing facilities not shown on this chart.

The impacts of the site options on these classifications and activities are discussed in Section 2.4.

Figure 2.2 Current airspace classifications and aviation facilities (not to scale)



Source: Base Image and Data Airservices Australia 2012

2.2.2.2 Possible airspace classifications for the site options

The MATS requires airspace to be designed with the application of strategic separation assurance. Strategic separation assurance is the designing of airspace, air routes, air traffic management plans and air traffic control practices, to reduce the likelihood that aircraft will come into conflict, particularly where traffic frequency congestion or system performance, amongst other considerations, may impair control actions.

Figures 2.3 to **2.10** depict indicative new lower-level airspace classifications that could be applicable to accommodate Options 1 and 1S, Options 2, 3, 4 5, 6 and 7 as discussed below. These classifications are shown by black lines and accompanying text in black. These indicative classifications should not be considered definitive. They will require detailed consideration, design and stakeholder consultation in accordance with CASA's Office of Airspace Regulation Operations Manual, Version 1.0: November 2010 in order to affect the necessary ACPs.

The indicative classifications have been developed having regard to CASA's Advisory Circular AC 2-5-1(0) Guidance for Controlled Airspace Design March 2010. They are also based in part on the preliminary findings in Airservices Australia's input to the Joint Study on Aviation Capacity for the Sydney Region contained in Report on Initial Location Analysis (Report C12). Assumptions common across all options include:

- Class C CTR – 7 nautical miles (nm) from runway thresholds, surface (SFC) to 1,500 feet;
- Adjacent Class C step 1,500 feet (minimum 700 feet) to approximately 10 nm;
- Next Class C step 2,500 feet to 20 nm;
- Next Class C step 4,500 feet to 30 nm; and
- Aerodrome elevation of 1,000 feet above sea level. (Note the actual elevation will vary between the options and will not be established until more detailed design has been carried out, however, for the purpose of this level of assessment, this common elevation value has been assumed).

Applying this aerodrome elevation results in the following altitude assumptions relative to mean sea level:

- Class C CTR, SFC to 2,500 feet;
- Adjacent Class C step 2,500 feet (minimum 1,700 feet);
- Next Class C step 3,500 feet; and
- Next Class C step 5,500 feet.

In relation to the lateral dimensions of a CTR, CASA's *Advisory Circular* indicates if a series of runways exist then the arcs of 7 nm from the runway thresholds should be joined by tangential lines or, if more convenient for clarity of presentation, and with no disadvantage to aircraft operations outside the CTR, the arcs may be contained within a circular CTR with the aerodrome reference point (ARP) (or, if applicable, a navaid) as the centre. This may result in a CTR with a radius greater than the minimum. In this case, the radius shall be rounded-up to the next half nautical mile. For the purpose of this assessment, a circular generic CTR has been adopted across all options encompassing arcs of 7 nm from runway thresholds. This results in a notional CTR of 8.5 nm radius.

Depending on matters such as final runway lengths and configuration, and decisions on the provision of a cross runway, the CTR lateral boundary may be able to be truncated slightly to a non-circular shape as provided for in CASA's *Advisory Circular.*

As stated above, that the indicative airspace classifications are based on application of the relevant CASA guidelines and provides detailed information on the various geometric properties of the individual airspace elements. They are not based on any other existing airport (either primary or secondary). For consistency, the same airspace template was applied to each site option, overlaid on the current airspace arrangements. In an airspace context there was no priority applied to existing airspace classifications in terms of minimising conflicts, however, some site options by virtue of the runway alignments adopted may have lower potential levels of conflict than others. The Booz & Company demand forecasts are not relevant in this airspace context.

2.2.3 Airservices Australia's comments

Airservices Australia's comments, as outlined in their Joint Study on Aviation Capacity for the Sydney Region – Further Assessment of Wilton Sites (at Appendix A) for Air Traffic Management, indicate a northwest - southeast parallel configuration is optimal for segregation from Sydney Airport operations. The runway directional range should be within 280 to 300 degrees (100 to 120 degrees). This alignment would reflect those of Sydney Airport (i.e. 16/34). Assuming a general northwest - southeast alignment of the parallel runways, alignment differences of small magnitude would not have a significant effect on flight paths at higher levels, except in the immediate vicinity of the proposed airport.

The nominal airport capacity would be 80 to 100 aircraft movements per hour using the parallel runways. Additional departure capacity may be realised with turbo-prop stub departures from the cross-runway. However, as stated below, this will increase complexity.

Any east-west cross-runway while feasible would exponentially increase the airspace modelling required for a minimal benefit, and potentially dilute efficiencies with airspace design.

If both Sydney Airport and the proposed Wilton airport were to both have crossing runways available, there could be up to nine modes at both locations (using the current Sydney Airport mode count as a baseline). This results in approximately 70 runway mode changes to model for each location separately. When combined for airspace and route analysis this leads to approximately 490 different mode changes to model. If Wilton and Sydney Airport were only proposed with parallel runways this would reduce the number of mode options to approximately four at each site. This produces only 16 different runway changes to model at each location, and approximately 64 different mode changes.

2.2.4 Implementation of new airspace classifications

2.2.4.1 Process

If staging of the Wilton airport occurred, with smaller aircraft accommodated in the initial years of its operation, these new airspace classifications would be required unless the airport was deemed to only require Class D procedures.

However, this analysis is based on the operation of an ultimate airport with capacity for 70 million passengers per annum. In this regard, given the hourly aircraft movement forecasts for the 'ultimate' capacity of 70 million passengers per year in the Working Paper *Airport Performance Specification for Wilton – Task and Infrastructure*, where, for example, the maximum is 79 movements per hour, the capacity of the parallel runways (100 aircraft movements per hour or 80 to 100 movements as advised by Airservices Australia) is not likely to be challenged.

Any decision to consider the initial adoption of Class D procedures would probably be undertaken by the OAR in conjunction with Airservices Australia. However, for the purposes of identifying potential issues associated with introducing these new arrangements, it was considered relevant to adopt the maximum potential aircraft requirements at the site, i.e. Class C procedures.

The addition of a new airport at Wilton with its requirement for new/revised airspace classifications, potential impacts on existing aerodromes and aviation related activities will necessitate a significant redesign of the already complex Sydney region's airspace architecture. However, this redesign is not significant enough to make an airport at Wilton not viable (refer to Airservices Australia' comments at Section 4.3).

For this reason the CTA definitions shown in **Figures 2.3** to **2.10** are depicted as discrete elements. In practice, it would be expected existing/modified CTA provisions for Sydney Airport would be integrated with new CTA provisions for Wilton reflecting the most critical lower limit at a particular location. This integration will be slightly different for each of the options and will need to take account of other potential changes to airspace such as RAs and DAs impacted by future operations at a new Wilton Airport. It is assumed this process will be undertaken by Airservices Australia as the proponent, with the OAR assessing and managing the necessary ACP, although the OAR's charter also includes participation in future strategic airspace planning. It will require user and stakeholder consultation given the requirements of the OAR's Operations Manual.

There will also be policy issues for government to consider in terms of impacts on existing airspace classifications, existing aerodromes and existing aviation-related activity. Both civil and Defence users would be impacted by a new major airport at Wilton, irrespective of which option might be developed in the future.

2.2.4.2 Richmond and Bankstown

The Government's announcements following the release of Joint Study Steering Committee's report included the following decision:

- Assessing the scope and consequences of utilising RAAF Base Richmond for limited civil operations, including consideration of social, economic and environmental impacts.

Also, the Joint Study Steering Committee made the following finding:

- Bankstown Airport has an important role as Sydney's main GA airport but could be made available for a level of regular public transport (RPT) operations by turboprop aircraft to provide an extra option for growth in that sector.

This Working Paper is focussed specifically on Wilton in terms of implications for existing airspace, other existing aerodromes and aviation related activities based on their current roles and functions. It does not therefore consider and any wider implications as might arise from the Richmond decision and Bankstown finding, and how these might operate in conjunction with a future major airport at Wilton.

Airservices Australia was tasked by the Steering Committee to examine a number of aspects addressing civil use of RAAF Base Richmond and RPT operations at Bankstown. This was documented in the Joint Study in the following three reports:

- Airspace Requirements to Support Regular Public Transport Operations at Bankstown Airport (Report C3);
- Sydney Airport Current Capacity and Potential Capacity Enhancement Air Traffic Management Implications of the Civil Use of RAAF Base Richmond, (Report C6); and
- Additional Report on the effect of civil operations at RAAF Base Richmond on Sydney Airport operations (Report C7).

Some of Airservices Australia' summary findings - in terms of the potential influences they might have when considering the issues raised in this Working Paper's analysis - are listed below.

It should also be noted that in the Joint Study, Airservices Australia advised that airspace segregation issues with Sydney Airport lessened as the localities/representative sites were located further south.

<u>Joint Study Technical Paper C3</u>

- The current airspace classification and CTR dimensions for Bankstown Airport do not support a combination of high density GA traffic and significant RPT turbo-prop movements;
- The feasibility of Bankstown Airport as a secondary RPT hub in the Sydney basin will require the relocation of GA traffic to another airport;
- Any development of Bankstown Airport as an additional RPT airport would have an effect on Sydney Airport operations, requiring airspace redesign:

- The Bankstown CTR reclassified airspace Class C and controlled by the Sydney Terminal Control Unit as an integrated airspace operating plan;
- The Class G airspace in the immediate vicinity of Bankstown reclassified as airspace Class E also controlled by the Sydney Terminal Control Unit;

- The proximity of military restricted airspace requires assessment against aircraft operational requirements for airborne manoeuvring to the southeast of Bankstown; and
- Any significant increase in traffic on the northern airways servicing Bankstown will require a redesign of military airspace northwest of Sydney.

<u>Joint Study Technical Papers C6 and C7</u>

Any development of Richmond Aerodrome as an additional civilian airport with traffic levels and mix similar to Newcastle would impact Sydney Airport operations requiring airspace redesign;

Any significant increase in aviation activity at Richmond will necessitate a redesign of LTOP;

Any development of Richmond Aerodrome as an additional civilian airport would require an integrated airspace operating plan to be developed to ensure safe and efficient airspace architecture in the Sydney region.

Figure 2.3 Option 1 indicative airspace arrangements (not to scale)

Source: Base Image Airservices Australia 2012 and AMPC analysis.

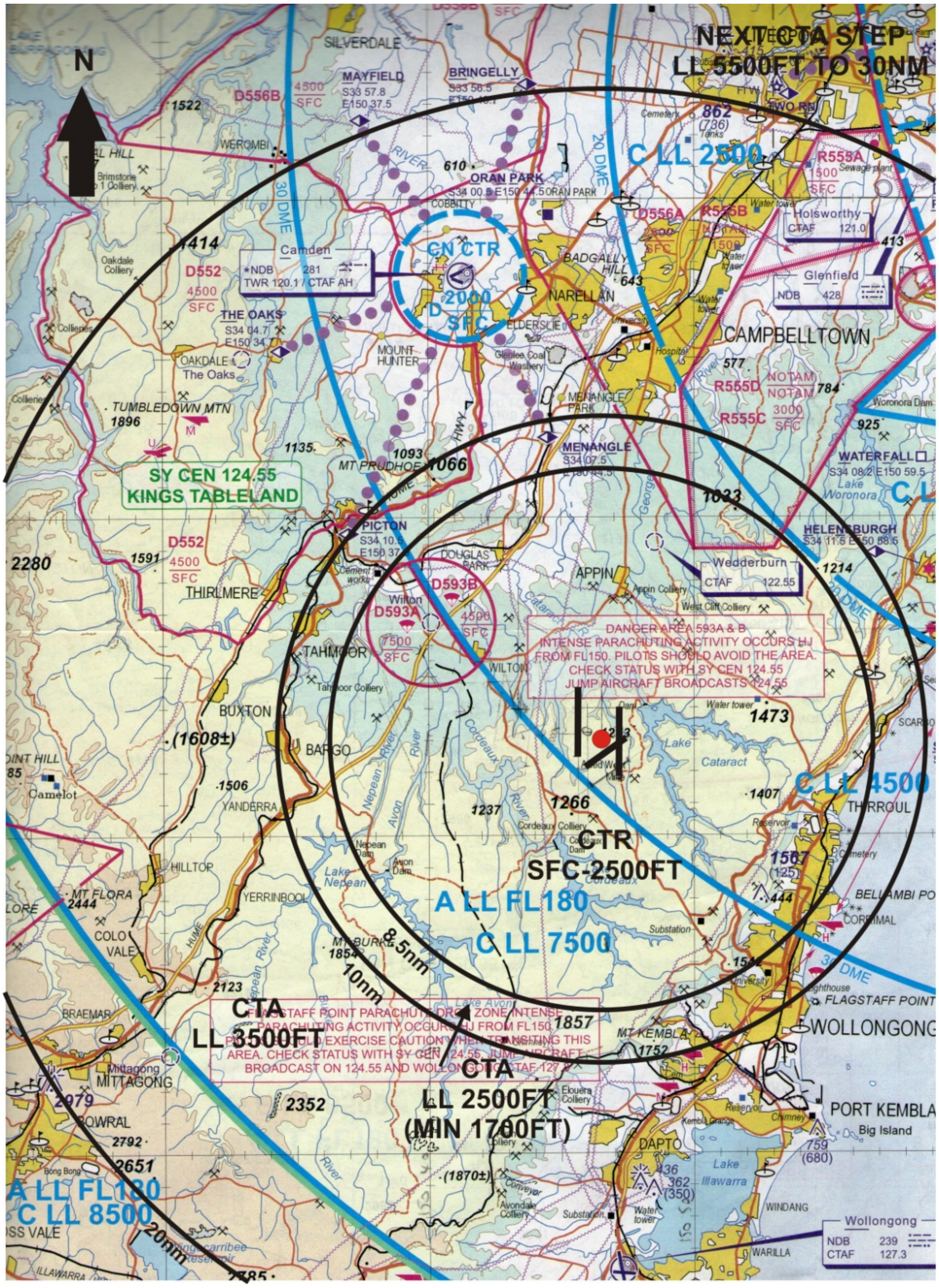
Figure 2.4 Option 1S indicative airspace arrangements (not to scale)

Source: Base Image Airservices Australia 2012 and AMPC analysis.

Figure 2.5 Option 2 indicative airspace arrangements (not to scale)

Source: Base Image Airservices Australia 2012 and AMPC analysis.

Figure 2.6 Option 3 indicative airspace arrangements (not to scale)

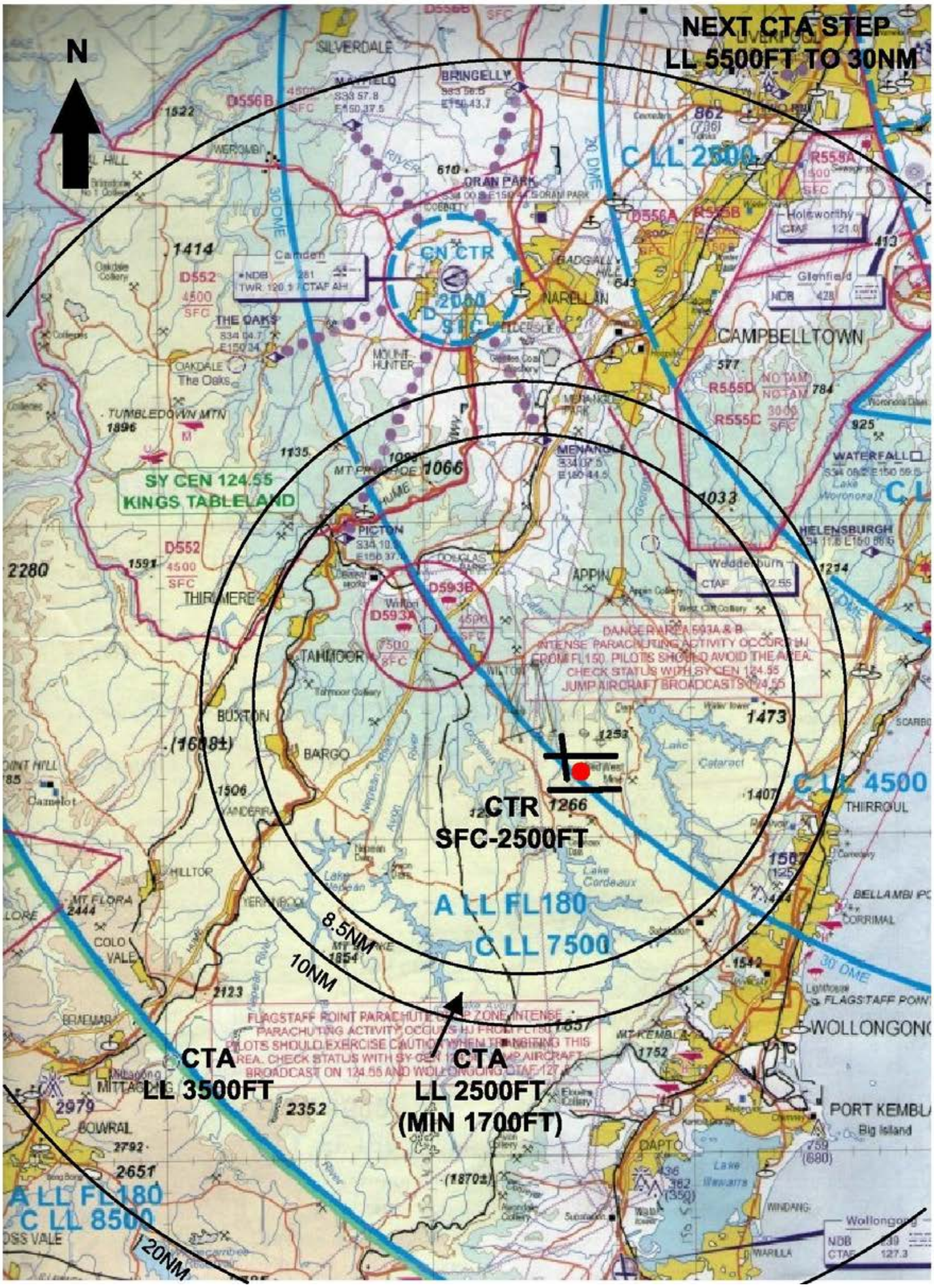


Source: Base Image Airservices Australia 2012 and AMPC analysis.

Figure 2.7 Option 4 indicative airspace arrangements (not to scale)

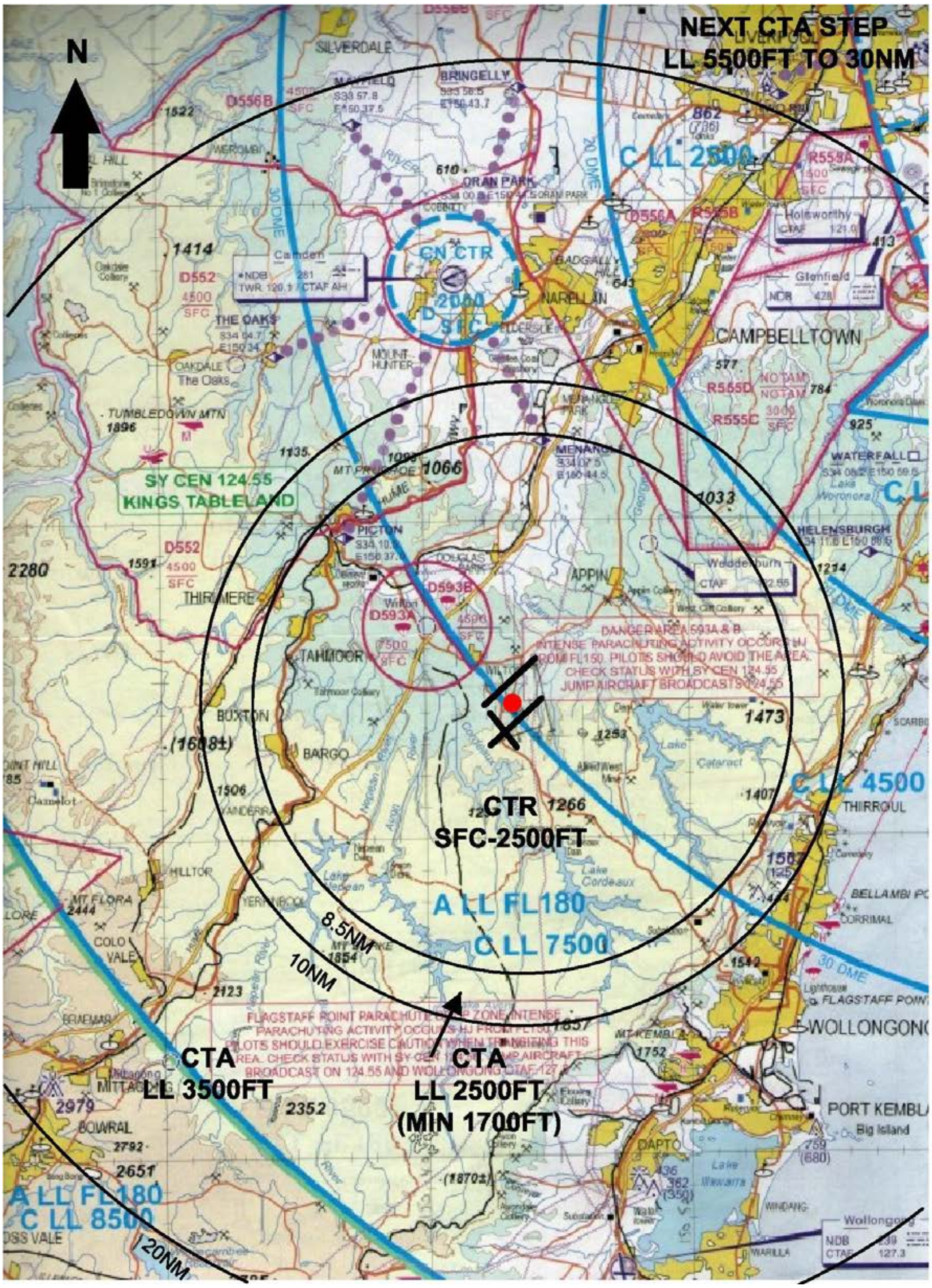
Source: Base Image Airservices Australia 2012 and AMPC analysis.

Figure 2.8 Option 5 indicative airspace arrangements (not to scale)



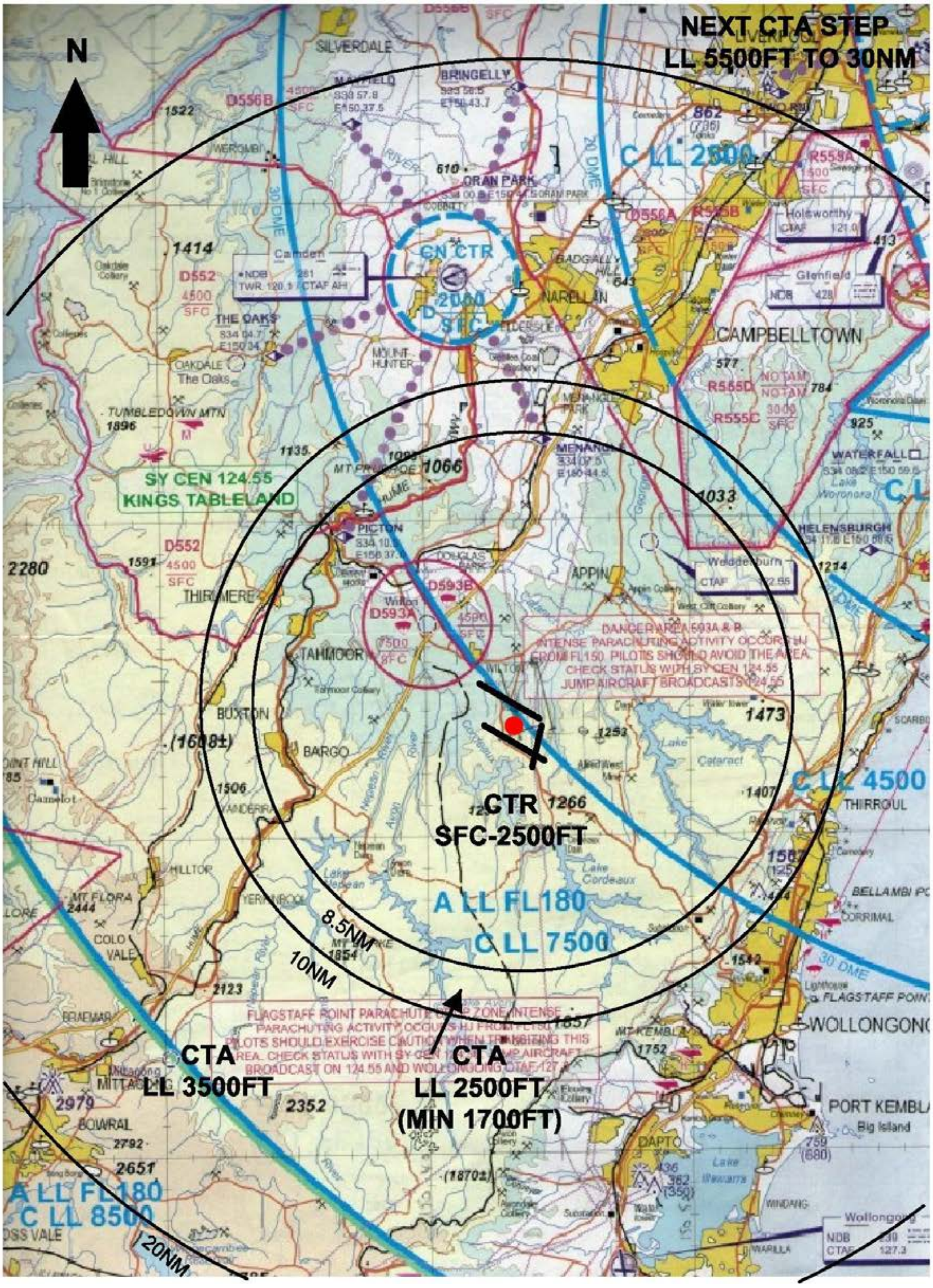
Source: Base Image Airservices Australia 2012 and AMPC analysis.

Figure 2.9 Option 6 indicative airspace arrangements (not to scale)



Source: Base Image Airservices Australia 2012 and AMPC analysis.

Figure 2.10 Option 7 indicative airspace arrangements (not to scale)



Source: Base Image Airservices Australia 2012 and AMPC analysis.

2.2.4.3 Assessment

Following is a brief description of possible interactions between the Wilton and Sydney circuit operations:

- With Option 1, 1S or Option 6 operating in a southerly flow mode there will be restriction to the north-eastern extent of the downwind / base leg of the Wilton circuit due to the Sydney circuit traffic. In the opposite direction departures should be able to turn-off or climb above the Sydney circuit traffic;
- For Options 2, 4 and 7, the runway directions are effectively parallel and should be able to operate independently of each other;
- Option 3, with north/south parallel runways is similar to 2 above with independent parallel operations possible; and
- Option 5 has east/west parallel runways however due to its distance south from Sydney Airport independent parallel operations should be possible with vertical separation. With Sydney in a northerly flow condition and Wilton westerly, the extents of the base leg / final of the two circuits will interact but should still allow independent operations with vertical separation, while opposite direction flows at both airports should pose no problems (although some restrictions) to operations.

The other main conclusions which can be drawn are as follows. These incorporate Airservices Australia's preliminary comments in its *Joint Study on Aviation Capacity for the Sydney Region – Further Assessment of Wilton Sites*, combined with issues based on further analysis as part of this Working Paper. The current aviation-related activities are shown in **Figure 2.2**.

- Sections of the current CTA associated with Sydney Airport will require lateral and vertical restructuring to incorporate a new CTR/CTA arrangement for and extending to Wilton;
- The existing uncertified/unregistered aerodromes6 of Wedderburn and existing Wilton fall within the new Wilton CTR and would therefore be incompatible with a new airport and need to close, as would the existing Wilton parachuting operations (i.e. D593A/B);
- Camden Airport (which currently accommodates IFR and VFR (would be limited to VFR operations and the adjacent training areas D552, and parts of D556A/B (Bankstown flying training) would need to be restructured vertically and possibly laterally to cater for the new CTA steps. The existing VFR routes from Picton and Menangle would not be compatible and alternatives would need to be evaluated;
- R536 series (Orchard Hills) with an upper limit of 4,500 feet will lie beneath the 20 nm CTA step lower limit of 5,500 feet and should therefore be compatible;
- Wollongong Aerodrome (certified) would be compatible, although parts of the current published IFR approaches would be within the CTA established for Wilton therefore requiring pilots to obtain a clearance before operating in this section of airspace;
- Southern VFR access to Bankstown Airport would require a transit lane, probably west of the CTR and the first Class C airspace step. There is the possibility of additional access via the coast and then north of R555C (Holsworthy). Provision of a transit lane would reduce the probability of violations of controlled airspace;
- Richmond Military Control Zone (and R468, R493 overlying). Airservices Australia has identified access would be required for northern arrivals (and possibly departures);
- Airservices Australia has identified the primary constraint is R555 series (Holsworthy) – artillery range activity – in the circuit area – not compatible above 3000 feet (i.e. R555B/D);

[6] The terms certified, registered and uncertified/unregistered refer to CASA's aerodrome categorisation system on which various aerodrome standards are based

- R495A/B – (Navy) – Airservices Australia has identified the northern portions may need to be civil airspace to segregate Sydney and new airport traffic;
- The north eastern corner of D451 (unmanned aerial vehicle testing) will fall within the lower limit of the 20 nm CTA step, requiring lateral and/or vertical restructuring;
- Flagstaff Point parachuting (near Wollongong) would be significantly restricted and probably not compatible. It is understood a new parachuting DA (to be designated D530) for an area of approximately 1 nm by 2 nm from the surface to the base of the CTA lower limit of 7,500 feet near Flagstaff Point, is to be promulgated in November 2012; and
- Hang gliding activities undertaken along the Illawarra escarpment may be impacted by the new CTR and 10 nm CTA step.

The Holsworthy facility is considered in Section 5.

Airservices Australia's summary comments are in Section 4.3 and Appendix A. Based on these comments, the difference of site options from Airservices Australia's recommended runway directional range would be as shown in **Table 2.2**.

Note that Wedderburn Airport has numerous existing hangars as shown in **Figure 2.11**. If the airport were required to be closed as a result of the development of an airport at Wilton, there will be a significant displacement of current users to an alternative GA airport. This should be taken into account when assessing the economic costs of a new airport.

Figure 2.11 Wedderburn Airport

Source: Earth Google Pro

Table 2.2 Difference of site options from Airservices Australia's recommended runway directional range

Option	Optimal for Segregation from Sydney Airport Operations (as interpreted from Airservices Australia comments dated 23 August 2012)	Main Runways Heading	Difference to Airservices Australia's Preferred Runway Directional Range (+/- Degrees)
1	Most complex	18/36	60
1S	Most complex	18/36	60
3	Complex	17/35	50
2	Complex	16/34	40
4	Complex	15/33	30
5	Complex (assuming vertical separation with northerly flow to Sydney Airport is possible)	08/26	20
6	Most complex	03/21	70
7	Complex	11/29	10 (within Airservices Australia preferred range)

Also, Airservices Australia's previous *Joint Study* findings in relation to RPT operations at Bankstown and civil use of RAAF Base Richmond need to be noted in the context of the potential for concurrent civil RPT operations occurring at all four airports i.e. Sydney, Wilton, Bankstown and Richmond at some point in the future. Airservices Australia's comments on the need for an integrated airspace operating plan for Sydney, Bankstown and Richmond may equally apply to the integration of Wilton airspace as part of this overall plan, noting the likely timeframe differences given the process that would be involved to develop a major new airport at Wilton.

2.3 Summary of mitigation methods and strategies

As noted above, one of the OAR's roles in regulating Australian airspace is protection of the environment. Airservices Australia is likely to be the proponent of the ACPs which would be required to establish a major airport at Wilton. Airservices Australia undertakes these tasks in accordance with its *Communication and consultation protocol 2011*, *Environment Strategy 2011-16* and the relevant environmental legislation.

Options which could be considered to ameliorate some of the airspace and operational implications are:

- Modification to the R555 series is required above 3,000 feet (i.e. potentially involving significant changes to the types of activities and/or the coordination of activities that can occur at the Defence facilities at Holsworthy); and
- Increased use of other GA aerodromes (i.e. Bankstown, Camden, Wollongong and Mittagong) to offset the loss of capacity currently afforded by the Wedderburn and existing Wilton aerodromes. Note that Wedderburn accommodates some aircraft operations by Recreation Aviation Australia registered aircraft. Pilots licensed to Recreational standard only without the appropriate endorsement are not permitted to operate in controlled airspace i.e. Bankstown and Camden.

The compatibility of the site options with the Holsworthy facility for aircraft overflying at greater than 3000 feet is in **Table 2.3**.

Table 2.3 Compatibility of site options with Holsworthy - operations of main runways only

Option	Compatibility with Holsworthy R555 with aircraft crossing at greater than 3000 feet	Comments
1	Potential conflict Compatible	Northerly departures overfly Southerly direction
1S	As for Option 1	As for Option 1
2	Compatible	Overflies
3	Compatible	Overflies
4	Compatible	Overflies
5	Compatible	Overflies
6	Major conflict	Southwest direction flight track overflies
7	Compatible	Overflies

Notes: 1. *Based on preliminary flight tracks in Working Paper* Acoustic Effects on People *assuming the R555C normal surface to 3000 feet for Holsworthy (see Figure 6.2).*

2. The preliminary flight tracks for all options overfly R555C and R555D.

3. If Defence NOTAMs any height greater than 3000 feet, there is complete incompatibility with landings in the southwest direction for Option 6 (which is 6.1 nm distant), unless Holsworthy is relocated.

2.3.1 Residual impacts

Residual effects arising from the airspace changes discussed above will include:

- Constraints on the military restricted airspace (R555 series) associated with Holsworthy (as above);
- Loss of Sydney region GA capacity due to the closure of Wedderburn and Wilton aerodromes;
- Loss of some aviation-related activities e.g. parachuting at Wilton and potentially north of Wollongong Aerodrome at Flagstaff Point (future D530), and hang gliding activities along the Illawarra Escarpment;
- Reductions to Camden Airport's operational capability i.e. IFR and flying training area capability i.e. D552;
- D556B, and possibly part of D556A (both Bankstown flying training) reduced capability; and
- IFR approaches to Wollongong Aerodrome will partly occur within the Wilton CTA.

With the exception of IFR approaches to Wollongong Aerodrome, the residual effects have government policy implications which will need to be considered. The most significant is considered to be at the Holsworthy artillery range which would be in the circuit area, as also identified by Airservices Australia.

2.4 Key findings

- The potential for concurrent RPT operations occurring at all four airports i.e. Sydney, Wilton, Bankstown and Richmond at some point in the future, probably requires Wilton to be part of an overall integrated airspace operating plan for the Sydney region;
- Some residual effects go to issues of government policy;

- As identified in, Airservices Australia's comments, from an air traffic management perspective, a northwest - southeast parallel configuration is optimal for segregation from Sydney Airport operations. The runway directional range should be within 280 to 300 degrees (100 to 120 degrees);
- A Wilton location allows an airspace redesign which is segregated from Sydney Airport operations, in particular for parallel runway modes;
- Preliminary evaluation indicates limited vertical profile constraint by current Sydney Airport operations in the airspace design for parallel runway modes;
- All Sydney Airport modes of operation under LTOP are compatible with the possibility of some effect on the timing of Mode 14A;
- Significant restructuring of parts of the existing Sydney region's airspace architecture will be necessary to accommodate the required Class C CTR and associated CTA steps. Restructuring may be a relatively lengthy process;
- This restructuring may need to include some RA and DA changes - the primary constraint is R555 series (Holsworthy) – artillery range activity – in the circuit area – which is not compatible above 3000 feet;
- Richmond Military Control Zone (and R468, R493 overlying) access would be required for northern arrivals (and possibly departures);
- R495A/B – (Navy) – northern portions may need to be civil airspace to segregate Sydney Airport and new Wilton airport traffic;
- R536 series (Orchard Hills) with an upper limit of 4,500 feet lies beneath the 20 nm CTA step lower limit of 5,500 feet and should therefore be compatible;
- The required ACPs will need to be assessed and managed by the OAR;
- The uncertified/unregistered aerodromes of Wedderburn and existing Wilton will be incompatible with a new airport, as would the associated parachuting operations i.e. D593A/B, therefore they would need to be closed or relocated;
- Camden Airport would be limited to VFR operations. The VFR routes from Picton and Menangle would not be compatible and alternatives evaluated;
- Training areas D552 (Camden flying training), and parts of D556A/B (Bankstown flying training) would need to be restructured vertically and possibly laterally to cater for the new CTA steps, leading to a reduction of some existing capabilities;
- Southern VFR access to Bankstown Airport would require a transit lane to avoid the CTR and possibly part of the 10 nm CTA step;
- Wollongong Aerodrome (certified) would be compatible, although parts of the current published IFR approaches would be within the CTA established for Wilton, therefore requiring pilots to obtain a clearance for operating in this section of airspace;
- The north eastern corner of D451 (unmanned aerial vehicle testing) will require lateral and/or vertical restructuring;
- Flagstaff Point parachuting (near Wollongong) would be significantly restricted and probably not compatible;
- Hang gliding activities undertaken along the Illawarra Escarpment may be impacted by the new CTR and 10 nm CTA; and

- Increased use of other GA aerodromes i.e. Bankstown, Camden, Wollongong and Mittagong may offset the loss of capacity currently afforded by the Wedderburn and existing Wilton aerodromes. Note that recreational licensed pilots that currently use Wedderburn may not have the appropriate qualifications to operate from Bankstown and Camden.

The difference between the site options is shown in **Table 2.4** below.

Table 2.4 Airspace management difference between options

	Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Main runways heading	18/36	18/36	16/34	17/35	15/33	08/26	03/21	11/29
Difference to Airservices' preferred runway directional range of 280 to 300 degrees (100 to 120 degrees) (plus or minus degrees)	60	60	40	50	30	20	70	10 (within Airservices Australia's preferred range)
CRITERION								
Optimal for segregation from Sydney Airport operations – for main runways only	Most complex	Most complex	Complex	Complex	Complex	Complex (assuming vertical separation with northerly flow to Sydney Airport is possible)	Most complex	Complex
Compatibility with Holsworthy R555 with aircraft crossing at greater than 3000 feet - for main runways only (note 2)	Potential conflict as Northerly departures overfly. Compatible in southerly direction	Potential conflict as Northerly departures overfly. Compatible in southerly direction	Compatible	Compatible	Compatible	Compatible	Major conflict as Southwest direction flight track overflies	Compatible
Mitigation measure	The primary existing airspace constraint is R555 series (Holsworthy) – artillery range activity – in the circuit area – which is not compatible above 3000 feet (i.e. potentially involving significant changes to the types of activities and/or the coordination of activities that can occur at the Defence facilities at Holsworthy). Notes: (1) The preliminary flight tracks for all options overfly R555C and R555D. (2) If Defence NOTAMs any height greater than 3000 feet, there is complete incompatibility with landings in the southwest direction for Option 6 (which is 6.1 nm distant), unless Holsworthy is relocated and the extent of impacts for the other options need to be addressed by Airservices Australia in later detailed design stages, unless R555 operations restricted or negated.							

2.5 References

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APPENDIX 2A AIRSERVICES AUSTRALIA'S COMMENTS

JOINT STUDY ON AVIATION CAPACITY FOR THE SYDNEY REGION

Further Assessment of Wilton Sites

Airport Design Considerations

The Airservices preference is that all design considerations relate to a Type 1 airport, utilising code F runways of similar length with a minimum centreline displacement of 2000M and that the relative displacement of runway thresholds is minimised, ideally by less than 150M. A design to these criteria will not impose any ICAO differences and will deliver optimal capacity.

Significant differences in runway length result in increased complexity of tactical operational planning (e.g. Flow management) and complex airspace and circuit design. Runways of similar length allow for more accurate and predictable air traffic management planning relating to aircraft operational requirements and permit segregated circuit operations aligned with point of origin or destination, thus reducing the number of conflict points in the airspace design with a consequent reduction in sub-optimal aircraft vertical profiles.

Reference documents for these criteria are the Manual on Simultaneous Operations on Parallel or Near Parallel Runways (SOIR) (ICAO Doc 9643) and Rules of the Air and Air Traffic Services (ICAO Doc 4444).

Strategic Separation Assurance

The Manual of Air Traffic Services (MATS) requires airspace to be designed with the application of strategic separation assurance. Strategic separation assurance is the designing of airspace, air routes, air traffic management plans and air traffic control practices, to reduce the likelihood that aircraft will come into conflict, particularly where traffic frequency congestion or system performance, amongst other considerations, may impair control actions.

Optimal Runway Alignment

For Air Traffic Management, a northwest - southeast parallel configuration is optimal for segregation from Sydney operations. The runway directional range should be within 280 to 300 degrees (100 to 120 degrees).

Initial wind rose data from the Bureau of Meteorology (Camden Airport site) indicates there would only be an excessive crosswind on a northwest - southeast parallel runway operation approximately 2% of the time. This is using 40km/h as a quantitative value for excessive crosswind. Any crossing runway would exponentially increase the airspace modelling required for a minimal benefit, and potentially dilute efficiencies with airspace design.

Assuming a general northwest - southeast alignment of the parallel runways, alignment differences of small magnitude would not have a significant effect on flight paths at higher levels, only in the immediate vicinity of the proposed airport.

Cross Runway - Operating Mode Considerations and Modelling

If both Sydney and the proposed Wilton airports were to both have crossing runways available, there could be up to 9 modes at both locations (using the current Sydney mode count as a baseline). This results in approximately 70 runway mode changes to model for each location separately. When combined for airspace and route analysis this leads to approximately 490 different mode changes to model.

With any current indicative STAR servicing Sydney, there are up to 5 different modes where this STAR could be used, and has to be modelled. Including Wilton with a crossing runway raises the figure to approximately 45 different modes that would have to be modelled for a single STAR track.

If Wilton and Sydney were only proposed with parallel runways this would reduce the number of mode options to approximately 4 at each site. This produces only 16 different runway changes to model at each location, and approximately 64 different mode changes.

The implementation of a crossing runway also results in off mode operational requirements, adding complexity and reducing efficiency. Off mode operational movements would have to be considered in airspace design.

The proposal of a crossing runway would exponentially increase the modelling required. The complexities and permutations required to accommodate crossing runway operations would result in inefficient airspace design.

Grid LSALT

5900FT AMSL

Restricted (and Danger) airspace

- Richmond Military Control Zone (and R468, R493 overlying) – access may be required for northern arrivals (and possibly departures) depending on the number of potential modes that would have to be modelled
- 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). The instrument approach procedures to Camden may not be compatible, potentially resulting in Camden becoming a VFR only airport.

Route structure

- **Network access to other aerodromes**
  - No significant change to routes accessing Sydney airport, however the continuation of mode 14a and 12 in Sydney places major constraints on efficiency of air route design to and from the proposed Wilton sites.
  - 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 Sydney Mode 14A.

Metroplex dependencies

Assuming a general northwest - southeast layout for parallel runways at Wilton, the interdependency with Sydney parallel runway modes will be limited. The interdependency increases with the accommodation of a crossing runway at both locations.

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 will 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 as a VFR airport.
- Wollongong would be compatible. However some of the instrument approaches may have to be modelled for compatibility

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, in particular for parallel runway modes. Crossing runway allowances will result in increased complexity and inefficiencies.
- Preliminary evaluation indicates limited vertical profile constraint by current Sydney operations in the airspace design for parallel runway modes.

Effect on the Long Term Operating Plan

- All modes of operation are compatible, although crossing runway modes (14a and 12) reduce efficiency
- Possibility of some effect on the timing of Mode 14A.

Optimum runway alignment and feasibility

- northwest - southeast will optimise segregation with Sydney operations.
- E/W cross runway is feasible although increases complexity and inefficiency .

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, however, as previously stated, this will increase complexity.

Wilton

- CTA steps 1500 to 10nm, 2500 to 20nm and 4500 to 30nm required.
- Rotation of RWY alignment more northwest - southeast 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 northwest - southeast 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 northwest - southeast 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

References to be used for analysis

- MATS, Airservices Australia
- Manual on Simultaneous Operations on Parallel or Near Parallel Runways (SOIR), ICAO Doc 9643
- Aeronautical Information Publication, Airservices Australia
- Rules of the Air and Air Traffic Services, ICAO Doc 4444
- Departure, Arrival and Air Route Management Design Rules, Airservices Australia
- Safety Management System Documents (Various) Airservices Australia
- Operations Manual- Part 173 (Instrument Flight Procedure Design), Airservices Australia

Specific Site Enablers

General assumption is that the catalyst to build a second airport with H24 parallel capacity is on the basis that Sydney (Kingsford Smith) Airport 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.

Wilton – Appin (Location 14)	Wilton	18/36 & 08/26	• Rotation of RWY alignment more northwest - southeast 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 northwest - southeast 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 northwest - southeast 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

3 WORKING PAPER – ACOUSTIC FOOTPRINTS

SUMMARY

This Working Paper outlines the assumptions used in designing the flight tracks incorporated into the aircraft noise contours for the airport site options developed in the Working Paper *Wilton Airport Site Selection and Airport Concepts.*

The flight tracks form an important input to the Integrated Noise Model (INM), used to produce the aircraft noise contours (ANEFs and N70 contours).

This Working Paper covers only noise from aircraft in flight. It does not cover ground-based operations of aircraft or noise from other airport sources, e.g. construction, buildings and vehicular traffic.

Based on the assumptions detailed in this Working Paper, the populations affected by aircraft noise for each option are detailed in the Working Paper *Acoustic Effects on People*. Operational noise mitigation measures are also suggested. Possible noise insulation and compensation measures are also identified.

3.1 Introduction

This Working Paper outlines the reasons for selection of the 20, 25, 30, 35 and 40 ANEF contours in the aircraft noise modelling for each of the airport site options identified in the Working Paper *Wilton Airport Site Selection and Airport Concepts*. It also describes the additional metrics N60 and N70 and supplementary metrics Person-Events Index (PEI) and Average individual Exposure (AEI) and shows flight tracks and frequency to supplement the ANEF analysis, to assist in better understanding the implications of a new airport development and options selection.

The assumptions used in designing the flight tracks incorporated into the various sets of aircraft noise contours provided for the options considered for the Wilton area include:

- The flight tracks are generally located within the circuit areas of the various runway layouts; and
- They do not provide other than a general description of the flight tracks away from the proposed airport site.

The flight tracks form an important input to the Integrated Noise Model, used to produce the aircraft noise metrics (ANEFs, LAMAX, N60 and N70 contours).

This Working Paper could act as an information paper to seek Airservices Australia's comment and input to the assumptions to be made for the flight tracks.

3.1.1 Statement of issue

This Working Paper assesses potential noise impacts from development of an airport in the Wilton Study Area. In the interest of safety and public amenity, development needs to be carefully managed in the vicinity of airport operations. However, there is also a need for airports to be easily accessible to population centres. There is a need to ensure that developments are undertaken in a way that is compatible with airport operations, both now and into the future.

This Working Paper covers only noise from aircraft in flight. It does not cover ground-based operations of aircraft or noise from other airport sources e.g. construction, buildings and vehicular traffic, which are considered in the Working Paper *Acoustic Effects on People*.

Based on these and other assumptions detailed in this Working Paper, the populations affected by aircraft noise for each option using the acoustic metrics are given in the Working Paper *Acoustic Effects on People.*

The impacts are based on 2006 Census data sourced from the Australian Bureau of Statistics (ABS), so may understate the potential noise impacts.

3.1.2 Description of aircraft noise

3.1.2.1 Australian Noise Exposure Forecast

The traditional system of aircraft noise assessment has been based around the Australian Noise Exposure Contour (ANEF) metric, which was a modification of the US Noise Exposure Forecast system. The ANEF is a generic name for three types of equal energy aircraft noise contours:

- The Australian Noise Exposure Forecast (ANEF) is the only metric approved and promoted by the Federal Government for use in determining the suitability of land use in regards to aircraft noise. The ANEF is generally provided for a 20-year time frame, is updated regularly and there can be only one approved set of ANEF contours at a given time. The technical accuracy approval is by Airservices Australia;
- The Australian Noise Exposure Index (ANEI) provides historical data on aircraft noise exposure. Normally one year's actual traffic at an airport is used to generate the ANEI and the approval process is the same as that for the ANEF; and

- The Australian Noise Exposure Concept (ANEC) is used as a planning tool to investigate likely changes to aircraft noise exposure resulting from proposed changes to conditions at an airport. Those changes include, among other things, changes to aircraft types or numbers.

At a planning level, ANEF and ANEC are often used interchangeably.

The ANEF system is described in the Australian Standard AS2021 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction and is the only method of controlling land use planning at all but two minor Australian aerodromes. It is not used to regulate aircraft operations, but rather to report on the effects of those activities. This system takes into account the frequency, intensity, time and duration of aircraft activities and calculates the total sound energy generated at any location. Governments recognise the need to consider a complementary suite of noise measures in conjunction with the ANEF system to better inform strategic planning and to provide more comprehensive and understandable information on aircraft noise for communities. In the last few years there have been supplementary indices or metrics developed to help better describe aircraft noise in terms that are more readily understood by the public. These indices include N70 (see Section 3.2) and Flight Track Frequency charts. See Section 3.1.3.2 for recent government initatives.

The only method of calculating ANEF contours is by use of the Integrated Noise Model (INM) developed by the Federal Aviation Administration of the USA. It cannot be directly measured. The INM calculates the aircraft noise exposure for an average day (averaged over a year) activity at an airport and for an ANEF, this day is an average day of a complete year at the forecast date.

The Australian Standard AS2021 provides guidance to regional, local authorities and others associated with urban and regional planning and building construction on the acceptable location of new buildings in relation to aircraft noise. Zones that are described as *"conditionally acceptable"* may be approved as building sites provided that any new construction incorporates sound proofing measures. Section 3.2 of the Standard gives guidelines for determining the acoustic acceptability of a particular site. Conversely, the Standard can be used to assess the noise impact of a new aerodrome or of altering an existing one, by the production of an ANEC.

The Australian Standard AS2021 provides recommended land use compatibility as reproduced at **Table 3.1** below. For land designated *"conditionally acceptable"* it should be noted that land use authorities might consider that "*the incorporation of noise control features in the construction of residences or schools is appropriate"*.

Table 3.1 *AS2021* Table of building site acceptability based on ANEF zones

Building Type	ANEF Zone of Site		
	Acceptable	**Conditional**	**Unacceptable**
House, home unit, flat, caravan park	Less than 20 ANEF (*Note 1 of AS2021*)	20 to 25 ANEF (*Note 2 of AS2021*)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (*Note 1 of AS2021*)	20 to 25 ANEF (*Note 2 of AS2021*)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (*Note 1 of AS2021*)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (*Note 1 of AS2021*)	20 to 30 ANEF	Greater than 30 ANEF

Building Type	ANEF Zone of Site		
	Acceptable	Conditional	Unacceptable
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

Source: AS2021-2000

Note: *1. The actual location of the ANEF contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of Clause 2.3.2 may be followed for building sites outside or near to the 20 ANEF contour.*

2. Within 20 to 25 ANEF some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate (see also Figure A1 of Appendix A of AS2021-2000).

3. There will be cases where a building of a particular type will contain spaces used for activities which would generally be found in a different type of building (e.g. an office in an industrial building). In these cases, Table 3.1 (above) should be used to determine site acceptability but internal design noise levels within the specific cases should be determined by using Table 9.2 of AS2021-2000.

This table becomes a planning tool for future land use as described in Section 3.2 and is the basis of the ANEFs used in the noise modelling.

For aerodromes that do not have ANEF charts published for them, *AS2021* provides a land use compatibility table based on measured aircraft noise and frequency of flight. **Table 3.2** reproduces that table.

Table 3.2 AS2021 Table of building site acceptability based on aircraft noise levels

Building Site	Aircraft Noise Level expected at building site, dB(A)					
	20 or less flights per day			Greater than 20 flights per day		
	Acceptable	Conditionally acceptable	Unacceptable	Acceptable	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park	<80	80 - 90	>90	<75	75 - 85	>85
Hotel, Motel, hostel	<85	85 - 95	>95	<80	80 - 90	>90
School, university	<80	80 - 90	>90	<75	75 - 85	>85
Hospital, nursing home	<80	80 - 90	>90	<75	75 - 85	>85
Public building	<85	85 - 95	>95	<80	80 - 90	>90
Commercial	<90	90 - 100	>100	<80	80 - 90	>90

Building Site	Aircraft Noise Level expected at building site, dB(A)					
	20 or less flights per day			Greater than 20 flights per day		
	Acceptable	Conditionally acceptable	Unacceptable	Acceptable	Conditionally acceptable	Unacceptable
Building						
Light industry	<95	95 - 105	>105	<90	90 - 100	>100
Heavy industry	No limit	No limit	No limit	No limit	No limit	No limit

Source AS2021-2000

The Integrated Noise Model (INM) model itself contains a detailed database of aircraft performance and noise characteristics that have been determined from actual detailed measurements of the required parameters and is described in Section 3.4.2.

3.1.2.2 Other metrics

Apart from the ANEF contours that are used for land use planning guidelines at Australian aerodromes there is a wide range of other metrics that can be calculated using the INM. These include:

Eight A-weighted metrics (used for standard noise analysis where aircraft noise spectra are modified by depressing noise levels in the low and high frequency bands to approximate the response of the human ear). These metrics include Day-night average sound level (the AS2021 Section 4-2 average exposure level) and LAMAX (the AS2021 Section 4.2 maximum exposure level, which is also used in this study);

Three C-weighted metrics (used for low-frequency noise analysis where aircraft noise spectra are modified by depressing noise levels in the low and high bands but to a lesser degree than A-weighting); and

Five perceived tone-corrected noise metrics (used for noise analysis based on aircraft noise certification tests where aircraft noise spectra are modified by depressing noise levels in the low and high frequency bands and elevating metric levels if there are tones in the spectra). This family of metrics includes the ANEF contours.

In the last few years there have been supplementary metrics/indices developed to help better describe aircraft noise in terms more readily understood by members of the public. These indices include N70, N60, Flight Track Frequency charts and Single Event Contours. While aircraft flight paths are a useful way of presenting information on aircraft activity, they do not include information on the actual noise level of flights.

The N70 contour chart is commonly used to supplement an aerodrome's ANEF charts. The N70 is calculated using the INM and indicates the number of aircraft noise events that exceed 70 dB(A). The 70 dB(A) value is used, as that is the external noise level that will be at the disturbance threshold of people in an average residence with doors and windows closed assuming 15 dB(A) attenuation through the building structure. These contour types can be calculated for whatever noise value is required. This is one of the metrics supported in the *National Airports Safeguarding Framework*.

The N60 is calculated using the INM and indicates the number of aircraft noise events that exceed 60 dB(A) and is generally used at GA airports or quiet regional areas.

3.1.2.3 National Airports Safeguarding Framework for noise

The overall *National Airports Safeguarding Framework* is discussed in more detail in the Working Paper *Airport Safeguarding*.

In regard to aircraft noise, the *National Airports Safeguarding Framework* comprises:

- Principles for National Airports Safeguarding Framework;
- Guideline A: Measures for Managing Impacts of Aircraft Noise (considered in this Working Paper);
  - Attachment 1 - Alternative Aircraft Noise; and
  - Attachment 2 - Indicative Aircraft Noise Contours.

The national land use planning framework is to ensure future airport operations and their economic viability are not constrained by incompatible residential development.

It is the responsibility of each state jurisdiction to implement the *Framework* into their respective planning systems.

Commonwealth, State and Territory Ministers considered the National Airports Safeguarding Framework at the Standing Council on Transport and Infrastructure (SCOTI) meeting held on 18 May 2012. Ministers agreed to:

- The Principles for a National Airports Safeguarding Framework;
- Guidelines B - F, subject to their operation being reported back to SCOTI in 12 months; and
- Guideline A - Measures for Managing Impacts of Aircraft Noise:
  - Subject to its use being for the purpose of guiding strategic planning decisions and monitored, with a report back to SCOTI in 12 months; and
  - Noting that, following a request from SCOTI, the Commonwealth's intention to seek a review by Standards Australia of Australian Standard AS 2021–2000 Acoustics Noise Intrusion–Building Siting and Construction (AS2021).

Furthermore, Ministers noted that the *Framework* and its implementation plan are likely to be refined over time to reflect:

- Processes that will address the review of AS2021 and Guideline A; and
- Any future guidance material to be incorporated within the National Airports Safeguarding Framework.

New South Wales noted they have reservations with the format of Guideline A.

Whilst the *Framework* is primarily about protecting airports from inappropriate off airport development, the same principles could apply to an airport site selection and subsequent embedding into land use instruments and plans.

Guideline A advises:

1) The established Australian Noise Exposure Forecast (ANEF) System and the *Australian Standard AS 2021-2000 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction (AS2021)* have been recognised by a number of jurisdictions in land use planning decisions. However, the 20 ANEF and 25 ANEF zones do not capture all high noise affected areas around an airport, and *AS2021* recognises that the ANEF contours are not necessarily an indicator of the full spread of noise impacts, particularly for residents newly exposed to aircraft noise.
2) Governments recognise the need to consider a complementary suite of noise measures in conjunction with the ANEF system to better inform strategic planning and to provide more comprehensive and understandable information on aircraft noise for communities. Further information on the limitations of the ANEF system, and alternative aircraft noise metrics is provided at Attachments 1 and 2 of Guideline A.

Guideline A recommends the following criteria for land use planning in rural or non-urban greenfield areas – the primary situation in the Wilton area:

Governments agree to ask Standards Australia to undertake a review of *AS2021-2000*, with the review to also consider (but not limited to) the application of the following approach to land use planning:

i. There should be no new designations or zoning changes that would provide for noise sensitive developments within a 20 ANEF where that land was previously rural or for non-urban purposes. Zoning for noise-sensitive development should be avoided where ultimate capacity or long range noise modelling for the airport indicates either:

    - 20 or more daily events greater than 70 dB(A);
    - 50 or more daily events of greater than 65 dB(A); or
    - 100 events or more daily events of greater than 60 dB(A).

ii. Zoning for noise-sensitive development should take into account likely night time movements and their impact on residents' sleeping patterns. Specifically, where there are more than 6 events predicted between the hours of 11pm to 6am which create a 60 dB(A) or greater noise impact, measures for aircraft noise amelioration and restriction on noise sensitive development would be appropriate.

For new developments within existing residential areas, the following is recommended:

Commonwealth, State, Territory, Local Governments and airport operators should support effective disclosure of aircraft noise to prospective residents. This should be considered as broadly as possible but required where ultimate capacity noise modelling for the airport indicates either:

- The area is within the 20 ANEF;
- 20 or more daily events greater than 70 dB(A);
- 50 or more daily events of greater than 65 dB(A);
- 100 events or more daily events of greater than 60 dB(A); or
- 6 or more events of greater than 60 dB(A) between the hours of 11pm and 6 am.

For planning purposes, a zone of influence around airports should be taken into account for planning, depending on the amount of traffic at the airport. The following zones are approximations and should be used as guidelines only:

- Within 15 km of an international airport, major domestic airport, or major military Aerodrome, as would apply to Wilton options.

3.1.2.4 Person-Events Index and Average Individual Exposure

To assist with options differentiation, the following metrics are also used, as advised in the Department's publications.

Person Events Index (PEI)

The PEI allows the total noise load generated by an airport to be computed by summing, over the 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 (*Department of Transport and Regional Services 2000*).

For example, if a departure off a specific runway at an airport by a particular aircraft type leads to 20,000 persons being exposed to a single event noise level greater than 70 dB(A) then the PEI(70) for that event would be 20,000. If there were a further similar event the PEI(70) would double to 40,000 since there would have been that number of instances where a person was exposed to a noise level louder than 70 dB(A).

The PEI is therefore expressed by the following formula:

$PEI(x) = \Sigma P_N N$

where

x = the single event threshold noise level expressed in dB(A)

P_N = the number of persons exposed to N events > x dB(A).

The PEI is summed over the range between N min (a defined cut-off level) and N max (the highest number of noise events louder than x dB(A)persons are exposed to during the period of interest).

By summing all the single events at an airport, say for an average day, a total PEI(70), etc) can be developed. The PEI(70) is the total number of instances on the average day where a person is exposed to a noise event greater than 70 dB(A) and is a measure of the total noise load generated by the airport.

Average Individual Exposure (AIE)

The PEI in itself does not indicate the extent to which the noise has been distributed over the exposed population. For example, a PEI(70) of 2 million for an airport could mean that one person has been exposed to two million events in excess of 70 dB(A) (assuming this were possible), or that two million people have each received one event or it could be arrived at by any other combination of the two factors. A summary of the noise distribution is provided by the Average Individual Exposure (AIE) which is given by the formula:

AIE = PEI/total exposed population

The AIE therefore gives the average individual noise exposure in the number of events greater than the specified noise level over the specified time. When comparing options at a particular airport, the AIE indicates the extent to which the noise is concentrated or shared. It is also useful in comparing site options, as in this study.

These metrics/ indices are not intended to replace the previous existing noise indicators but to supplement them. An index assists interpretation of data; detailed examination of the base data always needs to be made if definitive conclusions are to be drawn when comparing two noise exposure data sets (*Department of Transport and Regional Services 2000*).

3.2 Legislative status

3.2.1 Federal

3.2.1.1 Leased airports

Under the *Airports Act*, for federally leased airports, a master plan must demonstrate plans for managing aircraft noise intrusion in areas forecast to be subject to exposure above the significant ANEF levels – currently taken to be 30 ANEF. At this level of noise approximately 65% of people are expected to be seriously or moderately affected by aircraft noise, based on the advice in *AS2021-2000***,** subject to the limitations in Section 3.1 above, as it based is on the *1982 NAL Report 88* and a socio-acoustic survey undertaken at that time. A similar standard is expected to apply to any new airport developed by the Commonwealth at Wilton.

3.2.1.2 Insulation and compensation program

The Federal Government has noise insulation programs for reducing the impacts of aircraft noise on homes and public buildings (Schools, Churches, Day Care Centres and Hospitals) under flight paths near Sydney and Adelaide Airports. These programs have been by legislated levy on airlines and have included voluntary acquisition of residential properties over 40 ANEF and insulation and mechanical ventilation of public buildings over 25 ANEF and for residential properties over 30 ANEF.

At a combined cost in excess of $470 million, the Adelaide and Sydney Airport noise insulation programs have been labelled by the Government as an outstanding success with 4,083 homes and 99 public buildings insulated in Sydney; while in Adelaide, a further 648 homes and 7 public buildings have been insulated. [7]

A noise related acquisition policy was implemented by the Australian Government for a proposed airport at Badgerys Creek:

- The 35 ANEF was used for the voluntary acquisition of potentially noise affected properties at Badgerys Creek. This was based on the then Government's response in September 1990 to the report "Aircraft Operations and the Australian Community" by the House of Representatives Select Committee on Aircraft Noise (HORSCAN);
- Recommendation 23 of the HORSCAN report was that "The Commonwealth Government when acquiring land for new airports purchase all land within the 35 ANEF contour to provide noise buffer zones." In its response to that recommendation, the then Government committed to purchasing existing dwellings within the 35 ANEF contour at the request of the owner. This policy was therefore applied at Badgerys Creek and a number of eligible properties were acquired; and
- There is no Federal Government policy or legislation covering compensation for noise mitigation or for valuation of off-airport properties impacted by significant ANEF levels at this time, other than those outlined above. The Government's White Paper 2009 does, however, propose to develop a framework in consultation with stakeholders for an industry funded noise amelioration program where future major civil airport operations and air traffic changes place residences into high-noise exposure zones. This Framework is described in Section 3.1.2.3 and is silent on noise insulation and compensation.

Further discussion of possible mitigation measures based on the Draft EIS Second Sydney Airport Proposal 1997 is in Section 3.5.3.2.

3.2.2 NSW and Local Government

Properties newly impacted by ANEFs in the 20-25 zones, under *AS2021-2000 Acoustics – Aircraft noise intrusion – building siting and construction* are conditionally acceptable for residential land use, with the following note.

- *Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with all residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate (with the limitations at Section 2.3 of AS2021).*

The NSW Government's adopted policy and statutory position on land use zoning and aircraft noise is the *Section 117 (Local Planning) Direction*, *Development Near Licensed Aerodromes* under the NSW *Environmental Planning and Assessment Act*. The Local Planning Direction states that a draft *LEP* shall not rezone for residential purposes, nor increase residential densities in areas where the ANEF, as from time to time advised by that Department of the Commonwealth, exceeds 25.

The NSW Department of Planning has issued a standard LEP template for land use planning and for new LEPs. This template includes a standard clause for obstacle heights and aircraft noise which typically is for aircraft noise as taken from clauses 7.17 and 7.18 of *Liverpool LEP 2008* is given in Appendix A. This clause would apply in land use planning for the preferred option at Wilton.

The satisfaction of Clause 3(a) for a residential property in the vicinity of Bankstown Airport has been costed by Liverpool Council at $20,000-$30,000 for double glazed windows, roof insulation etc. (*Liverpool Council 2009*). Greater costs were assumed in the vicinity of the proposed Badgerys Creek Airport (*Draft EIS Second Sydney Airport Proposal 1997* in Section 5.3.2). It should be noted that some of these works, e.g. insulation is required under the

[7] Department of Infrastructure and Transport http://www.infrastructure.gov.au/aviation/environmental/insulation/index.aspx accessed 20 May 2011).

NSW Building Sustainability Index (BASIX) system in new or altered dwellings in any case for energy efficiency purposes.

There is no provision for compensation in this standard clause or NSW Government policy on this issue.

As noted in Section 3.1.3.2, the Department advises that the New South Wales Government noted they have reservations with the format of *Guideline A* for Aircraft Noise under the *National Airports Safeguarding Framework*.[8]

3.3 Summary of issues from SSA Site Selection Programme

As part of the SSA Site Selection Programme, the Draft 1985 EIS was prepared that included a preliminary master plan for an airport development at Wilton.

An objective during preparation of the preliminary master plan was to minimize the impact of aircraft noise from the worst case aircraft traffic assumption of 275,000 movements per year, recognizing that social surveys for Second Sydney Site Selection Programme identified noise as the major perceived disadvantage of a second Sydney airport.

The method of assessment or potential noise effects was based on the findings of the National Acoustic Laboratories study included in *AS2021* in Section 1.2 of this Working Paper (i.e. using the ANEF, the same peoples' reactions and same land use compatibility advice). The Draft 1985 EIS recognized the Terms of Reference of the House of Representatives Standing Committee which covered important matters outside the NAL study, inter alia relating to health and welfare, property values and compensation schemes, which at the time were referred to a Select Committee.

The ANEF system was used, using the then Department of Aviation calculation methods, recognizing that on a day by day basis the ANEF position would vary considerably with traffic patterns, temperature, wind, humidity and meteorological conditions. Temperature inversions are quite common at Wilton resulting in a 'sporadic bounce' effect from trapped sound waves, with the result that if the inversion layer is low, people farther from the airport may hear an aircraft more easily than others closer to it .

The ANEF contours were used to estimate the maximum future numbers of residents likely to be seriously or moderately affected under the worst case assumptions for two airport alignments, by:

- Estimation of the maximum number of allotments that could result from further subdivision under existing zoning controls (the unlikely prospect of areas within the 20 ANEF contour other nominated urban release areas being rezoned to permit urban residential development was not considered);
- Application of an average household size for the area from the 1981 Census (3.7 persons) to the maximum number of allotments, in order to derive the maximum population that could be expected within each ANEF contour; and
- Estimation of the population within each ANEF contour likely to be seriously or moderately affected by aircraft noise based on the findings of the National Acoustic Laboratory study.

The number of people within the 20 ANEF contour for the preferred east-west runway alignment was as given in **Table 2.3** and compared with other airports at the time.

[8] http://www.infrastructure.gov.au/aviation/airport_safeguarding/index.aspx accessed 8 June 2012

Table 2.3 Comparisons of populations within 20 ANEF zone

Table 14.2.10 **Comparison of populations within 20 ANEF contour**

Airport	Average number of aircraft movements*		Number of people within 20 ANEF**			
	Per day	Per night	Seriously affected by noise	Moderately+ affected by noise	Others	Total population
Wilton east/west alignment	371.2	135.6	18	68	62	130
Sydney, Kingsford-Smith	218.1	76.3	62,198	141,436	67,374	208,810
Melbourne, Tullamarine	166.0	55.0	2,238	8,188	6,374	14,562
Adelaide	49.3	21.5	10,005	31,586	19,347	50,933
Perth	27.6	24.4	3,438	9,812	9,234	19,046

* F27 size and over; day - 7 a.m. to 7 p.m; night - 7 p.m. to 7 a.m.

** For Wilton, numbers are estimated future maximum populations assuming continuity of existing land use zoning and construction of dwellings on all existing subdivisions; for major Australian airports, numbers are 1981 estimates.

\+ Includes seriously affected.

Source: Numbers for Wilton have been estimated by methods described in the text; numbers for other airports have been calculated from data contained in the National Acoustic Laboratories report, 1982. Although this data relates to NEF 3,6 contours which differ from ANEF contours, these differences are not significant. Aircraft movements for Tullamarine are as provided by the Department of Aviation.

The principal ameliorative measures considered were:

- Source and operational controls - discussed in our contemporary context in Section 3.5.7 of this Working Paper;
- Land use controls – discussed in Section 3.5 of this Working Paper; and
- Building controls – discussed in Section 3.5 of this Working Paper.

The principle of purchase of buffer areas for noise was left for future Parliamentary consideration.

There was no provision under the *Land Acquisitions Act* for the payment of compensation for injurious affectation such as may be caused by aircraft noise.

The principles for noise assessment remain similar. However since the Draft 1985 EIS, Governments recognise the need to consider a complementary suite of noise measures in conjunction with the ANEF system to better inform strategic planning and to provide more comprehensive and understandable information on aircraft noise for communities. These are as described in Section 3.1.3.

3.4 Analysis of noise issues in terms of current airport concepts

3.4.1 Aircraft flight track assumptions

3.4.1.1 Overall route structure

The design of the overall route structure to accommodate operations at both Sydney Airport and Wilton will be a complex operation to be undertaken by Airservices Australia prior to the commissioning of an aerodrome in the Wilton area. This task will require significant amounts of time and simulation modelling as well as a clear appreciation of the traffic flows to be accommodated at both Sydney Airport and Wilton. This is beyond the scope of the current exercise and rather than attempt a detailed route/airspace design a few general principles have been outlined below that it is believed will apply to any design. These principles have then been applied to the circuit flight tracks used in the modelling of aircraft noise at the possible runway layouts at Wilton.

Within an area of about 50 nm radius of the two airports there will be three inbound and three outbound corridors with all aircraft that are being processed to/from either Sydney Airport and Wilton being required to utilise those corridors. These corridors will be wide enough to encompass several streams of traffic (generally jets or turbo-props), will have altitude restrictions and probably require minimum/maximum airspeeds for jets and turbo-props. The three traffic streams will be north and east, south-west and north-west.

For this study it was assumed that the use of the arrival / departure corridors would vary to provide the simplest possible circuit operations at Wilton; i.e. arriving and departing traffic streams would not be required to cross over in the circuit area. This assumption will need testing as there may be significant problems in changing the use of the flight corridors to suit the runway direction at Wilton; potentially several times per day. Furthermore this change of usage of the flight corridors could also affect operations at Sydney.

From an airspace management perspective it may be preferable to utilise the same overall route structure regardless of the runway operational modes in use at either airport: each airport being required to amend its circuit operations to suit a common flight corridor usage. It is possible that this would render the present (Long Term Operating Plan) LTOPs operations at Sydney Airport difficult to continue implementing; however this Working Paper does not consider that possibility (see Working Paper *Airspace, Existing Aerodromes and Aviation-related Operational Assessment*).

3.4.1.2 Circuit dimensions and restrictions

Using the jet aircraft flight track maps published in the Sydney Noise and Flight Path Monitoring System Quarterly reports:

- Arriving aircraft are shown as; tracking on either side of the downwind leg of the circuit approximately 8 km to 20 km offset from the runway centreline and joining final 12 km to 35 km from the runway threshold. Much of this variation in flight tracks, especially the distance from the runway to join final comes from runway sequencing requirements; and
- Departing aircraft are much more flexible in the tracking requirements and can commence turns from runway heading just past the upwind end of the runway.

These flight track maps probably show the maximum extent of the circuit area tracks required for parallel runway operations as Sydney Airport handles a wide range of aircraft types with significantly varying performance and wake turbulence requirements. The forecasts prepared by Booz & Co for the Wilton 70 million passenger per annum scenario indicate that here will be a much less diverse range of aircraft operating at Wilton with few turbo-prop aircraft in the mix. This more homogeneous aircraft mix should result in a somewhat smaller circuit area however for the present noise modelling the larger circuits were assumed.

In the scenario where the main runways at Sydney Airport and Wilton are effectively parallel, there is sufficient clearance between them, approximately 54 km, to allow the two airport's circuits to operate independently of each other (*Airservices Australia 2011*). Once the included angle between the two runway systems increases then under some operating conditions the two circuit areas will conflict to some degree but should not preclude independent parallel runway operations at both airports. Likely restrictions would be to shorten the extent of one of the downwind legs (left or right) at Wilton, the possible imposition of altitude restrictions and the increased imposition of en-route sequencing requirements on arriving aircraft. For all options at Wilton, there will need to be considerably more work including getting a reasonable agreement with Airservices as to flight corridors / circuit tracks before any reasonable description as to the likely restrictions / conflictions is possible. There will also need to be significantly enhanced forecast aircraft movement data covering all two/three (including Richmond) airports as input data into any flight track design.

It should be noted that it has not been determined if the full range of the Sydney Airport LTOP would be possible regardless of the runway orientation/operating mode at Wilton.

The below section provides a brief description of possible interactions between the Wilton and Sydney circuit operations:

- With Option 1, 1S or Option 6 operating in a southerly flow mode there will be restrictions to the north-eastern extend of the downwind / base leg of the Wilton circuit due to the Sydney circuit traffic. In the opposite direction departures should be able to turn-off or climb above the Sydney circuit traffic;
- For Options 2, 4 and 7 the runway directions are effectively parallel and should be able to operate independently of each other;
- Option 3, with north/south parallel runways is similar to Option 2 above with independent parallel operations possible; and
- Option 5 has east/west parallel runways however due to its distance south from Sydney Airport independent parallel operations should be possible. With Sydney in a northerly flow condition and Wilton westerly the extents of the base leg / final of the two circuits will interact but should still allow independent operations while opposite direction flows at both airports should pose no problems (although some restrictions) to operations.

Having said that, independent parallel runway operations are possible, with restrictions, for any of the eight options although there may well be significant restrictions of aircraft flight profiles especially where arriving aircraft are required to overfly the other airport and then descend, in a relatively short distance, into the arrival circuit of their destination airport. Departing aircraft, with their significantly faster climb rate should be less restricted by the requirement to overfly the other airport on departure.

Crosswind runway operations were modelled for each of the Options in Working Paper *Meteorology*. However, these are expected to occur only for a few hours on a few days of the year as a result of strong westerly winds. The flight tracks modelled were for visual flight conditions with arrivals joining a 5 nm final and departures turning off runway heading close to the upwind end of the runway.

The concept runway alignments for all options are shown on **Figure 301015-02987-CRA-OPTIONS1-7(C)**

The flight tracks are shown on the following figures:

- Option 1 – Northerly Direction Figure 301015-02987-FT-OPTION-1-ND (B);
- Option 1 – Southerly Direction Figure 301015-02987-FT-OPTION-1-SD (B);
- Option 2 – Northerly Direction Figure 301015-02987-FT-OPTION-2-ND (A);
- Option 2 – Southerly Direction Figure 301015-02987-FT-OPTION-2-SD (A);
- Option 3 – Northerly Direction Figure 301015-02987-FT-OPTION-3-ND (A);
- Option 3 – Southerly Direction Figure 301015-02987-FT-OPTION-3-SD (A);
- Option 4 – Northerly Direction Figure 301015-02987-FT-OPTION-4-ND (A);
- Option 4 – Southerly Direction Figure 301015-02987-FT-OPTION-4-SD (A);
- Option 5 – Easterly Direction Figure 301015-02987-FT-OPTION-5-ED (A);
- Option 5 – Westerly Direction Figure 301015-02987-FT-OPTION-5-WD (A);
- Option 6 – North -Easterly Direction Figure 301015-02987-FT-OPTION-6-NED (A);
- Option 6 – South Westerly Direction Figure 301015-02987-FT-OPTION-6-SWD (A);
- Option 7 – North Westerly Direction Figure 301015-02987-FT-OPTION-7-NWD (A); and
- Option 7 – South Easterly Direction Figure 301015-02987-FT-OPTION-7-SED (A).

3.4.1.3 Circuit entry and exit at Wilton

It is noted that in *Airservices Australia 2011* the spacing between the two airports is such that independent circuit operations can be undertaken regardless of the runway operating modes at the two airports.

The flight tracks to the main runways used for the production of aircraft noise contours follow the general pattern below for parallel runway operations.

Arriving aircraft:

- From the north will overfly Sydney Airport and join a left downwind;
- From the east will overfly Sydney Airport and join a left downwind;
- From the south west track Bindook direct and join a right downwind; and
- From the north-west track direct for a straight-in approach.

Departing aircraft:

- To the north turn left and overfly Sydney Airport;
- To the east turn left and overfly Sydney Airport;
- To the south-west track straight ahead; and
- To the north-west turn right and track to Mudgee.

With Wilton operating in a northerly flow direction:

Arriving aircraft:

- From the north will overfly Sydney Airport and join a right downwind;
- From the east will overfly Sydney Airport and join a right downwind;
- From the south west track Bindook direct and join a left downwind; and
- From the north track direct for a left downwind.

Departing aircraft:

- To the north turn right and overfly Sydney Airport;
- To the east turn right and overfly Sydney Airport;
- To the south-west left and track to Wollongong; and
- To the north-west track straight-ahead to Mudgee.

Note that flight tracks for easterly use of the crosswind runway have been included but are expected to be little used in practice.

3.4.1.4 Conclusions and recommendations

The current design of the flight corridors/circuit area tracks for Wilton runway options is preliminary. It is intended to facilitate more detailed discussions with Airservices Australia if further work is to be undertaken for the Wilton site. No attempt was made to model tracks that would be in accordance with the present airspace restrictions including the various military areas. The assumptions included have not been tested including the assumption that aircraft would climb / descend without restriction.

The design of flight corridors leading to/from Sydney, Wilton and (possibly) Richmond will be a complex exercise that will need to be undertaken before circuit area flight tracks for each of the three airports can be designed. It is probable that these flight corridors will impose altitude restrictions on aircraft flight and also that there will be areas of conflictions where opposite direction streams of traffic are required to cross. The design, especially of the circuit area tracks will have some effect on the various aircraft noise contours that are being prepared.

Only with the directions that aircraft will be entering or leaving the circuit areas of the three airports will it then be possible to design reasonable average circuit tracks. These circuit operations will have instances where arriving / departing aircraft are in conflict and only after accounting for the volumes of each direction's traffic will it be possible to design the least restrictive procedures.

It is highly recommended that a significant study, including input from Airservices Australia be undertaken soon as possible into the design of flight corridors / flight tracks.

It could be expected that ATC will utilise a more comprehensive set of flight tracks to suit their operational needs including having arriving aircraft overfly to join the opposite side downwind leg or perhaps have departing aircraft set course overhead the airport.

These variations are not modelled, but experience at other airports is that anywhere within the circuit area is likely to have some aircraft overflights over the course of a year.

3.4.2 Integrated noise model

The USA FAA produces and supports the INM that is the only computer programme to be used in Australia to calculate ANEF contours as well as a variety of other aircraft noise metrics. This model is widely used by the international civil aviation community for the evaluation of aircraft noise impacts in the vicinity of airports.

The INM model itself contains a detailed database of aircraft performance and noise characteristics that have been determined from actual detailed measurements of the required parameters. In fact a part of the certification process for new aircraft types is that the manufacturer is required to undertake the required measurements to support the INM. The user of the INM is required to supply all other required data, typically covering aircraft operations over an average day with this day representing the average aviation activities for a whole year. The data required includes:

- Physical data; descriptions of runways and flight tracks and location of any sites that specific results are required for;
- Detailed flight characteristics for any non-standard aircraft operations to be modelled;
- A detailed description of all aircraft flights for the typical, or average, day being modelled; and
- Any variations to the standard output metrics that is required.

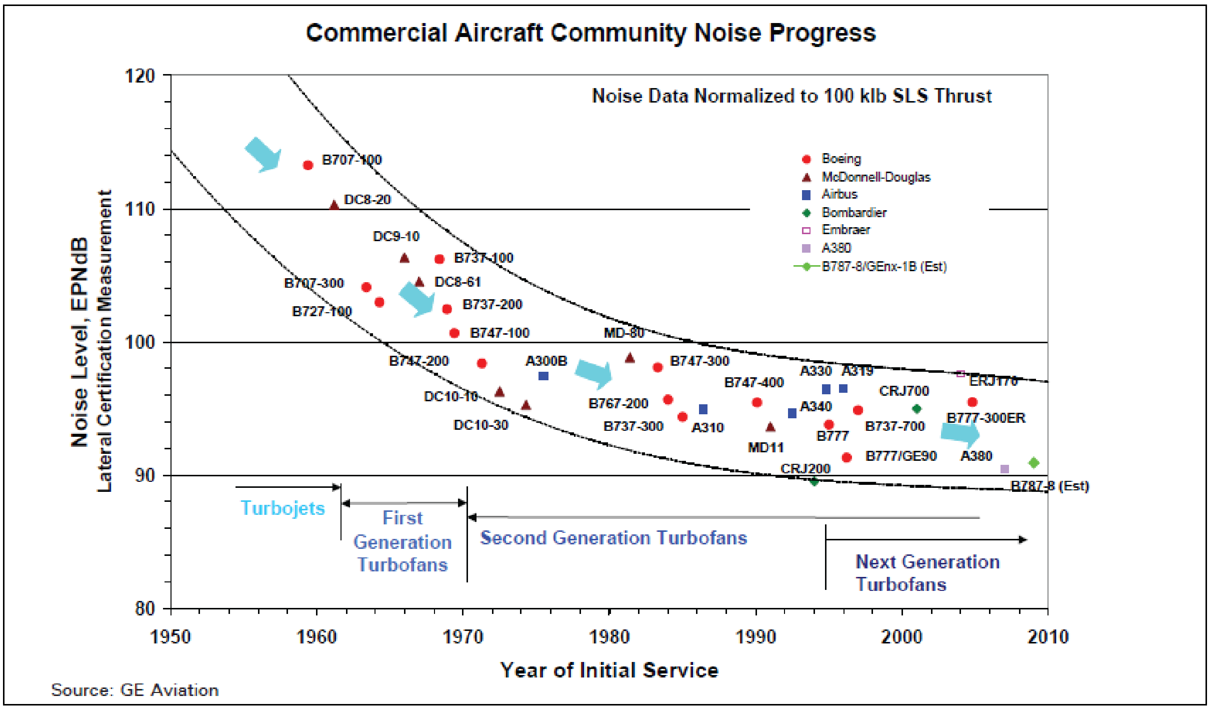
For this study the current version of the model was used and terrain modelling has been included.

3.5 Summary of mitigation methods and strategies

3.5.1 Technology

As a result of much improved technology, today's aircraft are much quieter than previous generation aircraft, with future aircraft also expected to have improved noise characteristics (see **Figure 3.1**). A limitation of the INM used to produce ANEF contours is that it adopts current aircraft to represent future operations. The normal planning horizon for an ANEF noise study is 20 years. For this study, a much longer planning horizon is involved. It is most unlikely that today's aircraft will be operating in the long term, having been replaced by quieter aircraft.

Figure 3.1 Progress in aircraft noise reduction



Source: SACL 2009

3.5.2 Adopted noise metrics

For this study, the following metrics have been adopted for the analysis of impacts in the Working Paper *Acoustic Effects on People*, as they are considered adequate for the purposes of options differentiation, which differs from land use planning and airport protection; they were used in the *Joint Study* and given that Guideline A of the *National Airports Safeguarding Framework* recommends a review of *AS2021-2000* to take account of the Guideline's metrics. For each option, the metrics/indices analysed are:

- The approximate population within the following noise contour categories based on the site specific alignment of the runway:
  - 20 ANEC;
  - 25 ANEC;
  - 30 ANEC;
  - 35 ANEC;
  - 40 ANEC;
- Number of persons exposed to 10 events greater than 70 db(A);
- Person-Events Index (PEI) measured by estimating over an average day the number of instances where an individual may be exposed to noise levels of 70 dB(A), to the nearest '000;
- Average Individual Exposure (AEI) which is the PEI divided by the number of persons exposed; and
- LAMAX.

Based on these and other assumptions detailed in this Working Paper, the populations affected by aircraft noise using the above metrics are given in the Working Paper *Acoustic Effects on People*.

Following approval of an EIS, Wollondilly and Wingecarribee Councils should incorporate relevant criteria from this Working Paper as Local Environmental Plan (LEP) amendments and planning scheme overlays to safeguard the airport from in appropriate development.

3.5.3 Further potential mitigation measures

3.5.3.1 Noise spreading

Table 3.4 provides the hourly aircraft movement forecasts for the ‘maximum’ capacity of 70 million passengers per hour, from Working Paper *Airport performance specification for Wilton – Task and Infrastructure*.

Table 3.4 Hourly aircraft movement forecasts

	Scheduled		Wilton
Hours	**Departure**	**Arrivals**	**Total** *Note 1*
1	0	0	2
2	0	0	3
3	0	0	2
4	0	0	4
5	0	0	5
6	8	21	32
7	38	27	71
8	39	36	79
9	27	31	63
10	29	22	52
11	26	34	63
12	18	24	45
13	21	17	40
14	23	25	51
15	19	35	56
16	21	23	48
17	35	27	66
18	34	35	74
19	28	27	60
20	20	10	34

	Scheduled		Wilton
Hours	**Departure**	**Arrivals**	**Total** *Note 1*
21	17	12	32
22	9	6	16
23	0	0	0
24	0	0	0
Total	**412**	**412**	**898**

Note: Includes scheduled, freight, regional and general aviation aircraft.

Source: Booz & Co. 11 July 2012.

Given the hourly aircraft movement forecasts for the maximum airport capacity of 70 million passengers per year**,** where for example the maximum is 79 movements per hour, the capacity of the parallel runways of about 100 aircraft movements per hour is not likely to be challenged. This affords the opportunity for noise spreading by varying operating modes to provide respite and rotation as is the case for the Long Term Operating Plan (LTOP) at Sydney Airport, or by varying arrival and departure runways as is done at Heathrow Airport.

3.5.3.2 Noise insulation and compensation

The Federal Government has noise insulation programs for reducing the impacts of aircraft noise on homes and public buildings (Schools, Churches, Day Care Centres and Hospitals) under flight paths near Sydney and Adelaide Airports. These programs have been by legislated levy on airlines and have included:

- Voluntary acquisition of residential properties over 40 ANEF;
- Insulation and mechanical ventilation of public buildings over 25 ANEF, and
- Insulation and mechanical ventilation of residential properties over 30 ANEF.

These programs could be applied to a preferred option at Wilton.

For reference, the *Draft EIS Second Sydney Airport Proposal (PPK 1997)* contained the following from the *Sydney Airport Noise Amelioration Program 1994:*

- Voluntary acquisition of residential properties and a church within the 40 ANEC contour;
- Insulation of public buildings (i.e. schools, colleges, child-care centres, hospitals, nursing homes and churches) within the 25 ANEC contour; and
- Assistance for the insulation of residences within the 30 ANEF contour.

Existing Commonwealth Government policy for the original Badgerys Creek Airport EIS allowed the voluntary acquisition of residential properties within the 35 ANEC contour, with acquisition costs varying from zero to $12 to $27 million depending on the option. Beyond acquisition within the 35 ANEC contour, consideration was also given to acoustical treatment of residential properties within the 30 or 25 ANEC contours. Treatment could be designed in accordance with *AS2021-2000.*

3.5.4 Residual impacts

As noted in Section 3.1.2.3, the New South Wales Government noted they have reservations with the format of *Guideline A* for Aircraft Noise under the *National Airports Safeguarding Framework*.

This also reflects the position of part of the development industry, in particular the Urban Task Force, which considers that “there is no case has been made for a change to how noise impact is controlled around airports from the current ANEF system which has been operating in Australia for 35 years and in America for 50 years. The addition of N60, N65 and N70 noise contours can only confuse everybody and lead to contestable planning decisions that will end up in the courts”. The view is partly based on the number of new dwellings and costs arising from applying the additional contours, as well as the ANEF contours.[9]

3.6 Key findings

- This Working Paper outlines the reasons for the adoption of the 20, 25, 30, 35 and 40 ANEFs in the aircraft noise modelling for the site selection, the use of the additional metrics N60 and N70 and of supplementary metrics PEI and AEI - and shows flight tracks and frequency - to supplement the ANEFs, to assist in better understanding the implications of a new airport development and in options selection;
- These metrics are considered adequate for the purposes of options differentiation, which differs from land use planning and airport protection. By summing all the single events at an airport, say for an average day, a total PEI (70) (or PEI (80), etc.) can be developed. The PEI (70) is the total number of instances on the average day where a person is exposed to a noise event greater than 70 dB (A) and is a measure of the total noise load generated by the airport;
- The AIE gives the average individual noise exposure in the number of events greater than the specified noise level over the specified time. When comparing options at a particular airport, the AIE indicates the extent to which the noise is concentrated or shared. Both indices are also useful in comparing site options, as in this study;
- The assumptions used in designing the flight tracks incorporated into the various sets of aircraft noise contours provided for several runway layouts considered for the Wilton site are outlined. These flight tracks are generally located within the circuit areas of the various runway layouts and do not provide other than a general description of the flight tracks away from the proposed airport;
- Based on these and other assumptions detailed in this Working Paper, the populations affected by aircraft noise and ranking for each option using the above metrics are given in the Working Paper Acoustic Effects on People;
- Given the capacity of the ultimate airport is unlikely to be challenged, based on the Booz & Co. forecasts, operational noise mitigation measures are also suggested; and
- Possible noise insulation and compensation measures are also identified.

3.7 References

Airservices Australia 2011, *Joint Study on Aviation Capacity for the Sydney Region – Further Assessment of the Wilton Sites*

Department of Infrastructure and Transport 2012, *National Airports Safeguarding Framework*

http://www.infrastructure.gov.au/aviation/airport_safeguarding/index.aspx accessed 8 June 2012

Department of Infrastructure, Transport, Regional Development and Local Government 2009, *National Aviation Policy*

[9] http://www.urbantaskforce.com.au/index.php?option=com_content&view=article&id=1556:federal-government-threatens-planning-chaos-around-airports&catid=71:media-releases&Itemid=17 accessed 12 June 2012.

White Paper: Flight Path to the Future

Department of Transport and Regional Services March 2000, *Expanding Ways to Describe and Assess Aircraft Noise. Discussion Paper*

Integrated Noise Model V7.0 – INM Users Guide

Liverpool Council 2009, *Submission to Bankstown Airport Preliminary Draft Master Plan*

PPK 1997*, Draft EIS Second Sydney Airport Proposal Volume 1* SACL 2009, *Sydney Airport Master Plan 2029*

Standards Australia*, Australian Standard AS 2021-2000 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction (AS2021)*

APPENDIX 3A LIVERPOOL LEP 2008 EXTRACT FOR AIRCRAFT NOISE

7.17 Development in flight paths

(1) The objectives of this clause are:

(a) to provide for the effective and on-going operation of airports, and

(b) to ensure that any such operation is not compromised by proposed development in the flight path of an airport.

(2) Development consent must not be granted to erect a building on land in the flight path of Bankstown Airport or Hoxton Park Aerodrome if the proposed height of the building would exceed the obstacle height limit determined by the relevant Commonwealth body.

(3) Before granting development consent to the erection of a building on land in the flight path of Bankstown Airport or Hoxton Park Aerodrome, the consent authority must:

(a) give notice of the proposed development to the relevant Commonwealth body, and

(b) consider any comment made by the relevant Commonwealth body within 28 days of its having been given notice of the proposed development, and

(c) consider whether the proposed use of the building will be adversely affected by exposure to aircraft noise.

(4) In this clause:

- *land is in the flight path of an airport if the relevant Commonwealth body has notified the consent authority that the land is in such a flight path.*

- *relevant Commonwealth body means the Department or other body of the Commonwealth having responsibility for airports.*

7.18 Development in areas subject to potential airport noise

(1) The objectives of this clause are to ensure that development in the vicinity of Bankstown Airport, Hoxton Park Airport and the proposed Badgery's Creek airport site:

(a) has regard to the use or potential future use of each site as an airport, and

(b) does not hinder or have any other adverse impact on the development or operation of the airports on those sites.

(2) Development consent is required for the erection of a building on land where the ANEF exceeds 20 if it is erected for residential purposes or

for any other purpose involving regular human occupation.

(3) The following development is prohibited unless it meets the requirements of AS 2021–2000, Acoustics—Aircraft noise intrusion—Building siting and construction with respect to interior noise levels:

(a) residential accommodation on land where the ANEF exceeds 20,

(b) business premises, entertainment facilities, office premises, public administration buildings, retail premises and tourist and visitor accommodation on land where the ANEF exceeds 25.

(4) The following development is prohibited:

(a) educational establishments, hospitals and places of public worship on land where the ANEF exceeds 20,

(b) dwellings on land where the ANEF exceeds 25 (other than development consisting of the alteration, extension or replacement of an existing dwelling house where the development is consistent with the objectives of this clause),

(c) business premises, entertainment facilities, office premises, public administration buildings, retail premises and tourist and visitor accommodation on land where the ANEF exceeds 30.

(5) In this clause:

ANEF means Australian Noise Exposure Forecast as shown on the Airport Noise Map.

APPENDIX 3B NOISE MODELLING

1 – Introduction

This Appendix describes the parameters used in the aircraft noise modelling undertaken for the eight runway layout options for the Wilton site. The metrics used are in Section 3.3.

Terrain modelling was included for each of the options.

2 – Wilton Site Options

The runway layout options are in Working Paper *Wilton Airport Site Selection and Airport concepts.*

3 – Flight Tracks

The flight track assumptions are in Section 3.1.

4 – Aircraft Operations

The forecasts of aircraft operations were for the maximum capacity airport with 70 million passengers per annum. In the Booz & Co. forecasts there were (where a movement is either an arrival or a departure);

- 824 movements of scheduled aircraft
- A total of 898 daily movements.

This is somewhat less than the runway capacity of the parallel runways which could be expected to be about 1,700 movements per day if operated over say 17 hours per the forecasts.

The forecast for the scheduled and freight and GA aircraft was given in terms of ICAO code aircraft types (see Working Paper *Airport Performance Specification for Wilton – Task and Infrastructure*) with there being:

- 206 code E;
- 190 code D; and
- 482 code C, aircraft.

As the INM requires specific aircraft types rather than ICAO code types it was assumed that:

- Code E aircraft would be 60% Boeing 747-400 and 40% Boeing 777-300 types;
- Code D aircraft would be 70% Boeing 767-400ER and 30% Airbus A310-200 types; and
- Code C aircraft would be 60% Boeing 737-800 and 40% Airbus A320-232 types.

The forecast was analysed and each aircraft ICAO code type assigned to a route (see above) and for departures a stage length. The overall route usage was:

- For code E; 55.3% northeast, 36.9% north-west and 7.8% southwest;
- For code D; 32.6% northeast, 6.3% north-west and 61.1% southwest; and
- For code C; 51.5% northeast, 2.9% north-west and 45.6% southwest.

The day / night split (where day is from 7:00am to 7:00pm and night 7:00pm to 7:00am) for the scheduled and freight and GA aircraft was:

- Day 80.7%, night 19.3%.

To place aircraft on the specific circuit area tracks it was assumed that 25% of the aircraft would use each of the tracks.

The overall usage of the runways (as a percentage of time) was determined from an analysis of Bureau of Meteorology records for each of the options modelled, see Working Paper *Meteorology.* In general about 82% of the aircraft movements were on the parallel runways with a southerly flow, 16% on the parallel runways with a northerly flow and 2% or less on the crosswind runway. For Option 5 it was assumed that a westerly flow would be preferred.

There was no attempt made to even out the runway usage between the parallel runways; the usage was as a result of applying the forecast movements to the flight tracks assumptions.

5 – Outcomes

The numbers of people within the various contours identified in this Working Paper are in Working Paper *Acoustic effects on People.*

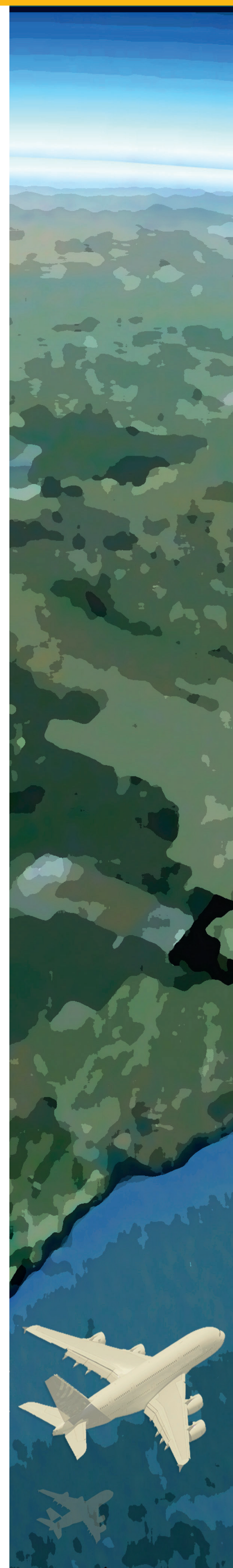
6 – Evaluating Aircraft Noise

The ANEF System and other metrics/indices are described in Section 3.3.

The Integrated Noise Model and Transport Noise Information Package (TNIP) are described in Section 3.2.

4

Infrastructure Analysis



DEPARTMENT OF INFRASTRUCTURE & TRANSPORT

Further Assessment of Airport Development Options at Wilton

Infrastructure Analysis

In association with

301015-03019 – EN-REP-002

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CONTENTS

1 WORKING PAPER – LAND TRANSPORT ACCESS

SUMMARY

The purpose of this Working Paper was to:

- Identify issues that might affect land transport access to major airport development at Wilton;
- Determine what is needed to provide road and rail access to airport development at Wilton; and
- Differentiate in land transport access terms between the eight airport options.

The desk study behind the preparation of this working paper was based on existing transport and land use data, publicly available policy and planning documents and estimates of airport usage and transport mode split for a full scale international airport handling 70 million passengers per year. It was assumed that this would occur around 2060.

The principal conclusions were:

- The airport will have a transformational effect on land use and the rail transport essential to allow a workable mode split to road transport;
- All sites lie on undulating topography which would likely require large volumes of cut and fill and tunnelling to provide high quality road and rail links commensurate with the ambience of a gateway to a large international airport;
- The isolated location of the airport provides the potential for some redundancy in the road network since while primary access would be from Route 31 (Hume Highway) to the west, secondary access would be from Route 1 (Princes Highway) in the east. There is much less redundancy in the rail network because of its sparseness so that rail access would be expected from the west;
- All existing main roads in the Wilton area (i.e. Routes 1 - Princes Highway, 31 - Hume Highway, Route 69 - Appin Road and Route 88 - Picton Road), would require augmentation and reconfiguration to handle the expect traffic flows. The traffic impact would be felt right back into the Sydney Region as large airport-generated traffic flows disperse. It is also likely that new major infrastructure, such as new bridges over the Cataract or even Nepean Rivers, would be required;
- Background non-airport traffic growth from the Sydney and Illawarra Regions, business parks and local area is expected to be substantial and the overall road network will need to be upgraded to avoid this impacting adversely on the airport and other traffic (such as to and from Port Kembla);
- In order to provide a frequent (e.g. four trains per hour) airport express service with travel times less than one hour, existing rail infrastructure along the East Hills and Main Southern Railways would have to be augmented and new lines constructed would have to be constructed south of Campbelltown, possibly making use of portions of the partially-built Maldon-Dombarton Railway. An underground rail terminus would have to be built into the airport terminus complex to complete the rail access package;
- Use of the Maldon-Dombarton Railway may reduce the costs of providing rail access to a Wilton Airport but it is likely that this railway would have to be duplicated to jointly handle freight and passenger traffic;
- The eastern sites (Options 3, 4 and 5) are not located on existing major roads and thus do not require relocation of existing roads, whereas the western sites (Options 1, 2, 6 and 7) will require relocations of roads such as Route 88 (Picton Road); and
- The eastern sites are further by road and by rail from main markets in the Sydney region and are not easily linked by two separate road connections (in order to provide redundancy in the road networks). On the other hand, the western sites are slightly closer to their travel markets in the Sydney Region than the

eastern sites, irrespective of whether these are Sydney Central Business District (CBD)-centric or Parramatta-centric. The four to 16 kilometres (km) travel distance differential on top of the basic 85 km to central Sydney, for example, will add to travel time, fuel consumption and emissions.

Further transportation work needs to be undertaken in order to develop a comprehensive land use plan to address trip generation around the airport and its hinterland. Further rail investigations need to be undertaken into the development of a Wentworth Railway alignment that could serve a Wilton Airport, an alternative alignment taking off from Douglas Park on the Main Southern Railway and/or overlay use of a future East Coast High Speed Railway alignment for airport access.

1.1 Introduction

1.1.1 Introduction

This Working Paper focuses on what Land Transport Access is needed to support a full scale international airport if developed within the Wilton Study Area. The key to assessing this transport task is an understanding of the customer service paradigm needs, and then estimating what is required to achieve that. This Working Paper explores how existing assets can assist in this, but also considers what is needed to make a superior airport land transport system work. Travel analysis has not, however, sought to optimize transit time, reliability, and service frequency regardless of cost, but reflects that these factors need to be sufficiently attractive to users to make the airport competitive with other Australian and overseas airports. Within the primary modes of road and rail, the Paper considers how to build on existing transport assets and how to make rail a competitive mode.

1.1.2 Statement of limitations

No consultation with Transportation agency stakeholders has been undertaken throughout the development of this Working Paper. As a result assumptions and engineering judgment have been used where information on existing assets is not publicly available. It has not been possible to confirm with the appropriate authorities the impact that the airport development will have on their wider infrastructure network. Subsequently, assumptions have been made in lieu of consultation and this will impact the accuracy and appropriateness of any estimates noted herein.

The figures in this Working Paper are sketch drawings in nature and use base drawings from previous studies.

1.2 Summary of current land transport network

1.2.1 Existing conditions and issues

1.2.1.1 Wilton Airport Study Area

The Wilton Study Area[1] is located approximately 85 km southwest of Sydney, in the Shire of Wollondilly. Access is available from Picton Road (off the Hume Highway) and Macarthur Drive. The Wilton Study Area is on the Woronora plateau at an average height of 310 metres (m) above sea level between the Cordeaux River and Cataract River and divided by Wallandoola Creek, situated west and east respectively. Ridges, plateau, slopes, gorges and streams are present within the site and the elevation varies between 240 m and 340 m above sea level.

The key point to note from this is that surface transportation access requires a (net) climb of over 300 m from population centres near sea level within the Sydney Metropolitan area and in the Illawarra. This is particularly relevant for rail and, in the case of access from the Illawarra, for both modes.

1.2.1.2 Existing transport demand in the region

Existing patterns of population are relevant when considering how existing transport links may need to be developed in the absence of an airport and in the event that an airport is developed in the Wilton Study Area.

Population and employment are concentrated in the Sydney metropolitan area and, closer to the Wilton Study Area, in the Illawarra area around Wollongong. Currently, transportation systems are set up and established to serve the pattern of demand that result from where people live and people work. Wilton is not currently a major location for

[1] Defined as the area contained within the following external boundaries: (1) Upper Nepean State Conservation Area (West), (2) the townships of Wilton, Douglas Park and Appin (North) and (3) the Cordeaux River and Cataract River dam areas (East– Cataract and South – Cordeaux). For land transport estimates centred on Picton Road near Picton.

either and accordingly does not have - other than the M5 Freeway and Main Southern Railway which transit the area to the west of Wilton - transportation systems which can support the demand that would result from a maximum airport.

1.2.1.3 Existing rail system

The Main Southern line was built in stages from Parramatta Junction to the border with Victoria near Albury between 1855 and 1881, and connected to the Victorian Railways at a break-of-gauge in 1883. Canberra was connected by rail by 1914. The existing rail alignment lies to the west of the Hume Highway and the Nepean River in the vicinity of Wilton. It passes about 15 km northwest of the Wilton airport sites.

The closest railway station is in the town of Douglas Park, located some 12 km north of the sites but the closest easily accessible station on the Main Southern Railway is Picton (74 km from Sydney). It lies approximately 15 km by road from the study area. The alternative Illawarra Line lies below the Illawarra Escarpment with the closest accessible station at Wollongong (83 km form Sydney). It lies approximately 40 km from the study area.

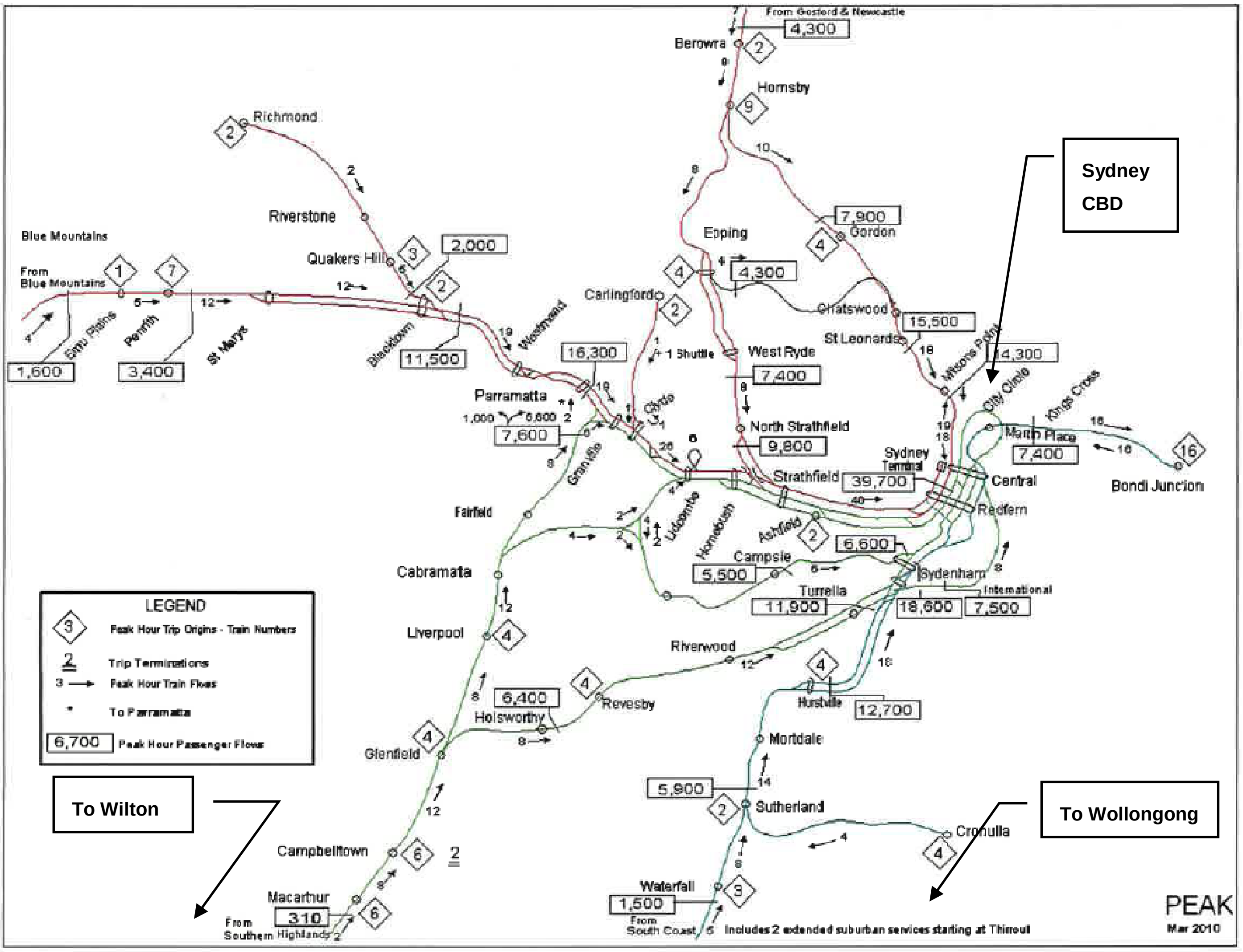
The Sydney suburban and intercity rail network[2] consists of 307 stations and over 2,060 km of track, extending to the upper Hunter Valley, as far west as Lithgow, as far south west as Goulburn and as far south as Nowra.

An average of one million rail passenger trips are made from these metropolitan, intercity and regional stations each day. The existing rail system, and the morning peak hour intensity of train services on lines connecting to south west Sydney is shown in the following **Figure 1.1**. The relevance of this is that any airport specific services would have to compete with and be timetables fit within the already capacity constrained RailCorp operations for metropolitan and regional Sydney.

Any future extension of the existing rail network to Wilton would take off from the existing Main Southern Railway, south of Campbelltown/Macarthur, possibly in the form the unfinished Maldon-Dombarton Railway or in the form of another new connection in the vicinity, for example, of Douglas Park.

[2] A Compendium of CityRail Travel Statistics – Seventh Edition

Figure 1.1 Regional rail system[3] service diagram



1.2.1.4 Existing road system

An area summary of the road system is given in the following **Figures 1.2** and **1.3**.

[3] A Compendium of CityRail Travel Statistics – Seventh Edition this diagram shows the indicative train plan for the morning peak one hour in 2010. The peak hour for the number of services varies by line between 07:30 and 09:00 arriving Central.

Figure 1.2 Regional road system[4]

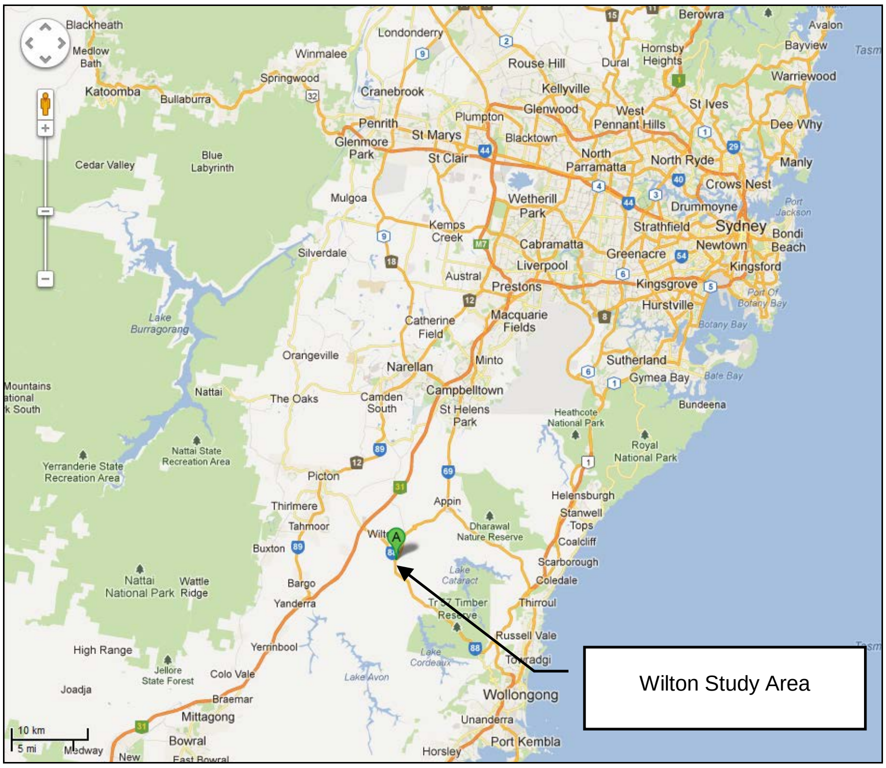


Figure 1.3 Local road network[5]

[4] Google Maps. (2012) For land transport, distance estimates were centred on the intersection of Picton Road and Macarthur Drive (shown A) within the Wilton Study Area.
[5] Google Maps. (2012

The Hume Highway (National Route 31, M5 route), which is located approximately 9 km north west from the Wilton Study Area, is a National Highway. Widening the 11 km section of the F5 Freeway between Brooks Road, Ingleburn and Narellan Road, Blair Athol, which is located 25 km north from the Wilton Study Area, commenced in February 2009 and was completed in March 2012. The widening the F5 Freeway, will create eight lanes between Brooks Road and Raby Road and six lanes between Raby Road and Narellan Road. There is understood to be no funding for the widening of the Hume Highway south of Narellan Road.

The Princes Highway (National Route 1, including the Southern Freeway F6 is a partial freeway standard road linking Sydney to Wollongong and is located 22 km east from the Wilton Study Area. As Wollongong and Port Kembla are important industrial centres, road freight traffic on routes to and from these centres is heavy and frequent[6]. Additionally, emergence of Wollongong as a commuter city of greater Sydney has kept the freeway and the adjacent Mount Ousley Road busy and often congested in peak periods with road commuters.

Access to the Wilton Study Area could be from Picton Road, Route 88, off the Hume Highway, which intersects with Macarthur Drive within some of the proposed sites. Existing land transport access to the Wilton Study Area is available from Picton Road (off the Hume Highway) and Macarthur Drive.

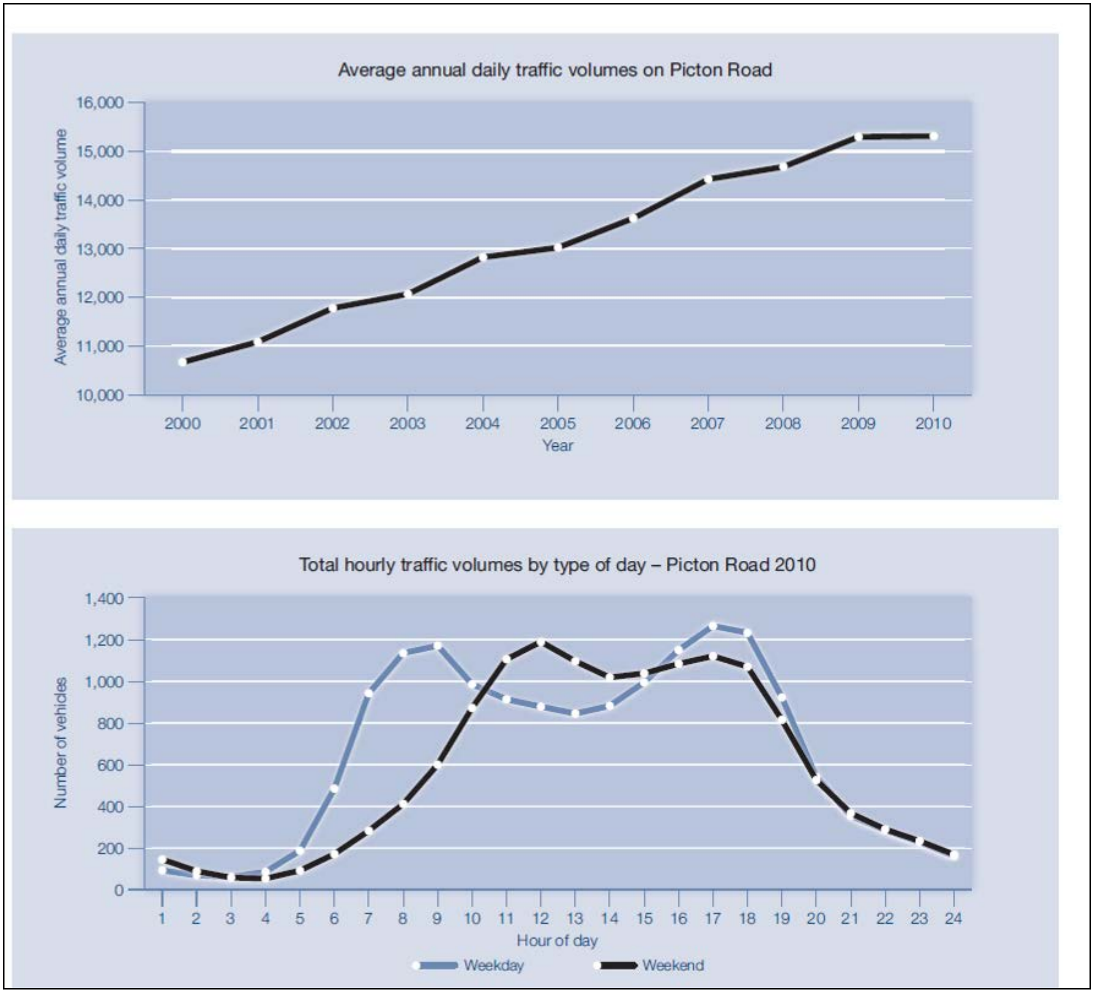
Picton Road (State Route 88) is a NSW Highway linking Picton and Wollongong. It provides an important link between the Hume and Southern freeways. From Picton, the highway runs in the south east direction, crosses the Hume Highway and continues over open grazing land and forested plateau east of Wilton (passing through Sydney Water Catchment areas) until it meets Mount Ousley Road (Southern Freeway) which leads to Wollongong or Helensburgh. The speed limit was 100km/h, but was reduced to 90 km/h for recent roadworks, which may be retained as the longer term speed limit.

In the section between Mount Ousley Road and the Hume Highway, Picton Road has had a poor crash history[7] in recent years involving both light and heavy vehicles. The $40.9 million RTA/RMS program of safety improvements along this section of Picton Road are well progressed and are expected to be completed by June 2013. They have been designed to address the most common types of crashes occurring along the route, and are reportedly having effect. Between 1 January 2005 and 20 January 2011 there were 170 crashes, 12 fatal crashes that resulted in 16 deaths, and 65 of the crashes resulted in injuries to 121 people. Traffic volumes on Picton Road east of Picton increased strongly at 4% per year over the decade to 2010.

[6] Mount Ousley Road 5.3% trucks and 8.4% articulated vehicles; (Source: Traffix (2009), Bulli Seam Operations, Road Transport Assessment, , May 2009)

[7] RMS Picton Road community Update, RMS NSW, May 2012

Figure 1.4 Picton Road traffic characteristics[8]



Appin Road (State Route 69) is a State Route and NSW secondary highway linking Campbelltown and the Sydney's south western and western suburbs with Wollongong. It is located approximately 15 km north from the Wilton Study Area. State Route 69 begins where Metroad 9 ends on the Narellan Road/Hume Highway interchange and continues until the Southern Freeway (leading to Wollongong) interchange at Bulli Tops passing through Campbelltown and the town of Appin along the way. It is dual-carriageway in Campbelltown and then narrows to a single carriageway southwards, with frequent overtaking lanes thereafter.

Appin Road also serves as a freight connection between Illawarra/Port Kembla and southwest Sydney/Campbelltown.

The western airport site options have relatively direct road access possible via the Wilton bypass realignment of Picton Road south from the F5 Freeway, completed in 1993. This road provides for high numbers of truck movements between the freeway, surrounding coalfields and Port Kembla in Wollongong. The Wilton bypass realignment was constructed as a two-lane two-way concrete roadway with overtaking lanes from the F5 south of Macarthur Road. However, much of this road would require relocating and reconstructing as it falls within the site boundaries of the airport options.

Access to the Study Area is also possible via Wilton Road and Appin Road from Campbelltown in southern Sydney, but with a steep narrow river crossing not suitable for trucks or large vehicles or heavy commuter traffic volumes as Broughton’s Pass has hairpin bends down to a narrow bridge over the Cataract River at the bottom of a major gorge

[8] RMS Picton Road community Update, RMS NSW, May 2012

Douglas Park Drive and Macarthur Drive provide a road link from Route 88 Picton Road south of Wilton to Wilton Road and the north under, but not intersecting with, Route 31 Hume Highway to cross the Nepean River into Route 56 Menangle Road at Douglas Park.

Metroad 9 is the outer western Sydney Bypass or orbital road connecting Campbelltown to Windsor. It replaced part of State Route 69 in December 1998 and consequently split State Route 69 into two sections. The northern section (Putty Road) connects Windsor to Singleton. The southern section (Appin Road) connects Campbelltown to Wollongong via the Southern Freeway. This suggests that Appin Road as well as Picton Road will be the main routes from Western Sydney into the Illawarra, but this needs to be confirmed with RMS/TfNSW.

Other roads in the area serve minor access functions and are generally two lane rural roads of variable standard.

Background traffic growth in the Wilton area is significant, albeit off a relatively low base on local roads. As the M7 tollway was opened in December 2005, later than the time of the most recent widely publicly available traffic data, this had some impacts on traffic patterns and volumes on key roads providing access to the Wilton area sites, particularly the F5 Freeway. The outcomes of the analysis presented in this Working Paper should therefore be considered in the context of the time period of available baseline traffic data which is indicated in recent local traffic studies in the range of 3% to 5% growth in traffic per year from 1990 to 2010.

1.2.1.5 Existing bus

Wilton is currently served by Picton BusLines Route 901. Picton BusLines is a private bus operator. Route 901 only provides a limited shopping service between Picton and Wilton.

These bus services serve the current relatively low numbers of residents and school children.

Development of demand on the scale of 70 million passengers per annum airport would result in a massive increase in all forms of bus transportation locally and regionally and nothing that exists at present is relevant.

1.2.1.6 Existing taxi

The Wilton Study Area lies outside the Sydney Metropolitan Transport District as defined by the NSW Government related to the Passenger Transport Act 1990, which is bounded by the Cataract River and the Wollongong Local Government Area boundary. Sydney taxis may drop off passengers at the Wilton site but may not pick up passengers at Wilton, and must return to a location within the Sydney Metropolitan District without passengers.

The Wilton site lies within the Wollongong District, and only Wollongong based taxis may pick up passengers from the site.

This issue for Sydney taxis would need to be resolved as part of ensuring services to a new major airport.

1.2.1.7 Gradient of existing local road and rail networks

Many steep grades exist on the local road and rail links with a resultant loss of transport speed and capacity and road safety.

The Illawarra escarpment plateau hills reach over 800 m, and the escarpment reaches a maximum of 768 m at Mount Murray southwest of Dapto, but the key road and rail routes through passes such as Route 1 Mount Ousley Road rise between 300m and 400m. The grades and few viable passes between the cliffs exacerbate the lack of road capacity up and down the escarpment between the coastal plain of the Illawara and the Study Area, especially for trucks and buses which are required by law to travel slowly in low gear.

Broughton’s Pass gorge on the Cataract River has steep grades and vehicle limits preventing trucks and caravans on hairpin bends along Wilton Road.

The Wilton Study Area site options are all adjacent to deep gullies and ravines and most will require either new access roads or existing roads to upgraded and realigned. Whilst this terrain does not preclude reconstruction of roads around the site, such roads would be expensive and difficult to construct and are likely to create even more environmental issues and sensitivities requiring mitigation measures.

The Main Southern Railway has a ruling gradient of 1:75 between Campbelltown and Picton. The Unanderra-Moss Vale Line which runs considerably to the south of Wilton has ruling gradients of 1:30. The unfinished Maldon-Dombarton Line, which runs quite close to the Wilton airport sites, has an eastbound ruling gradient of 1:60 and a westbound ruling gradient of 1:30.

1.2.1.8 Lack of redundancy of existing road and rail network

Motorways and high speed roads are sensitive to traffic disruption from vehicle breakdown, collision or adverse weather including fog. The M5 motorway/National Route 31 Hume Highway is the only major high capacity road serving the Study area, although Wilton Road-Appin Road and Macarthur Drive-Douglas Park Drive provide some reserve alternate route capacity.

Picton Road State Route 88 is the only existing road serving the proposed Wilton area sites via National Route 1 to the Illawarra. The terrain to the north and south would make construction of parallel road routes difficult and expensive to engineer and environmentally very difficult. As a result there is no alternative route from the Illawarra likely to available, except perhaps via Appin Route to the north.

Sections of Route 88 are isolated and difficult to secure and, as a result of the lack of alternative route, the Wilton Study Area could potentially be relatively easily isolated through incidents bushfire, sabotage, acts of war or terrorism or other forms of disaster. Land slips and major truck crashes do occur on the roads of Illawarra escarpment, and can disrupt road transport for hours.

There is no redundancy in the rail network south of Glenfield Junction.

1.2.1.9 Safety of existing roads

Road safety is a key concern for government, government authorities such as Roads and Maritime Services (RMS) NSW, and communities in terms of land transport network accidents and costs, and road and intersection capacity for general traffic and freight traffic.

For example, difficult intersection geometry exists at the intersection of Route 88/Route 1 where poor weather, fog, grades in the dip of Route 1, and no northbound merge lane on Route 1 can contribute to accidents.

The road local network is rural in nature with street lighting only in urban centres.

Road safety conflict between local activities and through traffic is already an issue through towns such as Wilton, Picton and Appin – a common road response is to bypass the towns, as occurred at Wilton.

Regardless of the provision of additional arterial road capacity, an airport is likely to induce more traffic and "*rat running*" on local connective roads, with adverse road safety outcomes unless counter-measures are introduced.

As a result, the entire road network will require to be reassessed to determine the measure which will be needed to preserve safe road conditions under vastly increased traffic pressures that would result from a maximum airport.

1.2.1.10 Existing intersection capacity

Road network capacity constraints usually occur at intersections rather than "mid-block" links. Key local junctions are shown in the following diagrams. Traffic modelling for the Route 31 Hume Highway interchange is underway with the RMS[9] to assist in determining the correct layout to address the crash history and future traffic volumes. The right turn from the Hume Highway ramp southbound to Picton Road west bound is the worst level of service LOS F in the am and pm peak –see **Figure 1.5**. The right turn from Picton Road to Hume Highway northbound ramp is the worst turn in the am peak, LOS E by 2022 and needs improvement. It is expected that this intersection will be progressively upgraded by RMS NSW regardless of a new airport.

Figure 1.5 Route 31 Hume Highway / Route 88 Picton Road

The left turn from Route 88 Picton road into Route 1 northbound is effectively at right angles, and does not have a significant acceleration lane northbound up a steep incline towards Sydney, a key movement from a potential airport in the Wilton area – see **Figure 1.6.**

Figure 1.6 Route 1 F6 / Route 88 Picton Road

[9] RMS website http://www.rta.nsw.gov.au/roadprojects/projects/south_eastern_region/picton/public_information.html

1.2.1.11 Existing car parking issues

Existing kerbside car parking in the Wilton area is currently uncontrolled and free, but with negligible usage. This has no relevance to an Airport at Wilton except that such matters may be expected to change very dramatically with changes to the nature of Wilton liable to accompany airport development.

1.2.1.12 Existing freight

Refer to Working Paper *National Transport Policy Context for Airport Development*

1.3 Summary of issues from 1985 SSA Site Selection Programme

1.3.1 Draft 1985 Environmental Impact Statement

The Draft Environmental Impact Statement (EIS)[10] 1985 assumed the 8.6 million passengers per year (ppa) in 1984 at Sydney (Kingsford Smith) Airport (Sydney Airport) would increase to 13.4 - 24 million passengers per year by 2010. This compared to the actual 35 million ppa in 2010.

The EIS noted that second airports in cities can display different user groups profiles and the like compared to an existing main airport, such as Sydney Airport, that was considered likely to continue as the main airport. For example, they may take much of the training, cheap fares, innovative or new airline players, general aviation, international charter, testing, pricing of landing rights, services that need or want to move outside the main airport's curfew hours, lopping off the peaks and leaving the original main airport to operate closer to full (albeit curfewed) capacity every day. Wilton Airport would form part of a multi –airport system serving NSW and Australia and potentially global destinations. It was considered important to note that such a system role may have quite different land-transport demands and outcomes, especially freight outcomes.

Similar statements were made in the EIS relating to ancillary services and business parks around second airports. The EIS also suggested that CBD-related passenger and freight hub services would likely remain at Sydney Airport, whereas rural, regional, and suburban related services might favour a Wilton airport. The EIS made the case to concentrate rail access on achieving connectivity with the CBD, despite it not being the only market for fliers or employees. This was rationalised as being because the CBD is the most accessible point on the NSW rail network and a destination of many international tourists.

Wilton was selected for assessment in the EIS because "*Wilton was the superior of the middle-distance sites"*. The middle distance sites identified in the EIS were acknowledged as less accessible to potential airport users than the short-distance sites, but to involve lower environmental and socio-economic impacts.

Key EIS assumptions for Wilton were:

- 13 million passengers per year;
- serve all types of aircraft;
- operational mix similar to Sydney Airport, with more General Aviation;
- operate without a night curfew.

The EIS also assumed the following averages:

- Airlines: 540 employees per million passengers (Table 14.6.6 breakdown);
- Airport Commerce: 60 employees per million pax;

[10] Second Sydney Airport Site Selection Program, Draft Environmental Statement, for Department of Aviation, by Kinhill Sterns, April 1985.

- Airport Admin 180 employees per million pax;
- General Aviation: 4 employees per 1000 aircraft movements;
- Airport associated employment (freight forwarders etc.) 500-900 persons;
- Airport Induced Employment (e.g. at Wilton):100 persons;
- Maximum flow-on employment in the sub-region: 2300 persons.

The EIS shows Mount Keira Road linking from the north, (now called Macarthur Drive) but at the time of the EIS there was no western Y leg connecting Mount Keira Road to Wilton and the Hume Freeway (i.e. where Picton Road is now located). The preliminary master plan layout presented in Figure 5 of the EIS proposes a Main Access Road looping around the eastern perimeter of the airport site. Such a road has since been constructed as the Route 88 Picton Road Wilton Bypass, in more of a direct line across the middle of the EIS site.

The railway proposed in the EIS was a loop using the north west of the site from the Maldon-Dombarton rail line. The alternative suburban railway via Appin would provide additional benefits to the developing MacArthur area.

Road upgrades proposed by the EIS in 1985, which have been progressed in the meantime, are:

- SW Freeway
- Wilton Road,
- Mount Keira Road.

The EIS stated[11] that if no rail link were provided to access the Wilton airport site, the impact on the road network would be more significant but not markedly so. (It is not clear that this referred to airport traffic only and may not have included the effect of the potential relief of through road freight diverted to the new railway if it was developed to accommodate both passenger and freight services.)

The EIS identified that the airport would be a major, but no means the only, traffic generator in the region connecting the Illawarra, south west Sydney and western NSW/ACT. It also suggested that a high capacity, quality surfaced road could attract significant through traffic.

The EIS noted[12] that the growth attracting effects of airports tend to be exaggerated, and that firms regularly using airport services can find their needs best met by an airport within a 45 minute drive. For example, Campbelltown is located at an equidistant point in between Sydney Airport, and the EIS Wilton site and a benefit of accessing Wilton as opposed to Sydney Airport for aviation needs would be its outer location relative to commuter flows in peak times.

The EIS assumptions relating to mode share and the origin-destination of passengers are presented below.

Table 1.1 Draft 1985 EIS assumed mode share of ground travel[13]

Mode / Scenario	No Rail %	Low Rail %	High Rail %
Taxis	5	5	5
Bus (regular scheduled)	15	-	-
Coach(tour and charter)	15	-	-
Total bus and coach	-	15	15

[11] pp 28
[12] pp 433
[13] Section 15.4.4 of EIS. Later benchmarking data are required in further study e.g. new Hong Kong airport aimed for 33% by public transport and has achieved the high 20's%.

Mode / Scenario	No Rail %	Low Rail %	High Rail %
Rail	0	35	45
Other	0	0	0
Total %	100	100	100
Person trips per day road	69,000	54,000	-

Table 1.2 Draft 1985 EIS assumed origins and destinations of air passengers

Area	Percentage of all Passengers
City	29
Inner areas (to Parramatta, Bankstown, Manly, Kogarah)	47
Outer Areas of Sydney	15
Other areas(outside Sydney)	4
Not stated	4
Total %(rounding errors)	100

Thus while the EIS assumptions and findings are still broadly relevant, road and rail issues need to be viewed in the light of more current expectations of greater air travel, higher population growth, lower mode split to airport rail, and other changes since the 1985 EIS. Regional land use and transport patterns can also change. For example, underlying freight demand accessing the local transport network in 1985 was coal from the highlands to Port Kembla; this has now declined to be dominated by back-loading from ports to Sydney, including cars. The current proposals for 70 million passengers per year at Wilton are so significant that the Draft EIS findings regarding road and rail access would require substantial upgrading.

1.4 Summary of future land transport network and demand

1.4.1 Future land use and transport

The area[14] around Wilton and the south west of Sydney is important in the production and transport of dairy, poultry, vegetables, and other agricultural produce, as a water catchment, and is actively undermined for coal. The M7 and M5 corridors which are located to the north and west of the Wilton Study Area are a focus for industrial production and distribution in NSW. The associated agricultural transport task is likely to grow quite slowly. The rate of mining and road and rail transport of coal is constrained by existing skills and equipment and is likely to remain similar for at least 30 years. Substantial residential development is expected around Wilton and Macarthur South release areas, up to 26,000 dwellings. There are 240 hectares (ha) of potential employment lands near Menangle.

[14] Data from attendees at Worley Parsons project workshop 20 June 2012

1.4.2 Indicative travel distances, times, and costs

Airport road links can be a combination of tollways, highways or local roads. An airport rail link is a service providing passenger rail transport from an airport to a nearby city; by mainline- or commuter trains, rapid transit, people mover or light rail. Direct links operate straight to the airport terminal, while other systems require an intermediate use of people mover or shuttle bus.

Although airport rail links have been popular solutions in Europe and Japan for decades, only recently have links been constructed in North America and Oceania, and the rest of Asia. Advantages for the rider include faster travel time and easy interconnection with other public transport, while authorities have benefited from less highway and parking congestion, less pollution, and additional business opportunities. Additionally, the links benefit airports by drawing in more passengers via easy access.

There is a time cost trade-off in most modes of airport travel that attracts different sectors of the airport traveller market. The Heathrow Express charges over A$30 for a quarter hour trip to central London leaving every quarter hour whereas a bus service is also available that takes over one and half hours for one quarter the express rail fare. The Airport Express charges A$12, which is understood to be partially cross subsidized from MTR's property development activities, for a 24 minute trip to Hong Kong Central, leaving every 10 minutes on one of the lines of the Mass Transit Railway (MTR) serving Hong Kong. Similar trade-offs would require careful consideration in future studies for Wilton.

The following indicative travel distances and times from a nominal airport location south of Wilton were estimated from mapping[15]. Note that these are indicative only and give no insight into peak congestion and travel time certainty and variability due to congestion or incidents, a major consideration for the perceived level of service for airport travellers. This variable congestion is a current issue in the M5 tunnels.

Airport to Sydney CBD by road:

- Via Hume and $10+ tolls: 86km, 1 h 3 min, estimated taxi fare A$175
- Via Route 1: 96km, 1h 25min

Airport to Wollongong CBD by road:

- Via Route 1: 31km, 28 minutes

Airport to Parramatta CBD by road:

- Via Hume (or M7 tolls) free route Metroad 5: 80km, 59min
- Via Route1 and Metroad 6: 99km, 1h 28 min

Airport to Canberra CBD by road:

- Via Hume: 216km, 2h 26min

Existing Sydney Airport to Sydney CBD by road

- Via Airport Motorway 16km, 20min.

Existing Sydney Airport to Sydney CBD by rail:

- Via AirportLink, 20min, economy single A$15.40

Picton to Sydney Central by Countrylink XPT rail:

- 1h 53min, economy single A$24.95 1h 9min by Countrylink Xplorer if the train stopped at Picton

[15] Google Maps, CityRail, and CountryLink.

1.4.3 Future rail

The unfinished Maldon-Dombarton Line runs 38 km from Maldon Junction on the Main Southern Railway to Dombarton on the Unanderra-Moss Vale Line. Its formation is largely complete but it is missing the Nepean River and Cordeaux River bridges and the Avon tunnel and fitout and signalling.

The draft Sydney Wollongong Corridor Strategy[16] notes that passenger and freight demands on the existing road and rail network will be compounded by further development of Port Kembla and expected commuters between the Illawarra and Sydney/Campbelltown/Western Sydney. The draft found that Mount Ousley Road was already operating at capacity in the morning peak (AADT[17] 34 500 in 2003 including 5500 heavy vehicles) and the rail line through Sydney cannot be used by freight trains for at least seven hours per day. The Maldon-Dombarton rail link for some coal and freight traffic would tie in with use of the new South Sydney Freight Line to Macarthur and freight terminals including Moorebank.

The proposed *"Wentworth Railway"* corridor would run over 48 km from Glen Alpine, south of Macarthur, to Aylmerton, south of Mittagong, bypassing 68 km of difficult alignment on the Main Southern Railway with a steeper but much straighter alignment suited to high speed trains. It is located, for most of its length to the east of the Hume Highway. Part of this corridor could be used as high speed rail link to a Wilton airport site.

The NSW Government recently released a rail strategy for Sydney[18] in advance of their overall Long Term Transport Masterplan for NSW. The key concept is *"A Three Tier Railway",* which includes:

- A rapid transit network (sic) extending as far south as Bankstown, Cabramatta, and Hurstville;
- A new crossing of Sydney Harbour;
- Suburban and Intercity services from Bondi Junction via Central to Wollongong;
- InterCity and Regional Diesel only south of Campbelltown;
- No new system to Sydney Airport;
- No suburban network south of Macarthur.

An airport at Wilton would need to be considered in any wider metro-style system of single deck high frequency railway of the type announced by the NSW Government in June 2012 for the North West Rail Link, and in the latest proposals for a Three Tier Railway.

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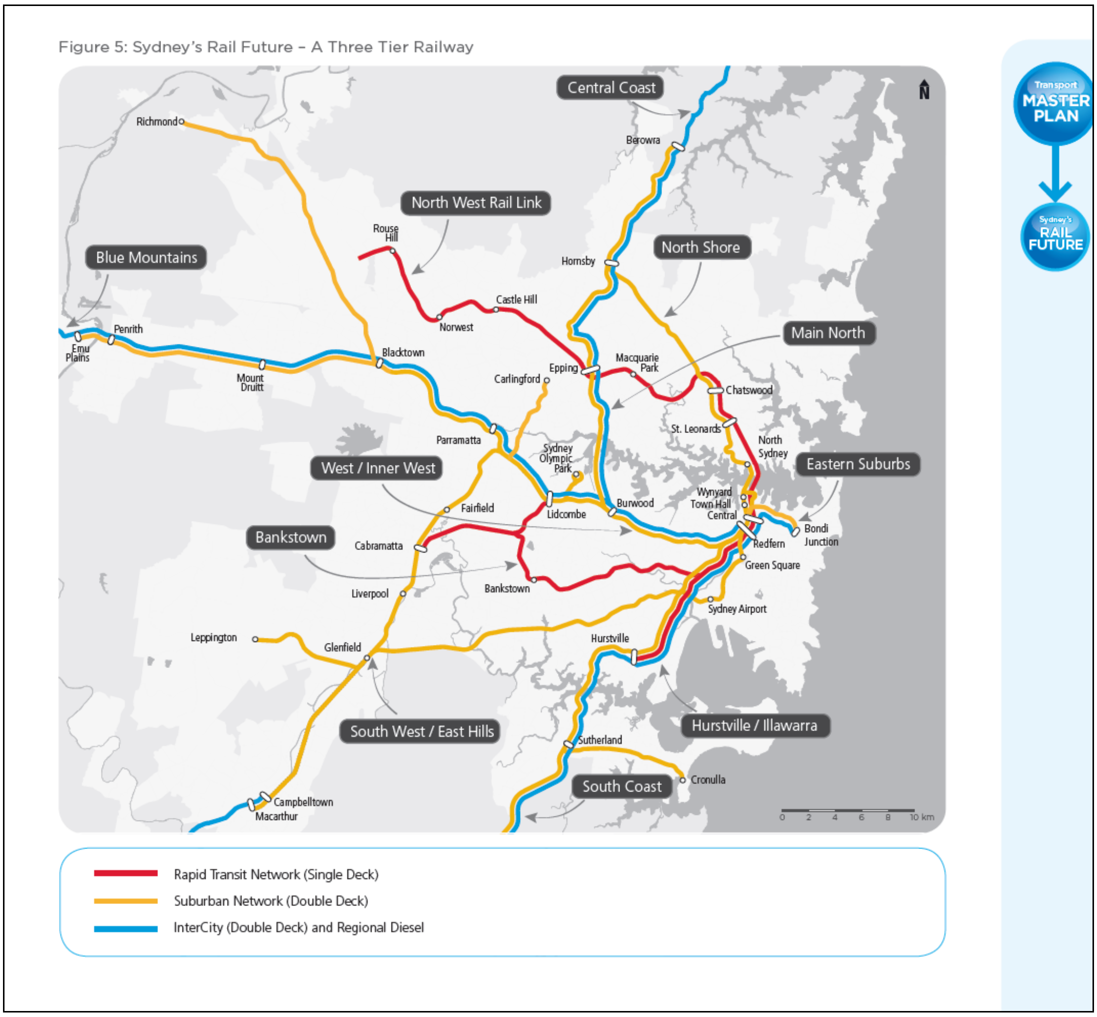
[16] DOTARS 2007, quoted in Laird, ARTF 2010.
[17] Annual Average Daily Traffic in vehicles per day
[18] Sydney's Rail Future, TfNSW, June 2012

Figure 1.7 Sydney's Rail Future[19] (TfNSW)



1.4.4 Future high speed rail

As discussed in further detail in the Working Paper *National Transport Policy Context for Airport Development* High Speed Rail (HSR) has been considered in Australia for a number of decades. The viability of HSR is currently being examined by the Commonwealth Department of Infrastructure and Transport. The second phase of the study is currently been undertaken. The Phase 1 High Speed Rail Study identified a number of the Sydney to Canberra corridors pass through the areas adjoining Wilton, generally in the corridor of the Hume Freeway.

It would principally be if stations were brought closer to or fully integrated with an airport site at Wilton site, that HSR may provide connections for travellers to an airport at Wilton. In addition, the Joint Study concluded that HSR development would not remove the need to act to provide additional aviation capacity. Therefore, it is suggested that the likelihood of a HSR providing connectivity to an airport at Wilton would be dependent on the whether the Phase 2 HSR analysis indicates the line (Brisbane-Newcastle-Sydney-Canberra-Melbourne) is economically viable on a standalone basis (not purely linked to aviation demand). Therefore, if this is the outcome of the Department's Phase 2 analysis, consideration of an additional station at an airport site at Wilton would need to be in light of the impact on longer travel time along the entire route and resulting impact demand and viability. However, it is more likely that airport specific HSR services would be operated, interposed between the operations of the intercapital HSR services, in much the same manner that the North Kent Line high speed services operate *"over the top"*[20] of the High Speed

[19] Sydney's Rail Future, NSW Government, TfNSW, June 2012
[20] In a timetabling sense

services between London and the Channel Tunnel in the United Kingdom. The reason for this is that the economics and markets of the two operations are quite different, with the intercapital service having to be as fast as possible to compete with other modes. A similar, though reversed situation, applies to the Hong Kong Airport Rail link where the Airport Express and the local Tung Cheung services co-exist.

1.4.5 Future road

Existing traffic growth on Picton Road has been a consistently high 4% per year over the last decade. Growth of 4% per year, if sustained, represents an increase in background traffic not related to the airport of 50% over ten years, 120% over 20 years, and 220% over 30 years. This suggests that significant upgrading of the road network will be required to accommodate background traffic growth alone; regardless of a new airport at Wilton.

NSW Roads and Maritime Services (RMS, then the NSW Roads and Traffic Authority (RTA)) has, in the past, indicated its support for constructing an interchange in the section of highway between Picton Road and Narellan Road perhaps in the vicinity of Moreton Park Road 10 km south of Narellan Road and the Hume Highway in the future which will be further investigated with the planning of the Appin Road/Bypass and its connection with the Hume Highway. [21]The constructability of an interchange at this location should not be a major issue. However no funding is understood to be set aside by RMS for the construction of this interchange.

Potential infrastructure upgrades planned by RMS for Appin Road include additional overtaking lanes in the short term and two lanes in each direction with the possibility of an Appin Bypass and a direct link to the Hume Highway in the long term.[22]

1.4.6 Future car parking

Future airport parking may be required a rate of 600 bays per million passengers per annum for the passenger airport types considered in the study.[23] At 70 million passengers per year this rate suggests 42,000 car bays, probably an upper bound estimate comparable with Australian capital city centres. Brisbane Airport has recently opened a new 5,000 bay domestic car park taking total spaces to 9,000. By contrast Sydney airport has around 15,000 spaces.

Car parking for substantial airport-related business parks would be additional. Parking provision rates, charges, and usage will be a major element of transport mode split and demand for public transport.

1.4.7 Future new motorway or transitway or toll road

The number of road accesses points to airports varies widely. Sydney Airport with 36 million passengers per annum (ppa) has a historic fine grain of local roads in surrounding suburbs and is ringed by freeways and toll roads, and a railway. Newer airports are often served by a limited number of expressways, such as Melbourne Tullamarine (2+2 lane freeway plus two 1+1 local roads) with no railway, or Hong Kong Chep Lap Kok (3+3 expressway lane bridge and 2+2 local lane bridge) and a railway. Changi Airport in Singapore with 40 million ppa in 2010 is fed by three major expressways in addition to good rail transport. This suggests that additional roads / motorways will be required on the basis of this information.

Beijing Airport reached 65 million ppa in 2009. The airport is accessible by four express tollways. Two of these run directly from north east Beijing to the airport. The other two connect to the airport from nearby highways. The Airport Expressway is a 20 km toll road that runs from the north eastern 3rd Ring Road at Sanyuanqiao directly to Terminals 1 and 2. It was built in the 1990s and has served as the primary road connection to the city. The 2nd Airport Expressway, opened in 2008, is a 15.6 km toll road that runs east from Yaojiayuan Lu at the eastern 5th Ring Road and then north to Terminal 3. The Northern Airport Line, opened in 2006, is an 11.3 km toll road that runs east from

[21] Henson Consulting pers. comm.
[22] ibid
[23] ibid

the Jingcheng Expressway to Terminals 1 and 2. The Southern Airport Line, opened in 2008, is a toll road that runs parallel and to the south of the Northern Airport Line from the Jingcheng Expressway to the eastern Sixth Ring Road at the Litian Bridge. This highway crosses the Airport Expressway and 2nd Airport Expressway, and enables drivers on the former to reach Terminal 3 and the latter to head to Terminals 1 and 2. In addition to the expressways, there is a tree-lined, two-lane road that runs just south of the Airport Expressway. This Old Airport Road was the primary access route to the airport prior to the expressway's opening and remains the only non-tolled road to the airport.

This scale of road improvements to provide a high quality road transport experience to a Wilton area airport suggests that major road and intersection improvements and tollways should be considered as part of the potential transport mix.

1.4.8 Future urban design issues

The shapes and fates of cities have always been shaped by transportation. The relatively new concept of an Aerotropolis[24] can be defined as a combination of giant airport, planned city[25], shipping facility, and business hub. The effect of a Wilton airport on centres such as Wollongong, Bowral and Campbelltown will differ depending on the role of new business parks around the airport. This should have more effect on the model of airport and transport infrastructure works chosen than merely augmenting what already exists:

Table 1.3 Airport models

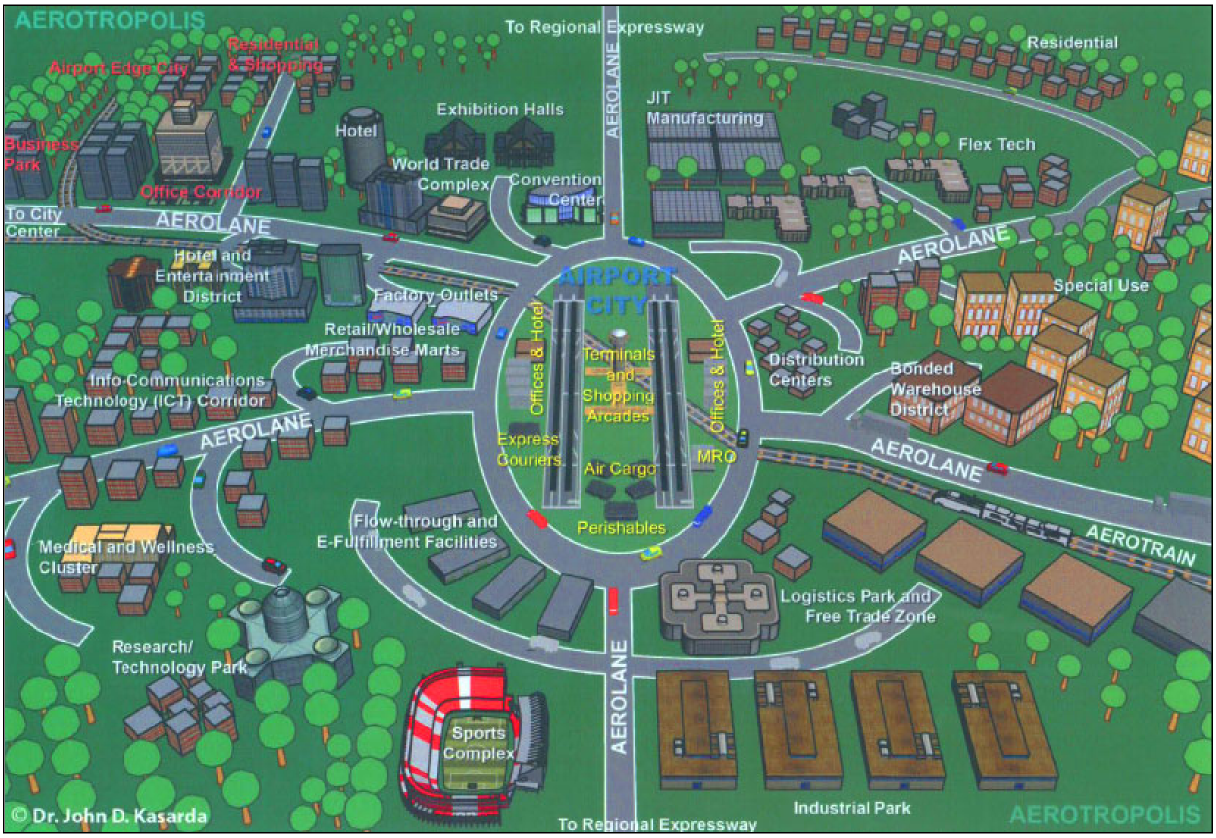
Model No. 1 Historical Airport	Model No. 2 Aerotropolis
Select best site based on historical accidents existing, and make good	Design a new airport and cities to maximise the societal benefit
Airport relegated to edge	Airport at the heart of the new city
Neighbours do not necessarily want the airport	Opportunity for a new city (Example of $35 billion (new Songdo) in South Korea)
Struggles to provide suitable development sites	Attracts the dotcoms and internet giants
Growing cargo volumes create urban amenity problems	Cargo doesn’t need quality of life, density or neighbourhoods. Only no congestion. This is a price.

Examples of a Model No. 1 historical airport is Sydney Airport in Sydney, or Essendon Aerodrome in Melbourne, or Adelaide Airport.

Model No. 2 has been used widely in Asia, but not in Australia to date. Brisbane Airport has land available for development directly related to the airport. In Amsterdam, Schiphol is now a designed airport city. A Dutch planner described it as: *“The airport leaves the city. The city follows the airport, the airport becomes a city.”*

[24] Aerotropolis - The way we’ll live next John D Kaskarda, Greg Lindsay, FSG books,
[25] Note the reference to planned city, not a city with unplanned growth.

Figure 1.8 Schematic example of Aerotropolis, Model #2



An example of a Model #2 airport is Hong Kong or New Songdo in Korea.

Songdo International Business District (SIBD) is a planned international CBD built from scratch currently under construction on 1,500 acres (6 km²) of reclaimed land along Incheon's waterfront, 65 km west of Seoul, South Korea and connected to Incheon International Airport by a 12.3 km reinforced concrete highway bridge, called Incheon Bridge. Along with Yeongjong and Cheongna, it is part of the Incheon Free Economic Zone

Incheon airport carries about 30M passengers per year and substantial freight, with a target of 100M ppa. The Incheon International Airport Railroad airport express (or AREX, and styled as A'REX) station is located in the Transportation Centre adjacent to the main terminal building and provides high-speed services to Gimpo Airport and Seoul. The AREX trains can speed up to 120 km/h, almost two times faster than a normal subway train. Passengers can choose a high-speed service stopping only at Incheon and Seoul, which takes 43 minutes between Incheon and Seoul but departs only every half-hour; or the all-station service, with a slightly longer journey time of 53 minutes but a more frequent departure timetable of every six minutes. Many of the stations along the AREX line provide connections to the Incheon Subway and Seoul Metropolitan Subway. A Korea Train Express (KTX- planned) Korean Transport and Maritime Affairs plan to construct a link line between Incheon International Airport Railroad and Gyeongui Line (Gyeongbu Line) by 2012~2013. This plan will bring KTX service to Incheon International Airport. A maglev link is under construction. The airport provides a short term parking lot for 4,000 cars and a long term parking lot for 6,000 cars. Shuttle services connect the long term parking lot to the passenger terminal and the cargo terminal. Car rental is located near the long term parking lot. The link to the mainland is provided by the toll Yeongjong Bridge and an expressway. A second expressway on the Incheon Bridge connects the island with central Incheon.

Built on 1,500 acres (6.1 km2) of land reclaimed from the Yellow Sea off Incheon, about 56 km from the South's capital Seoul, Songdo International Business District is one of the largest private real estate developments. By its completion date in 2015, the district is planned to contain 80,000 apartments, 50,000,000 square feet (4,600,000 m2) of office space and 10,000,000 square feet (930,000 m^2) of retail space.

Whilst there is no suggestion that development on this scale will occur around Wilton, and an Aerotropolis is not necessarily consistent with current assumptions regarding business parks, there are pressures for large scale development near airports. An issue from a land transport perspective is the overall transport demand generated by the associated land uses that may be of comparable magnitude to the airport itself. This will both put pressure on existing transport links, and support the justification for new links.

1.5 Analysis of issues in terms of current airport concepts

1.5.1 Proposed development - current airport concept

1.5.1.1 Current airport concept

The proposed Maximum airport will be a competitive international airport with 70million passengers per year in year 2060. Although the proposed Wilton airport looking forward over half a century was assessed largely by extrapolation of existing trends, this horizon will require vision and likely provide opportunities for step changes in land transport: looking back half a century there were no freeways, no tollways, no harbour tunnels, no mobile electronic communication, and Sydney was closing the largest tram system in the southern hemisphere. The airport of this scale will have a transformational effect on the selected site and surrounds, and in particular on transport links.

Key assumptions made in the Wilton airport concept assessed in this Working Paper were:

- 70 million airport passengers per year in year 2060;
- Two business parks totalling a minimum of 30 hectares site area (although some options are much greater);
- Logistics complex; and
- 18 000 to 26 000 car parking bays.

The main transport land transport groups are assumed to be:

- Air travellers domestic;
- Air travellers international;
- Air freight domestic;
- Air freight international;
- Airport services;
- Airport staff commuting;
- Business parks staff;
- Business parks freight;
- Construction traffic (both initial and ongoing); and
- Emergency services.

The main origins or destinations for people and freight have been grouped as:

- Sydney Central;
- Sydney Region, including regional centres and Central Coast;
- Canberra and south west NSW, Victoria, South Australia, Western Australia, Tasmania;

- North Coast, Queensland, and Northern Territory; and
- Illawarra and south coast.

The major land transport modes and consequent alignment and corridors considered were:

- Toll road;
- Freeway;
- Highway;
- Local road;
- Pedestrian/bike/personal mobility device path;
- Passenger rail:
  - Light rail/ transitway (unlikely because of remoteness from established urban areas);
  - Metrorail (unlikely with reference to **Figure 1.10**);
  - Conventional Sydney heavy rail;
  - Airport Express rail; and
  - High speed rail;
- Freight rail.

Travel parameters developed for the purpose of this analysis include:

- Rail and bus fares;
- Taxi fares;
- Road tolls and future road user charges;
- Smart ticketing and charges;
- Travel time duration;
- Travel time variability and certainty – delay for passenger and freight traffic;
- Number of changes of mode or vehicle;
- Comfort;
- Security;
- Baggage facilities; and
- Ability to work or recreation with communication and Wi-Fi.

Vehicle types incorporated into the analysis are:

- Pedestrian;
- Bike;
- Personal mobility devices ;
- Passenger train:
  - Trams, light rail, airport people mover systems;

- Suburban trains;
- Metro-style trains;
- Airport Express style trains; and
- High Speed Train;

- Freight train;
- Car and motorcycle;
- Hire car;
- Local bus;
- Coach;
- Commercial vehicle; and
- Trucks, combination vehicles such as B Doubles, and construction equipment.

1.5.1.2 Patronage forecasts

Patronage data[26] for air passengers using a Wilton airport showed the key parameters described in **Table 1.4** for the Competitive Scenario SC3/SC4 at Wilton for 54 million total passengers in year 2060.

Table 1.4 Wilton airport patronage forecast on year 2060

Type	Passengers Per Year
International	
Business	6,497,116
Leisure	18,350,464
Total	**24,847,580**
Domestic	
Business	6,858,802
Leisure	22,313,041
Total	**29,171,843**
Regional	
Business	108,159
Leisure	356,213
Total	**464,372**
SC3 Total Pax	**54,483,795**

[26] Patronage modelling of Alternative sites, Wilton complementary scenarios 1-3 and competitive scenarios 3 & 4, SC4, Version 02 July 2012, Booz &Co.

Type	Passengers Per Year
Dedicated freighter	Tonnes
International	157,904
Domestic	30,321
Belly space	
International	256,358
Domestic	74,724
Total tonnes freight	**519,307**

Further patronage analysis[27] forecasts that, in year 2060, Sydney Airport patronage will remain centred on Sydney Inner for about 38% of patronage, with inner Sydney and eastern suburbs totalling 54% of patronage. Wilton air passenger patronage will also draw heavily on these inner and eastern areas but to a lesser extent, 24% and 36% respectively. Wilton is forecast to draw more patronage more widely, from outer and western suburbs of Sydney, with major patronage of about 2% each from Sutherland, Baulkham Hills, Parramatta, Campbelltown, Blue Mountains, Wollondilly, and Hornsby.

This data requires more detailed investigation, but would suggest:

- A demand for good rail inter-connections via the CityRail network to Wilton airport;
- A demand for orbital road capacity from the north to the southwest that does not overload the inner Sydney road network;
- Further information is required on potential patronage from regional NSW including the Illawarra, Canberra, and interstate; and
- Further information is required on airport-related employee travel patterns, and possible residential clusters around Wollondilly Shire, the Illawarra, Southern Highlands, and Sutherland Shire.

1.5.2 Trip generation

Trip generation from 70 million per annum passenger per year airport was estimated based on the Joint Study and the prior technical experience. The mode split was estimated as shown in **Table 1.5**.

Table 1.5 Estimated trip generation for a 70 million ppa capacity airport at Wilton[28]

Mode Split	
Million air passengers per year	70
Rail %	20
Private car %	43
Rental car %	5

[27] WSC4 Individual , Booz & Co., 25 July 2012
[28] WorleyParsons and Henson Consulting 2012

Mode Split	
Bus %	12
Taxi[29] %	19
Rental car %	1
Total %	100
Rail	
Daily passengers by rail [30]	46,667
One-way peak hourly passengers[31]	2333
Average peak passengers per train[32]	583
Road	
Vehicle trips per airport passenger per day	0.79
Daily passengers	191781
Daily trips vehicles per day	151507
On-road peak hour[33] vehicle trips two directions	15151
On-road peak hour vehicle trips one direction [34]vehicles per hour	9848
Number of freeway lanes one-way [35]	5
Number of freeway lanes total without tidal lanes	10
Business Park	
Airport Business Parks hectares	30
Site area (m^2)	300000
Floor area GFAm2[36]	225000
Floor area GLAm2[37]	191250
Traffic generation peak hour peak direction per 100 m^2 GLA[38]	1.2

[29] Taxi include some form of hire and pool vehicles by 2060
[30] 300 days average assuming non-uniformity of travel over a week
[31] Assuming the peak hour represents 10% of daily travel in one direction
[32] Assuming 4 trains per peak hour in one direction
[33] 10% of daily
[34] 65% in peak direction
[35] 1860 vehicles/hour/lane
[36] Site area less 50% roads and open space, FSR 1.5 based on 50%coverage of 3 storey buildings
[37] Gross Leasable Floor Area = 85% of Gross Floor Area
[38] RTA Guidelines to Traffic Generating Development

Mode Split	
Traffic generation peak hour two directions	2295
traffic generation peak hour peak direction	2066
number of freeway lanes one way	1
number of freeway lanes total without tidal lanes	2
traffic generation daily trips vehicles per day	22950

1.5.3 Trip distribution and assignment

Detailed trip distribution and assignment was not possible with the level of origin-destination information currently available for an airport at Wilton. A conservative assumption was made of:

- Three lanes of traffic using the Hume Highway;
- Two lanes of traffic using the Princes Highway; and
- Two of traffic using the local road network.

1.5.4 Land transport access concept

The existing transport network can support a very small initial airport. It would be possible to start from a minimalist response to transport demand, and therefore only build roads and later railways as a response to unacceptable road congestion as the airport grows. However, the airport concept assumptions outlined above suggest a transport system that will match major international competitors of a similar scale such as Changi, Hong Kong, or Incheon airports. This suggests at least the following major transport elements for the 70 million passengers per year at Wilton:

- Airport express railway to central Sydney, with strategic connections to the suburban network and potential to develop this by:
  - connecting to a future East Coast high speed railway network; or
  - connecting to the southern and western sectors of regional Sydney Illawarra by passenger train via the Maldon-Dombarton line;
- Primary road link to Hume Highway/F5/M5/M7;
- Secondary road link to Princes Highway/F6; and
- Tertiary road links to the local road network.

1.5.5 Other issues and assumptions

Issues and assumptions used in this Working Paper that will require evaluation in developing a Transport Strategy for Wilton included:

- Airport operating hours are 24 hours per day, 7 days per week with no aircraft curfew of any sort;
- Effective 24/7 operation of public transport system including rail i.e. either the rail network is operating 24/7 to serve the airport or an equivalent (bus) system is in place;

- No vehicle load limits on the adjacent arterial road network serving the airport (i.e. no mass limits on trucks or limits on say B-double combination vehicles). This is important because a proportion of heavy vehicles will reduce the capacity of roads on hills;
- Government will continue to fund and improve the NSW road network to counter increasing levels of congestion. This is a key assumption that traffic will be able to reach the airport feeder roads in *"reasonable time"* as judged by evolving community attitudes to travel and congestion. (M5 widening, M4 East, M2-F3 link, M9 outer Sydney orbital road, Hume Highway upgrading, and the like);
- This may also imply some evolving attitudes to road pricing and public transport pricing (i.e. existing and some selected new toll roads), and perhaps some that will act to encourage higher car occupancies and divert some discretionary travel to public transport;
- As a consequence of these effects this Working Paper does not attempt to re-calculate travel isochrones by road and rail for the future Maximum Airport scenario, as these wider network effects that are critical to overall travel speeds and levels of service to the airport, are unknown at this time, and cannot be usefully predicted as part of this Working Paper;
- The availability, convenience, and pricing of car parking are a key determinant in mode choice to the airport for air travellers and employees. Existing Sydney Airport parking at about $50 per day is limited in supply and expensive, at least partly because of the limited site area. It is probable that parking at Wilton Airport could be constructed in the tens of thousands of bays and cover costs for as little as say $10 per day. Parking policy will directly affect the achievement of the proposed transport mode splits to public transport. The assumption is that parking supply constraints and parking charges will be tailored to support and realise the given assumed mode splits;
- Unlimited cheap car parking on site, or an effective shuttle bus service from satellite car parking off-site would invalidate many of the given transport assumptions. Such parking may need to be controlled though planning instruments and legislation;
- The so-called *"Global Crescent"* of employment opportunity in Sydney (Sydney Airport/CBD/North Sydney/Chatswood/Macquarie/Norwest) is likely to be complemented by a Western Arc (M7/ inland ports/Campbelltown/Wilton airport/Port Kembla) that would include Picton Road or Appin Road;
- Fine grain rerouting of traffic would need to be managed if the F5 or F6 is temporarily blocked;
- The role of Picton Road as an airport feeder road and/or as a through link from Sydney to the Illawarra assumes a high capacity road and interchanges that will attract through traffic;
- Delays occur at intersections, seldom mid-block. The analysis to date on the number of traffic lanes implies corresponding capacity improvements to the key controlling intersections;
- Local circulation will include bikes and electric personal mobility devices such as segways make a segregated path system desirable at least to Wilton, with sufficient width to accommodate this in road reserves;
- The scale of freight and mining operations in and around the airport, and from the Illawarra requires further study;
- Integrated electronic ticketing for public transport in NSW (the Opal Card) will be operating at airport opening, and should be extended to cover public transport to the Wilton Airport;
- Assumes that ARTC would provide track access rights for new airport passenger trains south of Campbelltown and that any railway lines accessing Wilton Airport would be electrified;
- The proposed *"Wentworth Railway"* HSR alignment would augment and not replace the existing Main Southern Railway service, which would focus on local communities;

- The wider issue of transport and land use futures in the Southern Highlands region and the Illawarra region are not addressed in this analysis, other than the imbedded assumptions of existing growth trends;
- Over the fifty year timeframe of this study, some consideration should be given to changes in aircraft capacity, helicopters and other emerging aircraft; however even with major changes to technology they are unlikely to have any substantial effect on the assumed overall land surface transport task in terms such as road and rail demand peaking characteristics;
- The Maldon-Dombarton Railway will be constructed to cater for existing and future growth in freight demand from Port Kembla and the Illawarra, and will relieve the growth in road freight on Picton Road, Appin Road, Princes Highway, and Hume Highway that are required to serve a Wilton airport.

1.5.6 Transport infrastructure for current airport concept

1.5.6.1 Rail

Introduction

A major airport located at Wilton needs to efficiently tap into the regional private and public transport networks if it is to usefully serve the Sydney and Illawarra Regions. It needs to access major corridors, such as freeways and motorways and passenger railways, to reduce travel times and maximise regional accessibility to compensate for its off-centre location, as compared to Sydney Airport. By land transport Wilton would lie 75 to 85 km from central Sydney versus Sydney Airport which lies less than 10 km from central Sydney. The strategies for private and public transport access will be different.

There is an established road hierarchy that can distribute airport passengers and employees around the Sydney and Illawarra Regions. The road issues are more likely to be whether there is capacity in the highway network to handle the private traffic attracted to the airport and what levels of service (i.e. congestion, travel time and their variability) such traffic would experience. At some stage various links in the highway network will need augmentation and/or conversion to higher levels of road infrastructure. It is less likely that links in the network will be missing.

The development of public transport access will depend upon what hierarchy of services (e.g. bus routes versus railways) needs to be offered. Then the question arises as to whether appropriate links in the public transport exist or would have to be created. Furthermore, what accessibility and connectivity could be achieved? Finally, what travel times could be delivered to what locations, bearing in mind that because public transport cannot offer the same levels of ubiquitous accessibility as private transport it has to be targeted at specific groups of travellers.

Indicative passenger demand and distribution assumptions have been developed from Sydney Airport's passenger (and employee) demand and distribution and complementary work previously carried out for the Joint Study combined with this current study (see Table 4) . As with all forecasts, there is an uncertainty about the level and type of passenger activity, together with uncertainty around timing of passenger activity that would be attracted to a Wilton airport.

Basic rail access strategy

The broad inferences that can be drawn from Booz & Co. demand estimates[39], as they affect the demand for a Wilton airport, are that:

- Central Sydney, including the Eastern Suburbs and the Lower North Shore, will still be significant attractors for Wilton air travellers, even in a two-airport scenario; and
- Western Sydney, from the Southwest to the Northwest, appears to attract more air travellers from Wilton than from Sydney Airport.

[39] As these stood at the time of drafting

If it is assumed that airport employees are drawn from a ring of suburbs and townships around the airport then there will be a need to provide for high quality rail access. From a maximum Wilton Airport, rail connectivity to Central Sydney with good connections to existing suburban passenger rail services along CityRail's southern and western corridors will be required. From Central Sydney, there should also be close connections to the Eastern Suburbs, North Shore, Inner West and Illawarra.

Since rail public transport will be an important component of creating a viable 70 mppa airport it needs to actively contribute to attracting patronage to a Wilton Airport. Because of the distance between central, and western, Sydney an Airport Express rail service needs to be developed to provide an in-town address for the airport, as is apparent in London, Oslo and Stockholm. Travel times need to be seen to be competitive with road travel without the variability experienced on the highway network, e.g. Oslo's exceptional Gardermoen Express runs at an average speed of 155 km/h and reputedly attracts 34% of air passengers[40]. Services need to be acceptably frequent (the European staple is that airport services generally run at least four trains per hour) and the trains need to have sufficient accommodation to seat passengers and hold their luggage, commensurate with the estimated peak patronage. It is estimated that peak hour trains would probably each need to carry nearly 600 passengers into or out of a Wilton Airport.

The Airport Express would need an identifiable central Sydney terminus that is well connected to CityRail's network as well as to taxis, buses and private vehicles. European practice[41] is to incorporate an Airport Express terminus into an existing main station or connect the CBD to the airport via an existing suburban railway, e.g.:

- Amsterdam Central to Schipol: 17 km, 20 minutes (51 km/h), 6 trains/hour;
- Copenhagen Main to Karlstrup: 12 km, 15 minutes (48 km/h), 6 trains/hour;
- Frankfurt Hbf to Frankfurt Flughafen: 10 km, 15 minutes (40 km/h), S8 or S9 @ 4-6 trains/hour;
- London Liverpool Street to Stanstead: 55 km, 46 minutes (72 km/h), Stanstead Express @ 4 trains/hour;
- London Paddington to Heathrow: 24 km, 15 minutes (96 km/h), Heathrow Express @ 4 trains/hour;
- London Victoria to Gatwick: 44 km, 30 minutes (88 km/h), Gatwick Express @ 4 trains/hour;
- Oslo Sentral to Gardermoen: 49 km, 19 minutes (155 km/h), Flytoget 2-4 trains/hour;
- Paris to Charles de Gaulle: 25 km, 35 minutes (43 km/h), RER Line B @ 4-8 trains/hour;
- Roma Termini to Fiumicino: 26 km, 31 minutes (50 km/h), Leonardo Express @ 2 trains/hour;
- Stockholm Central to Arlanda: 44 km, 20 minutes (132 km/h), Arlanda Express @ 4 trains/hour; and
- Zurich Hbf to Zurich Flughafen: 10 km, 13 minutes (46 km/h) S-bahn and other @ 7-8 trains/hour.

Because of the connectedness of these stations to urban, suburban and regional rail services. Central Station in Sydney presents a current opportunity, and St James Station presents a potential opportunity, for an in-town terminal.

The Sydney railway network also presents the opportunity to connect a Wilton airport to the existing Sydney Airport via the Airport Line if Airport Express services travelled along the East Hills Line. If Airport Express services travelled along the Airport Line then they would be more likely to use an in-town terminal at St James than at Central.

40 Wikipedia, Flytoget, the Airport Express Train
41 Cooks European Rail Timetable, January 2009

Because of the intervening national park and military reserve that lie between central and south western Sydney and a Wilton airport site only two broad corridors present themselves as potentially usable (setting aside alignment issues for the moment) for an Airport Express service:

- The Illawarra Line running to the south of Sydney beside Royal National Park; and
- The East Hills Line and Main Southern Railway running to the southwest of Sydney north and west of the Holsworthy military reserve.

This assumes that the current extent of Sydney's urbanisation largely precludes the development of new at-grade rail corridors from inner Sydney to an urban edge lying 40 to 50 km from the Sydney CBD. Note that this is similar to the distances between central Oslo or Stockholm and their respective principal airports. However, each of these airports lies at substantial distances outside their respective urban areas (e.g. at least 70% of their lengths are extra urban).

New inner area rail corridor construction in Sydney has been underground from the construction of the Airport Railway (opened 2000) onwards. Thus, it is unlikely that a new and dedicated underground railway would be constructed solely to access a major airport when the pass rate for new suburban railway construction appears to be for patronage levels possibly four times higher than those estimated for an airport. In fact, the 14.5 km tunnel running northwards from central Oslo and used by the Gardermoen Express is shared with suburban trains.

The immediate strategy is thus to seek to use existing railway corridors that are both reasonably direct and potentially offer access opportunities to the rest of the Sydney region for entry level airport services and keep open the options of developing future very high speed train services via a purpose-built railway.

The Illawarra Line runs to the east of Wilton and is separated from it by national park, heavily desiccated terrain and ultimately the Illawarra Escarpment. Furthermore, it currently has major line capacity constraints between Hurstville and Sutherland across the Georges River. Finally, it does not offer good access to western Sydney. Thus, there would be a high degree of difficulty in linking Wilton to the Illawarra Line which only favours the Sydney CBD, Eastern Suburbs and North Shore.

While the East Hills Line and Main Southern Railway corridor passes to the west of Wilton it can be readily linked to any of the Wilton airport options via the unfinished Maldon-Dombarton Railway as a start-up mode. This corridor could also make good use of the proposed high speed Wentworth Railway corridor and/or a cut-off from Douglas Park on the Main Southern Railway. While this corridor also has capacity constraints these should be more easily overcome than those on the Illawarra Line by quadruplication within existing corridors. Moreover, the East Hills/Main Southern corridor is already connected to rail links to Parramatta so it offers more regional connectivity than the Illawarra Line.

The nature of Airport Express services for Sydney is that they will need some intermediate stops to distribute passengers efficiently around the region: but not too many because then these services would become too slow. Wilton will lie roughly 80 km from central Sydney so passengers will need a number of strategic interchange stations to efficiently access the rest of the Sydney region by rail. It is suggested these strategic stations be:

- **Campbelltown** for access to the Macarthur sub-region;
- **Glenfield** for access to Parramatta, Blacktown, Richmond and Penrith; and
- A new station at **Wolli Creek** for access to Kogarah, Hurstville, Sutherland and Cronulla if Central was the in-town terminal.

Note that if Airport Express services were routed via the Airport Line then they would use the existing Wolli Creek station.

A terminus at Central provides access to the Inner West, Eastern Suburbs and North Shore. Moreover, these arrangements do not preclude the development of a purpose-built in-town terminal at St James. Nevertheless, such a development would be open to any alternative airport arrangement at Wilton and therefore does not discriminate between airport arrangements. **Figure 1.9** illustrates the basic airport rail access strategy.

An operational duty to stop at a small number of intermediate stations, 10 to 25 km apart for a maximum average speed of 90 to 120 km/h, is not compatible with very-high-speed rail where stations probably need to be at least 100 km apart, in order to achieve very high average speeds (e.g. 240 km/h). On the other hand, an Airport Express service still needs powerful interurban style trains (with high seating and luggage capacity) to maintain cruising speeds of 160 to 200 km/h, alignment permitting.

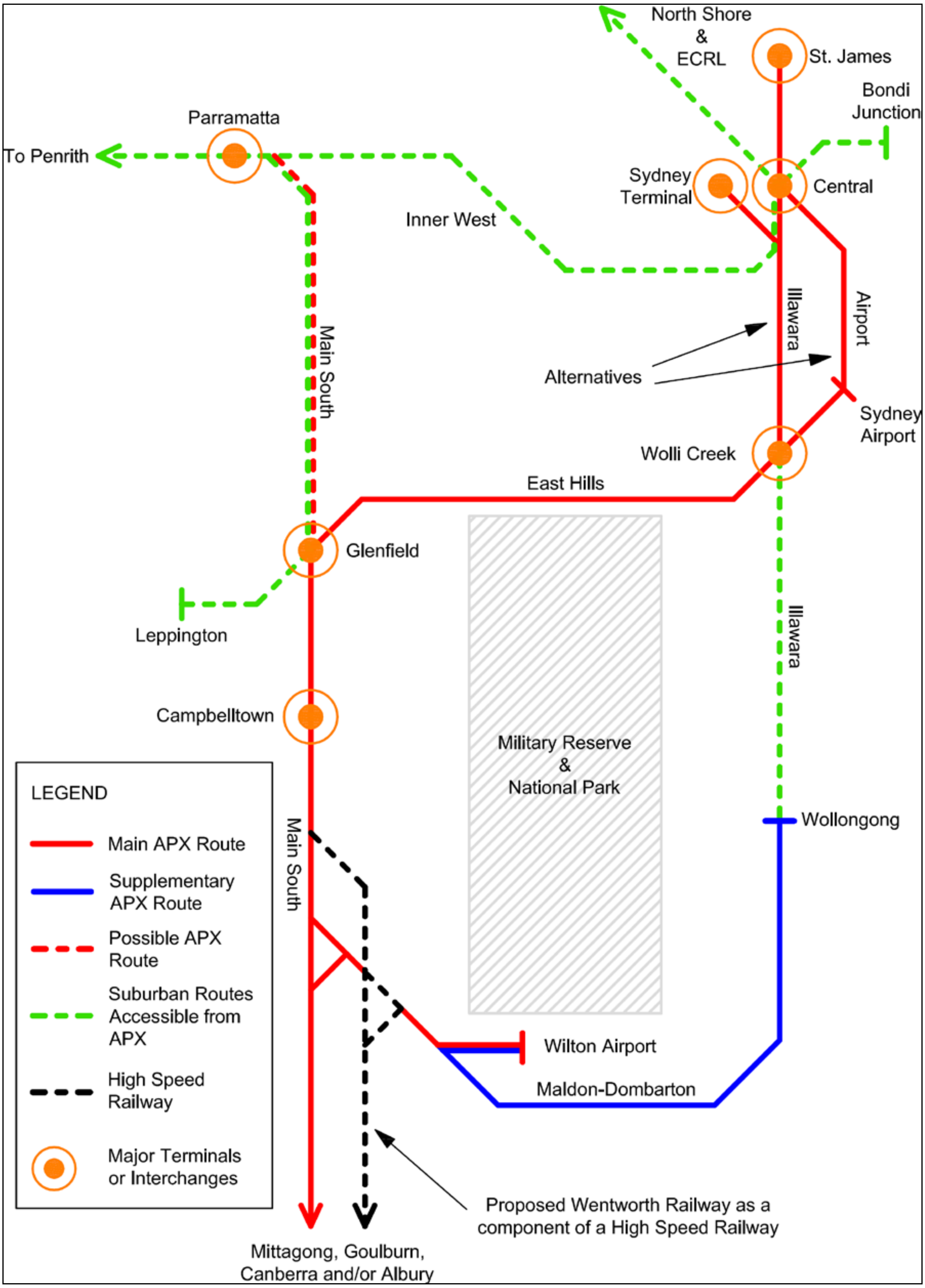
Connection though may not be during early airport staging. Existing corridors and planned corridors are considered below.

High speed rail alignment plans

The possibility of a high speed rail line passing close to the Wilton airport sites options was discussed earlier.

At this stage it is not possible to know whether such a project would be in operation. It is more realistic to assume that a maximum airport would require a high speed rail link and that will need a high speed alignment which may or may not be coincident with a high speed railway serving cities in the east coast corridor. This has been assumed **in Figure 1.9** which postulates that at least a part of that line would be constructed to link back to the metropolitan rail system.

Figure 1.9 Proposed Alternative 1 rail service[42]



[42] WorleyParsons 2012

General requirements for an airport express rail service

Obviously alignments should be as straight and fast as possible. However, there is concern about what is achievable within an established suburban environment that extends up to 50 km from central Sydney, especially since no details are yet available about any high-speed rail alignment running southwards out of Sydney. Therefore, it has been assumed that the existing East Hills Line and Main Southern Railway present the most realistically available alignment, provided that additional track can be added to provide capacity for an Airport Express service that would run over the top of existing suburban services and that line speeds can be driven up to at least 160 km/h, where feasible.

To this end it has been assumed that the following line capacity augmentation works would have been put in place:

- Use of the existing Main Line and Illawarra Dive exit from Central to Erskineville Junction;
- Sextuplication of the Illawarra Line between Erskineville Junction and Sydenham thence use of the existing 4-track Illawarra Line between Sydenham and Wolli Creek Junction;
- Provision of platforms on the East Hills Main tracks to enable passenger interchange between the East Hills, Airport and Illawarra Lines thence use of the existing 4-track East hills Line between Wolli Creek Junction and Revesby;
- Quadruplication of the East Hills Line between Revesby and East Hills;
- Resignalling of the East Hills Line between East Hills and Glenfield;
- Quadruplication of the Main Southern Railway between Glenfield and Macarthur;
- Electrification of the Main Southern Railway between Macarthur, Glen Alpine and Maldon Junction, for the unfinished Maldon-Dombarton Railway;
- Alternatively: construction of a new double track electrified high speed Wentworth Railway between Glen Alpine (south of Macarthur) and a junction with the unfinished Maldon-Dombarton Railway;
- Completion of construction of a duplicated and electrified Maldon-Dombarton Railway between Maldon Junction or Wentworth Junction and Wilton Junction;
- Construction of a double track electrified railway, with a westward and eastward triangular junction, between Wilton Junction on the unfinished Maldon-Dombarton Railway and the passenger terminal at Wilton Airport;
- Alternatively: construction of a double track electrified railway between Douglas Park, a transect of the Wentworth Railway and Wilton Airport;
- Possible completion of a duplicated and electrified Maldon-Dombarton Railway as far as Dombarton (while retaining a single track Avon Tunnel); and
- Possible completion of electrification between Dombarton and Unanderra.

Figures 1.10 and 1.11 illustrate the profile of an Airport Express route between Sydney and Wilton Airport utilising the East Hill Line, the Main Southern Railway, the proposed Wentworth Railway and the unfinished Maldon-Dombarton Railway. It includes embedded speed versus distance performance for out and back trains to illustrate how alternative Airport Express trains might perform.

New electrification within metropolitan Sydney and on the South Coast would be at 1500 Vdc. New electrification south of metropolitan Sydney and on the Maldon-Dombarton Railway would most likely be at 25 kVac.

Consideration should also be given to extending the Airport Line in tunnel to a double track terminus at St James, between the existing City Railway platforms, to create an in-town Airport Express terminus. Otherwise, there should be no difficulty in terminating four Airport Express trains per hour at Central using suitably branded platforms between Platforms 3 and 8.

The minimum configuration for a rail terminus at Wilton Airport would be two tracks around a 12 m wide, 210 m long island platform with leading 60 to 80 km/h K-crossovers. This configuration should reliably handle up to eight terminations per hour. If more terminations are expected then the station should be expandable to four platforms, comprising two islands, after the fashion of the Leppington Terminus on the South West Rail Link (SWRL). A four-track terminus should allow for a mixture of Airport Express and suburban train services and/or extension of Airport Express services to Parramatta and Blacktown and peak hour passenger loads up to 4000 passengers per hour.

Performance-wise, entry-level rolling stock for an airport access service could be 130 km/h interurban rolling stock. However, higher-performance rolling stock (i.e. 160 km/h and 250 km/h long distance rolling stock was examined to see what travel time reductions might be realistically achieved. Airport Express trains would need to be configured for level boarding by passengers encumbered with baggage. Ideally they should be single deck with two pairs of competent double doors similar to and conforming with the outline of RailCorp’s Hunter cars (i.e. roughly 25.2 m over coupling faces, car body at least 24.2 m long by 2.9 m wide with 16.8 m bogie centres and 1.2 m floor height above rail). Desirably, they should carry an average of at least 60 passengers per car in 2+2 seating inclusive of disabled seating and toilets. Trains should be capable of running in two-car, four-car, six-car and eight-car formations. To maximise speeds over existing tracks Airport Express trains should have active tilting bodies. They should be dual 1500 Vdc/25 kVac powered.

Figure1.10 Route profile between Sydney and Campbelltown via East Hills with embedded comparative train performance

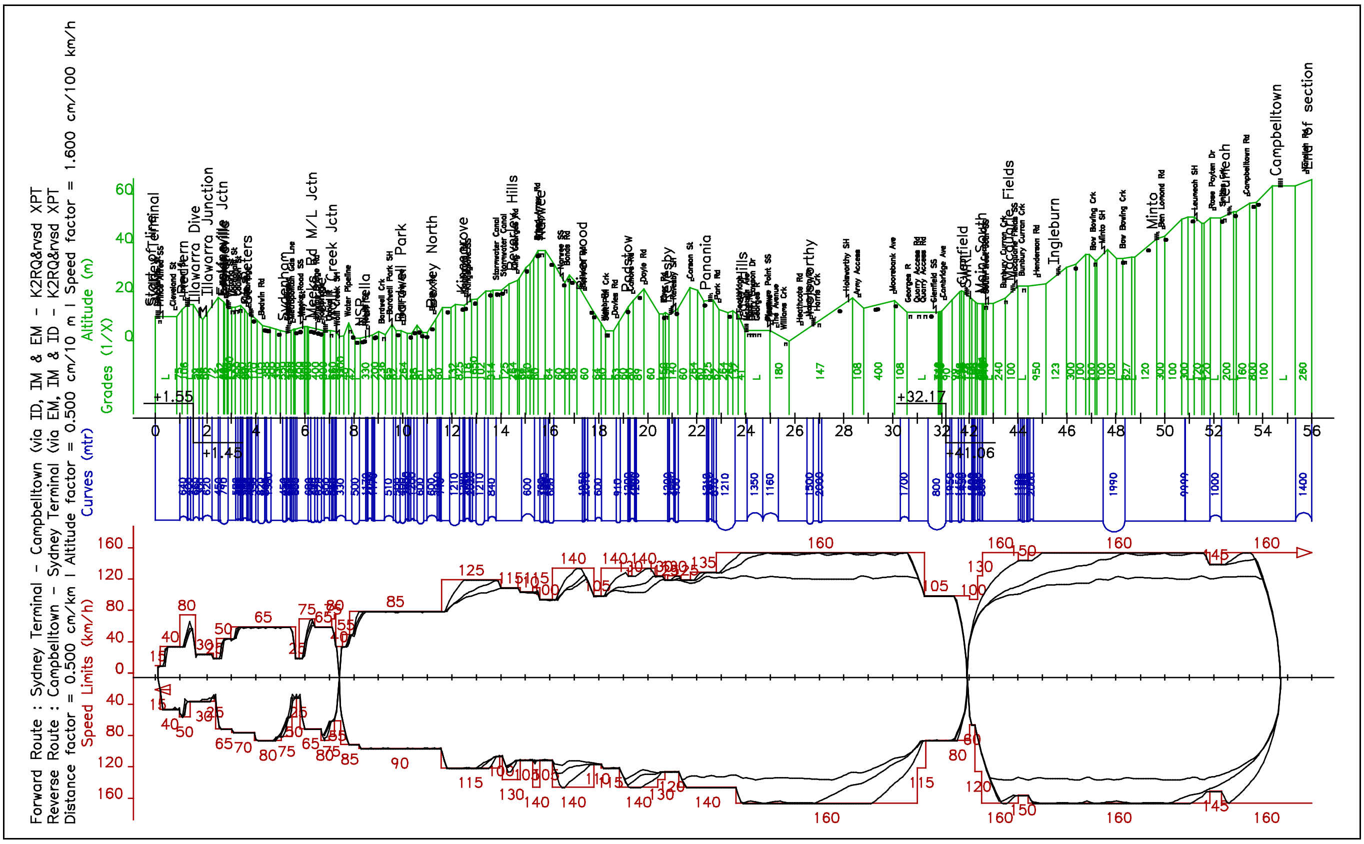
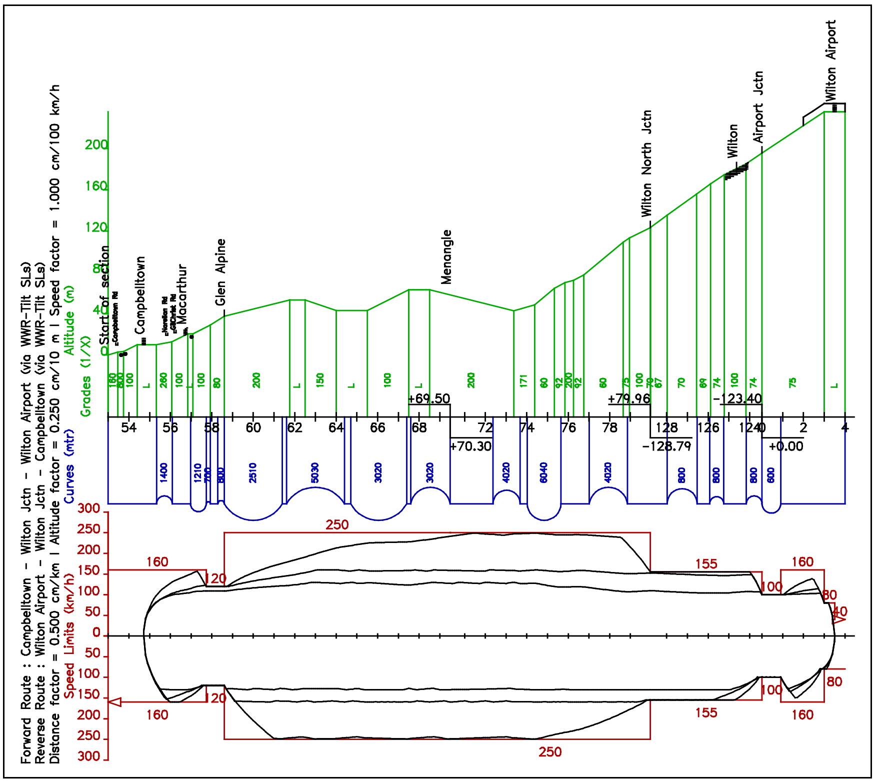


Figure 1.11 Route Profile between Campbelltown and Wilton Airport via the proposed Wentworth Railway with embedded comparative train performance



Intra- airport people mover

Both of the above options would ideally include a high capacity intra-airport people mover system for circulation from one main train station to all terminals and other major destinations within the airport site. The system should also ideally be capable of being extended to serve the airport-related business parks.

Travel time estimates for alternative train types and routes

Table 1.6 displays distances and travel times via the East Hills Line, Main Southern Railway and the unfinished Maldon-Dombarton Railway to minimise the construction of new alignments for 130 km/h trains. It also displays distances and travel times via the East Hills Line, Main Southern Railway, the proposed Wentworth Railway and the unfinished Maldon-Dombarton Railway for 130 km/h, 160 km/h and 250 km/h trains to illustrate the benefits of exploiting a possible high-speed route out of the Sydney region. It is assumed that airport trains would make the best use of multiple unit/XPT line speeds along the former route or would make good use of high-speed line speeds and a shorter route along the latter route. Note that these distances and times have been estimated for the western group of airport arrangements, being the closest to the existing rail corridor. The estimated distances and travel times for the eastern group of airport arrangements will be longer than those for the western ones because they all lie further from existing rail corridors.

The Sydney-Wilton travel times are realistic but not necessarily the minimum achievable times. If a new route were constructed from Douglas Park on the Main Southern Railway (intercepting the proposed Wentworth Railway if need be) then 4.5 to 8.5 km could be shaved off the route between Wilton, Campbelltown and Sydney. It is likely that six minutes could be shaved off travel times over the exclusively Main Southern Railway route and that three minutes could be shaved off travel times over the proposed Wentworth Railway route. However, such travel time improvements are available to all alternative airport arrangements and therefore do not discriminate between them.

Table 1.6 also displays estimated distances and travel times between Wilton and Wollongong. The unfinished Maldon-Dombarton Railway provides a reasonably direct route to Wollongong but it is encumbered by the very steep descent from the Avon Tunnel to Unanderra where line speeds will be necessarily low. Much of the unfinished Maldon-Dombarton Railway would have to be double track, rather than single track, to allow it to jointly handle passenger and freight train traffic.

Table 1.7 displays the local differences in airport access distances between airport arrangements in the western group (i.e. Options 1, 1S, 2, 6 and 7) and in the eastern group (i.e. Options 3, 4 and 5). It also shows the means of access of railway line into the airport terminal complex. Most airport arrangements could only be accessed from the unfinished Maldon-Dombarton Railway by tunnelling under runways. Only half the airport arrangements could be accessed directly from the Main Southern Railway, or a transect of the proposed Wentworth Railway, by tunnelling under runways. However, given that the terminal complex will be served by major car parks, then a railway line would probably still have to tunnel under them to enter the airport.

More importantly, the rail access distances for the western group of airport arrangements will be the same. This is because, broadly speaking, the western group of airport arrangements roughly pivot about the same central terminal location. The eastern group are more spread out so the rail terminal distances do vary slightly. However, the eastern group of airport arrangements are consistently further from existing rail corridors than the western group.

Table 1.6 Comparative rail access to alternative airport layouts[43]

Waypoint	Dist (km)	Dwell Time (min)	Sydney – Wilton – Wollongong (minutes – read down)				Wollongong – Wilton – Sydney (minutes – read up)			
			130 km/h	130 km/h	160 km/h	250 km/h	130 km/h	130 km/h	160 km/h	250 km/h
Sydney	0.0		0	0	0	0	63	59	55	51
Wolli Creek	7.4	2	11-13	11-13	12-14	11-13	50-52	46-48	42-44	39-41
Glenfield	33.0	2	29-31	29-31	29-31	28-30	32-34	28-30	25-27	22-24
Campbelltown	45.8	2	39-41	39-41	38-40	37-39	22-24	18-20	16-18	13-15
Wilton via MS	82.9		65	-	-	-	0	-	-	-
Wilton via WWR	79.2		-	60	56	52	-	0	0	0
Wilton	0		0	-	-	-	34	-	-	-
Unanderra	38.6	1	28-29	-	-	-	6-7	-	-	-
Wollongong	44.0		34	-	-	-	0	-	-	-

Table 1.7 Comparative travel times (minutes) between Sydney Terminal, the western group of Wilton airport layouts and Wollongong[44]

Option Group	Option	Line of Access (with respect to runways, etc)	Distance (km)	
			From MDR	From MSR
West	1N	Under WSP (W)	3.5	-
		Under XW	-	10.0
	1S	Under WSP (W)	3.5	-
		Under car parks	-	10.0
	2	Under WSP (W)	3.5	-
		Under car parks	-	10.0
	6	Under XW	3.5	-
		Under WSP (W)	-	10.0

[43] MS = Main Southern Railway, WWR = Wentworth Railway.
2. All running times include a 5% recovery margin. Dwell times, where indicated, are added to the running times.
3. All travel times to Wilton Airport are calculated for those options in the western group of airport layouts (i.e. 1N, 1S, 2, 6 and 7) along the worst case route option giving access to the airport sites off the Maldon-Dombarton Railway. It is estimated that travel times to the eastern group of airport layouts (i.e. 3, 4 and 5) would be 2-3 minutes longer to both Sydney and Wollongong.
4. Line speeds on the East Hills Line, Main Southern Railway and the Maldon-Dombarton Railway capped at 160 km/h, where achievable.
5. Line speeds on the Wentworth Railway capped at 250 km/h, where achievable

[44] . WSP = wide space parallel runway, XW = crosswind runway.
2. Qualifiers for WSP refer to either the Western or Northern runway, depending upon the orientation of the airport arrangement.
3. MDR = Maldon-Dombarton-Railway ex Airport Junction assumed to lie at 123.4 km, MSR = Main Southern Railway ex Douglas Park.
4. The worst case, i.e. longest, access to a Wilton Airport site would be via the Maldon-Dombarton Railway. The best case, i.e. shortest, access to a Wilton Airport site would be off the Main Southern Railway at Douglas Park or from an intercept of that route with the Wentworth Railway.

Option Group	Option	Line of Access (with respect to runways, etc)	Distance (km)	
			From MDR	From MSR
	7	Under car parks	3.5	-
		Under WSP (N)	-	10.0
East	3	Under WSP (W)	8.0	-
		Under car parks	-	13.5
	4	Under WSP (W)	8.0	-
		Under car parks	-	13.0
	5	Under XW	8.5	
		Under WSP (N)	-	14.5

Summary of rail option analysis

Further work will be required on the above options. All would meet the assumed volume of air passengers and workers to be transported by rail. The integrated service via the Maldon-Dombarton line would meet background needs of the Illawarra but may struggle to provide a world class Airport Express Rail service unless the line is duplicated. The purpose built line from the north may provide a faster and more attractive exclusive Airport Express route that might be, as has been noted, part of a wider HST/VFT route.

1.5.6.2 Road transport demand

The trend extrapolation of baseline traffic on key access roads over a 50 year period to 2060 results in substantial traffic volumes, requiring significant infrastructure upgrades regardless of any airport development. The scope of the work, however, is such that baseline road upgrades could not be fully considered in the context of wider network performance or management and budgetary strategies[45]. The road review takes account of earlier studies[46]analysis as part of the Joint Study analysis of an airport near Wilton. Computerised transport network modelling would provide improved outcomes for baseline plus airport traffic volume estimates balanced across the wider road network and land use/ demographic outcomes. The scale of this growth in road and rail transport demand[47] is very substantial. For the airport alone, 70 million passengers per year could equate to a daily transport task of:

- Over 200,000 air passengers on a busy day;
- More than two Sydney Olympic Stadiums of people per day;
- Two existing Sydney Airports passenger turnovers per day;

[45] Airports have a multiplier effect on the extent and location of population, workforce and land uses. An airport might vastly increase the number of jobs or houses in areas surrounding these sites. This has not been considered to date. There is a risk that this may impact and change assumptions made in this study. Land use is an intrinsic driver of transport demand. If land use is not planned and reserved and zoned well ahead of time, there is a risk of:

- inappropriate land uses or locations near the airport e.g. residential
- inability to create or widen road and rail reserves (note that this includes areas around key intersections which will need area to accommodate *"flyover"* full flow ramp solutions, and a buffer width to protect nearby communities from noise.)
- inability to achieve the straight flat reservations required for express or high speed mass transit
- inappropriate frontage land uses such as fuel/service stations and fast food outlets with frontage access that compromises arterial road flow and road safety.

[46] Reviewed and based on Arup analysis in Part 5 of Joint Study.

[47] Not all of these passengers will need road and rail transport external to the airport, depending on the proportion of passenger *"hub"* transfers from aircraft to aircraft within Wilton airport.

- Similar to the Sydney CBD Journey to work by all modes in 2005 (albeit concentrated in a morning peak); and
- Six times the Parramatta CBD journey to work by all modes in 2005.

As outlined in **Table 1.5**, this Working Paper made mode split estimates that allocate 20% of airport land transport patrons to rail. There is no certainty that that proportion will be achieved, but could be viewed as a lower case scenario from a road transport perspective and level of capacity required. Road capacity restraints would be relieved if that proportion of rail travellers can be increased in design development. Airports such as London Gatwick and Amsterdam Schiphol have 30% and 35% by rail respectively.

Road

Trend growth rates for the F5 Freeway to 2060 with addition of airport-related traffic indicate that extensive work will be required to provide capacity for transition to a maximum airport at Wilton. The suggested scale of widening of the F5 and connecting roads over a long distance implies significant expense.

This Working Paper process was not in a position to estimate any further road widening requirements in detail. However it is likely some of this growth can be absorbed by: undertaking the following:

- Further widen F5 (also create at least one extra lane in each direction by narrowing lanes, median, and shoulders) or a parallel route[48.] The choice of a parallel route would depend on the ability to continue widening the motorway carriageway under bridges etc, and may be easier to construct separately to serve dedicated airport traffic from say the M5/M7 junction;
- Extend motorway conditions to well south of the airport turnoffs at Picton Road;
- Improve intersection of F5 with Picton Road to full flow grade separation, at least the north to east, and east to north movements;
- Establish a second full flow grade separated interchange with F5 to serve the airport and airport-related business parks, perhaps near Douglas Park Drive;
- Improve the interchange of Picton Road with F6 to full free flow grade separation;
- Widen Picton Road to six lanes divided road (this refers to six effective lanes operating at the assumed LOS capacity. The steep terrain and high proportion of heavy trucks would mean much of the road would need auxiliary climbing/overtaking lanes for slow vehicles climbing or descending, an overall width of eight lanes);
- Establish a full flow grade separated intersection of Picton Road with the airport access roads. For the purposes of evaluating the site options, this interchange was assumed to cover an area up to 0.5 km by 0.5 km.
- Improve /widen F6 from Sutherland into the Illawarra
- Improve the capacity of Appin Road to at least a six effective lane divided road to attract through traffic between western Sydney and the Illawarra away from Picton Road and the airport
- Improve the link between Appin Road and Picton Road by by-passing the existing bottleneck of the Broughtons Pass gorge road and bridge, providing 2+2 lanes to serve mainly local traffic demand;
- Undertake local works and climbing lanes on all arterial roads to reduce grades and minimise the slowing of general traffic by heavy trucks;

[48] The analysis suggests an additional 3 freeway lanes in the peak direction, widening the existing 2+2 lane motorway to a 5+5 lane motorway.

- Create an effective local area road hierarchy and network to serve the areas around the airport extending out to Appin and Picton;
- Introduce time of day tolling and road pricing and High Vehicle Occupancy (HOV) Lanes;
- Improve Intelligent Transport Systems, resulting in reduced vehicle headways and increased traffic flow per lane;
- Manage the airport car parking supply and pricing to constrain the growth of road traffic, spread the peak periods, and encourage higher numbers of passengers per car, carpooling, and car share; and
- Provide excellent safe local walking and cycling tracks to encourage walking and cycling, and reduce motorised local trips within the airport and adjacent business parks and urban development.

As the airport approaches 70 million passengers per year and rail links are added, bus services to Sydney and Wollongong would require review in the context of the new rail services. Buses would likely still be required for areas not accessed via rail to Sydney and north, Wollongong, Canberra and the rest of NSW. Bus HOV lanes will likely be required on the F5 and F6.

Figure 1.12 shows the key road upgrades identified for a transition to the maximum airport scenario at Wilton.

A 70 million ppa airport located in the Wilton Study Area is recommended to be served by the following major road connections:

- Primary airport link from airport to nearest national route/motorway;
- Secondary airport link from airport to national route/motorway; and
- Tertiary airport link from the airport precinct to the local road network.

A key strategic design parameter is that the Primary airport link road to the airport approach be preferably via the *"open"* end of the three runway array, because roads under actual runways will be very expensive, have poor sustainability in terms of lighting and ventilation, road safety issues in tunnel, be difficult to upgrade or repair, and pose security threats such as fire or bomb threat. There are also aviation interaction effects such as windeage, headlight overspill, and driver/pilot distraction. (This assumption may be questioned and re-tested in later analyses.)

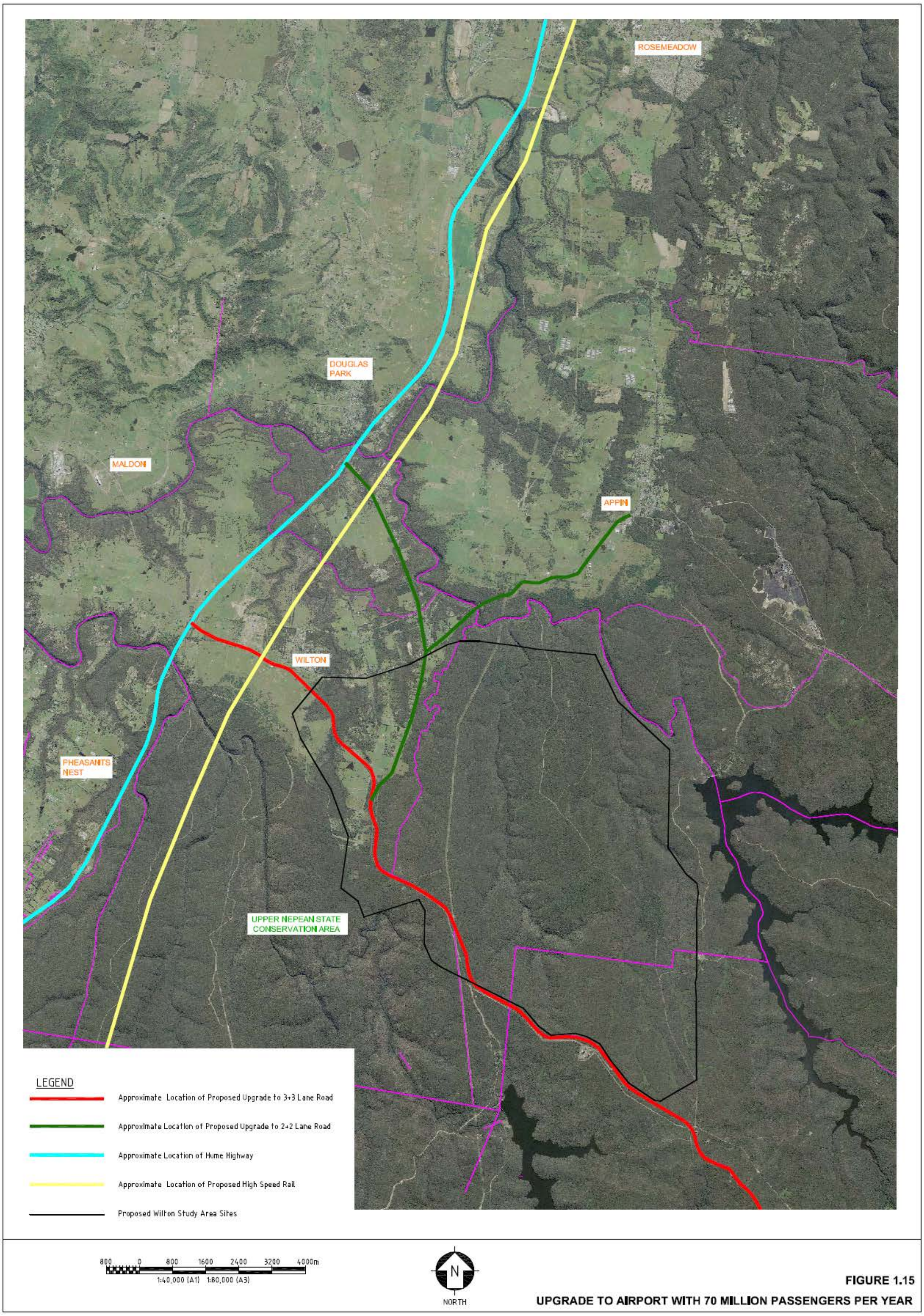
This *"open"* end of the runway array is also the focus of the option designs for commercial development and car parks. Because the airport options and layouts vary considerably, an Airport Gateway or ground transport centroid was estimated to be located in each option at the midpoint of a straight line joining the ends of the Runway End Safety Areas (RESA) areas at the open ends of the runway array.

The Primary route then connects the Airport Gateway back to a common timing point at the intersection of Route 88 Picton Road with Almond Street on the edge of Wilton township.

Road types proposed are:

- **Primary Airport Road**: 3+3 lanes to the airport site, 70 m reserve minimum, 100 m desirable;
- **Secondary Airport Road**: maintain through road capacity on Route 88, 3+3 lane capacity with climbing lanes requires a 4+4 reservation. 70 m reserve minimum, 100 m desirable;
- **Tertiary Airport Road**: provide local road link for local goods, service, and some backup, 2+2 lanes, 30 m reserve minimum. Links to local area probably via a new bridge across the Cataract River to avoid the bottleneck of the Cataract River Gorge Dam;
- **Airport Perimeter Road** within the site is 1+1 lane within the plotted boundary and that no external perimeter road is required for airport operations.

Figure 1.12 Proposed works for airport with 70 million passengers per year at Wilton



These roads would ideally form some sort of ring road around the airport site for redundancy and, although this is not considered absolutely necessary for all major airports such as Hong Kong, may be a factor mitigating against some of the airport sites options where the terrain would make a ring road very expensive.

Douglas Park Drive (currently 1+1) may be easier as a connection to the M5 because of the existing urban area, rather than a new route to the M5 or a new Wilton Road crossing of the Cataract River gorge. It currently has a separate crossing of the Nepean River from the M5. The design of this connection would depend more on the geometric requirements of the rail alignment.

Transport infrastructure geometry is subject to a complex range of criteria[49] including:

- Aesthetics and urban design;
- Branding and public perceptions as “Gateway” to the airport and to NSW;
- Operating speed;
- Network efficiency;
- Safety;
- Terrain and geotechnical and flood conditions;
- Vehicle fleet including trucks and road reserve public transport (which may include rail); and
- Capital and operating costs.

Road geometry is more flexible than rail geometry but at a design speed of 80 km/h with a modest 3% superelevation suggests a minimum curve radius of some 300 m increasing to 1500 m at a design speed of 130 km/h. Horizontal curves of 600 m radius are desirable, with 450 m minimum desirable to reduce accidents on rural roads. In areas with a non-rural environment a minimum interchange ramp radius of 90 m may be considered.

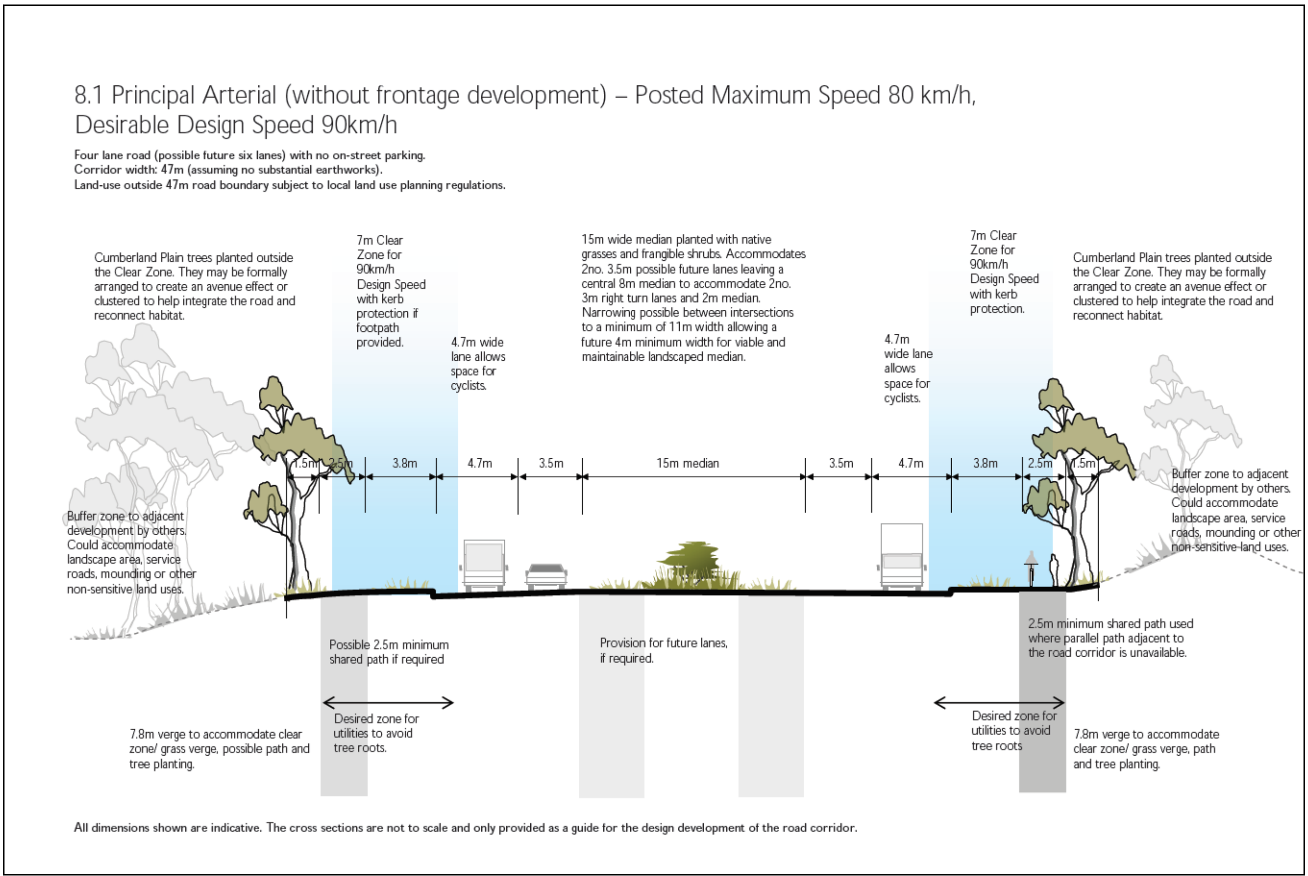
Cars lose little speed up to 5% grade, but trucks need auxiliary climbing lanes above this grade to maintain the capacity of the general through lanes. This suggests desirable road grades of less than 4% and maximum desirable road grades of 6%.

Road geometry was generally considered independently of the surface rail and underground rail links. The road reservation and road design should arguably not preclude the future addition of some form of mass rapid public transport within the same reservation. This suggests road grades of not more than 2% and horizontal curves of not less than 1000 m. The Kwinana Freeway in Perth, Western Australia, has a twin track rail reserve in the median of about 15 m width plus 5+5 lanes of traffic and bus lanes.

Typical road cross sections are shown as follows, inferring a minimum reserve width of 70 m and a desirable reserve width of 100 m where there is no existing knowledge or control of the frontage land use development types or setbacks. Vehicle access to individual sites would be served not from the frontage road but from separate service roads.

[49] The routes for the supporting infrastructure for each site were nominated based on a high level desktop study only. There is a risk that they prove to be not feasible and subsequent routes that are developed are more expensive.
High urban design standard airports and their supporting infrastructure are subject to a policy decision as to the level of urban design employed (i.e. world class or basic). Assumptions made in this report may be incorrect and this will impact on future costs estimates.

Figure 1. 13 Typical principal arterial road in 70m to 100m road reserve[50]



Major junctions

The width of mid-block road reserves are often tested more widely at major interchanges, with extra width required for auxiliary on/off ramps and associated earthworks, often up to two to three times the road corridor width. A desirable minimum spacing of motorway junctions is 2 km, often in urban areas, with double this in rural areas. The key junctions are:

- F5 / Route 88 - “signature” airport address - free flow;
- F5 / Douglas Park Drive / local route - possible signature airport address - free flow;
- F6 / Route 88 - free flow;
- F5 / Route 69 - near Appin, mooted by RMS, would supplement an airport bypass from the Illawarra and ports to western Sydney; and
- Wilton airport interchange - of Primary / Secondary / Tertiary routes with the airport access.

[50] Typical Principal Arterial road in say 70m road reserve including 10m buffer each side (ex Growth Centres Road Framework, RTA NSW); desirable reservation width 100m.

1.5.7 External road and rail layout for airport options

The following figures (provided at the end of this section) illustrate a road layout response based on the above criteria.

- PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 1 - WP-301015-03019-RAR-SK-001;
- PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 1S - WP-301015-03019-RAR-SK-001S;
- PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 2- WP-301015-03019-RAR-SK-002;
- PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 3 - WP-301015-03019-RAR-SK-003;
- PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 4 - WP-301015-03019-RAR-SK-004;
- PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 5 - WP-301015-03019-RAR-SK-005;
- PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 6 - WP-301015-03019-RAR-SK-006; and
- PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 7 - WP-301015-03019-RAR-SK-007.

A comprehensive area-wide road and transport hierarchy will be required in due course to protect local communities and businesses, and provide access by private vehicle, public transport, and walking and cycling without the need for local trips to use primary arterial roads.

1.5.8 Land Transport factors influencing the most suitable site for airport development

Risk factors that may impact the viability of airport development at Wilton are discussed within the above sections and in other Working Papers. Land transport factors and impacts are summarised in the following table.

Table 1.8 Land Transport factors influencing the most suitable site for airport development

	Option	**1**	**1S**	**2**	**3**	**4**	**5**	**6**	**7**
ROAD AND RAIL	Primary Existing Road Access from Sydney and Canberra	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road	F5 and Picton Road
	Secondary Existing Road Access from Sydney and Wollongong	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road	F6 and Picton Road
	Tertiary Existing Connecting Roads	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road	Picton Road, Wilton Road and Appin Road
	Alternative New Primary Access Point	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park	Through Douglas Park
	Proximity to Sydney Market	Same	Same	Same	Further	Further	Further	Same	Same
	Differential Primary road distance from Wilton timing point to Airport (from Sydney)	6.5km	3.5km	2.5km	8km	6.5km	18.5km	6km	2.5km
	Proximity to Canberra and Regional South-Western NSW Market	Same	Same	Same	Further	Further	Further	Same	Same
	Differential Primary road distance from Wilton timing point to Airport (from Canberra)	6.5km	3.5km	2.5km	8km	6.5km	18.5km	6km	2.5km
	Differential Road Distance to the Illawarra and South Coast	Further	Further	Further	Much further	Much further	Closest	Further	Further

	Option	1	1S	2	3	4	5	6	7
	Primary Airport Road access tunnel under runway	No	No	No	No	No	No	No	No
	Picton Road (Route 88) under Runway End Safety Area (RESA)	Yes	Yes	No	No	No	No	No	No
	Move or tunnel existing Picton Road (Route 88)	Yes	Yes	Yes, but minor	No	No	No	Yes	Yes
	Availability of Alternate Access Road	Yes	Yes	Yes	No	No	No	Yes	Yes
	Primary Existing Rail Access from Sydney and Canberra	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway	Main Southern Railway
	Distance to Central Railway Station	83km	83km	83km	91km	91km	86km	83km	83km
	Travel Time to Central Railway Station	65 minutes	65 minutes	65 minutes	69 minutes	69 minutes	67 minutes	65 minutes	65 minutes
	Potential Secondary Rail Access from Sydney and Wollongong	Unfinished Maldon-Dombarton Line	Unfinished Maldon-Dombarton Line	Unfinished Maldon-Dombarton Line	Unfinished Maldon-Dombarton Line	Unfinished Maldon-Dombarton Line	Unfinished Maldon-Dombarton Line	Unfinished Maldon-Dombarton Line	Unfinished Maldon-Dombarton Line
	Distance to Wollongong Railway Station	44km	44km	44km	52km	52km	47km	44km	44km
	Travel Time to Wollongong Railway Station	34 minutes	34 minutes	34 minutes	38 minutes	38 minutes	36 minutes	34 minutes	34 minutes

	Option	1	1S	2	3	4	5	6	7
	Alternative New Primary Access Point (a)	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment	Via prospective Wentworth Railway Alignment
	Distance to Central Railway Station (a)	79km	79km	79km	87km	87km	82km	79km	79km
	Travel Time to Central Railway Station by high performance train (a)	52 minutes	52 minutes	52 minutes	54 minutes	54 minutes	53 minutes	52 minutes	52 minutes
	Alternative New Primary Access Point (b)	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park	Transect of Main Southern Railway and prospective Wentworth Railway Alignment from Douglas Park
	Distance to Central Railway Station (b)	74km	74km	74km	82km	82km	77km	74km	74km
	Travel Time to Central Railway Station by high performance train (b)	50 minutes	50 minutes	50 minutes	52 minutes	52 minutes	51 minutes	50 minutes	50 minutes
	Primary Airport Rail access tunnel under runway	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

	Option	1	1S	2	3	4	5	6	7
	Relocation of existing transport infrastructure	No	No	No	No	No	No	No	No
	Possible to link to potential High Speed Rail link via purpose built airport connection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	1. Major upgrading of Sydney Regional road network, primarily F5/M5 and M7 to accommodate road traffic drawn to the Wilton Study Area is common to all options. 2. Major upgrading of the existing rail network, to accommodate an airport express service, is common to all options. 3. "Wentworth Railway" – refers to the prospective high speed railway alignment running from Glen Alpine (South of Campbelltown) to Aylmerton (South of Mittagong). 4. Travel times are inclusive of 5% recovery plus typically 2 minutes station stops at Wolli Creek, Glenfield, Campbelltown. 5. It is assumed for all options that there would be connections to suburban rail services to reach the Eastern Suburbs, North Shore, Illawarra and Main Western Lines. 6. Rail access to Canberra is being dealt with by the Commonwealth in their current High Speed Rail Study Phase 2								

1.5.9 Risks that may impact the viability of airport development at Wilton

The use of existing infrastructure demand trends as the basis of existing infrastructure demand trends is the best tool available for forecasting, but may prove incorrect, for example, in the event of the impact of road pricing or oil price shocks reducing car volumes in the peaks or green building sustainability advances reducing the demand for electricity and gas. The infrastructure analysis is generally based on recent historical trends and case studies of existing airports and cities. There is always a risk that the calculated demands and upgrades are inaccurate.

Forecasting the social, land use, and travel patterns of an airport 30 or 50 years into the future is problematic. Changes to IT, communications, technology, and behaviours have the potential to alter the basic consistent historical trends of population, technology, and travel growth applied in this project to date. The purpose of the forecasting in the Working Paper has been to investigate the feasibility of accommodating current trends. The Working Paper does not address fundamental changes to trends from unexpected events such as the *"Peak Oil"* scenario which may or may not lead to reduced travel, major changes to air transport or surface transport technology, or major competing technology such as high speed rail.

1.6 Summary of required actions

The forecasts for the maximum airport with 70 million passengers per year around the year 2060 imply a transformational effect on land use and road and rail systems, and suggest the following transport requirements:

- Primary airport access road connecting to Route 31 near Wilton;
- Secondary airport access road connecting to Route 88;
- Tertiary access network including local access to Route 31 and Menangle Road via Douglas Park Drive, and via Wilton Road to Appin and Route 69 to Campbelltown;
- Tertiary access road (or alternative Primary airport access road for some site options) connecting to Route1 via Douglas Park Drive or rail reservation;
- Improved through traffic capacity on Route 88 and Route 69;
- Major grade separated interchanges:
  - Route 88 / Route 31: full flow;
  - Route 88 / Route 1: full flow;
  - Route 88 / airport: full flow;
  - Route 69 / Wilton Road: diamond grade separation;
  - Route 69 / Route 31; and
  - Route 31 / Douglas Park Drive;
- Other major road infrastructure:
  - New Bridge over Cataract River as part of Wilton Road- Appin Road tertiary access routes; and
  - Upgrade Douglas Park Drive;
- Rail infrastructure including:
  - Airport Express style of fast trains from Sydney CBD Terminus to Wilton Airport with a travel time of less than one hour, departing at least four times per hour, using existing infrastructure and/or

corridors, with selected stops to ensure maximum interchange opportunities with the existing rail network;

- Key rail improvements within the Sydney rail system from Central to Macarthur;
- Construction of Maldon-Dombarton line with duplicated track;
- Dedicated rail track partly in tunnel into the airport; and
- Airport Rail Station underground with two long platforms;

- Further rail investigations including:
  - Wentworth Railway alignment;
  - Douglas Park spur railway line alignment; and
  - Reservations to accommodate a link to a future east coast high speed rail network alignment;
- A comprehensive land use plan to address trip generating development around the airport and in the region.

1.7 Key findings

The purpose of this Working Paper is to identify issues relating to land transport access by road and rail that may act as a barrier to airport development at Wilton or differentiate between the eight airport options.

This desk study was undertaken based on existing available transport and land use data, publicly available policy and planning documents, and estimates of airport usage and transport mode split for an airport used by 70 million passengers per year. Key conclusions include:

- The airport will have a transformational effect on land use and road and rail transport;
- All sites are on undulating topography which would likely require large volumes of cut and fill and tunnelling to provide high quality road and rail links commensurate with the ambience of a Gateway to a large international port;
- The isolated location of the airport provides the potential for some redundancy in the road network given access could be provided from the Route 1 Princes Highway in the east as well as the primary access off the Route 31 Hume Highway to the west;
- The sites for options the eastern sites 3, 4 and 5 are not located on existing major roads and require no relocation of existing roads, whereas the other sites do. (in particular, Picton Road);
- These eastern sites are however further by road and by rail from main markets in the Sydney region and are not easily linked by two separate road connections (in order to provide redundancy in the road networks). In transport terms the western group of site options are slightly closer to their travel markets in the Sydney Region, irrespective of whether these are Sydney CBD-centric or Parramatta-centric, than the eastern group. The extra four to 16 km travel distance to many destinations such as 85 km to central Sydney will be significant to a proportion of the travelling public and to fuel consumption and emissions;
- The proposed Maldon-Dombarton Rail Freight Link may be modified to present some potential to also connect passengers to an airport development at Wilton, providing them access to the Sydney rail network. Alternatively low cost connections to the existing railway by bus could be made but this is unlikely to be very attractive;

- Rail alignment tunnelling could be minimised if the level of the airport is linked to the Maldon-Dombarton line. However, this connection would be dependent on whether coal and passenger services could be safely and efficiently coordinated and integrated on the rail line;
- Background non-airport traffic growth from Sydney, the Illawarra, business parks, and local area, is expected to be substantial, and the overall road network will need to be upgraded to avoid this impacting adversely on the airport and other traffic (in particular, Port Kembla traffic); and
- Regardless of the provision of additional arterial road capacity, an airport is likely to induce more traffic and *"rat running"* on local connective roads, with adverse road safety outcomes. This emphasizes the need for alternative high standard routes. There could be a role for rail and bus to increase the public transport mode split for all other than airport travellers, including airport worker, business park workers, local residents, and school children. This will be key to liveability and reducing congestion on the road network.

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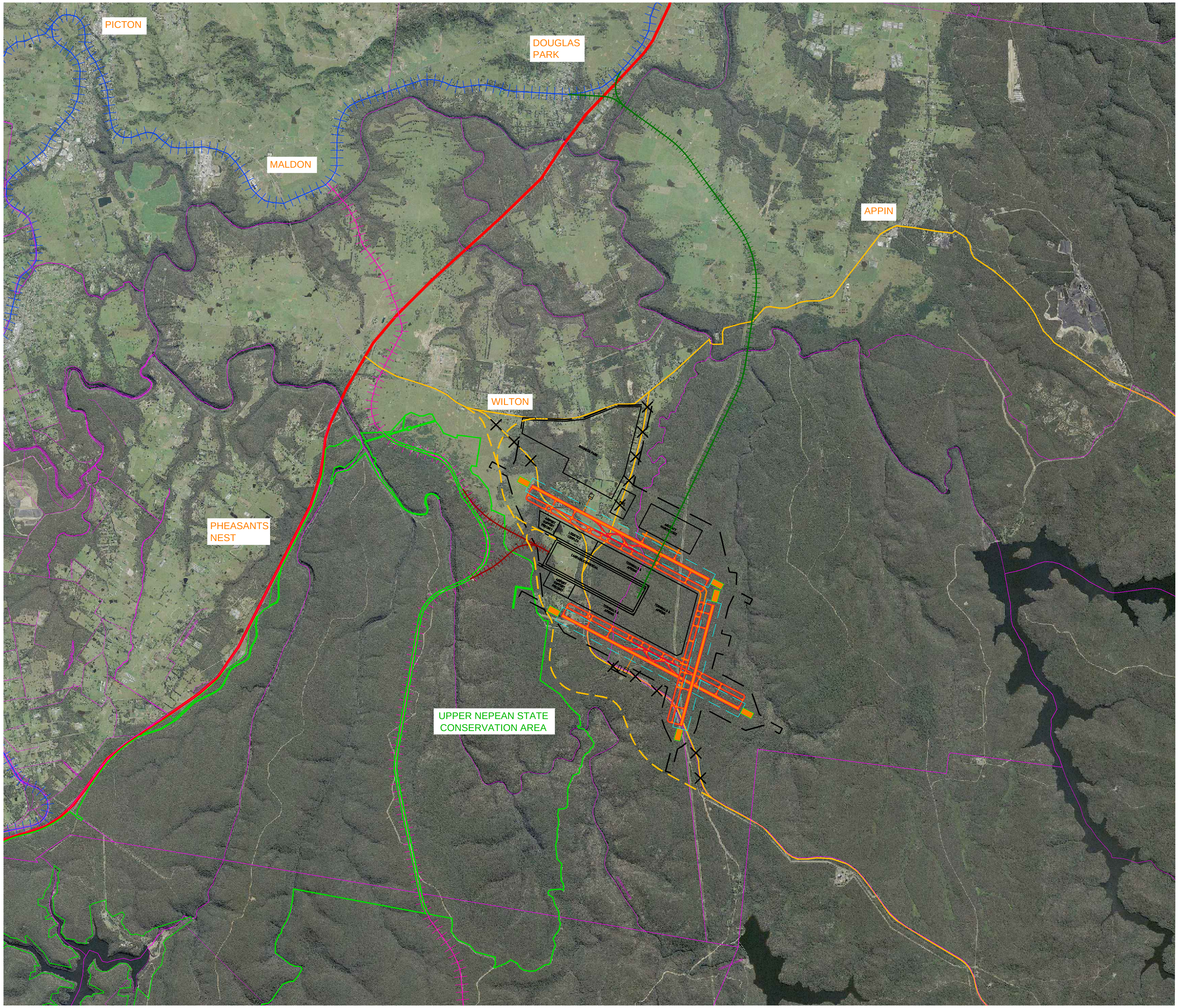

LEGEND

- Approximate Location of Existing Rail Line
- Approximate Proposed Maldon to Dombarton Rail Line
- Approximate Location of Hume Highway
- Approximate Location of Wilton and Appin Road
- Road to be Removed
- New Road Alignment
- Rail - Option A
- Rail - Option B

NOTES

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3. The aerial imagery shown on this drawing was captured in 2008 and has been supplied by NSW Lands and Property. It has been used to assist with the location of road and rail alignments.

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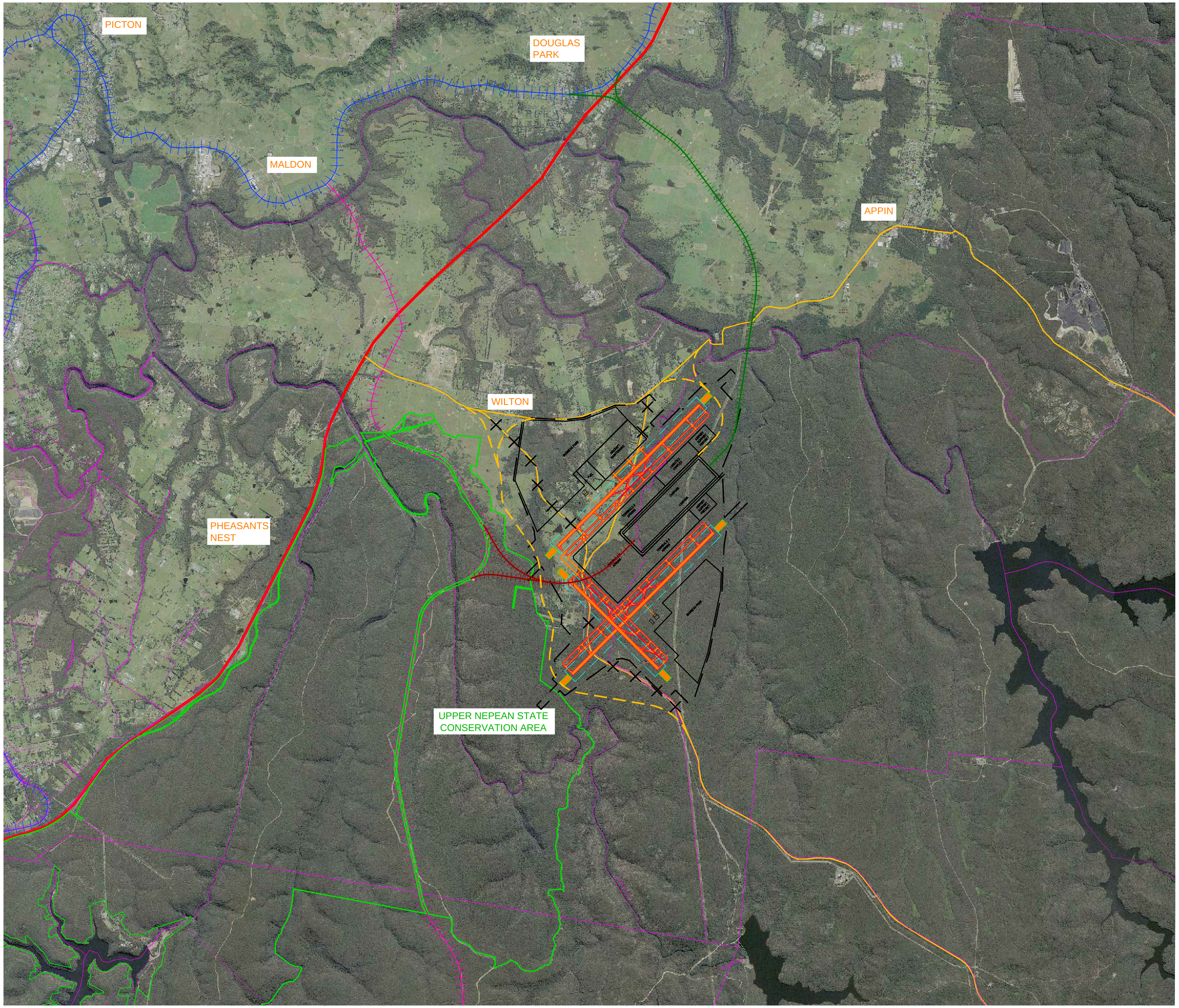
FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 7

WP-301015-03019-RAR-SK-007



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WILTON STUDY AREA
PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 6

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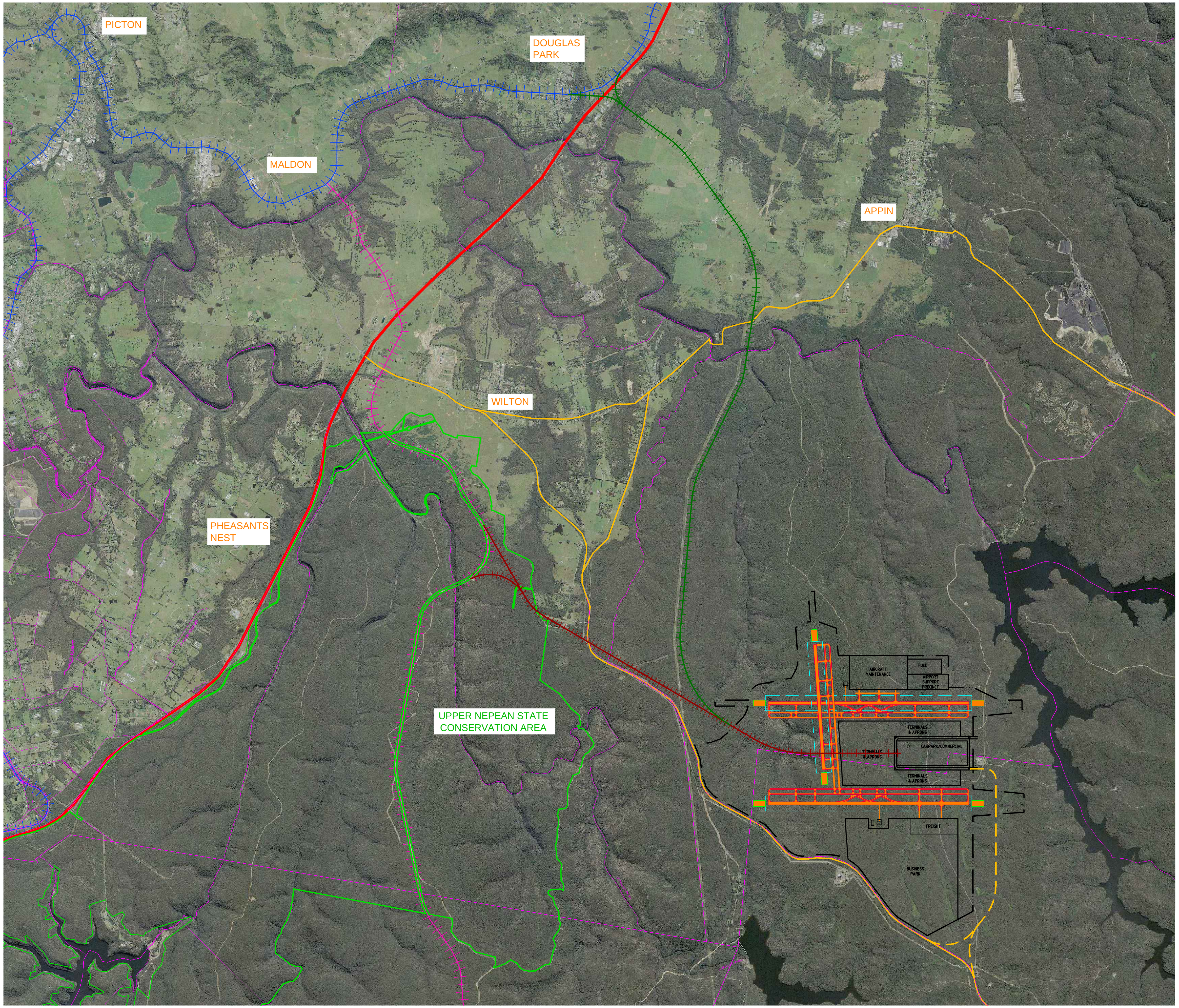

LEGEND

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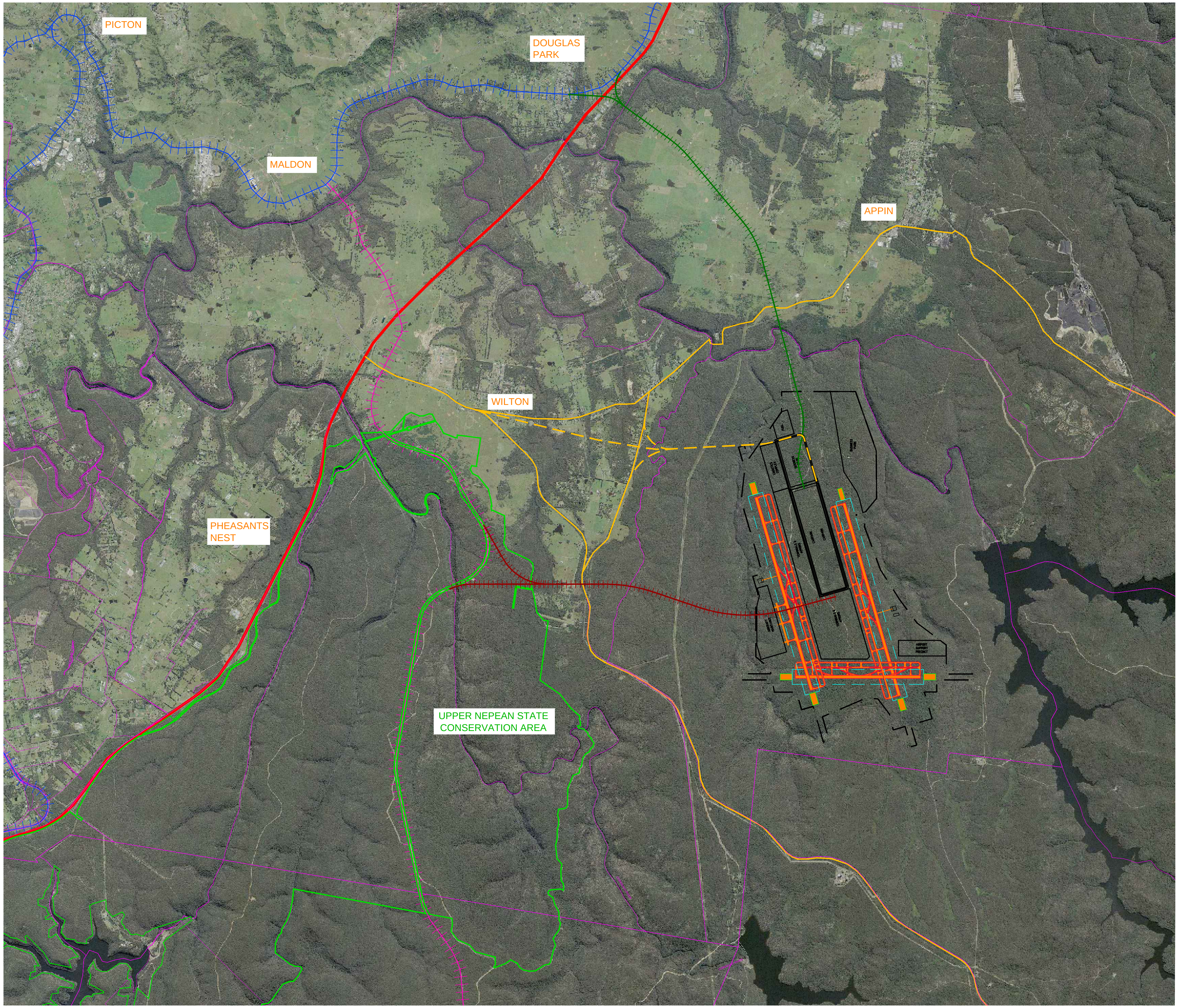

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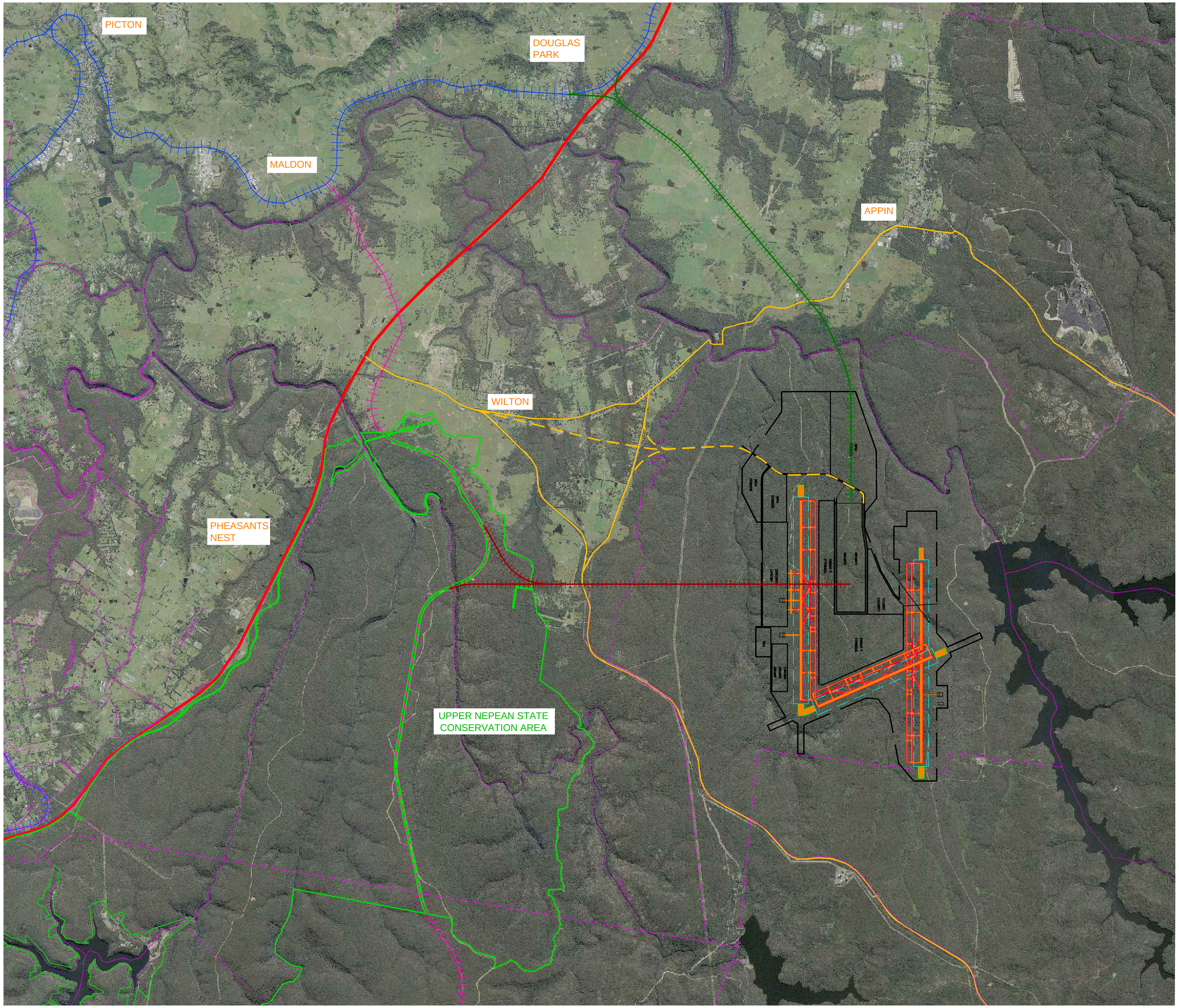

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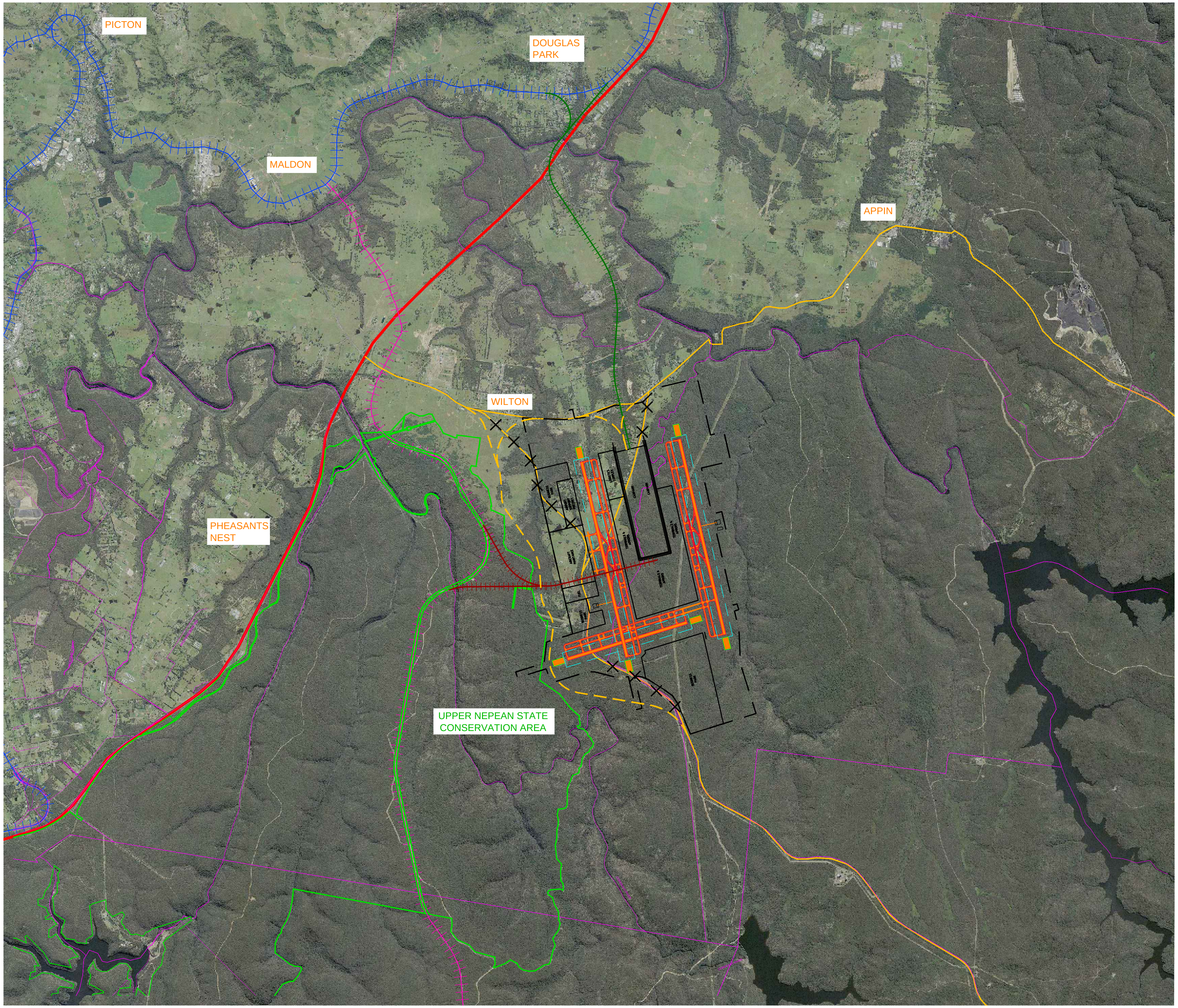

LEGEND

- Approximate Location of Existing Rail Line
- Approximate Proposed Maldon to Dombarton Rail Line
- Approximate Location of Hume Highway
- Approximate Location of Wilton and Appin Road
- Road to be Removed
- New Road Alignment
- Rail - Option A
- Rail - Option B

NOTES

1. 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.

2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.

3. The aerial imagery shown on this drawing was captured in 2008 and has been supplied by NSW Lands and Property. It has been used to assist with the location of road and rail alignments.

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ISSUE	DATE	ISSUE DESCRIPTION
C	31.07.12	ISSUED TO CUSTOMER
B	20.07.12	ISSUED WITH WORKING PAPER
A	18.07.12	DRAWING CREATED

800 0 800 1600 2400 3200 4000m
1:40,000 (A1) 1:80,000 (A3)

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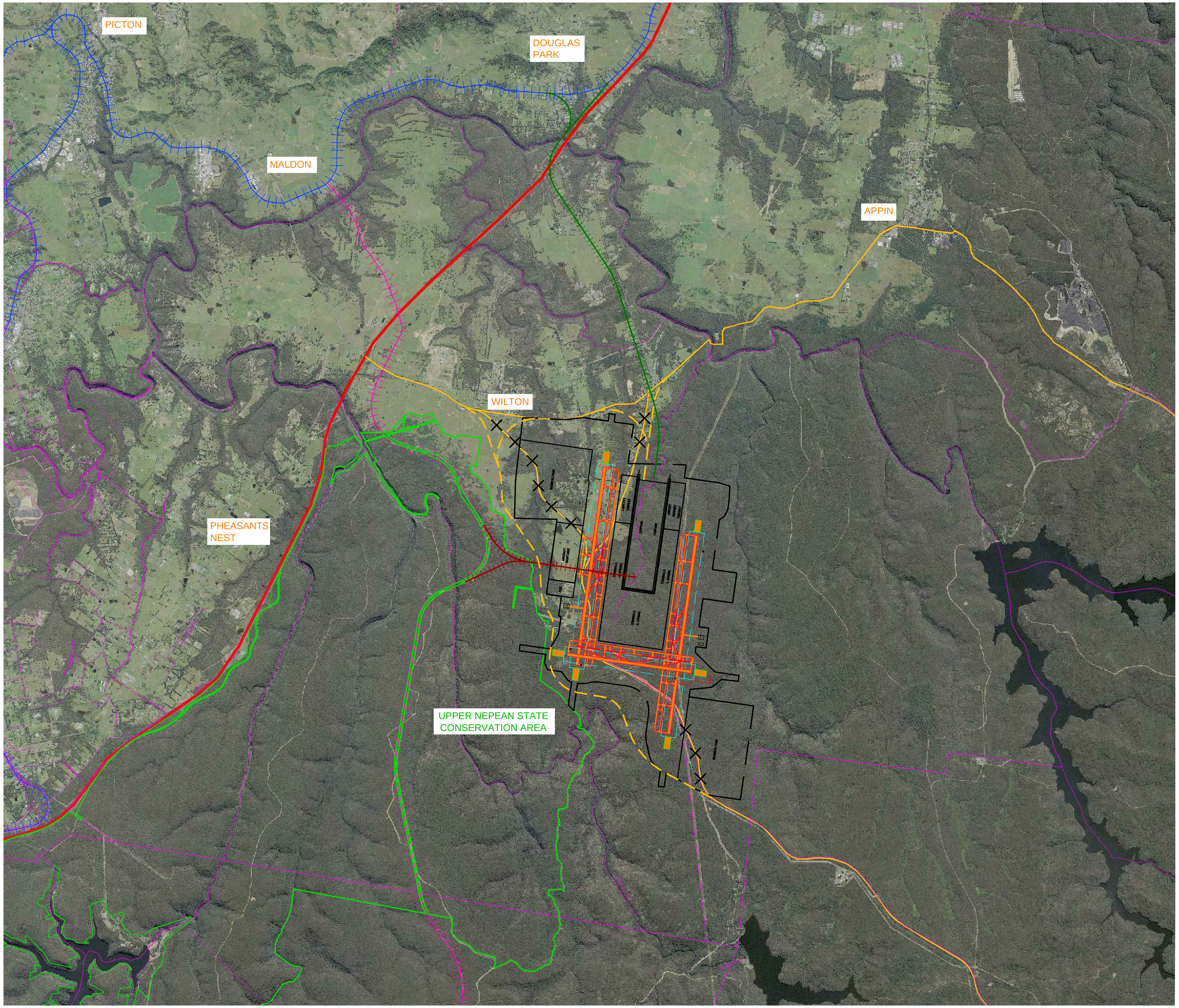
NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 2

WP-301015-03019-RAR-SK-002



LEGEND

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FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 1S

WP-301015-03019-RAR-SK-001S

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PLOT DATE & TIME: 1/8/2012 4:35:13 PM
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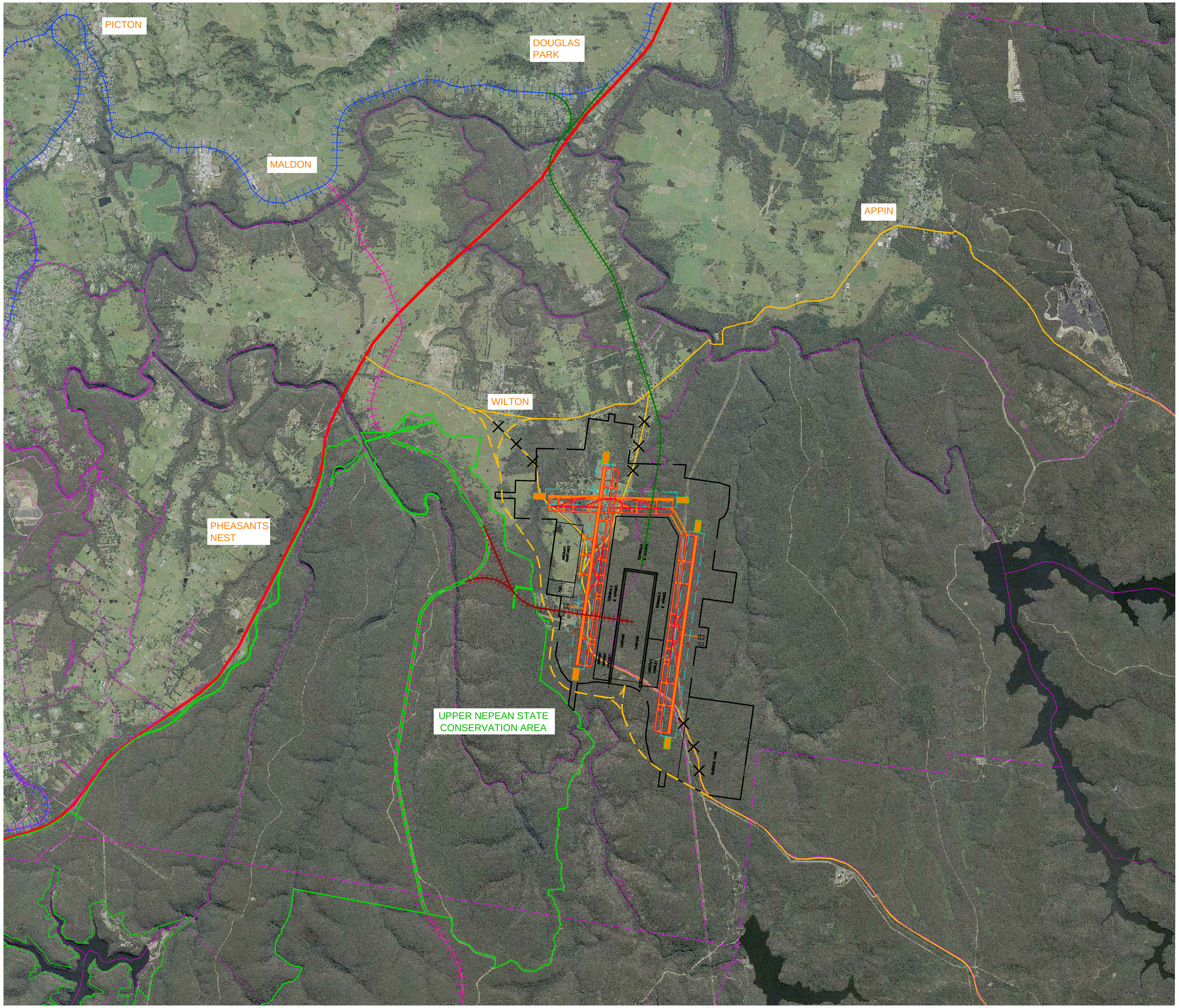

LEGEND

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FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY RAIL AND ROAD CONCEPT PLAN - OPTION 1

WP-301015-03019-RAR-SK-001

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2 WORKING PAPER – EFFECTS ON UTILITIES

SUMMARY

The purpose of this Working Paper is to identify any issues relating to:

- Existing utility assets that may be affected by the proposed airport sites; and
- The supply and reticulation of utilities for the Wilton airport site options (as detailed in Working Paper *Wilton Airport Site Selection and Airport Concepts*).

The utilities considered in this Working Paper are electricity, gas, telecommunications and fuel supply.

The methodology for the study included a review of publicly available information and previous studies, a site inspection and the application of engineering design principles at the concept level. Key sources of information included published development plans and maps of utilities such as TransGrid and Endeavour Energy, the National Electricity Rules (V.49).

Key issues identified in the Working Paper are:

- Need to relocate in the order of 20 km of TransGrid's 330 Kilovolt (Kv) transmission line 17 Avon-Macarthur to avoid airport footprints and / or meet the assumed OLS requirements for all options;
- Need to relocate a 66 kV distribution line, remove some 11 kV and 415 V distribution lines and potentially relocate others, all of which are owned by Endeavour Energy;
- Need to provide two 66 kV distribution lines from secure bulk supply points each capable of supplying an estimated load of 80 megavolt-ampere (MVA) for all options;
- Need to reduce the OLS requirements for Options 3, 4 and 5 if it is not possible to route the above transmission line (Line 17) through the State Conservation Area; and
- The environmental impacts of utility changes should be manageable under the normal planning processes with the possible exception of relocating transmission Line 17 through the State Conservation Area, for Options 3, 4 and 5, which may require the inclusion of this action in a formal EIS process.

2.1 Introduction

This Working Paper:

- Outlines the electricity, telecommunications and gas infrastructure that would potentially be affected by the airport options outlined in the Working Paper Wilton Airport Site Selection and Airport Concepts;
- Identifies and discusses issues associated with the relevant existing electricity, telecommunications and gas infrastructure; and
- The provision of electricity, telecommunications and aviation fuels infrastructure for such an airport.

2.1.1 Methodology

The methodology followed in preparing this Working Paper has involved:

- Review of the material provided for the Wilton site in this study, principally the layout of the runways and the airport footprint,
- Review of publicly available utility documentation on transmission and distribution assets in the south-west region of Sydney and plans for further development (Ref WP16-2, Ref WP16-3 and Ref WP16-4);
- Initial telephone contact with Endeavour Energy (the owner of distribution assets);
- Inspection of the proposed site at Wilton from public vantage points;
- Application of the relevant requirements of the National Electricity Rules (NER - Ref WP16-5);
- Application of concept engineering design principles and cost estimate methodologies for utility infrastructure; and
- Summarising the impact of the proposed sites on the utility infrastructure and in particular, the Obstacle Limitation Surface (OLS), in a relative manner.

2.1.2 Background

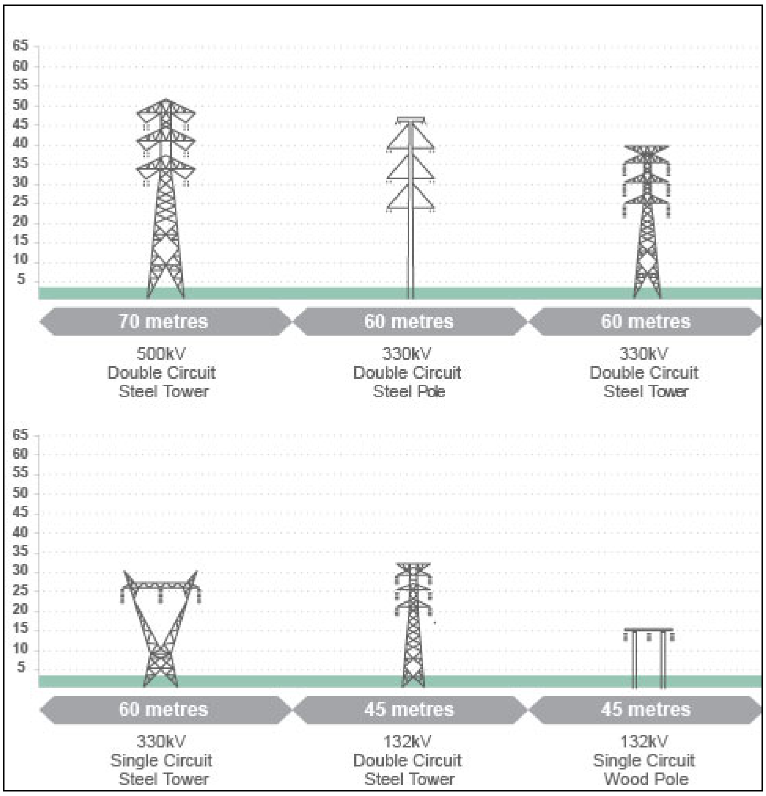
The footprints for the proposed airport sites at Wilton contain electrical infrastructure largely in the form of power lines owned by NSW government utilities. Such power lines fall into two broad categories, namely:

- Transmission power lines; and
- Distribution power lines.

Transmission lines are part of the electricity network that delivers high voltage electricity in bulk from power stations to the three distribution authorities in NSW. The transmission network is owned by TransGrid, a state-owned authority. It is responsible for the operation, maintenance and planning of the transmission network in NSW.

Voltages used in NSW for transmission purposes are 132 kV, 220 kV, 330 kV and 500 kV (kV means a thousand volts). The higher the voltage, the more electricity that can be transmitted and the larger the transmission line to deliver it. **Figure 2.1** shows schematically the relative size and shape of the towers used for transmission lines in NSW.

Figure 2.1 Typical NSW transmission line towers and easement widths



The three distribution authorities in NSW are AusGrid, Endeavour Energy and Essential Energy. These authorities distribute electricity to end-users using overhead distribution lines and underground cables that operate at voltages of 415 V, 11 kV, 22 kV, 33 kV, 66 kV and 132 kV. The higher the voltage, the more electricity that can be delivered by the power line. Most of these lines run along the side of roads with the lower voltages of 415 V and 11 kV being by far the most common lines seen and used to supply electricity to most end users.

Electricity networks in NSW are typically designed for a reliability level of N-1. This means that the failure of an element such as a power line, a transformer or switchgear should not result in loss of supply for a group of customers above a certain number.

Electricity supply in NSW is directly subject to the requirements of the National Electricity Rules (NER) and the NSW Electricity Supply Act 1995.

The footprint for the proposed airport sites at Wilton also contains gas infrastructure in the form of the trunk line for the Wilton – Wollongong underground supply lines, which is an off-shoot of the Moomba – Sydney trunk line. Exact layout mapping was not available from the distributing Authority (APA Group) due to *"security"* reasons. A review of aerial mapping, however, clearly shows the gas easements and warning signs. This allowed for the location of the main trunk gas line.

2.1.3 Key assumptions

This Working Paper has used assumptions regarding the airport consistent with the Working Papers *Wilton Airport Site Selection and Airport Concepts*.

Key assumptions in this Working Paper are detailed below.

- The airport will be a full service airport capable of serving all market segments and accommodating a future parallel runway layout. Accordingly, it will have an annual capacity of about 70 million passenger movements and for the purposes of this study will not include sources of power demand beyond those indicated in the template airport[51] which would otherwise substantially increase the electricity supply required from the current estimate of about 80 MVA. This estimate is based on the electricity demand of similar large scale airports in Australia;

- Future electricity demand from development in the south-west of Sydney and the estimated airport demand can be accommodated from expansion of the existing electricity transmission and distribution network in the region based on a review of the development plans of the utilities; and
- The OLS extends 7.5 km from the end of each runway. Power lines that fall within the OLS are to be removed or relocated if still required. This assumption has a material impact on the length of an existing 330 kV transmission line that requires relocation in all airport options.

2.1.4 Remainder of Working Paper

The remainder of this Working Paper on electricity infrastructure identifies:

- Issues related to existing electricity infrastructure and future airport supply;
- Potential relocation of the Wilton – Wollongong trunk main gas line;
- Concept electricity reticulation for the proposed airport;
- Telecommunication connectivity;
- Aviation fuel line connectivity;
- Potential Environmental Impacts;
- A summary of the issues and their mitigation; and
- References.

2.2 Issues for electrical infrastructure

This Section identifies and discusses the issues as they relate to the electrical infrastructure that would potentially be affected by the airport site and the electrical infrastructure that would be required to supply the airport site options.

2.2.1 Issue 1: Existing affected transmission lines

There is one 330 kV transmission line that is affected to a greater or lesser extent by the locations of all the proposed sites and. as indicated below, all the options will impact on this transmission line.

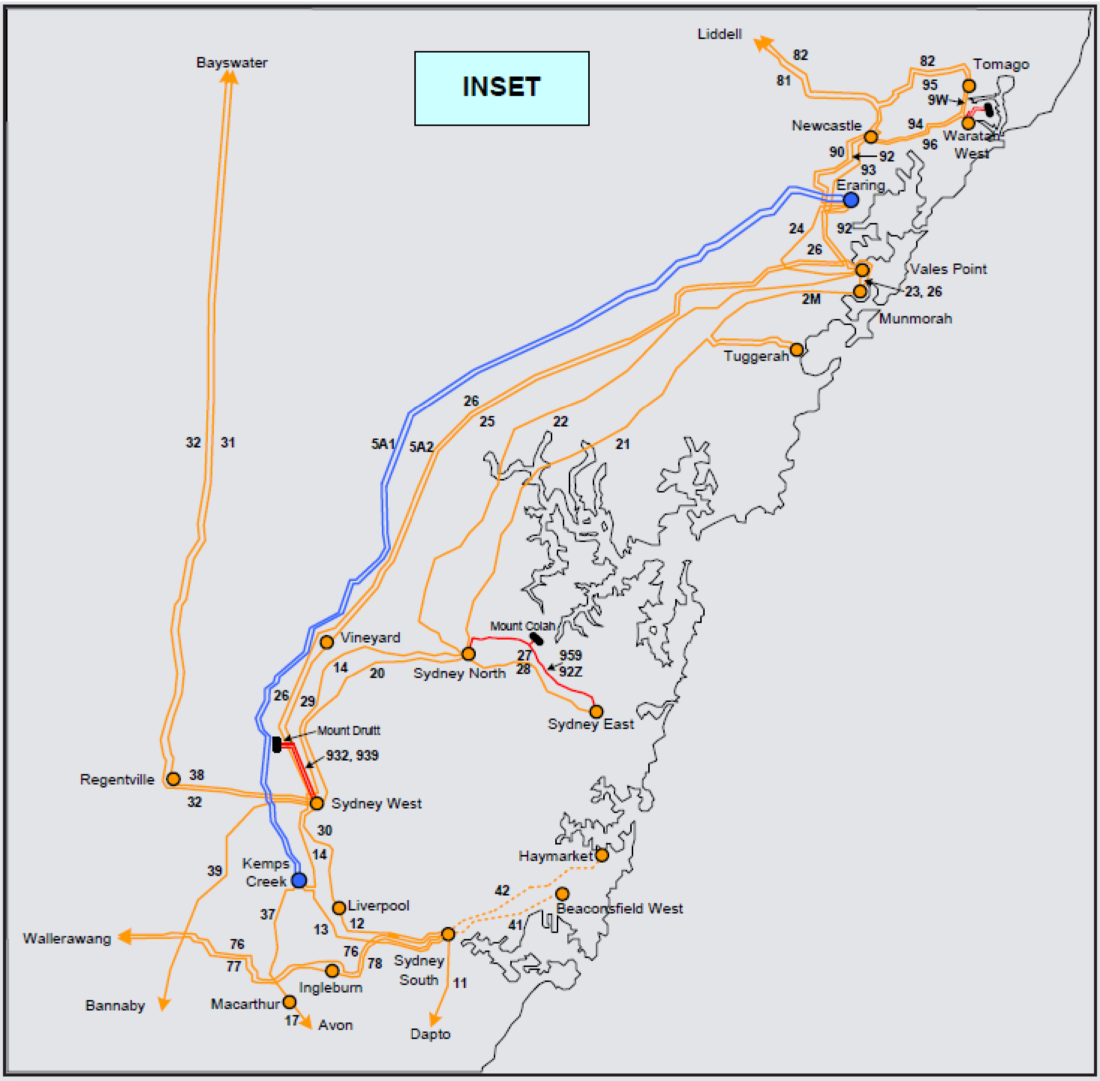
2.2.1.1 Issue description

A single circuit 330 kV transmission line owned by TransGrid traverses the proposed sites in Options 1, 2, 6 and 7 in a general north-south direction. The line lies about a kilometre or so to the west of the proposed sites for Options 3, 4 and 5 and for these three sites it encroaches on the assumed OLS.

The 330 kV line is designated *"17 Avon-Macarthur"* and connects TransGrid's Avon switchyard to the south-east to TransGrid's new Macarthur switchyard to the north-west as shown schematically in **Figure 2.2**.

[51] In other words, it does not include developments that would not be within the boundary of the airport precinct and therefore developed as a part of the airport itself

Figure 2.2 Section of NSW transmission network showing 330 kV line 17 Avon-Macarthur



Line 17 from Avon to Macarthur is shown in orange (indicating 330 kV) at the bottom of **Figure 2.2**. The blue line is 500 kV that will eventually form a ring main around Sydney.

Line 17 is part of a number of 330 kV transmission lines that connect Sydney to the Snowy Mountains hydroelectric scheme in the south as well as power stations in southern NSW and Victoria that form part of the National Electricity Market (NEM) via lines through Bannaby, Avon and Dapto. Depending on demand and supply conditions, power flows north or south over these transmission lines. As such, Line 17 is an integral part of the national network that supports the NEM.

The single circuit 330 kV transmission lines in NSW have a typical tower height of about 30 m though this can extend to over 40 m depending on terrain. No attempt has been made to determine the tower heights on the section of Line 17 that impinges on the footprint of the proposed sites or encroaches on their OLS. The total easement width of such lines is 60 m. Photos of sections of Line 17 in the vicinity of the proposed Wilton sites are shown in **Figure 2.3**.

Figure 2.3 Photos of sections of Line 17

View of Line 17 looking south from Wilton Rd. This section of the line is affected by the assumed OLS for most options.

View of Line 17 looking south across Picton Rd. Most towers visible are affected by the footprint of the proposed sites for Options 1 and 7 and the OLS for Options 3 and 5.

2.2.1.2 Mitigation strategies

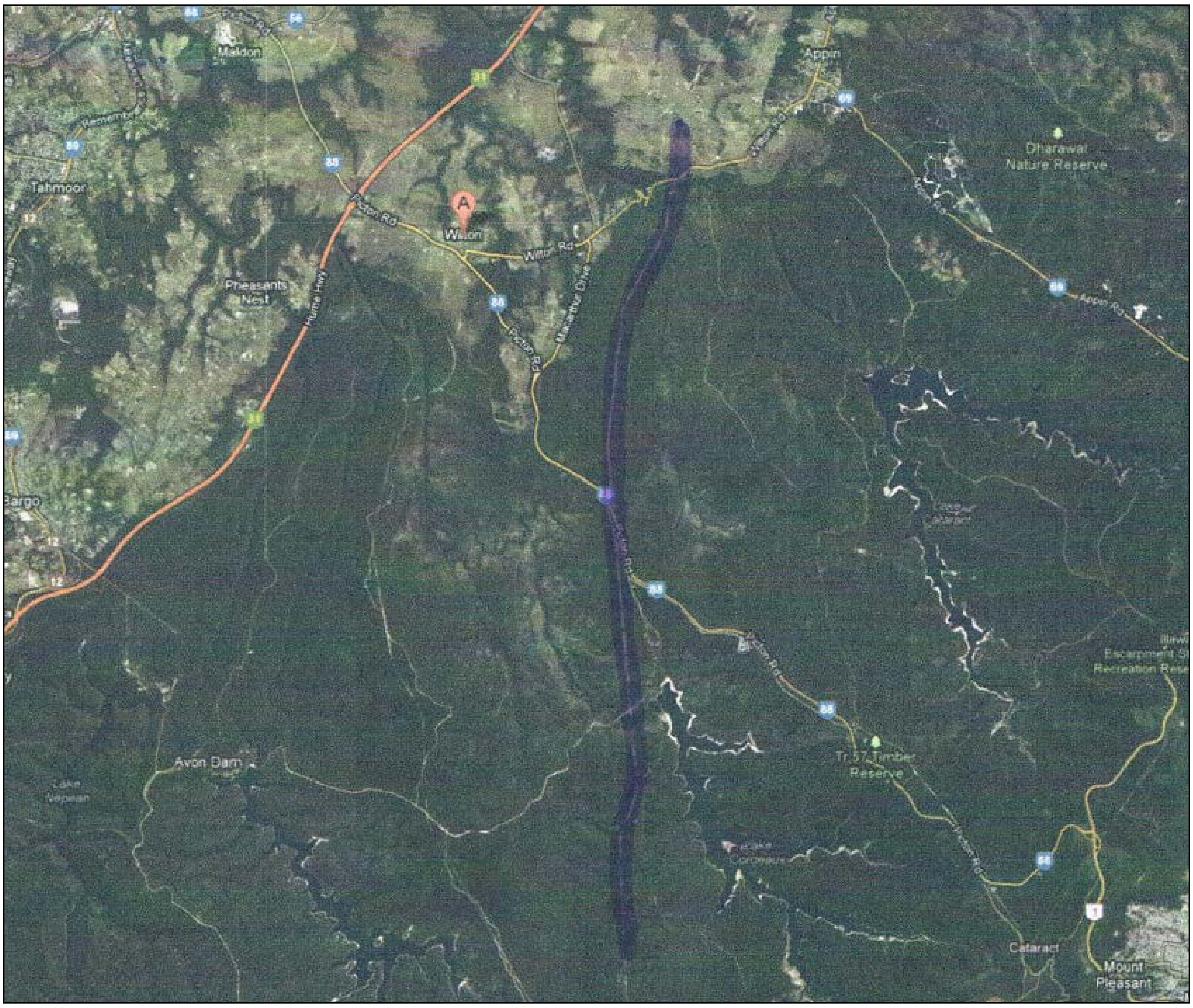
The lowest cost resolution of this issue would appear to be to relocate a section of Line 17 as indicated below. At a concept level, costs for such a relocation are likely to be in the range of AUD1 to 1.5 million (2012) per kilometre but will vary with topography, planning requirements and market conditions. The alternative of undergrounding the line is several times the cost of rebuilding the line above ground and potentially up to an order of magnitude more expensive depending on design and the cost of critical commodities such as copper. From the aerial shown in **Figure 2.4**, there would appear to be sufficient land to:

- The east to relocate Line 17 in that direction for Options 1, 2, 6 and 7; and
- The west to relocate the line in that direction for Options 3, 4 and 5.

It is noted that the land to the east is identified as a *"Special Area"* because it falls within the catchment area for part of Sydney's water supply. It is also noted that sections of Line 17 already lie within this area. Land to the west is identified as *"Conservation Area"* which will impact on line setback for the assumed OLS requirements for Options 3, 4 and 5.

Of the order of 20 km of line deviation will probably be required though this order-of-magnitude estimate will vary with each option and with trade-offs in the design of the deviation.

Figure 2.4 Aerial view showing the route of 330 kV Line 17 (purple) in vicinity of the sites



The easement for Line 17 in the vicinity of the sites is shown in purple running north-south in **Figure 2.4**. For Options 1,2 6 and 7, the line would need to be relocated to the immediate east of Lake Cataract in order to meet the assumed 7.5 km setback for OLS. This would increase the affected line length from about 20 km at present to about 30 km to allow for its relocation this far to the east. If this OLS assumption was relaxed[52], the line could be relocated to the immediate west of Lake Cataract.

For Options 3, 4 and 5, Line 17 needs to be relocated to the west to achieve the assumed OLS limit of 7.5 km from the end of any runway. This assumes that any encroachment on the conservation area is accepted or that the assumed OLS limit is relaxed a little to avoid such encroachment. Relocating the line to the east instead would result in a significantly longer deviation with greater technical difficulty.

Most of the construction should be able to be undertaken without an outage of Line 17. A short outage will be required to cut the new section into the existing line north and south of the proposed site(s). The existing section of line will then be removed.

[52] I.e. if a partial intrusion into the OLS were to be permitted

2.2.2 Issue 2: Existing affected distribution lines

There are a number of distribution lines that traverse the proposed sites for Options 1, 2, 6 and 7. Though there are fewer such lines that traverse the sites for Options 3, 4 and 5 because of their location in the water catchment area, the lines impact on the assumed OLS requirements.

2.2.2.1 Issue description

There is at least one 66 kV distribution line that impinges the footprint of the proposed sites. This line largely runs east-west and is owned by Endeavour Energy. There are a number of 11 kV lines that largely run beside roads that lie within most footprints. Photos of typical 66 kV lines and 11 kV lines are shown in **Figure 2.5**.

Figure 2.5 Examples of 66 kV, 11 kV and 415V distribution lines on or near the proposed site

Typical wood pole and post insulator construction of a 66 kV distribution line that traverses the northern extremities of the proposed site. A cable, possibly broadband, is slung from the pole below the three conductors and overhead earth wire of the line.

A typical 11 kV line (top three conductors), and a three phase 415 V line beneath it, is shown above. This line crosses Macarthur Drive in about the middle of the site.

2.2.2.2 Mitigation strategies

Relocation of any 66 kV distribution lines that impinge on a site's footprint and / or the assumed OLS limit, is relatively straight forward compared to relocating the 330 kV line. In general, the existing line(s) would be re-built to the north of Wilton Rd.

Relocation of 11 kV lines that only supply properties that lie within the proposed site will not be necessary as they will not be required. The lines can be removed with the roads they run beside and the properties they supply. Those 11 kV lines that cross the proposed site to supply other properties will require relocation. This should be a relatively low-cost exercise.

There should be minimal outages of lines as most of the new construction for the relocations can be carried out with the lines in service followed by short outages to cut the relocated sections into the line. The bypassed line sections would then be removed.

These relocations will have some environmental impacts that should be addressable within current planning requirements.

2.2.3 Issue 3: Electricity supply to airport

The proposed airport will require a relatively large supply compared with other loads in the area. This is largely because there are relatively low population densities in the area at present and therefore no large infrastructure such as mega shopping malls. Though there is some industrial infrastructure in the form of cement works to the west of the F5 freeway, the anticipated load of the proposed airport is likely to be larger.

2.2.3.1 Issue description

It has been estimated that the size of airport contemplated in the options for Wilton would require about 80 MVA of electricity supply capacity at a supply voltage of 66 kV. This estimate is based on the capacity of existing similar airports in Australia when adjusted for annual passenger movements. To ensure an N-1 reliability for the supply to the proposed airport, there should be at least two 66 kV power lines supplying the chosen site. Ideally, these two supplies will come from different substations.

The Wilton area falls within the Nepean region of Endeavour Energy. There are two 66 kV zone substations near Wilton; one, Maldon, a few kilometres to the west (see **Figure 2.6**) and the other, Appin, a few kilometres to the east. Endeavour is currently building a 66 kV zone substation at Wilton to meet anticipated load growth.

Figure 2.6 Maldon 66 kV zone substation

The zone substation transforms the 66 kV supply (left hand side in above photo) to 11 kV for reticulation to end-users

The above photo show part of the control building for the substation, some spare equipment and more 66 kV lines to the right

Subject to confirmation from Endeavour Energy, it is unlikely that the current 66 kV distribution system will be able to provide the 80 MVA supply currently estimated to be the demand required by the potential airport with N-1 reliability. This demand would substantially increase if large business parks, commercial areas and a shopping mall were built as part of the airport facility or as a consequence of the airport having been built there.

2.2.3.2 Mitigation strategies

South-west Sydney is a growth area and the electricity supply infrastructure is being augmented to meet this growth. The Macarthur switchyard installed by TransGrid and the Wilton zone substation currently being built by Endeavour Energy are examples of this. Though the plans do not comprehend the proposed airport, the transmission system should have the capacity to meet the anticipated load with an upgrade of the bulk supply points if required.

Over the next decade or so TransGrid is likely to construct the second last "*missing link*" in its 500 kV ring main by building a twin circuit 500 kV transmission line from Bannaby in the south (about 20 km north of Marulan) to western Sydney (nominally its Kemps Creek or Sydney West switchyards). This will substantially improve the power transfer capacity from / to the south of Sydney, so reducing reliance on the 330 kV system of which Line 17 is an element.

Subject to confirmation by Endeavour Energy, it is possible that new 66 kV distribution lines could be built from current bulk supply points at Macarthur and Nepean, with these bulk supply points being upgraded as necessary. Such expansions are part of the normal process of meeting load growth and relatively straight forward for distribution authorities through their planning processes. There are a number of possible ways that Endeavour could provide such a supply. Detailed discussions would be required with Endeavour to develop a concept design in order to develop Level 1 cost estimate. It is understood that this could be undertaken in the next phase of the study. The cost of such a supply would be comparable for all options.

Such supply arrangements will have some environmental impacts that should be addressable within current planning requirements.

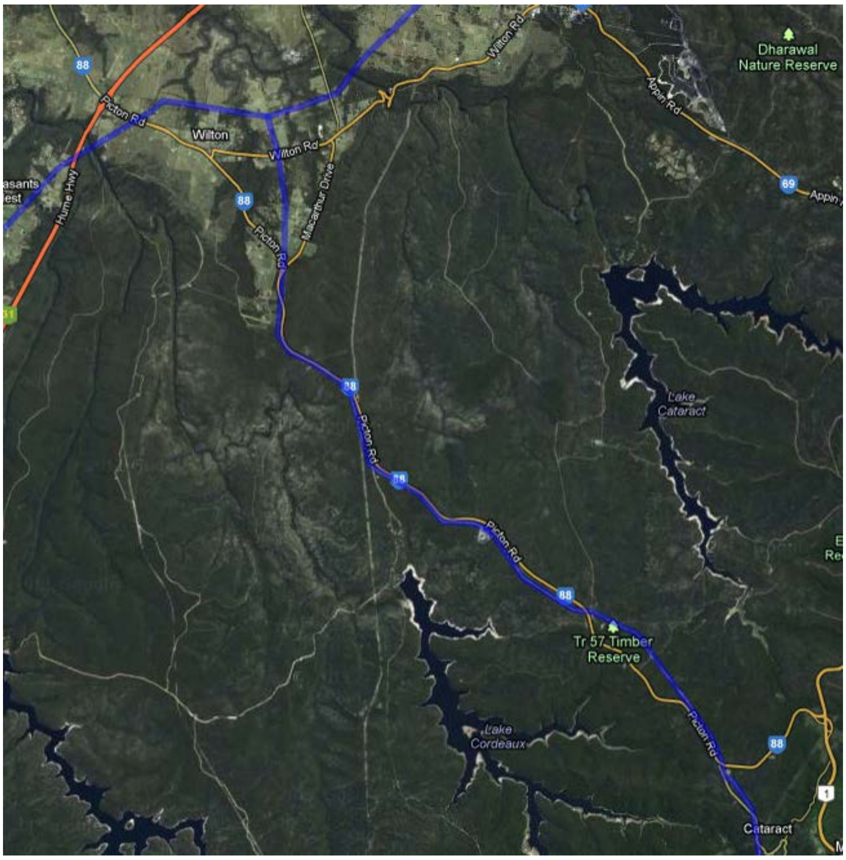
2.3 Existing affected gas line

There is one underground gas line that is affected by Options 1, 2, 6 and 7 of the proposed sites.

2.3.1.1 Issue description

The Wilton – Wollongong gas supply line, the main gas supply to the Illawarra region, traverses the proposed site in a general north-south direction and then generally follows Picton Road, then Mount Keira Road near Cataract. The route of the gas pipeline is shown in **Figure 2.7**.

Figure 2.7 Wilton – Wollongong Gas Pipeline Route



Source: Google Earth Pro

2.3.1.2 Mitigation strategies

The resolution of this issue would appear to be to relocate a section of the Wilton – Wollongong gas pipeline 1 km to the west for Options 1, 2, 6 and 7. Options 3, 4 and 5 would require no alignment change of the gas pipeline.

From the desktop studies, there would appear to be sufficient land to the west for the relocation, though it is noted that the route relocation would need to hug the boundary of the State Conservation Area.

Most of the construction should be able to be undertaken without an outage of the gas supply. A short outage will be required to cut the new section into the existing line north and south of the proposed site, this is foreseen to be between one and four days as an estimate. Re-routing of the gas supply during this period would need to be undertaken to ensure no loss on the network. The existing section of line will then be removed. .

2.4 Concept utility reticulation at the airport

This Section identifies the main elements of the reticulation of electricity, gas, telecommunications and supply of aviation fuels at the proposed airport.

2.4.1 Concept elements

2.4.1.1 Electricity

The main elements for electrical reticulation at the proposed airport to achieve an N-1 reliability criterion include:

- Two 66 kV distribution lines each supplying an on-site 66 kV / 11 kV substation with a 66 kV line linking the two substations. The two 66 kV lines should ideally originate from separate regional substations / bulk supply points and follow different routes;
- The 66 kV distribution lines for each option would follow similar routes, only deviating within the Wilton area depending on the proposed airport site chosen;
- 11 kV reticulation by underground cable within the site with duplicate 11 kV supplies (one from each 66 kV / 11 kV substation) to all critical and / or major loads;
- Duplicate 11 kV / 415 V transformers for all 415 V supplies;
- Uninterruptable Power Supply (UPS) for all critical loads such as essential communications, control facilities and security systems;
- Two diesel generators, one connected to each 66 kV / 11 kV substation, with back start capability to maintain supply to essential services should the grid supply fail despite designing for N-1 reliability; and
- At the +/-50% level of estimation, the costs of supply from the bulk supply points and electricity reticulation within the site would be likely to be comparable for all seven options.

2.4.1.2 Gas

Supply of gas to the airport is not seen as being an issue given the close proximity to the existing gas supply lines and the Wilton Custody Transfer Station (CTS) located approximately 500m east of Wilton Township.

2.4.1.3 Telecommunications

The main elements for telecommunications reticulation at the proposed airport to achieve reliable services include:

- Expansion of the existing Wilton telecommunication exchange. This will need to be upgraded as it currently only caters for ADSL, which does not have sufficient capacity to cope with the proposed usage; and

- Connection to the existing large regional exchanges at Campbelltown and Wollongong, or expansion of the existing roll out of the National Broadband Network (NBN). Scheduled to roll out in the Wilton area by 2015, this will need to be expanded to include the airport footprint. This is not seen as a significant cost as it will be an expansion of the existing roll out if undertaken during 2015.

2.4.1.4 Fuel supply

The main elements for supply of aviation fuels at the proposed airport to achieve reliable services include a direct connection to the existing refineries at Clyde and Port Botany. This would ensure a constant supply. This, however, will be a significant engineering undertaking as the fuel lines will need to run 60 km to connect the site to the existing refineries.

An estimate of the expected capacity of fuel delivery required, based on current Sydney Airport consumption, would be approximately 31 million litres per day for a 70 million per year passenger airport. This would mean a pipeline of 400 millimetre (mm) diameter to ensure delivery of 31 million litres per day from either site. An indicative pipeline alignment has been prepared and detailed as follows.

Port Botany to Plumpton

The proposed route would use the existing route of the Port Botany to Silverwater pipeline to Silverwater, and then proceed via the Silverwater to Newcastle pipeline until it reaches Plumpton. The pipeline would run supply to the Clyde refinery where the fuel will be stored and/or proceed to Wilton via Plumpton depending on the requirements of the airport. The route of this section of the pipeline is shown as a purple line on **Figure 2.8**.

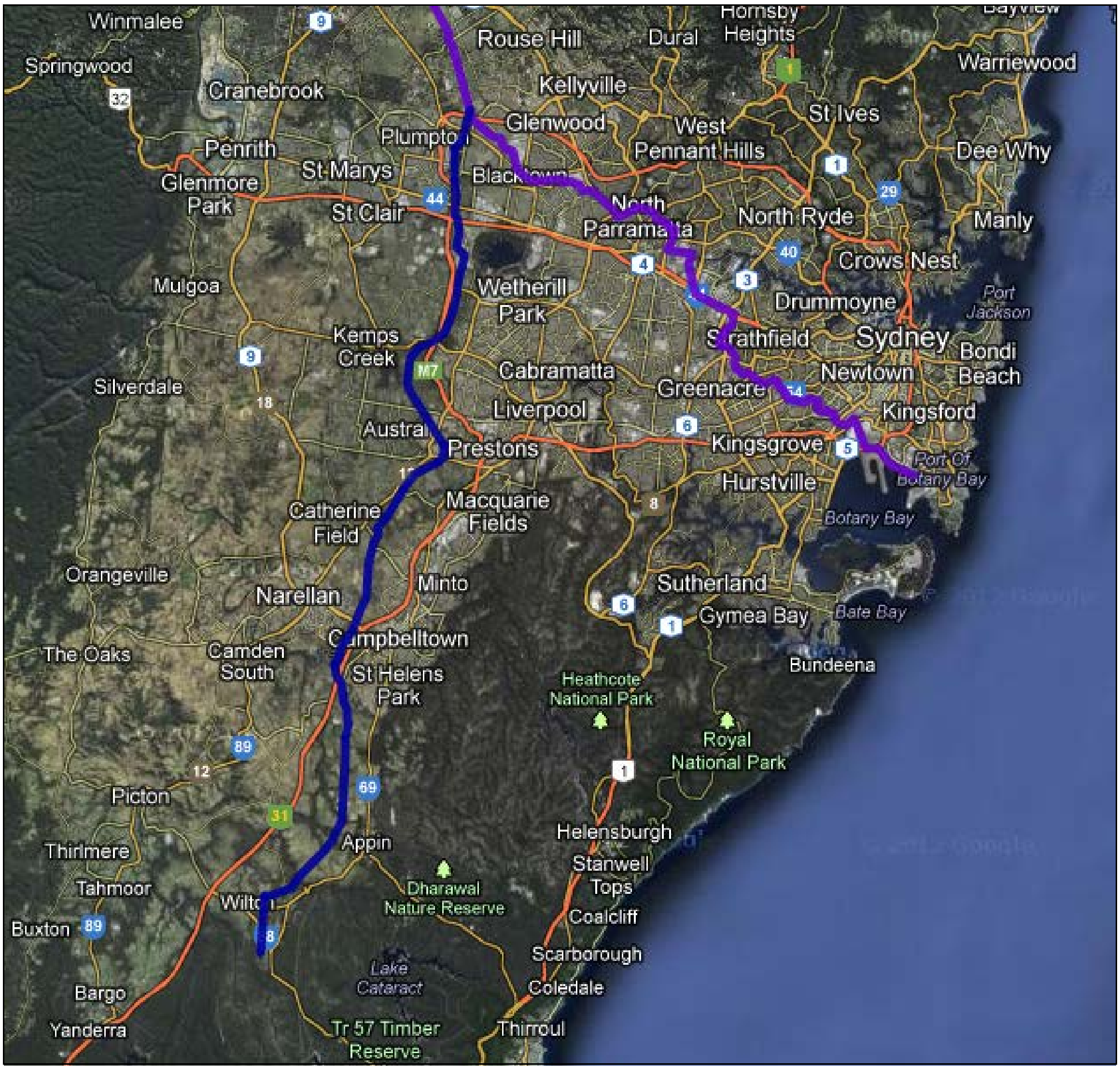
Plumpton to Wilton

The proposed route would continue from Plumpton south through the Jemena facility in Glendenning and follow the existing Easter Gas Pipeline route south until it reaches Wilton. This is shown below in **Figure 2.8** as a blue line.

Both of these routes would require agreement between the exiting easement owner/authority. Using this route would be the most efficient as it would use existing easements and would not require and land parcel purchasing.

An indicative pipeline alignment is shown on **Figure 2.8** below.

Figure 2.8 Indicative fuel pipeline alignment



Source: Google Earth Pro

2.4.2 Assessment of potential environmental impacts

This Section scopes the potential environmental impacts during construction and operation of the relocated electricity infrastructure. Mitigation strategies have been addressed elsewhere herein.

2.4.3 During construction

The main impacts during the relocations of electrical and gas utilities and construction of fuel supply are detailed below.

- Ecological impacts (flora and fauna), especially in the largely undisturbed lands of the *"Special Area"* to the east of the existing 330 kV transmission line. Should endangered species be discovered during the field assessments, mitigation strategies such as changing the route of the relocated line may be required.
- Noise and dust during construction, largely from vegetation removal for the relocation of the 330 kV transmission line;

- Some short duration interruptions to traffic movements during power pole erection and conductor stringing as well as some large truck movements for the delivery of power line components such as poles, steelwork, conductor and insulators; for concrete delivery and construction machinery;
- Potential for indigenous heritage impact, especially for construction of the 330 kV transmission line in largely undisturbed lands;
- Some impact on visual amenity of the new power lines during construction; and
- Potential for impact on water catchments due to run-off during construction and any oil leakage from construction equipment.

All of the above are typical impacts during construction and can be managed within the normal planning processes and the Construction Environmental Management Plans for each as appropriate.

2.4.4 During operation

The main impacts during the operation of the relocated electrical and gas utilities and constructed fuel supply are detailed below.

- Ecological impacts (flora and fauna) in the easements of the lines, particularly the 330 kV transmission line due to the need to keep the easement reasonably clear of some vegetation types. However, this should be the same as the ongoing impact of the existing power lines.
- Some impact on visual amenity of the sight of the new power lines, especially the 330 kV transmission line. However, this should be essentially the same as the ongoing impact of the existing power lines.
- Potential for concern on health from the electromagnetic fields (EMF) of high voltage transmission lines. However, utilities adopt the strategy of prudent avoidance in locating and designing such power lines given the levels of uncertainty of health impacts from EMF. In addition, there should be no change from existing levels.
- Potential leakage of the undergrounded gas and fuel lines.

All of the above are typical impacts during construction and can be managed within the normal planning processes and the Construction Environmental Management Plans for each as appropriate.

2.5 Key findings

This Working Paper has identified:

- A need to relocate in the order of 20 km or more of TransGrid's 330 kV transmission line 17 Avon-Macarthur to:
  - either avoid the airport footprint and meet the assumed OLS requirements (Options 1, 2, 6 and 7); or
  - meet the assumed OLS requirements (Options 3, 4 and 5);
- The cost of such relocation is – indicatively – of the order of AUD$1 to 1.5 million (2012) per kilometre but will vary with topography, planning requirements and market conditions. Relocation for Options 3, 4 and 5 will likely require specific planning approval to route the transmission line through a state conservation area;
- Need to relocate a 66 kV distribution line, remove some 11 kV and 415 V distribution lines and potentially relocate others, all of which are owned by Endeavour Energy. This is relatively low cost compared to relocation of the 330 kV transmission line;

- Need to provide two 66 kV distribution lines from secure bulk supply points to the proposed airport site, each capable of supplying an estimated load of 80 MVA given assumptions including annual passenger movements of 70 million. This is relatively straight forward and occurs for most new developments of this magnitude with high levels of reliability being required;
- Need to relocate the Wilton – Wollongong gas pipeline which is operated by APA Group;
- Need to provide an uninterrupted aviation fuel supply by linking the proposed airport to existing refineries. This would be a very significant cost to the project given the distance from the existing refineries/holding yards; and
- Need to provide a telecommunications network capable of supporting airport operations and capacity of usage.

The issues for each option are summarised in **Table 2.1**. The issues are all resolvable given normal planning requirements and utility practices and availability of funding. The issues are resolvable within the normal business practices of government agencies and utilities providers. No residual impacts are anticipated.

Table 2.1 Issues summary

Issue	Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Relocate 330 kV Line 17	Move least line 8 km east	Move least line 8 km east	Move least line 8 km v	Move least line 8 km west	Move less line 8 km west	Move more line 5 km west	Move more line 7 km east	Move less line 9 km east
Impact of 330 kV Line 17 move to the west	NA	NA	NA	Least entry into SCA	Less entry into SCA	More entry into SCA	NA	NA
Relocate 66 kV Line	Not significant impact	Not significant impact	Not significant impact	Less impact than Options 1, 2, 6 and 7	Less impact than Options 1, 2, 6 and 7	Less impact than Options 3 and 4	Not significant impact	Not significant impact
Relocate 11 kV Lines	Not material	Not material	Not material	Not material	Not material	Not material	Not material	Not material
New airport power supply	All options similar cost	All options similar cost	All options similar cost	All options similar cost	All options similar cost	All options similar cost	All options similar cost	All options similar cost
Wilton - Wollongong Gas Pipeline	Move west ~ 8 km	Move west ~ 8 km	Move west ~ 8 km	No issue	No issue	No issue	Move west ~ 8 km	Move west ~ 8 km

2.6 References

TransGrid 2012 *NSW Annual Planning Report* (June 2012)

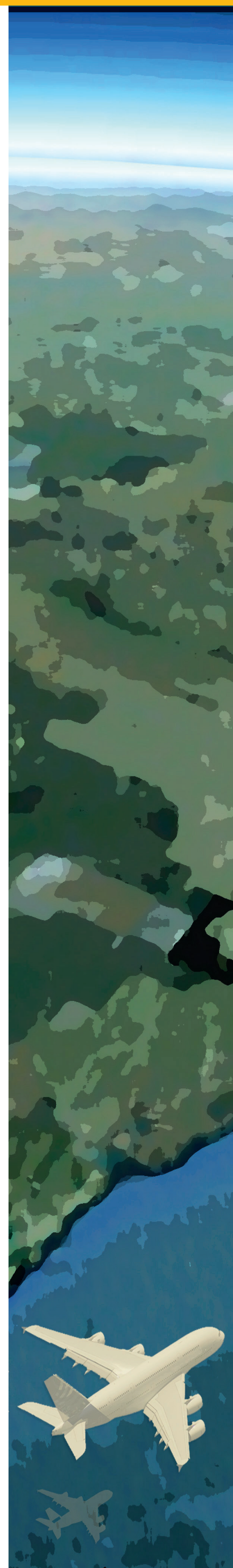
Annual Planning Statement: 2011 Electricity Development System Development Review" by Endeavour Energy (June 2011)

APA Group NSW Energy Infrastructure http://www.apa.com.au/our-business/energy-infrastructure/new-south-wales.aspx

"*National Electricity Rules*" by Australian Energy Market Commission; Version 49; 5 Apr 2012

5

Environmental Analysis



Environmental Analysis

DEPARTMENT OF INFRASTRUCTURE AND TRANSPORT

Further Assessment of Airport Development Options at Wilton

Environmental Analysis

In association with

301015-03019 – EN-REP-002

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CONTENTS

1 WORKING PAPER – LAND CLEARING AND EARTHWORKS

SUMMARY

The purpose of this Working Paper is to identify any issues relating to earthworks and land clearing that may act as a barrier to airport development at Wilton or to differentiate between the airport options. Earthworks and land clearing quantities have been assessed and compared for each airport option.

Earthworks quantities have been calculated using a combination of computer modelling and estimation where modelling would have proved impractical in the timeframe of this work (e.g., for stormwater facilities, road and rail). The modelling was undertaken by developing a proposed surface grading for the runway strip, taxiways, RESA's, aprons, terminal buildings, support buildings and car park/commercial area. This proposed surface grading was compared to the existing surface model to generate cut and fill earthworks volumes. The existing surface model is derived from LiDAR (Light Detection and Ranging) datasets that was captured in October 2009 and had a vertical accuracy of 50cm.

Land clearing areas have been measured to include the following for each option: site footprint, bushfire buffer zone, proposed road and rail easements and proposed electrical easements.

In the majority of airport options, filling across the creek lines has been limited to the upper regions of the catchments which means that conveyance structures are not required to allow creeks to flow from one side of the fill to the other. However, Option 3 fills across Lizard Creek and Option 5 fills across Wallandoola Creek. As these crossings are lower down in the reach of the creek then conveyance structures will be required. Preliminary details of these structures can be found in the Working Paper *Drinking Water Catchment, Hydrology and Drainage*.

1.1 Introduction

This Working Paper describes and quantifies the expected scale of earthworks and land clearing quantities associated with different airport development options in the Wilton Study Area. All the options have consistent airport types. The specifications of this type are described in the Working Paper *Wilton Airport Site Selection and Airport Concepts*. All airport options assessed comprise of the following:

- Two independent wide-spaced parallel runways 4000m long and 60m wide; and
- One cross runway 2500m long and 60m.

At this stage, eight concept airport layout options have been developed for assessment.

Ultimately, this Working Paper will compare the earthworks and clearing quantities associated with each option and outline ameliorative strategies that could reduce costs and the effects on the environment.

1.1.1 Statement of issue

The land clearing and earthworks required to reconfigure land from its natural formation to a state that is able to conform to the basic geometry required to construct an airport poses a significant environmental and financial cost to the construction of an airport.

The terrain in the Study Area is described as '*Heavily dissected montane plateau with open rural and some long linear ridge lines adjoining the deep gorges of the major rivers*.' This type of terrain is not easily converted to the wide flat areas required for airport development. More typically, airports of this size are developed on coastal of riverine floodplains.

For these reasons, the earthworks design needs to be carefully considered to ensure that the airport layout and geometry makes the most efficient use of the existing topography in order to minimize site preparation costs.

1.1.2 Description of issue

The Department of Infrastructure and Transport has highlighted that balancing earthworks cut and fill should be a key consideration (*RFO – Further Assessment of Airport Development Options Scope of Work*) in order to minimize costs of creating platform for an airport.

In addition to this, the following concept design targets were identified with the intention of reducing project development cost but without adversely affecting any other factors (e.g., aircraft requirements, environmental and social factors):

- Minimise volumes of cut and fill earthworks;
- Minimise heights of cut and fill embankments and especially across creek lines;
- Finished surface levels and grades to be in accordance with CASA Manual of Standards 139 – Aerodromes;
- The site grading strategy to conform to the requirements for site watershed, hydrology and drainage (refer to the Working Paper Drinking Water Catchment, Hydrology and Drainage); and
- Land clearing areas to be minimized.

1.2 Summary of issues from SSA Site Selection Programme

1.2.1 Summary of 1985 Proposal

The Draft Environmental Impact Statement ('the Draft EIS') prepared as part of the *Second Sydney Airport Site Selection Programme* in 1985 stated that where possible the airport design would utilize existing topography and natural features to minimize the volume of earthworks and height of cut and fill embankments. However, because of the requirement to achieve relatively flat grades for airport development that study recognized that much of the site would require clearing and levelling.

The airport development was designed to avoid the incised creeks and advantage was taken of the existing site grades and drainage features to divert all site run-off away from the water supply catchment. The runways were aligned approximately parallel to the contours to reduce the amount of deep cut and fill although some sections of runways would require considerable quantities of fill where they crossed creek lines.

The estimated amount of cut and fill is shown in **Table 1.1**. The calculations were based on "nearly level" runways and taxiways and involved up to about 20 m of fill in some locations (mainly to fill the creek beds). Up to 10 m of cut would be required under existing ridge lines across the runway.

Table 1.1 Estimate of earthworks for airport construction (taken from Draft 1985 EIS Report)

Facility	Cut (000m^3)	Fill (000 m^3)	Balance (000 m^3)
Long runway and associated taxiways	2,180	2,755	575 (F)
Short runway and associated taxiways	288	1,293	1,005 (F)
Connecting taxiway	139	37	102 (C)
Terminal and cargo areas	11,556	9,950	1,606 (C)
TOTAL	14,163	14,035	128 (C)

It was assumed that the balance of material would be used in road works and other construction activities and therefore there would be no need to dispose of material off-site.

1.2.2 Relevance of the Draft EIS Proposal

The earthworks quantities from the Draft EIS proposal have limited value for comparison with the current proposals due to the differences in the airport size, layout and location but they may assist in showing the variability that exists when attempting to locate a facility of this scale in this terrain.

Airport size and layout

Table 1.2 compares the total site area and other key dimensional criteria for the Draft EIS and current proposed airport. Option 1 has been chosen for comparison purposes because it has properties which are typical[1] with all the options. From the table, it can be seen that due to the shorter runway length, the reduced separation and the omission of the cross runway the Draft EIS layout allowed much greater flexibility to avoid the incised creeks and utilize the existing topography. For example the shorter 2nd runway length meant that the airport could be constructed without the need to fill across Cascade Creek. This can be seen in **Figure 1.1**.

[1] The options differ only in site area and the separation on the 4000m runways.

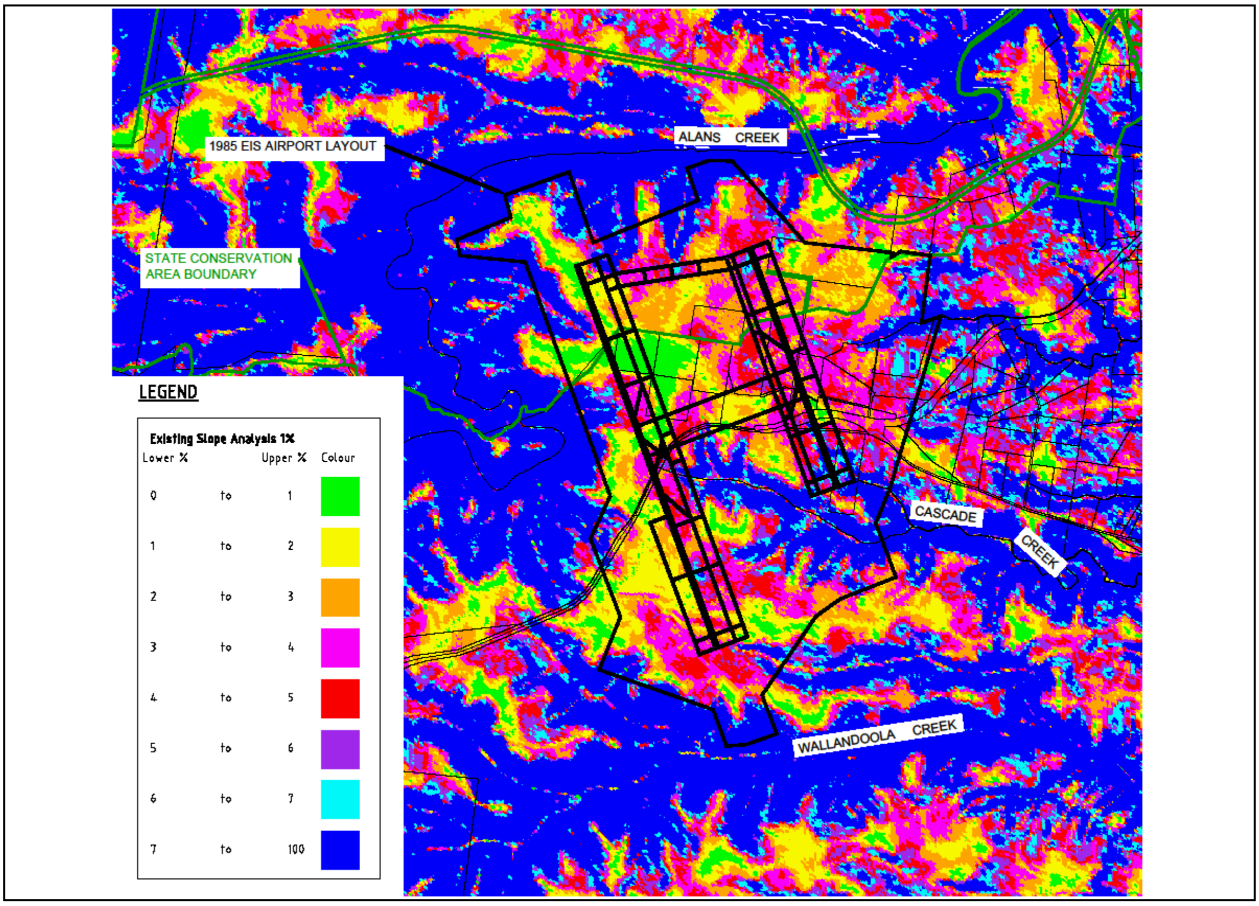
Table 1.2 Comparison of 1985 EIS Proposed Airport and Option 1 2012 Proposed Airport

	Site Area (ha)	Runway 1 Length (m)	Runway 2 Length (m)	Runway Separation (m)	Cross Runway Length (m)
1985 EIS	1,440	4,000	2,500	1,660	0
Option1 2012	1,930	4,000	4,000	2,000	2,500

Airport location

In the 1985 Draft EIS, the proposed airport was sited partially on land that has since been gazetted into the Upper Nepean State Conservation Area (SCA). As can been seen in **Figure 1.1**, this land has relatively more land comprising flatter grades than do the current sites. As it has now been adopted as a design criterion that an airport footprint must not impinge on SCA land, the use of much of this flatter land is precluded. However if the boundary of the SCA was able to be revised and the land released for use as a part of an airport site then it is likely that earthworks quantities could be significantly reduced.

Figure 1.1 Slope Analysis of Existing Surface for the 1985 Draft EIS Proposed Site



1.3 Analysis of issues in terms of current airport concepts

1.3.1 Typical requirements

Airports obviously require very 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. 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.

The Existing Slope Analysis & Site Constraints figure shows how many of the options have been located and orientated to make use of the land with the flatter slopes and avoid the steep creek lines.

1.3.2 Airport development geometry

The proposed geometry of an airport is defined by the on ground requirements for the safe and efficient operation of aircraft (including takeoff and landing) and supporting facilities and the airspace requirements in the form of defined imaginary surfaces in the air, known as obstacle limitation surface.

On ground requirements

The on ground requirements for airport design are defined in the *Manual of Standards 139 – Aerodromes* (CASA 2010) for the applicable runway classification. This document has been used to establish the geometry that will define the land surface, areas and grades for the airport.

For this stage of design some of the geometry requirements will be rationalised to increase the efficiency of the design process. Key geometric criteria that will be adopted at this stage include:

- Maximum runway longitudinal grade, 1%;
- Runway and taxiway crossfall,1.5%;
- Runway width, 60m;
- Runway Strip width, 300m;
- Apron maximum grade, 1.5%; and
- All earthworks batter slopes, 1V:2.5H.

Obstacle limitation surface (OLS)

Airports 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.

For each concept option the OLS has been modelled and runway levels adopted that conform to the OLS requirement.

Based on preliminary analysis, it does generally not appear that tall trees will penetrate the OLS beyond the extent of the earthworks footprint for most of the sites. For this reason, it has assumed that no major land clearing will be needed beyond the earthworks footprint for OLS requirements. However it is possible that due to the terrain surrounding these sites, some additional high ground and or other form of obstacle may need to be removed or adjusted. This would be determined more closely for a preferred site.

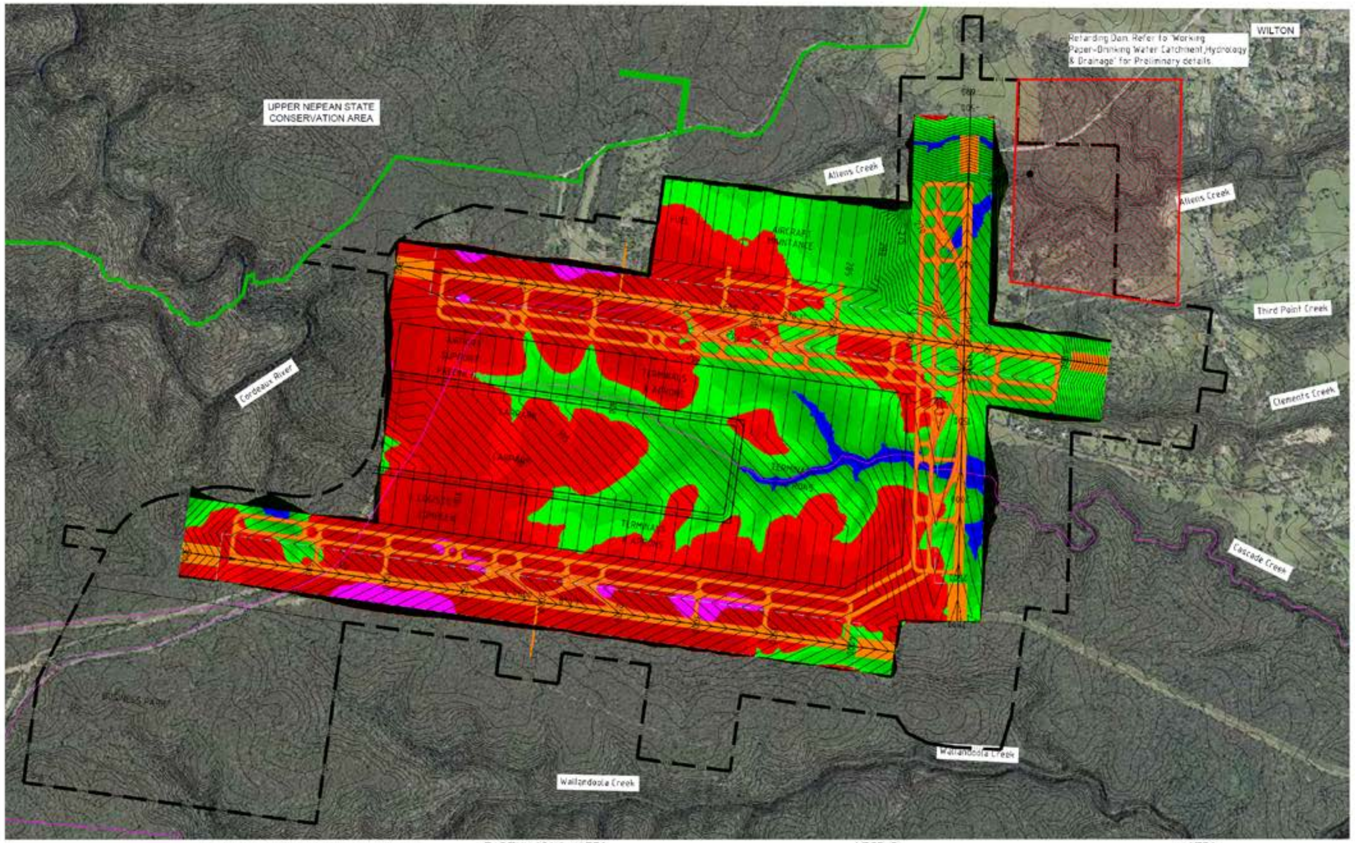
1.4 Assessment of earthworks and land clearing

1.4.1 Earthworks

Tables 1.4 to 1.6 compare earthworks volumes and cut/fill depths for each of the airport options. The quantities have been calculated from a combination of computer modelling and estimation. The results of the computer modelling for each option can been seen in the following figures:

- PRELIMINARY GRADING AND EARTHWORKS- OPTION 1 - WP-301015-03019-EW-SK-001;
- PRELIMINARY GRADING AND EARTHWORKS- OPTION 1S - WP-301015-03019-EW-SK-001S;
- PRELIMINARY GRADING AND EARTHWORKS- OPTION2 - WP-301015-03019-EW-SK-002;
- PRELIMINARY GRADING AND EARTHWORKS- OPTION 3 - WP-301015-03019-EW-SK-003;
- PRELIMINARY GRADING AND EARTHWORKS- OPTION 4 - WP-301015-03019-EW-SK-004;
- PRELIMINARY GRADING AND EARTHWORKS- OPTION 5 - WP-301015-03019-EW-SK-005;
- PRELIMINARY GRADING AND EARTHWORKS- OPTION 6 - WP-301015-03019-EW-SK-006; and
- PRELIMINARY GRADING AND EARTHWORKS- OPTION 7- WP-301015-03019-EW-SK-007.

Each figure shows existing surface contours, proposed grading contours and the depth of cut and fill earthworks required across the modelled area. The Business Park areas have not been included in the earthworks calculations as the size and locations of the Parks are somewhat subjective at this stage and in any event such development, within the OLS limits, can be more easily fitted to terrain



EARTHWORKS LEGEND

PRELIMINARY EARTHWORKS DEPTHS (m)			
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-25	to	-20	
-20	to	-15	
-15	to	-10	
-10	to	-5	
-5	to	0	
0	to	5	
5	to	10	
10	to	15	
15	to	20	
20	to	25	
25	to	30	
30	to	35	
35	to	40	
40	to	45	
45	to	50	
50	to	999999	

	RUNWAYS, APRONS TERMINALS, CARPARKS, & MAINTENANCE FACILITIES
AIRPORT DEVELOPMENT FOOTPRINT (ha)	1,930
MAXIMUM CUT DEPTH (m)	18
MAXIMUM FILL DEPTH (m)	40
VOLUME OF CUT (000m3)	52,000
VOLUME OF FILL (000m3)	52,000
BALANCE (000m3)	0
VOLUME OF CUT + FILL (000m3)	104,000

EARTHWORKS NOTES

1. The proposed grading shown on this drawing is conceptual only and has been established for earthworks and OLS calculations only.
2. All volumes and depths are approximate only and calculated between finished surface and existing surface levels.
3. No allowances have been made for boxing out for pavements and foundations or bulking and compaction factors.

LEGEND

325 — Existing Surface Contours (5m interval) Based on LiDAR Survey Captured October 2009

325 — Proposed Surface Contours (1m interval)

Airport Development Boundary

NOTES

1. 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.
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.
3. The aerial imagery shown on this drawing was captured in 2008 and has been supplied by NSW Lands and Property. No reliance has been made on the accuracy of the image for grading and earthworks investigations.

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B		ISSUED WITH WORKING PAPER
A		DRAWING CREATED
ISSUE	DATE	ISSUE DESCRIPTION

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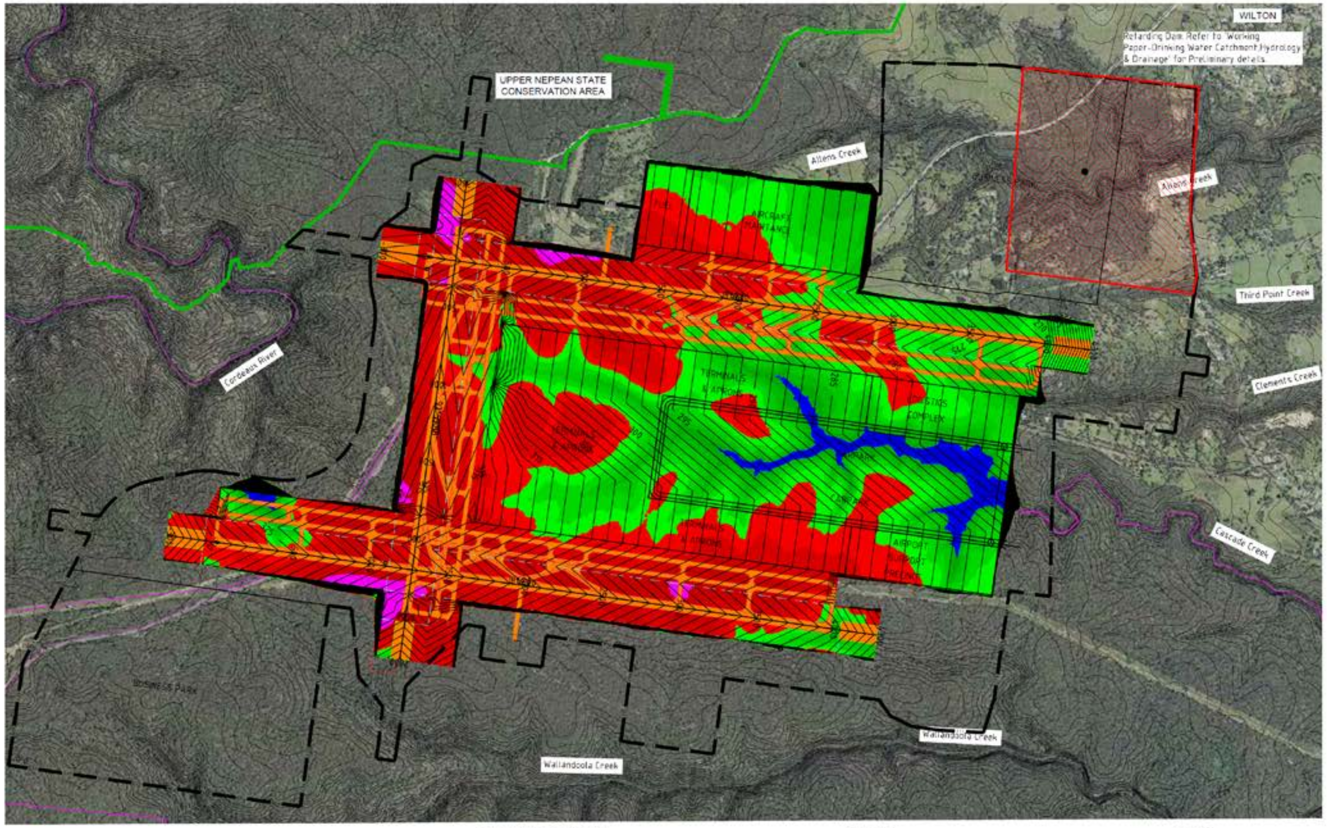
NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMNARY GRADING AND EARTHWORKS- OPTION 1
WP-301015-03019-EW-SK-001



EARTHWORKS LEGEND

PRELIMINARY EARTHWORKS DEPTHS (m)

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5	to	10	
10	to	15	
15	to	20	
20	to	25	
25	to	30	
30	to	35	
35	to	40	
40	to	45	
45	to	50	
50	to	999999	

	RUNWAYS, APRONS TERMINALS, CARPARKS, & MAINTENANCE FACILITIES
AIRPORT DEVELOPMENT FOOTPRINT (ha)	2,077
MAXIMUM CUT DEPTH (m)	21
MAXIMUM FILL DEPTH (m)	41
VOLUME OF CUT (000m3)	45,000
VOLUME OF FILL (000m3)	46,000
BALANCE (000m3)	1,000
VOLUME OF CUT + FILL (000m3)	91,000

EARTHWORKS NOTES

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LEGEND

325 — Existing Surface Contours (5m interval) Based on LiDAR Survey Captured October 2009

325 — Proposed Surface Contours (1m interval)

Airport Development Boundary

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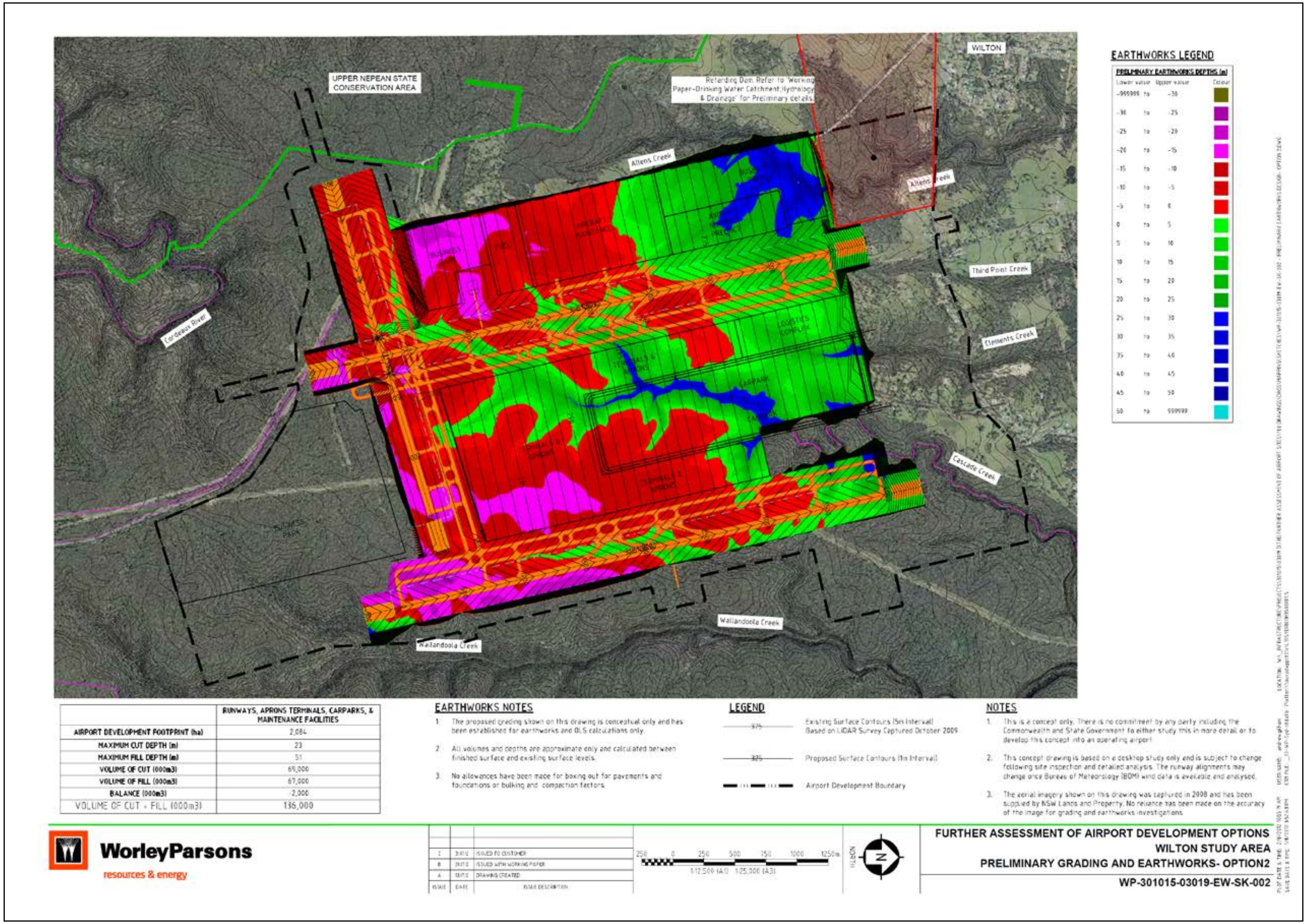
NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY GRADING AND EARTHWORKS- OPTION 1S
WP-301015-03019-EW-SK-001S


UPPER NEPEAN STATE CONSERVATION AREA
WILTON
Allens Creek
Third Point Creek
Clements Creek
Cascade Creek
Wallandoola Creek
Cordeaux River
EARTHWORKS LEGEND
PRELIMINARY EARTHWORKS DEPTHS (m)
RUNWAYS, APRONS TERMINALS, CARPARKS, & MAINTENANCE FACILITIES
AIRPORT DEVELOPMENT FOOTPRINT (ha) 2,084
MAXIMUM CUT DEPTH (m) 23
MAXIMUM FILL DEPTH (m) 51
VOLUME OF CUT (000m3) 69,000
VOLUME OF FILL (000m3) 67,000
BALANCE (000m3) -2,000
VOLUME OF CUT + FILL (000m3) 136,000
EARTHWORKS NOTES
1. The proposed grading shown on this drawing is conceptual only and has been established for earthworks and OLS calculations only.
2. All volumes and depths are approximate only and calculated between finished surface and existing surface levels.
3. No allowances have been made for boxing out for pavements and foundations or bulking and compaction factors.
LEGEND
Existing Surface Contours (5m Interval) Based on LIDAR Survey Captured October 2009
Proposed Surface Contours (1m Interval)
Airport Development Boundary
NOTES
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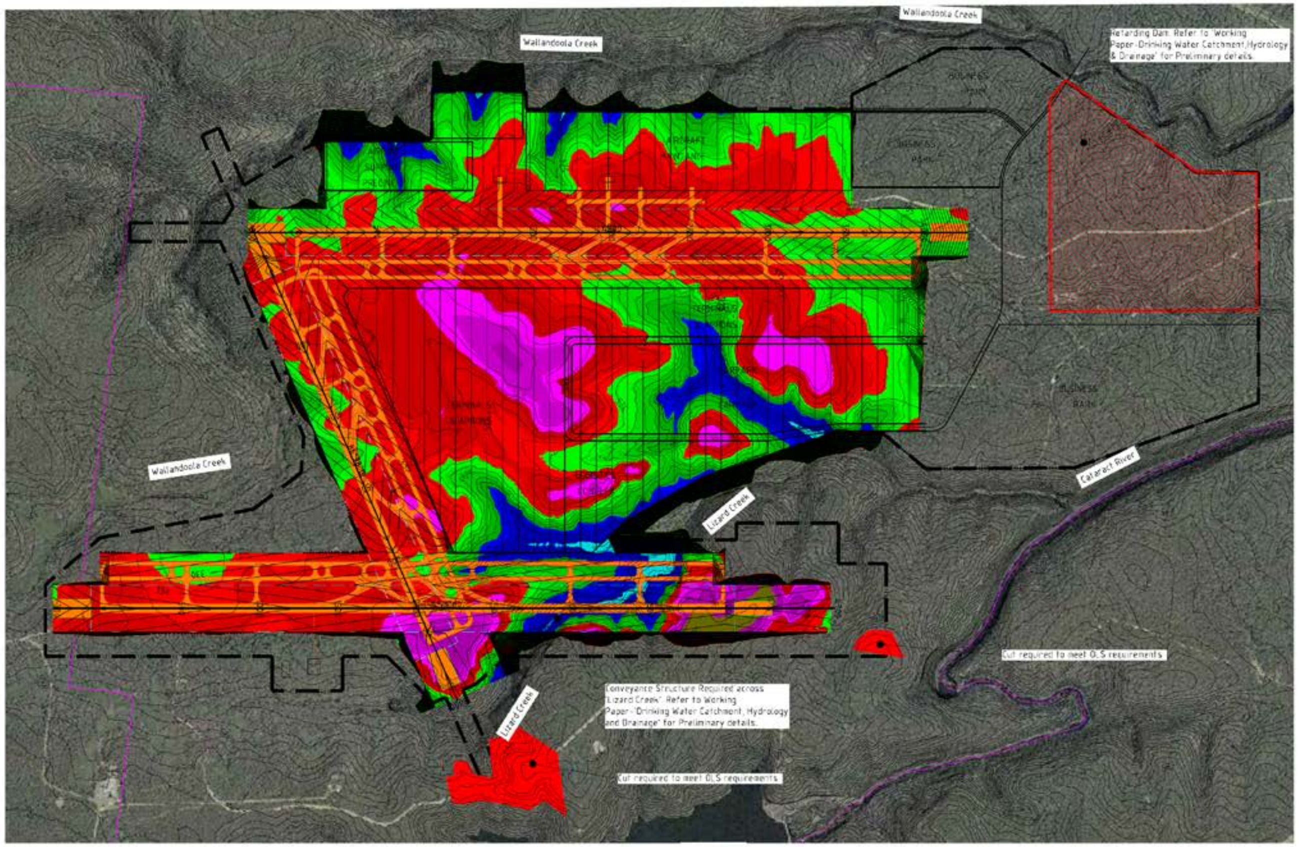
DRAWING CREATED
NORTH
FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY GRADING AND EARTHWORKS- OPTION2
WP-301015-03019-EW-SK-002



EARTHWORKS LEGEND

PRELIMINARY EARTHWORKS DEPTHS (m)

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35	to	40	
40	to	45	
45	to	50	
50	to	999999	

	RUNWAYS, APRONS TERMINALS, CARPARKS, & MAINTENANCE FACILITIES
AIRPORT DEVELOPMENT FOOTPRINT (ha)	1,996
MAXIMUM CUT DEPTH (m)	36
MAXIMUM FILL DEPTH (m)	63
VOLUME OF CUT (000m3)	78,000
VOLUME OF FILL (000m3)	79,000
BALANCE (000m3)	1,000
VOLUME OF CUT + FILL (000m3)	157,000

EARTHWORKS NOTES

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3. No allowances have been made for boxing out for pavements and foundations or bulking and compaction factors.

LEGEND

Symbol	Description
325	Existing Surface Contours (5m Interval) Based on LIDAR Survey Captured October 2009
325	Proposed Surface Contours (1m Interval)
	Airport Development Boundary

NOTES

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ISSUE	DATE	ISSUE DESCRIPTION
C	[illegible]	ISSUED TO CUSTOMER
B	[illegible]	ISSUED WITH WORKING PAPER
A	[illegible]	DRAWING CREATED

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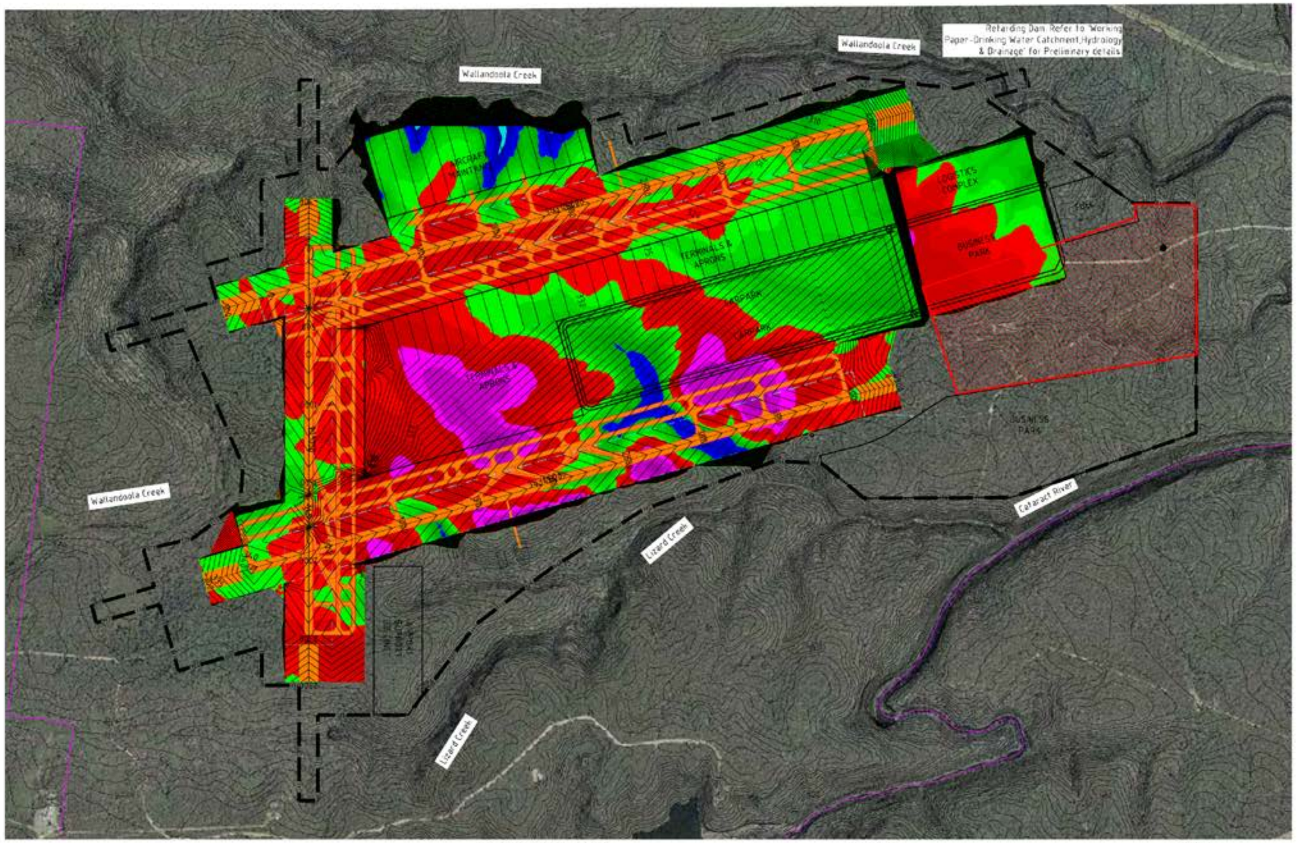
NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY GRADING AND EARTHWORKS- OPTION 3

WP-301015-03019-EW-SK-003



EARTHWORKS LEGEND

PRELIMINARY EARTHWORKS DEPTHS (m)			
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-25	to	-20	
-20	to	-15	
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15	to	20	
20	to	25	
25	to	30	
30	to	35	
35	to	40	
40	to	45	
45	to	50	
50	to	999999	

	RUNWAYS, APRONS TERMINALS, CARPARKS, & MAINTENANCE FACILITIES
AIRPORT DEVELOPMENT FOOTPRINT (ha)	1,720
MAXIMUM CUT DEPTH (m)	30
MAXIMUM FILL DEPTH (m)	65
VOLUME OF CUT (000m3)	49,000
VOLUME OF FILL (000m3)	49,000
BALANCE (000m3)	0
VOLUME OF CUT + FILL (000m3)	98,000

EARTHWORKS NOTES

1. The proposed grading shown on this drawing is conceptual only and has been established for earthworks and OLS calculations only.
2. All volumes and depths are approximate only and calculated between finished surface and existing surface levels.
3. No allowances have been made for boxing out for pavements and foundations or bulking and compaction factors.

LEGEND

- 325 — Existing Surface Contours (5m interval) Based on LIDAR Survey Captured October 2009
- 375 — Proposed Surface Contours (1m interval)
- Airport Development Boundary

NOTES

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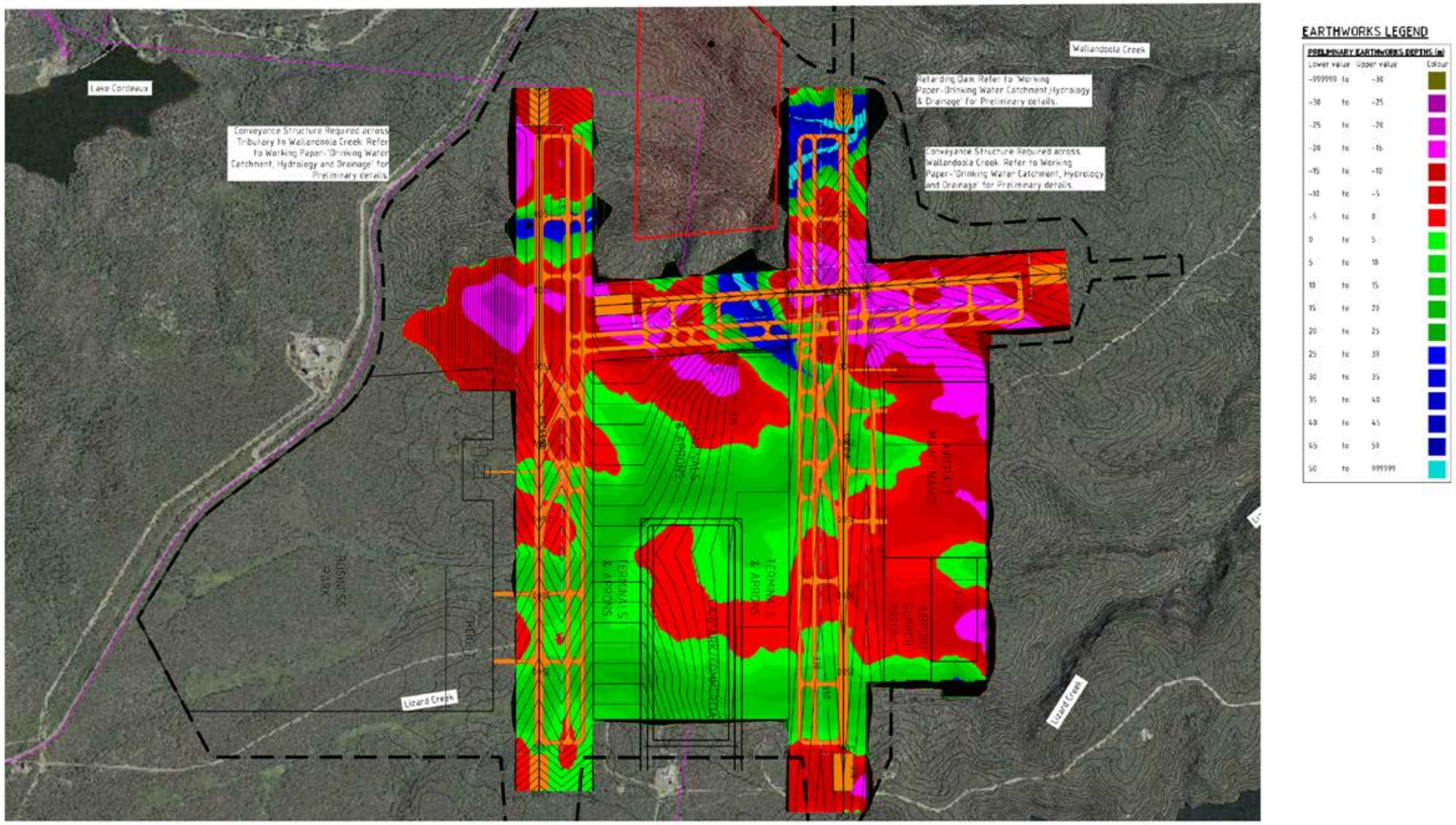
ISSUE	DATE	ISSUE DESCRIPTION
C	31/7/12	ISSUED TO CUSTOMER
B	31/7/12	ISSUED WITH WORKING PAPER
A	15/7/12	DRAWING CREATED

250 0 250 500 750 1000 1250m
1:12 500 (A1) 1:25 000 (A3)

NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY GRADING AND EARTHWORKS- OPTION 4
WP-301015-03019-EW-SK-004



	RUNWAYS, APRONS TERMINALS, CARPARKS, & MAINTENANCE FACILITIES
AIRPORT DEVELOPMENT FOOTPRINT (ha)	2,209
MAXIMUM CUT DEPTH (m)	23
MAXIMUM FILL DEPTH (m)	66
VOLUME OF CUT (000m3)	60,000
VOLUME OF FILL (000m3)	66,000
BALANCE (000m3)	6,000
VOLUME OF CUT + FILL (000m3)	126,000

EARTHWORKS NOTES

1. The proposed grading shown on this drawing is conceptual only and has been established for earthworks and OLS calculations only.
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3. No allowances have been made for boxing out for pavements and foundations or bulking and compaction factors.

LEGEND

325 Existing Surface Contours (5m Interval) Based on LiDAR Survey Captured October 2009

325 Proposed Surface Contours (1m Interval)

Airport Development Boundary

NOTES

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A	[illegible]	DRAWING CREATED

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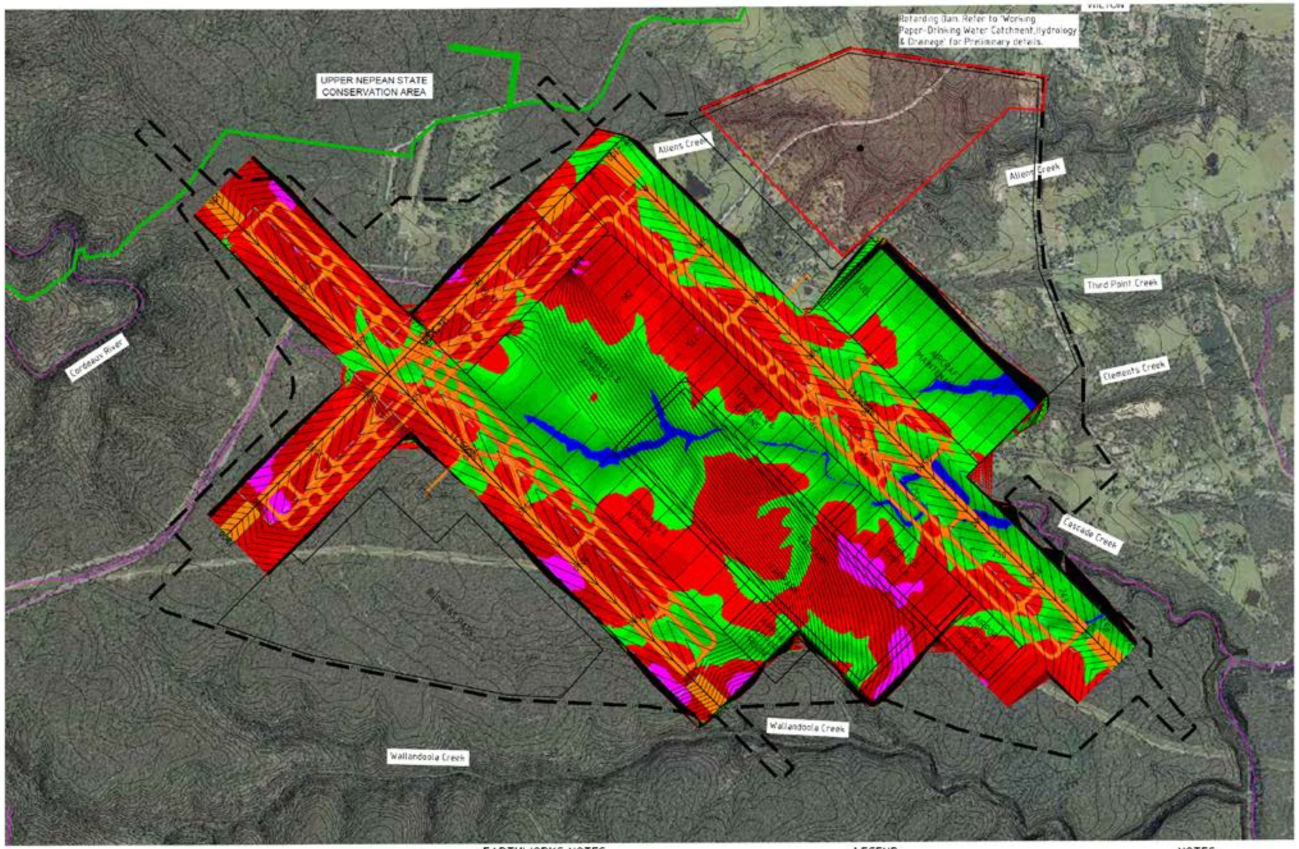
1:12,500 (A1) 1:25,000 (A3)

NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY GRADING AND EARTHWORKS- OPTION 5

WP-301015-03019-EW-SK-005



EARTHWORKS LEGEND

PRELIMINARY EARTHWORKS DEPTHS (m)

Lower value		Upper value	Colour
-999999	to	-30	
-30	to	-25	
-25	to	-20	
-20	to	-15	
-15	to	-10	
-10	to	-5	
-5	to	0	
0	to	5	
5	to	10	
10	to	15	
15	to	20	
20	to	25	
25	to	30	
30	to	35	
35	to	40	
40	to	45	
45	to	50	
50	to	999999	

	RUNWAYS, APRONS TERMINALS, CARPARKS, & MAINTENANCE FACILITIES
AIRPORT DEVELOPMENT FOOTPRINT (ha)	2,022
MAXIMUM CUT DEPTH (m)	20
MAXIMUM FILL DEPTH (m)	43
VOLUME OF CUT (000m3)	50,000
VOLUME OF FILL (000m3)	48,000
BALANCE (000m3)	-2,000
VOLUME OF CUT + FILL (000m3)	98,000

EARTHWORKS NOTES

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2. All volumes and depths are approximate only and calculated between finished surface and existing surface levels.
3. No allowances have been made for boxing out for pavements and foundations or bulking and compaction factors.

LEGEND

- 375 — Existing Surface Contours (5m Interval) Based on LIDAR Survey Captured October 2009
- 325 — Proposed Surface Contours (1m Interval)
- Airport Development Boundary

NOTES

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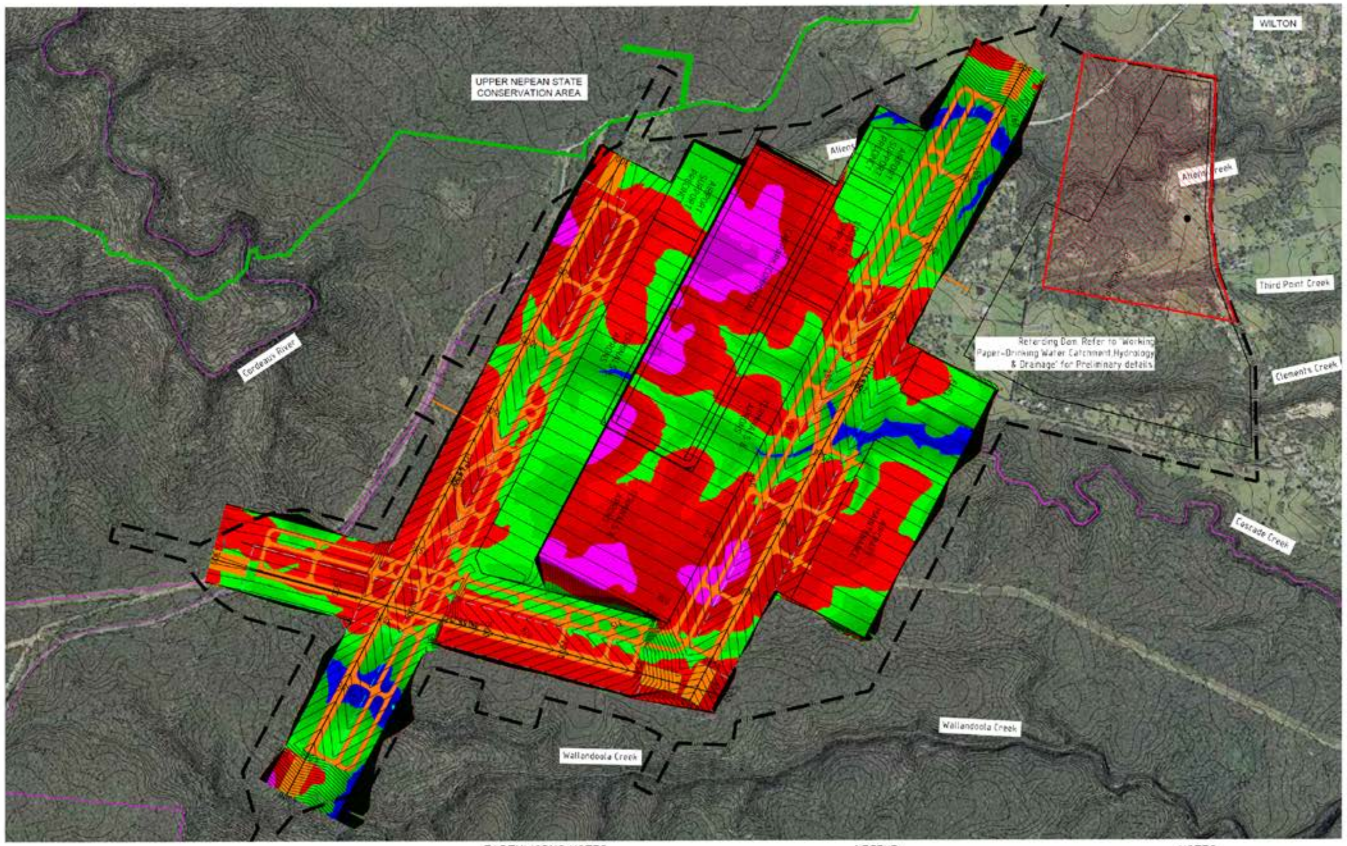
250 0 250 500 750 1000 1250m
1:12,500 (A1) 1:25,000 (A3)

NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY GRADING AND EARTHWORKS- OPTION 6

WP-301015-03019-EW-SK-006



EARTHWORKS LEGEND

PRELIMINARY EARTHWORKS DEPTHS (m)

Lower value		Upper value	Colour
-999999	to	-30	
-30	to	-25	
-25	to	-20	
-20	to	-15	
-15	to	-10	
-10	to	-5	
-5	to	0	
0	to	5	
5	to	10	
10	to	15	
15	to	20	
20	to	25	
25	to	30	
30	to	35	
35	to	40	
40	to	45	
45	to	50	
50	to	999999	

	RUNWAYS, APRONS TERMINALS, CARPARKS, & MAINTENANCE FACILITIES
AIRPORT DEVELOPMENT FOOTPRINT (ha)	1,823
MAXIMUM CUT DEPTH (m)	25
MAXIMUM FILL DEPTH (m)	50
VOLUME OF CUT (000m3)	49,000
VOLUME OF FILL (000m3)	50,000
BALANCE (000m3)	1,000
VOLUME OF CUT + FILL (000m3)	99,000

EARTHWORKS NOTES

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2. All volumes and depths are approximate only and calculated between finished surface and existing surface levels.
3. No allowances have been made for boxing out for pavements and foundations or bulking and compaction factors.

LEGEND

- 325 — Existing Surface Contours (5m Interval) Based on LiDAR Survey Captured October 2009
- 325 — Proposed Surface Contours (1m Interval)
- Airport Development Boundary

NOTES

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B	[illegible]	ISSUED WITH WORKING PAPER
A	[illegible]	DRAWING CREATED

250 0 250 500 750 1000 1250m
1:12 500 (A1) 1:25 000 (A3)

NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
PRELIMINARY GRADING AND EARTHWORKS- OPTION 7
WP-301015-03019-EW-SK-007

Table 1.4 Earthworks Calculated From Proposed Grading Plan

Option No.	Site Area (ha)	Modelled Cut (000 m^3)	Modelled Fill (000 m^3)	Modelled Balance (000 m^3)	Modelled Cut + Fill (000 m^3)
Option 1	1,930	-52,000	52,000	0	104,000
Option 1 South (1S)	2,077	-45,000	46,000	1,000	91,000
Option 2	2,084	-69,000	67,000	-2,000	136,000
Option 3	1,988	-78,000	79,000	1,000	157,000
Option 4	1,727	-49,000	49,000	0	98,000
Option 5	2,209	-60,000	66,000	6,000	126,000
Option 6	2,022	-50,000	48,000	-2,000	98,000
Option 7	1,823	-49,000	50,000	1,000	99,000

The volumes shown in **Table 1.4** have been calculated by creating a proposed airport ground surface and comparing this to an existing surface generated from LiDAR data using 12D computer software. The proposed surface grading covers the following items: runway strip, taxiways, RESA's, aprons, terminal buildings, support buildings and car park/commercial area.

It is anticipated that ,during further engineering refinement of the grading design, a neutral balance of cut to fill may be achieved for all airport options, taking proper account of the engineering properties of the cut materials.

Table 1.5 Estimated Earthworks and Totals

Option No.	Estimated Cut + Fill for Stormwater Facilities (000 m^3)	Estimated Cut + Fill for Roads and Rail (000 m^3)	Total Cut + Fill (000 m^3)	Cut + Fill per ha (000 m^3/ha)
Option 1	3,000	5,000	114,000	59
Option 1S	3,000	5,000	101,000	49
Option 2	3,000	5,000	146,000	70
Option 3	3,000	5,000	167,000	84
Option 4	3,000	5,000	108,000	63
Option 5	3,000	5,000	136,000	62
Option 6	3,000	5,000	108,000	53
Option 7	3,000	5,000	109,000	60

Table 1.6 Maximum Cut and Fill Depths

Option No.	Max Cut Depth (m)	Max Fill Depth (m)	Additional Infrastructure Required
Option 1	18	40	
Option 1S	21	41	
Option 2	23	51	
Option 3	36	63	Drainage Conveyance structure along Lizard Creek under fill
Option 4	30	65	
Option 5	23	66	Drainage Conveyance structure along Wallandoola Creek under fill
Option 6	20	43	
Option 7	25	50	

From the tables it can be seen that Option 1S (south cross runway) has the lowest amount of earthworks (cut plus fill) per hectare and Option 3 the highest. The primary reason for the difference in volumes between the options is the extent of the existing incised creek lines that need to be filled to allow construction of the airport.

It should be noted that the volumes have been estimated based on preliminary design and investigations. No contingency has been included. They volumes documented above should be used with care for comparison purposes only.

These cut and fill depths can be put into perspective by considering them against the height of the largest cut on the Sydney-Newcastle Freeway north of the Mooney Mooney, which was constructed through similar terrain to that at Wilton.

This cut is 40m high, which is only 60% of some of the gorges that have to be filled at Wilton under some of the Options. The scale of the fills at Wilton would be likely to be of a similar order and scale to the major fill also shown in this photo.

Source: F3 Sydney- Newcastle Freeway between Calga and Somersby Department of Main Roads April 1987

1.4.2 Comparison with other airport developments

The data in **Table 1.7** shows earthworks quantities from past airport proposals in the Sydney region.

Table 1.7 International and Australian Data for Airport Earthworks

Airport	Site Area (ha)	Cut plus Fill (m^3)	Cut plus Fill (m^3 per ha)
Australian Airport Proposals or Projects			
Badgerys Creek Option A Proposal Master Plan[2]	1,700	51,000,000	30,000
Wilton 1985 EIS Proposal[3]	1440	28,000,000	19,444
Holsworthy Option A Proposal Master Plan [1]	4,200	285,000,000	67,857
Holsworthy Option B [1] **Proposal Master Plan** [1]	2,800	340,000,000	121,429
Wilton 2012 Proposal (this study) Option 1S	2,077	101,000,000	49,000

From the table it can be seen that the earthworks volumes for Option 1S sit between those predicted for the earlier Badgerys Creek and Holsworthy proposals. Given the even more rugged nature of the Holsworthy terrain and the relatively flatter grades of the Badgerys Creek site, the earthworks values appear to correlate. It can also be seen that the earthworks estimated for Option 1S are significantly higher than the 1985 EIS at Wilton. This can be expected for the reasons described in earlier concerning flatter land now being incorporated into an SCA.

1.4.3 Site clearing

Table 1.8 compares the land clearing requirements for each option. Preliminary investigations have shown that clearing of trees for OLS requirements outside of the site boundary is likely to be required for Options 3 and 5 only. Note that the Site Areas includes an allowance for Business Parks and for all Options, other than 1 and 2, all stormwater infrastructure can be accommodated within the currently defined site boundaries. An allowance is included for clearing associated with land transport links to the airport. For an analysis of the types of clearing required and the vegetation communities affected refer to the Working Paper *Flora, Fauna and Ecological Values.*

Table 1.8 Estimated Land clearing in hectares

Option No.	Site Area (ha)	Site Area + Bushfire Buffer	Additional Area for Retarding Dam	Electrical Easement	Road and Rail Easements	Total Clearing Required
Option 1	1,930	2,131	29	95	156	2,411
Option 1S	2,077	2,293	0	120	179	2,592
Option 2	2,084	2,263	56	120	154	2,593
Option 3	1,996	2206	0	60	143	2,485
Option 4	1,720	1,894	0	60	135	2,089
Option 5	2,209	2,395	0	60	108	2,578

[2] Second Sydney Airport Planning and Design Summary Report, 1997
[3] Second Sydney Airport Draft EIS, 1985

Option No.	Site Area (ha)	Site Area + Bushfire Buffer	Additional Area for Retarding Dam	Electrical Easement	Road and Rail Easements	Total Clearing Required
Option 6	2,022	2,201	0	120	170	2,491
Option 7	1,823	2,012	0	120	161	2,293

1.5 Summary of mitigation methods and strategies

In order to reduce earthworks volumes, the following strategies could be considered and further investigated:

- Revise the boundary of the Upper Nepean State Conservation Area to utilize the relatively flatter land;
- Reduce one or both of the runway lengths;
- Remove the cross runway;
- Review terminal and car park building platform requirements with a view to reduce the fill over the incised creeks (e.g. benching within the buildings);
- Review minimum spacing of runways and locations, layout and size of the airport facilities;
- Consider a non-balanced earthworks approach that resulted in lower overall earthworks quantities but relied on imported fill material; and
- Further design optimization to the limits of the Standard in terms of relative levels and grading over the site.

The area of land clearing required is primarily defined by the site footprint. Therefore, the land clearing area can be most readily reduced by reviewing the airport layout and facilities required with a view to reducing the site area or identifying areas within the site which do not require clearing.

1.6 Key findings

- The earthworks required to construct an airport at Wilton range between 49,000 and 84,000 m^3/ha. This broadly accords with the assessment work made in the Joint Study;
- These volumes are relatively large compared to other airport developments around the globe, primarily because the topography at Wilton is undulating with deeply incised creeks which are difficult avoid with an airport configuration of two by 4000m runways with 2000m separations;
- Whilst in many options, the runways have been aligned parallel to the contours, along ridge lines and between the creek lines, a high volume of fill is still required to fill the creeks between the runways in order to create a pad for the terminal buildings and car parks;
- The variability in the amount of earthworks required to fill these creek lines is the main reason for the difference in earthworks volumes between the options;
- The scale of earthworks required to create an airport platform for some of the options can be considered as being of similar scale to the earthworks on the Sydney-Newcastle freeway;
- Land clearing for airport and associated infrastructure development – which means the removal of all native and non-native vegetation and transformation of the and surface would be required – for all options in the range of 2100ha to 2600ha and about 25% greater than the airport site itself; and
- Reduction in earthworks and in land clearing may occur if the scale of airport is trimmed back from the template airport and may also result from design optimization.

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2 WORKING PAPER – REGIONAL GEOLOGY

SUMMARY

The purpose of this Working Paper is to define the geology of the potential airport site at Wilton and to identify and identify potential geotechnical issues which may be encountered through development of the site options for an airport.

The majority of the site is underlain by Triassic Hawkesbury Sandstone, with some isolated patches in the north west part underlain by Wianamatta shales. This geology is very similar to the geology found in Sydney, and is not considered to be problematic in terms of foundations of expected airport structures and runways. However, some areas of peat, which may exist in swamps in the south east of the Study Area, have the potential for less favourable founding conditions. The water table is governed by the recharge from rainfall and is expected to be complicated at a local scale, but probably mimics the general topography in a subdued way.

The Wilton Site is located in one of the most seismically active parts of the continent. However, due to the expected long earthquake recurrence interval on individual faults (in the order of millions of years), a low seismic hazard is probable at the site.

Other geotechnical issues considered include:

- Excavatability of rock;
- Suitability of excavated rock and soil as fill material;
- Slope stability within the soil and rock, including in fill areas;
- Suitability of the soil and rock in bearing and settlement for foundations;
- Effects of structural geology and seismology; and
- Ability to tunnel through rock, if required.

None of these issues are expected to be significant enough to restrict potential development.

Issues relating to potential subsidence from long wall coal mining are considered in the Working Paper on *Regional Resources and Resource Extraction*

2.1 Statement of issue

This Working Paper addresses geology and geotechnical conditions in and around the Study area at Wilton.

This document gives a short summary of key features, mainly by way of drawings and plans, because the geology of the area is very well documented in many references[4].

2.2 Description of issue

The Wilton site is in the Shire of Wollondilly, in the Cordeaux Cataract locality, about 81km by road south west of Sydney and south of the town of Wilton. The Wilton study area is defined as the area contained within the following external boundaries: (1) Upper Nepean State Conservation Area (West), (2) the townships of Wilton, Douglas Park and Appin (North) and (3) the Cordeaux River and Cataract River dam areas (East– Cataract and South – Cordeaux).

This Working Paper seeks to outline the regional geology, and consequently discuss the geotechnical issues which would be faced at design and construction in terms of foundations for buildings, pavement/runway design, tunnelling and earthworks.

A Draft Environmental Impact Statement was prepared for the Wilton site for the Second Sydney Airport Site Selection Programme by Kinhill Stearns (1985) on behalf of the then Department of Aviation.

The study on regional geology (in Chapter 15 of the draft EIS) provides a thorough summary of the issues relating to geology and geotechnical information, including the expected sub-surface conditions, topography and cut and fill estimates.

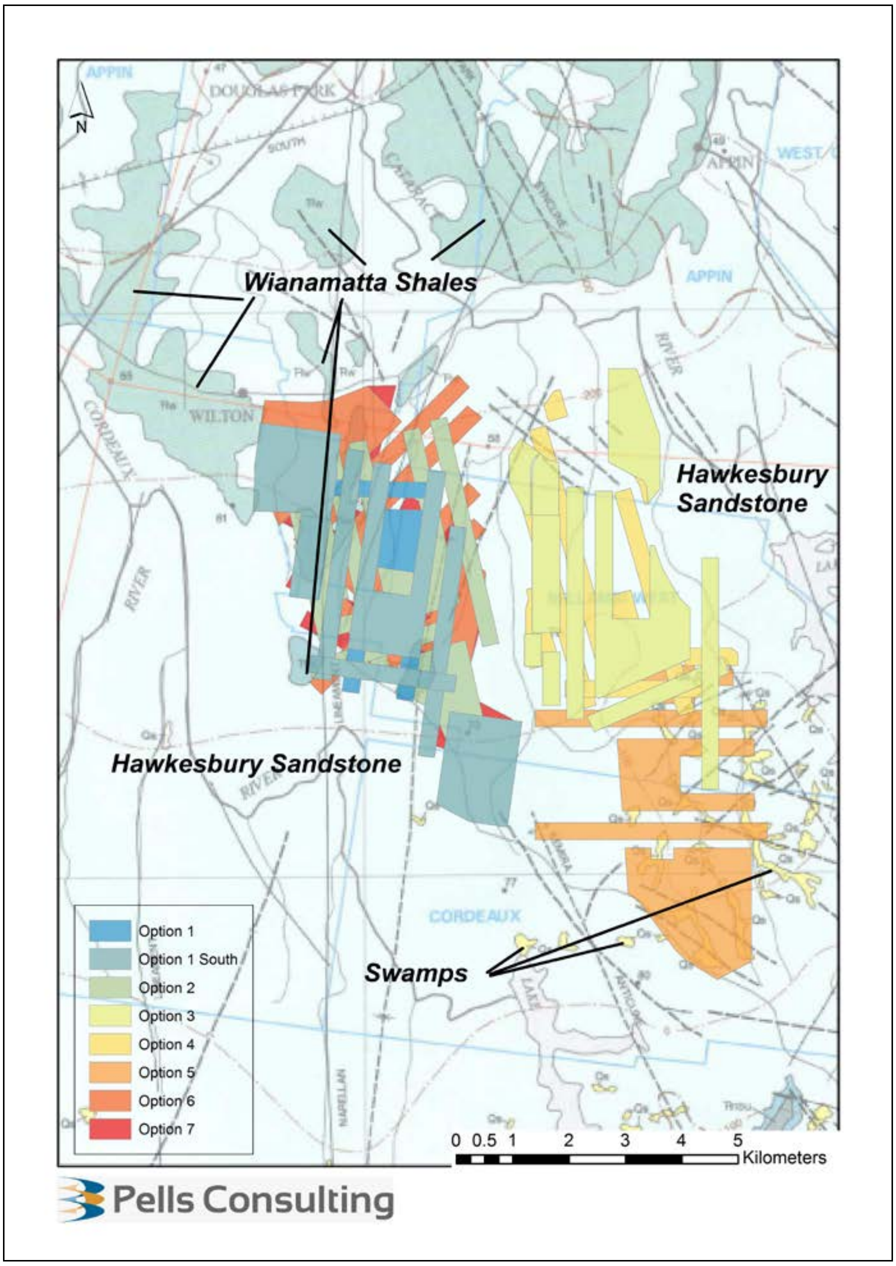
2.2.1 Surface geology

Figure **WP-301015-03019-GEO-SK-001 - GEOLOGICAL MAP** (provided at the end of this section) which follows shows the regional geological setting of the Wilton Study Area. It can be seen from this figure that most of the site is underlain by Triassic Hawkesbury Sandstone, with a few of the patches of higher ground in the north west part being capped by Wianamatta shales.

[4] See Dept. of Mineral Resources, Geology of the Wollongong and Port Hacking 1:100000 Sheets (1986), A Guide to the Sydney Basin (1980), and key geotechnical facets are covered in Pells (1985)

Figure 2.1 Regional geology

(Note runway locations indicated may not be in precisely the final positions as shown elsewhere herein)



The important point to note from **Figure 2.1** is that the geology of the site is very similar to the geology of the built up area of Sydney. It is benign from the viewpoint of foundation conditions for structures and runways, and equally benign from the viewpoint of major earthworks.

The area is dissected by deeply incised rivers (**Figure 2.2**), whose *Strahler* classifications from 1st order (minor tributaries) to 7th order (more substantial rivers) are shown in **Figure 2.3**.

Figure 2. 2 Incised river systems

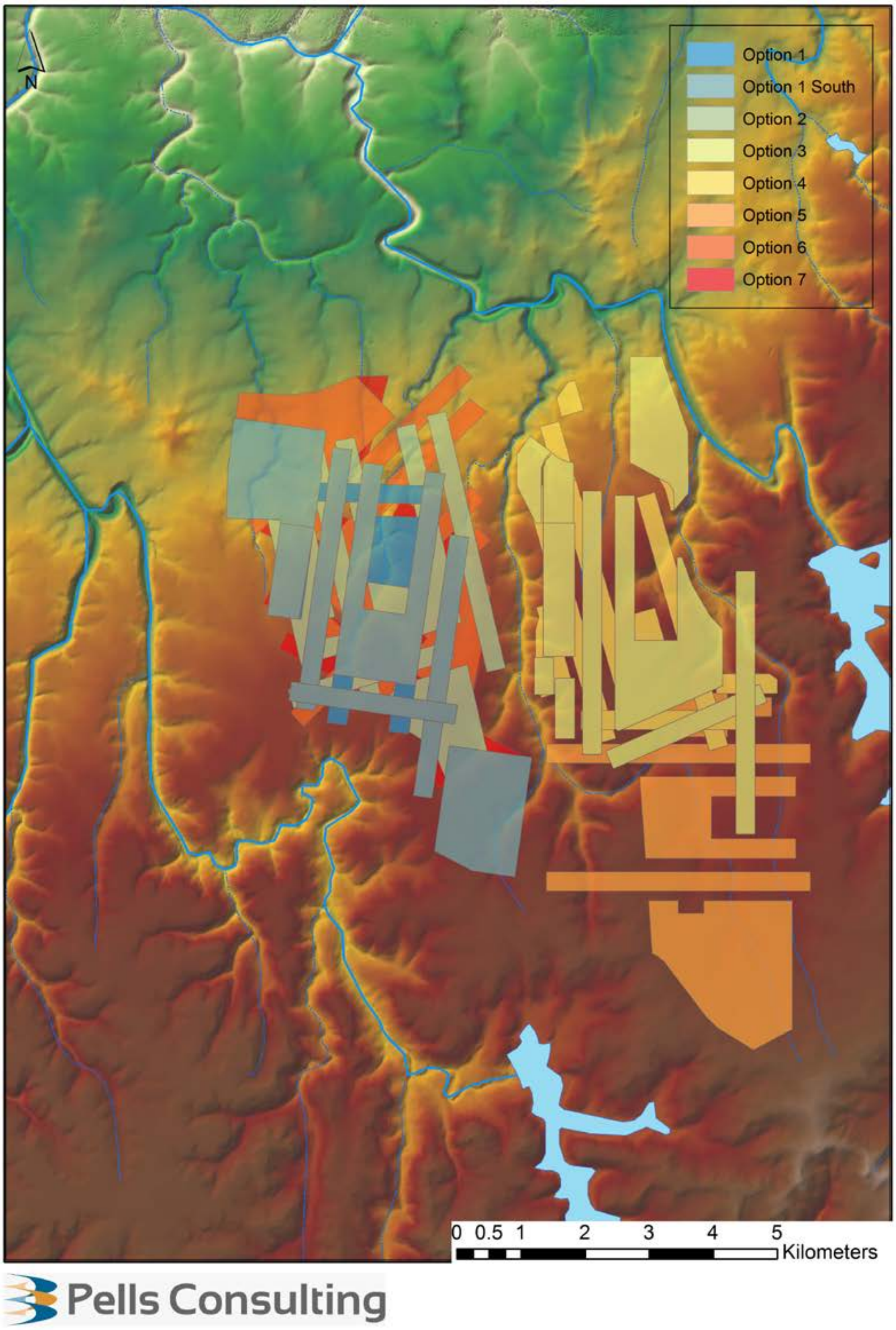
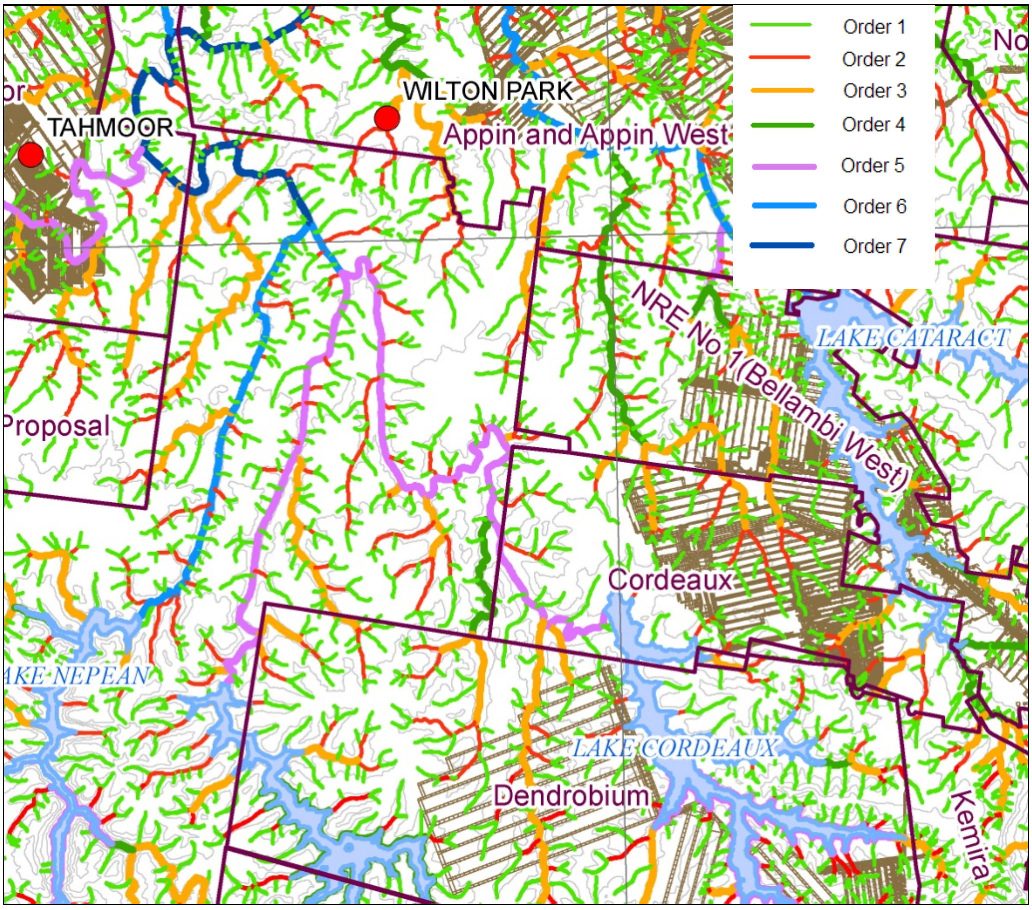


Figure 2.3 River system

(colour coded from green for Order 1 to blue-black for Order 7)



A particular feature of the south east part of the site is the occurrence of elevated swamps. Their locations are shown in **Figure 2.4**.

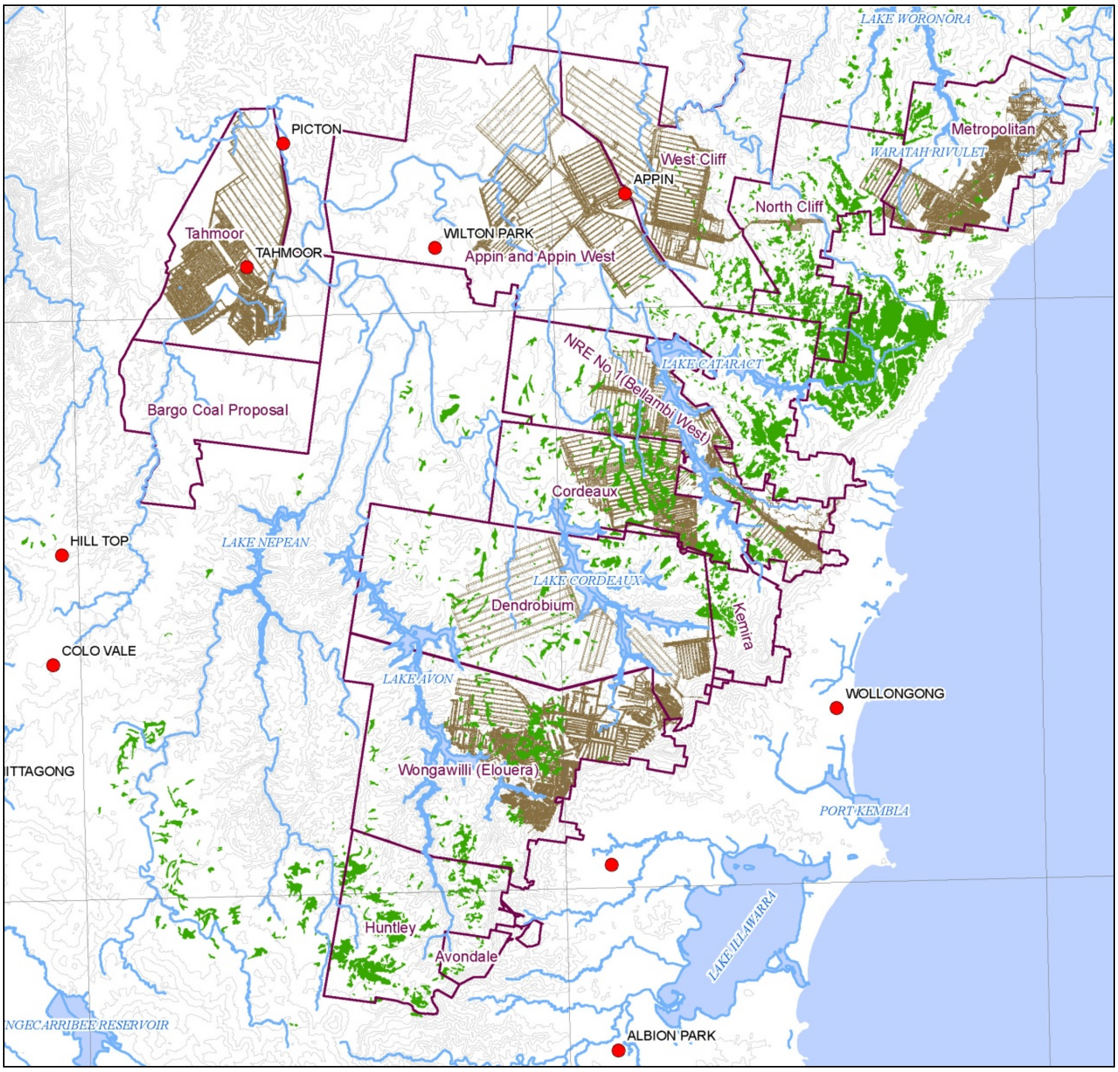
The swamps are identified by their distinct wetland vegetation composition (primarily sedges and heaths) compared with the surrounding dry sclerophyll forest which occurs on the better drained ridge tops and hill slopes. They are mostly hosted on Hawkesbury Sandstone and can be broadly classified as either headwater or valley infill swamps.

Headwater swamps are the significant majority of the upland swamps and are generally situated in areas near catchment divides where plateau incision is weak and topographic grades are shallow. These upland swamps can be quite extensive and 'drape' over the undulating Woronora Plateau. They can fill shallow valley floors and extend up the valley sides and drainage lines to straddle catchment divides in areas of shallow, impervious substrate formed by either the bedrock sandstone or clay horizons. DECC has recognised four large clusters of headwater swamps on the plateau areas, which it considers have particular significance in providing large contiguous areas of related habitat.

It has described these swamp clusters as:

- Maddens Plains (O'Hares and Cataract catchments);
- Wallandoola Creek (Cataract catchment);
- North Pole (southern Avon catchment); and
- Stockyard (southern Avon catchment).

Figure 2.4 Upland swamps in the Southern Coalfields



The swamp clusters were identified following a vegetation survey of the catchments of Nepean, Avon, Cordeaux, Cataract and Woronora Rivers and O'Hares Creek by the NPWS and SCA during 2003.

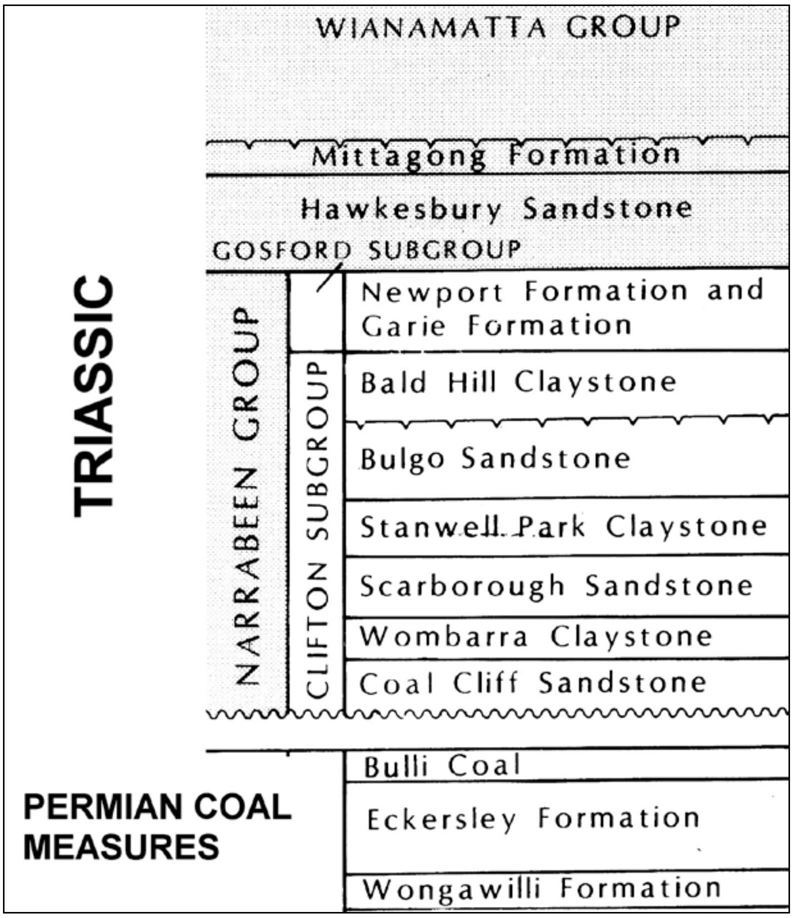
The other form of swamp is much less commonly developed. These *'valley infill'* swamps form as isolated pockets blanketing the floor of incised second or third stream valleys and therefore tend to be elongate downstream. They are believed to be initiated by rapid transportation of sediment material downstream and equally rapid deposition possibly as a result of channel profile-restriction (e.g. by log jams). Once initiated, the swamps are probably self-reinforcing, trapping more sediment, raising the water table and fostering the growth of organics and formation of peat.

2.2.2 Stratigraphy

The stratigraphy down to the level of the Permian Coal Measures is summarised in **Figure 2.5**

The Bulli Seam is at a depth of almost 500 m in the area just west of Cataract dam, and then rises very gently to the west, being about 400 m to 450 m below the land surface at Wilton.

Figure 2.5 Stratigraphy in the area of the site (not to scale)



2.2.2.1 Hawkesbury Sandstone Formation

The Hawkesbury Sandstone which covers the vast majority of the site consists of fine to coarse grained sandstone, with lenses of shale also present. The rock mass generally has bedding planes to within ±5% of horizontal, with jointing extending orthogonal to the bedding planes, and generally limited to within bedding layers. These details would need to be confirmed by geotechnical investigation.

The residual soils likely to be found is expected to comprise sands, sandy clays and sandy loams with fragments of intact sandstone. These soils are expected to be up to 2m thick in some of the lower-lying drainage areas. However, the majority of the site is expected to have a soil profile of less than 1m.

2.2.2.2 Wianamatta Group

The Wianamatta Group consists of claystones, siltstones and fine-grained sandstones, and may be found throughout the proposed site, but is expected to be more prevalent in the north-western areas, near and within Options 1 and 2.

The residual soil of the Wianamatta Group consists of sandy to silty clay topsoils with clay subsoils. These soils are expected to vary between 0.5 and 2m thick.

2.2.2.3 Mittagong Formation

The geological maps also indicate that small areas of interbedded shales and sandstones of the Mittagong Formation may exist in the southern areas of Options 1 and 2. This material generally consists of fine grained sandstone overlying the Hawkesbury Sandstone.

2.2.2.4 Quaternary Sediments

Small patches of the proposed site at the southern end of both Options 3 and 4 may contain Quaternary aged deposits of clayey sand, with some organic material. This is likely to occur in or around swamp areas.

2.2.3 Hydrogeology

Within the Southern Coalfield there are essentially two types of groundwater systems that are often, and usually incorrectly, referred to as aquifers. These are:

- **Shallow unconsolidated sediments:** these comprise soils and the underlying weathered bedrock (collectively, the 'regolith'), the swamp lands, and the alluvial deposits associated with the stream channels.
- **Consolidated rocks:** these are primarily fractured rocks, and some porous rocks. Siltstones and claystones may be aquitards due to low permeability. They typically impede groundwater exchange between adjacent strata. The Bald Hill Claystone, which separates the Hawkesbury Sandstone from the deeper Bulgo Sandstone, is an example of an aquitard.

The contrast between shallow unconsolidated aquifer systems (moderate to high permeability) and deeper consolidated rocks like the Hawkesbury Sandstone (low permeability) means that rates of groundwater flow through surficial unconsolidated sediments may be orders of magnitude higher than rates of flow through the rocks. As a result, contributions to stream base flows from shallow unconsolidated sediments (contained within the swamps and the regolith), are larger than contributions from deeper, unweathered consolidated rock. Consequently the groundwater emanating from unconsolidated deposits is very young while groundwater emanating from the deeper rocks is likely to be old. SCA has determined the age of groundwater in parts of the Hawkesbury Sandstone to be in the range 5,000 to 10,000 years old.

At a regional scale, a natural hydrophysical system has evolved whereby:

- Rainfall provides runoff to the regional drainage system and recharge to any unconsolidated materials within that system, and to underlying consolidated sandstone strata;
- The retention of recharge in the groundwater system is governed by the prevailing permeability and porosity of materials and other factors including natural evaporation and evapotranspiration;
- Runoff is impeded in upland areas where swamps are prevalent, or in areas where a soil or regolith profile is well developed and rainwater can infiltrate and surcharge groundwater. These areas act as water stores and provide a base flow component to stream flow runoff. They also support groundwater dependent ecosystems (GDE); and
- Runoff is rapid in the remaining areas where outcrop occurs or where the regolith is thin. These areas are unlikely to accommodate substantive groundwater recharge or to contribute significantly to stream base flow unless substantial secondary permeability and porosity is developed in fractures.

2.2.4 Regional water table geometry

Recharge by rainfall results in a shallow water table that, while poorly mapped, probably mimics the general topography in a subdued way. The geometry of this surface is governed by the drainage system which acts regionally to relieve groundwater pressures and constrain elevations of the groundwater table to stream levels within the valleys and gorges. Away from the valleys, rainfall continues to recharge the system thereby creating an elevated water table and sustaining groundwater flows toward the creeks and rivers. The water table is, however, often complicated at a local scale either by perching due to reductions in strata permeability, or by accelerated flow along structural defects like joints or bedding shears that are contained within the rock mass.

Perching of the water table is expected in the upland swamps and the regolith during rainfall events as rainwater slowly infiltrates to depth. Perching also persists through subsequent dry periods although in drought periods some drying can be expected.

2.2.5 Economic geology

Five of the eight underground coal mines currently operating in the Southern Coalfield use longwall mining methods. Of the Southern Coalfield's total production in 2006-07 of 11.08 Mt, 98% was produced by these five mines. In 2008-2009 production was 10.27 Mt.

Over 80% of coal produced is premium quality hard coking coal which is used for steelmaking, either in local coke works or in export markets. The Southern Coalfield is the dominant supplier of coking coal to the domestic steel industry. In 2005-06, the Southern Coalfield provided 3.5 Mt (or over 99.5%) of NSW's exports of hard coking coal, and some 26% of its total coking and other metallurgical coal exports, despite representing only 5.8% of total NSW coal exports. The small component of the overall exports reflects the great preponderance of steaming coal in NSW's coal exports.

As at June 2007, hard coking coal attracted a 70-80% price premium over thermal (or steaming) coal, with average export prices in June 2007 being $107 and $60 per tonne respectively. Based on these prices, the total value of coal delivered from the Southern Coalfield in 2006-07 was estimated at $1.1 billion, with roughly $640 m coming from exports.

The price for hard coking coal has increased substantially since that date, as shown by the following **Table 2.1**.

Table 2.1 Price for hard coking coal

Commonwealth Bank - Mining and Energy Commodities						
Coal Price Forecast (USD/tonne)						
	FY10	**FY11**	**FY12**	**FY13**	**FY14**	**FY15**
Hard Coking	147	238	255	226	204	189
Semi-hard Coking	134	215	226	190	167	150
Semi-soft Coking	104	175	187	154	136	118
Thermal	77	115	107	95	93	91

It should be noted that issues relating to subsidence and mining are discussed further in Working Paper *Regional Resources*.

2.2.6 Earthquake considerations

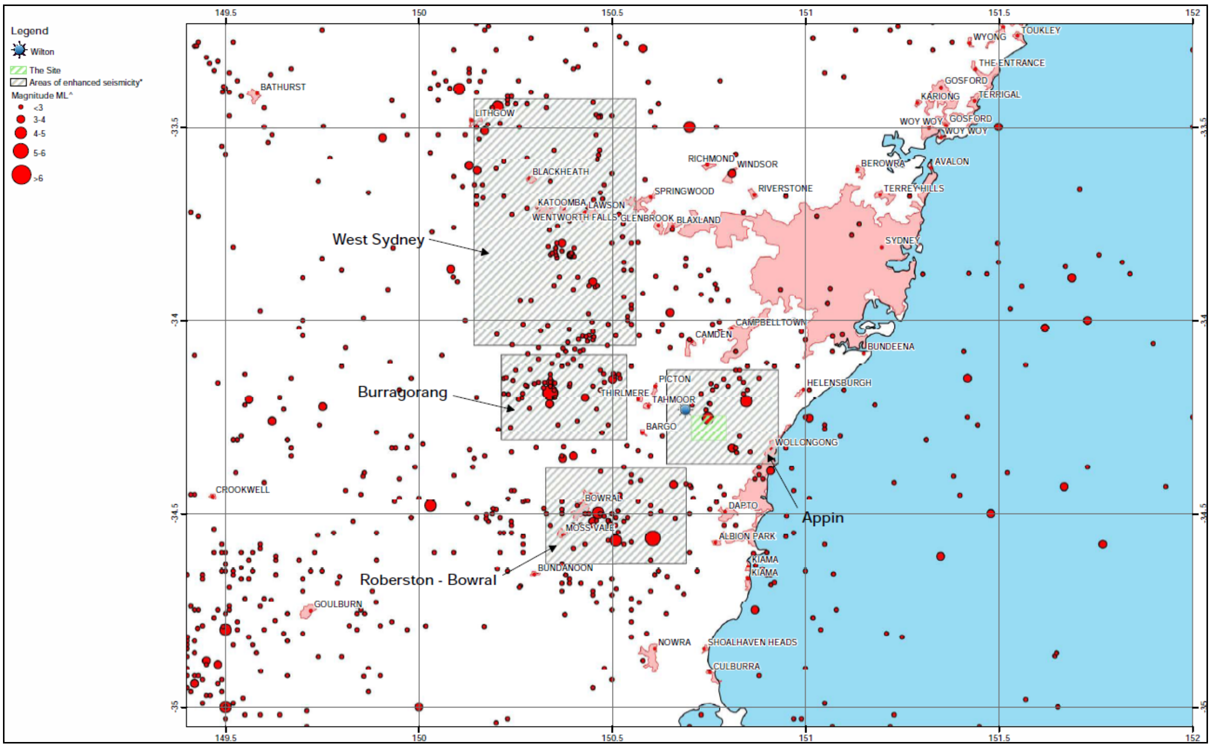
2.2.6.1 Australian seismotectonic setting

Australia is classified as a Stable Continental Region (SCR). It is located entirely within the Australian Plate, away from any major active tectonic margins and experiences infrequent seismicity in comparison with other regions around the world[5]. Despite its classification as a SCR, the Australian continent experiences a higher level of seismicity in comparison to other SCR.

[5] Johnston et al. 1994

The Wilton Site is located in south eastern Australia, which is one of the most seismically active parts of the continent. In the south east of Australia the region of enhanced seismicity extends from the west coast of Tasmania, through the Eastern Highlands of southeast Victoria and up into south eastern NSW, as shown in **Figure 2.6**.

Figure 2.6 Recorded earthquakes in south eastern New South Wales



2.2.7 Earthquake activity at the Wilton Study Area

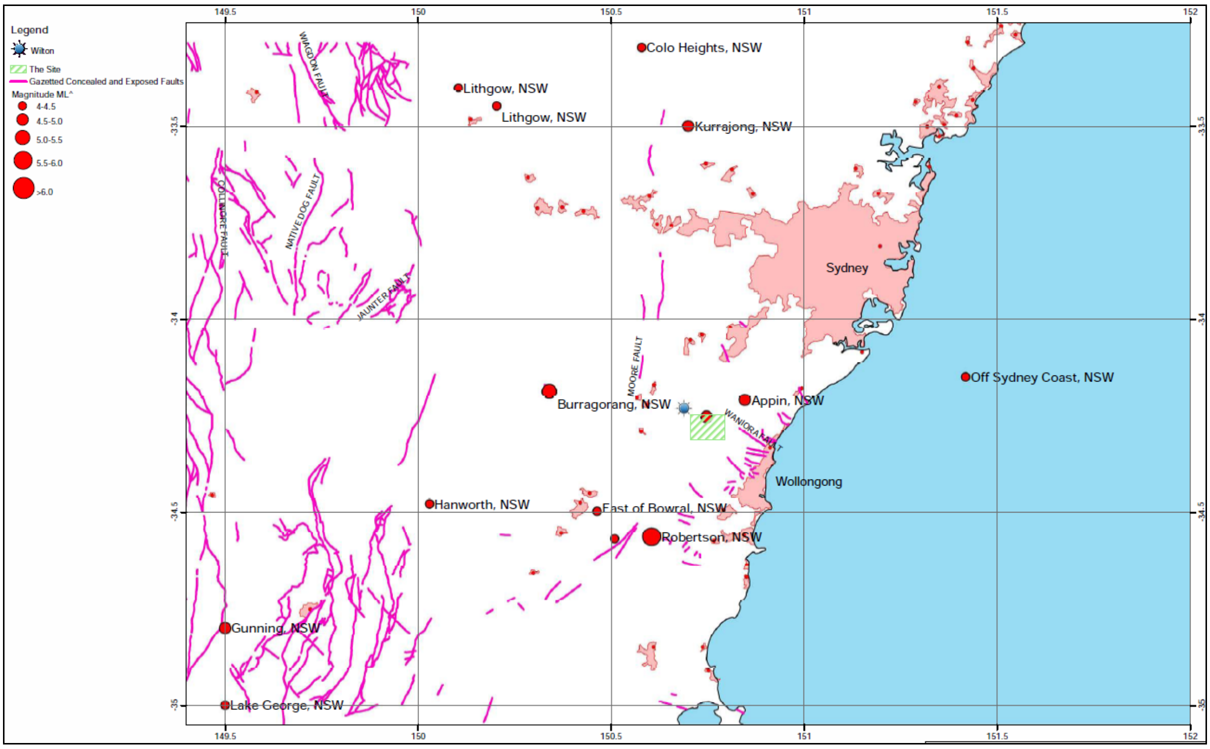
This assessment uses data from the earthquake catalogue collected[6] as part of an update of the Australian National Earthquake Map. The catalogue was compiled from the following sources:

- Earthquake catalogue compiled by Gary Gibson (from 1788 to May 2010);
- Geoscience Australia's earthquake catalogue (from 27/05/2010 to 26/08/2010);
- All earthquakes in the International Seismological Centre's (ISC) catalogue, attributed to the network AUST (from 31/01/11967 to 30/04/2008); and
- ISC Regional: additional regional earthquakes from 14/06/1906 to 17/04/2011.

This study has focussed on data collected between Sydney and North Canberra (the Region) between longitudes 149.6 and 151.8 and latitudes -33.3 and -35.25. **Figure 2.7** shows earthquake activity recorded in this Region and shows considerable variation in earthquakes.

[6] by Allen et al. (2011

Figure 2.7 Significant earthquakes in area south west of Sydney, around the Wilton Study Area



Of the 1,274 earthquakes recorded in the Region since 1788, two (2) events have recorded magnitudes (local magnitudes, M_L) greater than 5.0, eight (8) events recorded M_L values between 3.0 and 5.0 and 72 events recorded M_L values between 3.0 and 4.0. The remaining events have magnitudes less than 3.0 or do not have reported magnitudes. Many of the recorded events with magnitudes <3.0 are aftershocks of other significant earthquakes in the Region. **Table 2.2** lists the significant earthquakes in the Region, whilst **Figure 2.7** shows their location and magnitude graphically.

Table 2.2 Significant earthquakes in the region

Earthquake Date	Longitude (Degrees)	Latitude (Degrees)	Depth (km)	M_L	Location
22/06/1788	150.400	-34.300	10.00	N/A	SW of Port Jackson, NSW
18/10/1872	150.000	-33.700	10.00	N/A	Jenolan Caves, NSW
8/15/1919	150.700	-33.500	10.00	4.6	Kurrajong, NSW
5/21/1961	150.606	-34.564	18.81	5.6	Robertson, NSW
9/29/1962	150.030	-34.480	26.00	4.2	Hanworth, NSW
7/08/1968	150.510	-34.570	13.00	4.5	West of Kiama, NSW
3/09/1973	150.340	-34.187	28.9	5.5	Burragorang, NSW
1/23/1978	151.420	-34.150	N/A	4	Near Sydney, NSW
11/15/1981	150.847	-34.210	18.04	4.6	Appin, NSW

Earthquake Date	Longitude (Degrees)	Latitude (Degrees)	Depth (km)	M_L	Location
2/13/1985	150.204	-33.448	14.58	4.3	Lithgow, NSW
6/24/1987	150.105	-33.401	5.08	4.3	Lithgow, NSW
3/17/1999	150.748	-34.253	5.29	4.8	Appin, NSW
12/11/2003	150.464	-34.498	12.20	4.2	East of Bowral, NSW

Significant recorded earthquakes in the area are:

- The ML 5.6 Robertson earthquake in 1961 which caused significant damage to buildings in the Moss Vale, Robertson and Bowral area, blocked the Macquarie Pass road with rockfalls, and caused some power failures (Gibson, 2005);
- The ML 5.5 Burragorang earthquake (also known as the 'Picton earthquake') in 1973 which caused about $A500,000 of damage (1973 values). Structural damage was reported at different locations including Wollongong City (Gibson, 2005);
- Two events close to Appin in 1981 and 1999 with magnitudes ML 4.6 and 4.8, respectively. Power failure was associated with the 1999 event however there was no reported damage associated with the ML 4.6 in 1981; and
- The ML 4.2 event located to the east of Bowral in 2003. There is no available information on damage associated with this event.

2.2.7.1 Earthquake sources potentially affecting the Wilton Study Area

Zones of increased seismic activity

Four zones of increased earthquake activity can be recognised in the Region close to the Wilton Site, namely:

- Appin;
- Robertson – Bowral;
- Burragorang; and
- North of the Burragorang area and west of Sydney below the Blue Mountains.

The current seismicity in the Region indicates fault activity, although it is difficult to link earthquakes with causative faults due to uncertainty in earthquake locations and incomplete knowledge of faults.

Although in the last 10 years a significant effort has been made to understand fault activity and seismicity in Australia there is still significant uncertainty regarding fault behaviour. Nevertheless, an attempt has been made to assign earthquake activity to specific faults in the Region and to assess fault behaviour, as explained below.

Seismicity in the Appin, Robertson and Bowral zones has been tentatively associated with the Illawarra Fault (Gibson, 2005), although this author recognises that the nature of the fault has not been confirmed and that this structure has been mainly interpreted from an erosive scarp along the coast.

The majority of earthquakes in the Burragorang area and to the north of Burragorang and west of Sydney occur under the Blue Mountains and have been associated with the Lapstone Structural Complex (LSC - Gibson, 2005; Clark, 2005). The Lapstone Structural Complex consists of an association of east-facing monoclines, high-angle faults and fracture zones that form the frontal ridge of the Blue Mountains Plateau in the Permian to Triassic Sydney Basin rocks (Branagan & Pedram 1990, 1997).

Some studies have associated geomorphometric features of the LSC with neotectonic activity on the underlying faults (Clark, 2005). As is the case with other faults in Australia, the neotectonic indicators of the LSC are consistent with a model of periodic and temporarily clustered seismic activity separated by long periods of quiescence. As an example, preliminary paleoseismological studies of Kurrajong Fault in the LSC suggests that maximum magnitude earthquakes of ~Mw 7.0 might occur with a recurrence of ~1 million years (Clark, 2010).

2.2.7.2 Other possible fault earthquake sources

Based on fault data extracted from the Southern Coalfield to the northeast of the Wilton Site, Berryman et al. (2005) recognised two main sets of faults that strike approximately northeast and north to north-northeast. Under the current stress field of the region dominated by a northeast to east principal horizontal comprehensive stress, it is considered that fault re-activation could be associated with a component of reverse displacement on the north to northeast striking fault and sinistral strike-slip on northeast striking faults.

In an attempt to reconcile fault characteristics (i.e. fault dimension, fault patterns, densities and fault type) with earthquake magnitude and frequency, Berryman et al. (2005) concluded that magnitude distributions in the range M5.0 to 6.0 have long periods of recurrence (i.e. several million years). This conclusion of long periods of recurrence for faults in the region is predominately based on the low historical seismicity rate and the high density of fault structures over which the seismicity could be distributed.

Therefore, although active fault sources can contribute significantly to the seismic hazard at the Wilton Site, a low seismic hazard is implied within the Sydney Basin based on the recognition that the recurrence on individual faults is likely to be in the order of millions of years (Berryman et al., 2005; Clark, 2010).

In the next section, expected earthquake acceleration values for the Wilton Site are extracted from the current Australian Design Code (Earthquake Actions, AS1170.4 - 2007) in lieu of a specific PSHA for the Wilton Site.

2.2.7.3 Expected earthquake ground accelerations

The Australian Standard AS 1170.4-2007 provides the earthquake actions and general requirements for use in the design of structures subject to earthquakes. These actions depend on, among other factors, the type of structure and the exposure to earthquake shaking. In lieu of detailed information about the structure, the following discussion focuses on the earthquake ground acceleration values contained in the current Earthquake Hazard Map of Australia, a key component of AS 1170.40-2007.

The Earthquake Hazard Map for NSW shows hazard factor contours across the southeast region of Australia. The hazard factors relate to the effective peak ground acceleration (PGA) for bedrock with a 10% probability of exceedence in a 50 year period. These values are equivalent to a probability of exceedence of 1 in 475 years, which is commonly rounded to 500 years or an equivalent probability of exceedence of approximately 1/500.

According to the map, the seismic hazard at the Wilton Site has expected PGA values with 10% probability of exceedence in 50 years between 0.09g and 0.1g (Figure 7). In the Australian context, these values correspond to a low to moderate seismic hazard.

The current Earthquake Hazard Map of Australia is based on a hazard map from Gaull et al. (1990) which was extensively revised by McCue et al. (1993) and again in 2006 to be included in AS1170.4-2007. The map is currently being updated by Geoscience Australia. We understand that the acceleration values for the southeast of Australia in the updated map will be lower than those on the current Earthquake Hazard Map. Therefore, the seismic hazard of the Wilton Study Area is likely to be downgraded.

2.2.7.4 Conclusions in respect to seismic hazard

The main conclusions from the seismic hazard assessment of the Wilton Study Area are as follows:

- The Wilton Site is located is one of the most seismically active parts of the Australian continent;
- 13 significant earthquakes have been recorded in the Region surrounding the Wilton Site since 1788;
- Of these earthquakes, five (5) are of relevance to the Wilton Site due to their magnitude and location with three (3) associated with reported damage;
- There is significant uncertainty regarding the earthquake sources that control the seismic hazard at the Wilton Site. Possible earthquake sources include the Lapstone Structural Complex (LSC), the Illawarra Fault, and other, widely distributed faults across the Sydney Basin;
- Fault studies suggest that fault activity in the region may generate periodic and temporarily-clustered seismic activity separated by long periods of quiescence, potentially in the order of millions of years;
- A key input in assessing seismic hazard is to determine if a fault is experiencing an active or quiescent period;
- The recognition that the earthquake recurrence interval on individual faults is likely to be of the order of millions of years implies a low seismic hazard at the Wilton Site;
- The current Earthquake Hazard Map of Australia (AS 1170.4-2007) assigns expected values of PGA between 0.09g and 0.1g to the Wilton Site with 10% of probability of exceedence in 50 years;
- Whilst yet to be published, it is understood that earthquake acceleration values for the southeast of Australia in the new Earthquake Hazard Map will be lower than those shown on the current Earthquake Hazard Map; and
- This implies that the seismic hazard at the Wilton Study Area is likely to be downgraded. However, this data has not been finalised and is not currently publicly available.

2.3 Legislative status

Not applicable.

2.4 Summary of issues from SSA Site Selection Programme

The geotechnical issues which were expected to be raised during design and construction included:

- Excavatability of rock;
- Suitability of excavated rock and soil as fill material;
- Slope stability within the soil and rock, including in fill areas;
- Suitability of the soil and rock in bearing and settlement for foundations;
- Effects of structural geology and seismology; and
- Ability to tunnel through rock, if required.

The challenge presented by the large quantities of earthworks, while easily mitigated, was expected to be the most prominent geotechnical issue for the proposed airport development. As the topography of the area is highly undulating, it was considered that it would require significant volumes of cut and fill for the construction of an airport, and therefore the excavation of the material, as well as its behaviour as a placed fill would need to be considered.

2.5 Analysis of issues in terms of current airport concepts

For current airport concepts and assumptions, refer to Working Paper *4 Wilton Airport Site Selection and Airport Concepts.*

The following assessment has been made of the issues outlined in Section 4 above to the current airport options:

2.5.1.1 Excavatability of rock

The rock found in the proposed airport site commonly has high intact strength and spacing between joints, and therefore a significant volume of the excavation is expected to require rock-breaking equipment and/or blasting to excavate. This has been commonly undertaken in Hawkesbury Sandstone, and construction contractors would likely be familiar with the likely requirements in pricing and performing the excavation works.

The use of blasting and/or heavy machinery to excavate the rock is common and will not limit the potential development from a technical perspective. There may be a greater financial cost to excavating at this site due to the requirement for these excavation techniques; however this is not expected to be significant in comparison to the overall project cost.

Should one of the proposed airport site options be approved to be taken forward to more detailed consideration, a geotechnical site investigation would be expected to be undertaken to identify the parameters of the particular site, as discussed below and in relation to matters such as, *inter alia*, excavatability, including the intact strength, spacing of bedding and joints, bedding conditions and weathering.

2.5.1.2 Suitability of rock and soil material as fill

All excavated materials are potentially able be used in engineered earthworks, and there will be appropriate materials for any earth dams or similar dirty water storages.

Crushed Hawkesbury Sandstone is suitable as sub-base material for roads and runways, and if stabilized with cement can be used a base-course for roads. However, runway and apron pavements will require base-course comprising high quality crushed basalt, or dolerite from established quarries. A good alternative that should be considered would be crushed limestone from Marulan, which is already transported by rail as far as the Maldon cement factory.

Geotechnical investigations and analyses are required to quantify the optimum moisture content and density of compaction, as well as the expected settlement of the compacted material.

2.5.1.3 Slope stability

A study undertaken by the University of Wollongong indicates that the airport options lie within areas considered to have some susceptibility for landslips. However, this is expected to be mitigated through investigation and design.

Within the rock, the likely bedding and jointing within the Hawkesbury Sandstone may result in relatively steep cuts; however this would need to be confirmed with a geotechnical investigation involving a drilling program and geological mapping to develop an understanding of potential failure mechanisms.

Within residual soil, permanent and temporary batter slopes are likely to be stable with a batter slope of around 3:1, however this should be quantified following a geotechnical investigation. This should be undertaken prior to detailed earthworks design to enable the use of batters with steps if required. Common construction practices such as shoring and retaining walls are likely to be sufficient for shallow (less than 2m) slopes.

2.5.1.4 Foundations

The soils and rocks to be encountered in the proposed airport sites are expected to have sufficient bearing capacity and settlement characteristics to allow for shallow foundations for most infrastructure. Buildings which have particularly high loads or which are highly sensitive to settlement may require bored piers or piles.

Geotechnical investigations and analyses are required to quantify the settlement estimates and bearing capacities in rock, natural soil and fill.

It should be noted that subsidence effects from mining beneath the airport footprint have been considered in Working Paper - *Regional Resources and Resource Extraction*, and would have a very significant impact on settlement and foundation design if this occurs after airport construction.

2.5.1.5 Structural geology

The assessment undertaken in the 1985 Draft EIS indicates that the site is likely to observe earthquakes with a Modified Mercalli Scale intensity of five (MMV), which corresponds to:

“Felt inside by most, may not be felt by some outside in non-favourable conditions. Dishes and windows may break and large bells will ring. Vibrations like large train passing close to house.”

AS1170.4-2007 estimates the hazard factor of 0.09g to 0.1g, which is roughly equal to that of Melbourne. During design of a potential airport development when detail of the subsurface conditions, and foundation types and depths are known this document should be used to determine the structural design requirements. Due to the moderate hazard factor applied for the proposed site there are not expected to be onerous structural constraints.

2.5.1.6 Tunnelling for transportation and other links

As with any tunnelling project, should tunnelling be required as part of the proposed development, extensive geotechnical investigations will be required at the proposed tunnel location to identify rock type, strength, failure mechanisms and other information to allow for design and determination of tunnelling methodology.

Tunnelling in Hawkesbury Sandstone in particular has been done extensively throughout the Sydney Basin, and within the study area is not expected to present particular challenges in comparison to other potential sites, although will need to be considered in regard to potential for mining and subsidence below the tunnels.

2.6 Assessed environmental impacts

The environmental effects relating to the bulk earthworks are addressed in Working Paper - *Land Clearing and Earthworks.*

2.7 Ameliorative strategies to reduce effects to acceptable levels

The geotechnical issues raised in Section 2.5 are common and can all be mitigated through geotechnical investigation, involving geological mapping, the excavation of boreholes and/or test pits at targeted locations, and laboratory testing to fully understand and document the material engineering properties.

Should one of the proposed sites be approved, a geotechnical investigation should be undertaken to include, but not necessarily limited to, the following:

- Confirmation/development of subsurface profiles;
- Confirmation/assessment of rock parameters to determine potential excavation techniques;
- On site and laboratory testing to determine likely behaviour of excavated rock and soil as fill material;

- Various soil, groundwater and rock parameters (including mapping of defects to identify potential failure mechanisms) to enable assessment of slope stability and enable design of any required retention structures; and
- An assessment of settlement potential in the soil and rock, as well as strength assessment to enable foundation design.

Should tunnelling be required, an extensive geotechnical investigation would be required to identify the potential failure mechanisms and risks which are particular to the tunnel site.

The issues relating to seismic activity and geological structures are likely to be resolved through reference to AS1170.4-2007 once foundation depths and founding material properties are known in greater detail. As the hazard factor for the proposed development is moderate (less than most capital cities) it is unlikely that the structural requirements imposed by this document would present any major challenges.

2.8 Residual effects

The risks posed from geotechnical issues such as slope stability, excavatability, safe foundation design and fill specifications are all expected to be mitigated with a geotechnical investigation involving excavation of boreholes and test pits, a landslide inventory of the proposed site, laboratory testing and geological mapping. A specific program should be developed upon selection of one of the site options for further consideration.

To mitigate against potential seismic activity the geotechnical investigation should be followed by reference to the Australian Standard AS1170.4-2007 for Structural Design Actions, Part 4: Earthquake Actions in Australia during the design of structures.

2.9 Key findings

The geotechnical issues which would be encountered at the proposed Wilton airport do not provide any challenges which would limit the site as a potential airport. The factors discussed within this paper can be mitigated through geotechnical investigations and design, which should be undertaken regardless of the site of any proposed airport development.

- The geology of the potential airport site consists of materials expected to be well-suited to foundations of buildings and runway construction;
- While the undulating topography would likely require large volumes of cut and fill, the excavation is expected to be within the capability of any construction contractors;
- The excavated material would be suitable for re-use on-site as fill;
- The geology at the site is not expected to limit the potential of tunnelling; and
- While some geological structures including faults are known to exist in the vicinity of the proposed site, the effects can be mitigated through use of AS1170.4-2007 in the design of structures.

There are very few differentiators between site options in terms of the regional geology and geotechnical issues. These are summarised in **Table 2.3**.

Table 2.3 Options matrix

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Possible minor expansive soil potential (Wianamatta Shale)	Yes	Yes	No	No	No	Yes	Yes
Option underlain by known geological structure	Yes	Yes	Yes	No	Yes	Yes	Yes

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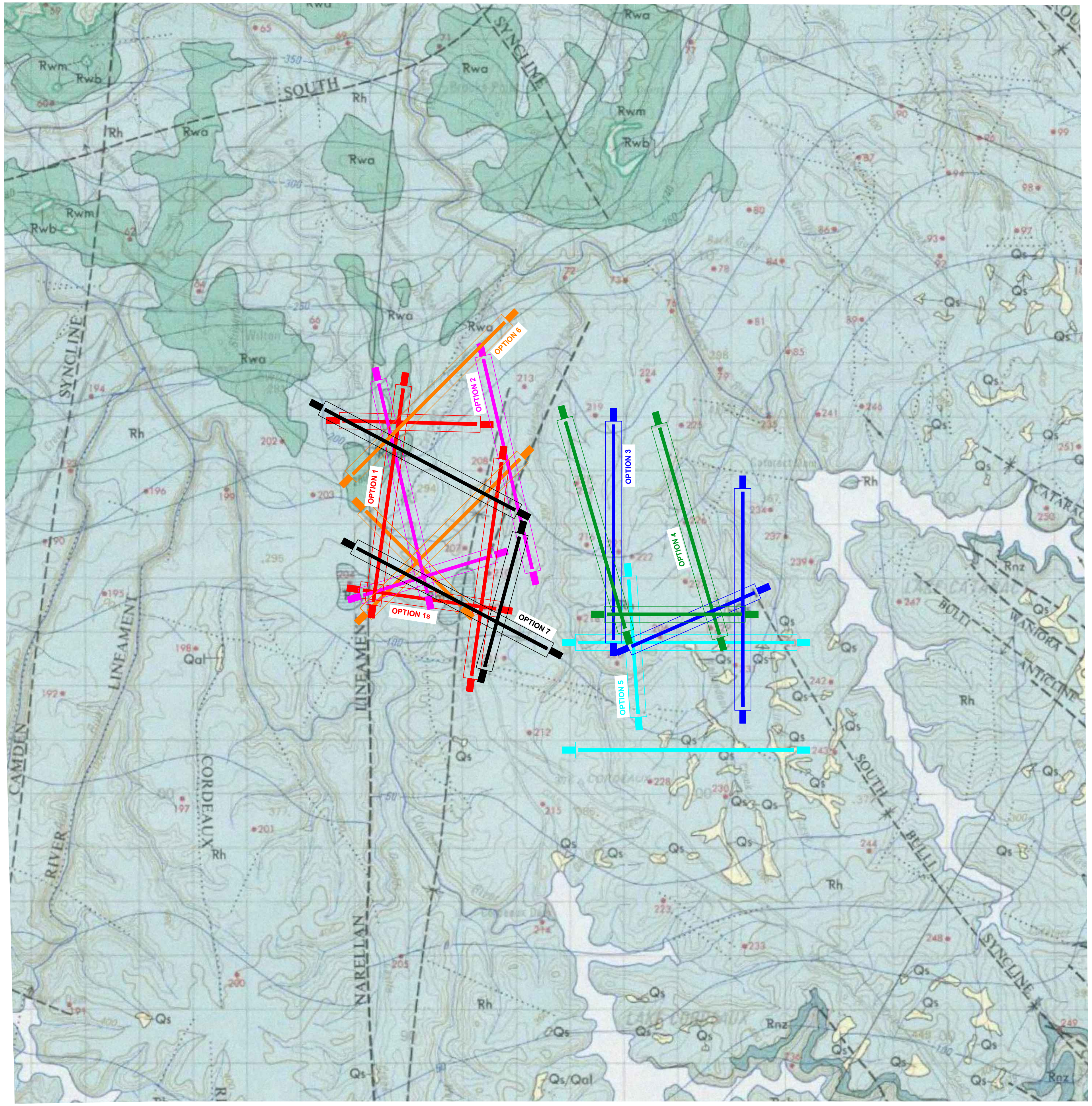
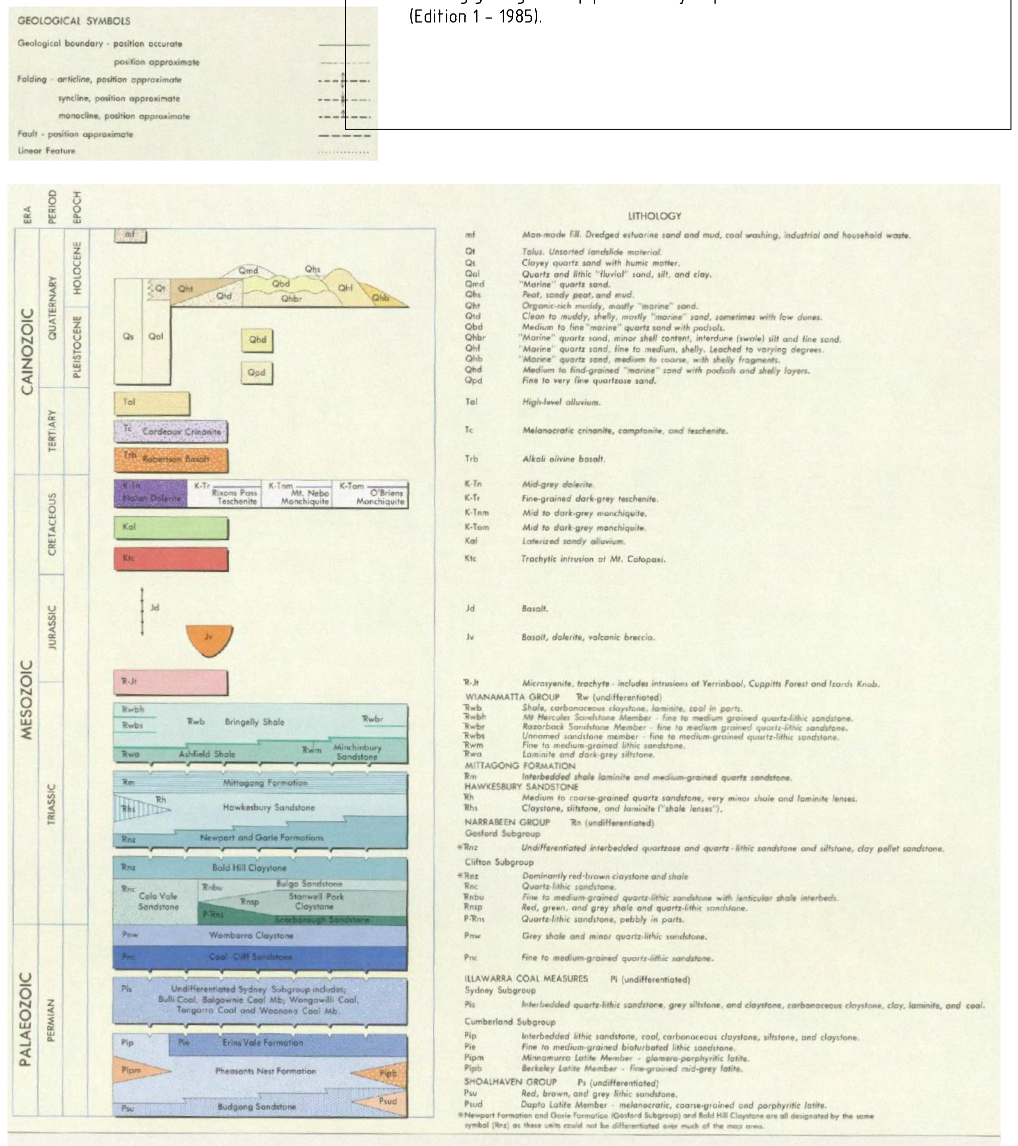


NOTES

1. 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.
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.
3. The base map shown on this drawing is the 1:100,000 Wollongong - Port Hacking geological map produced by Department Mineral Resources (Edition 1 - 1985).



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C	31.07.12	ISSUED TO CUSTOMER
B	20.07.12	ISSUED WITH WORKING PAPER
A	27.06.12	DRAWING CREATED

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NORTH

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resources & energy

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
GEOLOGICAL MAP

WP-301015-03019-GEO-SK-001

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3 WORKING PAPER – REGIONAL RESOURCES AND RESOURCE EXTRACTION

SUMMARY

The Wilton Study Area is underlain by the coal measures of the Sydney Basin which are the key economic resource relevant to the area. The Bulli Seam is at a depth of approximately 400m below the surface of the Study Area and the Wongawilli Seam is about 25m below the Bulli Seam. Both seams have been mined for coking coal in the Southern Coalfields for over a century.

BHPB Illawarra Coal operates Appin Mine immediately north of the Wilton Study Area, and has to date only mined the Bulli Seam. In the southern and south eastern part of the Wilton Site is the area of operation of Gujarat NRE who is commencing mining the Wongawilli Seam in the area of the old Bellambi Colliery, which mined the Bulli Seam.

Within the central and western parts of the Wilton Study Area, there are no current mining leases, but the area is underlain by the same coal seams. The website of the Department of Mines indicates that there is an exploration lease over this area but the operative status of this lease is unknown. Advice from senior personnel at Gujarat NRE is that the coal quality in this exploration lease area is possibly not as good as that to the north and east, and in addition much of the surface land is within a Sydney Catchment Authority area.

All mining in the vicinity of the Wilton Study Area is by longwall methods, and this Working Paper includes an addendum giving a general explanation of longwall mining for the lay person.

In essence, the study shows that the whole Wilton Study Area is underlain by coking coal resources with an indicative sale value of about $1 billion dollars (2012) per square kilometre. During mining of the seams the nature and magnitude of subsidence, which results from longwall mining, is incompatible with a major airport being on the surface above. In areas that have been mined for both the Bulli Seam and Wongawilli Seam, the post-mining and post major subsidence surface movements would not preclude the construction and operation of an airport. However, the only portion of the Wilton Study Area that would fall into this category is the south eastern area just west of Cataract Reservoir where Gujarat NRE may have completed mining by about the year 2035.

If an airport is to be located elsewhere within the Wilton Study Area, it would be necessary to either sterilise an amount of coal or defer airport construction until the coal has been removed and major subsidence has occurred.

This cannot be fully quantified at this time because little is known about the coal resources in the part of the Study Area that is presently under an exploration licence and not under a mining lease, i.e. the aforementioned exploration area. However, from a broad assessment of practical constraints on future coal extraction it is considered that Option 1, Option 1S and Option 7 are likely to cause the least sterilisation of coal resources. These are the Options that are in the southwest of Study Area. Additionally, these Options are further from where both current active and planned mining is to take place in existing coal mining lease areas. This may also lead to lower sterilisation compensation costs.

The Study Area is also underlain by reserves of coal seam gas. The effects of extracting these resources are, in terms of an operating airport, significantly less than those of coal extraction.

3.1 Introduction

This Working Paper addresses Regional Resources and Resource Extraction within the Wilton Study Area. In essence, the resources dealt with in this report are the coal seams that underlay and surround the Wilton site ('the Site'). These are a source of coal for the steel making industry of Australia, Japan, China and India. They are also a potential source of Coal Seam Gas.

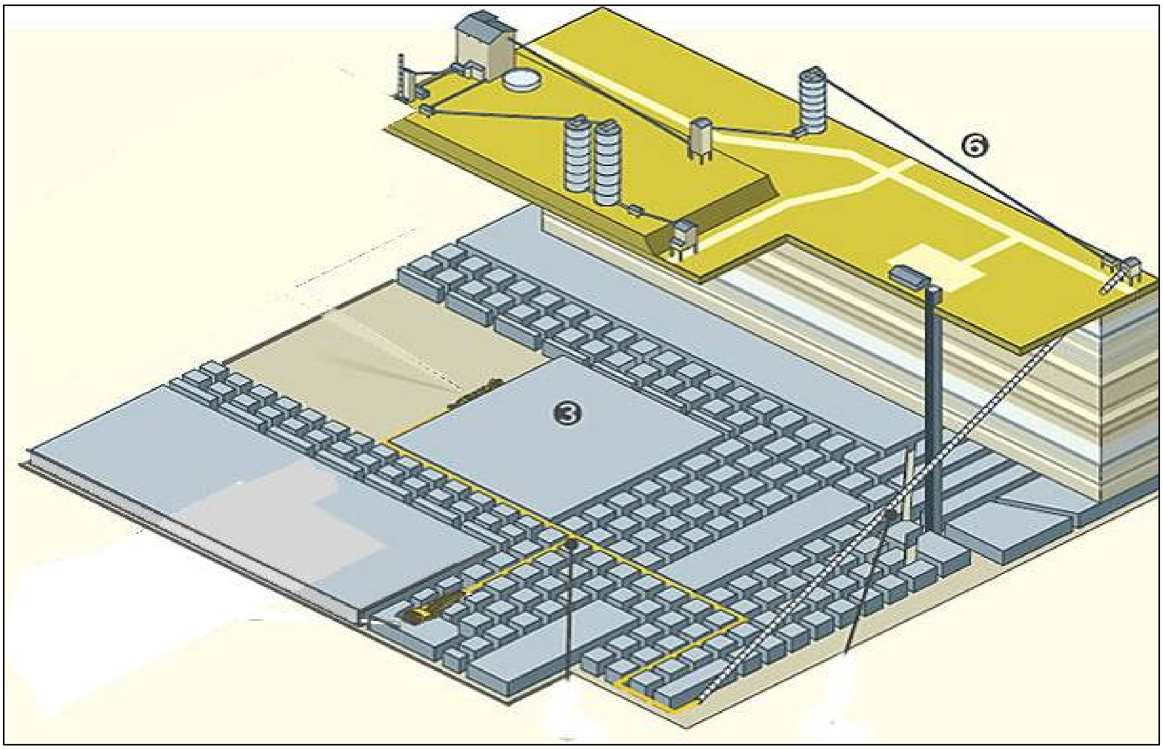
The geology of the site is discussed in the Working Paper *Regional Geology* and that paper should be read as a precursor to this Working Paper. In particular it should be noted that there are three significant seams underlying the site, namely:

- The Bulli Seam at a depth of about 450 m, about 3 m mining thickness;
- The Balgownie Seam about 8 m below the Bulli Seam, a thin seam of valuable low phosphorus coal, only mined to date near the Illawarra Escarpment; and
- The Wongawilli Seam about 20 m below the Bulli Seam, more than 10 m thick, but parts of which are of high ash content resulting in a typical mining thickness is about 3.5 m.

3.1.1 Longwall mining

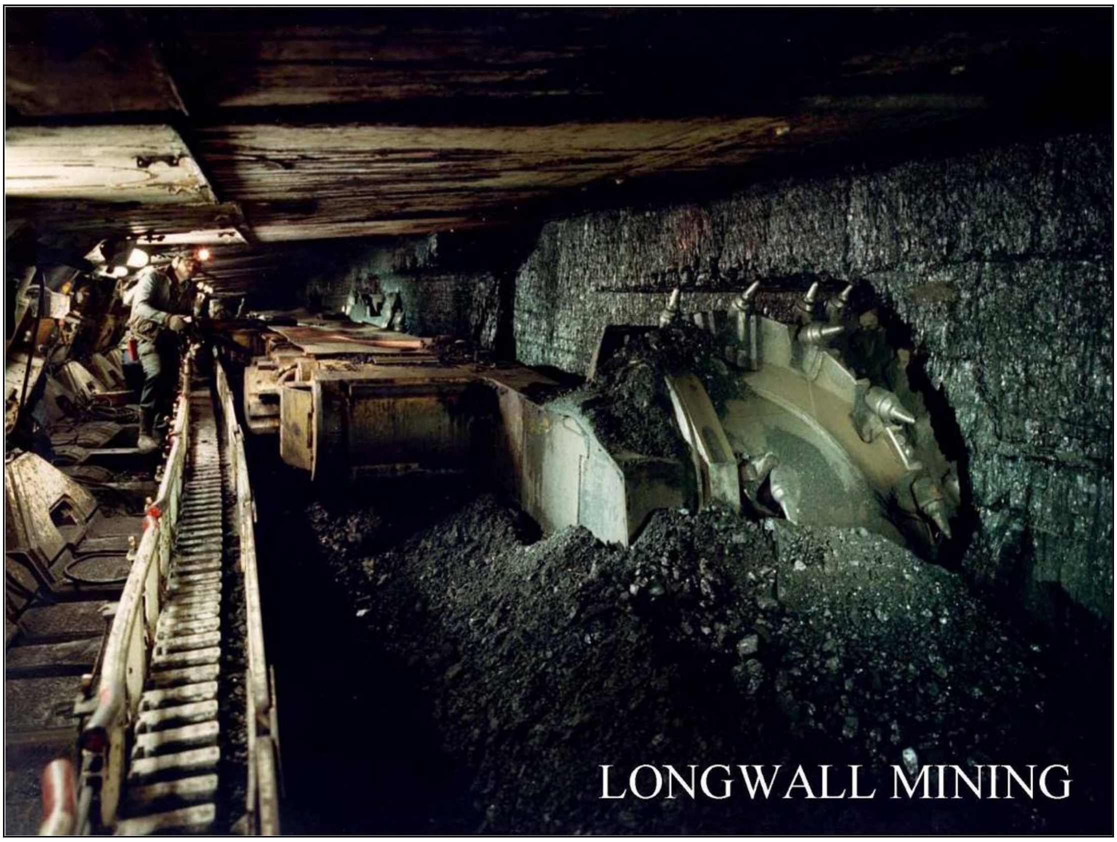
All extraction of coal from the seams beneath, and in the vicinity of the site, has been, and for the foreseeable future will be, by longwall mining (see **Figures 3.1 and 3.2**).

Figure 3.1 Typical longwall mine layout



Source: Pells Consulting

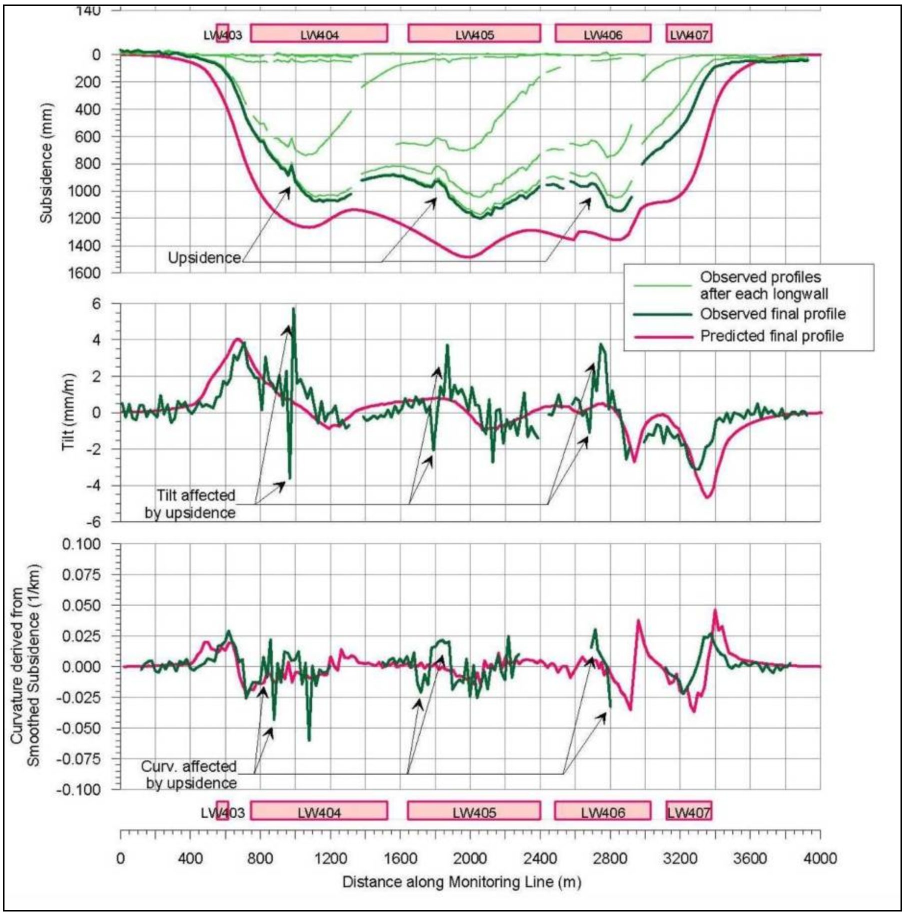
Figure 3.2 Longwall face shearer, chain conveyor and hydraulic roof support



Source: Internet

Longwall mining of the Bulli Seam results in surface subsidence above the centre of a longwall of about 1.2m to 1.5m. The subsidence occurs as a wave across the countryside behind the extraction face, which typically moves at about 30m to 50m per week (see **Figure 3.3**). Typically in the geology of the Study Area, the majority of subsidence can be expected to occur within 1-3 years of coal extraction.

Figure3.3 Subsidence profiles across Appin Longwalls 403 to 407



Source Mine Subsidence Engineering Consultants

The general effects and risks of subsidence on the elements of airport infrastructure from subsidence of this scale are anticipated to be as follows as tabulated below:

Table 3.1 General effects and risks of subsidence on airport infrastructure

Element	Typical Form of damage	Effect and Remedial Actions
Runways and taxiways	Geometrical deformation outside CASA/ICAO rules Physical damage (cracking) of pavements	Loss of capacity with runway out of service for realignment, reconstruction and resurfacing.
Buildings	Geometrical deformation leading to structural damage of building structure and fabric and fit out	Potential loss of some or all of building floor space s to enable re alignment and repairs. Loss of space in which airport process occur leading to loss of capacity
Services	Fracture or geometrical deformation of services leading to non-operation	Disconnection of services such as communications; change in flow paths of surface and subsurface stormwater; sewer and water supply. Deformations leading to rupture of fuel storage tanks

Element	Typical Form of damage	Effect and Remedial Actions
Transportation links	Geometrical deformation outside operational design standards for freeways, major roads, bridges and railways	Loss of access capacity; travel disruptions to passengers and workforce accessing the airport Reconstruction over several kilometres of transport links.

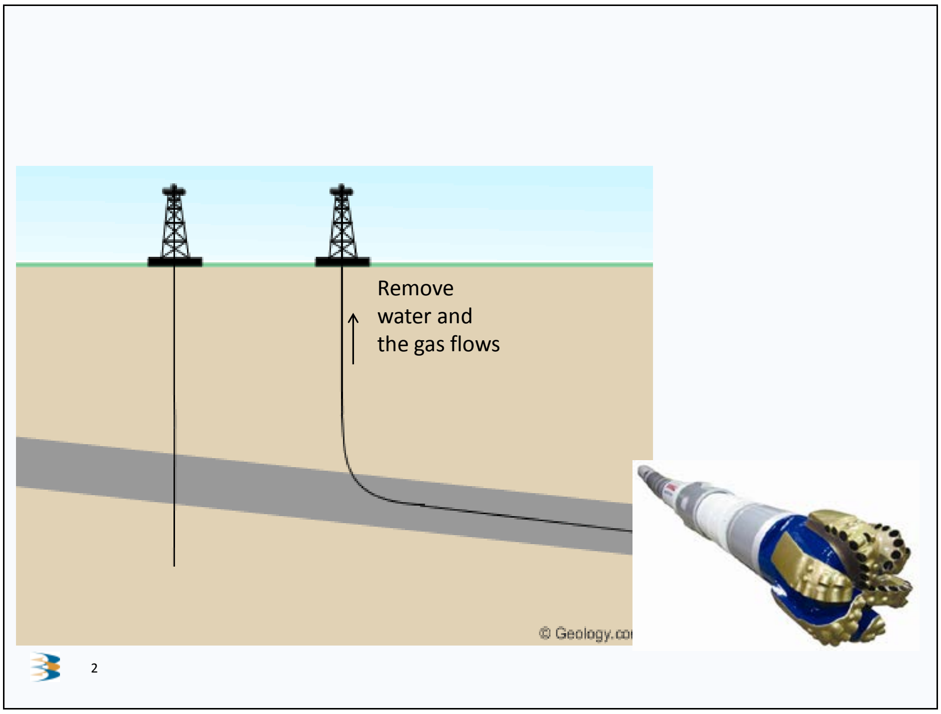
While it is possible to design infrastructure to accommodate deformations which result from mine subsidence – as has been done for some freeway infrastructure in the Sydney Basin, it is at additional cost and there remains the risk that the provision made will not be adequate. An analogous situation existed at Brisbane Airport which is built on reclaimed land with deep sediments. There the domestic terminal was designed to enable jacking of every column in the building to allow its shape to be readjusted in the event of adverse amounts of differential settlement.

A summary of the key aspects of subsidence associated with longwall mining is given in the Appendix at the end of this Working Paper. It is taken directly from a publication of the Sydney Catchment Authority, prepared for the Inquiry into the Southern Coalfields.

3.1.2 Coal seam gas extraction

Coal Seam Gas (CSG) is extracted from coal seams using directionally drilled boreholes. The groundwater has to be depressurised and substantially removed from the seams to allow the methane to desorb from the coal micro-pores, collect in the coal cleats and flow to the boreholes. There is insignificant surface subsidence associated with this gas extraction (see **Figure 3.4**)

Figure 3.4: CSG extraction



Source: Pells Consulting

3.1.3 Existing and proposed mines in the vicinity of the Study Area

The existing coal titles are shown in **Figures 3.5 and 3.6**. Coal titles cover existing mines, although the mine workings, presently, may not cover a full title.

The different airport options are shown on these figures, but because many of them overlap they do not appear as distinct entities. However, because the impacts of coal resources and subsidence are very broad, there is no need to discriminate between details of options that are within the same general area.

Figure 3.5 Existing Coal Titles, showing title numbers

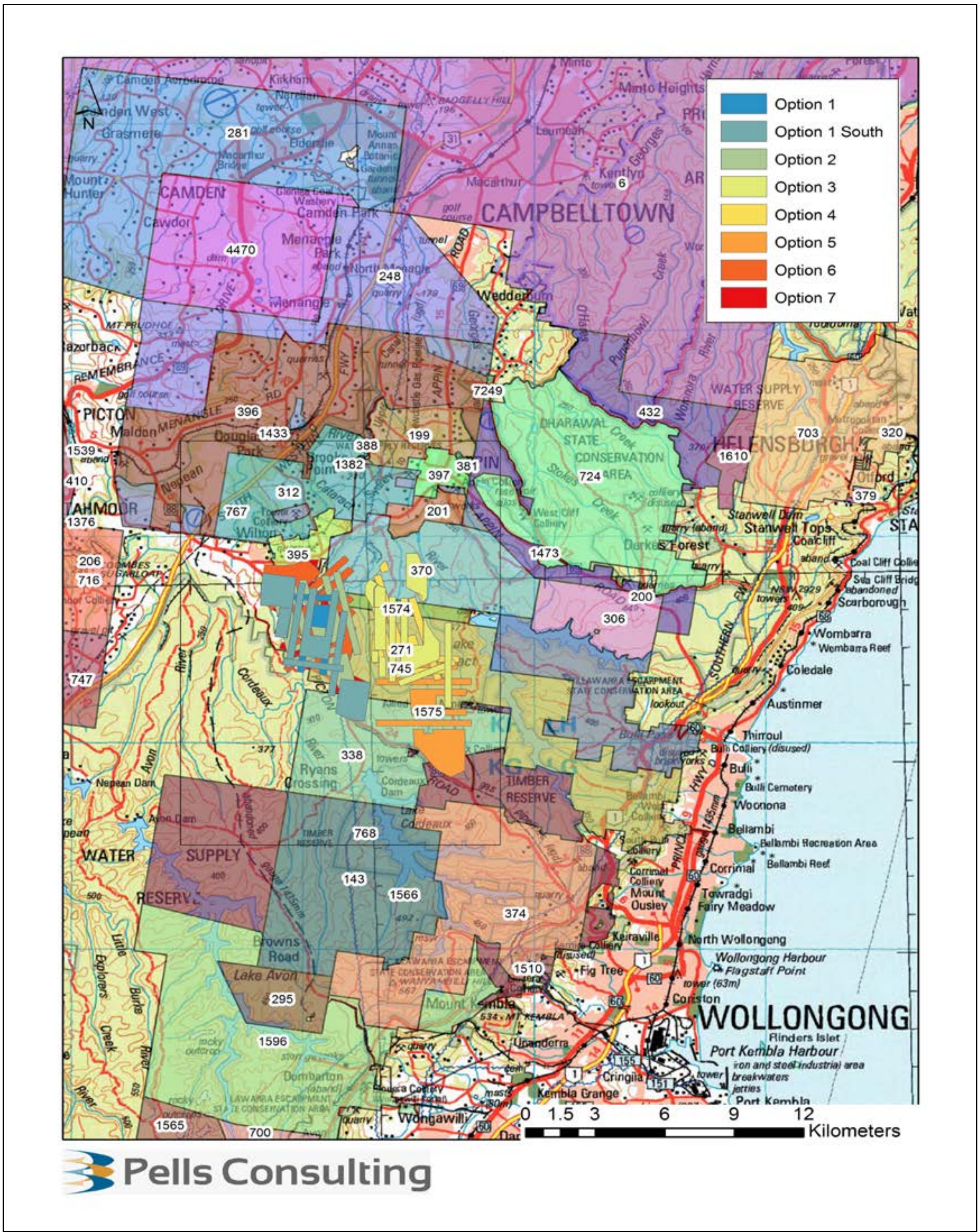
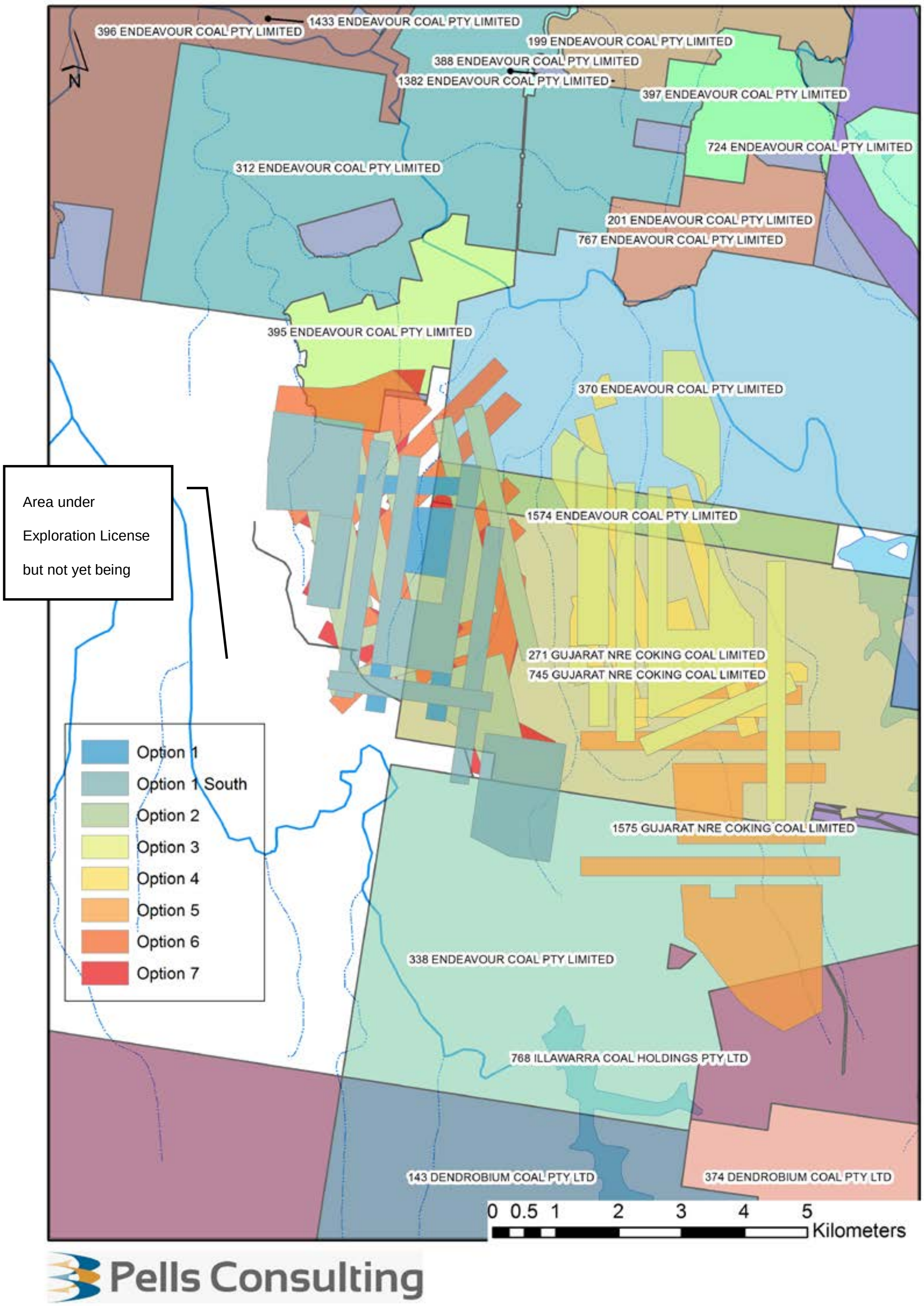
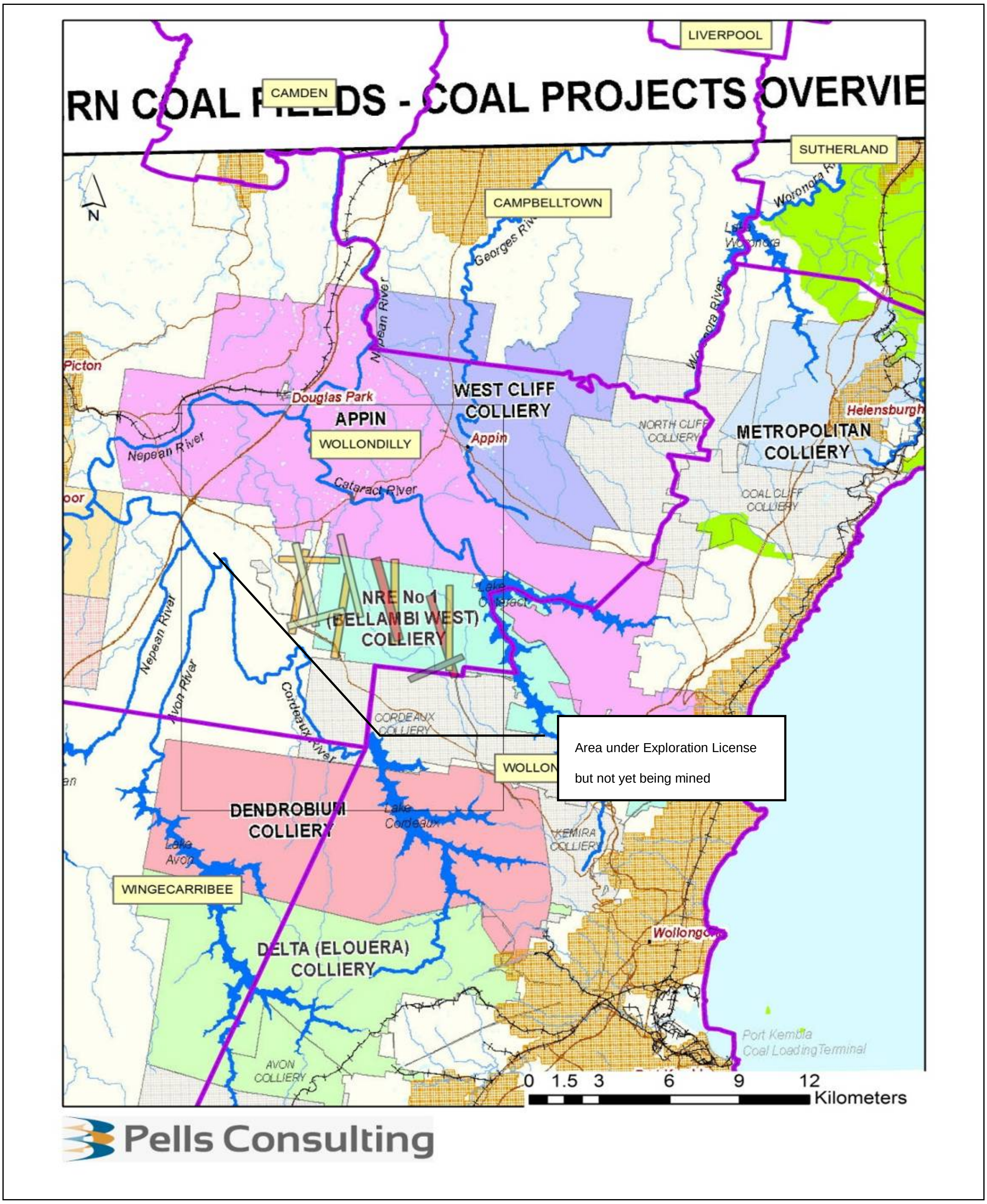


Figure 3.6 Coal title holdings



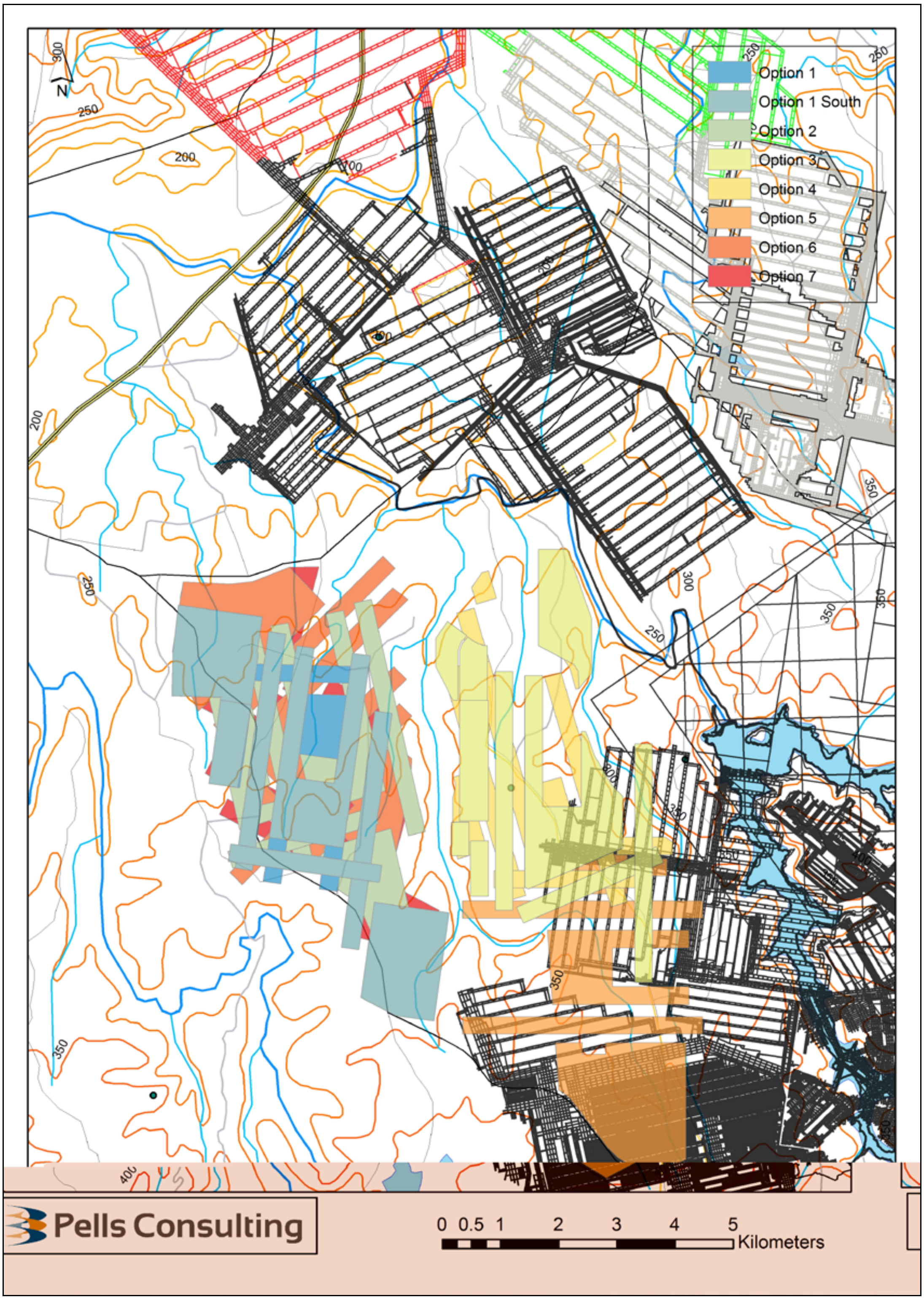
With reference to **Figure 3.6**, Endeavour Coal Pty Ltd is associated with BHP Illawarra Coal, and Gujarat NRE No1 has taken over the old South Bulli and Bellambi Coal lease and is to mine the Wongawilli Seam in that lease. Names of the mines are shown in **Figure 3.7**.

Figure 3.7 Coal titles and colliery names and LGA areas



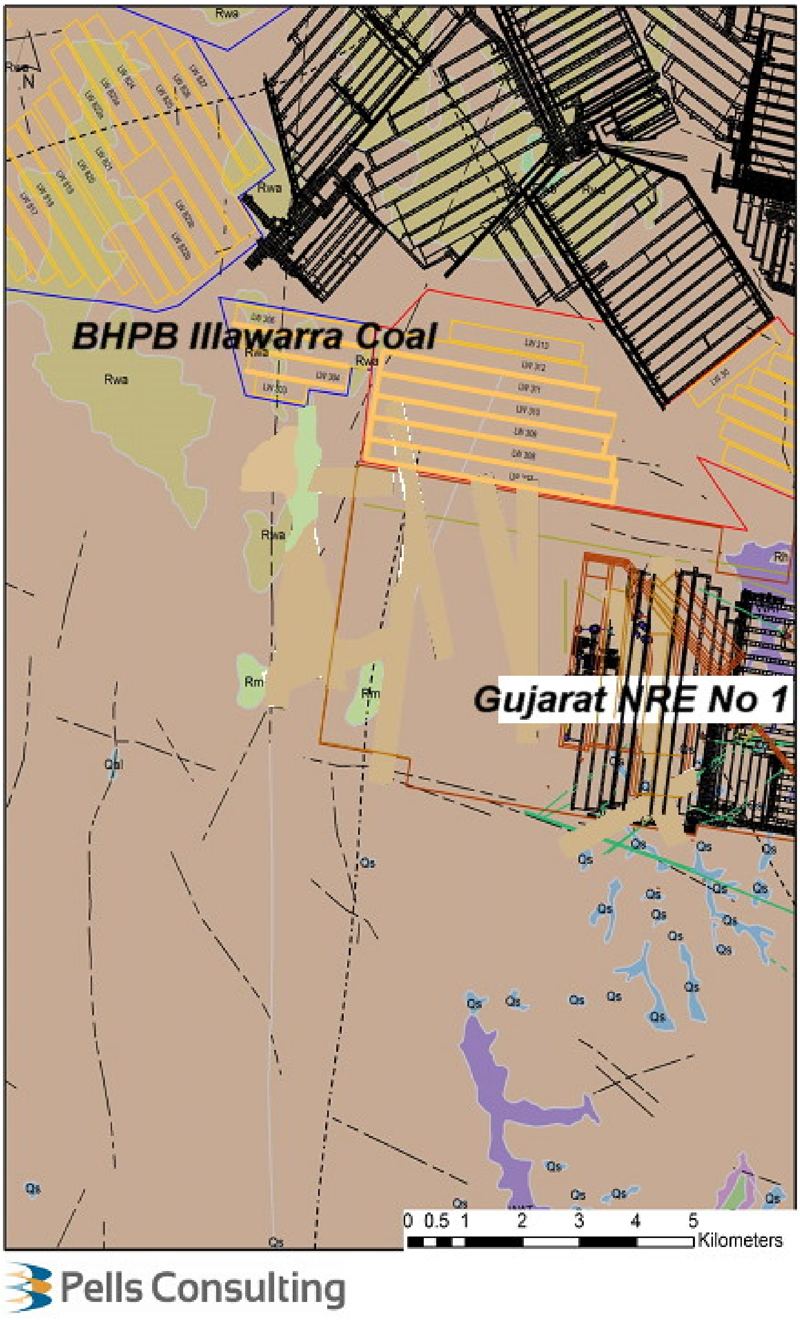
The areas of completed mining, current mining, and areas proposed by BHP Illawarra Coal, and Gujarat NRE No1, are shown in **Figures 3.8** and **Figure 3.9**.

Figure 3.8 Existing coal workings in Black (current BHP Illawarra Coal coal workings (Area 7) in red)



Source BHP Illawarra Coal and Gujarat NRE

Figure 3.9 Existing and proposed workings by BHP Illawarra Coal in the 30 year mine plan, and presently by Gujarat NRE No 1.

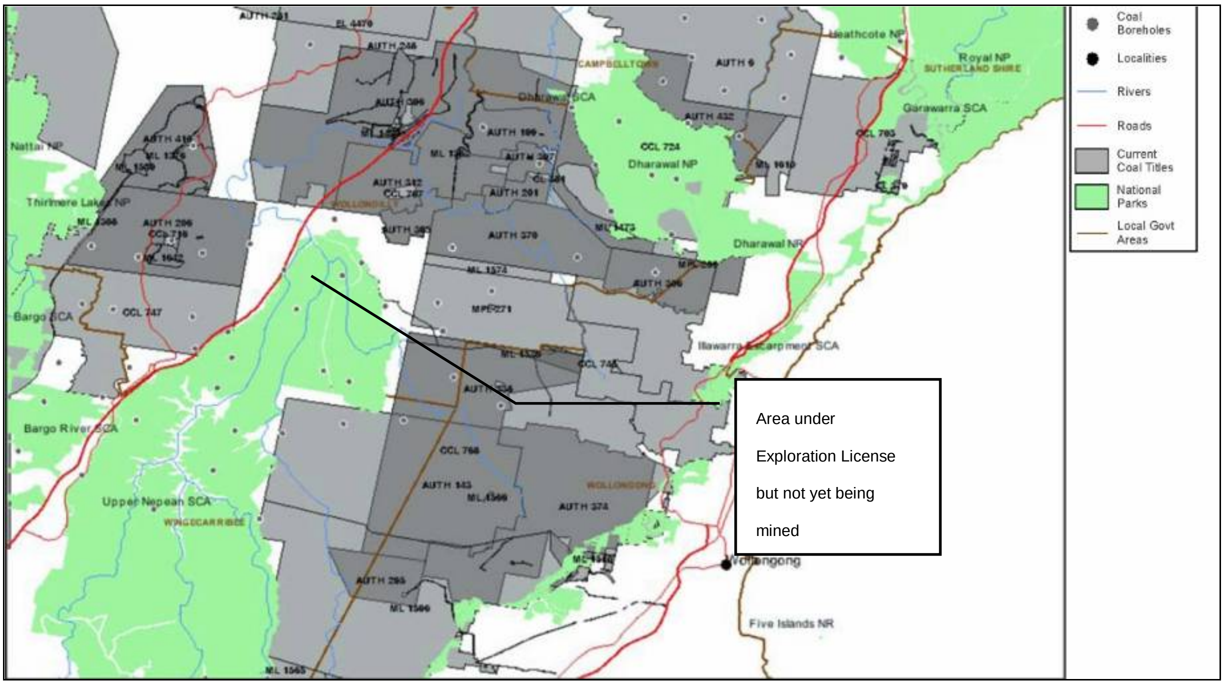


Two points should be noted from **Figures 3.6 to 3.9**

- Within the lease of Gujarat NRE No 1, the Bulli Seam was originally mined by Bellambi Coal only in the western part of the lease, near and partly beneath Cataract Dam. Similarly Gujarat NRE No 1 also show their planned mine in the Wongawilli Seam in that same area, beneath the extracted Bulli Seam; and
- To the west of Gujarat NRE No 1 and south of the BHPB Appin area, there is an area as indicated in **Figure 3.6** with no coal title.

It is understood that there is a significant fault at coal seam level to the west of the existing workings in Gujarat NRE No 1, and it is also understood that coal quality in the Bulli seam beneath this area is of lesser quality. This much of area is also within the State Conservation Area (see **Figure 3.10**).

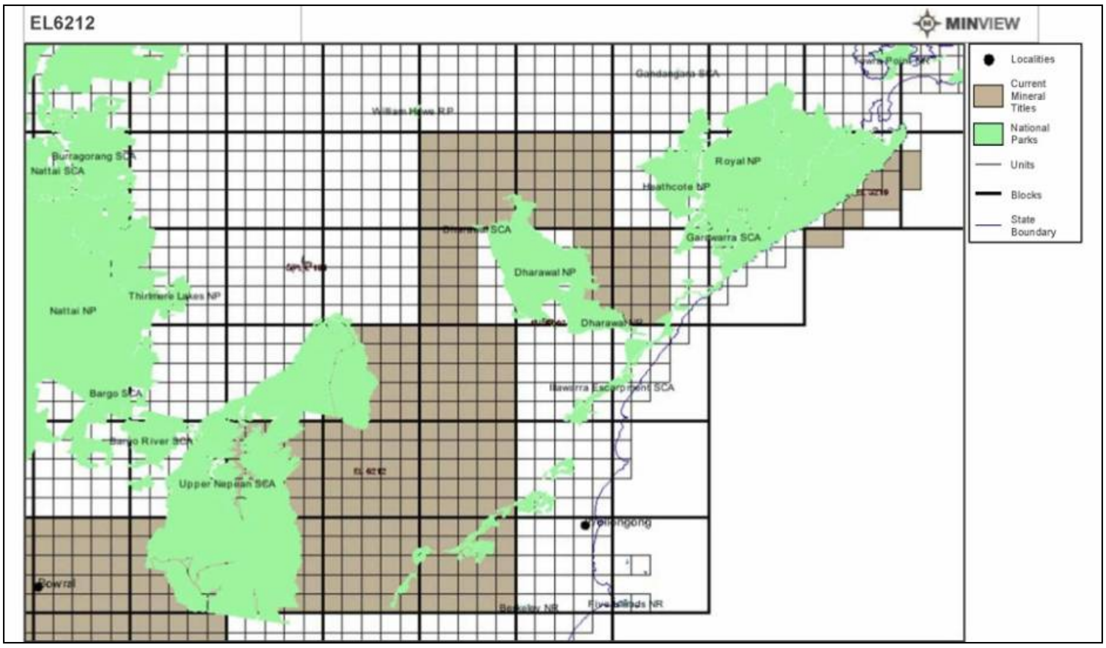
Figure 3.10 Existing coal titles and Protected Lands



According the Dept. of Primary Industries' Minview website, there is a Mineral Exploration Title that covers part of the 'white rectangle' area, as indicated, and which is not presently covered by coal title (see **Figure 3.11**).

The status of exploration of this Mineral Exploration Title is not known. It covers much of the western part of the Wilton Study area wherein there has been no mining to date. From what is known of the geology of the area, it is expected that this area is underlain by mineable coal in the Bulli and Wongawilli seams.

Figure 3.11 Current mineral exploration titles



The mineral title is EL6212 and details are as set out below.

Localities 0 feature(s)

Name

Current Mineral Titles 1 feature(s) view all features

	Title Code	Title No.	Act Year	Company	Grant Date	Expiry Date	Renewal Date	Minerals	Groups
View	EL	6212	1992	LONGREACH OIL LIMITED	04 Mar 2004	03 Mar 2013	25 Jan 2012	Group 8	GROUP8

National Parks 0 feature(s)

Name	Type	Date Gazetted

Units 2 feature(s) view all features

	1:1M Map Sheet	Block No	Unit	Key
View	SYD	2025	o	SYD2025o
View	SYD	2025	t	SYD2025t

Blocks 1 feature(s) view all features

	1:1M Map Sheet	Block No	Key
View	SYD	2025	SYD2025

Pells Consulting has not been able to discover further details of this exploration title, but it cannot be for Coal Seam Gas, because CSG titles are under Petroleum Titles and not Mineral Titles. It will be necessary to obtain specialist legal advice as to the present status of this exploration title.

3.1.4 Value of resources

If it is assumed that thickness of 2m of coking coal could be extracted from the Bulli seam, and 3m from the Wongawilli seam, then, at an average sale price of $200 per tonne[7] and assuming 65% overall extraction rate, the indicative value of the coal is about 1 billion dollars per square kilometre.

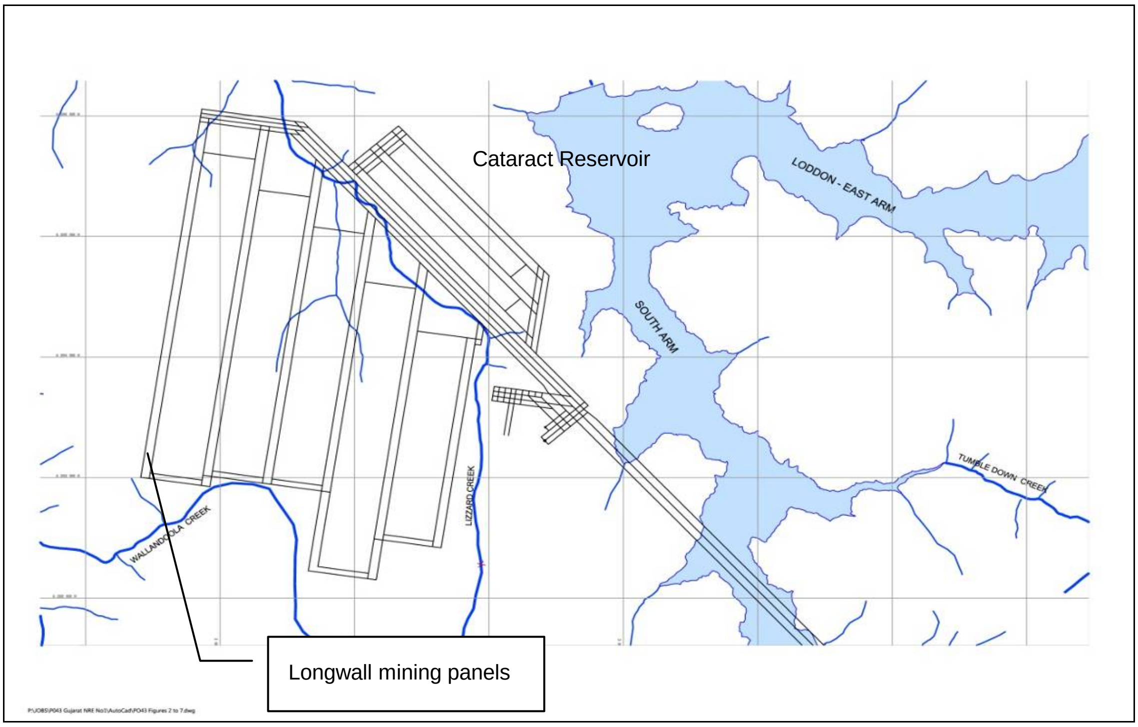
3.2 Subsidence

As already stated, future subsidence associated with the BHPB Illawarra Coal longwalls shown in **Figure 1.8** is likely to be similar to that of Figure 14.3, although magnitudes are likely to be slightly higher, say up to 2m, because wider longwall faces may be adopted. The present longwall faces are 250m to 300m, but there are mines in NSE already operating with 400m faces – i.e. coal is being continuously mined and extracted across a 400m long working face.

The subsidence above the proposed Gujarat NRE No 1 longwalls, in the Wongawilli seam, will be greater than that from the Bulli seam workings because the Wongawilli longwalls will be beneath an area already mined by Bellambi Coal in the Bulli Seam. Gugarat NRE No 1 refers to this area as Wonga West and their current proposed layout (but not showing the overlying old Bellambi workings) is detailed in **Figure 3.12**.

[7] See Working Paper *"Regional Geology"*

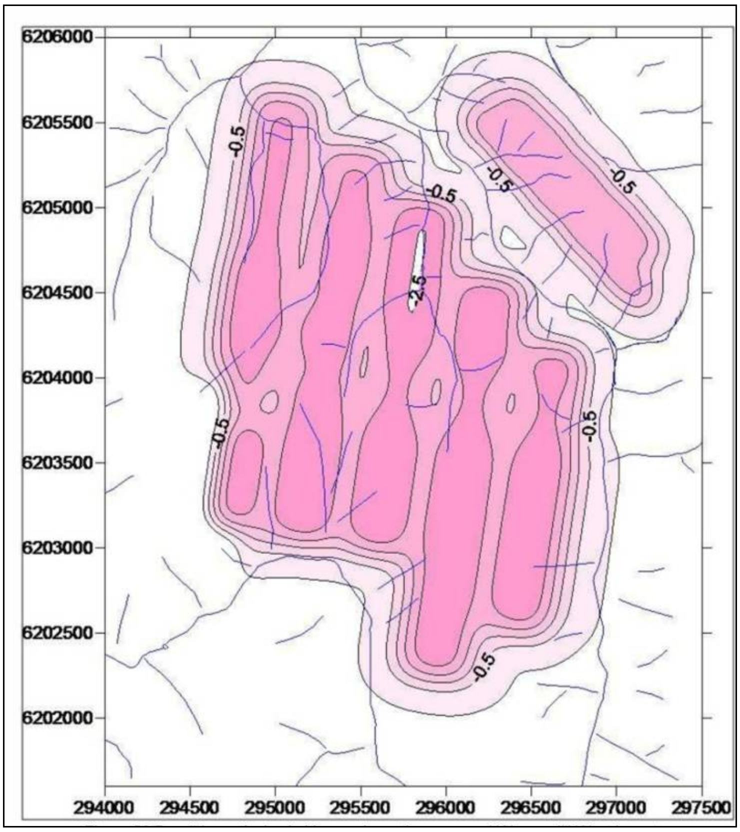
Figure 3.12 Proposed Wonga West longwalls in the Wongawilli Seam



Source: Gujarat NRE

The predicted subsidence contours above the presently proposed mine layout is shown in **Figure 3.13**.

Figure 3.13 Predicted subsidence contours in metres above Wonga West longwalls



Source: Gujarat NRE and Seedsman Geotechnics

It can be seen from **Figure 3.13** that subsidence of up to 2.5m may be expected in this area during the approximate period 2014 to 2030. After mining is completed there will be very little ongoing settlement. However, it is not known at this time whether Gujarat NRE No 1 would then move to the west within their lease and continue mining towards the westernmost airport sites.

If any of the area is to be mined for CSG extraction, surface subsidence would be negligible and will not impact on airport planning or operations.

3.3 Assessment of Options

It is apparent that there are some differences between the conditions that exist in respect of the potential for interaction between coal mining activities and airport development at each of the seven options considered. The key differences are noted in **Table 3.2** and further summarized in **Table 3.3**.

Table 3.2 Key differences between Airport Options in respect of coal mining activities

Option	Constrain Imposed by Existing Mining or Coal Resources
1	Away from existing mining and mostly south of area included in BHP Illawarra Coal 30 year mine plan. Would sterilise coal with a possible sale value of about 20 billion dollars
2	Away from existing mining and mostly south of area included in BHP Illawarra Coal 30 year mine plan. Would sterilise coal with a possible sale value of up to about 20 billion dollars
3	Above area of previous mining in Bulli seam, and proposed mining by Gujarat NRE in Wongawilli seam that will possibly extend to the year 2030 to 2035. Extending to unmined area to west where coal would be sterilized – the amount depending on when the airport is built and the unknown plans of Gujarat NRE.
4	Above area of previous mining in Bulli seam, and proposed mining by Gujarat NRE in Wongawilli seam that will possibly extend to the year 2030 to 2035. Extending to unmined area to west where coal would be sterilized – the amount depending on when the airport is built and the unknown plans of Gujarat NRE
5	Above area of previous mining in Bulli seam, and proposed mining by Gujarat NRE in Wongawilli seam that will possibly extend to the year 2030 to 2035. Extends into area of Cordeaux Colliery that is now closed and is gradually filling with water. If the Wongawilli seam were to be mined in this colliery the colliery would have to be dewatered. This appears unlikely.
6	Away from existing mining but within area included in BHP Illawarra Coal 30 year mine plan. Would sterilise coal with a possible sale value of up to about 20 billion dollars
7	Away from existing mining but partially within area included in BHP Illawarra Coal 30 year mine plan. Would sterilise coal with a possible sale value of up to about 20 billion dollars

The following **Table 3.3** summarizes a qualitative assessment of the relative effects of coal mining and potentially subsidence on the options for airport development.

Table 3.3 Summary qualitative assessment

	Airport Option							
	1	**1S**	**2**	**3**	**4**	**5**	**6**	**7**
Site Underlain by Coal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Site covered by current mining lease	Yes >50%	Yes >50%	Yes >50%	Yes 100%	Yes 100%	Yes 100%	Yes 100%	Yes >50%
Past or Active mining	No	No	No	Yes	Yes	Yes	No	No
Proposed mining beneath airport site	No	No	Yes partial	Yes	Yes	Yes	Yes partial	No
Potential for airport site to subside	No	No	Yes partial site	Yes entire site	Yes entire site	Yes entire site	Yes partial site	No
Scale of Subsidence expected	Unlikely	Unlikely	Up to 1.5 m	Up to 2.5 m	Up to 2.5 m	Up to 2.5 m	Up to 1.5 m	Unlikely
Additional design Cost for Infrastructure	Less Likely	Less Likely	Very Likely	Very Likely	Very Likely	Very Likely	Very Likely	Less Likely
Value of resources Sterilised	Up to $20 billion (if fully mineable) with a possible lower limit of $5-6 billion	Up to $20 billion (if fully mineable with a possible lower limit of $5-6 billion	Up to $20 billion	Up to $20 billion	Up to $20 billion	Up to $20 billion	Up to $20 billion	Up to $20 billion (if fully mineable with a possible lower limit of $5-6 billion

Based on this assessment it appears that Options 1 and 1S and 7 are the least likely to be affected by subsidence in the foreseeable future.

In the case of Option 1, it would be significantly better because the cross runway, as currently positioned, is basically above what would always remain as a barrier of unmined coal between the BHP Bulli Seam operations in the north, and the possible Gujarat NRE colliery holdings to the south. In addition, the western NS runway is above what would have to be a barrier pillar between the Gujarat holdings and the Exploration area to the west. Option 1 could be considered as in effect sterilising only the coal from midway between the parallel North - South runways and the eastern footprint of the easternmost North-South runway. This could reduce the degree of sterilisation to about 5- 6 sq. km. The footprint of Option 7 would similarly create a reduced degree of sterilisation. However, in all cases, this degree of reduced effect requires more detailed assessment.

In addition to the economic cost of sterilisation there may be compensatory costs in some form required to be paid to the mining companies for their loss of sections of their existing mining leases.

3.4 Key findings

- There are two conflicting facets that have to be evaluated in assessing the impact of regional resources, in particular coal, on the proposed airport;
- Within the north west and western part of the Wilton Study area there has been no mining to date, but the area is underlain by the Bulli and Wongawilli seams, with an indicative coal sale value estimated as about 1 billion dollars per square kilometre;
- Given that the site area for the typical options prepared for this study is about 20 square kilometres, and assuming that active mining beneath runways, taxiways and major buildings would not be tolerable, it can be seen that the potential value of sterilised coal is high, possibly of the order of $20 billion for the full airport footprint; For some options this may be reducible to about $5-6 billion due to their lesser footprint on existing mining leases;
- Within the south east portion of the Wilton Study Area, there has already been mining in the Bulli seam and Gujarat NRE is planning to mine the Wongawilli seam, between the present time and, probably, about 2035. Once the mining is completed there would be little residual subsidence, which could be accommodated in the design of the runways and other components of the airport;
- Of the two groups of airport sites , to the east and west of Wallandoola Creek, those to the west are less likely to be affected by future mining activity and those to the south west (1, 1S and 7) are the least likely to be affected and on current proposals may not be affected at all;
- Construction of an airport on land above economically valuable and mineable coal will necessarily require sterilisation of that resource to eliminate the possibility of subsidence damage to the airport assets and loss of operability; An airport could be constructed on land which has already subsided and is not liable to be mined beneath again;
- Compensatory costs may be payable to mining companies for loss of existing mining lease area; and
- The key issue then is balancing the timing of construction of the facility and that of resource extraction and the value of sterilised coal.

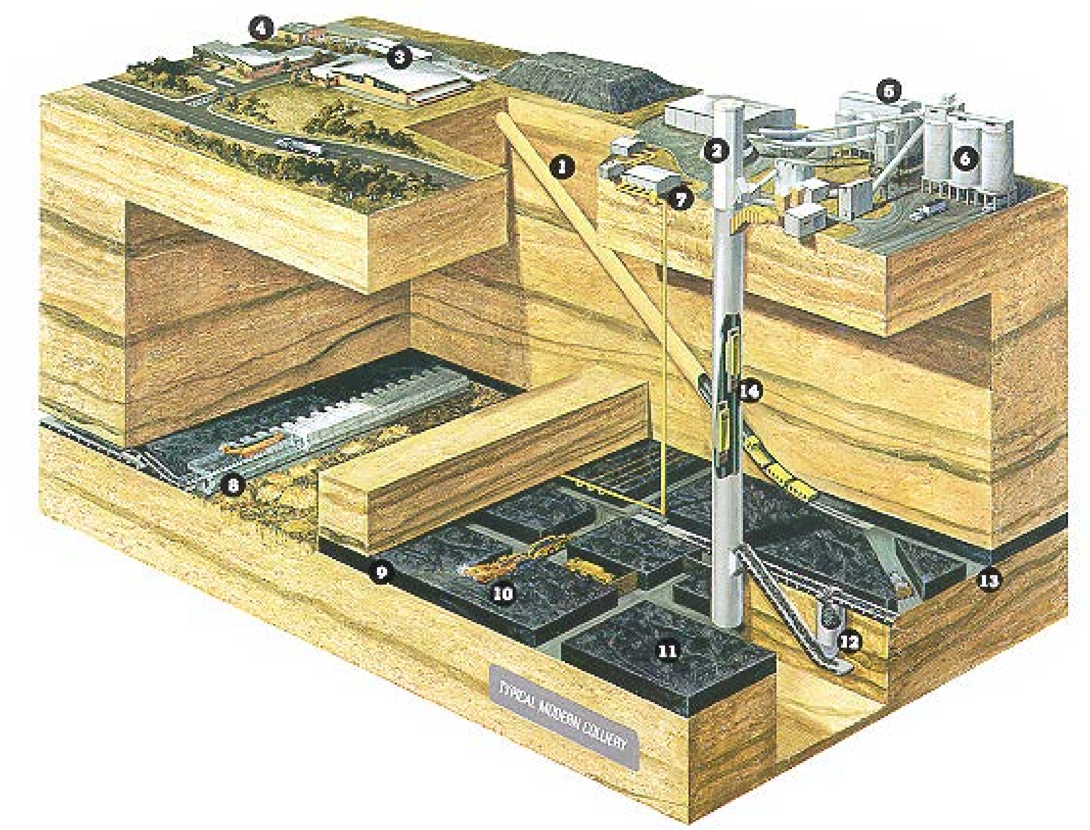
APPENDIX 3A Introduction to Longwall Mining and Subsidence

INTRODUCTION TO LONGWALL MINING AND SUBSIDENCE
by MINE SUBSIDENCE CONSULTANTS

(www.minesubsidence.com/index_files/files/Mine_Subs_Damage_to_Bld_Structures.pdf)

The Longwall Mining Process

Figure A.1, below, shows a cutaway diagram of a typical longwall mine. The main features of the mine are indicated in the key below the diagram. The longwall face is indicated by the number 8 in the diagram.



1. Drift for men and materials access	8. Longwall face equipment
2. Shaft winder house	9. Coal seam
3. Bathhouse and administration building	10. Continuous miner unit
4. Workshops	11. Coal pillar
5. Coal preparation plant	12. Underground coal bin
6. Coal storage bins	13. Main roadway or heading
7. Gas drainage system	14. Coal skips to carry coal to the surface

Figure A.1 Typical longwall mine

In longwall mining, a panel of coal, typically around 150 to 300 metres wide, 1000 to 3500 metres long and 2 to 5 metres thick, is totally removed by longwall shearing machinery, which travels back and forth across the coalface. A typical section through a coal face is shown in Fig. A.2 and a photograph of typical longwall face equipment is shown in Fig. 10.2 of the main text of this Working Paper. The shearer cuts a slice of coal from the coalface on each pass and a face conveyor, running along the full length of the coalface, carries this away to discharge onto a belt conveyor, which carries the coal out of the mine.

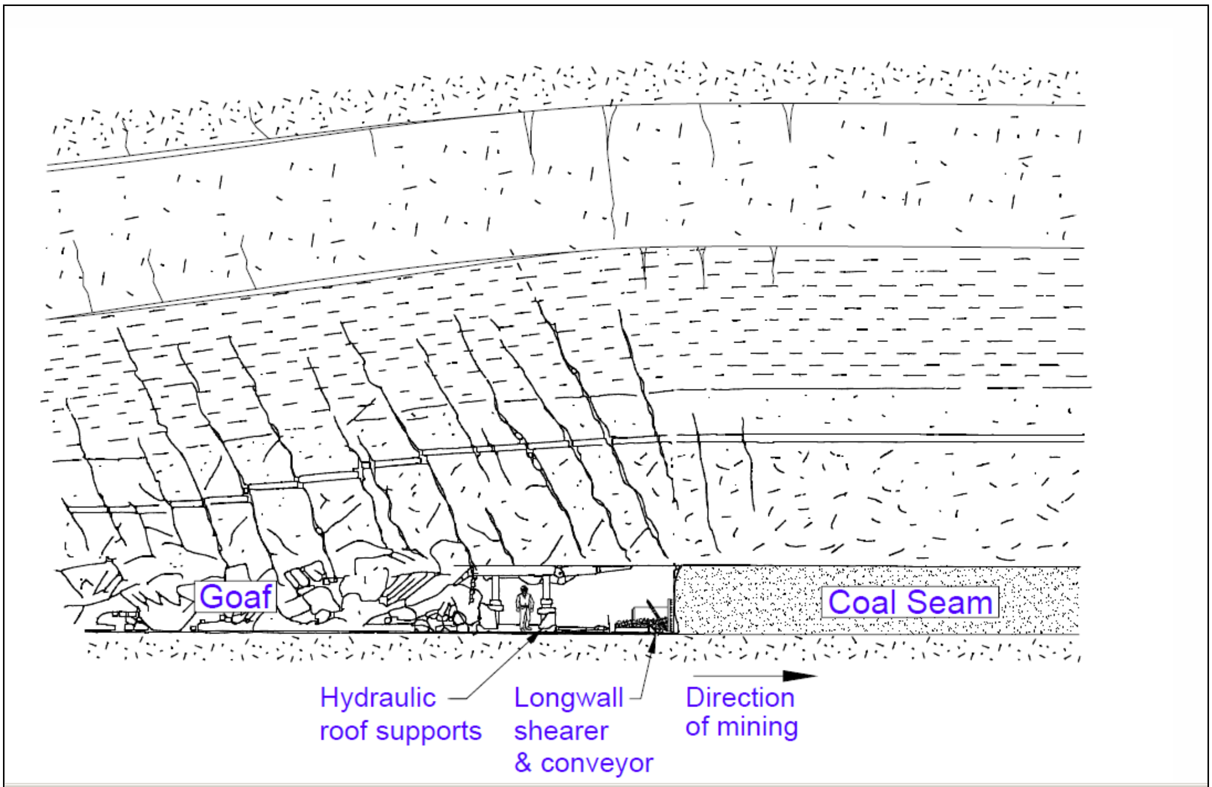


Figure A.2 Cross-section through longwall face

The area immediately in front of the coalface is supported by a series of hydraulic roof supports, which temporarily hold up the roof strata and provide a working space for the shearing machinery and face conveyor. After each slice of coal is removed, the hydraulic roof supports, the face conveyor and the shearing machinery are moved forward.

Fig. A.3 shows a typical layout of a group of longwalls. Before the extraction of a longwall panel

commences, continuous mining equipment extracts coal to form roadways (known as headings) around the longwall panel. These roadways form the mine ventilation passages and provide access for people, machinery, electrical supply, communication systems, water pump out lines, compressed air lines and gas drainage lines. The roadways, which provide access from the mine entrance to the longwalls, are referred to as the main headings. Once the main headings have been established additional roadways, known as development headings, are driven on both sides of the longwall panel and are connected together across the end of the longwall.

The longwall face equipment is established at the end of the panel that is remote from the main headings and coal is extracted within the panel as the longwall equipment moves towards the main headings. This configuration is known as retreat mining. Typically, a longwall face retreats at a rate of 50 metres to 100 metres per week, depending on the seam thickness and mining conditions. The coal between the development headings and between the main headings is left in place as pillars to protect the roadways as mining proceeds. The pillars between the development headings are referred to as chain pillars. When coal is extracted using this method, the roof immediately above the seam is allowed to collapse into the void that is left as the face retreats. This void is referred to as the goaf. Miners working along the coalface, operating the machinery, are shielded from the collapsing strata by the canopy of the hydraulic roof supports. As the roof collapses into the goaf behind the roof supports, the fracturing and settlement of the rocks progresses through the overlying strata and results in sagging and bending of the near surface rocks and subsidence of the ground above, as illustrated in Fig. A.2.

If the width of an extracted panel of coal is small and the rocks above the seam are sufficiently strong, it is possible that the roof will not collapse and hence no appreciable subsidence will occur at the surface. However, to maximise the utilisation of coal resources and for other economic reasons, wide panels of coal are generally extracted and, in most cases, the roof is unable to support itself.

Longwall panel widths between 250 metres and 300 metres are becoming common as collieries strive towards more cost-efficient production and some collieries are now considering longwall widths of 400 metres or more.

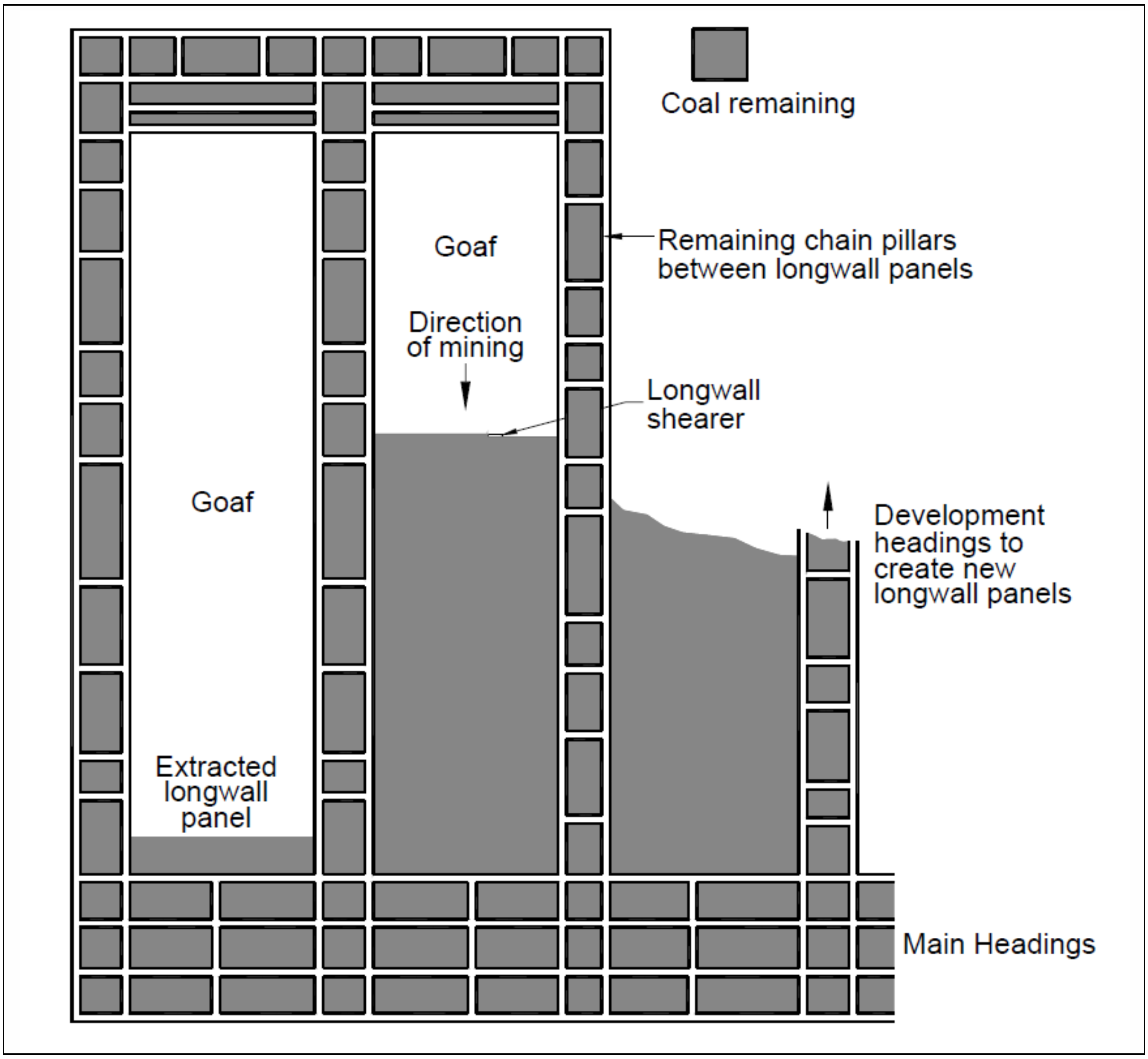


Figure A.3 Longwall layout

The Development of Subsidence

Subsidence Mechanisms

As the immediate roof strata, i.e. the rocks immediately above the seam, collapse into the goaf, the rocks above them lose support and sag to fill the void beneath them. The mechanism progresses towards the surface and the affected width increases so that at the surface, an area somewhat larger than the extracted panel of coal undergoes settlement. Fig. 10.1 in the main text of this working paper shows a typical subsidence profile above an extracted longwall panel and it can be seen that the majority of the subsidence occurs over the centre of the longwall and tapers off around the perimeter of the longwall. The subsidence is typically less than the thickness of coal extracted underground.

The angle at which the subsidence spreads out towards the limit of subsidence, at the surface, is referred to as the angle of draw. The angle of draw depends upon the strength of the strata and the depth of cover to the coal seam and typically lies between 10 and 35 degrees from the vertical, depending on how the limit of subsidence is defined.

It is generally accepted that subsidence of less than 20 mm will have negligible effect on surface infrastructure and this is generally adopted as the cut-off point for determination of the angle of draw.

In the Coalfields of NSW, if local data is not available, the cut-off-point is taken as a point on the surface defined by an angle of draw of 26.5 degrees from the edge of the extraction, i.e. a point on the surface at a distance of half the depth of cover from the goaf edge. Where local data exists and it can be shown that the angle is generally less than 26.5 degrees, then, the lower angle of draw can be used.

The subsidence of the surface is considerably less than the thickness of coal removed, due to the voids that are left within the collapsed strata. The extent of the settlement at the surface is therefore dependent upon the strength and nature of the rocks overlying the coal seam and is a direct function of their capacity to bridge over the voids.

When a panel has a width that is small, relative to the depth of the seam below the surface, the fractured rocks have a tendency to bridge over the goal by arching between the solid abutments on each side of the panel, thus reducing the amount of subsidence.

As the panel width is increased, however, the overlying rocks are less able to arch over the goaf and a limiting panel width is reached where no support is available and maximum subsidence occurs. This limiting panel width is referred to as the critical width and is usually taken to be 1.4 times the depth of cover. It does, however, depend upon the nature of the strata.

Where several panels are mined in a series and chain pillars are left between the panels, the maximum subsidence does not occur unless each panel is, at least, of critical width. The chain pillars crush and distort as the coal is removed from both sides of them, but, usually, they do not totally collapse and, hence, the pillars provide a considerable amount of support to the strata above them.

Where large super-critical areas are extracted, the maximum possible subsidence is typically 55% to 65% of the extracted seam thickness, but, because chain pillars are normally left in place, and provide some support, this maximum possible subsidence is rarely reached.

Research has shown that the incremental subsidence of a second or subsequent panel in a series is greater than the subsidence of an individual isolated panel of identical geometry. Because the subsidence effects above a panel extend beyond its goaf edges, these effects can overlap those of neighbouring panels. Where the width to depth ratios of the panels in a series are sub-critical, which is normally the case in the Southern Coalfield, the amount of subsidence in each panel is determined by the extent of these overlaps, which are further influenced by the widths of the chain pillars. In this situation, the first panel in a series will generally exhibit the least subsidence and the second and subsequent panels will exhibit greater subsidence due to disturbance of the strata caused by mining the preceding panels and consequential redistribution of stresses within the strata.

The subsidence at the surface does not occur suddenly but develops progressively as the coal is extracted within the area of influence of the extracted panel. In many cases, when the cover over the coal seam is deep, a point on the surface will be affected by the extraction of several adjacent panels.

When extraction of coal from a panel is commenced, there is no immediate surface subsidence, but as the coal within the panel is extracted and the resulting void increases in size, subsidence develops gradually above the goaf area. As mining continues, a point is reached within the panel where a maximum value of subsidence occurs and despite further mining beyond this point, within the panel, this level of subsidence is not increased.

As further adjacent panels are extracted, additional subsidence is experienced, above the previously mined panel or panels. However, a point is also reached where a maximum value of subsidence is observed over the series of panels irrespective of whether more panels are later extracted.

The subsidence effect at the surface occurs in the form of a wave, which moves across the ground at approximately the same speed as the longwall face retreats within the longwall panel. The extraction of each panel creates its own wave as the panels are mined in sequence.

The development of subsidence at any point on the surface of the ground can be seen to be a very complex mechanism and the cumulative effect of a number of separate movements.

Subsidence Parameters

Subsidence, tilt, horizontal displacement, curvature and strain are the subsidence parameters normally used to define the extent of the surface movements that will occur as mining proceeds and generally form the basis for the assessment of the impacts of subsidence on surface infrastructure. These parameters are illustrated in Fig. A.4 which shows a typical subsidence profile drawn to an exaggerated vertical scale.

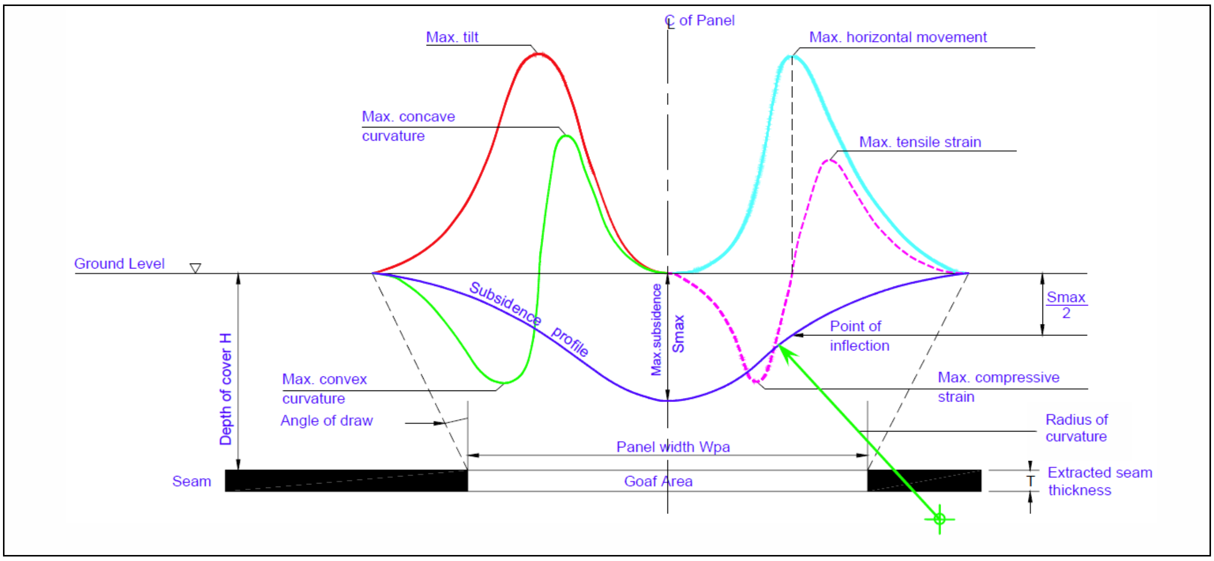


Figure A.4 Subsidence parameters

Subsidence

Subsidence usually refers to vertical displacement of a point, but subsidence of the ground actually includes both vertical and horizontal displacements. These horizontal displacements can in many cases be greater than the vertical subsidence, where the subsidence is small. The amplitude of subsidence is usually expressed in millimetres.

Tilt

Tilt is calculated as the change in subsidence between two points divided by the distance between those points. Tilt is, therefore, the first derivative of the subsidence profile. The sign of tilt is not important, but the convention usually adopted is for a positive tilt to indicate the ground increasing in subsidence in the direction of measurement.

The maximum tilt, or the steepest portion of the subsidence profile, occurs at the point of inflection in the subsidence trough, where the subsidence is roughly equal to one half of the maximum subsidence. Tilt is usually expressed in millimetres per metre.

Horizontal Displacement

The horizontal component of subsidence, or horizontal displacement, is greatest at the point of maximum tilt and declines to zero at the limit of subsidence and at the point of maximum subsidence. Horizontal displacement is usually expressed in millimetres.

Curvature

Curvature is the second derivative of subsidence, or the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections. Curvature is usually expressed as the inverse of the radius of curvature with the units of 1/km, or km-1, but the value of curvature can be inverted, if required, to obtain the radius of curvature, which is usually expressed in kilometres.

Curvature is convex or 'hogging' over the goaf edges and concave or 'sagging' toward the bottom of the subsidence trough. The convention usually adopted is for convex curvature to be positive and concave curvature to be negative.

Strain

Strain is caused by bending and differential horizontal movements in the strata. Measured strain is determined from monitored survey data by calculating the horizontal change in length of a section of a subsidence profile and dividing this by the initial horizontal length of that section.

If the section has been extended, the ground is in tension and the change in length and the resulting strain are positive. If the section has been shortened, the ground is in compression and the change in length and the resulting strain are negative.

The unit of measurement adopted for strain is millimetres per metre. The maximum strains coincide with the maximum curvature and hence the maximum tensile strains occur towards the sides of the panel whilst the maximum compressive strains occur towards the bottom of the subsidence trough.

Subsidence Impacts at the Surface

The most significant impacts on surface infrastructure are experienced during the development of the subsidence trough, when maximum ground movements normally occur.

As the subsidence wave approaches a point on the surface, the ground starts to settle, is displaced horizontally towards the mined void and is subjected to tensile strains, which build from zero to a maximum over the length of convex or hogging curvature, as shown in Fig. A.5.

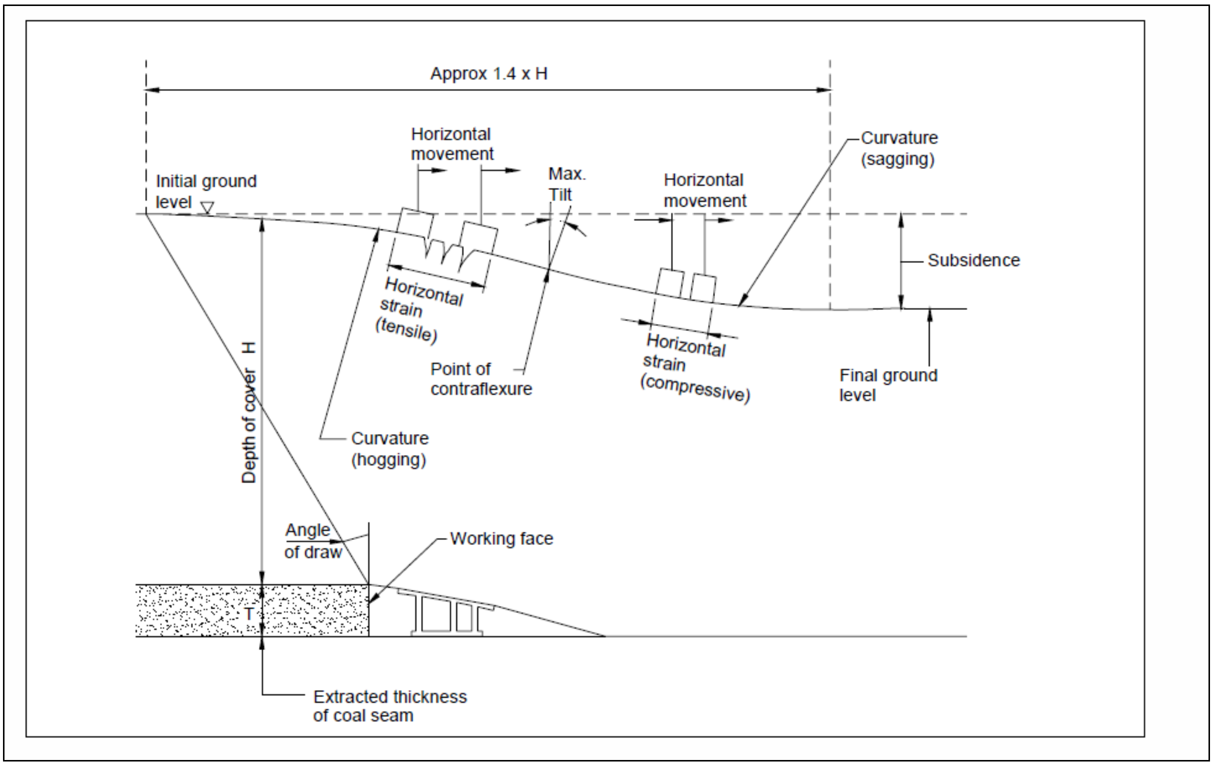


Fig A.5 Development of Subsidence Trough

The position of maximum hogging curvature is the position of maximum tensile strain. When vertical subsidence is approximately half of the maximum subsidence, i.e., as the face passes under the surface point, the ground reaches its maximum horizontal displacement and the strain reduces to zero again.

As the longwall face moves further away from the surface point the settlement continues, horizontal displacement reduces and the ground is subjected to compressive strains, which build from zero to a maximum over the length of concave or sagging curvature and then decline to zero as maximum subsidence is reached. The position of maximum sagging curvature is the position of maximum compressive strain. When the subsidence is complete, the ground is commonly left with no horizontal displacement and little residual tilt or strain.

Between the tensile and compressive zones is the point of inflection, which is the point at which maximum tilt and maximum horizontal displacement occurs. For critical extraction conditions, it is also the point at which the subsidence is, approximately, equal to half the maximum subsidence.

As the longitudinal wave passes, the transverse subsidence profile gradually develops and is completed as maximum subsidence is reached. The transverse subsidence profiles over each side of the panel are similar in shape to the longitudinal subsidence profile and have the same distribution of tilts, curvatures and strains. Most of the points on the surface will thus be subjected to three-dimensional movements, with tilt, curvature and strain in both the transverse and longitudinal directions. The impact of subsidence on surface infrastructure is therefore dependent upon its position within the trough.

The above sequence of ground movements, along the length of a panel, only applies to surface structures if they are located at a point where the maximum subsidence is likely to occur. Elsewhere, the impacts, in the both the transverse and longitudinal direction are reduced.

If a structure is located on the perimeter of the subsidence trough, it will only be slightly affected, will suffer little settlement and will have little residual tilt or strain.

A structure or surface feature on the side of the trough between the tension and compression zones will experience some subsidence, and will be left with residual horizontal displacement and tilt, but will be subjected to lower curvatures and strains. Structures or surface features located at the positions of maximum curvature and strain would generally suffer the greatest impact.

As each panel within a series is extracted in turn, an incremental subsidence trough is formed above it. If the width-to-depth ratios of the panels are low, the incremental subsidence troughs overlap at the surface and the resulting subsidence at any point, in these circumstances, is a combination of the effects of a number of panels.

A point on the surface may then be subjected to a series of subsidence waves, which occur as each panel is extracted, and the duration of these impacts will depend upon the position of the point relative to each of the subsidence troughs that are formed.

4 WORKING PAPER – DRINKING WATER CATCHMENT, HYDROLOGY AND DRAINAGE

SUMMARY

The purpose of this Working Paper is to identify any issues relating to the discharge of treated effluent and stormwater from an airport development at Wilton with respect to the boundary of the Sydney Drinking Water Catchment, and to outline the impacts of the airport options (as developed in Working Paper *Wilton Airport Site Selection and Airport Concepts)*.

The identification and assessment of issues involved consultation with the Sydney Catchment Authority (SCA) and basic hydrologic and hydraulic analyses to determine potential drainage impacts for each airport option. The components of a preliminary drainage concept for the airport have also been configured.

Key findings of this Working Paper are detailed below:

- The discharge of treated effluent from the airport site into creeks and rivers that form part of the direct water supply route is not permitted;
- Airport options located to the west (Options 1, 1S, 2, 6 and 7) will be able to drain to Allens Creek, which is located outside of the water supply route / drinking water catchment;
- Airport options located to the east (Options 3, 4 and 5) will require additional works to ensure that discharges up to the 100 year Average Recurrence Interval (ARI) flow are drained back to Allens Creek via a pipe/tunnel system. Alternative strategies have been considered, including moving the Sydney water supply off-take location and thereby, effectively moving the boundary of the drinking water catchment; and
- All options will result in a loss of catchment area that drains to the water supply route, thereby posing a cost to SCA for the lost water.

4.1 Introduction

The following Working Paper identifies and comments on the issues relating to the discharge of treated effluent and stormwater from a potential airport in the Wilton Study Area.

The components of a preliminary drainage concept for the airport have also been configured. In light of the proximity and overlap of the airport footprint with Sydney's Drinking Water Catchment, various options and mitigation strategies have been considered to address the associated water quality and supply issues for Sydney.

4.2 Legislative status

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are the primary pieces of planning legislation relevant to a proposed airport development.

There is no Commonwealth legislation specifically relevant to water management issues in the vicinity of the Wilton airport site.

4.2.1 NSW legislation

State Acts specific to water management in the vicinity of Wilton include:

- Sydney Water Catchment Management Act 1998; and
- Water Management Act 2000.

4.2.2 Sydney Water Catchment Management Act 1998

The *Sydney Water Catchment Management Act 1998* (SWCM Act) establishes the Sydney Catchment Authority (SCA) to manage and protect Sydney's water supply catchment areas. The boundary of the drinking water catchment is shown in **Figure 4.1**.

The SWCM Act sets out the principal objectives of the SCA as being:

- *To ensure that the catchment areas and the catchment infrastructure works are managed and protected so as to protect water quality, protect public health and safety, and protect the environment;*
- *To ensure that water supplied by the SCA complies with appropriate standards of quality;*
- *Where SCA activities affect the environment, to conduct its activities in compliance with the principles of ecologically sustainable development; and*
- *To manage SCA's catchment infrastructure works efficiently and economically and in accordance with sound commercial principles.*

Areas surrounding SCA dams and storages are subject to additional management measures to especially protect the quality of water. These areas, known as Special Areas, are lands declared under the *Sydney Water Catchment Management Act 1998* (SWCM Act) for their value in protecting the quality of the raw water used to provide drinking water to greater Sydney and for their ecological integrity. The SCA manages around 3,700 km^2 of Special Areas.

SCA states that the Special Areas are a critical element in its multi-barrier approach to protecting drinking water quality. This approach includes managing the hydrological catchments, the storages, quality treatment and delivery of water to retail customers. The Special Areas essentially act as a filtration system for water entering water storages by reducing nutrients, sediments and other substances that can affect water quality. The environmental integrity of the Special Areas is therefore important in their role of protecting water quality.

The Wilton Study Area is within the Metropolitan Special Area of the Sydney Drinking Water Catchment. This includes all land draining to Pheasants Nest Weir on the Nepean River or Broughtons Pass Weir on the Cataract River (*a total* *of 89,000 ha, refer* **Figure 4.1**). This Special Area includes the Cataract Dam and Cataract River (*upstream of Broughtons Pass Weir)* and the Cordeaux, Avon and Nepean Dams *(upstream of Pheasants Nest Weir*), which are all located within the Upper Nepean catchment.

Under the SWCM Act, public agencies must first give notice to SCA of their intention to exercise their functions within a Special Area, and those agencies may not exercise those functions contrary to any representations that SCA makes except with 28 days' notice (*see s. 47 SWCMA*). The *Sydney Water Catchment Management (General) Regulation 2000* regulates conduct in Special Areas to protect water supply and biodiversity. It categorises Special Area lands as:

- Schedule 1 - No Entry; or
- Schedule 2 - Restricted Access.

The SCA's management approach for the Special Areas is outlined in its *Special Areas Strategic Plan of Management* (SASPoM), which was first adopted by the Government in 2001 and replaced by a fully revised version in February 2007. The SCA and OEH are joint sponsors of the plan. The SASPoM essentially seeks to control impacts on the water supply catchments rather than to control land uses as such while the SCA supports, oversee and regulate planning and development in the catchment to protect catchment health and water quality. They are responsible for implementing the *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011* to regulate development and activities in the catchment. SCA also implement the associated Local Planning Direction 5.2 Sydney Drinking Water Catchments to influence land planning and zoning in the catchment.

4.2.3 Water Management Act 2000

The *Water Management Act 2000* (WMA) governs sustainable and integrated management of water sources across the State.

Under the provisions of Section 115ZG (1)(g) of the EP&A Act, *'a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the Water Management Act 2000'* is not required for approved State Significant Infrastructure.

4.2.4 State Environmental Planning Policy – Sydney Drinking Water Catchment 2011

Under the NSW Environmental Planning and Assessment Act, the *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*, which commenced on 1st March 2011, aims to:

- Provide for healthy water catchments that will deliver high quality water while permitting development that is compatible with that goal;
- Provide that a consent authority must not grant consent to a proposed development unless it is satisfied that the proposed development will have a neutral or beneficial effect on water quality; and
- Support the maintenance or achievement of the water quality objectives for the Sydney drinking water catchment.

The implications of this SEPP are that

> *"a consent authority must not grant consent to a proposed development unless it is satisfied that the proposed development will have a neutral or beneficial effect on water quality. This must be demonstrated using the Neutral or Beneficial Effect on Water Quality Assessment Guideline 2011 (**NorBE Guideline)** prepared by the Authority and the **NorBE Tool** set out in Appendix 1 to the NorBE Guideline."*

The boundary of the drinking water catchment is shown in **Figure 4.1** relative to the footprint of Options 1, 1S, 2, 6 and 7 for a Wilton airport.

The drinking water catchment is shown in **Figure 4.2** relative to the footprint of Options 3, 4 and 5.

4.3 Summary of issues from SSA Site Selection Programme

4.3.1 Drinking water catchment

In the *Second Sydney Airport Site Selection Programme* Draft Environmental Impact Statement ('the Draft EIS') the siting of the airport was such that stormwater runoff from the site would be discharged to Allens Creek, which feeds to the Nepean River system downstream from the water supply off-takes at Broughtons Pass and Pheasants Nest Weirs (refer **Figure 4.1**).

It is understood that the emergency dumping of fuel by aircraft was considered to offer only slight risk to the Drinking Water Catchment and only limited potential environmental impact.

The loss of effective catchment area from the Drinking Water Catchment, via diversion of airport drainage to Allens Creek, was calculated to be about 875 hectares. The estimated value of the lost water in 1985 dollars was $23,600 per annum.

4.3.2 Site drainage system and downstream flooding

Stormwater runoff from the airport was considered as either:

- Runoff from contaminated areas; or
- Runoff from clean areas.

Treatment of clean-water runoff would be via small retention ponds as part of a first flush system. Once the initial flush passed through, any excess runoff would bypass the ponds and feed to a large 1300ML flood retarding dam at the head of Allens Creek.

Stormwater calculations and the drainage system concept were based on rainfall for the Probable Maximum Precipitation (*PMP*) event, which it is understood was to guarantee that no runoff from the site would make its way into the Drinking Water Catchment.

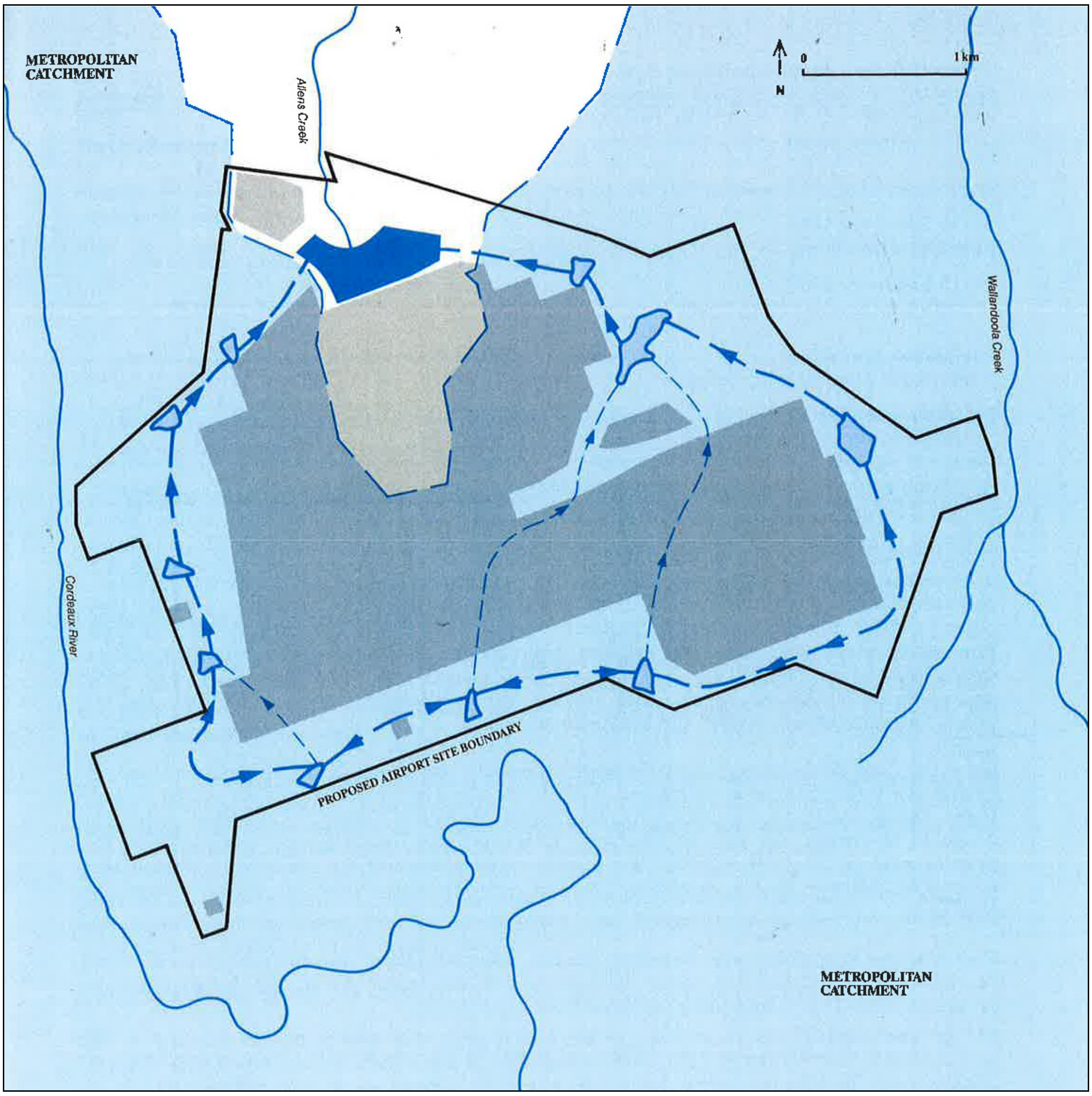
Runoff would feed to the retarding dam via a perimeter canal (*15 to 100m width*) and subsurface pipes (*refer* **Figure 4.3**). The undulating terrain at the site would mean that there would need to be some excavation of ridge-tops to provide for the canals between basins, or use piped system between basins. This was not designed in detail as part of the previous concept for drainage.

The large retarding dam was to be designed such that downstream peak flows are not to exceed existing flows during events up to and including 100 year ARI (*Average Recurrence Interval*) event.

Treatment of clean stormwater prior to discharge to Allens Creek would include settlement and screening to remove solids.

Contaminated stormwater would be treated appropriately prior to disposal, potentially using a separate first flush system, with subsequent runoff to the clean stormwater treatment system.

Figure 4.3 Stormwater Drainage Schematic from SSA Site Selection Programme (1985)



4.3.3 Water quality

All waterways draining to the Drinking Water Catchment were previously classified as Class S waters (*Specially Protected waters*, *as per system used at the time*), which includes all waterways in the vicinity of the site, other than Allens Creek and other minor tributaries draining to the Nepean River system downstream from the water supply off-take weirs. Allens Creek and the downstream reaches of the Nepean River system were classified as Class P waters (*Protected waters*).

All stormwater from airport areas (*plus treated wastewater*) was to be collected and treated and eventually discharged to Allens Creek at the northern corner of the site and hence, discharged to the Nepean River system downstream from the water supply off-takes.

Accordingly, discharge to the Drinking Water Catchment would be avoided, including during all rainfall events up to the Probable Maximum Precipitation event.

With regard to downstream water quality during airport operations (*Allens Creek and beyond*):

- The nutrient loading in the treated site runoff was assumed equivalent to a fully developed urban area; and
- It was considered that the impact on nutrient levels in the downstream Camden assimilation zone would be expected to be minimal, including treated effluent from on-site sewage treatment.

4.3.4 Groundwater

Groundwater characteristics:

- Mostly Hawkesbury Sandstone underlying the site and surrounding area;
- Some small areas of Mittagong Formation;
- Low salinity;
- Low yield; and
- May have some iron content.

The above factors were considered to limit possible uses of the groundwater.

Drainage from the site could find its way into the groundwater only at points where a fracture joint or bedding plane parting gave access. It was considered that drainage would most likely reach only the groundwater lying at the topmost level and would be unlikely to seep down through further strata of rock. It is understood that no detailed analysis or groundwater modelling was undertaken.

4.4 Analysis of issues and potential impacts for current airport concepts

4.4.1 Drinking water catchment

Consultation was undertaken with Sydney Catchment Authority (SCA) to determine key issues for the discharge of treated effluent and stormwater from an airport site, and the potential impact on the Drinking Water Catchment (*DWC, otherwise known as the Sydney water supply catchment*).

The boundary of the DWC is shown in **Figures 4.1** and **4.2** relative to the eight airport options.

The waterway classification system has changed since 1985 (*i.e., they are no longer classified as Class S or P waters*). However, the principles governing the protection of water quality for the water supply remain and the discharge of any effluent (treated or otherwise) to waterways that form part of the water supply route, including Cataract River and tributaries that feed into the river between Cataract Dam and the Broughtons Pass off-take weir, is not permitted.

A schematic of Sydney's water supply system is shown below in **Figure 4.4**, sourced from SCA. The indicative location of the airport site at Wilton is shown as the yellow circle.

As water provider to Sydney Water Corporation (SW), SCA need to ensure that the water does not contain any pollutants that cannot be readily treated by SW in their plants (*e.g., pesticides and herbicides*). Along water supply canals and direct water supply routes they aim to meet the Australian Drinking Water Guidelines (2004) water quality criteria, but accepting that raw water will be treated by Sydney Water prior to distribution. SCA does what it can to preserve the naturally good quality of water from the drinking water catchment, so that Sydney Water has to apply minimal treatment.

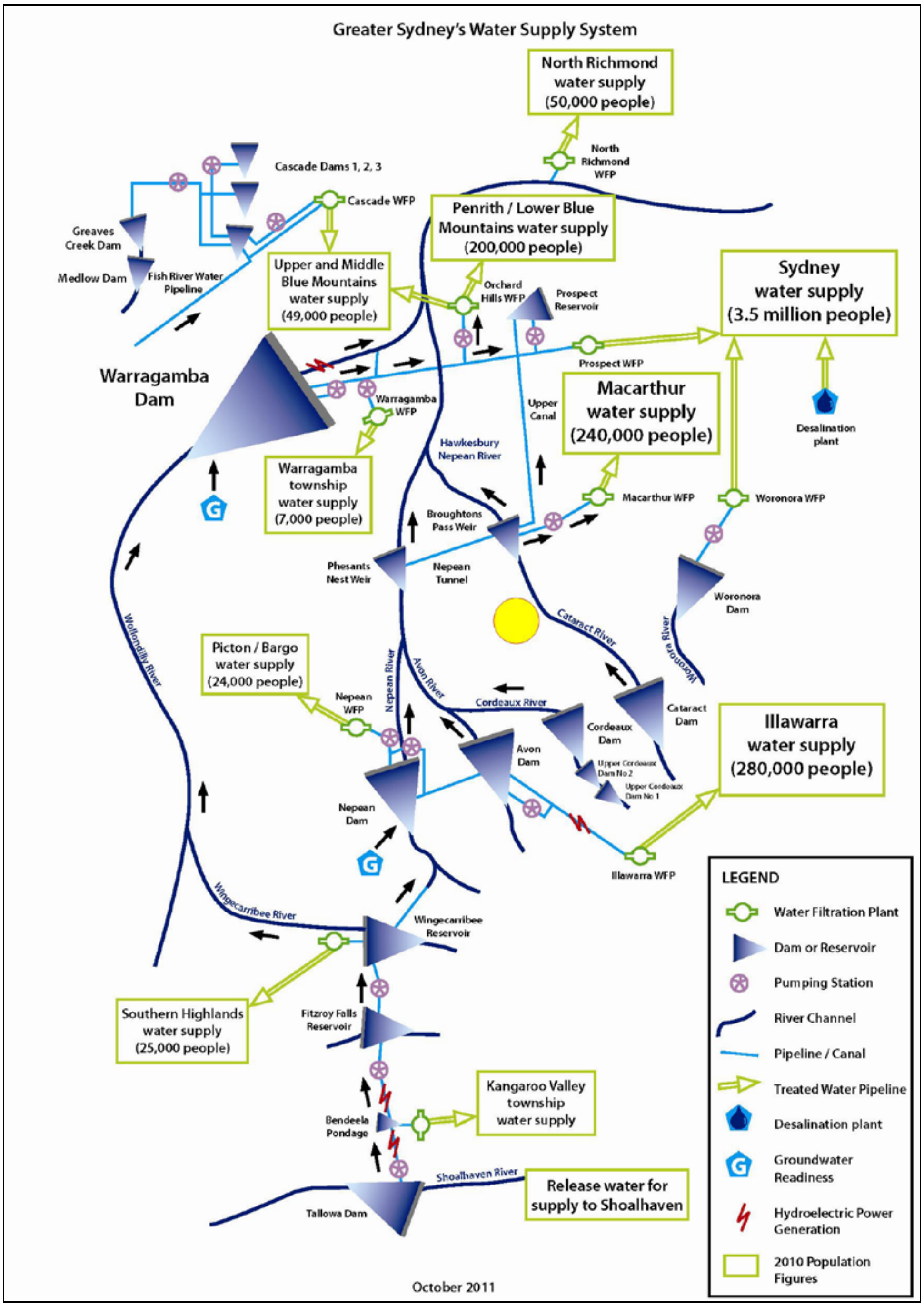
The SCA's main concerns are regarding the health of end users of the water supply. The detection of pollutants that can pose health risks to users can often be delayed. Some pollutants can also have longer term impact on efficacy of the downstream treatment processes by Sydney Water, which may have follow-on impact on water supply in general. Protecting the supply of water to Sydney is another key aim for SCA.

There is an existing Sydney Water extraction point at the Broughtons Pass weir on the Cataract River that feeds to customers in the Macarthur/Campbelltown area. This supply needs to be maintained.

There is a control gate at the weir which allows about 300 to 350ML/day of water to flow into the Upper Water Supply Canal that feeds to Prospect Reservoir (refer **Figure 4.1**). It is understood that this gate does not need to be adjusted on a regular basis.

Each airport option would result in the loss of catchment area from the Drinking Water Catchment. The associated area is not significant compared to the remainder of the catchment and this was not flagged as a major issue by SCA in terms of maintaining a stable water supply for Sydney, as compared with protecting the quality of the water supply, for example.

Figure 4.4 Sydney's water supply system (Source: Sydney Catchment Authority website)



4.4.2 Discharge of treated effluent and stormwater

A similar system to that proposed in the Draft EIS could be used to treat stormwater and wastewater streams for the current airport options, albeit involving advancements in water reuse opportunities and technologies.

Further information on the proposed on-site water and wastewater management system is contained in the Working Paper *Water and Watershed Management* and is also discussed in the next section. Treated effluent streams would need to be discharged to Allens Creek, as before.

In terms of the discharge of untreated stormwater during extreme storm events, it was consulted with SCA the possibility of discharging excess flow into the Drinking Water Catchment (*i.e. flow above a peak 20 or 100 year ARI flow threshold*). Any discharge would only occur once the threshold event has been exceeded and only following the diversion of initial flows to suitable first-flush systems and Allens Creek as part of the stormwater treatment system.

While not explicitly opposed to such a system, SCA indicated that for any runoff to the DWC it would need to be demonstrated that there is Neutral or Beneficial Effect (*NorBE*) on water quality within the water supply route, as is the requirement for any development. SCA did highlight that during rainfall and flooding equivalent to a 5 to 20 year ARI event historically there has been very poor water quality in the water supply system, which has challenged the Warragamba supply and therefore placed increased pressure on back-up supplies such as in the Upper Nepean dams.

Accordingly, the preference would be for a drainage and stormwater canal system that can accommodate the Probable Maximum Precipitation (*PMP*) flow generated within the site. However, such a system involves significant widths for drainage canals of up to 160 metres. Further information on a system of this scale is included in the next section.

By accommodating the PMP flow (*recognised as the 1 in 10,000 year or larger event*), the potential to discharge runoff from the airport site to the DWC is effectively eliminated.

4.4.2.1 Airport Options 1, 1S, 2, 6 and 7

Options 1, 1S, 2, 6 and 7 are located further to the west, near Picton Road (*refer* **Figure 4.1**).

Due to their proximity to Allens Creek and the edge of the DWC boundary, it is likely for these options that both treated effluent and stormwater would be readily discharged to Allens Creek, thereby avoiding the DWC.

Stormwater discharges during events up to the PMP storm may be contained within large canals and discharged overland to Allens Creek. As for the 1985 concept, a large retarding dam would be constructed to attenuate flows to an acceptable level to minimise flooding impact downstream along Allens Creek during events up to a 100 year ARI storm.

For these options, a key area for concern is the existing depression/valley at Cascade Creek, which would otherwise naturally drain to Cataract River and the DWC. It may be difficult to drain water from a smaller retention/treatment pond at this gorge over the ridge to the west and into the proposed retarding dam at the head of Allens Creek. The potential for the system to function under gravity flows will be subject to the final earthworks design for the airport. At this stage, the proposed earthworks will result in a grade of approximately 1% from south to north, which should be suitable for site drainage.

4.4.2.2 Airport Options 3, 4 and 5

Due to the distance between Options 3, 4 and 5 and the Drinking Water Catchment boundary, it is unlikely to be possible to provide an overland flowpath to drain the airport site back to Allens Creek (*i.e., to outside of the DWC*).

The undulating topography between the sites and Allens Creek means that discharges would need to be piped or tunnelled. This may be manageable for the discharge of treated effluent streams to Allens Creek during normal dry weather flow conditions, although there would be valleys and waterways to negotiate, including Cascade and

Wallandoola Creeks (refer **Figure 4.2**). The length of pipe/tunnel required would be approximately 5 to 6 kilometres. If adopting a unit rate for tunnelling of up to $200 Million per kilometre (*pers comm. SCA*), the indicative cost would be in the order of $1 - $1.2 billion.

Discharge of treated effluent to Wallandoola Creek or Lizard Creek and effectively to Cataract River, which are part of the DWC and water supply route, would not be permitted by SCA.

In large storms such as the 5, 10, 20 or 100 year ARI event, it is unlikely to be feasible to pipe such magnitudes of flow to Allens Creek. In order to avoid any spillage of runoff into nearby Wallandoola Creek or Lizard Creek, Options 3, 4 and 5 will require a retarding dam with increased capacity in order to hold the entire volume of flow during a 100 year ARI storm, rather than only attenuating the outflow to acceptable levels. Following such a storm the stored water would be gradually drained from the dam over a period of time via the pipe/tunnel system back to Allens Creek.

Excess flows in larger storms up to the PMP storm would overtop the dam and then drain into Wallandoola Creek or Lizard Creek and thereby discharge to the DWC. In terms of protecting the water quality of the water supply this would not be preferred and this scenario would need to be assessed in more detail to demonstrate that the NorBE requirements of SCA are met. It is possible that any pollutants would be heavily diluted due to the large quantity of flow.

4.4.3 Cost of lost water

The drainage of the airport back to Allens Creek will effectively reduce the size of the catchment draining to the water supply off-take at Broughtons Pass on Cataract River. The loss of effective catchment area from the Drinking Water Catchment was calculated to be between 1,200 and 2,200 hectares for the range of airport options.

The yearly rainfall and associated runoff from the airport site was considered in determining the yearly volume of runoff that is expected to be diverted from the DWC to Allens Creek.

The average annual rainfall at nearby Douglas Park (*approximately 5 km north of Wilton*) is reported to be 754 mm (*Bureau of Meteorology*).

A runoff coefficient of 0.8 was adopted for existing site conditions. This is a relatively high coefficient (*i.e., a conservative estimate*), but is considered appropriate given the potential for rainfall to infiltrate into local aquifers and ultimately discharge to local watercourses draining to the off-take at Broughtons Pass Weir. Some water will make its way into the deeper aquifers and would be *"lost",* but infiltration to these deeper levels would likely be minimal.

The annual volume of lost water was calculated for each airport option considering the above information on yearly rainfall, runoff coefficient and footprint areas within the Drinking Water Catchment.

The SCA has indicated that there are two ways that the cost to SCA of the lost water can be interpreted:

- Direct financial cost in terms of lost sales if this water was not available to be stored;
- Every KL of water lost from sales would result in a loss of revenue of approximately 8c per KL. This volumetric charge rate is based on the 2012 IPART Price Determination for 2012/13 with the desalination plant not operating;
- Economic cost from the lost yield in the long term; and
- IPART estimated the opportunity cost of water using a methodology called Long Run Marginal Cost, which is the long run cost both in capital and operating expenditure in replacing one KL of water otherwise available to the system. IPART's estimate ranged from $1.82 to $2.54 per KL, using discount rates similar to SCA's cost of capital or NSW Treasury's social discount rate. IPART used this range of costs to justify holding the system water usage price at $2.10 per KL (pers comm. SCA).

SCA has indicated there may be other cost factors related to the particular water quality of the water foregone, but these would be very difficult to quantify.

Using the above cost rates per KL the *financial* cost of lost water would range between $0.6M and $1.1M per year for the range of airport options. The longer term *economic* cost of lost water would range between $15M and $28M per year.

4.4.4 Environmental flows

All airport options will result in an increase in normal dry weather flow and stormwater flow along Allens Creek, either via overland flows in the case of Options 1, 1S, 2, 6 and 7 or via piped flows in the case of Options 3, 4 and 5.

There will be a commensurate decrease in the normal environmental flows to Cascade Creek and Wallandoola Creek in the case of Options 1, 1S, 2, 6 and 7.

Similarly, there will be a decrease in the environmental flows to Wallandoola Creek and Lizard Creek in the case of Options 3, 4 and 5.

Given the current pristine nature of the Cascade, Wallandoola and Lizard Creeks, it is likely that the reduction in environmental flow will have some impact on local ecology along the watercourses. The potential impacts have not been investigated in detail. However, they may include an increase in toxic blue-green algal blooms, loss of native fish and other aquatic fauna populations (frogs etc.), changes in macro invertebrate populations (this may have indirect impacts to aquatic ecology), changes to aquatic flora and increased salinity.

4.4.5 Water quality

Aside from the water quality issues outlined above regarding the discharge of treated effluent and stormwater runoff from the airport, SCA have flagged the potential for aerosols and aviation fuel emissions from aircraft during landing and take-off to affect the Drinking Water Catchment and thereby, Sydney's water supply.

There is minor potential for these pollutants to fall directly into the water supply reservoirs and rivers that form part of the water supply route, including Cataract Dam and River, Cascade, Wallandoola and Lizard Creeks, and waterways further afield such Cordeaux Dam and River, Avon Dam and River, Nepean Dam and River. There is also potential for these pollutants to fall onto land within the DWC and thereby runoff into rivers and reservoirs on the water supply route.

However, there is not expected to be significant settling of such pollutants out of the air column, particularly once aircraft have gained any significant altitude. Accordingly, the potential for these pollutants to cause an impact on the water supply is considered to be minimal.

4.4.6 Groundwater

There is potential that these same airborne pollutants will settle on the ground and then following rainfall infiltrate into the groundwater system via fractures and interfaces between sandstone formations. The pollutants could then discharge via aquifer flows into nearby Cataract River (*or Cordeaux River*) and hence into the water supply network.

The emergency dumping of fuel by aircraft could also pose a threat to the water supply in the case that the dumping occurs close to the airport and not over the ocean. This potential, and other air quality issues, have been considered in Working Paper *Effects on Airshed and Air Quality*.

4.4.7 Flooding

Development of an airport with associated impervious areas will increase peak stormwater discharges and volumes of runoff to downstream waterways. If all flow is diverted to Allens Creek, there will also be an increase in the catchment area draining to the creek of between 1,200 to 2,200 hectares, subject to which option is chosen.

Accordingly, it will be a requirement that suitable detention be provided on-site to reduce discharges to Allens Creek to existing levels during events up to and including the 100 year ARI storm. As discussed, this will be provided using a large retarding dam at the head of Allens Creek for Options 1, 1S, 2, 6 and 7. There will be a residual flood impact in Allens Creek during extreme events larger than the 100 year ARI storm due to increased peak flows. Although such an impact would manifest only very rarely, due to the large scale of additional catchment area draining to Allens Creek, it is recommended this issue be given further consideration in the next phases of investigation and design.

For Options 3, 4 and 5, an increased volume of flood storage will be required to ensure that the entire volume of flow up to the 100 year ARI storm can be stored on-site and piped back to Allens following a storm. During a larger storm there will be overtopping from the dam to Wallandoola Creek. This could pose additional flood impact, but would occur only on very rare occasions.

If discharge occurs to other waterways as part of alternative drainage works for Options 3, 4 and 5 (*as discussed further in the next section*), then it would be a standard requirement that detention be provided during storms up to the 100 year ARI event for all other affected waterways.

The magnitude of flooding along Cascade, Wallandoola and Lizard Creeks, which are affected by the footprint of the airport options, would be reduced in the case that flows are diverted to Allens Creek.

4.5 Mitigation measures and strategies

4.5.1 Stormwater drainage strategy

The following stormwater drainage concept has been configured according to a similar system presented in the Draft EIS.

There have been advancements in the analysis of hydrology and runoff since 1985, including the publication of the widely adopted *Australian Rainfall and Runoff* (*1987*), which is currently in the process of being updated again.

It should be noted that the total site area for the current options ranges between 1,700 and 2,200 hectares, which is larger than the concept airport covered by the 1985 study (*about 1,440 hectares*). For runoff calculations for the post-development scenario it has been assumed that impervious areas represent 75% of the site area.

Rainfall Intensity Frequency Duration (*IFD*) data was obtained for the site and used in the estimation of design rainfalls for the 10 and 100 year ARI events, where applicable. The General Short Duration Method (*BOM, 2003*) was used in the estimation of Probable Maximum Precipitation (PMP) rainfall.

This data was routed through a simplified XP-RAFTS hydrologic model for the airport site. XP-RAFTS is commonly adopted modelling software used in flood and stormwater analysis.

4.5.1.1 First flush treatment system

The collection and treatment of stormwater runoff during relatively minor storms will be undertaken according to a similar concept to that presented in the 1985 study. This will involve up to 10 small retention ponds at various locations throughout the site (*to be determined*) to collect various clean and contaminated stormwater streams for treatment as part of the first flush system. Opportunities for runoff and wastewater reuse will be considered, as outlined in Working Paper *Water and Watershed Management*.

The first flush retention ponds would be sized to cater for up to a 10 year ARI event where the storm duration is equal to the time of concentration of each sub-catchment within the site. The system would capture flow up to the time of concentration and also the following 15 minutes of flow to ensure that a majority of the pollutants are captured for treatment.

The size of storage required as part of the first flush system would be approximately 400 m^3/ha, with each of the 10 basins having an area of the order of 7 to 9 hectares assuming a basin depth of 1 metre. It is envisaged that alternative design criteria could be adopted for the first flush system based on further investigation of the on-site hydrology, thereby potentially reducing the volume of storage required. The first flush of the contaminated stormwater streams will require separation and extraction of hydrocarbons and other pollutants before being piped to a central treatment plant for further treatment. The treatment plant would discharge to the retarding dam, and subsequently to Allens Creek.

4.5.1.2 Airport drainage canals

During large storms, excess flows following the first flush would travel along two large canals down each side of the airport. The exact alignment of the canals has not been determined, but in order to convey the PMP flow it is calculated that each canal would need to be up to 40 metres wide if 3 metres deep, or 160 metres wide if 1 metre deep.

This maximum width has been calculated assuming a 1% grade across the site from south to north and would be applicable at the bottom end of the site. A Manning's coefficient of 0.03 was adopted in the hydraulic analysis, assuming a grass-lined channel. The width would be reduced if a concrete lining was adopted.

4.5.1.3 Flood retarding dam – Options 1, 1S, 2, 6 and 7

For these options, the canals would discharge the excess flow into a large flood retarding dam at the head of Allens Creek.

For the purpose of assessing flood detention requirements, it was assumed that 200 hectares of the proposed site lies within the existing catchment of Allens Creek (*this may vary between options*). The corresponding base case flow in the 100 year ARI storm would have a peak of about 21 m^3/s.

The large retarding dam would be located in the section of the sites to the south of Wilton Road.

In order to provide sufficient detention to reduce post-development flows to existing flows during events up to and including the 100 year ARI storm, the retarding dam will need to have a storage capacity of approximately 5,000 ML. This is considerably larger than the 1,300ML storage suggested in the 1985 study, which is likely a result of increased rainfall data inputs used in analysing the 100 year ARI event. The IFD data for the site indicates that this area is exposed to relatively high intensity rainfall events compared with other areas of NSW and Australia. This is likely reflective of the orographic nature of the catchment and rainfall that occurs, the site being located just west of the escarpment above Wollongong.

If the depth of the retarding dam is between 3 and 4 metres, the required area for the basin will be approximately 150 hectares. This is considered an upper limit of the dam footprint because the steepness of the valley at Allens Creek suggests the maximum depth of the retarding dam would actually be more than 10 metres.

A residual impact on flooding along Allens Creek is likely to be an increase in peak flows during events larger than the 100 year ARI storm (*i.e., up to a PMP storm*). The potential to attenuate flows up to a PMP storm was briefly investigated. Although not impossible, it should be recognised that if this is required, the volume of the retarding dam would be increased approximately three-fold.

4.5.1.4 Flood retarding dam – Options 3, 4 and 5

For these options the canals would discharge the excess flow into a large flood retarding dam located typically at the northern end of the site.

The retarding dam for these options would need to accommodate the entire volume of the 100 year ARI storm in order to avoid any spillage to the Drinking Water Catchment. Preliminary calculations indicate that the required storage volume would be between 7,000 and 9,000 ML, which is significantly larger than the storage required for options located further to the west. The equivalent number of Olympic-size swimming pools is between 3,000 and 3,600.

4.5.2 Alternative discharge strategies for Options 3, 4 and 5

As discussed, up to 6 km length of pipe/tunnel would be required for Options 3, 4 and 5 in order to convey treated effluent and runoff to Allens Creek and away from the Drinking Water Catchment.

Two alternative strategies have been considered in lieu of such a system. These have been discussed briefly with Sydney Catchment Authority and are outlined in the following.

4.5.2.1 Discharge to Cataract River downstream from Broughtons Pass

An alternative discharge arrangement could be to pipe/tunnel discharges to Cataract River at a location downstream from the water supply off-take at Broughtons Pass Weir (*refer* **Figure 4.5**).

For Options 3 and 4 this system would involve between 2 and 3 km of tunnelling. The pipe/tunnel would need to be appropriately lined so that discharge does not seep from the pipe into the groundwater system. The cost of such a system would be in the order of $400 to $600 Million.

This type of system would not be worthwhile for Option 5, because of its location further to the south. The resultant length of pipe/tunnel that is required would be about 8 km (*refer* **Figure 4.5**), which would be longer and more costly than that required to convey effluent and runoff to Allens Creek.

If employed for Options 3 and 4, it should be recognised that such a system would not address the issue of excess runoff during storms larger than the 100 year ARI event. Excess runoff in extreme storms would spill from the retarding dam and into Cataract River via Wallandoola and Lizard Creeks and into the water supply network. As discussed above, SCA would prefer that no discharges are made to the Drinking Water Catchment.

4.5.2.2 Relocation of the Broughtons Pass Weir water supply off-take

The option to move the water supply off-take at Broughtons Pass to a location further upstream on Cataract River was also considered. If the off-take was moved upstream to Cataract Dam, this would effectively move the boundary of the Drinking Water Catchment so that the sub-catchments of Cascade Creek, Wallandoola Creek and Lizard Creek are excluded. Treated effluent and runoff that is discharged from the airport into these creeks would not enter the water supply route.

A new “bypass” pipe/tunnel would be required as part of the water supply route between Cataract Dam and the Upper Water Supply Canal, which would have a length of approximately 8.5 km.

SCA has indicated that, while this is a possibility, such a system would not be ideal from a water supply perspective due to the removal of a significant portion of the Drinking Water Catchment (*roughly 7,000 hectares*). The cost for the proposed tunnelling would also be significant; in the order of $1.7 Billion.

Under this system Options 3, 4 and 5 would no longer require flood storage that caters for the entire volume of flow in a 100 year ARI event. The storage requirement would be reduced to similar volumes as Options 1, 1S, 2, 6 and 7 (*i.e., approximately 5,000ML*), whereby a continuous but controlled outflow would be permitted.

SCA is separately investigating a water supply augmentation that involves pumping water from Tallowa Dam on the Shoalhaven River to Avon Dam. The resulting system would bypass the pumping required to Wingecarribee Reservoir and the downstream run-of-river route to Warragamba Dam via the Wollondilly River. It is understood that removal of run-of-river sections from the water supply network is considered to benefit the network because of the reduced potential for overland contamination, reduced potential for river losses, and increased manageability of the water supply in terms of controlling the distribution of flows.

If considering a proposed pipe/tunnel connection from Cataract Dam to the Upper Canal as part of Options 3, 4 and 5, a suggestion was made that the system could be expanded to link the four Upper Nepean dams (*Nepean, Avon, Cordeaux and Cataract Dams*) via a pipe/tunnel network (refer **Figure 4.6**). Such a connection already exists between the Nepean and Avon Dams and is used to regulate the storage levels in the dams.

A total of 25 km of additional pipe/tunnel would be required between Avon Dam and the Upper Canal, with diameter up to 3 or 3.5 metres. The tunnel would need to be lined so that potential groundwater seepage into the tunnel is minimised. Preliminary inspection of the topography and water levels in the dams indicates that the flow between the dams would be gravity fed, thereby avoiding the need for pumping stations.

Despite the excise of a portion of the Drinking Water Catchment downstream from the dams (*refer* **Figure 4.6**), there would be benefits to SCA in terms of reduced run-of-river sections downstream from the dams and a more manageable water supply system.

A benefit associated with the removal of this section of the DWC would be the reduced potential for emissions from aircraft to enter the drinking water supply, either via direct deposition into rivers in this reach or via groundwater infiltration and travel.

In this regard, it is recognised that such a joint initiative with SCA would benefit any of the eight airport options in terms of reduced potential for contamination of the water supply.

The section of SCA land excised from the Drinking Water Catchment could be used for other appropriate land uses, with potential to promote commercial or recreational uses in the area (*subject to other environmental constraints*).

At this stage, a significant obstacle for this scale of water supply augmentation would be the cost. If adopting a unit rate for tunnelling of up to $200 Million per kilometre, the cost would be in the order of $5 Billion.

4.5.3 Flow conveyance structures

The eight airport options will all involve removal of a portion of the upstream catchments and stream reaches for the local creeks, including Cascade, Wallandoola and Lizard Creeks.

Due to their layout with respect to the alignment of Lizard Creek, Airport Options 3 and 5 will require additional works to provide for conveyance of flows along Lizard Creek from the upstream to downstream end of the airport. The alignment of these conveyance structures is shown in **Figure 4.7**.

In order to convey flows up to the local Probable Maximum Precipitation (*PMP*) event, it was determined that a tunnel up to 6 metres high and 30 metres wide would be required at the base of airport fill platform at Lizard Creek.

4.5.4 Comparison of Airport Options

	Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Watercourses impacted by the footprint of the airport	Allens Creek, Cascade Creek and tributaries	Allens Creek, Cascade Creek and tributaries	Allens Creek, Cascade Creek and tributaries	Lizard Creek and tributaries of Wallandoola Creek	Tributaries of Wallandoola and Lizard Creeks	Wallandoola Creek, Lizard Creek	Allens Creek, Cascade Creek	Allens Creek, Cascade Creek
Area of lost drinking water catchment (ha)	1,530	1,570	1,600	1,990	1,730	2,210	1,420	1,210
Financial cost to Sydney Catchment Authority of lost water p.a.	$0.7M	$0.8M	$0.8M	$1.0M	$0.8M	$1.1M	$0.7M	$0.6M
Long term *economic* cost to SCA of lost water p.a.	$19.4M	$19.9M	$20.4M	$25.2M	$21.9M	$28.0M	$18.0M	$15.4M
Discharge of treated stormwater and effluent	Direct to Allens Creek	Direct to Allens Creek	Direct to Allens Creek	to Allens Creek via 5km pipe/tunnel system (~$1.0B)	to Allens Creek via 5km pipe/tunnel system (~$1.0B)	to Allens Creek via 6km pipe/tunnel system (~$1.2B)	Direct to Allens Creek	Direct to Allens Creek
Alternative strategies to avoid discharge of treated effluent and stormwater to drinking water catchment	NA	NA	NA	3km pipe/tunnel to downstream of Broughtons Pass off-take (~$600M)	3km pipe/tunnel to downstream of Broughtons Pass off-take (~$600M)	8km pipe/tunnel to downstream of Broughtons Pass off-take (~$1.6B)	NA	NA
Alternative strategies to avoid discharge of treated effluent and stormwater to drinking water catchment (*cont'd*)				Move the water supply off-take upstream to Cataract Dam (~$1.2B)	Move the water supply off-take upstream to Cataract Dam (~$1.2B)	Move the water supply off-take upstream to Cataract Dam (~$1.2B)		

	Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
				Water supply augmentation (~$5.0B)	Water supply augmentation (~$5.0B)	Water supply augmentation (~$5.0B)		
Flood retarding dam operation (*during storms up to 100 yr ARI event*)	Low flow outlet and spillway flow	Low flow outlet and spillway flow	Low flow outlet and spillway flow	Pipe outflow only	Pipe outflow only	Pipe outflow only	Low flow outlet and spillway flow	Low flow outlet and spillway flow
Size of retarding dam	~5,000ML	~5,000ML	~5,000ML	~8,000ML	~7,000ML	~9,000ML	~5,000ML	~5,000ML
Discharge of excess stormwater in extreme rainfall event *(>100 yr)*	to Allens Creek	to Allens Creek	to Allens Creek	Spillage to drinking water catchment	Spillage to drinking water catchment	Spillage to drinking water catchment	to Allens Creek	to Allens Creek
Flow conveyance structure required for local waterway(s)	No	No	No	Yes, at Lizard Creek (1.5km)	No	Yes, at Lizard Creek (4km)	No	No

4.6 Key findings

- Options 1, 1S, 2, 6 and 7 are considered to be more readily achievable and less costly from the perspective of stormwater drainage and potential impact on the Drinking Water Catchment (DWC). This is because the footprint of these options extends to outside of the DWC and therefore, the discharge of treated effluent and stormwater can be made directly to Allens Creek;
- Aside from potential waterway and groundwater contamination due to aircraft emissions (as raised by Sydney Catchment Authority), it is likely that suitable mitigation measures and drainage strategies can be employed to minimise potential impacts on downstream flooding and the water quality of Allens Creek;
- Due to their location deeper and wholly within the DWC, Options 3, 4 and 5 will require additional drainage works (and costs) to convey discharges back to Allens Creek and thereby avoid discharge to the DWC;
- In addition, the discharge of excess runoff to the DWC during extreme storms larger than the 100 year ARI event cannot be avoided for these options unless the existing water supply off-take at Broughtons Pass Weir is moved upstream to Cataract Dam. The cost of the associated works would be in the order of $1.2 Billion. The works could be further expanded to incorporate additional water supply augmentation works that links the four Upper Nepean Dams, which would be beneficial to SCA in terms of water supply management. However, the additional cost would be in the order of $5 Billion; and
- Options 3, 4 and 5 will typically result in larger areas being lost from the Drinking Water Catchment compared to the other options, which will translate to increases in the yearly cost to Sydney Catchment Authority of the lost water. The long term economic cost to SCA of the lost water would be up to $28 Million per year.

4.7 References

Commonwealth Bureau of Meteorology (2003), '*The Estimation of Probable Maximum Precipitation in Australia: General Short-Duration Method*', prepared by the Hydrometeorological Advisory Service.

Department of Aviation (*1985*), *'Second Sydney Airport – Site Selection Programme'*.

Institution of Engineers Australia (*1998*), '*Australian Rainfall & Runoff; A Guide to Flood Estimation*', originally printed in 1987.

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5 WORKING PAPER – WATER AND WASTEWATER MANAGEMENT

SUMMARY

The purpose of this Working Paper is to identify any issues relating to the supply of potable water, treatment of sewage and the reuse of treated effluent that might act as a barrier to airport development at Wilton or differentiate between the airport options developed in the Working Paper *Wilton Airport Site Selection and Airport Concepts*.

The methodology used would be as follows:

- Investigate what sources of water is available for potable use;
- Development of a staged treatment plant (water and sewage) scenario to keep up with the airport development;
- Propose a sewerage treatment strategy to reuse treated effluent on site and allow excess water to be discharged into Allens Creek;
- Investigate the possibility to use storm water to supplement the water requirements on the sites;
- Prepare a risk profile for unforeseen events; and
- Prepare a mitigation strategy for unforeseen events.

Option 1, 1S and to a lesser extend Option 2 would be the most preferred locations for water treatment plants to prevent effluent generated on site from the treatment process gravitating into the Sydney Drinking Water Catchment (SDWC) streams and rivers. Options 6 and 7 could also work but would have longer discharge lines to Allens Creek, which is the preferred means of discharging back into natural watercourses. Options 3, 4 and 5, although feasible to execute, would be less preferable from a water treatment perspective as they are far from Allens Creek which would be the release conduit of excess – albeit treated - effluent that cannot be reused on site.

Water treatment technologies exist to treat all the effluent generated on site (no matter how highly polluted the water is) to a class better than drinking water standards. As the water demand, and hence the volume of polluted effluents generated, would be fairly low the cost of treatment compared to the total capital cost of the project would be minimal.

All waters generated on the site could be contained and treated on site with beneficial outcomes by reusing the water for purposes of irrigation and toilet flushing in the airport and surrounds.

Mitigation strategies will need to be put into place to prevent any water borne pollution from an airport site reaching the environmentally sensitive streams and rivers in and around the Study Area at Wilton.

5.1 Introduction

This paper covers the treatment of all waters potentially generated on the proposed new airport site(s) at Wilton.

The Wilton Study Area lies in a highly sensitive area as far as water is concerned. Run off generated from the proposed new airport site at Wilton (regardless of what option is chosen) will flow into highly sensitive rivers feeding the water catchment of Sydney and surrounds.

The waterway classification system has changed since 1985 (*i.e., they are no longer classified as Class S or P waters*). However, the principles governing the protection of water quality for the water supply remain and the discharge of any effluent (treated or otherwise) to waterways that form part of the water supply route, including Cataract River and tributaries that feed into the river between Cataract Dam and the Broughtons Pass off-take weir, is not permitted.

However, it is still possible to discharge effluent which complies with the legal requirements into Allens Creek.

The sewage treatment plant should be constructed prior to the start of the airport construction to allow effluent to be produced for construction purposes such as dust suppression thus preventing pollution of the sensitive streams and rivers. This procedure has previously been employed at building construction sites in Sydney.

5.1.1 Statement of the issue

This paper will explore the options for treatment and ease of disposal of effluents generated on the proposed site(s).

5.1.2 Description of the issue

No water generated on a site that is polluted in any way (e.g. storm water runoff from the landing strips) would be allowed to flow into the rivers and creeks surrounding the possible new airport options identified for the Wilton site (for more details refer to the Working Paper *Drinking Water Catchment, Hydrology and Drainage*).

It is not currently possible to dispose of any waters – treated or otherwise - generated on the airport site into the rivers deemed as Drinking Water Catchment water (drainage basins to the Cordeaux River, Wallandoola Creek or Cascade Creek). All effluent waters need to be treated to standard suitable for to the Allens Creek drainage basin.

5.2 Summary of issues from SSA Site Selection Programme (1985)

This Section details findings relating to water and watershed management made in the Draft Environmental Impact Statement (the Draft EIS) prepared as part of the *Second Sydney Airport Site Selection Programme.* The relevant findings from the below extracts from the Draft EIS have informed the analysis conducted for the current airport concepts.

Drainage and water quality

- Four water storages: Nepean, Avon, Cordeaux and Cataract Reservoirs;
- Nepean, Avon and Cordeaux have confluence at Pheasants Nest Weir; and
- Allens Creek does not flow into the waters of the Sydney Water supply system but flows into the Nepean River.

The Study Area contained parts of four drainage basins

- Allens Creek drainage basin;
- Cascade Creek drainage basin;
- Wallandoola Creek drainage basin; and
- Numerous tributaries of the Cordeaux River.

Surface and subsurface water

- Cascade Creek is the dominant watercourse; and
- Very little groundwater available on site.

Water quality

Without any mitigation, surface water runoff from the site would have flowed into Class P or S waters.(as defined in the 1985 EIS) No effluent could be discharged into Class S waters and discharges of effluents into class P waters must be of a quality similar to that required as a raw water source of potable water. Contaminants could be grouped as follows:

- Chemical or process effluent arising from aircraft maintenance;
- Domestic sewage from toilets and kitchens;
- Contaminated stormwater from heavily used areas (e.g. wash downs); and
- Clean stormwater from cleared and grassed areas.

Domestic sewage

No sewerage treatment facilities were located within or adjacent to the site.

The then Department of Aviation (or the operator of the airport) would either have had to treat domestic sewage in a dedicated plant located on the airport site or transport it to a future Sydney Water Corporation (SWC) plant. These plants would have to have had tertiary treatment systems to remove nitrogen and phosphorus.

Contaminated stormwater

The process could comprise pre-treatment on site and discharge to a water treatment plant operated by SWC or full treatment on site.

5.2.1 Assessments of effects and safeguards

Possible effects during the construction and operation of the proposed airport were considered under the following categories:

- Risk of contamination of Sydney's water supply;
- Loss of an area of water supply catchment;
- Increased potential for flooding in Allens Creek;
- Effects on groundwater;
- Effects on water quality during construction; and
- Effects on water quality during operation.

Contamination of Sydney's water supply

The undertaking made by the Department of Aviation to divert run-off from those parts of the site, that would be used for airport operations and that drained into the Sydney water supply system, to Allens Creek, would ensure that no contaminated water from the site entered the Sydney Water supply system.

Loss of catchment area

The Metropolitan Water Sewerage and Drainage Board (MWS&DB) estimated the cost of the water lost at $23,600 per annum (based on 1985 costs).

Water quality during operation

Stormwater run-off from the proposed site and discharges from the water pollution control plant - which could be located either on-site or off site as a joint-use facility - would be directed to enter Allens Creek, and thence would flow into the Hawkesbury-Nepean River system and into the ocean at Broken Bay.

The contribution of nutrients has been calculated using the following assumptions:

- Domestic sewage for 20,000 population equivalents associated with airport activities would be treated at a new water pollution control plant located off-site and also serving other development, and would produce daily effluent flows of 0.27 m^3 per day per population equivalent, with total nitrogen of 5 g/m^3 and total phosphorous of 1 g/m^3; and
- Nutrients in site run-off would be equivalent to that for a fully developed urban area, and would be estimated at 7 kg/ha per annum for nitrogen and 1 kg/ha per annum of phosphorus.

Precaution against birds

In addition to the safeguards adopted to minimise water pollution, the Department of Aviation proposed to implement measures to reduce the attractiveness of the drainage system to birds. These included design provisions such as constructing vertical walls to discourage plant growth, and operational measures such as ensuring that these basins were empty except during and after rainfall events.

Water supply

The provision of a water supply for a future airport and adjacent development would have required the construction of a new system consisting of a water treatment plant, pumping station and water mains. The source of supply was to be the Cataract River at Broughtons Pass.

Requirements for tourist, transport, warehouse and light industrial developments adjacent to the airport were assessed as equivalent to those for a population of 10,000 people.

On this basis, the airport would use an average of 3.8 ML of water per day, with a maximum consumption of 9 ML/d and a maximum peak-hour consumption of 0.75 ML, the adjacent development would require an average of 6 ML/d, with a maximum consumption of 11 ML/d and a maximum peak hour consumption of 0.83 ML.

Facilities, needed to serve a future airport and adjacent development, were proposed as being:

- A pumping station at river level at Broughtons Pass;
- A water treatment plant and pumping station on a site above the river;
- A reservoir on high land close to the airport site; and
- Rising mains between the pumping stations, water treatment plant and reservoir.

The MWS&DB indicated that it would need to be provided with the financial or material resources to design and construct these facilities.

Sewerage

The Draft EIS indicated that there were no sewage treatment schemes in the vicinity of the site and none was scheduled under short to medium term urban development proposals. Thus a new sewerage facility would be needed. The plant would have to have been constructed in stages, and the size of each stage and of the total plant would depend on the rate of airport development and of the surrounding areas that might be served by the same plant.

However, if it were ultimately sized for the maximum capacity of the airport (the worst case) and for the development in surrounding areas, then the equivalent population capacity of the plant would be 30,000, including 10,000 equivalent population for development in areas surrounding the airport.

Waste disposal

There was a 6 m wide easement, registered under a Mining Purpose Lease MPL 205, traversing the proposed site identified in the Draft EIS. It carried a water pipe used to transfer wastewater from the Cordeaux mine pit-top facilities, located some 6 km to the south-east of the proposed site and within the Metropolitan Catchment to an area of about 35.5 ha outside the catchment and adjacent to the north-western boundary of the proposed site, where the wastewater is disposed of by spray irrigation.

This pipeline would have had to be relocated if it impacted on the final selected site.

The airport at maximum development would have generated about 16,000 m^3 of solid waste weekly, which would have been removed to regional waste disposal sites operated by the Metropolitan Waste Disposal Authority.

5.3 Analysis of issues in terms of current airport concepts

5.3.1 Drainage and water quality

Issues relating to drainage and water quality are detailed in the Working Paper *Drinking Water Catchment, Hydrology and Drainage.*

5.3.2 Airport development- general

The airport site option’s position within the Study Area will dictate the drainage system used to prevent stormwater from the site draining into the Sydney Drinking water catchment system. The demands that will be placed on a water treatment and reuse facility (for toilet flushing, irrigation and wash-down requirements) will be established once the growth profile (stages over time) has been confirmed.

The following assumptions have been made:

- The sewage treatment plant will be implemented in stages as per the growth profile of the airport and adjacent airport associated facilities;
- A sewerage reticulation system will be supplied for all toilets, restaurants and other sources. to collect the sewage and convey it to the treatment plant. Where required, pumping stations will be used to lift the sewage from low lying areas to the treatment plant;
- A high quality effluent will be produced for reuse on site and that the water will be treated to such a quality that it can, when there is a low demand for reuse water, be released into Allens Creek. This will reduce the size of the potable water treatment facility (if water cannot be obtained directly from Sydney Water);
- Given today’s emphasis of sustainability and environmental design, a three pipe system is proposed conveying sewage, potable water and reuse around the site with sufficient capacity to be expanded in future for the ultimate development. Reuse pipes and fittings will be fully separate from that of the potable system;
- All the wastes generated at the sewage treatment plant (screenings, aerobically digested sludge etc.) will be dewatered on site and the solids will be trucked off site for disposal at a nearby approved landfill facility;
- A pumping station for raw water (if potable water cannot be obtained from Sydney Water) will be constructed at river level at Broughtons Pass;
- A water treatment plant (if potable water cannot be obtained from Sydney Water and the plant to be upgraded as potable demand increases from the airport development) and pumping station constructed on

a site above the river (an alternative is to construct the plant at the airport site and be integrated with the wastewater plant for ease of operation and disposal of sludge generated);

- A reservoir on high land close to the airport site (if insufficient elevation is available, the water reservoir needs to be elevated or pressurised by pumps); and
- Rising mains between the pumping stations, water treatment plant and reservoir with a distribution system on site.

5.3.3 Stormwater

5.3.3.1 Clean stormwater

Issues relating to clean stormwater are detailed in the Working Paper *Drinking Water Catchment, Hydrology and Drainage.*

5.3.3.2 Contaminated stormwater / process water

Contaminated stormwater will be generated from fuel spill areas, wash down of aircraft, workshops and the like. This type of water will have to be kept separately and treated separately from normal stormwater as it could contain all sorts of pollutants such as hydrocarbons which will have to be removed before the water can be released into Allens Creek or reused on the airport site.

It is proposed that a Gross Pollutant Trap (GBT) would be installed at each of these locations to capture all pollutants during the first flush. An overflow will direct the clean water to bypass the system and flow directly into the retention ponds. All these pollutants can be removed by physical/chemical means but the waste generated from these processes needs to be disposed of at approved disposal sites.

At the influence of the retention ponds a floating boom will be installed to prevent oils and greases to contaminate the stormwater that will flow to the retarding dam. An oil and grease removal system will be installed upstream from the floating boom to collect the oil and grease and dispose of it into a suitable container to be removed when it is full.

It is proposed that all polluted water be stored on site and ultimately conveyed to a treatment plant next to the wastewater and potable treatment plants to centralise all treatment for synergies in chemical usage and disposal of wastes generated during the different processes. Floating plastic covers will need to be placed on all exposed water bodies to prevent reflections blinding the pilots and birds using it as a breeding place.

5.3.4 Water supply

After the size and future upgrades of the proposed airport have been established, a water balance taking into account all waters such as stormwater, sewage generated, reuse requirements and the outcome of the water balance will then be used to establish the short fall in water requirements during the different seasons. This shortfall will have to be augmented by water from the river system (or from the retention storage).

This will be the potable water requirement and will determine the size of the potable treatment plant or the size of the potable pipe line from the SWC supply system. The intent is to use as much water (stormwater and reused effluent) to limit the abstraction from the current sources to the SCW supply. It will also be of economic benefit to use local available waters and not pump it over long distances and elevations as this increases the unit costs of water dramatically.

To generate sewage of about 8ML/d based on the ultimate capacity of the airport, and assuming that 80% of the water consumed as potable water on site is generated as sewage, the water treatment plant will have to have a capacity of about 10ML/d to cater for the final development to a maximum airport. This plant would also be designed to be constructed in stages to cater for the increased demand as the airport is developed.

5.3.5 Sewage treatment

Most of the Sydney Water sewage treatment plants that are located inland are tertiary treatment plants which means that the effluent produced is of such a quality that it can be released into our waterways. The sewage treatment plant for any of the eight airport options at Wilton will be required to produce a similar quality of effluent before it can be discharged from the site. There are no additional costs involved as the requirements are the same for all waterways that are classed as sensitive (all inland rivers).

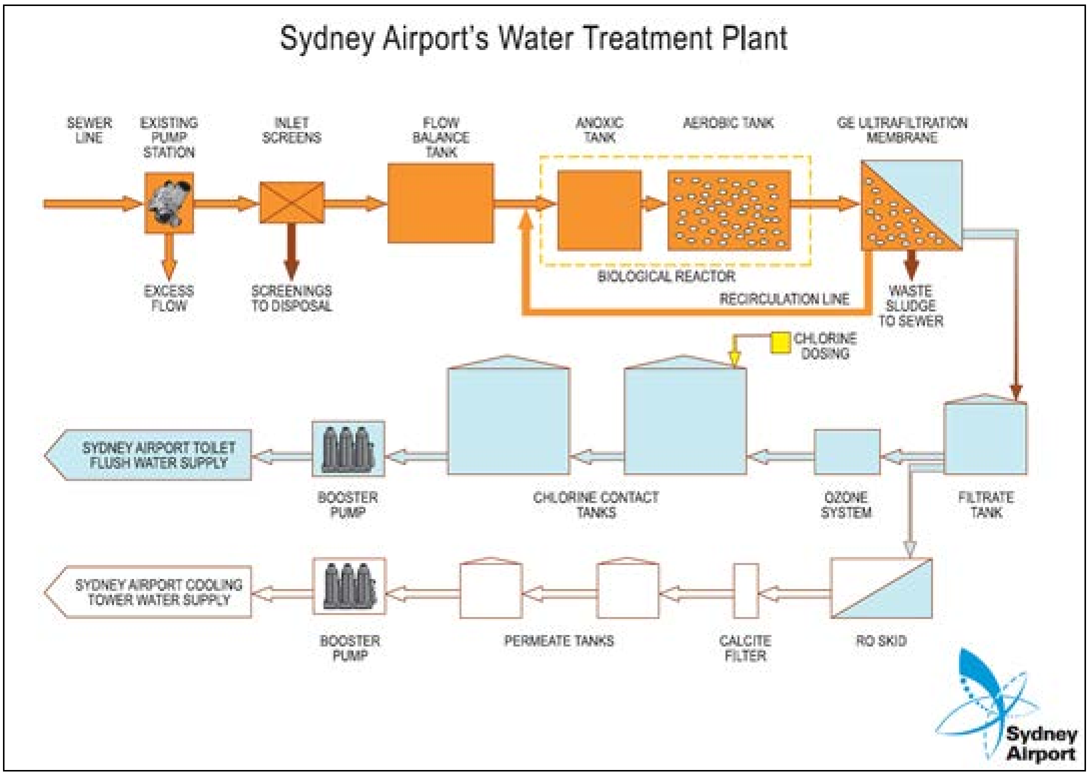
The trend with the development of most new airports worldwide (and existing airports, such as Kingsford Smith in Sydney), is to reuse wastewater generated on site for reuse opportunities such as toilet flushing, wash down water, irrigation and the like.

The sewage treatment plant proposed would be able to remove nitrogen and phosphorous down to the levels required before it is released into Allens Creek or reused on site. If provision is made to treat the sewage generated by an ultimate population equivalent (PE) of 30,000 it would generate about 8ML/d (0.27m3/d/PE) of sewage that need to be treated. The sewage treatment plant will be designed as such that it can be seamlessly be upgraded from the initial size required to the ultimate plant. It is not practical to provide a treatment plant, initially sized for the ultimate load as it would not work properly.

Depending on the treatment system used in a sewage treatment plant, but certainly with modern systems such as a Membrane Bio Reactor (MBR), it is possible to produce a Class A effluent of between 85-90% of the total volume of the raw sewage flowing into the plant that is of quality that can be reused on site or released into Allens Creek.

The process flow diagram for the Sydney Airport system is as follows:

Figure 5.1 Flow diagram of Sydney Airport's water treatement plant



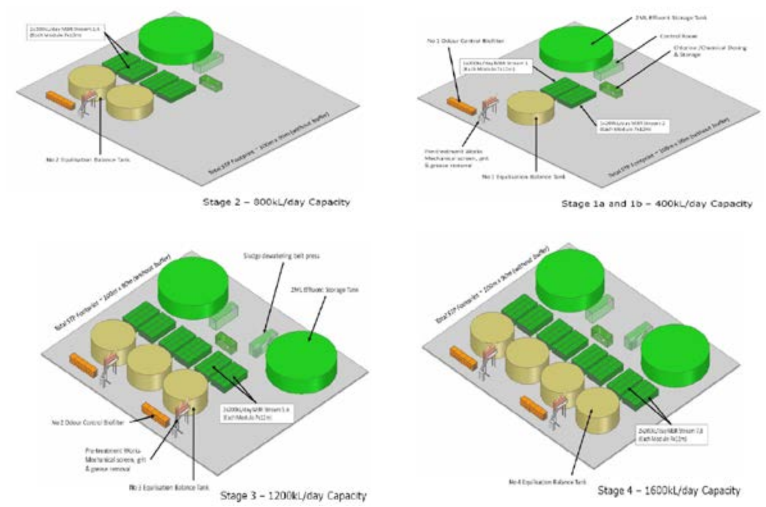
The benefits of the water reuse project include:

- Environmental – reducing the amount of sewage that has to be disposed;
- Sustainable – reducing the amount of fresh drinking water consumed and supplied; and
- Commercial – saving on overall water costs.

With the invention and use of membranes to treat sewage, it can be converted into a Class A water at relatively low costs which is fit for the purposes as described above. If this system is adopted, it will also improve the airport's green star rating.

These MBR systems can be modularised to allow for expansion of the airport in stages. It is based on the activated sludge system and if the system is covered and aerobic digestion is used it is virtually odourless and can be housed indoors. This concept is illustrated below.

Figure 5.2 Modularised implementation of the sewage treatment plant



Major shopping complexes now use MBR systems and as an example, Westfield in Sydney's CBD has an MBR in its basement to produce water for toilet flushing, irrigation and cooling tower water. The new development at Barrangaroo at Darling Harbour will also have a similar system utilising effluent in a similar capacity as the Westfield complex. This system is a high rate system (high MLSS) and thus requires less footprint area than a conventional activated sludge system.

All waste products produced such as screenings and waste activated sludge would be dewatered on site and removed to an approved disposal site remote from the airport site.

The effluent produced from the MBR plant will after disinfection with sodium hypochlorite be suitable for toilet flushing, irrigation or wash down water.

A typical MBR plant is shown below:

Figure 5.3 Typical MBR plant

5.3.5.1 Reuse possibilities

A large proportion of the potable water supplied to an airport ends up being wastewater that has to be treated by the wastewater treatment plant. Instead of disposing of this high quality water (after treatment), it can be reused for various water saving measures that can be implemented around the site.

A few examples of this are:

- Toilet flushing;
- Irrigation of vegetation on site and inside buildings;
- Wash down of aircraft;
- Fire water on site;
- Hose down of tarmacs; and
- Wash water for laundry.

If water cooled air-conditioning units are being considered for the airport, the blow down water from the units will have to be treated before the water can be released to the environment. The most cost effective way to treat this is to use a Reverse Osmosis (RO) system to remove the concentrated salts (high TDS =Total Dissolved Solids) from the water. This brings another complication as the salts removed from the water need to be further concentrated for removal off site. There are various cost effective small scale systems that work with low grade heat (70-80 degrees C) to effect this.

Conventional treatment of this high TDS waters is to provide a RO system of sufficient capacity to remove the TDS to values which are acceptable for other uses. A typical installation would be as follows:

Figure 5.4 Typical RO plant

5.3.6 Analysis of issues in terms of airport options

5.3.6.1 Airport Options 1, 2, 6 and 7

The objective should be to have all the treatment plants (water, wastewater and reuse) close to each other - while also being as far as possible from people for safety reasons due to the use of chlorine and chemicals which are hazardous to humans - because of the following reasons:

- They use similar chemicals and delivery to one site will be easier for storage and handling on site;
- Access from the main roads would be easier for deliveries and removal of solids produced;
- They all need to be on the low side of the terrain to allow sewage to gravitate to the sewage treatment plant;
- The possibility exists that odours might be generated by the sewage treatment plant;
- They all should be as close as possible to the highest demand/production sources to have the most cost effective distribution system; and
- They all should be as close as possible to Allens Creek if effluent has to be released which cannot be used on site.

As far as the complexity of water and wastewater treatment is concerned both Options 1 and 2 are very similar. It is envisaged that the treatment plants for both options will be located next to the Retarding Dam. (See Working Paper *Drinking Water Catchment, Hydrology and Drainage* for more details). The elevation will be such that it cannot be flooded if the Retarding Dam overspills.

The Retarding Dam will need to have an isolated portion with sufficient capacity to prevent polluted water mixing with the water already in the dam and possibly further polluting it. This separate dam will be able to be drained into the dam if the water is of a sufficient quality. If not, it can be treated by the reuse treatment plant until it is of such a quality that it can be released via the dam.

The excess water produced by the MBR sewage treatment plant can be released directly into Allens Creek or into the Retarding Dam to improve the water quality in the Retarding Dam. The treatment plants normally would have a backup power plant to keep most of the plant in operation if there is a power outage to prevent untreated effluent to be discharged into Allens Creek.

The effluent under normal circumstances will be discharged into the stormwater dam which forms part of the Retarding Dam to prevent the accidental discharge of untreated sewage into Allens Creek during power outages.

Sewage pump stations that will pump to the sewage treatment plant will be designed with storage facilities for up to 8 hours based on average dry weather flow to allow no spillages of raw sewage during periods of power outages. The sewage pump stations will be equipped with the facilities to bring a mobile power plant to allow the pump station to be operational within the 8 hours that it will take to fill the storage tank.

5.3.6.2 Risks

The major risks are spillages of contaminated or polluted waters from retention ponds, sewage pump stations or the sewage treatment plant into the sensitive rivers and streams when power or equipment failures occur.

5.3.6.3 Mitigation of risks

Retention pond spillages: It would be unlikely – though of course not impossible **-** to have spillages from the retention ponds as they would be designed in such a way as to have capacity to capture all surface generated runoff under an extreme wet weather event.. It will then overflow to the stormwater dam which is part of the Retarding Dam. Only when the quality is of an approved quality it will be released into the Retarding dam for release into Allens Creek.

Sewage pump stations: Sewage pump stations would be provided with an emergency storage facility to store up to 8 hours of average dry weather flow before it will overflow. The overflow would be piped to the stormwater dam where it can be retained and pumped to the sewage treatment plant to be treated under low flow conditions before it is released into Allens Creek or reused on site.

As an additional safety measure, a facility would be provided to hook an auxiliary power source such as a portable diesel generator set (genset) to the pump station within the 8 hour period to pump the sewage to the treatment plant.

Sewage treatment plant: The sewage treatment plant, as proposed, would be a Membrane Bioreactor (MBR) type which produces a very high quality effluent that can be reused on site. As the plant would most probably be elevated to prevent flooding as it would be close to the Retarding Dam, the raw sewage would most probably be pumped into the plant. Initially, when the plant is small a diesel genset can be provided to power the plant during periods of outages to prevent the release of substandard quality effluent for reuse or release into Allens Creek.

As the size of the plant is increased it will not be economical to provide a 100% standby power capacity and only the most critical elements would be powered using a standby genset. The effluent produced from this plant would then be directed to the stormwater dam which is separate from the Retarding Dam to enable substandard quality effluent to be retreated during low flow conditions for reuse or release via the Retarding Dam into Allens Creek.

5.3.6.4 Airport Options 3, 4 and 5

The objectives for these options will be the same as for Options 1, 2, 6 and 7 as well as the location close to the Retarding dam.

Similar risks exists for these options than the options discussed earlier but the risk of an overflow or spillage into the Drinking water Catchment is more pronounced as these options are not close to Allens Creek and all effluent should be kept out of these sensitive rivers and streams.

The same type of storm water dam as for the previous options is proposed to enable the substandard water quality to be treated before release into the Retarding Dam. From the Retarding Dam, the effluent should be piped or directed by a canal system to Allens Creek for release (Refer to Working Paper *Drinking Water Catchment, Hydrology and Drainage* for more details).

The same risk mitigation measures as for options 1, 1S, 2, 6 and 7 are proposed in this instance.

5.3.7 Water treatment for potable purposes

5.3.7.1 Airport Options 1, 1S, 2, 6 and 7

There are two options that are available to supply potable water to the airport. These are as follows:

- Option A: Obtain potable water from an existing water treatment plant in the vicinity. If insufficient treatment capacity exists, it might be cost effective to augment the treatment capacity with pipe lines to the airport sites; and
- Option B: If it is not possible to augment existing treatment capacity, a new potable water treatment facility could be constructed that can be modularised to increase its capacity as and when required without stopping the existing plant.

Option A:

This option would be the most cost effective as it would either use existing infrastructure or because such infrastructure can be cost effectively be upgraded to supply sufficient capacity for the needs of the airport as the demand increases as the airport expands to its ultimate capacity.

Depending from where the water is obtained, both options will require easements to some extent to the various airport options.

Advantages:

- Cost effective use of existing infrastructure;
- Can obtain water at a known price; and
- Does not have to operate the treatment plant.

Disadvantages:

- No control over quality or quantity requirements;
- Uses older technology (sufficient if raw water quality is good);
- Long lead time to obtain approvals for increases in capacity requirements; and
- Might require infrastructure upgrades such as power and the like, which might be expensive.

For Option A, the water will be treated at a current facility and all sludge will be disposed of through the current practices. Only the potable water will be pumped through a rising main, sized for the ultimate capacity required, in an easement to the various airport site options to the highest point near that option and where a reservoir with sufficient capacity for the ultimate airport size would need to be constructed.

The reservoir could be a concrete tank with an internal lining or a steel tank either glass coated or lined internal surface. Because of height restrictions the reservoir will be elevated as high as possible with additional pressure supplied with the aid of booster pumps for the airport development.

From the reservoir, the potable water will be chlorinated if required and distributed site wide to users via a mains pipe sufficiently sized for the ultimate development. It is preferable to have the main pipe located in a services tunnel or dedicated surface corridor for access purposes to allow new connections and maintenance, as and when required.

It is proposed to have a three pipe system for site wide reticulation of potable, reuse water and sewage. Sewage will be transferred to the sewage treatment plant as was discussed previously. If a reuse system is used for toilet flushing and other non-potable uses, about 80% of the potable water will eventually be returned to the sewage treatment plant.

Option B:

This option will have a dedicated potable water treatment plant that will be upgradable to cater for the capacity increases at the airport development. It would be preferable to have the plant at the raw water abstraction site to only pump the potable water and not the dirty raw water to the airport sites for the various options. Raw water can be abstracted from Broughtons Pass Weir or closer if a suitable sustainable source can be found and if it complies with the requirements of the SCA.

Advantages:

- Will have direct control over the potable water treatment plant;
- Can use the most cost effective solution when constructing the plant;
- Can place it as close as possible to the airport sites making it more cost effective; and
- Can be designed as a modular plant, making capacity upgrades easier.

Disadvantages:

- Airport owner will have to operate plant;
- Efficiency of size will not be applicable (water might be more expensive per cu. m);
- Approvals for a new site might take longer; and
- Sludge generated in the treatment process will have to be disposed of.

The potable water will be pumped through a rising main sized for the ultimate capacity required in an easement to the various airport options to the highest point where a reservoir with sufficient capacity for the ultimate airport size will be constructed.

The reservoir would be essentially the same as for Option A.

From the reservoir, the potable water would be chlorinated if required and distributed site wide to the users via a mains pipe sufficiently sized for the ultimate development. Reticulation would be similar to Option A.

5.3.7.2 Airport Options 3, 4 and 5

For potable water treatment, options 3, 4 and 5 are very similar to the options previously discussed. The only difference might be the positions of the treatment plant which will influence the cost to provide infrastructure such as power to the plant and the cost of slightly longer or possibly shorter potable delivery lines.

This can only be established once the position of the potable water treatment plant has been approved by SCA and other relevant government agencies.

5.3.7.3 Impact level assessment

An relative assessment based on the water (potable and sewage) aspects for the eight options for airport sites at Wilton is be given below.

Table 5.1 Water impact level assessment for the different options

	Option 1 and 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Close to access roads	Yes	Yes	No	No	No	Yes	Yes
Close to Allens Creek	Yes	Yes	No	No	No	Yes	Yes

	Option 1 and 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Close to Drinking Water Catchments	No	No	Yes	Yes	Yes	No	No
Closeness to town for sharing water services	Yes	Yes	No	No	No	Yes	Yes
Next to Retarding Dam	Yes	Yes	Yes	Yes	Yes	Yes	Yes

As can be seen from the above **Table 5.1** as far as water and sewage treatment for the eight options is concerned, there is not much difference between them in respect of the best site but it is clear that options 1, 1S, 2, 6 and 7 are the better options compared to options 3, 4 and 5 as far as water and sewage treatment services are concerned.

The biggest concern for options 3, 4 and 5 is that if there is a spillage of contaminated water or effluent it will have to be contained and piped to Allens Creek, which is much more difficult to achieve because of gorge, and gulley stream crossings and the costs of achieving this.

5.3.8 Indicative cost estimate

For relative comparison purposes only, a +/-50% cost estimate has been done for Wilton based on the assumption that potable water could most probably be sourced from the closest Water Filtration Plant (WFP) and that an adequate potable water reservoir is available close to the airport site. The other facilities are as discussed above.

No provision in this estimate has been done to allow for neither the first flush system nor an earthen canal around site or the 1300ML retention dam. This will need to be priced separately under the stormwater treatment system. (See Working Paper *Drinking Water Catchment, Hydrology and Drainage*)

The costs as shown are based on passengers transiting the airport and are only an order of magnitude for relativity comparisons. They can only be determined more accurately once the engineering details of the airport site and development becomes known.

Table 5.2 Indicative costs for water infrastructure ($2012)

Scenario	Pax Per Annum	Potable ($)	Sewerage ($)	Recycled ($)	Fire ($)	Total ($) (+30% contingency)
1	2 m	6.8 m	2.9 m	3.4 m	10.8 m	31 m
2	5 m	6.8 m	4.2 m	3.4 m	10.8 m	33 m
3	20 m	6.9 m	11 m	3.5 m	10.8 m	42 m
4	30 m	6.9 m	15.5 m	3.5 m	10.8 m	48 m
5	70 m	7.1 m	33.4 m	3.7 m	10.8 m	72 m
6	90 m	7.2 m	42.4 m	3.8 m	10.8 m	83.5 m

As can be seen from **Table 5.2,** in relation to the likely multibillion dollar cost of the total airport development, the indicative water infrastructure costs are only a very small percentage.

5.4 Potential environmental impacts

As discussed, previously the effluents generated on the proposed sites might have potential environmental impacts by impacting on the DWC and other sensitive water systems if not stopped from reaching them and being treated to the required quality before being released into Allens Creek.

On-line monitoring devices can be installed to make sure the effluent produced by the sewage or storm water treatment plants complies at all times with the specified water quality criteria before being released or reused.

However, the technology exists to treat the effluent to the required standards without polluting the DWC water or Allens Creek. Sufficient safety measures such as retention dams would need to be provided to ensure that the effluent produced for release which is not to standard can be stored for retreatment to ensure the correct quality effluent is released into Allens Creek.

It is possible to mitigate all possible effects that a sewage or storm water treatment plant could have on the environment by providing relatively inexpensive preventative measures after the treatment plants, although the transmission of such treated water to a discharge point on Allens creek is liable to be far more expensive for the Options 3, 4 and 5.

5.5 Summary of mitigation methods and strategies

The key overall measure is to prevent any runoff generated from the proposed sites to reach the Drinking Water Catchment waters and treat all effluent to the required standards before release into Allens Creek.

The following mitigation measures should be provided:

- Capture all spillages such as hydrocarbons with retention ponds that will allow the water to be treated to the right standard before it is released or reused;
- Supply eight hours storage of raw sewage at sewage pumping stations;
- Provide facility at sewage pumping stations to connect a diesel generator to allow it to operate during power outages preventing overflows;
- Provide an overflow retention pond at each sewage pumping station to prevent spillages;
- Construct the sewage treatment plant first to allow raw sewage produced during the construction stage to be treated and reused for construction activities;
- Provide diesel standby facilities at the treatment plants to prevent raw sewage to be released;
- Provide in line instrumentation to detect off specification effluent and to automatically direct it to retention ponds; and
- Provide retention ponds for off specification effluent to have it retreated during low flow conditions.

5.5.1 Residual impacts

A small amount of surface runoff will be diverted from the current Sydney catchment area. However, as onsite reuse of water is considered, the development will place less demand on the existing water resources. This aspect is covered in Working Paper *Drinking Water Catchment, Hydrology and Drainage*.

5.6 Key findings

- No effluent may be discharged into DWC waters and discharges of effluents into other sensitive waters must be of a quality similar to that required as a raw water source of potable water;
- However, mitigation strategies can be put into place to prevent pollution to the sensitive streams and rivers at Wilton;

- Water treatment technologies exist to treat the effluent generated on site (no matter how highly polluted the water is) to a class better than drinking water standards;
- It is also proposed that a sewage treatment plant should be built during the start of the construction to allow effluent reuse to be produced for construction purposes thus preventing pollution of the sensitive streams and rivers. This approach has been previously been employed at building construction sites in Sydney;
- As the water demand, and hence the volume of polluted effluents generated, would be fairly low the cost of treatment compared to the total capital cost of the project would be minimal;
- All waters generated on the site could be contained and treated on site with beneficial outcomes by reusing the water for purposes of irrigation and toilet flushing in the airport and surrounds;
- Option 1, 1S and to a lesser extend Option 2 would be the most preferred locations for preventing effluent generated on site to gravitate into the DWC streams and rivers; and
- Options 6 and 7 could also work but the other Options 3, 4 and 5 , although possible to execute, would be less preferable from a water treatment perspective, as they are far from Allens Creek which would be the release conduit of excess treated effluent that cannot be reused on site.

6 WORKING PAPER – FLORA, FAUNA AND ECOLOGICAL VALUES

SUMMARY

The purpose of this Working Paper is to identify any issues relating to ecological impacts and identify residual impacts post-mitigation to differentiate between the eight airport options for an airport development at Wilton.

Flora and fauna threatened species were identified at a national level through a search of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) search tool and at the NSW State level through a search of Office of Environment and Heritage databases. A literature review of flora and fauna surveys conducted in and around the Wilton Study Area were also conducted and mapping data used, where available, to inform a high level assessment of impacts associated with each option.

A summary of the findings includes:

- In addition to a large number of threatened flora and fauna identified to occur in the Wilton Study Area, five endangered ecological communities were found to occur. The Cumberland Koala Linkage and two Priority Fauna Habitats were also found to occur;
- The high incidence of threatened species at the Wilton Study Area is due to its location in and adjacent to the Metropolitan Special Area (drinking water catchment) which has been relatively undisturbed;
- All options require substantial clearing of native vegetation including endangered ecological communities and priority fauna habitat. This would impact a large number of threatened flora and fauna;
- Options 1, 1S, 2, 6 and 7 would impact the Cumberland Koala Linkage. Options 3, 4 and 5 would not impact this linkage however these options would impact Koala habitat (as well as other threatened species);
- Each option is likely to significantly impact watercourses and aquatic habitat containing threatened aquatic fauna (frogs and fishes); and
- Due to the large area required for clearing, residual impacts to terrestrial and aquatic flora and fauna are likely to be significant. Environmental offsets are therefore likely to be required.

6.1 Introduction

The purpose of this Working Paper is to identify as far as possible any potentially major ecological issues or constraints associated with a proposed airport site at Wilton and to suggest strategies to mitigate any identified issues.

6.1.1 Statement of issue

Development at Wilton would involve a new greenfield airport. This Working Paper expands on the preliminary investigations, analyses and indicative designs undertaken for the *Joint Study on Aviation Capacity in the Sydney Region* ('the Joint Study') to further refine airport development concepts at a Wilton site from the planning, construction and operational perspective taking into account both the potential on-site and off-site impacts. This Working Paper has considered the options for a potential full service airport capable of serving all market segments and accommodating a future parallel runway layout Airport (as developed in the Working Paper *Wilton Site Selection and Airport Concepts*) and reviews potential ecological impacts associated with each option.

6.1.2 Objective

This further analysis has been conducted to ensure the identification of ecological values, including threatened flora and fauna, to address any potential future Environmental Impact Statement (EIS) which may be conducted by the Australian and/or NSW Governments under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) and the *Environmental Planning and Assessment Act 1979* (NSW). Proposed mitigation measures for identified impacts are also suggested.

6.1.3 Overview

To achieve the objective stated above, the Working Paper documents the following:

- Federal and NSW Legislation relevant to fauna and flora species and habitat protection (Section 6.2);
- Summary of relevant findings of the Environmental Impact Statement (Kinhill Stearns,1985) and the Joint Study on Aviation Capacity (Section 6.3);
- Desktop assessment of the occurrence of Federal Government and NSW Government protected terrestrial fauna and flora and aquatic fauna species (Section 6.4); and
- Potential impacts to flora and fauna of each option. Ecological impact mitigation and management recommendations. (see Section 6.5).

6.2 Legislative status

The Australian Government and the NSW Government both have legislation protecting threatened flora and fauna. Identification of protected fauna and flora likely to occur in the Wilton Study Area is provided in Section 6.4, and discussion of potential impacts to identified species in the context of the legislation is provided in Section 6.5.

6.2.1 Commonwealth legislation

Species and ecological communities which are threatened on a national level are protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The EPBC Act protects:

- Fauna and flora on land controlled or owned by the Commonwealth;
- Fauna and flora that may be harmed by the activities of the Commonwealth or a Commonwealth agency, as is the case with a proposed airport development; and

- Nationally listed threatened species or communities which might be significantly impacted by an activity or development.

6.2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's key piece of environmental legislation which commenced 16 July 2000 and, therefore, was not a consideration in the Draft Environmental Impact Statement of the Wilton site conducted in 1985 as part of the Second Sydney Airport Site Selection Programme. The EPBC Act is administered by the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

The EPBC Act enables the Australian Government to focus on environment and heritage protection and biodiversity conservation through the protection of matters of national environmental significance, with the states and territories having responsibility for matters of state and local significance. The EPBC Act also requires the Australian Government to determine impacts of proposed actions conducted by the Commonwealth and / or on Commonwealth land.

Matters of national environmental significance

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance, require approval from the Australian Government Minister for DSEWPaC (the Minister). The Minister will decide whether assessment and approval is required under the EPBC Act. There are two matters of National Environmental Significance relevant to the Wilton Study Area:

- Listed threatened species and ecological communities; and
- Migratory species protected under international agreements.

Three categories exist for listing threatened flora and fauna and threatened ecological communities under the EPBC Act:

- Critically endangered;
- Endangered; and
- Vulnerable.

6.2.2 NSW legislation

In NSW, threatened species are protected under the following three Acts which operate in conjunction with each other:

- The Threatened Species Conservation Act 1995 (TSC Act) addresses the listing of species, the declaration of critical habitat, recovery plans, threat abatement plans, licencing, biodiversity certification and biobanking;
- The National Parks and Wildlife Act 1974 (NPW Act) contains additional licencing provisions, and provisions for criminal offences; and
- The Environmental Planning and Assessment Act 1979 (EP&A Act) imposes obligations on developers and consent authorities to assess and consider the impacts of proposed development on threatened species during the development assessment process (e.g. by requiring a species impact statement in some circumstances).

Threatened fish (both saltwater and freshwater) and their habitat, and threatened marine vegetation, are protected under the *Fisheries Management Act* 1994 (FM Act).

There are many native species of flora (plants) and fauna (animals) which, although not threatened, still have some degree of legal protection. These are protected under the NPW Act.

Habitat loss through land clearing and development is one of the key threatening processes leading to loss of biodiversity in NSW. Land clearing in general is regulated under the *Native Vegetation Act 2003* (NV Act).

6.2.2.1 Threatened Species Conservation Act 1995

The TSC Act identifies threatened species, populations, endangered ecological communities (EECs), critical habitats and key threatening processes, with the exception of fish and marine plants, which are protected under Part 7A of the FM Act (see below).

All terrestrial threatened species, populations and ecological communities are listed in Schedules to the TSC Act. The Office of Environment and Heritage (OEH) administers the TSC Act, but the Schedules are maintained by an independent Scientific Committee.

The TSC Act provides for the identification, conservation and recovery of threatened species and their populations and ecological communities, but it does not contain a specific approval regime. Instead, the Act is integrated with regulatory procedures under both the EP&A Act and the NPW Act. This allows for integration of threatened species assessment into the planning system and removes the requirement to obtain a separate threatened species license in addition to development consent or project approval under the EP&A Act.

Section 5A of the EP&A Act requires that for the purposes of the Act, consideration of whether the proposal is likely to impact on threatened species, populations or ecological communities is required. It establishes seven factors on which this assessment must be based (the ‘Seven Part Test’). Where a significant impact is considered likely, a Species Impact Statement (SIS) must be prepared. The SIS would then be considered in and submitted with the EIS.

Under Section 91 of the TSC Act, the Director-General may grant a licence authorising a person to take action which is most likely to result in harm to any animal that is of, or is part of, a threatened species, population or ecological community. A licence under Section 91 of the TSC Act is not required for the carrying out of an activity by or in accordance with an approval by a determining authority within the meaning of Part 5 of the EP&A Act if the determining authority has complied with that Part.

Recent amendments to the TSC Act also provide for developers to provide native vegetation offsets where their activities will lead to impacts on biodiversity values (the ‘Biobanking Scheme’). The OEH is currently undertaking a pilot for the Biobanking Scheme. Under the Scheme, developers may be required to purchase and retire sufficient biodiversity credits to ensure that the impact of their development on biodiversity values is fully offset, as well as to take onsite measures to minimise any negative impact on biodiversity values.

Recent amendments to Part 3A EP&A Act provide that the Minister for Planning may approve a project subject to a condition that requires the proponent to acquire and retire (in accordance with the TSC Act) biodiversity credits of a number and class specified by the Minister (see s. 75JA EPAA). The Minister may permit the deferred retirement of some or all of the biodiversity credits, pending completion of rehabilitation or restoration actions to be undertaken on the project site to restore or improve biodiversity values affected by the project.

A range of threatened species and ecological communities are known to occur in the region and this is discussed further in Section 6.4. Recovery Plans and Priorities Action Statements for all species, populations and ecological communities listed as critically endangered, endangered or vulnerable on the Schedules of the TSC Act (other than species presumed extinct) are also discussed where relevant in Sections 6.4 and 6.5.

6.2.2.2 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) contains provisions for the identification and protection of threatened species, populations and ecological communities of marine and freshwater fish and aquatic plants. These provisions are parallel to those in the TSC Act covering terrestrial species, including the concepts of threatened species, key threatening processes, recovery plans and a Scientific Committee. The FM Act is also integrated with the EP&A Act in a similar way as is the TSC Act.

The provisions of the FM Act cover all fish (freshwater, estuarine and marine), aquatic invertebrates and marine plants. The definition of fish includes any marine, estuarine or freshwater fish or other aquatic animal (e.g., oysters, prawns, sharks, rays, starfish, insects and worms), at any stage of their life history. It does not include whales, mammals, birds, reptiles and amphibians.

Part 7 of the *Fisheries Management Act 1994* requires a permit for a number of activities, including those involving dredging and reclamation work and those involving harm to marine vegetation.

Threatened species are known to occur in the region and this is discussed further in Sections 6.4 and 6.5.

6.2.2.3 Native Vegetation Act 2003

The *Native Vegetation Act 2003* regulates the clearing of native vegetation outside national parks, conservation areas, state forests and reserves and urban areas (as defined in Schedule 1 to the Act).

A review of the regulations for the NV Act, including the *Native Vegetation Regulation 2005*, the Environmental Outcomes Assessment Methodology (EOAM) and the Private Native Forestry Code of Practice (PNF Code) is currently being conducted.

6.2.2.4 Environmental Planning and Assessment Act 1979

The EP&A Act establishes the system of environmental planning and assessment in NSW. The former Part 3A of the EP&A Act prescribed the environmental impact assessment for those developments classified as major projects. Transitional arrangements are now in place for those projects under this assessment regime. Part 4.1 of the EP&A Act now deals with State significant development, while State Significant Infrastructure is assessed under the provisions of Part 5.1 of the EP&A Act.

Relevant State Environmental Planning Policies (SEPP) that apply under the EP&A Act to the protection of threatened species includes the *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44).

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)

The *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat; and

(b) by encouraging the identification of areas of core koala habitat; and

(c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

Although Wollondilly Shire Council would not be the Determining Authority for a proposed airport development at Wilton, SEPP 44 requires that before a council may grant consent to a development application for consent to carry out development on land to which this Part applies that it is satisfied is a core koala habitat, there must be a plan of management prepared in accordance with Part 3 that applies to the land.

The council’s determination of the development application must not be inconsistent with the plan of management.

6.2.2.5 National Parks and Wildlife Act 1974

All native animals such as mammals, birds, reptiles and amphibians are protected in NSW under the NPW Act. There is therefore no list showing which native species are protected (Lists of protected species are provided under the TSC Act). The NPW Act provides for the protection of all animals (fauna) except those which are listed as *"unprotected fauna“.* Unprotected fauna include: bears, lions, dogs, moles, hedgehogs, cloven hoofed animals, horses, donkeys, apes, monkeys, elephants, hares, rabbits and Indian Palm Squirrels.

The native plants which are protected under the NPW Act *"protected native plants"* are listed in Schedule 13 of the Act. The list includes over 100 native plant species.

Parts of the Wilton site are within the system of parks and reserves managed by the National Parks and Wildlife Service (now part of OEH) including the Upper Nepean State Conservation Area.

6.2.2.6 Upper Nepean State Conservation Area

The Upper Nepean State Conservation Area was created in February 2007. It covers an area of 25,237 hectares. State conservation areas are lands reserved to protect and conserve significant or representative ecosystems, landforms, natural phenomena or places of cultural significance, while providing opportunities for sustainable visitation, enjoyment, use of buildings and research.

The principal difference between the management, objectives and principles of national parks and state conservation areas is that mineral and petroleum exploration and mining may be permitted in state conservation areas.

The Upper Nepean State Conservation Area was part of the Metropolitan Special Area which is jointly managed by the SCA and OEH.

6.2.2.7 Sydney Water Catchment Management Act 1998

The *Sydney Water Catchment Management Act 1998* (SWCM Act) establishes the Sydney Catchment Authority (SCA) to manage and protect Sydney's water catchment areas. The SWCM Act sets out the principal objectives of the SCA as being:

- To ensure that the catchment areas and the catchment infrastructure works are managed and protected so as to protect water quality, protect public health and safety, and protect the environment;
- To ensure that water supplied by the SCA complies with appropriate standards of quality;
- Where SCA activities affect the environment, to conduct its activities in compliance with the principles of ecologically sustainable development; and
- To manage SCA's catchment infrastructure works efficiently and economically and in accordance with sound commercial principles.

Areas surrounding SCA dams and storages are subject to additional management measures to especially protect the quality of water. These areas, known as Special Areas, are lands declared under the *Sydney Water Catchment Management Act 1998* (SWCM Act) for their value in protecting the quality of the raw water used to provide drinking water to greater Sydney and for their ecological integrity. The SCA manages around 3,700 km2 of Special Areas.

SCA states that the Special Areas are a critical element in its multi-barrier approach to protecting drinking water quality. This approach includes managing the hydrological catchments, the storages, quality treatment and delivery of water to retail customers. The Special Areas essentially act as a filtration system for water entering water storages by reducing nutrients, sediments and other substances that can affect water quality. The ecological integrity of the Special Areas is therefore important in their role of protecting water quality.

The Special Area within part of the proposed Wilton site (see Working Paper - *Drinking Water Catchment, Hydrology and Drainage*) includes the Metropolitan Special Area. This includes all land draining to Pheasants Nest Weir on the Nepean River or Broughtons Pass Weir on the Cataract River (a total of 89,000 ha). This Special Area includes the Cataract Dam (upstream of Broughtons Pass Weir) and the Cordeaux, Avon and Nepean Dams (upstream of Pheasants Nest Weir) which are all within the Upper Nepean catchment.

Under the SWCM Act, public agencies must first give notice to SCA of their intention to exercise their functions within a Special Area, and those agencies may not exercise those functions contrary to any representations that SCA makes except with 28 days' notice (see s. 47 SWCMA). The *Sydney Water Catchment Management (General) Regulation 2000* regulates conduct in Special Areas to protect water supply and biodiversity. It categorises Special Area lands as:

- Schedule 1 - No Entry; or
- Schedule 2 - Restricted Access.

The Metropolitan Special Area is classified as Schedule 1 – No Entry.

The SCA's management approach for the Special Areas is outlined in its *Special Areas Strategic Plan of Management* (SASPoM), which was first adopted by the Government in 2001 and replaced by a fully revised version in February 2007. The SCA and OEH are joint sponsors of the plan. The SASPoM essentially seeks to control impacts on the water supply catchments rather than to control land uses as such, while the SCA supports, oversees and regulates planning and development in the catchment to protect catchment health and water quality. They are responsible for implementing the *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011* to regulate development and activities in the catchment. SCA also implement the associated Local Planning Direction 5.2 Sydney Drinking Water Catchments to influence land planning and zoning in the catchment.

6.2.2.8 Catchment Management Authorities Act 2003

The Hawkesbury-Nepean Catchment Action Plan (CAP) 2007-2016 sets the direction for the activities and investment of the Hawkesbury Nepean CMA and documents management of the catchment with the following goals:

- Improve river health;
- Protect biodiversity; and
- Encourage best practice soil and land management.

The CAP is a non-regulatory statutory plan created under the *Catchment Management Authorities Act* 2003. Although its contents are not legally binding or enforceable, the EIS Guidelines for the Brisbane New Parallel Runway Project required the development to address the Catchment Management Plan.

6.3 Summary of issues from SSA Site Selection Programme and Joint Study on Aviation Capacity

A summary of the issues identified in the Second Sydney Airport Site Selection Programme and the Joint Study on Aviation Capacity are discussed below.

6.3.1 Second Sydney Airport Site Selection Programme

A Draft Environmental Impact Statement (EIS) was prepared for the Wilton site for the Second Sydney Airport Site Selection Programme by Kinhill Stearns (1985) on behalf of the then Department of Aviation. The location of the proposed airport and EIS study area is shown in **Figure 4.3**.

The 1985 EIS assessed a range of issues, including potential impacts to terrestrial and aquatic ecology. A summary of the ecological issues identified in the 1985 EIS and their relevance to the current proposed Wilton airport site is provided below.

6.3.1.1 Flora

The EIS determined that much of the proposed site was within the Sydney water catchment area and therefore consisted of mostly undisturbed native vegetation, consequently, about 350 species were located including a remnant stand of open forest on ridge top shales of the Wianamatta Group.

Five vegetation types were identified:

- Type 1: Swamp-wet heath;
- Type 2: Scribbly gum woodland;
- Type 3: Peppermint woodland;
- Type 4: Riverine complex; and
- Type 5: Open forest on shale.

In the 1985 EIS, the site was considered of significant value for the conservation of flora of the Sydney region and the State. The following species were listed as being of particular importance:

- *Acacia oxycedrus;*
- *Austromyrtus tenuifolia;*
- *Blechnum ambiguum;*
- *Bossiaea neo-anglica;*
- *Darwinia grandiflora;*
- *Dodonaea falcate;*
- *Epacris coriacea;*
- *Grevillia capitellata;*
- *Hibbertia nitida;*
- *Leucogpogon amplexicaulis;* and
- *Lomandra fluviatilis.*

The five vegetation types and flora species considered to be of significant value are likely to be present in the current Wilton study area (see Section 6.4).

The 1985 EIS found that construction and operation of the future airport would have serious effects, both direct and indirect.

Direct impacts were assessed in 1985 as:

- Destruction of most, if not all, occurrences of the five vegetation types including loss of six rare plant species;
- Loss of riverine complex vegetation, which would be particularly serious, as it is isolated to small occurrences within the region and contains the fern *Blechnum ambiguum*, which is classified as vulnerable or threatened by extinction; and
- Substantial loss of open forest vegetation occurring on shale-capped plateau areas in the middle of the future runway, as this occurrence represents the only known example of this plant community within a radius of 25km of the proposed site.

Indirect impacts were assessed in 1985 as:

- Drainage changes, erosion and siltation;
- Pollution;

- Changes in the fire regime; and
- Increased access to native bushland.

Drainage changes were expected to impact vegetation communities and various species due to changes in water flow as well as erosion and sedimentation.

Unburnt and partially burnt fuel, released by aircraft during takeoff and landing, could damage vegetation immediately beyond the ends of the runways.

If aircraft were required to jettison fuel before landing, this could cause extensive destruction of vegetation within the site and surrounds. The 1985 EIS concluded that, if fuel jettison occurs above 300 m then there is little likelihood of any flammable mist accumulating near the ground. Accidental fires during construction or operation could impact on the vegetation communities. During operation of an airport, it would be necessary to conduct more frequent hazard reduction burning which was assessed to potentially drastically simplify the vegetation communities where the burning is conducted. The risks of accidental fires were recommended to be minimized through strict maintenance regimes and security fencing would be erected around the site and access areas.

It was suggested that increased access to the bushland surrounding a proposed airport may lead to unauthorized public access which may contribute to illegal dumping. Access tracks would also need to be created which could contribute to weed infestation and soil erosion issues.

The 1985 EIS concluded that *"little could be done to reduce the direct impact of airport development on the flora of the proposed site. The destruction of such an integrated and well-preserved example of the regional vegetation would constitute a permanent and very significant loss."* The only mitigation is to minimize the extent of vegetation cleared.

6.3.1.2 Fauna

Habitat types used to assess fauna species and distribution in the 1985 EIS included:

- Open forest on shale;
- Scribbly gum woodland;
- Cleared land; and
- Creek-line woodland.

Areas of each habitat type were sampled and results revealed twelve native mammal, ninety six bird, nine reptilian and eleven amphibian species which was reported in the EIS to be relatively high for so small an area and assumed to be due to the high range of habitats available.

Small ground mammals were not frequently located which was possibly attributed to the low density of ground vegetation. Larger carnivorous animals were represented by introduced cats, dogs and foxes. The diversity of reptiles was relatively low which was attributed to the cool climate at the time of surveying.

Nearly all reptiles, amphibians and mammals found were regarded as common except the koala which, at the time, was listed as fauna of special concern under the *National Parks and Wildlife Act 1974.*

Most bird species were regarded as common however, several bird species were regarded as fauna of special concern (e.g. spotted quail thrush), vulnerable (gang gang cockatoo), rare (turquoise parrot) and threatened (eastern bristlebird).

Of the four habitat types sampled, the open forest on shale supported the highest diversity of bird and mammal species. It was concluded that the whole survey site was of high ecological value, with the southern part (i.e. in the Metropolitan Catchment) as the more important.

The 1985 EIS found that construction of the airport would have impacts on many species and the development might have an adverse effect on threatened species. There would be a risk that several small watercourses would be disrupted due to design of the airport site to prevent contaminated runoff entering the water catchment. This would impact on aquatic species and also terrestrial fauna species which use the waterways as movement corridors.

6.3.1.3 Aquatic ecology

In terms of aquatic ecology, the 1985 EIS found that there were no developed floodplains within the proposed site however creeks such as Allens, Cascade and Wallandoola were subject to flash flooding during storm events due to the high rate of runoff in their catchments.

Water runoff was classified as protected to ensure a high level of water quality protection and no effluents could be discharged unless of similar quality to that of raw water.

Indirect impacts were assessed in 1985 as:

- Drainage changes, erosion and siltation; and
- Pollution.

Drainage changes were expected to impact vegetation communities and various species due to changes in water flow as well as erosion and sedimentation.

Water quality could be negatively impacted due to accidental pollution from fuel and other chemical spillages. It was recommended that storage of chemicals would be in bunded and covered areas and stormwater drainage designed to minimize off site impacts.

A variety of sources of potential water pollutants were listed in Table 15.2.3 of the EIS as:

- Sediment and erosion from construction site earthworks;
- Sewage;
- Kitchen waste;
- Battery acid;
- Engine maintenance chemicals such as oils, lubricants, grease, solvents;
- Paint, paint strippers, aircraft wash water;
- Fire fighting chemicals;
- Aviation fuel;
- Tyre rubber from aircraft touch down; and
- Pesticides and herbicides from ground maintenance.

The 1985 EIS concluded the following impacts relevant to water quality and aquatic habitat:

- The risk of emergency dumping of fuel was considered to be slight;
- Risk of contamination of water supply by exhaust emissions from aircraft and ground vehicles was considered to be slight;
- Loss of 875 ha from the catchment area was estimated to cost $23,600 per annum from loss of water.
- Drainage characteristics of Allens Creek would be changed which would result in a greater potential for flooding; and

- Potential issues associated with reducing the attractiveness of the drainage system to birds which could increase the risk of aircraft bird strikes.

To mitigate these impacts, it was proposed to capture and treat all contaminated stormwater at the site and storage of fuel and chemicals would comply with relevant legislation.

Areas that were deemed to contain "*clean stormwater*" were to be diverted to a number of retention basins which would then be discharged to a retarding basin on Allens Creek resulting in all "*clean*" stormwater being diverted away from the Sydney drinking water catchment.

6.3.1.4 Summary of 1985 EIS

The 1985 EIS considered impacts from the airport footprint. However, impacts from proposed road and rail routes were not assessed. The current study assesses potential impacts from infrastructure alignments (road, rail, power) to a proposed airport site.

The impacts determined in the 1985 EIS remain relevant as indicative of what effects an airport at Wilton may have and of which it may have to take account. .However, given that the EIS for the Wilton site was prepared almost thirty years ago and there have been substantial changes in environmental legislation during this time, including the introduction of the EPBC Act in 1999, a complete desktop revision of the status of the ecological values of the area has been conducted and this is documented in Section 6.4.

6.3.2 Joint Study on Aviation Capacity

The Joint Study on Aviation Capacity in the Sydney Region (Australian and NSW Governments, March 2012) identified potential Airport sites based on a number of criteria including flora and fauna species in the locality (Criterion 21A) and flora and fauna species within the representative site (Criterion 21B). Criterion 21A and 21B were two of ten primary criteria out of thirty criteria used to assess potential sites. A number of threatened flora, fauna and ecological communities were identified at the Wilton site.

The Working Paper builds on the results of flora and fauna criteria contained in the Joint Study to provide further details on the Wilton study area.

6.4 Analysis of issues in terms of current airport concepts

Since the 1985 EIS was conducted development in and around Wilton has consisted of:

- Construction of the Bingara Gorge residential development has recently commenced;
- Further applications for residential development areas are currently being assessed;
- Expansion of underground mining activity is currently occurring. Previous and current mining operations have resulted in subsidence in certain areas adjacent to the proposed site; and
- Part of the southern section of the site identified is now the Upper Nepean State Conservation Area.

Discussion of land use planning and future development is provided in Working Paper *Land use planning context and future development*. As the Wilton Study Area has remained relatively undeveloped, this has implications for the presence of flora and fauna as discussed below.

6.4.1 Methodology

The analysis of terrestrial and aquatic ecological values included a search of databases for threatened flora and fauna and a review of existing studies and assessments conducted in the surrounding area.

Database searches were used to identify any endangered, threatened or vulnerable species that may occur in the Study Area in accordance with the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), *Threatened Species Conservation Act 1995* (TSC Act) and *Fisheries Management Act* 1994 (FM Act). The following Databases were searched:

- Atlas of NSW Wildlife records (OEH);
- Native Vegetation of the Cumberland Plain (NPWS 2002/Tozer 2003) database;
- Native vegetation of the Woronora, O'Hares and Metropolitan Catchments database;
- OEH list of threatened species found within the Sydney Cataract and Upper Nepean catchment subregions; and
- An EPBC Act Protected Matters Search using coordinates -34.314 150.692,-34.234 150.694,-34.235 150.75,-34.315 150.748,-34.314 150.692 (a search area of approximately 15 km x 9 km) and covering the study area (SEWPaC, 2012).

Meetings or telephone discussions were also held with the following stakeholders to source additional data on vegetation communities and the distribution on fauna in the area:

- Sydney Catchment Authority;
- NSW Department of Planning and Infrastructure; and
- Australian Government Department of Sustainability, Environment, Water, Population and Communities.

The NSW Office of Environment and Heritage and NSW National Parks and Wildlife Service were also contacted to obtain databases on flora and fauna surveys conducted in and around the Wilton study area.

A review of environmental studies, assessments and reports within and around the study area was also conducted and these are referenced where relevant.

6.4.2 Landscape

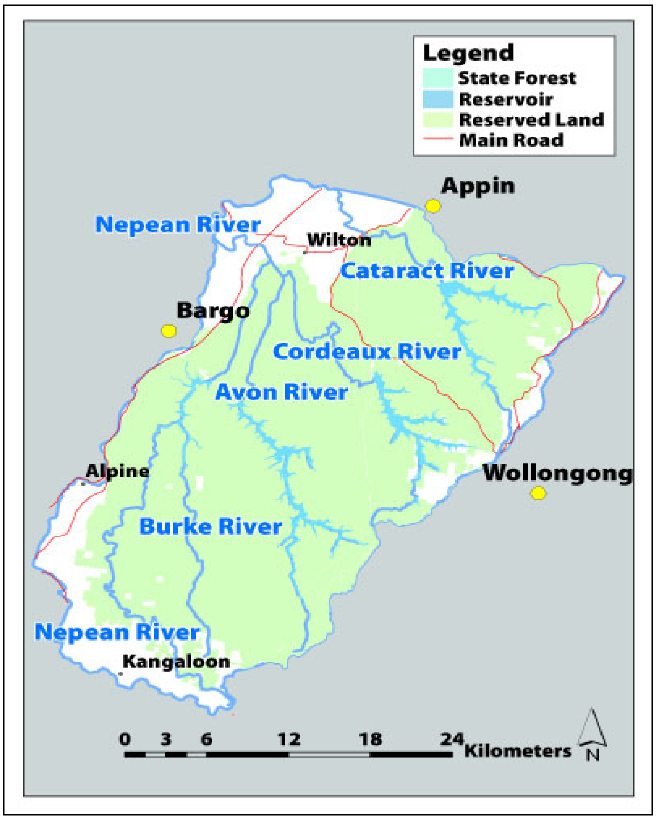
The Wilton study area is located in the Upper Nepean River sub catchment which contains four large water supply reservoirs including Nepean, Avon, Cordeaux and Cataract Lakes, as shown in **Figure 6.1**.

These reservoirs are part of the drinking water supply for metropolitan Sydney. The rivers associated with these dams/lakes (the Nepean, Avon, Cordeaux and Cataract rivers) are the major rivers of this sub catchment. Most of the land within this sub catchment falls within the Special Areas of the Sydney Catchment Authority, thus restricting the land use in the sub catchment.

Over 50% of the sub catchment is native forest, yet there are small areas of agriculture (beef and dairy cattle) and rural-residential development in the headwaters of the Upper Nepean River and the lower reaches of the Upper Nepean and Cataract Rivers, including Wilton.

The location of the study area in the Upper Nepean River sub catchment has implications for the following discussion on terrestrial and aquatic ecology.

Figure 6.1 Location of Wilton in the Upper Nepean River Sub catchment



6.4.3 Terrestrial ecology

The Wilton Study Area is located on the Woronora Plateau, and is predominantly covered by natural bushland, interspersed with wetlands and waterways, which has been protected from agricultural development by the generally infertile nature of the soil. Since the early 1900s, the area has largely been protected from urbanisation or other development by being substantially dedicated as water supply catchments (currently as *'Special Areas'* under the *Sydney Water Catchment Management Act 1998*) for the Illawarra and Sydney Regions.

The Wilton study area is mostly (approximately 85%) within the Metropolitan Special Area which, together with the adjoining Woronora and O'Hares Creek Special Areas are regionally significant for flora and fauna due to the low level of vegetation disturbance. 48 separate vegetation communities were mapped in the three Special Areas by the NPWS and SCA in 2003 using aerial photo interpretation and field surveys. 80% of the 10,244ha study area is native bushland with the remaining, areas mostly comprising freehold agricultural land along the western edge of the Metropolitan Special Area. Extensive terrestrial fauna and flora surveys have been conducted within the Upper Nepean catchment and the broader region, and this data has been used to inform this Working Paper. (NPWS 2003, OEH 2005).

6.4.3.1 Possible occurrences of threatened species

A range of threatened species and ecological communities are known to occur in the study area.

The desktop review identified the likely occurrence of matters of national environmental significance, protected under the EPBC Act. These include four threatened ecological communities, thirty three threatened species, fourteen migratory species and twelve listed marine species as shown in **Tables 6.1** to **6.8**.

The review also determined the likelihood of threatened species, populations and ecological communities listed under Schedules 1 (endangered), 1A (critically endangered) and 2 (vulnerable) of the TSC Act as shown in **Tables 6.1** to **6.5**.

The results of the EPBC database searches are provided in Appendix 6A.

6.4.3.2 Terrestrial flora

The types of vegetation communities and fauna habitat present in any given area are mostly determined by the topographical and geological characteristics of that area. The two major topographic and geological units identified within the Wilton study area include the Dissected Hawkesbury Sandstone Plateau and the Shale-dominated areas. The site is primarily underlain by Hawkesbury Sandstone, interbedded with some shale of the Wianamatta Group. Geology and soils are further discussed in Working Paper *Regional Geology*.

The vegetation communities identified within the study area can be broadly categorised into eight types, as listed below.

- Dry rainforest;
- Tall forest;
- Open woodland;
- Gully forest;
- Riparian;
- Low woodland heath;
- Upland swamp; and
- Cleared agricultural land.

Figure WP-301015-03019-FFE-SK-001 (provided at Appendix 8B) shows the distribution of vegetation communities in the study area and the location of potential airport options.

While all native vegetation in NSW is subject to controls under the NV Act (see Section 2.2.3), this Working Paper focuses on those species/communities protected under the EPBC Act and TSC Act. **Table 6.1** shows threatened flora species that are likely to occur in the Wilton Study Area.

Table 6.1 Threatened flora - possible occurrences within the Wilton Study Area or immediate surrounds

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Caladenia tessellata	Thick-lipped Spider-orchid, Daddy Long-legs	Vulnerable	Endangered
Cryptostylis hunteriana	Leafless Tongue-orchid	Vulnerable	Vulnerable
Cynanchum elegans	White-flowered Wax Plant	Endangered	Endangered
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Vulnerable	Endangered
Melaleuca biconvexa	Biconvex Paperbark	Vulnerable	Vulnerable
Melaleuca deanei	Deane's Melaleuca	Vulnerable	Vulnerable
Pelargonium sp. Striatellum (G.W.Carr 10345)	Omeo Stork's-bill	Endangered	Endangered

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Persoonia bargoensis	Bargo Geebung	Vulnerable	Endangered
Pimelea spicata	Pink Pimelea	Endangered	Endangered
Pomaderris brunnea	Rufous Pomaderris	Vulnerable	Vulnerable
Pterostylis saxicola	Sydney Plains Greenhood	Endangered	Endangered
Pultenaea aristata	Prickly Bush-pea	Vulnerable	Vulnerable
Streblus pendulinus	Siah's Backbone, Sia's Backbone, Isaac Wood	Endangered	-
Thelymitra sp. Kangaloon (D.L.Jones 18108)	Kangaloon Sun-orchid	Critically Endangered	Critically Endangered

6.4.3.3 Endangered ecological communities

The EPBC search revealed the likely presence of four Endangered Ecological Communities in the Wilton Study Area as shown in **Table 6.2**.

Vegetation mapping of the Cumberland Plain (NPWS 2003) and Metropolitan, O'Hares and Woronora Catchments (NPWS 2010) has been conducted by NPWS. The results of this mapping confirm the presence of Cumberland Shale Plains Woodland and Shale/Sandstone Transition Forest as well as the presence of species that comprise the Turpentine-Ironbark Forest and Upland Basalt Eucalypt Forests. The mapping also identified the presence of Upland Swamps which are listed as an Endangered Ecological Community under the TSC Act. **Table 6.2** summarises Endangered Ecological Communities within or around the Wilton study area.

Table 6.2 Endangered ecological communities - possible occurrences within the Wilton Study Area or immediate surrounds

Name	Conservation Status EPBC Act	Conservation Status TSC Act
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically endangered	Critically Endangered (Cumberland Plain Woodland), Endangered (Shale-Gravel Transition Forest)
Shale/Sandstone Transition Forest	Endangered	Endangered
Turpentine-Ironbark Forest in the Sydney Basin Bioregion	Critically endangered	Endangered
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Endangered Robertson Basalt Tall Open Forest in the Sydney Basin Bioregion and Mt Gibraltar Forest in the Sydney Basin Bioregion
Coastal Upland Swamp in the Sydney Basin bioregion	-	Endangered

CUMBERLAND PLAIN SHALE WOODLANDS AND SHALE-GRAVEL TRANSITION FOREST

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest was formerly extensive across the Cumberland Plain, but now occurs as mostly small patches. The federal environment minister listed the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest as a critically endangered ecological community in December 2009. The advice by the Threatened Species Scientific Committee indicated that this ecological community is critically endangered because it has a very restricted distribution, faces significant ongoing threats, and has undergone a very severe reduction in its integrity. The committee also found that the ecological community had undergone a severe decline in its extent and that it was experiencing a substantial rate of continuing detrimental change.

In New South Wales the national ecological community is listed as two separate threatened ecological communities under the TSC Act*:* Cumberland Plain Woodland in the Sydney Basin Bioregion; and Shale-Gravel Transition Forest in the Sydney Basin Bioregion.

The Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest lies in a coastal valley rain shadow that occupies the driest part of the Cumberland Plain. It typically occurs on flat to undulating or hilly terrain, at elevations up to about 350 m above sea level, and on clay soils (derived from Wianamatta Group shales), with some occurrences on other soils. This ecological community has several vegetation layers in its natural state. The tree canopy is typically dominated by *Eucalyptus moluccana* (grey box), *E. tereticornis* (forest red gum), and/or *E. fibrosa* (red ironbark). Other canopy species may occur in association with the typical dominants and may be locally dominant at some sites, depending on local variation in the landscape. Smaller trees and shrubs grow underneath the tree canopy. The vegetation on the ground is a mix of grasses and herbs.

The preservation of woodland remnants, such as the ecological community, will contribute to native vegetation corridors that will improve quality of life as the area becomes increasingly urbanised. It will also help to maintain valuable connectivity among native vegetation remnants that are essential to retain the fauna that live or migrate through the region. For example, birds and bats, including some threatened species, use the ecological community to move from north to south through western Sydney and beyond, and from east to west across the Great Dividing Range to the coast, as seasons change.

SHALE/SANDSTONE TRANSITION FOREST

The ecological community Shale/Sandstone Transition Forest (SSTF) is listed as endangered under the EPBC Act and the TSC Act. It is restricted to transitional areas between the clay soils derived from the Wianamatta shale and sandy soils derived from Hawkesbury sandstone within the Sydney Basin Bioregion. The SSTF is a naturally restricted ecological community that has declined significantly in extent and, due to its location within the Sydney Basin Bioregion, is subject to ongoing threatening processes (e.g. clearing, weeds, changed fire regimes). These threats effectively reduce the community's regeneration processes.

Characteristic tree species in SSTF are: *Eucalyptus punctata, Eucalyptus resinifera*, one of the stringybarks (*Eucalyptus globoidea*, *Eucalyptus eugenioides*, *Eucalyptus sparsifolia, Eucalyptus agglomerata*). One or more ironbarks (*Eucalyptus fibrosa, Eucalyptus crebra, Eucalyptus paniculata, Eucalyptus beyeriana*) may be locally important.

SSTF has an understorey which may be either grassy or herbaceous or of a shrubby nature. In areas that have not been burnt for an extended period of time the understorey may be dense.

Adjacent communities on shale soils are generally Cumberland Plain Woodland, while adjacent communities on sandstone soils are generally part of the Sydney Sandstone Complex.

Small areas of SSTF are presently included in only three conservation reserves, Blue Mountains National Park, Cattai National Park and Gulguer Nature Reserve.

Turpentine-Ironbark Forest in the Sydney Basin Bioregion

The ecological community known as 'Turpentine-Ironbark Forest in the Sydney Basin Bioregion' is listed as critically Endangered under the *EPBC Act* and endangered under the TSC Act.

The Turpentine-Ironbark Forest ecological community listed under the EPBC Act is narrower in scope than the Sydney Turpentine-Ironbark Forest and Blue Mountains Shale Cap Forest communities listed under the TSC Act. The first includes only remnant patches that meet specific condition criteria, including patch size and canopy cover. The latter two include all remnants of Turpentine-Ironbark Forest and Blue Mountains Shale Cap Forest vegetation irrespective of the size of a remnant patch or its condition.

Several vulnerable fauna species including the Glossy Black-Cockatoo (*Calyptorhynchus lathami)*, the Powerful Owl (*Ninox strenua)* and Grey-headed Flying Fox (*Pteropus poliocephalus*) are recorded as being associated with areas containing Turpentine-Ironbark Forest .

The Powerful Owl and Glossy Black-Cockatoo rely, in part, on the mature trees in Turpentine-Ironbark Forest as they provide nest hollows (New South Wales Scientific Committee 2000a).

Five tree species that occur in the tallest tree layer of Turpentine-Ironbark Forest—*Syncarpia glomulifera* (Turpentine), *Eucalyptus saligna* (Sydney Blue Gum), *Corymbia gummifera* (Red Bloodwood), *Angophora costata* (Sydney Red Gum) and *A. floribunda* (Rough-barked Apple)—provide food resources (nectar and pollen) for the Grey-headed Flying Fox (*Pteropus poliocephalus*). The Grey-headed Flying Fox is also known to utilise canopy trees, lower trees and the tall shrub layer of open forest vegetation for warming and cooling under a range of wind and day temperature conditions.

Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion

The Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion ecological community is listed as endangered under the EPBC Act. Since January 2011, the ecological community incorporates two NSW-listed endangered ecological communities: ‘Robertson Basalt Tall Open Forest in the Sydney Basin Bioregion’ and ‘Mt Gibraltar Forest in the Sydney Basin Bioregion.

The Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion is typically tall open eucalypt forests found on basalt and basalt-like substrates in, or adjacent to, the Sydney Basin Bioregion.

The structure of the ecological community varies from tall open forest to woodland depending on aspect, slope, soil conditions, soil depth, and previous disturbance

Upland Swamps

Coastal Upland Swamp in the Sydney Basin bioregion was recently (March 2012) listed as an Endangered Ecological Community on Part 3 of Schedule 1 of the TSC Act.

The Woronora Plateau contains the largest concentration of upland swamps on the Australian mainland, with many of these identified in the Study Area as shown in **Figures WP-301015-03019-FFE-SK001 and SK002** (provided at Appendix 8C).

Several studies of the swamps of the Woronora Plateau have been conducted by DECC (OEH), Illawarra Coal (through its consultants Biosis and Ecoengineers) and by Macquarie University as part of a collaborative research effort with SCA. Localised studies have also been conducted by the SCA as part of impact assessments in respect of development of the Kangaloon aquifer, and by other mining companies, including Helensburgh Coal. The swamps are identified by their distinct wetland vegetation composition (primarily sedges and heaths) compared with the surrounding dry sclerophyll forest which occurs on the better drained ridge tops and hill slopes. They are mostly hosted on Hawkesbury Sandstone and can be broadly classified as either headwater or valley infill swamps.

Headwater swamps are the significant majority of the upland swamps and are generally situated in areas near catchment divides where plateau incision is weak and topographic grades are shallow. OEH has recognised four large clusters of headwater swamps on the plateau areas, which it considers to have particular significance in providing large contiguous areas of related habitat. Wallandoola Creek in the Cataract catchment is one of the four Upland Swamps of significance.

The other form of swamp is much less commonly developed. These *'valley infill'* swamps form as isolated pockets blanketing the floor of incised second or third stream valleys and therefore tend to be elongate downstream.

The swamps are exceptionally species rich with up to 70 plant species in 15 m^2, in one reported instance (Keith and Myerscough 1993) and were considered by the NSW Scientific Committee to be habitats of particular conservation significance for their biota. Many swamps are characterised by ti-tree thicket, cyperoid heath, sedgeland, restioid heath and *Banksia* thicket with the primary floristic variation being related to soil moisture and fertility (Keith and Myerscough 1993).

The swamps provide habitat for a range of fauna including birds, reptiles and frogs. Reliance of fauna on the swamps also increases during low rainfall periods. The importance of swamps as significant water stores is evident from **Figures 6.2 and 6.3** which illustrates their regional extent. Contained surface water and groundwater storage from the larger swamps contributes to base flow in respective catchments but contributions from some of the smaller swamps may be limited and seasonally variable. Direct connectivity between swamps and underlying groundwater systems appears to depend on location.

The SCA and OEH have mapped the locations of upland swamp communities in the study area based on extensive flora and fauna surveys.

6.4.4 Terrestrial fauna

Fauna Surveys of the Metropolitan Special Area have previously been conducted as part of a joint project between the Sydney Catchment Authority and the NSW Department of Environment and Climate Change (now Office of Environment and Heritage) under the Special Areas Strategic Plan of Management (SASPoM). Survey locations included the Wilton study area (Complete terrestrial vertebrate fauna list (including the number of records) for the Woronora Plateau Special Areas) which confirmed the results of the EPBC search shown in **Tables 6.3** to **6.8**.

Table 6.3 Threatened mammals - possible occurrences within the Wilton Study Area or immediate surrounds

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Cercartetus nanus	Eastern Pygmy-possum	-	Vulnerable
Chalinolobus dwyeri	Large-eared Pied Bat, Large Pied Bat	Vulnerable	Vulnerable
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Vulnerable (Spotted-tail Quoll)
Falsistrellus tasmaniensis	Eastern False Pipistrelle	-	Vulnerable
Isoodon obesulus obesulus	Southern Brown Bandicoot (Eastern)	Endangered	Endangered
Macropus parma	Parma Wallaby	-	Vulnerable

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	-	Vulnerable
Mormopterus norfolkensis	Eastern Freetail-bat	-	Vulnerable
Petaurus australis	Yellow-bellied Glider	-	Vulnerable
Petaurus norfolcensis	Squirrel Glider	-	Vulnerable
Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable	Endangered
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala	Vulnerable	Vulnerable
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	Vulnerable	Endangered
Pseudomys novaehollandiae	New Holland Mouse	Vulnerable	-
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable
Scoteanax rueppellii	Greater Broad-nosed Bat	-	Vulnerable

Table 6.4 Threatened reptiles - possible occurrences within the Wilton Study Area or immediate surrounds

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Hoplocephalus bungaroides	Broad-headed Snake	Vulnerable	Endangered
Varanus rosenbergi	Rosenberg's Goanna	-	Vulnerable

Table 6.5 Threatened Birds Possible Occurrences within the Wilton Study Area or Immediate Surrounds

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Anthochaera phrygia	Regent Honeyeater	Endangered	Critically Endangered
Botaurus poiciloptilus	Australasian Bittern	Endangered	Endangered
Burhinus grallarius	Bush Stone-curlew	-	Endangered
Callocephalon fimbriatum	Gang-gang Cockatoo	-	Vulnerable
Calyptorhynchus lathami	Glossy Black Cockatoo	-	Vulnerable
Chthonicola sagittata	Speckled Warbler	-	Vulnerable
Climacteris picumnus	Brown Treecreeper	-	Vulnerable

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
victoriae			
Dasyornis brachypterus	Eastern Bristlebird	Endangered	Endangered
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	Critically Endangered
Ixobrychus flavicollis	Black Bittern	-	Vulnerable
Lathamus discolor	Swift Parrot	Endangered	Endangered
Lophoictinia isura	Square-tailed Kite	-	Vulnerable
Melanodryas cucullata cucullata	Hooded Robin	-	Vulnerable
Melithreptus gularis gularis	Black-chinned Honeyeater	-	Vulnerable
Neophema pulchella	Turquoise Parrot	-	Vulnerable
Ninox strenua	Powerful Owl	-	Vulnerable
Pachycephala olivacea	Olive Whistler	-	Vulnerable
Pezoporus wallicus wallicus	Ground Parrot	-	Vulnerable
Ptilinopus superbus	Superb Fruit-Dove	-	Vulnerable
Rostratula australis	Australian Painted Snipe	Vulnerable	Endangered
Stagonopleura guttata	Diamond Firetail	-	Vulnerable
Stictonetta naevosa	Freckled Duck	-	Vulnerable
Tyto novaehollandiae	Masked Owl	-	Vulnerable
Tyto tenebricosa	Sooty Owl	-	Vulnerable

Table 6.6 Threatened migratory marine birds - possible occurrences within the Wilton Study Area or immediate surrounds

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Apus pacificus	Fork-tailed Swift	Threatened	-
Ardea alba	Great Egret, White Egret	Threatened	-
Ardea ibis	Cattle Egret	Threatened	-

Table 6.7 Threatened migratory terrestrial species - possible occurrences within the Wilton Study Area or immediate surrounds

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Haliaeetus leucogaster	White-bellied Sea-Eagle	Threatened	-
Hirundapus caudacutus	White-throated Needletail	Threatened	-
Merops ornatus	Rainbow Bee-eater	Threatened	-
Monarcha melanopsis	Black-faced Monarch	Threatened	-
Myiagra cyanoleuca	Satin Flycatcher	Threatened	-
Rhipidura rufifrons	Rufous Fantail	Threatened	-
Xanthomyza phrygia	Regent Honeyeater	Endangered	-

Table 6.8 Threatened migratory wetland species - possible occurrences within the Wilton Study Area or immediate surrounds

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Ardea alba	Great Egret, White Egret	Threatened	-
Ardea ibis	Cattle Egret	Threatened	-
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Threatened	-
Rostratula benghalensis (sensu lato)	Painted Snipe	Vulnerable	-

6.4.5 Priority fauna species

The Long-nosed potoroo is the highest priority species on the Woronora Plateau which is the last area it is thought to exist in Greater Sydney. DECC (2007) suggest it probably remains as a few small, isolated populations that remain vulnerable.

Species of moderate regional priority include the Beautiful Firetail, Grey-headed Flying-fox, Southern Emu-wren, Tawny-crowned honeyeater, Rosenberg’s Goanna, Giant Burrowing Frog, Red-crowned Toadlet, Eastern Pygmy-possum and the Sooty Owl which are mostly associated with the Upland Swamps.

Species of high regional priority include the Broad-headed snake, Littlejohn’s tree frog, Spotted Tailed Quoll and Large-footed Myotis.

Mapping of predicted habitats for the Wilton Study area showed the entire site as potential habitat for many species, including the koala. For the purposes of the Working Paper, the koala is discussed below and other fauna are discussed in terms of habitat.

6.4.6 Koala

Koala (*Phascolarctos cinereus*) populations in Queensland, New South Wales and the Australian Capital Territory have recently (2nd May 2012) been listed as vulnerable under the EPBC Act. The Koala is also listed as vulnerable under the TSC Act.

The location of koala colony in the Avon Upper Nepean catchments may possibly be the best protected colony in NSW as koala habitat elsewhere mainly occurs on private land (DECC 2007). It may be the largest population remaining south of Sydney and is therefore a high conservation priority.

SEPP 44 Koala Habitat Protection (see Section 6.2.2.4.1), requires that the location of koala habitat is determined by Local Governments for each Local Government Area. The Wollondilly Local Environment Plan does not provide information on koala habitat locations however there have been several surveys which have identified koalas in the Wilton study area.

6.4.7 Priority fauna habitat

A fauna habitat is a broad environment utilised by a suite of fauna with similar habitat requirements. Priority fauna habitats are fauna habitats that have exceptional importance for the conservation of vertebrate fauna, particularly threatened species. Protection and enhancement of priority fauna habitats will generate the maximum benefit to threatened species conservation and to vertebrate diversity in the region.

Two habitats were assessed to have outstanding value for the conservation of fauna in the Greater Southern Sydney Region: Grassy Box Woodlands and Upland Swamps (Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region - Background Report). The location of the two priority fauna habitats and the potential airport option locations are shown **Figure WP-301015-03019-FFE-SK002** (provided at Appendix 8B).

6.4.7.1 Grassy Box Woodland

Grassy Box Woodland is the highest priority fauna habitat within the Greater Southern Sydney Region. It is key habitat for at least 16 of the 45 highest ranked priority fauna species, plus a number of other species that have already become locally extinct. Importantly, Grassy Box Woodlands are extremely important for several species that are endangered under the EPBC Act: the Regent Honeyeater and Swift Parrot.

The following vegetation species comprise Grassy Box Woodlands. (Key Habitat Mapped Vegetation Community DECC combined veg map for the Greater Southern Sydney Region).

- Grassy Box Woodlands Blue Mountains Shale Cap Forest;
- Coastal Grassy Red Gum Forest;
- Cooks River Castlereagh Ironbark Forest;
- Cumberland Plain Alluvial Woodland;
- Cumberland Plain Shale Hills Woodland;
- Cumberland Plain Shale Plains Woodland;
- Cumberland Plain Shale Sandstone Transition Forest (Low Sandstone Influence);
- Devonian Red Gum-Grey Box Woodland;
- Devonian Red Gum-Ironbark Woodland;
- Devonian Red Gum-Yellow Box Woodland;
- Douglas Scarp Woodland;

- Lowland Melaleuca-Woollybutt forest;
- Moist Shale Woodland;
- Permian Footslopes Grassy Red Gum-Box Forest;
- Regenerating Vegetation;
- Shale/Gravel Transition Forest;
- Tablelands Snow Gum Woodland;
- Transitional Shale Dry Ironbark Forest; and
- Turpentine-Ironbark Forest.

Grassy Box Woodlands are particularly important for conserving declining woodland birds that are found in the region; including the Diamond Firetail, Brown Treecreeper, Hooded Robin, Restless Flycatcher and Speckled Warbler. This habitat type was once extensive in the Region, occurring on higher-fertility soils of the Cumberland Plain, Illawarra Coastal Plain and in the rain-shadow valleys of the Southern Blue Mountains such as in the Burragorang, Nattai and Wollondilly Valleys.

6.4.7.2 Upland Swamps

Upland swamps have been discussed in Section 6.4.3.3 Upland Swamps have been identified as a priority fauna habitat as they contain a diverse and unique array of fauna, many of which are of conservation concern. These swamps are key habitat for at least 12 of the most-threatened fauna species; including the Beautiful Firetail, Eastern Bristlebird and Giant Burrowing Frog.

Upland Swamps are fragile environments that are very sensitive to disturbance, particularly changes in hydrology and overly frequent fire.

6.4.8 Fauna corridors

Fauna pathways and corridors are generally defined as a link of habitat between two or more larger areas of wildlife habitat. These types of corridor are thought to be critical for the ecological health of remnant wildlife habitat (DECC 2007b) with isolated patches of vegetation retaining a greater proportion of their original faunal diversity if they have corridors linking them. When fauna species are able to use corridors to move into and out of a patch, the risk of inbreeding and local extinction is decreased. It has been proven that many species will use corridors, though the extent to which they are used by rare species continues to be debated.

Fauna corridors have been defined as regional pathways, linkages or corridors (DECC 2007b):

- Regional Pathways - Provide for fauna movements at a landscape-scale, e.g. between highlands and lowlands. Include vegetated and cleared land;
- Fauna Linkages - Networks of viable habitat for particular fauna species; and
- Biodiversity Corridors - Primary vegetated links between protected areas. Include multiple habitats. Provide connectivity for flora and fauna. Account for land-use impacts on connectivity.

Fauna Linkages have been defined as linkages of fauna habitat that comprise a single fauna habitat and are designed to facilitate the movement of a particular species, or a suite of species about the landscape. Linkages comprise connected or closely spaced remnants, they are not necessarily linear, often highlighting a network of potential routes through a landscape. (DECC 2007a) Three key areas identified for a number of Species of Conservation Concern include:

- Bargo Linkage - the sandstone vegetation that links the sandstone plateaux of the Woronora with that of the southern Blue Mountains;
- Cumberland Koala Linkage - remnants of linked or closely-spaced vegetation around the rim of the Cumberland Plain; and
- Wollondilly Linkage - remnants of closely-spaced Grassy Box Woodland that occur along the Wollondilly River and adjacent escarpment.

A review of the mapping of the three linkages identified above showed that the Cumberland Koala Linkage is associated with the Wilton Study area as shown in **Figure WP-301015-03019-FFE-SK003** (provided at Appendix 8B).

6.4.8.1 Cumberland Koala Linkage

The Cumberland Koala Linkage consists of linked remnant vegetation around the edge of the Cumberland Plain, providing a connection of suitable habitat between the four Koala colonies at Wedderburn, Avon/Nepean, South Nattai and Glenbrook. It is probable that these Koala colonies were once part of the same population, but have been fragmented by development on the Cumberland Plain.

To the south of the Study Area, these colonies may be linked to populations in the Southern Highlands and Wollondilly. The Koala populations at Avon-Nepean and southern Nattai, like that at Wedderburn and in the Lower Blue Mountains, appear to be relatively small and their continued survival will be enhanced by ensuring gene-flow between these colonies. Gene-flow will more likely occur if suitable vegetation connects the colonies, enabling dispersing Koalas to readily migrate from one area to another.

The environments identified in this linkage are unique and provide habitat for a distinctive range of species, many of which are highly threatened and close to local extinction in this area, such as the Squirrel Glider. The Koala was chosen to represent all species that will benefit by the retention of this linkage for several reasons. Firstly, sightings of the Koala have been very well documented throughout this Study Area, giving an accurate picture of the areas used. In addition, habitat modelling has shown that the Koala has a somewhat broader range of habitat preferences than many other species with similar habitat requirements, such as the declining woodland birds. Finally, the Koala is a large-bodied and relatively sparsely populated species. Therefore, a linkage that is suitable for the Koala is likely to benefit the maximum number of other fauna species that have similar habitat requirements but may persist in smaller patches.

The Cumberland Koala Linkage traces the enriched sandstone and shale soils that dominate the rim of the Cumberland Plain. South-western Sydney has been extensively cleared. However, a linkage has been identified of connected, or closely spaced remnants that runs around the rim of the Cumberland Plain from east of Liverpool to south of Bargo and north to Glenbrook in the Lower Blue Mountains. Some of this linkage is in poor condition, having been extensively underscrubbed, thinned or cleared, and some areas have suffered significant weed invasion from African Olive. Nevertheless, Koala will disperse through areas with scattered trees and do not require old-growth trees or hollows. Recent Koala records occur throughout much of this linkage, proving that Koala will disperse through degraded habitat. There is some evidence that both the Wedderburn and Avon-Nepean Koala colonies are expanding *(DECC 2007c)* and this Koala linkage may be particularly important in the future if Koala are to re-establish in areas from which they have been extirpated.

A number of major roads bisect this linkage and these are a significant, impediment to the movement of Koalas. Dispersing Koala continue to be found well away from the colony centres, often traversing the Hume Highway near Pheasants Nest and Picton Road between Wentworth Drive and Cordeaux Road. While anecdotal accounts suggest that Koala regularly successfully cross these roads, there are also many roadkills recorded for the region, particularly on Heathcote Road. It appears that Koala will most often cross roads where high-quality habitat is intersected. This linkage of Koala habitat will be useful in determining the best locations for road underpasses or overpasses to facilitate movement of Koala. Other species will also make use of this linkage.

6.4.9 Aquatic ecology

There are a wide variety of aquatic environments in the Study area, reflecting the diversity of watercourses. These watercourses include the thousands of small, often intermittent springs and gullies which, in turn, flow to more substantial creeks and streams across the upper catchments, and finally combine to form the large upland and lowland rivers.

6.4.9.1 Possible occurrences of threatened species

The OEH considers the location of Upland Swamps to be the most appropriate indicator of the possible presence of threatened swamp dependent species.

Since 1974, fisheries researchers from the Department of Primary Industries (DPI - Fisheries) have conducted some 17 projects at over 300 sites within the Hawkesbury-Nepean Basin, a number of which were within the catchments of the Wilton study area.

Literature and database reviews identified two threatened fish species (**Table 6.9**) are present in the region, and that several other threatened aquatic species, including frogs (**Table 6.10**) may be present.

Table 6.9 Threatened fish - possible occurrences within the Wilton Study Area or immediate surrounds

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status FM Act
Maccullochella macquariensis	Trout Cod	Endangered	Endangered
Macquaria australasica	Macquarie Perch	Endangered	Endangered

Table 6.10 Threatened Frogs Possible Occurrences within the Wilton Study Area or Immediate Surrounds

Scientific Name	Common Name	Conservation Status EPBC Act	Conservation Status TSC Act
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Vulnerable
Litoria aurea	Green and Golden Bell Frog	Vulnerable	Endangered
Litoria littlejohni	Littlejohn's Tree Frog, Heath Frog	Vulnerable	Vulnerable
Litoria raniformis	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog	Vulnerable	Endangered
Mixophyes balbus	Stuttering Frog	Vulnerable	Endangered
Pseudophryne australis	Red-crowned Toadlet	N/A	Vulnerable

6.4.9.2 Platypus

Monitoring of Platypus in the Metropolitan Special Area has found Platypus to occur in low numbers and surveys of the Cumberland Plain have detected this species in the Upper Nepean River near Douglas Park (DECC 2007). The Platypus is not currently listed as threatened under the EPBC Act or the FM Act.

6.4.9.3 Riparian vegetation

Riparian vegetation comprises plant habitats and communities along watercourses and banks and are characterized by hydrophilic plants. Riparian vegetation is important in protecting water quality and providing fauna corridors along watercourses.

6.5 Potential environmental impacts and proposed mitigation

There are a range of activities for an airport and associated ancillary development that could impact flora and fauna in and around the site. Impacts and mitigation due to construction activities are shown in **Table 6.11** and operational activities are shown in **Table 6.12**. As **Table 6.11** shows, residual impacts due to vegetation clearing would remain and this is discussed for each option in Section 6.5.1 below.

A detailed assessment of impacts due to construction and operation would be conducted during an EIS (see Working Paper: *Planning and Approvals* and Section 6.5.1 below). Mitigation measures would be documented in a Construction Environmental Management Plan and an Operational Environmental Management Plan which would be required to address conditions of approval, mitigation measures documented in the EIS and relevant legislation such as, to the extent that it may apply, the Airports Act and the NSW POEO Act.

Table 6.11 Construction activities that may cause impacts

Construction Activities	Potential Ecological Impacts	Mitigation and Residual Impacts
Clearing and Grubbing	Loss of native and threatened vegetation. Significant impacts likely. See Section 5.1.	Avoidance/minimising clearing of EEC, and native vegetation as much as possible using vegetation surveys to guide options for location of airport footprint. Riparian vegetation should be retained as far as possible. Where vegetation communities / habitat cannot be avoided biobanking and offsets can be used as compensation however significant impacts will remain likely. See Section 5.1.
	Loss of fauna habitat and threatened fauna. Significant impacts likely. See Section 5.1.	Avoidance/minimising clearing of EEC and native vegetation that supports threatened fauna (Fauna Linkages, Priority Fauna Habitat) as much as possible using fauna surveys to guide options for location of airport footprint. Where vegetation communities / habitat cannot be avoided biobanking and offsets can be used as compensation however significant impacts will remain likely. See Section 5.1.
	Loss of aquatic habitat – Significant impacts likely - see Section 5.2	Waterways should be avoided as much as possible however it is likely the airport footprint will need to be constructed across some watercourses. The optimum solution (after avoidance) would be to maintain the watercourses by piping them if necessary (under roads or runways) to ensure fish and other aquatic species have a passage through. Aquatic ecology surveys would be required to guide decision-making as to the most suitable mitigation and to minimise impacts to threatened species. Significant impacts will remain likely. See Section 5.2.
	Dust - Air quality impacts would be greatest at locations where dust-	Impacts would be temporary in nature and anticipated to be manageable through the application of standard mitigation

Construction Activities	Potential Ecological Impacts	Mitigation and Residual Impacts
	generating activities are proposed to be undertaken in proximity to fauna habitat. This would primarily occur during excavation and earthworks.	measures.
Operation of construction plant and equipment	Exhaust emissions during construction would be associated with the combustion of fuel in both diesel and petroleum-powered vehicles. Air quality impacts associated with exhaust emissions are likely to be minor.	While the operation of petrol/diesel powered machinery could temporarily reduce local air quality at some sensitive receivers it is not likely to impact flora or fauna as long as standard mitigation measures are implemented.
	Noise emissions to surrounding fauna could cause fauna to attempt to relocate and disruptions to breeding.	Construction noise guidelines are set out in the OEH *Interim Construction Noise Guidelines* (ICNG). Impacts to fauna would depend on species present. Together with standard noise mitigation measures, a fauna survey should be used to guide the timing of high-noise construction activities to avoid breeding times and other fauna sensitive times.
Storage of hazardous substances, concrete batching plant and other construction materials	Potential pollution to land could impact flora and fauna however can be managed with standard mitigation measures.	Storage in a bunded area that complies with the POEO Act and relevant Australian Standards as well as management of activities should not result in residual impacts.
Lighting	Construction may require lighting which may negatively impact on nocturnal fauna.	Lighting should be minimised or sited so it does not impact on vegetation and habitat.
Waste and litter, Vehicles accessing site with weeds on wheels	Construction activity in proximity to EEC and native vegetation may lead to spread of weeds and may attract feral animals.	Waste management and weed mitigation measures should not result in residual impacts.

Once construction is completed, most potential operational impacts to flora and fauna would be off-site as shown in **Table 6.12**.

Table 6.12 Activities that may cause operational impacts

Operational Activities	Potential Ecological Impacts	Mitigation and Residual Impacts
Storage of hazardous substances and dangerous goods such as aviation fuel, aircraft maintenance materials	Potential pollution to land could impact flora and fauna however can be managed with standard mitigation measures.	Storage in a bunded area that complies with the POEO Act and relevant Australian Standards as well as management of activities should not result in residual impacts.
Aircraft operations and airport ground transport vehicles Maintenance and aircraft washing facilities	Air Emissions, particularly from aircraft have the potential to impact terrestrial and aquatic flora and fauna.	Compliance with the *Airports Act 1996* (to the extent that it applies) and Protection of the Environment Operations Act 1997 and NEPM. Provide fauna over and underpasses. Ensure fish and other aquatic species passage. See *Working Paper : Effects on Airshed and Air Quality*
Aircraft operations and airport ground transport vehicles	Noise is likely to impact fauna around the airport site depending on locations of runways. Location of a koala colony at Avon Upper Nepean which is outside the study area but could still be impacted due to noise depending on which option is selected.	Mitigation measures such as noise walls will reduce noise impacts from ground transport vehicles however fauna in proximity to the airport flight paths are likely to remain impacted by aircraft noise. See *Working Paper Acoustic Footprints.*
Stormwater runoff	Aquatic habitat may potentially be impacted due to stormwater runoff containing pollutants.	Stormwater management measures are documented in Working Paper *Drinking Water Catchments, Hydrology and Drainage* and *Working Paper 24: Water and Wastewater Management*. The objective of stormwater management is to capture and treat all stormwater on site to prevent pollutants being released offsite. Should these measures be implemented, no residual impacts to aquatic habitat is expected.
Lighting	Airport operations will require lighting which may negatively impact on nocturnal fauna.	Lighting should be minimised or sited so it does not impact on vegetation and habitat (within the constraints of Aviation Safety and Standards).
Waste and litter may attract feral animals	Construction activity in proximity to EEC and native vegetation may lead to spread of weeds and may attract feral animals.	Waste management and weed mitigation measures should not result in residual impacts however regular ongoing monitoring would be required.

6.5.1 Land clearing and earthworks

As a greenfield airport site, Wilton will require cut and fill earthworks (see Working Paper *Drinking Water Catchment, Hydrology and Drainage)* to suitably level or grade the land for use as an airport. Prior to cut and fill, clearing of vegetation would be required. Potential impacts to flora and fauna would be due to land clearing associated with the airport footprint, fire buffer zone and infrastructure (power, road, rail) alignments. The amount and type of vegetation to be cleared would depend on the option selected as shown in **Table 6.13** for a potential airport footprint and **Table 6.14** for infrastructure for each option. **Figures 6.2 to 6.4**. show the proposed location of each option and infrastructure alignments and the ecological communities likely to be impacted

Table 6.13 Area and type of vegetation to be cleared for the footprint for each option

Option	Clearing for Site Area[1] and bushfire buffer	Endangered Ecological Community Present	Other Vegetation Communities Present
1	2131 ha	Cumberland Shale Plains Woodland Shale Sandstone Transition Forest Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Regenerating Vegetation – Acacia Scrubs Transitional Shale Dry Ironbark Forest
1S	2293 ha	Cumberland Shale Plains Woodland Shale Sandstone Transition Forest Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Regenerating Vegetation – Acacia Scrubs Transitional Shale Dry Ironbark Forest
2	2263 ha	Shale Sandstone Transition Forest Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Sandstone Gully Peppermint Forest Transitional Shale Dry Ironbark Forest
3	2198 ha	Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Rock Plate Heath-Mallee Sandstone Gully Peppermint Forest Transitional Shale Open Blue Gum Forest Transitional Shale Stringbybark Forest
4	1901 ha	Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Sandstone Gully Peppermint Forest Transitional Shale Stringbybark Forest
5	2395 ha	Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Sandstone Gully Peppermint Forest Transitional Shale Open Blue Gum Forest Transitional Shale Stringbybark Forest

Option	Clearing for Site Area[1] and bushfire buffer	Endangered Ecological Community Present	Other Vegetation Communities Present
6	2201 ha	Shale Sandstone Transition Forest Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Sandstone Gully Peppermint Forest Transitional Shale Dry Ironbark Forest Transitional Shale Stringbybark Forest
7	2012 ha	Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Transitional Shale Dry Ironbark Forest

[1] Clearing for the airport footprint also includes clearing for Obstacle Limitation Surfaces

Table 6.14 Area and type of vegetation to be cleared for infrastructure for each option

Option	Approximate Area for Infrastructure Clearing (ha)				Endangered Ecological Community / Priority Fauna Habitat Present	Other Vegetation Communities Present
	Road	Rail Option A (ha)	Rail Option B (ha)	Power		
1	126	118	107	95	Shale Sandstone Transition Forest Grassy Box Woodland	Exposed Sandstone Scribbly Gum Woodland Tall Open Gully Gum Forest
1S	153	98	103	120	Shale Sandstone Transition Forest Grassy Box Woodland Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Tall Open Gully Gum Forest
2	125	90	117	120	Shale Sandstone Transition Forest Grassy Box Woodland	Exposed Sandstone Scribbly Gum Woodland Tall Open Gully Gum Forest
3	104	114	154	60	Shale Sandstone Transition Forest Grassy Box Woodland	Exposed Sandstone Scribbly Gum Woodland Tall Open Gully Gum Forest
4	97	106	153	60	Grassy Box Woodland	Exposed Sandstone Scribbly Gum Woodland Tall Open Gully Gum Forest
5	59	194	168	60	Upland Swamp	Exposed Sandstone Scribbly Gum Woodland Tall Open Gully Gum Forest
6	142	102	110	120	Grassy Box Woodland	Exposed Sandstone Scribbly Gum Woodland Tall Open Gully Gum Forest

Option	Approximate Area for Infrastructure Clearing (ha)				Endangered Ecological Community / Priority Fauna Habitat Present	Other Vegetation Communities Present
	Road	Rail Option A (ha)	Rail Option B (ha)	Power		
7	128	128	128	128	Grassy Box Woodland	Exposed Sandstone Scribbly Gum Woodland Tall Open Gully Gum Forest

6.5.1.1 Vegetation impacted by clearing

Native vegetation in particular plays a vital role in supporting biodiversity and ecosystems. As discussed in Section 6.2, protection of threatened species legislation that would apply includes the EPBC Act at the Federal level and the TSC Act, the NV Act and the EP&A Act in NSW which operate in conjunction with each other as discussed below.

"Land clearance" is listed as a key threatening process under the EPBC Act. The definition of land clearing under the EPBC Act is that it "consists of the destruction of the above ground biomass of native vegetation and its substantial replacement by non-local species or by human artefacts. Native vegetation is defined as vegetation in which native species constitute more than 70% of the plant cover, or other vegetation containing populations of species listed under the EPBC Act. Substantial replacement by non-local species or human artefacts is defined as *"the achievement of more than 70% of the total cover by species or human artefacts that did not occur previously on the site."* Should the airport proposal at Wilton proceed, land clearing for the airport would fall under this definition.

If a potential impact on an NES matter is identified, a significance assessment is required in accordance with the SEWPaC significant impact guidelines.

Clearing of native vegetation is also listed as a key threatening process in Schedule 3 of the TSC Act. A species impact statement (SIS) would also be required under Sections 109–113 of the TSC Act (terrestrial species) for a proposed activity that:

- Would have a significant effect on critical habitat of flora or fauna; and
- Would have a significant effect on threatened species, populations or ecological communities or their habitats.

A flora and fauna impact assessment which would be required as part of a potential EIS conducted to address Commonwealth and NSW legislation would require the significance of potential impacts to endangered ecological communities and threatened species of national and NSW conservation significance to be assessed.

The purpose of the Species Impact Statements is to guide decision-making where threatened species are concerned. In deciding whether to grant consent, a consent authority must take into account the likely impacts of the development on threatened species and their habitat. In the case of a proposed airport development at Wilton, land clearing may require the following consents:

- EPBC approval by the Federal Environment Minister;
- land clearing in rural areas, is regulated under the NV Act which would require clearing to be authorised under a development consent; and
- Under the EP&A Act, a consent authority (e.g. NSW DP&I) may grant development consent which will adversely affect threatened species.

In deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, the consent authority must take into account the 7-part test set out in the EP&A Act. These factors include whether a viable local population of the species is likely to be placed at risk of extinction, whether habitat will be removed or modified, and whether habitat is likely to become fragmented or isolated from other areas.

Under NSW legislation, there are many native species of flora and fauna which, although not threatened, still have some degree of legal protection. These are protected under NPW Act.

In NSW, if a development is proceeding under the BioBanking Scheme, a SIS is not required.

6.5.1.2 Mitigation and residual impacts

The key measure used to prevent, mitigate and manage potential impacts to all vegetation clearing, particularly, Coastal Upland Swamps, Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest, Shale/Sandstone Transition Forest, Turpentine-Ironbark Forest, Upland Basalt Eucalypt Forest and Cumberland Koala Linkage involves the retention and protection of substantial areas of the community, and particularly those areas with the greatest biodiversity value and ecological viability.

For Endangered Ecological Communities listed under the EPBC Act, condition thresholds have been established for the national ecological community to determine which patches are of highest conservation value and should receive full protection as a matter of national environmental significance under the EPBC Act. The condition thresholds are intended to focus national legal protection on native vegetation patches that are functional, relatively natural and in relatively good condition. Some patches of ecological community are in such a heavily degraded state that they would not meet the condition thresholds.

A flora survey required as part of an EIS would need to determine if the Threatened Ecological Communities meet the Condition thresholds.

6.5.1.2.1 Fauna relocation and corridors

Prior to any clearing being conducted, standard mitigation in NSW includes the presence of a fauna specialist to relocate fauna to a safe area. The fauna specialist would also be present during tree removal to inspect trees for the presence of fauna not removed prior to clearing and remove and relocate them to a safe area. A mitigation measure which was successfully used on the Tugun Bypass was to move certain small ponds which were important frog habitat.

Fauna over and underpasses (over or under roads) are also standard practice however their success is variable due to various factors including predation by feral animals such as foxes.

Maintaining fauna linkages and wildlife corridors is important to the continuing viability and survival of fauna species that move around to breed and source food.

6.5.1.2.2 Environmental offsets

The Australian Government defines environmental offsets as '*actions taken outside a development site that compensate for the impacts of that development - including direct, indirect or consequential impacts*'. Environmental offsets provide an opportunity to achieve long-term conservation outcomes whilst providing flexibility for proponents seeking to undertake development which will have environmental impacts.

Environmental offsets provide compensation for those impacts which cannot be adequately reduced through avoidance and mitigation. They should be distinguished from mitigation, which refers to the range of actions that can be undertaken to reduce the level of impacts of a development (typically undertaken on-site).

Actions that can be considered as environmental offsets are generally categorized into direct and indirect offsets.

Direct offsets

Direct offsets are aimed at on-ground maintenance and improvement of habitat or landscape values. They may include:

- Long-term protection of existing habitat – including through the acquisition and inclusion of land in the conservation estate, and covenanting arrangements on private land;
- Restoration or rehabilitation of existing degraded habitat; and
- Re-establishing habitat.

Indirect offsets

Indirect offsets are the range of other actions that improve knowledge, understanding and management leading to improved conservation outcomes. They may include:

- Implementation of recovery plan actions – including surveys;
- Contributions to relevant research or education programs;
- Removal of threatening processes;
- Contributions to appropriate trust funds or banking schemes that can deliver direct offsets;
- Through a consolidation of funds and investment in priority areas;
- On-going management activities such as monitoring, maintenance, preparation; and
- Implementation of management plans and the like.

The Commonwealth Government and NSW Governments implement offsets as discussed below.

6.5.1.2.3 EPBC Offsets

In the context of the EPBC Act, offsets are a mechanism available through environmental impact assessment and approvals processes to compensate for the impacts of developments on those matters of national environmental significance protected by the EPBC Act.

Environmental offsets can be used under the EPBC Act to maintain or enhance the health, diversity and productivity of the environment as it relates to matters protected by the EPBC Act (i.e. matters of national environmental significance and the environment more broadly for actions involving the Commonwealth, as is the case with a proposed airport development).

Environmental offsets can be applied as an approval condition under the EPBC Act for developments that have undergone assessment. They may be used when a development will result in impacts on a matter protected by the EPBC Act.

Environmental offsets are not applicable to all approvals under the EPBC Act. Each approval is assessed on a case-by-case basis and must take into account the scale and intensity of impact from the development on the site and the potential for conservation outcomes through offsets. In some circumstances suitable offsets may not be available to adequately compensate for the impacts of a development and a decision on the overall acceptability of the project will need to be made.

The EPBC Act 1999 Environmental Offsets Policy (SEWPaC October 2012) identifies ten principles for the use of environmental offsets under the EPBC Act. These ten principles will be used to assess any proposed environmental offsets to ensure consistency, transparency and equity under the EPBC Act.[8]

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[8] At the time of writing a new policy was expected to be published by DSEWPaC

6.5.1.2.4 BioBanking Statements

The NSW Government introduced the Biodiversity Banking and Offsets Scheme (or 'BioBanking') in 2008 to help address the loss of biodiversity values, including threatened species.

The framework for the scheme was established under Part 7A of the TSC Act and is supported by the *Threatened Species Conservation (Biodiversity Banking) Regulation 2008*, BioBanking Assessment Methodology (the methodology) and Compliance Assurance Strategy.

Under the Scheme, an owner of land containing threatened species or habitat for threatened species may have their land approved as a biobank site and can enter into a biobanking agreement with the Environment Minister for which biodiversity credits are issued in return for the landowner agreeing to protect threatened vegetation and threatened species.

A proponent can apply to the Director-General for a biobanking statement which will state how many biodiversity credits, and what type, the developer must buy (and retire) in order to offset the impacts of their development on threatened species. A biobanking statement can be obtained for any development that requires development consent under Part 4 of the EPA Act, and for any Part 5 activity.

Participation in the Scheme is voluntary. A proponent can choose to obtain a biobanking statement in order to avoid the need to carry out a species impact statement. The conditions of a biobanking statement must be incorporated into the conditions of the development consent. A biobanking statement expires after two years unless it is acted upon.

A review of BioBanking and the BioBanking Assessment Methodology are currently being conducted under the TSC Act.

6.5.1.2.5 EPBC Act Conservation Agreements

A conservation agreement is an agreement between the Australian Government Environment Minister and another relevant party for the protection and conservation of biodiversity in an area of land or sea.

A conservation agreement can, amongst other things and in addition to those matters listed above, require the owner of a place to:

- Carry out activities that promote the protection and conservation of biodiversity;
- Refrain from, or control, activities that may adversely affect the species, ecological community, or habitat, covered by the agreement;
- Permit access to the place by specified persons;
- Contribute towards the costs incurred under the agreement;
- Spend any money paid to them under the agreement in a specified manner; and
- Forfeit any money paid to them under the agreement if they contravene the agreement.

Conservation agreements are legally binding on the Commonwealth, all other parties to the agreement; and any parties that gain an interest in any part of the area after the agreement is entered into.

6.5.1.3 Administrative measures

Extensive environmental conditions and controls would be imposed as part of the Conditions of Approval from SEWPAC and the NSW Department of Planning and Infrastructure. Impact mitigation would also need to address Conservation Plans such as the Recovery Plans (e.g. Koala Recovery Plan, Recovery Plan for Large Forest Owls) which are relevant to the Wilton Study Area.

6.5.2 Aquatic ecology potential impacts and mitigation

The major potential impact to aquatic habitat would result from construction of the airport over watercourses without allowing for continuity of watercourse passage. The potential removal / loss of watercourses associated with each option is shown in **Table 6.15**.

Table 6.15 Aquatic habitat impacted for each option

Option	Watercourses / Aquatic Habitat Impacted Directly	Watercourses / Aquatic Habitat Impacted Indirectly
1	• Allens Creek • Third Point Creek • Clements Creek • Cascade Creek	• Wallandoola Creek • Cordeaux River
1S	• Allens Creek • Third Point Creek • Clements Creek • Cascade Creek	• Wallandoola Creek • Cordeaux River
2	• Allens Creek • Third Point Creek • Clements Creek • Cascade Creek	• Wallandoola Creek • Cordeaux River • Cataract River
3	• Wallandoola Creek • Lizard Creek	• Cataract River • Lake Cataract
4	• Wallandoola Creek • Lizard Creek	• Cataract River
5	• Wallandoola Creek • Lizard Creek • Cordeaux Creek	• Lake Cataract • Lake Cordeaux
6	• Allens Creek • Third Point Creek • Clements Creek • Cascade Creek • Wallandoola Creek	• Cordeaux River
7	• Allens Creek • Third Point Creek • Clements Creek • Cascade Creek • Wallandoola Creek	• Cordeaux River

Note: a number of unnamed tributaries may also be impacted by each Option.

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is a key threatening process under the TSC Act.

Part 7 of the FM Act requires a permit for a number of activities, including those activities temporarily or permanently obstructing fish passage.

A species impact statement is required under Sections 221J and 221K of the FM Act (aquatic species) for a proposed activity that:

- Would have a significant effect on critical habitat of flora or fauna; and
- Would have a significant effect on threatened species, populations or ecological communities or their habitats.

Thus, a development application which is likely to significantly affect a threatened species of fish will require a species impact statement to accompany the development application. Instead of requiring the concurrence of the Environment Minister, the concurrence of the Minister for Primary Industries will be required.

Another primary impact during construction is sedimentation, as a result of land disturbance, has the potential to impact aquatic habitat. Increased sedimentation of waterways can smother benthic habitats and organisms, and can increase levels of nutrients, metals, salt and other potential toxicants that attach to the sediment particles. Substantial erosion and sediment control measures would be required to prevent this.

6.6 Key findings

Land clearing for earthworks associated with the airport footprint is likely to have a significant residual impact on flora and fauna, particularly threatened species, populations and ecological communities. This criterion has therefore been used to attempt to differentiate between options as shown in **Table 6.16** for an airport footprint and **Table 6.17** for associated infrastructure.

Table 6.16 Summary of potential ecological impacts for each option (airport footprint)

Ecological Impact Criteria	Options							
	1	**1S**	**2**	**3**	**4**	**5**	**6**	**7**
Previously cleared land	Yes (approx. 10%)	Yes (approx. 10%)	Yes (approx. 15%)	No[1]	No[1]	No[1]	Yes (approx. 15%)	Yes (approx. 15%)
Clearing of Endangered Ecological Community	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clearing of Protected Fauna Habitat	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clearing of Koala habitat	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cumberland Koala Linkage Impacted	Yes	Yes	Yes	No[2]	No[2]	No[2]	Yes	Yes

Ecological Impact Criteria	Options							
	1	1S	2	3	4	5	6	7
Location within Metropolitan Special Area	1,348ha (70%)	1,496 ha (72%)	1,510ha (72%)	100%	100%	100%	1,346ha (67%)	1,111ha (61%)
Aquatic Habitat Impacted	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

[1]Except for access roads

[2]Not impacted directly by airport footprint but may be impacted by noise

Table 6.17 Summary of potential ecological impacts for infrastructure

Ecological Impact Criteria	Infrastructure		
	Road	Rail	Power
Clearing of Endangered Ecological Community	Yes	Yes	Yes
Clearing of Protected Fauna Habitat	Yes	Yes	Yes
Clearing of Koala habitat	Yes	Yes	Yes
Cumberland Koala Linkage Impacted	Yes	Yes	Yes

6.7 References

DECC (2007a) *Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region. Volume One: Background Report.*

DECC (2007b) *Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region. Volume Two: Fauna of Conservation Concern.*

DECC (2007c) *Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region. Volume Four: The Fauna of the Metropolitan, O'Hares Creek and Woronora Special Areas.*

DECCW (2009) The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area. Department of Environment, Climate Change and Water NSW, Hurstville.

Kinhill Stearns (1985) Sydney Second Airport Site Selection Programme Draft Environmental Impact Statement. Department of Aviation.

Department of Planning (2008) 'Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield – Strategic Review.' New South Wales Government. ISBN 978 0 7347 5901 6.

Keith DA, Myerscough PJ (1993) Floristics and soil relations of upland swamp vegetation near Sydney. *Australian Journal of Ecology* 18, 325-344.

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7 WORKING PAPER - EFFECTS ON AIRSHED AND AIR QUALITY

SUMMARY

The purpose of this working paper is to provide an overview of air quality issues in the Sydney basin and in the Wilton locality, and to quantify the impact of the air emissions on local and regional air quality.

A desktop assessment of the air emissions impact is presented. The background air quality data was sourced from publicly available documents developed by the NSW Department of Environment and Climate Change. The assessment was based on assumptions of maximum annual passenger movements and vehicle movements in and out of the Wilton airport development. Air emissions from vehicle travel and aircraft movements were calculated using emission factors from the National Pollutant Inventory.

The key points from this working paper are:

- In terms of current air quality, significant improvements have been made as the primary pollutants lead, carbon monoxide, sulphur dioxide and nitrogen dioxide levels have dropped by as much as 30% in the last ten years;
- Ozone and particulate pollution remains a problem with exceedences of national standards occurring between 2 and 20 days per annum. This is significant in terms of the health impacts of ozone and fine particulates on nearby residents and those in the Sydney Basin. Bringelly, Bargo and Oakdale are some of the worst affected areas in terms of high ozone levels;
- The analysis showed that primary air emissions from aircraft movements and airport infrastructure were not significant in terms of overall pollutant levels in the Sydney region. The largest impact results from the estimated 70 million vehicle movements per annum, spread throughout the Wilton locality and the wider Sydney metropolitan region;
- It is expected that ozone and particulate levels will increase as a result of the airport development, but the magnitude cannot be assessed as detailed dispersion modelling, meteorological data and assessment of air drainage flows in the vicinity of the airport site are required;
- Key mitigation measures include development of sustainable transport modes to reduce vehicle use – public transport (trains and buses); reduce aircraft taxiing times; and eliminate use of diesel/petrol ground-based support infrastructure; and
- In terms of each of the eight runway options, this high level assessment is not sufficiently detailed to differentiate the impact each option could have on local and regional air quality. It is expected that each option will produce approximately the same impact because vehicle and aircraft movements are not expected to change significantly.

7.1 Introduction

7.1.1 Statement of issue

This Working Paper addresses the issue of air quality effects[9] and impacts in relation to the operations of an airport to be sited in Wilton. The issue can be split into local air quality impacts in close proximity to the airport (known as the Wilton Study Area[10]), and impacts on the Greater Sydney metropolitan area. The approach taken is to consider the present levels of air pollution in Sydney and the percentage increase in air emissions from the operations of the proposed airport at Wilton. This assessment precludes a detailed analysis of local and regional air movements, the formation of photochemical smog (ozone and fine particulates), and the impacts on nearby sensitive receptors and on the Greater Sydney metropolitan area.

7.2 Description of issue

Aircraft and motor vehicles consume hydrocarbon fuels for energy and in doing so generate air pollutants. The primary air pollutants covered by federal legislation include:

- Hydrocarbon emissions - these arise from two sources: anthropogenic emissions from e.g. fugitive releases of fuel vapour; and biogenic emissions from e.g. oil vapours released by vegetation. Both of these come under the general category of volatile organic compounds or VOC;
- Nitrogen oxides (also referred to as NOx);
- Sulphur dioxide;
- Carbon monoxide; and
- Particulate emissions as PM.

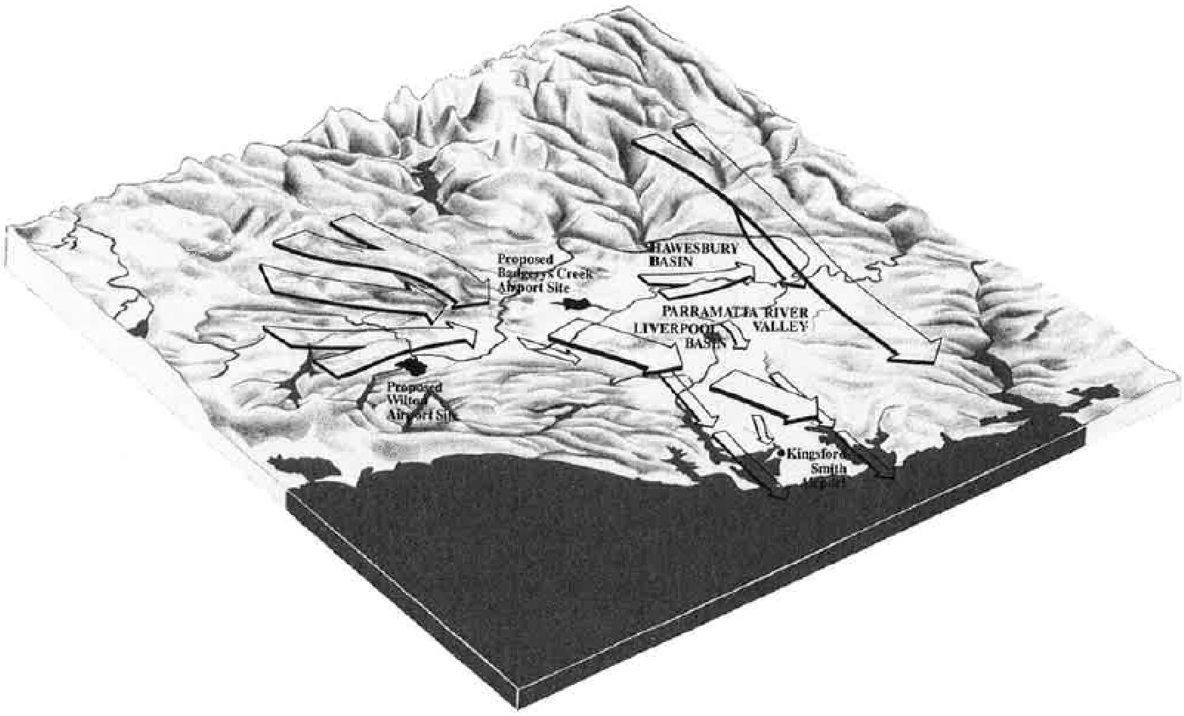
Ozone is also a criteria pollutant, however it is a secondary pollutant formed by the interaction of sunlight with air parcels containing mixtures of nitrogen dioxide and volatile organic compounds. Ultrafine particulates also form from these interactions, such as $PM_{2.5}$ (particulate matter less than 2.5 microns in diameter) although these are not classed as a criteria pollutant in current federal or state legislation. Ozone and $PM_{2.5}$ is also collectively known as *photochemical smog*.

The meteorological factors affecting air quality are:

- Climatic influences – rainfall, solar radiation, summer and winter diurnal and nocturnal temperatures, wind speed;
- Temperature inversions; and
- Topographic influences on air movements – for the proposed airport at Wilton the south-west regional drainage flow and its frequency is salient. This flow has the potential to transport pollutants from the proposed site into the Sydney Basin. The diagram below indicates the drainage flows into Sydney Basin.

[9] CO2 emissions were not considered is because it is not an airshed pollutant under Schedule 1 of the National Environment Protection (Ambient Air Quality) Measure; Greenhouse gases (GHGs) such as CO2 are covered under the National Greenhouse and Energy Reporting Act (2007) and the Clean Energy Act (2011).
[10] Defined as the area contained within the following external boundaries: (1) Upper Nepean State Conservation Area (West), (2) the townships of Wilton, Douglas Park and Appin (North) and (3) the Cordeaux River and Cataract River dam areas (East– Cataract and South – Cordeaux)

Figure 7.1. Topography and air drainage flow in the Sydney Region[11,12]



According to the Action for Air report[13], there have been significant improvements in air quality in NSW since the 1980s with initiatives to reduce air pollution implemented across industry, business, homes and motor vehicles (e.g. unleaded petrol post 1985). Concentrations of many of the most dangerous air pollutants have been reduced by nearly 30%. Concentrations of carbon monoxide, lead, nitrogen dioxide and sulphur dioxide now consistently meet national air quality standards.

7.3 Legislative status

At the time of the Second Sydney Airport Study in 1985, air quality criteria for urban air pollutants had not been defined. The State Pollution Control Commission at that time developed guidelines based on the National Health and Medical Research Council and the World Health Origination.

Subsequently, State and Federal laws have been enacted with associated regulations to limit the emission of air pollutants.

The most applicable Federal and State legislation are listed below. This legislation applies to the regulation of emissions of pollutants to the air from the operations of the second airport despite the fact that the airport is yet to be constructed.

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[11]. Hyde, R., Heggie, A.E., Malfroy, H.R. and Hawke, G.S. *The Western Basin Experiment*. School of Earth Sciences, Macquarie University, Sydney. 1980.

[12]. Department of Aviation, *Second Sydney Airport, Site Selection Programme, Draft EIS*, Kinhill Stearns, April 1985.

[13]. Department of Environment, Climate Change, and Water, NSW. *Action for Air*, 2009 Update. November 2009.

7.3.1 Applicable Federal legislation

The Airports Act 1996 [14] *and the Airports (Environment Protection) Regulations 1997*[15] are relevant sources of what legislative controls may be applicable to an airport at Wilton.

Air quality within the boundary of the airport and surrounding areas needs to be in compliance with the air quality goals established in Schedule 1 of this instrument, which lists the acceptable limits for a variety of substances in air emissions. The relevant pollutant limits for *stationary sources* as set out in the Regulations are listed below:

Table 7.1. Accepted Limits of Contamination (Reference 15, Schedule 1)

Substance	Source	Limit
Solid particles	Boiler	0.25 g/m^3
	Incinerator (consumes < 300 kg/h of material)	0.5 g/m^3
	Incinerator (consumes ≥ 300 kg/h of material)	0.25 g/m^3
	Other sources	0.25 g/m^3
Sulphuric acid mist	Any source	0.1 g/m^3
Acid gases	Any process including aircraft maintenance	0.4 g/m^3 as HCl
Nitrogen oxides	Gas turbines (< 10 MW) burning gas	0.09 g/m^3
	Gas turbines (> 10 MW) burning gas	0.07 g/m^3
	Gas turbines (< 10 MW) burning fuel other than gas	0.09 g/m^3
	Gas turbines (> 10 MW) burning fuel other than gas	0.15 g/m^3
Vapour from volatile organic liquids – from liquids stored in tanks	Incinerated vapour	1.5 g/m^3 of unburnt vapour
	Recovered vapour	110 mg of vapour per litre of liquid passing into tank over 4 hours
Vapour from volatile organic liquids – transfer into a delivery tank of 12 KL or more in capacity, exceeding 30 ML per year	Incinerated vapour	1.5 g/m^3 of unburnt vapour

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14. Australian Government, *Airports Act 1996*, (27 December 2011 Compilation). http://www.comlaw.gov.au/Details/C2012C00080/Html/Text#_Toc313882706

15. Australian Government, *Airports (Environment Protection) Regulations 1997*, (28 May 2004 Compilation). http://www.comlaw.gov.au/Series/F1997B02530

Substance	Source	Limit
	Recovered vapour	110 mg of vapour per litre of liquid passing into tank over 4 hours
Fluorine compounds	Any source	0.05 g/m^3 as HF
Chlorine and chlorine compounds	Any source	0.2 g/m^3
Carbon monoxide	Any source except a stationary diesel vehicle or a standby generator	1.0 g/m^3
Lead	Any source	10.0 mg/m^3 either as a pure substance or a compound

Regulation 2.01 states that air pollution has occurred when a pollutant is present in air in a quantity, way, or condition, or under a circumstance, in which harm is likely to be caused to the environment; or unreasonable inconvenience is likely to be caused to a person. In addition, Regulation 4.01 requires operators at the airport (including airport tenants) to take all reasonable and practicable measures to prevent the generation of pollution.

Note that this working paper does not attempt to determine whether the emissions limits are likely to be met or exceeded from the sources listed in **Table 7.1** in relation to the proposed airport development at Wilton.

National Environment Protection (Ambient Air Quality) Measure (gazetted in 1998)[16]

This instrument formulates national standards or goals for ambient air quality for six criteria pollutants. This NEPM required compliance to the standards by all states and territories by 2008. The relevant ambient air quality goals, as set out in the NEPM, are shown in **Table 7.2**.

Table 7.2. Standards and goal for pollutants other than particles as $PM_{2.5}$ (Reference 16, Schedule 2)

Substance	Averaging Period	Maximum Concentration (ppm) Unless Otherwise Stated	Maximum Allowable Exceedences
Lead	1 year	0.50 µg/m^3	none
Photochemical oxidants (as ozone)	1 hour	0.10	1 day per annum
	4 hours	0.08	1 day per annum
Sulphur dioxide	1 hour	0.20	1 day per annum
	1 day	0.08	1 day per annum
	1 year	0.02	none
Particles as PM_{10}	1 day	50 µg/m^3	5 days per annum
Nitrogen oxides	1 hour	0.12	1 day per annum

16. Australian Government, *National Environment Protection (Ambient Air Quality) Measure*, 1994 (1998 update), http://www.comlaw.gov.au/Details/F2007B01142.

Substance	Averaging Period	Maximum Concentration (ppm) Unless Otherwise Stated	Maximum Allowable Exceedences
	1 year	0.03	none
Carbon monoxide	8 hours	9.0	1 day per annum

Monitoring of the six criteria pollutants is mandatory.

In 2003 the Air NEPM was varied[17] to include advisory reporting standards for particles as $PM_{2.5}$ (these are particles with diameters smaller than 2.5 microns). The advisory reporting standards and goals are:

- 1 day averaging period: 25 µg/m^3; and
- 1 year averaging period: 8 µg/m^3.

National Environment Protection (National Pollutant Inventory) Measure (gazetted in 1998) [18]

This instrument establishes an internet database designed to provide publicly available information on the types and amounts of certain chemicals being emitted to the air, land, and water. All air emissions including air toxics are captured under this NEPM.

National Environment Protection (Diesel Vehicle Emissions) Measure 2009 [19]

Motor vehicles, particularly those with diesel engines, are significantly disproportionate contributors of fine particle pollution and nitrogen oxides. This NEPM has been developed to reduce the impact of emissions from diesel vehicles.

Air Navigation (Aircraft Engine Emissions) Regulations 1997 [20]

These regulations ensure that aircraft within Australia comply with the emission standards contained within the Convention on International Civil Aviation (Volume II, Annex 16). The standards are aimed at reducing ground level emissions and establish limits for relevant parameters including nitrogen oxides, carbon monoxide, hydrocarbons and smoke.

Pollutants included in the *Air Toxics NEPM* [21] are benzene, formaldehyde, toluene and polycyclic aromatic hydrocarbons. These pollutants were briefly assessed in this working paper.

7.3.2 Applicable NSW legislation

Protection of the Environment Operations Act 1997, Part 5.8 [22]*; and the Protection of the Environment Operations (Clean Air) Regulation 2002 – Part 3* [23].

These regulations cover measures for domestic solid fuel heaters, control of burning, motor vehicles and motor vehicle fuels, and emissions from industry. The criteria pollutants for the proposed airport at Wilton would be covered

17. National Environment Protection (Ambient Air Quality) Measure as amended, National Environment Protection Council, Canberra, 2003, www.ephc.gov.au/taxonomy/term/23.
18. Australian Government, *National Environment Protection (National Pollutant Inventory) Measure*, 1994, http://www.comlaw.gov.au/Details/F2007B01123 and http://www.npi.gov.au/npi/nepm-development.html.
19. Australian Government, *National Environment Protection (Diesel Vehicle Emissions) Measure* 2001 (2009 update), http://www.comlaw.gov.au/Details/F2009C00402.
20. Australian Government, *Air Navigation (Aircraft Engine Emissions) Regulations 1997*, http://www.comlaw.gov.au/Details/F2004C00156.
21. Australian Government, *National Environment Protection (Air Toxics) Measure 2004*, http://www.ephc.gov.au/taxonomy/term/35.
22. New South Wales Government, Protection of the Environment Operations Act 1997 No 156, http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
23. New South Wales Government, *Protection of the Environment Operations (Clean Air) Regulation 2002,* http://www.legislation.nsw.gov.au/sessionalview/sessional/sr/2010-428.pdf

by the Airports (Environment Protection) Regulations 1997 and the National Environment Protection (Ambient Air Quality) Measure.

7.4 Methodology

This assessment that utilizes publically available information, which is consistent with the methodology used in the Second Sydney Airport, Site Selection Programme Draft EIS (Reference.2). The methodology is broken down as follows:

- Understand present air quality and future trends for the Sydney Basin;
- Quantify at a high level the air emissions generated by aircraft, airport infrastructure and additional vehicle kilometres travelled by passengers and employees; and
- Quantify the impacts of the criteria air emissions on the Sydney Basin.

The present and future trends in air quality for the greater Sydney, Newcastle and Wollongong regions have been covered in the Air Emissions Inventory for the Greater Metropolitan Region[24]. This report gives the levels for five of the six key criteria pollutants. (Lead levels in NSW were consistently below NEPM goals, hence monitoring was discontinued.) The Action for Air Report report includes the criteria pollutants and covers exceedences of the Ambient Air Quality NEPM goals for the secondary pollutants ozone and $PM_{2.5}$.

To quantify air emissions from the proposed airport at Wilton, National Pollutant Inventory (NPI) air emission factors[25] are used. These factors cover air emissions from aircraft landing and take-off (LTO) activities for a mixture of aircraft types. It was assumed that the number of LTOs was 370,000 per annum.

Given that the number of ground support equipment is unknown, an estimate of air emissions was based on Sydney Airport's likely air emissions from this source in 2014[26]. This data was scaled up based on the ratio of the projected number of passenger movements at Sydney Airport and the maximum number of passenger movements at the proposed airport at Wilton.

The additional vehicle kilometres driven as a result of travelling to Wilton is based on the results of the Traffic and Transport analysis performed in this study. This is the likely to be the most significant source of air emissions, as found in the 1985 Second Sydney Airport, Site Selection Study. This is also based on the maximum number of passenger movements.

The air emissions impacts on the Sydney Basin are then expressed as the percentage increases in each of the five criteria pollutants as a result of the activities associated with the proposed airport at Wilton.

7.4.1 Exclusions

The following issues are excluded from consideration at this stage of assessment.

- The regional scale movement of clean and polluted air masses into and out from the Wilton site, and the impacts caused as a result of the complex meteorological conditions;
- The expected number of ozone and PM10 exceedences in the Sydney Basin due to activities associated with the proposed airport at Wilton;

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24. Department of Environment and Climate Change NSW, *Air Emissions Inventory for the Greater Metropolitan Region in New South Wales, Criteria Pollutant Emissions for all Sectors: Results*, 2007, http://www.environment.nsw.gov.au/resources/air/tr1aei0712.pdf

25. Australian Government, Department of Sustainability, Environment, Water, Population and Communities, Emission estimation technique manuals, http://www.npi.gov.au/publications/emission-estimation-technique/index.html.

26. Sydney Airports, *Sydney Airport Environment Strategy 2010 – 2015*, 25 June 2009. http://www.sydneyairport.com.au/corporate/community-environment-and-planning/environment/~/media/Files/Corporate/Environment%20Plan/Policy%20and%20Strategy/EnviroStratgy102015.pdf

- Impacts of polluted air masses on nearby sensitive receptors such as housing developments at Douglas Park, Wilton and Appin;
- Assessment of the present frequency of temperature inversions (leading to more localized pollution) and the south-west regional drainage flow (leading to transport of air pollution into the Sydney Basin); and
- Cumulative impacts in the context of the airport, coal mining and other local industrial and housing developments have been ignored.

7.5 Summary of issues from SSA Site Selection Programme

There are a number meteorological factors affecting air quality identified in this study.

- Compared with Sydney, Wilton was assessed as having lower rainfall, more sunshine, higher summer temperatures and lower winter temperatures. This makes photochemical smog production more likely in Wilton than in Sydney;
- Temperature inversions at Wilton were not measured, but they were thought to be more frequent, stronger and deeper than at Sydney Airport. This meant that all pollutants emitted near the ground remain close to the ground, leading to high local levels of pollution; and
- The south-west regional drainage flow (see Figure 7.1) is governed by topography, channelled by the Illawarra Escarpment to the east, the Mittagong ridge to the south and Lake Burragorang to the west. The flow occurred at Wilton on 26 nights during a 45 day observation period.

A key issue was the potential for the south-west regional drainage flow to transport air pollutants from the proposed airport at Wilton into various parts of the Sydney Basin. It is not known how frequently this airflow *presently* operates and to what extent it could transport air pollutants into the Sydney Basin. This question can only be resolved with monitoring of ambient meteorological conditions and accurate pollution dispersion modelling.

Other important issues identified were:

- Motor vehicles were by far the major source of air pollution in the Sydney Basin in 1985 and this is also currently the case.24 Motor vehicles will also likely to be the major source of air emissions in relation to travel to and from Wilton and this will impact the air quality in the wider Sydney Basin;
- Given the changes in the number of aircraft movements, vehicle pollution control technologies and the increase in the number of vehicles in Sydney, it is not clear what the precise impact of the airport will be on local and regional air quality without detailed analysis. However, the following changes suggest that the 1985 study now underestimates the potential deterioration in air quality:
  - In the 1985 study, approximately 20 million vehicle trips per annum were predicted compared to the current assumption of 70 million vehicle trips; and
  - In the 1985 study, 275,000 aircraft movements per annum were predicted compared with the current assumption of 370,000 per annum;
- If aircraft take off and land over the ocean then aircraft emissions would probably not be transported into the Sydney Basin. This will also greatly reduce the impact of any fuel jettisoned by aircraft over populated areas in the event of an emergency.

In relation to these issues there have been a number of relevant changes since 1985 including:

- New housing developments and other sensitive receptors (e.g. schools, hospitals, nursing homes etc.) have been established in the near vicinity of the proposed site. An assessment of air quality impacts on these sensitive receptors is required; and

- Lead levels in Sydney Basin have improved since the introduction of ULP in 1986 so this should not be a major issue.

7.6 Analysis of issues in terms of current airport concepts

The most recent air emissions inventory for the Sydney Basin was released in 2007 in the Air Emissions Inventory for the Greater Metropolitan Region in New South Wales. The air emissions inventory is a detailed listing of pollutants discharged into the atmosphere by each source type during a given time period and at a specific location. The study area covers 57,330 km^2, which includes the greater Sydney, Newcastle and Wollongong regions, known collectively as the Greater Metropolitan Region (GMR).

The air pollutant inventory is summarised in the tables below. It is relevant to include both biogenic and anthropogenic air pollutant emissions as both sources can give rise to secondary photochemical smog formation in the form of ozone and $PM_{2.5}$.

7.7 Air pollution levels as at 2007

Comparing the results of 2007 air emissions inventory to the air quality projections to 2000 in the SSA Site Selection study of 1985, it was found that:

- Carbon monoxide levels are 22% lower than projected;
- NOx levels are 8% lower than projected;
- Total volatile organic compounds (hydrocarbons) have risen by 30%; and
- Particulates as PM_{10} have risen by 60%.

In relation to the hydrocarbon emissions, the biogenic sources were probably not included in the early projections. If these are ignored, the total VOC emissions are 130,834 tonnes per annum, very close to the 1985 projections.

As a result of industry, motor vehicle and fuel regulation and other programs put in place progressively since 1985, concentrations of lead are generally well below the Air NEPM standards. Monitoring of lead levels in Sydney ceased in 2004 as NEPM standards were achieved. Therefore, lead emissions were not considered further in this working paper.

The emissions inventory for 2007 is shown in **Table 7.3**, sourced from reference 24. The salient data for this study is the total anthropogenic and biogenic emissions in Sydney.

Table 7.3 Total estimated annual biogenic and anthropogenic emissions in the Sydney region (reference 24)

Biogenic sources	(tonnes/year)
Carbon Monoxide	27,346
Lead and compounds	0.813
Oxides of nitrogen	1,585
Particulate matter < 10 □m	2,699
Particulate matter < 2.5 □m	2,331
Sulfur dioxide	69,393
Total VOCs	33,989

Anthropogenic sources	(tonnes/year)
Carbon Monoxide	528,011
Lead and compounds	29.044
Oxides of nitrogen	92,768
Particulate matter < 10 □m	21,305
Particulate matter < 2.5 □m	13,126
Sulfur dioxide	13,764
Total VOCs	130,834
Total Biogenic and Anthropogenic Emissions	**(tonnes/year)**
Carbon Monoxide	555,357
Lead and compounds	29,858
Oxides of nitrogen	94,353
Particulate matter < 10 □m	24,004
Particulate matter < 2.5 □m	15,457
Sulfur dioxide	13,833
Total VOCs	164,822

The sources for each of the criteria pollutants are shown in **Table 7.4** below.

Table 7.4. Total estimated annual anthropogenic emissions in the Sydney region by source (reference 24)

Substance	Anthropogenic Source Type					Anthropogenic Total
	Commercial	Domestic - Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Annual Emissions (tonnes/year) - GMR						
Carbon monoxide	1,801	90,516	603,133	32,144	559,047	1,286,641
Lead and compounds	0.194	0.153	11.964	54,917	13,701	80.292
Oxides of nitrogen	2,648	1,791	175,537	23,470	88,609	292,054
Particulate matter < 10 µm	4,032	6,651	46,530	14,567	3,349	75,128

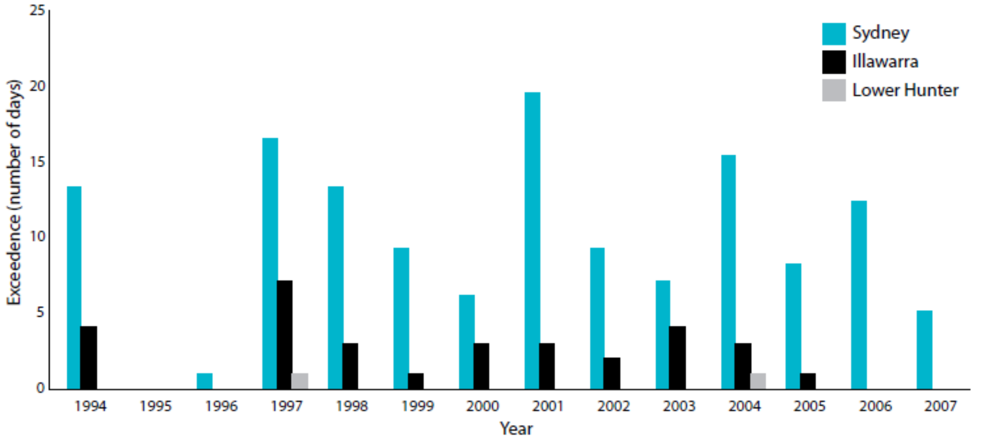
Substance	Anthropogenic Source Type					Anthropogenic Total
	Commercial	Domestic - Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Particulate matter < 2.5 µm	1,270	6,428	13,127	6,486	3,188	30,499
Sulfur dioxide	71.005	143	295,819	4,170	1,660	301,863
Total VOCs	13,844	67,303	17,786	7,640	64,493	171,067
Annual Emissions (tonnes/year) - Sydney						
Carbon monoxide	1,265	67,221	8,004	20,251	431,270	528,011
Lead and compounds	0.189	0.114	4.703	13.325	10.713	29.044
Oxides of nitrogen	1,870	1,356	14,032	9,514	65,996	92,768
Particulate matter < 10 µm	2,143	4,993	7,911	3,707	2,552	21,305
Particulate matter < 2.5 µm	723	4,826	3,390	1,761	2,426	13,126
Sulfur dioxide	48,074	108	10,980	1,374	1,254	13,764
Total VOCs	9,973	51,929	13,989	4,772	50,171	130,834

In the Sydney region, the bulk of the carbon monoxide, NOx, and hydrocarbon emissions arise from on-road mobile (cars and trucks) and off-road mobile (heavy industrial vehicles e.g. bulldozers, trains, ships, boats, and aircraft) sources. PM_{10} is produced by a mixture of on- and off-road vehicles, domestic/commercial industry (from solid fuel combustion), and industrial (crushing, grinding or separating works or other land-based extraction). Sulphur dioxide emissions are produced by petroleum refining with a small proportion from shipping. Lead emissions still arise primarily from on- and off-road mobile sources.

7.7.1 Exceedences of NEPM ambient air quality goals in the Sydney Basin

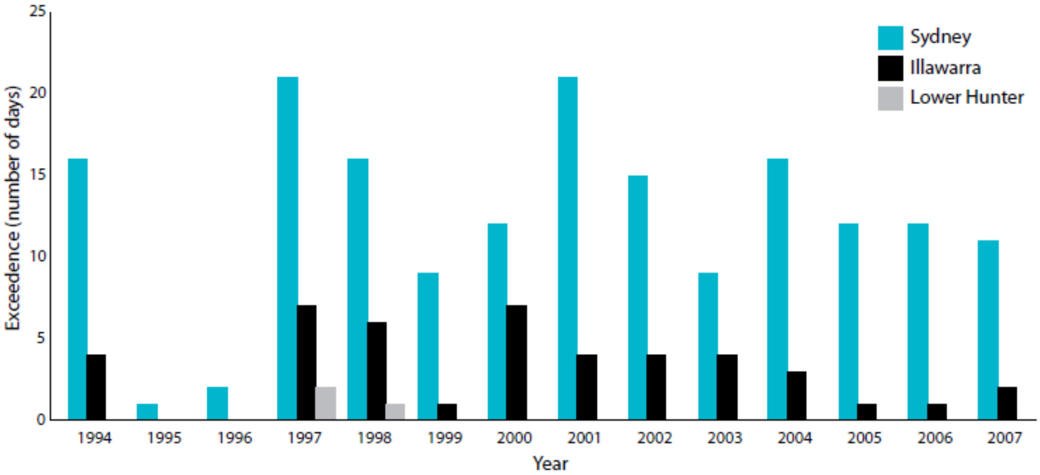
In 2009, the NSW Department of Environment, Climate Change and Water published an update to its Action for Air report which was the then NSW Government's 25-year air quality management plan for Sydney. The executive summary of the report stated that air quality had improved over the previous 10 years with many of the most dangerous pollutants down by 30% and national air quality standards for four of six major air pollutants (lead, carbon monoxide, sulfur dioxide and nitrogen dioxide) being consistently met. These reductions are significant as Sydney's population had grown by 21% and the number of passenger vehicles, the main contributor of several significant air pollutants, had increased by 58% since 1989. Ozone and particulate pollution remains problematic. National standards for ozone were exceeded in Sydney as are particle standards in some regional areas. These exceedences generally occur between two and 20 days per year. Current and projected ozone and particulate levels are a concern in view of growing evidence of the health impacts of air pollution. The ozone exceedence thresholds are indicated in **Table 7.2**. The figures below from the Action for Air report indicate the regional ozone exceedences by year:

Figure 7.2. Exceedences of the 1-hour Air NEPM Standards for Ozone in the Greater Metropolitan Region (reference 13)



Source: DECC 2008 (see www.environment.nsw.gov.au/aqms/aqi.htm)

Figure 7.3 Exceedences of the 4-hour Air NEPM Standards for Ozone in the Greater Metropolitan Region (reference 13)



Source: DECC 2008 (see www.environment.nsw.gov.au/aqms/aqi.htm)

In Sydney in the years 1994 to 2007, the number of days in which concentrations exceeded the 4-hour standard ranged from 1 to 21, with 11 exceedence days in 2007. For the same period, exceedence of the 1-hour standard ranged from 0 to 19, with five exceedence days in 2007. Western Sydney tends to experience the highest ozone levels. Exceedences are less frequent in the Illawarra, having occurred on up to seven days per year for either standard. The Lower Hunter region has only recorded one exceedence of the 1-hour standard since 1999. Data for exceedences in the southern highlands region are addressed in Section 7.7.2 below.

In terms of the ozone precursors NOx and VOC, the main source of NOx is motor vehicles (on-road mobile; 71.1%) and the main sources of VOC are motor vehicles (38%) and the domestic–commercial sector (39.7%).

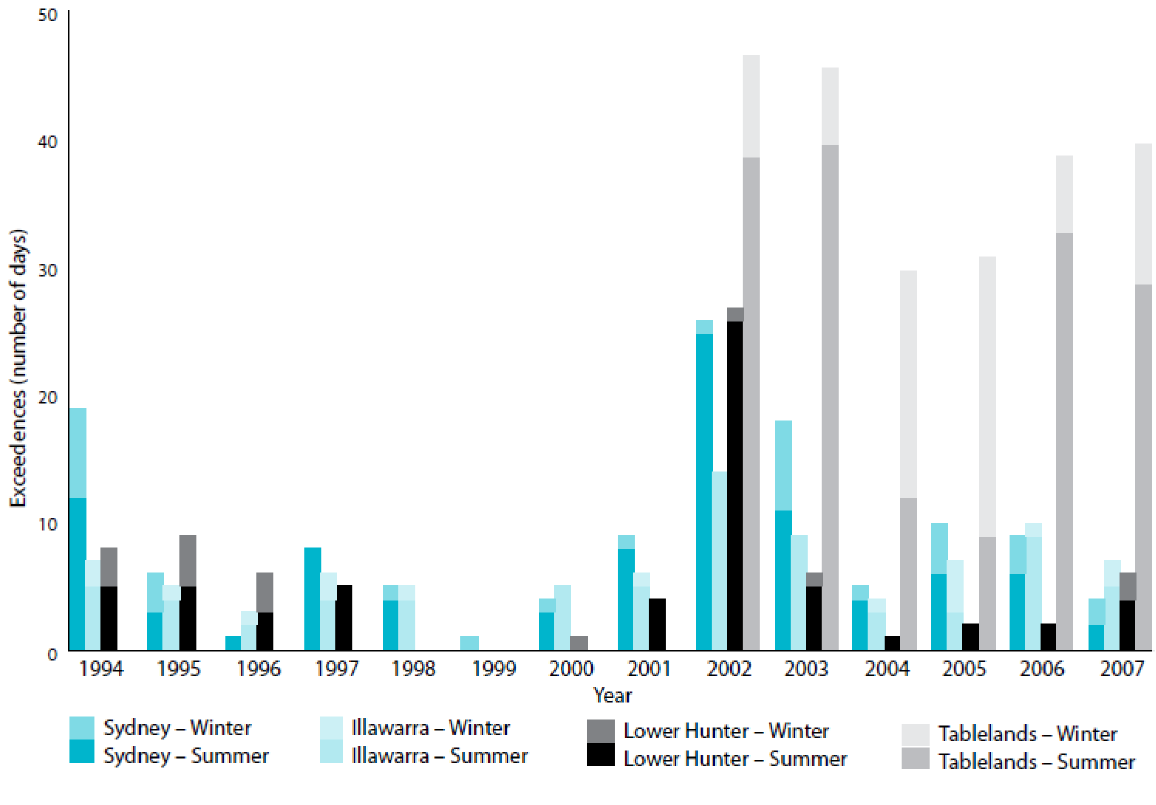
The Action for Air report[13] states that particulate pollution remains a health issue, particularly at the local level (such as near busy roads), even when ambient levels are low. At greatest risk from particulate pollution are people with heart or lung disease, older adults and children. The national standard for PM_{10} is generally being met in Sydney, except in years with bushfires or dust storms.

Figure 7.4 below shows summer (October to March) and winter (April to September) exceedences of the Air NEPM standard for particles in NSW regions from 1994 to 2007. Bushfires in 1994 and 2001 to 2003 were responsible for the extremely high concentrations of particle pollution recorded in the Greater Metropolitan Region in those years. The number of exceedences varies greatly from year to year as shown by the marked drop in 2004.

The data shown in the figure below for the PM_{10} exceedences in the tablelands may be of concern. The goal for PM_{10} emissions over a 24-hour is a maximum 50µg/m^3 with five exceedences per year allowed. Summer and winter time exceedences in the “tablelands” (no differentiation between southern and central tablelands) are substantially above the limit. This reflects the use of solid-fuel heaters and perhaps agricultural burn-off in many rural and regional areas. This contributes a large proportion of particle emissions, especially during the colder months. Note that specific PM_{10} data in the immediate vicinity of the Wilton site are not available.

The major sources of anthropogenic PM_{10} emissions in the Sydney region are industry (37.1%), the commercial and domestic sectors (23.7%), off-road mobile (17%) and motor vehicles (12%). Off-road mobile includes aircraft, railways, boats, and non-registered mining, construction and industrial vehicles. Diesel vehicles are the major contributor to motor vehicle particle emissions, and domestic solid-fuel heating makes up a significant proportion of commercial and domestic emissions in winter.

Figure 7.4 Exceedences of the 24-hour Air NEPM standard for particles (PM_{10}) in NSW regions (Reference 13)



Source: DECC 2008 (see www.environment.nsw.gov.au/aqms/aqi.htm)

7.7.2 Photochemical smog in the south-west of Sydney

Ground level ozone is harmful to human health and vegetation. It is also a good indicator of photochemical smog formation. The closest and most appropriate monitoring sites to base observations about current ozone levels in relation to the Wilton airport site are at Oakdale and Bargo.

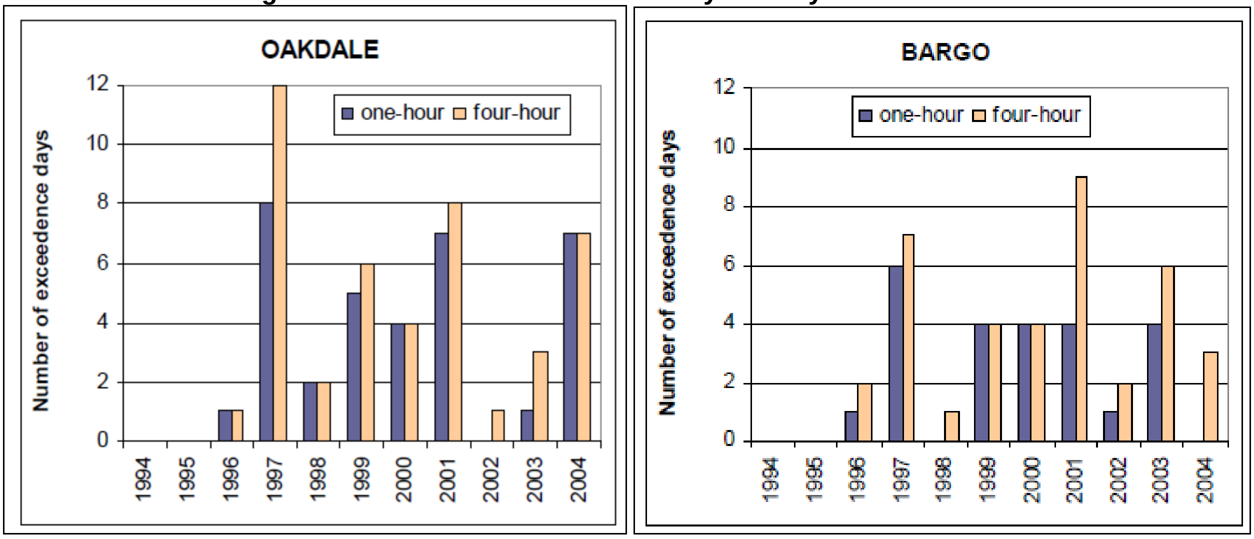
Figure 7.6 below shows the number of 1-hour and 4-hour ozone exceedences[27] at Oakdale and Bargo over the period 1996-2004. The number of days when ozone standards are exceeded in any given year is strongly dependent on the meteorological conditions experienced in that year. High ozone levels occur when north-easterly to easterly sea breezes carry urban plumes into the area. There are presently no significant NOx sources in these areas and local photochemical smog production would be minimal.

Analysis of data over the period 1994-2004 showed exceedences of the one-hour ozone standard on a maximum of nine days at Bringelly in 2001, followed by Oakdale with eight exceedence-days in 1997. The four-hour standard was exceeded on a maximum of 12 days at both Bringelly in 2001 and Oakdale in 1997, followed by 11 exceedence-days at St Marys in 2001. The Bargo site showed that the one-hour ozone standard was exceeded on 6 days in 1997, and the four-hour ozone standard was exceeded on 9 days in 2001.

Assuming an eight-hour ozone standard of 0.06 ppm, the most exceedence-days were recorded at Bringelly followed by St Marys, Bargo and Oakdale.

The ozone data confirms that exceedences of the current one-hour and four-hour ozone standards occur more frequently in western and south-western Sydney.

Figure 7.6 Number of exceedence-days each year at each site



7.7.3 Future trends

The Action for Air report states that over the next 10 to 15 years the projected performance for four of the air NEPM pollutants is for stable levels or continuing reductions in concentrations. Carbon monoxide concentrations have continued to fall with the turnover of the vehicle fleet and older vehicles being replaced with newer vehicles with more stringent emission limits. Emissions of NOx from motor vehicles are predicted to fall due to the progressive introduction of stricter standards for fuel quality and vehicle emissions, despite forecast increases in vehicle kilometres travelled. The regulation of emissions from industrial sources has helped to ensure that sulfur dioxide concentrations remain well below the NEPM standard.

Further emission reductions are needed to achieve ozone NEPM standards well into the next decade, emphasising the need for ongoing reductions from all major sources of ozone precursors.

Motor vehicles will remain the most significant source of ozone and particulate-forming pollutants in the Sydney region. Gains from tighter fuel and vehicle emission standards are likely to be partially offset by growth in vehicle

[27]. Department of Environment, Climate Change and Water, *State of Knowledge: Ozone*, 2010, http://www.environment.nsw.gov.au/resources/aqms/10577sokozone.pdf

numbers and travel, both private and commercial, and use of heavier vehicles. This will require a continuing focus on motor vehicle emissions, including emphasis on integrated land-use and transport planning and public transport planning.

Particulate emissions in the Sydney region also need to be addressed as concentrations approach the national standard for PM_{10} even in the absence of bushfires and dust storms. In some rural and regional areas, exceedences of the national standard for PM_{10} highlight the need for better management of anthropogenic sources, particularly agricultural burning and emissions from solid-fuel heaters.

The impacts of climate change may lead to increased temperatures, resulting in a longer season for elevated concentrations of summertime ozone with predicted increases in the average number of days over the 1-hour and 4-hour ozone standard. The geographical extent of ozone impacts is also expected to increase under these climate change scenarios.

7.8 Potential environmental impacts

Emissions of five of the six *NEPM (Ambient Air)* pollutants were assessed at a high level for the operations associated with the proposed airport. Airport construction related emissions, e.g. from land clearances, earthworks and dispersal of dust were ignored as these emissions are likely to be immaterial.

The pollutants assessed were:

- Carbon monoxide (CO);
- Nitrogen oxides (NOx);
- Particulate matter as PM10;
- Sulphur dioxide (SO2); and
- Total hydrocarbons.

The air emissions were spilt into three categories:

- Aircraft emissions (including emergency fuel jettison);
- Aircraft handling emissions; and
- Increased road traffic emissions.

Each set of air emissions calculations are described in the sections below.

7.8.1 Aircraft emissions – fuel combustion

The emissions from aircraft are based on the projected number of landings and take-off (LTOs). The maximum assumed LTOs is 370,000 per annum[28] - assumed to be a “worst case scenario”.

To calculate the aircraft emission factors per LTO the emission factors per mode are used (NPI Estimation Technique Manual for Aggregated Emissions from Aircraft, **Table 7.3**).[29]

The international and domestic fleet mix is obtained from the Sydney Airports Assumption Book. A split of 30% international flights and 70% domestic flights was assumed[30].

[28]. Suitable Sites Maximum Data Matrix

[29]. Australian Government, Department of the Environment, Water, Heritage and the Arts, *National Pollutant Inventory, Emission Estimation Technique Manual for Aggregated Emissions from Aircraft*, version 2.2, March 2003. http://www.npi.gov.au/publications/aedmanuals/aircraft.html

[30]. Department of Infrastructure and Transport, Sydney Airports Assumption Book, 24 June 2011, Ernst & Young.

The calculation method is :

$$E_m = \sum_o I_o E_{m,o}$$

Where $E_{m,o}$ is the emissions per mode, I_o is the annual number of LTOs for international and domestic aircraft, and $E_{m,o}$ is the emission factor for mode *m* and aircraft fleet *o*, in kg/LTO. The flight modes are:

- Approach;
- Taxi/idle;
- Take-off; and
- Climb-out.

7.8.2 Aircraft emissions - fuel dumping

During very rare emergency situations, it may be necessary for aircraft to jettison fuel into the atmosphere to reduce the overall weight of an aircraft to a safe landing weight. Jettisoning of fuel is largely confined to larger aircraft flying long-haul routes. British Airways estimates[31] that only a very small percentage (on the order of 0.01%) of fuel used by the aviation industry each year is jettisoned. Further, CASA guidelines[32] dictate that when there is a need to do a controlled dump of fuel it should be done in *"clear air over a non-populated area, preferably over the sea and from the greatest practical height, taking into account the prevailing wind."*

To estimate the mass of hydrocarbons released through fuel jettisoning, it was assumed that of the 370,000 LTOs per annum, 30% of the LTOs are international flights and fuel would only be jettisoned by incoming international flights (assume 50% of LTOs are landing aircraft). Therefore, approximately 55,000 international flights would land at the proposed airport at Wilton. Assuming all incoming international flights were 747s carrying 175 tonnes of fuel[33]; this amounts to a total of about 9.6 million tonnes of fuel. If only 0.01% of all fuel consumed by international flights was jettisoned, and 10% of that was over land, approximately 96 tonnes of hydrocarbon would be released. Given the high volatility of aviation fuel, jettisoned fuel would evaporate and disperse quickly. Therefore, the impact on air quality and risk to contaminating waterways should be immaterial.

The emissions from all assessed aircraft activities (i.e. emissions from combustion of fuel for LTOs and dumping fuel) is summarised (in tonnes per annum) in **Table 7.5**.

Table 7.5 Emissions from aircraft LTOs and fuel dumping

Source	CO	NOx	SO_2	PM_{10}	VOC
All aircraft related emissions	4,236	6,636	415	126	742

[31]. J.E.Penner, D.H.Lister, D.J.Griggs, D.J.Dokken, and M.McFarland (Eds.), *International Panel on Climate Change - Aviation and the Global Atmosphere,* Cambridge University Press, UK, 1999.

[32]. Civil Aviation Safety Authority Australia, Advisory Circular AC 91-155(0), Dropping of Objects and Substances from Aircraft other than Agricultural and Fire Fighting, May 2003.

[33]. http://www.airnewzealand.com.au/aircraft-statistics

Taken in isolation, the SO_2, PM_{10} and VOC emissions are relatively insignificant when compared to the background emissions within the Sydney Basin (refer **Table 7.3**). However, the NOx generated by aircraft LTOs represents a 6.5% increase over background levels and is therefore seen as a significant increase because it is a precursor to photochemical smog formation.

7.8.3 Aircraft handling emissions

Given the absence of data on aircraft handling infrastructure for the airport considered herein, only a brief calculation of emissions can be made. The basis of the estimate is the 2014 air quality data from the Sydney Airport Environment Strategy, Table 18.3, ref. 26. This table features air emissions for the five criteria pollutants for each of the eight sources listed below. These emissions are then scaled up to approximate the emissions from the airport proposed at the Wilton site.

The scale factor used here is the ratio of annual passenger movements. For Sydney Airport, the estimated number of passenger movements in 2014 was 45.6 million[34]; the estimated maximum number of passenger movements for the proposed Wilton airport was assumed to be 70 million per annum . The scale factor for the emissions is 1.54.

The results are presented below (in tonnes per annum):

Table 7.6 Air emissions from aircraft handling equipment

Source	**CO**	**NOx**	**SO_2**	**PM_{10}**	**VOC**
Ground Support Equipment	1,597	198	5	8	57
Auxiliary Power Units	97	103	15	-	8
Aircraft Maintenance	3	340	8	-	2
Refuelling and fuel storage	-	-	-	-	0.2
Other fuel storage	-	-	-	-	113
Boilers	4	5	0	1	-
Generators	2	4	1	1	-
Surface Prep and Coating	-	-	-	-	17
Totals	1,703	650	28	10	198

The emissions from ground-based aircraft handling equipment are all relatively insignificant when compared to the background emissions within the Sydney Basin.

7.8.4 Motor vehicle emissions

Motor vehicles travelling to and from the airport and business park to be sited at Wilton will produce emissions throughout the Sydney metropolitan area. Although there will be additional electric rail services, the air emissions associated with the generation of electricity will likely occur in the Hunter Valley or west of the Blue Mountains. Air emissions from these sources will have a minor effect on Sydney's air quality and are therefore not considered any further.

[34] Sydney Airport Master Plan 2009, Section 5.0, Aviation Activity Forecasts, http://www.sydneyairport.com.au/corporate/community-environment-and-planning/master-plan.aspx

Assumptions for this assessment are based on data supplied by Henson Consulting [35]. Estimates were based on 70 million passengers per annum travelling on average 85 km per trip. This amounts to 5,660 million vehicle km per annum. Emission factors for petrol cars were sourced from the NPI Estimation Technique Manual for Combustion Engines, Table 10.[36]

The results are presented below (in tonnes per annum):

Table 7.7 Air emissions from vehicle travel

Source	CO	NOx	SO_2	PM_{10}	VOC
Vehicle emissions	25,130	4,528	66	45	1,653

Table 7.7 indicates that the NOx levels generated by additional motor vehicle travel represent a 4.5% increase over background levels. This is significant given that NOx is a precursor to photochemical smog formation. The small rise in VOC levels (approx. 1% over background levels) will also contribute to additional smog formation as VOC is also a precursor to smog formation.

7.8.5 Summary of air quality impacts

The estimated air emissions from all sources in relation to a proposed airport at Wilton are summarized below:

Table 7.8 Total air emissions in relation to emissions in the Sydney Basin

Source	CO	NOx	SO_2	PM_{10}	VOC
All air emissions (tonnes/year)	31,070	11,814	510	181	2,593
Total Sydney Basin emissions (tonnes/year)	555,357	94,353	13,833	24,004	164,822
Percentage increase to Sydney Region emissions	5.3%	11.1%	3.6%	0.7%	1.5%

From this analysis the air emission impacts from all aspects of the proposed airport are small to moderate except for the increase in NOx levels. The bulk of the increase in NOx will arise from aircraft LTOs and the additional vehicle travel throughout the Sydney metropolitan area to reach the Wilton area.

Given that NOx is a precursor for photochemical smog, producing more NOx could lead to additional photochemical smog formation (fine particles and ozone) around the proposed airport and in the Sydney Basin. This is exacerbated by the increase in VOC which also arises from vehicle usage. The increase in air emissions could be especially problematic in the south-west of Sydney where ozone exceedences are relatively frequent in the Oakdale and Bargo areas (*refer section* 7.7.2).

Given the non-linear mechanisms underpinning the formation of smog, a more detailed assessment involving ambient air sampling at the proposed site and dispersion modelling is required to resolve local and regional smog impacts.

7.8.6 Impacts of air toxics and particulate matter on waterways

The five key air toxics are benzene, toluene, xylenes, formaldehyde and polycyclic aromatic hydrocarbons such as naphthalene and benzo-α-pyrene (Reference 3). The Air Toxics NEPM requires monitoring of these compounds:

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[35]. Henson Consulting, emails on 22 and 26 June 2012.

[36]. Australian Government, Department of the Environment, Water, Heritage and the Arts, *NPI Estimation Technique Manual for Combustion Engines*, version 3.0, June 2008. http://www.npi.gov.au/publications/emission-estimation-technique/eng.html.

- Where significantly elevated levels are likely to occur;
- Where there is a likelihood of significant population exposure; and
- Where there are not already programs in place to manage emissions of concern.

Elevated levels of air toxics could occur at locations close to specific sources, such as clusters of industrial sites, heavily trafficked or congested roads, busy airports and areas affected by woodsmoke.

Monitoring at sites in the Greater Metropolitan Region and some regional centres found that ambient concentrations of air toxics are mostly very low compared to international goals (see www.environment.nsw.gov.au/air/toxics.htm). A small number of air toxics – benzene, 1,3-butadiene and benzo-α-pyrene – require ongoing assessment to ensure they remain at acceptable levels in the future. Strategies such as increasingly stringent regulation of motor vehicle emissions and fuel quality will assist in controlling air toxics.

In terms of the airport site at Wilton, there is concern that these air toxics may enter nearby waterways and affect catchment areas. To determine the impact, a high level calculation was performed to determine the level of air toxics arising from aircraft LTOs and vehicle traffic.

For aircraft movements, the VOC in aircraft exhaust emissions has been speciated into 11 air toxics (Reference 19, Table 4). Based on the estimated 742 tonnes of VOC produced in aircraft exhaust emissions, the masses of individual air toxics (per annum) are shown in **Table 7.9**.

For petrol vehicle emissions, emission factors are given in ref. 26, **Table 7.9**. Emissions of air toxics from vehicles travelling to and from the airport site at Wilton will be distributed throughout the Sydney metropolitan area. A conservative estimate of 20% of air toxics emissions is assumed to be localized in the Wilton region. A more accurate assessment of the time vehicles spend in the Wilton area cannot be made at this stage of assessment.

Table 7.9 Estimate of air toxic emissions from aircraft and motor vehicle usage (tonnes per annum)

Air Toxics	Benzene	1,3 Butadiene	Ethylbenzene	PAH	Toluene	Xylenes
Aircraft exhaust	12.5	11.6	1.1	6.8	3.4	3.1
Motor vehicle exhaust	15.9	7.9	-	0.0007	-	-

Under NPI reporting guidelines, the benzene and 1,3 butadiene emissions from aircraft LTOs are the only reportable emissions as they exceed the 10 tonnes per annum reporting threshold. The emissions of PAH may be significant, but this high level assessment is not definitive.

In terms of impacts on waterways, the volatile nature of these air toxics mean that they will tend to be dispersed over a wide area and the impacts on waterways should be minimal. The greater risk probably arises from fuel leaks from storage tanks entering the groundwater system.

A similar potential risk to waterways exists from the local emissions of particulate matter. Particulate matter can be broadly divided into *deposited* and *suspended* fractions. Deposited particulate matter rapidly falls from the air because of its size (greater than 20 microns) and density. Suspended matter such as PM_{10} and $PM_{2.5}$ can stay suspended for significant periods.

Deposited particulate matter arises predominantly from land clearances and earthworks. If the land is not contaminated, it would be expected that the generated dust would not be harmful to waterways. The smaller PM_{10} and $PM_{2.5}$ would likely be transported in and out of the region through air parcel movements. This suspended particulate matter should have no impact on waterways, but the human health impacts through inhalation of particulates remains.

7.8.7 Impacts of climate change on air quality

The *Current Air Quality in New South Wales 2010* report[37] states *"climate change projections for NSW suggest significant increases in the frequency of drought, increases in the frequency of hot days, and increases in the frequency of high fire risk weather."*

Ozone pollution events have been linked to the frequency of hot, sunny days, and the highest particle pollution concentrations are linked to the presence of bushfires and dust storms.

A preliminary modelling study[38] into the impact of climate change on air quality in the Sydney region showed that without any changes to current technology, climate change has the potential to increase both peak ozone concentrations and population exposure to elevated ozone concentrations. The increased population exposure comes from increases in the size and duration of elevated ozone concentrations. The modelling showed that elevated ozone concentrations out to 2060 were particularly severe in the Picton, Oakdale, and Bargo regions.

7.9 Summary of mitigation methods and strategies

- Develop an Air Quality Monitoring program, perform an annual review of this program to re-evaluate testing parameters and determine the future direction for monitoring. Perform dispersion modelling and assess local air quality. Sampling of emission sources within the airport boundary may be required;
- To this end, establishment of an Automatic Weather Station able to collect air quality data – as also recommended for collecting aviation meteorology data – would be beneficial in further consideration of any site at Wilton;
- Develop an air emissions inventory and review the inventory at least annually. Include ground based emissions;
- Consider fixed electrical ground power units (FEGPU), reducing the need for diesel/petrol/gas powered APUs (auxiliary power units) or GPUs (ground power units). This will reduce NOx, VOC, SO2, PM10 and CO emissions from ground based vehicles although overall impact is relatively small;
- Consider aircraft spray painting operations and ensure compliance with applicable regulatory requirements – this will reduce VOC emissions although impact is relatively small;
- Consider more advanced ground transport using cleaner/alternative fuels (i.e. hybrid vehicles and/or emission reduction devices) – this will reduce CO, SO2, PM10, VOC and NOx emissions although impact is relatively small;
- Ensure all vehicles/plant undergo a regular maintenance program – this will reduce CO, PM10, VOC and NOx emissions although impact is relatively small;
- Investigate alternative fuels for fire training, in conjunction with Air Services Australia (e.g. natural gas). Restrict fuel burning for fire training to appropriate days in accordance with NSW EPA guidelines – this will reduce CO and PM10 emissions although impact is relatively small;
- Reporting: carry out annual NPI reporting and submit to the NSW EPA; the Airport Environment Officer will need to be updated on air emissions issues on a monthly basis; and report on air quality issues to the Federal Department of Infrastructure and Transport as part of the Annual Environment Report;

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[37] State of New South Wales and Department of Environment, Climate Change and Water NSW, Current Air Quality in New South Wales: A technical paper supporting the Clean Air Forum, 2010. http://www.environment.nsw.gov.au/air/cpairqual.htm

[38] Cope M. et al. A Methodology for Determining the Impact of Climate Change on Ozone Levels in an Urban Area, Clean Air Research Program Final Report May 2008 www.environment.gov.au/atmosphere/airquality/publications/climate-change.html

- The Air Navigation (Aircraft Engine Emissions) Regulations ensures that aircraft within Australia comply with air emissions standards. The adoption of fuel efficient aircraft should be encouraged. This is demonstrated by the A380 aircraft and will soon be demonstrated by the B787 and A350 XWB aircraft. This will reduce CO, NOx, PM10 and VOC emissions – impact is significant;
- Ensure airfield and terminal infrastructure can manage A380 aircraft and B787 aircraft;
- Liaise with Air Services Australia and other key stakeholders on ways to minimise aircraft taxiing times and unnecessary aircraft engine usage. This will reduce NOx, CO, PM10 and VOC emission; impact is moderate;
- Explore the use of a Kerosene Vapour Capture and Processing Systems as a means of reducing VOC emissions – moderate impact;
- Encourage the increased use of sustainable transport modes (including public transport and cycling). This will help to minimise airport traffic-related air and noise emissions. Given that motor vehicle emissions will have a large impact on air quality in the Wilton area, a measure to reduce motor vehicle usage will have a positive impact; and
- Implement dust suppression measures during airport construction projects.

7.9.1 Residual impacts

To quantify residual impacts, the following data is required:

- A detailed assessment of the meteorological conditions near the Wilton airport site. This can be obtained in the most part from BoM monitoring stations at Bargo, Bringelly, and Oakdale. Data from other sites within the Sydney Basin would be useful;
- Monitoring of ambient pollutant conditions at the Wilton airport site over at least a 12-month period;
- An accurate assessment of vehicle movements in relation to the airport and business park in Wilton – this is the largest source of air emissions. Any measures to reduce vehicle travel to Wilton should be quantified;
- More accurate estimates of aircraft movements (per aircraft type) and ground based equipment (especially fugitive emissions of fuel vapour at the airport); and
- Detailed dispersion modelling taking into account the complexities of the various drainage flows and sea-breezes which cause the re-circulation of pollutants throughout the Sydney Basin. Again this should occur over a 12-month period so as to capture the seasonality of secondary ozone and particulate formation.

7.9.2 Stakeholders

Possible stakeholders in air quality matters include people who may possibly be affected by air quality changes and those responsible for regulating such matters – for example:

- Nearby schools, hospitals, nursing homes, housing developments and the like;
- Air Services Australia;
- Federal Department of Infrastructure and Transport; and
- NSW EPA and NSW OEH.

7.9.3 Impact of various airport options on air quality

CRA-OPTIONS-1-7-A Layout (1)' identifies two sites with a series of runway options as listed below:

Western precinct Options

- Option 1 and 1S – N/S;
- Option 2 – approx. NW/SE;
- Option 6 – approx. NE/SW; and
- Option 7 – approx. NW/SE.

Eastern precinct Options

- Option 3 – N/S;
- Option 4 – NW/SE; and
- Option 5 - E/W.

This assessment does not allow the air quality impacts for each option to be assessed. It is expected that there would be no discernible difference in the air quality impacts of each option, and that each option would result in the approximately same impact on air quality.

The key factors affecting air quality are the numbers of annual vehicle and aircraft movements. It is expected that each option will result in the same level of vehicle and aircraft movements and therefore the same level of air emissions.

However, there may be local issues with drainage of air flows down the various gullies and canyons leading into the Cordeaux, Cataract and Nepean Rivers. This could affect the transport of pollutants from the site into the local and the Sydney metropolitan regions. Only high resolution pollution dispersion modelling can address these local issues in the context of regional air quality.

Table 7.10 Air pollution impacts as a function of runway option

	Option 1 and 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Produces air pollution impacts on the airshed	Yes	Yes	Yes	Yes	Yes	Yes	Yes

7.10 Key findings

The impact on Sydney's air quality from the release of the five criteria pollutants from the operation of the airport and aircraft LTOs minor in relation to the overall air emissions inventory for Sydney. Similarly, the impact of fuel dumping, deposited and suspended particulates and air toxics on waterways is estimated to be minor. The largest impact is expected from the 11% increase in NOx emissions from the rise in motor vehicle usage for passengers and employees. As NOx is a precursor for the formation of photochemical smog (ozone and fine particulate pollution), such an increase will likely lead to more photochemical smog. However, the precise nature of the impacts on local and regional air quality cannot be addressed.

One of the complexities is the movement of clean and polluted air parcels over the site and the potential for these to produce additional air pollution locally and in the Sydney Basin. The flow of pollution *out of the area* into Sydney is thought to be governed by the south-west regional drainage Flow. The present frequency at which this drainage flow operates is not known. The present frequency of temperature inversions in the Wilton area is also not known – inversions tend to isolate the air emissions near the point of origin. Of concern to Government in NSW are the relatively high ozone levels currently measured in semi-rural areas near Wilton, such as Bargo and Oakdale. These occur when north-easterly to easterly sea breezes carry urban plumes *into* the area from Sydney Basin. At night, cool air flows from the south and south-west and pushes the smog north and east again, back into the Sydney Basin.

In short, the drainage flows in combination with other flows such as the sea breeze, provide opportunities for the recirculation of air pollutants throughout the Sydney region.

Because of these complexities in the meteorology, the potential for increased smog formation near the proposed airport site in Wilton and in the Sydney Basin cannot be determined in this working paper. The potential impact on local sensitive receptors (schools, housing developments, hospitals, nursing homes etc.) also cannot be determined. Infants and the elderly are particularly vulnerable to increases in primary and secondary air pollutant emissions.

The cumulative impact of the air emissions from the proposed airport in relation to, for example new mining and associated industrial developments (which may include development which is airport related) in the Wilton locality or in the broader Sydney Basin also not known.

Questions on the local and regional scale impacts of air emissions from aircraft, the airport and most importantly, from increased vehicle traffic can be resolved to some extent with dispersion modelling techniques.

Smog formation through the recirculation of polluted air parcels is a more difficult question due to the non-linear smog production processes. Monitoring of ambient meteorological conditions near the proposed site and sampling of pollutants over a 12-month period can help resolve the issues. Modelling studies should be considered to specifically address the impacts of the airport on the:

- Sydney Metropolitan region, as defined in reference 14;
- South-west sub-region, as defined by the NSW Department of Planning and Infrastructure; and
- Surrounding Local Government Authorities e.g. Wollondilly, Camden, Wollongong and Campbelltown LGAs.

The meteorological questions to be resolved are:

- What, if any, changes to the local weather patterns have occurred in the Wilton area since 1985?
- What is the present frequency of temperature inversions and the south west drainage flow?
- Have there been any changes in the prevailing wind conditions?

Some account should be made of the impacts of climate change. The frequency of drought and increases in the frequency of hot days are thought to lead to elevated ozone levels, particularly in the south-west of Sydney.

The presence of a second airport in the Wilton area (with emissions primarily from aircraft landings and take-offs) and the increased use of motor vehicles will lead to increased NOx levels and slightly higher VOC levels compared with background air pollutant levels. Both compounds are precursors to smog formation. Photochemical smog formation is sensitive to temperature and any increases in the number of hot days will increase the number of ozone exceedences presently experienced in the Wilton area.

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8 WORKING PAPER – RISKS AND SITE HAZARDS – VULNERABILITY TO FLOOD AND FIRE

SUMMARY

The purpose of this working paper is to identify any flooding or bushfire hazards that may act as a barrier to airport development at Wilton and differentiate between the airport options developed in the Working Paper *Wilton Airport Site Selection and Airport Concepts*.

An analysis was undertaken to investigate the potential for flooding and bushfire in the area. The following was identified:

- All sites are on undulating topography which ensures that there is no risk of major riverine flooding at any of the airport options;
- All sites are situated within historic bushfire prone lands, with the western most sites being possibly less susceptible to bushfire given they are not situated deep within the forested areas and have several forms of defensive lines such as the F5 freeway;
- All sites will be adversely affected by smoke from bushfire given the close proximity to the forested areas; and
- All sites will require buffer zones or defensive lines such as roads to assist in defending the airport against bushfire and will be likely require to have multiple access and egress points which provide for both evacuation of the airport and fire fighting.

8.1 Introduction

The purpose of this Risks and Hazards (R&H) paper is to ensure that any potentially major risks or hazards within the Wilton Study Area[39] are identified as early as possible, and strategies suggested to mitigating any identified issues.

8.1.1 Methodology

Database searches were used to identify any existing fire and flood reporting or mapping data. A review of the following sources within and around the Study Area was conducted:

- Wollondilly Local Environmental Plan (LEP) 2011;
- NSW Rural Fire Service;
- Second Sydney Airport Site Selection Programme - Draft Environmental Impact Statement, Kinhill Stearns (1985); and
- Sydney Catchment Authority.

8.2 Summary of issues from SSA Site Selection Programme

A Draft Environmental Impact Statement (EIS) was prepared for the Wilton site for the *Second Sydney Airport Site Selection Programme* by Kinhill Stearns (1985) on behalf of the then Department of Aviation (‘*the Draft EIS*’). This Draft EIS is still seen as relevant in the areas of flooding and bushfire hazards given that the area has not been highly developed since the Draft EIS was undertaken.

8.2.1 Flood

The Draft EIS outlined the potential for flooding. Based on the information within the Draft EIS, the proposed airport sites in the Working Paper *Wilton Airport Site Selection and Airport Concepts* do not fall within floodplains or overland flow-paths. As such, it is not expected that there would be any major riverine flooding issues within the proposed airport site options, with localised flooding to be captured by the site drainage network.

8.2.2 Bushfire

The Draft EIS outlined the potential for bushfire. The Draft EIS did include discussion about a bushfire which did pass through the area of the proposed sites in 1985. Even though Wollondilly Council or the NSW Rural Fire Service (RFS) do not classify the area as Bushfire Prone Land, there is potential for bushfires within the proposed site boundaries. The extent of the 1985 bushfire and the proposed sites developed in the Working Paper *Wilton Airport Site Selection and Airport Concepts* are shown in the figure in Appendix 8A.

8.3 Analysis of issues in terms of current airport concepts

8.3.1 Flood

As in the 1985 EIS, none of the proposed sites developed in the Working Paper *Wilton Airport Site Selection and Airport Concepts* are affected by major riverine flooding. This is to be expected given their location on top of the Woronora Plateau and confirmed by Wollondilly Shire Council’s flooding maps which do not site the region as flood prone in its given state. There may be some localised flooding across the options, but this can be overcome by the internal drainage network.

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[39] Defined as the area contained within the following external boundaries: (1) Upper Nepean State Conservation Area (West), (2) the townships of Wilton, Douglas Park and Appin (North) and (3) the Cordeaux River and Cataract River dam areas (East– Cataract and South – Cordeaux).

The proposed airport options do not pose a flooding threat to the local environment and its surrounds. The area is currently not prone to large scale flooding and does not have any significant floodplains or overland flow-paths, and this will not change with the introduction of an airport. The airport will be required to have a system of managing and discharging storm water as outlined elsewhere herein which would include detention of stormwater to avoid excessive discharges into the river system.

8.3.2 Bushfire

Based on the information in the 1985 Draft EIS and information available on the NSW Rural Fire Service, the footprints of the eight options under investigation for the Wilton site will fall within an area with a history of bushfire. The investigation of the bushfire history has revealed two significant bushfires in the last 20 years, the 2001 Christmas Bushfires and another large fire in 2004.

Several NSW Rural Fire Service reports covering the 2001 *'Black Christmas'* fires have indicated that the area of the proposed airport sites were affected by the fire, with smoke clouding the area for an estimated 21 days.

In 2004, a fire broke out in the area to the north of the proposed airport sites, with fire fighting teams battling the blaze for 3 days. The fire was active within a perimeter surrounded by Brooks Point Rd, Lachlan Vale Rd, Wilton Rd, Condell Park Rd and the Hume Hwy and had dropped into Cataract Gorge. The fire was contained by the afternoon of the third day.

When considering the airport site options, the sites located most westerly (for example, option 1, 1S, 2, 6 and 7) would be better located in relation to bushfire risk as they are not wholly within the forested area and have various forms of bushfire defence infrastructure, such as roads, already in place The sites to the east (for example, option 3, 4 and 5) would be relatively the most prone to bushfire, depending, of course, on where the initial point of ignition occurred and factors such as the wind direction at that time. In relation to smoke from any bushfires in the area, all locations would be affected.

8.4 Summary of mitigation methods and strategies

8.4.1 Flood

As previously discussed, from information gathered from the Draft EIS and from Wollondilly Shire Council's flooding maps, the area is currently not prone to large scale flooding and does not have any significant floodplains or overland flow-paths, and this will not change with the introduction of an airport. As such, the localised drainage network should cater for any potential localised flooding. Details regarding flow capture can be found in the Working Paper *Drinking Water Catchment, Hydrology and Drainage*.

8.4.2 Bushfire

It has been established that the area where the proposed eight options are located has the historical potential to be affected by bushfire, as such it would be prudent that the site be cleared to ensure there is a '*buffer'* perimeter around the airport to reduce the chances of engulfment of the airport. Based on the NSW Rural Fire Service's Asset Protection Zone (APZ) calculations where undertaken with the following parameters:

- Development Purposes: Special Fire Protection;
- LGA: Wollondilly;
- Fire Weather Area/FFDI: Illawarra/Shoalhaven;
- Vegetation: Forest;
- Effective Slope: 0 – 5 degrees;
- Area not within Alpine area.

Given these parameters, it was determined that an APZ of a minimum of 70 m is required around the perimeter of the airport. It is proposed this be taken from the final perimeter fence line of the airport.

Investigations of airfields and airports throughout Australia and around the world have uncovered only a few airports being within the vicinity of forests or national parks, and none as close to a densely populated forest site as the proposed Wilton site will be. For example, Colorado Springs airport is located approximately 8km from Cheyenne Mountain State Park. Mitigation factors which have been used in this location to reduce the chances of fire in the area include thinning of bushland and trees and removing dead and dying bushland. This would reduce the probability of fire in the immediate vicinity of the airport, but would not stop the effects on the airport due to smoke from a more remote fire.

In terms of establishing a best practice for siting an airport in regard to this form of hazard there appears at this stage to be limited international guidance and accordingly an approach will need to be developed should an airport at Wilton proceed.

Given this, a bushfire management plan will need to be incorporated as part of a detailed investigation of the site to ensure the operation of the airport is not adversely effected due to fire and smoke. Several mitigation factors can be looked at which have been incorporated into airports internationally.

To try and reduce the risk further, controlled back burning would need to take place during low movement periods to reduce the effects of smoke on movements at the airport. Again, this would not remove the risk, but it would reduce the effect on the airport. The vicinity to the forest is the biggest issue in relation to the effects of smoke and fire.

Should a bushfire incident occur, there will need to be a bushfire operations plans which outlines the potential airport operations during this time. There would also need to be a bushfire evacuation and management plan which would need to be prepared in conjunction with the Rural Fire Service and the State Emergency Service to ensure that the most stringent safety guidelines are met.

This would probably result in the airport site being accessible through at least two high quality and capacity roads to facilitate both access for fire fighting or evacuation of the airport site.

8.5 Key findings

Following the investigation and review of the available documentation, it can be stated that major riverine flooding is not a potential hazard for a Wilton airport, and such an airport will not create potential major riverine flooding hazard in the area or in downstream waterways, especially as a result of a system of detention ponding being required as part of controlling water pollution emanating from the site.

There is, however, a history of bushfire in the area of the proposed airport and this may cause a potential issue. Further investigations will need to be undertaken to determine the mitigation measures to protect the airport from bushfire and the potential effects on flight movements of bushfire smoke. The following table summarises these findings and shows that there is no significant difference between any of the options.

	Option 1	Option 1S	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Flooding Hazard	No	No	No	No	No	No	No	No
Bushfire Hazard	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

8.6 References

http://www.rfs.nsw.gov.au/file_system/attachments/State/Attachment_20050302_9F3BFCBB.pdf

http://www.rfs.nsw.gov.au/dsp_content.cfm?cat_id=1180

http://www.rfs.nsw.gov.au/dsp_more_info.cfm?CON_ID=1415&CAT_ID=606

http://www.rfs.nsw.gov.au/file_system/attachments/State/Attachment_20050308_DDBF2C8D.pdf

http://www.disasters.ema.gov.au/Browse%20Details/DisasterEventDetails.aspx?DisasterEventID=1320

Wollondilly Local Environmental Plan (LEP) 2011

NSW Rural Fire Service

Second Sydney Airport Site Selection Programme - Draft Environmental Impact Statement, Kinhill Stearns (1985)

Sydney Catchment Authority

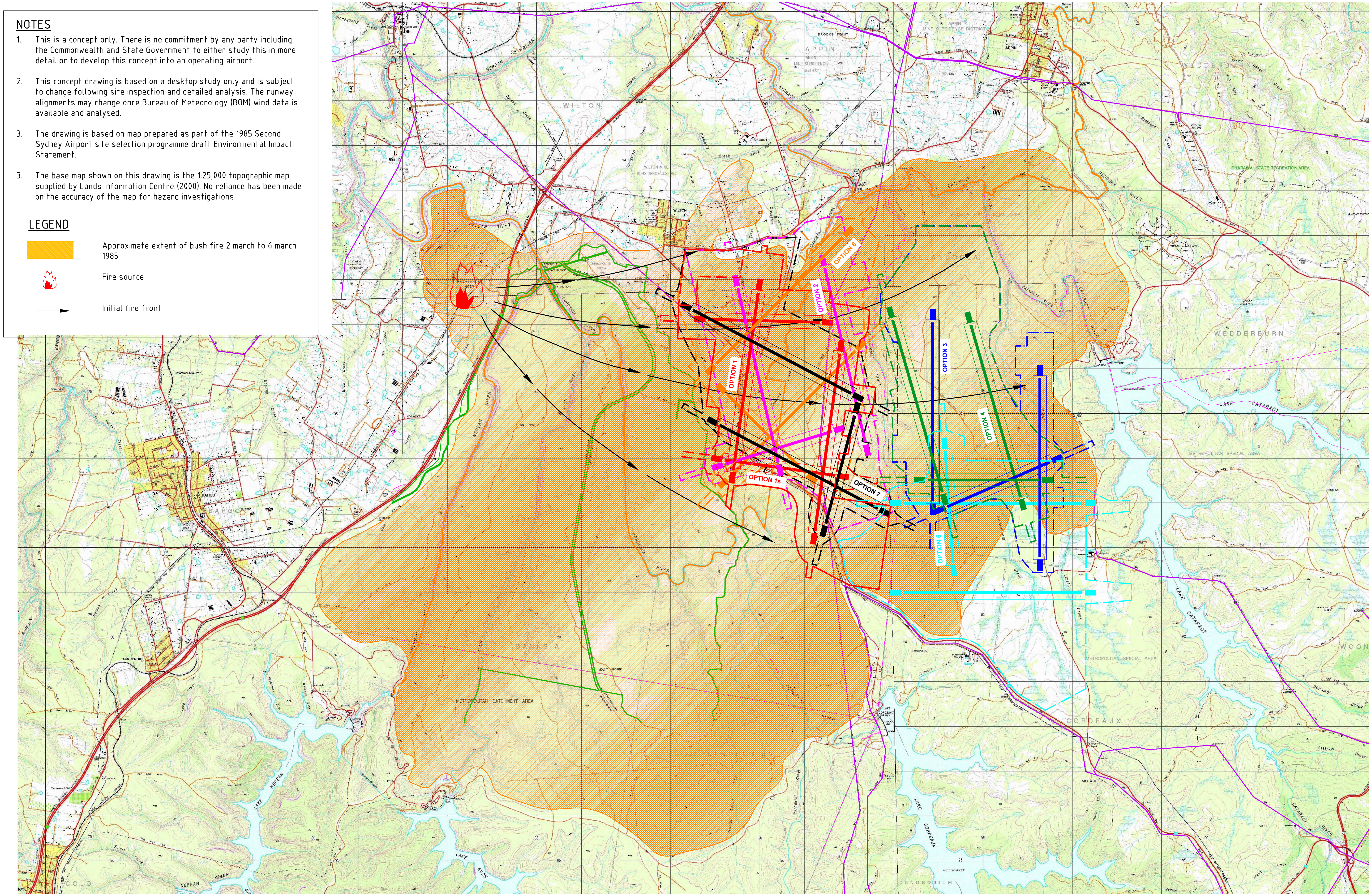
APPENDIX 8A WP-301015-03019-RSH-SK-001 - WILTON HAZARD SITE MAP

NOTES

1. 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.
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.
3. The drawing is based on map prepared as part of the 1985 Second Sydney Airport site selection programme draft Environmental Impact Statement.
3. The base map shown on this drawing is the 1:25,000 topographic map supplied by Lands Information Centre (2000). No reliance has been made on the accuracy of the map for hazard investigations.

LEGEND

(orange shading)	Approximate extent of bush fire 2 march to 6 march 1985
(flame symbol)	Fire source
(arrow)	Initial fire front



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ISSUE	DATE	ISSUE DESCRIPTION
C	31.07.12	ISSUED TO CUSTOMER
B	20.07.12	ISSUED WITH WORKING PAPER
A	26.06.12	DRAWING CREATED

800 0 800 1600 2400 3200 4000m
1:40000 (A1) 1:80000 (A3)

NORTH

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
HAZARD SITE MAP

WP-301015-03019-RSH-SK-001

PLOT DATE & TIME: 1/8/2012 4:39:51 PM
SAVE DATE & TIME: 1/8/2012 11:08:43 AM

NOTES

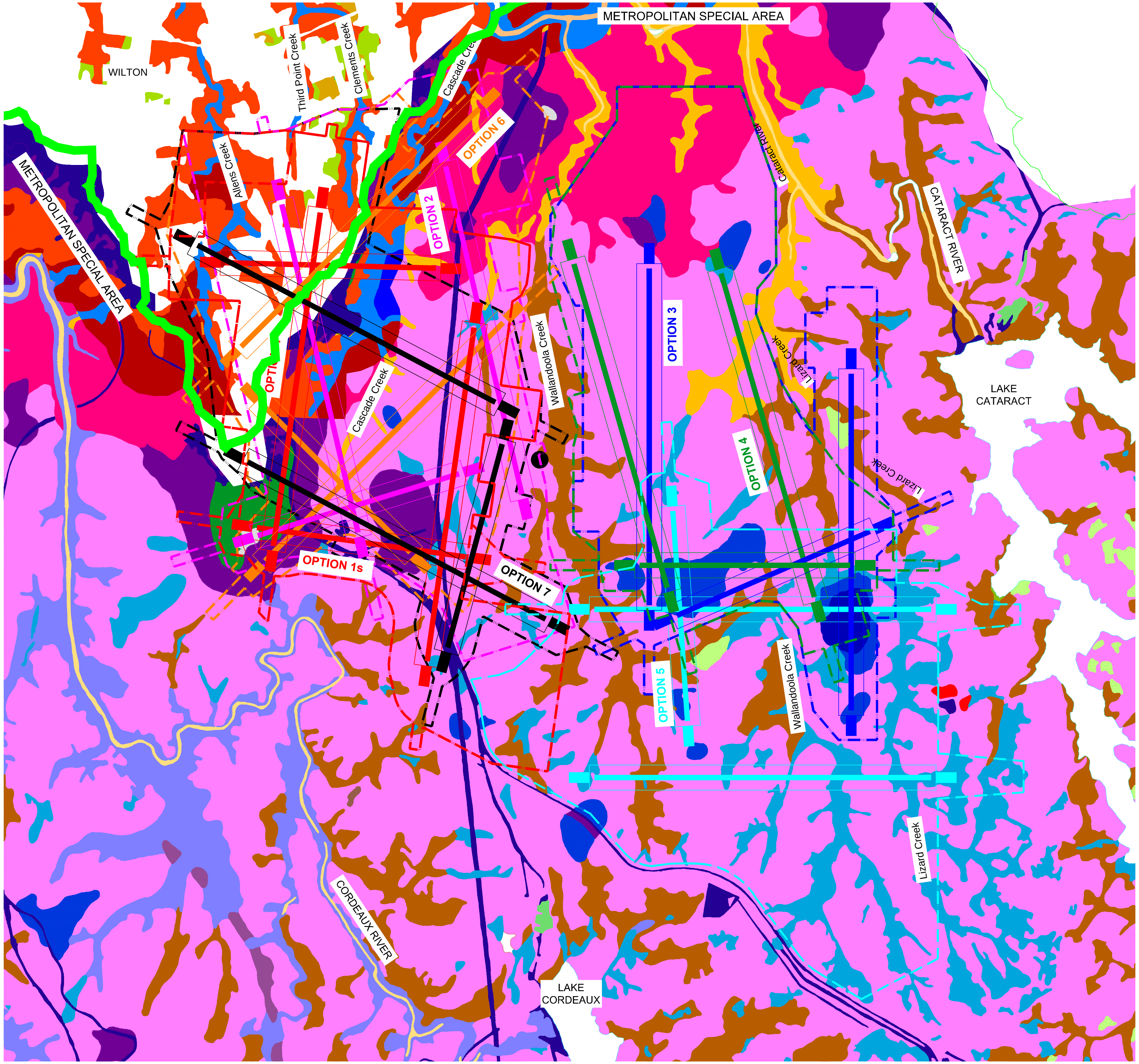
1. This is a concept only. There is no commitment by any party including the Commonwealth and State Government to either study this in more detail or to develop this concept into an operating airport.
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.
3. Vegetation Information on this drawing is based on the data downloaded from the Office of Environment and Heritage Mapdata webpage. The vegetation information used in this drawing are :
   - Native Vegetation of the Cumberland Plain (NPWS 2002/ Tozer 2003)
   - Native Vegetation of the Woronora O'hares and Metropolitan Catchments South Coast Vegetation Information Mapping (Tozer et al 2010)

LEGEND

- Artificial Wetlands
- Cleared
- Cliffline Coachwood Scrub
- Cumberland Shale Hills Woodland
- Cumberland Shale Plains Woodland
- Dwarf Apple Heath
- Escarpment Blackbutt Forest
- Exposed Sandstone Scribbly Gum Woodland
- Highlands Shale Tall Open Forest
- Moist Coastal White Box Forest
- Nepean Gorge Moist Forest
- Nepean Sandstone Gully Forest
- Regenerating Vegetation
- Rock Pavement Heath
- Rock Plate Heath Mallee
- Sandstone Gully Apple Peppermint Forest
- Sandstone Gully Peppermint Forest
- Sandstone Riparian Scrub
- Silvertop Ash Ironstone Woodland
- Tall Open Gully Gum Forest
- Transitional Shale Dry Ironbark Forest
- Transitional Shale Open Blue Gum Forest
- Transitional Shale Stringybark Forest
- Upper Georges River Sandstone Woodland
- Water MGAWeeds and Exotics
- Western Sandstone Gully Forest
- Woronora Tall Mallee Heath
- O Hares Creek
- Upland Swamps

LEGEND

- 1 Shale Sandstone Transition Forest
- 10 Shale Plains Woodland
- 2 Shale Sandstone Transition Forest
- 31 Sandstone Ridgetop Woodland
- 32 Upper Georges River Sandstone Woodland
- 33 Western Sandstone Gully Forest
- 35 Riparian Scrub
- 9 Shale Hills Woodland



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ISSUE	DATE	ISSUE DESCRIPTION
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B	20.07.12	ISSUED WITH WORKING PAPER
A	18.07.12	DRAWING CREATED

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FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
VEGETATION COMMUNITIES

WP-301015-03019-FFE-SK-001

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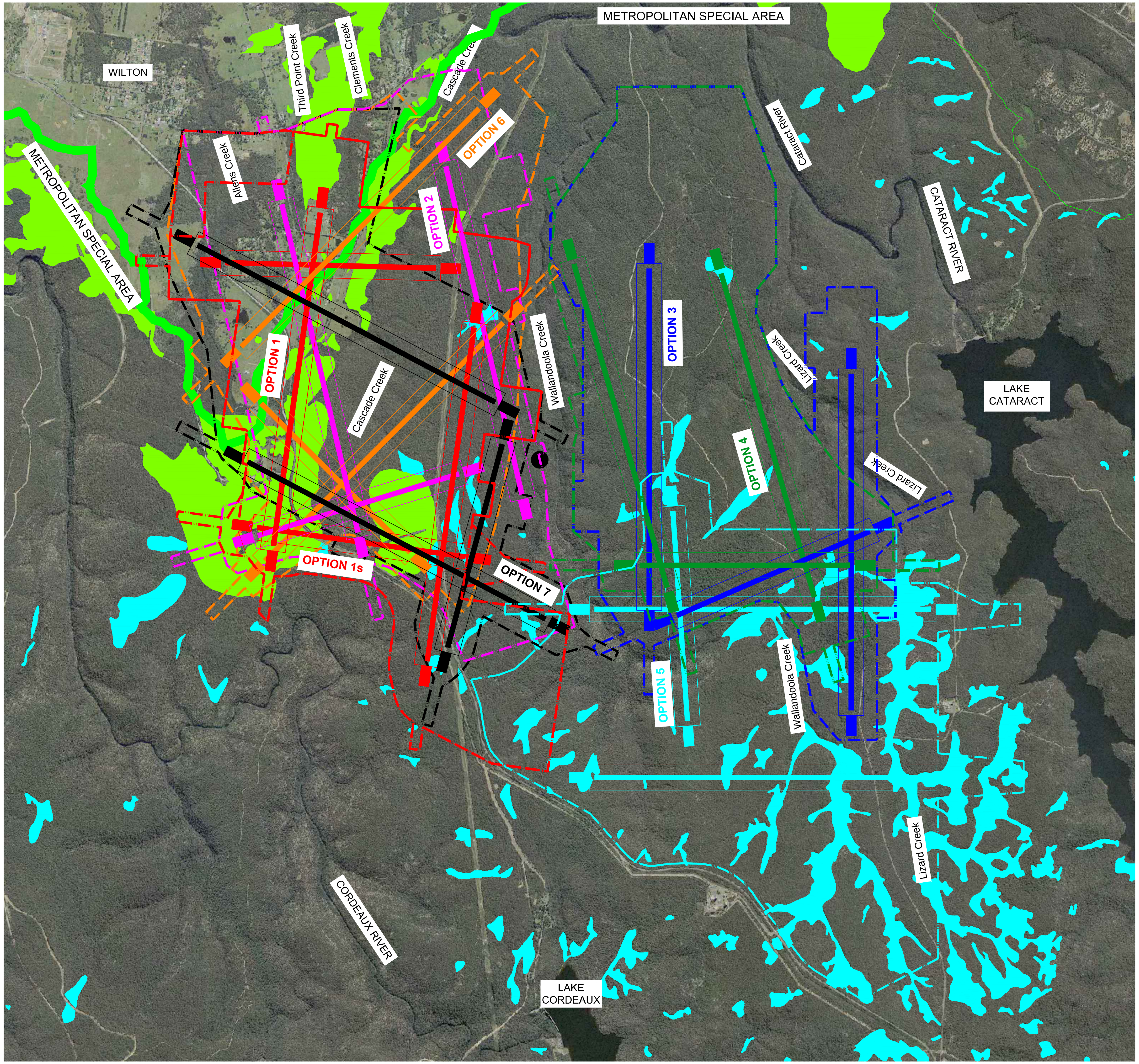
NOTES

1. 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.
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.
3. The aerial imagery shown on this drawing was captured in 2008 and has been supplied by NSW Lands and Property. No reliance has been made on the accuracy of the image for flora and fauna investigations.
4. Priority Fauna Habitats information on this drawing is based on data provided by Office of Environment & Heritage.

LEGEND

- Grassy Box Woodland Priority Habitat
- Upland Swamps Priority Habitat



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B	27.07.12	ISSUED WITH WORKING PAPER
A	24.07.12	DRAWING CREATED

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FURTHER ASSESSMENT OF AIRPORT DEVELOPTMENT OPTIONS
WILTON STUDY AREA
PRIORTIY FAUNA HABITATS

WP-301015-03019-FFE-SK-002

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NOTES

1. 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.

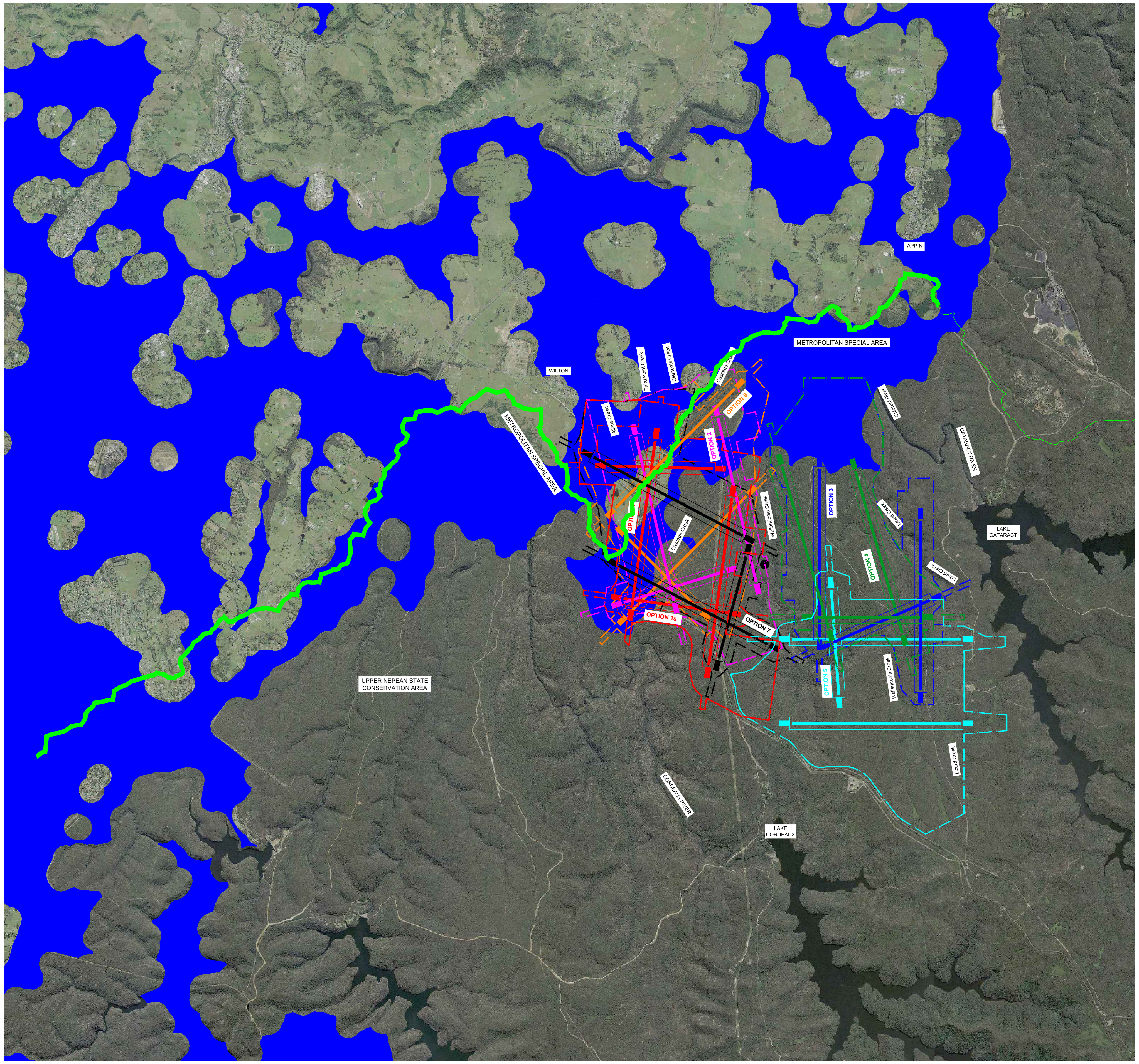
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.

3. The aerial imagery shown on this drawing was captured in 2008 and has been supplied by NSW Lands and Property. No reliance has been made on the accuracy of the image for flora and fauna investigations.

4. Koala habitat linkage information on this drawing is based on data provided by Office of Environment & Heritage.

LEGEND

Koala Habitat Linkage



ISSUE	DATE	ISSUE DESCRIPTION
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FURTHER ASSESSMENT OF AIRPORT DEVELOPTMENT OPTIONS
WILTON STUDY AREA
KOALA HABITAT LINKAGE

WP-301015-03019-FFE-SK-003

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9 WORKING PAPER – EUROPEAN CULTURAL HERITAGE

SUMMARY

The purpose of this Working Paper is to identify any issues relating to European Heritage Items that are listed on either the New South Wales State Heritage Register or on Wollondilly Local Environmental Plan, 2011(the LEP) and that may be either within the footprints of or in the vicinity of the footprints of any of the options. Particular consideration has been given to identifying if any of the European Heritage Items may act as a barrier to airport development at Wilton and to provide some differentiation between the airport options developed in the Working Paper *Wilton Airport Site Selection and Airport Concepts*.

The methodology for preparing the Paper has included the preparation of **Reference Map WP-301015-03019-SK-001**, review of relevant Registers and Schedules of Heritage items and background reports, including the Draft Environmental Impact Statement (EIS) prepared as part of the Second Sydney Airport Site Selection Programme in 1985. The information has been used to identify the location of items in relation to the footprints of the options and then to assess impacts, if any, of the proposed options on the heritage significance of the Heritage Items

Key points are:

- All listed Heritage Items are outside the footprints of all of the airport options. Therefore, consideration of impacts, if any, relate to "*development in the vicinity of heritage items*". Impacts, if any, will arise from the construction and operation of the airport through enlargement or removal of existing infrastructure (e.g. roads) or through new infrastructure (e.g. new roads and suggested rail options, both passenger and freight);
- The proposed "*Business Park*" in the north-west corner of Options 1S, 2, 6 and 7 is likely to intensify vehicular activity and have a more direct effect on two heritage items in the vicinity of those footprints, namely, the Cottage at No. 1090 and St Luke's Church at Nos. 1096-1099 Argyle Street, Wilton; and
- Resolution of mitigation of impacts, if any, on the two heritage items in Argyle Street, will relate to consideration of context and setting of the items in relation to the proposed "*Business Park*" component in the north-west footprints of those Options.

9.1 Introduction

The intent of this Working Paper is to:

- Identify heritage items that are listed on either the New South Wales State Heritage Register or on Schedule 5 to Wollondilly Local Environmental Plan, 2011(the LEP) that are either within the footprints of or in the vicinity of the footprints of any of the airport options;
- Identify the impacts, if any or any issues relating to European Heritage Items that may act as a barrier to airport development at Wilton; and
- Provide some differentiation in heritage terms in relation to impacts, if any, between the airport options.

9.1.1 Methodology

This review of European Heritage Items is based on the following methodology:

- Preparation of Reference Map WP-301015-03019-SK-006 which involved fixing the location of the airport options and then using a 5km and a 10km radius, respectively, from the “centre of origin” to ascertain the location of heritage items within the 5km and 10km radii and then some 2km beyond the 10km radii;
- The purpose of using such measures of distance is to create a relatively accurate information base that locates statutorily listed heritage items in relation to sites of proposed development. This information is essential for two reasons. Firstly, it establishes if a heritage item is within the site of a proposed development or if it is in the vicinity of a proposed development. This also includes location of existing or proposed infrastructure such as roads and rail networks. Secondly, it facilitates the application of the appropriate conservation statutory planning provisions/criteria to assess the impacts, if any, of development on heritage items where they may be located within a development site or located within the vicinity of a development site;
- Review the relevant Schedules and Inventories of Heritage Items in the Wollondilly, Wingecarribee and Wollongong Local Environmental Plans (LEP);
- Review of relevant policies and site locations on the AHIMS for the management of Aboriginal Heritage sites as one of the heritage sites is an Aboriginal Heritage site in Schedule 5 to the LEP;
- Review the State Heritage Register, the State Heritage Inventory and the NSW Heritage Act, 1977 Section 170 State Agency heritage register;
- Review the National Trust Register and the Register of the National Estate;
- Macarthur Regional Environmental Study;
- Review of the Regional Histories used to support the preparation of the NSW Heritage Manual; and
- Carrying out a site inspection.

9.2 Location of heritage items and their distance to the Options

Reference Map WP-301015-03019-SK-001 identifies:

- The location of the heritage items that are on either the New South Wales State Heritage Register (coloured blue) or on Schedule 5 to the LEP (coloured red); and
- The locations of the airport options; and (c) approximate locations of existing roads and railway lines and options for locating new rail lines.

There are six (6) items of State Heritage Significance located either wholly within the 10km radius of the centre of origin or approximately within 2 km beyond the 10km radius.

Four of the items are owned by the State and are directly associated with the Sydney Water Supply system that was established in the second half of the 19th Century They are the Cordeaux Dam, the Cataract Dam, the Upper Nepean Scheme-Upper Canal and the Upper Nepean Scheme Pheasant's Weir.

These four items are also listed on *Schedule 5 Heritage Items* to *Wollondilly Local Environmental Plan 2011*. They are entered on the *NSW State Heritage Register*. They are on the *NSW Heritage Act Section 170 State Agency Register*. Under the provisions of Section 170, the State Agency is required to ensure the proper maintenance of the items. Conservation Management Plans (CMPs) have been prepared for each of the items. Those CMPs have not been reviewed as part of this review. The fifth item of State significance is Wilton Park – Stables, coachhouse, water tanks, stallion boxes, covered yards - c1890. In addition to it being on the State Heritage Register, it is on Schedule 5 Heritage Items to the LEP. It is on the National Trust Register and the Register of the National Estate. It is located some 12km from the centre of origin, being about 2km outside the 10km radius

The sixth item of State significance is the Windmill Hill Group Wilton Park Stables (c1890). This item is located approximately 2kms northwest beyond the 10km radius.

In addition to the above State Heritage Items, the following heritage items are on Schedule 5 to the LEP, located in the localities of Wilton, Douglas Park and Appin.

Wilton:

- Cottage – No. 1090 Argyle Street;
- St Luke's Church – No's 1096 – 1099 Argyle Street;
- Aboriginal Shelters – 80 Condell Park Road, Wilton Park;
- Upper Nepean Scheme – Pheasants Nest Weir;
- Cottage - 180 Wilton Park Road, Wilton; and
- Kedron – 305 Wilton Park Road.

Douglas Park:

- Railway Cottage – 3 Camden Road;
- Stone Cottages – 380 Douglas Park Road;
- St Mary's Towers – 415 Douglas Park Drive; and
- Mountbatten Group – house, chapel and garden building.

Appin:

- Cataract Dam lies to the east, with its western edge just on the boundary of the 5km radius. The distance of the western edge of the Dam to the eastern edges of the footprints for Options 3, 4 and 5 varies from approximately 1-2km at the northern edge of the footprints to 2km towards the southern point of the footprints. The eastern and south eastern reaches of the Cataract Dam extend across the whole of the distance between the 5km and 10km radii;
- The Cordeaux Dam very slightly straddles the 5km radius to the south and extends approximately 1.5km further south between the 5km and 10km radii. The south western edge of the footprint of Option 5 is about 1km from the Dam with the southern edge of the footprints of Options 1s and 7 being about 2km from the Dam;

- To the north is the Upper Nepean Scheme-Upper Canal which is approximately 1km inside the 10km radius and extends some 3.5 km further north beyond the 10km radius. The nearest footprints are those of Options 1, 1S, 2 and 6;
- A Stone Ruin and the Upper Nepean Scheme – Broughton Pass Weir are approximately 5.5 km from the centre of origin 0.5km north of the 5km radius;
- The Northampton-Dale Group and "Elladale" are located some 7.5km from the centre of origin, 2.25km from the 5km radius and about 5km from the northern ends of the western runways for Options 3 and 4 and the eastern runway for Option 3. It is directly in line with the western runway for Option 4;
- The Windmill Farm Group is located some 6.5km from the centre of origin, 3.5km from the northern end of the eastern runway for Option 3 and 4.5km from the northern end of the eastern runway for Option 4; and
- There are 15 heritage items in Appin proper that are on Schedule 5 Heritage Items to the LEP. They are shown on the Map. They are some 5-7 km from the nearest footprints of any of the Options, namely, Options 3-6.

There are two archaeological sites[40]:

- Darcy's House Site – 51 Appin Road, Appin, (see above regarding distance from nearest footprints); and
- Stone ruin – 45 Whitticase Lane, Douglas Park – approximately 4-5km from the nearest footprints of any of the Options, namely, Options 1, 1S, 2 and 6.

Map WP-301015-03019-SK-001 indicates that:

- None of the listed heritage items are within the footprints of the airport options; and
- All of the listed heritage items are within various distances of vicinity of the footprints of the airport options.

In relation to the latter, with the exception of Wilton Park – Stables, coachhouse, water tanks, stallion boxes, covered yards, Kedron – 305 Wilton Park Road, Cottage - 180 Wilton Park Road, Wilton and Farm Cottage, all of the heritage items listed above are within the 10km radius from point of centre. The excepted items are approximately 12km west to north west of centre of origin. This gives rise to consideration of the question *"which airport options are closest to the heritage items"*? As can be seen from the map, the majority of the heritage items are located within the 5km to 10km radii and generally northwest and north of all options.

The implications of locating any of the proposed Options close to a heritage item will depend on at least two factors:

- Firstly, the heritage significance of the item; and
- Secondly, the degree of impact/s, if any, that the development may have on the heritage significance of the item.

[40] Note: all of these are items and archaeological sites that have been identified and assessed under the referred to Registers, Schedules and Lists. It does not exclude the possibility of other European archaeological sites being identified during the assessment process of the site and Options and recommendations for their listing.

9.2.1 Impacts

There are two types of impacts - direct and indirect.

- **Direct impact** –applies where development includes a heritage item or an archaeological site. As stated above, none of the heritage items are located within the footprints of any of the airport options. However, it is noted that Rail Option A appears to pass through St Mary's Tower, Douglas Park. This will need to be further considered as the rail option is developed;
- **Indirect impact** – applies to impacts of development on the heritage significance of a heritage item/s or archaeological site/s in the vicinity of the site of the proposed development. Section 1.2 above sets out the heritage items and the estimated distances of their locations to the Options. It is concluded that at this stage, two items, namely, Nos. 1090 and 1096-1099 Argyle Street, Wilton, are in the nearest vicinity of the footprints of Options 1S, 2, 6 and 7. The proposed "Business Park" component of those Options is likely to have the most impact on those items. The impacts are likely to arise from the augmentation of the vehicular access to facilitate that component.

Mitigation of any impacts on those two items can include appropriately *"heritage sensitive"* design of any changes that may be required to the road infrastructure.

The next nearest heritage items in the vicinity are the *"stone ruins"* and the *"Upper Nepean Scheme – Broughton Pass Weir"* which are approximately 1-1.5km north of the footprints of Options 2 and 6. The nature and degree of impacts, if any, on these two items are not fully known at this stage.

At this point in the review process, it is considered that impacts, if any, on the other items will be relative to distance to the vicinity of respective components of the airport Options.

An assessment of these is set out in the Table below.

Table 9.1: Heritage items within airport sites and footprints

Item	Option No.							
	1	1S	2	3	4	5	6	7
Heritage Item within footprint	No	No	No	No	No	No	No	No
Number of Heritage Items within footprint	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Heritage Item within immediate vicinity of footprint	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Heritage Items within immediate vicinity of footprint	2	4	4	Nil	Nil	2	4	4

9.2.2 Analysis of issues in terms of current airport concepts

As indicated in Section 9.2.1 above, the location of the proposed "*Business Park*" component in Options 1, 1S, 2, 6 and 7 being "development in the vicinity of" the heritage items is likely to trigger the application of the heritage provisions of Clause 5.10 of the LEP 2011.

Section 9.2.1 above states that the impacts, if any, that are likely to arise will be from the augmentation of the vehicular access to facilitate *"Business Park"* component of those Options.

Mitigation of any impacts on those two items can include sensitive design of any changes that may be required to the road infrastructure. Consideration of impacts if any on any of the other items will be part of the ongoing development of the options.

9.2.3 Assessed effects

The section above identifies the heritage items most likely to be effected by the stated Options, the likely impacts and how those impacts could be mitigated.

9.2.4 Ameliorative strategies to reduce effects to acceptable levels

Refer to the sections above.

9.2.5 Residual effects

These will become clearer as the design of the Options is developed and the degree of impacts, if any, are known and appropriate ameliorative strategies are put in place, Suggested measures are referred to above such as "*heritage sensitive"* design of any changes that might be required to existing or proposed road infrastructure.

9.3 Legislative status

At this point in the review process, Heritage Conservation Planning provisions of Wollondilly Local Environmental Plan 2011 may apply in relation to Options 1S, 2, 6 and 7 being *"development in the vicinity of"* the heritage items.

Those provisions are as follows:

> *"(5) Heritage assessment*
>
> *The consent authority may, before granting consent to any development:*
>
> *(a) on land on which a heritage item is located, or*
>
> *(b) on land that is within a heritage conservation area, or*
>
> *(c) on land that is within the vicinity of land referred to in paragraph (a) or (b),*
>
> *require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned."*

9.4 Summary of issues from the SSA Site Selection Programme

The Draft Environmental Impact Statement ('Draft EIS') prepared as part of the Second Sydney Airport Site Selection Programme examined heritage items in the Wilton area. The assessment of heritage items was based primarily on a desktop study. It identified three key areas:

- That there had been little early European settlement in the area due to it having low agricultural prospects;
- A major event was the setting aside of lands for Water Catchment purposes by the then MWS&DB as early as the 1880's; and

- Development in the area is said to have picked up in the 1920's but still mainly for cattle grazing.

The Draft EIS found that there "*are no surviving structures of any kind relating to the early farming and grazing development of the proposed site.* This finding was supported by aerial photographs.

The Draft EIS's conclusion was that "*the historical resource on the proposed site is minimal and that similar patterns of development could be expected outside the area."*

A review of Schedule 1 Heritage items to Wollondilly LEP 1991 showed that there have been very few additions of heritage items to Schedule 5 to LEP 2011. A key change between the heritage provisions of LEP 1991 and LEP 2011 has been the addition of provisions to include Aboriginal heritage conservation planning controls. The provisions would be called into operation if there were to be any impacts on the "Aboriginal Shelters – 80 Condell Park Road, Wilton".

The findings of the Draft EIS remain relevant as well as providing an important continuum in the review process of the suitability of the Wilton site as an international airport.

9.5 Key findings

The key findings of this Working Paper are summarised in the below points:

- All listed Heritage Items are outside the footprints of all of the airport options. Therefore, consideration of impacts, if any, relate to "*development in the vicinity of heritage items*". Impacts, if any, will arise from the construction and operation of the airport through enlargement or removal of existing infrastructure (e.g. roads) or through new infrastructure (e.g. new roads and suggested rail options, both passenger and freight);
- The proposed "*Business Park*" in the north-west corner of Options 1S, 2, 6 and 7 is likely to intensify vehicular activity and have a more direct effect on two heritage items in the vicinity of those footprints, namely, the Cottage at No. 1090 and St Luke's Church at Nos. 1096-1099 Argyle Street, Wilton; and
- Resolution of mitigation of impacts, if any, on the two heritage items in Argyle Street, will relate to consideration of context and setting of the items in relation to the proposed "*Business Park*" component in the north-west footprints of those Options.

9.6 References

1985 Draft EIS

New South Wales State Heritage Register

New South Wales State Heritage Inventory

Wingecarribee Local Environmental Plan 2010

Wollondilly Local Environmental Plan 2011

Wollongong Local Environmental Plan 1990

Wollongong Local Environmental Plan 2009

Regional Histories prepared for the New South Wales Heritage Manual

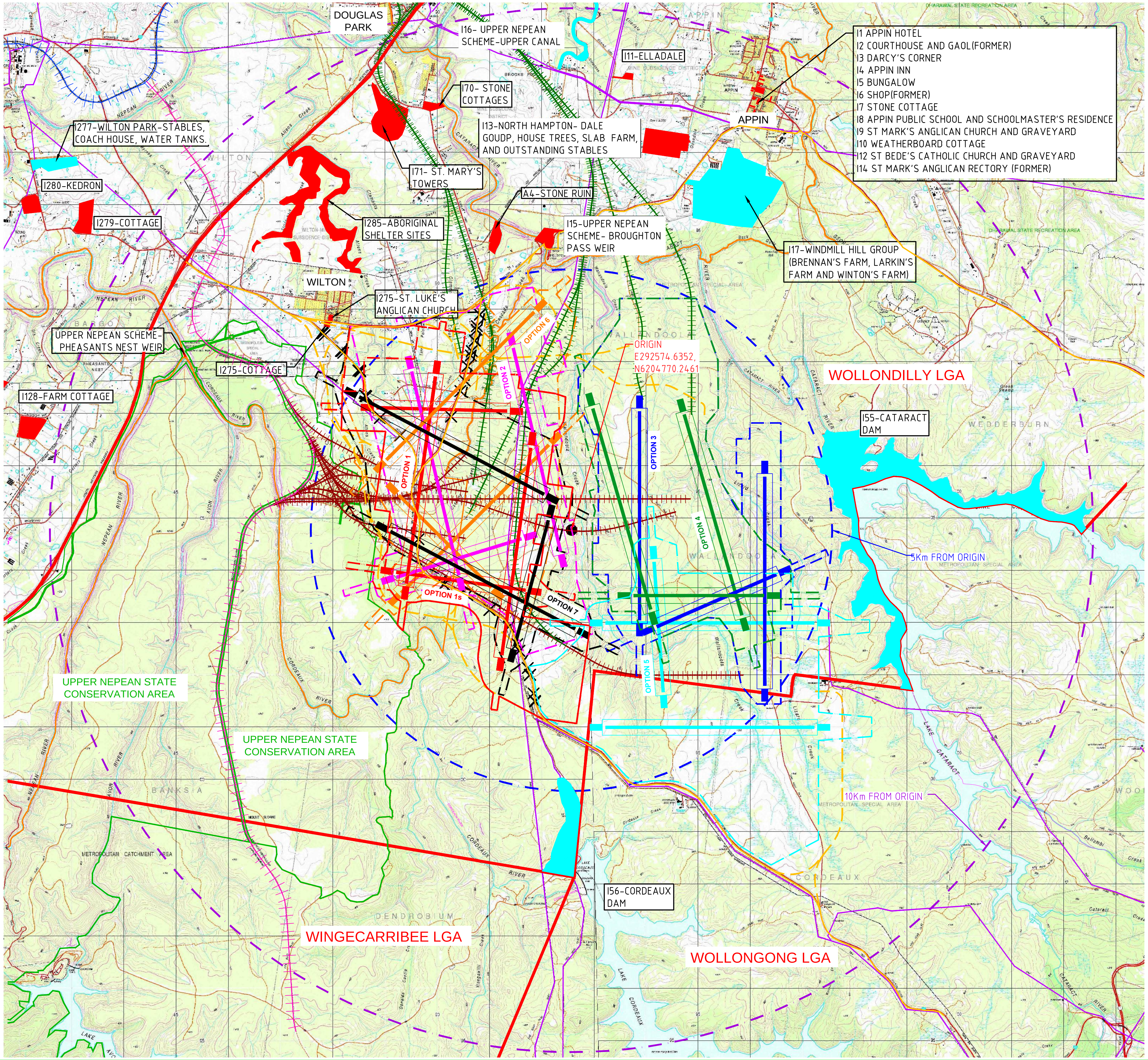
Macarthur Regional Environmental Study - Working Paper 3

NOTES

1. 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.
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.
3. The base map shown on this drawing is the 1:25,000 topographic map supplied by Lands Information Centre (2000). No reliance has been made on the accuracy of the map for cultural and heritage investigations.
4. Heritage locations on this drawing are based on Wollondilly LEP 2011, Heritage Map - Sheet HER_011B - 011C.
5. Appin massacre location taken from Monument Australia webpage.

LEGEND

- Approximate Location of Existing Rail Line
- Approximate Proposed Maldon to Dombarton Rail Line
- Approximate Location of Hume Highway
- Approximate Location of Wilton and Appin Road
- Road to be Removed
- New Road Alignment
- Rail - Option A
- Rail - Option B
- Center of origin for the 5km and 10km zones
- Local heritage site
- State heritage site



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FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
EUROPEAN HERITAGE SITE MAP

WP-301015-03019-ECH-SK-001

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10 WORKING PAPER – ABORIGINAL CULTURAL HERITAGE

SUMMARY

The purpose of this Working Paper is to identify any issues relating to Aboriginal Heritage Items that may be either within the footprints of or in the vicinity of the footprints of any of the airport options (as developed in the Working Paper *Wilton Airport Site Selection and Airport Concepts)* that may act as a barrier to airport development at Wilton and to provide some differentiation between the airport options. The Aboriginal Heritage Items identified are listed on either the New South Wales Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS) New South Wales State Heritage Register or on Wollondilly Local Environmental Plan, 2011 (the LEP).

The methodology for preparing the Working Paper has included the preparation of **Reference Map WP-301015-03019-ICH-SK-001 Indigenous Cultural Heritage** (the Map) based on information received from OEH, which indicates the location of Indigenous Cultural Heritage Sites (the heritage sites), review of relevant Registers and Schedules of Heritage items and background reports, including the Draft Environmental Impact Statement (*'the Draft EIS'*) prepared as part of the Second Sydney Airport Site Selection Programme. The information has been used to identify the location of items in relation to the footprints of the options and then to assess impacts, if any, of the proposed options on the heritage significance of the Heritage Items

The key findings of this Working Paper are:

- The Map indicates the location of the heritage sites within the footprints of the Options and the sites within the vicinity of the footprints of the Options. It appears that there are some 22 heritage sites within the area within which the footprints of all airport options are located. Most of them lie within the footprints of Options 1, 1S, 2, 4, 6 and 7;
- It is possible that at least 9 heritage sites would be directly impacted on by the "Business Park" component located in the north west of Options 1S, 2, 3, 6 and 7;
- Approximately 31 heritage sites are also within the vicinity of Options 1, 1S, 2, 6 and 7;
- Approximately 35 further sites lie within the north to west segment beyond the heritage sites stated above as being in the vicinity of the footprints of Options 1, 1S, 2, 6 and 7; and
- Resolution of mitigation of impacts, on the heritage sites will relate to consideration of design resolution, and context and setting of the sites in relation to both the proposed airport itself and the "Business Park" component in the footprints of those Options.

10.1 Introduction

The intent of this Working Paper is to:

- Identify Aboriginal Heritage Sites that are either within the footprints of or in the vicinity of the footprints of any of the airport options;
- Identify the impacts, if any or any issues relating to Aboriginal Heritage Sites that may act as a barrier to airport development at Wilton; and
- Provide some differentiation in aboriginal heritage terms in relation to impacts, if any, between the airport options.

10.1.1 Methodology

This Review of Aboriginal Heritage Sites is based on the following Methodology:

- Preparation of Reference Map WP-301015-03019-ICH-SK-001 which involved fixing the location of the eight options and then using a 5km and a 10km radius, respectively, from the "centre of origin" to ascertain the location of heritage items within the 5km and 10km radii and then some 2km beyond the 10km radii;
- The purpose of using such measures of distance is to create a relatively accurate information base that locates statutorily listed heritage items in relation to sites of proposed development. This information is essential for two reasons. Firstly, it establishes if a heritage item is within the site of a proposed development or if it is in the vicinity of a proposed development. This also includes location of existing or proposed infrastructure such as roads and rail networks. Secondly, it facilitates the application of the appropriate conservation statutory planning provisions/criteria to assess the impacts, if any, of development on heritage items where they may be located within a development site or located within the vicinity of a development site;
- Review the relevant Schedules and Inventories of Heritage Items in the Wollondilly, Wingecarribee and Wollongong Local Environmental Plans;
- Obtaining records of heritage sites from OEH and the AHIMS;
- Review of relevant policies and site locations on the AHIMS for the management of Aboriginal Heritage sites;
- Review the State Heritage Register, the State Heritage Inventory and the NSW Heritage Act, 1977 Section 170 State Agency heritage register;
- Macarthur Regional Environmental Study - Working Paper 3;
- Review of the Regional Histories used to support the preparation of the New South Wales Heritage Manual; and
- A site inspection.

10.2 Location of Aboriginal heritage sites and their distance to the options

Map WP-301015-03019-ICH-SK-001 identifies the Options (as developed in the Working Paper *Wilton Airport Site Selection and Airport Concepts)*:

- The Map indicates the location of the heritage sites within the footprints of the Options and the heritage sites within the vicinity of the footprints of the Options;
- It appears that there are some 22 heritage sites located within the footprints of all airport options. Most of them lie within the footprints of Options 1, 1S, 2, 4, 6 and 7;

- It is possible that at least 9 heritage sites would be directly impacted on by the “Business Park” component located in the north west of Options 1S, 2, 3, 6 and 7;
- Approximately 31 heritage sites are also within the vicinity of Options 1, 1S, 2, 6 and 7; and
- Approximately 35 further sites lie within the north to west segment beyond the heritage sites stated above as being in the vicinity of the footprints of Options 1, 1S, 2, 6 and 7.

Note: the *Aboriginal Shelters Sites* located at 80 Condell Park Road, Wilton Park have been identified and listed under the provisions of the Wollondilly Local Environmental Plan 2011, prepared under the provisions of the Environmental Planning and Assessment Act, 1979. Details regarding those provisions are set out in Section 1.3 below.

The information contained in the searches provided under the AHIMS by the OEH indicates that the great majority of the heritage sites are “*Shelter with Art*”. Further, the heritage sites are described as “*Closed*”[41].

Further research and consultations with the appropriate representatives of the relevant Local Aboriginal Land Council/s should be undertaken to establish the present condition of the heritage sites and what steps may need to be taken to ensure their conservation in accordance with the Guidelines issued by the NSW Office of Environment and Heritage (OEH). Reference to the need for further consultation with the Local Aboriginal Land Council is contained in **Section 10.4** below.

The question of whether the presence of heritage sites either within the footprints of Options or in the vicinity of ultimate site for an international airport can only be answered by having regard to significance of the heritage item/s that may be impacted by the proposed development. It is noted that a similar caveat as to the need for further research and consultation was provided in the 1985 EIS.

It is also important to note that information regarding the location of sites is not as readily available as for European Heritage Items. This is because a site (or sites) may be subject to Indigenous cultural values and the manner of conveying information unique to the Aboriginal community. People, items or events that may be readily spoken about in European culture may be held sacred or unspoken about in Aboriginal culture.

10.2.1 Impacts

There are two types of impacts direct and indirect:

- **Direct** – applies where development would be carried out on a heritage site. The section above details the location of those heritage sites within the footprints of the stated Options. Refer to the section Legislative Status below regarding likely statutory planning controls Other provisions of the National Parks and Wildlife Act, 1974 may also apply; and
- **Indirect** – Impacts of development on the heritage significance of an Aboriginal heritage archaeological site/s in the vicinity of the site of the proposed development. Generally, same comments and qualifications apply as referred to above under “Direct” above.

An assessment is set out in the Table below.

[41] The term “closed” is used to indicate that due to the cultural significance of a site its location remains confidential.

Table 10.1 Aboriginal heritage sites within airport sites and footprints

	Option No.							
	1	**1S**	**2**	**3**	**4**	**5**	**6**	**7**
Heritage sites within footprint	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Number of Heritage sites within footprint	20	13	19	1	8	Nil	18	15
Heritage sites within immediate vicinity of footprint	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Heritage sites within immediate vicinity of footprint	22	21	18	6	7	2	20	16

10.2.2 Analysis of issues in terms of current airport concepts

The provision of likely footprints and the initial identification and location of heritage sites based on the data provided by the NSW AHIMS has established a good basis for the next phase of the review/investigative process. Based on the findings of the Draft EIS and the review for the current process, there is a sound bases upon which to build further research and field surveys in collaboration/consultation with the relevant representatives. It is not possible to conclude one way or the other whether the significance of any of the sites would prevent the carrying out of development for the purposes of an international airport. It appears unlikely that the Aboriginal sites in the Wilton area would be declared places of *'special significance'* under relevant Acts and therefore, prevent airport development in Wilton. This comment is based on a review of material in which representations and statements have been made by community members. An issue that will need to be considered is the impact, if any, on the significance of streams, creeks waterways, and the like which may be of cultural or heritage significance to the Aboriginal Community. This is because of the value and connection placed on them in the life of the community.

Confidentiality regarding the release of information on sites and their locations is a stated matter of concern to the Aboriginal community. Therefore consultation with Aboriginal leaders will greatly assist in identification and assessment of sites and their preservation, if required.

10.2.3 Native Title

Following the introduction of the *Commonwealth Native Title Act 1993*, resulting from the High Court Mabo judgement, Aboriginal people are now able to seek recognition of their Native Title to land.

Native Title is the legal name given to the traditional ownership of land and waters that have always belonged to Aboriginal people according to their traditions, laws and customs. These rights are different to and separate from the statutory right of Aboriginal Land Councils to make claims for land under the NSW *Aboriginal Land Rights Act 1983*.

A search of the National Native Title Tribunal web site[42] found Native Title applications (blue shaded area) to the west of Wilton (**Figure 10.1**). There are also NSW Future Act Notices (brown spotted area) to the north and east of the Wilton Study Area (**Figure 10.1**).

[42] (http://www.nntt.gov.au/Applications-And-Determinations/Search-Applications/Pages/Search.aspx)

Figure 10.1 Native Title applications (blue shading) and NSW Future Act Notices (brown spotted area) near Wilton

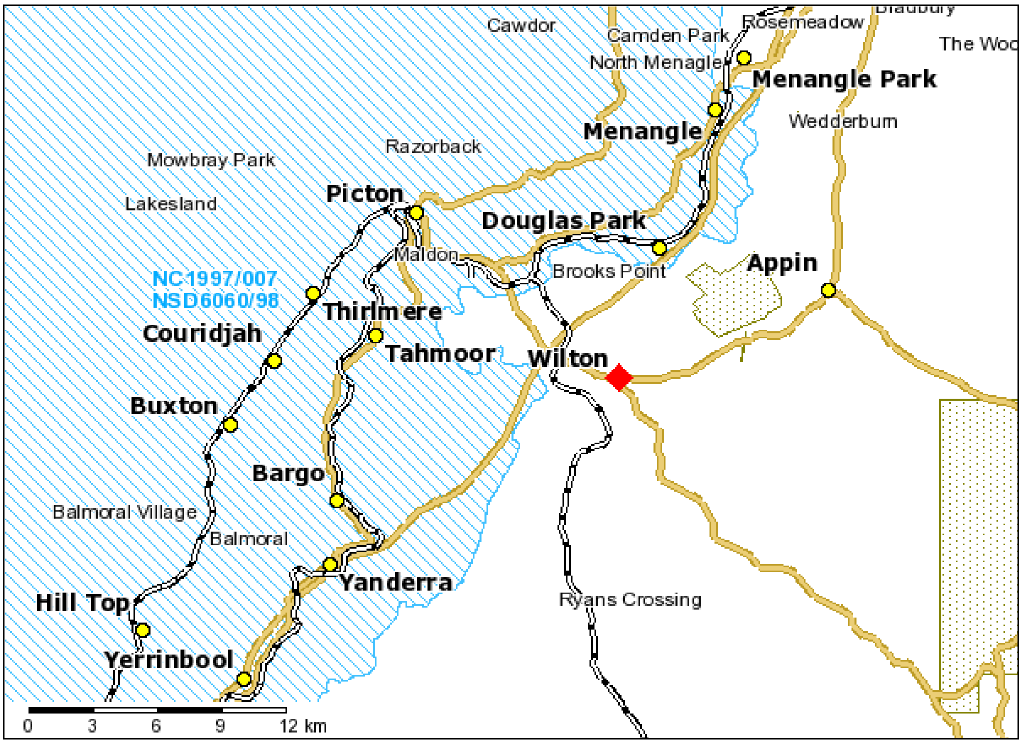


Figure 10.1 does not show any claims over the Wilton Study Area. However, continued searching of Commonwealth Native Title and NSW Future Act Notices claims should carried out, if further assessment of the Wilton Study Area is required.

10.2.4 Assessed effects

Extent of impacts/effects, if any, is not known at this stage of the process. However, it is may be that sites within footprints will be lost.

10.2.5 Ameliorative strategies to reduce effects to acceptable levels

Likely appropriate strategies can be developed. These can include Interpretation strategies.

10.3 Legislative status

At this point in the review process, the Heritage Conservation Planning provisions of Clause 5.10 (5) of Wollondilly Local Environmental Plan 2011 may apply in relation to the "*Aboriginal Shelter Site*" at 80 Condell Park Road to Options 1, 1S, 2, 6 and 7 being *"any development in the vicinity of"* the heritage site.

Those provisions are as follows:

> *"(5) Heritage assessment*
>
> *The consent authority may, before granting consent to any development:*
>
> *(a) on land on which a heritage item is located, or*
>
> *(b) on land that is within a heritage conservation area, or*
>
> *(c) on land that is within the vicinity of land referred to in paragraph (a) or (b),*

> *require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned."*

Depending on the significance of a site, the provisions of Section 84 Aboriginal Places may be triggered. The Section empowers the Minister responsible for the administration of the National Parks and Wildlife Act, 1974 to declare a place to be a place of special significance. There are provisions providing exemptions to harming or disturbing such places. There are also provisions for obtaining permits where there may be impacts on heritage sites or places covered under the National Parks and Wildlife Act, 1974 may apply. These provisions will be likely to be triggered if additional sites or places are identified through further research or field surveys.

10.4 Summary of issues from the SSA Site Selection Programme

The 1985 Draft EIS was based firstly on a desktop study, followed by the preparation of a "*predictive statement*" which was then used to devise fieldwork methods to consider site conditions "*affecting archaeological visibility, such as ground surface visibility and exposure." (p. 393)*

- Focus of Field work - The fieldwork focussed along the major drainage lines. The results are recited as "*two of the rock shelters with Aboriginal drawings located adjacent to Allens Creek identified in 1982 were visited and found to be within the proposed site*…" (p. 397). These would appear to be additional to those sites listed in the LEP which are located off Gordon's Road to the north (Reference Map WP-301015-03019-ICH-SK-001). Reference is also made to two "rock shelter sites with possible stone artefacts were located adjacent to Cascade Creek";
- Assessment of effects - The 1985 Draft EIS archaeological assessment was "*confined to the effects of the proposed acquisition and ...future airport development at the site*." (p. 398) "*The conclusion drawn from the field survey is, however, that the number and significance of these sites (sandstone and shale derived soils) is not high and that representative samples occur in stable settings immediately outside the proposed site which would not be affected by the construction of as airport*."(p. 398);
- It was also noted that the two Allens Creek sites were not well preserved and that their deterioration decreased their conservation values in relation to "*their scientific, aesthetic or heritage significance*." (p. 398); and
- Concerns of the Aboriginal People – this item dealt with, inter alia, the consultation processes with officers of the Western Metropolitan and the South Coast Regional Aboriginal Land Councils and the Tharawal and Illawarra Local Aboriginal Land Councils. The Section also canvassed the distinction between an Archaeological Survey (concerned with physical evidence of the past) and an Anthropological Survey (concerned with observable and written evidence of the past and present human activity).

The 1985 Draft EIS also notes the fact that there were a large number of Aboriginal sites that have been recorded by the NP&WS in areas beyond the airport site that could be affected by noise, air and water pollution or changes to stream levels.

The findings of the Draft EIS remain relevant as well as providing an important continuum in the review process of the suitability of the Wilton site as an international airport. However, it is considered that an EIS prepared under today's Environmental Impact Assessment regime at both Commonwealth and State levels is likely to include a further consultation process with the relevant Aboriginal representatives, which would hopefully result in more information being made available on heritage sites.

10.5 Key findings

The key findings of this Working Paper are detailed below:

- The Map indicates the location of the heritage sites within the footprints of the Options and the sites within the vicinity of the footprints of the Options. It appears that there are some 22 heritage sites located within the footprints of all airport options. Most of them lie within the footprints of Options 1, 1S, 2, 4, 6 and 7;
- It is possible that at least 9 heritage sites would be directly impacted on by the "*Business Park*" component located in the north west of Options 1S, 2, 3, 6 and 7;
- Approximately 31 heritage sites are also within the vicinity of Options 1, 1S, 2, 6 and 7;
- Approximately 35 further sites lie within the north to west segment beyond the heritage sites stated above as being in the vicinity of the footprints of Options 1, 1S, 2, 6 and 7; and
- Resolution of mitigation of impacts, on the heritage sites will relate to consideration of design resolution, and context and setting of the sites in relation to both the proposed airport itself and the "*Business Park*" component in the footprints of those Options.

The consultation with the Aboriginal community remains an important issue and should be conducted if further consideration of an airport in the form of any of the Option at Wilton is undertaken.

10.6 References

1985 Draft EIS

New South Wales State Heritage Register

New South Wales State Heritage Inventory

AHIMS

Wingecarribee Local Environmental Plan 2010 - Schedule 5 Environmental heritage Wollondilly Local Environmental Plan 2011 - Schedule 5 Environmental heritage

Wollongong Local Environmental Plan 1990 - Schedule 1 Items of heritage significance

Wollongong Local Environmental Plan 2009 - Schedule 5 Environmental Heritage

Regional Histories prepared for the New South Wales Heritage Manual – published 1996

Macarthur Regional Environmental Study - Working Paper 3 – published 1985 Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales - Published by: Department of Environment, Climate Change and Water September 2010

OEH Aboriginal Places Policy - published by: OEH August 2011

Guidelines for developing management plans for declared Aboriginal Places - Published by: NSW Office of Environment and Heritage February 2012

Submission on the strategic review of the impacts of underground mining in the Southern Coalfield 30 July 2007

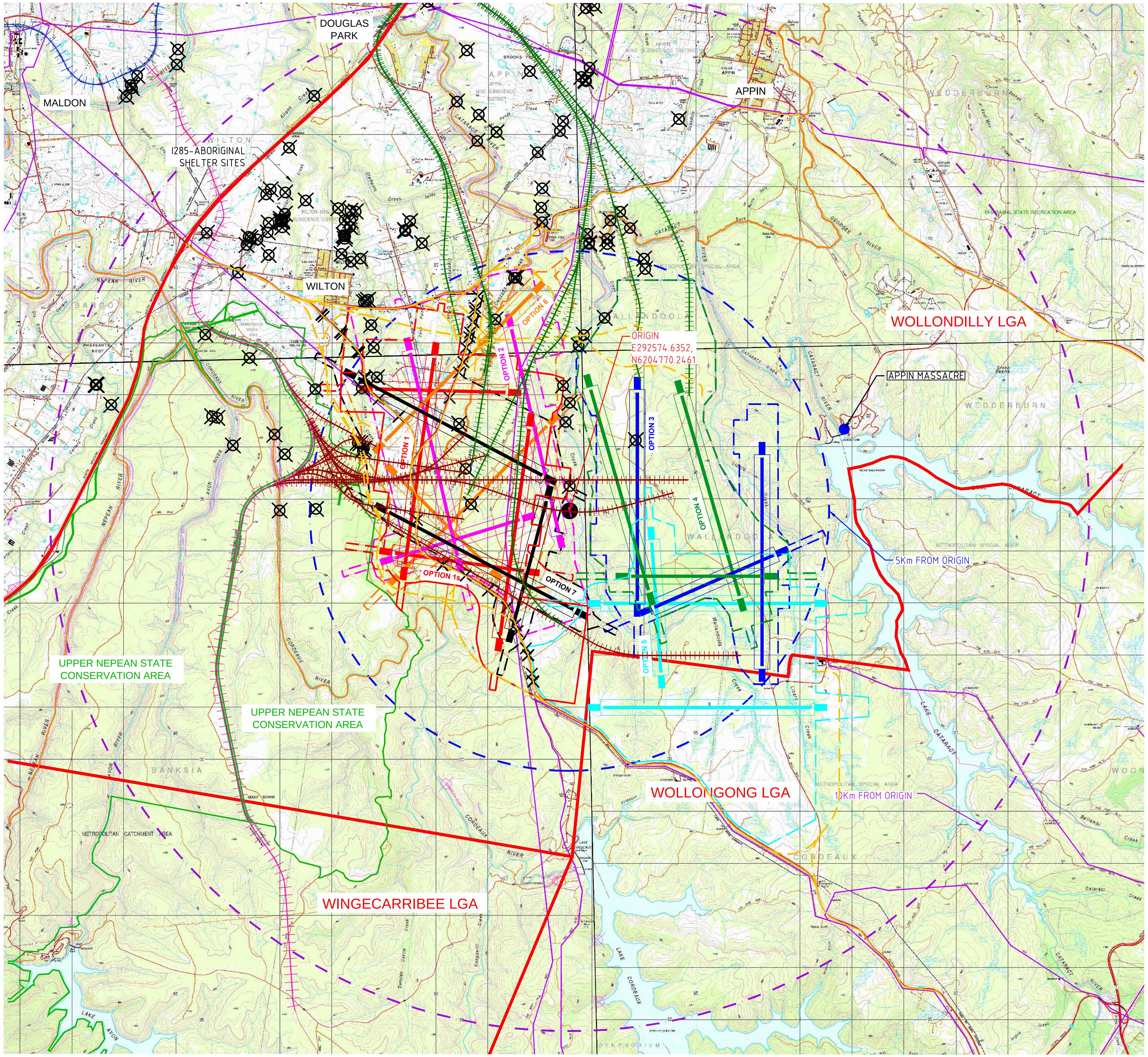
BHP Billiton Illawarra Coal Appin Area 8, 9 and Macarthur -Exploration Program *"Review Of Environmental Factors- For the NSW Department of Industry and Investment"*

NOTES

1. 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.
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.
3. The base map shown on this drawing is the 1:25,000 topographic map supplied by Lands Information Centre (2000). No reliance has been made on the accuracy of the map for cultural and heritage investigations.
4. Heritage locations on this drawing are based on Wollondilly LEP 2011, Heritage Map – Sheet HER_011B - 011C.
5. Appin massacre location taken from Monument Australia webpage.
6. Aboriginal Sites in this drawing are based on data received from AHIMS search.

LEGEND

- Approximate Location of Existing Rail Line
- Approximate Proposed Maldon to Dombarton Rail Line
- Approximate Location of Hume Highway
- Approximate Location of Wilton and Appin Road
- Road to be Removed
- New Road Alignment
- Rail - Option A
- Rail - Option B
- Center of origin for the 5km and 10km zones
- Aboriginal heritage site as per AHIMS searches



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A	29.06.12	DRAWING CREATED
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NORTH

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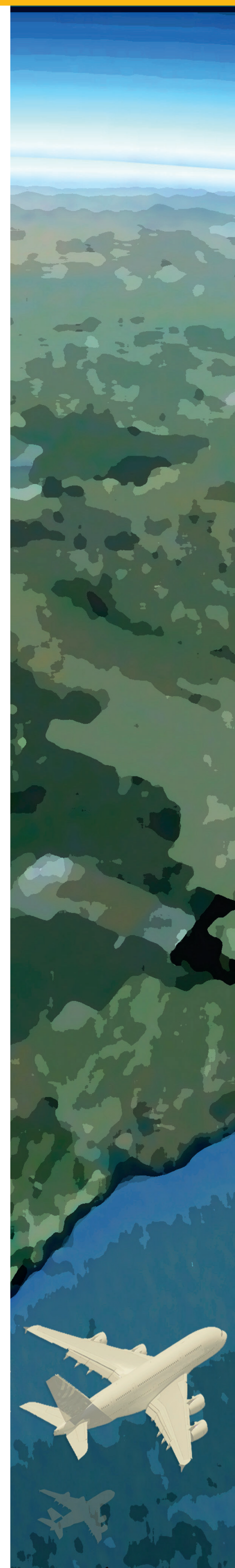
FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
INDIGENOUS CULTURAL HERITAGE SITE MAP
WP-301015-03019-ICH-SK-001

PLOT DATE & TIME: 1/8/2012 3:59:01 PM USER NAME: enosh.newar LOCATION: W:_INFRASTRUCTURE\PROJECTS\301015\03019 DITRD FURTHER ASSESSMENT OF AIRPORT SITES\11.0 DRAWINGS\DRGS\MAPPING\SKETCHES\WP-301015-03019-ICH-SK-001 - WILTON ABORIGINAL HERITAGE SITE MAP.DWG
SAVE DATE & TIME: 31/7/2012 4:35:41 PM CTB FILE: _00-WP-Syd-std.ctb Plotter:\\ausydwpprt01v\L10SYDRICOH3500RPCS

6

Social and Economic Analysis



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DEPARTMENT OF INFRASTRUCTURE & TRANSPORT

Further Assessment of Airport Development Options at Wilton

Social and Economic Analysis

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CONTENTS

1 WORKING PAPER – AIRPORT SAFEGUARDING (EXCEPT NOISE)

SUMMARY

This Working Paper presents an assessment of the suitability of the options described in the Working Paper *Wilton Airport Site Selection and Airport Concepts* in terms of airport safeguarding issues and third party risks.

A *National Airports Safeguarding Framework* ('*the Framework'*) was released by the Department of Infrastructure and Transport in May 2012. The primary issue from the Framework in this Working Paper is Obstacle Limitations Surfaces (OLS). Drawings have been developed of the impact of the airport site options based on the OLS established in this Working Paper. They show:

- The Obstacle Limitation Surfaces for the runways;
- The terrain penetration (obstacles) for the lowest OLS surface; and
- The highest points of penetration.

It should be noted that the presence of obstacles within the OLS is not unusual and not necessarily a problem, within the context described in this Working Paper. To evaluate the effect of obstacles on precision instrument approach operations (ILS or MLS), the obstacle assessment procedure for the Basic ILS is generally accepted: when *ICAO Annex 14* (or *CASA MOS 139*) obstacle assessment surfaces are penetrated, Obstacle Assessment Surfaces (OAS) as defined in *ICAO Doc 8168 Vol II* are used for assessment. At this stage, this is considered to be acceptable for all airport options.

Additionally consideration has been given to the third party risk associated with aircraft accidents through the use of the UK NATS public safety zone in options development.

1.1 Introduction

This Working Paper presents a preliminary assessment of the suitability of airport options described in the Working Paper *Wilton Airport Site Selection and Airport Concepts*, by considering the following that may occur from the development of each option and differentiate between options:

- Airport safeguarding issues, which include:
  - Obstacle Limitation Surfaces (OLS);
  - Protection of Instrument Operations Procedures for Air Navigation Services – Operations (PANS-OPS) Surfaces;
  - Building Generated Windshear and Turbulence;
  - Wildlife Strikes in the Vicinity of the airport concepts; and
  - Lighting in the Vicinity of the airport concepts;
- Third party risk by the application of public safety zones.

It is prepared in the *National Airports Safeguarding Framework* strategic context of the Department of Infrastructure and Transport. This Working Paper does not examine aircraft noise, which is discussed in the Working Papers *Acoustic Footprints, Acoustic Effects on People and Property Impacts*.

1.2 Airport safeguarding

1.2.1 Background

Airports are critical pieces of national infrastructure and suitable locations for airports are scarce. The current and future viability of aviation operations at Australian airports can be threatened by inappropriate off-airport development. Communities under flight paths and near airports can be affected by issues including noise, development restrictions and safety risks. In the interest of safety and public amenity development needs to be carefully managed in the vicinity of airport operations. However, there is also a need for airports to be easily accessible to population centres. There is a need to ensure that developments are undertaken in a way that is compatible with airport operations, both now and into the future.

A key initiative of the Australian Government's *Aviation White Paper* (released in December 2009) is to safeguard airports and the communities in their vicinity and to develop, with state, territory and local governments, a national land use planning regime to apply near airports and under flight paths. The National Airports Safeguarding Advisory Group, comprising high-level Commonwealth, State and Territory transport and planning officials, has prepared the *National Airports Safeguarding Framework.*

Ministers agreed to implement the *Safeguarding Framework* at the Standing Council on Transport and Infrastructure (SCOTI) meeting on 18 May 2012.[1]

[1] (http://www.infrastructure.gov.au/aviation/airport_safeguarding/index.aspx accessed 8 June 2012).

1.2.2 Description of airport safeguarding framework

The *National Airports Safeguarding Framework* comprises:

- Principles for National Airports Safeguarding Framework;
- Guideline A: Measures for Managing Impacts of Aircraft Noise (considered in the Working Paper *Acoustic Footprint*):
  - Attachment 1 — Alternative Aircraft Noise Metrics;
  - Attachment 2 — Indicative Aircraft Noise Contours;
- Guideline B: Managing the Risk of Building Generated Windshear and Turbulence at Airports:
  - Guideline B: Executive Summary;
- Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports:
  - Attachment 1 — Wildlife Attraction Risk and Actions by Land Use;
  - Attachment 2 — Brisbane Airport Buffers;
- Guideline D: Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation;
- Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports:
  - Attachment 1 — Diagram of Maximum Intensity of Light Sources; and
- Guideline F: Managing the Risk of Intrusions into the Protected Airspace of Airports and it Attachments.

The national land use planning framework is to ensure future airport operations and their economic viability are not constrained by incompatible residential development, while at the same time to maintain safeguarding.

It is the responsibility of each state jurisdiction to implement the *Framework* into their respective planning systems.

Commonwealth, State and Territory Ministers considered the *Framework* at the Standing Council on Transport and Infrastructure (SCOTI) meeting on 18 May 2012. Ministers agreed to:

- The Principles for a National Airports Safeguarding Framework;
- Guidelines B to F, subject to their operation being reported back to SCOTI in 12 months; and
- Guideline A - Measures for Managing Impacts of Aircraft Noise, subject to its use being for the purpose of guiding strategic planning decisions and monitored, with a report back to SCOTI in 12 months and noting the Commonwealth's intention to seek a review by Standards Australia of Australian Standard AS 2021-2000 Acoustic Noise Intrusion- Building Siting and Construction (AS2021).

Furthermore, Ministers noted that the *Framework* and its implementation plan are likely to be refined over time to reflect:

- Processes that will address the review of AS2021 and Guideline A; and
- Any future guidance material to be incorporated within the National Airports Safeguarding Framework.

New South Wales noted they have reservations with the format of Guideline A.

Whilst the *Framework* is primarily about protecting airports from inappropriate off airport development, the same principles apply to an airport site selection and concepts and subsequent embedding into land use instruments and plans. If site selection in the Wilton study area can be done in a way to minimise safety and other risks and to avoid current plans for off airport development, then the principles of the *Framework* can be more readily implemented following airport development.

1.3 Legislative status

1.3.1 Australian Government

The overall legislative status for airport development and aviation operations is given in the Working Paper *National Transport Policy Context for Airport Development.*

Those legislated issues through *CAR 1988*, *CASR 1998* or *MOS Part 139 Aerodromes* in this Working Paper are:

- Obstacle Limitation Surfaces (OLS); and
- Lighting in the Vicinity of Aerodromes.

Procedures for Air Navigation Services – Operations (PANS-OPS) surfaces derive from the ICAO *Procedures for Air Navigation Services – Operations (PANS-OPS)*.

Further protection of the chosen OLS and PANS-OPS is given to leased Federal airports as protected airspace under Part 12 of the *Airports Act 1996* and the *Airports (Protection of Airspace) Regulations 1996* and through master planning processes under that *Act.* It is expected that any new airport developed by the Commonwealth would need to meet similar standards to those applying to existing leased Federal Airports.

1.3.2 NSW and Local Government

The NSW Department of Planning and Infrastructure has issued a standard LEP template for land use planning and for new LEPs. This template includes a standard clause for obstacle heights and aircraft noise which, typically for obstacle heights, is as taken from clauses 7.17 and 7.18 of *Liverpool LEP 2008* and given in Appendix A. This clause would apply in planning for the preferred option at Wilton.

1.4 Summary of issues from SSA Site Selection programme

As part of the Second Sydney Airport (SSA) Site Selection Programme, a Draft Environmental Impact Statement ('the Draft EIS') was prepared which contained a preliminary master plan for airport development at Wilton. The approach and departure surfaces for the preliminary master plan for the preferred east-west runway alignment had a gradient of 1.6%, thus meeting the then Department of Aviation's criteria (see Section 5.1). Apart from this, the Draft EIS is generally silent on OLS issues, except for in the site selection comparisons, the Wilton site rating highly on the degree to which the runway alignment can be altered within topographic and obstruction clearance limitations.

The other relevant principles/guidelines in the *National Airports Safeguarding Framework* were not considered – apart from aircraft noise.

The principle of third party risk or public safety zones was not a consideration in the Draft EIS and is still not part of the *Safeguarding Framework.*

1.5 Analysis of issues in terms of current airport concepts

1.5.1 Obstacle limitation surface

OLS protects the immediate airspace in the vicinity of the airport for visual operations and are based on specifications laid down in the CASA *Manual of Standards (MOS) 139 – Aerodromes* (*CASA 2012*) for the applicable runway classification. The OLS comprise a series of imaginary planes, which desirably should be kept free of obstacles to ensure the safety of the intended aircraft operations and to prevent the airport from becoming unusable by the growth of obstacles around the airport.

A check has been made of the most critical elements of the OLS for the Wilton runway options. One of these concerns the Instrument Precision approach surface for Code 4 runways, which is also used to determine the runway threshold location in relation to obstacle clearance requirements. The dimensions of the approach surface are:

- 300 m wide inner edge located 60 m beyond the threshold;
- Divergence of 15% on each side;
- A first section length of 3,000 m at a slope of 2%;
- A second section length of 3,600 m at a slope of 2.5%; and
- A horizontal section length of 8,400 m.

This is highlighted in **Table 1.1a** and illustrated in **Figure 1.1** based on *CASA MOS 139 - Aerodromes*.

Table 1.1a CASA Specifications for Obstacle Limitation Surfaces – Approach Runways MOS 139

OLS & Dimensions (in metres and percentages)	Runway Classification									
	Non-instrument				Instrument					
					Non-precision			Precision		
	Code No				Code No			I Code No		II & III Code No
	1*	2	3	4	1,2	3	4	1,2	3,4	3,4
OUTER HORIZONTAL										
Height (m)									150	150
Radius (m)									15000	15000
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height (m)	35	55	75	100	60	75	100	60	100	100
INNER HORIZONTAL										
Height (m)	45	45	45	45	45	45	45	45	45	45
Radius (m)	2000	2500	4000	4000	3500	4000	4000	3500	4000	4000
APPROACH										
Length of inner edge (m)	60	80	150[a]	150	90	150	300[b]	150	300	300
Distance from threshold (m)	30	60	60	60	60	60	60	60	60	60
Divergence each side	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%

OLS & Dimensions (in metres and percentages)	Runway Classification									
	Non-instrument				Instrument					
					Non-precision			Precision		
	Code No				Code No			I Code No		II & III Code No
	1*	2	3	4	1,2	3	4	1,2	3,4	3,4
First section length (m)	1600	2500	3000	3000	2500	3000	3000	3000	3000	3000
Slope	5%	4%	3.33%	2.5%	3.33%	3.33%	2%	2.5%	2%	2%
Second section length (m)	-	-	-	-	-	3600[c]	3600	12000	3600	3600
Slope	-	-	-	-	-	2.5%[c]	2.5%	3%	2.5%	2.5%
Horizontal section length (m)	-	-	-	-	-	8400[c]	8400	-	8400	8400
Total length (m)	1600	2500	3000	3000	2500	15000[d]	15000	15000	15000	15000
INNER APPROACH										
Width (m)								90	120	120
Distance from threshold (m)								60	60	60
Length (m)								900	900	900
Slope								2.5%	2%	2%
TRANSITIONAL										
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
INNER TRANSITIONAL										
Slope								40%	33.3%	33.3%
BAULKED LANDING										
Length of inner edge (m)								90	120	120
Distance from threshold (m)								[e]	1800[f]	1800
Divergence each side								10%	10%	10%
Slope								4%	3.3%	3.3%

Notes All distances are measured horizontally unless otherwise specified.

* Runways used for RPT operations at night by aircraft with maximum take-off mass not exceeding 5,700 kg are required to meet code 2 standards.

[a] 90 m where width of runway is 30 m.

[b] 150 m if only used by aeroplanes requiring 30 m wide runway.

[c] No actual ground survey required unless specifically required by procedure designer Procedure designer will use topographical maps and tall structure databank to determine minimum altitudes.

[d] Approach area up to this distance needs to be monitored for new obstacles. Refer to Procedure designer's advice on significant high ground or tall structure that needs monitoring.

[e] Distance to end of runway strip.

[f] Or to the end of the runway strip, whichever is less.

The other OLS concerns take-off / surfaces as highlighted in **Table 1.1b**.

Table 1.1b CASA Specifications for Obstacle Limitation Surfaces – Take-Off Runways MOS 139

Take-off climb surface Dimensions (in metres and percentages)	Take-off Runways Code number		
	1*	2[a]	3 or 4
Length of inner edge	60	80	180 [b]
Minimum distance of inner edge from runway end [c]	30	60	60
Rate of divergence (each side)	10%	10%	12.5%
Final width	380	580	1800 [d]
Overall length	1600	2500	15000
Slope	5%	4%	2%[e]

Notes All dimensions are measured horizontally unless otherwise specified.

* Runways used for RPT operations at night by aircraft with maximum take-off mass not exceeding 5,700 kg are required to meet code 2 standards.

[a] For aircraft above 5,700 kg the survey area does not cover full extent of obstacle clearance required as specified in CAO 20.7.1 B.

[b] The length of the inner edge may be reduced to 90 m if the runway is intended to be used by aeroplanes having an mass less than 22,700 kg and operating in VMC by day. In this case the final width may be 600 m, unless the flight path may involve a change of heading in excess of 15°.

[c] The take-off climb starts from the end of clearway if a clearway is provided.

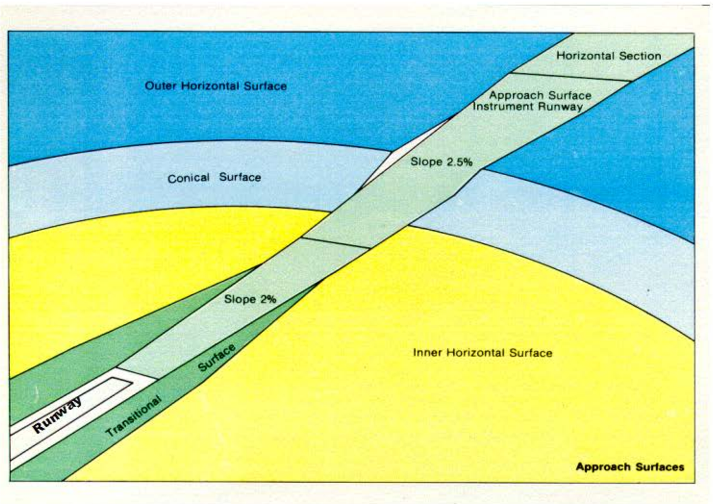
[d] The final width may be reduced to 1200 m if the runway is used only by aircraft with take-off procedure which does not include changes of heading greater than 15° for operations conducted in IMC or at night.

[e] The operational characteristics of aircraft for which the runway is intended should be examined to see if it is desirable to reduce the slope to cater for critical operating conditions as specified in CAO 20.7.1 B. If the specified slope is reduced, corresponding adjustment in length for take-off climb is to be made so as to provide protection to a height of 300 m. If no

object reaches the 2% take-off climb surface, new objects should be limited to preserve the existing obstacle free surface or a surface down to a slope of 1.6%.

These airspace requirements in the form of the above defined imaginary surfaces in the air which may not be significantly breached by obstacles extend 15 km from and beyond the runway.

Figure 1.1 Approach surface for an instrument approach runway



Source: CASA 2012

Analysis

An OLS template has been developed based on the information *for a take-off and an approach surface only,* the most critical element of the OLS for the parallel runways and the cross runway. This concerns the Instrument Precision approach surface for Code 4 runways. It was applied to see whether the various components of the OLS can be accommodated, given the surrounding terrain. This template was applied over the standard 1:25,000 topographical mapping available for the area. It should be noted this assessment only looks at terrain clearance based on the vertical accuracy of +/- 5m applicable to the contours shown on the base mapping. It does not fully address any natural or man-made obstacles which may be present in the relevant location, given the lack of data available.

The options in the Working Paper *Wilton Airport Site Selection and Airport Concept* incorporate this criterion and work and the Obstacle Limitation Surface drawings and impacts are in Section 1.7.

1.5.2 Protection of instrument operations by Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces

A second group of criteria is used to determine the volumes and dimensions of airspace required to protect the safety of Instrument Flight Rule (IFR) operations. Under IFR operations, pilots fly aircraft relying on instruments for navigation. Airspace protection for IFR operations cannot allow for any long term penetrations.

ICAO established these criteria which are published in a document titled Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS). The surfaces determined by using the criteria in the PANS-OPS publication are called PANS-OPS surfaces.

Analysis

These surfaces have not been assessed for the runway options. Generally, the PANS-OPS surfaces are above the OLS. For instrument runways, the PANS-OPS surfaces also extend beyond the OLS of the airport. They have been considered in general terms in Section 5.

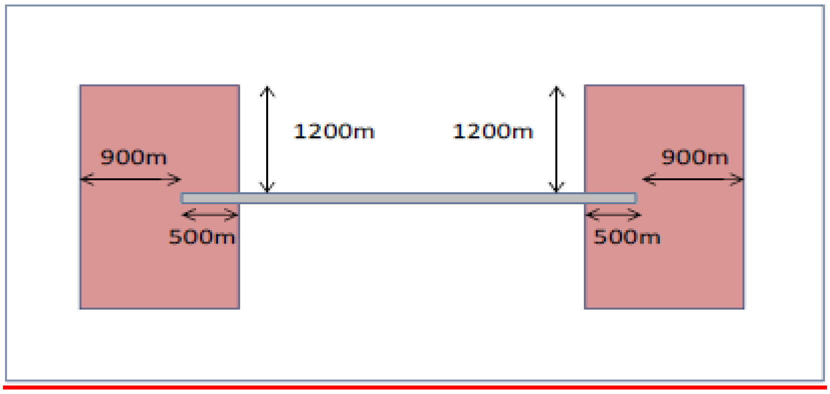
1.5.3 Building generated windshear and turbulence at airports

Guideline B of the *Safeguarding Framework* identifies research conducted by the Aeronautical Research Laboratory of the Netherlands (NLR) which indicates that this safety risk is highest for buildings between the runway and 200feet above the runway[2]. This research was conducted in response to safety incidents at Amsterdam airport caused by building induced wind effects.

As shown in **Figure 1.2**, buildings that could pose a safety risk are those located:

- 1200 m or closer perpendicular to the runway centreline; or
- 900 m or closer in front of runway threshold (i.e. towards the landside of the airport); or
- 500 m or closer from the runway threshold along the runway.

Figure 1.2 Envelope around runways within which buildings should be assessed



At airports, a combination of strong runway cross winds and obstacles to the prevailing wind flow such as large buildings can create:

- Low-level wind shear (horizontal and vertical);
- additional (building-generated) turbulence; and
- Vortices.

[2] That is, the safety risk is highest for landing and departing aircraft when the aircraft are below a height of 200 feet above the runway.

For stand-alone buildings, the first step is to rely on a *'height multiplier'* rule to determine the acceptability of buildings. The rule to be adopted in Australia is based on one developed in the Netherlands. This proposes that buildings with a distance to the runway centre-line that is less than 35 times the height of the building (the 1:35 rule) should be subject to aerodynamic modelling. The 1:35 rule can be applied to rule out buildings that will clearly not pose a risk. This rule will therefore be applied as the first test that will be applied when regulators are presented with a building to assess. This approach will enable the vast majority of developments at airports to be assessed very quickly. The rule is very conservative and any building that meets this test will not create unsafe wind effects.

For buildings that do not meet the 1:35 rule, an alternative approach is required. This approach is the adoption of a windshear criterion to be applied as the basis of regulatory controls. NLR developed the following criterion:

The variation in mean wind speed due to wind disturbing structures must remain below 7 knots along the aircraft trajectory at heights below 200ft. The speed deficit change of 7 knots must take place over a distance of at least 100m.

This criterion has been adopted in the *Safeguarding Framework* to apply in Australia.

Analysis

These *Guidelines* and criteria are taken into account in the siting of buildings in the airport concepts and are a matter for detailed planning of individual facilities. The primary impact is anticipated to be siting of buildings laterally, as the OLS and the requirement for runway lighting will mean the envelope on the runway alignments preclude building development. Consequently this is not a differentiating criterion between options.

1.5.4 Wildlife Strikes in the Vicinity of Airports

Part 139 of the *Civil Aviation Safety Regulations 1998* imposes an obligation on airports to reduce the risks of wildlife strikes. These regulations are administered by the Civil Aviation Safety Authority (CASA). All Certified Airports are required to document procedures for wildlife hazard management in their Aerodrome Manual.

Most wildlife strikes occur on and in the vicinity of airports, where aircraft fly at lower elevations. The risk of a strike on airport relates to the level and form of wildlife activity both within the boundary of an airport and in surrounding areas. Wildlife attracted to land uses around airports can migrate onto the airport or across flight paths, increasing the risk of strikes.

The International Civil Aviation Organisation (ICAO) has developed specific advice on land uses with the potential to become high risk wildlife attractants. These include:

- Food garbage disposal;
- Sewage treatment and disposal;
- Artificial and natural lakes;
- Abattoirs and freezing works;
- Fish processing plants;
- Bird sanctuaries; and
- Outdoor theatres.

Table 1.2 aligns with international benchmarks set by ICAO and other international aviation regulators. It provides guidance on the land uses that present a risk of attracting wildlife and triggers (based on distance from an airport) for adopting active measures to mitigate that risk. **Table 1.2** is a tool to assess plans for new or revised land uses within 3 km, 8 km and 13 km of an airport.

Table 1.2 Land uses that present a risk of attracting wildlife

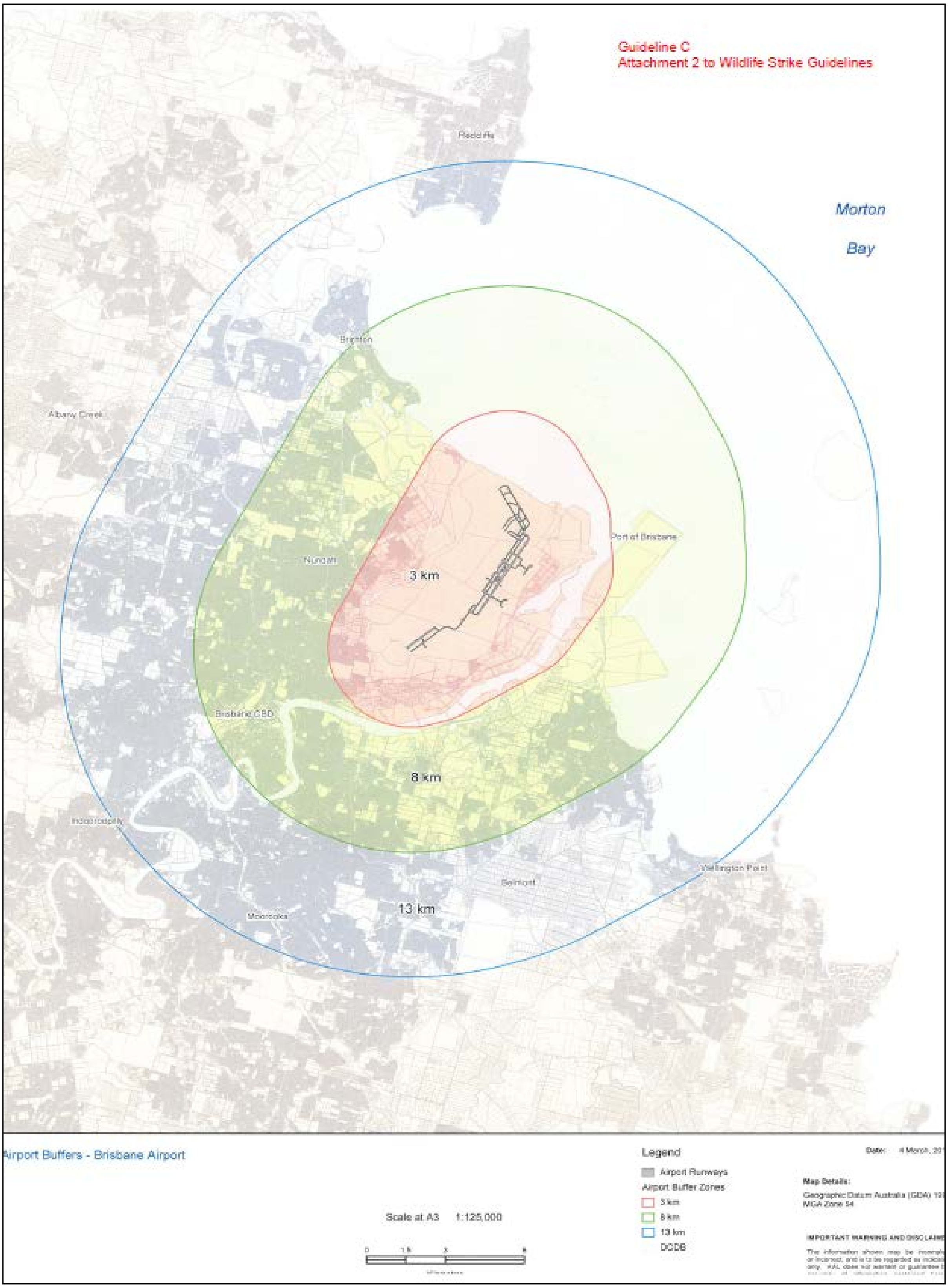
Prepared by the Australian Aviation Wildlife Hazard Group

Guideline C
Attachment 1 to Wildlife Strike Guidelines

Land Use	Wildlife Attraction Risk	Actions for Existing Developments			Actions for Proposed Developments/ Changes to Existing Developments		
		3 km radius (Area A)	8 km radius (Area B)	13 km radius (Area C)	3 km radius (Area A)	8 km radius (Area B)	13 km radius (Area C)
Agriculture							
Turf farm	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Piggery	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Fruit tree farm	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Fish processing /packing plant	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Cattle /dairy farm	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Poultry farm	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Forestry	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Plant nursery	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Conservation							
Wildlife sanctuary / conservation area - wetland	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Wildlife sanctuary / conservation area - dryland	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Recreation							
Showground	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Racetrack / horse riding school	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Golf course	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Sports facility (tennis, bowls, etc)	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Park / Playground	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Picnic / camping ground	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Commercial							
Food processing plant	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Warehouse (food storage)	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Fast food / drive-in / outdoor restaurant	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Shopping centre	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Office building	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Hotel / motel	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Car park	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Cinemas	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Warehouse (non-food storage)	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Petrol station	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Utilities							
Food / organic waste facility	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility - landfill	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility - transfer station	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Non-putrescible waste facility - landfill	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Non-putrescible waste facility - transfer station	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Sewage / wastewater treatment facility	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Potable water treatment facility	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action

Figure 1.3 shows these buffer areas for Brisbane Airport.

Figure 1.3 Brisbane Airport wildlife strike buffers



Analysis

The buffer areas would need to be modified to apply to reflect the runway configurations in the Working Paper *Wilton Airport Site Selection and Airport Concepts*. However, as they are unlikely to be a significant differentiation criterion, they have not been included for analysis in Working Paper *Risks and Site Hazards*.

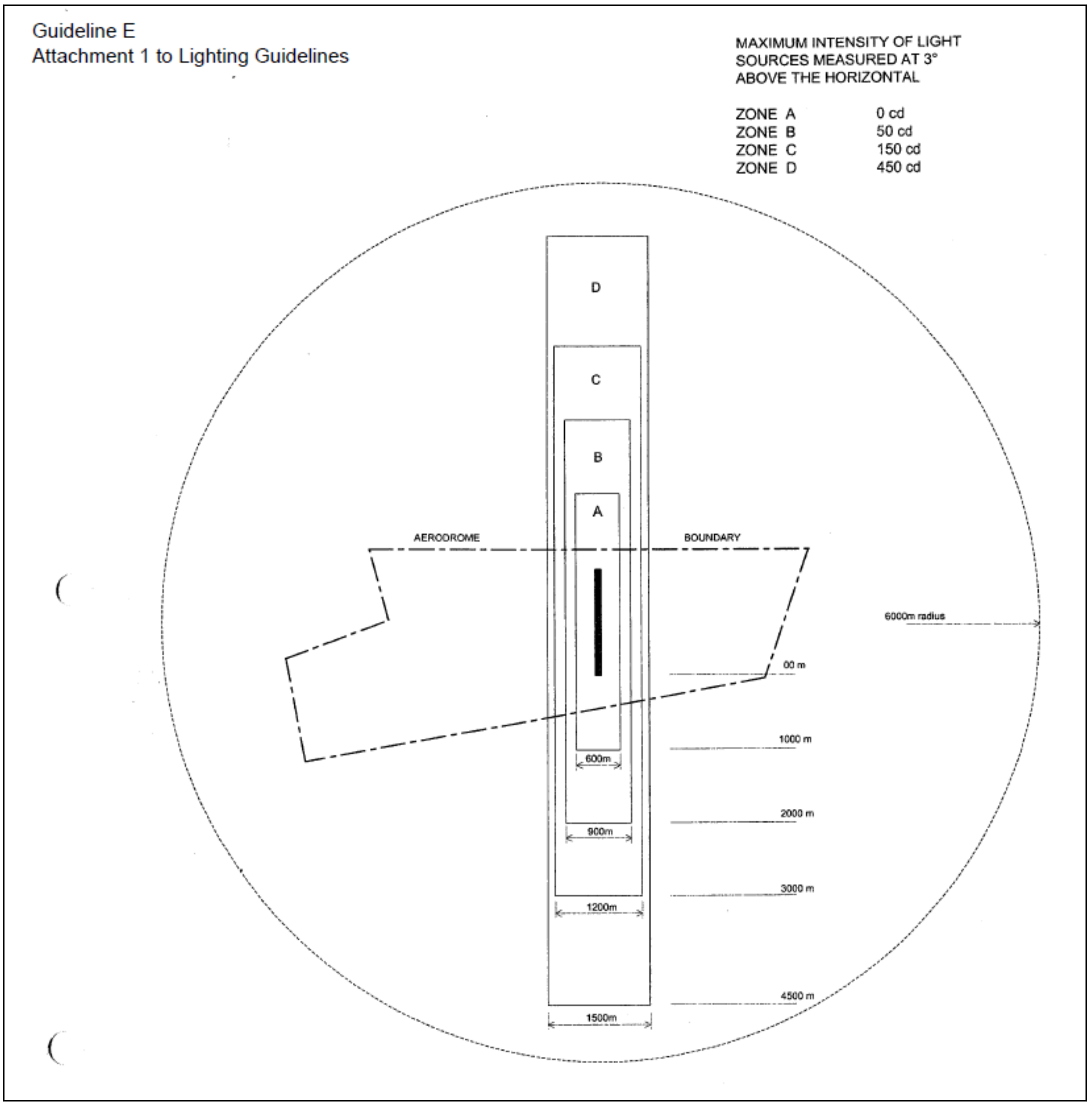
These buffer areas should be shown as a planning overlay in the affected planning schemes for any approved airport concept. See Section 1.6.1.

1.5.5 Lighting in the vicinity of airports

The *Safeguarding Framework* contains guidelines to assist development proponents and planning authorities to ensure that lighting in the vicinity of airports does not compromise aviation safety. They should assist also in maintaining compliance with Regulation 94 of the Civil Aviation Regulations 1988.

Advice for the guidance of designers and installation contractors is provided for situations where lights are to be installed within a 6 km radius of a known aerodrome. Lights within this area fall into a category most likely to be subject to the provisions of Regulation 94 of CAR 1988. Within this large area there exists a primary area which is divided into four light control zones: A, B, C and D. These zones reflect the degree of interference ground lights can cause as a pilot approaches to land. The primary area is shown in **Figure 1.4**.

Figure 1.4 Zones of maximum intensity of light sources



Analysis

This is primarily an issue for the detailed airport master plan and design and off-airport land use planning at a later time and is not a differentiating criterion between options.

1.6 Public safety zones

1.6.1 Aviation Policy White Paper

In the *National Aviation Policy White Paper (Department of Infrastructure, Transport, Regional Development and Local Government 2009)*, the Australian Government indicated its intention to work with state, territory, local governments and industry stakeholders to undertake a detailed examination of the implications of public safety zones in the vicinity of airports. This policy initiative followed an earlier Discussion Paper associated with the Green Paper, entitled *Safeguards for airports and the communities around them* (*Department of Infrastructure, Transport Regional Development and Local Government 2009*) which was released with the aim of increasing public safety and protecting aviation infrastructure from inappropriate development around airports and under flight paths. The Discussion Paper noted that with the exception of Queensland, there are no guidelines or standards currently operating in Australia. Nor is this issue considered in the *National Airports Safeguarding Framework* in Section 1.2 of this Working Paper.

The *Aviation Policy White Paper* notes that the boundaries of a Public Safety Zone (PSZ) would be determined by reference to levels of statistical chance of an accident at a particular location. The number of aircraft movements, and the distance of the location from the critical take-off and landing points, would be considered to model the total statistical chance of a fatal accident at the location over a one-year period. In line with the broad approach to PSZs overseas, a conservative approach might be adopted, with the PSZ defined, for example, to include those areas where it is assessed that there would be more than a one in 100,000 chance of a fatality in a year.

The PSZ system is primarily a means for focussing attention on potential new developments, but a defined PSZ may also include areas where development already exists. Overseas experience suggests the impact of introducing PSZs would be limited, and that remedial action for existing development has rarely been called for.

Where a PSZ is identified, additional scrutiny might be considered for new developments that:

- Increase residential use and population density in the zone;
- Attract large numbers of people, such as major retail or entertainment developments;
- Involve institutional uses, such as schools and hospitals;
- Involve the manufacture or depot storage of noxious and hazardous materials; and
- Attract significant static traffic.

Examples of new developments that would not be affected may include:

- Property extensions not increasing population density;
- Warehouse development (where the number of people is low);
- Low intensity use public open space, but not playgrounds and sports grounds;
- Long stay surface car parking;
- Agriculture and mineral extraction (not increasing bird hazards); and
- Road and rail infrastructure – risk assessed.

PSZs as described in this Section have been adopted for options differentiation and in the airport options in the Working Paper *Wilton Airport Site Selection and Airport Concepts*.

1.6.2 Existing Australian Public Safety Area Guidelines - Queensland Government Policy

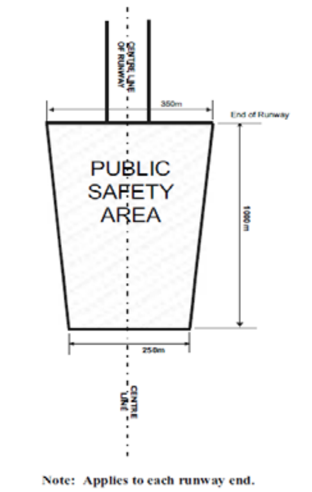
Within its *State Planning Policy 1/02* and associated guidelines, the Queensland Government has requirements for public safety areas (PSA) which are applicable at a number of Queensland aerodromes. The PSA are based on UK research undertaken in the late 1990's by NATS (see Section 1.6.3)) and on which UK public safety zone policy is currently based.

Although these PSA requirements only apply in Queensland, some airports in other jurisdictions, e.g. Bankstown Airport, nevertheless apply the Queensland PSA in the absence of the national policy still to be determined. The Queensland policy seeks to avoid significant increases in people living, working or congregating in the PSA and the use or storage of hazardous materials. In the PSA, the risk of an accident is sufficient to justify restrictions on development within those areas. Increased risks to public safety can arise from development that involves the following:

- Residential uses;
- The manufacture or bulk storage of inflammable, explosive or noxious materials;
- Uses that attract large numbers of people e.g. sports stadium, shopping centre, industrial uses involving large numbers of workers or customers; or
- Institutional uses e.g. schools, hospitals.

The Queensland *State Planning Policy 1/02* dimensions for a public safety area for all runway ends are given in **Figure 1.5**.

Figure 1.5 Queensland Planning Policy dimensions for a public safety area



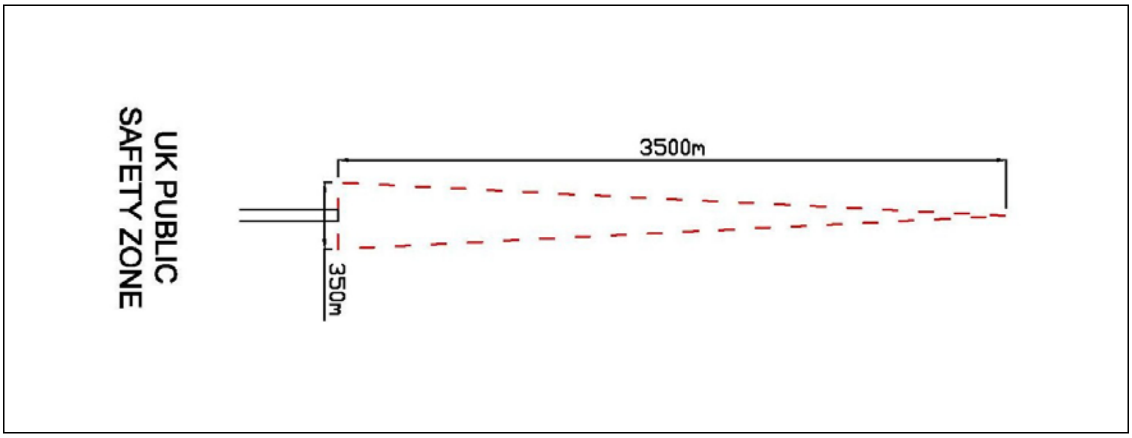
Explanatory Notes:

1. The dimensions above indicate an area where the risk per year, resulting from an aircraft crash, to a representative individual (individual risk) is of the order of 1 in 10,000 (10^{-4}).
2. The dimensions also partially enclose an area of individual risk of the order of 1 in 100,000 (10^{-5}). As general guidance, it would be inappropriate for a use described in Section 6.13 of the SPP to be exposed to a higher individual risk than 1 in 10,000 (10^{-4}).

1.6.3 UK Policy

The UK NATS *R&D Report 9636 Third Party Risk Near Airports and Public Safety Zone Policy (National Air Traffic Services Limited, June 1997)* divides airports requiring development restrictions into two classes based on their movements and uses triangles with fixed dimensions of 0.35 km width and 3.5 km long for the busier airports and two thirds of these for the less busy airports, as shown in **Figure 1.6**, for all runway ends. This is based on setting the areas for Public Safety Zones corresponding to the zones which experience individual risk of 10^{-5} (1 in 100,000) or greater.

Figure 1.6 End of runway contour corresponding approximately to the 10^{-5} contour



Analysis

The Queensland *State Planning Policy 1/02* dimensions for a public safety area has been shown on all runway ends in the airport concepts in Working Paper *Wilton Airport Site Selection and Airport Concepts*, as is customary for airport planning in the absence of a national policy in the *National Airports Safeguarding Framework*.

The Queensland *State Planning Policy 1/02* dimensions for a public safety area should be shown as a planning overlay in the affected planning schemes for any approved airport concept. See Section 1.1.[3]

1.7 Potential impacts of obstacle limitation surfaces

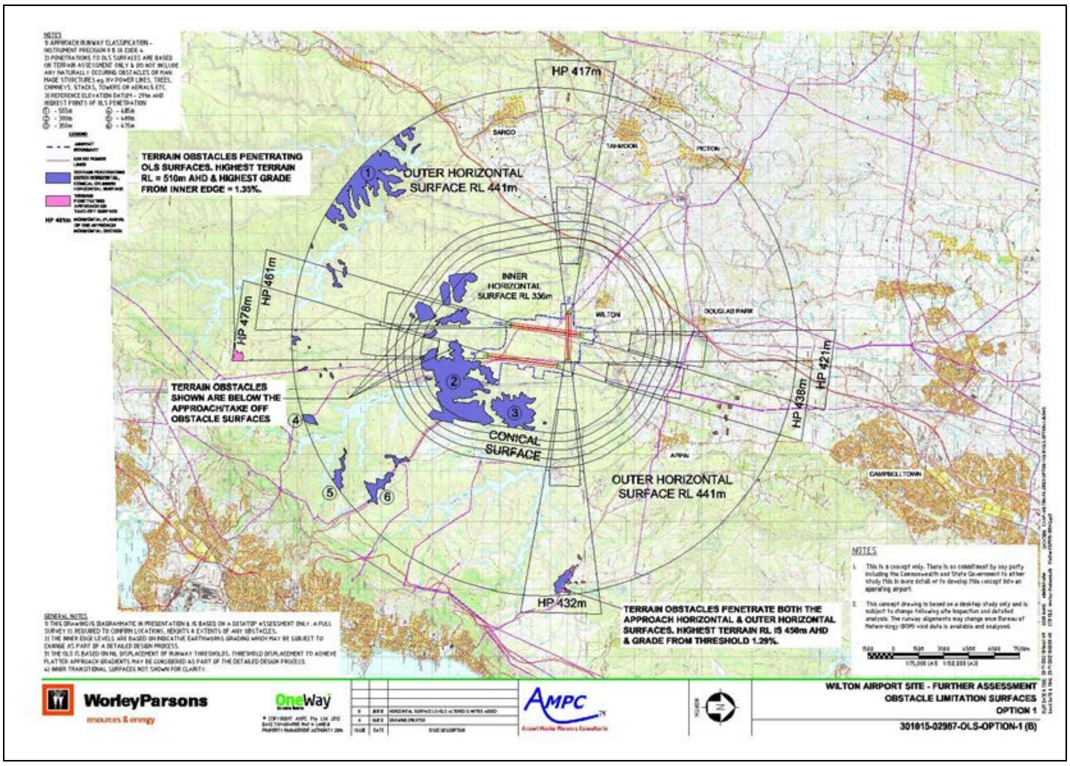
This Section assesses the impacts of the OLS for the options. The impacts of the other airport safeguarding criteria are considered non-differentiating between options in Section 5.

The impact for Option 1 based on the Obstacle Limitation Surfaces established in Section 1.7 is in **Figure 1.7**, which shows:

- The OLS for the runways;
- The terrain penetration (obstacles) for the lowest OLS surface in blue; and
- The highest points of penetration.

[3] Note that the Lucas Heights nuclear facility is protected by the restricted airspace R521. It is 20 km from Sydney Airport and 28 km from Wilton. It is unlikely that aircraft operations would need to be conducted at 2,000 feet or below, through the designated Restricted Area and the site is distant from the area defined by the UK NATS public safety zone.

Figure 1.7 Obstacle limitation surfaces for Option 1



The impact for Option 3 is in Figure 1.8, with the terrain penetration (obstacles) for the lowest OLS surface shown in blue and red. These are considered representative options for OLS purposes, as the Aerodrome Reference Points (ARPs) are similar for the remaining options.

Figure 1.8 Obstacle limitation surfaces for Option 3

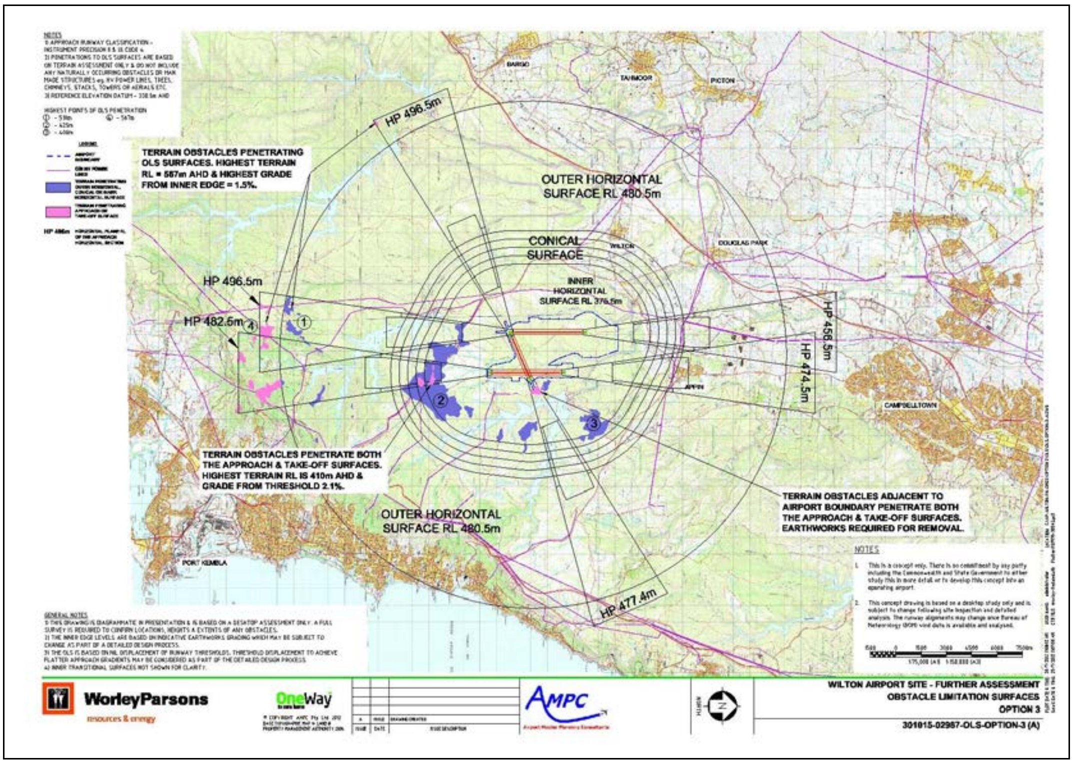


Table 1.3 summarizes the terrain obstacles penetrating the take-off/approach surfaces for the other options.

Table 1.3 Terrain obstacles penetrating take-off/approach surfaces for other options

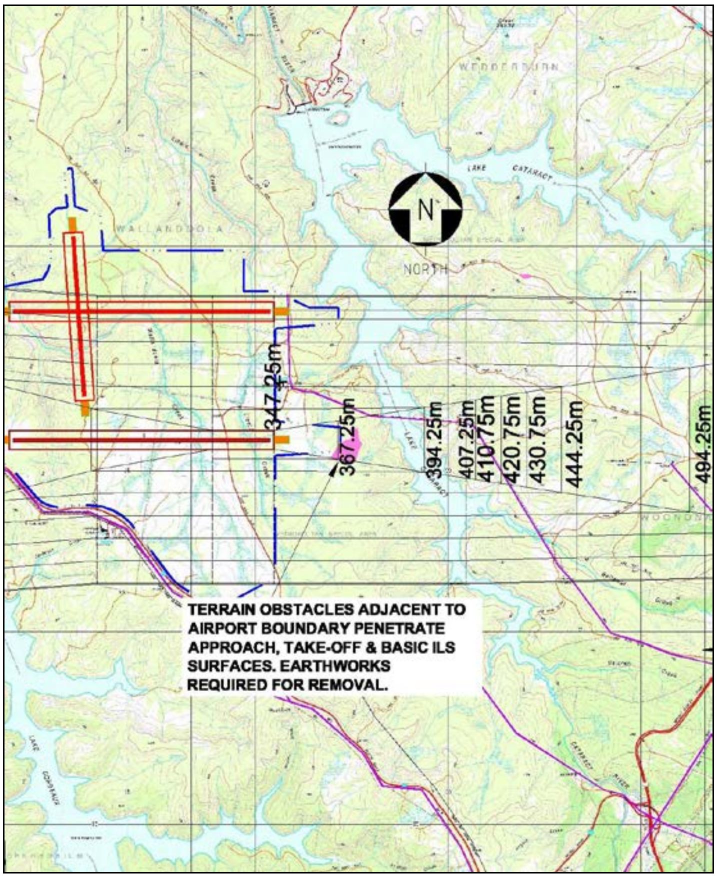
Option	Obstacle Location Measured from end of Runway Noted	Terrain RL (m AHD)	Surface Infringed	Grade %	Comments
1S	As for Option 1 with Nil obstacles on cross runway				
2	15 km West - cross runway	472	Approach	1.05	<2%
	12.75 km South - main runways	510	Approach	1.44	<2%
4	14.1 km South - main runways	540	Approach	1.4	<2%
5	3.83 km East –main northern runway	410	Take-Off	2.05	>2% (clear of ILS)
	0.97 km East - main southern runway	370	Take-Off & Approach	2.35	>2% (infringes ILS)
	11.7 km South - cross runway	510	Approach	1.39	<2%
	12.7 km South - cross runway	540	Approach	1.51	<2%
	13.1 km South - cross runway	560	Approach	1.62	<2%
6	11.2 km South-East - cross runway	470	Approach	1.38	<2%
	12.2 km South-East - cross runway	480	Approach	1.35	<2%
	11.4 km South-West - main northern runway	450	Approach	1.45	<2%
	14.7 km South-West - main northern runway	560	Approach	1.88	<2%
	10.75 km South-West - main southern runway	480	Approach	1.56	<2%
	11.4 km South-West - main southern runway	530	Approach	1.91	<2%
	12.2 km South-West - the main southern runway	550	Approach	1.95	<2%
	13.04 km South-West - main southern runway (Fire tower approx. 20 m higher assumed to be relocated)	573	Approach	2.00	=2%
7	NIL				

<u>NOTE</u> *Penetrations of OLS Surfaces are based on terrain assessment only and do not include any naturally occurring obstacles or man-made structures e.g. High Voltage power lines, trees, chimneys, stacks, towers or aerials etc.*

Table 1.3 indicates that for all of the other listed options, except for Option 5, that a gradient from runway strip end to terrain of 2% or less is achievable (based on assumed runway end levels). For Option 5 some earth works off-site (but adjacent to the proposed site boundary) are required. **Figure 1.10** illustrates the basic ILS obstacle assessment surface for Option 5 to the east of the southern main runway. As can be seen there are some terrain penetrations shown to this surface. The earthworks will provide clearance to the OLS surfaces close to the end of the runway.

The current assessment is limited to terrain. Detailed survey may identify other obstacles such as power lines, trees, communication towers etc. that may need to be assessed for relocation, lowering and/or marking and lighting.

Figure 1.10 Basic ILS obstacle assessment surface for Option 5 to the east



The following process in these circumstances where terrain obstacles exist is from *Kazda and Caves* (see references).

Usually the significance of any object in the airport surroundings is assessed by two separate groups of basic criteria. The first is the OLS for the particular runways and their intended operation as has been done in the figures. As described in Section 3, *CASA MOS 139 – Aerodromes* is the basis for this assessment. It should be noted that the presence of obstacles within the OLS is not unusual and not necessarily a problem, within the following context.

The second set of criteria relates to the *Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS*) (*ICAO Doc 8168*). Surfaces defined by this standard guarantee obstacle free airspace for instrument and visual flight procedures by specifying minimum heights/altitudes for each segment of the procedure. The limits depend on the installed navigational equipment, its type and position and also on the speed of an aircraft.

It is not possible to give a simple rule for an objective assessment, as to whether everything that exceeds specified limits must be banned or whether an object that does not penetrate a defined surface is not considered an obstacle, as no two airports and no two obstacles are alike. To consider all aspects of the problem, CASA may still allow operation on the basis of a study, often using the ICAO Collision Risk Model.

To evaluate the effect of obstacles on precision instrument approach operations (ILS or MLS), the following obstacle assessment procedure is generally accepted: when *ICAO Annex 14* (or *CASA MOS 139*) obstacle limitation surfaces are penetrated, Obstacle Assessment Surfaces (OAS) as defined in *ICAO Doc 8168 Vol II* are used in lieu of *ICAO Annex 14* surfaces*.* When even OAS are penetrated, the Collision Risk Model (CRM) is utilised. However, in the latter case, the complete obstacle situation in the vicinity of the airport has to be fully transformed into the CRM format, as the risk corresponding to each individual obstacle contributes to the cumulative risk of the approach.

Obstacles in the take-off climb and approach surfaces and in the transitional surfaces are assessed most stringently. The construction of new obstacles or extensions of existing obstacles shall not be permitted if they would penetrate the *Annex 14* surfaces. It is, however, not always possible to eliminate the occurrence of obstacles. Then it is necessary to determine special operating procedures such as offset approach or take-off trajectory, or install special equipment for the runway, or limit the runway operation with higher visibility and ceiling operating limits as well as marking and lighting the obstacles.

If the obstacles only penetrate the conical surface or the inner horizontal surface, less stringent criteria are used. Even in that case, for an assessment of a specific obstacle, the location and character of the obstacle are important. It is necessary to investigate whether the obstacle is shielded by an existing immovable object, or to prove by an aeronautical study that the object would not adversely affect the safety or the regularity of operations of aircraft.

Some objects may be considered particularly dangerous and should be removed or at least marked even if they do not obstruct any obstacle limitation surfaces. They are in particular, isolated thin objects such as chimneys, poles and posts, or aerial high and extra high tension transmission lines in the approach and take-off surfaces. CASA may order removal (e.g. trees) or marking (e.g. aerial high tension transmission line) of any object that might after aeronautical study endanger aircraft on the airport movement area or in the air. The object should generally be removed by its owner, not by the airport operator. Notification to CASA of objects 100 m above ground level is compulsory and the marking of objects which extend to a height of 150 m or more above ground level is generally compulsory.

1.8 Summary of mitigation methods and strategies

The options development and site selection process have been undertaken using relevant criteria identified in this Working Paper.

1.9 Residual impacts

1.9.1 Future planning

With approval of a Wilton airport proposal, following an EIS process, the NSW Government and Wollondilly and Wingecarribee Councils should incorporate relevant criteria in Section 5 as Local Environmental Plan (LEP) amendments and planning scheme overlays as identified in this Paper, together with appropriate restrictions and development assessment in a planning scheme amendment – to ensure appropriate controls and assessment of future land uses, which may result in increased risks arising from the issues in this Paper.

1.9.2 Obstacle limitation surfaces

The further process for the assessment of the terrain obstacles in Section 1.7 will need to be undertaken in future detailed planning and an EIS process.

1.10 Key findings

Drawings have been developed of the impact for the site options runways based on the Obstacle Limitation Surfaces (relative only to terrain) established in this Paper, from the above documents. They show:

- The Obstacle Limitation Surfaces for the runways;
- The terrain penetration (obstacles) for the lowest OLS surface; and
- The highest points of penetration.

It should be noted that the presence of obstacles within the OLS is not unusual and not necessarily a problem, within the context described in this Paper. To evaluate the effect of obstacles on precision instrument approach operations (ILS or MLS), the following obstacle assessment procedure is generally accepted: when *ICAO Annex 14* (or *CASA MOS 139*) obstacle assessment surfaces are penetrated, Obstacle Assessment Surfaces (OAS) as defined in *ICAO Doc 8168 Vol II* are used for assessment. At this stage the OLS clearance to terrain for each option are considered feasible, but not ideal. There are penetrations to some surfaces and some off-site earth works have been identified. Additionally it is assumed that some man made obstacle such as power lines can be lowered or relocated. If further work were to be undertaken on any option detailed survey would be required of the surrounding terrain and obstacles including man made obstacles and trees would be required. The detailed design would then address final runway levels and an analysis of which obstacles were critical and may require removal or lowering or alternatively marking and lighting. This assessment can be supplemented by specific aircraft operating procedures, if necessary.

The difference between the options is shown below. The options have been rated in relation to the presence of terrain obstacles penetrating the lowest OLS. All options have some penetrations and are therefore not *"Ideal".* The analysis suggests that the options all require further survey and analysis with a *"moderate"* extent of terrain penetration. None of the options have been found to be unworkable or *"not acceptable*".

Table 1.4: Terrain obstacles

Criterion	**Option No.**							
	1	**1S**	**2**	**3**	**4**	**5**	**6**	**7**
Terrain obstacles (see note)	Moderate	Moderate	Moderate	Moderate Offsite earthworks required	Moderate	Moderate Off Site earthworks required	Moderate	Moderate
Note: Presence of terrain obstacles penetrating the lowest Obstacle Limitation Surface								
Mitigation measure	Through CASA, Obstacle Assessment Surfaces (OAS) are assessed and specific aircraft operating procedures may be applied if necessary							

Additionally consideration has been given to the risk associated with aircraft accidents through the use of the UK NATS public safety zone in options development. The Queensland State Planning Policy 1/02 dimensions for a public safety area have been shown on all runway ends in the airport concepts in the Working Paper Wilton Airport Site Selection and Airport Concepts.

Table 1.5: Third party risks

Criterion	**Option No.**							
	1	**1S**	**2**	**3**	**4**	**5**	**6**	**7**
Numbers of people (see Note)	Nil	20	44	Nil	Nil	Nil	2	2
Note: Numbers of people exposed to risk to third parties due to aircraft crash (Typical UK NATS Public Safety Zone)								
Numbers of allotments	3	10	33	1	1	Nil	10	9
Note: - Numbers of allotments exposed to risk to third parties due to aircraft crash (Typical UK NATS Public Safety Zone)								
Mitigation measure	Land use planning controls							

Following approval of an EIS, Wollondilly and Wingecarribee Councils should incorporate relevant criteria from this Working Paper as Local Environmental Plan (LEP) amendments and planning scheme overlays to safeguard the airport.

1.11 References

Civil Aviation Safety Authority 2012, *Manual of Standards Part 139 – Aerodromes*. Version 1.5

Civil Aviation Safety Authority 2011, *Manual of Standards Part 172 – Air Traffic Services*, Version 2 June 2011

Civil Aviation Safety Authority 2011, *Manual of Standards Part 173 – Standards Applicable to Instrument Flight Procedure Design,* Version 2 May 2011

Department of Infrastructure and Transport 2012, *National Airports Safeguarding Framework*

http://www.infrastructure.gov.au/aviation/airport_safeguarding/index.aspx accessed 8 June 2012

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APPENDIX 1A LIVERPOOL LEP 2008 CLAUSE FOR OBSTACLES

7.17 Development in flight paths

(1) The objectives of this clause are:

(a) to provide for the effective and on-going operation of airports, and

(b) to ensure that any such operation is not compromised by proposed development in the flight path of an airport.

(2) Development consent must not be granted to erect a building on land in the flight path of Bankstown Airport or Hoxton Park Aerodrome ***if the proposed height of the building would exceed the obstacle height limit determined by the relevant Commonwealth body****.*

(3) Before granting development consent to the erection of a building on land in the flight path of Bankstown Airport or Hoxton Park Aerodrome, the consent authority must:

(a) give notice of the proposed development to the relevant Commonwealth body, and

(b) consider any comment made by the relevant Commonwealth body within 28 days of its having been given notice of the proposed development, and

(c) consider whether the proposed use of the building will be adversely affected by exposure to aircraft noise.

(4) In this clause:

- *land is in the flight path of an airport if the relevant Commonwealth body has notified the consent authority that the land is in such a flight path.*
- *relevant Commonwealth body means the Department or other body of the Commonwealth having responsibility for airports.*

7.18 Development in areas subject to potential airport noise

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2 WORKING PAPER – PROPERTY IMPACTS

SUMMARY

The purpose of this Working Paper is to identify the approximate number of properties affected by an airport development at Wilton as well as any potential issues relating to land acquisition that may act as a barrier to airport development.

The methodology applied was to identify the approximate number of properties located within the Australian Noise Exposure Concept (ANEC) contours 40, 35, 30 and 25.

The results are summarised in the table below:

Option	ANEC 40	ANEC 35	ANEC 30	ANEC 25	Total
Option 1	10	16	31	73	**130**
Option 1S	6	15	27	66	**114**
Option 2	7	18	70	144	**239**
Option 3	1	2	2	8	**13**
Option 4	n/a	n/a	1	11	**12**
Option 5	n/a	1	2	2	**5**
Option 6	4	11	35	444	**494**
Option 7	10	16	27	66	**119**

The properties were also identified by Deposited Plan (DP), Lot number and Area.

The option with the most number of properties impacted is Option 6 with approximately 494 properties located within all ANEC contours 40, 35, 30 and 25. The airport option with the least amount of properties impacted is Option 5 with approximately 5 properties located within all ANEC contours 40, 35, 30 and 25.

Notwithstanding the above, the Australian Standard AS2021 provides guidance to regional, local authorities and others associated with urban and regional planning and building construction on the acceptable location of new buildings in relation to aircraft noise. Zones that are described as *"conditionally acceptable"* may be approved as building sites provided that any new construction incorporates sound proofing measures. These areas include residential dwellings within ANEC 20 - 25.

Having regard to the above, that dwellings are "*conditionally acceptable"* within ANEC 20-25 with the incorporation of sound proofing measures, the focus of decision making should be based on properties impacted by ANEC 25-40.

In 2000, the Department of Transport and Regional Services (as it was then) prepared a Discussion Paper that provides a Comparison of Aircraft Noise Based Land Use Planning Controls for a number of countries. In relation to Australia, the table indicates the following:

- >40 ANEC - no housing;
- 30 -40 ANEC - no new housing;
- 25-30 ANEC- insulation of existing housing and no new housing;

- 20 – 25 ANEC– new housing with insulation; and
- <20 ANEC – no restrictions.

Working Paper *Land Use Planning context and Future Development* identifies five land owner nominated sites for potential residential release within the vicinity of the Wilton study area. These sites are identified as Bingara Gorge, Wilton West, Wilton South, Brooks Point and Appin Vale.

With the exception of Option 5, all other options impact with varied ANEC contours, the land owner nominated sites.

The *Land Acquisition Act 1989* provides specific powers to the Commonwealth Government to acquire interest in land. The Commonwealth can acquire land through three ways:

- Compulsory acquisition;
- Negotiated agreement; or
- Urgent acquisition.

Potential adverse impacts of land acquisition include loss of property, severance of property, loss of income, loss of livelihood and loss of community.

Beneficial impacts of land acquisition as a result of the airport may include increased employment opportunities, increased economic activity within the Wilton area and beyond and indirect and direct benefits accrued throughout the community.

Ameliorative strategies could include measures to communicate and harness positive social benefits of airport development arising from increased scope of employment opportunities and consequential facilities that are likely to be available from an airport development.

Different communication strategies for a wide range of stakeholders should be put in place with the use of various communication tools.

In terms of compulsory land acquisition, it is important to provide environments for negotiation over the compulsory purchase to ensure that the interests of existing property and business owners are catered for.

Land acquisition and resettlement actions also have the potential to impact on remaining residents (loss of personal/community connections or impacts on facilities) and businesses (fear, real or imagined, of competition from new business). Consideration also needs to be had to potential impacts of resettlement on the *"host"* community. Other policy and legal frameworks could be explored to mitigate negative direct and indirect environmental and social effects.

2.1 Statement of property and commercial impact issue

The Wilton Study Area is being assessed in terms of the potential implications of developing a new greenfield airport in the area. The purpose of this Working Paper is to identify the approximate number of properties affected by an airport development at Wilton as well as any potential issues relating to land acquisition that may act as a barrier to airport development.

This Working Paper identifies the level of impact for the Wilton Study Area having regard to properties affected by the various ANEC footprints. It outlines the Commonwealth's existing legislative framework and process for compulsory and voluntary acquisition. It also has regard to the State Government's process for land acquisition. Finally, this paper addresses the implementation of environmental safeguards and monitoring programmes.

2.2 Legislative status

In considering the "*legislative status",* attention is drawn to the COAG Agreement regarding the Commonwealth and States agreement that where possible, the Commonwealth will comply with relevant State legislation and land use planning controls.

The following legislation is relevant to airport development at Wilton in that it will help determine the process of land acquisition and some of the associated issues such as compensation and rights of appeal etc.

2.2.1 Commonwealth

There is no Federal Government policy or legislation covering compensation for noise mitigation or for valuation of off-airport properties impacted by significant ANEF levels at present, other than those outlined in Section 2.2.1.9 Insulation Program. The Government's White Paper 2009 does, however, propose to develop a framework in consultation with stakeholders for an industry funded noise amelioration program where future major civil airport operations and air traffic changes place residences into high-noise exposure zones.

2.2.1.1 Airports Act 1996

While not applicable to development of a new airport, the *Airports Act 1996* includes social/community issues in scope for Airport Master Plans and Major Development Plans – a community would see this as reasonable guidance for issues to be addressed in planning for a new airport

2.2.1.2 Land Acquisition Act 1989

The *Land Acquisition Act 1989* provides specific powers to the Commonwealth Government to acquire interest in land. The Minister for Finance and Deregulation is responsible for administering the Act.

The Act provides a regime designed to protect a land owner within the acquisition area when the Commonwealth wants to acquire an interest in land.

Under the Act, anyone who owns or has an interest in the land:

- Must be told in advance of the Commonwealth's decision to acquire an interest in the land;
- Can ask an independent body to assess the Commonwealth's decision to acquire the interest;
- Can get reasonable professional advice, paid for by the Australian Government; and
- Has the right to be compensated on *'just terms'* for the Commonwealth's acquisition of the land or interest in land.

The Act refers to acquiring an '*interest in land'* which could include:

- Own land outright;
- Have a mortgage;
- Have an easement over land to be acquired;
- Be a lessee or licensee; or
- Have an established native title interest.

The Commonwealth can acquire land through three ways:

- Compulsory acquisition;
- Negotiated agreement; or
- Urgent acquisition.

2.2.1.3 Compulsory acquisition

The Commonwealth Government is able to compulsorily acquire land or an interest in land anywhere in Australia for public purposes.

Compulsory acquisition can be used whether or not an owner is willing to sell their interest in the land, when the land has no title, when an owner has difficulty establishing proof of title, or if an owner cannot be found.

- Pre-acquisition declaration;
- Acquisition declaration.

If a property is acquired by compulsory process, compensation is payable in accordance with the provisions of the Lands Acquisitions Act 1989.

The '*public purpose'* provisions in the various State and Commonwealth legislation of Australia are non-descript in providing for the variety of purposes which may fit the intended application of a public purpose.

2.2.1.4 Negotiated agreement

Acquisition by negotiated agreement involves the owner and the Commonwealth agreeing to the terms of the agreement and the amount of compensation.

2.2.1.5 Urgent Acquisition

In some circumstances, such as in time of national emergency, the Commonwealth may need to acquire land urgently and therefore the process may go more quickly than the usual procedures for compulsory acquisition. In such a case, the Minister may issue a section 24 certificate in place of the pre-acquisition declaration.

If a section 24 certificate is issued, the Minister has to provide a copy of the certificate before both Houses of Parliament within three parliamentary (3) sitting days and, as soon as possible, give a copy to the owner of the interest in the land. A copy of the certificate may also be published in the Commonwealth Gazette and in a local newspaper, but this is not compulsory.

This certificate overrides any pre-acquisition declaration already issued, and means a person with an interest cannot appeal to the Administrative Appeals Tribunal about the Minister's decision to acquire the land. All compensation rights remain unchanged.

2.2.1.6 Access and pre-acquisition

The Act allows the Minister for Finance and Deregulation to authorise persons to enter on to the land on behalf of the Commonwealth. If the Minister authorises a person in that event, the landowner(s) must receive a notice in writing which:

- Explains that someone has been authorised to access the land;
- Sets out the reasons why the Minister has authorised a person to access the land; and
- Advises that you may be entitled to seek compensation for losses or damages you may suffer as a result of the authorised entry on to the land.

The authorised person is allowed to access the land 7 days after written notice has been provided.

2.2.1.7 Compensation

Several factors are considered when compensation is calculated:

- The market value of the land;
- Additional financial value;

- Severance;
- Disturbance; and
- Reasonable legal or professional costs.

2.2.1.8 Rights of appeal

If an owner is unable to agree with the Commonwealth on the amount of compensation to be received, they may choose to have it decided by any one of the following:

- **Arbitration**;
- **An expert** - An *'expert'* is someone expert in the determining the value of the particular kind of land in question. No time limit has been imposed on the approach to an arbiter or an expert. Arbitration or expert decisions may lead to legal expenses that the owner will not be compensated for as the cost of the mediated settlement is shared between the Commonwealth and the claimant;
- **Administrative Appeals Tribunal review** - The owner must make an appeal to the Tribunal within three (3) months of the final offer of compensation; or
- **The Federal Court** - No minimum time limit restricts an owner's right to appeal to the Federal Court. However, the Commonwealth cannot apply to the Federal Court until three (3) months after the claim has been filed.

2.2.1.9 Insulation and compensation program

The Federal Government has noise insulation programs for reducing the impacts of aircraft noise on homes and public buildings (Schools, Churches, Day Care Centres and Hospitals) under flight paths near Sydney and Adelaide Airports. These programs have been by legislated levy on airlines and have included voluntary acquisition of residential properties over 40 ANEF and insulation and mechanical ventilation of public buildings over 25 ANEF and for residential properties over 30 ANEF.

At a combined cost in excess of $470 million, the Adelaide and Sydney Airport noise insulation programs have resulted in 4,083 homes and 99 public buildings being insulated in Sydney; while in Adelaide, a further 648 homes and 7 public buildings have been insulated.

2.2.2 State

2.2.2.1 Environmental Planning and Assessment Act 1979

Under *AS2021-2000 Acoustics – Aircraft noise intrusion – building siting and construction,* properties newly impacted by ANEFs in the 20-25 zones, are conditionally acceptable for residential land use, with the following *'Note'*.

Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with all residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate.

The NSW Government's adopted policy and statutory position on land use zoning and aircraft noise is the *Section 117 (Local Planning) Direction*, *Development Near Licensed Aerodromes* under the NSW *Environmental Planning and Assessment Act*. The Local Planning Direction states that a draft *LEP* shall not rezone for residential purposes, nor increase residential densities in areas where the ANEF, as from time to time advised by that Department of the Commonwealth, exceeds 25.

The NSW Department of Planning has issued a standard LEP template for land use planning and for new LEPs. This template includes a standard clause for obstacle heights and aircraft noise which typically is for aircraft noise.

There is no provision for compensation in this standard clause or NSW Government policy on this issue.

The Department has advised that New South Wales Government has expressed reservations with the format of *Guideline A* for Aircraft Noise under the *National Airports Safeguarding Framework*.

2.2.2.2 Land Acquisition (Just Terms Compensation) Act 1991

This Act applies to the acquisition of land (by agreement or compulsory process) by an authority of the State which is authorised to acquire the land by compulsory process.

Under this Act, land can be acquired either -

- With the land owner's consent; or
- Without the landowner's consent.

Land can also be acquired non-compulsorily, that is, with consent and private (voluntary) agreement (outside the terms of the Just Terms Compensation) Act.

Acquisition procedures

- Compulsory acquisition by notice in Gazette:
  - (1) An authority of the State that is authorised to acquire land by compulsory process may, with the approval of the Governor, declare, by notice published in the Gazette, that any land described in the notice is acquired by compulsory process;
  - (2) A copy of the acquisition notice is, if practicable, to be published in at least one newspaper circulating in the district in which the land concerned is situated;
  - (3) An acquisition notice may relate to part only of the land described in the relevant proposed acquisition notice;
- Effect of acquisition notice.

Relevant matters to be considered in determining amount of compensation

In determining the amount of compensation to which a person is entitled, regard must be had to the following matters only (as assessed in accordance with this Division):

(a) the market value of the land on the date of its acquisition;

(b) any special value of the land to the person on the date of its acquisition;

(c) any loss attributable to severance;

(d) any loss attributable to disturbance;

(e) solatium; and

(f) any increase or decrease in the value of any other land of the person at the date of acquisition which adjoins or is severed from the acquired land by reason of the carrying out of, or the proposal to carry out, the public purpose for which the land was acquired.

Objections and appeals to Land and Environment Court

A person who has claimed compensation under Part 3 of this Act may, within 90 days after receiving a compensation notice, lodge with the Land and Environment Court an objection to the amount of compensation offered by the authority of the State.

If any such objection is duly lodged, the Land and Environment Court is required to hear and dispose of the person's claim for compensation.

2.3 Summary of issues from the SSA Site Selection Programme

The proposed site at Wilton was identified in the Draft EIS1985 as being in wholly government or private company ownership and it was concluded that the effects of acquisition or transfer of ownership would be minimal. However, it was considered possible that some severance of private land could ultimately be involved.

Severance of property occurs when it is necessary to locate a site boundary line through a property rather than around the property boundary, thus cutting the property into two sections. An alternative form of property severance would be the establishment of an easement or reserve through a property, such as pipeline easements or road reserves.

Property owners have the right to claim compensation from the Commonwealth for severance of land in accordance with provisions outlined in Section 23 of the *Lands Acquisition Act 1955*.

Agreement on the amount of compensation is usually achieved through negotiation between the property owner and the Commonwealth (Chief Property Officer attached to the NSW office of the Dept. of Local Government and Administrative Services). If agreement cannot be reached on the amount of compensation payable for severance, the same two courses of action open to property owners, claiming compensation for acquisition are available – either court proceedings or arbitration.

Since the 1985 Draft EIS, there has been no Federal Government policy or legislation covering compensation for noise mitigation or for valuation of off-airport properties impacted by significant ANEF levels at this time, other than those outlined in Section 3.1 for Sydney Airport and Adelaide Airport.

Safeguards and monitoring

The Draft EIS indicated that for the privately owned land within the Wilton site, two options were available to the Commonwealth.

1. To lease back the properties to the original owners; and
2. To lease the properties through the invitation of public tenders.

The Commonwealth's preferred course of action was to lease land back to original owners, at fair market rental, in all instances where the original owner requested continued occupation of the property pending construction of the airport.

2.4 Australian Noise Exposure Forecast (ANEF)

The traditional system of aircraft noise assessment has been based around the Australian Noise Exposure Forecast (ANEF) metric, which was a modification of the US Noise Exposure Forecast system.

The ANEF system is described in the Australian Standard AS2021 and is the only method of controlling land use planning at all but two minor Australian aerodromes. It is not used to regulate aircraft operations, but rather to report on the effects of those activities. This system takes into account the frequency, intensity, time and duration of aircraft activities and calculates the total sound energy generated at any location. While ANEF contour charts are often misunderstood by the public at large, various expert committees that have considered the regulation of aircraft noise around Australian aerodromes have concluded that they are the most appropriate measure available. In the last few years there have been supplementary indices developed to help better describe aircraft noise in terms that are more readily understood by the public. These indices include N70 and Flight Track Frequency charts.

The Australian Standard AS2021 provides guidance to regional, local authorities and others associated with urban and regional planning and building construction on the acceptable location of new buildings in relation to aircraft noise. Zones that are described as *"conditionally acceptable"* may be approved as building sites provided that any new construction incorporates sound proofing measures. Section 2 of the Standard gives guidelines for determining the acoustic acceptability of a particular site. Conversely, the standard can be used to assess the noise impact of a new aerodrome or of altering an existing one, by the production of an Australian Noise Exposure Concept (ANEC).

The Australian Standard AS2021 provides recommended land use compatibility as reproduced at **Table 2.1** below. For land designated "*conditionally acceptable*" it should be noted that land use authorities might consider that *"the incorporation of noise control features in the construction of residences or schools is appropriate"*.

Table 2.1 AS2021 Table of building site acceptability based on ANEF zones

Building Type	ANEF Zone of Site		
	Acceptable	**Conditional**	**Unacceptable**
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1 of *AS2021*)	20 to 25 ANEF (Note 2 of *AS2021*)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1 of *AS2021*)	20 to 25 ANEF (Note 2 of *AS2021*)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1 of *AS2021*)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1 of *AS2021*)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

Source: AS2021-2000

2.5 Comparison of Aircraft Noise Based Land Use Planning Controls

The ANEF system is used to reduce the amount of noise emitted over residential areas through the use of specified flight paths and curfews. It is also used to protect the receiver from the noise through the use of land use planning controls to prevent encroachment of residential areas toward airports and insulation programs.

The following table has been reproduced from the Department of Transport and Regional Services' 2000 Discussion Paper – '*Expanding ways to describe and assess aircraft noise'.* **Table 2.2** shows a comparison of criteria for a number of countries including Australia.

Table 2.2 Comparison of aircraft noise based land use planning controls

Noise Exposure ANEF	Australia	United States	Netherlands	France	Canada	Germany
> 40	No housing	No housing	No housing	No new housing	Housing not recommended	No new housing
30 – 40	No new housing; insulation of existing housing at Sydney	No new housing; insulation of existing housing	No new housing; insulation of existing housing	Limited new housing	Housing not recommended	Limited new housing
25 – 30	No new housing	No restrictions	No new housing	No restrictions	New housing with insulation	Restrictions in some States
20 – 25	New housing with insulation	No restrictions	No new housing	No restrictions	No restrictions	Restrictions in some States
< 20	No restrictions	No restrictions	No restrictions	No restrictions	No restrictions	No restrictions

The Australian land use planning criteria in the Standard AS2021 for residential development having regard to aircraft noise are amongst the strictest in the world.

2.6 Analysis of property issues in terms of current airport concepts

Since the 1985 study, there has been an increase in the number of people living within the Wollondilly LGA and an increase in the population density of Wilton, Appin and Douglas Park. This essentially means that more properties (residential and commercial) could be affected by aircraft noise and land acquisition depending on the location of an airport and the alignment of the runways.

2.6.1 Regulations on exploration and mining on Commonwealth land

Section 124 of the *Lands Acquisition Act 1989* allows for regulations to be made on the following matters:

- The exploration for minerals on relevant land;
- The mining for, or recovery of, minerals on or from relevant land; and
- The carrying on of operations, and the execution of works, relating to the above.

To date, no regulations have been made pursuant to section 124. However the amendments to the LAA Act 1989 effective (12 July 2008) now provide a platform for the making of mining regulations. The Act provides at subsection 124(8) that until such time as the regulations are made and take effect, the provisions of the 1955 legislation continue. Essentially these provide that the Minister for Finance and Deregulation may authorise exploration on Commonwealth lands while the Governor-General may authorise the granting of leases/licences to mine on Commonwealth land.

Any proposals to explore or mine on Commonwealth land are considered in accordance with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* and the *Native Title Act 1993*, where applicable.

2.6.2 Property and commercial impacts of land acquisition at Wilton

2.6.2.1 Properties impacted by ANEC contours

The following tables identify the *approximate* number of properties impacted by ANEC contours 40, 35, 30 and 25 for each airport option at the Wilton site. The methodology used to calculate the number of properties is outlined in Working Paper *Acoustic Effects on People.*[4]

Option 1

Contour	Zoning	DP/LOT	Area (m²)
40	RU2	DP236173/6	158415.7
40	RU2	DP862676/101	53146.41
40	RU2	DP242048/4	96459.74
40	RU2	DP860754/201	49485.15
40	RU2	DP242871/13	100806
40	RU2	DP242871/12	102671.5
40	RU2	DP812178/31	89070.36
40	RU2	DP242871/5	102242.7
40	RU2	DP242871/15	104922.8
40	E2	DP814316/62	16246.5
Total Lots		**10**	
35	E2	DP814316/56	157.05
35	RU2	DP236173/6	158415.7
35	RU2	DP242871/6	100463.5
35	RU2	DP814316/60	292036.3
35	RU2	DP862676/101	53146.41
35	RU2	DP242048/4	96459.74
35	RU2	DP860754/201	49485.15
35	RU2	DP242871/13	100806
35	RU2	DP242871/12	102671.5
35	RU2	DP242048/3	105008
35	RU2	DP812178/31	89070.36
35	RU2	DP242871/5	102242.7
35	RU2	DP242871/15	104922.8
35	E2	DP814316/62	16246.5
35	E2	DP814316/57	209254.8
35	E2	DP751297/59	158585.5
Total Lots		**16**	
30	E2	DP236173/1	2699.34
30	E2	DP814316/56	157.05
30	RU2	DP5152/52	147782.3
30	RU2	DP31244/3	3985.64

[4] Note: Properties located within the ANEC contour 20 have not been recorded in the below tables as residential development is considered *'acceptable'* or '*conditionally acceptable'* within this contour according to the Australian Standard AS2021.

Contour	Zoning	DP/LOT	Area (m²)
30	RU2	DP236173/6	158415.7
30	RU2	DP805046/472	19771.67
30	RU2	DP862676/102	47330.54
30	RU2	DP242871/6	100463.5
30	RU2	DP814316/60	292036.3
30	RU2	DP31244/2	4102.26
30	RU2	DP862676/101	53146.41
30	RU2	DP242048/4	96459.74
30	RU2	DP860754/201	49485.15
30	RU2	DP601401/2	53091.02
30	RU2	DP31244/4	4073.78
30	RU2	DP601401/1	56486.8
30	RU2	DP805046/471	88765.15
30	RU2	DP31244/1	3917.79
30	RU2	DP242871/13	100806
30	RU2	DP242871/12	102671.5
30	RU2	DP242048/3	105008
30	RU2	DP860754/202	49978.89
30	RU2	DP812178/30	72947.61
30	RU2	DP812178/31	89070.36
30	RU2	DP242871/5	102242.7
30	RU2	DP900152/2	90257.95
30	RU2	DP242871/15	104922.8
30	E2	DP814316/62	16246.5
30	E2	DP745822/1	555092
30	E2	DP814316/57	209254.8
30	E2	DP751297/59	158585.5
Total Lots		**31**	
25	RU2	DP812178/34	23573.55
25	RU2	DP812178/33	10060.76
25	RU2	DP814316/61	75121.3
25	E2	DP236173/1	2699.34
25	E2	DP814316/56	157.05
25	E2	DP254418/21	5945.99
25	RU2	DP309188/1	88709.38
25	RU2	DP5152/52	147782.3
25	RU2	DP229156/7	86181.75
25	RU2	DP31244/3	3985.64
25	RU2	DP236173/6	158415.7
25	RU2	DP210206/2	41118.65
25	RU2	DP31244/8	4033.95
25	RU2	DP805046/472	19771.67
25	RU2	DP862676/102	47330.54

Contour	Zoning	DP/LOT	Area (m²)
25	RU2	DP242871/6	100463.5
25	RU2	DP957689/5	18407.59
25	RU2	DP814316/60	292036.3
25	RU2	DP31244/2	4102.26
25	RU2	DP210206/1	44450.69
25	RU2	DP31244/5	4089.35
25	RU2	DP862676/101	53146.41
25	RU2	DP32515/C	24349.07
25	RU2	DP242048/4	96459.74
25	RU2	DP1139182/2021	91105.96
25	RU2	DP1139195/221	37564.27
25	RU2	DP860754/201	49485.15
25	RU2	DP601401/2	53091.02
25	RU2	DP30307/9	60760.64
25	RU2	DP585567/1	13064.28
25	RU2	DP216237/1	99077.46
25	RU2	DP31244/6	4016.33
25	RU2	DP31244/4	4073.78
25	RU2	DP817111/38	223055.8
25	RU2	DP1096901/10	178427
25	RU2	DP597781/4	11406.32
25	RU2	DP572548/1	119514
25	RU2	DP31244/7	4090.76
25	RU2	DP1101129/1	341256
25	RU2	DP601401/1	56486.8
25	RU2	DP586801/1	196335.8
25	RU2	DP812178/35	39147.21
25	RU2	DP805046/471	88765.15
25	RU2	DP32515/B	157487.7
25	RU2	DP1137867/7301	21707.96
25	RU2	DP216237/3	40930.34
25	RU2	DP242871/7	101829.3
25	RU2	DP957689/4	2324.75
25	RU2	DP785888/101	4857.36
25	RU2	DP229156/4	502.49
25	RU2	DP31244/1	3917.79
25	RU2	DP900152/1	91092.63
25	RU2	DP242871/13	100806
25	RU2	DP242871/12	102671.5
25	RU2	DP242048/3	105008
25	RU2	DP1096901/11	160714.4
25	RU2	DP5152/37A	48230.62
25	RU2	DP860754/202	49978.89

Contour	Zoning	DP/LOT	Area (m²)
25	RU2	DP812178/30	72947.61
25	RU2	DP812178/31	89070.36
25	RU2	DP242871/5	102242.7
25	RU2	DP900152/2	90257.95
25	RU2	DP242871/15	104922.8
25	RU2	unknown	637.75
25	E2	DP751297/27	190413.7
25	E2	DP1100128/42	400483.2
25	E2	DP814316/62	16246.5
25	E2	DP745822/1	555092
25	E2	DP814316/57	209254.8
25	E2	DP751297/56	160665.4
25	E2	DP751297/59	158585.5
25	E2	DP751297/54	159637.5
25	E2	DP751297/57	159635.3
Total Lots		**73**	

Option 1 South

Contour	Zoning	DP/LOT	Area (m²)
40	RU2	DP236173/6	158415.7
40	RU2	DP862676/101	53146.41
40	RU2	DP860754/201	49485.15
40	RU2	DP242871/5	102242.7
40	E2	DP814316/62	16246.5
40	E2	DP751297/59	158585.5
Total Lots		**6**	
35	E2	DP814316/56	157.05
35	RU2	DP236173/6	158415.7
35	RU2	DP242871/6	100463.5
35	RU2	DP814316/60	292036.3
35	RU2	DP862676/101	53146.41
35	RU2	DP242048/4	96459.74
35	RU2	DP860754/201	49485.15
35	RU2	DP805046/471	88765.15
35	RU2	DP31244/1	3917.79
35	RU2	DP242048/3	105008
35	RU2	DP242871/5	102242.7
35	RU2	DP242871/15	104922.8
35	E2	DP814316/62	16246.5
35	E2	DP814316/57	209254.8
35	E2	DP751297/59	158585.5
Total Lots		**15**	
30	E2	DP236173/1	2699.34
30	E2	DP814316/56	157.05

Contour	Zoning	DP/LOT	Area (m²)
30	RU2	DP5152/52	147782.3
30	RU2	DP31244/3	3985.64
30	RU2	DP236173/6	158415.7
30	RU2	DP805046/472	19771.67
30	RU2	DP862676/102	47330.54
30	RU2	DP242871/6	100463.5
30	RU2	DP814316/60	292036.3
30	RU2	DP31244/2	4102.26
30	RU2	DP862676/101	53146.41
30	RU2	DP242048/4	96459.74
30	RU2	DP860754/201	49485.15
30	RU2	DP601401/2	53091.02
30	RU2	DP31244/4	4073.78
30	RU2	DP586801/1	196335.8
30	RU2	DP805046/471	88765.15
30	RU2	DP31244/1	3917.79
30	RU2	DP242048/3	105008
30	RU2	DP860754/202	49978.89
30	RU2	DP242871/5	102242.7
30	RU2	DP900152/2	90257.95
30	RU2	DP242871/15	104922.8
30	E2	DP814316/62	16246.5
30	E2	DP814316/57	209254.8
30	E2	DP751297/56	160665.4
30	E2	DP751297/59	158585.5
Total Lots		**27**	
25	RU2	DP814316/61	75121.3
25	E2	DP236173/1	2699.34
25	E2	DP814316/56	157.05
25	E2	DP254418/21	5945.99
25	RU2	DP309188/1	88709.38
25	RU2	DP5152/52	147782.3
25	RU2	DP229156/7	86181.75
25	RU2	DP31244/3	3985.64
25	RU2	DP236173/6	158415.7
25	RU2	DP210206/2	41118.65
25	RU2	DP31244/8	4033.95
25	RU2	DP805046/472	19771.67
25	RU2	DP862676/102	47330.54
25	RU2	DP242871/6	100463.5
25	RU2	DP957689/5	18407.59
25	RU2	DP814316/60	292036.3
25	RU2	DP31244/2	4102.26

Contour	Zoning	DP/LOT	Area (m²)
25	RU2	DP210206/1	44450.69
25	RU2	DP31244/5	4089.35
25	RU2	DP862676/101	53146.41
25	RU2	DP32515/C	24349.07
25	RU2	DP242048/4	96459.74
25	RU2	DP1139182/2021	91105.96
25	RU2	DP1139195/221	37564.27
25	RU2	DP860754/201	49485.15
25	RU2	DP601401/2	53091.02
25	RU2	DP30307/9	60760.64
25	RU2	DP585567/1	13064.28
25	RU2	DP216237/1	99077.46
25	RU2	DP31244/6	4016.33
25	RU2	DP31244/4	4073.78
25	RU2	DP817111/38	223055.8
25	RU2	DP1096901/10	178427
25	RU2	DP597781/4	11406.32
25	RU2	DP572548/1	119514
25	RU2	DP31244/7	4090.76
25	RU2	DP1101129/1	341256
25	RU2	DP601401/1	56486.8
25	RU2	DP586801/1	196335.8
25	RU2	DP805046/471	88765.15
25	RU2	DP32515/B	157487.7
25	RU2	DP1137867/7301	21707.96
25	RU2	DP216237/3	40930.34
25	RU2	DP242871/7	101829.3
25	RU2	DP957689/4	2324.75
25	RU2	DP229156/4	502.49
25	RU2	DP31244/1	3917.79
25	RU2	DP900152/1	91092.63
25	RU2	DP242871/13	100806
25	RU2	DP242048/3	105008
25	RU2	DP1096901/11	160714.4
25	RU2	DP5152/37A	48230.62
25	RU2	DP860754/202	49978.89
25	RU2	DP242871/5	102242.7
25	RU2	DP900152/2	90257.95
25	RU2	DP242871/15	104922.8
25	RU2	Unknown	637.75
25	E2	DP751297/27	190413.7
25	E2	DP1100128/42	400483.2
25	E2	DP814316/62	16246.5

Contour	Zoning	DP/LOT	Area (m²)
25	E2	DP745822/1	555092
25	E2	DP814316/57	209254.8
25	E2	DP751297/56	160665.4
25	E2	DP751297/59	158585.5
25	E2	DP751297/54	159637.5
25	E2	DP751297/57	159635.3
Total Lots		**66**	

Option 2

Contour	Zoning	DP/LOT	Area (m²)
40	RU2	DP242871/6	100463.5
40	RU2	DP601401/2	53091.02
40	RU2	DP601401/1	56486.8
40	RU2	DP242871/7	101829.3
40	RU2	DP242871/15	104922.8
40	E2	DP751297/27	190413.7
40	E2	DP751297/59	158585.5
Total Lots		**7**	
35	RU2	DP236173/6	158415.7
35	RU2	DP242871/6	100463.5
35	RU2	DP814316/60	292036.3
35	RU2	DP31244/12	4074.76
35	RU2	DP601401/2	53091.02
35	RU2	DP31244/14	4288.6
35	RU2	DP601401/1	56486.8
35	RU2	DP31244/13	4029.78
35	RU2	DP242871/8	104385.6
35	RU2	DP31244/11	4082.25
35	RU2	DP380750/B	28751.94
35	RU2	DP242871/7	101829.3
35	RU2	DP1096901/13	159954.9
35	RU2	DP218161/1	65553.37
35	RU2	DP242871/15	104922.8
35	E2	DP751297/27	190413.7
35	E2	DP751297/59	158585.5
35	E2	DP369011/A	205968.1
Total Lots		**18**	
30	E2	DP814316/56	157.05
30	RU2	DP236173/6	158415.7
30	RU2	DP214417/23	993.65
30	RU2	DP214417/26	973.48
30	RU2	DP380750/A	100999.1
30	RU2	DP242871/6	100463.5
30	RU2	DP800151/390	92546.97

Contour	Zoning	DP/LOT	Area (m²)
30	RU2	DP570000/1	16248.14
30	RU2	DP814316/60	292036.3
30	RU2	DP31244/12	4074.76
30	RU2	DP214417/48	1054.46
30	RU2	DP601401/2	53091.02
30	RU2	DP573736/2	9880.24
30	RU2	DP570000/2	17744.78
30	RU2	DP214417/2	1248.26
30	RU2	DP214417/24	971.64
30	RU2	DP214417/33	5129.82
30	RU2	DP214417/37	4832.94
30	RU2	DP218161/2	3945.72
30	RU2	DP31244/14	4288.6
30	RU2	DP214417/38	5447.43
30	RU2	DP214417/42	6084.83
30	RU2	DP214417/22	949.2
30	RU2	DP601401/1	56486.8
30	RU2	DP31244/13	4029.78
30	RU2	DP214417/32	6125.3
30	RU2	DP214417/47	942.98
30	RU2	DP214417/41	6185.19
30	RU2	DP214417/39	9891.54
30	RU2	DP214417/44	1266.64
30	RU2	DP242871/8	104385.6
30	RU2	DP869746/510	28876.12
30	RU2	DP800151/391	24432.43
30	RU2	DP31244/16	4104.36
30	RU2	DP31244/11	4082.25
30	RU2	DP214417/25	1014.43
30	RU2	DP214417/43	1267.22
30	RU2	DP214417/1	983.15
30	RU2	DP214417/28	967.73
30	RU2	DP214417/46	980.59
30	RU2	DP869746/511	30373.14
30	RU2	DP214417/3	1194.97
30	RU2	DP380750/B	28751.94
30	RU2	DP242871/7	101829.3
30	RU2	DP1096901/13	159954.9
30	RU2	DP624968/391	125340.5
30	RU2	DP31244/15	4125.68
30	RU2	DP242871/13	100806
30	RU2	DP214417/36	3514.56
30	RU2	DP214417/30	1182.49

Contour	Zoning	DP/LOT	Area (m²)
30	RU2	DP214417/35	2172.6
30	RU2	DP1096901/11	160714.4
30	RU2	DP218161/1	65553.37
30	RU2	DP214417/29	980.58
30	RU2	DP242871/5	102242.7
30	RU2	DP214417/27	974.49
30	RU2	DP214417/34	3135.12
30	RU2	DP214417/45	1000.36
30	RU2	DP214417/31	985.83
30	RU2	DP242871/15	104922.8
30	RU2	DP214417/40	5431.33
30	RU2	DP309188/3	96465.95
30	RU2	DP1096901/12	161739.5
30	E2	DP375976/1	48341.46
30	E2	DP751297/27	190413.7
30	E2	DP1100128/42	400483.2
30	E2	DP128462/1	227331
30	E2	DP369011/A	205968.1
30	E2	DP663835/40	26332.33
30	E2	DP751297/59	158585.5
Total Lots		**70**	
25	RU2	DP814316/61	75121.3
25	E2	DP236173/1	2699.34
25	E2	DP814316/56	157.05
25	RU2	DP309188/1	88709.38
25	RU2	DP30307/5	8788.62
25	RU2	DP205275/4	9244.42
25	RU2	DP205275/6	8877.96
25	RU2	DP236173/6	158415.7
25	RU2	DP210206/2	41118.65
25	RU2	DP31244/20	3952.11
25	RU2	DP214417/10	289.59
25	RU2	DP415392/A	99876.88
25	RU2	DP214417/23	993.65
25	RU2	DP214417/26	973.48
25	RU2	DP380750/A	100999.1
25	RU2	DP862676/102	47330.54
25	RU2	DP242871/6	100463.5
25	RU2	DP800151/390	92546.97
25	RU2	DP570000/1	16248.14
25	RU2	DP1133866/582	158604.4
25	RU2	DP5152/56	366270.7
25	RU2	DP604283/2	81193.3

Contour	Zoning	DP/LOT	Area (m²)
25	RU2	DP814316/60	292036.3
25	RU2	DP31244/12	4074.76
25	RU2	DP210206/1	44450.69
25	RU2	DP214417/16	1352.15
25	RU2	DP214417/13	1151.08
25	RU2	DP214417/17	2206.91
25	RU2	DP206280/1	180.44
25	RU2	DP862676/101	53146.41
25	RU2	DP214417/48	1054.46
25	RU2	DP242048/4	96459.74
25	RU2	DP860754/201	49485.15
25	RU2	DP601401/2	53091.02
25	RU2	DP745611/1	24160.2
25	RU2	DP619005/231	8393.04
25	RU2	DP573736/2	9880.24
25	RU2	DP570000/2	17744.78
25	RU2	DP31244/19	4174.81
25	RU2	DP214417/4	1140.78
25	RU2	DP206280/2	9112.25
25	RU2	DP214417/2	1248.26
25	RU2	DP214417/5	949.91
25	RU2	DP214417/9	390.98
25	RU2	DP214417/24	971.64
25	RU2	DP214417/33	5129.82
25	RU2	DP214417/37	4832.94
25	RU2	DP1096901/10	178427
25	RU2	DP572548/1	119514
25	RU2	DP205275/7	9238.81
25	RU2	DP205275/9	9388.75
25	RU2	DP31244/17	4075.51
25	RU2	DP218161/2	3945.72
25	RU2	DP31244/10	4385.24
25	RU2	DP31244/14	4288.6
25	RU2	DP31244/18	4150.28
25	RU2	DP242871/9	98197.57
25	RU2	DP214417/12	231.99
25	RU2	DP214417/38	5447.43
25	RU2	DP214417/42	6084.83
25	RU2	DP214417/19	1955.91
25	RU2	DP214417/22	949.2
25	RU2	DP1101129/1	341256
25	RU2	DP601401/1	56486.8
25	RU2	DP205275/8	9549.16

Contour	Zoning	DP/LOT	Area (m²)
25	RU2	DP573736/3	203366.1
25	RU2	DP205275/10	9272.67
25	RU2	DP205275/5	8457.17
25	RU2	DP31244/13	4029.78
25	RU2	DP570000/3	328746.8
25	RU2	DP214417/21	1038.8
25	RU2	DP214417/32	6125.3
25	RU2	DP214417/47	942.98
25	RU2	DP214417/7	709.16
25	RU2	DP556344/21	103399
25	RU2	DP214417/41	6185.19
25	RU2	DP214417/39	9891.54
25	RU2	DP214417/44	1266.64
25	RU2	DP242871/8	104385.6
25	RU2	DP869746/510	28876.12
25	RU2	DP800151/391	24432.43
25	RU2	DP807994/1	20027.72
25	RU2	DP604283/1	19732.51
25	RU2	DP31244/16	4104.36
25	RU2	DP31244/11	4082.25
25	RU2	DP214417/14	1116.48
25	RU2	DP214417/25	1014.43
25	RU2	DP214417/43	1267.22
25	RU2	DP214417/1	983.15
25	RU2	DP214417/28	967.73
25	RU2	DP214417/46	980.59
25	RU2	DP32515/E	28126.29
25	RU2	DP869746/511	30373.14
25	RU2	DP214417/11	227.31
25	RU2	DP214417/3	1194.97
25	RU2	DP380750/B	28751.94
25	RU2	DP736081/50	13239.16
25	RU2	DP242871/7	101829.3
25	RU2	DP1096901/13	159954.9
25	RU2	DP309188/2	97423.43
25	RU2	DP624968/391	125340.5
25	RU2	DP573736/1	9989.5
25	RU2	DP785888/101	4857.36
25	RU2	DP773816/511	161333.8
25	RU2	DP229156/4	502.49
25	RU2	DP31244/15	4125.68
25	RU2	DP242871/13	100806
25	RU2	DP214417/18	2030.75

Contour	Zoning	DP/LOT	Area (m^2)
25	RU2	DP214417/36	3514.56
25	RU2	DP214417/30	1182.49
25	RU2	DP242871/12	102671.5
25	RU2	DP214417/20	2258.76
25	RU2	DP214417/35	2172.6
25	RU2	DP214417/8	417.49
25	RU2	DP242048/3	105008
25	RU2	DP1096901/11	160714.4
25	RU2	DP5152/37A	48230.62
25	RU2	DP860754/202	49978.89
25	RU2	DP773816/510	19516.97
25	RU2	DP218161/1	65553.37
25	RU2	DP214417/29	980.58
25	RU2	DP242871/5	102242.7
25	RU2	DP214417/27	974.49
25	RU2	DP214417/34	3135.12
25	RU2	DP214417/45	1000.36
25	RU2	DP214417/31	985.83
25	RU2	DP214417/6	1878.55
25	RU2	DP242871/15	104922.8
25	RU2	DP214417/15	951.69
25	RU2	DP214417/40	5431.33
25	RU2	DP309188/3	96465.95
25	RU2	DP1096901/12	161739.5
25	E2	DP375976/1	48341.46
25	E2	DP435855/B	99753.83
25	E2	DP751297/27	190413.7
25	E2	DP1100128/42	400483.2
25	E2	DP814316/62	16246.5
25	E2	DP128462/1	227331
25	E2	DP369011/B	250751.2
25	E2	DP369011/A	205968.1
25	E2	DP745822/1	555092
25	E2	DP663835/40	26332.33
25	E2	DP751297/56	160665.4
25	E2	DP751297/59	158585.5
Total Lots		**144**	

Option 3

Contour	Zoning	DP/LOT	Area (m^2)
40	E2	DP751291/21	9136.6

Contour	Zoning	DP/LOT	Area (m²)
Total Lots		**1**	
35	E2	DP751291/9	178447.32
35	E2	DP751291/21	9136.6
Total Lots		**2**	
30	E2	DP751291/9	178447.32
30	E2	DP751291/21	9136.6
Total Lots		**2**	
25	RU2	DP554953/2	107395.36
25	RU2	DP87980/2	7405.43
25	RU2	DP554953/1	116522.38
25	RU2	DP850925/60	548453.37
25	RU2	DP804375/1	13550.19
25	E2	DP751291/9	178447.32
25	E2	DP751291/21	9136.6
25	E2	DP751269/42	197520.97
Total Lots		**8**	

Option 4

Contour	Zoning	DP/LOT	Area (m²)
30	E2	DP751291/21	9136.6
Total Lots		**1**	
25	E2	DP254418/21	5945.99
25	RU2	DP87980/2	7405.43
25	RU2	DP623982/301	167033.96
25	RU2	DP554953/1	116522.38
25	RU2	DP817111/36	215239.74
25	RU2	DP623982/302	52834.58
25	RU2	DP1137867/7301	21707.96
25	E2	DP87980/3	251535.51
25	E2	DP751291/9	178447.32
25	E2	DP751291/41	159969.1
25	E2	DP751291/21	9136.6
Total Lots		**11**	

Option 5

Contour	Zoning	DP/LOT	Area (m²)
35	E2	DP751291/21	9136.6
Total Lots		**1**	
30	E2	DP751291/9	178447.3
30	E2	DP751291/21	9136.6
Total Lots		**2**	
25	E2	DP751291/9	178447.3
25	E2	DP751291/21	9136.6
Total Lots		**2**	

Option 6

Contour	Zoning	DP/LOT	Area (m²)
40	RU2	DP236173/6	158415.7
40	RU2	DP814316/60	292036.3
40	RU2	DP242048/4	96459.74
40	RU2	DP242048/3	105008
Total Lots		**4**	
35	RU2	DP236173/6	158415.7
35	RU2	DP814316/60	292036.3
35	RU2	DP242048/4	96459.74
35	RU2	DP242048/3	105008
35	RU2	DP860754/202	49978.89
35	E2	DP87980/3	251535.5
35	E2	DP128462/1	227331
35	E2	DP908904/1	42879.82
35	E2	DP108340/3	151416.2
35	E2	DP751297/59	158585.5
35	E2	DP751297/57	159635.3
Total Lots		**11**	
30	RU2	DP883647/4	102040.2
30	RU2	DP883647/3	134163.9
30	RU2	DP883647/2	129203.2
30	RU2	DP108340/2	614720.9
30	RU2	DP812178/32	372089.2
30	RU2	DP814316/61	75121.3
30	RU2	DP236173/6	158415.7
30	RU2	DP862676/102	47330.54
30	RU2	DP554953/2	107395.4
30	RU2	DP814316/60	292036.3
30	RU2	DP242048/4	96459.74
30	RU2	DP87980/2	7405.43
30	RU2	DP584515/1	17380.16
30	RU2	DP850925/61	24434.51

Contour	Zoning	DP/LOT	Area (m²)
30	RU2	DP816238/1	135426.3
30	RU2	DP819476/202	19975.87
30	RU2	DP249446/1	106923.7
30	RU2	DP623982/302	52834.58
30	RU2	DP249286/2	103640.6
30	RU2	DP804375/1	13550.19
30	RU2	DP249446/3	20284.04
30	RU2	DP584515/2	3025.24
30	RU2	DP242048/3	105008
30	RU2	DP249286/3	105539.7
30	RU2	DP860754/202	49978.89
30	RU2	DP242871/15	104922.8
30	RU2	DP249286/4	106692.7
30	E2	DP87980/3	251535.5
30	E2	DP128462/1	227331
30	E2	DP908904/1	42879.82
30	E2	DP751297/56	160665.4
30	E2	DP751297/59	158585.5
30	E2	DP122226/1	378752.4
30	E2	DP751297/57	159635.3
30	E2	DP108340/3	151416.2
Total Lots		**35**	
25	RE1	DP776873/40	15173.04
25	RE1	DP258218/3	1170.66
25	B2	DP540843/4	1048.04
25	B2	SP69692/	2053.65
25	B2	DP1112297/101	1335.88
25	B2	DP540843/1	955.04
25	B2	DP540843/2	996.25
25	B2	DP811711/71	1189.31
25	B2	DP811711/72	2815.43
25	B2	DP1099896/1	2053.06
25	B2	DP1058518/1	48.16
25	B2	DP227868/1	16356.49
25	B2	DP1112297/102	4708.6
25	B2	DP540843/3	1033.15
25	B2	DP758022/9	80.81
25	B2	DP758022/8	2063.14
25	RE1	DP747042/1	4028.57
25	R2	DP616983/2	1006.27
25	R2	DP747040/7	993.87
25	R2	DP776873/31	1002.41
25	R2	DP747040/1	1082.73

Contour	Zoning	DP/LOT	Area (m²)
25	R2	DP747040/4	1005.07
25	R2	DP747041/23	1021.14
25	R2	DP774424/17	969.16
25	R2	DP774424/7	1063.48
25	R2	DP758022/16	2022.83
25	R2	DP774424/14	1225.2
25	R2	DP774424/18	1034.64
25	R2	DP774424/21	1008.08
25	R2	DP758022/4	2061.1
25	R2	DP1064402/51	1034.2
25	R2	DP1091955/100	1726.68
25	R2	DP616983/1	1022.43
25	R2	DP776873/16	966.67
25	R2	DP776873/15	984.73
25	R2	DP747040/8	993.27
25	R2	DP747041/27	1345.14
25	R2	DP774424/4	1106.66
25	R2	DP758022/9	2012.25
25	R2	DP776542/116	1039.34
25	R2	DP774424/10	1139.37
25	R2	DP1064402/50	1004.04
25	R2	DP1091955/101	3351.15
25	R2	DP871327/171	1101.53
25	R2	DP776873/13	995.51
25	R2	DP747040/2	1030.9
25	R2	DP568048/421	1036.31
25	R2	DP568048/420	1033.48
25	R2	DP774424/8	1113.81
25	R2	DP758022/2	2024.29
25	R2	DP758022/3	2057.03
25	R2	DP774424/2	996.84
25	R2	DP758022/19	2005.81
25	R2	DP758022/5	2097.97
25	R2	DP774424/25	1204.77
25	R2	DP774424/5	1108.84
25	R2	DP758022/19	1994.19
25	R2	DP787520/38	2043.01
25	R2	DP774424/13	1017
25	R2	DP774424/16	1076.33
25	R2	DP774424/11	1013.14
25	R2	DP774424/15	1048.94
25	R2	DP758022/12	2034.23
25	R2	DP758022/6	2003.21

Contour	Zoning	DP/LOT	Area (m²)
25	R2	DP1155075/50	939.97
25	R2	DP747040/5	995.58
25	R2	DP747041/25	974.72
25	R2	DP774424/24	1119.12
25	R2	DP774424/12	966.8
25	R2	DP774424/19	1017.31
25	R2	DP758022/4	2012.73
25	R2	DP758022/7	1945.65
25	R2	DP563025/1	1016.99
25	R2	DP871327/172	920.6
25	R2	DP776873/12	1000.17
25	R2	DP776873/14	966.48
25	R2	DP776873/32	1218.79
25	R2	DP787520/39	2113.78
25	R2	DP747040/6	991.88
25	R2	DP747041/22	1058.75
25	R2	DP747041/26	1045.79
25	R2	DP747041/24	1088.65
25	R2	DP776542/117	984.87
25	R2	DP758022/7	2057.06
25	R2	DP774424/6	1066.77
25	R2	DP758022/14	2008.11
25	R2	DP758022/18	2055.52
25	R2	DP563025/2	1002.01
25	R2	DP1155075/51	1936.65
25	R2	DP776873/11	999.61
25	R2	DP758022/6	2007.09
25	R2	DP774424/26	985.11
25	R2	DP774424/9	990.92
25	R2	DP776873/18	1230.49
25	R2	DP747040/3	992.93
25	R2	DP776873/17	977.43
25	R2	DP774424/1	1016.87
25	R2	DP774424/20	993.76
25	R2	DP758022/11	2022.61
25	R2	DP758022/17	2016.03
25	R2	DP774424/23	1181.6
25	R2	DP774424/3	1014.9
25	R2	DP774424/22	1104.33
25	RE1	DP23717/20	16146.85
25	RE1	DP92836/7001	29100.79
25	RE1	DP255654/46	8504.21
25	RE1	DP548840/3	4803.17

Contour	Zoning	DP/LOT	Area (m²)
25	RE1	DP23717/21	4493.85
25	RU2	DP752012/62	20848.94
25	RU2	DP808006/3	19962.53
25	RU2	DP826121/2	163367.3
25	RU2	DP808006/2	19907.97
25	RU2	DP808006/1	19585.15
25	RU2	DP883647/4	102040.2
25	RU2	DP883647/6	215591.7
25	RU2	DP883647/3	134163.9
25	RU2	DP883647/5	213927.5
25	RU2	DP883647/2	129203.2
25	RU2	DP108340/2	614720.9
25	RU2	DP812178/32	372089.2
25	RU2	DP814316/61	75121.3
25	RE1	DP835406/32	6708.22
25	E2	DP236173/1	2699.34
25	E2	DP814316/56	157.05
25	IN2	DP112177/2	28103.01
25	IN2	DP1089998/32	2371.28
25	IN2	DP839258/10	4284.58
25	IN2	DP852649/12	2336.73
25	IN2	DP112177/1	25997.33
25	IN2	DP1089998/33	2346.14
25	IN2	DP230526/5	8103.29
25	IN2	DP864208/11	2244.99
25	IN2	DP1014839/190	3786.75
25	IN2	DP1018350/101	5237.71
25	IN2	DP1089998/30	8051.7
25	IN2	DP839258/13	2399.4
25	IN2	DP1006935/20	1508.21
25	IN2	SP77884/	4907.51
25	IN2	DP839258/14	2433.18
25	IN2	DP1030127/21	5019.19
25	IN2	DP1089998/31	3800.47
25	R3	DP243256/28	2095.9
25	R3	DP758022/11	2063.57
25	R3	DP243256/29	2028.02
25	R3	DP243256/27	2022.27
25	R3	DP758022/13	2025.51
25	R3	DP243256/26	1997.92
25	R3	DP90412/20	2067.62
25	R3	DP758022/12	2049.35
25	R3	DP758022/19	2021.13

Contour	Zoning	DP/LOT	Area (m²)
25	R3	DP243256/30	1985.75
25	R3	DP803193/20	1254.5
25	R3	DP214110/2	978.72
25	R3	DP214110/3	975.16
25	R3	DP529457/1	6932.96
25	R3	DP38713/7	928.35
25	R3	DP38713/2	899.83
25	R3	DP803193/22	1671.35
25	R3	DP214110/4	983.78
25	R3	DP38713/8	915.06
25	R3	DP214110/1	993.64
25	R3	DP38713/1	1772.69
25	R3	DP803193/21	976.01
25	R3	DP38713/6	937.07
25	R3	DP38713/5	901.07
25	R3	DP38713/3	923.11
25	R3	DP38713/4	915.54
25	R2	DP542977/1	176.54
25	R2	DP711665/1	1384.36
25	R2	DP1148758/1	720.05
25	R2	DP594426/2	1255.49
25	R2	DP594426/3	1307.97
25	R2	DP594426/1	1249.19
25	R2	DP594426/4	1197.74
25	B2	DP529457/2	1968.06
25	B2	DP21608/4	1258.69
25	B2	DP878338/1	980.46
25	B2	DP878338/3	956.97
25	B2	SP38785/	1010.34
25	B2	DP340554/A	1164.9
25	B2	DP340554/B	1139.8
25	B2	DP878338/5	923.41
25	B2	DP228517/2	2150.89
25	B2	DP878338/2	956.48
25	B2	DP775457/56	1701.64
25	B2	DP228517/1	14656.04
25	B2	DP193968/1	1050.62
25	B2	DP782250/1	7326.82
25	B2	DP197719/1	1965.69
25	B2	DP605597/1	848.77
25	B2	DP1139080/1	998.69
25	B2	DP21608/1	1391.73
25	B2	DP209779/3	2566.29

Contour	Zoning	DP/LOT	Area (m²)
25	B2	DP21608/2	1397.92
25	B2	DP596928/1	4263.27
25	B2	DP433997/A	3144.62
25	B2	DP784347/1	934.33
25	B2	DP878338/4	957.69
25	R2	DP205516/2	883.92
25	R2	DP507820/2	1215.56
25	R2	DP389406/C	1559.92
25	R2	DP569062/2	1020.62
25	R2	DP846049/1	1164.87
25	R2	DP752012/57	6174.5
25	R2	DP758022/9	2116.32
25	R2	DP583532/19	2037.17
25	R2	DP758022/18	2000.21
25	R2	DP758022/1	1942.7
25	R2	DP758022/10	996.63
25	R2	DP783229/1	2024.94
25	R2	DP758022/6	2032.33
25	R2	DP23717/14	1619.26
25	R2	DP23717/12	1513.65
25	R2	DP881875/411	1259.09
25	R2	DP205516/1	779.72
25	R2	DP556481/2	993.59
25	R2	DP569571/2	2971.09
25	R2	DP714960/61	11222.37
25	R2	DP507820/1	722.14
25	R2	DP1058091/62	1016.61
25	R2	DP752012/59	8116.27
25	R2	DP758022/13	1412.3
25	R2	DP758022/4	2010.81
25	R2	DP758022/8	2007.82
25	R2	DP758022/11	1198.12
25	R2	DP758022/7	2072.91
25	R2	DP758022/9	2036.79
25	R2	DP758022/5	2015.13
25	R2	DP826431/8	976
25	R2	DP1058091/61	1004.93
25	R2	DP846049/2	1828.66
25	R2	DP758022/15	2062.75
25	R2	DP758022/7	1005.3
25	R2	DP758022/3	2049.66
25	R2	DP758022/7	1997.97
25	R2	DP758022/8	2021.8

Contour	Zoning	DP/LOT	Area (m²)
25	R2	DP758022/2	2039.6
25	R2	DP758022/9	1010.27
25	R2	DP758022/12	1210.14
25	R2	DP758022/15	1455.78
25	R2	DP835406/31	6734.14
25	R2	DP1150723/100	1033.5
25	R2	DP1150723/101	1031.28
25	R2	DP23717/19	1549.43
25	R2	DP23717/18	1572.47
25	R2	DP23717/7	12628.03
25	R2	DP23717/16	1577.98
25	R2	DP23717/17	1527.75
25	R2	DP714960/62	967.76
25	R2	DP205516/3	885.43
25	R2	DP1069125/11	1054.52
25	R2	DP604200/2	969.97
25	R2	DP758022/1	2012.72
25	R2	DP758022/14	1449.13
25	R2	DP758022/6	2045.54
25	R2	DP758022/10	1197.36
25	R2	DP758022/20	1963.46
25	R2	DP1108783/2	2126.87
25	R2	SP81706/	970
25	R2	DP826431/6	975.54
25	R2	DP556481/1	1079.61
25	R2	DP758022/16	2028.4
25	R2	DP1079081/110	1000.68
25	R2	DP1080332/12	1176.97
25	R2	DP1150723/102	1022.22
25	R2	DP23717/10	1495.56
25	R2	DP1061254/112	1010.61
25	R2	DP999885/11	2030.49
25	R2	DP752012/60	10141.71
25	R2	DP758022/1	2020.1
25	R2	DP758022/13	2024.19
25	R2	DP758022/17	2032.48
25	R2	DP758022/3	2014.27
25	R2	DP23717/11	1694.23
25	R2	DP23717/8	1762.12
25	R2	DP826431/12	1110.54
25	R2	DP23717/13	1556.74
25	R2	DP714960/63	1019.49
25	R2	DP604200/3	973.37

Contour	Zoning	DP/LOT	Area (m²)
25	R2	DP569062/1	1004.66
25	R2	DP752012/88	9826.99
25	R2	DP846049/3	1586.81
25	R2	DP569062/3	14294.73
25	R2	DP758022/6	2019.18
25	R2	DP758022/2	2026.35
25	R2	DP758022/7	2055.78
25	R2	DP758022/14	1963.02
25	R2	DP758022/2	2052.19
25	R2	DP758022/4	2026.79
25	R2	DP1079081/111	1012
25	R2	DP1080332/13	1359.81
25	R2	SP85055/	2046.33
25	R2	DP23717/15	1559.05
25	R2	DP826431/7	975.42
25	R2	DP23717/9	1501.13
25	R2	DP826431/5	975.81
25	R2	DP389406/A	1438.4
25	R2	DP758022/12	2134.84
25	R2	DP758022/5	1194.12
25	R2	DP758022/3	2049.31
25	R2	DP758022/8	1009.45
25	R2	DP758022/9	1228.02
25	R2	DP1108783/1	10404.74
25	R2	DP1150723/103	1052.11
25	E3	DP257529/65	307891.3
25	E3	DP826431/11	1641.6
25	E3	DP826431/10	1679.85
25	E3	DP826431/9	1186.35
25	R2	DP595758/23	1069.45
25	R2	DP214110/6	986.66
25	R2	DP255654/31	1118.1
25	R2	DP235130/14	1184.9
25	R2	DP246207/38	1181.14
25	R2	DP235130/3	1018.65
25	R2	DP235130/7	1166.91
25	R2	DP235130/11	1478.48
25	R2	DP235130/22	1153.2
25	R2	DP255654/25	987.82
25	R2	DP255654/33	1150.49
25	R2	DP258218/8	1003.12
25	R2	DP1009041/11	1004.7
25	R2	DP258218/9	987.81

Contour	Zoning	DP/LOT	Area (m²)
25	R2	DP246207/37	1179.46
25	R2	DP246207/36	1350.47
25	R2	DP235130/6	1214.53
25	R2	DP235130/17	1079.21
25	R2	DP235130/5	1154.94
25	R2	DP595758/22	1313.08
25	R2	DP214110/5	976.31
25	R2	DP255654/28	1337.93
25	R2	DP1009041/13	988.53
25	R2	DP258218/14	1240.74
25	R2	DP258218/6	974.9
25	R2	DP258218/7	1009.19
25	R2	DP1009041/19	1063.68
25	R2	DP258218/11	964.01
25	R2	DP235130/21	1477.01
25	R2	DP235130/23	1079.13
25	R2	DP235130/13	1124.74
25	R2	DP255654/27	1246.72
25	R2	DP255654/35	1177.17
25	R2	DP255654/26	1143.32
25	R2	DP1009041/18	1215.1
25	R2	DP1009041/15	1203.57
25	R2	DP235130/18	1110.45
25	R2	DP235130/8	1496.61
25	R2	DP235130/19	1009.79
25	R2	DP255654/36	1162.09
25	R2	DP1009041/14	982.33
25	R2	DP1009041/20	1123.99
25	R2	DP258218/10	966.39
25	R2	DP258218/4	974.8
25	R2	DP258218/12	1085.71
25	R2	DP258218/15	1028.81
25	R2	DP246207/40	1450.89
25	R2	DP235130/15	1044.16
25	R2	DP716345/203	1828.34
25	R2	DP214110/8	969.35
25	R2	DP255654/29	1203.59
25	R2	DP214110/7	993.95
25	R2	DP1009041/16	1165.59
25	R2	DP258218/2	1043.11
25	R2	DP235130/4	1406.88
25	R2	DP235130/9	1422.11
25	R2	DP595758/24	1025.5

Contour	Zoning	DP/LOT	Area (m²)
25	R2	DP255654/32	1120.82
25	R2	DP1009041/12	978.28
25	R2	DP258218/1	963.69
25	R2	DP258218/13	976.22
25	R2	DP258218/5	966.61
25	R2	DP235130/16	1090.93
25	R2	DP235130/2	2401.57
25	R2	DP235130/1	1126.77
25	R2	DP716345/204	1834.69
25	R2	DP255654/30	1127.6
25	R2	DP255654/34	1167.01
25	R2	DP1009041/17	991.94
25	R2	DP235130/10	1550.63
25	R2	DP235130/20	998.13
25	RU2	DP236173/6	158415.7
25	RU2	DP862676/102	47330.54
25	RU2	DP554953/2	107395.4
25	RU2	DP814316/60	292036.3
25	RU2	DP558807/1	134190.8
25	RU2	DP862676/101	53146.41
25	RU2	DP242048/4	96459.74
25	RU2	DP87980/2	7405.43
25	RU2	DP249286/1	112872.6
25	RU2	DP860754/201	49485.15
25	RU2	DP601401/2	53091.02
25	RU2	DP619005/231	8393.04
25	RU2	DP584515/1	17380.16
25	RU2	DP249446/4	112138.1
25	RU2	DP554953/1	116522.4
25	RU2	DP850925/61	24434.51
25	RU2	DP816238/1	135426.3
25	RU2	DP819476/202	19975.87
25	RU2	DP249446/1	106923.7
25	RU2	DP850925/60	548453.4
25	RU2	DP623982/302	52834.58
25	RU2	DP812178/35	39147.21
25	RU2	DP249286/2	103640.6
25	RU2	DP804375/1	13550.19
25	RU2	DP819476/201	20005.65
25	RU2	DP249446/3	20284.04
25	RU2	DP584515/2	3025.24
25	RU2	DP242871/13	100806
25	RU2	DP242871/12	102671.5

Contour	Zoning	DP/LOT	Area (m²)
25	RU2	DP242048/3	105008
25	RU2	DP249286/3	105539.7
25	RU2	DP860754/202	49978.89
25	RU2	DP242871/15	104922.8
25	RU2	DP249286/4	106692.7
25	E2	DP752012/85	6124.88
25	E2	DP826431/13	1349.8
25	E2	DP601443/1	9625.96
25	E2	DP599222/1	25832.12
25	E2	DP1108783/3	725.66
25	E2	DP595675/1	138922.1
25	E2	DP835406/33	482.46
25	RU2	DP503708/1	2308
25	RU2	DP532903/1	2073.87
25	RU2	DP601443/2	4008.98
25	RU2	DP522044/2	587455.1
25	E2	DP375976/1	48341.46
25	E2	DP87980/3	251535.5
25	E2	DP830740/1	576323.6
25	E2	DP435855/B	99753.83
25	E2	DP751297/27	190413.7
25	E2	DP1100128/42	400483.2
25	E2	DP814316/62	16246.5
25	E2	DP128462/1	227331
25	E2	DP369011/A	205968.1
25	E2	DP745822/1	555092
25	E2	DP908904/1	42879.82
25	E2	DP814316/57	209254.8
25	E2	DP751297/56	160665.4
25	E2	DP751297/59	158585.5
25	E2	DP751297/54	159637.5
25	E2	DP122226/1	378752.4
25	E2	DP751297/57	159635.3
25	E2	DP108340/3	151416.2
25	E2	DP751297/62	157589.8
25	E2	DP1100128/42	400483.2
Total Lots		**444**	

Option 7

Contour	Zoning	DP/LOT	Area (m²)
40	RU2	DP812178/34	23573.55
40	RU2	DP812178/33	10060.76
40	RU2	DP814316/60	292036.3
40	RU2	DP812178/35	39147.21
40	RU2	DP242871/12	102671.49
40	RU2	DP812178/30	72947.61
40	RU2	DP812178/31	89070.36
40	E2	DP1100128/42	400483.19
40	RU2	DP883647/6	215591.7
40	E2	DP814316/57	209254.82
Total Lots		**10**	
35	RU2	DP883647/6	215591.7
35	RU2	DP812178/34	23573.55
35	RU2	DP883647/5	213927.45
35	RU2	DP812178/33	10060.76
35	E2	DP236173/1	2699.34
35	RU2	DP236173/6	158415.71
35	RU2	DP814316/60	292036.3
35	RU2	DP812178/35	39147.21
35	RU2	DP242871/13	100806.01
35	RU2	DP242871/12	102671.49
35	RU2	DP812178/30	72947.61
35	RU2	DP812178/31	89070.36
35	E2	DP1100128/42	400483.19
35	E2	DP814316/57	209254.82
35	E2	DP203231/2	249491.51
35	E2	DP751297/54	159637.51
Total Lots		**16**	
30	RU2	DP883647/4	102040.16
30	RU2	DP883647/6	215591.7
30	RU2	DP812178/34	23573.55
30	RU2	DP883647/5	213927.45
30	RU2	DP812178/32	372089.22
30	RU2	DP812178/33	10060.76
30	RU2	DP837310/75	436253.56
30	RU2	DP702025/2	34494.25
30	E2	DP236173/1	2699.34
30	E2	DP814316/56	157.05
30	RU2	DP236173/6	158415.71
30	RU2	DP814316/60	292036.3
30	RU2	DP242871/9	98197.57
30	RU2	DP601401/1	56486.8

Contour	Zoning	DP/LOT	Area (m²)
30	RU2	DP812178/35	39147.21
30	RU2	DP785888/101	4857.36
30	RU2	DP242871/13	100806.01
30	RU2	DP242871/12	102671.49
30	RU2	DP812178/30	72947.61
30	RU2	DP812178/31	89070.36
30	E2	DP1100128/42	400483.19
30	E2	DP814316/57	209254.82
30	E2	DP203231/2	249491.51
30	E2	DP751297/54	159637.51
30	E2	DP122226/1	378752.4
30	E2	DP88145/1	2750.4
30	E2	DP751297/62	157589.77
Total Lots		**27**	
25	RU2	DP883647/4	102040.16
25	RU2	DP883647/6	215591.7
25	RU2	DP587498/1	101194.86
25	RU2	DP812178/34	23573.55
25	RU2	DP883647/3	134163.91
25	RU2	DP883647/5	213927.45
25	RU2	DP883647/2	129203.19
25	RU2	DP812178/32	372089.22
25	RU2	DP1076362/1	170164.39
25	RU2	DP812178/33	10060.76
25	RU2	DP814316/61	75121.3
25	RU2	DP837310/75	436253.56
25	RU2	DP837310/71	93685.2
25	RU2	DP837310/73	98958.18
25	RU2	DP445344/1	232.73
25	RU2	DP702025/3	4097.59
25	RU2	DP702025/2	34494.25
25	RU2	DP251051/18	145285.66
25	RU2	DP88145/2	6983.34
25	RU2	DP837310/72	93590.72
25	E2	DP236173/1	2699.34
25	E2	DP814316/56	157.05
25	RU2	DP584470/22	77048.83
25	RU2	DP749823/41	23689.4
25	RU2	DP609222/2	147822.23
25	RU2	DP233845/7	169049.95
25	RU2	DP251051/16	99881.58
25	RU2	DP233845/1	178549.31
25	RU2	DP233845/6	160692.91

Contour	Zoning	DP/LOT	Area (m²)
25	RU2	DP400704/Y	3334.31
25	RU2	DP584470/21	75502.35
25	RU2	DP233845/5	162688.97
25	RU2	DP233845/2	161550.99
25	RU2	DP233845/3	160436.82
25	RU2	DP749823/40	136637.76
25	RU2	DP236173/6	158415.71
25	RU2	DP814316/60	292036.3
25	RU2	DP242048/4	96459.74
25	RU2	DP601401/2	53091.02
25	RU2	DP242871/9	98197.57
25	RU2	DP601401/1	56486.8
25	RU2	DP812178/35	39147.21
25	RU2	DP242871/8	104385.63
25	RU2	DP785888/101	4857.36
25	RU2	DP242871/13	100806.01
25	RU2	DP242871/12	102671.49
25	RU2	DP242048/3	105007.97
25	RU2	DP812178/30	72947.61
25	RU2	DP812178/31	89070.36
25	RU2	DP242871/15	104922.81
25	E2	DP751297/27	190413.73
25	E2	DP1100128/42	400483.19
25	E2	DP814316/62	16246.5
25	E2	DP751291/9	178447.32
25	E2	DP751291/21	9136.6
25	E2	DP814316/57	209254.82
25	E2	DP751297/56	160665.42
25	E2	DP203231/2	249491.51
25	E2	DP732649/10	25220.51
25	E2	DP751297/59	158585.53
25	E2	DP751297/54	159637.51
25	E2	DP122226/1	378752.4
25	E2	DP88145/1	2750.4
25	E2	DP1096065/17	110281.1
25	E2	DP108340/3	151416.17
25	E2	DP751297/62	157589.77
Total Lots		**66**	

2.6.3 Summary of Airport Options

Table 1.3 summarises the approximate number of properties located within the Australian Noise Exposure Concept (ANEC) contours 40, 35, 30 and 25 for all options.

Table 1.3 Approximate number of properties located within ANEC contours

Option	ANEC 40	ANEC 35	ANEC 30	ANEC 25	Total
Option 1	10	16	31	73	**130**
Option 1 south	6	15	27	66	**114**
Option 2	7	18	70	144	**239**
Option 3	1	2	2	8	**13**
Option 4	n/a	n/a	1	11	**12**
Option 5	n/a	1	2	2	**5**
Option 6	4	11	35	444	**494**
Option 7	10	16	27	66	**119**

The option with the most number of properties impacted is Option 6 with approximately 494 properties located within all ANEC contours 40, 35, 30 and 25. The airport option with the least amount of properties impacted is Option 5 with approximately 5 properties located within all ANEC contours 40, 35, 30 and 25.

Notwithstanding the above, the Australian Standard AS2021 provides guidance to regional, local authorities and others associated with urban and regional planning and building construction on the acceptable location of new buildings in relation to aircraft noise. Zones that are described as *"conditionally acceptable"* may be approved as building sites provided that any new construction incorporates sound proofing measures. These areas include residential dwellings within ANEC 20 -25.

Having regard to the above, that dwellings are *'conditionally acceptable'* within ANEC 20-25 with the incorporation of sound proofing measures, the focus of decision making should be based on properties impacted by ANEC 25-40.

2.7 Local Government Areas affected by ANEC contours

The following table identifies the Local Government Areas (LGAs) affected by the ANEC contours for each airport option.

Table 1.4 LGAs affected by ANEC contours for airport options

Option/LGA	Wollondilly	Wollongong	Wingecarribee
Option 1	Yes	No	Yes
Option 1 south	Yes	Yes	Yes
Option 2	Yes	Yes	Yes
Option 3	Yes	Yes	No
Option 4	Yes	Yes	No

Option/LGA	Wollondilly	Wollongong	Wingecarribee
Option 5	Yes	Yes	No
Option 6	Yes	Yes	Yes
Option 7	Yes	Yes	No

As indicated in **Table1. 4**, Option 1 South, Option 2, and Option 6 contain ANEC contours which extend into all three Local Government Areas (LGAs).

2.8 Land owner nominated sites located within ANEC contours

A series of reviews are currently underway by the NSW Government as part of its commitment to increase housing supply to meet projected housing demand across NSW. These include looking at the impediments to the release of additional housing, along with a review of major landholdings for their potential to provide more homes. To assist in this process, the NSW Department of Planning & Infrastructure requested the participation of a range of major development companies, industry associations and landowners.

In 2011 the Minister for Planning and Infrastructure invited owners of large lots to express their interest in developing their land for housing (*'Landowner Nominated Sites'*). Forty three (43) submissions were received by the closing date of 29 November 2011. Of these, twelve (12) submissions were found to be inadequate and a decision was made that no further assessment would be undertaken on them under the current process.

The process resulted in ten (10) sites being nominated within the Wollondilly LGA. One of the sites within the Wollondilly LGA was not considered suitable for further assessment (a 2.3ha site at Reservoir Road, Bargo). The remaining nine (9) sites are currently being considered by the Department of Planning and Infrastructure for housing development (refer table 2.5below).

Table 2.5 Housing development Wollondilly LGA (source: NSW Department of Planning and Infrastructure)

Site Name	Site Location	Area (ha)
WOLLONDILLY LGA		
Appin Vale	West of Appin Village	517.1
Bingara Gorge	North of Picton Road and east of the F6 Freeway (Hume Highway), Wilton	290.3
Brooks Point, Appin	South west of Appin village	240.0
Cawdor	Cawdor Road and Remembrance Drive Cawdor	531.2
Mayfarm Road	Mayfarm Road, Brownlow Hill	406.0
Silverdale	Taylors Roads and Eltons Road, Silverdale	238.0
West Thirlmere	Stone Quarry Creek and Lakes Street, Thirlmere	819.5
Wilton South	South of Picton Road and east of F6 Freeway (Hume Highway), Wilton	391.9
Wilton West	West of F6 Freeway (Hume Highway) and north of Picton Road, Wilton	626.6

No sites were nominated within the Wollongong LGA.

One site within the Wingecarribee LGA at Mary Street, Mittagong (75.8ha) was nominated. However the site was found to be inadequate and a decision was made that no further assessment would be undertaken.[5]

There are five land owner nominated sites occurring within 3 km of the Wilton study area:

- Bingara Gorge (approved and currently under construction)*;
- Wilton South*;
- Brooks Point*;
- Wilton West (6,000 dwellings); and
- Appin Vale (10,000 dwellings).

A total of 10,000 dwellings are contemplated for Bingara Gorge, Wilton South and Brooks Point. Bingara Gorge is a new residential release area approved by Wollondilly Council in 2006. The approved Masterplan provides for 1,165 residential allotments which would accommodate 3,500 people.

If all land owner nominated sites are approved, this would result in approximately 26,000 new dwellings and between 60,000 – 75,000 additional people around the Wilton site.

The following sections provide a summary of the five land owner nominated sites affected by ANEC contours for each airport option. Refer to Figures – ANEC Footprints for Runway Options 1-7 in Working Paper *Acoustic Effects on People.*

2.8.1 Option 1

Wilton South is partially located within Option 1 airport footprint. Part of the nominated land site is also located within ANEC contours 25 and 20.

Both Brooks Point and Appin Vale nominated land sites are partially located within ANEC contours 25 and 20 of Option 1.

Bingara Gorge and Wilton West are not located within the ANEC contours of Option 1.

2.8.2 Option 1 south

Wilton South is partially located within the Option 1 south airport footprint and is also partially located within ANEC contour 20.

Both Brooks Point and Appin Vale are partially located within ANEC contour 25 and 20.

Bingara Gorge and Wilton West are not located within the ANEC contours of Option 1 south.

2.8.3 Option 2

Wilton South is partially located within ANEC contour 20.

Bingara Gorge is partially located within ANEC contours 25 and 20.

Wilton West abuts ANEC contour 20.

Brooks Point is partially located within ANEC contours 25 and 20.

Appin Vale is not located within the ANEC contours for this option.

2.8.4 Option 3

Brooks Point and Appin Vale are partially located within ANEC contours 25 and 20.

[5] The NSW Government commenced a review of potential housing opportunities on sites nominated by landowners and a draft report was expected in August 2012.

Bingara Gorge, Wilton South and Wilton West are not located within the ANEC contours for this option.

2.8.5 Option 4

Brooks Point and Appin Vale are partially located within ANEC contours 25 and 20.

Bingara Gorge, Wilton South and Wilton West are not located within the ANEC contours for this option.

2.8.6 Option 5

All land nominated sites are not located within ANEC contours for this option.

2.8.7 Option 6

Wilton South is located within the airport footprint for Option 6 and is also partially located within ANEC contours 40, 35, 30, 25 and 20.

Brooks Point and Appin Vale are partially located within ANEC contours 30, 25 and 20.

Bingara Gorge and Wilton West are not located within ANEC contours for this option.

2.8.8 Option 7

Wilton South is partially located within the airport footprint and is also partially located within ANEC contours 40, 35, 30, 25 and 20.

Bingara Gorge, Wilton West, Brooks Point and Appin Vale are not located within ANEC contours for this option.

2.9 Potential Impacts

Potential property impacts can arise from both direct and indirect impacts.

Direct property impacts include land take, which refers to how much land is required for the airport. Depending on the type of land built on or enclosed, land take can lead to:

- Wildlife habitat loss and fragmentation (refer Working Paper Flora and Fauna);
- Impacts on water catchments (refer Drinking Water Catchment, Hydrology and Drainage);
- Loss of existing housing and entire communities (refer Working Paper Land Use Planning and Future Development);
- Loss of agricultural land (refer Working Paper Land Use Planning and Future Development); and
- Loss of land that could otherwise be used for housing, community facilities, open space and playing fields (refer Working Paper Land Use Planning and Future Development).

Indirect property impacts include matters such as visual, noise, social and economic impacts.

More generally, land take for airport-related development can add to a drip-feed of development in an area which adds up to a change from a rural to a more urban atmosphere.

The Commonwealth Government may consider the acquisition of properties depending on their proximity to a potential airport site and the level of ANEC exposure.

Key impacts as a result of land acquisition would include the following:

- Loss of property;
- Severance of property;
- Amount of compensation given;
- Loss of livelihood;
- Loss of income; and
- Loss of community.

Whilst direct beneficial impacts of land acquisition would require specific investigation, subsequent construction of an airport at Wilton would result in the following:

- Increased employment opportunities;
- Increased economic activity within the Wilton area and beyond; and
- Indirect and direct benefits accrued throughout the community.

2.10 Residential

Having regard to the ANEC footprints for each airport option, the level of impact is outlined at Section 6.

The potential for local resistance to change often increases in proportion to length of residence as well as the sense of loss and disruption to self, community, livelihoods and so forth.

2.11 Business

Assessment of impacts on businesses requires a different approach. Particularly having regard to the types of businesses within the Wilton Study Area (horse stud farms, stables, grazing, dairy farms, and collieries) which are land uses generally not located in a business zone. An estimate of temporary financial loss and of temporary relocation costs will be required for businesses that will be able to relocate within the immediate area. For businesses that will have to move out of the area, or that will suffer a major loss of clientele, it will be necessary to estimate the cost of income, relocation and re-establishment.

- Rural land uses including farming; and
- Industrial land uses including mining.

2.12 Impacts on land owner nominated sites

A number of land owner nominated urban development sites are located within ANEC contours 20-40 of the airport Options for Wilton. The Australian Standard AS2021-2000 provides criteria which prohibits or restricts certain types of development. Depending on which ANEC contour land is located in, the guidelines also suggest compulsory acquisition.

It will be necessary to ensure that such developments – if they proceed - do not proceed in forms which would lead to operational constraint of an airport at Wilton in any of its various stages of development, should one of the options for an airport be further considered.

2.13 Ameliorative strategies to reduce effects

In order to reduce property impacts the following strategies could be considered and further investigated:

- Review the specific locations, layout and size of the airport facilities; and
- Review the runway alignments (impact on ANEC contours).

Ameliorative strategies could include measures to communicate and harness positive social benefits of airport development arising from increased scope of employment opportunities and consequential facilities that are likely to be available from an airport development

Different communication strategies for a wide range of stakeholders should be put in place with the use of various communication tools.

In terms of compulsory land acquisition, it is important to provide environments for negotiation over the compulsory purchase to insure that the interests of existing property and business owners are catered for. At present the legislation governing the acquisition process is fragmented into heads of compensation in which an affected party must navigate in order to prove their compensation (Mangioni, 2009).

Land acquisition and resettlement actions also have the potential to impact on remaining residents (loss of personal/community connections or impacts on facilities) and businesses (fear, real or imagined, of competition from new business). Consideration also needs to be had to potential impacts of resettlement on the *"host"* community.

Other policy and legal frameworks could be explored to mitigate negative direct and indirect environmental and social effects.

2.14 References

Department of Infrastructure and Transport http://www.infrastructure.gov.au/aviation/environmental/insulation/index.aspx 20 May 2011).

Department of Transport and Regional Services (2000) *Discussion Paper – expanding ways to describe and assess aircraft noise*.

Standards Australia*, Australian Standard AS 2021-2000 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction (AS2021)*

Vince Mangioni (2009) *'The evolution of the 'Public Purpose Rule'* in 'Compulsory acquisition Referred paper', Pacific Rim Real Estate Society Conference Sydney, Australia 18-21 January, University of Technology, Sydney, accessed on 31 July 2012 from:

http://www.prres.net/papers/Mangioni_The_Evolution_Of_The_Public.pdf

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3 WORKING PAPER – SOCIAL EFFECTS OF AIRPORTS

SUMMARY

This Working Paper identifies the suite of social issues likely to be associated with the various stages of the planning, development and operation of an airport at Wilton. Based on global and local experience, the planning, development and operation of large scale airports can have a range of social impacts – both positive, such as enhanced employment opportunities and negative, such as changes to amenity and character – on various communities. The nature and locational spread of such impacts depend to a large extent on either the proximity of residential areas to the airport or the functional relationship that people have to the airport as either airport users or airport workers.

The direct and quantitative social impacts of airport development at Wilton assessed in this Working Paper are:

- The number of properties to be acquired (as per the findings of the Working Paper Impacts on Properties); and
- The number of social assets to be acquired and potentially requiring re-establishment elsewhere in the local area.

A number of strategies can be implemented to reduce the social impacts of airport development, including:

- Ensuring that the acquisition process is undertaken in a timely, responsive and sensitive manner;
- Ensuring clear lines of communication are available between the affected property owners and the agency undertaking the acquisition process;
- Ensuring that the acquired property is managed in an appropriate manner in the period between completion of the acquisition process and the commencement of construction so that access to the land is appropriately controlled to prevent inappropriate activities, manage bushfire risk and ensure that the land does not look neglected;
- Ensuring that the wider community – both locally and relevant stakeholders – are kept informed of the progress of land acquisition and management of land acquired; and
- Providing specific assistance, if required or requested, to help residents undertake the relocation process, for example, if there are affected residents who are unsure about or unfamiliar with the process of locating and acquiring another property, confidential assistance could be offered to assist with this process.

3.1 Introduction

The intent of this Working Paper is to identify the suite of social issues likely to be associated with the various stages of the planning, development and operation of an airport at Wilton. These issues are identified and discussed in this Working Paper, together with ameliorative measures to reduce adverse impacts. Any residual impacts are also identified.

3.2 Social impacts

3.2.1 Nature of social impacts

Based on global and local experience, the planning, development and operation of large scale airports can have a range of social impacts – both positive and negative – on various communities. The nature and locational spread of such impacts depend to a large extent on either the proximity of residential areas to the airport or the functional relationship that people have to the airport as either airport users or airport workers.

Social Impact Assessment (SIA) is a social research tool that is used to review and assess the potential social impact of a planned intervention, such as a policy change, public program or infrastructure development. SIA is used to review the intended and unintended social consequences, both positive and negative, of planning interventions and any social change processes invoked by those interventions. The International Association of Impact Assessment (IAIA) identified the following social impact variables, as a way to conceptualise social impacts.

Social impacts are changes to one or more of the following:

- People's way of life: that is, how they live, work, play and interact with one another on a day-to-day basis;
- Their culture: that is, their shared beliefs, customs, values and language or dialect;
- Their community: its cohesion, stability, character, services and facilities;
- Their political systems: the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose;
- Their environment: the quality of the air and water people use; the availability and quality of the food they eat; the level of hazard or risk, dust and noise they are exposed to; the adequacy of sanitation; their physical safety; and their access to and control over resources;
- Their health and wellbeing: health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity;
- Their personal and property rights: particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties; and
- Their fears and aspirations: their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children. (International Association of Impact Assessment 2003).

3.2.2 Social impacts of airport planning and development

The consideration of social impacts of airport development and operations is recognised by most of the international organisations involved in various aspects of airport development and operation such as the International Civil Aviation Organisation (ICAO) and the Airports Council International (ACI), see for example:

> *"The ACI membership is committed to the principles of sustainable development, which include finding the appropriate balance between the social, economic and environmental aspects of growth. We believe that we can indeed grow and respect limits. The question is how, and what are the best strategies for each of the aviation stakeholders to employ in meeting their environmental responsibilities. (ACI)"*

In terms of technical assessment, a comprehensive guide to the environmental assessment of airport projects is provided by the USA's Federal Aviation Administration's Airport's Desk Reference (2007). The Desk Reference includes information addressing ways to evaluate potential environmental impacts due to a proposed airport action, and when appropriate, its reasonable alternatives. It also provides information on mitigation measures. One of the 23 environmental impact categories addressed in this Reference is social impacts. This chapter is prefaced as follows:

> *"FAA must evaluate proposed airport development actions to determine if they would cause social impacts. This evaluation should include effects on health and safety risks to children, and socioeconomic impacts. Those impacts include moving homes or businesses; dividing or disrupting established communities; changing surface transportation patterns; disrupting orderly, planned development; or creating a notable change in employment."*

As part of the *Joint Study on Aviation Capacity in the Sydney Region* (the Joint Study) WorleyParsons and AMPC prepared the *Airport Suitable Sites - Specified Localities* technical paper. Of the criteria used to identify more suitable sites for new aviation capacity in the Sydney region, several have a social dimension (see bold criteria below):

- **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 which usually would be provided by ASA, CASA and the Department of Defence[6];
- 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. (Emphasis added)**

3.2.3 Social impact criteria used in this paper

Based on the above discussion and with the intention of avoiding '*double counting'* of the same or similar impact with other technical assessments, the following social impact criteria have been adopted for use in relation to assessment of the Wilton site. These criteria are listed in relative chronological order in which they would be manifest in the airport planning and development process. These criteria are:

6 At the time of finalising this report, a limited response from ASA had been received.

Planning phase

- The number of occupied dwellings on landholdings to be acquired to form the notional airport site and, as a result, the number of permanent residents who would have to relocate;
- The number and nature of social assets that would have to be relocated or reorganised as a result of land acquisition to form the notional airport site;

Construction and operational phase

- Proximity of the notional airport site to designated population and employment growth centres;

Operational phase

- Aircraft noise impacts on residents beyond the notional airport site boundaries (including the number of person-events).

The above criteria are all measurable and can be defined from desk studies or other assessments being prepared as part of the further assessment of the Wilton site.

It should be noted that there will be other social impacts that are largely qualitative that will be manifest at all stages of the planning, development and operation of an airport at Wilton. Qualitative impacts include (and are not limited to):

- Concerns by landowners and residents about land acquisition and related impacts such as the need for relocation;
- Concerns by the local community not directly affected by land acquisition about potential changes in the local community structure through the relocation of local residents and changes in the character of the Wilton and other local communities flowing from the development of a major infrastructure element and related land use and transport changes; and
- Concerns by residents located further afield who may be subject to the introduction of exposure to aircraft noise and other real or perceived adverse operational aspects.

3.3 Description of issue

3.3.1 Communities of interest

Five community levels of interest have been identified as relevant to the social impacts of airport development at Wilton (see Table 3.1) ranging from metropolitan level to the site-specific level.

In terms of the social impact criteria which have been adopted for use in relation to assessment of the Wilton site (see Section 3.2.3), the largely beneficial social impacts likely to be experienced at the three higher order levels of interest (such as the availability of air travel options for the broader community and the job opportunities created) are unlikely to assist differentiation between the seven options proposed at Wilton.

As the assessment focuses progressively on the regional and local communities of interest, the adopted social impact criteria (both beneficial and adverse) will assist in identifying differences between the options. These criteria are:

- Number of people required to relocate from existing dwellings located within the airport footprint for each defined airport option; and
- Number of social assets located within the airport footprint for each defined airport option.

3.3.2 Population of the Wilton Area

The 2011 Census recorded a population of 1,890 persons in the area defined by the ABS as Wilton (NSW) (SSC12510) with an area of 64.9 sq. km.

Table 3.1 Communities of interest

Study Regions	Basis of Definition	Relationship to Social Impacts	Relevance to Wilton Options Assessment
Sydney region	Area used in the Joint Study (defined as 'as far north as Williamtown in the Hunter and as far south as Canberra')	Encompasses the area from which most airport users would be drawn and who would benefit from the availability of a second airport.	Unlikely to assist differentiation between options.
South West Sydney sub-region	NSW Department of Planning and Infrastructure	Encompasses area from which most airport workers would be drawn who would benefit from the range of employment opportunities generated during the various phases of airport development.	Unlikely to assist differentiation between options.
Surrounding LGAs	Region comprising LGAs of Wollondilly, Camden, Campbelltown and Wollongong – boundaries as gazetted under the NSW Local Government Act	Encompasses area within which most offsite adverse impacts would be experienced especially exposure to aircraft noise.	Social impacts at this scale will assist differentiation between options.
Wollondilly LGA	Boundary gazetted under NSW Local Government Act	As the total proposed airport site is located within this LGA, this area encompasses all local social impacts (adverse and beneficial) during construction and operation impacts.	Social impacts at this scale will assist differentiation between options.
Wilton study area	Area contained in the following boundaries: • Upper Nepean State Conservation Area (West); • the townships of Wilton, Douglas Park and Appin (North); • Cordeaux River and Cataract River dam areas (East–Cataract and South – Cordeaux).	The area within which an airport at Wilton would be located including the area of direct local social impacts such as relocation of residents resulting from property acquisition, localized construction impacts and localized operation impacts.	Social impacts at this scale will assist differentiation between options.

3.4 Legislative Status

Legislation that provides the context for the consideration of social issues in relation the planning, development and construction of large-scale airports is set out below.

3.4.1 Commonwealth

At the Commonwealth level, the *National Aviation Policy White Paper: Flight Path to the Future* (Commonwealth of Australia 2009) recognised community concerns about the planning, development and operation of airports and proposed stronger planning and consultative measures to respond to community concerns about airport development and the environmental impacts of airport operations. An outcome of the White Paper process was the amendment of the *Airports Act 1996* in 2010 to give effect to the findings of this process.

3.4.1.1 Airports Act 1996

The *Airports Act 1996* (and related Regulations) regulates the planning and operation of existing leased airports on Commonwealth land and applies to a number of major Australian airports in capital cities, including Sydney Airport.

Various sections of this Act provide guidance about issues that the community would see as reasonable to be addressed in planning for a new airport. While not identifying '*social impacts'* as such, these sections provide a broad framework within which relevant social and community impacts can be identified and assessed. These sections are:

- Section 71 of this Act sets out the matters to be included in a Final Master Plan for an airport regulated by this Act. These matters include a wide range of planning and environmental considerations related to the planning for and operation of the subject airport and the key offsite impacts such as exposure to aircraft noise. In the first five years of a Master Plan, there is a particular emphasis on landside ground transport including wider transport network relationships and effects on *'….the local and regional economy and community, including an analysis of how the proposed developments fit within the planning schemes for commercial and retail development in the area that is adjacent to the airport'*;
- Stakeholder consultation is an essential element of the preparation of a Master Plan including compliance with the statutory requirements under the Act and consistency with the Australian Government's suggested approach to effective consultation for airport master plans, as outlined in the Airport Development Consultation Guidelines (2007). These Guidelines could be viewed as setting a minimum standard for consultation during Master Plan preparation; and
- Section 89 which sets out what constitutes a *'major airport development'* and, as a result, required the approval by the Minister of Infrastructure and Transport of a Major Development Plan (MDP). Major airport developments includes a range of airport development types such as terminals and runways as well as development that may have significant environmental or ecological impacts or which may affect an area of environmental significance identified in an airport Environment Strategy. This section also includes the more recently introduced category through the 2010 amendments to the Act. This category of *'major airport development'* is not further defined in the Act.

In response to the introduction of this new '*trigger*' for preparation of an MDP, the Department of Infrastructure and Transport (2012) issued the *Significant Impact on the Local or Regional Community Guide* (the Guide). The purpose of this Guide is:

> *"…to assist industry stakeholders including airports, developers and the public with an understanding of the factors that may be relevant to determining whether a proposed development triggers the 'significant impact on the local or regional community' clause, which is s89(1)(na) of the Airports Act 1996:".*

In addition to possible significant environmental or ecological impacts, community security or land use planning, the Guide advises that airport lessee companies, as managers of the airport site, should carefully consider the possible community impacts if:

- The type of development is of known concern to the community or government (for example, has an issue been identified in a Ministerial approval of a master plan or raised concerns in discussions at planning forums?);
- The proposed development is in conflict with planning schemes for the local and regional communities surrounding the airport; or

- The type of development has raised substantial community concerns (for example, have comparable developments attracted adverse community reaction in the past or raised concerns in community consultation groups).

The Guide advises that in assessing whether the impacts of the proposed development are significant, considerations taken into account will include:

- The duration of impact;
- The timing of impact;
- The scale of impact, both in terms of geographic coverage and numbers of people or businesses affected; and
- Any mitigation strategies proposed to address possible impacts.

Consultation with the community is considered to be an important element in the identification of possible community impacts as noted in the Guide:

A full understanding of the potential impacts of a proposed development will only emerge from discussions between the developer, community stakeholders, and planning authorities. An impact that was not initially obvious in the framing of a proposal may be identified through community comment and scrutiny by planning authorities.[7]

Section 91 of the Act sets out what the content of an MDP must include – specifically in relation to what might be considered social issues and impacts:

a) the likely effect of the proposed developments that are set out in the major development plan, or the draft of the major development plan, on:
   i. traffic flows at the airport and surrounding the airport; and
   ii. employment levels at the airport; and
   iii. the local and regional economy and community, including an analysis of how the proposed developments fit within the local planning schemes for commercial and retail development in the adjacent area;
b) the airport-lessee company's assessment of the environmental impacts that might reasonably be expected to be associated with the development...

Community consultation is also built into the MDP process and guided by the *Airport Development Consultation Guidelines* (2007).

3.4.1.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places - defined in the EPBC Act as eight matters of national environmental significance.

In addition, the EPBC Act confers jurisdiction over actions that have a significant impact on the environment where the actions affect, or are taken on, Commonwealth land, or are carried out by a Commonwealth agency (even if that significant impact is not on one of the eight matters of '*national environmental significance*'). If an '*action*' is required to be assessed under the EPBC Act by means of an Environmental Impact Statement (EIS), the Minister must issue to

[7] See reference 6 pp 6

the proponent of the proposed action written guidelines for the preparation of the EIS. Public comment may be invited by the Minister on draft guidelines and considered before the '*final*' guidelines area issued.

A recent aviation sector project that was subject to an accredited process (by means of both an MDP under the *Airports Act 1996* and an EIS under the EPBC Act) was the New Parallel Runway Project at Brisbane Airport. These guidelines included the following social impacts to be addressed in the assessment documentation:

- A description of the key demographic characteristics of the South East Queensland region, including demographic trends;
- Impacts of runway construction and airport operation on regional and local communities including noise, traffic, air quality, amenity, demands on local services, changes to lifestyle and everyday activities;
- Impacts of airport operations on regional and local communities including impacts on demographic characteristics due to redevelopment or changes in land values;
- Property acquisition requirements and processes;
- Impacts on potential Native Title claimants; and
- Impacts on radio and television reception. [8]

3.4.2 New South Wales

3.4.2.1 Environmental Planning and Assessment Act 1989

Planning and development in New South Wales is carried out under the *Environmental Planning and Assessment Act 1979* and *Environmental Planning and Assessment Regulation 2000*. Section 4 of this Act defines *'environment'* as including '*all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings*'. Arguably, this definition provides the framework in which impacts on people or social impacts are to be considered.

Under State Environmental Planning Policy (State and Regional Development) 2011, an EIS has to be prepared as part of the consent process for development that is identified as '*State significant development'* (SSD) or *'State significant infrastructure*'. One of the categories of SSD is '*Air transport facilities'* which is defined as '*development for the purpose of air transport facilities that has a capital investment value of more than $30 million*".

When an EIS is prepared for a SSD, the Director-General of the Department of Infrastructure and Planning issues requirements for the matters to be addressed in the EIS. These requirements for SSDs regularly require relevant social impacts to be addressed. As of 14 July 2012, no recent airport projects are included on the Department of Planning and Infrastructure's Major Project Assessments register.

3.5 Summary of issues from the Second Sydney Airport Site Selection Process

As part of the Second Sydney Airport Site Selection Programme, a Draft Environmental Impact Statement (the Draft EIS) was prepared. The analysis of the Wilton site in the Draft EIS focussed on land use patterns in the area and the land acquisition process. No material was presented on the structure of the local community or on likely social impacts related, for example, the relocation of residents as a result of land acquisition or on the local community structure through residents relocating away from the Wilton area.

[8] Brisbane Airport Corporation. 2007. New parallel runway Draft EIS/MDP B9 pp 418

3.6 Analysis of issues in terms of current airport concepts

3.6.1 Social changes in the Wilton area

Since the Draft EIS was conducted in 1985, development in and around Wilton has included:

- Development of the master planned Bingara Gorge residential development located north of Picton Road and east of the Hume Highway, which will ultimately accommodate a population of approximately 3,500 people has recently commenced;
- Further applications for residential development areas are currently being assessed; and
- Expansion of underground mining activity is currently occurring. Previous and current mining operations have resulted in subsidence in certain areas adjacent to the proposed site.

Discussion of land use planning and future development is provided in the Working Paper *Land use Planning Context and Future Development*. The relatively low population densities in Wilton have implications for direct social impacts associated with future land acquisition for an airport site (as discussed in the Working Paper *Property Impacts)*.

3.6.2 Assessed social effects

The direct and quantitative social impacts of airport development at Wilton assessed in this Working Paper are:

- The number of properties to be acquired and related assessment of the residential population that may have to relocate; and
- The number of social assets to be acquired and potentially requiring re-establishment elsewhere in the local area.

In addition, if there are residents relocated from the airport footprint, there may be related impacts on the local population and community structure in and around Wilton.

Indirect social impacts including broader community concerns about impacts of airport development and operation such as aircraft noise[9], risk of aircraft incidents, air emissions, and increased ground traffic would become progressively manifest during the airport planning process and through community consultation programs.

3.6.2.1 Estimated number of residents to be relocated

The number of allotments located within each airport footprint is shown in Table 3.2 along with the estimated number of existing dwellings. When an occupancy rate of 3.13 persons per dwelling (derived from family size from 2011 Census data for the Wilton State Suburb classification) is applied to these dwellings, an estimate of the number of people who may need to be relocated as a result of land acquisition for the airport footprint can be derived.

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[9] Note – the number of people potentially affected by various levels of exposure to aircraft noise is addressed in the Working Paper Acoustic Effects on People and, to avoid 'double counting' in the assessment process, this impact category is not addressed in this Working Paper.

Table 3.2 Estimate of number of people required to relocate from airport footprints

Criterion	Option No.							
	1	**1S**	**2**	**3**	**4**	**5**	**6**	**7**
Estimate of Residents Directly Affected								
Number of allotments within airport footprint	69	88	102	4	4	4	106	102
Estimated population within airport footprint (polygons)	69	109	138	0	0	0	145	149

On the basis of the estimated population within airport footprints (polygons), the following conclusions could be drawn:

- Options 1, 1 South, 2, 6 and 7 would require the relocation of residents;
- Of these options, Option 1 would require a lower number of residents to be relocated - approximately 69 compared with over 100 for Options 1 South, 2, 6 and 7; and
- Options 3, 4 and 5 would not require the relocation of any residents.

To put this in a local context, a *'worst case'* relocation of say 149 people for Option 7 would represent in the order of 8% of the 2011 population in the Wilton SSC (see Section 3.3.2). From a *"social impact on Wilton"* perspective, this would be considered to be a *'significant'* impact both in absolute and relative terms, although such numbers are very small by comparison with what might occur at Sydney Airport if – hypothetically - it were to expand beyond its existing site boundaries into adjoining urban areas. This is because there are likely to be more social linkages and connections in a small community like Wilton.

Following relocation of the population within the airport footprint, further acquisition of properties and subsequent relocation of people may be required due to noise impacts. Properties located within ANEC contours 40, 35, 30 and 25 may need to be acquired. The approximate population exposed to these ANEC contours for each airport option is shown in Table 3.3.[10]

Table 3.3 Approximate number of properties and approximate population within ANEC contours

Criterion	Option No.							
	1	**1S**	**2**	**3**	**4**	**5**	**6**	**7**
Estimate of residents directly affected								
ANEC 40								
Number of allotments within ANEC Contour	10	6	7	1	n/a	n/a	4	10
Estimated population exposed to ANEC Contour	0	0	0	0	0	0	0	0

[10] Note - calculations regarding ANEC noise contours have assumed that the population currently within the airport footprint has been relocated.

Criterion	Option No.							
	1	1S	2	3	4	5	6	7
ANEC 35								
Number of allotments within ANEC Contour	16	15	18	2	n/a	1	11	16
Estimated population exposed to ANEC Contour	0	4	2	0	0	0	0	0
ANEC 30								
Number of allotments within ANEC Contour	31	27	70	2	1	2	35	27
Estimated population exposed to ANEC Contour	18	20	98	0	0	0	27	4
ANEC 25								
Number of allotments within ANEC Contour	73	66	144	8	11	2	444	66
Estimated population exposed to ANEC Contour	77	77	205	9	11	0	952	51
TOTAL								
Number of allotments within ANEC Contours 40, 35, 30 and 25	130	114	239	13	12	5	494	119
Estimated population exposed to ANEC Contours 40, 35, 30 and 25	95	101	305	9	11	0	979	55

The airport option with the most number of properties which may need to be acquired is Option 6 with approximately 494 properties located within ANEC contours 40, 35, 30 and 25. The airport option with the least amount of properties which may need to be acquired is Option 5 with approximately five properties located within ANEC contours 40, 35, 30 and 25.

Option 6 would also impact on the greatest population, with 979 people expected to be impacted. ANEC contours 40, 35, 30 and 25 for Options 3, 4 and 5 would impact on the smallest population.

3.6.2.2 Social Assets Directly and Indirectly Affected

Based on land use zoning and analysis of aerial photography, an estimate has been made of the number and type of social assets that may have to be acquired and relocated/re-established (see **Table 3.4**). Social assets are considered to include community facilities that accommodate services such as education, health or community welfare. Recreation resources – as defined by protected lands such as State Recreation Areas – are addressed in Working Paper *Land Use Planning Context and Future Development*.

Table 3.4 Number and type of social assets affected by airport options

Criteria	Option No.							
	1	1S	2	3	4	5	6	7
Number of social assets directly affected	0	0	0	0	0	0	0	0
Type of social assets directly affected	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Number of social assets affected by aircraft noise (25 ANEC)	0	0	0	0	0	0	1 (Appin Public School)	0

3.7 Ameliorative strategies to reduce adverse effects to acceptable levels

The following strategies could be considered to reduce potential adverse effects to acceptable levels.

3.7.1 Number of people required to relocate

Assuming that the function and scale of the airport remains unchanged,[11] the best way to reduce the number of people required to relocate from acquired properties is to reduce the area of the airport development site footprint and potentially the number of landholdings to be acquired. However, this approach may result in a situation where properties and/or dwellings remain in close proximity to the planned infrastructure and, from a social amenity perspective, this may be a less desirable outcome for affected residents than outright acquisition and relocation.

In the event that the reduction or realignment of the airport footprint is not feasible to reduce the potential number of dwellings to be acquired, there are a number of actions that could be taken to reduce potential concerns about the acquisition process. However, these actions are unlikely to include increasing the amount of money paid for required properties because the acquisition of land for the development of public infrastructure is usually undertaken within a statutory framework that is directly related to market valuations.

In the absence of being able to increase the financial arrangements above and beyond those legally stipulated for land acquisition by a government agency, helpful actions to deal fairly with those who may bear the social costs of airport development could include:

- Ensuring that the acquisition process is undertaken in a timely, responsive and sensitive manner;
- Erring on the side of generosity in compensation and in addressing the full costs of dislocational impacts on people;
- Ensuring clear lines of communication are available between the affected property owners and the agency undertaking the acquisition process;
- Ensuring that the acquired property is managed in an appropriate manner in the period between completion of the acquisition process and the commencement of construction so that access to the land is appropriately controlled to prevent inappropriate activities, manage bushfire risk and ensure that the land does not look neglected;

[11] Obviously, if acceptable in terms of capacity created, the alternative to this is to reduce the scale of the airport

- Ensuring that the wider community – both locally and relevant stakeholders – are kept informed of the progress of land acquisition and management of land acquired; and
- Providing specific assistance, if required or requested, to help residents undertake the relocation process, for example, if there are affected residents who are unsure about or unfamiliar with the process of locating and acquiring another property, confidential assistance could be offered to assist with this process.

3.7.2 Social assets

The best way to reduce the number of social assets directly affected is to reduce and/or reorient the area and number of landholdings on which social assets are located to be acquired. As noted previously, it is self-evident that an airport of lesser scale would have fewer effects on social assets, if the reduced capacity of the airport was acceptable.

3.8 Residual effects

Based on implementation of identified amelioration strategies, the residual effects discussed in Sections 3.8.1 and 3.8.2 would remain.

3.8.1 Number of people who may be required to relocate

Given the large size of the defined airport footprints, even if the boundaries are modified to reduce the number of dwellings directly affected, it is likely that, for some airport options, a relatively large proportion of residents – in the context of the population of Wilton - may still have to be relocated as a result of land acquisition for the preferred airport option.

The impacts at the household and individual level of relocation are likely to be significant[12] and, in some cases, traumatic. However, based on experience on other infrastructure projects that require acquisition of residential properties, there are usually some affected residents who are quite happy to have their property acquired at a price established relative to market value. Such an acquisition may enable residents to exit from an area that otherwise may have been problematic because of, for example, lack of market demand and then enable them to purchase elsewhere within a reliable budget. Once property owners understand the likely impacts of infrastructure projects, some are also happy to have their land acquired in total rather than remaining adjacent to a development that may adversely affect or reduce the residential amenity that they previously enjoyed.

The net residual impact would be a number of residents who would have to relocate and who, all things being equal, would not have planned to relocate from their current residential locations.

This relocation of residents would have flow-on effects to the local community through the reduction in the local population and reductions in associated formal and informal social interactions at the individual and community levels such as membership of clubs/organisations and friendships respectively. While there may be an influx of new residents attracted by the employment and other benefits of an airport, these are not likely to be replacement social interactions but an entirely new set of such interactions, with attendant changes in social character to the locality of Wilton.

3.8.2 Social assets

Given the nature of the land use and settlement pattern and the size of the airport footprint areas in the Wilton area, there are few (if any) social assets that would have to be acquired and relocated/re-established.

[12] Unlike roads and possibly railways which can alter their proposed alignment or use tunnels in order to avoid affecting population of the order of 100 it is more difficult for an airport project to do so. By comparison then and at this scale of people affected a Wilton airport would have a *"significant"* social effect.

As a result, there would little residual effect on the broader pattern of provision and usage of social assets in the Wilton area, for example, through increased usage of facilities that serve other communities/localities.

However, the built character of Wilton would be likely to change to support the operation of the airport and quite possibly result in increased social assets.

3.9 Key findings

There is a statutory framework at both the Commonwealth and State levels for the assessment of social impacts of the planning, development and operation of a new airport.

The direct and quantitative social impacts of airport development at Wilton assessed in this Working Paper are:

- The number of properties to be acquired and related assessment of the residential population that may have to relocate are lowest for Options 3, 4 and 5; and highest for Options 2 and 6;with affected population corresponding;
- In terms of the numbers of people liable to be affected, 8-10 % of the population is a significant proportion compared to non-urban road and rail projects;
- The number of social assets to be acquired and potentially requiring re-establishment elsewhere in the local area is very low; and
- The scale and social character of Wilton would change significantly with an airport being located in close proximity.

A number of strategies can be implemented to reduce or mitigate the social impacts of airport development and to reduce the perception – real or otherwise – that one group of people is bearing the cost while another group enjoys the benefits.

3.10 References

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4 WORKING PAPER – VISUAL EFFECTS OF AIRPORT

SUMMARY

The intent of this Working Paper is to identify the suite of landscape and visual issues likely to be associated with the various stages of the planning, development and operation of an airport at Wilton. The visual impact issues are identified and discussed in this paper, together with ameliorative measures to reduce adverse impacts.

The approach to the visual assessment of airport options at Wilton used in this paper involves:

- A broad assessment of character and quality of existing visual character of the study area;
- Discussion of likely landform and landscape/visual changes resulting from airport development;
- Measures to mitigate adverse visual impacts; and
- Identification of residual impacts.

Because of the projected scale of a full-scale international airport, regardless of mitigation measures, all airport options (as detailed in the Working Paper *Wilton Airport Site Selection and Airport Concepts)* have the potential for significant visual impact because of the huge amount of earthworks and related vegetation clearance required. However, Options 2, 3 and 5 have substantially higher modelled cut and fill as well as area of vegetation cleared which, arguably, have the potential for greater visual impact at the construction stage. The remaining options (Options 1, 1 south, 4, 6 and 7) all have lower levels of both modelled cut and fill and vegetation cleared.

4.1 Introduction

4.1.1 Statement of issue

Airports have a very large a physical footprint and require as extensive topographic alterations for airfield elements and construction of sprawling and largely horizontal building elements[13] for the terminals and other functions. By way of example, a 5 km by 4 km site for a maximum airport contained 40 by 100m wide strips of land or a total strip length of 200 km. That is to say, the airport site is the equivalent of 200km of dual carriageway freeway. Additionally, airports have a very large footprint in one locality on one consolidated site, which can result in concentrated areas of impact on surrounding areas or communities - compared with linear infrastructure which usually occupy or impact relatively small areas within any given community/locality. By contrast, the Port of Melbourne (the busiest container port in Australia) owns and manages 510 ha - less than 1/3 the area of an airport footprint at Wilton.

As a result, the planning, development and operation of large scale airports can have a range of visual and landscape impacts – both positive and negative – on various areas and viewing communities. The nature and locational spread of such impacts depends on factors including:

- The physical nature of the site and the extent of physical change required to the existing environment (landform, hydrology, vegetation and land use) to construct an airport,
- The layout and design of the airport and its constituent elements, including new transport corridors to link to existing transport networks;
- The extent and nature of night lighting for aviation and other airport operations; and
- The location and size of potential viewing audiences of the completed airport.

The intent of this Working Paper is to identify the suite of landscape and visual issues likely to be associated with the various stages of the planning, development and operation of an airport at Wilton. These issues are identified and discussed in this paper, together with ameliorative measures to reduce adverse impacts. Any residual impacts are also identified.

Visual Impact Assessment (VIA) is a technique for identifying and assessing the likely visual impacts of an introduced element to an existing landscape or cityscape environment. There are a range of methodologies available with most involving the use of visual simulations from representative view locations within defined visual catchments to facilitate the assessment of visual impact from viewing locations within, as appropriate, the immediate vicinity, local and regional levels and from the air or water.

4.1.2 Approach to issue

The approach to the visual assessment of airport options at Wilton used in this paper involves:

- Broad assessment of character and quality of existing visual character of the Wilton Study Area defined as the area contained within the following external boundaries;
  - Upper Nepean State Conservation Area (West),
  - The townships of Wilton, Douglas Park and Appin (North), and
  - The Cordeaux River and Cataract River dam areas (East– Cataract and South – Cordeaux).

[13] Airport terminals are listed as accounting for 10 of the 30 largest buildings in the world in terms of floor area – see http://en.wikipedia.org/wiki/List_of_largest_buildings_in_the_world

- Discussion of likely landform and landscape/visual changes resulting from airport development;
- Measures to mitigate adverse visual impacts; and
- Identification of residual impacts.

4.2 Legislative status

Legislation that provides the context for the consideration of visual issues in relation the planning, development and construction of large-scale airports is set out below.

4.2.1 Commonwealth

At the Commonwealth level, the *National Aviation Policy White Paper: Flight Path to the Future* (Commonwealth of Australia 2009) recognised community concerns about the planning, development and operation of airports and proposed stronger planning and consultative measures to respond to community concerns about airport development and the environmental impacts of airport operations. An outcome of the White Paper process was the amendment of the *Airports Act 1996* in 2010 to give effect to the findings of this process.

4.2.1.1 Airports Act 1996

This Act (and related Regulations) regulates the planning and operation of existing leased airports on Commonwealth land and applies to a number of major Australian airports in capital cities including Sydney Airport.

While not applicable to the planning for and development of a new airport on a site such as Wilton, various sections of this Act provide guidance about issues that the community would see as reasonable to be addressed in planning for a new airport. While not identifying '*visual impacts'* as such, these sections provide a broad framework within which relevant visual and landscape impacts can be identified and assessed. The relevant sections are detailed in the Working Paper *Social Effects of Airports.*

4.2.1.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places—defined in the EPBC Act as eight matters of national environmental significance.

In addition, the EPBC Act confers jurisdiction over actions that have a significant impact on the environment where the actions affect, or are taken on, Commonwealth land, or are carried out by a Commonwealth agency (even if that significant impact is not on one of the eight matters of '*national environmental significance'*). This latter jurisdiction particularly applies to airports regulated under the *Airports Act 1996* as they are located on Commonwealth land and thus subject to the provisions of the EPBC Act. The determining authority for an assessment under the EPBC Act is the Commonwealth Environment Minister.

Guidance material has been issued by the relevant Departments to assist ALCs to prepare draft MDP documentation to a standard that will, when appropriate, enable accreditation of the MDP process under the EPBC Act. This requires that the MDP addresses:

- The matters in section 91 of the Airports Act and regulation 5.04 of the Airport Regulations (see Section 3.1.1 above) ; and
- The matters in Part 2 of Schedule 3 of the EPBC Regulations, which also includes the matters in items 3 to 8 of Part 1 of Schedule 3.

If an *'action'* is required to be assessed under the EPBC Act by means of an EIS, the Minister must issue to the proponent of the proposed action written guidelines for the preparation of the EIS. Public comment may be invited by the Minister on draft guidelines and considered before the *'final'* guidelines area issued.

A recent aviation sector project that was subject to an accredited process (by means of both an MDP under the *Airports Act 1996* and an EIS under the EPBC Act was the New Parallel Runway Project at Brisbane Airport. The visual assessment of the runway involved:

- A description of the proposed development in terms of its visual character;
- A description of the methods used to undertake the landscape visual assessment;
- A description of the limitations and assumptions of this method;
- An evaluation of the baseline condition, i.e. the existing visual character of the surrounding area;
- A description of the consultation, policies and guidelines which have been used to inform this assessment;
- A description of the visual components of the proposed development and how they differ from the existing;
- An assessment of the visual impact of the proposal focusing on an evaluation of representative views;
- An assessment of the cumulative and interactive effects of any identified impacts;
- A description of measures being incorporated into the site planning and landscape design to mitigate these visual impacts;
- An assessment of the residual effects, considering the implementation of these mitigation measures; and
- An assessment summary matrix, which summarises the results of this assessment.[14]

4.2.2 New South Wales

4.2.2.1 Environmental Planning and Assessment Act 1989

Planning and development in New South Wales is carried out under the Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulation 2000. Under State Environmental Planning Policy (State and Regional Development) 2011, an EIS has to be prepared as part of the consent process for development that is identified as '*state significant development*' (SSD) or '*state significant infrastructure*'. One of the categories of SSD is '*Air transport facilities*' which is defined as *'development for the purpose of air transport facilities that has a capital investment value of more than $30 million'*.

When an EIS is prepared for an SSD, the Director-General of the Department of Planning issues requirements for the matters to be addressed in the EIS. These requirements for SDDs regularly require relevant visual impacts to be addressed. As of 14 July 2012, no recent airport projects are included on the Department of Planning and Infrastructure's Major Project Assessments register.

There are no specific policy or guideline documents published by the NSW Department of Planning in relation to the assessment of visual and landscape impacts.

[14] (Brisbane Airport Corporation, 2008, B13-576).

4.3 Summary of issues from SSA Site Selection Programme

As part of the Second Sydney Airport Site Selection Programme, a Draft Environmental Impact Statement ('*the Draft EIS'*) was prepared. Section 15.6 of the Draft EIS provided an assessment of the landscape and visual quality of the Wilton area. In terms of landscape features, the EIS noted that:

> *"The proposed site is contained within a single landscape zone, although it comprises a number of different landforms: the most predominant and common of these are the plateau and slopes features, which cover about 70% of the site. Eucalypt vegetation covers 90% of the site. Previous European occupation is evidenced by an old abandoned airstrip and by previously cleared areas which had been used for farming. Parts of the northern portion of the site which had been cleared and which are not within the Metropolitan Catchment are still used for farming.*
>
> *The site contains about 14 km of stream and creek channels, of which about 80% are in minor swales. The most significant of the channels occur along Allens and Cascade creeks. There are also a number of artificial farm dams or small water storages on the site. All creeks are either intermittent or contain a small flow of water which is charged by groundwater seepage". (Draft EIS1985, 511- 512)*

The Draft EIS also analysed the visual quality of the study area and concluded that:

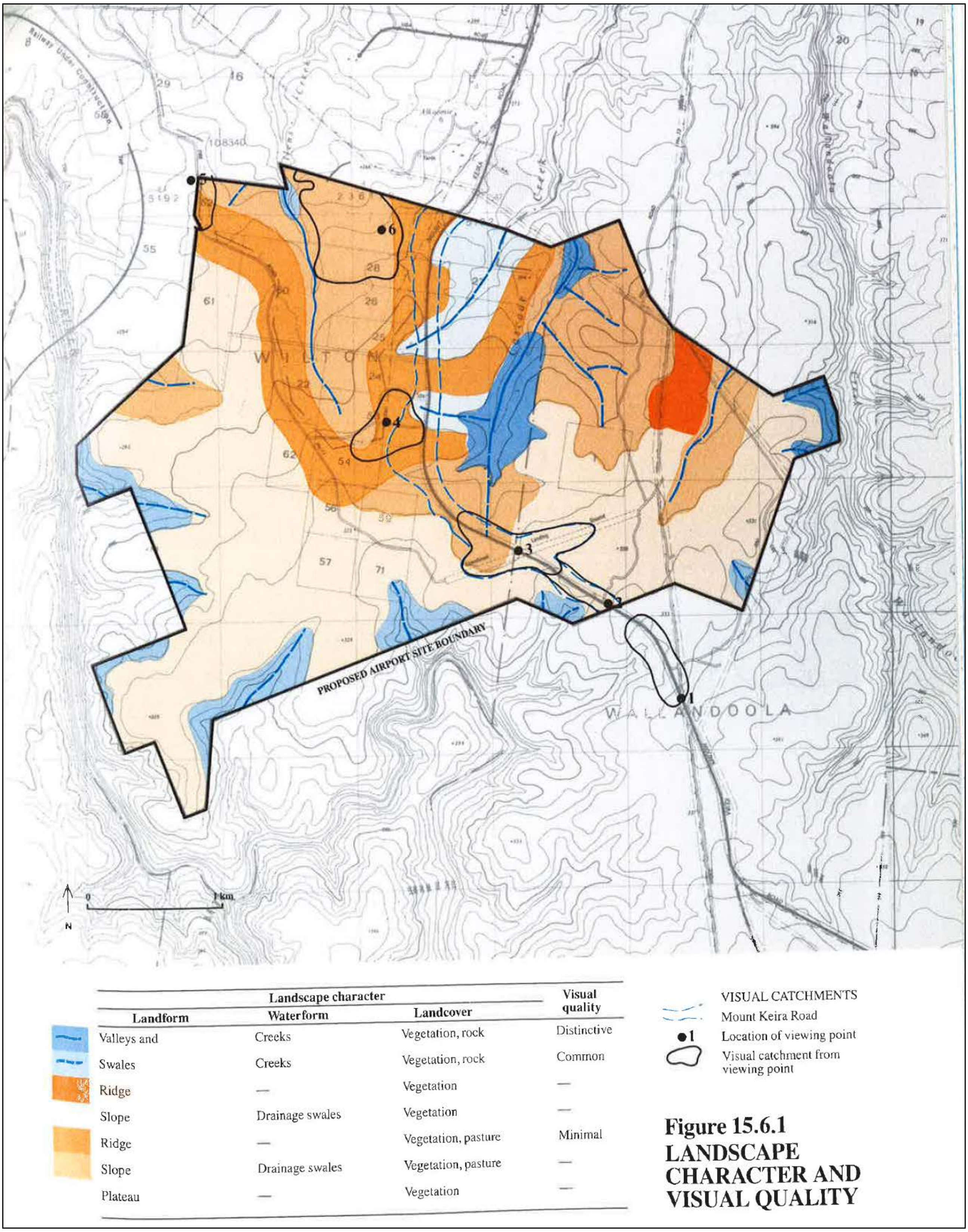
> *….the proposed site does not contain any significant or prominent features that can be viewed from public roads in the area. Over 80% of the site is classified as being of minimal landscape or visual quality. The only distinctive landscape and visual features consist of a small part of Cascade Creek and a small section of escarpment on the eastern boundary which forms part of the Wallandoola Gorge. However, these cannot be seen from any public road and occupy only about 5% of the site. (Draft EIS 1985, 512)*

The overall conclusion in relation to the visual impact of airport development at Wilton was that:

> *"The site's landscape and visual character would be irreversibly altered by airport construction, as it would be transformed from its present largely natural vegetated form to one that had marked linear and block built forms surrounded by areas of natural landscape to the east, west and south. These forms would dominate the landscape when viewed from the air but would be made aesthetically acceptable when viewed from ground level by careful design and extensive landscaping and tree planting around major buildings and car parks. During the operational phase it might be necessary to selectively clear vegetation impinging on the required approach part clearance surface about 2km from the eastern end of the long runway. However, the effect of this is considered to be minimal, as it would involve only a small area of land and this would not need to be totally cleared of all vegetation". (Draft EIS 1985, 515)*

The mapped Landscape and Visual Quality presented in the Draft EIS is shown below.

Figure 4.1 Landscape character and visual quality



4.4 Analysis of issues in terms of current airport concepts

4.4.1 Landscape changes in the Wilton Study Area

Since the Draft EIS was conducted in 1985, development in and around Wilton has included:

- Development of the master planned Bingara Gorge residential development located north of Picton Road and east of the Hume Highway, which will ultimately accommodate a population of approximately 3,500 people has recently commenced;
- Further applications for residential development areas are currently being assessed; and
- Expansion of underground mining activity is currently occurring (as described in Working Paper Regional Resources and Resource Extraction).

Discussion of land use planning and future development is provided in the Working Paper *Land use Planning Context and Future Development*. Discussion of the extent and nature of vegetation coverage is presented in the Working Paper *Flora fauna and ecological values*.

As the Wilton study area has remained relatively undeveloped, this has implications for visual impacts associated with future land acquisition for an airport site.

4.4.2 Assessed visual effects

The direct and quantitative potential visual impacts of airport development at Wilton assessed in this Working Paper are related to:

- The extent of existing vegetation to be removed; and
- The extent of earthworks required.

4.5 Potential environmental impacts

The direct visual impacts of airport development will be principally related to the combination of, firstly, land clearing and earthworks to achieve required largely flat landform for airport development and, secondly, the introduction of built forms such as terminals and new or upgraded ground transport corridors. The extent and nature of actual impacts will then depend on the identification of viewing points and viewing population and the potential to mitigate permanent visual impacts.

The modelled or calculated extent of vegetation clearance and earthworks required for each the footprint of each airport option is presented on **Table 4.1**. A detailed description of earthworks and land clearing is detailed in the Working Paper *Land Clearing and Earthworks.*

In terms of determining if there is a relationship between the modelled amount of cut and fill and area of vegetation cleared, a correlation analysis indicates that this association is not statistically significant ($P>0.05$) (see **Table 4.2** and **Figure 4.2**).

Table 4.2 Correlation analysis – modelled cut and fill amount and area of vegetation cleared

Correlations			Model Cut	Vegetation Area Cleared
Spearman's rho	Modelled Cut	Correlation Coefficient	1.000	0.120
		Sig. (2-tailed)	.	0.778
		N	8	8
	Veg Area Cleared	Correlation Coefficient	0.120	1.000
		Sig. (2-tailed)	0.778	.
		N	8	8

Figure 4.2 Graphic representation

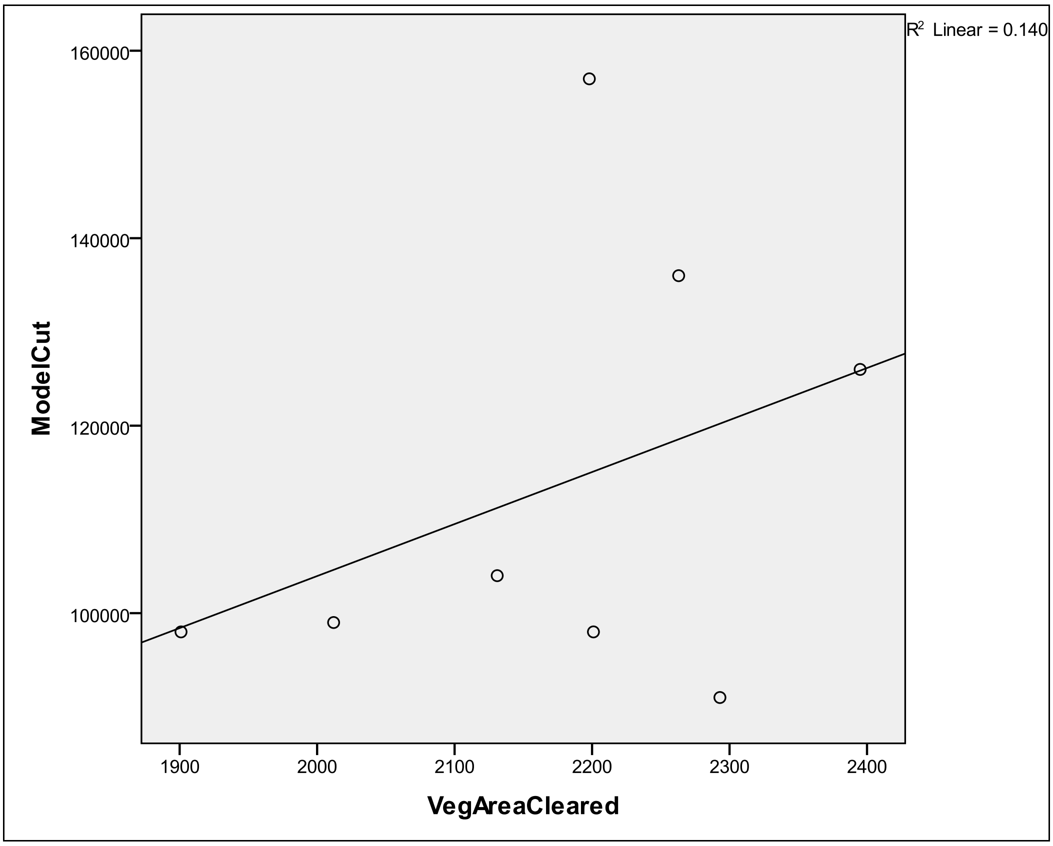


Table 4.3 Earthworks and vegetation clearance

(as detailed in the Working Paper Working *Land Clearing and Earthworks*)

	Option No.							
	1	**1S**	**2**	**3**	**4**	**5**	**6**	**7**
Earthworks element								
Modelled cut ('000m^3)	-52,000	-45,000	-69,000	-78,000	-49,000	-60,000	-50,000	-49,000
Modelled fill ('000m^3)	52,000	46,000	67,000	79,000	49,000	66,000	48,000	50,000
Modelled balance ('000m^3)	0	1,000	-2,000	1,000	0	6,000	-2,000	1,000
Modelled cut and fill ('000m^3)	104,000	91,000	136,000	157,000	98,000	126,000	98,000	99,000
Cut and fill per ha ('000m^3/ha)	59	49	70	84	63	62	53	60
Max cut depth (m)	18	21	23	36	30	23	20	25
Max fill depth (m)	40	41	51	63	65	66	43	50
Additional infrastructure required	No	No	Yes[1]	No	No	Yes[2]	No	No
Vegetation clearance								
Previously cleared land	Yes (approx. 10%)	Yes (approx.10 %)	Yes (approx. 15%)	No[3]	No[1]	No[3]	Yes (approx. 15%)	Yes (approx. 15%)
Area of vegetation to be cleared for the each footprint option[4] (ha)	2,131	2,293	2,263	2,198	1,901	2,395	2,201	2,012

Notes:

1 Conveyance structure across Lizard Creek

2 Conveyance structure across Wallandoola Creek

3 Drafting note: to be confirmed

4 Clearing for the airport footprint also includes clearing for Obstacle Limitation Surfaces see Working Paper *Land Clearing and Earthworks and environmental buffer zone* but does not include for business park areas that are directly associated with the airport or other development that is not directly related.

Because of the projected scale of a major international airport, all options have the potential for significant visual impact because of the amount of earthworks and related vegetation clearance.

However, there are three options (2, 3 and 5) with substantially higher modelled cut and fill as well as area of vegetation cleared which, arguably, have the potential for greater visual impact at the construction stage.

The remaining options five options (1, 1 south, 4, 6 and 7) all have lower levels of both modelled cut and fill and vegetation cleared.

4.6 Summary of mitigation strategies and methods

The following mitigation strategies and measures could be considered as means of reducing the visual impact of airport development:

During planning stage:

- Reduce/optimise the extent of both vegetation clearing and earthworks particularly in areas that might be considered visually sensitive or that would provide a boundary screen during construction. Such further design investigation would assist in determining the extent to which both the vegetation and earthworks could be reduced in areas of visual sensitivity. This is an accepted process in the progressive planning and design of infrastructure and other major projects; and
- Where possible and consistent with aviation and security requirements, introduce localized/superficial topographic diversity to assist with the ultimate visual and landscape/vegetated integration of the airport site into the adjacent environment.

During construction:

- Through retention of vegetation and/or planting of quick growing species in advance of the commencement of construction, provide a screen around those parts of the site boundary where significant site clearing and construction would be visible from key public viewing points; and
- Where possible, rehabilitate disturbed areas as soon as possible in accordance with a defined landscape master plan with vegetation appropriate to airport environs, that is, species consistent with management of bird strike risk.

4.6.1 Residual impacts

Because of the projected scale of a major international airport, regardless of mitigation measures, all options have the potential for significant visual impact because of the huge amount of earthworks and related vegetation clearance required.

4.7 Key findings

There is a statutory framework at both the Commonwealth and State levels for the assessment of visual impacts of the planning for and development and operation of a new airport.

The direct and quantitative visual impacts of airport development at Wilton assessed in this Working Paper are:

- The extent of existing vegetation to be removed; and
- The extent of earthworks required.

Because of the projected scale of a major international airport, regardless of mitigation measures, all options have the potential for significant visual impact because of the huge amount of earthworks and related vegetation clearance required.

However, there are three options (2, 3 and 5) with substantially higher modelled cut and fill as well as area of vegetation cleared which, arguably, have the potential for greater visual impact at the construction stage.

The remaining options five options (1, 1 south, 4, 6 and 7) all have lower levels of both modelled cut and fill and vegetation cleared.

5 WORKING PAPER - ACOUSTIC EFFECTS ON PEOPLE

SUMMARY

The purpose of this Working Paper is to determining the number of residents that each airport option will expose to noise in order to determine the likely differences between the eight airport options in respect of this effect.

The effect of noise on human health, sources of airport noise, and future population growth are discussed. The input data and methodology used for the calculation of acoustic effects on people, as well as the results of the calculation, are presented.

This Working Paper only covers the effects of noise resulting from aircraft operations. It does not cover the effects of noise resulting from ground based activities.

This Working Paper only considers the population as of the 2011 Census[15]. It does not take into account future population growth.

[15] As the data relevant to this task from the 2011 census was available this was used, although for other forms of analysis data from the 2006 census was used pending release of the relevant 2011 data.

5.1 Introduction

Exposure of people and especially residents of domestic properties, to aviation noise is one of the most significant environmental and social issues surrounding airport development and operation. Given this, it is important that as part of the airport site selection process the potential effects of airport noise on residents are quantified, and that these effects are understood and taken into account in the airport decision making, planning and design process.

5.1.1 Effects of noise on human health

The effects of noise on human health have been studied extensively. It is generally agreed among health experts that, at certain levels, exposure to noise can cause or contribute to:

- Annoyance;
- Sleep disturbance;
- Reduced cognitive performance; and
- Cardiovascular disease.

These effects operate through a number of different pathways including direct effects, interference with cognitive processes, and reaction to interference in communication and daily activities.

Current evidence suggests that children, people with existing physical and mental illness, and the elderly are most susceptible to the effects of noise. There is also evidence that reducing noise can have health benefits.

Given the potential effects of exposure to noise on human health, it is vital that airport noise is effectively managed and minimised, especially in areas surrounding an airport where noise exposure is greater. As a result, a key objective in airport planning is to orient runways, to the extent possible commensurate with other airport planning criteria, to minimise the degree to which people are or may become exposed to aviation noise.

5.1.2 Sources of airport noise

Airport noise is grouped into noise from ground based activities and noise from aircraft operations. Sources of ground based noise include:

- Road traffic;
- Construction and development activities;
- Operation of audible alarm and warning systems;
- Operation of plant and equipment;
- Taxiing aircraft;
- Aircraft engine ground running; and
- Operation of aircraft auxiliary power units (APUs).

Construction noise associated with the earthworks required for the runways and terminal areas would likely be heard beyond the boundaries of the site. This noise could be 10-15 dB (A) higher than background levels, which would be noticeable and could potentially cause nuisance to nearby residents. However, construction noise would be regulated under the State’s relevant noise control legislation or as may be specified in the approval thorough an EIS process.

It is identified in the 2009 Sydney Airport Master Plan that only a small proportion of annual complaints that are received by Sydney Airport are in relation to noise generated by ground-based activities. The majority of these complaints relate to aircraft engine ground-running. The vast majority of the annual complaints that are received by Sydney Airport are in relation to aircraft operations.

This Working Paper only covers the effects of noise resulting from aircraft operations. It does not cover the effects of noise resulting from ground based activities. This is because the noise from aircraft operations has a much larger impact on the surrounding area than the noise from ground based activities.

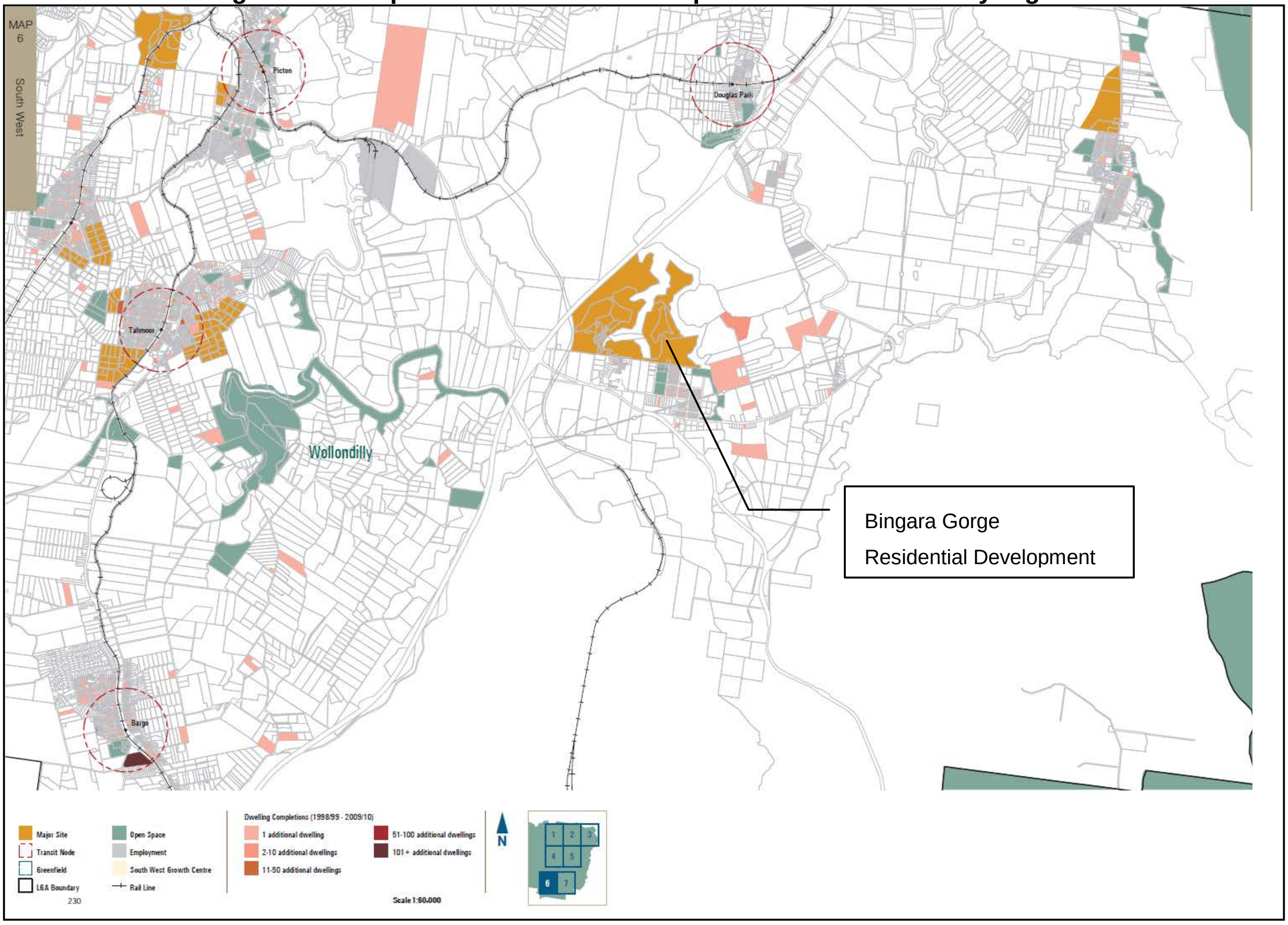
5.1.3 Population growth

The Wollondilly Region has been designated as a growth centre by the Department of Planning and Infrastructure in the 2010/11 Metropolitan Development Program Report. It has been estimated by the Department that 1,998 homes will be built in the area by 2026. These homes will be built in a number of proposed residential developments. The estimated number of homes that will be built in each of the proposed residential developments can be seen below in **Table 5.1**. The location of the proposed residential developments can be seen in **Figure 5.1**.

posed residential housing in the Wollondilly regionLGA	Site Name	Timeframe		
		2005 -2010	2010 -2015	2015 -20
	Bingara Gorge	0	200	345
	Appin North	0	192	150
	Menangle Street, Picton	0	0	39
	Mallams Subdivision, Picton	0	30	50
	Seniors Living, Brundah Road, Thirlmere	0	60	61
	Seniors Living, Progress Street, Tahmoor	0	100	67
	Seniors Living, York Street, Tahmoor	0	21	0
	Westbourne Avenue, Thirlmere	0	22	0

Source: 2010/11 Metropolitan Development Program Report

Figure 5.1: Proposed residential development in the Wollondilly region



Source: 2010/11 Metropolitan Development Program Report

Bingara Gorge is a major residential development proximate to the Wilton Study Area. The Bingara Gorge development is currently being undertaken by Lend Lease Corporation. Based on information that Lend Lease has made available, as of December 2011, there are approximately 300 residents living in the Bingara Gorge development. It has been estimated that Bingara Gorge will eventually be home to up to 3,500 residents in 1,145 homes. Given the proximity of the Bingara Gorge development to the existing Wilton township and to the Wilton Study Area, runway orientations and end of runway locations were identified in Working Paper – *Wilton Airport Site Selection and Airport Concepts* to maximise separation for this and other known population centres in surrounding areas. Notwithstanding having done so, some exposure to aircraft noise may still be possible as a result of flight paths and this is assessed in this Working Paper.

This Working Paper is based on the data recorded in the 2011 Census. It does not take into account future population growth in its numerical analysis.

5.2 Calculation of acoustic effects on people

A GIS analysis[16] was carried out to determine the approximate population inside the ANEC and N70 contours for the eight airport options. The analysis was based on spatial information imported to the GIS model about the location of residents as revealed in the 2011 Census data.

[16] Using waterRide™ WorleyParsons proprietary GIS software which has been customised to permit the type of analysis required.

5.2.1 Input data

Five datasets were used for the GIS analysis. These datasets are:

- The 2011 Australian Census;
- ANEC and N70 contours for the eight airport options;
- Site extents for the eight airport options;
- Cadastre data for the Local Government Areas (LGAs) inside the ANEC and N70 contours; and
- Zoning data for the LGAs inside the ANEC and N70 contours.

5.2.1.1 Census

The 2011 Australian Census Basic Community Profile Data Pack for statistical area level 1 and the GIS boundary file for statistical area level 1 were obtained from the Australian Bureau of Statistics. Statistical area level 1 was used for the analysis as it provides the highest level of precision available.

The *"Total Persons"* field was extracted from the Basic Community Profile Data Pack and mapped onto the GIS boundary file for statistical area level 1 to enable further calculation.

5.2.1.2 Cadastre

The Local Government Areas (LGAs) inside the ANEC and N70 contours were determined to be Wollondilly, Wingecarribee, Wollongong, and Campbelltown. The cadastre data for Wollondilly, Wingecarribee, and Wollongong was provided by the Department of Planning and Infrastructure. It was found that only a small portion of the Campbelltown LGA is inside the ANEC and N70 contours, and as such, cadastre data for this area was not included in the analysis.

5.2.1.3 Zoning

The Local Government Areas (LGAs) inside the ANEC and N70 contours were determined to be Wollondilly, Wingecarribee, Wollongong, and Campbelltown. The Department of Planning and Infrastructure provided the following zoning information:

- Wollondilly LEP 2011;
- Wingecarribee LEP 2010; and
- Wollongong LEP 2009.

These LEPs all conform to the NSW Government Standard Instrument Order.

5.2.2 Methodology

The GIS analysis was carried out in a number of stages.

The zones that permit residential development within the different LGA LEPs were determined. These zones are listed in Table 5.2.

Table 5.2: Zones where Residential Development is permitted under Wollondilly LEP 2011, Wingecarribee LEP 2010, and Wollongong LEP 2009

Zone	Name
RU1	Primary Production
RU2	Rural Landscape
RU4	Primary Production Small Lots
R2	Low Density
R3	Medium Density
R5	Large Lot Residential
B1	Neighbourhood Centre
B2	Local Centre
B4	Mixed Use
E3	Environmental Management
E4	Environmental Living

Additionally under the Wollongong LEP 2009 residential development is permitted in zones R1 General Residential and B3 Commercial Core.

The cadastre and zoning data for the LGAs was then loaded into the analysis software. The zone polygons for each LGA were looped through. Each zone polygon was checked against the list of zones where residential development is permissible. If residential development was found to be permissible then the loop was paused and the cadastre polygons for that LGA were looped through. If residential development was found to not be permissible then the polygon was skipped.

During the cadastre polygon loop the centroid of each cadastre polygon was checked to see if it was inside the current zoning polygon. If the centroid was inside the current zoning polygon then the centroid was recorded. If the centroid was not inside the current zoning polygon then the cadastre polygon was skipped.

The resulting list of centroids for the three LGAs was written to a new GIS file. This list of centroids represents the lots of land where residential development is permissible and shall henceforth be referred to as the residential data.

The Census data was then loaded into the analysis software and the statistical area polygons were looped through. For each statistical area polygon the residential data points were looped through twice. The first loop was used to determine the number of residential data points within the current statistical area polygon. The average population per residential data point was then determined by dividing the total population within the current statistical area polygon by the number of residential data points within the current statistical area polygon. During the second loop, the average population per residential data point was written to the residential data points that were inside the current statistical area polygon.

Each residential data point then represented a household with an approximate population.

A source of *"error"*[17] in this calculation is that each lot of land that is zoned for residential development does not necessarily have a household on it, although for the purposes of this calculation it is assumed that it does. As a result of this, it would be expected that there would be more households per statistical area assessed in this calculation than there are recorded by the census. However, there is another source of *"error"* in the calculation that counteracts this. Apartment blocks can have more than one household on a lot. As a result of this, it would be expected that there would be fewer households per statistical area assessed in this calculation than that recorded by the census. The balance between these two errors is dependent on the residential character and zoning of the statistical area.

The ANEC contour data, N70 contour data, and site extents data was then loaded into the analysis software. The ANEC polygons and N70 polygons for each of the eight airport options were looped through. For each ANEC and N70 polygon the residential data points were looped through. Each residential data point was checked to see if it was inside the current polygon and outside the relevant site extents polygon. If a residential data point met these criteria then the population associated with the data point was added to a population total for the current polygon. If the residential data point did not meet these criteria then the point was skipped. The population total for each polygon was written to an output file.

The residential data points inside the relevant site extents were removed from the analysis as these properties will have to be acquired for airport development. It is assumed that the population within these properties will relocate to an area outside the ANEC and N70 contours.

5.2.3 Results

A GIS analysis was carried out to determine the approximate population inside the ANEC and N70 contours for the eight airport options. Plots of the ANEC and N70 contours for the eight airport options can be seen in the following figures (provided at the end of this section):

- ANEC Footprints for runway Option 1 - WP-301015-03019-NOI-SK-001;
- ANEC Footprints for runway Option 1S - WP-301015-03019-NOI-SK-001S;
    - ANEC Footprints for runway Option 2 - WP-301015-03019-NOI-SK-002;
- ANEC Footprints for runway Option 3 - WP-301015-03019-NOI-SK-003;
- ANEC Footprints for runway Option 4 - WP-301015-03019-NOI-SK-004;
- ANEC Footprints for runway Option 5 - WP-301015-03019-NOI-SK-005;
- ANEC Footprints for runway Option 6 - WP-301015-03019-NOI-SK-006;
- ANEC Footprints for runway Option 7 - WP-301015-03019-NOI-SK-007; and
- ANEC Footprints for all runway Options - WP-301015-03019-NOI-SK-000.

5.2.3.1 ANEC[18]

The approximate population within each of the ANEC contour bands for the eight airport options can be seen in **Table 5.5** and in **Figure 5.2**.

The approximate cumulative population within each of the ANEC contour bands for the eight airport options can be seen in **Table 5.6** and **Figure 5.3**.

[17] "*Error*" is used in the sense that the computation necessarily makes approximations not that the computation itself is incorrect. As the intention of this analysis is to draw broad conclusions about airport locations and runway orientations not to identify effects on people with the precision of a single individual, such approximation is reasonable.
[18] ANEC is defined in Working Paper *Acoustic Footprints*

Figure 5.2: Approximate Population exposed to noise within defined ANEC ranges

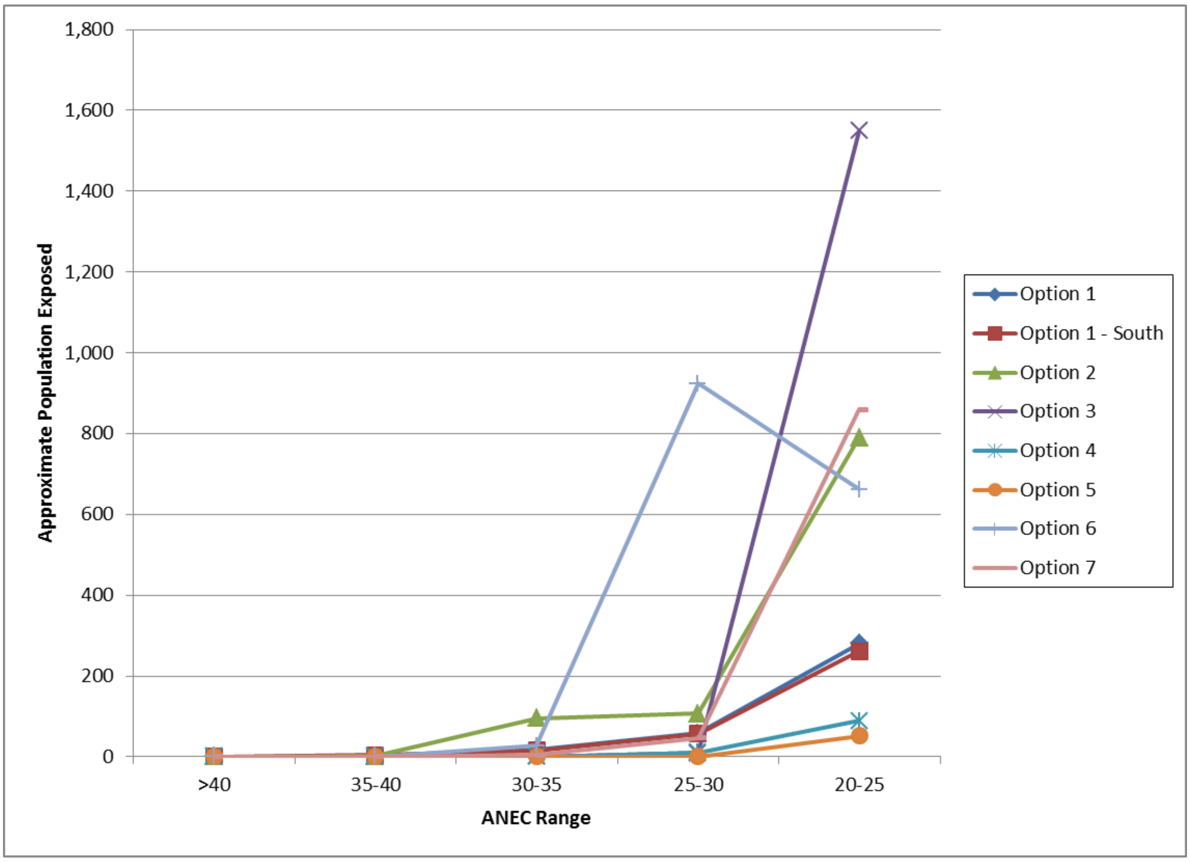


Table 5.3: Approximate population exposed to noise within defined ANEC ranges

Site	ANEC Range	Approximate Population Exposed
Option 1	>40	0
	35-40	0
	30-35	18
	25-30	59
	20-25	280
Option 1 - South	>40	0
	35-40	4
	30-35	16
	25-30	57
	20-25	261
Option 2	>40	0
	35-40	2

Site	ANEC Range	Approximate Population Exposed
	30-35	95
	25-30	107
	20-25	791
Option 3	>40	0
	35-40	0
	30-35	0
	25-30	9
	20-25	1,550
Option 4	>40	0
	35-40	0
	30-35	0
	25-30	11
	20-25	90
Option 5	>40	0
	35-40	0
	30-35	0
	25-30	0
	20-25	51
Option 6	>40	0
	35-40	0
	30-35	27
	25-30	924
	20-25	661
Option 7	>40	0
	35-40	0
	30-35	4
	25-30	46
	20-25	859

Figure 5.3: Approximate cumulative population exposed to noise within defined ANEC contours

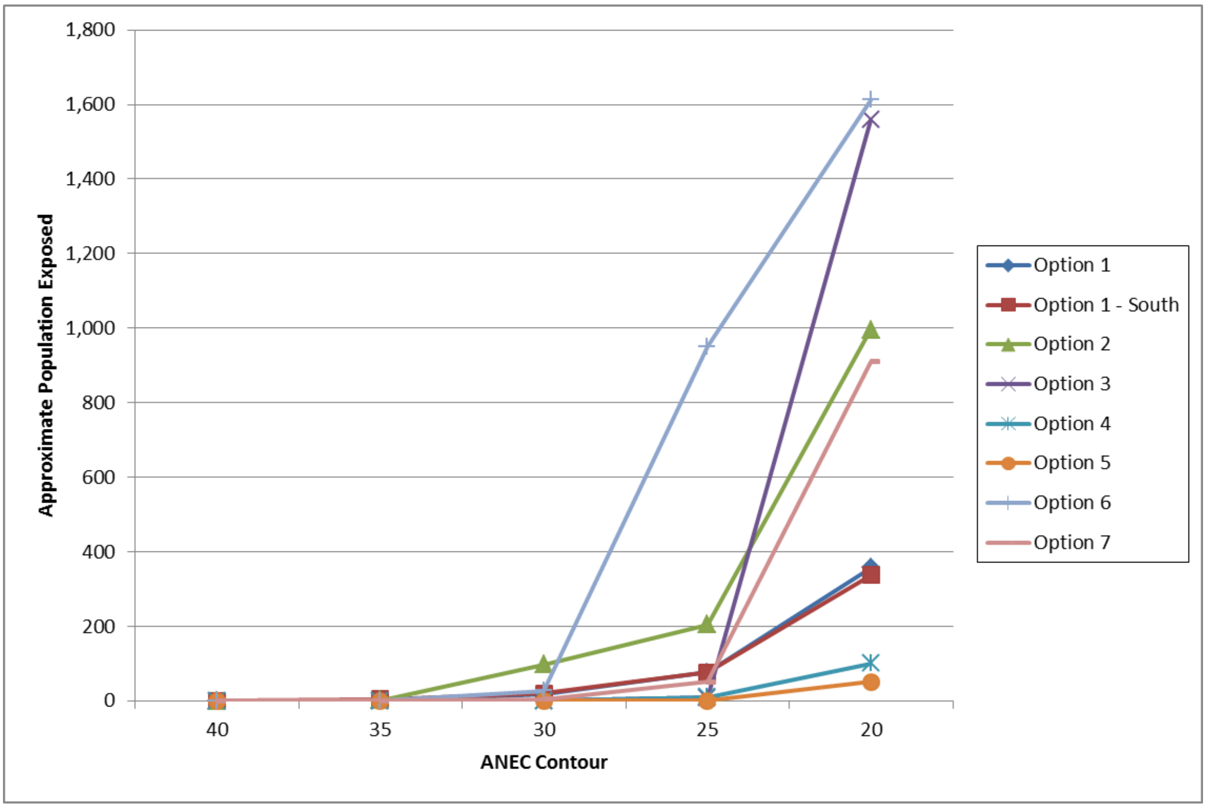


Table 5.4: Approximate cumulative population exposed to noise within defined ANEC contours

Site	ANEC Contour	Approximate Population Exposed
Option 1	40	0
	35	0
	30	18
	25	77
	20	357
Option 1 - South	40	0
	35	4
	30	20
	25	77
	20	338
Option 2	40	0
	35	2

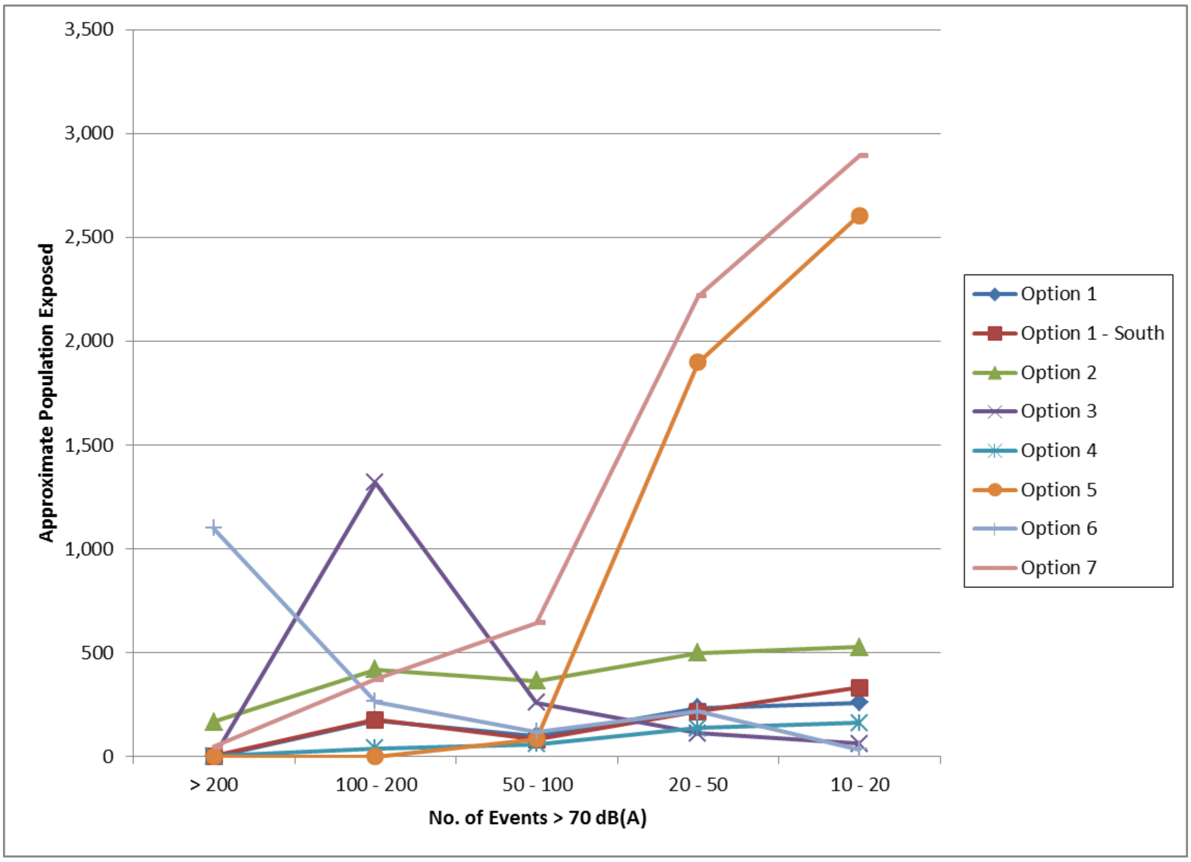
Site	ANEC Contour	Approximate Population Exposed
	30	98
	25	205
	20	996
Option 3	40	0
	35	0
	30	0
	25	9
	20	1,558
Option 4	40	0
	35	0
	30	0
	25	11
	20	100
Option 5	40	0
	35	0
	30	0
	25	0
	20	51
Option 6	40	0
	35	0
	30	27
	25	952
	20	1,613
Option 7	40	0
	35	0
	30	4
	25	51
	20	910

5.2.3.2 N70[19]

The approximate population within each of the N70 contour bands for the eight airport options can be seen in **Table 5.7** and in **Figure 5.4**.

The approximate cumulative population within each of the N70 contour bands for the eight airport options can be seen in **Table 5.8** and **Figure 5.5**.

Figure 5.4: Approximate population exposed to noise within N70 ranges



[19] N70 is defined in is defined in Working Paper *Acoustic Footprints*

Table 5.5: Approximate population exposed to noise within N70 ranges

Site	No. of Events > 70 dB(A)	Approx. Population Exposed	No. of Person-Events	AIE
Option 1	> 200	0	0	250
	100 - 200	176	26,391	150
	50 - 100	100	7,508	75
	20 - 50	236	8,263	35
	10 - 20	260	3,907	15
Option 1 - South	> 200	4	893	250
	100 - 200	178	26,658	150
	50 - 100	83	6,224	75
	20 - 50	219	7,657	35
	10 - 20	334	5,015	15
Option 2	> 200	167	41,833	250
	100 - 200	421	63,167	150
	50 - 100	366	27,485	75
	20 - 50	501	17,533	35
	10 - 20	528	7,927	15
Option 3	> 200	0	0	250
	100 - 200	1,320	198,035	150
	50 - 100	260	19,469	75
	20 - 50	112	3,928	35
	10 - 20	63	949	15
Option 4	> 200	4	893	250
	100 - 200	41	6,152	150
	50 - 100	61	4,603	75
	20 - 50	139	4,863	35
	10 - 20	162	2,437	15
Option 5	> 200	0	0	250
	100 - 200	0	0	150
	50 - 100	87	6,521	75
	20 - 50	1,899	66,455	35
	10 - 20	2,605	39,076	15

Site	No. of Events > 70 dB(A)	Approx. Population Exposed	No. of Person-Events	AIE
Option 6	> 200	1,100	275,008	250
	100 - 200	266	39,939	150
	50 - 100	121	9,110	75
	20 - 50	219	7,670	35
	10 - 20	37	553	15
Option 7	> 200	49	12,190	250
	100 - 200	372	55,848	150
	50 - 100	646	48,475	75
	20 - 50	2,219	77,675	35
	10 - 20	2,893	43,391	15

Figure 5.5: Approximate cumulative population exposed to noise within N70 contours

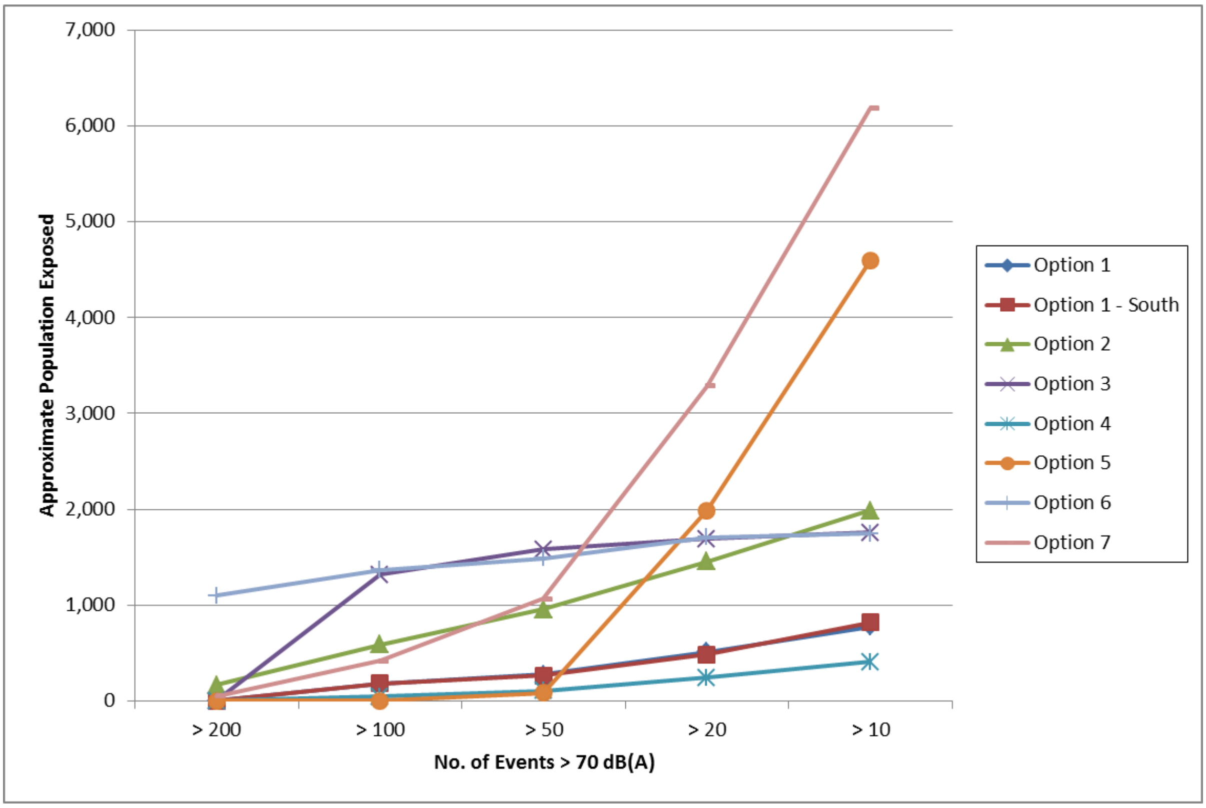


Table 5.6: Approximate cumulative population exposed to noise within N70 contours

Site	No. of Events > 70 dB(A)	Approx. Population Exposed	No. of Person-Events	AIE
Option 1	> 200	0	0	250
	> 100	176	26,391	150
	> 50	276	33,899	123
	> 20	512	42,162	82
	> 10	773	46,069	60
Option 1 - South	> 200	4	893	250
	> 100	181	27,551	152
	> 50	264	33,774	128
	> 20	483	41,431	86
	> 10	817	46,445	57
Option 2	> 200	167	41,833	250
	> 100	588	104,999	178
	> 50	955	132,484	139
	> 20	1,456	150,016	103
	> 10	1,984	157,944	80
Option 3	> 200	0	0	250
	> 100	1,320	198,035	150
	> 50	1,580	217,504	138
	> 20	1,692	221,431	131
	> 10	1,755	222,380	127
Option 4	> 200	4	893	250
	> 100	45	7,044	158
	> 50	106	11,647	110
	> 20	245	16,509	67
	> 10	407	18,946	47
Option 5	> 200	0	0	250
	> 100	0	0	150
	> 50	87	6,521	75
	> 20	1,986	72,976	37
	> 10	4,591	112,052	24

Site	No. of Events > 70 dB(A)	Approx. Population Exposed	No. of Person-Events	AIE
Option 6	> 200	1,100	275,008	250
	> 100	1,366	314,947	231
	> 50	1,488	324,057	218
	> 20	1,707	331,727	194
	> 10	1,744	332,280	191
Option 7	> 200	49	12,190	250
	> 100	421	68,038	162
	> 50	1,067	116,513	109
	> 20	3,287	194,188	59
	> 10	6,179	237,579	38

5.3 Analysis of acoustic effects on people

In order to understand the relative effects of the airport options on people some further analysis has been undertaken as shown in **Tables 5.9** and **5.10** below.

These tables combine the results of both the ANEC and N70 analyses with geometric data on runway orientation and physical location of the airport site. In respect of the latter, there are, as will have been noted in preceding Working Papers, essentially two groups of overlapping airport sites – one group to the east of Wallandoola Creek and one group to the west of Wallandoola Creek.

Table 5.9: Ranking of site options based on total persons within the ANEC 25[20] contour

Option	Total persons within ANEC 35	Total persons within ANEC 25	Total persons within ANEC 20	Basic Cardinal Runway Orientation	Eastern or Western Grouping	Name of Communities principally affected
5	0	0	51	EW	E	ANEC 25 - NA, ANEC 20 - Bargo
3	0	9	1558	NS	E	ANEC 25 - NA, ANEC 20 - Appin
4	0	11	100	NWSE	E	ANEC 25 - NA, ANEC 20 - NA
7	0	51	910	NWSE	W	ANEC 25 - Wilton ANEC 20 - Wilton, Pheasants Nest, Tahmoor, Thirlmere
1	0	77	357	NS	W	ANEC 25 - Wilton, ANEC 20 - Wilton
1S	4	77	338	NS	W	ANEC 25 - Wilton, ANEC 20 - Wilton
2	2	205	996	NS	W	ANEC 25 - Wilton, Douglas Park ANEC 20 - Wilton, Douglas Park

[20] 25 adopted as being the limit for residential exposure

Option	Total persons within ANEC 35	Total persons within ANEC 25	Total persons within ANEC 20	Basic Cardinal Runway Orientation	Eastern or Western Grouping	Name of Communities principally affected
6	0	952	1613	NESW	W	ANEC 25 - Wilton, Appin ANEC 20 - Wilton, Appin

From this it can be seen that the eastern options rank significantly better than the western options, this is primarily due to the eastern options not affecting the Wilton Township. It should be noted that if the larger ANEC 20 Contours were used to rank the Site options then the results would differ. Option 3 would move from second to second last, due to the ANEC 20 for the North-South runway encompassing the Appin Township, while Option 1S and 1 would move to third and fourth respectively.

It can also be seen that, in terms of the Commonwealth's 1990 policy for property acquisition at Badgerys Creek – (see Working Paper - *Acoustic Footprints*), there are almost no people and, presumably properties, within the 35 ANEC

A similar assessment can be made using the results of the N70 analysis, as shown below in **Table 5.10**.

Table 5.10: Ranking of site options based on the person-events Index for the 10 event N70 contour

Option	Person-Events Index	Total persons exposed to > 10 events/day	Average Individual Exposure	Basic Cardinal Runway Orientation	Eastern or Western Grouping	Name of Communities principally affected
4	18946	407	47	NWSE	E	Wilton, Douglas Park
1	46069	773	60	NS	W	Wilton, Douglas Park, Menangle
1S	46445	817	57	NS	W	Wilton, Douglas Park, Menangle
5	112052	4591	24	EW	E	Thirroul, Austinmer, Bargo
2	157944	1984	80	NS	W	Wilton, Douglas Park
3	222380	1755	127	NS	E	Appin
7	237579	6179	38	NWSE	W	Wilton, Pheasants Nest, Tahmoor, Thirlmere, Lakesland
6	332280	1744	191	NESW	W	Wilton, Appin

It can be seen that the results from the N70 analysis differ to those from the ANEC analysis. Option 5 has moved from first to fourth due to the 10 Event N70 Contour for this option encompassing parts of Thirroul and Austinmer, resulting in a relatively large total persons count. Despite this, Option 5 still achieves the lowest Average Individual Exposure for the eight options, due its distance from the communities that it affects. Option 4 has moved from third to first, while Option 1 and 1S have moved from fifth and sixth to second and third respectively. Options 4, 1, and 1S all benefit from only affecting smaller communities, such as Wilton, Douglas Park, and Menangle. However, due to the close proximity of these communities, the average individual exposure is higher for these options than for Option 5 and 7.

It can be concluded that minimum overall noise impact on people would generally result from airport sites located in the eastern part of the study area. However, North-South runway orientations in this area can result in amongst the worst of overall effects, and therefore care is needed to avoid orientating a runway towards obvious concentrations of population, such as exists in Appin. The western part of the study area can accommodate North-South orientated runways which, while generating a relatively greater effect in terms of numbers of people[21], may be better oriented for air space management and air navigation reasons.

5.4 Key findings

- An analysis combining 2011 Census data with projected ANEC and N70 Contours has been undertaken to estimate the effect of noise on residential populations in and around Wilton for each of 8 airport site concepts;
- Of the two groupings of airports in the Wilton Study Area – the Eastern and Western separated by the Wallandoola Creek gorge – the Eastern grouping generates the lowest impacts on current patterns of residents and urban development, provided a North-South runway orientation is not adopted;
- The Western grouping, however, can supply a number of sites, which include North-South orientated runways, whose noise effects on people are the next lowest in magnitude within the context of the Wilton Study Area;
- Within either the Western or Eastern groupings of options, runway orientations can be found that produce a relatively large noise effect on residential populations. This emphasizes the need for caution when setting runway thresholds and orientations, regardless of the site location; and
- The overall numbers of people liable to affected under any of these options is very small in a comparative sense with other localities investigated in the Joint Study.

[21] Relatively greater only within the context of Options in the Wilton Study Area and as assessed in this Study – as found in the Joint Study, an airport in the Wilton locality would expose significantly fewer people to aircraft noise than would an airport in the other localities considered in that Study.

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LEGEND

B1	B1 Neighbourhood Centre
B2	B2 Local Centre
B4	B4 Mixed Use
E1	E1 National Parks and Nature Reserves
E2	E2 Environmental Conservation
E3	E3 Environmental Management
E4	E4 Environmental Living
IN2	IN2 Light Industrial
IN3	IN3 Heavy Industrial
R2	R2 Low Density Residential
R3	R3 Medium Density Residential
R5	R5 Large Lot Residential
RE1	RE1 Public Recreation
RE2	RE2 Private Recreation
RU1	RU1 Primary Production
RU2	RU2 Rural Landscape
RU4	RU4 Rural Small Holdings
SP2	SP2 Infrastructure
	Local Government Area Boundary

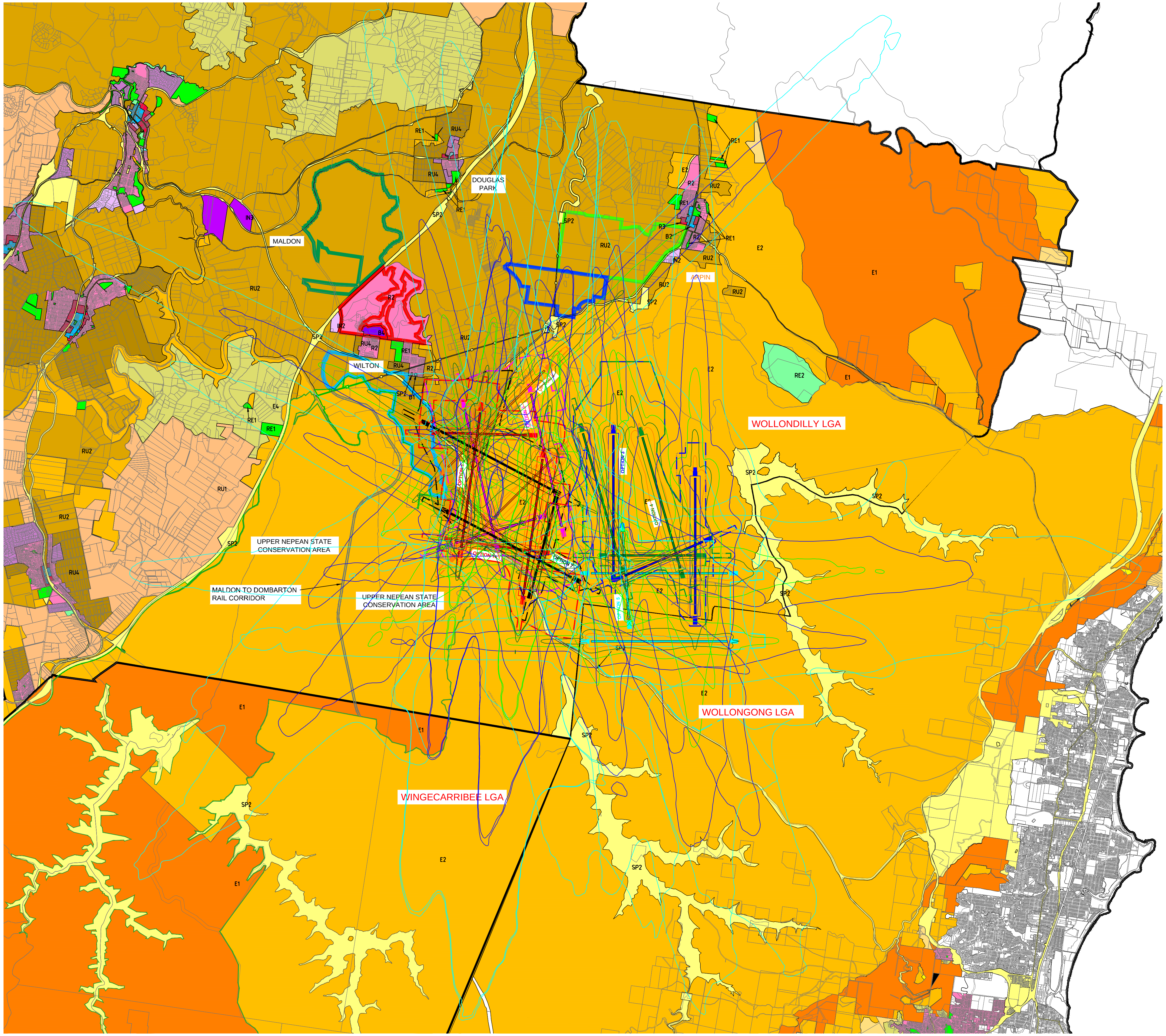
LANDOWNER NOMINATED SITES LEGEND

- Appin Vale *
- Brooks Point*
- Bingara Gorge
- Wilton West*
- Wilton South*

* Currently Being Assessed by Department of Planning and Infrastructure

ANEC CONTOUR LEGEND

- ANEC-CONTOUR 20
- ANEC-CONTOUR 25
- ANEC-CONTOUR 30
- ANEC-CONTOUR 35
- ANEC-CONTOUR 40



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ANEC FOOTPRINTS FOR ALL RUNWAY OPTIONS

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- B4 — B4 Mixed Use
- E1 — E1 National Parks and Nature Reserves
- E2 — E2 Environmental Conservation
- E3 — E3 Environmental Management
- E4 — E4 Environmental Living
- IN2 — IN2 Light Industrial
- IN3 — IN3 Heavy Industrial
- R2 — R2 Low Density Residential
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- R5 — R5 Large Lot Residential
- RE1 — RE1 Public Recreation
- RE2 — RE2 Private Recreation
- RU1 — RU1 Primary Production
- RU2 — RU2 Rural Landscape
- RU4 — RU4 Rural Small Holdings
- SP2 — SP2 Infrastructure
- Local Government Area Boundary

LANDOWNER NOMINATED SITES LEGEND

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- Wilton South*

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ANEC CONTOUR LEGEND

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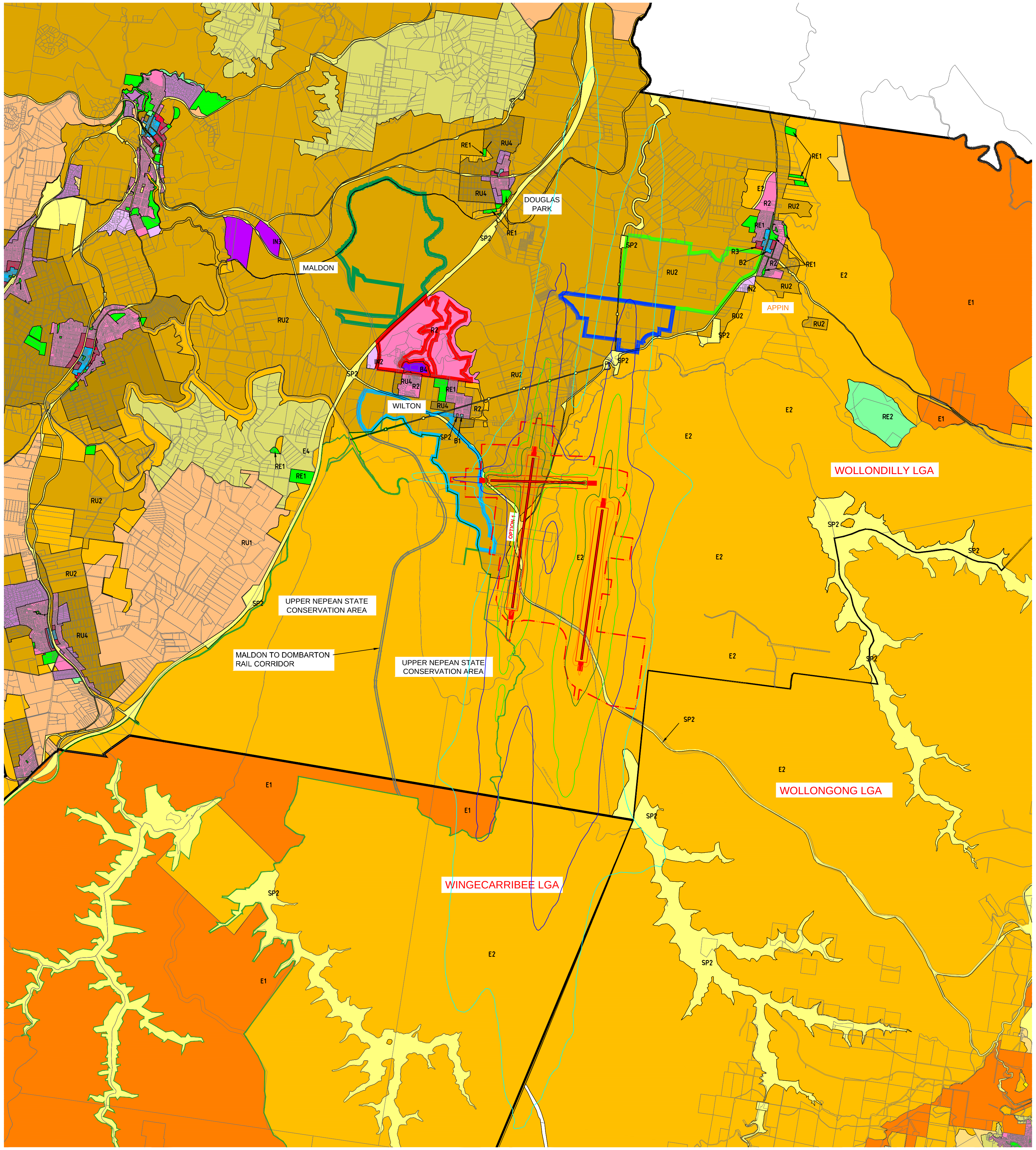

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LEGEND

B1	B1 Neighbourhood Centre
B2	B2 Local Centre
B4	B4 Mixed Use
E1	E1 National Parks and Nature Reserves
E2	E2 Environmental Conservation
E3	E3 Environmental Management
E4	E4 Environmental Living
IN2	IN2 Light Industrial
IN3	IN3 Heavy Industrial
R2	R2 Low Density Residential
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ANEC CONTOUR LEGEND

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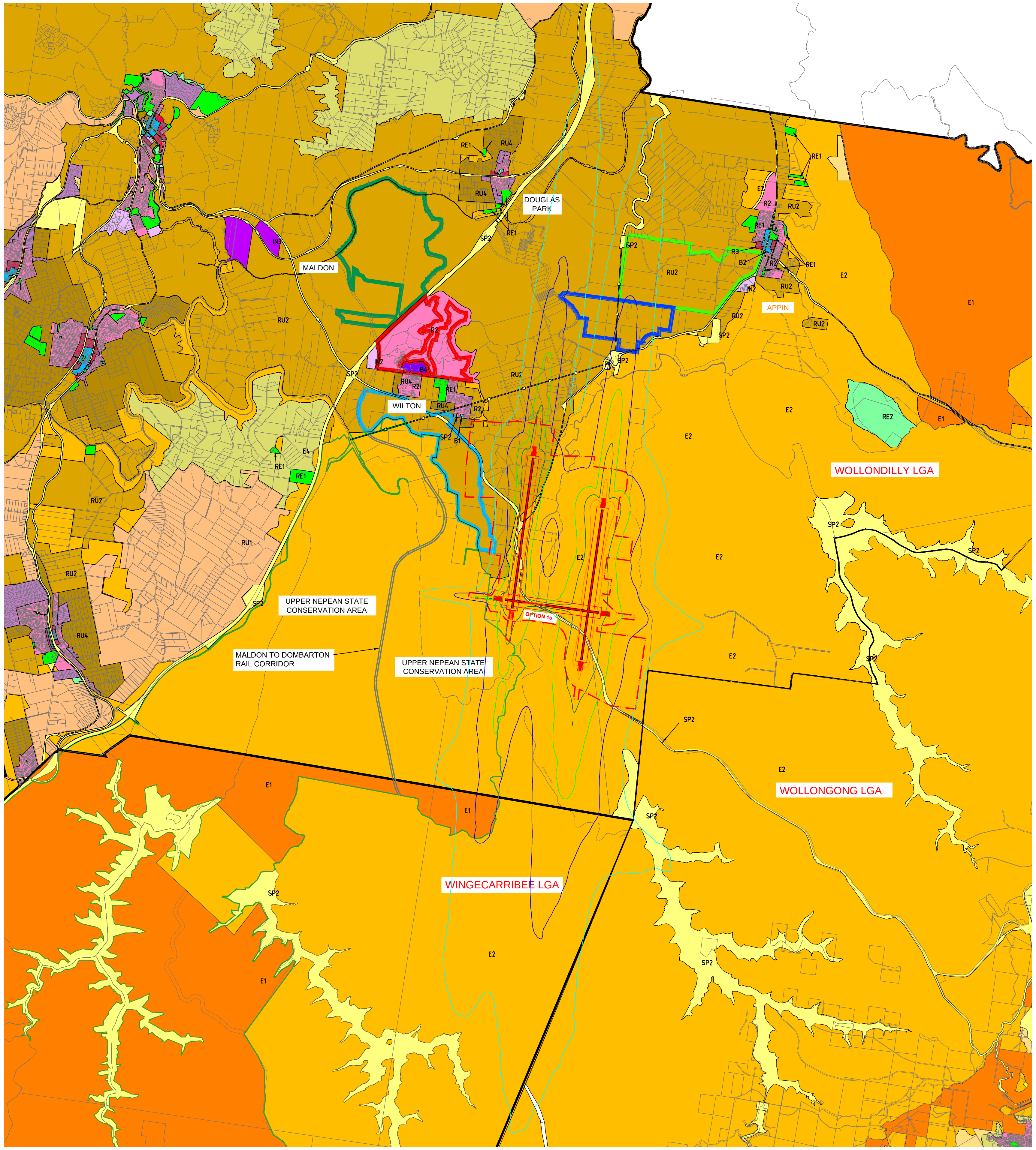

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LEGEND

- B1 — B1 Neighbourhood Centre
- B2 — B2 Local Centre
- B4 — B4 Mixed Use
- E1 — E1 National Parks and Nature Reserves
- E2 — E2 Environmental Conservation
- E3 — E3 Environmental Management
- E4 — E4 Environmental Living
- IN2 — IN2 Light Industrial
- IN3 — IN3 Heavy Industrial
- R2 — R2 Low Density Residential
- R3 — R3 Medium Density Residential
- R5 — R5 Large Lot Residential
- RE1 — RE1 Public Recreation
- RE2 — RE2 Private Recreation
- RU1 — RU1 Primary Production
- RU2 — RU2 Rural Landscape
- RU4 — RU4 Rural Small Holdings
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- Wilton West*
- Wilton South*

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ANEC CONTOUR LEGEND

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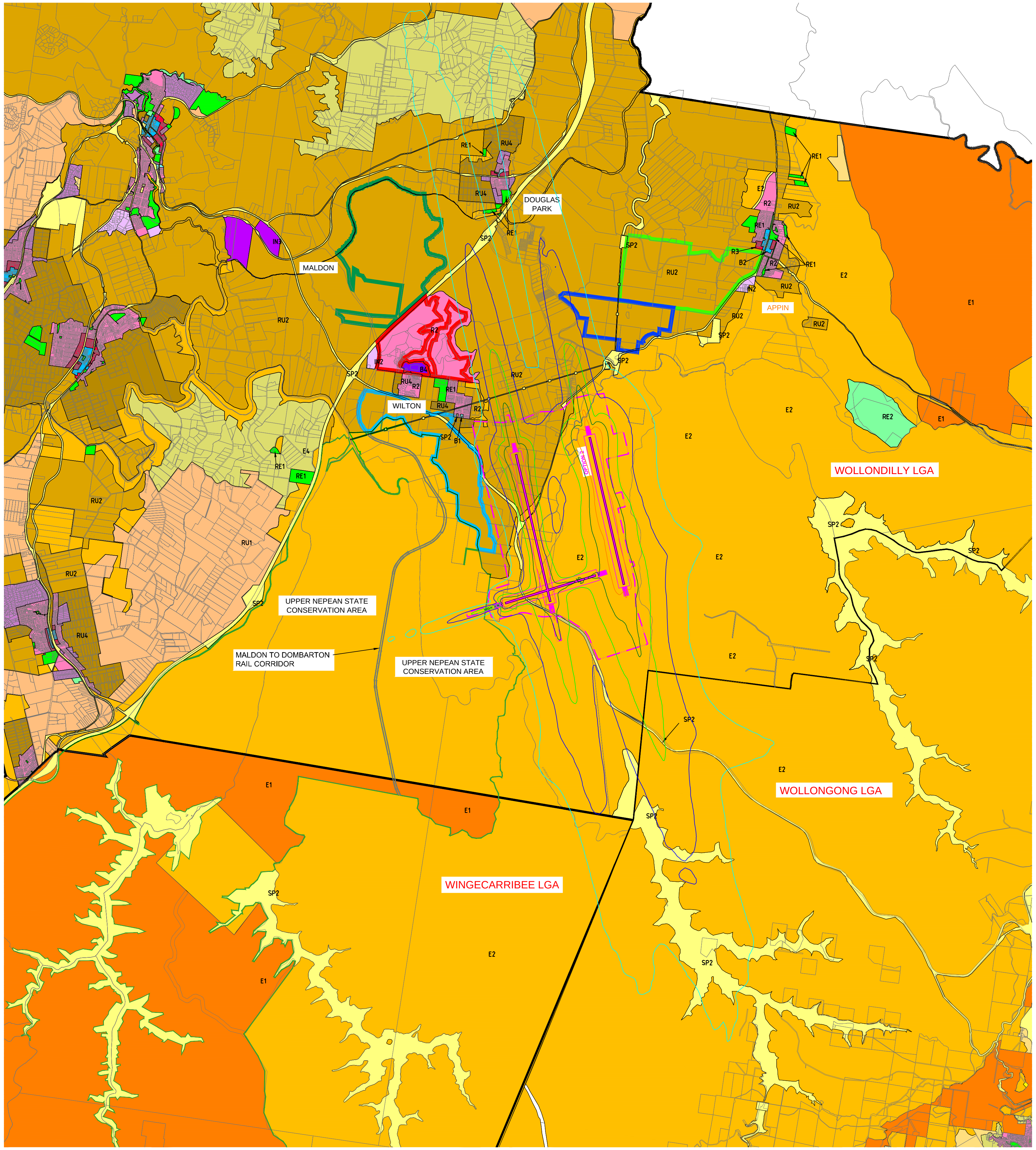

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ANEC CONTOUR LEGEND

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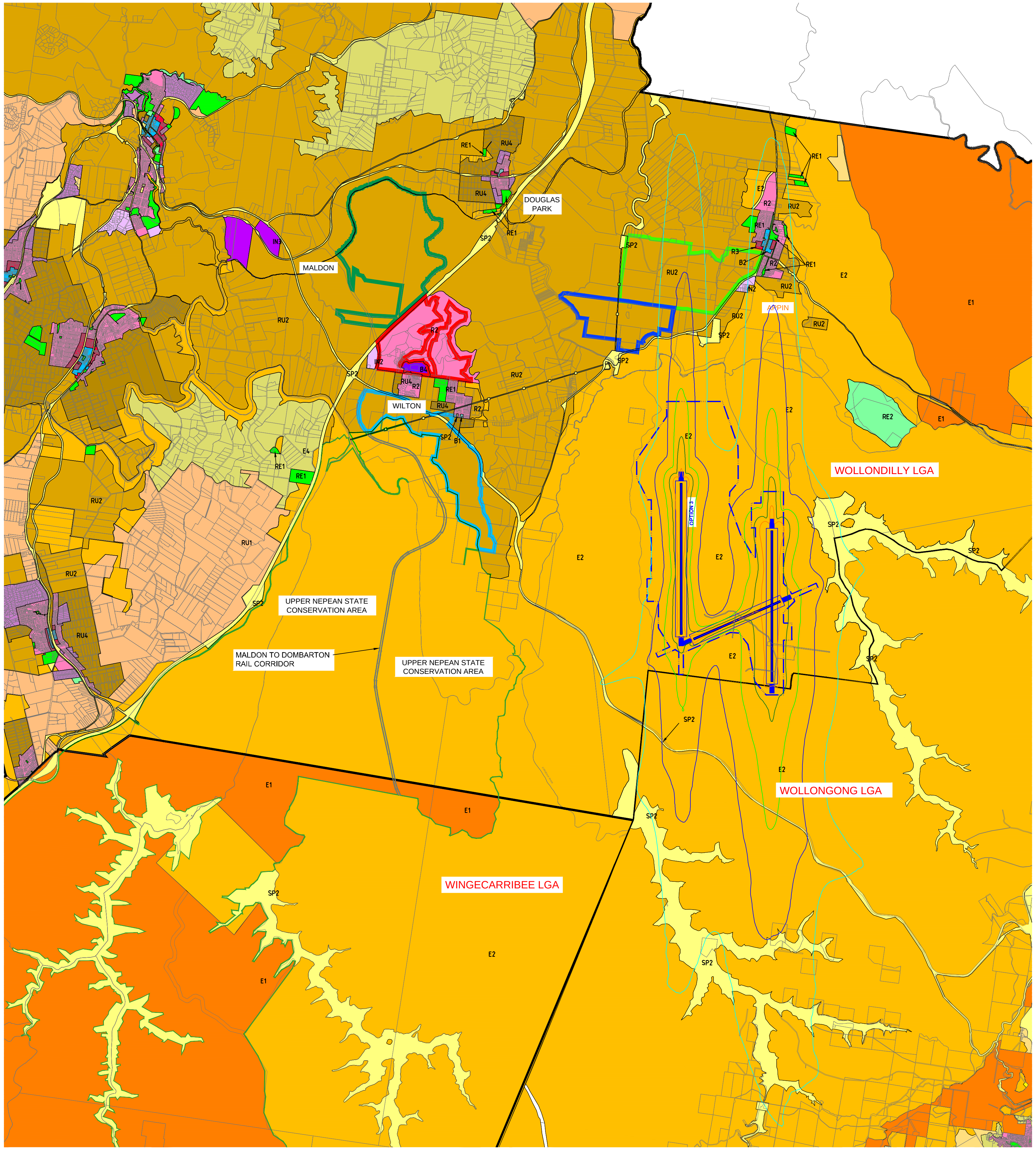

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ANEC FOOTPRINTS FOR RUNWAY OPTION 3

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LEGEND

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- B2 Local Centre
- B4 Mixed Use
- E1 National Parks and Nature Reserves
- E2 Environmental Conservation
- E3 Environmental Management
- E4 Environmental Living
- IN2 Light Industrial
- IN3 Heavy Industrial
- R2 Low Density Residential
- R3 Medium Density Residential
- R5 Large Lot Residential
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ANEC CONTOUR LEGEND

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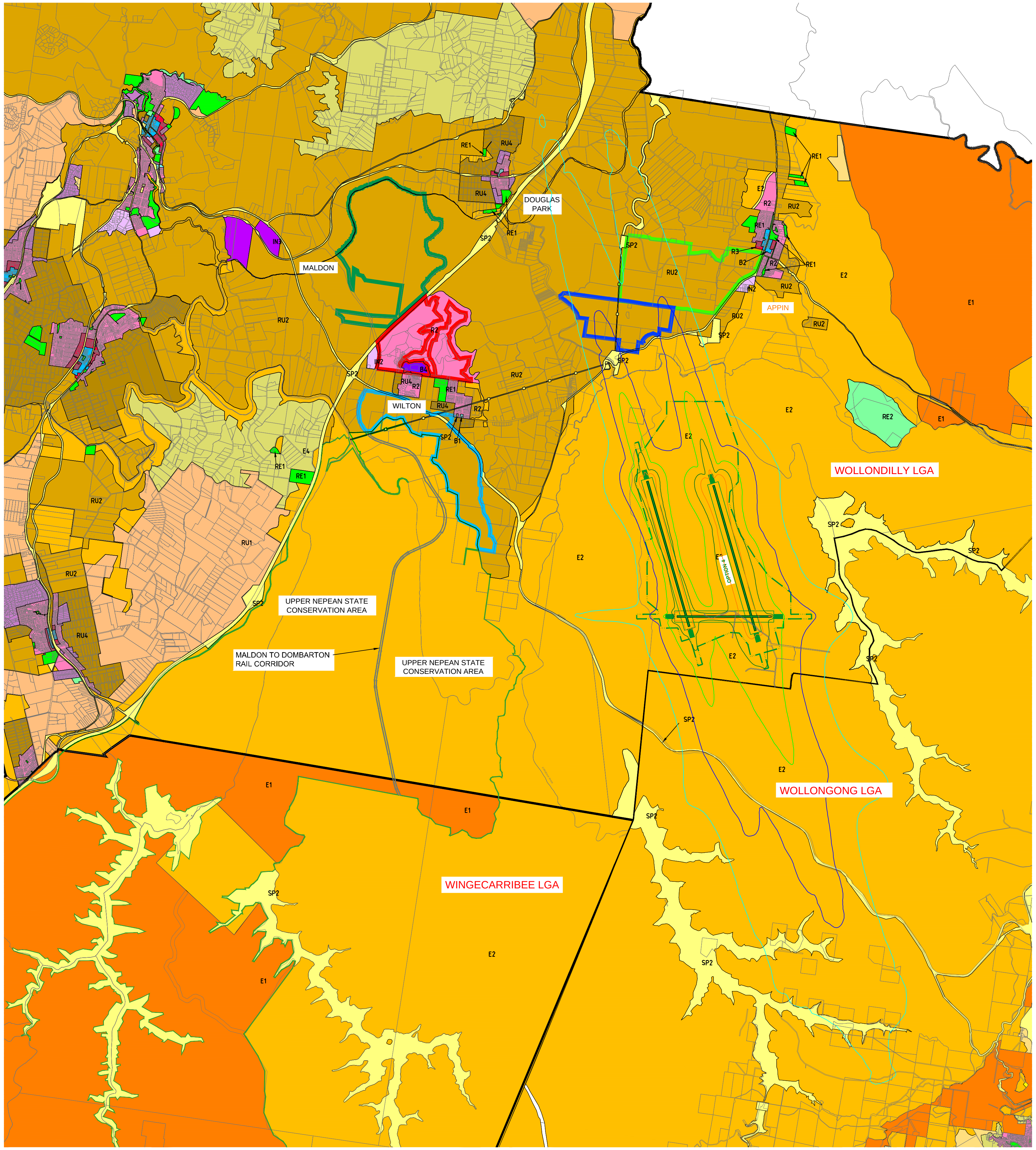

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WILTON STUDY AREA
ANEC FOOTPRINTS FOR RUNWAY OPTION 4

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- B4 — B4 Mixed Use
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- E2 — E2 Environmental Conservation
- E3 — E3 Environmental Management
- E4 — E4 Environmental Living
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LANDOWNER NOMINATED SITES LEGEND

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ANEC CONTOUR LEGEND

- ANEC-CONTOUR 20
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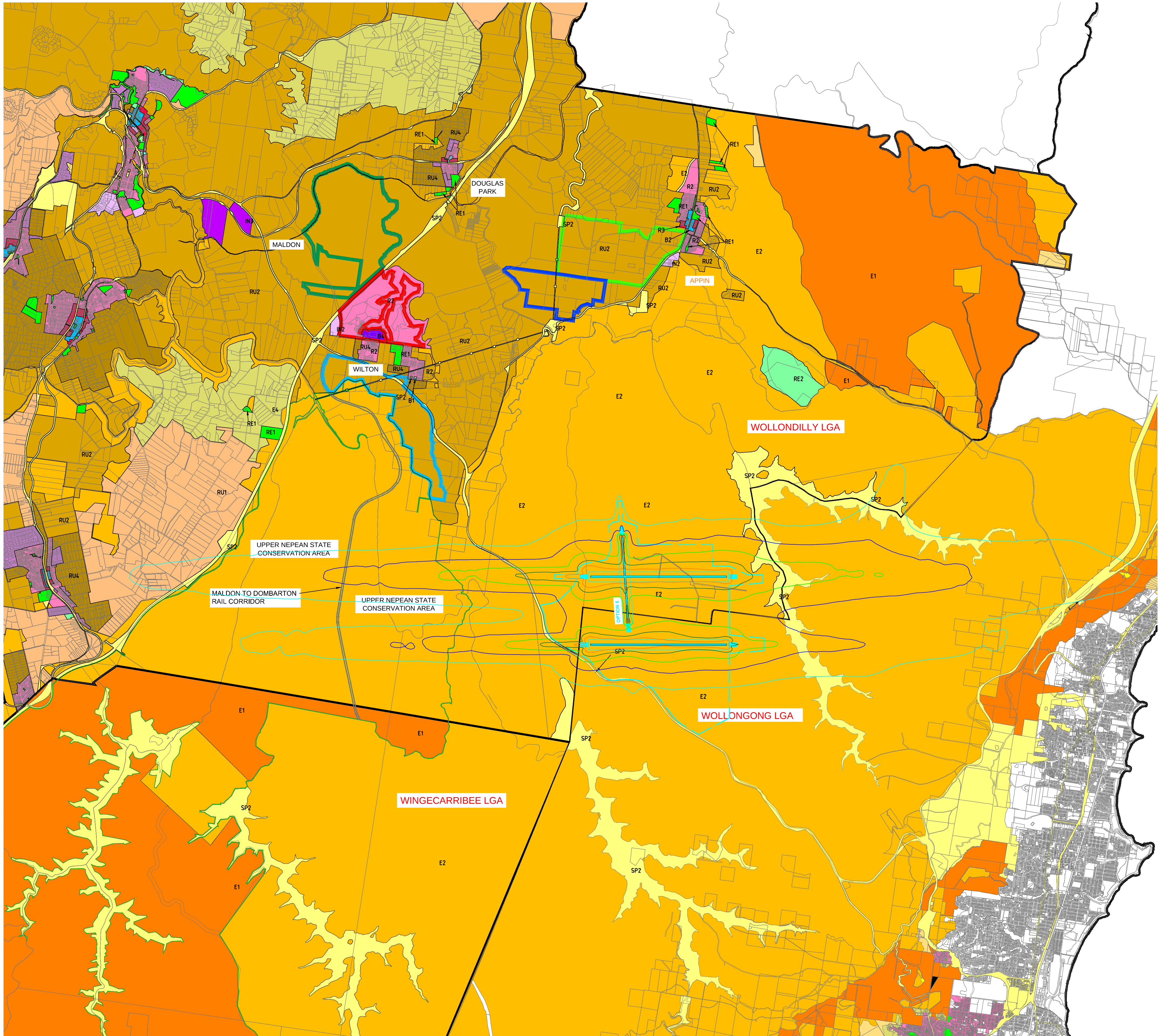

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WILTON STUDY AREA
ANEC FOOTPRINTS FOR RUNWAY OPTION 5

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LEGEND

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- IN3 — IN3 Heavy Industrial
- R2 — R2 Low Density Residential
- R3 — R3 Medium Density Residential
- R5 — R5 Large Lot Residential
- RE1 — RE1 Public Recreation
- RE2 — RE2 Private Recreation
- RU1 — RU1 Primary Production
- RU2 — RU2 Rural Landscape
- RU4 — RU4 Rural Small Holdings
- SP2 — SP2 Infrastructure
- Local Government Area Boundary

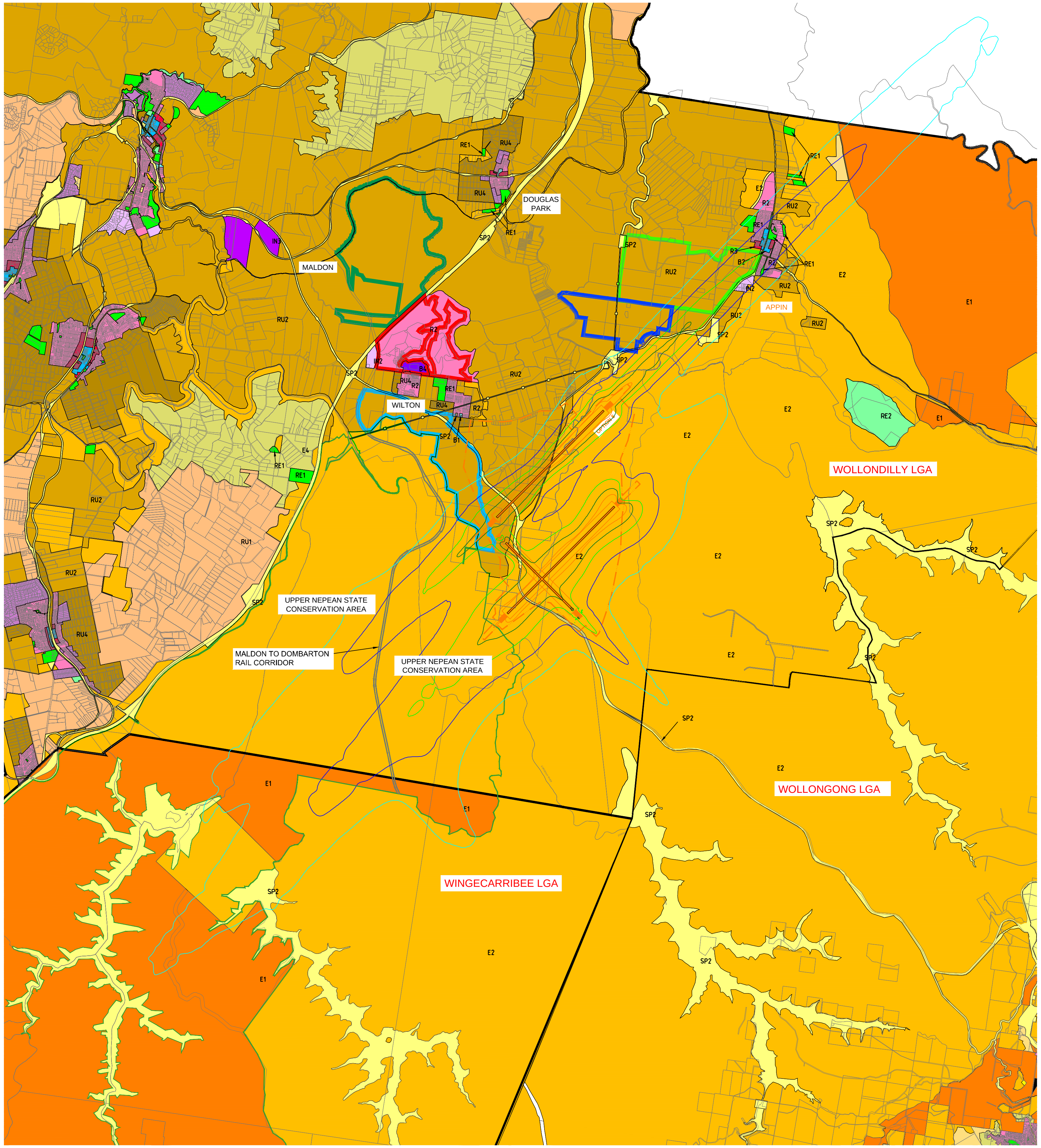
LANDOWNER NOMINATED SITES LEGEND

- Appin Vale *
- Brooks Point*
- Bingara Gorge
- Wilton West*
- Wilton South*

* Currently Being Assessed by Department of Planning and Infrastructure

ANEC CONTOUR LEGEND

- ANEC-CONTOUR 20
- ANEC-CONTOUR 25
- ANEC-CONTOUR 30
- ANEC-CONTOUR 35
- ANEC-CONTOUR 40



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ISSUE	DATE	ISSUE DESCRIPTION
A	30.07.12	ISSUED TO CUSTOMER

FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
ANEC FOOTPRINTS FOR RUNWAY OPTION 6

WP-301015-03019-NOI-SK-006

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NOTES

1. 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.
2. This concept drawing is based on a desktop study only and is subject to change following site inspection and detailed analysis. The runway alignments may change once Bureau of Meteorology (BOM) wind data is available and analysed.
3. Land zoning on this drawing is based on Wollongong LEP 2009, Wollondilly LEP 2011, and Wingecarribee LEP 2010
4. Cadastre base data as provided by NSW LPMA. Addendum Data: 17.05.2010 Wollondilly Shire Council, 28.10.09 & 10.11.11 Wollongong City Council and 04.05.10 Wingecarribee Shire Counccil

LEGEND

- B1 B1 Neighbourhood Centre
- B2 B2 Local Centre
- B4 B4 Mixed Use
- E1 E1 National Parks and Nature Reserves
- E2 E2 Environmental Conservation
- E3 E3 Environmental Management
- E4 E4 Environmental Living
- IN2 IN2 Light Industrial
- IN3 IN3 Heavy Industrial
- R2 R2 Low Density Residential
- R3 R3 Medium Density Residential
- R5 R5 Large Lot Residential
- RE1 RE1 Public Recreation
- RE2 RE2 Private Recreation
- RU1 RU1 Primary Production
- RU2 RU2 Rural Landscape
- RU4 RU4 Rural Small Holdings
- SP2 SP2 Infrastructure
- Local Government Area Boundary

LANDOWNER NOMINATED SITES LEGEND

- Appin Vale *
- Brooks Point*
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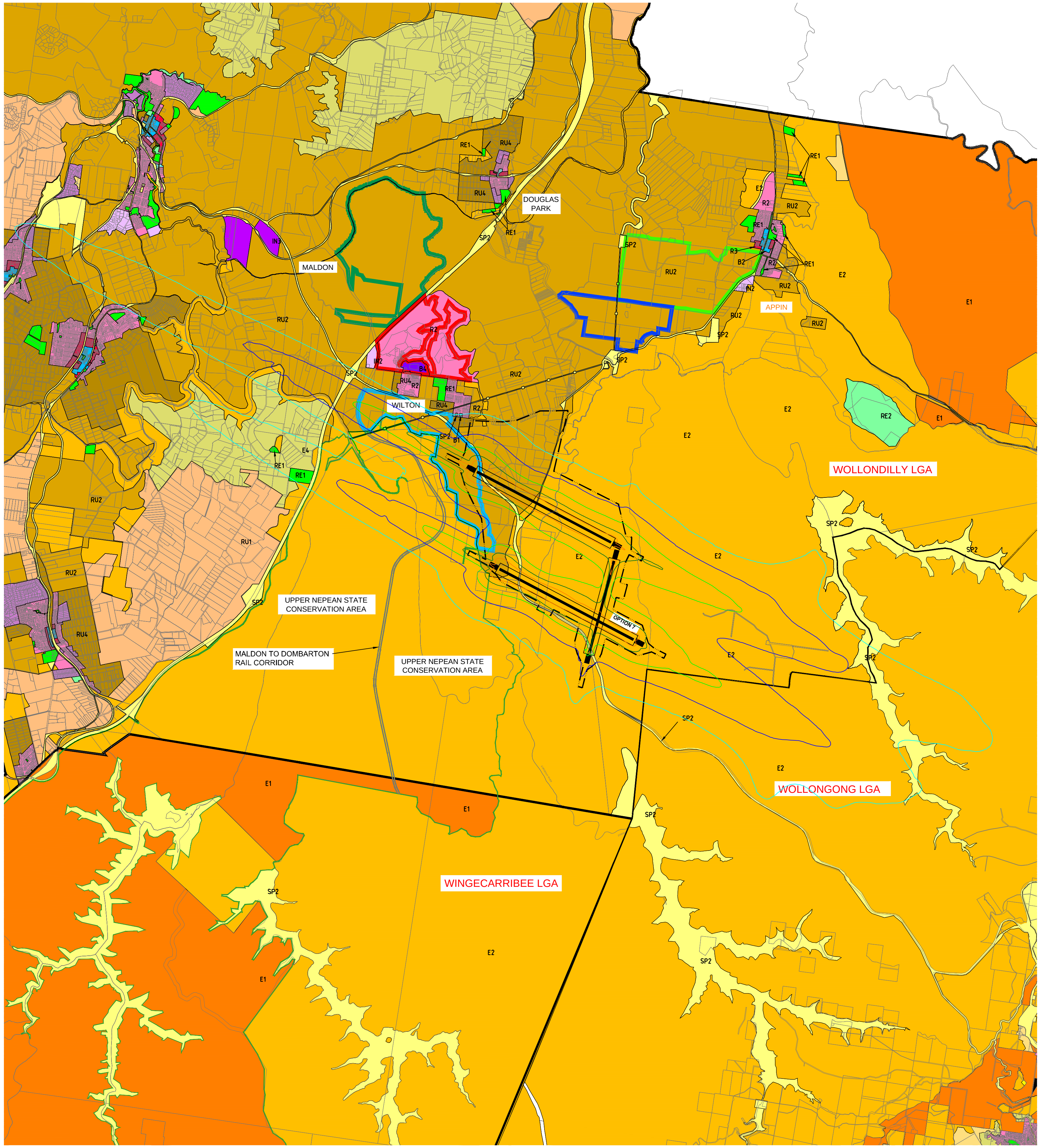
- Wilton West*
- Wilton South*

* Currently Being Assessed by Department of Planning and Infrastructure

ANEC CONTOUR LEGEND

- ANEC-CONTOUR 20
- ANEC-CONTOUR 25
- ANEC-CONTOUR 30
- ANEC-CONTOUR 35
- ANEC-CONTOUR 40



A	30.07.12	ISSUED TO CUSTOMER
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FURTHER ASSESSMENT OF AIRPORT DEVELOPMENT OPTIONS
WILTON STUDY AREA
ANEC FOOTPRINTS FOR RUNWAY OPTION 7

WP-301015-03019-NOI-SK-007

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SAVE DATE & TIME: 31/7/2012 5:47:19 PM CTB FILE: __00-WP-Syd-std.ctb