



Roads and Maritime Services/Sydney Airport Corporation Limited

Sydney Gateway Road Project

Environmental Impact Statement/ Preliminary Draft Major Development Plan

Chapter 11 Airport operations



November 2019

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Chapter 11

Airport operations

This chapter describes the key facilities and safety requirements at Sydney Airport, identifies potential hazards and risks to aviation and the operation of the airport during construction and operation, and provides measures to mitigate and manage the impacts identified. Further information is provided in Technical Working Paper 3 (Airport Operations).

The relevant SEARs and MDP requirements are listed below. Full copies of the SEARs and MDP requirements, and where they are addressed in this document, are provided in Appendices A and B respectively.

Reference	Requirement	Where addressed
Key issue SEARs		
16	Hazards and risks	
16.2	The EIS must outline the process for assessing the risks of the project on airport operations, including encroachment into the prescribed airspace, potential impacts to airport communication, navigation and surveillance systems, light spill and landscaping associated with the construction and operation of the project.	The assessment process is outlined in section 11.1. Potential impacts are considered in sections 11.3 and 11.4
Major development plan requirements (in accordance with Section 91 of the Airports Act)		
91(1)(ea)	If the development could affect flight paths at the airport – the effect that the development would be likely to have on those flight paths.	The project would not affect flight paths at Sydney Airport. The potential impacts on Sydney Airport's prescribed airspace and other aircraft operational issues are considered in sections 11.3 and 11.4

11. Airport operations

11.1 Assessment approach

Obstructions and lighting in the vicinity of an airport have the potential to create hazards to aviation and constrain the operation of the airport. The most critical areas of concern (in terms of the potential for hazards and risks) are the immediate approach and take-off areas. These potential hazards have been, and would continue to be, important considerations during the design process.

The project site is located close to Sydney Airport. Some parts of the project site are located directly within or adjacent to Sydney Airport land (Commonwealth-owned land leased by Sydney Airport Corporation). The project includes new elevated road infrastructure (such as bridges, overpasses, viaducts, abutments, ramps and lighting) and emplacement mounds close to the airport.

An assessment of the potential impacts of the project on Sydney Airport's operations (including potential hazards to aviation) was undertaken, with reference to the relevant legislation and the *National Airports Safeguarding Framework* (Department of Infrastructure, Regional Development and Cities, 2018b), 2018). An overview of the approach to the assessment is provided below, including the legislative and policy context and a summary of the assessment methodology.

This chapter focuses on the findings of this assessment in relation to the potential for hazards and risks to aviation operations. Other potential impacts on Sydney Airport land and the operation of the airport, including the potential for traffic and access, noise and vibration, air quality, contamination, water quality, flooding, heritage, land use and property, visual amenity, biodiversity and cumulative impacts, are considered in Chapters 9, 10 and 12 to 27. Other hazard and risk issues associated with the project are considered in Chapter 23 (Health, safety and hazards).

11.1.1 Legislative and policy context to the assessment

The assessment has been undertaken in accordance with the SEARs and MDP requirements (provided in Appendices A and B) and with reference to the following:

- Relevant legislation, including the EP&A Act, the Airports Act and regulations, and the Civil Aviation Act 1988 (Cth) and regulations
- *National Airports Safeguarding Framework* (Department of Infrastructure, Regional Development and Cities, 2018b)
- *Manual of Standards Part 139 – Aerodromes* (CASA, 2017)
- *Recommended Practices No. 1 – Standards for Aerodrome Bird/Wildlife Control* (International Birdstrike Committee, 2006)
- *Sydney Airport Master Plan 2039* (SACL, 2019a)
- *Sydney Airport Environment Strategy 2019-2024* (SACL, 2019b).

11.1.2 Methodology

Study area

The study area for the assessment was defined primarily as the project site (as described in Chapter 2 (Location and setting)) and the Sydney Airport operations area. The assessment also considered all the protected areas (ie prescribed airspace and lighting intensity zones) surrounding Sydney Airport where relevant.

Key tasks

The assessment involved:

- Undertaking a risk screening to identify hazards with the potential to affect aviation and airport operations, including issues covered by the *National Airports Safeguarding Framework* (described below)
- Assessing the potential for the project to intrude into the prescribed airspace of Sydney Airport based on review of a three dimensional model of the obstacle limitation and high intensity approach lighting surfaces (provided by Sydney Airport Corporation) and a desktop review of other publicly available information on other protected surfaces – the information on the prescribed airspace was current at the time the review was undertaken
- Assessing the potential impacts of lighting and headlight glare based on a desktop review of relevant plans and design standards
- Assessing the potential for windshear and turbulence as a result of the project (described below)
- Assessing other potential airport operational issues identified via the risk screening
- Identifying measures to manage and mitigate the identified impacts
- Preparing a report to describe the results of the assessment.

Further information on the assessment methodology is provided in section 3 of Technical Working Paper 3 (Airport Operations).

National Airports Safeguarding Framework

The *National Airports Safeguarding Framework* is a national land use planning framework that aims to:

- Improve safety outcomes by ensuring aviation safety requirements are recognised in land use planning decisions through guidelines being adopted by jurisdictions on various safety-related issues
- Improve community amenity by minimising aircraft noise-sensitive developments near airports.

The framework provides guidance on planning requirements for development with the potential to affect aviation operations. This includes building activity around airports that might penetrate an airport's operational airspace and/or affect aircraft navigational procedures.

The framework consists of nine guidelines (see Figure 11.1), with each focusing on a particular risk. Guidelines B, C, E, F, G and I are relevant to the project and were considered by the assessment.

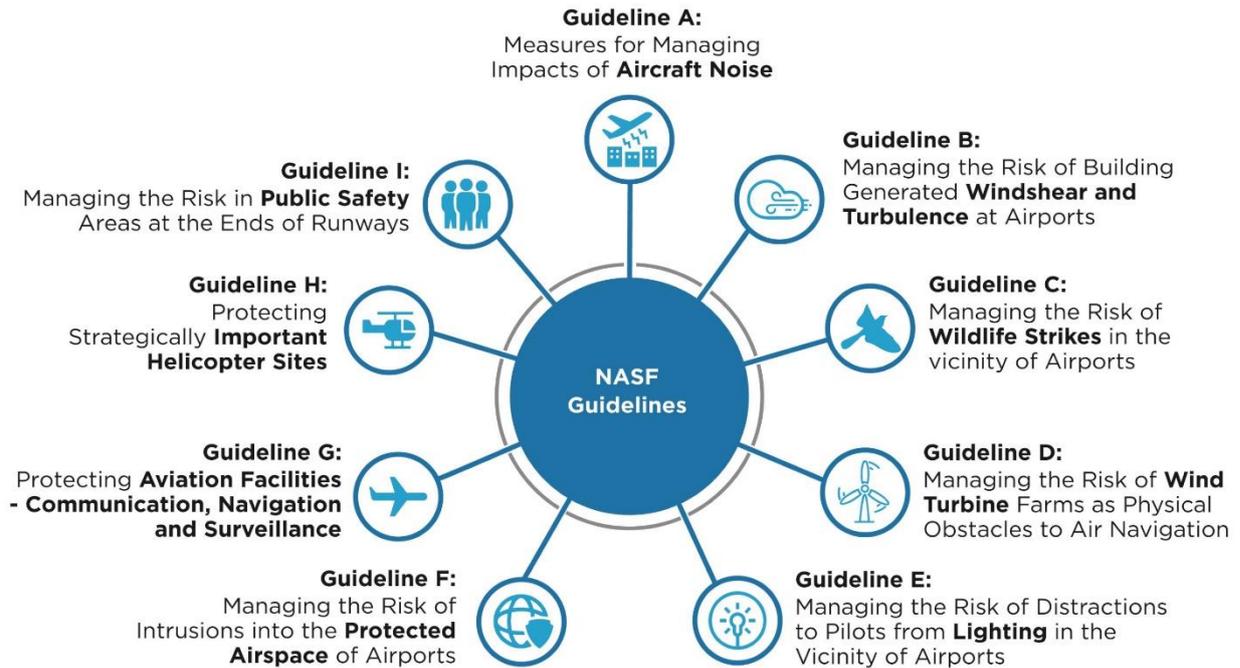


Figure 11.1 National Airports Safeguarding Framework

Windshear and turbulence

Windshear is defined as a change of horizontal wind direction and/or speed with height. Rapid changes in wind velocity encountered during the landing and take-off phases of flight can be hazardous to aircraft.

Turbulence is caused by a disruption to smooth air flow. Turbulence in the lower atmosphere is generally created by the flow of air around obstacles such as landforms or buildings. Meteorological conditions such as boundaries between different air masses can also result in turbulence.

In accordance with Guideline B of the *National Airports Safeguarding Framework*, developments proposed close to runways should be assessed for their potential to create windshear and turbulence that could affect aviation safety. Sydney Airport's windshear assessment trigger areas, prepared in accordance with Guideline B, are shown on Figure 11.2. As the project site is located within these envelopes, principally within those associated with the main north–south runway, a windshear and turbulence assessment was undertaken. This included testing a model of Sydney Airport's north–south runway approach and surrounds using a wind tunnel, and modelling a number of project scenarios (including emplacement mound options) for representative wind directions.

Further information on the windshear and turbulence assessment is provided in section 3.3 of Technical Working Paper 3.

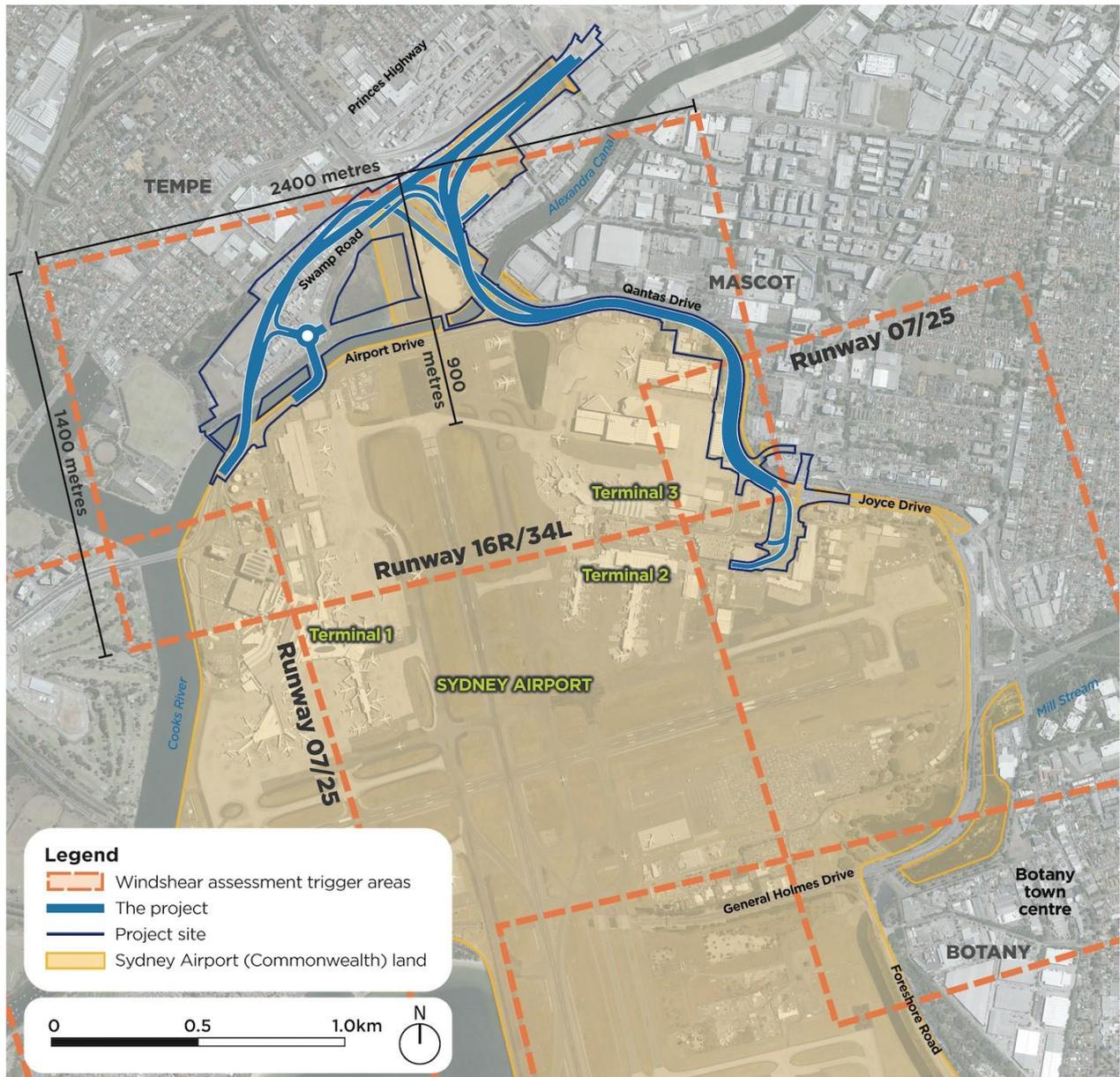


Figure 11.2 Windshear assessment trigger areas for runways near project

11.1.3 Risks identified

An environmental risk assessment was undertaken as an input to the impact assessment (see Appendix G). This involved identifying potential environmental risks during construction and operation of the project as a whole, and rating the potential risks according to likelihood, consequence and overall level of risk, in general accordance with *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*. Risks related to aviation with an assessed overall rating of medium or above, identified by the environmental risk assessment, included:

- Temporary or permanent intrusions into Sydney Airport’s prescribed airspace
- Light spill during construction and operation, including as a result of construction lighting, new lighting on roads, and headlight glare from vehicles using bridges and overpasses
- Interference with navigational aids
- Accidental disruptions to utilities and services, which may affect airport lighting or power to navigational aids

- Windshear and turbulence caused by new infrastructure or landforms close to Sydney Airport.

The assessment included consideration of these potential risks, as well as other potential risks identified as part of the assessment. These included:

- Wildlife attraction
- Smoke or dust reducing visibility
- Flooding
- Disruption to access to Sydney Airport terminals or other airport facilities (such as freight handling) during construction (this potential impact was considered in detail by Technical Working Paper 1 (Transport, Traffic and Access) and the results of the assessment are summarised in Chapter 9 (Traffic, transport and access))
- Interference with communications or navigation equipment
- Security of Sydney Airport's airside area.

11.2 Existing environment and safety requirements at Sydney Airport

11.2.1 Sydney Airport facilities

A summary of the facilities at Sydney Airport is provided below (SACL, 2019a). These include the major infrastructure elements required to safely operate a modern and efficient international airport. Key facilities are shown on Figure 11.3.

Movement areas

The majority of the Sydney Airport site (about 558 hectares out of a total of 907 hectares) is occupied by the aircraft movement areas, described below.

Runways and safety equipment

Sydney Airport has three runways:

- Main north–south runway (Runway 16R/34L), which is located closest to the project site
- Parallel north–south runway (Runway 16L/34R)
- East–west runway (Runway 07/25).

The runways and the airport include a variety of features to assist with safe take-off and landing during low visibility conditions:

- High intensity approach lighting systems (HIAL) at both north–south runways – the northern end of the HIAL for the main north–south runway is located within and adjacent to the project site north of Alexandra Canal
- Precision approach path indicator systems to provide visual approach slope guidance
- Transmissometer units to provide accurate visibility assessments
- Instrument landing systems to permit aircraft to conduct precision approaches in poor weather
- Stop bars at runway ends
- Runway end safety areas – areas surrounding the end of runways designed to facilitate the deceleration of an aircraft in the event of an overrun.

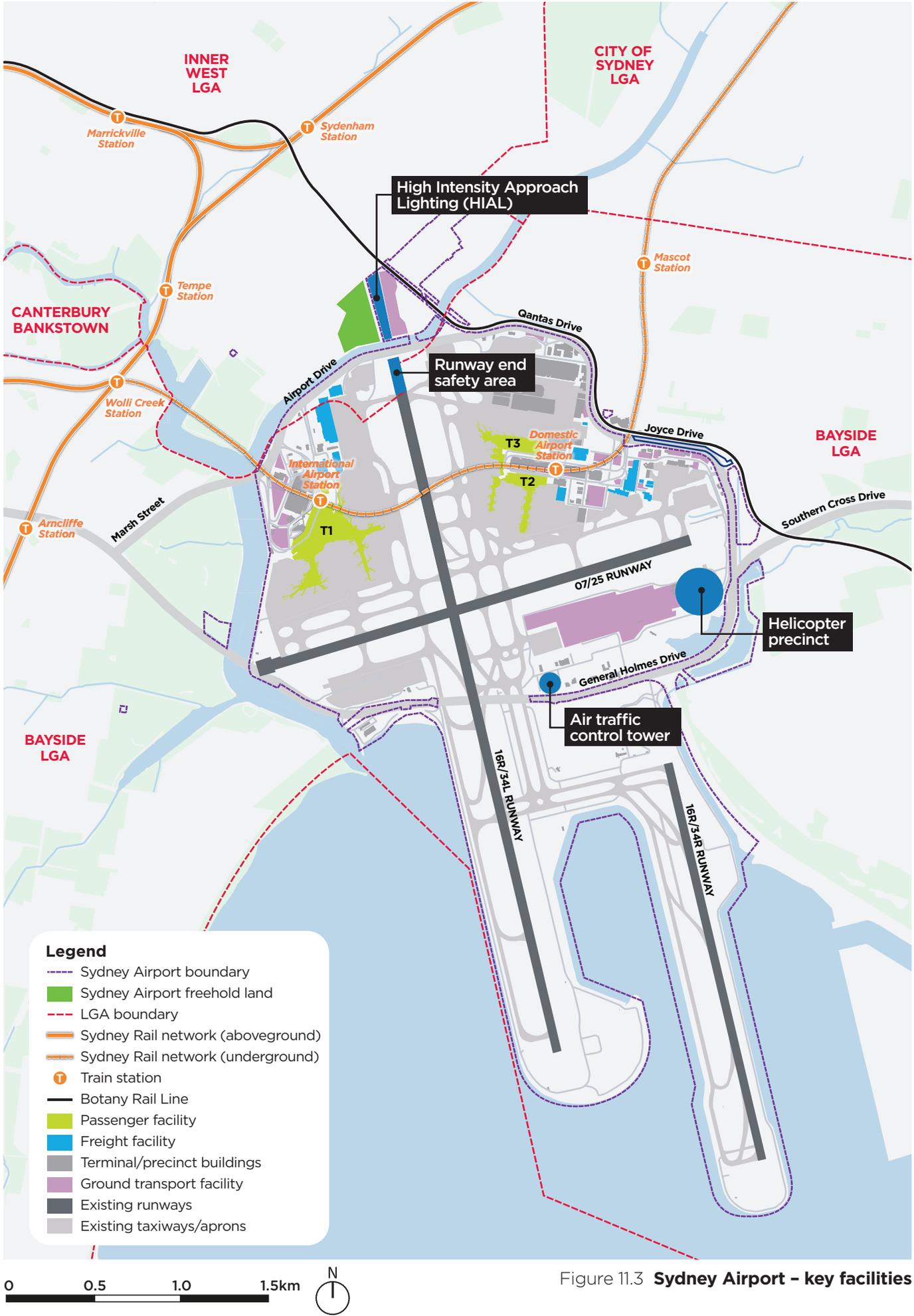


Figure 11.3 Sydney Airport - key facilities

Other movement areas

Other movement areas include:

- Taxiways to facilitate the efficient movement of aircraft between the runways and terminal areas
- Apron areas and stands to facilitate aircraft parking and support activities associated with the servicing of aircraft, such as baggage, freight, refuelling and flight catering
- Sydney Airport Jet Base
- Emergency facilities
- General aviation parking
- Helicopter precinct.

Terminals

Sydney Airport has three passenger terminals:

- Terminal 1 – Sydney Airport's international terminal
- Terminal 2 – one of Sydney Airport's two domestic terminals, used by a number of domestic and regional airlines including Virgin Australia, Jetstar and Rex
- Terminal 3 – Qantas' domestic terminal.

Terminal 1 is located in the North West Sector of Sydney Airport, close to the south-western end of the project site. Terminals 2/3 are located adjacent to each other in Sydney Airport's North East Sector, close to the eastern end of the project site (shown on Figure 11.3). Further information on the airport's land use sectors (as defined by the Sydney Airport Master Plan) is provided in Chapter 19 (Land use and property).

Existing road access arrangements to the terminals are described in Chapter 9.

Freight facilities

Air freight is transported in the cargo hold of passenger aircraft and in dedicated freight aircraft. Air freight facilities, which are operated by various service providers, are located on land leased from Sydney Airport Corporation. These facilities occupy a total area of about 13.7 hectares. International freight facilities, including livestock handling facilities, are located close to Terminal 1 (off Link Road) adjacent to the project site. Domestic freight facilities are located near Terminals 2/3.

Aviation support facilities

Aviation support facilities located on Sydney Airport land include fuelling facilities, aircraft maintenance facilities, ground support equipment and flight catering facilities.

Access facilities

A description of the traffic and transport environment surrounding Sydney Airport, including access arrangements and key roads, is provided in section 9.2.

Access facilities within the airport site include internal public roadways, kerbside transfer, car parking, cycling and pedestrian facilities. A number of recent ground transport improvements have been undertaken by Sydney Airport Corporation to facilitate improved access to the airport precinct (see section 5.1.4).

Communications, navigation aids and surveillance systems

The communications, navigation and surveillance infrastructure and facilities at Sydney Airport enable pilot navigation, instrument approach procedures, communication between pilots and air traffic control and monitoring of aircraft locations by air traffic control. Information regarding the location of these facilities is collated by Airservices Australia and the Australian Department of Defence and is not released to the general public.

Airport security

Sydney Airport's airside (operational) areas are surrounded by security fencing, with access to this area available at designated access gates for approved staff. Within and close to the project site, airside security fencing is located along the southern edge of Airport Drive and Qantas Drive (west of Lancastrian Drive). The Jet Base is generally located airside with the exception of a few building entrances located outside the airside area. Access to the airside area within the project site is provided via a security checkpoint located at Lancastrian Road.

Jet Base and Qantas Flight Training Centre

The Jet Base provides facilities for the maintenance and servicing of aircraft, including engineering facilities, layover parking and aviation support. It is located on an area of about 30 hectares, which is adjacent to Qantas Drive on land leased from Sydney Airport Corporation. The Qantas Flight Training Centre is located on the same site, partially on land within the project site.

The flight training centre supports the training requirements of Qantas pilots and flight crew. It includes facilities such as flight simulators, aircraft cabin mock-ups, ditching pools, and other training rooms and facilities.

11.2.2 Sydney Airport's prescribed airspace

The airspace around Sydney Airport is subject to controls (under the Airports Act and the Airports (Protection of Airspace) Regulations 1996 (Cth)) to restrict structures and/or other obstructions and obstacles from affecting the safe operation of aircraft. This protected airspace is formally known as the 'prescribed airspace'.

The prescribed airspace is defined by section 181(1) of the Airports Act as '...an airspace specified in, or ascertained in accordance with, the regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected under this Part'.

Clause 6(1) of the Airports (Protection of Airspace) Regulations provides that the prescribed airspace consists of:

- (a) *the airspace above any part of either an OLS or a PANS-OPS surface for the airport; and*
- (b) *airspace declared in a declaration, under regulation 5, relating to the airport.*

The prescribed airspace for Sydney Airport was declared, pursuant to the Airports (Protection of Airspace) Regulations, on 20 March 2015. It consists of:

- The OLS, which defines the lower limits of an airport's airspace, which should be kept free of obstacles during the initial and final stages of flight or manoeuvring
- The Procedures for Navigational Services – Aircraft Operations (PANS-OPS), which protects aircraft flying into and out of the airport when the flight is guided solely by instruments in conditions of poor visibility (generally situated above the OLS)
- High intensity approach lighting protected surfaces
- Navigation aids protected surfaces
- Radar terrain clearance chart surfaces
- Combined radar departure assessment surfaces
- Precision approach path indicator system protection surfaces.

These surfaces are shown on Sydney Airport's airspace protection charts.

The critical protected surface in terms of the project is the OLS, which extends for a distance of about 15 kilometres from the ends of Sydney Airport's runways. The OLS in the vicinity of the project is shown on Figure 11.4.

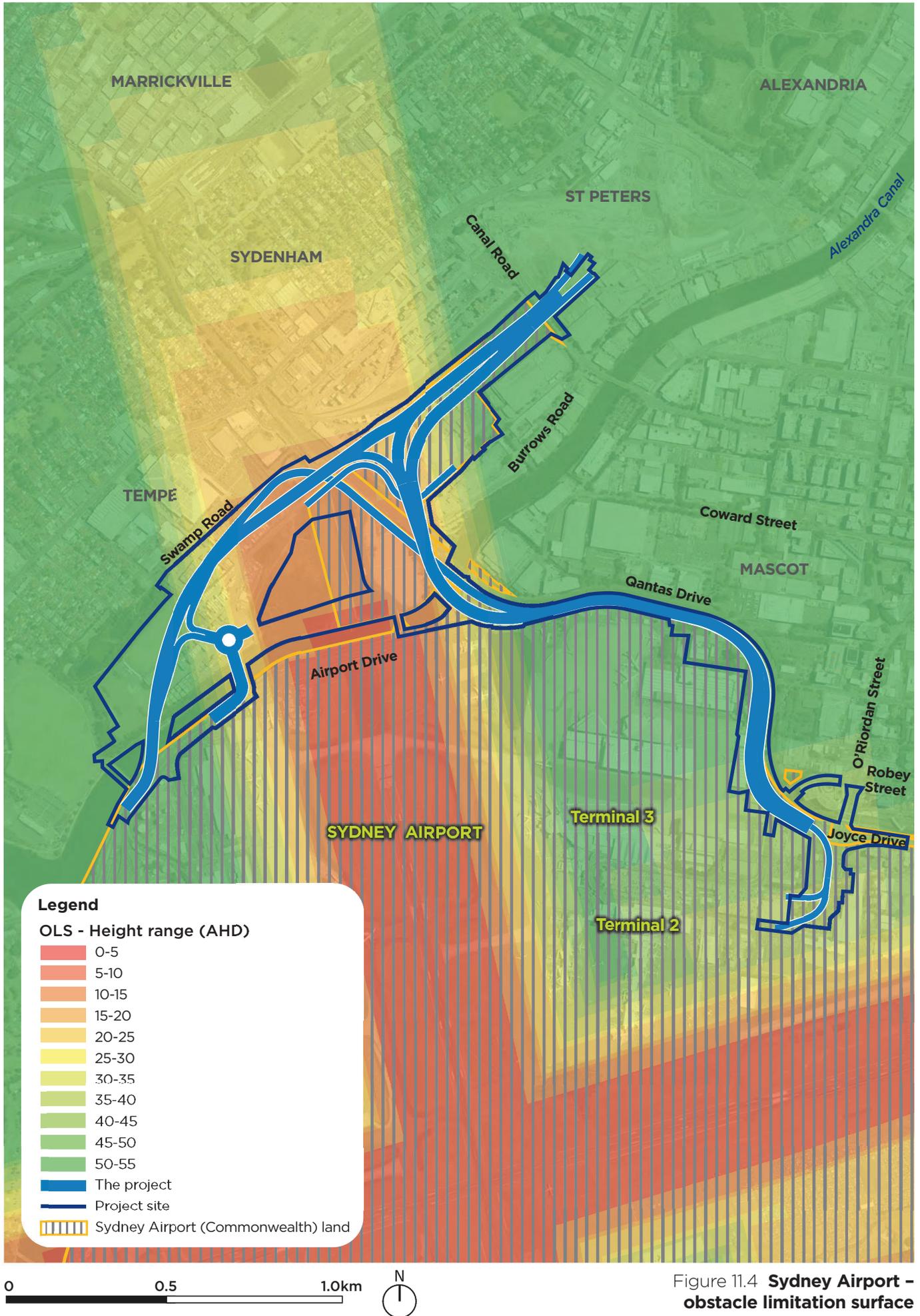


Figure 11.4 Sydney Airport – obstacle limitation surface

Guideline G of the *National Airports Safeguarding Framework* indicates that only specified government agencies have access to information on the location of communications, navigation aids and surveillance facilities. Where a proposed development has the potential to impact on these facilities, information about the development needs to be referred to Airservices Australia to enable the potential impacts to be assessed and appropriate mitigation measures developed. Airservices Australia will also assess the cumulative impacts of a proposed development with existing obstacles, and will provide technical advice regarding appropriate mitigation.

11.2.3 Restricted lighting zones

Lights in the vicinity of an airport can confuse or distract pilots, depending on their colour, location, direction and/or intensity of emission. Under the Civil Aviation Regulations 1988 (Cth), Civil Aviation Safety Authority (CASA) has the authority to control ground lights where they have the potential to create a safety hazard. CASA has established guidelines (in the Manual of Standards) on the location and permitted intensities of ground lighting within a six kilometre radius of an airport. External advertising, sports field floodlighting and street lighting are some of the more likely lighting sources requiring consideration in the vicinity of Sydney Airport and the project site.

The intensity of external lighting and reflected sunlight (as well as smoke, dust or particulate matter) may be considered controlled activities under the Airports (Protection of Airspace) Regulations.

Sydney Airport's restricted lighting zones, based on CASA's requirements, are shown on Figure 11.5. These zones reflect the degree of interference that ground lights can cause as a pilot approaches landing, and specify the maximum permitted intensity of lights. The lighting intensity zones shown in Figure 11.5 are based on varying levels of intensity measured in candela (cd) units. One candela is roughly the equivalent to one common wax candle.

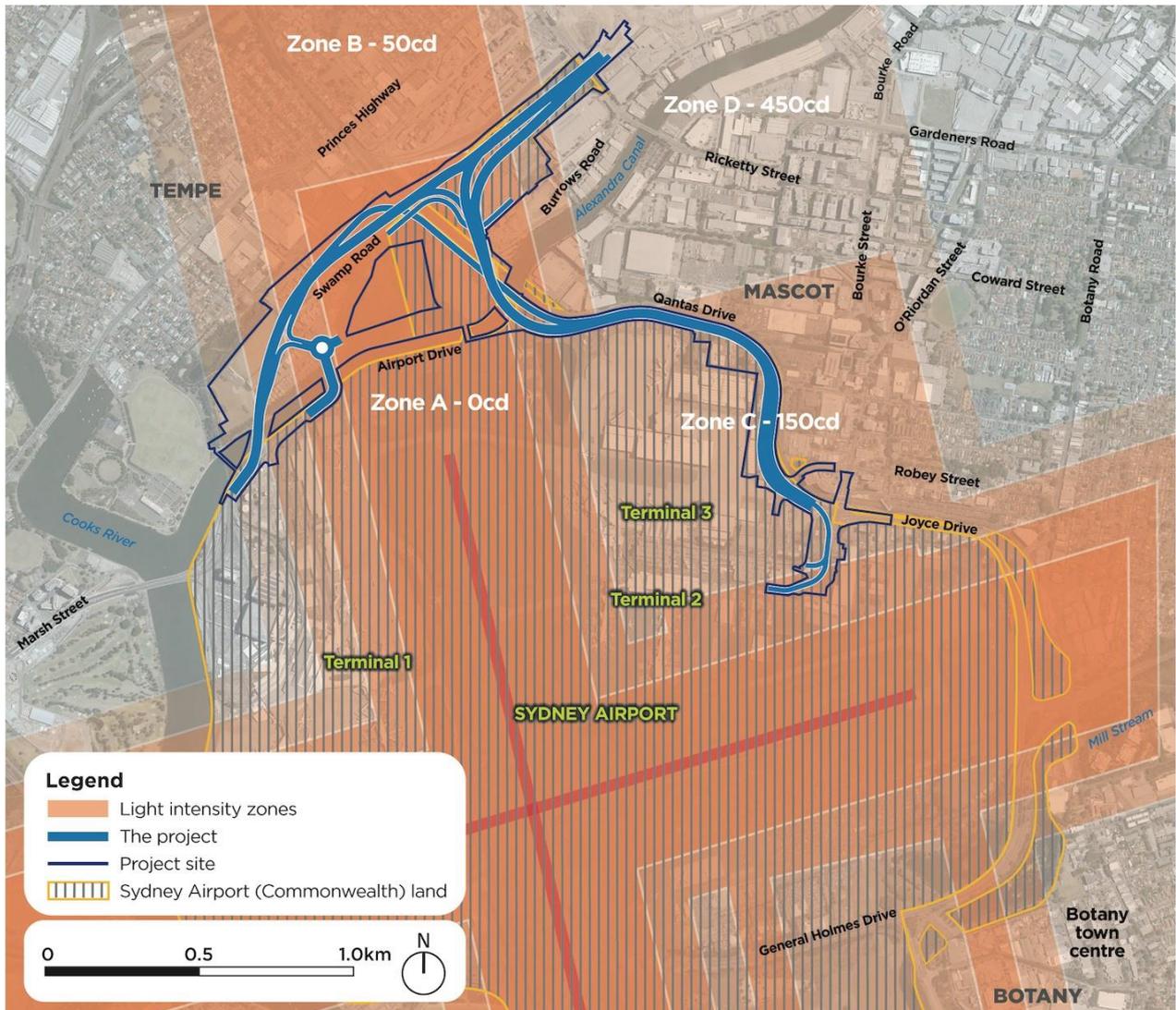


Figure 11.5 Sydney Airport – lighting intensity zones

11.2.4 Public safety areas

Guideline I of the *National Airports Safeguarding Framework* states that the way land use is managed beyond airport boundaries, specifically at runway ends, can contribute to mitigating the risk of on-ground fatalities due to aircraft incidents.

The guideline advises that the public safety areas relate to the statistical chance of an accident occurring at a particular location. In general, areas close to the final approach have a higher risk of an aviation incident occurring, and this risk reduces further from the runway, statistical analysis can be used to model the likelihood of a fatal accident occurring at a set location over a one-year period. Development within the public safety area is discouraged as it increases the risk of fatalities in the event of an aircraft accident occurring.

The public safety area at Sydney Airport in the vicinity of the project is shown on Figure 11.6. Part of the project would be located in this area. Guideline I includes considerations for transport infrastructure in public safety areas. It notes that particular sections of roads are only used by individuals for short periods of time; however, at any one point in time there may be a large number of people in the area. The density of occupation throughout a day could therefore be similar to a residential development. As such, the average density of people should be assessed for exposure to the risk. Calculations can therefore be used to predict the average density of people over a one-year period. Inputs would include numbers of vehicles using the road, average speeds, and average occupancy.

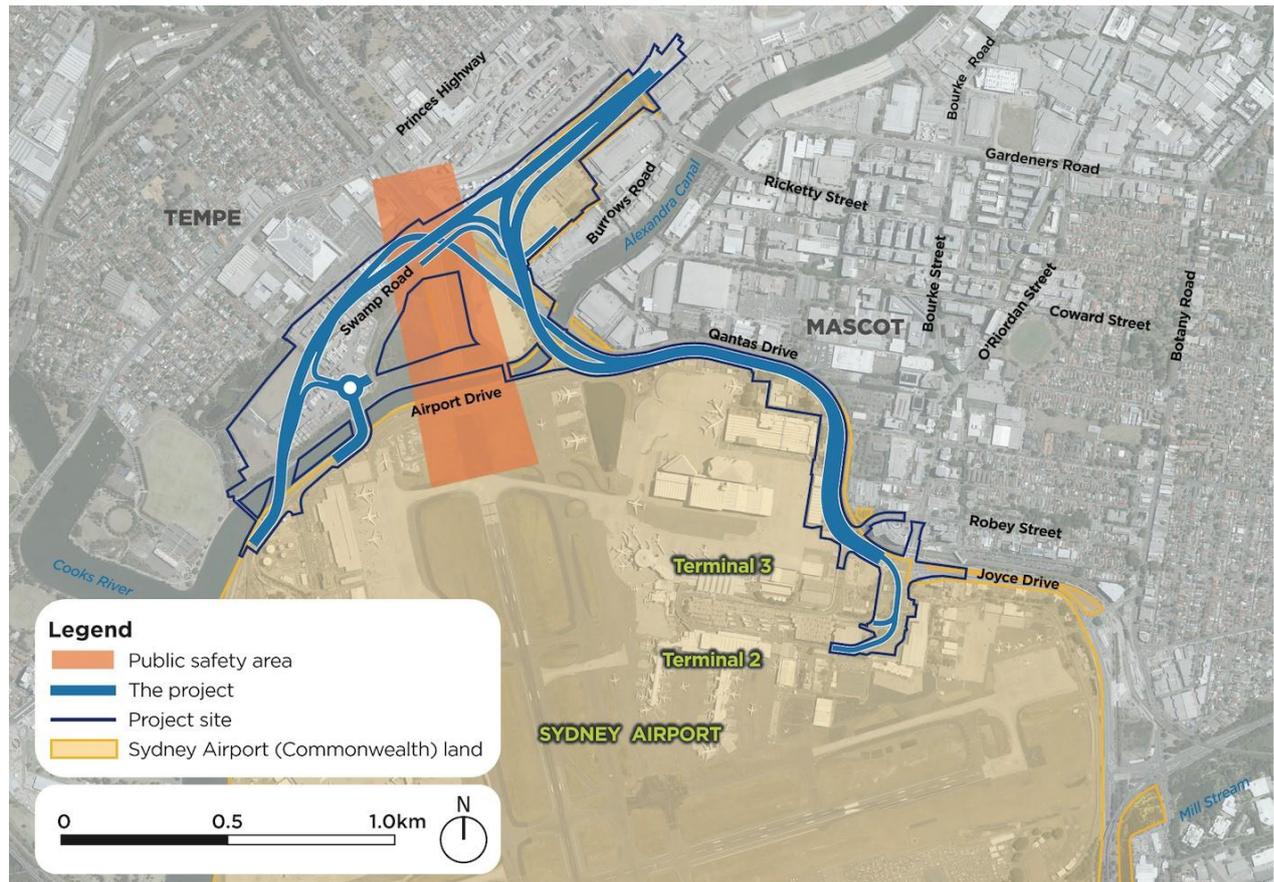


Figure 11.6 Public safety area for Runway 16R/34L at Sydney Airport

11.2.5 Wildlife attraction

The presence of wildlife (including birds and other animals such as flying foxes or bats) on or in the immediate vicinity of an airport site can create an aviation safety hazard. Wildlife strike can occur as a collision between a bird or other animal and an aircraft in flight or during take-off or landing.

Sydney Airport Corporation monitors and controls the presence of birds and other wildlife on or in the vicinity of the airport in accordance with CASA regulations. Sydney Airport's Wildlife Management Plan describes the practices and procedures for managing wildlife hazards caused by the presence of birds or animals on or near the airport.

11.3 Assessment of construction impacts

11.3.1 Impacts on Sydney Airport's prescribed airspace

The potential for temporary intrusions of the protected surfaces that form Sydney Airport's prescribed airspace are summarised in Table 11.1. Publicly available information has been used to undertake this assessment as far as possible. However, the potential impacts on some of these surfaces need to be assessed in detail by Airservices Australia (see section 11.2.2).

Table 11.1 Potential impacts on Sydney Airport's prescribed airspace during construction

Protected surface	Potential for intrusions?	Comment
OLS	Yes	Large plant and equipment (such as cranes) would likely intrude into the OLS. Further information is provided below the table.
PANS-OPS	No	There would be no temporary intrusions of this surface as the PANS-OPS lies above the OLS.
HIAL	Yes	The project site is located on land that is currently occupied by part of the HIAL. Sydney Airport Corporation would undertake the relocation of the HIAL prior to construction. This work would be undertaken in accordance with a separate approval process. There is the potential for temporary intrusions into the HIAL light plane as a result of the movement of tall vehicles or equipment. Any intrusions into the light plane would be discussed with Sydney Airport Corporation and approvals obtained as required. Where possible, any intrusions into the light plane would occur outside Sydney Airport's operating hours.
Radar terrain clearance chart surfaces	No	The radar terrain clearance chart shows the prescribed surface at a level of 152 metres. This is significantly higher than any construction activities.
Navigation aids protected surfaces Combined radar departure assessment surfaces Precision approach path indicator system protection surfaces	To be confirmed by Airservices Australia	Detailed review and assessment of the potential for impacts would be undertaken during detailed design and construction planning by Airservices Australia.

Impacts on the OLS

Construction activities involving the use of tall plant and equipment (such as piling rigs used to construct piles and cranes used to lift bridge segments) would likely result in temporary intrusions into the OLS. Where possible, construction would be undertaken in a manner that avoids such intrusions from occurring; however, some intrusions would be unavoidable. The locations of activities with the potential to intrude into the OLS are shown on Figure 8.10. It is proposed to undertake such works during Sydney Airport's curfew (ie between 11pm and 6am), staged over a number of nights. While some flights still occur during the curfew hours, there are significantly fewer flights. In addition, during these hours, flights typically arrive from and depart to the south to minimise impacts on residential areas. This arrangement means that the project is unlikely to impact aviation operations during the curfew hours.

Works with the potential to intrude into the OLS would be controlled activities for the purposes of the Airports Act (see Chapter 3 (Statutory context and approval requirements)). These works would need to occur in accordance with the conditions of a controlled activity approval to be issued by Sydney Airport Corporation for short term works (less than three months) or Department of Infrastructure, Transport, Cities and Regional Development for long term works (more than three months).

11.3.2 Impacts on communications, navigation and surveillance systems and associated utility networks

Construction may affect communications, navigation and surveillance equipment located on Sydney Airport land, due to impacts on utilities (ie power to systems) or infringements of the Sydney Airport Navigational Aids Protection Surfaces. As the location of this infrastructure is not publicly available, assessment by Airservices Australia may be required upon referral by an authorised party. This would apply to potentially affected navigation aids, radar departure assessment surfaces and the precision approach path indicator system. Roads and Maritime has undertaken early consultation with Airservices Australia and provided a

briefing on this issue. Any requirements for protection of communications, navigation and surveillance equipment during construction will be confirmed by Airservices Australia.

Utility works are described in Chapter 8 (Construction). Where there is a need to re-locate utilities (such as electricity supply lines), there may be the potential for some temporary interruptions while supply is switched over. Consultation with Sydney Airport Corporation would be undertaken prior to any works with the potential to affect utilities servicing the airport's communication, navigation and radar systems. Procedures would be established as part of this consultation to ensure that any disruptions are minimised. It is noted that these systems have multiple backup systems in place currently to ensure that equipment remains operational during interruptions to supply. Therefore any disruptions are unlikely to cause interruptions to supply due to these existing systems.

As with any project, there is also the potential for unplanned/accidental interruptions to occur. The existing backup systems would ensure that there are minimal impacts on Sydney Airport's communication, navigation and radar systems as a result of unplanned/accidental utility interruption.

11.3.3 Wildlife attraction

Temporary site drainage/stormwater management infrastructure, including sedimentation ponds, would be installed during construction. In addition, the project's operational flood mitigation basin would be constructed early so that it can also be used during construction for flood mitigation.

Such infrastructure has the potential to attract wildlife, particularly birds. All sedimentation basins and other temporary project infrastructure with the potential to store water for a prolonged period would be designed and managed in accordance with Sydney Airport's Wildlife Management Plan to minimise the risk of attracting wildlife. Measures include ensuring that water does not remain on site for more than five days or placing nets over waterbodies to deter birds from using them.

Another risk relates to excavation and emplacement activities at the former Tempe landfill site. The exposure of waste material, and any odour generated by these works, may have the potential to attract birds. Notwithstanding that the waste is not expected to be of a type likely to attract birds, measures would be implemented during construction to manage waste in accordance with relevant waste management guidelines to minimise this potential risk. Further information about the management of waste during construction is provided in Chapter 24 (Waste management).

11.3.4 Pilot lighting distraction/light spill

Construction would involve some works during the night, including those with the potential to intrude into the OLS (see section 11.3.1). Parts of the project site are located within the restricted lighting zones defined by Sydney Airport's Restricted Lighting Plan. This includes works in zone A (see Figure 11.5), which covers the area to the north of the main north-south runway and is subject to the highest restrictions (ie a lighting intensity of zero candelas at three degrees below the horizontal).

Construction lighting may still be used, provided it does not exceed the specified intensity at an angle of three degrees below the horizontal. Lights would be selected and located in accordance with *National Airports Safeguarding Framework Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports*.

11.3.5 Other potential issues

Impacts to the high intensity approach lighting

The project site would require an area of land currently occupied by a number of HIAL masts for the main north-south runway.

Adjustments to the HIAL and the roadway design have been co-ordinated with Sydney Airport Corporation to ensure regulatory requirements are able to be maintained. The HIAL would be adjusted by Sydney Airport Corporation separately from the project prior to construction commencing in this area. Ongoing

consultation regarding the adjustment of the HIAL would occur as part of the Airport Precinct Infrastructure Coordination Group. Any intrusions into the modified HIAL light plane would be discussed with Sydney Airport Corporation with all relevant approvals to be obtained.

Airport security

Some works along Airport Drive and Qantas Drive would need to be undertaken inside the existing secure fenced area (airside). The fence line would be relocated by Sydney Airport Corporation prior to works commencing. Sydney Airport Corporation would also manage any potential security concerns in accordance with current procedures. Consultation would be undertaken with Sydney Airport Corporation as part of the Airport Precinct Infrastructure Coordination Group to ensure the adjustment of the fence is undertaken in an appropriate manner.

Visibility

Dust generation

Construction would include ground disturbance, earthworks and other activities with the potential to generate dust. Uncontrolled dust generation has the potential to create visibility and safety issues for aviation operations. An air quality assessment, which included consideration of the potential dust impacts, was undertaken as an input to the impact assessment. This included an assessment of the potential for dust emissions to exceed regulatory limits, including those in the Airports (Environment Protection) Regulations 1997. The results of the assessment are summarised in Chapter 12 (Air quality).

Best practice air quality mitigation and management measures would be implemented during construction to minimise the potential for dust generation. These measures are standard on major infrastructure projects and are expected to be effective in reducing dust to levels that would not affect aviation safety. In the event of adverse flight crew comments with respect to dust and visibility, immediate action would be required to mitigate the issue.

Further information, including mitigation and management measures to minimise dust generation, are provided in Chapter 12.

Smoke and vehicle emissions

Smoke as a result of fires can also pose a risk to aviation safety. This is most likely to be a risk in the former Tempe landfill and Tempe Lands. These areas include vegetation and grassed areas, as well as the potential for landfill gases. As a result, accidental ignition is possible.

The risk of fire would be managed in accordance with the hot works procedures developed for the project. Any fires during construction would be managed in accordance with emergency response protocols.

Emissions from construction equipment and other vehicles would not be substantial enough to pose a hazard to aviation operations.

Sight line from the air traffic control tower

Construction would not impact the sight line from the tower to any area of the airport.

Flooding

A detailed assessment of the potential for flooding was undertaken by Technical Working Paper 6 (Flooding). The assessment confirms that any changes to existing flooding conditions during construction would either be minor or negligible. As a result, no risks to the operation of Sydney Airport are predicted during construction. Further information is provided in Chapter 14 (Flooding).

Aircraft movement areas

Some buildings within the Jet Base would be removed as part of the project. These include administration buildings and Building 167, which were formerly used for air freight but are now vacant (further information is provided in Chapter 8 and 19). However, no aircraft movement areas would be impacted by the project.

11.4 Assessment of operational impacts

11.4.1 Impacts on Sydney Airport's prescribed airspace

The potential for permanent intrusions of the protected surfaces that form part of Sydney Airport's prescribed airspace are summarised in Table 11.2.

Table 11.2 Potential impacts on Sydney Airport's prescribed airspace during operation

Protected surface	Potential for intrusions?	Comment
OLS	No	The project has been, and would continue to be, designed to ensure all operational facilities are located below the OLS. The existing design of the project (including lighting) would not result in any intrusions into the prescribed airspace. This includes no intrusions from the tallest vehicle (a 4.6 metre tall B-double truck) likely to use the new roadways.
PANS-OPS	No	The project has been, and would continue to be, designed to ensure all operational facilities are located below the PANS-OPS.
HIAL	No	The HIAL would be modified by Sydney Airport Corporation prior to construction. This work would be carried out separately from the project. This adjustment would be undertaken to ensure that the project's operational features and the movement of vehicles would not intrude into the light plane.
Radar terrain clearance chart surfaces	No	The radar terrain clearance chart shows the prescribed surface at a level of 152 metres. This is significantly higher than any permanent infrastructure.
Navigation aids protected surfaces Combined radar departure assessment surfaces Precision approach path indicator system protection surfaces	To be confirmed by Airservices Australia	Detailed review and assessment of the potential for impacts would be undertaken during detailed design and construction planning by Airservices Australia.

11.4.2 Windshear and turbulence

Windshear

In relation to windshear, Guideline B of the *National Airports Safeguarding Framework* requires that the variation in mean wind speed along a flight path due to wind disturbing structures must remain below:

- Seven knots (3.6 metres per second) parallel to the runway centreline (known as the 'seven knot along-wind' windshear criterion)
- Six knots (3.1 metres per second) perpendicular to the runway centreline (known as the 'six knot across-wind' windshear criterion).

The results of the windshear assessment indicated that the six knot across-wind criterion is the governing criterion. The lowest gust wind speeds required to exceed the criterion with the project present were between 44 and 47 knots (depending on the emplacement mound option selected).

The modelling indicated that wind speeds required to exceed the six knot across-wind criterion would also be well above the normal operating and discretionary limits for operating the main north–south runway at Sydney Airport (ie the 25 knot limit applied at Sydney Airport). In such winds, the east–west runway is likely to be used to land aircraft. As a result, the project is not expected to result in any windshear issues that would cause a hazard to landing aircraft.

Turbulence

The *National Airports Safeguarding Framework* (Guideline B) criterion for turbulence is that the standard deviation of wind velocity along a flight path must remain below four knots (2.1 metres per second). The results of modelling showed that the gust wind speeds required to exceed the turbulence criterion were generally significantly lower than those required to exceed the windshear criteria (described above).

The wind speeds required to exceed the turbulence criterion at all measured heights and for all tested wind directions were in excess of the standard 20 knot cross-wind operational limit wind speed.

At some individual measurement points, the wind speeds required to exceed the turbulence criteria were less than the local discretionary 25 knot cross-wind operational limit wind speed. The lowest wind speed required to exceed the turbulence criterion was 24 knots. It is noted however that wind tunnel testing of the existing situation (ie without the project), also showed wind speeds required to exceed the turbulence criteria that were below the 25 knot cross-wind operational limit wind speed. The differences in gust wind speeds required to exceed the turbulence criterion with project and existing situation conditions are not considered to be substantial.

The impact of the project on wind conditions on the approach to the north–south runway is considered to be minimal, based on the wind directions tested in the initial windshear and turbulence assessment.

The road infrastructure and landforms, including the emplacement mound options, were developed as part of the concept design and indicative construction methodology for the project. The road infrastructure and final landforms (including the mounds) would be reviewed and refined during detailed design to:

- Address aviation matters according to the ‘as low as reasonably practicable’ principle
- Minimise the volume of material excavated from the former Tempe landfill
- Avoid disturbance outside the project boundary
- Enable compatible uses for remaining land within the project area.

To achieve the above requirements, alternative mound locations, heights and shapes would be considered. With respect to aviation, any revised mound options would be assessed in relevant wind directions, in accordance with the *National Airports Safeguarding Framework* (Guideline B), to identify an optimal mound configuration. The optimisation process would address Sydney Airport operational requirements, and would occur in consultation with Sydney Airport Corporation, aviation stakeholders, and Australian, NSW and local government agencies.

11.4.3 Impacts on communication, navigation and radar systems

As the location of this infrastructure is not publicly available, assessment by Airservices Australia may be required upon referral by an authorised party. This assessment would be undertaken as part of detailed design with the assessment to be undertaken by Airservices Australia. Any requirements for protection of communications, navigation and surveillance equipment during operation will be confirmed by Airservices Australia.

This would apply to potentially affected navigation aids, radar departure assessment surfaces and the precision approach path indicator system.

Roads and Maritime has undertaken early consultation with Airservices Australia and provided a briefing on this issue.

11.4.4 Landscaping and wildlife attraction

The project's operational infrastructure would include a flood mitigation basin on the western side of Alexandra Canal. This basin would be designed to remain dry, except for periods immediately after rainfall and for less than five days. As a result, it is not expected to attract wildlife such that there would be an increased aviation hazard. The basin would continue to be designed to minimise the potential for water ponding and wildlife attraction.

The project would also include landscaping in appropriate locations, including the former Tempe landfill. The vegetation species, locations and design of landscaping would be defined in the urban design and landscape plan for the project, which would be prepared in consultation with key stakeholders, including Sydney Airport Corporation. The plan would include consideration of relevant requirements and species lists under Sydney Airport's Wildlife Management Plan and other relevant guidelines, including the *National Airports Safeguarding Framework (Guideline C)* and *Recommended Practices No. 1 – Standards for Aerodrome Bird/Wildlife Control* (International Birdstrike Committee, 2006). Landscaping would be designed to minimise the potential to attract wildlife at levels likely to pose a hazard to aviation.

11.4.5 Pilot lighting distraction/light spill

Vehicle headlights

As vehicles travel along a road near an airport, there is the potential that headlights can shine upwards towards incoming aircraft. Headlights can also cause dazzling and distraction of pilots if the glare is excessive. Headlights that shine upwards in the vicinity of a HIAL can cause confusion for approaching pilots.

The assessment identified that there would be a risk of headlight glare at the following locations:

- On the Qantas Drive bridge for northbound vehicles
- St Peters interchange connection in the vicinity of the southern underpass for westbound vehicles
- Northern lands access road in the vicinity of the road for westbound vehicles.

The project includes headlight glare shields on sections of Qantas Drive bridge to avoid the potential for safety issues associated with headlight glare.

The other locations do not align with the HIAL or runway. As a result, the risks associated with glare are expected to be minimal. The need for headlight glare screening would continue to be reviewed during detailed design to ensure that headlight glare is appropriately managed as required. With the ongoing consideration of glare and the implementation of appropriate mitigation, risks associated with headlight glare are considered to be minimal.

Street lights

Glare from street lights generally poses a low risk to aviation safety. Upwards light spill from street lights is controlled by Australian/New Zealand Standard AS/NZS 1158.1.1:2005 *Lighting for roads and public spaces Part 1.1: Vehicular traffic (Category V) lighting – Performance and design requirements*. Adherence to this design standard would be adequate to minimise pilot distraction.

11.4.6 Other potential issues

Obstruction of the high intensity approach lighting

As noted in section 11.3.5, Sydney Airport Corporation would adjust the HIAL prior to construction. These adjustments would ensure that there are no permanent obstructions of the lighting as a result of the project's operational features.

Public safety areas

It is understood that there is no NSW legislation relevant to permissible off-airport land uses with respect to aircraft crash risk. However, Guideline I of the *National Airports Safeguarding Framework* proposes that transport infrastructure be assessed in terms of the average density of people that may be exposed to risk due to an aviation incident.

Clause 39 of NASF Guideline I refers to the risk of a person remaining in the same location for a period of a year being killed as a result of an aircraft accident around an airport. Comparisons between vehicles on a road and a person in a residence (which is an incompatible land use identified in Guideline I) can be estimated based on traffic volumes, average speeds and the surface area of the road within the public safety area.

As outlined in Clause 49 of NASF, a preliminary assessment has estimated the density of occupation (average hours/year/square metre) that vehicles using the Sydney Gateway road project would be present within the public safety area and compared that with a person present in a residential dwelling within the same area. On average, cars would be present for about 13 hours per year per square metre compared to a resident being present for about 40 hours per year per square metre. This indicates that a person in a vehicle would be at less risk in the public safety area than a person in a dwelling (an incompatible land use identified in NASG Guideline I). Further work would be undertaken during detailed design to refine this calculation. An 'as low as reasonably practicable' (ALARP) public risk assessment would also be undertaken to determine the risks associated with operating the project within the public safety area.

Sight line from the air traffic control tower

The project would not affect the sight line from the tower to any area of the airport.

Flooding risk

Flood modelling undertaken in Technical Working Paper 6 (Flooding) and summarised in Chapter 14 (Flooding) found that under a range of storm events, the potential impact of flooding on operational areas of Sydney Airport (eg to the south of Airport Drive and Qantas Drive) would generally remain the same.

Further information is provided in Chapter 14.

11.4.7 Consistency with the Sydney Airport Master Plan

Section 16 of the *Sydney Airport Master Plan 2039* (SACL, 2019a) (the Master Plan) provides strategies and requirements relevant to safeguarding at Sydney Airport. It recognises that development near the airport can affect operations at the airport. The plan recognises the *National Airports Safeguarding Framework* and includes requirements consistent with the framework and the Manual of Standards.

The design of the project has been undertaken in accordance with the *National Airports Safeguarding Framework*, the Manual of Standards and other relevant legislation and standards, and has taken into account Sydney Airport Corporation's requirements.

Consistency with the relevant guidelines of the *National Airports Safeguarding Framework* is addressed in the following sections of this chapter:

- Guideline B: Windshear and Turbulence (section 11.4.2)
- Guideline C: Wildlife Strikes (sections 11.3.3 and 11.4.4)

- Guideline E: Lighting (sections 11.3.4 and 11.4.5)
- Guideline F: Protected Airspace (sections 11.3.1 and 11.4.1)
- Guideline G: Aviation Facilities – Communication, Navigation and Surveillance (sections 11.3.2 and 11.4.3)
- Guideline I: Public Safety (sections 11.3.5 and 11.4.6).

The project is therefore considered consistent with the Master Plan.

11.5 Cumulative impacts

11.5.1 Construction

Similar to the Sydney Gateway road project, construction of the Botany Rail Duplication project also has the potential to result in intrusions of the prescribed airspace associated with construction of the proposed new rail bridges. This would be managed for both projects in accordance with required procedures under the Airports Act and the Airports (Protection of Airspace) Regulations 1996. Controlled activity approvals would be obtained as required, and works would be undertaken in accordance with the conditions of these approvals. As a result, no potential cumulative impacts are anticipated.

The Botany Rail Duplication project would also increase the amount of construction lighting in the study area. No cumulative impacts are anticipated assuming that construction lighting located within the restricted lighted zones defined by Sydney Airport's Restricted Lighting Plan would be managed in accordance with *National Airports Safeguarding Framework Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports*.

No other potential cumulative impacts on airport operations are anticipated during construction.

11.5.2 Operation

Together with the Sydney Gateway road project, operation of the Botany Rail Duplication may contribute to an additional source of pilot distraction associated with the headlights of trains moving along the rail corridor. Subject to the implementation of appropriate mitigation for each project, no potential cumulative impacts are anticipated.

No other potential cumulative operation impacts on airport operations, associated with the operation of the Sydney Gateway road project and other projects, are anticipated.

11.6 Management of impacts

11.6.1 Approach

Approach to mitigation and management

The project has been, and would continue to be, designed to minimise the potential for impacts on operations at Sydney Airport. The majority of potential aviation hazards would be avoided by ensuring the design continues to have regard to necessary safety requirements, including those defined by the guidelines and requirements described in sections 11.1.1 and 11.2.

Although the majority of potential impacts (such as intrusions into Sydney Airport's prescribed airspace) would be avoided by appropriate design, some additional management approaches and measures would be implemented:

- In the event that temporary impacts cannot be avoided (such as intrusions into prescribed airspace during construction)
- To ensure that construction is managed to minimise the potential for hazards and impacts on airport operations
- To continue to minimise the potential for hazards (such as appropriate landscaping to minimise risks associated with wildlife).

Measures to manage the potential impacts of dust and the exposure of waste materials at the former Tempe landfill during construction are provided in Chapters 12 and 24.

Other mitigation measures are detailed in section 11.6.2.

Expected effectiveness

The measures provided in section 11.6.2 have been identified as an outcome of the airport operations assessment and include the consideration of the *National Airports Safeguarding Framework* and other relevant guidelines and design standards. Due to the application and adherence to these agreed guidelines which have been applied to developments located in the vicinity of Sydney Airport and other airports within Australia, they are considered to be effective to minimise impacts on the operations at Sydney Airport.

11.6.2 List of mitigation measures

Measures that will be implemented to minimise potential impacts on airport operations (aviation hazards and risks) are listed in Table 11.3. These measures will support those provided in other chapters aimed at minimising impacts to the operation of Sydney Airport (such as measures to minimise access, air quality and flooding impacts).

Table 11.3 Airport operations (hazards and risks) mitigation measures

Impact/issue	Ref	Mitigation measure	Timing
Windshear and turbulence	AS1	<p>The road infrastructure and final landforms (including the emplacement mounds) will be reviewed and refined during detailed design to:</p> <ul style="list-style-type: none"> ■ Address aviation matters ■ Minimise the volume of material excavated from the former Tempe landfill ■ Maximise open space and community use opportunities ■ Avoid disturbance outside the project boundary. <p>To achieve the above requirements, alternative mound locations, heights and shapes will be considered. With respect to aviation, any changes to road infrastructure and final landforms will be assessed in relevant wind directions, in accordance with the <i>National Airports Safeguarding Framework</i> (Guideline B), to identify an optimal design.</p> <p>The optimisation process will address Sydney Airport operational requirements, and will occur in consultation with Sydney Airport Corporation, aviation stakeholders, and Australian, NSW and local government agencies.</p>	Detailed design

Impact/issue	Ref	Mitigation measure	Timing
Runway public safety areas	AS2	A risk assessment in accordance with the principle of 'as low as reasonably practicable' (ALARP) will be undertaken to confirm the risk associated with operating the project within the public safety area to the north of the main north–south runway. The assessment will include consideration of the <i>National Airports Safeguarding Framework</i> (Guideline I). The results of the assessment will inform the design of the project.	Detailed design
Permanent intrusions of Sydney Airport's prescribed airspace	AS3	The project will continue to be designed to avoid intrusions of Sydney Airport's prescribed airspace by permanent project infrastructure.	Detailed design
Wildlife attraction as a result of drainage and flooding management infrastructure	AS4	All temporary and permanent drainage and flood management infrastructure (including the flood mitigation basin) will be designed in accordance with Sydney Airport's Wildlife Management Plan to minimise the risk of attracting wildlife. Appropriate measures will be developed and implemented, including designing the infrastructure to ensure that water does not pond for more than five days. Drainage and flood management infrastructure will be managed during construction and operation to minimise the risk of attracting wildlife.	Detailed design, construction, operation
	AS5	The urban design and landscape plan for the project will include consideration of appropriate landscape designs and species lists to minimise opportunities to attract wildlife at levels likely to present a hazard to aviation operations. The plan will have regard to relevant requirements and species lists under Sydney Airport's Wildlife Management Plan and other relevant guidelines, including the <i>National Airports Safeguarding Framework</i> (Guideline C) and <i>Recommended Practices No. 1 – Standards for Aerodrome Bird/Wildlife Control</i> (International Birdstrike Committee, 2006).	Detailed design
Pilot distraction as a result of street lighting and headlight glare	AS6	Lighting will continue to be designed in accordance with <i>AS/NZS 1158.1.1:2005 Lighting for roads and public spaces Part 1.1: Vehicular traffic (Category V) lighting – Performance and design requirements</i> .	Detailed design
	AS7	The project will continue to be designed to minimise the risk of headlight glare and pilot distraction. This will include providing glare screens in those locations where there is an unacceptable risk of pilot distraction.	Detailed design
Interference with communication, navigation and surveillance equipment	AS8	The detailed design will be referred to Airservices Australia to confirm that there will be no impacts to navigations aids, communications or surveillance equipment.	Detailed design
	AS9	The utilities contingency management plan (measure HS2) will include measures to respond to any unplanned outages of services to critical Sydney Airport infrastructure, including navigations aids, communications and surveillance equipment.	Pre-construction, construction
Construction lighting	AS10	Construction lighting will be selected and located to meet Sydney Airport's restricted lighting zone requirements. For locations where it is not possible to achieve the required intensity levels, works requiring lighting will be undertaken in accordance with the requirements of Sydney Airport Corporation, which may involve restricting the timing of works to outside Sydney Airport's operational hours. Construction lighting will comply with section 9.21 of the <i>Manual of Standards</i> (CASA, 2017) and the <i>National Airports Safeguarding Framework</i> (Guideline E).	Pre-construction, construction

Impact/issue	Ref	Mitigation measure	Timing
Temporary intrusions of Sydney Airport's prescribed airspace	AS11	<p>Construction planning will ensure that intrusions of Sydney Airport's prescribed airspace are minimised as far as practicable.</p> <p>Where temporary intrusions of the prescribed airspace cannot be avoided, works likely to result in intrusions will be undertaken in accordance with the requirements of Sydney Airport Corporation (for short-term works less than three months) or the Department of Infrastructure, Transport, Cities and Regional Development for long-term works (more than three months) and any controlled activity approvals for these works.</p> <p>This will include timing works to avoid Sydney Airport's operational hours.</p>	Pre-construction, construction

11.6.3 Managing residual impacts

Residual impacts are impacts of the project that may remain after implementation of:

- Design measures to avoid and minimise impacts (see sections 6.4 and 6.5)
- Construction planning and management approaches to avoid and minimise impacts (see sections 6.4 and 6.5)
- Specific measures to mitigate and manage identified potential impacts (see section 11.6.2).

With the application of the measures provided in section 11.6.2, including any further assessments required by Airservices Australia, no residual impacts are expected in relation to the operation of Sydney Airport.