

Coombes Property Group

2-4 Hale Street, Botany – Proposed Waste Management Facility

Aviation Impact Assessment

Reference

Final | 26th March 2024

Arup, 2024

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1. Introduction

This Aviation Impact Assessment report has been prepared by Arup to support a State Significant Development Application (SSDA)(SSD-62855708) for the construction and operation of a waste management facility with associated car parking and landscaping at 2-4 Hale Street, Botany (Lot 1 DP 562374), henceforth referred to as the site.

The site is located approximately 8 km south of Sydney's Central Business District (CBD) and adjacent to Sydney Airport. The site comprising of approximately 7,439 m² is in the Bayside Local Government Area (LGA).

The development proposal is for an enclosed facility which will accept up to 300,000 tonnes per annum (tpa) of Construction and Demolition (C&D) waste (non-putrescible). The enclosed facility will operate as a waste transfer station undertaking receipt and basic sorting, with aggregation of material for bulk transport to advanced resource recovery facilities within the KLF group where more advanced sorting and recycling will be undertaken.

Avlaw Aviation Consulting Pty Ltd (Avlaw) were engaged in the early stages of this Development Application to undertake an assessment of the maximum development height restrictions at the site against prescribed airspace limits. These limits exist to provide necessary safety clearances (mandated in legislation) between an aircraft and an obstacle. The findings of Avlaw's initial report (30th June 2023) informed the early consultations with Airservices Australia (Airservices) and Sydney Airport which have subsequently been progressed by Arup. AvLaw's findings were shared with the design team to inform design refinements.

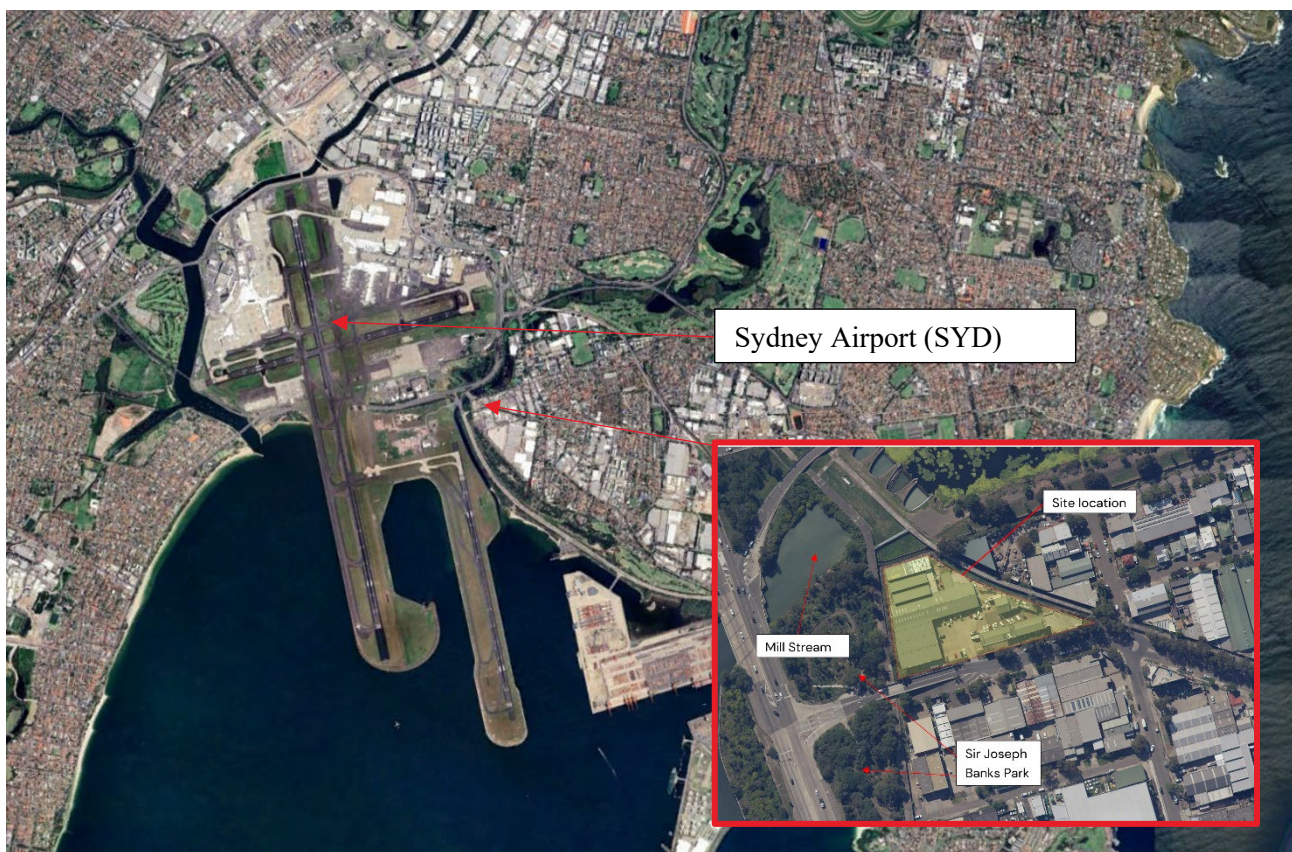


Figure 1: Site location in local context

2. Proposed Development

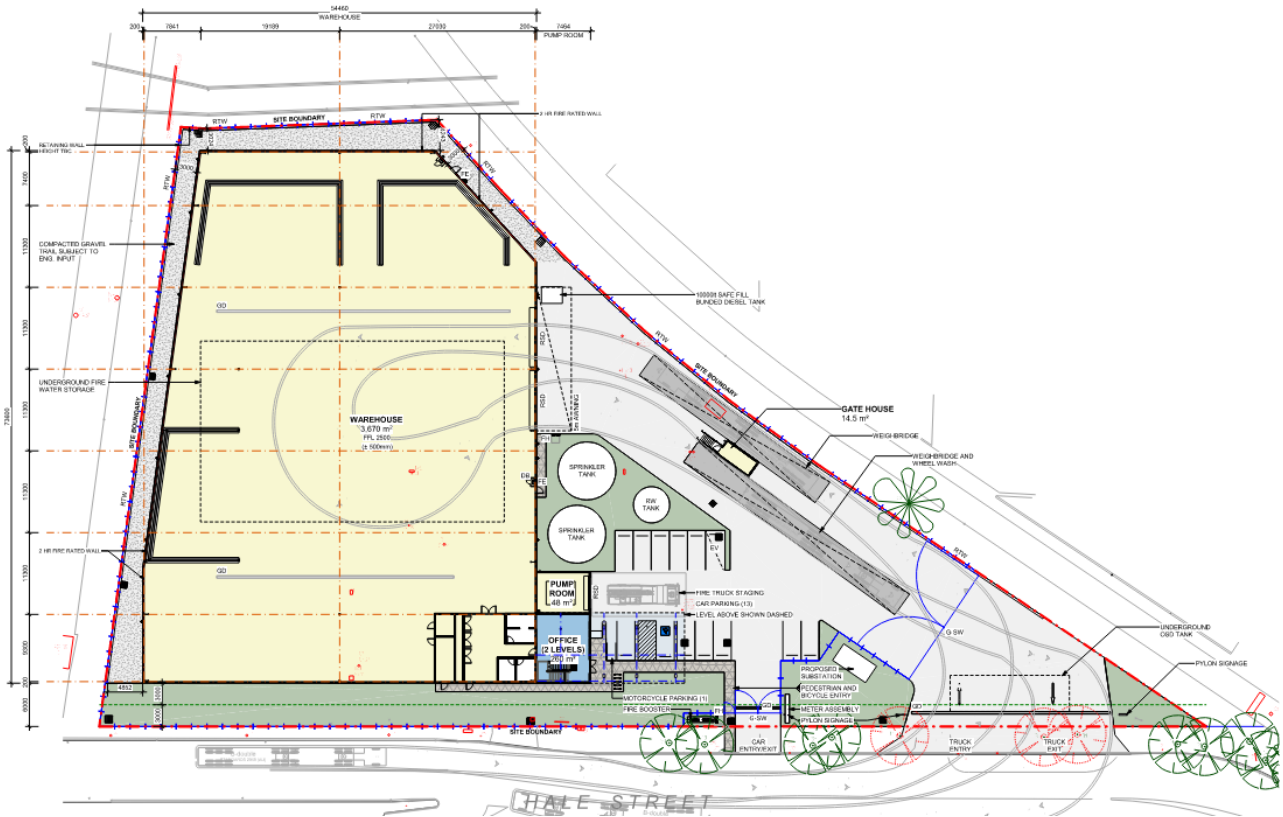


Figure 2: Proposed Concept Design (Source: Reid Campbell - 1220011_ A005[D])

Physical features of the proposed development include a new hardstand, a purpose-built warehouse, lunchroom, office and amenities and two new crossovers. Sprinkler tanks supporting the dust suppression activities on site will be fully enclosed. The indicative site plan is provided in Figure 2 above.

Waste will be brought in from the City of Sydney and the southern Sydney region including the Botany area. The facility will receive and sort primarily construction and demolition waste with some commercial and industrial waste, both classified as general solid waste (non-putrescible). Operational waste activities at the site will involve receipt of waste, sorting, and aggregation for transport to other facilities. Waste will be sorted into four types:

- Bulky and heavier material;
- Brick and concrete;
- Metal; and
- Light mixed waste material.

The EIS will seek approval for 24-hour 7 days a week operation to allow the facility to capture waste generated from the increasing number of sites undertaking construction activities outside of standard construction hours.

3. Assessment Framework

3.1 Secretary's Environmental Assessment Requirements (SEARs)

As outlined in the SEARs document (25th October 2023), this Aviation Impact Assessment addresses the safeguarding requirements set out in Table 1.

Table 1: EIS Requirements (SEARS)

EIS Requirements (SEARS)	Our response
an aviation impact assessment, including: • an assessment of impacts on the protected airspace and operations of Sydney Airport, including (but not limited to) the impacts of wind-blown dust, wildlife hazards and lighting; • consideration of the National Airport Safeguarding Framework (NASF) Guidelines; • details of any aviation mitigation, management and monitoring activities and/or methodologies; and • details of consultation outcomes with the airport authorities on the aviation impact assessment, including any recommended management or mitigation measures.	Section 4 outlines the assessments completed for the protected airspace, operations and NASF guidelines related to Sydney Airport, with relevant email correspondence captured in Appendix A.1. Section 4.8 outlines the mitigations in place to minimise wind-blown dust. Sections 4.3 and 4.4 outline the wildlife management and lighting requirements to align with the NASF guidelines and Sydney Airport feedback. Details of mitigations, monitoring and consultation outcomes are captured, as required, through Section 4.

Of the stakeholders listed within the SEARs document, the following stakeholders were identified for aviation safeguarding consultation:

- Sydney Airport (SYD)
- Civil Aviation Safety Authority (CASA)
- Airservices Australia
- Bayside City Council.

3.2 Planning Documents

The Sydney Airport Master Plan (2039) was assessed in line with the safeguarding requirements outlined in the SEARs (issued on 25th October 2023). Whilst not specifically required in the SEARs document, noise considerations of aircraft operations on the site and its occupants were considered in the context of Australian Standards (AS 2021:2015) - Section 2: Building siting against aircraft noise intrusion.

3.3 National Airports Safeguarding Framework

The National Airports Safeguarding Framework (NASF) contains nine planning guidelines (A-I) that provide a consistent approach to planning protections at and around airports.

The proposed development was assessed against the following NASF Guidelines:

- Guideline B: Managing the Risk of Building Generated Windshear and Turbulence at Airports
- Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports
- Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airport
- Guideline F: Managing the Risk of Intrusions into the Protected Airspace of Airports.
- Guideline G: Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS).
- Guideline H: Protecting Strategically Important Helicopter Landing Sites (HLS).

NASF Guideline A: Measures for Managing Impacts of Aircraft Noise is not supported by NSW. An alternative review was undertaken for aircraft noise using the latest Sydney Airport Master Plan (2039). It is noted that NASF guidelines for wind turbines (Guideline D) and Public Safety Areas (PSA)(Guideline I) were not applicable for this assessment due to the nature of the development and local requirements related to PSAs.

3.4 Protected airspace approvals

A controlled activity is defined where a development is planned to protrude into protected airspace. Controlled activities include the following events and are differentiated between short-term (not longer than three months) and long-term (longer than three months):

- constructing permanent structures, such as buildings, intruding into the protected airspace.
- temporary structures such as cranes intruding into the protected airspace.
- activities causing non-structural intrusions into the protected airspace such as air turbulence from stacks or vents, smoke, dust, steam or other gases or particulate matter.

Approvals are required where a controlled activity is planned to be carried out. Applications for approval are made to the relevant airport operator and the approvals processes depend on the type of controlled activity to be carried out as outlined in Table 2.

Table 2 - Approvals processes by controlled activity[#]

Activity	Process
Short-term controlled activities (OLS intrusion)	Approved or refused by the airport operator after consultation with the Civil Aviation Safety Authority (CASA) and Airservices or referred by the airport to the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (the Department) for a decision.
Short-term controlled activities (PANS-OPS intrusion)	Airport operator is required to consult with CASA and Airservices and then refer applications to the Department for a decision. This referral is to include advice about whether the short-term penetration of the PANS-OPS has the support of the airport operator.
Long-term controlled activities (OLS intrusion)	Referred by the airport operator to the Department for a decision after consultation with CASA, Airservices and the relevant building authority.
Long-term controlled activities (PANS-OPS intrusion)	Not permitted. The airport operator can notify the refusal of such controlled activities.

[#] Adapted from Airspace Protection at Leased Federal Airports, DITRDCA. Additional information regarding the protected airspace controls and approvals is provided by the Department¹.

¹ Airspace Protection at Leased Federal Airports, Department of Infrastructure, Transport, Regional Development, Communications and the Arts, accessed July 14, 2022. <https://www.infrastructure.gov.au/infrastructure-transport-vehicles/vehicles/aviation/safety/protection/leased>

4. Aviation Safeguarding Assessment

A protected airspace and planning assessment was undertaken using Sydney Airport's published airspace protection surfaces and planning guidance outlined in their 2039 Master Plan.

The following are to be noted in the assessment below:

- All listed heights provided are relative to the Australian Height Datum (AHD) with a ground level of 2.5 m AHD as per the architectural drawings issued as part of this proposal.
- The assessment has been conducted using publicly available and published data.

4.1 Noise Exposure

The development of noise exposure contours by the airport operator safeguards land in the vicinity of airports such that only appropriate development can come forward, minimising the introduction of unnecessary constraints on airport operations and negative impacts on the community.

The ANEF system is the primary tool used for assessing and communicating aircraft noise impacts in Australia. AS2021-2015 Aircraft noise intrusion - Building Siting and Construction contains acceptability criteria for land within the various ANEF contours, as shown in Table 3 below. The ANEF along with other contour values (e.g. N70) assist the local councils in managing noise sensitive land uses around airports.

Table 3: Building site acceptability based on ANEF zones, AS2021:2015 (Table 2.1)

Building Type	Acceptable	Conditionally Acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF	20 to 25 ANEF	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	20 to 25 ANEF	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF	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		

4.1.1 Site location

The Australian Noise Exposure Forecast (ANEF) contained in the Master Plan 2039 (Figure 3 below) indicates the site is located on the 30 ANEF contour, with part of the site potentially exposed to higher levels of noise akin to 35 ANEF.

Given the industrial designation of the site and the nature of the proposed operations, the aircraft noise profile is not considered to be an issue for the proposed site and operation.

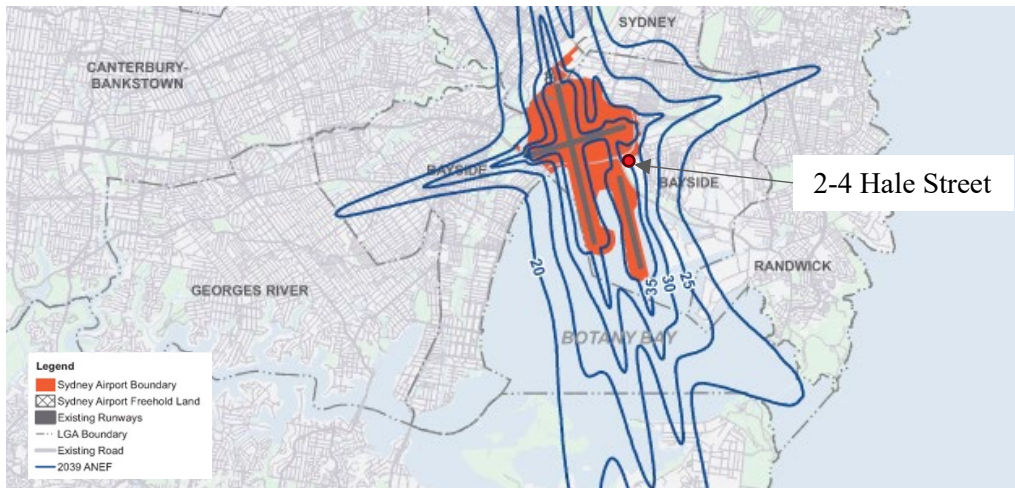


Figure 3: Sydney Airport ANEF 2039 (Source: Sydney Airport Master Plan 2039)

4.2 Windshear Zones

A building generated windshear and turbulence impact assessment of the proposed waste facility was completed by the Arup Wind Engineering team, considering the criteria set out in Guideline B of the Australian National Airports Safeguarding Framework (NASF, 2018).

The proposed facility is located inside the Guideline B assessment zones for Runways 16L and Runway 25 (see Figure 4).



Figure 4: Aerial view showing NASF Guideline B assessment zones (Google Earth 2021)

For approaches on Runway 25 the proposed facility is below the 1:35 slope height plane from the runway centreline and therefore does not require further assessment. However, for Runway 16L the proposed facility penetrates the 1:35 plane requiring additional consideration for potential impacts on Runway 16L operations.

A conservative assessment of the Building Wake Deficit behind the building to Runway 16L indicates that a gust wind speed of 41.5 kt would be required to exceed the NASF Guideline B, 6 kt cross-flight wind shear criterion. This is more than the operational cross-flight criterion at Sydney Airport and under normal operations, aircraft would be redirected to land towards Runway 07.

The proposed facility is located more than 600 m away from the Runway 16L threshold so aircraft would be above the building induced turbulence from the south-east quadrant. Such strong winds are exceptionally infrequent at Sydney Airport. The critical operational wind directions would be from the east quadrant. For winds more to the south, aircraft approaching Runway 16L would be above the building induced wake region, and for winds more to the north, aircraft would land on Runway 34R.

The proposed waste facility is not expected to increase the risk of turbulence issues compared with the existing natural turbulence. Physical or numerical modelling is not considered appropriate for this relatively well-positioned, low-rise development.

4.3 Wildlife hazards – mitigation and management

4.3.1 Introduction

The proposed facility will manage inert, non-putrescible construction and demolition waste. No food or putrescible waste will be processed or disposed of on the site. All waste will be received, inspected, accepted and sorted within the enclosed warehouse. The risk of attracting wildlife is therefore considered to be low.

Given the proposed land use and close location of the site relative to the aircraft operations at Sydney Airport (less than 3km), the site is categorised as Area A within the NASF Guideline Attachment 1 table², indicating the proposed development should undertake specialist review to mitigate any potential attraction of wildlife through design and operations.

This section outlines the high-level principles that would be covered through the Wildlife Management Plan that would be prepared in consultation with Sydney Airport and the Department of Planning, Housing and Infrastructure (DPHI), prior to operations commencing.

4.3.2 Overview of on-site activities and the associated risk of wildlife attraction

The following assessment is provided to describe how on-site activities and facilities may reduce bird strike risk at Sydney Airport:

- Active use of light industrial equipment on site is likely to reduce the attractiveness to wildlife;
- Construction activities will include the removal of any foraging opportunities on site for bird species including scattered vegetation, ponds or water bodies;
- Construction activities may create temporary foraging habitats to wildlife in the form of soil stockpiles which is considered to be low risk in the context of a busy construction site with moving equipment and personnel actively deterring the presence of wildlife.
- Water storage on site will be contained within fully enclosed containers and not provide any foraging habitat for wildlife.

Further mitigations and management are considered in section 4.3.5 below.

4.3.3 Monitoring

The Wildlife Management Plan will establish monitoring and reporting protocols for:

- the presence and behaviour of wildlife;
- evidence of sheltering or nesting wildlife in the facility infrastructure (i.e., building awnings, light posts and/or landscaping);
- the identification of attractants on site (i.e., water, food sources, light and sheltering/nesting); and
- the effectiveness of wildlife mitigation measures.

The reporting format and data collected will be outlined and reviewed with Sydney Airport. In cases where wildlife sheltering or nesting is detected on site, the Wildlife Management Plan will outline removal protocols, and trigger thresholds for further management.

As the facility is considered as having a low risk in terms of wildlife attraction, regular monitoring of the site is proposed for an initial period of twelve months from operations commencing. Subject to the findings in this initial period, the frequency and extent of monitoring activities will be reviewed with Sydney Airport. Should the monitoring over the initial period identify negligible wildlife presence on site, and provided the waste management operations do not change in future, it is proposed that the Wildlife Management Plan will adjust to align with the monitoring and reporting required as part of the broader Waste Management Plan for the facility, with the relevant wildlife information shared with Sydney Airport.

² Guideline C—Attachment 1—Wildlife hazard management action table—December 2023—PDF (infrastructure.gov.au)

4.3.4 Training

Wildlife awareness and management training will be completed by all staff and construction contractors during the induction process. Feeding of wildlife will not be permitted.

4.3.5 Recommended mitigation/management measures

Whilst the management of non-putrescible construction waste is considered a low-risk operation from the perspective of increasing bird strikes at the airport, the NASF guidelines recommend developments within 3 km take active measures to mitigate the risk and reduce the attractiveness to wildlife. The following mitigation measures will be incorporated into the detailed design for the facility:

- No new planting (e.g. for landscaping) on the site that provides an opportunity for shelter/nesting locations or produces fruit or flowers that are likely to attract birds and wildlife.
- The building designs, including on fences and lighting, should minimise areas for wildlife, especially birds, to use for breeding, roosting, or perching. This could include:
 - having no eaves or ensuring there is no access to the roof through the eaves; and
 - using 'bird-spikes' on roof edges, fences and lighting.

The following management measures will be documented in the Wildlife Management Plan:

- Monitoring protocols – monitoring will likely consist of a regular checklist conducted by nominated waste facility staff members who have been appropriately inducted. They will log the findings as supporting information for the review completed by a qualified specialist at agreed intervals;
- Appropriate waste acceptance procedures will be documented in the approved Waste Management Plan and Wildlife Management Plan to ensure putrescible waste is not inadvertently accepted by the waste facility in comingled waste loads. This will include initial inspection of incoming waste on the weighbridge and subsequent inspection once the load is tipped within the waste facility internal area. Any loads contaminated with putrescible loads will be reloaded and directed to leave the waste facility;
- Where perching, roosting or nesting activity is detected on waste facility infrastructure, install exclusionary devices such as netting, or anti-perching strikes and evaluate the effectiveness of any retrospective installation of exclusionary devices;
- Waste management on site will include careful management of any food waste from employees, for example by providing waste bins which are inaccessible to birds and vermin; and
- The Wildlife Management Plan will define roles, responsibilities, and actions to ensure management measures are implemented and maintained.

4.4 Lighting

Pilots rely on specific patterns of aeronautical ground lights during poor weather and outside daylight hours to align their aircraft with the runway and enable them to land the aircraft on an appropriate part of the runway. Lighting around an airport can cause distractions to pilots and are required to be managed to minimise this risk. There are four lighting control zones with maximum lighting intensity limits and a lighting intensity radius 6km from each runway.

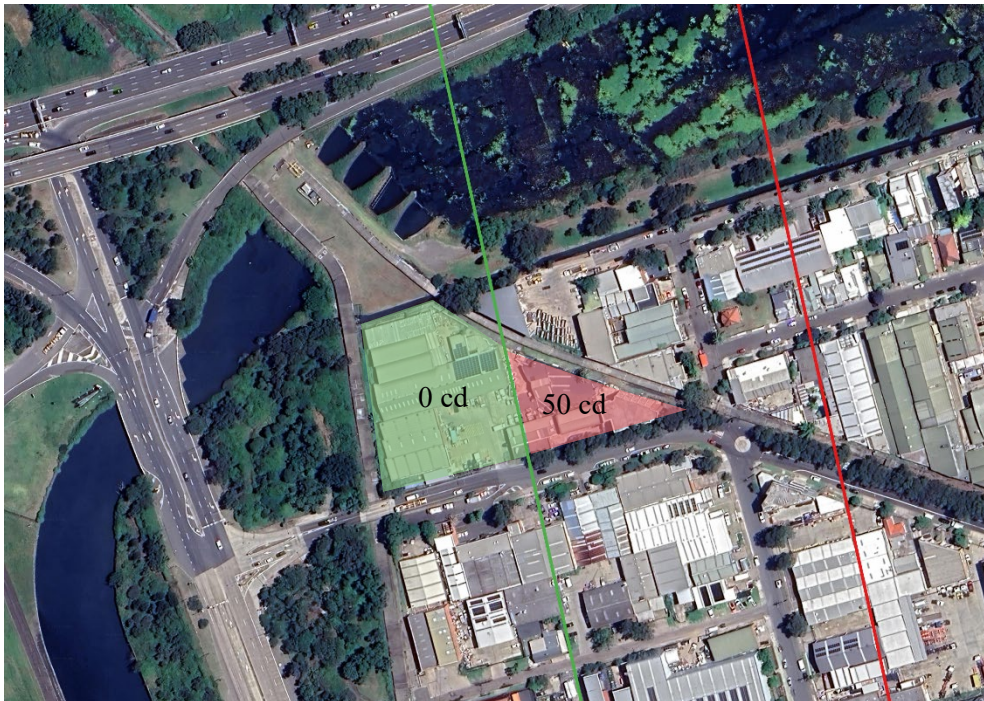


Figure 5: NASF Lighting Zones related to the proposed waste facility (Candela (cd) limit for lights emitting 3 degrees above horizontal (Source: Google Earth)

As indicated in Figure 5 above, the extents of the proposed waste facility site are within Zones A and B. The following mitigation measures apply to the development:

- For green site areas within Zone A, light fittings and angles will be selected such that the maximum intensity of light sources measured at 3 degrees above the horizontal is 0 cd.
- For red site areas within Zone B, light fittings and angles will be selected such that the maximum intensity of light sources measured at 3 degrees above the horizontal is 50 cd.
- In the event that a specific light source is selected that is not within the maximum intensity of the respective zone, screen fittings will be installed to limit light emission to zero above the horizontal.
- The site development will not install coloured or flashing lights, unless required for the purposes of identifying crane operations.
- The appearance, material, reflectivity, and aesthetics of the roofscapes will consider the flight path and flight zone to potential for glare.

For all other runway operations, the site sits outside of the four lighting control zones.

4.5 Obstacle Limitation Surface

The Obstacle Limitation Surface (OLS) defines a volume of airspace above and around an airport that should be kept free of obstacles that could endanger aircraft on visual operations or during the visual stages of an instrument approach. Figure 6 below indicates the approximate location of the site relative to the Sydney Airport OLS, falling beneath the 16L approach transitional surface.

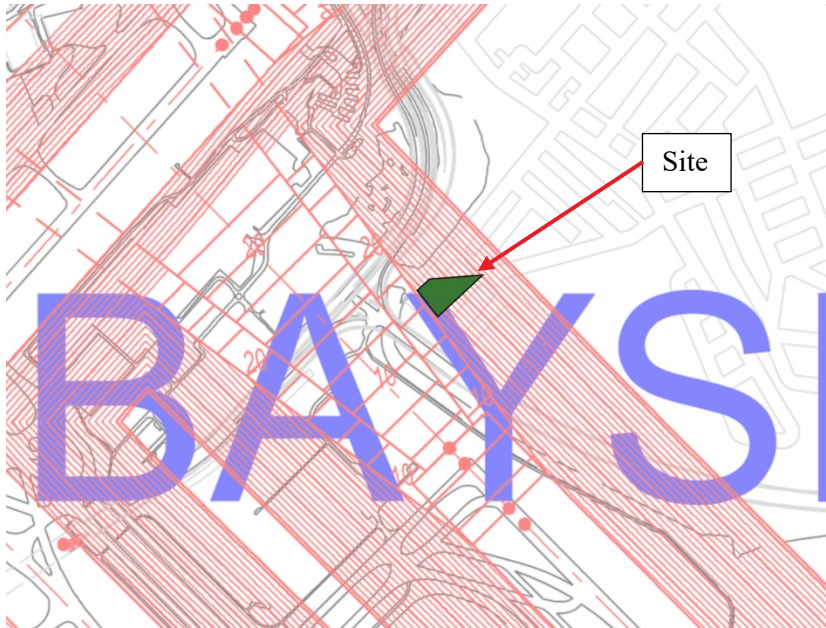


Figure 6: Overlay of site location on Sydney Airport OLS Chart³ (Dated 05/02/21)

The design team for the waste facility has considered the OLS as a hard constraint, with all structures on site remaining beneath this surface. Avlaw prepared a 3D OLS model that was incorporated into the waste facility 3D designs to be reviewed against the proposed design. Figure 7 below provides a visual summary of the OLS surfaces and the avoidance of any penetrations across the site.

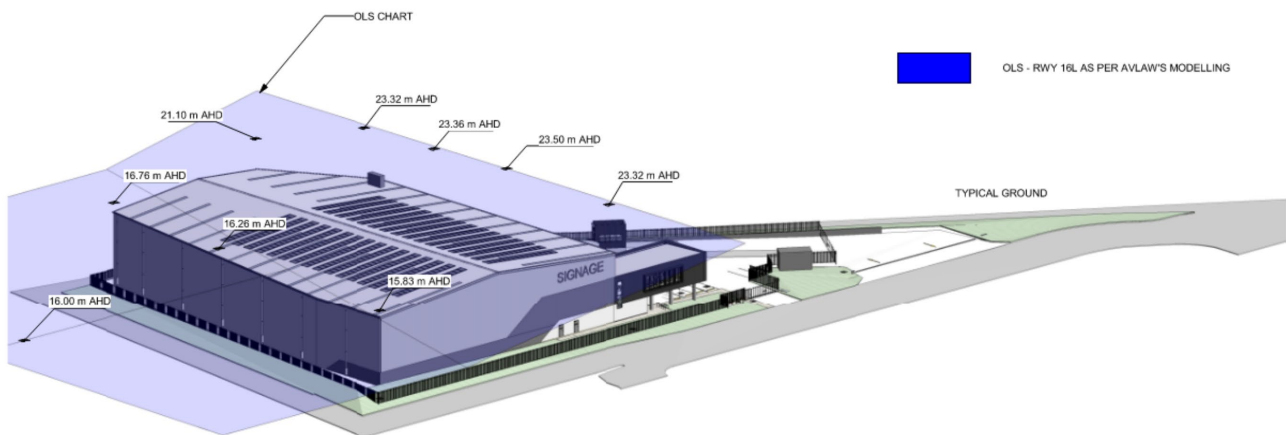


Figure 7: Obstacle Limitation Surface (OLS) render

Further modelling of the OLS was completed by Air Traffic Solutions (ATS) to review the final design. Outlined in Figure 8 below are the calculated OLS elevations at key locations of the enclosed facility. Only

³ Sydney Airport OLS Chart

one point (HST002) is below tallest part of the building 17.0 m AHD. However, the building height in this location is below 15.45 m AHD, as such there are no infringements of the OLS.



Waypoint	Latitude	Longitude	OLS/Basic ILS Height (m)
HST001	33:56:45.89	151:11:23.89	17.162
HST002	33:56:45.48	151:11:23.72	16.988
HST003	33:56:43.61	151:11:23.40	17.484
HST004	33:56:43.44	151:11:24.12	20.248
HST005	33:56:43.32	151:11:24.62	22.139
HST006	33:56:43.67	151:11:25.30	24.300
HST007	33:56:45.49	151:11:25.93	24.923
HST008	33:56:45.73	151:11:24.71	21.042

Figure 8: OLS Actual height data (Source: ATS)

The exact construction sequencing and methodology has not yet been established. However, where possible, Coombes Property Group (CPG) and the design team will avoid the need for crane operations on site that penetrate the OLS. In the event that crane operations are critical to the build, CPG will coordinate with Sydney Airport and Airservices to minimise disruption to airport operations.

4.6 Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS)

An assessment of the PANS-OPS surfaces was also undertaken by ATS and this identified that the lowest of these had an elevation of 44.57 m AHD, far exceeding the tallest point of proposed facility (17 m AHD).



Figure 9: PANS-OPS - X and Y surfaces (16L Approach)

4.7 Roof Top Exhaust Plumes

As detailed within the architectural design reports of this submission, there are no exhaust plumes anticipated within the proposed waste facility.

The amenities and lunchroom on site will have simple cooking facilities (e.g. microwave). However, no commercial kitchen extractor fans are required.

4.8 Windblown Dust

The Air Quality Impact Assessment prepared by Northstar consultants outlines the proposed mitigation measures that will be employed on site to avoid windblown dust.

The three main emissions controls are as follows:

- Indoor activities – the proposed waste management activities will take place within an enclosed facility, with only vehicle movements taking place outside.
- Three-sided enclosures around storage piles.
- Water misting system on-site.

Maximum incremental 24-hour particulate matter 2.5 concentrations of $0.2 \mu\text{g}\cdot\text{m}^{-3}$ were predicted at the closest location of the Sydney Airport runway to the site. These concentrations would not be anticipated to measurably reduce the Runway Visual Range (RVR).

Furthermore, given the non-buoyant nature of the emission sources at the site, a reduction in visual range at heights greater than ground level is not anticipated to occur.

4.9 Foreign Object Debris

Foreign Object Debris (FOD) is defined by CASA as fragments of loose material (such as sand, stone, paper, wood, metal, fragments of pavement) that are detrimental to aircraft structures or engines and may impair the operation of aircraft if they strike or are ingested into an aircraft engine⁴.

Since the proposed facility will only process non-putrescible construction waste the risk of FOD generation on site is considered to be very low. The unloading operations within the enclosed facility, water misting system and strict waste management operations on site will proactively control the potential waste from exiting the site.

Summarised below are some additional measures that will be employed at the facility to reduce the potential for FOD:

1. Covered loads
 - a. Incoming loaded vehicles will arrive covered.
 - b. Covers removed for loads to be visually inspected before being cleared to move to weighbridge.
 - c. Vehicles proceed to warehouse uncovered.
 - d. Outgoing loaded vehicles are also covered before leaving the premises.
2. Wheelwashing
 - a. A wheelwashing bay will be located before the outgoing weighbridge for all outgoing vehicles.
3. Fencing
 - a. Given the building largely protects the western boundary adjacent to the airport, it is anticipated that fence heights at other locations will be standard 1.8m – 2.1m tall to provide an additional protection from FOD exiting the site.

⁴ [CASA AC 139.C-03 v1.1](#)

4.10 Aviation Facilities – Communication, Navigation and Surveillance (CNS)

4.10.1 Introduction

As part of the early assessments undertaken by Avlaw Aviation Consulting Pty Ltd (Avlaw), the Building Restricted Areas protecting CNS operations were developed and reviewed with Airservices.

4.10.2 Initial Airservices response

Preliminary advice received from Airservices (15 September 2023) in relation to a maximum height of 17.62m AHD (note, the design has since been revised down to 17m AHD) indicated the following:

Airservices Non-Precision Navigation Aids, Anemometers, HF/VHF/UHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links - No objections.

Instrument Landing System (ILS) – Airservices identified a potential risk to further deteriorate the ILS signal (SYD 16L CAT II/III operations) post completion of this development, and recommended CPG should plan or take into consideration and be ready to put in counter measures. If a flight inspection assessment of ILS post completion shows there is an impact to the signal in space, CPG will have to take measures to eliminate the scalloping effect.

Air Traffic Control (ATC) Operations – No additional instructions or concerns from the Airservices ATC team.

Airspace procedures – not assessed.

4.10.3 Further Investigation of SYD 16L CAT II/III operations

Further advice received from Airservices (20th September 2023) advised the approximate height at which the development would fall below the ILS glidepath Building Restricted Area (BRA) at 8.97m AHD.

Additionally stating: “As per our [Airservices] previous advice, you could technically go through this, however this is where the potential for scalloping may present”.

Following this advice, CPG sought proposals from an external specialist to undertake impact assessments of the potential ILS signal interference and advise on design solutions if mitigation would be required. A further meeting was arranged by CPG with Airservices (19th December 2023) to follow up on a data request required to enable an assessment to be undertaken. At this meeting, Airservices advised:

- Their previous flight data demonstrated existing degradation and interference with the signal (refer to Figure 10 below).
- Airservices shared results of their own initial modelling studies that considered a 16m high, 74m long wall with a metal façade and a rotation of approximately 4-5 degrees off parallel to the runway.

Airservices’s initial findings showed a potential reflection of the signal from the proposed façade; however it was noted that their modelling did not include the whole building, nor any surrounding developments that may be located between the ILS equipment and the site including the container stacking activities on adjacent sites.

- Given the unique nature of the software, Airservices suggested that there would be no benefit in CPG commissioning a secondary study.
- Airservices confirmed the only way to determine the impact would be to through a flight inspection post completion of the proposed development.

In order to avoid or prevent further signal interference, CPG sought guidance from Airservices on potential mitigation measures that could be employed. These included:

1. Reduce height of critical façade (~10 m tall façade returned a negligible impact)
2. Change rotation off parallel (10 degrees returned a negligible impact)
3. Incorporate façade panels with projections above the point of interference (i.e. ~10m).

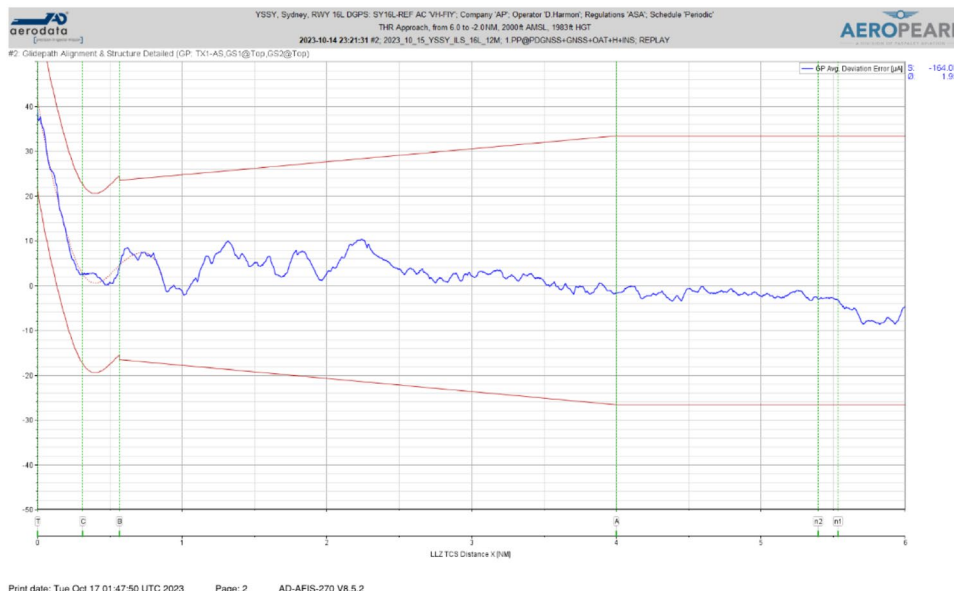


Figure 10 - Flight inspection data of SY 16L ILS signal, October 2023 (Source: Airservices)

4.10.4 Follow-up meeting with Airservices to discuss design refinements

A further meeting was held with Airservices on 27th February 2023 to discuss the outcome of CPG's design mitigation review.

A full reduction of façade height below the BRA and a 10-degree rotation off parallel were both identified to significantly limit the operable area of the waste facility such that it would no longer support the intended waste processing functions. However, a small height reduction was achieved for the critical façade and Airservices completed a re-run of the modelling during the meeting to consider the latest height (14 m from GP Ground level), façade angle (4 degrees off parallel to runway) and to update the façade material from metal to concrete, which reduced the potential for signal interference. The results outlined in Figure 11 indicate the reduced potential for signal interference.

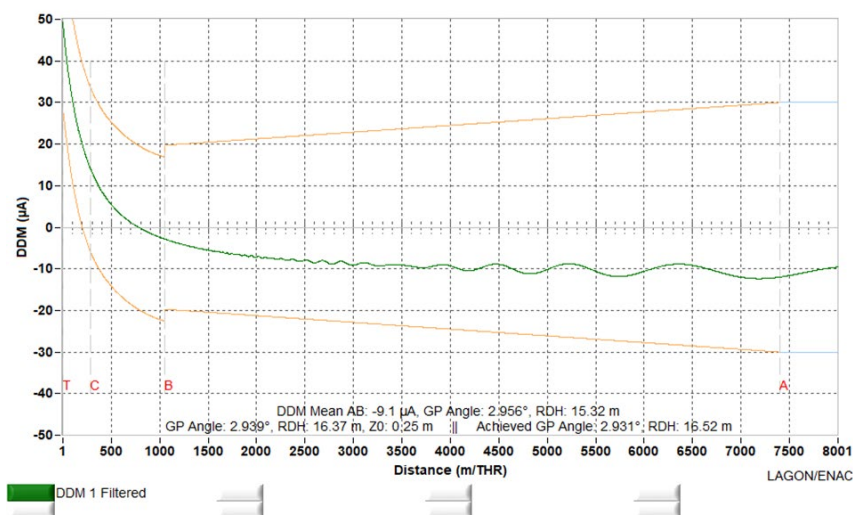


Figure 11 - Modelling of potential signal interference to SY 16L ILS (Source: Airservices)

4.10.5 Impact of crane operations on Airservices operation

In terms of crane operations during construction, correspondence received from Airservices (21 September 2023) confirmed that cranes have a much smaller surface area and would therefore not cause any significant issues to Airservices requirements provided a formal approvals process is undertaken as outlined in Table 2.

4.10.6 Summary

Early engagement with Airservices enabled productive discussions and design refinements to be incorporated into the facility design. The reduced façade height, change of façade type/design to concrete and potential post construction mitigations that were explored have all contributed to the low potential for signal interference.

CPG proposed the following way forward to progress the development application whilst preparing to mitigate any potential signal interference:

- Airservices to provide test flight data from recent surveys for CPG to analyse and identify any variations in readings over time; and to establish a baseline and suitable threshold against which post construction results will be reviewed.
- During the design development phase, the incorporation of ‘impressions’ or ‘textured finish’ to the concrete façade panels will be explored to further mitigate the potential for reflection.
- Western wall façade design to consider mitigation options (above ~10m high) which could be installed post completion should the development further impact the signal.
- Upon the next routine Airservices flight inspection post construction, a meeting between Airservices and CPG will be arranged to discuss findings.

4.11 Strategic Helicopter Landing Sites (SHLSs)

The preliminary AIA report completed by Avlaw, confirmed that there are no hospitals with helipads near the site that require restrictions on the heights of buildings or cranes at the site.

Unlike fixed wing operations, there is currently no formal protections for the airspace associated with helipads on an airport like Sydney Airport. However, Avlaw’s review of the coded clearances to and from the airport identified two routes to be most relevant to the site, Cape Banks 5 Inbound and Cape Banks 5 Outbound. The proposed development is in the immediate vicinity of these helicopter activities. However, the report confirmed the height of the built structure at the site will not introduce any unacceptable risks to operations to/from the helicopter area at Sydney Airport and Port Botany.

Whilst the crane heights will be temporarily taller during construction, no material impact is expected to helicopter operations on the Cape Banks 5 Inbound and Outbound routes.

A.1 Consultation response

As set out in the SEARs dated 25th October 2023, consultation with numerous stakeholders was required during the preparation of the Environmental Impact Statement (EIS). Summarised below are extracts of the key stakeholder engagements and feedback that have been completed through the preparation of the application.

Lewis Caswell

From: Amin Hamzavian <ahamzavian@avlaw.com.au>
Sent: Thursday, 21 September 2023 10:47 AM
To: Airport Developments
Cc: Peter Bleasdale; Ray Romano; Nellie O'Keeffe
Subject: RE: AIRSERVICE RESPONSE: YSSY-CA-819 - Dev, 2-4 Hale St, Botany

Thanks for following up Richard, much appreciated.

Amin

From: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Sent: Thursday, September 21, 2023 9:54 AM
To: Amin Hamzavian <ahamzavian@avlaw.com.au>
Cc: Peter Bleasdale <peter.bleasdale@syd.com.au>; Ray Romano <rromano@avlaw.com.au>; Nellie O'Keeffe <Nellie@coombesgroup.com.au>
Subject: RE: AIRSERVICE RESPONSE: YSSY-CA-819 - Dev, 2-4 Hale St, Botany

OFFICIAL

Hi Amin,

Just confirmed from him that due to the crane having a much smaller surface area, it should not cause any significant issues.

If you have any further queries, please let me know.

Kind regards,



Richard Tomlinson
airport developments & engagement advisor

From: Amin Hamzavian <ahamzavian@avlaw.com.au>
Sent: Wednesday, September 20, 2023 4:08 PM
To: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Cc: Peter Bleasdale <peter.bleasdale@syd.com.au>; Ray Romano <rromano@avlaw.com.au>; Nellie O'Keeffe <Nellie@coombesgroup.com.au>
Subject: RE: AIRSERVICE RESPONSE: YSSY-CA-819 - Dev, 2-4 Hale St, Botany

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Hi Richard,

Appreciate you chasing up your colleague. I'll need to pick Ray's brain on the diagrams and how it differs to the horizontal plane from his model.

Did your engineer offer any comments on the impacts of crane activities above this height? Given the temporary nature, did he agree as we discussed that it would not be a show stopper/as significant an issue as the built structure?

Regards,

Amin Hamzavian
Managing Director

M. +61 424 162 116
D. +61 2 9980 6836
T. +61 2 9980 7717
E. ahamzavian@avlaw.com.au



Suite 6.13
6 Middlemiss St
Lavender Bay NSW 2060 Australia

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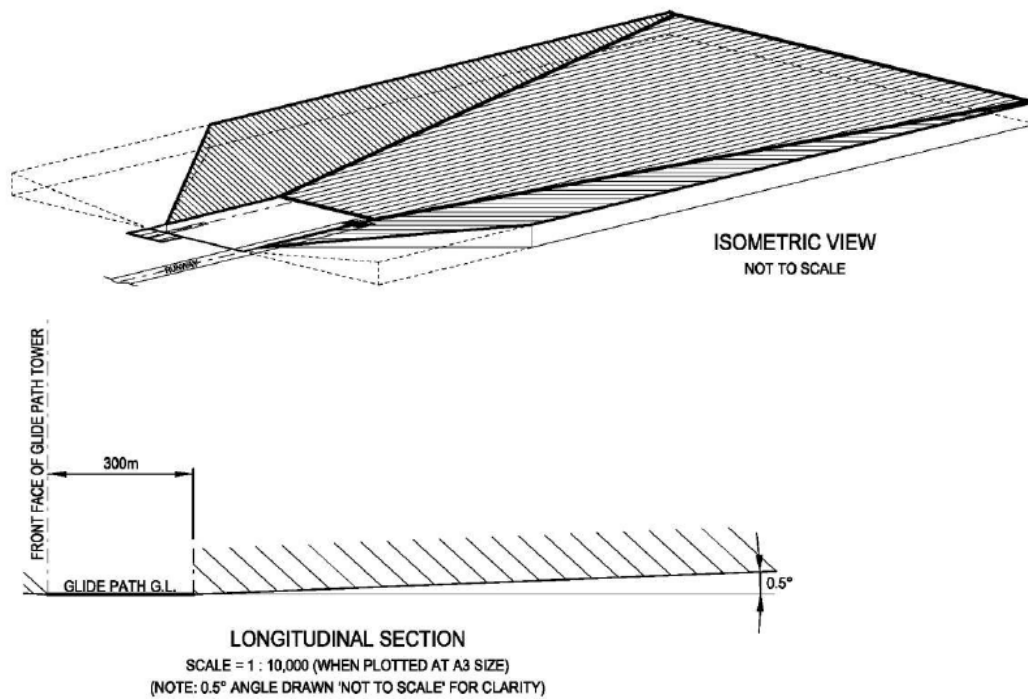
From: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Sent: Wednesday, September 20, 2023 4:00 PM
To: Amin Hamzavian <ahamzavian@avlaw.com.au>
Cc: Peter Bleasdale <peter.bleasdale@syd.com.au>
Subject: RE: AIRSERVICE RESPONSE: YSSY-CA-819 - Dev, 2-4 Hale St, Botany

OFFICIAL

Hi Amin,

Apologies for the delay getting an engineering response regarding the approximate height at which the development would fall below the ILS glidepath building restricted area (BRA).

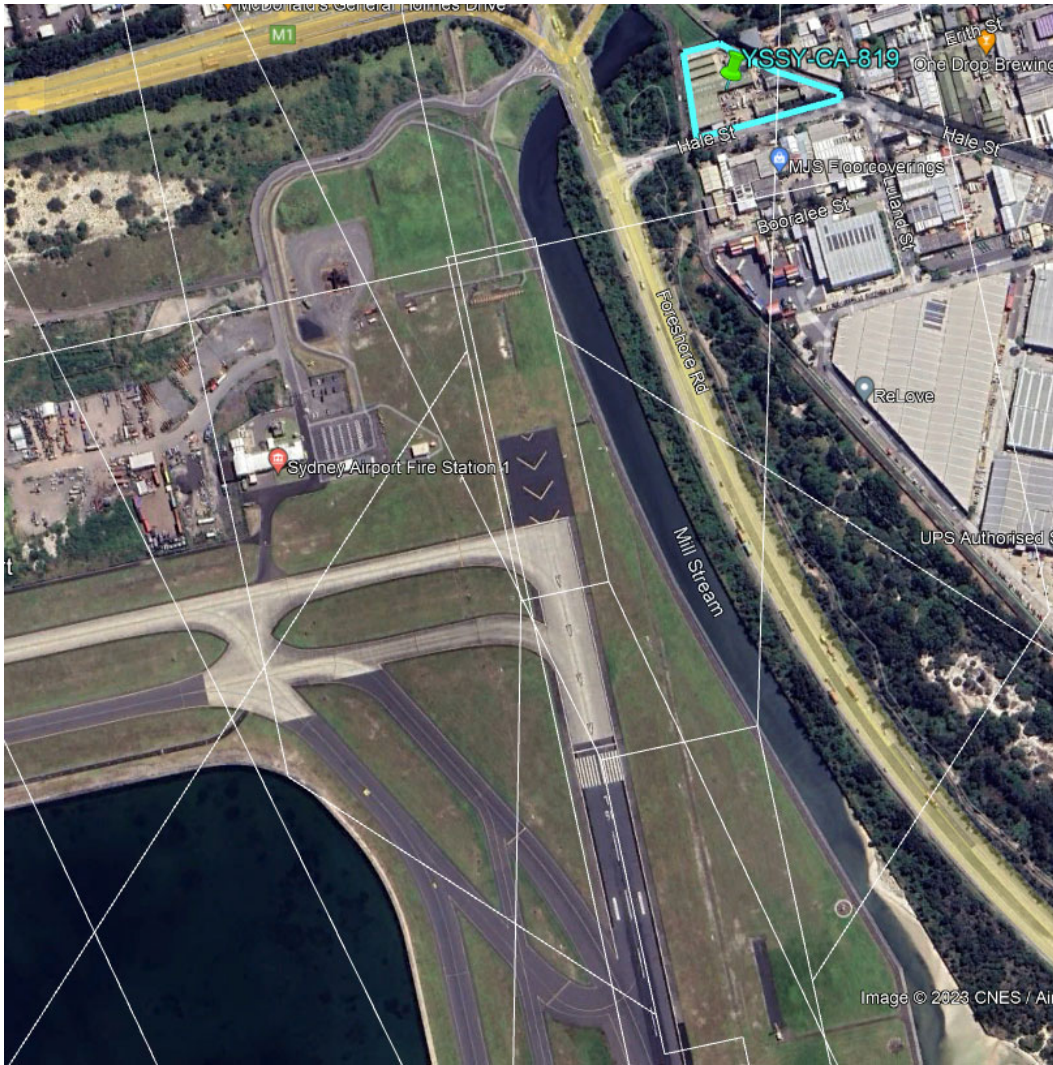
As explained to me, the glidepath BRA is not a flat surface but, is a set of surfaces that slope 0.5° longitudinally and 2° laterally from a flat section at ground level. See below diagrams.



The development sits primarily within the longitudinal section (see below diagram) and therefore the height of the glidepath BRA for a particular point is calculated as follows:

Distance from commencement of 0.5° slope to obstacle (using southern edge of existing building onsite as example) = $598\text{m} \times 0.5^\circ$ (0.0087%) = 5.20m + antenna ground height of 3.77m = **8.97m (29.43ft) AHD**.

As per our previous advice, you could technically go through this, however this is where the potential for scalloping may present.



Kind regards,



Richard Tomlinson
airport developments & engagement advisor

From: Amin Hamzavian <ahamzavian@avlaw.com.au>
Sent: Tuesday, September 19, 2023 12:00 PM
To: Airport Developments <Airport.Developments@AirservicesAustralia.com>; Richard Tomlinson <richard.tomlinson@AirservicesAustralia.com>
Cc: Peter Bleasdale <peter.bleasdale@syd.com.au>
Subject: RE: AIRSERVICE RESPONSE: YSSY-CA-819 - Dev, 2-4 Hale St, Botany

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Hi Richard,

I've just left a voicemail on your mobile. I was hoping to have a chat with you to clarify a couple points prior to another link-up I have with our client at 1600 AEST.

If you can give me a call before then on 0424 162 116 that would be ideal.

Regards,

Amin Hamzavian
Managing Director

M. +61 424 162 116
D. +61 2 9980 6836
T. +61 2 9980 7717
E. ahamzavian@avlaw.com.au



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6 Middlemiss St
Lavender Bay NSW 2060 Australia

[Website](#)
[LinkedIn](#)
[Twitter](#)

From: Airport Developments <Airport.Developments@AirservicesAustralia.com>

Sent: Friday, September 15, 2023 11:37 AM

To: Amin Hamzavian <ahamzavian@avlaw.com.au>

Cc: Peter Bleasdale <peter.bleasdale@syd.com.au>

Subject: AIRSERVICE RESPONSE: YSSY-CA-819 - Dev, 2-4 Hale St, Botany

OFFICIAL

Hi there,

I refer to your request for an Airservices preliminary CNS assessment of the proposed activity at 2-4 Hale St, Botany.

Airspace Procedures

Not assessed at this stage – see summary.

Communications/Navigation/Surveillance (CNS) Facilities

We have assessed the proposed activity to a maximum height of 17.62m (58ft) AHD for any impacts to Airservices Non-Precision Navigation Aids, Anemometers, HF/VHF/UHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links and have no objections.

However, we do note an impact to precision navigation aid namely, SY16L CAT II/III operations, as described by the system technical expert, along with advice on solutions below:

There is a risk to further deteriorate the ILS signal in space post completion of this development, which the developer should plan or take into consideration and be ready to put in any counter measures in place.

What the above means is that, if the flight inspection assessment of ILS post completion of this DA shows that there is an impact to the signal in space, then, the Developer will have to take measures to eliminate the scalloping effect by installing anti-reflective barriers or some sort of stealthy solution to the façade facing the runway, or sections of the building which impact the ILS signal.

However, the impact assessment and its customised designed solution to minimise/eliminate the scalloping effect will need to be done by external companies as Airservices does not provide these solutions. The developer should also keep us informed of the progress of the Development so that we can plan for any interference effect observed by the airlines and also plan for a flight inspection at completion.

Air Traffic Control (ATC) Operations

There are no additional instructions or concerns from our ATC.

Summary

Based on the above assessment, our view is that the proposed activity would have an impact on Airservices CNS facilities at Sydney aerodrome.

Note: If you plan to proceed with the development, you will need to consult Sydney Airport to arrange for a full assessment against Sydney OLS and Airservices designed Airspace Procedures and/or ATC operations.

If you have any further queries, please let our team know.

Kind regards,



Richard Tomlinson

airport developments & engagement advisor

From: Amin Hamzavian <ahamzavian@avlaw.com.au>

Sent: Monday, August 7, 2023 4:30 PM

To: Airport Developments <Airport.Developments@AirservicesAustralia.com>

Cc: Ray Romano <rromano@avlaw.com.au>; Raymond Romano <inneredgeaviation@gmail.com>; Nellie O'Keeffe <Nellie@coombesgroup.com.au>

Subject: Proposed development: 2-4 Hale St, Botany

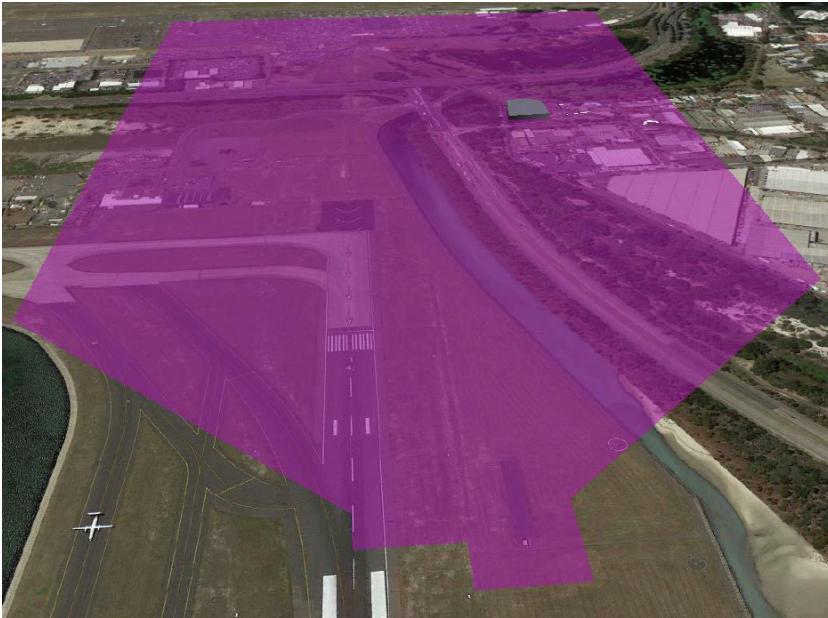
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Hi Richard,

My name is Amin Hamzavian and I am the Managing Director of Avlaw Aviation Consulting. I am writing to you on behalf of Coombes Property Group (Coombes) who have engaged our organisation to identify the aeronautical restrictions that cover a proposed development site at 2-4 Hale St in Botany.

Our findings have determined that the RWY 16L ILS glide path is a horizontal plane at 12.5m AHD across the entire site. The development at the site is currently proposed to reach a maximum height of 17.62m AHD (see attached), therefore penetrating this critical surface.



We would like to schedule a video call with Airservices (from Monday 14 Aug onwards) to discuss the proposal and to understand what (if any) adverse impacts there will be on the operation of the glide path if the development was to proceed. Crane heights are unknown at the time of writing.

Ray Romano (cc'd) produced the model upon which the above findings have been based on and he will be joining the discussions along with myself and Ms Nellie O'Keefe (also cc'd) who is the Executive Development Director from Coombes.

I am available on my mobile as well (see below) if you would prefer to chat over a call.

Regards,

Amin Hamzavian
Managing Director

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D. +61 2 9980 6836
T. +61 2 9980 7717
E. ahamzavian@avl.com.au



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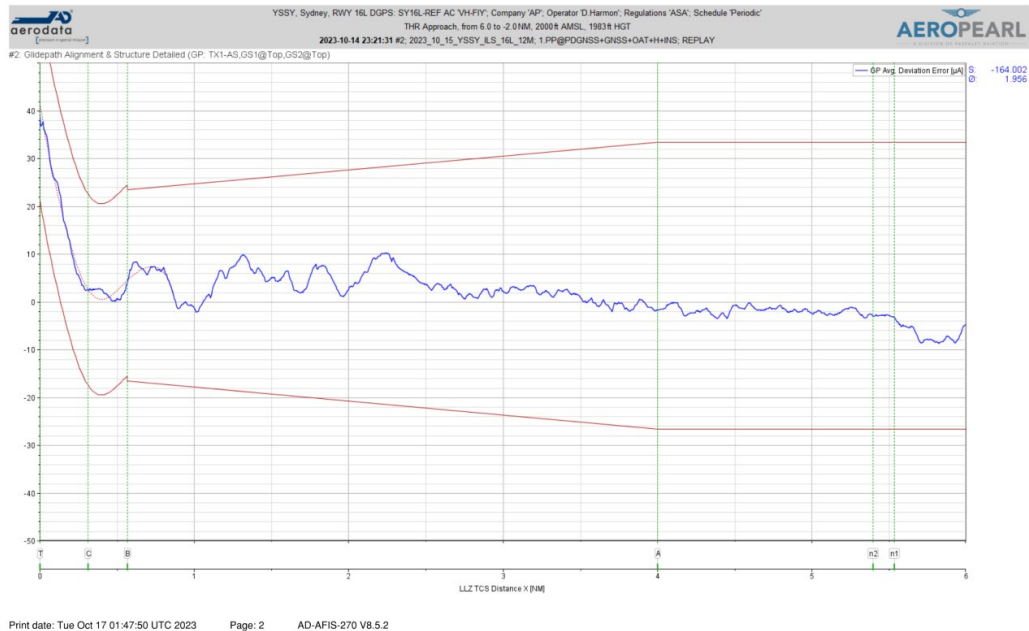
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From: [Lewis Caswell](#)
To: [Lewis Caswell](#)
Subject: FW: SSD-62855708 2-4 Hale Street Botany - Pre-lodgement meeting
Date: Friday, 15 March 2024 11:25:16 AM
Attachments: [image001.png](#)
[image002.png](#)

Attachment(2023_10_15_YSSY_ILS_16L_12M_RPT_V0 14):



From: Nellie O'Keeffe
Sent: Wednesday, February 28, 2024 5:44 PM
To: peter.bleasdale@syd.com.au
Subject: FW: SSD-62855708 2-4 Hale Street Botany - Pre-lodgement meeting

Hi Peter,

Further to my voicemail a short time ago, we had a positive meeting with Airservices Australia yesterday in relation to our proposed development at 2-4 Hale Street, Botany.

Key takeaways from the meeting were:

- Airservices provided the attached most recent flight inspection results (October 2023) which confirms there is existing interference for the navigation aids / signal for 16L;
- Below is output from their model of our development. They are only interested in the west wall which is modelled as 14m high (effective height above GP ground level), -4 deg off parallel of the runway centreline and with a concrete finish. The output shows minimal interference.
- Airservices verbally expressed that whilst there is a risk of further interference, the risk is low and are happy to regroup once the development is complete.

They're comfortable with our proposed methodology and feel that we are now in a position to finalise our Aviation Impact Assessment for inclusion with our SSDA.

Also, we met with CASA last week, David Alder, he had no issues and largely noted that many of the matters would be deferred to Airservices or yourselves.

Feel free to call tomorrow if you'd like to discuss further. Appreciate your assistance and willingness to

engage at this early stage and hope that it makes assessing our application more effective for you.

Kind regards,

Nellie O'Keeffe
Executive Development Director
Coombes Property Group

N: +61 400 208 658

E: nellie@coombesgroup.com.au

W: coombespropertygroup.com.au

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From: Anthony Ranieri <Anthony.Ranieri@AirservicesAustralia.com>

Sent: Tuesday, February 27, 2024 3:51 PM

To: Nellie O'Keeffe <Nellie@coombesgroup.com.au>; Richard Tomlinson <richard.tomlinson@AirservicesAustralia.com>; Airport Developments <Airport.Developments@AirservicesAustralia.com>; Lewis Caswell <Lewis.Caswell@arup.com>; Mike Lockwood <mike@airtrafficsolutions.com>

Cc: Jim Peacock <Jim.Peacock@arup.com>

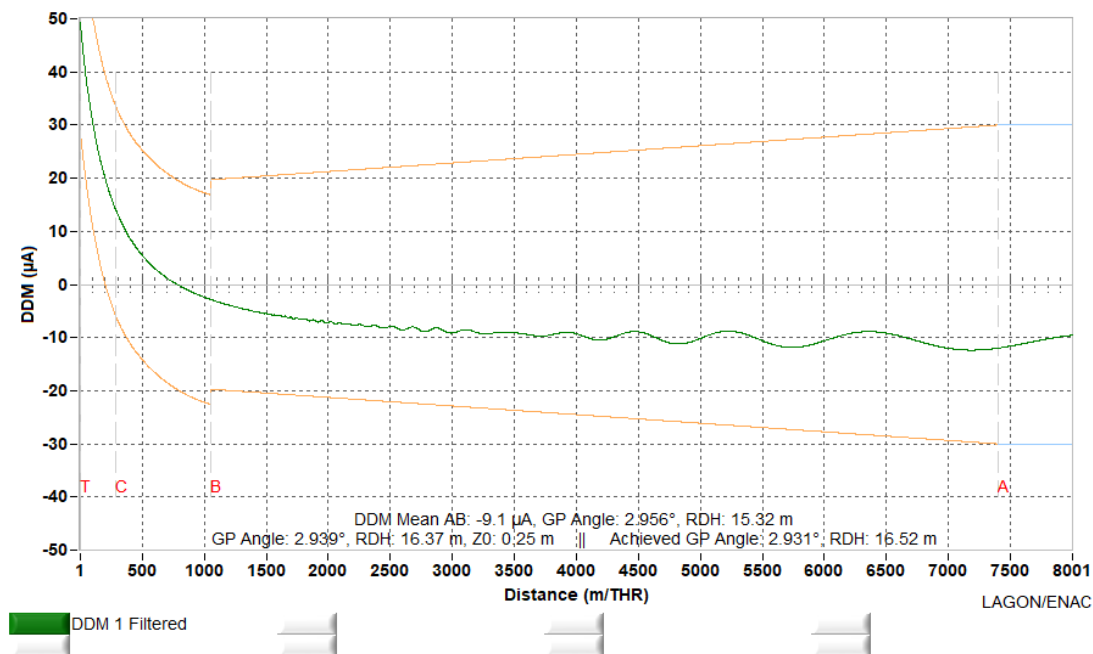
Subject: RE: SSD-62855708 2-4 Hale Street Botany - Pre-lodgement meeting

OFFICIAL

Hi All

Attached is the most recent flight inspection glidepath alignment plot for Sydney 16L.

Below is an output of the model for your building and its impact on the 16L GP. For reference the GP ground level is 3.85mAHD



Cheers,
Anthony

OFFICIAL

-----Original Appointment-----

From: Nellie O'Keeffe <Nellie@coombesgroup.com.au>

Sent: Tuesday, February 20, 2024 4:41 PM

To: Nellie O'Keeffe; Richard Tomlinson; Airport Developments; Anthony Ranieri; Lewis Caswell; Mike Lockwood

Cc: Jim Peacock

Subject: SSD-62855708 2-4 Hale Street Botany - Pre-lodgement meeting

When: Tuesday, 27 February 2024 3:00 PM-3:30 PM (UTC+10:00) Canberra, Melbourne, Sydney.

Where: Microsoft Teams Meeting

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Attendees:

Air Services – Richard Tomlinson and Anthony Ranieri

Applicant – Nellie O'Keeffe, Coombes Property Group (CPG); Lewis Caswell, Arup; and Mike Lockwood, ATS

Agenda:

1. Recap of previous meeting – AirServices to share modelling output from previous meeting
2. Aviation Impact Assessment – CPG / ARUP / ATS proposed approach for addressing ILS signal (SY 16L CAT II/III operations) post completion

3. Next Steps & Timing – CPG

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A.2 Wind shear and turbulence report

Coombes Property Group

2-4 Hale Street, Botany

Wind shear and turbulence report

Reference: Report

Rev. 00 | 10 November 2023

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number: crm 952655

Arup Australia Pty. Ltd. | ABN 76 625 912 665

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Level 5, 151 Clarence Street
Sydney
NSW 2000
Australia
[arup.com](https://www.arup.com)

Document Verification

Project title 2-4 Hale Street, Botany
Document title Wind shear and turbulence report
Job number crm 952655
Document ref
File reference

Revision	Date	Filename	2-4 Hale Street_ARUP wind REP_231110.docx		
00	10 November 2023	Description	Initial release		
			Prepared by	Checked by	Approved by
		Name	Graeme Wood		Graeme Wood
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			

Issue Document Verification with Document ☒

Executive Summary

Arup have been commissioned to provide an experienced-based impact assessment of the proposed development at 2-4 Hale Street, Botany on the potential impact on aircraft operations at Sydney Airport. The development will be located to the east of the approach to Runway 16L, and to the south of Runway 25. This report follows on from a review of the latest drawings, combined with our experience in wind shear and turbulence studies at airports around the world.

It is important to appreciate the difference between wind shear and mechanical turbulence, and some general discussion is included in Appendix A.1. This assessment has used the Australian National Airports Safeguarding Framework (NASF, 2018) Guideline B for building generated wind shear and mechanical turbulence.

The proposed development is located inside the NASF (2018) Guideline B assessment zones for Runways 16L and 25. The building is below the 1:35 slope height plane from the runway centreline to Runway 25 hence does not require additional consideration, however exceeds the plane for Runway 16L. A conservative assessment of the Building Wake Deficit behind the building to Runway 16L indicates that a gust wind speed of 41.5 kt would be required to exceed the NASF Guideline B, 6 kt cross-flight wind shear criterion. This is in excess of the operational cross-flight criterion at Sydney Airport and under normal operations, aircraft would be redirect to land towards Runway 07.

The turbulence criterion cannot be assessed with the desktop procedures in the NASF (2018) guideline, and more detailed numerical or physical modelling would be required. The building is well located at over 600 m prior to the Runway 16L threshold so would be above the building induced turbulence from the south-east quadrant. Such strong winds are historically exceptionally infrequent at Sydney Airport. The critical operational wind directions would be from the east quadrant. For winds more to the south, aircraft approaching Runway 16L would be above the building induced wake region, and for winds more to the north would land on Runway 34R. The proposed building would not be expected to increase the risk of turbulence issues compared with the existing natural turbulence.

Physical or numerical modelling would be required to quantify the qualitative advice contained within the report, but is not considered appropriate for this relatively well-positioned, low-rise development.

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Disclaimer

This assessment of the site environmental wind conditions is presented based on engineering judgement. In addition, experience from more detailed simulations have been used to refine recommendations. No detailed simulation, physical or computational study has been made to develop the recommendations presented in this report.

1. Introduction

The primary aim of this section of the report is to determine the influence of the proposed development on the wind characteristics for landing aircraft to Runways 16L and 25 at Sydney Airport. This report assesses the structure in accordance with the Australian Guidelines as defined in NASF (2018). Landing aircraft are decelerating and moving slower than departing aircraft, and are more susceptible to changes in the relative wind speed between the aircraft and the wind. Departing aircraft are generally accelerating, and ascend more rapidly than landing aircraft descend, further reducing their susceptibility to changes in wind conditions. The point of most interest for aircraft operations is therefore on the immediate approach to the touchdown point and subsequent deceleration along the runway.

The relative location of the proposed development building to relevant runways is shown in Figure 1 showing anemometer locations.



Figure 1: Aerial view showing NASF Guideline B assessment zones (Google Earth 2021)

There are two mechanisms of concern for aircraft operations: wind shear and turbulence. Wind shear is the difference in mean wind speed between two locations along the flight path, whereas turbulence is a measure of the temporal fluctuations in the wind at the same location. Typically, turbulence is generally significantly worse than wind shear on aircraft operations. A longer discussion is presented in Appendix A.1. Generally, the greatest wind shear generated by a structure is during a cross-wind when the wind is coming directly over the structure perpendicular to the nominated runway. For turbulence, the impact of the structure is greatest directly downwind of the structure.

2. Assessment

The Australian National Airports Safeguarding Advisory Group (NASAG) has released Guideline B for the effect of buildings on wind shear and turbulence for aircraft, NASF (2018). This is based on an extensive study completed by the Dutch combining field studies, wind-tunnel testing, and flight simulator experiments on a range of plane sizes from a Fokker 100 to a Boeing 747 and described in Nieuwpoort (2010). These criteria have been adopted by various airports around the world.

The wind-shear criteria in NASF (2018) are that over a distance of 100 m along the flight path the change in mean wind-speed should be less than 7 knots (3.6 m/s) in the component of wind speed in the along-flight direction, and 6 knots (3.1 m/s) in the cross-flight direction, Figure 2. The turbulence criterion states that the standard deviation of building induced wind speed should be less than 4 knots (2.1 m/s). These criteria do not give an indication of the size of, or energy level associated with the gusts as aircraft would comfortably land in natural turbulence levels in excess of 4 knots (2.1 m/s). A spectral analysis would be required to extract the frequency structure of the gusts from which a measure of the size could be inferred. This is beyond the scope of the current discussion and current research.

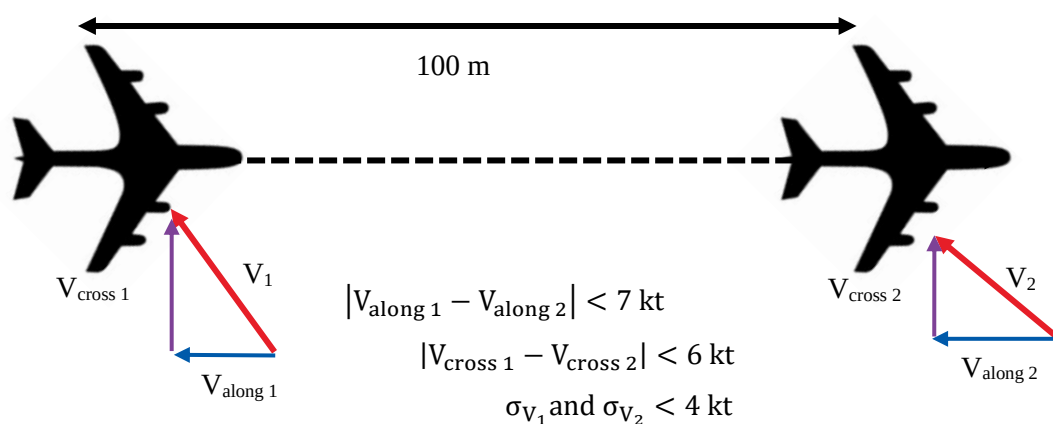


Figure 2: Interpretative sketch of NLR criteria

The National Airports Safeguarding Framework (NASF) Guideline B (NASF 2018) provides guidance on managing the risks posed by building-generated wind shear and turbulence at airports. The NASF assessment methodology is reproduced in Figure 3 where CASA is the Civil Aviation Safety Authority, the government aviation approval body in Australia.

Step 1

Buildings require assessment if they are within the grey assessment zones indicated in Figure 4 relative to the runway threshold. These zones are illustrated in Figure 1, indicating that the proposed development is inside the assessment zone for Runways 16L and 25.

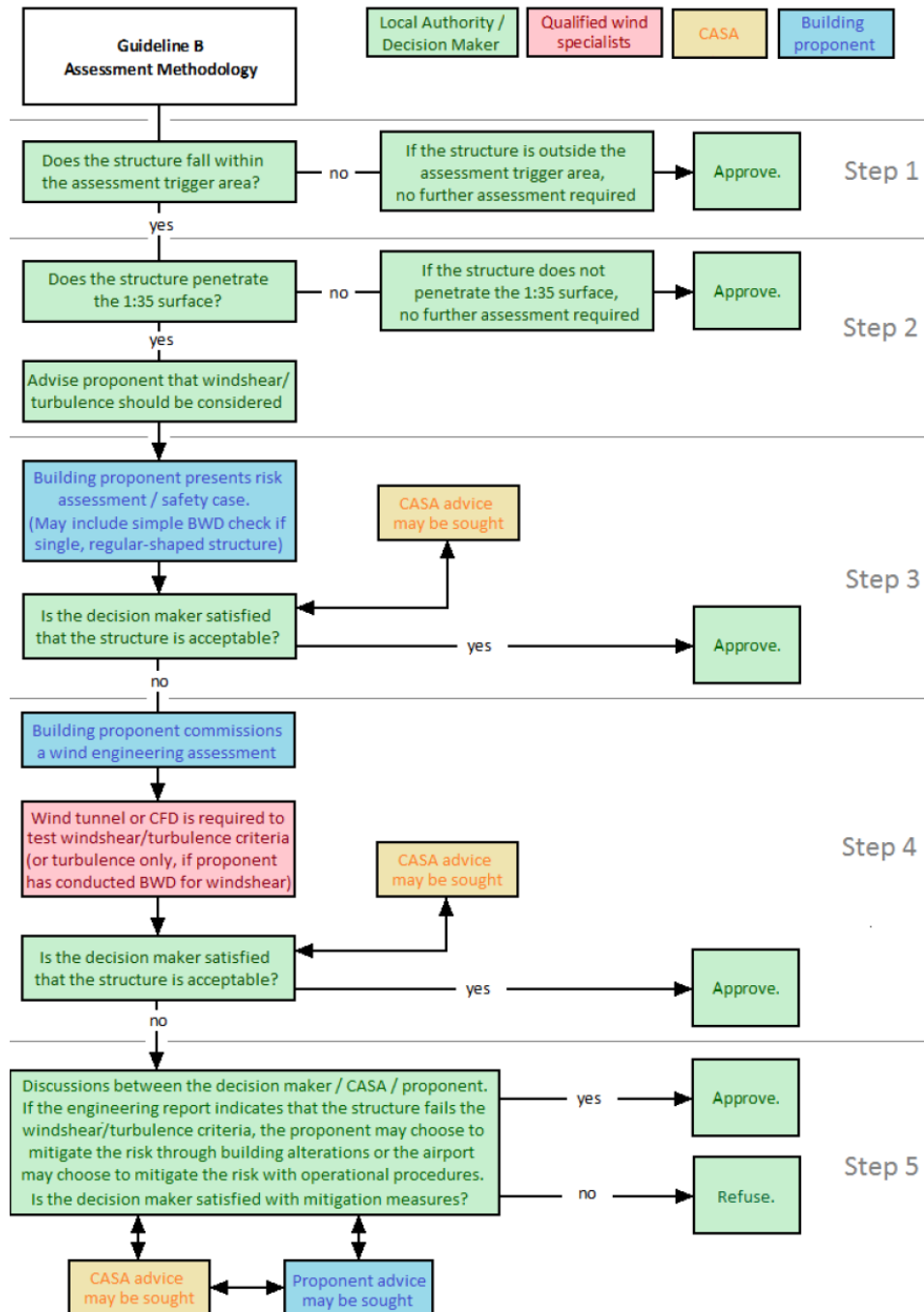


Figure 3: NASF (2018) assessment methodology

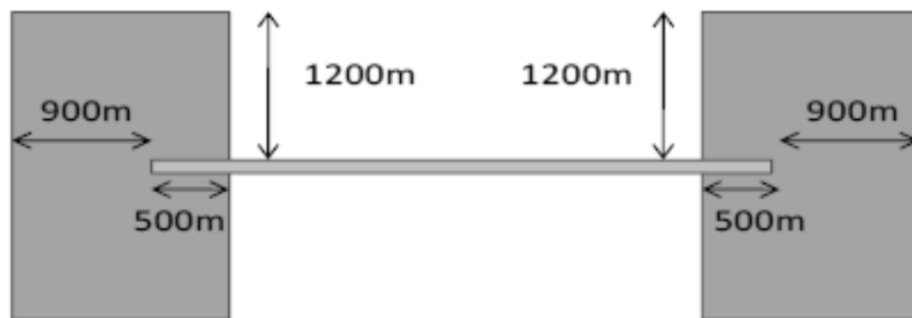


Figure 4: Runway assessment envelope (NASF, 2018)

Step 2

Step 2 in NASF (2018) is to assess the height of the structure relative to a height plane rising at a slope of 1:35 from the centreline of the Runway extension. Drawings of the proposed development are presented in Figure 5. The highest section of the proposed building is at 15.1 m above the local ground level. Ground level at the site is about 1 m higher and 2 m lower than the thresholds to Runway 16L and 25 respectively, at a distance of about 22 and 840 m from the runway centrelines.

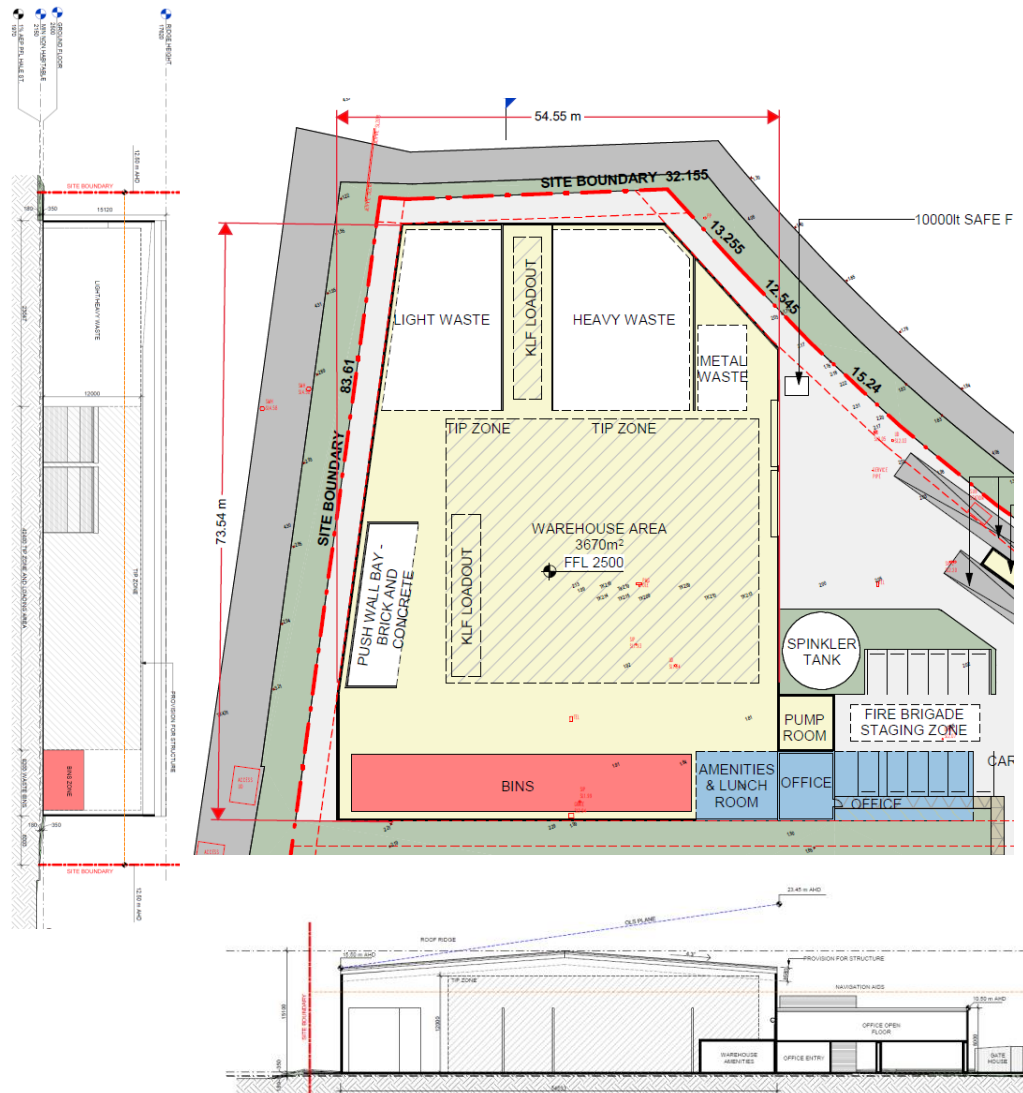


Figure 5: Ground floor plan, and sections looking east and north

Figure 6 shows the relatively height of the building to the 1:35 height plane from the Runway thresholds, with Runway 16L to the left and 25 to the right. It is evident that the building protrudes through the 1:35 plane from the Runway centreline for Runway 16L, but is below the for Runway 25 hence does not require any additional assessment.

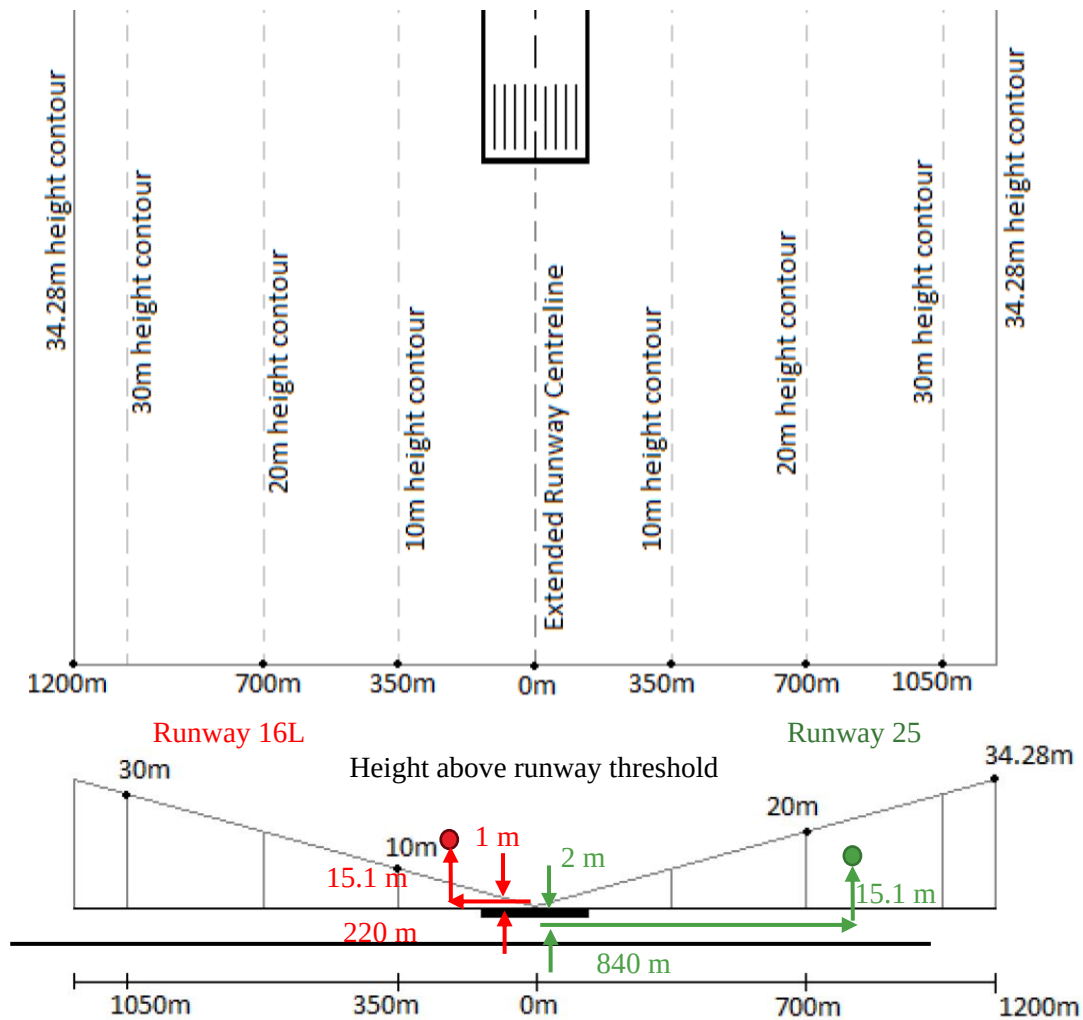


Figure 6: Plan (T) and elevation (B) of 1:35 plane within the assessment area (from NASF 2018)

Step 3

For buildings exceeding the height limit, Step 3 assesses the impact of the building for a cross-wind event producing wind shear through a building wake deficit (BWD) check. Buildings are further classified depending on the plan form shape and whether they are isolated or multiple (NASF 2012). An assessment using the Guideline B estimation procedure assuming an isolated building has been undertaken for the approach to Runway 16L, due to the lower neighbouring buildings and relatively prismatic form of the building, including adoption of a “very conservative” safety margin, Figure 7.

Case C	Building Shape: Complex Building Shape AND/ OR Multiple Buildings	In this instance, unless a very conservative safety margin is added to the mean velocity deficit data provided in Table 1 , one of the following quantitative modelling techniques should be used: 1. Wind Tunnel using Hot-Wire Sensors, 2. Wind Tunnel using Particle Image Velocimetry (PIV), or 3. Computational Fluid Dynamics (CFD).
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Figure 7: Extract from NASF (2012) Guideline B, Table 2

From the analysis it was found that the 6 knot cross-flight wind shear criterion at building height would require a 3 second gust wind speed at the anemometer location in similar turbulence characteristics of 41.5 kt to exceed the criterion. This wind speed is in excess of normal cross-flight component criterion for runway operational procedure at Sydney Airport, hence aircraft would be directed to land on Runway 07. The building is located about 600 m upstream of the runway threshold, hence on approach aircraft would be a minimum height of 30 m above ground level hence would be above the building-induced wake region.

In addition, the amount of time that the 3 s gust wind speed would exceed 40 kt from south of the perpendicular wind direction to the runway is only about 0.2 hours per annum, as highlighted in Figure 8. For winds to the north of perpendicular to the runway, aircraft would be directed to land on Runway 34R into a headwind.

		Calm 28 3 s gust wind speed in an hour/kt					Sum
Direction /°		<20	20 to 25	25 to 30	30 to 40	>40	
0		140.3	6.8	1.5	0.4	0.0	149
10		141.6	12.0	2.9	0.6	0.0	157
20		166.9	40.7	14.9	5.5	0.2	228
30		205.3	75.4	29.1	12.9	0.3	323
40		164.5	63.5	20.9	10.1	0.5	259
50		143.2	48.7	10.0	2.9	0.2	205
60		107.2	25.5	2.2	0.4	0.0	135
70		102.3	17.3	1.2	0.5	0.0	121
80		103.5	8.2	0.6	0.2	0.0	112
90		116.6	7.6	1.3	0.1	0.0	126
100		84.7	5.6	0.9	0.3	0.0	92
110		106.0	7.6	2.0	0.3	0.0	116
120		133.3	11.5	2.3	0.7	0.0	148
130		176.0	19.0	3.2	0.8	0.2	199
140		144.2	23.7	4.2	1.5	0.1	174
150	Hours per annum	126.1	30.3	7.1	3.5	1.1	168
160		147.6	45.1	17.4	9.6	1.0	221
170		202.6	81.5	30.6	18.8	1.4	335
180		140.7	75.6	32.1	20.8	2.2	271
190		131.0	70.0	31.4	23.6	3.6	260
200		106.5	44.9	20.6	15.4	3.3	191
210		91.0	25.6	11.0	9.9	3.1	141
220		76.2	10.4	3.4	2.8	0.3	93
230		90.4	10.4	2.8	1.1	0.0	105
240		98.3	15.5	3.9	1.6	0.3	119
250		135.8	28.8	9.6	4.7	0.3	179
260		129.4	29.0	10.7	6.6	0.5	176
270		128.0	27.5	12.3	9.2	1.1	178
280		126.7	19.5	7.6	6.9	0.9	162
290		168.1	16.6	8.8	8.7	1.2	203
300		195.7	12.2	7.2	6.7	0.5	222
310		253.4	11.6	4.6	4.3	0.8	275
320		221.8	8.1	2.4	1.8	0.6	235
330		183.2	8.4	2.5	1.8	0.3	196
340		114.8	7.4	2.0	1.4	0.0	126
350		128.9	8.7	2.8	1.1	0.0	142
Sum		5031.9	960.1	328.1	197.6	24.1	6542

Figure 8: Temporal distribution of the 3 s gust wind speed from 5 am to 11 pm at Sydney Airport

3. Conclusions

The proposed development is located inside the NASF (2018) Guideline B assessment zone for Runways 16L and 25 so requires a detailed assessment. The proposed building is under the 1:35 slope height assessment zone from the Runway 25 centreline so does not require additional assessment, but exceeds the plane for Runway 16L requiring an additional assessment.

A detailed building wake deficit calculation indicates that the cross-flight wind shear criterion at building height would be exceeded at a 3 s gust wind speed at an anemometer location in similar turbulence characteristics of 20.6 m/s (41.5 kt), which is above the normal operational cross-flight criterion for the airport. At this location, the aircraft would be above the wake region, hence the wind shear at this height would be considerably lower than that estimated through the Building Wake Deficit assessment at roof height.

From the assessment, the proposed building would have negligible impact on aircraft operations to Runways 16L and 25.

Physical or numerical modelling would be required to quantify the advice contained within the report, but is not considered appropriate for this development.

References

ICAO (International Civil Aviation Authority), 2005, Manual on low-level wind shear.

NASF, 2012, Managing the risk of building generated windshear and turbulence at airports, Guideline B.

NASF, 2018, Managing the risk of building generated windshear and turbulence at airports, Guideline B.

Nieuwpoort, A.M.H., J.H.M. Gooden, & J.L. de Prins, 2010, Wind criteria due to obstacles at and around airports, National Aerospace Laboratory, NLR-TP-2010-312.

Peterka, J.A., R.N. Meroney, and K.M. Kothari, 1985, Wind Flow Patterns About Buildings, Journal of Wind Engineering and Industrial Aerodynamics, Vol. 21, pp.21-38.

A.1 Discussion on wind shear and mechanical turbulence

Paragraph 2.2.1 from ICAO (2005) states:

'In the explanation of wind shear given in Chapter 1, the changes in wind speed and/or direction concern changes in the mean (or prevailing) wind from one reference point in space to another. Short-term fluctuations of the wind about a mean direction and/or speed are normally referred to as "variations" from the prevailing wind. Such variations of the wind, individually at least, are temporary, like eddies; while eddies clearly involve wind shear; because they are on a much smaller scale than an aircraft, they tend to affect the aircraft as bumpiness or turbulence. The scale on which the wind shear operates, in relation to the overall size of the aircraft concerned, is therefore of fundamental importance.'

From the above, it can be appreciated that wind shear is based on a difference in mean wind speed between two locations, whereas turbulence is the variation in wind speed and direction at a location with respect to time.

The "variations" mentioned above are generally called turbulence in the wind engineering community and will be used in this document. Turbulence can be quantified with the standard deviation of wind speed at a location with time. This does not give an indication of the size of, or energy level associated with the gusts. A spectral analysis would be required to extract the frequency structure of the gusts from which a measure of the size could be inferred. This is beyond the scope of the current discussion, and would be impractical to monitor full-scale.

To emphasise the difference between wind shear and turbulence, a brief discussion on the driving mechanisms involved in generating turbulence, and low level wind shear in the form of a thunderstorm downburst is included. Low level in wind engineering terms is defined as below about 500 m.

The typical atmospheric boundary layer created by large synoptic wind events is created by friction at the ground surface, and therefore changes from the ground up. The boundary layer typically extends about 500 to 1000 m above ground level. Increasing friction caused by ground objects causes a decrease in the near ground mean wind speed and an increase in turbulence. During strong wind events, the ratio of mean wind speed at 500 m to that at 10 m is typically about 1.6 for winds over open terrain (scattered trees and uncut grass), and 2.1 times for winds over suburbia. The mean wind speed at 500 m over open terrain is about 10% higher than that over suburbia. During strong wind events, turbulence intensity ratios between 500 m and 10 m are typically about 0.4, with winds over suburbia having about 1.3 times the turbulence intensity of those created over open country terrain. Turbulence intensity is defined as the standard deviation normalised by the local mean wind speed. It should be noted that at lower wind speeds, less than 10 m/s, the standard deviation and hence turbulence intensity values can increase.

To develop ICAO (2005) defined moderate and strong wind shear in open country terrain from 40 m to 10 m above ground level, the mean wind speed at 10 m would have to be in excess of 18 m/s (36 kt), and 33 m/s (66 kt) respectively. However, paragraph 5.2.8 of ICAO (2005) indicates that an aircraft could withstand a wind shear of 1.67 m/s per s (3 kt/s); for an aircraft landing in open country terrain with a ground speed of 55 m/s on a 3° glide slope, this would relate to a mean wind speed at a height of 10 m of approximately 75 m/s (150 kt), which would evidently never occur.

Turbulence intensity is wind speed dependent and the lower the mean wind speed the higher the turbulence intensity. However, once the mean wind speed exceeds about 10 m/s, (20 kt) the turbulence statistics become relatively less sensitive to wind speed. At the lower wind speeds,

turbulence intensity is not considered a significant issue to aircraft safety, as the change in relative air speed between the aircraft and the wind is negligible. Turbulence is also a function of the meteorological event; local pressure driven winds such as a summer onshore wind will contain much smoother flow than winds associated with a large frontal system, even if they come from the same direction. This report only deals with developed atmospheric boundary layer flows and does not deal with meteorological events such as frontal systems and thunderstorm events, which cannot be practically modelled.

It is evident from the above, and an appreciation of the different surrounding terrain roughness that the existing wind conditions at an Airport are diverse depending on wind speed and direction. Determining the cause of any wind related pilot complaints based on isolated meteorological data would be exceptionally difficult; especially if it could be proven there were a lack of complaints during similar wind event days. It would be considered necessary to investigate the number of similar meteorological events and determine whether similar complaints were received on those days. Discussions with pilots would also be considered important to determine the frequency and severity of turbulent events.

The most likely cause of low-level wind shear at the Airport is caused by a frontal system, thunderstorm downdraft, or some form of temperature inversion. A mechanism for generating low level wind shear in thunderstorms is created by a descending column of cold air reaching the ground, then being turned by the ground plane, Figure 9. These events are called thunderstorm downbursts and have a central diameter of between 400 m and 4 km. The dashed white line starting on the left of Figure 9 at an elevation 1 k ft (300 m) is a typical glide slope for a landing aircraft. The concern for aviation is that a landing aircraft initially experiences a significant headwind in excess of 20 m/s (40 kt), which changes into a tailwind after passing through the centre of the descending column of air where the wind is coming vertically downward. The headwind causes the aircraft to rise, whereby the pilot will lower the throttle causing the aircraft to descend back to the glide slope, but then tailwind causes a reduction in lift causing the aircraft to land short of the runway. Thunderstorm downburst events typically last for only a few minutes and therefore have the spatial and temporal size to create localised wind shear.

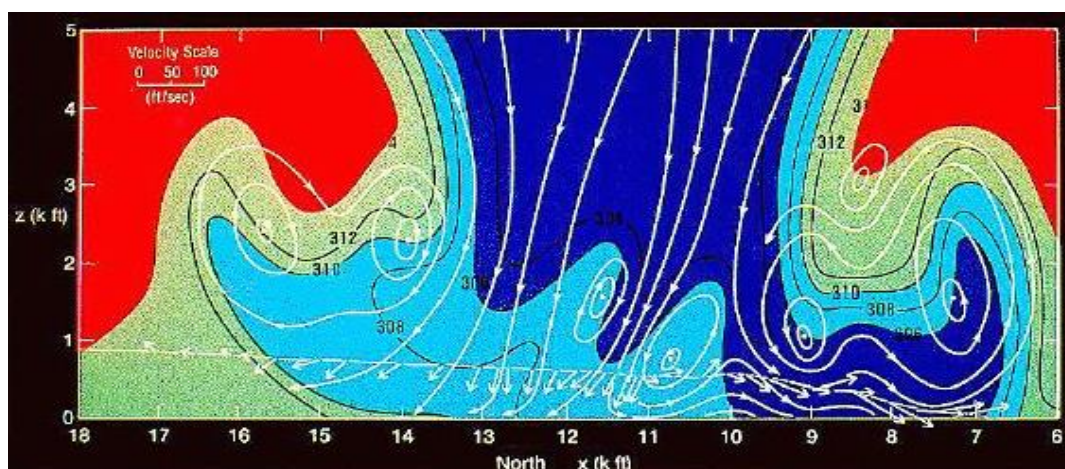


Figure 9: Radar image of a thunderstorm downburst

The wind flow patterns over a building Figure 10, are completely different in that there will be recirculation zones near the windward wall and roof edge, and in the immediate lee of the building. The typical extent of these recirculation zones relative to the height of the structure, h , is illustrated conservatively in Figure 10; for instance Peterka et al. (1985) describe the downstream recirculation zone extending 2 to 6 times the height of the structure. These regions are not fixed but fluctuate in time thereby increasing downstream turbulence, but wind shear would only be experienced in the recirculation zones. As the distance increases from the structure the flow pattern will resort to the undisturbed state. This distance is a function of the geometry of the building, and the roughness of

the surrounding terrain, but the mean velocity and turbulence intensity at roof height would be expected to be within 10% of the free stream conditions at 10 times the height of the structure downwind from the building. The building will influence the wind pattern to a distance larger than this, but the magnitude of any change would be slight. The frequency of turbulence shed from the building would be expected to be fairly high and the spatial extent of a similar size to a large aircraft, therefore any effect would be expected to be of short duration.

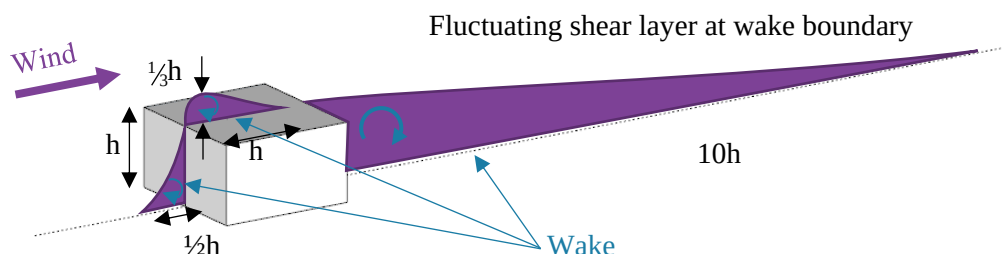


Figure 10: Sketch of the flow pattern over an isolated structure

It is evident from the above that the wind shear situation for flow over a structure is completely different to that for a thunderstorm. Unless the aircraft were to fly directly through one of the small wake regions, which are probably smaller in spatial extent than the aircraft itself, it would not experience any wind shear. The only concern would be if a large building were constructed right next to the runway and there were no provisions for using another runway during strong cross-wind events.

For oblique wind directions, flow around a large isolated regular structure has the potential to generate strong vortices that can extend for a significant distance downwind. These vortices have the potential to impact aircraft operations.

The wind flow pattern behind a group of buildings is significantly more complicated as the flow pattern is based on the compound shape. There is no method to analyse these complex flow pattern and physical or numerical modelling has to be adopted.

This discussion is in agreement with the ICAO Manual which in section 3.2.2 states:

'...This means that while the buildings are comparatively low, they present a wide and solid barrier to the prevailing surface wind flow. The wind flow is diverted around and over the buildings causing the surface wind to vary along the runway. Such horizontal wind shear, which is normally very localised, shallow and turbulent, is of particular concern to light aircraft operating into smaller aerodromes, but has also been known to affect larger aircraft.'

A.3 Protected Airspace Review



AIR TRAFFIC SOLUTIONS

FOR EXCEPTIONAL AIR TRAFFIC MANAGEMENT

Protected Airspace Review-Hale Street Development

CPG-RPT-001

Version 2.0

Valid From 13th March 2024

Version prepared by:
Luke Chandler
Version approved by:
Mike Lockwood

Confirm document is current prior to use

Document Change History

Version	Valid From	Details
0.1	8 th March	Initial Draft
0.2	10 th March	Internal review
1.0	11 th March 2024	Release to Client
1.1	12 th March 2024	Minor edits
2.0	13 th March 2024	Document updated with georeferenced site plan data and diagrams

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1 Introduction

Air Traffic Solutions (ATS) is an Air Traffic Management (ATM) consultancy company based in Brisbane, Australia. ATS has extensive experience in both PANS OPS and Obstacle Limitation Surface (OLS) procedure development. The Chief Designer for ATS has over 10 years PANS OPS experience and is currently the Acting Design Authority for the Royal Australian Air Force (RAAF) Aeronautical Information Service (AIS).

2 Background

Combes Property Group (CPG) is proposing to develop a Waste Management Facility (WMF) at 2-4 Hale Street, Botany. The location of the proposed development requires that an Aviation Impact Assessment (AIA) be completed

CPG has engaged ATS to review previously assessed PANS OPS Surfaces for the Runway (RWY) 16L Instrument Landing System (ILS) and the RWY 16L OLS.

ATS will conduct an independent review to confirm that the proposed WMF building heights do not infringe either the RWY16L OLS or ILS protection areas.

3 Proposed Development

The site is located approximately 8 km south of Sydney's CBD and adjacent to Sydney Airport. The site comprising of approximately 7,439 m² is in the Bayside Local Government Area (LGA).

The site proposes to accept up to 300,000 tonnes per annum (tpa) of construction and demolition waste. The enclosed facility would operate as a waste transfer station undertaking receipt, basic sorting and recycling with aggregation of material for bulk transport to advanced resource recovery facilities within the KLF group where more advanced sorting and recycling would be undertaken.

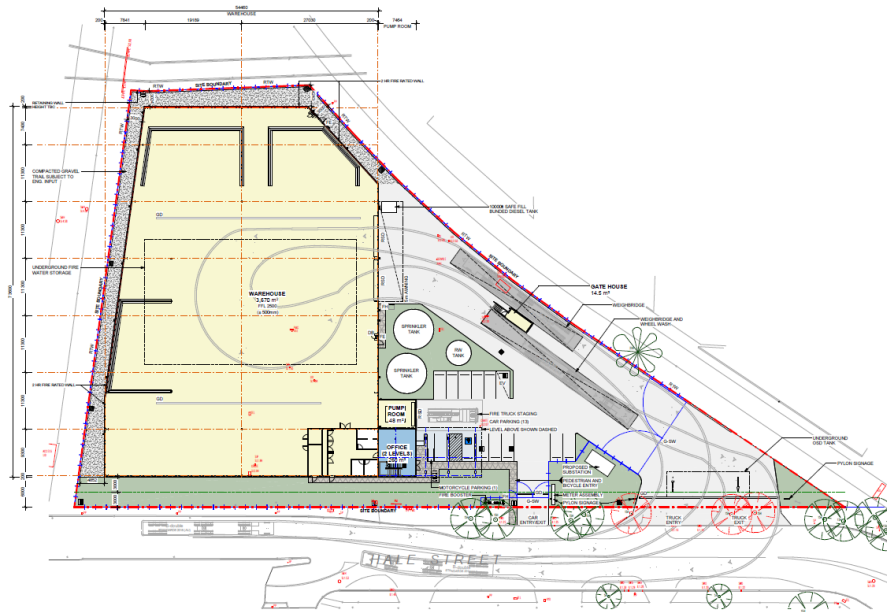


Figure 1-WMF Site Plan

The ATS calculated latitude and longitude positions that have been used in the calculations for this report are shown below.



Figure 2-ATS Building Coordinates

4 Executive Summary

The ATS assessment of the RWY 16L OLS and ILS PANS OPS surfaces does not indicate any infringement of protected airspace.

5 Review Process

ATS has assessed the protected surfaces in accordance with the following:

- CPG supplied architectural drawings
- OLS calculated in accordance with Civil Aviation Safety Authority (CASA) Manual of Standards (MOS) Part 139
 - Precision Instrument Runway Aircraft Code 3/4
- RWY 16L runway data as published via the Australian Aeronautical Information Publication (AIP)
- International Civil Aviation Authority (ICAO) Document 8168 Volume II- Construction of Visual and Instrument Flight Procedures
- Review of assessment by two independent PANS OPS designers
 - This review included the utilisation of two separate automated CAD systems to verify results

6 Assessment

In accordance with the details specified at Section 5, the following data was produced to verify the potential impact of the proposed WMF upon protected airspace.

6.1 Obstacle Limitation Surfaces

The proposed development was assessed against the OLS for RWY 16L.

The site is shown below against the OLS approach transitional surfaces.



Figure 3-Site Plan OLS

Shown below are the detailed OLS segments against the building plans. The heights shown are the OLS surfaces at each point of the building. The maximum height of the proposed development is 17.0M. As such, all heights shown in Figure 4 above 17.0M can be discounted as the building is below the OLS. Only one point (HST002) is below 17.0M. The building height in these locations is below 15.45M, as such there are no infringements of the OLS.



Figure 4-Site Plan OLS Actual Heights

Figure 5 details the exact OLS/Basic ILS latitude/longitude and heights allowed without infringing the OLS.

Waypoint	Latitude	Longitude	OLS/Basic ILS Height (m)
HST001	33:56:45.89	151:11:23.89	17.162
HST002	33:56:45.48	151:11:23.72	16.988
HST003	33:56:43.61	151:11:23.40	17.484
HST004	33:56:43.44	151:11:24.12	20.248
HST005	33:56:43.32	151:11:24.62	22.139
HST006	33:56:43.67	151:11:25.30	24.300
HST007	33:56:45.49	151:11:25.93	24.923
HST008	33:56:45.73	151:11:24.71	21.042

Figure 5-OLS Height Details

6.2 PANS OPS Surfaces

The proposed development was assessed against the ILS PANS OPS Obstacle Assessment Surfaces (OAS) for RWY 16L.

The site is shown below against the ILS OAS X and Y surfaces.



Figure 6-X and Y Surfaces

The maximum height of the proposed development is 17.0M. The lowest PANS OPS surface is 44.569M. As such, there is no penetration of the PANS OPS protected surfaces.

7 Conclusion

ATS has assessed the proposed development at 2-4 Hale Street, Botany, to ensure that there are no infringements of the protected airspace associated with the RWY 16L OLS or ILS PANS OPS (OAS) surfaces.

Two independent reviews were conducted, utilising two differing CAD software programs. Where there was any difference between the two results, the more conservative results were utilised for the assessment.

Parts of the protected airspace for the ILS PANS OPS surfaces are contained within the OLS, and then there are further assessments above the OLS. These are the OAS surfaces that are shown at Section 6.2. The critical protected surface for the proposed development is the OLS.

ATS assessments showed that there was no infringement of the protected surfaces for RWY 16L.

The proposed WMF at 2-4 Hale Street, Botany, has no impact on either the RWY 16L OLS or ILS (OAS X and Y) protected surfaces.